Compilation of SUSY particle spectra from Snowmass 2001 benchmark models

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Abstract

A comparative study of supersymmetric particle spectra calculated by the programs Isajet, Susygen and Pythia is presented for various SUSY scenarios defined at the Snowmass 2001 workshop.

At the Snowmass 2001 'Summer Study on the Future of Particle Physics’ a consensus was reached to define a list of SUSY models as benchmarks to be investigated in future collider studies. Various scenarios, so-called 'Snowmass Points and Slopes' (SPS), were proposed in terms of a few parameters describing ‘typical’ to ‘extreme’ RP conserving supersymmetry breaking mechanisms of mSUGRA, GMSB and AMSB. All benchmark points respect currently existing experimental constraints.

| mSUGRA scenario | m₀ | m₁/₂ | A₀ | tan β | sign μ |
|-----------------|----|------|----|-------|--------|
| SPS 1 typical point | 100 | 250 | −100 | 10 | + |
| SPS 2 focus point region | 1450 | 300 | 0 | 10 | + |
| SPS 3 model line into coannihilation region | 90 | 400 | 0 | 10 | + |
| SPS 4 large tan β | 400 | 300 | 0 | 50 | + |
| SPS 5 light stop | 150 | 300 | −1000 | 5 | + |
| SPS 6 non-unified gaugino masses | 150 | 300 | 0 | 10 | + |

| GMSB scenario | Λ | Mₓ | Nₓ | tan β | sign μ |
|---------------|----|----|----|-------|--------|
| SPS 7 NLSP = ˜τ₁ | 40,000 | 80,000 | 3 | 15 | + |
| SPS 8 NLSP = ˜χ₀¹ | 100,000 | 200,000 | 1 | 15 | + |

| AMSB scenario | m₀ | m₃/₂ | tan β | sign μ |
|---------------|----|------|-------|--------|
| SPS 9 small Δm(˜χ⁺₁₀ – ˜χ₀₁) | 400 | 60,000 | 10 | + |

masses and scales in GeV

However, at Snowmass it was recommended to take the SUSY particle spectrum as generated by the program Isajet as the reference for benchmark models, instead of the few high energy

1 'SUSY benchmark discussion' at Snowmass 2001, http://lotus.phys.nwu.edu/~schmittm/snowmass
2 M Battaglia et al, 'The Snowmass points and slopes: benchmarks for SUSY searches', Snowmass proceedings, in preparation
3 H Baer et al, hep-ph/0001086, Isajet, http://paige.home.cern.ch/paige
parameters. This arbitrary choice certainly does not imply that this program is superior to any other modern program. In fact, the purpose of this note is to compare different codes and thus to get a feeling on the reliability of presently available calculations. We present SPS model spectra, i.e. using the same input parameters, as generated by ISAJET 7.58 in comparison with results from the programs SUSYGEN 3.00/27 and PYTHIA 6.2/00. These event generators are most popular and frequently used for SUSY studies and simulations.

ISAJET uses the package ISASUGRA to solve numerically the two-loop RGE’s in the MSSM couplings in the 3rd generation approximation. Theta-function thresholds are included in the gauge and Yukawa one-loop running couplings. Decay modes are calculated with ISASUSY applying decay matrix elements. Besides generic MSSM models, specific scenarios can be selected with the mSUGRA, GMSB or AMSB options.

In SUSYGEN the mSUGRA scenarios are calculated with the program SUSPECT 2.0. All masses and couplings (except scalar masses which are run at one-loop) are evaluated numerically using two-loop RGE’s in the 3rd generation approximation and including smooth thresholds. The Higgs branching ratios are calculated using HDECAY. General models with a limited number of parameters can be chosen; GMSB and AMSB scenarios can be generated by setting the appropriate MSSM parameters.

PYTHIA is a fast and robust program and uses semi-analytical formulae to solve the RGE’s with one-loop beta functions. Thresholds are not included. Several SUSY models such as mSUGRA or fixed gaugino masses can be chosen. GMSB and AMSB scenarios can be realised via generic MSSM parameters.

In general all three programs provide mass spectra which agree at the level of about 10% for not too extreme choices of parameters. However, huge mass differences of up to factors of 2 or even more may occur in models with very large parameters, e.g. high $m_0 \gg m_{1/2}$ (SPS 2) or high $\tan \beta$ (SPS 4). Such extreme situations are very sensitive to higher order corrections, for which the programs may not be prepared. In a study of SPS model lines it was observed that ISAJET exhibits mass instabilities or wiggles as a function of gaugino masses at the level of a few percent, but which may increase up to $\sim 30\%$ for the light chargino in SPS 3 depending on the value of $m_{1/2}$.

Another concern are the decay modes and branching ratios which are treated in the three programs with different sophistication. Some of them seem to be incomplete, e.g. missing sfermion decays into gauge and Higgs bosons and missing chargino decays into Higgs (SUSYGEN) or missing Higgs decays into supersymmetric particles (PYTHIA). Obvious problems arise due to mass differences, which may suppress or open certain decay channels. The user has to carefully examine the decay modes and possibly consult the original literature. For the Higgs sector dedicated programs like HDECAY or FEYNHIGGS may be used as cross checks.

We adopt a user’s point of view and feel unable to judge which is the optimal code or event generator to produce SUSY particle spectra. However, if benchmark studies should be useful and should allow to do comparisons, we strongly advise the authors of future analyses to give

\[4\] N Ghodhane et al, hep-ph/9909499, SUSYGEN, http://lyoinfo.in2p3.fr/susygen/susygen3.html
\[5\] T Sjöstrand et al, hep-ph/0108264, PYTHIA, http://www.thep.lu.se/~torbjorn//Pythia.htm
\[6\] A Djouadi et al, hep-ph/9901240, SUSPECT, http://www.lpm.univ-montp2.fr:6714/~kneur/suspect.html
\[7\] A Djouadi et al, Comp. Phys. Comm. 108 (1998) 56
\[8\] B C Allanach, ‘Theoretical uncertainties in sparticle mass predictions’, hep-ph/0110227
\[9\] S Heinemeyer et al, Comp. Phys. Comm. 124 (2000) 76
the complete list of sparticle masses and decay branching ratios which have been used. In order to reproduce the Isajet spectra with Susygen and Pythia all necessary information is given in the SPS compilations below. Besides the physical masses and branching ratios, further relevant MSSM parameters are:

- MSSMA \( m_{\tilde{g}}, \mu, m_A, \tan^\beta \) gluino mass, \( \mu \), \( A \) mass, \( \tan^\beta \)
- MSSMB \( m_{\tilde{q}_L}, m_{\tilde{d}_R}, m_{\tilde{m}_R}, m_{\tilde{e}_L}, m_{\tilde{e}_R} \) 1\textsuperscript{st} generation squark and slepton masses
- MSSMC \( m_{\tilde{q}_L}, m_{\tilde{t}_R}, m_{\tilde{t}_L}, m_{\tilde{s}_L}, m_{\tilde{s}_R} \) squark and slepton mixings
- MSSMD \( m_{\tilde{q}_L}, m_{\tilde{s}_R}, m_{\tilde{c}_R}, m_{\tilde{\mu}_L}, m_{\tilde{\mu}_R} \) 2\textsuperscript{nd} generation squark and slepton masses
- MSSME \( M_1, M_2 \) gaugino masses

Keeping in mind the previous remarks, we briefly comment the main characteristics of the superparticle spectra obtained with the program codes Isajet, Susygen and Pythia. Note that there exist variants to SPS 1 and SPS 8 with \( \tan^\beta = 30 \), leading to very similar spectra\(^2\).

**SPS 1** The spectra of this ‘typical’ mSUGRA scenario provided by the three programs are in remarkable agreement with each other to within a few percent. Also the decay modes are reasonably similar.

**SPS 2** Most striking in this ‘focus point’ scenario with large \( m_0 \gg m_{1/2} \) are the completely different neutralino and chargino mass spectra of all three programs. Factors of 2 with respect to some central value may easily occur. This is related to the derived values of \( \mu \) which exhibit discrepancies of the same order, casting doubt on the calculations. The other sparticle masses are in reasonable agreement with each other. However, large controversies exist in the treatment of the decays. The heavy sleptons and squarks can decay via all charginos and neutralinos, which apparently do have completely different gaugino and higgsino admixtures, thus leading to different \( \chi \)’s in the final states. This model as a whole needs certainly more care and a better theoretical understanding.

**SPS 3** All spectra of this scenario which lies on a model line into the ‘coannihilation region’ are in good agreement with each other. The masses differ within a few up to ten percent, some branching ratios may need to be adjusted.

**SPS 4** In general the mass spectra are consistent to within 10%. But due to the high \( \tan^\beta \) value larger discrepancies are observed for the third generation of sleptons and squarks and for the Higgs sector of Pythia. The original purpose of this parameter choice was to provide a model with relatively light Higgs bosons. At the time of the Snowmass meeting\(^1\) a value of \( m_A \simeq 310 \text{ GeV} \) was supported by Isajet 7.51 and Suspect 2.0 (point d’Aix 3). Meanwhile the new release Isajet 7.58 gives a considerably higher mass \( m_A = 404 \text{ GeV} \), probably a consequence of a new treatment of the Yukawa bottom coupling at two-loops in the RG evolution. Similarly, if Suspect takes into account additional radiative corrections to all squarks and gauginos, one also gets a larger value of \( m_A = 354 \text{ GeV} \). Thus, in this parameter space with large \( \tan^\beta \) the Higgs spectrum depends sensitively on the details of higher order corrections. This also explains the lowish Higgs masses of Pythia, which uses a one-loop approximation.
SPS 5  The sparticle spectra of all three programs are in general agreement. But the scalar top $\tilde{t}_1$, which should be light in this scenario, is about 20% heavier in Pythia. This leads to quite different decay modes.

SPS 6  Very good agreement among the spectra is observed, since in this mSUGRA like scenario with non-unified gaugino masses the MSSM parameters calculated by Isajet serve as input to Susygen and Pythia. Slight discrepancies occur in the branching ratios.

SPS 7 & 8  Only Isajet is able to generate genuine GMSB scenarios. Since the gravitino is incorporated, the MSSM parameters of Susygen and Pythia are adjusted accordingly. Pythia does not offer to treat $\tilde{\tau}_1$ as NLSP (SPS 7). All the masses are in agreement by construction, except for discrepancies of 5 - 20% in the heavy Higgs sector of Susygen; for the time being a more precise tuning appears problematic. Again there are some differences in the decay channels, most important are those of $\tilde{e}_R$ and $\tilde{\mu}_R$ decays in model SPS 7. The specified parameters do not fix the lifetime of the NLSP, which depends on the fundamental scale $\sqrt{F}$ of SUSY breaking. Isajet allows to set this scale, such that finite decay length distributions $c\tau \sim F^2 \cdot m_{NLSP}^{-5}$ of the NLSP can be studied.

SPS 9  An elementary treatment of AMSB scenarios is only possible in Isajet. Using the corresponding MSSM parameters the appropriate spectra can be produced with Susygen and Pythia. Again there are some inconsistent decay modes, e.g. $\tilde{e}_R$ and $\tilde{\mu}_R$ decays and, more important, the $\tilde{\chi}_1^\pm$ decays. The characteristic feature is the near degeneracy of the lightest chargino and neutralino masses, which critically determines the $\tilde{\chi}_1^\pm$ lifetime and decay modes. The present parameters give $\tau = 165 \text{ ps} (c\tau = 50 \text{ mm})$. The lifetime and proper branching ratios determine the $\tilde{\chi}_1^\pm/\tilde{\chi}_1^0$ search strategy and it is advisable to consult the literature\textsuperscript{10}.

Conclusions  The three event generators Isajet, Susygen and Pythia produce consistent supersymmetric particle spectra for a wide range of commonly accepted SUSY parameters. However, severe discrepancies exist for scenarios with extreme values of parameters, e.g. large $m_0 \gg m_{1/2}$ in the focus point scenario SPS 2 (chargino and neutralino sector) and high $\tan\beta$ of SPS 4 (Higgs sector, 3rd generation sleptons and squarks), where some particle characteristics depend sensitively on higher order corrections. Although the programs are flexible enough to be adjusted to any mass spectrum (including decay modes), it is a priori not obvious which program to prefer. It is the aim of the present compilation to provide detailed information and to help those who are interested to study the properties of the Snowmass benchmark models.

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\textsuperscript{10} J F Gunion, S Mrenna, Phys. Rev. D 64 (2001) 075002
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1 SPS 1 – mSUGRA scenario

| Parameter | Value |
|-----------|-------|
| $m_0$    | 100 GeV |
| $m_{1/2}$ | 250 GeV |
| $A_0$    | $-100$ GeV |
| $\tan \beta$ | 10 |
| sign $\mu$ | $+$ |

‘typical’ scenario $m_0 = 0.4 m_{1/2} = -A_0$

1.1 Spectrum & parameters of ISAJET 7.58

Figure 1: SPS 1 mass spectrum of ISAJET
Isajet parameters

Minimal supergravity (mSUGRA) model:

\[ \begin{align*}
M_0, & \quad M_(1/2), \quad A_0, \quad \tan(\beta), \quad \text{sgn}(\mu), \quad M_t = \\
100.000 & \quad 250.000 \quad -100.000 \quad 10.000 \quad 1.0 \quad 175.000
\end{align*} \]

ISASUGRA unification:

\[ \begin{align*}
M_{\text{GUT}} &= 0.218\times10^{17} \quad g_{\text{GUT}} = 0.714 \quad \alpha_{\text{GUT}} = 0.041 \\
F_{\text{T}} &= 0.481 \quad F_{\text{B}} = 0.046 \quad F_{\text{L}} = 0.069
\end{align*} \]

\[ \begin{align*}
1/\alpha_{\text{em}} &= 127.70 \quad \sin^2(\theta_{\text{w}}) = 0.2309 \quad \alpha_s = 0.119 \\
M_1 &= 99.13 \quad M_2 = 192.74 \quad M_3 = 580.51 \\
\mu(Q) &= 352.39 \quad B(Q) = 44.54 \quad Q = 454.65 \\
M_{H1}^2 &= 3.33\times10^5 \quad M_{H2}^2 = -3.12\times10^5
\end{align*} \]

ISAJET masses (with signs):

\[ \begin{align*}
M(\text{GL}) &= 595.19 \\
M(\text{UL}) &= 537.25 \quad M(\text{UR}) = 520.45 \quad M(DL) = 543.04 \quad M(DR) = 520.14 \\
M(B1) &= 491.91 \quad M(B2) = 524.59 \quad M(T1) = 379.11 \quad M(T2) = 574.71 \\
M(SN) &= 186.00 \quad M(EL) = 202.14 \quad M(ER) = 142.97 \\
M(NTAU) &= 185.06 \quad M(TAU1) = 133.22 \quad M(TAU2) = 206.13 \\
M(Z1) &= -96.05 \quad M(Z2) = -176.82 \quad M(Z3) = 358.81 \quad M(Z4) = -377.81 \\
M(W1) &= -176.38 \quad M(W2) = -378.23 \\
M(HL) &= 113.97 \quad M(HH) = 394.15 \quad M(HA) = 393.63 \quad M(H+) = 401.77 \\
\theta_t &= 0.9603 \quad \theta_b = 0.4916 \quad \theta_l = 1.2876 \quad \alpha_h = 0.1107
\end{align*} \]

Neutralino masses (signed):

\[ \begin{align*}
-96.05 & \quad -176.82 \quad 358.815 \quad -377.811
\end{align*} \]

Eigenvector 1:

\[ \begin{align*}
0.05441 &= -0.15001 \quad -0.05711 \quad 0.98553
\end{align*} \]

Eigenvector 2:

\[ \begin{align*}
0.16023 &= -0.27963 \quad -0.94070 \quad -0.10592
\end{align*} \]

Eigenvector 3:

\[ \begin{align*}
-0.71046 &= -0.69495 \quad 0.09245 \quad -0.06120
\end{align*} \]

Eigenvector 4:

\[ \begin{align*}
0.68309 &= -0.64525 \quad 0.32137 \quad -0.11730
\end{align*} \]

Chargino masses (signed):

\[ \begin{align*}
-176.383 & \quad -378.229
\end{align*} \]

Gammal, Gammar:

\[ \begin{align*}
1.99234 &= 1.80868
\end{align*} \]

Isajet equivalent input:

\[ \begin{align*}
\text{MSSMA:} & \quad 595.19 \quad 352.39 \quad 393.63 \quad 10.00 \\
\text{MSSMB:} & \quad 539.86 \quad 519.53 \quad 521.66 \quad 196.64 \quad 136.23 \\
\text{MSSMC:} & \quad 495.91 \quad 516.86 \quad 424.83 \quad 195.75 \quad 133.55 \quad -510.01 \quad -772.66 \quad -254.20 \\
\text{MSSMD:} & \quad \text{SAME AS MSSMB (DEFAULT)} \\
\text{MSSME:} & \quad 99.13 \quad 192.74
\end{align*} \]
1.2 Spectrum & parameters of SUSYGEN 3.00/27

![Figure 2: SPS 1 mass spectrum of SUSYGEN](image-url)
Susygen parameters

Susygen Inputs:
----------------
\( m_0 = 100.000 \)
\( \tan B = 10.000 \)
\( m_{1/2} = 250.000 \)
\( \mu/|\mu| = 1 \)
\( A_0 = -100.000 \)

Sparticle masses:
----------------
\( \text{SUPR} 550. \) \( \text{SUPL} 570. \)
\( \text{SDNR} 549. \) \( \text{SDNL} 575. \)
\( \text{SELR} 145. \) \( \text{SELL} 204. \)
\( \text{SNU} 188. \)
\( \text{STP1} 412. \) \( \text{STP2} 576. \) \( \cosmix = 0.534 \)
\( \text{SBT1} 520. \) \( \text{SBT2} 550. \) \( \cosmix = 0.913 \)
\( \text{STA1} 136. \) \( \text{STA2} 208. \) \( \cosmix = 0.271 \)
\( \text{SGLU} 618. \)

Gaugino masses:
----------------
\( M_1 = 102.191 \)
\( M_2 = 191.812 \)
\( M_3 = 588.293 \)

\( \text{NEUTRALINO m, CP, ph/zi/ha/hb 1} = 98.8 \)
\( \text{NEUTRALINO m, CP, ph/zi/ha/hb 2} = 174.9 \)
\( \text{NEUTRALINO m, CP, ph/zi/ha/hb 3} = 348.4 \)
\( \text{NEUTRALINO m, CP, ph/zi/ha/hb 4} = 368.7 \)

\( \text{CHARGINO MASSES} = 174.211 \)
\( \text{CHARGINO ETA} = -1.000 \)

\( \text{U matrix} \)
\( W_1SS+ = -0.905 \)
\( W_1SS- = 0.968 \)
\( W_2SS+ = 0.426 \)
\( W_2SS- = 0.249 \)

Higgses masses:
----------------
\( \text{Light CP-even Higgs} = 111.794 \)
\( \text{Heavy CP-even Higgs} = 384.532 \)
\( \text{CP-odd Higgs} = 384.598 \)
\( \text{Charged Higgs} = 392.561 \)
\( \sin(a-b) = -0.111 \)
\( \cos(a-b) = 0.994 \)
1.3 Spectrum & parameters of PYTHIA 6.2/00

Figure 3: SPS 1 mass spectrum of PYTHIA
Pythia parameters

SUGRA input parameters

| Parameter | IMSS | RMSS |
|-----------|------|------|
| m_0       | 8    | 100.0|
| m_1/2     | 1    | 250.0|
| A_0       | 16   | -100.0|
| tan_beta  | 5    | 10.00 |
| sign mu   | 4    | 1.000 |

sparticle masses & widths

| Parameter | IMSS | RMSS |
|-----------|------|------|
| M_se_R    | RMSS(8) = 145.8 (0.204) | M_se_L 211.4 (0.235) | M_sne_L 195.8 (0.173) |
| M_se_R    | RMSS(9) = 145.8 (0.204) | M_sm_L 211.4 (0.235) | M_snm_L 195.8 (0.173) |
| M_st_1    | RMSS(10) = 146.0 (0.198) | M_st_2 220.2 (0.335) | M_snt_L 195.6 (0.171) |
| M_ch0_1   | RMSS(11) = 99.9 (0.000) | M_ch0_2 188.4 (0.015) | M_ch0_3 375.7 (2.209) |
| M_ch0_4   | RMSS(12) = 394.2 (2.946) | M_ch+1 187.7 (0.012) | M_ch+2 394.8 (2.888) |
| M_h0      | RMSS(13) = 111.7 (0.004) | M_H0 412.1 (0.910) | M_A0 411.9 (0.980) |
| M_H+      | RMSS(14) = 419.5 (0.855) | M_g~ 627.8 (11.779) |
| M_uL      | RMSS(15) = 554.4 (5.376) | M_uR 535.3 (1.127) | M_dL 559.3 (5.159) |
| M_dR      | RMSS(16) = 534.4 (0.281) | M_b1 504.2 (3.590) | M_t1 381.3 (1.768) |
| M_t2      | RMSS(17) = 587.1 (7.620) | |

Parameter settings IMSS, RMSS

| Parameter | IMSS | RMSS |
|-----------|------|------|
| IMSS(1)   | 2    | 250.0 |
| IMSS(2)   | 0    | 204.0 |
| IMSS(3)   | 600.2 | 369.6 |
| IMSS(4)   | 10.00 | 145.8 |
| IMSS(5)   | 145.8 | 100.0 |
| IMSS(6)   | 100.0 | -532.9 |
| IMSS(7)   | 700.0 | 430.3 |
| IMSS(8)   | 504.9 | 211.2 |
| IMSS(9)   | 530.1 | 145.3 |
| IMSS(10)  | 504.9 | 145.3 |
| IMSS(11)  | 412.1 | 800.0 |
| IMSS(12)  | 100.0 | 1.000 |
| IMSS(13)  | 0.4100E-01 | 0.1000E+05 |
| IMSS(14)  | 0.4100E-01 | 0.1000E+05 |
| IMSS(15)  | 0.4100E-01 | 0.1000E+05 |
| IMSS(16)  | 0.4100E-01 | 0.1000E+05 |
| IMSS(17)  | 0.4100E-01 | 0.1000E+05 |
| IMSS(18)  | 0.4100E-01 | 0.1000E+05 |
| IMSS(19)  | 0.4100E-01 | 0.1000E+05 |
| IMSS(20)  | 0.4100E-01 | 0.1000E+05 |
| IMSS(21)  | 0.4100E-01 | 0.1000E+05 |
| IMSS(22)  | 0.4100E-01 | 0.1000E+05 |
| IMSS(23)  | 0.4100E-01 | 0.1000E+05 |
| IMSS(24)  | 0.4100E-01 | 0.1000E+05 |
| IMSS(25)  | 0.4100E-01 | 0.1000E+05 |
| IMSS(26)  | 0.4100E-01 | 0.1000E+05 |
| IMSS(27)  | 0.4100E-01 | 0.1000E+05 |
| IMSS(28)  | 0.4100E-01 | 0.1000E+05 |
| IMSS(29)  | 0.4100E-01 | 0.1000E+05 |
| IMSS(30)  | 0.4100E-01 | 0.1000E+05 |
| IMSS(31)  | 0.4100E-01 | 0.1000E+05 |
| IMSS(32)  | 0.4100E-01 | 0.1000E+05 |
| IMSS(33)  | 0.4100E-01 | 0.1000E+05 |
| IMSS(34)  | 0.4100E-01 | 0.1000E+05 |
| IMSS(35)  | 0.4100E-01 | 0.1000E+05 |
| IMSS(36)  | 0.4100E-01 | 0.1000E+05 |
| IMSS(37)  | 0.4100E-01 | 0.1000E+05 |
| IMSS(38)  | 0.4100E-01 | 0.1000E+05 |
| IMSS(39)  | 0.4100E-01 | 0.1000E+05 |
| IMSS(40)  | 0.4100E-01 | 0.1000E+05 |
1.4 Decay modes

| particle | $m_I$  | $m_S$  | $m_P$  | decay     | $B_I$ | $B_S$ | $B_P$ |
|----------|--------|--------|--------|-----------|------|------|------|
| $\tilde{e}^-_R$ | 143.0  | 144.9  | 145.8  | $\tilde{\chi}^0_1 e^-$ | 1.000 | 1.000 | 1.000 |
| $\tilde{e}^-_L$ | 202.1  | 204.1  | 211.4  | $\tilde{\chi}^0_1 e^-$ | 0.490 | 0.408 | 0.556 |
|              |        |        |        | $\tilde{\chi}^0_2 e^-$ | 0.187 | 0.218 | 0.159 |
|              |        |        |        | $\tilde{\chi}^0_1 \nu_e$ | 0.323 | 0.374 | 0.285 |
| $\tilde{\nu}_e$ | 186.0  | 188.2  | 195.8  | $\tilde{\chi}^0_1 \nu_e$ | 0.885 | 0.786 | 0.920 |
|              |        |        |        | $\tilde{\chi}^0_2 \nu_e$ | 0.031 | 0.057 |       |
|              |        |        |        | $\tilde{\chi}^+ e^-$ | 0.083 | 0.157 | 0.059 |
| $\tilde{\mu}^-_R$ | 143.0  | 144.9  | 145.8  | $\tilde{\chi}^0_1 \mu^-$ | 1.000 | 1.000 | 1.000 |
| $\tilde{\mu}^-_L$ | 202.1  | 204.1  | 211.4  | $\tilde{\chi}^0_1 \mu^-$ | 0.490 | 0.408 | 0.556 |
|              |        |        |        | $\tilde{\chi}^0_2 \mu^-$ | 0.187 | 0.218 | 0.159 |
|              |        |        |        | $\tilde{\chi}^0_1 \nu_\mu$ | 0.323 | 0.374 | 0.285 |
| $\tilde{\nu}_\mu$ | 186.0  | 188.2  | 195.8  | $\tilde{\chi}^0_1 \nu_\mu$ | 0.885 | 0.786 | 0.920 |
|              |        |        |        | $\tilde{\chi}^0_2 \nu_\mu$ | 0.031 | 0.057 |       |
|              |        |        |        | $\tilde{\chi}^+ \mu^-$ | 0.083 | 0.157 | 0.059 |
| $\tilde{\tau}^-_1$ | 133.2  | 136.0  | 146.0  | $\tilde{\chi}^0_1 \tau^-$ | 1.000 | 1.000 | 1.000 |
| $\tilde{\tau}^-_2$ | 206.1  | 207.7  | 220.2  | $\tilde{\chi}^0_1 \tau^-$ | 0.526 | 0.453 | 0.504 |
|              |        |        |        | $\tilde{\chi}^0_2 \tau^-$ | 0.174 | 0.203 | 0.179 |
|              |        |        |        | $\tilde{\chi}^0_1 \nu_\tau$ | 0.300 | 0.344 | 0.316 |
| $\tilde{\nu}_\tau$ | 185.1  | 187.2  | 195.6  | $\tilde{\chi}^0_1 \nu_\tau$ | 0.906 | 0.806 | 0.926 |
|              |        |        |        | $\tilde{\chi}^0_2 \nu_\tau$ | 0.052 |       |       |
|              |        |        |        | $\tilde{\chi}^+ \tau^-$ | 0.067 | 0.142 | 0.054 |

Table 1: Slepton masses (GeV) and significant branching ratios (> 3%) from Isajet (I), Susygen (S) and Pythia (P)
| particle | $m_I$ | $m_S$ | $m_P$ | decay | $B_I$ | $B_S$ | $B_P$ |
|----------|-------|-------|-------|-------|-------|-------|-------|
| $\tilde{\chi}^0_1$ | 96.1  | 98.8  | 99.9  |       | 1.000 | 1.000 | 1.000 |
| $\tilde{\chi}^0_2$ | 176.8 | 174.9 | 188.4 | $\tilde{e}_R e^+$ | 0.031 | 0.037 | 0.044 |
|          |       |       |       | $\tilde{e}_R e^-$ | 0.031 | 0.037 | 0.044 |
|          |       |       |       | $\tilde{\mu}_R \mu^+$ | 0.031 | 0.037 | 0.044 |
|          |       |       |       | $\tilde{\mu}_R \mu^-$ | 0.031 | 0.037 | 0.044 |
|          |       |       |       | $\tilde{\tau}_1 \tau^+$ | 0.437 | 0.424 | 0.407 |
|          |       |       |       | $\tilde{\tau}_1 \tau^-$ | 0.437 | 0.424 | 0.407 |
| $\tilde{\chi}^0_3$ | 358.8 | 348.4 | 375.7 | $\tilde{\chi}^+_1 W^-$ | 0.298 | 0.349 | 0.299 |
|          |       |       |       | $\tilde{\chi}^+_1 W^+$ | 0.298 | 0.349 | 0.299 |
|          |       |       |       | $\tilde{\chi}^0_2 Z^0$ | 0.108 | 0.087 | 0.106 |
|          |       |       |       | $\tilde{\chi}^0_2 Z^0$ | 0.215 | 0.155 | 0.218 |
| $\tilde{\chi}^0_4$ | 377.8 | 368.7 | 394.2 | $\tilde{\chi}^+_1 W^-$ | 0.263 | 0.302 | 0.263 |
|          |       |       |       | $\tilde{\chi}^+_1 W^+$ | 0.263 | 0.302 | 0.263 |
|          |       |       |       | $\tilde{\chi}^0_2 h^0$ | 0.064 | 0.054 | 0.062 |
|          |       |       |       | $\tilde{\chi}^0_2 h^0$ | 0.134 | 0.103 | 0.144 |

Table 2: Neutralino masses (GeV) and significant branching ratios (> 3%) from Isajet (I), Susygen (S) and Pythia (P)

| particle | $m_I$ | $m_S$ | $m_P$ | decay | $B_I$ | $B_S$ | $B_P$ |
|----------|-------|-------|-------|-------|-------|-------|-------|
| $\tilde{\chi}^+_1$ | 176.4 | 174.2 | 187.7 | $\tilde{\tau}^+ \nu_\tau$ | 0.979 | 0.864 | 0.847 |
|          |       |       |       | $\tilde{\chi}^+_1 W^+$ | 0.153 |       |       |
| $\tilde{\chi}^+_2$ | 378.2 | 369.0 | 394.8 | $\tilde{\chi}^+_2 W^+$ | 0.064 | 0.062 | 0.065 |
|          |       |       |       | $\tilde{\chi}^0_2 W^+$ | 0.296 | 0.303 | 0.065 |
|          |       |       |       | $\tilde{\nu}_L \nu_e$ | 0.052 | 0.056 | 0.049 |
|          |       |       |       | $\tilde{\mu}_L \mu^+$ | 0.052 | 0.056 | 0.049 |
|          |       |       |       | $\tilde{\tau}_2 \nu_\tau$ | 0.056 | 0.055 | 0.051 |
|          |       |       |       | $\tilde{\chi}^+_2 Z^0$ | 0.244 | 0.393 | 0.243 |
|          |       |       |       | $\tilde{\chi}^+_2 h^0$ | 0.170 | 0.173 |       |

Table 3: Chargino masses (GeV) and significant branching ratios (> 3%) from Isajet (I), Susygen (S) and Pythia (P)
| particle | $m_I$  | $m_S$  | $m_P$  | decay       | $B_I$   | $B_S$   | $B_P$   |
|----------|--------|--------|--------|-------------|--------|--------|--------|
| $h^0$    | 114.0  | 111.8  | 111.7  | $\tau^- \tau^+$ | 0.051  | 0.080  | 0.068  |
|          |        |        |        | $bb$ | 0.847  | 0.792  | 0.809  |
|          |        |        |        | $cc$ | 0.035  | 0.043  |        |
|          |        |        |        | $gg$ |        | 0.060  |        |
|          |        |        |        | $W^+W^-$ | 0.040  |        |        |
| $H^0$    | 394.1  | 384.5  | 412.1  | $\tau^- \tau^+$ | 0.059  | 0.091  | 0.094  |
|          |        |        |        | $bb$ | 0.807  | 0.703  | 0.848  |
|          |        |        |        | $tt$ | 0.031  | 0.038  | 0.043  |
|          |        |        |        | $\tilde{\chi}^0_1 \tilde{\chi}^0_2$ | 0.034  |        |        |
|          |        |        |        | $\tilde{\chi}^+_1 \tilde{\chi}^-_1$ |        |        | 0.042  |
| $A^0$    | 393.6  | 384.6  | 411.9  | $\tau^- \tau^+$ | 0.049  | 0.060  | 0.087  |
|          |        |        |        | $bb$ | 0.681  | 0.465  | 0.791  |
|          |        |        |        | $tt$ | 0.092  | 0.099  | 0.119  |
|          |        |        |        | $\tilde{\chi}^0_1 \tilde{\chi}^0_2$ | 0.065  | 0.082  |        |
|          |        |        |        | $\tilde{\chi}^0_2 \tilde{\chi}^0_1$ | 0.058  | 0.075  |        |
|          |        |        |        | $\tilde{\chi}^+_1 \tilde{\chi}^-_1$ |        |        | 0.194  |
| $H^+$    | 401.8  | 392.6  | 419.5  | $\nu_\tau \tau^+$ | 0.077  | 0.093  | 0.102  |
|          |        |        |        | $tb$ | 0.770  | 0.727  | 0.895  |
|          |        |        |        | $\tilde{\chi}^0_1 \tilde{\chi}^0_1$ | 0.130  | 0.165  |        |

Table 4: Higgs masses (GeV) and significant branching ratios ($>3\%$) from **Isajet** (I), **Susygen** (S) and **Pythia** (P)
| particle | $m_I$  | $m_S$  | $m_P$  | decay      | $B_I$  | $B_S$  | $B_P$ |
|----------|-------|-------|-------|------------|-------|-------|-------|
| $t_1$    | 379.1 | 411.6 | 381.3 | $\tilde{\chi}_{1t}^0$ | 0.179 | 0.146 | 0.189 |
|          |       |       |       | $\tilde{\chi}_{2t}^0$ | 0.095 | 0.115 | 0.078 |
|          |       |       |       | $\tilde{\chi}_{1b}^+$ | 0.726 | 0.664 | 0.732 |
|          |       |       |       | $\tilde{\chi}_{2b}^+$ | 0.075 |       |       |
| $t_2$    | 574.7 | 575.7 | 587.1 | $\tilde{\chi}_{1b}^+$ | 0.206 | 0.241 | 0.193 |
|          |       |       |       | $\tilde{\chi}_{2b}^+$ | 0.216 | 0.361 | 0.198 |
|          |       |       |       | $Z^0\tilde{t}_1$ | 0.225 |       | 0.270 |
|          |       |       |       | $\tilde{h}_{1t}^0$ | 0.042 |       | 0.034 |
|          |       |       |       | $\tilde{\chi}_{1t}^0$ | 0.030 |       | 0.032 |
|          |       |       |       | $\tilde{\chi}_{2t}^0$ | 0.080 | 0.056 | 0.078 |
|          |       |       |       | $\tilde{\chi}_{3t}^0$ | 0.033 | 0.163 | 0.036 |
|          |       |       |       | $\tilde{\chi}_{4t}^0$ | 0.166 | 0.164 | 0.158 |
| $b_1$    | 491.9 | 520.0 | 504.2 | $\tilde{\chi}_{1b}^0$ | 0.062 | 0.061 | 0.035 |
|          |       |       |       | $\tilde{\chi}_{2b}^0$ | 0.362 | 0.357 | 0.330 |
|          |       |       |       | $\tilde{\chi}_{1t}^-$ | 0.428 | 0.542 | 0.401 |
|          |       |       |       | $W^-\tilde{t}_1$ | 0.133 |       | 0.224 |
| $b_2$    | 524.6 | 550.4 | 534.6 | $\tilde{\chi}_{1b}^0$ | 0.148 | 0.196 | 0.242 |
|          |       |       |       | $\tilde{\chi}_{2b}^0$ | 0.171 | 0.118 | 0.192 |
|          |       |       |       | $\tilde{\chi}_{3b}^0$ | 0.053 | 0.181 |       |
|          |       |       |       | $\tilde{\chi}_{4b}^0$ | 0.072 | 0.205 |       |
|          |       |       |       | $\tilde{\chi}_{1t}^-$ | 0.213 | 0.153 | 0.255 |
|          |       |       |       | $\tilde{\chi}_{2t}^-$ | 0.147 |       |       |
|          |       |       |       | $W^-\tilde{t}_1$ | 0.344 |       | 0.304 |

Table 5: Light squark masses (GeV) and significant branching ratios (> 3%) from ISAJET (I), SUsYGEN (S) and PYTHIA (P)
2 SPS 2 – mSUGRA scenario

| Parameter | Value       |
|-----------|-------------|
| $m_0$     | 1450 GeV    |
| $m_{1/2}$ | 300 GeV     |
| $A_0$     | 0 GeV       |
| $\tan \beta$ | 10       |
| sign $\mu$ | +          |

‘focus point’ scenario

$m_0 = 2m_{1/2} + 800$ GeV

2.1 Spectrum & parameters of ISAJET 7.58

Figure 1: SPS 2 mass spectrum of ISAJET
Isajet parameters

Minimal supergravity (mSUGRA) model:

\[
M_0, \ M_{1/2}, \ A_0, \ \tan(\beta), \ \sgn(\mu), \ M_t =
1450.000 \ 300.000 \ 0.000 \ 10.000 \ 1.0 \ 175.000
\]

ISASUGRA unification:

\[
M_GUT = 0.270E+17 \quad g_GUT = 0.701 \quad \alpha_GUT = 0.039
\]

\[
FT_GUT = 0.460 \quad FB_GUT = 0.048 \quad FL_GUT = 0.068
\]

\[
1/\alpha_{em} = 127.71 \quad \sin^2(\theta_{\text{w}}) = 0.2310 \quad \alpha_s = 0.119
\]

\[
M_1 = 120.36 \quad M_2 = 234.12 \quad M_3 = 696.46
\]

\[
u(Q) = 124.77 \quad B(Q) = 1653.71 \quad Q = 1077.13
\]

\[
M_{H_1^2} = 0.205E+07 \quad M_{H_2^2} = 0.319E+05
\]

ISAJET masses (with signs):

\[
\begin{align*}
M(GL) &= 784.37 \\
M(UL) &= 1532.70 \quad M(UR) &= 1530.08 \\
M(B1) &= 1296.56 \quad M(B2) &= 1520.09 \\
M(SN) &= 1454.17 \quad M(EL) &= 1456.33 \\
M(NTAU) &= 1448.15 \quad M(TAU1) &= 1439.46 \\
M(Z1) &= -79.54 \quad M(Z2) &= 135.34 \\
M(W1) &= -104.03 \quad M(W2) &= -269.03 \\
M(HL) &= 115.71 \quad M(HH) &= 1444.10 \\
\theta_t &= 1.4446 \quad \theta_b = 0.0094 \\
\alpha_h &= 0.1007
\end{align*}
\]

NEUTRALINO MASSES (SIGNED) =

\[-79.537 \quad 135.343 \quad -140.839 \quad -269.450\]

EIGENVECTOR 1 =

\[0.45040 \quad -0.64968 \quad -0.26524 \quad 0.55200\]

EIGENVECTOR 2 =

\[0.72890 \quad 0.65991 \quad -0.14274 \quad 0.11336\]

EIGENVECTOR 3 =

\[0.35117 \quad -0.31805 \quad -0.32663 \quad -0.81782\]

EIGENVECTOR 4 =

\[-0.37752 \quad 0.20316 \quad -0.89587 \quad 0.11668\]

CHARGINO MASSES (SIGNED) =

\[-104.031 \quad -269.026\]

GAMMAL, GAMMAR =

\[2.85552 \quad 2.58052\]

ISAJET equivalent input:

MSSMA: 784.37 124.77 1442.95 10.00
MSSMB: 1533.62 1530.29 1530.49 1455.57 1451.04
MSSMC: 1295.25 1519.86 998.47 1449.56 1438.88 -563.70 -797.21 -187.83
MSSMD: SAME AS MSSMB (DEFAULT)
MSSME: 120.36 234.12
2.2 Spectrum & parameters of SUSYGEN 3.00/27

![Figure 2: SPS 2 mass spectrum of Susygen](image)
Susygen **parameters**

Susygen inputs:

--------------

m0 = 1450.000  \( \tan\beta = 10.000 \)

m1/2 = 300.000  \( \mu/|\mu| = 1 \)

A0 = 0.000

Sparticle masses:

--------------

SUPR 1584.  \( \text{SUPL} \) 1593.

SDNR 1583.  \( \text{SDNL} \) 1595.

SELR 1455.  \( \text{SELL} \) 1465.

SNU 1463.

STP1 1022.  \( \text{STP2} \) 1340.  \( \text{cosmix} = 0.103 \)

SBT1 1335.  \( \text{SBT2} \) 1571.  \( \text{cosmix} = 1.000 \)

STA1 1441.  \( \text{STA2} \) 1459.  \( \text{cosmix} = 0.140 \)

SGLU 811.

Gaugino masses:

--------------

\( \text{NEUTRALINO} \) 1, CP, \( \phi/\zeta/\chi/\eta/\theta \) 1 = 123.1 1. 0.837 -0.523 0.077 0.142

\( \text{NEUTRALINO} \) 1, CP, \( \phi/\zeta/\chi/\eta/\theta \) 2 = 214.6 1. -0.543 -0.763 0.218 0.276

\( \text{NEUTRALINO} \) 1, CP, \( \phi/\zeta/\chi/\eta/\theta \) 3 = 377.6 -1. -0.009 0.100 -0.637 0.764

\( \text{NEUTRALINO} \) 1, CP, \( \phi/\zeta/\chi/\eta/\theta \) 4 = 399.9 1. -0.067 -0.368 -0.735 -0.566

\( \text{CHARGINO MASSES} \) = 213.915 399.841

\( \text{CHARGINO ETA} \) = -1.000 1.000

U matrix \( \text{WINO} \) HIGGSINO V matrix \( \text{WINO} \) HIGGSINO

W1SS+ -0.901 0.434 W1SS- 0.960 -0.279

W2SS+ 0.434 0.901 W2SS- 0.279 0.960

Higgses masses:

--------------

Light \( \text{CP-even Higgs} \) = 114.873

Heavy \( \text{CP-even Higgs} \) = 1490.196

\( \text{CP-odd Higgs} \) = 1489.165

\( \text{Charged Higgs} \) = 1491.171

\( \sin(a-b) \) = -0.100

\( \cos(a-b) \) = 0.995
2.3 Spectrum & parameters of PYTHIA 6.2/00

![SPS 2 mass spectrum of Pythia](image)

Figure 3: SPS 2 mass spectrum of PYTHIA
Pythia parameters

SUGRA input parameters
----------------------------
m_0 \quad \text{RMSS}(8) = 1450.
m_{1/2} \quad \text{RMSS}(1) = 300.0
A_0 \quad \text{RMSS}(16) = 0.000
tan\_beta \quad \text{RMSS}(5) = 10.00
sign \mu \quad \text{RMSS}(4) = 1.000

sparticle masses & widths
----------------------------
M_{se\_R} \quad 1455.3 (7.470) \quad M_{se\_L} \quad 1466.8 (19.692) \quad M_{sne\_L} \quad 1464.6 (19.753)
M_{sm\_R} \quad 1455.3 (7.471) \quad M_{sm\_L} \quad 1466.8 (19.693) \quad M_{snm\_L} \quad 1464.6 (19.754)
M_{st\_1} \quad 1450.0 (8.659) \quad M_{st\_2} \quad 1466.1 (19.071) \quad M_{snt\_L} \quad 1462.2 (19.923)
M_{ch0\_1} \quad 122.0 (0.000) \quad M_{ch0\_2} \quad 238.1 (0.001) \quad M_{ch0\_3} \quad 632.3 (4.785)
M_{ch0\_4} \quad 640.3 (4.759)
M_{ch+\_1} \quad 238.0 (0.002) \quad M_{ch+\_2} \quad 641.2 (4.815)
M_{h0} \quad 114.1 (0.004) \quad M_{H0} \quad 1572.3 (3.711) \quad M_{A0} \quad 1571.6 (3.733)
M_{H^+} \quad 1574.6 (3.802)
M_{g^-} \quad 814.1 (0.004)
M_{uL} \quad 1559.7 (68.025) \quad M_{uR} \quad 1549.1 (51.354) \quad M_{dL} \quad 1561.7 (68.063)
M_{dR} \quad 1548.3 (48.633)
M_{b1} \quad 1259.8 (55.517) \quad M_{b2} \quad 1530.2 (47.344) \quad M_{t1} \quad 882.7 (8.311)
M_{t2} \quad 1274.0 (52.448)

parameter settings IMSS, RMSS
-------------------------------
IMSS(1) = 2 \quad IMSS(4) = 1 \quad IMSS(7) = 0 \quad IMSS(10) = 0
IMSS(2) = 0 \quad IMSS(5) = 0 \quad IMSS(8) = 0 \quad IMSS(11) = 0
IMSS(3) = 0 \quad IMSS(6) = 0 \quad IMSS(9) = 0 \quad IMSS(12) = 0
RMSS(1) = 300.0 \quad RMSS(9) = 700.0 \quad RMSS(17) = 0.000
RMSS(2) = 244.9 \quad RMSS(10) = 1259. \quad RMSS(18) = -0.1004
RMSS(3) = 706.3 \quad RMSS(11) = 1530. \quad RMSS(19) = 1573.
RMSS(4) = 628.3 \quad RMSS(12) = 876.4 \quad RMSS(20) = 0.4100E-01
RMSS(5) = 10.00 \quad RMSS(13) = 1464. \quad RMSS(21) = 1.000
RMSS(6) = 1467. \quad RMSS(14) = 1450. \quad RMSS(22) = 800.0
RMSS(7) = 1455. \quad RMSS(15) = 0.000 \quad RMSS(23) = 0.1000E+05
RMSS(8) = 1450. \quad RMSS(16) = -610.2 \quad RMSS(24) = 0.1000E+05
2.4 Decay modes

| particle | $m_I$  | $m_S$  | $m_P$  | decay | $\mathcal{B}_I$ | $\mathcal{B}_S$ | $\mathcal{B}_P$ |
|----------|--------|--------|--------|-------|----------------|----------------|----------------|
| $\tilde{e}_R$ | 1451.7 | 1455.1 | 1455.3 | $\chi_1^0 e^-$ | 0.308 | 0.973 | 0.995 |
|           |        |        |        | $\chi_2^0 e^-$ | 0.667 |       |       |
| $\tilde{e}_L$ | 1456.3 | 1464.9 | 1466.8 | $\chi_1^0 e^-$ | 0.074 | 0.300 | 0.307 |
|           |        |        |        | $\chi_2^0 e^-$ | 0.190 | 0.030 | 0.113 |
|           |        |        |        | $\chi_3^0 e^-$ | 0.207 | 0.563 | 0.601 |
|           |        |        |        | $\tilde{\chi}_1^+ \nu_e$ | 0.051 | 0.498 | 0.582 |
|           |        |        |        | $\tilde{\chi}_2^+ \nu_e$ | 0.551 | 0.104 |       |
| $\tilde{\nu}_e$ | 1454.2 | 1462.7 | 1464.6 | $\chi_1^0 \nu_e$ | 0.103 | 0.112 | 0.101 |
|           |        |        |        | $\chi_2^0 \nu_e$ | 0.231 | 0.285 |       |
|           |        |        |        | $\chi_3^0 \nu_e$ | 0.274 | 0.048 |       |
|           |        |        |        | $\tilde{\chi}_1^+ \mu^-$ | 0.179 | 0.563 | 0.601 |
|           |        |        |        | $\tilde{\chi}_2^+ \mu^-$ | 0.426 | 0.043 |       |
| $\tilde{\mu}_R$ | 1451.7 | 1455.1 | 1455.3 | $\chi_1^0 \mu^-$ | 0.308 | 0.973 | 0.995 |
|           |        |        |        | $\chi_2^0 \mu^-$ | 0.667 |       |       |
| $\tilde{\mu}_L$ | 1456.3 | 1464.9 | 1466.8 | $\chi_1^0 \mu^-$ | 0.074 | 0.300 | 0.307 |
|           |        |        |        | $\chi_2^0 \mu^-$ | 0.190 | 0.030 | 0.113 |
|           |        |        |        | $\chi_3^0 \mu^-$ | 0.207 | 0.563 | 0.601 |
|           |        |        |        | $\tilde{\chi}_1^+ \nu_\mu$ | 0.051 | 0.498 | 0.582 |
|           |        |        |        | $\tilde{\chi}_2^+ \nu_\mu$ | 0.551 | 0.104 |       |
| $\tilde{\nu}_\mu$ | 1454.2 | 1462.7 | 1464.6 | $\chi_1^0 \nu_\mu$ | 0.103 | 0.112 | 0.101 |
|           |        |        |        | $\chi_2^0 \nu_\mu$ | 0.231 | 0.285 |       |
|           |        |        |        | $\chi_3^0 \nu_\mu$ | 0.274 | 0.048 |       |
|           |        |        |        | $\tilde{\chi}_1^+ \mu^-$ | 0.179 | 0.563 | 0.601 |
|           |        |        |        | $\tilde{\chi}_2^+ \mu^-$ | 0.426 | 0.043 |       |
| $\tilde{\tau}_1$ | 1439.5 | 1441.3 | 1450.0 | $\chi_1^0 \tau^-$ | 0.306 | 0.869 | 0.819 |
|           |        |        |        | $\chi_2^0 \tau^-$ | 0.039 | 0.054 |       |
|           |        |        |        | $\chi_3^0 \tau^-$ | 0.613 | 0.045 |       |
|           |        |        |        | $\tilde{\chi}_1^+ \nu_\tau$ | 0.045 | 0.555 | 0.102 |
| $\tilde{\tau}_2$ | 1450.4 | 1458.5 | 1466.1 | $\chi_1^0 \tau^-$ | 0.079 | 0.108 |       |
|           |        |        |        | $\chi_2^0 \tau^-$ | 0.291 | 0.293 |       |
|           |        |        |        | $\chi_3^0 \tau^-$ | 0.190 | 0.033 |       |
|           |        |        |        | $\tilde{\chi}_1^+ \nu_\tau$ | 0.046 | 0.478 | 0.554 |
|           |        |        |        | $\tilde{\chi}_2^+ \nu_\tau$ | 0.545 | 0.111 |       |
| $\tilde{\nu}_\tau$ | 1448.2 | 1456.0 | 1464.4 | $\chi_1^0 \nu_\tau$ | 0.101 | 0.112 | 0.100 |
|           |        |        |        | $\chi_2^0 \nu_\tau$ | 0.231 | 0.282 |       |
|           |        |        |        | $\chi_3^0 \nu_\tau$ | 0.270 | 0.048 |       |
|           |        |        |        | $\tilde{\chi}_1^+ \tau^-$ | 0.190 | 0.563 | 0.595 |
|           |        |        |        | $\tilde{\chi}_2^+ \tau^-$ | 0.421 | 0.042 |       |

Table 1: Slepton masses (GeV) and significant branching ratios (> 3%) from Isajet (I), Susygen (S) and Pythia (P)
| particle | $m_I$ | $m_S$ | $m_P$ | decay | $B_I$ | $B_S$ | $B_P$ |
|----------|-------|-------|-------|-------|-------|-------|-------|
| $\tilde{\chi}_1^0$ | 79.5  | 123.1 | 122.0 | $\tilde{\chi}_1^0$ | 1.000 | 1.000 | 1.000 |
| $\tilde{\chi}_2^0$ | 135.3 | 214.6 | 238.1 | $\tilde{\chi}_1^0 ud$ | 0.033 |       |       |
|          |       |       |       | $\tilde{\chi}_I^0 d\bar{u}$ | 0.033 |       |       |
|          |       |       |       | $\tilde{\chi}_I^0 c\bar{s}$ | 0.033 |       |       |
|          |       |       |       | $\tilde{\chi}_I^0 u\bar{u}$ | 0.096 |       |       |
|          |       |       |       | $\tilde{\chi}_I^0 d\bar{d}$ | 0.124 |       |       |
|          |       |       |       | $\tilde{\chi}_I^0 s\bar{s}$ | 0.124 |       |       |
|          |       |       |       | $\tilde{\chi}_I^0 c\bar{c}$ | 0.096 |       |       |
|          |       |       |       | $\tilde{\chi}_I^0 b\bar{b}$ | 0.114 |       |       |
|          |       |       |       | $\tilde{\chi}_I^0 \nu_e\bar{\nu}_e$ | 0.056 |       |       |
|          |       |       |       | $\tilde{\chi}_I^0 \nu_\mu\bar{\nu}_\mu$ | 0.056 |       |       |
|          |       |       |       | $\tilde{\chi}_I^0 \nu_\tau\bar{\nu}_\tau$ | 0.056 |       |       |
|          | $\tilde{\chi}_I^0 Z^0$ |       |       | 1.000 | 0.223 |       |       |
|          | $\tilde{\chi}_I^0 h^0$ |       |       |       | 0.777 |       |       |
| $\tilde{\chi}_3^0$ | 140.8 | 377.6 | 632.3 | $\tilde{\chi}_1^0 ud$ | 0.155 |       |       |
|          |       |       |       | $\tilde{\chi}_I^0 \nu_e\bar{e}^+$ | 0.052 |       |       |
|          |       |       |       | $\tilde{\chi}_I^0 \nu_\mu\bar{\mu}^+$ | 0.052 |       |       |
|          |       |       |       | $\tilde{\chi}_I^0 d\bar{u}$ | 0.155 |       |       |
|          |       |       |       | $\tilde{\chi}_I^0 e^-\bar{\nu}_e$ | 0.052 |       |       |
|          |       |       |       | $\tilde{\chi}_I^0 \mu^-\bar{\nu}_\mu$ | 0.052 |       |       |
|          |       |       |       | $\tilde{\chi}_I^0 c\bar{s}$ | 0.155 |       |       |
|          |       |       |       | $\tilde{\chi}_I^0 \nu_\tau\tau^+$ | 0.052 |       |       |
|          |       |       |       | $\tilde{\chi}_I^0 \tau^-\bar{\nu}_\tau$ | 0.052 |       |       |
|          | $\tilde{\chi}_I^0 Z^0$ |       |       |       | 0.094 | 0.075 |       |
|          | $\tilde{\chi}_I^0 h^0$ |       |       |       | 0.151 | 0.253 |       |
|          | $\tilde{\chi}_2^0 h^0$ |       |       |       | 0.033 |       |       |
|          | $\tilde{\chi}_I^0 W^-$ |       |       | 0.369 | 0.309 |       |       |
|          | $\tilde{\chi}_I^0 W^+$ |       |       | 0.369 | 0.309 |       |       |
| $\tilde{\chi}_4^0$ | 269.4 | 399.9 | 640.3 | $\tilde{\chi}_1^0 W^-$ | 0.371 | 0.391 | 0.314 |
|          |       |       |       | $\tilde{\chi}_1^0 W^+$ | 0.371 | 0.391 | 0.314 |
|          |       |       |       | $\tilde{\chi}_1^0 Z^0$ | 0.152 | 0.038 |       |
|          |       |       |       | $\tilde{\chi}_1^0 h^0$ | 0.033 | 0.069 | 0.068 |
|          |       |       |       | $\tilde{\chi}_3^0 h^0$ | 0.119 | 0.242 |       |
|          |       |       |       | $\tilde{\chi}_I^0 h^0$ | 0.050 |       |       |

Table 2: Neutralino masses (GeV) and significant branching ratios (> 3%) from Isajet (I), Susygen (S) and Pythia (P)
| particle | $m_I$ | $m_S$ | $m_P$ | decay | $\mathcal{B}_I$ | $\mathcal{B}_S$ | $\mathcal{B}_P$ |
|----------|------|------|------|-------|----------------|----------------|----------------|
| $\tilde{\chi}_1^+$ | 104.0 | 213.9 | 238.0 | $\tilde{\chi}_1^0 u d$ | 0.333 | 0.333 | 0.111 |
|          |      |      |      | $\tilde{\chi}_1^0 c \bar{s}$ |      |      |      |
|          |      |      |      | $\tilde{\chi}_1^0 e^+ \nu_e$ | 0.111 | 0.111 | 0.111 |
|          |      |      |      | $\tilde{\chi}_1^0 \mu^+ \nu_\mu$ |      |      |      |
|          |      |      |      | $\tilde{\chi}_1^0 \tau^+ \nu_\tau$ |      |      |      |
|          |      |      |      | $\tilde{\chi}_1^0 W^+$ | 1.000 | 1.000 |      |
| $\tilde{\chi}_2^+$ | 269.0 | 399.8 | 641.2 | $\tilde{\chi}_2^0 W^+$ | 0.126 | 0.084 | 0.085 |
|          |      |      |      | $\tilde{\chi}_3^0 W^+$ | 0.250 | 0.378 | 0.328 |
|          |      |      |      | $\tilde{\chi}_1^+ Z^0$ | 0.187 |      | 0.297 |
|          |      |      |      | $\tilde{\chi}_1^+ h^0$ | 0.297 | 0.537 | 0.307 |

Table 3: Chargino masses (GeV) and significant branching ratios (> 3%) from Isajet (I), Susygen (S) and Pythia (P)
| particle | $m_I$     | $m_S$     | $m_P$     | decay | $B_I$    | $B_S$    | $B_P$    |
|----------|-----------|-----------|-----------|-------|---------|---------|---------|
| $h^0$    | 115.7     | 114.9     | 114.1     | $\tau^-\tau^+$ | 0.049   | 0.076   | 0.065   |
|          |           |           |           | $bb$   | 0.819   | 0.747   | 0.774   |
|          |           |           |           | $c\bar{c}$ | 0.040   | 0.048   |         |
|          |           |           |           | $gg$   | 0.031   | 0.071   | 0.040   |
|          |           |           |           | $W^+W^-$ | 0.070   | 0.061   |         |
| $H^0$    | 1444.1    | 1490.2    | 1572.3    | $bb$   | 0.149   | 0.094   | 0.724   |
|          |           |           |           | $t\bar{t}$ | 0.032   | 0.033   | 0.184   |
|          |           |           |           | $\tilde{\chi}^0_1\tilde{\chi}^0_1$ | 0.060   |         |         |
|          |           |           |           | $\tilde{\chi}^0_2\tilde{\chi}^0_4$ | 0.055   |         |         |
|          |           |           |           | $\tilde{\chi}^0_3\tilde{\chi}^0_2$ | 0.033   |         |         |
|          |           |           |           | $\tilde{\chi}^0_3\tilde{\chi}^0_3$ | 0.114   |         |         |
|          |           |           |           | $\tilde{\chi}^0_3\tilde{\chi}^0_4$ | 0.133   |         |         |
|          |           |           |           | $\tilde{\chi}^0_1\tilde{\chi}^0_1$ | 0.118   | 0.082   |         |
|          |           |           |           | $\tilde{\chi}^+_1\tilde{\chi}^-_2$ | 0.177   | 0.211   |         |
|          |           |           |           | $\tilde{\chi}^-_1\tilde{\chi}^+_2$ | 0.177   | 0.211   |         |
| $A^0$    | 1443.0    | 1489.2    | 1571.6    | $bb$   | 0.151   | 0.094   | 0.720   |
|          |           |           |           | $t\bar{t}$ | 0.033   | 0.034   | 0.190   |
|          |           |           |           | $\tilde{\chi}^0_1\tilde{\chi}^0_1$ | 0.080   |         |         |
|          |           |           |           | $\tilde{\chi}^0_2\tilde{\chi}^0_4$ | 0.069   |         |         |
|          |           |           |           | $\tilde{\chi}^0_3\tilde{\chi}^0_2$ | 0.046   |         |         |
|          |           |           |           | $\tilde{\chi}^0_3\tilde{\chi}^0_4$ | 0.086   | 0.064   |         |
|          |           |           |           | $\tilde{\chi}^0_4\tilde{\chi}^0_4$ | 0.062   |         |         |
|          |           |           |           | $\tilde{\chi}^0_5\tilde{\chi}^0_4$ | 0.033   |         |         |
|          |           |           |           | $\tilde{\chi}^0_5\tilde{\chi}^0_4$ | 0.044   |         |         |
|          |           |           |           | $\tilde{\chi}^+_1\tilde{\chi}^-_1$ | 0.143   | 0.114   |         |
|          |           |           |           | $\tilde{\chi}^-_2\tilde{\chi}^+_2$ | 0.035   | 0.044   |         |
|          |           |           |           | $\tilde{\chi}^-_1\tilde{\chi}^+_2$ | 0.152   | 0.181   |         |
|          |           |           |           | $\tilde{\chi}^-_1\tilde{\chi}^+_2$ | 0.152   | 0.181   |         |
| $H^+$    | 1446.2    | 1491.2    | 1574.6    | $tb$   | 0.167   | 0.125   | 0.912   |
|          |           |           |           | $\tilde{\chi}^+_1\tilde{\chi}^0_1$ | 0.045   |         |         |
|          |           |           |           | $\tilde{\chi}^+_2\tilde{\chi}^0_2$ | 0.030   |         |         |
|          |           |           |           | $\tilde{\chi}^+_3\tilde{\chi}^0_3$ | 0.098   | 0.219   |         |
|          |           |           |           | $\tilde{\chi}^+_4\tilde{\chi}^0_4$ | 0.191   | 0.229   |         |
|          |           |           |           | $\tilde{\chi}^+_2\tilde{\chi}^0_1$ | 0.186   | 0.034   |         |
|          |           |           |           | $\tilde{\chi}^+_2\tilde{\chi}^0_2$ | 0.186   | 0.295   |         |
|          |           |           |           | $\tilde{\chi}^+_2\tilde{\chi}^0_3$ | 0.104   | 0.034   |         |

Table 4: Higgs masses (GeV) and significant branching ratios (> 3%) from Isajet (I), Susygen (S) and Pythia (P)
| particle | $m_I$   | $m_S$   | $m_P$   | decay                  | $B_I$    | $B_S$    | $B_P$    |
|----------|---------|---------|---------|------------------------|----------|----------|----------|
| $t_1$    | 1003.9  | 1022.4  | 882.7   | $\tilde{g}t$           | 0.119    | 0.233    |          |
|          |         |         |         | $\tilde{\chi}_1^0 t$   | 0.112    | 0.053    | 0.214    |
|          |         |         |         | $\tilde{\chi}_2^0 t$   | 0.225    |          |          |
|          |         |         |         | $\tilde{\chi}_3^0 t$   | 0.089    | 0.172    | 0.178    |
|          |         |         |         | $\tilde{\chi}_4^0 t$   | 0.036    | 0.142    | 0.113    |
|          |         |         |         | $\tilde{\chi}_1^+ b$   | 0.342    | 0.055    | 0.059    |
|          |         |         |         | $\tilde{\chi}_2^0 b$   | 0.077    | 0.321    | 0.409    |
| $t_2$    | 1307.4  | 1340.1  | 1274.0  | $\tilde{g}t$           | 0.456    | 0.376    | 0.420    |
|          |         |         |         | $\tilde{\chi}_1^+ b$   | 0.034    | 0.140    | 0.183    |
|          |         |         |         | $\tilde{\chi}_2^0 t$   | 0.129    |          | 0.202    |
|          |         |         |         | $\tilde{\chi}_1^0 t$   | 0.051    |          |          |
|          |         |         |         | $\tilde{\chi}_2^0 t$   | 0.145    | 0.051    | 0.088    |
|          |         |         |         | $\tilde{\chi}_3^0 t$   | 0.052    | 0.113    | 0.112    |
|          |         |         |         | $\tilde{\chi}_4^0 t$   | 0.109    | 0.117    | 0.128    |
| $b_1$    | 1296.6  | 1334.9  | 1259.8  | $\tilde{\chi}_3^0 b$  | 0.080    | 0.087    |          |
|          |         |         |         | $\tilde{\chi}_4^0 b$   | 0.063    |          |          |
|          |         |         |         | $\tilde{g} b$           | 0.468    | 0.670    | 0.464    |
|          |         |         |         | $\tilde{\chi}_1^0 t$   | 0.207    | 0.151    | 0.167    |
|          |         |         |         | $\tilde{\chi}_2^0 t$   | 0.216    | 0.057    | 0.224    |
|          |         |         |         | $W^- t_1$               |          |          | 0.051    |
| $b_2$    | 1520.1  | 1570.6  | 1530.2  | $\tilde{g} b$           | 0.948    | 0.921    | 0.980    |

Table 5: Light squark masses (GeV) and significant branching ratios (> 3%) from **Isajet (I)**, **Susygen (S)** and **Pythia (P)**
3 SPS 3 – mSUGRA scenario

| Parameter | Value   |
|-----------|---------|
| $m_0$     | 90 GeV  |
| $m_{1/2}$ | 400 GeV |
| $A_0$     | 0 GeV   |
| $\tan \beta$ | 10     |
| sign $\mu$ | +      |

model line into 'coannihilation region'

$m_0 = 0.25 m_{1/2} - 10$ GeV

3.1 Spectrum & parameters of ISAJET 7.58

Figure 1: SPS 3 mass spectrum of ISAJET
Isajet parameters

Minimal supergravity (mSUGRA) model:
\[
M_0, M_{1/2}, A_0, tan(beta), sgn(mu), M_t = 90.000, 400.000, 0.000, 10.000, 1.0, 175.000
\]

ISASUGRA unification:
\[
M_GUT = 0.166E+17, g_GUT = 0.711, alpha_GUT = 0.040
\]
\[
1/alpha_{em} = 127.72, sin^2(\theta_w) = 0.2304, alpha_s = 0.121
\]
\[
M_1 = 162.83, M_2 = 311.38, M_3 = 894.68
\]
\[
u(Q) = 508.59, B(Q) = 64.52, Q = 703.81
\]
\[
M_{H1^2} = 0.700E+05, M_{H2^2} = -0.248E+06
\]

ISAJET masses (with signs):
\[
M(GL) = 914.26
\]
\[
M(UL) = 816.57, M(UR) = 791.78, M(DL) = 820.39, M(DR) = 789.34
\]
\[
M(B1) = 757.50, M(B2) = 791.35, M(T1) = 623.83, M(T2) = 819.54
\]
\[
M(SN) = 275.99, M(EL) = 287.11, M(ER) = 178.33
\]
\[
M(NTAU)= 275.11, M(TAU1)= 170.59, M(TAU2)= 289.22
\]
\[
M(Z1) = -160.55, M(Z2) = -296.95, M(Z3) = 512.87, M(Z4) = -529.57
\]
\[
M(W1) = -296.85, M(W2) = -529.51
\]
\[
M(HL) = 116.95, M(HH) = 573.03, M(HA) = 572.42, M(H+) = 578.30
\]
\[
theta_t= 1.0446, theta_b= 0.4105, theta_l= 1.3960, alpha_h= 0.1052
\]

NEUTRALINO MASSES (SIGNED) = -160.555, -296.949, 512.872, -529.573

EIGENVECTOR 1 = 0.04140, -0.10275, -0.02726, 0.99347

EIGENVECTOR 2 = 0.15060, -0.23308, -0.95905, -0.05670

EIGENVECTOR 3 = 0.70876, 0.70153, -0.06164, 0.04133

EIGENVECTOR 4 = 0.68794, -0.66556, 0.27510, -0.08996

CHARGINO MASSES (SIGNED) = -296.846, -529.512

GAMMAL, GAMMAR = 1.91245, 1.78958

ISAJET equivalent input:
\[
\text{MSSMA: } 914.26, 508.59, 572.42, 10.00
\]
\[
\text{MSSMB: } 818.29, 788.94, 792.57, 283.27, 172.98
\]
\[
\text{MSSMC: } 760.72, 785.64, 661.24, 282.42, 170.03, -733.51, -1042.16, -246.11
\]
\[
\text{MSSMD: SAME AS MSSMB (DEFAULT)}
\]
\[
\text{MSSME: } 162.83, 311.38
\]
3.2 Spectrum & parameters of SUSYGEN 3.00/27

![Figure 2: SPS 3 mass spectrum of Susygen](image-url)
Susygen parameters

Susygen inputs:
-------------

\[ \begin{align*}
m_0 & = 90.000 \\
m_{1/2} & = 400.000 \\
A_0 & = 0.000 \\
m_{\mu/\bar{\mu}} & = 1 \\
\tan \beta & = 10.000
\end{align*} \]

Sparticle masses:
-------------

\[ \begin{align*}
\text{SUPR} & = 835. \\
\text{SDNR} & = 831. \\
\text{SNU} & = 280. \\
\text{STP1} & = 668. \\
\text{SBT1} & = 800. \\
\text{STA1} & = 175. \\
\text{SGLU} & = 949.
\end{align*} \]

Gaugino masses:
-------------

\[ \begin{align*}
M_1 & = 165.439 \\
M_2 & = 309.159 \\
M_3 & = 910.421
\end{align*} \]

Neutralino masses:

\[ \begin{align*}
\text{Neutralino } m, \text{ CP, ph/zi/ha/hb} & = \begin{array}{rrrrrr}
1 & 1 & 0.857 & -0.503 & 0.053 & 0.100 \\
2 & 2 & -0.513 & -0.811 & 0.175 & 0.219 \\
3 & 3 & -0.006 & 0.075 & -0.635 & 0.768 \\
4 & 4 & 0.053 & -0.288 & -0.750 & -0.593 \\
\end{array}
\end{align*} \]

Chargino masses:

\[ \begin{align*}
\text{Chargino masses} & = 294.202 \\
\text{Chargino eta} & = -1.000 \\
\end{align*} \]

\[ \begin{align*}
U \text{ matrix } & \quad W1SS+ \\
V \text{ matrix } & \quad W1SS- \\
W1SS+ & = -0.941 \\
W1SS- & = 0.339 \\
W2SS+ & = 0.339 \\
W2SS- & = 0.941
\end{align*} \]

Higgses masses:
-------------

\[ \begin{align*}
\text{Light CP-even Higgs} & = 114.496 \\
\text{Heavy CP-even Higgs} & = 569.934 \\
\text{CP-odd Higgs} & = 570.032 \\
\text{Charged Higgs} & = 575.354 \\
\sin(\alpha-\beta) & = -0.105 \\
\cos(\alpha-\beta) & = 0.994
\end{align*} \]
3.3 Spectrum & parameters of PYTHIA 6.2/00

Figure 3: SPS 3 mass spectrum of PYTHIA
### Pythia parameters

#### SUGRA input parameters

| Parameter | RMSS value |
|-----------|-------------|
| m_0       | 90.00       |
| m_1/2     | 400.0       |
| A_0       | 0.000       |
| tan_beta  | 10.00       |
| sign mu   | 1.000       |

#### sparticle masses & widths

| Particle | Mass (GeV) |
|----------|------------|
| M_se_R   | 184.4 (0.046) |
| M_se_L   | 305.8 (0.185) |
| M_sne_L  | 295.2 (0.196) |
| M_sm_R   | 184.4 (0.046) |
| M_sm_L   | 305.8 (0.185) |
| M_snm_L  | 295.2 (0.227) |
| M_st_1   | 184.2 (0.045) |
| M_st_2   | 311.9 (0.246) |
| M_snt_L  | 295.0 (0.227) |
| M_ch0_1  | 162.5 (0.000) |
| M_ch0_2  | 314.7 (0.103) |
| M_ch0_3  | 573.9 (3.857) |
| M_ch0_4  | 587.5 (4.406) |
| M_ch+1   | 314.4 (0.100) |
| M_ch+2   | 587.9 (4.398) |
| M_h0     | 114.9 (0.004) |
| M_H0     | 633.8 (1.470) |
| M_A0     | 633.7 (1.531) |
| M_H+     | 638.9 (1.511) |
| M_g^-    | 951.2 (21.123) |
| M_uL     | 834.6 (7.816) |
| M_uR     | 800.8 (1.684) |
| M_dL     | 837.9 (7.677) |
| M_dR     | 797.5 (0.419) |
| M_b1     | 756.0 (7.559) |
| M_b2     | 795.7 (1.538) |
| M_t1     | 591.7 (2.509) |
| M_t2     | 824.7 (12.076) |

#### parameter settings IMSS, RMSS

| IMSS(1) | IMSS(2) | IMSS(3) | IMSS(4) | IMSS(5) | IMSS(6) | IMSS(7) | IMSS(8) | IMSS(9) | IMSS(10) | IMSS(11) | IMSS(12) | IMSS(13) | IMSS(14) | IMSS(15) | IMSS(16) | IMSS(17) | IMSS(18) | IMSS(19) | IMSS(20) | IMSS(21) | IMSS(22) | IMSS(23) | IMSS(24) |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| 2       | 0       | 0       | 1       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       |

| RMSS value | RMSS value | RMSS value | RMSS value |
|-------------|-------------|-------------|-------------|
| 400.0       | 700.0       | 0.000       |
| 326.5       | 757.1       | -0.1040     |
| 914.1       | 792.1       | 634.1       |
| 570.0       | 638.0       | 0.4100E-01  |
| 10.00       | 305.6       | 1.000       |
| 184.4       | 0.000       | 0.1000E+05  |
| 90.00       | -813.6      | 0.1000E+05  |
3.4 Decay modes

| particle | $m_I$ | $m_S$ | $m_P$ | decay | $B_I$ | $B_S$ | $B_P$ |
|----------|-------|-------|-------|-------|-------|-------|-------|
| $\tilde{e}^-_R$ | 178.3 | 182.1 | 184.4 | $\tilde{\chi}_1^0 e^-$ | 1.000 | 1.000 | 1.000 |
| $\tilde{e}^-_L$ | 287.1 | 290.8 | 305.8 | $\tilde{\chi}_1^0 e^-$ | 1.000 | 1.000 | 1.000 |
| $\tilde{\nu}_e$ | 276.0 | 279.8 | 295.2 | $\tilde{\chi}_1^0 \nu_e$ | 1.000 | 1.000 | 1.000 |
| $\tilde{\mu}^-_R$ | 178.3 | 182.1 | 184.4 | $\tilde{\chi}_1^0 \mu^-$ | 1.000 | 1.000 | 1.000 |
| $\tilde{\mu}^-_L$ | 287.1 | 290.8 | 305.8 | $\tilde{\chi}_1^0 \mu^-$ | 1.000 | 1.000 | 1.000 |
| $\tilde{\nu}_\mu$ | 276.0 | 279.8 | 295.2 | $\tilde{\chi}_1^0 \nu_\mu$ | 1.000 | 1.000 | 1.000 |
| $\tilde{\tau}_1$ | 170.6 | 175.0 | 184.2 | $\tilde{\chi}_1^0 \tau^-$ | 1.000 | 1.000 | 1.000 |
| $\tilde{\tau}_2$ | 289.2 | 292.7 | 311.9 | $\tilde{\chi}_1^0 \tau^-$ | 0.873 | 1.000 | 0.847 |
| $\tilde{\nu}_\tau$ | 275.1 | 278.9 | 295.2 | $\tilde{\chi}_1^0 \nu_\tau$ | 0.872 | 1.000 | 0.862 |

Table 1: Slepton masses (GeV) and significant branching ratios (> 3%) from Isajet (I), Susygen (S) and Pythia (P)

| particle | $m_I$ | $m_S$ | $m_P$ | decay | $B_I$ | $B_S$ | $B_P$ |
|----------|-------|-------|-------|-------|-------|-------|-------|
| $\tilde{\chi}_1^0$ | 160.6 | 163.1 | 162.5 | $\tilde{\chi}_1^0 h^0$ | 0.089 | 0.140 | 0.098 |
| $\tilde{\chi}_2^0$ | 296.9 | 294.5 | 314.7 | $\tilde{\chi}_1^0 h^0$ | 0.121 | 0.177 | 0.126 |
| $\tilde{\tau}_1^- \tau^-$ | 121 | 1.177 | 0.126 |
| $\tilde{\nu}_e \nu_e$ | 0.083 | 0.067 | 0.088 |
| $\tilde{\nu}_\mu \nu_\mu$ | 0.083 | 0.067 | 0.088 |
| $\tilde{\nu}_\tau \nu_\tau$ | 0.090 | 0.074 | 0.089 |
| $\tilde{\chi}_3^0$ | 512.9 | 508.5 | 573.9 | $\tilde{\chi}_1^0 W^-$ | 0.295 | 0.334 | 0.298 |
| $\tilde{\chi}_4^0$ | 529.6 | 525.5 | 587.5 | $\tilde{\chi}_1^0 W^+$ | 0.272 | 0.306 | 0.278 |

Table 2: Neutralino masses (GeV) and significant branching ratios (> 3%) from Isajet (I), Susygen (S) and Pythia (P)
### Table 3: Chargino masses (GeV) and significant branching ratios (> 3%) from Isajet (I), Susygen (S) and Pythia (P)

| particle | $m_I$ | $m_S$ | $m_P$ | decay | $B_I$ | $B_S$ | $B_P$ |
|----------|-------|-------|-------|-------|-------|-------|-------|
| $\tilde{\chi}_1^+$ | 296.8 | 294.2 | 314.4 | $\tilde{\chi}_1^0W^+$ | 0.108 | 0.450 | 0.111 |
| | | | | $\tilde{\nu}_e e^+$ | 0.185 | 0.169 | 0.189 |
| | | | | $\tilde{\nu}_\mu \mu^+$ | 0.185 | 0.169 | 0.189 |
| | | | | $\tilde{\nu}_\tau \tau^+$ | 0.202 | 0.189 | 0.194 |
| | | | | $\tilde{\mu}_L \nu_e$ | 0.039 | 0.037 | 0.037 |
| | | | | $\tilde{\tau}_L \nu_e$ | 0.219 | 0.240 | 0.240 |
| $\tilde{\chi}_2^+$ | 529.5 | 525.4 | 587.9 | $\tilde{\chi}_1^0W^+$ | 0.080 | 0.087 | 0.081 |
| | | | | $\tilde{\chi}_2^0W^+$ | 0.291 | 0.322 | 0.296 |
| | | | | $\tilde{\mu}_L \nu_e$ | 0.035 | 0.038 | 0.038 |
| | | | | $\tilde{\tau}_L \nu_e$ | 0.039 | 0.039 | 0.039 |
| | | | | $\tilde{\chi}_1^+ Z^0$ | 0.260 | 0.415 | 0.270 |
| | | | | $\tilde{\chi}_1^+ h^0$ | 0.201 | 0.226 | 0.226 |

### Table 4: Higgs masses (GeV) and significant branching ratios (> 3%) from Isajet (I), Susygen (S) and Pythia (P)

| particle | $m_I$ | $m_S$ | $m_P$ | decay | $B_I$ | $B_S$ | $B_P$ |
|----------|-------|-------|-------|-------|-------|-------|-------|
| $h^0$ | 117.0 | 114.5 | 114.9 | $\tau^- \tau^+$ | 0.049 | 0.077 | 0.065 |
| | | | | $b \bar{b}$ | 0.820 | 0.761 | 0.777 |
| | | | | $c \bar{c}$ | 0.037 | 0.045 | 0.045 |
| | | | | $g g$ | 0.066 | 0.038 | 0.038 |
| | | | | $W^+ W^-$ | 0.062 | 0.063 | 0.063 |
| $H^0$ | 573.0 | 569.9 | 633.8 | $\tau^- \tau^+$ | 0.061 | 0.096 | 0.090 |
| | | | | $b \bar{b}$ | 0.799 | 0.693 | 0.764 |
| | | | | $t \bar{t}$ | 0.113 | 0.164 | 0.139 |
| $A^0$ | 572.4 | 570.0 | 633.7 | $\tau^- \tau^+$ | 0.057 | 0.088 | 0.086 |
| | | | | $b \bar{b}$ | 0.748 | 0.638 | 0.735 |
| | | | | $t \bar{t}$ | 0.144 | 0.202 | 0.176 |
| | | | | $\tilde{\chi}_1^0 \tilde{\chi}_2^0$ | 0.037 | 0.037 | 0.037 |
| $H^+$ | 578.3 | 575.4 | 638.9 | $\nu_\tau \tau^+$ | 0.072 | 0.095 | 0.088 |
| | | | | $t \bar{b}$ | 0.861 | 0.820 | 0.910 |
| | | | | $\tilde{\chi}_1^+ \tilde{\chi}_1^0$ | 0.057 | 0.078 | 0.078 |
| particle | $m_I$  | $m_S$  | $m_P$  | decay | $B_I$  | $B_S$  | $B_P$  |
|----------|--------|--------|--------|-------|--------|--------|--------|
| $t_1$    | 623.8  | 667.7  | 591.7  | $\tilde{\chi}^0_{1t}$ | 0.231  | 0.189  | 0.311  |
|          |        |        |        | $\tilde{\chi}^0_{2t}$ | 0.159  | 0.128  | 0.155  |
|          |        |        |        | $\tilde{\chi}^0_{1b}$ | 0.483  | 0.390  | 0.534  |
|          |        |        |        | $\tilde{\chi}^0_{2b}$ | 0.128  | 0.294  |        |
| $t_2$    | 819.5  | 830.4  | 824.8  | $\tilde{\chi}^0_{1b}$ | 0.206  | 0.220  | 0.223  |
|          |        |        |        | $\tilde{\chi}^0_{2b}$ | 0.157  | 0.330  | 0.107  |
|          |        |        |        | $Z^0\tilde{\tau}_1$ | 0.143  |        | 0.259  |
|          |        |        |        | $h^0\tilde{\tau}_1$ | 0.053  |        | 0.069  |
|          |        |        |        | $\tilde{\chi}^0_2$ | 0.090  | 0.071  | 0.096  |
|          |        |        |        | $\tilde{\chi}^0_3$ | 0.088  | 0.172  | 0.051  |
|          |        |        |        | $\tilde{\chi}^0_4$ | 0.238  | 0.195  | 0.166  |
| $b_1$    | 757.5  | 800.2  | 756.0  | $\tilde{\chi}^0_{1b}$ |        |        | 0.037  |
|          |        |        |        | $\tilde{\chi}^0_{2b}$ | 0.233  | 0.311  | 0.249  |
|          |        |        |        | $\tilde{\chi}^0_{1t}$ | 0.373  | 0.555  | 0.395  |
|          |        |        |        | $\tilde{\chi}^0_{2t}$ | 0.224  |        | 0.051  |
|          |        |        |        | $W^-\tilde{\tau}_1$ | 0.127  |        | 0.333  |
| $b_2$    | 791.3  | 831.3  | 795.7  | $\tilde{\chi}^0_{1b}$ | 0.125  | 0.168  | 0.255  |
|          |        |        |        | $\tilde{\chi}^0_{2b}$ | 0.087  | 0.078  | 0.123  |
|          |        |        |        | $\tilde{\chi}^0_{3b}$ | 0.041  | 0.137  |        |
|          |        |        |        | $\tilde{\chi}^0_{4b}$ | 0.058  | 0.165  |        |
|          |        |        |        | $\tilde{\chi}^0_{1t}$ | 0.143  | 0.130  | 0.203  |
|          |        |        |        | $\tilde{\chi}^0_{2t}$ | 0.356  | 0.322  | 0.101  |
|          |        |        |        | $W^-\tilde{\tau}_1$ | 0.189  |        | 0.315  |

Table 5: Light squark masses (GeV) and significant branching ratios (> 3%) from ISAJET (I), SUSYGEN (S) and PYTHIA (P)
4 SPS 4 – mSUGRA scenario

| Parameter | Value   |
|-----------|---------|
| $m_0$     | 400 GeV |
| $m_{1/2}$ | 300 GeV |
| $A_0$     | 0 GeV   |
| $\tan \beta$ | 50     |
| sign $\mu$ | +       |

‘large tan $\beta$’ scenario

4.1 Spectrum & parameters of ISAJET 7.58

Figure 1: SPS 4 mass spectrum of ISAJET
**ISAJET parameters**

Minimal supergravity (mSUGRA) model:

\[
\begin{align*}
M_0, & \quad M_{1/2}, \quad A_0, \quad \tan(\beta), \quad \text{sgn}(\mu), \quad M_t = \\
400.000 & \quad 300.000 \quad 0.000 \quad 50.000 \quad 1.0 \quad 175.000
\end{align*}
\]

ISASUGRA unification:

\[
\begin{align*}
M_{\text{GUT}} &= 0.211E+17 \quad g_{\text{GUT}} = 0.710 \quad \alpha_{\text{GUT}} = 0.040 \\
F_{\text{T_GUT}} &= 0.486 \quad F_{\text{B_GUT}} = 0.186 \quad F_{\text{L_GUT}} = 0.463
\end{align*}
\]

\[
\begin{align*}
\frac{1}{\alpha_{\text{em}}} &= 127.73 \quad \sin^2(\theta_{\text{w}}) = 0.2310 \quad \alpha_s = 0.119 \\
M_1 &= 120.80 \quad M_2 = 233.17 \quad M_3 = 689.41 \\
\mu(Q) &= 377.03 \quad B(Q) = 13.05 \quad Q = 571.25 \\
M_{H1^2} &= 0.602E+05 \quad M_{H2^2} = -0.140E+06
\end{align*}
\]

**ISAJET masses (with signs):**

\[
\begin{align*}
M(\text{GL}) &= 721.03 \\
M(\text{UL}) &= 730.24 \quad M(\text{UR}) = 715.10 \quad M(\text{DL}) = 734.59 \quad M(\text{DR}) = 714.32 \\
M(\text{B1}) &= 606.86 \quad M(\text{B2}) = 706.45 \quad M(\text{T1}) = 530.58 \quad M(\text{T2}) = 695.88 \\
M(\text{SN}) &= 441.22 \quad M(\text{EL}) = 448.40 \quad M(\text{ER}) = 416.54 \\
M(\text{NTAU}) &= 389.43 \quad M(\text{TAU1}) = 267.61 \quad M(\text{TAU2}) = 414.91 \\
M(Z1) &= -118.66 \quad M(Z2) = -218.14 \quad M(Z3) = 383.91 \quad M(Z4) = -401.08 \\
M(W1) &= -218.06 \quad M(W2) = -402.28 \\
M(\text{HL}) &= 115.39 \quad M(\text{HH}) = 404.63 \quad M(\text{HA}) = 404.43 \quad M(\text{H+}) = 416.28 \\
\end{align*}
\]

\[
\begin{align*}
\theta_t &= 1.0387 \quad \theta_b = 0.6261 \quad \theta_l = 1.1998 \quad \alpha_h = 0.0204
\end{align*}
\]

**NEUTRALINO MASSES (SIGNED) = -118.657 -218.137 383.909 -401.079**

**EIGENVECTOR 1** = 0.04547 -0.13669 -0.03365 0.98900

**EIGENVECTOR 2** = 0.17072 -0.28852 -0.93876 -0.07966

**EIGENVECTOR 3** = -0.70951 -0.69629 0.09011 -0.06055

**EIGENVECTOR 4** = -0.68219 0.64285 -0.33089 0.10895

**CHARGINO MASSES (SIGNED) = -218.062 -402.275**

**GAMMAL, GAMMAR = 1.99843 1.81882**

**ISAJET equivalent input:**

**MSSMA:** 721.03 377.03 404.43 50.00

**MSSMB:** 732.20 713.87 716.00 445.90 414.23

**MSSMC:** 640.09 673.40 556.76 394.72 289.48 -552.20 -729.52 -102.27

**MSSMD:** SAME AS MSSMB (DEFAULT)

**MSSME:** 120.80 233.17
4.2 Spectrum & parameters of SUSYGEN 3.00/27

Figure 2: SPS 4 mass spectrum of Susygen
Susygen parameters

Susygen inputs:
----------------
\[ m_0 = 400.000 \quad \text{TANB} = 50.000 \]
\[ m_{1/2} = 300.000 \quad \mu/|\mu| = 1 \]
\[ A_0 = 0.000 \]

Sparticle masses:
----------------

\begin{align*}
\text{SUPR} & \quad 755. \\
\text{SDNR} & \quad 753. \\
\text{SELR} & \quad 418. \\
\text{SNU} & \quad 445. \\
\text{STP1} & \quad 569. \\
\text{SBT1} & \quad 628. \\
\text{STA1} & \quad 296. \\
\text{SGLU} & \quad 747. \\
\end{align*}

Gaugino masses:
----------------
\[ M_1 = 124.255 \quad M_2 = 232.053 \quad M_3 = 694.630 \]
\[ \text{NEUTRALINO m, CP, ph/zi/ha/hb 1} = 122.0 \quad 1. \quad 0.849 \quad -0.508 \quad 0.050 \quad 0.138 \]
\[ \text{NEUTRALINO m, CP, ph/zi/ha/hb 2} = 216.9 \quad 1. \quad -0.525 \quad -0.782 \quad 0.177 \quad 0.286 \]
\[ \text{NEUTRALINO m, CP, ph/zi/ha/hb 3} = 382.6 \quad -1. \quad -0.009 \quad 0.109 \quad -0.695 \quad 0.710 \]
\[ \text{NEUTRALINO m, CP, ph/zi/ha/hb 4} = 400.0 \quad 1. \quad -0.062 \quad -0.345 \quad -0.695 \quad -0.628 \]
\[ \text{CHARGINO MASSES} = 216.667 \quad 401.170 \]
\[ \text{CHARGINO ETA} = -1.000 \quad 1.000 \]

\begin{align*}
\text{U matrix} & \quad \text{WINO} \quad \text{HIGGSINO} \\
\text{U1SS+} & \quad -0.909 \quad 0.417 \\
\text{U2SS+} & \quad 0.417 \quad 0.909 \\
\text{V matrix} & \quad \text{WINO} \quad \text{HIGGSINO} \\
\text{V1SS-} & \quad 0.969 \quad -0.246 \\
\text{V2SS-} & \quad 0.246 \quad 0.969 \\
\end{align*}

Higgses masses:
----------------
\[ \text{Light CP-even Higgs} = 113.437 \]
\[ \text{Heavy CP-even Higgs} = 351.833 \]
\[ \text{CP-odd Higgs} = 353.570 \]
\[ \text{Charged Higgs} = 361.880 \]
\[ \sin(a-b) = -0.021 \]
\[ \cos(a-b) = 1.000 \]
4.3 Spectrum & parameters of PYTHIA 6.2/00

Figure 3: SPS 4 mass spectrum of PYTHIA
Pythia parameters

SUGRA input parameters

| Parameter | RMSS(8) |   | RMSS(1) |   | RMSS(16) |   | RMSS(5) |   | RMSS(4) |   |
|-----------|---------|---|---------|---|----------|---|---------|---|---------|---|
| m_0       | 400.0   |   | m_1/2   | 300.0 | A_0      | 0.000 | tan_beta | 50.00 | sign mu | 1.000 |

sparticle masses & widths

| sparticle | RMSS(1) |   | RMSS(2) |   | RMSS(3) |   | RMSS(4) |   | RMSS(5) |   | RMSS(6) |   | RMSS(7) |   | RMSS(8) |   | RMSS(9) |   | RMSS(10) |   | RMSS(11) |   | RMSS(12) |   | RMSS(13) |   | RMSS(14) |   | RMSS(15) |   | RMSS(16) |   | RMSS(17) |   | RMSS(18) |   | RMSS(19) |   | RMSS(20) |   | RMSS(21) |   | RMSS(22) |   | RMSS(23) |   | RMSS(24) |   |
|-----------|---------|---|---------|---|---------|---|---------|---|---------|---|---------|---|---------|---|---------|---|---------|---|---------|---|---------|---|---------|---|---------|---|---------|---|---------|---|---------|---|---------|---|---------|---|---------|---|---------|---|---------|---|---------|---|
| M_se_R    | 418.8 (1.782) |   | M_se_L  | 457.2 (3.377) | M_sne_L  | 450.1 (3.396) |   | M_sm_R   | 418.8 (1.783) | M_sm_L  | 457.2 (3.377) | M_snm_L  | 450.1 (3.396) |   | M_st_1   | 356.4 (1.972) | M_st_2  | 467.2 (2.618) | M_snt_L  | 433.7 (3.243) |   | M_ch0_1  | 121.7 (0.000) | M_ch0_2  | 233.3 (0.001) | M_ch0_3  | 440.9 (2.634) |   | M_ch0_4  | 454.0 (2.855) |   | M_ch+_1  | 233.1 (0.005) | M_ch+_2  | 455.6 (3.020) |   | M_h0     | 114.1 (0.004) | M_H0    | 209.6 (7.886) | M_A0     | 209.8 (7.909) |   | M_H+     | 226.9 (3.453) |   | M_g~     | 749.4 (7.937) |   | M_uL     | 746.3 (7.718) | M_uR    | 725.0 (1.563) | M_dL     | 750.4 (7.534) |   | M_dR     | 723.4 (0.390) |   | M_b1     | 519.8 (1.335) | M_b2     | 634.0 (4.829) | M_t1     | 486.7 (2.672) |   | M_t2     | 668.7 (10.050) |   |
### 4.4 Decay modes

| particle | $m_I$ (GeV) | $m_S$ (GeV) | $m_P$ (GeV) | decay | $B_I$ | $B_S$ | $B_P$ |
|----------|-------------|-------------|-------------|-------|-------|-------|-------|
| $\tilde{e}_R^-$ | 416.5 | 418.3 | 418.8 | $\tilde{\chi}_1^0 e^-$ | 0.996 | 0.995 | 0.996 |
| $\tilde{e}_L^-$ | 448.4 | 452.0 | 457.2 | $\tilde{\chi}_1^0 e^-$ | 0.127 | 0.122 | 0.136 |
| | | | | $\tilde{\chi}_2^0 e^-$ | 0.318 | 0.320 | 0.309 |
| | | | | $\tilde{\chi}_1^+ \nu_e$ | 0.546 | 0.547 | 0.555 |
| $\tilde{\nu}_e$ | 441.2 | 444.9 | 450.1 | $\tilde{\chi}_1^0 \nu_e$ | 0.157 | 0.155 | 0.157 |
| | | | | $\tilde{\chi}_2^0 \nu_e$ | 0.250 | 0.250 | 0.261 |
| | | | | $\tilde{\chi}_1^+ e^-$ | 0.588 | 0.590 | 0.582 |
| $\tilde{\mu}_R^-$ | 416.5 | 418.3 | 418.8 | $\tilde{\chi}_1^0 \mu^-$ | 0.996 | 0.995 | 0.996 |
| $\tilde{\mu}_L^-$ | 448.4 | 452.0 | 457.2 | $\tilde{\chi}_1^0 \mu^-$ | 0.127 | 0.122 | 0.136 |
| | | | | $\tilde{\chi}_2^0 \mu^-$ | 0.318 | 0.320 | 0.309 |
| | | | | $\tilde{\chi}_1^+ \nu_\mu$ | 0.546 | 0.547 | 0.555 |
| $\tilde{\nu}_\mu$ | 441.2 | 444.9 | 450.1 | $\tilde{\chi}_1^0 \nu_\mu$ | 0.157 | 0.155 | 0.157 |
| | | | | $\tilde{\chi}_2^0 \nu_\mu$ | 0.250 | 0.250 | 0.261 |
| | | | | $\tilde{\chi}_1^+ \mu^-$ | 0.588 | 0.590 | 0.582 |
| $\tilde{\tau}_1^-$ | 267.6 | 296.0 | 356.4 | $\tilde{\chi}_1^0 \tau^-$ | 0.836 | 0.742 | 0.631 |
| | | | | $\tilde{\chi}_2^0 \tau^-$ | 0.057 | 0.090 | 0.129 |
| | | | | $\tilde{\chi}_1^+ \nu_\tau$ | 0.107 | 0.168 | 0.240 |
| $\tilde{\tau}_2^-$ | 414.9 | 424.1 | 467.2 | $\tilde{\chi}_1^0 \tau^-$ | 0.196 | 0.222 | 0.292 |
| | | | | $\tilde{\chi}_2^0 \tau^-$ | 0.263 | 0.308 | 0.261 |
| | | | | $\tilde{\chi}_1^+ \nu_\tau$ | 0.378 | 0.437 | 0.407 |
| | | | | $Z^0 \tilde{\tau}_1^-$ | 0.088 | 0.031 | |
| | | | | $h^0 \tilde{\tau}_1^-$ | 0.063 | |
| $\tilde{\nu}_\tau$ | 389.4 | 400.8 | 433.7 | $\tilde{\chi}_1^0 \nu_\tau$ | 0.152 | 0.171 | 0.157 |
| | | | | $\tilde{\chi}_2^0 \nu_\tau$ | 0.209 | 0.246 | 0.248 |
| | | | | $\tilde{\chi}_1^+ \tau^-$ | 0.542 | 0.583 | 0.595 |
| | | | | $W^+ \tilde{\tau}_1^-$ | 0.097 | |

Table 1: Sleponte masses (GeV) and significant branching ratios (> 3%) from Isajet (I), Susygen (S) and Pythia (P)
Table 2: Neutralino masses (GeV) and significant branching ratios (> 3%) from Isajet (I), Susygen (S) and Pythia (P)

| particle | $m_I$ | $m_S$ | $m_P$ | decay | $B_I$ | $B_S$ | $B_P$ |
|----------|------|------|------|-------|------|------|------|
| $\tilde{\chi}^0_1$ | 118.7 | 122.0 | 121.7 | $\tilde{\chi}^0_1 Z^0$ | 1.000 | 1.000 | 1.000 |
| $\tilde{\chi}^0_2$ | 218.1 | 216.9 | 233.3 | $\tilde{\chi}^0_1 W^-$, $\tilde{\chi}^0_1 W^+$, $\tilde{\chi}^0_2 Z^0$, $\tilde{\tau}_1^+ \tau^+$, $\tilde{\tau}_1^+ \tau^-$ | 0.989 | 0.995 | 1.000 |
| $\tilde{\chi}^0_3$ | 383.9 | 382.6 | 440.9 | $\tilde{\chi}^0_1 W^-$, $\tilde{\chi}^0_1 W^+$, $\tilde{\chi}^0_2 Z^0$, $\tilde{\tau}_1^+ \tau^+$, $\tilde{\tau}_1^+ \tau^-$ | 0.323 | 0.345 | 0.279 |
| $\tilde{\chi}^0_4$ | 401.1 | 400.0 | 454.0 | $\tilde{\chi}^0_1 W^-$, $\tilde{\chi}^0_1 W^+$, $\tilde{\chi}^0_2 Z^0$, $\tilde{\tau}_1^+ \tau^+$, $\tilde{\tau}_1^+ \tau^-$ | 0.312 | 0.364 | 0.285 |

Table 3: Chargino masses (GeV) and significant branching ratios (> 3%) from Isajet (I), Susygen (S) and Pythia (P)

| particle | $m_I$ | $m_S$ | $m_P$ | decay | $B_I$ | $B_S$ | $B_P$ |
|----------|------|------|------|-------|------|------|------|
| $\tilde{\chi}^+_1$ | 218.1 | 216.7 | 233.1 | $\tilde{\chi}^0_1 W^+$ | 0.998 | 1.000 | 1.000 |
| $\tilde{\chi}^+_2$ | 402.3 | 401.2 | 455.6 | $\tilde{\chi}^0_1 W^+$, $\tilde{\chi}^0_2 W^+$, $\tilde{\tau}_1^+ \nu_\tau$, $\tilde{\tau}_1^+ \tau^+$, $\tilde{\tau}_1^+ \tau^-$ | 0.100 | 0.103 | 0.082 |

Table 4: Higgs masses (GeV) and significant branching ratios (> 3%) from Isajet (I), Susygen (S) and Pythia (P)

| particle | $m_I$ | $m_S$ | $m_P$ | decay | $B_I$ | $B_S$ | $B_P$ |
|----------|------|------|------|-------|------|------|------|
| $h^0$ | 115.4 | 113.4 | 114.1 | $\tau^- \tau^+$, $b\bar{b}$, $c\bar{c}$, $gg$, $W^+ W^-$ | 0.050 | 0.078 | 0.066 |
| $H^0$ | 404.6 | 351.8 | 209.6 | $\tau^- \tau^+$, $b\bar{b}$ | 0.067 | 0.112 | 0.137 |
| $A^0$ | 404.4 | 353.6 | 209.8 | $\tau^- \tau^+$, $b\bar{b}$ | 0.067 | 0.112 | 0.137 |
| $H^+$ | 416.3 | 361.9 | 226.9 | $\nu_\tau \tau^+$, $t\bar{b}$ | 0.105 | 0.149 | 0.339 |
| particle | $m_I$  | $m_S$  | $m_P$  | decay | $\mathcal{B}_I$ | $\mathcal{B}_S$ | $\mathcal{B}_P$ |
|----------|--------|--------|--------|-------|----------------|----------------|----------------|
| $t_1$    | 530.6  | 568.5  | 486.7  | $\tilde{t}_1$ | 0.150          | 0.127          | 0.192          |
|          |        |        |        | $\tilde{t}_2$ | 0.127          | 0.116          | 0.154          |
|          |        |        |        | $\tilde{t}_1^+ b$ | 0.468          | 0.396          | 0.631          |
|          |        |        |        | $\tilde{t}_2^+ b$ | 0.256          | 0.343          | 0.488          |
| $t_2$    | 695.9  | 688.8  | 666.7  | $\tilde{t}_1^+ b$ | 0.209          | 0.207          | 0.488          |
|          |        |        |        | $\tilde{t}_2^+ b$ | 0.343          | 0.344          | 0.720          |
|          |        |        |        | $W^+ \tilde{b}_1$ | 0.190          |                |                |
|          |        |        |        | $Z^0 \tilde{t}_1$ | 0.057          |                |                |
|          |        |        |        | $\tilde{\chi}_1^0 t$ | 0.040          |                |                |
|          |        |        |        | $\tilde{\chi}_2^0 t$ | 0.058          | 0.054          | 0.133          |
|          |        |        |        | $\tilde{\chi}_3^0 t$ | 0.079          | 0.175          | 0.208          |
|          |        |        |        | $\tilde{\chi}_4^0 t$ | 0.210          | 0.209          | 0.243          |
| $b_1$    | 606.9  | 627.5  | 519.8  | $\tilde{b}_1$ | 0.072          | 0.060          | 0.139          |
|          |        |        |        | $\tilde{b}_2$ | 0.273          | 0.206          | 0.411          |
|          |        |        |        | $\tilde{b}_3$ | 0.166          | 0.204          |                |
|          |        |        |        | $\tilde{b}_4$ | 0.099          | 0.133          |                |
|          |        |        |        | $\tilde{\chi}^0_1 t$ | 0.343          | 0.333          | 0.447          |
|          |        |        |        | $\tilde{\chi}^0_2 t$ | 0.047          | 0.064          |                |
| $b_2$    | 706.5  | 700.7  | 634.0  | $\tilde{b}_1$ | 0.042          |                |                |
|          |        |        |        | $\tilde{b}_2$ | 0.213          | 0.243          | 0.215          |
|          |        |        |        | $\tilde{b}_3$ | 0.208          | 0.220          |                |
|          |        |        |        | $\tilde{b}_4$ |                | 0.319          |                |
|          |        |        |        | $W^- \tilde{t}_1$ | 0.450          | 0.488          | 0.073          |
|          |        |        |        | $Z^0 \tilde{b}_1$ | 0.086          | 0.310          | 0.033          |

Table 5: Light squark masses (GeV) and significant branching ratios (> 3%) from Isajet (I), Susygen (S) and Pythia (P)
5 SPS 5 – mSUGRA scenario

\[
\begin{array}{|l|c|}
\hline
m_0 & 150 \text{ GeV} \\
\hline
m_{1/2} & 300 \text{ GeV} \\
\hline
A_0 & -1000 \text{ GeV} \\
\hline
\tan \beta & 5 \\
\hline
\text{sign } \mu & + \\
\hline
\end{array}
\]

‘light stop’ scenario

5.1 Spectrum & parameters of ISAJET 7.58

Figure 1: SPS 5 mass spectrum of ISAJET
**ISAJET parameters**

Minimal supergravity (mSUGRA) model:

\[
M_0, \ M_{(1/2)}, \ A_0, \ \tan(\beta), \ \text{sgn}(\mu), \ M_t =
\begin{array}{cccccc}
150.000 & 300.000 & -1000.000 & 5.000 & 1.0 & 175.000
\end{array}
\]

ISASUGRA unification:

\[
\begin{align*}
M_{\text{GUT}} &= 0.190\times10^{17} \\
g_{\text{GUT}} &= 0.713 \\
\alpha_{\text{GUT}} &= 0.040 \\
1/\alpha_{\text{em}} &= 127.66 \\
\sin^2(\theta_{\text{W}}) &= 0.2309 \\
\alpha_s &= 0.119 \\
M_1 &= 121.39 \\
M_2 &= 234.56 \\
M_3 &= 694.68 \\
\mu(Q) &= 639.80 \\
B(Q) &= 144.90 \\
Q &= 449.79 \\
M_{H1}^2 &= 0.572\times10^5 \\
M_{H2}^2 &= -0.393\times10^6 \\
M_{H1} &= 119.79 \\
M_{H2} &= 694.03 \\
M_{H1} &= 693.86 \\
M_{H+} &= 698.49 \\
\theta_t &= 1.0031 \\
\theta_b &= 0.1580 \\
\theta_l &= 1.3356 \\
\alpha_h &= 0.2069 \\
\text{NEUTRALINO MASSES (SIGNED)} &= -119.510, -226.329, 642.833, -652.949 \\
\text{EIGENVECTOR 1} &= 0.02835, -0.07603, -0.02968, 0.99626 \\
\text{EIGENVECTOR 2} &= 0.07465, -0.14434, -0.98579, -0.04251 \\
\text{EIGENVECTOR 3} &= -0.70833, -0.70332, 0.05073, -0.03201 \\
\text{EIGENVECTOR 4} &= 0.70135, -0.69190, 0.15735, -0.06807 \\
\text{CHARGINO MASSES (SIGNED)} &= -226.327, -652.683 \\
\text{GAMMAL, GAMMAR} &= 1.77997, 1.67887
\end{align*}
\]

ISAJET equivalent input:

MSSMA: 710.31 639.80 693.86 5.00
MSSMB: 643.88 622.91 625.44 252.24 186.76
MSSMC: 535.16 620.50 360.54 250.13 180.89 -905.63 -1671.36 -1179.34
MSSMD: SAME AS MSSMB (DEFAULT)
MSSME: 121.39 234.56
5.2 Spectrum & parameters of SUSYGEN 3.00/27

![Figure 2: SPS 5 mass spectrum of Susygen](image-url)

Figure 2: SPS 5 mass spectrum of Susygen
Susygen parameters

Susygen inputs:

\[
\begin{align*}
m_0 &= 150.000 \\
m_{1/2} &= 300.000 \\
A_0 &= -1000.000
\end{align*}
\]

\[
\begin{align*}
\text{TANB} &= 5.000 \\
\text{mu}/|\text{mu}| &= 1
\end{align*}
\]

Sparticle masses:

\[
\begin{align*}
\text{SUPR} &= 658. \\
\text{SDNR} &= 656. \\
\text{SELR} &= 193. \\
\text{SNL} &= 248. \\
\text{STP1} &= 210. \\
\text{STP2} &= 632. \\
\text{SBT1} &= 561. \\
\text{SBT2} &= 654. \\
\text{STA1} &= 183. \\
\text{STA2} &= 261. \\
\text{SGLU} &= 728.
\end{align*}
\]

Gaugino masses:

\[
\begin{align*}
M_1 &= 123.173 \\
M_2 &= 231.684 \\
M_3 &= 712.143
\end{align*}
\]

\[
\begin{align*}
\text{NEUTRALINO } m, \text{ CP, ph/zi/ha/hb } 1 &= 121.2 \\
\text{NEUTRALINO } m, \text{ CP, ph/zi/ha/hb } 2 &= 223.1 \\
\text{NEUTRALINO } m, \text{ CP, ph/zi/ha/hb } 3 &= 628.5 \\
\text{NEUTRALINO } m, \text{ CP, ph/zi/ha/hb } 4 &= 639.0
\end{align*}
\]

\[
\begin{align*}
\text{CHARGINO MASSES} &= 222.964 \\
\text{CHARGINO ETA} &= -1.000
\end{align*}
\]

\[
\begin{align*}
U \text{ matrix } \\
W1SS^+ &= -0.977 \\
W1SS^- &= 0.214 \\
W2SS^+ &= 0.214 \\
W2SS^- &= 0.977
\end{align*}
\]

\[
\begin{align*}
V \text{ matrix } \\
W1SS^+ &= 0.994 \\
W1SS^- &= -0.112 \\
W2SS^+ &= 0.112 \\
W2SS^- &= 0.994
\end{align*}
\]

Higgses masses:

\[
\begin{align*}
\text{Light CP-even Higgs} &= 113.925 \\
\text{Heavy CP-even Higgs} &= 679.220 \\
\text{CP-odd Higgs} &= 679.964 \\
\text{Charged Higgs} &= 684.484 \\
\sin(a-b) &= -0.205 \\
\cos(a-b) &= 0.979
\end{align*}
\]
5.3 Spectrum & parameters of PYTHIA 6.2/00

Figure 3: SPS 5 mass spectrum of PYTHIA
Pythia parameters

SUGRA input parameters

\[
\begin{align*}
\text{m}_0 & \quad \text{RMSS}(8) = 150.0 \\
\text{m}_{1/2} & \quad \text{RMSS}(1) = 300.0 \\
A_0 & \quad \text{RMSS}(16) = -1000. \\
\text{tan}_\beta & \quad \text{RMSS}(5) = 5.000 \\
\text{sign } \mu & \quad \text{RMSS}(4) = 1.000
\end{align*}
\]

Sparticle masses & widths

\[
\begin{align*}
\text{M}_{\text{se}_R} & \quad 194.4 \ (0.366) \\
\text{M}_{\text{se}_L} & \quad 267.1 \ (0.349) \\
\text{M}_{\text{sne}_L} & \quad 255.7 \ (0.281) \\
\text{M}_{\text{sm}_R} & \quad 194.4 \ (0.366) \\
\text{M}_{\text{sm}_L} & \quad 267.1 \ (0.349) \\
\text{M}_{\text{snm}_L} & \quad 255.7 \ (0.281) \\
\text{M}_{\text{st}_1} & \quad 195.9 \ (0.373) \\
\text{M}_{\text{st}_2} & \quad 271.3 \ (0.399) \\
\text{M}_{\text{snt}_L} & \quad 255.1 \ (0.276) \\
\text{M}_{\text{ch0}_1} & \quad 121.4 \ (0.000) \\
\text{M}_{\text{ch0}_2} & \quad 236.5 \ (0.004) \\
\text{M}_{\text{ch0}_3} & \quad 649.9 \ (12.037) \\
\text{M}_{\text{ch0}_4} & \quad 660.1 \ (24.943) \\
\text{M}_{\text{ch}+1} & \quad 236.2 \ (0.005) \\
\text{M}_{\text{ch}+2} & \quad 660.0 \ (15.581) \\
\text{M}_{\text{h0}} & \quad 111.9 \ (0.004) \\
\text{M}_{\text{H0}} & \quad 702.4 \ (1.405) \\
\text{M}_{\text{A0}} & \quad 702.0 \ (1.610) \\
\text{M}_{\text{H}+} & \quad 707.6 \ (1.624) \\
\text{M}_{\text{g}^{-}} & \quad 737.6 \ (19.386) \\
\text{M}_{\text{uL}} & \quad 658.1 \ (6.389) \\
\text{M}_{\text{uR}} & \quad 634.3 \ (1.344) \\
\text{M}_{\text{dL}} & \quad 662.1 \ (6.306) \\
\text{M}_{\text{dR}} & \quad 632.5 \ (0.335) \\
\text{M}_{\text{b1}} & \quad 547.2 \ (14.603) \\
\text{M}_{\text{b2}} & \quad 629.3 \ (0.466) \\
\text{M}_{\text{t1}} & \quad 274.0 \ (0.068) \\
\text{M}_{\text{t2}} & \quad 647.9 \ (15.171)
\end{align*}
\]

Parameter settings IMSS, RMSS

\[
\begin{align*}
\text{IMSS}(1) & = 2 \quad \text{IMSS}(4) = 1 \quad \text{IMSS}(7) = 0 \quad \text{IMSS}(10) = 0 \\
\text{IMSS}(2) & = 0 \quad \text{IMSS}(5) = 0 \quad \text{IMSS}(8) = 0 \quad \text{IMSS}(11) = 0 \\
\text{IMSS}(3) & = 0 \quad \text{IMSS}(6) = 0 \quad \text{IMSS}(9) = 0 \quad \text{IMSS}(12) = 0
\end{align*}
\]

\[
\begin{align*}
\text{RMSS}(1) & = 300.0 \quad \text{RMSS}(9) = 700.0 \quad \text{RMSS}(17) = 1000.0 \\
\text{RMSS}(2) & = 244.9 \quad \text{RMSS}(10) = 544.6 \quad \text{RMSS}(18) = -0.2049 \\
\text{RMSS}(3) & = 706.3 \quad \text{RMSS}(11) = 628.4 \quad \text{RMSS}(19) = 703.5 \\
\text{RMSS}(4) & = 646.9 \quad \text{RMSS}(12) = 384.8 \quad \text{RMSS}(20) = 0.4100\times10^{-1} \\
\text{RMSS}(5) & = 5.000 \quad \text{RMSS}(13) = 266.5 \quad \text{RMSS}(21) = 1.000 \\
\text{RMSS}(6) & = 267.1 \quad \text{RMSS}(14) = 192.7 \quad \text{RMSS}(22) = 800.0 \\
\text{RMSS}(7) & = 194.4 \quad \text{RMSS}(15) = 1000.0 \quad \text{RMSS}(23) = 0.1000\times10^{5} \\
\text{RMSS}(8) & = 150.0 \quad \text{RMSS}(16) = -819.2 \quad \text{RMSS}(24) = 0.1000\times10^{5}
\end{align*}
\]
## 5.4 Decay modes

| particle | $m_I$ | $m_S$ | $m_P$ | decay | $B_I$ | $B_S$ | $B_P$ |
|----------|-------|-------|-------|-------|-------|-------|-------|
| $\tilde{e}_R$ | 191.4 | 193.5 | 194.4 | $\tilde{\chi}_1^0 e^-$ | 1.000 | 1.000 | 1.000 |
| $\tilde{e}_L$ | 256.3 | 259.3 | 267.1 | $\tilde{\chi}_1^0 e^-$ | 0.536 | 0.448 | 0.552 |
| | | | | $\tilde{\chi}_2^0 e^-$ | 0.161 | 0.191 | 0.154 |
| | | | | $\tilde{\chi}_1^0 \nu_e$ | 0.303 | 0.361 | 0.294 |
| $\tilde{\nu}_e$ | 244.5 | 247.7 | 255.7 | $\tilde{\chi}_1^0 \nu_e$ | 0.764 | 0.651 | 0.762 |
| | | | | $\tilde{\chi}_2^0 \nu_e$ | 0.075 | 0.110 | 0.075 |
| | | | | $\tilde{\chi}_1^+ e^-$ | 0.161 | 0.239 | 0.163 |
| $\tilde{\mu}_R$ | 191.4 | 193.5 | 194.4 | $\tilde{\chi}_1^0 \mu^-$ | 1.000 | 1.000 | 1.000 |
| $\tilde{\mu}_L$ | 256.3 | 259.3 | 267.1 | $\tilde{\chi}_1^0 \mu^-$ | 0.536 | 0.448 | 0.552 |
| | | | | $\tilde{\chi}_2^0 \mu^-$ | 0.161 | 0.191 | 0.154 |
| | | | | $\tilde{\chi}_1^0 \nu_\mu$ | 0.303 | 0.361 | 0.294 |
| $\tilde{\nu}_\mu$ | 244.5 | 247.7 | 255.7 | $\tilde{\chi}_1^0 \nu_\mu$ | 0.764 | 0.651 | 0.762 |
| | | | | $\tilde{\chi}_2^0 \nu_\mu$ | 0.075 | 0.110 | 0.075 |
| | | | | $\tilde{\chi}_1^+ \mu^-$ | 0.161 | 0.239 | 0.163 |
| $\tilde{\tau}_1^-$ | 180.7 | 182.7 | 195.9 | $\tilde{\chi}_1^0 \tau^-$ | 1.000 | 1.000 | 1.000 |
| $\tilde{\tau}_2^-$ | 257.9 | 260.5 | 271.3 | $\tilde{\chi}_1^0 \tau^-$ | 0.573 | 0.490 | 0.517 |
| | | | | $\tilde{\chi}_2^0 \tau^-$ | 0.148 | 0.176 | 0.166 |
| | | | | $\tilde{\chi}_1^+ \nu_\tau$ | 0.279 | 0.334 | 0.317 |
| $\tilde{\nu}_\tau$ | 242.3 | 245.4 | 255.1 | $\tilde{\chi}_1^0 \nu_\tau$ | 0.801 | 0.686 | 0.773 |
| | | | | $\tilde{\chi}_2^0 \nu_\tau$ | 0.064 | 0.099 | 0.072 |
| | | | | $\tilde{\chi}_1^+ \tau^-$ | 0.134 | 0.215 | 0.155 |

Table 1: Slepton masses (GeV) and significant branching ratios (> 3%) from Isajet (I), Susygen (S) and Pythia (P)
| particle | $m_I$ | $m_S$ | $m_P$ | decay | $B_I$ | $B_S$ | $B_P$ |
|----------|-------|-------|-------|-------|-------|-------|-------|
| $\tilde{\chi}_1^0$ | 119.5 | 121.2 | 121.4 |       | 1.000 | 1.000 | 1.000 |
| $\tilde{\chi}_2^0$ | 226.3 | 223.1 | 236.5 | $\tilde{\tau}_1^- \tau^+$ | 0.466 | 0.465 | 0.224 |
|           |       |       |       | $\tilde{\tau}_2^+ \tau^-$ | 0.466 | 0.465 | 0.224 |
|           |       |       |       | $\tilde{\chi}_1^0 h^0$ |       |       | 0.416 |
| $\tilde{\chi}_3^0$ | 642.8 | 628.5 | 649.9 | $\tilde{\chi}_1^+ W^-$ | 0.125 | 0.079 | 0.139 |
|           |       |       |       | $\tilde{\chi}_1^- W^+$ | 0.125 | 0.079 | 0.139 |
|           |       |       |       | $\tilde{\chi}_1^0 Z^0$ | 0.033 |       | 0.036 |
|           |       |       |       | $\tilde{\chi}_1^0 Z^0$ | 0.106 | 0.062 | 0.118 |
|           |       |       |       | $\tilde{t}_1 \tilde{t}$ | 0.294 | 0.373 | 0.270 |
|           |       |       |       | $\tilde{t}_1 t$ | 0.294 | 0.373 | 0.270 |
| $\tilde{\chi}_4^0$ | 652.9 | 639.0 | 660.1 | $\tilde{\chi}_1^+ W^+$ | 0.064 | 0.089 | 0.068 |
|           |       |       |       | $\tilde{\chi}_1^- W^+$ | 0.064 | 0.089 | 0.068 |
|           |       |       |       | $\tilde{\chi}_2^0 h^0$ | 0.049 | 0.064 | 0.054 |
|           |       |       |       | $\tilde{t}_1 \tilde{t}$ | 0.391 | 0.352 | 0.383 |
|           |       |       |       | $\tilde{t}_1 t$ | 0.391 | 0.352 | 0.383 |

Table 2: Neutralino masses (GeV) and significant branching ratios (> 3%) from Isajet (I), Susygen (S) and Pythia (P)

| particle | $m_I$ | $m_S$ | $m_P$ | decay | $B_I$ | $B_S$ | $B_P$ |
|----------|-------|-------|-------|-------|-------|-------|-------|
| $\tilde{\chi}_1^+$ | 226.3 | 223.0 | 236.2 | $\tilde{\chi}_1^0 W^+$ | 0.205 | 0.369 | 0.667 |
|           |       |       |       | $\tilde{t}_1 \tilde{b}$ | 0.163 | 0.548 |       |
|           |       |       |       | $\tilde{\tau}_1^+ \nu_\tau$ | 0.622 | 0.080 | 0.333 |
| $\tilde{\chi}_2^+$ | 652.7 | 638.8 | 660.0 | $\tilde{\chi}_2^0 W^+$ | 0.109 | 0.112 | 0.117 |
|           |       |       |       | $\tilde{t}_1 \tilde{b}$ | 0.647 | 0.723 | 0.623 |
|           |       |       |       | $\tilde{\chi}_1^+ Z^0$ | 0.103 | 0.115 | 0.109 |
|           |       |       |       | $\tilde{\chi}_1^+ h^0$ | 0.093 |       | 0.099 |

Table 3: Chargino masses (GeV) and significant branching ratios (> 3%) from Isajet (I), Susygen (S) and Pythia (P)
Table 4: Higgs masses (GeV) and significant branching ratios (> 3%) from Isajet (I), Susygen (S) and Pythia (P)

| particle | $m_I$ | $m_S$ | $m_P$ | decay     | $B_I$ | $B_S$ | $B_P$ |
|----------|-------|-------|-------|-----------|-------|-------|-------|
| $h^0$    | 119.8 | 113.9 | 111.9 | $\tau^+\tau^-$ | 0.048 | 0.080 | 0.066 |
|          |       |       |       | $bb$       | 0.798 | 0.790 | 0.796 |
|          |       |       |       | $c\bar{c}$  | 0.036 | 0.047 |       |
|          |       |       |       | $gg$       | 0.034 | 0.037 |       |
|          |       |       |       | $W^+W^-$   | 0.060 | 0.045 |       |
| $H^0$    | 694.0 | 679.2 | 702.4 | $bb$       | 0.058 | 0.030 | 0.237 |
|          |       |       |       | $t\bar{t}$  | 0.162 | 0.139 | 0.708 |
|          |       |       |       | $\tilde{t}_1\tilde{t}_1$ | 0.735 | 0.790 |       |
| $A^0$    | 693.9 | 680.0 | 702.0 | $bb$       | 0.065 | 0.121 | 0.208 |
|          |       |       |       | $t\bar{t}$  | 0.214 | 0.641 | 0.764 |
|          |       |       |       | $\tilde{t}_1\tilde{t}_1$ | 0.661 |       |       |
|          |       |       |       | $\tilde{h}^0\tilde{h}^0$ |       |       | 0.111 |
| $H^+$    | 698.5 | 684.5 | 707.6 | $tb$       | 0.885 | 0.891 | 0.973 |
|          |       |       |       | $\tilde{t}_1\tilde{h}^0$ | 0.051 | 0.058 |       |
|          |       |       |       | $\tilde{t}_1\tilde{\tau}_1^+$ | 0.036 |       |       |

Table 5: Light squark masses (GeV) and significant branching ratios (> 3%) from Isajet (I), Susygen (S) and Pythia (P)

| particle | $m_I$ | $m_S$ | $m_P$ | decay     | $B_I$ | $B_S$ | $B_P$ |
|----------|-------|-------|-------|-----------|-------|-------|-------|
| $t_1$    | 220.7 | 210.0 | 274.0 | $\tilde{x}^0_{1c}$ | 1.000 | 1.000 | 1.000 |
|          |       |       |       | $\tilde{x}^+_1b$   |       |       |       |
| $t_2$    | 644.6 | 631.6 | 647.9 | $\tilde{x}^+_1b$   | 0.125 | 0.704 | 0.155 |
|          |       |       |       | $Z^0\tilde{t}_1$   | 0.612 | 0.611 |       |
|          |       |       |       | $h^0\tilde{t}_1$   | 0.139 | 0.112 |       |
|          |       |       |       | $W^+\tilde{b}_1$   | 0.060 | 0.043 |       |
|          |       |       |       | $\tilde{x}^0_1t$   | 0.061 |       |       |
|          |       |       |       | $\tilde{x}^0_2t$   | 0.048 | 0.235 | 0.060 |
| $b_1$    | 535.9 | 560.8 | 547.2 | $\tilde{x}^0_2b$   | 0.080 | 0.389 | 0.101 |
|          |       |       |       | $\tilde{x}^0_1t$   | 0.101 | 0.584 | 0.129 |
|          |       |       |       | $W^-\tilde{t}_1$   | 0.813 | 0.764 |       |
| $b_2$    | 623.0 | 654.5 | 629.3 | $\tilde{x}^0_1b$   | 0.285 | 0.894 | 0.711 |
|          |       |       |       | $\tilde{\tau}_2^0b$ | 0.041 |       |       |
|          |       |       |       | $\tilde{x}^0_1t$   | 0.042 | 0.062 |       |
|          |       |       |       | $W^-\tilde{t}_1$   | 0.644 | 0.238 |       |
6 SPS 6 – MSSM scenario

| Parameter | Value     |
|-----------|-----------|
| $m_0$     | 150 GeV   |
| $m_{1/2}$ | 300 GeV   |
| $A_0$     | 0 GeV     |
| $\tan \beta$ | 10 |
| sign $\mu$ | +        |

‘non-unified gaugino masses’

$M_1 = 480$ GeV, $M_2 = M_3 = 300$ GeV

$m_0 = 0.5 M_2$

6.1 Spectrum & parameters of ISAJET 7.58

Figure 1: SPS 6 mass spectrum of ISAJET
**ISAJET parameters**

Minimal supergravity (mSUGRA) model:

\[
\begin{align*}
M_0, & \quad M_{(1/2)}, \quad A_0, \quad \tan(\beta), \quad \text{sgn}(\mu), \quad M_t = \\
& 150.000 \quad 300.000 \quad 0.000 \quad 10.000 \quad 1.0 \quad 175.000 \\
M_1(\text{GUT}) = & \quad 480.00 \quad M_2(\text{GUT}) = \quad 300.00 \quad M_3(\text{GUT}) = \quad 300.00
\end{align*}
\]

**ISASUGRA unification:**

\[
\begin{align*}
M_GUT = & \quad 0.190E+17 \quad g_GUT = 0.713 \quad \alpha_GUT = 0.040 \\
\alpha_{em} = & \quad 127.65 \quad \sin^2(\theta_{\text{w}}) = 0.2308 \quad \alpha_s = 0.119 \\
M_1 = & \quad 195.89 \quad M_2 = \quad 232.06 \quad M_3 = \quad 691.24 \\
\mu(Q) = & \quad 393.89 \quad B(Q) = 54.73 \quad Q = 548.25 \\
M_{H1}^2 = & \quad 0.612E+05 \quad M_{H2}^2 = -0.151E+06 \\
\theta_t = & \quad 0.9831 \quad \theta_b = 0.3882 \quad \theta_l = 1.1799 \quad \alpha_h = 0.1079 \\
\text{EIGENVECTOR 1} = & \quad -0.11796 \quad 0.21288 \quad 0.25953 \quad -0.93456 \\
\text{EIGENVECTOR 2} = & \quad 0.13928 \quad -0.22503 \quad -0.90923 \quad -0.32133 \\
\text{EIGENVECTOR 3} = & \quad -0.70987 \quad -0.69812 \quad 0.08065 \quad -0.04702 \\
\text{EIGENVECTOR 4} = & \quad -0.68027 \quad 0.64550 \quad -0.31533 \quad 0.14534 \\
\end{align*}
\]

**ISAJET masses (with signs):**

\[
\begin{align*}
M(\text{GL}) = & \quad 708.45 \\
M(\text{UL}) = & \quad 639.13 \quad M(\text{UR}) = \quad 628.29 \quad M(\text{DL}) = \quad 644.01 \quad M(\text{DR}) = \quad 622.27 \\
M(\text{B1}) = & \quad 588.93 \quad M(\text{B2}) = \quad 624.45 \quad M(\text{T1}) = \quad 476.16 \quad M(\text{T2}) = \quad 660.67 \\
M(\text{SN}) = & \quad 252.77 \quad M(\text{EL}) = \quad 264.88 \quad M(\text{ER}) = \quad 236.76 \\
M(\text{NTAU}) = & \quad 251.75 \quad M(\text{TAU1}) = \quad 227.92 \quad M(\text{TAU2}) = \quad 269.64 \\
M(\text{Z1}) = & \quad -189.37 \quad M(\text{Z2}) = \quad -217.91 \quad M(\text{Z3}) = \quad 399.31 \quad M(\text{Z4}) = \quad -419.98 \\
M(\text{W1}) = & \quad -215.34 \quad M(\text{W2}) = \quad -418.91 \\
M(\text{HL}) = & \quad 114.83 \quad M(\text{HH}) = \quad 463.62 \quad M(\text{HA}) = \quad 463.04 \quad M(\text{H+}) = \quad 470.11
\end{align*}
\]

\[
\begin{align*}
\theta_t = & \quad 0.9831 \quad \theta_b = \quad 0.3882 \quad \theta_l = \quad 1.1799 \quad \alpha_h = \quad 0.1079 \\
\text{NEUTRALINO MASSES (SIGNED)} = & \quad -189.375 \quad -217.905 \quad 399.307 \quad -419.978 \\
\text{EIGENVECTOR 1} = & \quad -0.11796 \quad 0.21288 \quad 0.25953 \quad -0.93456 \\
\text{EIGENVECTOR 2} = & \quad 0.13928 \quad -0.22503 \quad -0.90923 \quad -0.32133 \\
\text{EIGENVECTOR 3} = & \quad -0.70987 \quad -0.69812 \quad 0.08065 \quad -0.04702 \\
\text{EIGENVECTOR 4} = & \quad -0.68027 \quad 0.64550 \quad -0.31533 \quad 0.14534 \\
\end{align*}
\]

**CHARGINO MASSES (SIGNED):**

\[
\begin{align*}
\text{GAMMAL, GAMMAR} = & \quad 1.97743 \quad 1.81705 \\
\end{align*}
\]

**ISAJET equivalent input:**

\[
\begin{align*}
\text{MSSMA:} & \quad 708.45 \quad 393.89 \quad 463.04 \quad 10.00 \\
\text{MSSMB:} & \quad 641.33 \quad 621.76 \quad 629.29 \quad 260.71 \quad 232.75 \\
\text{MSSMC:} & \quad 591.24 \quad 618.96 \quad 516.96 \quad 259.71 \quad 230.48 \quad -569.95 \quad -811.30 \quad -213.39 \\
\text{MSSMD: SAME AS MSSMB (DEFAULT)} \\
\text{MSSME:} & \quad 195.89 \quad 232.06
\end{align*}
\]
6.2 Spectrum & parameters of SUSYGEN 3.00/25

Figure 2: SPS 6 mass spectrum of SUSYGEN
Susygen parameters

Susygen inputs:
--------------
\[ \begin{align*}
  m_0 & = 150.000 \\
  m_{1/2} & = 300.000 \\
  A_0 & = 0.000 \\
  \tan \beta & = 10.000 \\
  \mu/|\mu| & = 1
\end{align*} \]

Sparticle masses:
--------------

\[
\begin{align*}
  \text{SUPR} & \quad 639. \\
  \text{SDNR} & \quad 644. \\
  \text{SELR} & \quad 237. \\
  \text{SNU} & \quad 253. \\
  \text{STP1} & \quad 476. \\
  \text{STP2} & \quad 661. \quad \cos \text{mix} = 0.554 \\
  \text{SBT1} & \quad 589. \\
  \text{SBT2} & \quad 624. \quad \cos \text{mix} = 0.926 \\
  \text{STA1} & \quad 228. \\
  \text{STA2} & \quad 270. \quad \cos \text{mix} = 0.381 \\
  \text{SGLU} & \quad 708.
\end{align*}
\]

Gaugino masses:
--------------

\[
\begin{align*}
  M_1 & = 195.890 \\
  M_2 & = 232.060 \\
  M_3 & = 691.240
\end{align*}
\]

\[
\begin{align*}
  \text{NEUTRALINO} & \quad m, \text{CP}, \phi/z/\bar{h}/a/hb \ 1 = 189.3 \quad 1. \quad -0.693 \quad 0.678 \quad -0.139 \quad -0.201 \\
  \text{NEUTRALINO} & \quad m, \text{CP}, \phi/z/\bar{h}/a/hb \ 2 = 217.8 \quad 1. \quad 0.720 \quad 0.641 \quad -0.161 \quad -0.210 \\
  \text{NEUTRALINO} & \quad m, \text{CP}, \phi/z/\bar{h}/a/hb \ 3 = 399.3 \quad -1. \quad -0.002 \quad 0.094 \quad -0.637 \quad 0.765 \\
  \text{NEUTRALINO} & \quad m, \text{CP}, \phi/z/\bar{h}/a/hb \ 4 = 420.1 \quad 1. \quad -0.025 \quad -0.347 \quad -0.741 \quad 0.574
\end{align*}
\]

\[
\begin{align*}
  \text{CHARGINO} \quad \text{MASSES} & = 215.088 \quad 419.050 \\
  \text{CHARGINO} \quad \text{ETA} & = -1.000 \quad 1.000
\end{align*}
\]

\[
\begin{align*}
  U \text{ matrix} & \quad W1SS+/ \quad -0.918 \quad 0.396 \\
  \text{WINO} & \quad HIGGSINO \quad W1SS-/ \quad 0.970 \quad -0.244 \\
  V \text{ matrix} & \quad W2SS+/ \quad 0.396 \quad 0.918 \\
  \text{WINO} & \quad HIGGSINO \quad W2SS-/ \quad 0.244 \quad 0.970
\end{align*}
\]

Higgses masses:
--------------

\[
\begin{align*}
  \text{Light \ CP-even \ Higgs} & = 114.830 \\
  \text{Heavy \ CP-even \ Higgs} & = 463.620 \\
  \text{CP-odd \ Higgs} & = 463.040 \\
  \text{Charged \ Higgs} & = 470.110 \\
  \sin(a-b) & = 0.108 \\
  \cos(a-b) & = 0.994
\end{align*}
\]
6.3 Spectrum & parameters of PYTHIA 6.2/00

Figure 3: SPS 6 mass spectrum of PYTHIA

**Figure 3:** SPS 6 mass spectrum of PYTHIA
### Pythia parameters

**MSSM input parameters**

| Parameter | IMSS Value | RMSS Value |
|-----------|------------|------------|
| M_1       | 1          | 195.0      |
| M_2       | 2          | 235.0      |
| M_3       | 3          | 680.0      |
| tan_beta  | 5          | 10.00      |
| mu        | 4          | 400.0      |

**Sparticle masses & widths**

| Sparticle | IMSS Value | RMSS Value |
|-----------|------------|------------|
| M_se_R    | 195.0      | (0.146)    |
| M_se_L    | 265.0      | (0.343)    |
| M_sne_L   | 252.0      | (0.281)    |
| M_sm_R    | 237.0      | (0.146)    |
| M_sm_L    | 265.0      | (0.343)    |
| M_snm_L   | 252.0      | (0.281)    |
| M_st_1    | 227.8      | (0.095)    |
| M_st_2    | 269.6      | (0.369)    |
| M_snt_L   | 247.5      | (0.224)    |
| M_ch0_1   | 189.1      | (0.000)    |
| M_ch0_2   | 220.7      | (0.000)    |
| M_ch0_3   | 405.3      | (2.256)    |
| M_ch+1_1  | 218.2      | (0.000)    |
| M_ch+2_2  | 424.2      | (2.282)    |
| M_h0      | 112.2      | (0.004)    |
| M_H0      | 465.0      | (1.051)    |
| M_A0      | 464.8      | (1.124)    |
| M_H+      | 471.5      | (1.022)    |
| M_g^-     | 713.5      | (10.510)   |
| M_uL      | 637.8      | (6.177)    |
| M_uR      | 619.0      | (1.145)    |
| M_dL      | 642.7      | (5.991)    |
| M_dR      | 620.5      | (0.287)    |
| M_b1      | 589.7      | (4.359)    |
| M_b2      | 623.6      | (1.080)    |
| M_t1      | 474.3      | (2.734)    |
| M_t2      | 662.0      | (9.357)    |

**Parameter settings IMSS, RMSS**

| IMSS( 1) | 1 |
| IMSS( 2) | 0 |
| IMSS( 3) | 0 |
| IMSS( 4) | 1 |
| IMSS( 5) | 0 |
| IMSS( 6) | 0 |
| IMSS( 7) | 0 |
| IMSS( 8) | 0 |
| IMSS( 9) | 0 |
| IMSS(10)| 0 |
| IMSS(11)| 0 |
| IMSS(12)| 0 |

| RMSS( 1) | 195.0 |
| RMSS( 2) | 235.0 |
| RMSS( 3) | 680.0 |
| RMSS( 4) | 400.0 |
| RMSS( 5) | 10.00 |
| RMSS( 6) | 265.0 |
| RMSS( 7) | 237.0 |
| RMSS( 8) | 640.0 |
| RMSS( 9) | 620.0 |
| RMSS(10)| 590.0 |
| RMSS(11)| 620.0 |
| RMSS(12)| 515.0 |
| RMSS(13)| 260.0 |
| RMSS(14)| 230.0 |
| RMSS(15)| 0.000 |
| RMSS(16)| -560.0 |
| RMSS(17)| 0.000 |
| RMSS(18)| -0.1078 |
| RMSS(19)| 465.0 |
| RMSS(20)| 0.4100E-01 |
| RMSS(21)| 1.000 |
| RMSS(22)| 620.0 |
| RMSS(23)| 0.1000E+05 |
| RMSS(24)| 0.1000E+05 |
6.4 Branching ratios

| particle | $m_I$ | $m_S$ | $m_P$ | decay | $B_I$ | $B_S$ | $B_P$ |
|----------|------|------|------|-------|------|------|------|
| $\tilde{e}^-$ | 236.8 | 236.8 | 237.0 | $\tilde{\chi}^0_1 e^-$ | 0.979 | 0.979 | 0.988 |
| $\tilde{e}^+_L$ | 264.9 | 264.9 | 265.0 | $\tilde{\chi}^0_1 e^-$ | 0.046 | 0.045 | 0.070 |
|  |  |  |  | $\tilde{\chi}^0_2 e^-$ | 0.370 | 0.370 | 0.355 |
|  |  |  |  | $\tilde{\chi}^+_1 \nu_e$ | 0.583 | 0.585 | 0.575 |
| $\tilde{\nu}_e$ | 252.8 | 252.8 | 252.7 | $\tilde{\chi}^0_1 \nu_e$ | 0.394 | 0.392 | 0.409 |
|  |  |  |  | $\tilde{\chi}^0_2 \nu_e$ | 0.121 | 0.121 | 0.126 |
|  |  |  |  | $\tilde{\chi}^+_1 e^-$ | 0.485 | 0.487 | 0.465 |
| $\tilde{\mu}^R$ | 236.8 | 236.8 | 237.0 | $\tilde{\chi}^0_1 \mu^-$ | 0.979 | 0.979 | 0.988 |
| $\tilde{\mu}^L$ | 264.9 | 264.9 | 265.0 | $\tilde{\chi}^0_1 \mu^-$ | 0.046 | 0.045 | 0.070 |
|  |  |  |  | $\tilde{\chi}^0_2 \mu^-$ | 0.370 | 0.370 | 0.355 |
|  |  |  |  | $\tilde{\chi}^+_1 \nu_\mu$ | 0.583 | 0.585 | 0.575 |
| $\tilde{\nu}_\mu$ | 252.8 | 252.8 | 252.7 | $\tilde{\chi}^0_1 \nu_\mu$ | 0.394 | 0.392 | 0.409 |
|  |  |  |  | $\tilde{\chi}^0_2 \nu_\mu$ | 0.121 | 0.121 | 0.126 |
|  |  |  |  | $\tilde{\chi}^+_1 \mu^-$ | 0.485 | 0.487 | 0.465 |
| $\tilde{\tau}^-$ | 227.9 | 227.9 | 227.8 | $\tilde{\chi}^0_1 \nu_\tau$ | 0.933 | 0.932 | 0.966 |
|  |  |  |  | $\tilde{\chi}^+_1 \nu_\tau$ | 0.040 | 0.041 |  
| $\tilde{\tau}^-$ | 269.6 | 269.6 | 269.6 | $\tilde{\chi}^0_{1,2} \nu_\tau$ | 0.135 | 0.133 | 0.159 |
|  |  |  |  | $\tilde{\chi}^0_2 \tilde{\tau}^- | 0.346 | 0.346 | 0.329 |
|  |  |  |  | $\tilde{\chi}^+_1 \nu_\tau$ | 0.519 | 0.521 | 0.511 |
| $\tilde{\nu}_\tau$ | 251.7 | 251.8 | 247.5 | $\tilde{\chi}^0_1 \nu_\tau$ | 0.400 | 0.398 | 0.450 |
|  |  |  |  | $\tilde{\chi}^0_2 \nu_\tau$ | 0.120 | 0.119 | 0.115 |
|  |  |  |  | $\tilde{\chi}^+_1 \tau^-$ | 0.480 | 0.483 | 0.435 |

Table 1: Slepton masses (GeV) and significant branching ratios (> 3%) from Isajet (I), Susygen (S) and Pythia (P)
| particle | $m_I$ | $m_S$ | $m_P$ | decay | $B_I$ | $B_S$ | $B_P$ |
|---|---|---|---|---|---|---|---|
| $\tilde{\chi}_1^0$ | 189.4 | 189.3 | 189.1 | | 1.000 | 1.000 | 1.000 |
| $\tilde{\chi}_2^0$ | 217.9 | 217.8 | 220.7 | $\tilde{\chi}_1^0 e^- e^+$ | 0.131 | 0.169 | 0.123 |
| | | | | $\tilde{\chi}_1^0 \mu^- \mu^+$ | 0.131 | 0.169 | 0.123 |
| | | | | $\tilde{\chi}_1^0 \tau^- \tau^+$ | 0.375 | 0.195 | 0.272 |
| | | | | $\tilde{\chi}_1^0 \nu_e \bar{\nu}_e$ | 0.093 | 0.119 | 0.116 |
| | | | | $\tilde{\chi}_1^0 \nu_\mu \bar{\nu}_\mu$ | 0.093 | 0.119 | 0.116 |
| | | | | $\tilde{\chi}_1^0 \nu_\tau \bar{\nu}_\tau$ | 0.099 | 0.127 | 0.160 |
| $\tilde{\chi}_3^0$ | 399.3 | 399.3 | 405.3 | $\tilde{\chi}_1^0 W^-$ | 0.305 | 0.350 | 0.305 |
| | | | | $\tilde{\chi}_1^0 W^+$ | 0.305 | 0.350 | 0.305 |
| | | | | $\tilde{\chi}_1^0 Z^0$ | 0.192 | 0.144 | 0.176 |
| | | | | $\tilde{\chi}_2^0 Z^0$ | 0.152 | 0.114 | 0.165 |
| $\tilde{\chi}_4^0$ | 420.0 | 420.1 | 425.6 | $\tilde{\chi}_1^0 W^-$ | 0.279 | 0.337 | 0.276 |
| | | | | $\tilde{\chi}_1^0 W^+$ | 0.279 | 0.337 | 0.276 |
| | | | | $\tilde{\chi}_1^0 h^0$ | 0.121 | 0.072 | 0.111 |
| | | | | $\tilde{\chi}_2^0 h^0$ | 0.099 | 0.059 | 0.114 |

Table 2: Neutralino masses (GeV) and significant branching ratios (> 3%) from Isajet (I), Susygen (S) and Pythia (P)

| particle | $m_I$ | $m_S$ | $m_P$ | decay | $B_I$ | $B_S$ | $B_P$ |
|---|---|---|---|---|---|---|---|
| $\tilde{\chi}_1^+ u d$ | 215.3 | 215.1 | 218.2 | | 0.295 | 0.303 | 0.292 |
| $\tilde{\chi}_1^+ c s$ | 215.3 | 215.1 | 218.2 | $\tilde{\chi}_1^0 e^+ \nu_e$ | 0.133 | 0.137 | 0.136 |
| | | | | $\tilde{\chi}_1^0 \mu^+ \nu_\mu$ | 0.133 | 0.137 | 0.136 |
| | | | | $\tilde{\chi}_1^0 \tau^+ \nu_\tau$ | 0.144 | 0.128 | 0.146 |
| $\tilde{\chi}_2^+ e^+ L$ | 418.9 | 419.0 | 424.9 | $\tilde{\chi}_2^0 W^+$ | 0.363 | 0.376 | 0.356 |
| | | | | $\tilde{\chi}_2^0 \nu_e$ | 0.038 | 0.040 | 0.038 |
| | | | | $\tilde{\chi}_2^0 \nu_\mu$ | 0.038 | 0.040 | 0.038 |
| | | | | $\tilde{\chi}_2^0 \nu_\tau$ | 0.041 | 0.037 | 0.042 |
| | | | | $\tilde{\chi}_1^0 Z^0$ | 0.265 | 0.433 | 0.263 |
| | | | | $\tilde{\chi}_1^0 h^0$ | 0.185 | 0.188 |

Table 3: Chargino masses (GeV) and significant branching ratios (> 3%) from Isajet (I), Susygen (S) and Pythia (P)
| particle | $m_I$   | $m_S$   | $m_P$   | decay | $B_I$ | $B_S$ | $B_P$ |
|----------|---------|---------|---------|-------|-------|-------|-------|
| $h^0$    | 114.8   | 114.8   | 112.2   | $\tau^-\tau^+$ | 0.050 | 0.069 | 0.067 |
|          |         |         |         | $b\bar{b}$     | 0.837 | 0.799 | 0.802 |
|          |         |         |         | $c\bar{c}$     | 0.036 |        | 0.044 |
|          |         |         |         | $gg$          | 0.060 | 0.034 |       |
|          |         |         |         | $W^+W^-$      | 0.047 | 0.043 |       |
| $H^0$    | 463.6   | 463.6   | 464.9   | $\tau^-\tau^+$ | 0.060 | 0.066 | 0.092 |
|          |         |         |         | $b\bar{b}$     | 0.817 | 0.560 | 0.818 |
|          |         |         |         | $t\bar{t}$     | 0.074 | 0.111 | 0.078 |
|          |         |         |         | $\tilde{\chi}_1^+\tilde{\chi}_1^-$ |       | 0.090 |       |
|          |         |         |         | $\tilde{\chi}_1^0\tilde{\chi}_3^0$ | 0.064 |        |       |
|          |         |         |         | $\tilde{\chi}_2^0\tilde{\chi}_2^0$ | 0.036 |        |       |
| $A^0$    | 463.0   | 463.0   | 464.8   | $\tau^-\tau^+$ | 0.051 | 0.062 | 0.086 |
|          |         |         |         | $b\bar{b}$     | 0.693 | 0.529 | 0.767 |
|          |         |         |         | $t\bar{t}$     | 0.118 | 0.141 | 0.144 |
|          |         |         |         | $\tilde{\chi}_1^0\tilde{\chi}_1^1$ | 0.036 |        |       |
|          |         |         |         | $\tilde{\chi}_1^0\tilde{\chi}_2^1$ | 0.060 |        |       |
|          |         |         |         | $\tilde{\chi}_1^1\tilde{\chi}_2^1$ | 0.263 |        |       |
| $H^+$    | 470.1   | 470.1   | 471.5   | $\nu_\tau\tau^+$ | 0.076 | 0.077 | 0.096 |
|          |         |         |         | $t\bar{b}$     | 0.839 | 0.746 | 0.902 |
|          |         |         |         | $\tilde{\chi}_1^+\tilde{\chi}_1^0$ | 0.074 | 0.138 |       |
|          |         |         |         | $\tilde{\chi}_1^0\tilde{\chi}_1^1$ | 0.032 |        |       |

Table 4: Higgs masses (GeV) and significant branching ratios (> 3%) from **Isajet** (I), **Susygen** (S) and **Pythia** (P)
| particle | $m_I$  | $m_S$  | $m_P$  | decay   | $B_I$  | $B_S$  | $B_P$  |
|----------|--------|--------|--------|---------|--------|--------|--------|
| $t_1$    | 476.2  | 476.2  | 474.3  | $\tilde{\chi}_1^0 t$ | 0.134  | 0.115  | 0.140  |
|          |        |        |        | $\tilde{\chi}_2^0 t$ | 0.166  | 0.143  | 0.163  |
|          |        |        |        | $\tilde{\chi}_1^- b$  | 0.624  | 0.639  | 0.635  |
|          |        |        |        | $\tilde{\chi}_2^+ b$  | 0.075  | 0.103  | 0.062  |
| $t_2$    | 660.7  | 660.7  | 662.0  | $\tilde{\chi}_1^+ b$  | 0.182  | 0.200  | 0.180  |
|          |        |        |        | $\tilde{\chi}_2^+ b$  | 0.210  | 0.359  | 0.203  |
|          |        |        |        | $Z^0 t_{\tilde{t}1}$   | 0.155  |        | 0.169  |
|          |        |        |        | $h^0 t_{\tilde{t}1}$   | 0.036  |        |        |
|          |        |        |        | $\tilde{\chi}_2^0 t$  | 0.088  | 0.060  | 0.089  |
|          |        |        |        | $\tilde{\chi}_3^0 t$  | 0.072  | 0.181  | 0.076  |
|          |        |        |        | $\tilde{\chi}_4^0 t$  | 0.249  | 0.196  | 0.247  |
| $b_1$    | 588.9  | 588.9  | 589.7  | $\tilde{\chi}_1^0 b$  | 0.102  | 0.113  | 0.072  |
|          |        |        |        | $\tilde{\chi}_2^0 b$  | 0.281  | 0.282  | 0.293  |
|          |        |        |        | $\tilde{\chi}_1^- t$  | 0.479  | 0.559  | 0.481  |
|          |        |        |        | $W^- t_{\tilde{t}1}$   | 0.115  |        | 0.140  |
| $b_2$    | 624.5  | 624.5  | 623.6  | $\tilde{\chi}_1^0 b$  | 0.121  | 0.133  | 0.253  |
|          |        |        |        | $\tilde{\chi}_2^0 b$  | 0.099  | 0.108  | 0.152  |
|          |        |        |        | $\tilde{\chi}_3^0 b$  | 0.056  | 0.179  |        |
|          |        |        |        | $\tilde{\chi}_4^0 b$  | 0.078  | 0.201  |        |
|          |        |        |        | $\tilde{\chi}_1^- t$  | 0.127  | 0.111  | 0.235  |
|          |        |        |        | $\tilde{\chi}_2^- t$  | 0.325  | 0.268  | 0.159  |
|          |        |        |        | $W^- t_{\tilde{t}1}$   | 0.193  |        | 0.191  |

Table 5: Light squark masses (GeV) and significant branching ratios (> 3%) from Isajet (I), Susygen (S) and Pythia (P)
7  SPS 7 – GMSB scenario

| Parameter | Value |
|-----------|-------|
| $\Lambda$ | 40 TeV |
| $M_{mess}$ | 80 TeV |
| $N_{mess}$ | 3 |
| $\tan \beta$ | 15 |
| sign $\mu$ | $+$ |

NLSP = $\tilde{\tau}$

$M_{mess} = 2 \Lambda$

7.1 Spectrum & parameters of ISAJET 7.58

![Diagram of SPS 7 mass spectrum of ISAJET](image)

Figure 1: SPS 7 mass spectrum of ISAJET
**Isajet parameters**

Minimal gauge mediated (GMSB) model:

\[
\begin{align*}
\Lambda, & \quad M_{\text{mes}}, \quad N_5, \quad \tan(\beta), \quad \text{sgn}(\mu), \quad M_t, \quad C_{\text{grav}} = \\
& 0.400 \times 10^5 \quad 0.800 \times 10^5 \quad 3.000 \quad 15.000 \quad 1.0 \quad 175.000 \quad 0.100 \times 10^1 \\
\end{align*}
\]

GMSB2 model input:

\[
\begin{align*}
R_{\text{s}}, \quad \Delta m_{\text{d}}^2, \quad \Delta m_{\text{u}}^2, \quad d_Y, \quad N_{5,1}, \quad N_{5,2}, \quad N_{5,3} = \\
& 1.000 \quad 0.000 \times 10^0 \quad 0.000 \times 10^0 \quad 3.000 \quad 3.000 \quad 3.000 \\
\end{align*}
\]

\[M(\text{gravitino}) = 0.770 \times 10^{-09}\]

\[1/\alpha_{\text{em}} = 127.86 \quad \sin^2(\theta_{\text{w}}) = 0.2311 \quad \alpha_s = 0.118\]

\[
\begin{align*}
M_1 & = 168.59 \quad M_2 & = 326.81 \quad M_3 & = 895.45 \\
\mu(Q) & = 300.03 \quad B(Q) & = 31.35 \quad Q & = 839.57 \\
M_{H1}^2 & = 0.574 \times 10^5 \quad M_{H2}^2 & = -0.746 \times 10^5 \\
\end{align*}
\]

**Isajet masses (with signs):**

\[
\begin{align*}
M(\text{GL}) & = 926.04 \quad M(\text{UL}) & = 859.66 \quad M(\text{UR}) & = 830.54 \quad M(\text{DL}) & = 863.34 \quad M(\text{DR}) & = 828.93 \\
M(\text{B1}) & = 822.17 \quad M(\text{B2}) & = 843.35 \quad M(\text{T1}) & = 779.09 \quad M(\text{T2}) & = 863.00 \\
M(\text{SN}) & = 249.06 \quad M(\text{EL}) & = 261.47 \quad M(\text{ER}) & = 127.43 \\
M(\text{NTAU}) & = 248.62 \quad M(\text{TAU1}) & = 120.45 \quad M(\text{TAU2}) & = 263.40 \\
M(\text{Z1}) & = -161.65 \quad M(\text{Z2}) & = -260.06 \quad M(\text{Z3}) & = 306.26 \quad M(\text{Z4}) & = -379.94 \\
M(\text{W1}) & = -256.33 \quad M(\text{W2}) & = -379.45 \\
M(\text{HL}) & = 113.57 \quad M(\text{HH}) & = 378.37 \quad M(\text{HA}) & = 377.89 \quad M(\text{H+}) & = 386.70 \\
\theta_t & = 1.1366 \quad \theta_b & = 1.0603 \quad \theta_l & = 1.4237 \quad \alpha_h & = 0.0765 \\
\end{align*}
\]

**Neutralino masses (signed):**

\[-161.653 \quad -260.057 \quad 306.255 \quad -379.941\]

**Eigenvector 1**

\[0.13633 \quad -0.23326 \quad -0.07337 \quad 0.96001\]

**Eigenvector 2**

\[0.48781 \quad -0.55279 \quad -0.62706 \quad -0.25151\]

**Eigenvector 3**

\[0.71148 \quad 0.69498 \quad -0.08382 \quad 0.06142\]

**Eigenvector 4**

\[-0.48709 \quad 0.39625 \quad -0.77096 \quad 0.10653\]

**Chargino masses (signed):**

\[-256.330 \quad -379.452\]

**Gammal, Gammar**

\[2.54887 \quad 2.38244\]

**Isajet equivalent input:**

**MSSMA:**

\[926.04 \quad 300.03 \quad 377.89 \quad 15.00\]

**MSSMB:**

\[861.32 \quad 828.55 \quad 831.31 \quad 257.19 \quad 119.73\]

**MSSMC:**

\[836.27 \quad 826.88 \quad 780.14 \quad 256.77 \quad 117.61 \quad -319.43 \quad -350.48 \quad -38.97\]

**MSSMD:**

SAME AS MSSMB (DEFAULT)

**MSSME:**

\[168.59 \quad 326.81\]
7.2 Spectrum & parameters of SUSYGEN 3.00/27

Figure 2: SPS 7 mass spectrum of Susygen
Susygen parameters

Susygen inputs:
--------------

\[
\begin{align*}
M2 & = 326.810 & \mu & = 300.030 \\
M1 & = 168.590 & M3 & = 895.450 \\
XRFSUSY & = 56.568 & NFAM & = 3 \\
TANB & = 15.000
\end{align*}
\]

Sparticle masses: (input from Isajet)
--------------

\[
\begin{align*}
\text{SUPR} & = 831. & \text{SUPL} & = 860. \\
\text{SDNR} & = 829. & \text{SDNL} & = 863. \\
\text{SELR} & = 127. & \text{SELL} & = 261. \\
\text{SNU} & = 249. \\
\text{STP1} & = 779. & \text{STP2} & = 863. \cosmix = 0.421 \\
\text{SBT1} & = 822. & \text{SBT2} & = 843. \cosmix = 0.489 \\
\text{STA1} & = 120. & \text{STA2} & = 263. \cosmix = 0.147 \\
\text{SGLU} & = 926.
\end{align*}
\]

Gravitino mass: 0.769799202 eV
--------------

Gaugino masses:
--------------

\[
\begin{align*}
M1 & = 168.590 & M2 & = 326.810 & M3 & = 895.450 \\
\text{NEUTRALINO} m, \text{CP, ph/zi/ha/hb 1} & = 161.6 & 1. & 0.806 & -0.526 & 0.152 & 0.224 \\
\text{NEUTRALINO} m, \text{CP, ph/zi/ha/hb 2} & = 259.9 & 1. & -0.523 & -0.429 & 0.523 & 0.519 \\
\text{NEUTRALINO} m, \text{CP, ph/zi/ha/hb 3} & = 306.3 & -1. & -0.013 & 0.103 & -0.664 & 0.741 \\
\text{NEUTRALINO} m, \text{CP, ph/zi/ha/hb 4} & = 380.1 & 1. & -0.277 & -0.727 & -0.513 & -0.363 \\
\text{CHARGINO MASSES} & = 256.014 & 379.662 \\
\text{CHARGINO ETA} & = -1.000 & 1.000
\end{align*}
\]

\[
\begin{align*}
\text{U matrix} \quad \text{WINO} & \quad \text{HIGGSINO} \quad \text{V matrix} \quad \text{WINO} & \quad \text{HIGGSINO} \\
\text{W1SS+} & = -0.559 & 0.829 & \text{W1SS-} & = 0.689 & -0.725 \\
\text{W2SS+} & = 0.829 & 0.559 & \text{W2SS-} & = 0.725 & 0.689
\end{align*}
\]

Higgses masses:
--------------

\[
\begin{align*}
\text{Light CP-even Higgs} & = 113.895 \\
\text{Heavy CP-even Higgs} & = 400.218 \\
\text{CP-odd Higgs} & = 400.000 \\
\text{Charged Higgs} & = 407.406 \\
\sin(a-b) & = -0.076 \\
\cos(a-b) & = 0.997
\end{align*}
\]
### 7.3 Decay modes

| particle | $m_I$ | $m_S$ | $m_P$ | decay | $B_I$ | $B_S$ | $B_P$ |
|----------|------|------|------|-------|-------|-------|-------|
| $\tilde{e}^-_R$ | 127.4 | 127.4 | | $\tilde{\tau}^-_1 e^-\tau^+$ | 0.342 | | |
| | | | | $\tilde{\tau}^+_1 e^-\tau^-$ | 0.591 | | |
| | | | | $e^-\tilde{G}$ | 0.067 | 1.000 | |
| $\tilde{e}^-_L$ | 261.5 | 261.5 | | $\tilde{\chi}^0_1 e^-$ | 0.987 | 0.986 | |
| $\tilde{\nu}_e$ | 249.1 | 249.1 | | $\tilde{\chi}^0_1 \nu_e$ | 1.000 | 1.000 | |
| $\tilde{\mu}^-_R$ | 127.4 | 127.4 | | $\tilde{\tau}^-_1 \mu^-\tau^+$ | 0.342 | | |
| | | | | $\tilde{\tau}^+_1 \mu^-\tau^-$ | 0.591 | | |
| | | | | $\mu^-\tilde{G}$ | 0.067 | 1.000 | |
| $\tilde{\mu}^-_L$ | 261.5 | 261.5 | | $\tilde{\chi}^0_1 \mu^-$ | 0.987 | 0.986 | |
| $\tilde{\nu}_\mu$ | 249.1 | 249.1 | | $\tilde{\chi}^0_1 \nu_{\mu}$ | 1.000 | 1.000 | |
| $\tilde{\tau}^-_1$ | 120.4 | 120.4 | | $\tau^-\tilde{G}$ | 1.000 | 1.000 | |
| $\tilde{\tau}^-_2$ | 263.4 | 263.4 | | $\tilde{\chi}^0_1 \tau^-$ | 0.604 | 0.978 | |
| | | | | $Z^0\tilde{\tau}^-_1$ | 0.168 | | |
| | | | | $h^0\tilde{\tau}^-_1$ | 0.215 | | |
| $\tilde{\nu}_{\tau}$ | 248.6 | 248.6 | | $\tilde{\chi}^0_1 \nu_{\tau}$ | 0.746 | 1.000 | |
| | | | | $W^+\tilde{\tau}^-_1$ | 0.254 | | |

Table 1: Slepton masses (GeV) and significant branching ratios (> 3%) from Isajet (I), Susygen (S) and Pythia (P)
Table 2: Neutralino masses (GeV) and significant branching ratios (> 3%) from Isajet (I), Susygen (S) and Pythia (P)
### Table 3: Chargino masses (GeV) and significant branching ratios (> 3%) from Isajet (I), Susygen (S) and Pythia (P)

| particle | $m_I$ | $m_S$ | $m_P$ | decay       | $B_I$  | $B_S$  | $B_P$ |
|----------|-----|-----|-----|-------------|-----|-----|-----|
| $\tilde{\chi}_1^+$ | 256.3 | 256.0 | | $\tilde{\chi}_1^+ W^+$ | 0.292 | 0.954 | |
| | | | | $\tilde{\chi}_1^+ \nu_\tau$ | 0.638 | | |
| $\tilde{\chi}_2^+$ | 379.5 | 379.7 | | $\tilde{\chi}_2^+ W^+$ | 0.143 | 0.109 | |
| | | | | $\tilde{\chi}_2^+ \nu_e$ | 0.118 | 0.090 | |
| | | | | $\tilde{\chi}_2^+ \nu_\mu$ | 0.118 | 0.090 | |
| | | | | $\tilde{\chi}_2^+ \nu_\tau$ | 0.122 | 0.094 | |
| | | | | $\tilde{\tau}_L^+ \nu_e$ | 0.131 | 0.100 | |
| | | | | $\tilde{\tau}_L^+ \nu_\mu$ | 0.131 | 0.100 | |
| | | | | $\tilde{\tau}_L^+ \nu_\tau$ | 0.131 | 0.103 | |
| | | | | $\tilde{\chi}_1^+ Z^0$ | 0.092 | 0.304 | |

### Table 4: Higgs masses (GeV) and significant branching ratios (> 3%) from Isajet (I), Susygen (S) and Pythia (P)

| particle | $m_I$ | $m_S$ | $m_P$ | decay       | $B_I$  | $B_S$  | $B_P$ |
|----------|-----|-----|-----|-------------|-----|-----|-----|
| $h^0$ | 113.6 | 113.9 | | $\tau^- \tau^+$ | 0.051 | 0.070 | |
| | | | | $bb$ | 0.854 | 0.810 | |
| | | | | $c\bar{c}$ | 0.032 | | |
| | | | | $gg$ | 0.052 | | |
| | | | | $W^+W^-$ | 0.045 | | |
| $H^0$ | 378.4 | 400.2 | | $\tau^- \tau^+$ | 0.066 | 0.097 | |
| | | | | $bb$ | 0.921 | 0.877 | |
| $A^0$ | 377.9 | 400.0 | | $\tau^- \tau^+$ | 0.065 | 0.096 | |
| | | | | $bb$ | 0.898 | 0.868 | |
| | | | | $t\bar{t}$ | 0.034 | | |
| $H^+$ | 386.7 | 407.4 | | $\nu_\tau \tau^+$ | 0.107 | 0.118 | |
| | | | | $tb$ | 0.887 | 0.878 | |
| particle | $m_I$ | $m_S$ | $m_P$ | decay | $B_I$ | $B_S$ | $B_P$ |
|---------|------|------|------|-------|------|------|------|
| $t_1$   | 779.1| 779.1|       | $\tilde{\chi}_1^0 t$ | 0.083 | 0.071|
|         |      |      |       | $\tilde{\chi}_2^0 t$ | 0.156 | 0.152|
|         |      |      |       | $\tilde{\chi}_3^0 t$ | 0.263 | 0.190|
|         |      |      |       | $\tilde{\chi}_1^+ b$ | 0.409 | 0.463|
|         |      |      |       | $\tilde{\chi}_2^+ b$ | 0.065 | 0.095|
| $t_2$   | 863.0| 863.0|       | $\tilde{\chi}_1^+ b$ | 0.047 | 0.126|
|         |      |      |       | $\tilde{\chi}_2^+ b$ | 0.310 | 0.253|
|         |      |      |       | $\tilde{\chi}_2^0 t$ | 0.133 | 0.066|
|         |      |      |       | $\tilde{\chi}_3^0 t$ | 0.221 | 0.173|
|         |      |      |       | $\tilde{\chi}_4^0 t$ | 0.282 | 0.144|
|         |      |      |       | $\tilde{g} t$     |      | 0.214|
| $b_1$   | 822.2| 822.2|       | $\tilde{\chi}_1^0 b$ | 0.115 | 0.121|
|         |      |      |       | $\tilde{\chi}_2^0 b$ | 0.167 | 0.226|
|         |      |      |       | $\tilde{\chi}_3^0 b$ | 0.059 | 0.130|
|         |      |      |       | $\tilde{\chi}_1^+ t$ | 0.438 | 0.481|
|         |      |      |       | $\tilde{\chi}_2^+ t$ | 0.205 | 0.034|
| $b_2$   | 843.4| 843.4|       | $\tilde{\chi}_2^0 b$ | 0.048 | 0.089|
|         |      |      |       | $\tilde{\chi}_3^0 b$ | 0.041 | 0.132|
|         |      |      |       | $\tilde{\chi}_4^0 b$ | 0.115 | 0.196|
|         |      |      |       | $\tilde{\chi}_1^+ t$ | 0.297 | 0.130|
|         |      |      |       | $\tilde{\chi}_2^+ t$ | 0.492 | 0.448|

Table 5: Light squark masses (GeV) and significant branching ratios (> 3%) from ISAJET (I), SUSYGEN (S) and PYTHIA (P)
8 SPS 8 – GMSB scenario

| Parameter | Value |
|-----------|-------|
| $\Lambda$ | 100 TeV |
| $M_{mess}$ | 200 TeV |
| $N_{mess}$ | 1 |
| $\tan \beta$ | 15 |
| sign $\mu$ | $+$ |

NLSP = $\tilde{\chi}^0_1$

$M_{mess} = 2 \Lambda$

8.1 Spectrum & parameters of ISAJET 7.58

Figure 1: SPS 8 mass spectrum of ISAJET
**ISAJET parameters**

Minimal gauge mediated (GMSB) model:

$$\Lambda, M_{\text{mes}}, N_5, \tan(\beta), \text{sgn}(\mu), M_t, C_{\text{grav}} =$$

| Value       |
|-------------|
| 0.100E+06   |
| 0.200E+06   |
| 1.000       |
| 15.000      |
| 1.0         |
| 175.000     |
| 0.100E+01   |

GMSB2 model input:

$$R_{\text{s}l}, \ d_{\text{mH}_d^2}, \ d_{\text{mH}_u^2}, \ d_Y, \ N_{5_1}, N_{5_2}, N_{5_3} =$$

| Value       |
|-------------|
| 1.000       |
| 0.000E+00   |
| 0.000E+00   |
| 1.000       |
| 1.000       |
| 1.000       |

$$M(\text{gravitino}) = 0.481E-08$$

$$\frac{1}{\alpha_{\text{em}}} = 127.87 \quad \sin^2(\theta_{\text{w}}) = 0.2311 \quad \alpha_{s} = 0.118$$

$$M_{1} = 140.00 \quad M_{2} = 271.80 \quad M_{3} = 755.00$$

$$\mu(Q) = 398.31 \quad B(Q) = 44.32 \quad Q = 987.76$$

$$M_{\text{H1}}^2 = 0.111E+06 \quad M_{\text{H2}}^2 = -0.135E+06$$

ISAJET masses (with signs):

$$M(\text{GL}) = 820.50$$

$$M(\text{UL}) = 1080.25 \quad M(\text{UR}) = 1033.16 \quad M(DL) = 1083.17 \quad M(DR) = 1029.29$$

$$M(\text{B1}) = 1021.90 \quad M(\text{B2}) = 1048.26 \quad M(T1) = 957.65 \quad M(T2) = 1058.68$$

$$M(\text{SN}) = 347.61 \quad M(\text{EL}) = 356.61 \quad M(\text{ER}) = 175.87$$

$$M(\text{NTAU}) = 346.94 \quad M(\text{TAU1}) = 169.42 \quad M(\text{TAU2}) = 357.59$$

$$M(\text{Z1}) = -137.19 \quad M(\text{Z2}) = -252.33 \quad M(\text{Z3}) = 404.00 \quad M(\text{Z4}) = -426.28$$

$$M(\text{W1}) = -252.03 \quad M(\text{W2}) = -426.47$$

$$M(\text{HL}) = 114.83 \quad M(\text{HH}) = 515.01 \quad M(\text{HA}) = 514.49 \quad M(H^+) = 521.17$$

$$\theta_{\text{t}} = 1.3169 \quad \theta_{\text{b}} = 1.1767 \quad \theta_{\text{l}} = 1.4639 \quad \alpha_{h} = 0.0719$$

Neutralino masses (signed):

[-137.192, -252.334, 404.003, -426.276]

Eigenvector 1 = [0.05427, -0.13503, -0.03750, 0.98864]

Eigenvector 2 = [0.20544, -0.30581, -0.92547, -0.08815]

Eigenvector 3 = [0.70961, 0.69819, -0.07827, 0.05344]

Eigenvector 4 = [0.67179, -0.63307, 0.36873, -0.10936]

Chargino masses (signed):

[-252.028, -426.469]

Gamma, Gamma = [2.02894, 1.87308]

ISAJET equivalent input:

MSSMA: 820.50 398.31 514.49 15.00

MSSMB: 1081.56 1028.98 1033.78 353.48 170.37

MSSMC: 1042.74 1025.51 952.74 352.82 167.23 -296.71 -330.28 -36.69

MSSMD: SAME AS MSSMB (DEFAULT)

MSSME: 140.00 271.80

Warning in SSXINT: Bad convergence for 508 intervals.
8.2 Spectrum & parameters of SUSYGEN 3.00/27

Figure 2: SPS 8 mass spectrum of Susygen
Susygen parameters

Susygen inputs:
--------------

\[ \begin{align*}
M_2 &= 271.800 \quad \text{mu} &= 398.310 \\
M_1 &= 140.000 \quad M_3 &= 755.000 \\
XRFSUSY &= 141.421 \quad NFAM &= 1 \\
TANB &= 15.000
\end{align*} \]

Sparticle masses: (input from Isajet)
--------------

\[ \begin{align*}
SUPR &= 1033. \quad SUPL &= 1080. \\
SDNR &= 1029. \quad SDNL &= 1083. \\
SELR &= 176. \quad SELL &= 357. \\
SNU &= 348. \\
STP1 &= 958. \quad STP2 &= 1059. \cos\text{mix} = 0.425 \\
SBT1 &= 1022. \quad SBT2 &= 1048. \cos\text{mix} = 0.384 \\
STA1 &= 169. \quad STA2 &= 358. \cos\text{mix} = 0.107 \\
SGLU &= 820.
\end{align*} \]

Gravitino mass: 4.81125246 eV
--------------

Gaugino masses:
--------------

\[ \begin{align*}
M_1 &= 140.000 \quad M_2 &= 271.800 \quad M_3 &= 755.000
\end{align*} \]

\[ \begin{align*}
\text{NEUTRALINO m, CP, ph/zi/ha/hb 1} &= 137.2 \quad 1. \quad 0.849 \quad -0.508 \quad 0.063 \quad 0.131 \\
\text{NEUTRALINO m, CP, ph/zi/ha/hb 2} &= 252.2 \quad 1. \quad -0.522 \quad -0.769 \quad 0.226 \quad 0.292 \\
\text{NEUTRALINO m, CP, ph/zi/ha/hb 3} &= 404.0 \quad -1. \quad -0.009 \quad 0.095 \quad -0.662 \quad 0.744 \\
\text{NEUTRALINO m, CP, ph/zi/ha/hb 4} &= 426.4 \quad 1. \quad -0.082 \quad -0.377 \quad -0.712 \quad -0.587
\end{align*} \]

\[ \begin{align*}
\text{CHARGINO MASSES} &= 251.761 \quad 426.622 \\
\text{CHARGINO ETA} &= -1.000 \quad 1.000
\end{align*} \]

\[ \begin{align*}
U \text{ matrix} &= W1SS+ \quad -0.896 \quad 0.443 \quad W1SS- \quad 0.955 \quad -0.298 \\
W1SS+ &= 0.443 \quad 0.896 \quad W2SS- \quad 0.298 \quad 0.955 \\
W2SS+ &= -0.896 \quad 0.443 \quad V \text{ matrix} \quad W1SS- \\
W1SS- &= 0.955 \quad -0.298 \\
\end{align*} \]

Higgses masses:
--------------

\[ \begin{align*}
\text{Light CP-even Higgs} &= 116.282 \\
\text{Heavy CP-even Higgs} &= 400.221 \\
\text{CP-odd Higgs} &= 400.000 \\
\text{Charged Higgs} &= 407.301 \\
\sin(a-b) &= -0.076 \\
\cos(a-b) &= 0.997
\end{align*} \]
8.3 Spectrum & parameters of PYTHIA 6.2/00

Figure 3: SPS 8 mass spectrum of PYTHIA
### Pythia parameters

#### MSSM input parameters

| Parameter | RMSS(1) |
|-----------|---------|
| M_1       | 140.0   |
| M_2       | 272.0   |
| M_3       | 740.0   |
| tan_beta  | 15.00   |
| mu        | 406.0   |

#### sparticle masses & widths

| Sparticle | Mass (GeV) | Width (GeV) |
|-----------|-----------|-------------|
| M_se_R    | 176.0     | 0.134       |
| M_se_L    | 356.0     | 1.239       |
| M_sne_L   | 346.9     | 1.197       |
| M_sm_R    | 176.0     | 0.134       |
| M_sm_L    | 356.0     | 1.239       |
| M_snm_L   | 346.9     | 1.197       |
| M_st_1    | 169.8     | 0.101       |
| M_st_2    | 357.9     | 1.342       |
| M_snt_L   | 343.8     | 1.248       |
| M_ch0_1   | 137.3     | 0.000       |
| M_ch0_2   | 253.5     | 0.028       |
| M_ch0_3   | 411.6     | 1.832       |
| M_ch0_4   | 432.9     | 2.306       |
| M_ch+1    | 252.8     | 0.026       |
| M_ch+2    | 433.4     | 2.192       |
| M_h0      | 114.3     | 0.004       |
| M_H0      | 517.0     | 2.425       |
| M_A0      | 516.9     | 2.456       |
| M_g~      | 824.3     | 0.021       |
| M_uL      | 1078.7    | 23.774      |
| M_uR      | 1029.4    | 10.449      |
| M_dL      | 1081.6    | 23.823      |
| M_dR      | 1030.3    | 8.794       |
| M_b1      | 1021.0    | 12.139      |
| M_b2      | 1045.9    | 29.128      |
| M_t1      | 955.9     | 23.923      |
| M_t2      | 1058.4    | 28.340      |

#### parameter settings IMSS, RMSS

| IMSS(1) | IMSS(4) | IMSS(7) | IMSS(10) |
|---------|---------|---------|----------|
| 1       | 1       | 0       | 0        |

| RMSS(1) | RMSS(9) | RMSS(17) |
|---------|---------|----------|
| 140.0   | 1030.   | -35.00   |
| 272.0   | 1040.   | -0.7168E-01 |
| 740.0   | 1025.   | 517.0   |
| 406.0   | 950.0   | 0.4100E-01 |
| 15.00   | 353.0   | 1.000   |
| 356.0   | 168.0   | 1030.   |
| 176.0   | -330.0  | 0.1000E+05 |
| 1080.   | -295.0  | 0.1000E+05 |
### 8.4 Decay modes

| particle | \( m_I \) | \( m_S \) | \( m_P \) | decay | \( B_I \) | \( B_S \) | \( B_P \) |
|----------|--------|--------|--------|------|-----|-----|-----|
| \( \tilde{e}_R^- \) | 175.9 | 175.9 | 176.0 | \( \tilde{\chi}_1^0 e^- \) | 1.000 | 1.000 | 1.000 |
| \( \tilde{e}_L^- \) | 356.6 | 356.6 | 356.0 | \( \tilde{\chi}_1^0 e^- \) | 0.225 | 0.224 | 0.228 |
| | | | | \( \tilde{\chi}_2^0 e^- \) | 0.287 | 0.287 | 0.283 |
| | | | | \( \tilde{\chi}_1^- \nu_e \) | 0.488 | 0.490 | 0.489 |
| \( \tilde{\nu}_e \) | 347.6 | 347.6 | 346.9 | \( \tilde{\chi}_1^0 \nu_e \) | 0.292 | 0.291 | 0.294 |
| | | | | \( \tilde{\chi}_2^0 \nu_e \) | 0.209 | 0.209 | 0.209 |
| | | | | \( \tilde{\chi}_1^+ e^- \) | 0.499 | 0.500 | 0.497 |
| \( \tilde{\mu}_R^- \) | 175.9 | 175.9 | 176.0 | \( \tilde{\chi}_1^0 \mu^- \) | 1.000 | 1.000 | 1.000 |
| \( \tilde{\mu}_L^- \) | 356.6 | 356.6 | 356.0 | \( \tilde{\chi}_1^0 \mu^- \) | 0.225 | 0.224 | 0.228 |
| | | | | \( \tilde{\chi}_2^0 \mu^- \) | 0.287 | 0.287 | 0.283 |
| | | | | \( \tilde{\chi}_1^- \nu_\mu \) | 0.488 | 0.490 | 0.489 |
| \( \tilde{\nu}_\mu \) | 347.6 | 347.6 | 346.9 | \( \tilde{\chi}_1^0 \nu_\mu \) | 0.292 | 0.291 | 0.294 |
| | | | | \( \tilde{\chi}_2^0 \nu_\mu \) | 0.209 | 0.209 | 0.209 |
| | | | | \( \tilde{\chi}_1^+ \mu^- \) | 0.499 | 0.500 | 0.497 |
| \( \tilde{\tau}_1^- \) | 169.4 | 169.4 | 169.8 | \( \tilde{\chi}_1^0 \tau^- \) | 1.000 | 1.000 | 1.000 |
| \( \tilde{\tau}_2^- \) | 357.6 | 357.6 | 357.9 | \( \tilde{\chi}_1^0 \tau^- \) | 0.215 | 0.232 | 0.218 |
| | | | | \( \tilde{\chi}_2^0 \tau^- \) | 0.262 | 0.286 | 0.262 |
| | | | | \( \tilde{\chi}_1^- \nu_\tau \) | 0.441 | 0.482 | 0.447 |
| | | | | \( Z^0 \tilde{\tau}_1^- \) | 0.038 | 0.041 | 0.041 |
| | | | | \( h^0 \tilde{\tau}_1^- \) | 0.044 | 0.032 | 0.032 |
| \( \tilde{\nu}_\tau \) | 346.9 | 346.9 | 343.8 | \( \tilde{\chi}_1^0 \nu_\tau \) | 0.271 | 0.292 | 0.278 |
| | | | | \( \tilde{\chi}_2^0 \nu_\tau \) | 0.193 | 0.209 | 0.191 |
| | | | | \( \tilde{\chi}_1^+ \tau^- \) | 0.463 | 0.499 | 0.456 |
| | | | | \( W^+ \tilde{\tau}_1^- \) | 0.073 | 0.075 | 0.075 |

Table 1: Slepton masses (GeV) and significant branching ratios (> 3%) from Isajet (I), Susygen (S) and Pythia (P)
| particle | $m_I$ | $m_S$ | $m_P$ | decay | $B_I$ | $B_S$ | $B_P$ |
|----------|------|------|------|-------|------|------|------|
| $\tilde{\chi}_1^0$ | 137.2 | 137.2 | 137.3 | $G\gamma$ | 0.947 | 0.974 | 0.968 |
|            |      |      |      | $\tilde{G}Z^0$ | 0.033 | 0.032 |      |
| $\tilde{\chi}_2^0$ | 252.3 | 252.2 | 253.5 | $\tilde{\chi}_1^0Z^0$ | 0.086 | 0.091 | 0.075 |
|            |      |      |      | $\tilde{\chi}_1^0h^0$ | 0.078 | 0.078 | 0.168 |
|            |      |      |      | $\tilde{e}_R^+e^-$ | 0.053 | 0.057 | 0.043 |
|            |      |      |      | $\tilde{\mu}_R^+\mu^-$ | 0.053 | 0.057 | 0.043 |
|            |      |      |      | $\tilde{\tau}_1^+\tau^-$ | 0.311 | 0.340 | 0.292 |
| $\tilde{\chi}_3^0$ | 404.0 | 404.0 | 411.7 | $\tilde{\chi}_1^+W^-$ | 0.289 | 0.363 | 0.291 |
|            |      |      |      | $\tilde{\chi}_1^-W^+$ | 0.289 | 0.363 | 0.291 |
|            |      |      |      | $\tilde{\chi}_1^0Z^0$ | 0.142 | 0.092 | 0.133 |
|            |      |      |      | $\tilde{\chi}_1^0h^0$ | 0.207 | 0.134 | 0.211 |
| $\tilde{\chi}_4^0$ | 426.3 | 426.4 | 432.9 | $\tilde{\chi}_1^+W^-$ | 0.307 | 0.361 | 0.303 |
|            |      |      |      | $\tilde{\chi}_1^-W^+$ | 0.307 | 0.361 | 0.303 |
|            |      |      |      | $\tilde{\chi}_1^0h^0$ | 0.087 | 0.063 | 0.082 |
|            |      |      |      | $\tilde{\chi}_1^0h^0$ | 0.142 | 0.102 | 0.153 |

Table 2: Neutralino masses (GeV) and significant branching ratios (> 3%) from **Isajet** (I), **Susygen** (S) and **Pythia** (P)

| particle | $m_I$ | $m_S$ | $m_P$ | decay | $B_I$ | $B_S$ | $B_P$ |
|----------|------|------|------|-------|------|------|------|
| $\tilde{\chi}_1^+$ | 252.0 | 251.8 | 252.8 | $\tilde{\chi}_1^0W^+$ | 0.508 | 0.899 | 0.480 |
|            |      |      |      | $\tilde{\tau}_1^+\nu_\tau$ | 0.491 | 0.099 | 0.520 |
| $\tilde{\chi}_2^+$ | 426.5 | 426.6 | 433.4 | $\tilde{\chi}_1^0W^+$ | 0.097 | 0.089 | 0.093 |
|            |      |      |      | $\tilde{\chi}_2^0W^+$ | 0.348 | 0.323 | 0.343 |
|            |      |      |      | $\tilde{\chi}_1^+Z^0$ | 0.283 | 0.509 | 0.281 |
|            |      |      |      | $\tilde{\chi}_1^+h^0$ | 0.173 | 0.099 | 0.180 |

Table 3: Chargino masses (GeV) and significant branching ratios (> 3%) from **Isajet** (I), **Susygen** (S) and **Pythia** (P)
| particle | $m_I$ | $m_S$ | $m_P$ | decay | $B_I$ | $B_S$ | $B_P$ |
|----------|-------|-------|-------|-------|-------|-------|-------|
| $h^0$    | 114.8 | 117.3 | 114.3 | $\tau^-\tau^+$ | 0.050 | 0.077 | 0.066 |
|          |       |       |       | $bb$   | 0.837 | 0.758 | 0.789 |
|          |       |       |       | $c\bar{c}$ | 0.036 | 0.043 |        |
|          |       |       |       | $gg$   |        | 0.057 | 0.035 |
|          |       |       |       | $W^+W^-$ | 0.076 | 0.055 |        |
| $H^0$    | 515.0 | 400.1 | 517.0 | $\tau^-\tau^+$ | 0.067 | 0.112 | 0.100 |
|          |       |       |       | $bb$   | 0.888 | 0.860 | 0.874 |
| $A^0$    | 514.5 | 400.0 | 516.9 | $\tau^-\tau^+$ | 0.063 | 0.107 | 0.099 |
|          |       |       |       | $bb$   | 0.845 | 0.822 | 0.864 |
|          |       |       |       | $tt$   | 0.031 | 0.038 | 0.036 |
|          |       |       |       | $\tilde{\chi}_1^0\tilde{\chi}_2^0$ | 0.033 |       |        |
| $H^+$    | 521.2 | 407.3 | 523.0 | $\nu_\tau\tau^+$ | 0.086 | 0.131 | 0.109 |
|          |       |       |       | $tb$   | 0.854 | 0.833 | 0.890 |
|          |       |       |       | $\tilde{\chi}_1^+\tilde{\chi}_1^0$ | 0.056 | 0.033 |        |

Table 4: Higgs masses (GeV) and significant branching ratios (> 3%) from ISAJET (I), SUSYGEN (S) and PYTHIA (P)
| particle | $m_I$ | $m_S$ | $m_P$ | decay | $B_I$ | $B_S$ | $B_P$ |
|----------|-------|-------|-------|-------|-------|-------|-------|
| $t_1$    | 957.6 | 957.7 | 955.9 | $\tilde{\chi}_1^0 t$ | 0.089 | 0.066 | 0.081 |
|          |       |       |       | $\tilde{\chi}_2^0 t$ | 0.057 | 0.077 | 0.056 |
|          |       |       |       | $\tilde{\chi}_3^0 t$ | 0.245 | 0.195 | 0.248 |
|          |       |       |       | $\tilde{\chi}_4^0 t$ | 0.140 | 0.122 | 0.144 |
|          |       |       |       | $\tilde{\chi}_1^+ b$ | 0.131 | 0.197 | 0.127 |
|          |       |       |       | $\tilde{\chi}_2^+ b$ | 0.339 | 0.343 | 0.345 |
| $t_2$    | 1058.7| 1058.7| 1058.4| $\tilde{g} t$ | 0.269 | 0.230 | 0.140 |
|          |       |       |       | $\tilde{\chi}_1^+ b$ | 0.174 | 0.125 | 0.189 |
|          |       |       |       | $\tilde{\chi}_2^+ b$ | 0.098 | 0.282 | 0.092 |
|          |       |       |       | $\tilde{\chi}_3^0 t$ | 0.088 | 0.041 | 0.102 |
|          |       |       |       | $\tilde{\chi}_1^0 t$ | 0.158 | 0.195 | 0.204 |
|          |       |       |       | $\tilde{\chi}_2^0 t$ | 0.209 | 0.122 | 0.267 |
| $b_1$    | 1021.9| 1021.9| 1021.5| $\tilde{\chi}_1^0 b$ | 0.049 | 0.038 | 0.041 |
|          |       |       |       | $\tilde{\chi}_2^0 b$ | 0.075 | 0.069 | 0.046 |
|          |       |       |       | $\tilde{\chi}_3^0 b$ | 0.030 | 0.050 |       |
|          |       |       |       | $\tilde{g} b$ | 0.594 | 0.651 | 0.639 |
|          |       |       |       | $\tilde{\chi}_1^0 t$ | 0.144 | 0.132 | 0.093 |
|          |       |       |       | $\tilde{\chi}_2^0 t$ | 0.098 | 0.037 | 0.175 |
| $b_2$    | 1048.3| 1048.3| 1045.9| $\tilde{\chi}_2^0 b$ | 0.082 | 0.082 | 0.095 |
|          |       |       |       | $\tilde{\chi}_3^0 b$ |       |       | 0.046 |
|          |       |       |       | $\tilde{\chi}_4^0 b$ | 0.038 | 0.063 |       |
|          |       |       |       | $\tilde{g} b$ | 0.322 | 0.509 | 0.312 |
|          |       |       |       | $\tilde{\chi}_1^0 t$ | 0.164 | 0.144 | 0.197 |
|          |       |       |       | $\tilde{\chi}_2^0 t$ | 0.367 | 0.152 | 0.373 |

Table 5: Light squark masses (GeV) and significant branching ratios (> 3%) from Isajet (I), Susygen (S) and Pythia (P)
9 SPS 9 – AMSB scenario

| Parameter | Value |
|-----------|-------|
| $m_0$     | 400 GeV |
| $m_{3/2}$ | 60 TeV  |
| $\tan \beta$ | 10    |
| sign $\mu$ | +     |

$m_0 = 0.0075 \, m_{3/2}$

9.1 Spectrum & parameters of ISAJET 7.58

Figure 1: SPS 9 mass spectrum of ISAJET
Isajet parameters

WARNING: TACHYONIC SLEPTONS AT GUT SCALE
POINT MAY BE INVALID

Supergravity model with right-handed neutrinos:

\[ M_0, \ M_{(3/2)}, \ \tan(\beta), \ \text{sgn}(\mu), \ M_t = \]
\[ 400.000 \ 60000.000 \ 10.000 \ 1.0 \ 175.000 \]

ISASUGRA unification:

\[ M_{GUT} = 0.101E+17 \ g_{GUT} = 0.711 \ \alpha_{GUT} = 0.040 \]
\[ F_T_{GUT} = 0.476 \ \ F_B_{GUT} = 0.046 \ \ F_L_{GUT} = 0.069 \]

\[ 1/\alpha_{\text{em}} = 127.81 \ \sin^2(\theta_{\text{w}}) = 0.2306 \ \alpha_s = 0.120 \]
\[ M_1 = -550.60 \ M_2 = -175.53 \ M_3 = 1232.27 \]
\[ \mu(Q) = 869.90 \ \ B(Q) = 94.70 \ \ Q = 1076.05 \]
\[ M_{H1^2} = 0.714E+05 \ \ M_{H2^2} = -0.720E+06 \]

ISAJET masses (with signs):

\[ M(GL) = 1275.18 \]
\[ M(UL) = 1218.09 \ M(UH) = 1227.35 \ M(DL) = 1220.65 \ M(DR) = 1237.81 \]
\[ M(B1) = 1112.07 \ M(B2) = 1232.88 \ M(T1) = 1005.17 \ M(T2) = 1128.80 \]
\[ M(SN) = 309.71 \ M(EL) = 319.66 \ M(ER) = 303.01 \]
\[ M(TAU)= 300.71 \ M(TAU1)= 271.28 \ M(TAU2)= 322.54 \]
\[ M(Z1) = 175.51 \ M(Z2) = 549.03 \ M(Z3) = -874.37 \ M(Z4) = 875.97 \]
\[ M(W1) = 175.67 \ M(W2) = 877.22 \]
\[ M(HL) = 114.83 \ M(HH) = 912.56 \ M(HA) = 911.74 \ M(H+) = 915.83 \]

\[ \theta_t = 1.3055 \ \ \theta_b = 0.0919 \ \ \theta_l = 1.0546 \ \ \alpha_h = 0.1020 \]

NEUTRALINO MASSES (SIGNED) = 175.505 549.027 -874.365 875.970
EIGENVECTOR 1 = -0.00966 -0.09301 -0.99562 0.00004
EIGENVECTOR 2 = 0.04358 0.07687 -0.00765 -0.99606
EIGENVECTOR 3 = 0.70715 -0.70420 0.05892 -0.02386
EIGENVECTOR 4 = 0.70565 0.69968 -0.07220 0.08543

CHARGINO MASSES (SIGNED) = 175.672 877.221
GAMMAL, GAMMAR = 1.70212 1.55731

ISAJET equivalent input:

MSSMA: 1275.18 869.90 911.74 10.00
MSSMB: 1219.24 1237.55 1227.86 316.22 299.89
MSSMC: 1111.59 1231.65 1003.22 307.41 281.16 -350.26 216.41 1162.39
MSSMD: SAME AS MSSMB (DEFAULT)
MSSME: -550.60 -175.53
WARNING IN SSXINT: BAD CONVERGENCE FOR 264 INTERVALS.
9.2 Spectrum & parameters of SUSYGEN 3.00/27

Figure 2: SPS 9 mass spectrum of Susygen
Susygen parameters

Susygen inputs:

\[
\begin{align*}
M2 &= 175.530 \quad \mu &= 869.900 \\
M1 &= 550.600 \quad M3 &= 1232.270 \\
TANB &= 10.000
\end{align*}
\]

Sparticle masses: (input from Isajet)

\[
\begin{align*}
\text{SUPR} &= 1227. \quad \text{SUPL} &= 1218. \\
\text{SDNR} &= 1238. \quad \text{SDNL} &= 1221. \\
\text{SELR} &= 303. \quad \text{SELL} &= 320. \\
\text{SNU} &= 310. \\
\text{STP1} &= 1005. \quad \text{STP2} &= 1129. \quad \cosmix = 0.262 \\
\text{SBT1} &= 1112. \quad \text{SBT2} &= 1233. \quad \cosmix = 0.996 \\
\text{STA1} &= 271. \quad \text{STA2} &= 323. \quad \cosmix = 0.493 \\
\text{SGLU} &= 1275.
\end{align*}
\]

Gaugino masses:

\[
\begin{align*}
M1 &= 550.600 \quad M2 &= 175.530 \quad M3 &= 1232.270
\end{align*}
\]

\[
\begin{align*}
\text{NEUTRALINO} \quad m, CP, ph/zi/ha/hb \ 1 &= 172.5 \quad 1 \quad -0.475 \quad -0.874 \quad 0.038 \quad 0.094 \\
\text{NEUTRALINO} \quad m, CP, ph/zi/ha/hb \ 2 &= 547.6 \quad 1 \quad 0.879 \quad -0.466 \quad 0.067 \quad 0.079 \\
\text{NEUTRALINO} \quad m, CP, ph/zi/ha/hb \ 3 &= 872.9 \quad -1 \quad 0.006 \quad 0.052 \quad -0.634 \quad 0.772 \\
\text{NEUTRALINO} \quad m, CP, ph/zi/ha/hb \ 4 &= 878.9 \quad 1 \quad 0.048 \quad -0.126 \quad -0.769 \quad -0.624
\end{align*}
\]

\[
\begin{align*}
\text{CHARGINO MASSES} &= 172.486 \quad 877.866 \\
\text{CHARGINO ETA} &= -1.000 \quad 1.000
\end{align*}
\]

\[
\begin{align*}
U \text{ matrix} \quad WINO \quad HIGGSINO \quad V \text{ matrix} \quad WINO \quad HIGGSINO \\
W1SS+ &= -0.991 \quad 0.136 \quad W1SS- &= 0.999 \quad -0.040 \\
W2SS+ &= 0.136 \quad 0.991 \quad W2SS- &= 0.040 \quad 0.999
\end{align*}
\]

Higgses masses:

\[
\begin{align*}
\text{Light CP-even Higgs} &= 114.830 \\
\text{Heavy CP-even Higgs} &= 912.560 \\
\text{CP-odd Higgs} &= 911.740 \\
\text{Charged Higgs} &= 915.830 \\
\sin(a-b) &= 0.102 \\
\cos(a-b) &= 0.995
\end{align*}
\]
9.3 Spectrum & parameters of PYTHIA 6.2/00

Figure 3: SPS 9 mass spectrum of PYTHIA
### Pythia parameters

**MSSM input parameters**

| Parameter   | RMSS Value |
|-------------|------------|
| M_1         | 550.6      |
| M_2         | 178.5      |
| M_3         | 1200.      |
| tan_beta    | 10.00      |
| mu          | 870.0      |

**Sparticle masses & widths**

| Sparticle | RMSS Value |
|-----------|------------|
| M_se_R    | 303.0 (0.000) |
| M_se_L    | 319.7 (1.949) |
| M_sne_L   | 309.6 (1.807) |
| M_sm_R    | 303.0 (0.000) |
| M_sm_L    | 319.7 (1.949) |
| M_snm_L   | 309.6 (1.807) |
| M_st_1    | 274.5 (0.619) |
| M_st_2    | 320.4 (0.959) |
| M_snt_L   | 284.5 (1.381) |
| M_ch0_1   | 175.4 (0.000) |
| M_ch0_2   | 547.6 (6.016) |
| M_ch0_3   | 873.0 (6.869) |
| M_ch0_4   | 879.0 (7.023) |
| M_ch+_1   | 175.7 (0.000) |
| M_ch+_2   | 878.0 (7.060) |
| M_h0      | 113.3 (0.004) |
| M_H0      | 911.4 (2.071) |
| M_H+      | 915.3 (2.236) |
| M_g^-     | 1275.4 (5.103) |
| M_uL      | 1217.8 (15.156) |
| M_uR      | 1236.5 (1.836) |
| M_dL      | 1220.4 (15.051) |
| M_dR      | 1237.2 (0.460) |
| M_b1      | 1112.5 (15.069) |
| M_b2      | 1233.2 (0.654) |
| M_t1      | 1005.5 (3.225) |
| M_t2      | 1132.0 (15.159) |

**Parameter settings IMSS, RMSS**

| IMSS Setting | RMSS Value |
|--------------|------------|
| IMSS(1) = 1  | 550.6      |
| IMSS(4) = 1  | 1237.      |
| IMSS(7) = 0  | 1162.      |
| IMSS(10) = 0 | 0           |
| IMSS(2) = 0  | 1112.      |
| IMSS(5) = 0  | 1232.      |
| IMSS(8) = 0  | 912.0      |
| IMSS(3) = 0  | 1003.      |
| IMSS(6) = 0  | 0.4100E-01 |
| IMSS(9) = 0  | 295.4      |
| IMSS(12) = 0 | 1.000      |
## 9.4 Decay modes

| particle | $m_I$  | $m_S$  | $m_P$  | decay                      | $B_I$  | $B_S$  | $B_P$  |
|----------|--------|--------|--------|----------------------------|--------|--------|--------|
| $\tilde{e}_R^-$ | 303.0  | 303.0  | 303.0  | $\tilde{\chi}_1^0 e^-\tilde{\tau}_1^- e^-\tau^+$  | 0.103  | 1.000  | 1.000  |
|           |        |        |        | $\tilde{\tau}_1^+ e^-\tau^-$                     | 0.657  |        |        |
| $\tilde{e}_L^-$ | 319.7  | 319.7  | 319.7  | $\tilde{\chi}_1^0 e^-\tilde{\chi}_1^- e^-$       | 0.336  | 0.334  | 0.335  |
|           |        |        |        | $\tilde{\chi}_1^0 \nu_e\tilde{\chi}_1^- e^-$     | 0.664  | 0.667  | 0.665  |
| $\tilde{\nu}_e$ | 309.7  | 309.7  | 309.6  | $\tilde{\chi}_1^0 \nu_e\tilde{\chi}_1^- e^-$     | 0.332  | 0.333  | 0.333  |
|           |        |        |        | $\tilde{\chi}_1^0 \nu_e\tilde{\chi}_1^- e^-$     | 0.668  | 0.667  | 0.667  |
| $\tilde{\mu}_R^-$ | 303.0  | 303.0  | 303.0  | $\tilde{\chi}_1^0 \mu^-\tilde{\chi}_1^- \nu_\mu \tilde{\tau}_1^- \mu^-\tau^+$ | 0.103  | 0.886  | 0.888  |
|          |        |        |        | $\tilde{\tau}_1^- \mu^-\tau^+$                     | 0.240  | 0.114  | 0.112  |
|           |        |        |        | $\tilde{\tau}_1^- \mu^-\tau^+$                     | 0.657  |        |        |
| $\tilde{\mu}_L^-$ | 319.7  | 319.7  | 319.7  | $\tilde{\chi}_1^0 \mu^-\tilde{\chi}_1^- \nu_\mu \tilde{\tau}_1^- \mu^-\tau^+$ | 0.336  | 0.334  | 0.335  |
|          |        |        |        | $\tilde{\tau}_1^- \mu^-\tau^+$                     | 0.664  | 0.666  | 0.665  |
|           |        |        |        | $\tilde{\tau}_1^- \mu^-\tau^+$                     | 0.668  | 0.667  | 0.667  |
| $\tilde{\nu}_\mu$ | 309.7  | 309.7  | 309.6  | $\tilde{\chi}_1^0 \nu_\mu\tilde{\chi}_1^- \mu^-\tau^+$ | 0.332  | 0.333  | 0.333  |
|          |        |        |        | $\tilde{\tau}_1^- \mu^-\tau^+$                     | 0.668  | 0.667  | 0.667  |
|           |        |        |        | $\tilde{\tau}_1^- \mu^-\tau^+$                     | 0.668  | 0.667  | 0.667  |
| $\tilde{\tau}_1^-$ | 271.3  | 271.3  | 275.4  | $\tilde{\chi}_1^0 \tau^-\tilde{\chi}_1^- \nu_\tau \tilde{\tau}_1^- \tau^+$ | 0.336  | 0.334  | 0.335  |
|           |        |        |        | $\tilde{\tau}_1^- \tau^+$                           | 0.664  | 0.666  | 0.665  |
|           |        |        |        | $\tilde{\tau}_1^- \tau^+$                           | 0.664  | 0.666  | 0.665  |
| $\tilde{\tau}_2^-$ | 322.5  | 322.5  | 320.4  | $\tilde{\chi}_1^0 \tau^-\tilde{\chi}_1^- \nu_\tau \tilde{\tau}_2^- \tau^+$ | 0.336  | 0.334  | 0.335  |
|           |        |        |        | $\tilde{\tau}_2^- \tau^+$                           | 0.664  | 0.666  | 0.665  |
|           |        |        |        | $\tilde{\tau}_2^- \tau^+$                           | 0.664  | 0.666  | 0.665  |
| $\tilde{\nu}_\tau$ | 300.7  | 300.7  | 284.5  | $\tilde{\chi}_1^0 \nu_\tau\tilde{\chi}_1^- \tau^+$ | 0.332  | 0.333  | 0.333  |
|           |        |        |        | $\tilde{\tau}_1^- \tau^+$                           | 0.668  | 0.667  | 0.667  |

Table 1: Slepton masses (GeV) and significant branching ratios (> 3%) from Isajet (I), Susygen (S) and Pythia (P)
### Table 2: Neutralino masses (GeV) and significant branching ratios (> 3%) from Isajet (I), Susygen (S) and Pythia (P)

| particle | $m_I$ | $m_S$ | $m_P$ | decay | $B_I$ | $B_S$ | $B_P$ |
|----------|-------|-------|-------|-------|-------|-------|-------|
| $\tilde{\chi}^0_1$ | 175.5 | 172.5 | 175.4 |       | 1.000 | 1.000 | 1.000 |
| $\tilde{\chi}^0_2$ | 549.0 | 547.6 | 547.6 | $\tilde{e}_R e^+$ | 0.110 | 0.109 | 0.110 |
|        |       |       |       | $\tilde{e}_R e^-$ | 0.110 | 0.109 | 0.110 |
|        |       |       |       | $\tilde{\mu}_R \mu^+$ | 0.110 | 0.109 | 0.110 |
|        |       |       |       | $\tilde{\mu}_R \mu^-$ | 0.110 | 0.109 | 0.110 |
|        |       |       |       | $\tilde{\tau}_1 \tau^+$ | 0.108 | 0.107 | 0.082 |
|        |       |       |       | $\tilde{\tau}_2 \tau^-$ | 0.108 | 0.107 | 0.082 |
|        |       |       |       | $\tilde{\tau}_2 \tau^+$ | 0.042 | 0.042 | 0.062 |
|        |       |       |       | $\tilde{\tau}_2 \tau^-$ | 0.042 | 0.042 | 0.062 |
| $\tilde{\chi}^0_3$ | 874.4 | 872.9 | 873.0 | $\tilde{\chi}^+_1 W^-$ | 0.304 | 0.292 | 0.302 |
|        |       |       |       | $\tilde{\chi}^-_1 W^+$ | 0.304 | 0.292 | 0.302 |
|        |       |       |       | $\tilde{\chi}^0_1 Z^0$ | 0.181 | 0.221 | 0.230 |
|        |       |       |       | $\tilde{\chi}^0_2 Z^0$ | 0.057 | 0.067 | 0.069 |
|        |       |       |       | $\tilde{\chi}^0_3 h^0$ | 0.115 | 0.097 | 0.067 |
| $\tilde{\chi}^0_4$ | 876.0 | 878.9 | 879.0 | $\tilde{\chi}^+_1 W^-$ | 0.296 | 0.322 | 0.291 |
|        |       |       |       | $\tilde{\chi}^-_1 W^+$ | 0.296 | 0.322 | 0.291 |
|        |       |       |       | $\tilde{\chi}^0_1 Z^0$ | 0.118 | 0.075 | 0.068 |
|        |       |       |       | $\tilde{\chi}^0_2 Z^0$ | 0.171 | 0.158 | 0.219 |
|        |       |       |       | $\tilde{\chi}^0_3 h^0$ | 0.054 | 0.049 | 0.064 |

### Table 3: Chargino masses (GeV) and significant branching ratios (> 3%) from Isajet (I), Susygen (S) and Pythia (P)

| particle | $m_I$ | $m_S$ | $m_P$ | decay | $B_I$ | $B_S$ | $B_P$ |
|----------|-------|-------|-------|-------|-------|-------|-------|
| $\tilde{\chi}^+_1$ | 175.7 | 172.5 | 175.7 | $\tilde{\chi}^0_1 \pi^+$ | 0.960 |       |       |
|        |       |       |       | $\tilde{\chi}^0_1 \nu_{\tau} e^+$ | 1.000 |       |       |
|        |       |       |       | $\tilde{\chi}^0_1 \nu_{\mu} \mu^+$ |       | 0.500 |       |
| $\tilde{\chi}^+_2$ | 877.2 | 877.9 | 878.0 | $\tilde{\chi}^0_2 W^+$ | 0.300 | 0.416 | 0.298 |
|        |       |       |       | $\tilde{\chi}^0_2 W^+$ | 0.066 | 0.112 | 0.079 |
|        |       |       |       | $\tilde{\chi}^0_2 Z^0$ | 0.298 | 0.421 | 0.293 |
|        |       |       |       | $\tilde{\chi}^+_1 h^0$ | 0.286 |       | 0.283 |
Table 4: Higgs masses (GeV) and significant branching ratios (>3%) from Isajet (I), Susygen (S) and Pythia (P)

| particle | m_I | m_S | m_P | decay | B_I | B_S | B_P |
|----------|-----|-----|-----|-------|-----|-----|-----|
| h^0      | 114.8 | 114.8 | 113.3 | τ^-τ^+ | 0.050 | 0.071 | 0.065 |
|          |      |      |      | bb    | 0.827 | 0.824 | 0.783 |
|          |      |      |      | c\bar{c} | 0.040 | 0.044 | 0.048 |
|          |      |      |      | gg    | 0.030 | 0.051 | 0.038 |
|          |      |      |      | W^+W^- |       | 0.032 | 0.054 |
| H^0      | 912.6 | 912.6 | 911.4 | τ^-τ^+ | 0.055 | 0.089 | 0.092 |
|          |      |      |      | bb    | 0.680 | 0.808 | 0.726 |
|          |      |      |      | t\bar{t} | 0.133 | 0.057 | 0.178 |
|          |      |      |      | \tilde{\chi}_1^+ \tilde{\chi}_1^- | 0.030 |         |       |
| A^0      | 911.7 | 911.7 | 911.1 | τ^-τ^+ | 0.054 | 0.081 | 0.090 |
|          |      |      |      | bb    | 0.670 | 0.735 | 0.713 |
|          |      |      |      | t\bar{t} | 0.143 | 0.147 | 0.195 |
|          |      |      |      | \tilde{\tau}_1^- \tilde{\tau}_1^+ | 0.030 |         |       |
|          |      |      |      | \tilde{\chi}_1^+ \tilde{\chi}_1^- | 0.033 |         |       |
| H^+      | 915.8 | 915.8 | 915.3 | ν_ττ^+ | 0.064 | 0.097 | 0.086 |
|          |      |      |      | tb    | 0.826 | 0.873 | 0.913 |
|          |      |      |      | \tilde{\tau}_1^- \tilde{\nu}_τ | 0.066 |         |       |

Table 5: Light squark masses (GeV) and significant branching ratios (>3%) from Isajet (I), Susygen (S) and Pythia (P)

| particle | m_I | m_S | m_P | decay | B_I | B_S | B_P |
|----------|-----|-----|-----|-------|-----|-----|-----|
| t_1      | 1005.2 | 1005.2 | 1005.5 | \tilde{\chi}_1^0 t | 0.095 | 0.116 | 0.129 |
|          |      |      |      | \tilde{\chi}_2^0 t | 0.341 | 0.291 | 0.302 |
|          |      |      |      | \tilde{\chi}_1^+ b | 0.205 | 0.259 | 0.280 |
|          |      |      |      | \tilde{\chi}_2^+ b | 0.359 | 0.334 | 0.289 |
| t_2      | 1128.8 | 1128.8 | 1132.0 | \tilde{\chi}_1^0 b | 0.558 | 0.442 | 0.545 |
|          |      |      |      | \tilde{\chi}_2^0 b | 0.184 |         |       |
|          |      |      |      | \tilde{\chi}_1^0 t | 0.262 | 0.198 | 0.256 |
|          |      |      |      | \tilde{\chi}_3^0 t | 0.088 | 0.082 | 0.054 |
|          |      |      |      | \tilde{\chi}_4^0 t | 0.042 | 0.087 | 0.103 |
| b_1      | 1112.1 | 1112.1 | 1112.5 | \tilde{\chi}_1^0 b | 0.301 | 0.333 | 0.297 |
|          |      |      |      | \tilde{\chi}_1^0 t | 0.565 | 0.624 | 0.556 |
|          |      |      |      | \tilde{\chi}_2^0 t | 0.114 |         | 0.133 |
| b_2      | 1232.9 | 1232.9 | 1233.2 | \tilde{\chi}_1^0 b |         | 0.063 |       |
|          |      |      |      | \tilde{\chi}_2^0 b | 0.434 | 0.303 | 0.690 |
|          |      |      |      | \tilde{\chi}_3^0 b | 0.097 | 0.182 |       |
|          |      |      |      | \tilde{\chi}_4^0 b | 0.098 | 0.181 |       |
|          |      |      |      | \tilde{\chi}_1^0 t |         | 0.119 |       |
|          |      |      |      | \tilde{\chi}_2^0 t | 0.256 | 0.324 | 0.061 |
|          |      |      |      | \tilde{t_1}W^- |         | 0.037 |       |