Performance of BeBe, a dedicated beam-beam monitoring detector for the MPD-NICA experiment at JINR

Marco Alberto Ayala Torres\textsuperscript{a}, Lucina Gabriela Espinoza Beltrán\textsuperscript{b,d}, Marcos Aurelio Fontaine Sanchez\textsuperscript{a}, Luis A. Hernández-Cruz\textsuperscript{b}, Luis Manuel Montaño\textsuperscript{d}, Braian Adair Maldonado Luna\textsuperscript{b}, Eduardo Moreno-Barbosa\textsuperscript{b}, Lucio Fidel Rebolledo Herrera\textsuperscript{b}, Mario Rodríguez-Cahuautzi\textsuperscript{1b}, Valeria Z. Reyna-Ortiz\textsuperscript{b}, Guillermo Tejeda-Muñoz\textsuperscript{b} and C. H. Zepeda Fernández\textsuperscript{b,c}

\textsuperscript{a}Departamento de Física, CINVESTAV
\textsuperscript{b}Facultad de Ciencias Físico Matemáticas, Benemérita Universidad Autónoma de Puebla, Av. San Claudio y 18 Sur, Edif. EMA3-231, Ciudad Universitaria 72570, Puebla, México
\textsuperscript{c}Cátedra CONACyT, 03940, CdMx México
\textsuperscript{d}Facultad de Ciencias Físico-Matemáticas, Universidad Autónoma de Sinaloa, Avenida de las Américas y Boulevard C.P. 80000, Culiacán, Sinaloa, México

E-mail: mario.rodriguez@correo.buap.mx

ABSTRACT: The Multipurpose Detector (MPD) is an experimental array, currently under construction, designed to study the nuclear matter created during the collisions that will be provided by the Nuclotron-based Ion Collider fAcility (NICA) at JINR. The MPD-NICA experiment consists of a typically array of particle detectors as those used to study heavy-ion collisions at LHC and RHIC. To complement the current trigger system of MPD-NICA, conformed by the forward detectors FFD and FHCAL, the BeBe detector has been proposed. Based on Monte Carlo simulations, a discussion of the potential physics performance of BeBe detector is given for triggering tasks and for the resolution in the determination of the event plane reaction and the centrality of the collisions at NICA. This document is a first public version that will be updated when submitted for publication to JINST. Most of the authors are former members of the MPD-NICA experiment. This written is a report of the acquired commitments in the signed M&O between experimental groups of BUAP and CINVESTAV Mexican institutes with MPD-NICA Collaboration. Warning: This version may need a proofreading.

KEYWORDS: particle detectors, beam monitoring, MPD-NICA

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1 Introduction

In collider experiments, the use of a detector capable to monitor the beam activity is desirable. The information provided by such kind of particle detectors is useful to identify and to discriminate beam-beam minimum bias or centrality events from background and beam-gas interactions. These kind of detectors can be used for the reconstruction of physical observable of interest in heavy-ion collisions such as multiplicity of charged particles, key observable for the determination of the centrality of the collision events and the event plane resolution, and luminosity measurements for determining the absolute cross section of specific reaction processes. Experiments such as PHENIX at RHIC [1] and ALICE at LHC [2] have successfully employed particle detectors based in plastic scintillator material to generate a minimum bias trigger signal and to monitor the beam activity.

To extend the QCD phase diagram in a richest baryon region, with respect to LHC and RHIC heavy-ion experiments, it is currently under construction the Multi-Purpose Detector (MPD-NICA) [3] at JINR where heavy nuclei will collide at $\sqrt{s_{NN}} = 4 – 11$ GeV [4] for Bi+Bi and Au+Au beam species. The planned physics studies of the MPD Collaboration considers the characterization of the nuclear matter produced in heavy-ion collisions through anisotropic flow measurements, electromagnetic and hard probes as well as the measurement of global observables of the charged particles produced at NICA such as multiplicity and mean transverse momentum, among others.

To perform all this kind of studies, it is crucial the developing of dedicated particle detectors for online beam monitoring and triggering tasks. Usually, this type of systems are quite useful in offline determination of the event reaction plane and collision centrality, two key observables in the
study of the nuclear matter produced in heavy-ion collisions. This is the case of the Beam-Beam monitoring detector (BeBe) [5], a proposed system to increase the trigger capabilities of MPD detector. It is expected that BeBe contributes to the discrimination of beam-gas interactions from beam-beam collision events and also in the determination of the centrality and reaction plane of the collision events expected to be registered by the MPD-NICA experiment.

It is shown that the BeBe detector can be used for online luminosity measurements of NICA beam (5.1). In fact, the BeBe trigger efficiency is found to be of 55% and 94% for proton+proton and Bi+Bi/Au+Au collisions respectively at a center of mass energy of 9 and 11 GeV. Moreover, the maximum event plane resolution given by BeBe, for the 1st harmonic, is of the order of 44% for a impact parameter range of 6 to 11 (5.2). The resolution of the centrality determination by BeBe detector of the expected collisions at NICA is of 0.05-0.1 for centralities percentages between 20% and 100%. Indeed, it is shown that BeBe compensates the low trigger efficiency for low multiplicity proton+proton collision events given by the Fast Forward Detector (FFD) [6], and also compensates the decrease of the resolution of the centrality determination for peripheral collisions given by the Forward Hadron Calorimeter (FHCAL) [20] (5.3).

2 BeBe general description

The BeBe detector is planned to be made of two arrays of BC-404 plastic scintillator counters located 2 meters away from the MPD-NICA interaction point, at opposite sides. BeBe will cover a pseudorapidity range of $1.68 < |\eta| < 4.36$, see Table 1 and Fig. 2. Each detector consists of an array of 80 cells, 1 cm width, arranged in five concentric rings, see Fig. 10. The considered geometry for BeBe is similar to the one used for the VZERO-ALICE [8] detector during the Run 1 and 2 of the LHC.

Figure 1. BeBe design geometry as rendered by the MPD offline environment.

The BeBe trigger signal may be useful to generate a trigger logic to identify and to discriminate beam-beam events, either for minimum bias or with a given centrality, from background and beam-gas interactions. In addition, the BeBe information can be used for the reconstruction of
Table 1. Pseudorapidity and BeBe rings dimensions (and $R_{min}$ is the minimum radius of the ring and $R_{max}$ is the maximum radius).

| Ring | $\eta$ | $R_{min}$ | $R_{max}$ |
|------|--------|-----------|-----------|
| 1    | 3.87-4.36 | 5.1       | 8.3       |
| 2    | 3.31-3.87 | 8.5       | 14.5      |
| 3    | 2.84-3.31 | 14.7      | 23.4      |
| 4    | 2.26-2.84 | 23.6      | 42        |
| 5    | 1.68-2.26 | 42.2      | 76.63     |

physical observables of interest in heavy-ion collisions such as a reference multiplicity of charged particles, collision centrality determination, event plane resolution and the absolute cross section determination from luminosity measurements. As a first approach, the light produced in the sensitive material will be collected by Silicon Photo Multipliers (SiPMs) coupled directed to each individual plastic scintillator cell. As it was reported in [5], the SiPMs photosensor may provide an excellent intrinsic time resolution for the detector of the order of tens of picoseconds. The optimization of the number of SiPMs per cell is currently a study in progress and it will be reported elsewhere. The photo sensors, front-end-electronics and plastic scintillator components of the BeBe detector must be radiation hardness. They also need to work properly in high magnetic field environment.

3 Front-End electronics

The proposed Front-End to collect the deposited charge from the scintillator and SiPM (MicroFC-60035 SensL) is shown in figure 3, where the polarization voltage $V_{bias}$ is 30 V and the output
voltage $V_o$ is related with the generated current by the shunt resistor as $R_s, I_s$. The photosensor model has two analog outputs described as fast and standard with a linear relation between them [9, 10]. Given the required flight time characteristics of the order of picoseconds, the fast signal is the most adequate to use. The fast analog output will feed an electronic discriminator whose duration in time is proportional to the time that the analog signal is above a reference voltage $V_{th}$. This type of system is called Time-Over-Threshold (TOH). The digital output from each hexagonal cell is sent to a TRB3 FPGA card [11], capable of collect up to 264 input channels. As TRB3 is controlled by a Linux workstation, all the information from each SiPM can be stored in this computer for offline processing. The develop of an interface between TRB3 card and central MPD-NICA systems is currently under discussion.

![Figure 3](image.png)

Figure 3. Front-end electronics design per cell.

4 Laboratory measurements on time resolution

This is a section that will be updated with the analysis of CINVESTAV group. The authors of CINVESTAV institute carried out time resolution measurements during the last two months to study the performance of two cells of the proposed BeBe detector.

By means of an independent project supported by CONACyT grant number A1-S-13525. We have found, from measurements carried out in BUAP, that a simple plastic scintillator detector coupled to a Sens-L SiPM can reach a global time resolution of the order of 320 ps, see Fig. 4. In the next version of this written Fig. 4 figure will be replaced by the measurements made at CINVESTAV laboratory.

5 Simulation studies

A simulation of the BeBe detector geometry, as described in section 2, was performed within the official offline framework of the MPD-NICA experiment, MPDRoot [12]. To evaluate the BeBe detector physics performance for triggering and determination of the resolution of the event
plane and centrality of the collision, we performed simulations of 1,000,000 Minimum Bias (MB) \((b = 0 – 15.9 \text{ fm})\) events for Bi+Bi collisions at \(\sqrt{s_{NN}} = 9 \text{ GeV}\) and 1,000,000 MB \((b = 0 – 15.9 \text{ fm})\) events for Au+Au collisions at \(\sqrt{s_{NN}} = 11 \text{ GeV}\), using UrQMD [13, 16] and 9,500 MB \((b = 0 – 15.9 \text{ fm})\) events for Au+Au collisions at \(\sqrt{s_{NN}} = 11.5 \text{ GeV}\) LAQGSM [17, 18] models. The implementation of the BeBe geometry considered only the sensitive material, BC-404, and thus all the analyses were done at the level of simulated hits. As expected, the large density of hits is expected in the two inner most rings of the BeBe detector, see Fig. 5. With the information given by the number of hits per cell, it is possible to estimate the performance of BeBe detector for centrality and event plane determination. All the simulations considered smearing (with) and no smearing (without) in the vertex simulation.

5.1 Estimation of BeBe trigger efficiency

To the date, the MPDRoot framework does not include tools to make a detailed simulation of the trigger signals from the MPD-NICA detectors. For this reason, the studies presented in this section assumes that BeBe will generate a valid beam-beam trigger signal based in the time of flight of the generated charged particles from the MPD-NICA interaction point reaching the BeBe sensitive cells.

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**Figure 4.** Measured time resolution of a simple plastic scintillator detector coupled to a Sens-L SiPM. This is a preliminary result of the Master Thesis of Yael Antonio Vasquez Beltrán, student at FCFM-BUAP associated with ALICE-BUAP group. This is a work in progress and it will be reported somewhere else.
The main purpose of the BeBe detector is to provide a trigger signal for the identification of Bi+Bi and Au+Au collisions. The raw information of the BeBe trigger signal, generated by either one hit in any of the two BeBe arrays located at opposite sides of the MPD-NICA experiment or two hits in coincidence at a certain time window in both of them, can be used for online luminosity determination of the NICA beam, as it has been demonstrated by the VZERO-ALICE [8] and LUCID-ATLAS [19] detectors at LHC.

The elapsed time of flight of the charged particles produced in heavy-ion collisions at NICA, from the interaction point to the BeBe detector cells of any of its two arrays, in average is of the order of 7 ns, see Fig. 6. To simulate the BeBe trigger signals for heavy-ion collisions at NICA the time of flight information of the BeBe simulated hits was used.

Based on the fit from Fig. 6, a time window of $\Delta \tau = 7ns \pm 3ns$ was defined to simulate the following BeBe trigger flags:

- **BBR**: if the Z coordinate of the BeBe hit is positive and the time of flight of the first BeBe hit is within the time window defined by $\Delta \tau$.

- **BBL**: if the Z coordinate of the BeBe hit is negative and the time of flight of the first BeBe hit is within the time window defined by $\Delta \tau$.

- **BBR AND BBL**: logical AND of the coincidence of BBR and BBL.
Figure 6. Time of flight of the produced charged particles from the interaction point of the collision to BeBe detector.

Table 2. Trigger efficiencies using UrQMD with the next detectors switched ON in the transport Mbb+FFD+BeBe.

| Process                  | BBR  | BBL  | BBRandBBL | BBRorBBL |
|--------------------------|------|------|-----------|----------|
| pp@9GeV with             | 58.063% | 57.86% | 20.26% | 95.66% |
| pp@9GeV without          | 72.85% | 72.79% | 50.12% | 95.52% |
| pp@11GeV with            | 59.84% | 59.87% | 23.41% | 95.52% |
| pp@11GeV without         | 74.31% | 74.42% | 52.7%  | 96.03% |
| BiBi@9GeV with           | 94.07% | 94.07% | 89.88% | 98.26% |
| BiBi@9GeV without        | 100%  | 100%  | 100%     | 100% |
| AuAu@11GeV Con           | 100%  | 100%  | 100%     | 100% |
| AuAu@11GeV Sin           | 100%  | 100%  | 100%     | 100% |

- **BBR OR BBL**: logical OR of BBR and BBL.

For p+p collisions at $\sqrt{s} = 9$ GeV and $\sqrt{s} = 11$ GeV the trigger efficiency given either by BBR or BBL is of the order of 58% if a vertex smearing is assumed (with) in the simulation. Our results suggest that both trigger efficiencies increases up to 73% when no smearing on the vertex simulation is considered. Thus, the BBL and BBR trigger efficiencies will have a strong dependence of the vertex smearing, which is directly related with the NICA beam quality. The BBR AND BBL and BBR OR BBL trigger efficiencies are 20.26% and 95.6% respectively for p+p collisions at $\sqrt{s} = 9$ GeV. For heavy-ion collisions the trigger efficiencies are larger than 90% in all the assumed configurations. The estimation of the trigger efficiencies of BeBe detector seems to be independent of the Monte Carlo generator used. In this case we estimated the BeBe trigger efficiencies with UrQMD [13, 16] and LAQGSM models [17], see tables 2, 3 and 4.

5.2 Centrality determination

Centrality is a key variable for characterizing the geometric properties of the heavy-ion collisions. Many experimental techniques devoted to the study of the nuclear matter created in ultra relativistic
Transport Detectors: miniBeBe+BeBe, 1,000,000 events

| Process          | BBR  | BBL  | BBRandBBL | BBRonBBL |
|------------------|------|------|-----------|----------|
| pp@9GeV with     | 56.07% | 57.86% | 16.79% | 95.17% |
| pp@9GeV without  | 71.99% | 72.05% | 49.01% | 95.03% |
| pp@11GeV with    | 57.66% | 57.46% | 19.26% | 95.85% |
| pp@11GeV without | 73.35% | 73.43% | 51.25% | 95.53% |
| BiBi@9GeV with    | 100% | 100% | 100% | 100% |
| BiBi@9GeV without | 100% | 100% | 100% | 100% |
| AuAu@11GeV Con    | 100% | 100% | 100% | 100% |
| AuAu@11GeV Sin    | 100% | 100% | 100% | 100% |

Table 3. Trigger efficiencies using UrQMD with the next detectors switched ON in the transport Mbb+BeBe.

Transport Detectors: Mbb+BeBe+FHCal+FFD, 9,000 events

| Process          | BBR  | BBL  | BBRandBBL | BBRonBBL |
|------------------|------|------|-----------|----------|
| AuAu@11.5GeV     | 97.7% | 97.6% | 95.4% | 99.9% |

Table 4. Trigger efficiencies using LAQGSM with the next detectors switched ON in the transport Mbb+BeBe+FHCal+FFD.

Heavy-ion collisions are such confident as a good performance of the particle detectors in reconstructing the centrality of the collision which in most of the cases is based in a good charged particle multiplicity reconstruction [32].

To estimate the BeBe detector capabilities in centrality determination of the heavy-ion collisions at NICA energies, an UrQMD and LAQGSM simulations of 9,500 Minimum Bias Au+Au collision events at $\sqrt{s_{NN}} = 11$ GeV were generated within the MPDroot framework. As a first step we computed the number of charged particles reaching the BeBe detector cells, number of hits, as a function of the simulated impact parameter. In the case of plastic scintillator detectors, it has been shown by VZERO-ALICE [8] at LHC that the shape of the number of hits in the detector can be described in terms of the Glauber model [15]. With the proposed geometry for BeBe detector, we observe that it is not a good option to employ all the five rings of BeBe detector, UrQMD prediction. This behavior is in contrast with the prediction given by LAQGSM model where the BeBe hits distribution exhibits a nice curve that can be adjusted by a Glauber like function, see Fig. 7. For UrQMD, this situation improves if we only take into account the hit multiplicity of the three outer rings of BeBe, Fig. 8. In tables 5 and 6 the minimum and maximum values of hit multiplicities in BeBe detector are given. This values were obtained inspired in the method discussed in [32].

5.3 Centrality resolution

To compute the centrality resolution given by BeBe detector, we correlate the generated impact parameter with the hit multiplicity in BeBe and look for the best curve behaviour, a linear correlation. As can be seen in Fig. 9, such linear correlation is predicted by LAQGSM model independently of the number of BeBe rings used.
Table 5. Centrality classes and impact parameter ranges and number of charged particles in 9,500 events of Au+Au at 11 GeV UrQMD using all rings (top) and 3-5 rings (bottom).

The prediction given by UrQMD suggest to employ only the three outer rings of BeBe detector. With the computed values shown in tables 5 and 6 we are able to estimate a mean value of the centrality using the number of hits in BeBe detector. This value can be compared with the truth value of the centrality given by the generated impact parameter. Event by event, we compute the difference between the centrality given by the number of hits in the BeBe detector \((\text{cent}_{\text{BeBe}})\) with respect to the generated centrality \((\text{cent}_{\text{MC}})\), \(\text{cent} = \text{cent}_{\text{MC}} - \text{cent}_{\text{BeBe}}\). The width of a Gaussian fit of \(\text{cent}\) distribution will give us the centrality resolution of BeBe detector with respect to the centrality of the collision. This method is based on an ideal performance of the proposed detector and we don’t take into account detector inefficiencies from the whole data acquisition chain, underestimation of secondaries due to material budget or reconstruction effects. In Fig. 10, the centrality resolution of BeBe detector for UrQMD and LAQGSM models is shown. Using the hit multiplicity of all the BeBe detector rings, UrQMD model predicts a centrality resolution of 45\% and LAQGSM model prediction is of 34 \% for central collision. As the percentage of the centrality increases, the centrality resolution given by BeBe improves up to 5 \% for both models.
From Fig. 5, the largest hit multiplicity is found in the two most inner BeBe rings. Thus, different BeBe rings configuration can be explored to optimize the centrality resolution of the proposed detector. In Fig. 11 different BeBE rings configurations were assumed to estimate the centrality resolution. For central collisions the centrality resolution improves as the number of rings decreases from the inner to the outer. In this case, if we use the number of hits in the two outer rings is equivalent to the information given by the three inner rings (black and purple squares). For semicentral and peripheral collisions, the BeBe centrality resolution is equivalent for all the six rings assumed configurations. It is worth to mention that even the rings 4 and 5 gives a good centrality resolution of 35% for central collisions.

The centrality determination given by BeBe detector is fully complementary to the one that can be reached with the FHCAL [20] detector at MPD-NICA, specially for central collisions where the FHCAL detector may losses resolution.
5.4 Event plane resolution

The BeBe detector aims to improve MPD’s determination of the reaction plane, a key measurement for flow studies which provides physics insight into the early stages of the reaction. This is useful to study the anisotropic flow of particles produced in heavy-ion collisions which is typically quantified by the coefficients in the Fourier decomposition of the azimuthal angular particle distribution [21, 22]. If the particle azimuthal angle is measured with respect to the direction of the reaction plane [24], then this Fourier analysis leads to

$$E \frac{dN}{d^3 p} = \frac{1}{2\pi} \frac{dN}{p_T dp_T d\eta} \left\{ 1 + 2 \sum_{n=1}^{\infty} \nu_n(p_T, \eta) \cos \{ n(\varphi - \Psi_n) \} \right\},$$

(5.1)

where $E$, $N$, $p$, $p_T$, $\varphi$ and $\eta$ are the particle’s energy, yield, total 3-momentum, transverse momentum, azimuthal angle and pseudo-rapidity, respectively. As shown in Fig. 12 $\Psi_n$ is the reaction plane angle corresponding to the $n^{\text{th}}$-order harmonic, $\nu_n$. Experimentally, $\Psi_n$ can be determined using the sub-event correlation method discussed in Ref. [25].

Profiting from the high granularity of the BeBe, we can resolve the event plane angle $\Psi_{BB}$ corresponding to the $n^{\text{th}}$-order harmonic, using the reconstructed multiplicity provided by each disk.
cell of the hodoscope as follows [23]

\[ \psi_{n}^{BB} = \frac{1}{n} \tan^{-1} \left[ \sum_{i=1}^{m} \frac{w_i \sin(n\varphi_i)}{\sum_{i=1}^{m} w_i \cos(n\varphi_i)} \right], \]  

(5.2)

where \( w_i \) is the multiplicity measured in the \( i \)-th cell, \( m \) is the total number of BeBe cells and \( \varphi_i \) is the \( i \)-th cell’s azimuthal angle measured from the center of the hodoscope to the cell centroid.

To estimate the event plane resolution with the proposed BeBe detector geometry, we simulated 1,000,000 minimum bias Bi+Bi collision events at \( \sqrt{s_{NN}} = 9 \text{ GeV} \). The event generation was done with UrQMD, which includes multiple particle interactions, the excitation and fragmentation of colour strings and the formation and decay of hadron resonances, in the simulation of p+p, p+A and A+A collisions. We used the MPD-ROOT offline framework [12]. The produced particles were propagated through the detectors using GEANT-3 as a transport package. The multiplicity per cell, \( w_i \), was estimated at hit-level and the event plane resolution with the BeBe detector for \( n = 1 \) was computed as [23]

\[ \left\langle \cos \left( n \times (\psi_{n}^{BB} - \psi_{n}^{MC}) \right) \right\rangle \]  

(5.3)
Figure 9. Correlation between multiplicity and impact parameter for all BeBe rings (top) and 3-5 BeBe rings (bottom) for 9,500 MB Au+Au at 11 GeV with UrQMD (left) and Au+Au at 11.5 GeV with LAQGSM (right).

where $\Psi_n^{MC}$ is the true value given by the Monte Carlo for the $n$-th order harmonic. Figure 13 shows the dependence of the event plane resolution with the impact parameter for $n = 1$. This effect has been also reported in Refs. [8, 26, 27]. The BeBe is capable to reach a maximum of the event plane resolution for a impact parameter range of 6-11 for Bi+Bi collisions at $\sqrt{s_{NN}} = 9$ GeV.

6 Simulation of BeBe cell prototype with Geant-4

To estimate the intrinsic time resolution of BeBe detector we performed simulations using the GEANT-4 v.10.06 toolkit simulation software [28]. We simulated the BeBe geometry taking as sensitive material the BC404 plastic scintillator, for three size cells, that correspond to ring 1, ring 3 and ring 5, respectively. The thicknesses was considered for disk cell, 1.5 cm. We put a scorer which represent the photosensors (SensL-SiPM). The scorer was coupled to the disk cell, for two cases: center and superior left corner. In each configuration, we simulated 1000 events with muons with an energy of 1 GeV striking the center, the corner and arbitrarily distributed over the entire of the disk cell. The intrinsic time resolution from simulations was estimated from the fit of the time of flight of the emitted photons within the plastic scintillator that reach each scorer following a Landau distribution. Figure 14 shows the results of GEANT-4 simulations. We notice that for a
Figure 10. Centrality resolution for 9,500 MB events for Au+Au@11 GeV with UrQMD and 9,500 MB events for Au+Au@11.5 GeV with LAQGSM, using in both cases all BeBe rings.

Figure 11. Centrality resolution for several BeBe rings configuration.

disk cell made of BC404, coupled with one light sensor, the simulations are in good agreement, the intrinsic time resolution is not a constant for a detector, it depends of the interaction point, number of scorers (SiPMs), energy and particle type. The combination of the optical path and the size of the scintillator are the explanation for the increase in value. For the corner and central interaction, the optical photon time of flight is a Gaussian distribution, however, for the aleatory interaction, it can be obtain a multiple Gaussian distribution, due to the multiple interaction point. Each distribution represents the bunch of optical photons that arrives at different time to the scorer. They can be
Figure 12. Azimuth angle of particles in momentum coordinates $\varphi$, the reaction plane angle $\Phi_{RP}$ and $\varphi'$ is the difference of the azimuth angle of particles and the reaction plane angle and $\tilde{Q}$ is the vector used in the standard event plane angle method.

Figure 13. Estimated event plane resolution using the BeBe detector.

seen in Figure 14. From these results, it is obtained that for an arbitrarily interaction for the rings 0, 33 and 65, the intrinsic time resolution is 6, 15 and 82 ps for SiPM center location, respectively and 18, 20 and 60 ps for SiPM corner location, respectively. Assuming that such a time resolution behaves as $1/\sqrt{N}$, where $N$ is the number of light sensors coupled to the plastic scintillator, the time resolution of the cells (0, 33 and 65) made of a BC404 disk coupled to the a SiPM light sensor on different positions, will have a central value of 40 ps. The development of particle detectors with such a time resolution has been explored also in Refs. [29–31].

7 Conclusions

The simulated geometry for BeBe detector proposal shows a good performance in triggering, event plane and centrality determination. Our results suggest that at NICA energies the BeBe detector
Figure 14. Intrinsic time resolution values for the three muon interaction and both SiPM location.

will be useful for NICA beam monitoring in p+p and heavy-ion collisions with excellent trigger efficiencies for both systems. The maximum event plane resolution of BeBe is of 43% for a impact parameter range between 6 and 11. For centrality determination, BeBe is a complementary detector to the FHCAL for central collisions. The BeBe detector could provide valuable information in heavy-ion collisions at NICA energies with the MPD.

The proposed BeBe detector is a two plastic scintillator array stations located at ± 2 meters from the MPD interaction point. The plastic scintillator width is of 1 cm. The proposed geometry of BeBe detector is similar to the one used in ALICE with the VZERO detector and its upgrade.
for the LHC Run 3, Fast Interaction Detector (FIT, V0+), a plastic scintillator disk segmented in 80 cells per station. As a first approach we estimate a time resolution, per cell of about 320 ps with SensL SiPM coupled directly to each cell. The estimated intrinsic time resolution of an individual BeBe cell is of the order of 40 ps.

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