**Figure S1.** Confocal microscopy images of immunofluorescence of RyR2 antibodies in 25 SANCs (image 1 shows two cells: 1a and 1b). Images show fluorescence intensity approximately at the middle of each cell. The size (w × h) of the images is shown in micrometers at the top of each panel. Bars, 20 µm. RyRs are rare or absent inside 15 cells (marked by an asterisk at their numbers).
**Video 1.** Periodic global calcium waves in a 3-D model of SANCs with initial SR calcium load of 1.15 mM. In this SANC model, couplings were spaced regularly at 0.7-µm spacing longitudinally and azimuthally. RyR cooperativity was set to 3. The cell was “sealed” to calcium by disabling NCX, L-type current, and background current, and voltage clamping at \(-65\) mV. The cytosolic \([\text{Ca}^{2+}]\) is coded by red shades from 100 nM (black) to 5,000 nM (saturation). Calcium dynamics is shown within the outer shell of cytosolic voxels (i.e., directly linked to cell surface membrane). See also Fig. 5.

**Video 2.** 3-D model of SANCs generates chaotic “calcium fibrillation” consisting of many small waves when an initial SR calcium load of 1.15 mM is increased only slightly by 4% (vs. conditions in Video 1) to 1.2 mM and self-synchronization is lost. Except for the SR calcium, all other parameters remained the same as in the simulation shown in Video 1. The cytosolic \([\text{Ca}^{2+}]\) is coded by red shades from 100 nM (black) to 5,000 nM (saturation). Calcium dynamics is shown only for the outer shell of cytosolic voxels. See also Fig. 6.

**Video 3.** Local calcium dynamics of a free-running calcium clock in a 3-D SANC model with a random network of RyR clusters simulated immediately after the switch to a voltage clamp at \(-50\) mV, i.e., at a potential close to the onset of the L-type current. With time, LCR events become less synchronous, as cell calcium declines as a result of extrusion of calcium by NCX. The cytosolic \([\text{Ca}^{2+}]\) is coded by red shades from 100 nM (black) to 5,000 nM (saturation). JSR \([\text{Ca}^{2+}]\) is coded by a cyan color from(0) (black) to 600 µM (saturation). Calcium dynamics is shown only for the outer shell of cytosolic voxels. See also Fig. 11.

**Video 4.** Chaotic, high amplitude calcium fluctuations in the steady state in a 3-D SANC model under voltage clamp at \(-3\) mV, i.e., at a potential at which \(I_{\text{SR}}\) is close to zero and cell calcium is not depleted. The cytosolic \([\text{Ca}^{2+}]\) is coded by red shades from 100 nM (black) to 5,000 nM (saturation). JSR \([\text{Ca}^{2+}]\) is coded by a cyan color from 0 (black) to 600 µM (saturation). Calcium dynamics is shown only for the outer shell of cytosolic voxels. \(P_{\text{op}} = 12 \text{nM/s}\). See also Fig. 12.

**Video 5.** Limited-size LCR events are generated in the steady state after depolarization to \(-50\) mV in a 3-D SANC model. Calcium dynamics is shown only for the outer shell of cytosolic voxels. Calcium is shown by red shades on an enhanced scale (500 mM saturation, 100 nM black). JSR \([\text{Ca}^{2+}]\) is shown on an enhanced scale (560 µM saturation, 480 µM black) by cyan color. Calcium dynamics is shown only for the outer shell of cytosolic voxels. \(k_{\text{NCX}} = 45 \text{ pA/µF}\). See also Fig. 14.

**Video 6.** Same 3-D model simulation set as in Video 5 but showing complex spatiotemporal pattern of local SR \(\text{Ca}^{2+}\) depletions. Limited-size LCR events generate limited SR calcium depletions within the LCR close proximity. But the depletions are surrounded by a halo in which uptake of cytosolic calcium by SERCA produces increased FSR calcium in advance of the leading edge of the wave. FSR and JSR calcium are shown on an enhanced scale (560 µM saturation, 480 µM black) by red and cyan shades, respectively. See also Fig. 15 and Results for more details.

**Video 7.** The “coupled clock” function in 3-D SANC model. Simulations of local cytosolic calcium dynamics within outer shell and in a cell cross section performed using a 3-D SANC model spontaneously firing action potentials (red curve). Rising diastolic calcium release consists of multiple propagating LCR events that expand by recruitment of couplings that increases NCX current (green curve). L-type current (blue curve) triggers release by a local control mechanism in each coupling, simultaneously depleting the JSR in all couplings, thereby resynchronizing the clocks. See Results for further details and Figs. 18 and 19. The cytosolic \([\text{Ca}^{2+}]\) is coded by red shades from 0.1 µM (black) to 5 µM (saturation). JSR \([\text{Ca}^{2+}]\) is coded by cyan color (1,000 µM saturation, 650 µM black). \(k_{\text{NCX}} = 45 \text{ pA/µF}\) and \(P_{\text{op}} = 24 \text{ nM/s}\).

**Video 8.** Same as in Video 7, but showing local calcium dynamics within FSR (instead of cytosolic calcium). FSR and JSR calcium are shown by red and cyan shades, respectively (1,000 µM saturation, 650 µM black).

**Video 9.** “A partially coupled clock” function in a 3-D SANC model in which NCX density (\(k_{\text{NCX}}\)) was reduced from 45 (Videos 7 and 8) to 17.5 pA/µF, with all other model parameters and display settings remaining the same as in the simulations shown in Videos 7 and 8. See Fig. 20 and Results for details.
**Model Equations**

**L-type Calcium Channel**
Transition rates (states numbered from 1 to 8).

\[ r_{1,2} = r_{12\_dl} \]
\[ r_{1,3} = r_{12\_fl} \]
\[ r_{1,4} = r_{12\_fca} \]
\[ r_{2,1} = r_{21\_dl} \]
\[ r_{2,5} = r_{12\_fl} \]
\[ r_{2,6} = r_{12\_fca} \]
\[ r_{3,1} = r_{21\_fl} \]
\[ r_{3,5} = r_{12\_dl} \]
\[ r_{3,7} = r_{12\_fca} \]
\[ r_{4,1} = r_{21\_fca} \]
\[ r_{4,6} = r_{12\_dl} \]
\[ r_{4,7} = r_{12\_fl} \]
\[ r_{5,2} = r_{21\_fl} \]
\[ r_{5,3} = r_{21\_dl} \]
\[ r_{5,8} = r_{12\_fca} \]
\[ r_{6,2} = r_{21\_fca} \]
\[ r_{6,4} = r_{21\_dl} \]
\[ r_{6,8} = r_{12\_fl} \]
\[ r_{7,3} = r_{21\_fca} \]
\[ r_{7,4} = r_{21\_fl} \]
\[ r_{7,8} = r_{12\_dl} \]
\[ r_{8,5} = r_{21\_fca} \]
\[ r_{8,6} = r_{21\_fl} \]
\[ r_{8,7} = r_{21\_dl} \]
\[
\begin{align*}
\text{r12 } \text{dl} &= -\frac{0.02839(V + 35)}{e^{-0.4(V + 35)} - 1} - \frac{0.0849V}{e^{-0.20833V} - 1} + \frac{0.01143(V - 5)}{e^{0.4(V - 5)} - 1} \\
\text{r21 } \text{dl} &= -\left(\frac{1}{e^{-0.00518(V + 32.5)} + 1}\right) - \frac{0.02839(V + 35)}{e^{-0.4(V + 35)} - 1} - \frac{0.0849V}{e^{-0.20833V} - 1} + \frac{0.01143(V - 5)}{e^{0.4(V - 5)} - 1} \\
\text{r12 } \text{fl} &= \frac{1}{\left(257.1e^{-0.00518(V + 32.5)} + 44.3\right)\left(e^{0.13699(V + 35)} + 1\right)} \\
\text{r12 } \text{fca} &= \alpha_{\text{fca}} \\
\text{r21 } \text{fca} &= \frac{\alpha_{\text{fca}}}{\text{kmfca}} \\
\end{align*}
\]

L-type unitary current = \(uic \ (1-V/Eca)\)  
(0 if \(V_m<-50 \text{ mV}\))

Membrane Currents

\[
dV/dt = -(I_{CaL} + I_{CaT} + I_t + I_{st} + I_{Kr} + I_{Ks} + I_{to} + I_{sas} + I_{NaK} + I_{NCX} + I_{bCa} + I_{bNa})/C_m \\
\]

\[
dy/dt = (y_i,\infty - y) / \tau_{yi} \\
(y_i = d_T, f_T, p_A, p_S, p_i, n, q, r, y, a, q_i) \\
\]

\(\tau_{yi}\): Time constant for a gating variable \(y_i\).

\(\alpha_{yi}\) and \(\beta_{yi}\): Opening and closing rates for channel gating.

\(y_i,\infty\): Steady-state curve for a gating variable \(y_i\).

T-type \(Ca^{2+}\) current (\(I_{CaT}\))

\[
I_{CaT} = C_m g_{CaT} (V - E_{CaT}) d_T f_T \\
d_{T,\infty} = 1/\{1 + \exp[-(V + 26.3)/6.0]\} \\
f_{T,\infty} = 1/\{1 + \exp[(V + 61.7)/5.6]\} \\
\tau_{dT} = 1/\{1.068\exp[(V + 26.3)/30] + 1.068\exp[-(V + 26.3)/30]\} \\
\]

RyR clustering enables calcium clock
\[ \tau_{\text{T}} = 1/\{0.0153 \cdot \exp[-(V + 61.7)/83.3] + 0.015 \cdot \exp[(V + 61.7)/15.38]\} \]

Rapidly activating delayed rectifier \( K^+ \) current \( (I_{\text{Kr}}) \)
\[ I_{\text{Kr}} = C_m \cdot g_{\text{Kr}} \cdot (V - E_K) \cdot (0.6 \cdot p_{\text{a}} + 0.4 \cdot p_{\text{as}}) \cdot p_i \]
\[ p_{a,\infty} = 1 / \{1 + \exp[-(V + 23.2)/10.6]\} \]
\[ p_{i,\infty} = 1 / \{1 + \exp[(V + 28.6)/17.1]\} \]
\[ \tau_{p_{\text{a}}F} = 0.84655354 / \{0.0372 \cdot \exp(V/15.9) + 0.00096 \cdot \exp(-V/22.5)\} \]
\[ \tau_{p_{\text{a}}S} = 0.84655354 / \{0.0042 \cdot \exp(V/17.0) + 0.00015 \cdot \exp(-V/21.6)\} \]
\[ \tau_{p_i} = 1/\{0.1 \cdot \exp(-V/54.645) + 0.656 \cdot \exp(V/106.157)\} \]

Slowly activating delayed rectifier \( K^+ \) current \( (I_{\text{Ks}}) \)
\[ I_{\text{Ks}} = C_m \cdot g_{\text{Ks}} \cdot (V - E_{Ks}) \cdot n^2 \]
\[ \alpha_n = 0.014 / \{1 + \exp[-(V - 40)/9]\} \]
\[ \beta_n = 0.001 \cdot \exp(-V/45) \]
\[ n_{\infty} = \alpha_n / (\alpha_n + \beta_n) \]
\[ \tau_n = 1/\{\alpha_n + \beta_n\} \]

4-aminopyridine-sensitive currents \( (I_{\text{4AP}} = I_{\text{to}} + I_{\text{sus}}) \)
\[ I_{\text{to}} = C_m \cdot g_{\text{to}} \cdot (V - E_K) \cdot q \cdot r \]
\[ I_{\text{sus}} = C_m \cdot g_{\text{sus}} \cdot (V - E_K) \cdot q \cdot r \]
\[ q_{\infty} = 1 / \{1 + \exp[-(V + 49)/13]\} \]
\[ r_{\infty} = 1 / \{1 + \exp[-(V - 19.3)/15]\} \]
\[ \tau_q = 39.102 / \{0.57 \cdot \exp[-0.08 \cdot (V + 44)] + 0.065 \cdot \exp[0.1 \cdot (V + 45.93)]\} + 6.06 \]
\[ \tau_r = 14.40516 / \{0.137 \cdot \exp[0.09 \cdot (V + 30.61)] + 0.369 \cdot \exp[-0.12 \cdot (V + 23.84)]\} + 2.75352 \]

Hyperpolarization-activated, “funny” current \( (I_f) \)
\[ I_f = I_{\text{fNa}} + I_{\text{fK}} \]
\[ y_{\infty} = 1 / \{1 + \exp[(V - V_{f,1/2})/13.5]\} \]
\[ \tau_y = 0.7166529 / \{\exp[-0.08 \cdot (V + 386.9)/45.302] + \exp[(V - 73.08)/19.231]\} \]
\[ I_{\text{fNa}} = C_{m} \cdot 0.3833 \cdot g_{\text{fNa}} \cdot (V - E_{Na}) \cdot y_{\infty}^2 \]
\[ I_{\text{fK}} = C_{m} \cdot 0.6167 \cdot g_{\text{fK}} \cdot (V - E_{K}) \cdot y_{\infty}^2 \]

Sustained inward current \( (I_s) \)
\[ I_s = C_m \cdot g_s \cdot (V - E_{s}) \cdot q_a \cdot q_i \]
\[ q_{a,\infty} = 1 / \{1 + \exp[-(V + 57)/5]\} \]
\[ \alpha_q = 0.15 \cdot \exp(-V/11) + 0.2 \cdot \exp(-V/700) \]
\[ \beta_q = 1 / \{16 \cdot \exp(V/8) + 15 \cdot \exp(V/50)\} \]
\[ \tau_q = 1 / \{\alpha_q + \beta_q\} \]
\[ \alpha_q = 0.15 \cdot \exp(-V/13) + 0.7 \cdot \exp(V/700) \]
\[ \beta_q = 1 / \{95 \cdot \exp(-V/10) + 50 \cdot \exp(-V/700)\} + 0.0000229 / [1 + \exp(-V/5)] \]
\[ \tau_q = 6.65 / \{\alpha_q + \beta_q\} \]
\[ q_{i,\infty} = \alpha_q / (\alpha_q + \beta_q) \]

\( Na^+ \)-dependent background current \( (I_{bNa}) \)
\[ I_{bNa} = C_{m} \cdot g_{bNa} \cdot (V - E_{Na}) \]

RyR clustering enables calcium clock
\[ I_{\text{NaK}} = C_m \cdot I_{\text{NaKmax}} \cdot \{1 + (K_mK_p/K_{co})^{1.2}\}^{-1} \cdot \{1 + (K_mNa/K_{a})^{1.3}\}^{-1} \cdot \{1 + \exp[-(V - E_{\text{Na}} + 120)/30]\}^{-1} \]

\[ I_{\text{bCa}} = C_m \cdot g_{\text{bCa}} \cdot (V - E_{\text{CaL}}) \]

\[ I_{\text{NCX}} = C_m \cdot k_{\text{NCX}} \cdot (k_{21} \cdot x_2 - k_{i1} \cdot x_1) / (x_1 + x_2 + x_3 + x_4) \]

\[ d_i = 1 + (Ca/K_{co}) \cdot \{1 + \exp(Q_{co} \cdot V/E_T)\} + (Na/K_{1n}) \cdot \{1 + (Na/K_{2no}) \cdot (1 + Na/K_{3no})\} \]

\[ k_{12} = (Ca/K_{ci}) \cdot \exp(-Q_{ci} \cdot V/E_T) / d_i \]

\[ k_{14} = (Na/K_{1ni}) \cdot (Na/K_{2ni}) \cdot (1 + Na/K_{3ni}) \cdot \exp(-Q_{ni} \cdot V/(2E_T)) / d_i \]

**Cytosolic Ca\(^{2+}\) buffering in each voxel**

\[ d_{fTC}/dt = k_{fTC} \cdot Ca_i \cdot (1 - f_{TC}) - k_{bTC} \cdot f_{TC} \]

\[ d_{fTMC}/dt = k_{fTMC} \cdot Ca_i \cdot (1 - f_{TMC} - f_{TMM}) - k_{bTMC} \cdot f_{TMC} \]

\[ d_{fTMM}/dt = k_{fTMM} \cdot Mg_i \cdot (1 - f_{TMC} - f_{TMM}) - K_{fTMM} \cdot f_{TMM} \]

\[ d_{fCM}/dt = k_{fCM} \cdot Ca_i \cdot (1 - f_{CMi}) - k_{bCM} \cdot f_{CMi} \]

\[ d_{fCM} / dt = k_{fCM} \cdot Ca_{sub} \cdot (1 - f_{CM}) - k_{bCM} \cdot f_{CM} \]

\[ d_{fCQ}/dt = k_{fCQ} \cdot Ca_{jSR} \cdot (1 - f_{CQ}) - k_{bCQ} \cdot f_{CQ} \]

RyR clustering enables calcium clock
**Typical Parameters**

\( \alpha_{Ca} = 0.021 \text{ ms}^{-1} \): Ca\(^{2+}\) dissociation rate constant for \( I_{CaL} \)
\( CAO = 0.1E-03 \text{ mM}: \) initial intracellular [Ca\(^{2+}\)]
\( Ca_o = 1 \text{ mM}: \) extracellular [Ca\(^{2+}\)]
\( CASR0=1 \text{ mM}: \) Initial [Ca\(^{2+}\)] in the SR
\( CELLENGTH = 100 \mu\text{m}: \) Nominal cell length,
Actual cell length = 112 \mu\text{m}
\( CM_{tot} = 0.045 \text{ mM}: \) Total calmodulin concentration.
\( COUPSP = 1.4 \mu\text{m}: \) major couplon spacing
\( CSQTL = 30 \text{ mM}: \) [Calsequestrin] in jSR
\( DCA = 0.15 \mu\text{m}^2/\text{ms}: \) diffusion coefficient for free Ca\(^{2+}\) in cleft
\( DCAG = 0.35 \mu\text{m}^2/\text{ms}: \) diffusion coefficient of free Ca\(^{2+}\) in cytosol
\( DCM = 0.01 \mu\text{m}^2/\text{ms}: \) diffusion coefficient of calmodulin in cytosol
\( DSR = 0.028 \mu\text{m}^2/\text{ms}: \) diffusion coefficient of free Ca\(^{2+}\) in free SR
\( DUP = 0.3 \text{ ms}^{-1}: \) free Ca\(^{2+}\) diffusion rate constant from fSR to jSR
\( E_{CaL} = 45: \) Apparent reversal potential of \( I_{CaL} \).
\( E_{Cat} = 45: \) Apparent reversal potential of \( I_{CaT} \).
\( E_K = -87.0013 \text{ mV} = E_T \cdot \ln{(K_{oo}/K_o)}: \) Equilibrium potential for K\(^+\).
\( E_{Ks} = -49.4464 \text{ mV} = E_T \cdot \ln{(K_{oo}+0.12 \cdot Na_o)/(K_o +0.12 \cdot Na_o)}: \) Reversal potential of \( I_{Ks} \).
\( E_{Na} = 70.5328 \text{ mV} = E_T \cdot \ln{(Na_o/Na)}: \) Equilibrium potential for Na\(^+\).
\( E_ia = 37.4: \) Apparent reversal potential of \( I_a \).
\( FVCYTO = 0.46 \) fractional volume of cytosol
\( FVFSR = 0.35E-01 \) fractional volume of fSR
\( g_{bCa} = 0.0006 \text{ nS/pF}: \) Background Ca\(^{2+}\) current conductance
\( g_{bNa} = 0.00486 \text{ nS/pF}: \) Background Na\(^+\) current conductance
\( g_{CaT} = 0.1832 \text{ nS/pF}: \) T-type Ca\(^{2+}\) current conductance
\( g_{K} = 0.15 \text{ nS/pF}: \) Hyperpolarization-activated current conductance
\( g_{Kr} = 0.08113973 \text{ nS/pF}: \) Delayed rectifier K\(^+\) current rapid component conductance
\( g_{Ks} = 0.0259 \text{ nS/pF}: \) Delayed rectifier K\(^+\) current slow component conductance
\( g_{a} = 0.003 \text{ nS/pF}: \) Sustained non-selective current conductance
\( g_{sus} = 0.02 \text{ nS/pF}: \) 4-aminopyridine sensitive sustained K\(^+\) current conductance
\( g_{so} = 0.252 \text{ nS/pF}: \) 4-aminopyridine sensitive transient K\(^+\) current conductance
\( HJ = 0.297900E-01 \mu\text{m}: \) Effective cleft height including surface charge
\( HP = 1.78700: \) SR Ca\(^{2+}\) pump cooperativity
\( I_{NaK_{max}} = 2.88 \text{ pA/pF}: \) maximal Na\(^+\)/K\(^+\) pump current
\( K_{1ni} = 395.3: \) intracellular Na\(^+\) binding to first site on NCX.
\( K_{1no} = 1628: \) extracellular Na\(^+\) binding to first site on NCX.
\( K_{2ni} = 2.289: \) intracellular Na\(^+\) binding to second site on NCX.
\( K_{2no} = 561.4: \) extracellular Na\(^+\) binding to second site on NCX.
\( K_{3ni} = 26.44: \) intracellular Na\(^+\) binding to third site on NCX.
\( K_{3no} = 4.663: \) extracellular Na\(^+\) binding to third site on NCX.
\( k_{DCM} = 0.542 \text{ ms}^{-1}: \) Ca\(^{2+}\) dissociation constant for calmodulin.
\( k_{HTC} = 0.446 \text{ ms}^{-1}: \) Ca\(^{2+}\) dissociation constant for the troponin-Ca\(^{2+}\) site.
\( k_{HTMC} = 0.00751 \text{ ms}^{-1}: \) Ca\(^{2+}\) dissociation constant for the troponin-Mg\(^{2+}\) site.
\( k_{HTMM} = 0.751 \text{ ms}^{-1}: \) Mg\(^{2+}\) dissociation constant for the troponin-Mg\(^{2+}\) site.
$K_{c}\text{I} = 0.0207$: intracellular $\text{Ca}^{2+}$ binding to NCX transporter.

$K_{c\text{Ni}} = 26.44$: intracellular $\text{Na}^{+}$ and $\text{Ca}^{2+}$ simultaneous binding to NCX.

$K_{c\text{O}} = 3.663$: extracellular $\text{Ca}^{2+}$ binding to NCX transporter.

$K_{\text{DCSQ}} = 0.638$: $K_d$ of calsequestrin

$k_{f\text{CM}} = 227.7 \text{ mM}^{-1} \cdot \text{ms}^{-1}$: $\text{Ca}^{2+}$ association constant for calmodulin.

$k_{f\text{TC}} = 88.8 \text{ mM} / \text{ms}$: $\text{Ca}^{2+}$ association constant for troponin.

$k_{f\text{TM}} = 227.7 \text{ mM} / \text{ms}$: $\text{Ca}^{2+}$ association constant for the troponin-$\text{Mg}^{2+}$ site.

$k_{f\text{TMM}} = 2.277 \text{ mM} / \text{ms}$: $\text{Mg}^{2+}$ association constant for the troponin-$\text{Mg}^{2+}$ site.

$K_{\text{MF}} = 0.246000 \text{E}^{-3}$: the cytosolic side $K_d$ of SERCA

$k_{f\text{NCX}} = 150 \text{ pA/pF}$: maximal $\text{Na}^{+}/\text{Ca}^{2+}$ exchanger (NCX) current

$EC_{50} = 0.1 \text{E}^{-01} \text{ mM}$: RyR Po half point activation by $\text{Ca}^{2+}$ on the cytosolic site

$K_{\text{M}} = 0.246000 \text{E}^{-3}$: the lumenal side $K_d$ of SERCA

$K_{\text{mfCa}} = 0.1 \text{E}^{-01} \text{ mM}$: Dissociation constant of $\text{Ca}^{2+}$-dependent $I_{\text{CaL}}$ inactivation.

$K_{\text{mKp}} = 1.4 \text{ mM}$: Half-maximal $K_o$ for $I_{\text{NaK}}$.

$K_{\text{mNap}} = 14 \text{ mM}$: Half-maximal $Na_i$ for $I_{\text{NaK}}$.

$K_{\text{MR}} = 2.46 \text{ mM}$: the lumenal side $K_d$ of SERCA

$K_{\text{NCX}} = 150 \text{ pA/pF}$: maximal $\text{Na}^{+}/\text{Ca}^{2+}$ exchanger (NCX) current

$EC_{50} = 0.1 \text{E}^{-01} \text{ mM}$: RyR Po half point activation by $\text{Ca}^{2+}$ on the cytosolic site

$K_{\text{M}} = 0.246000 \text{E}^{-3}$: the lumenal side $K_d$ of SERCA

$k_{f\text{NCX}} = 150 \text{ pA/pF}$: maximal $\text{Na}^{+}/\text{Ca}^{2+}$ exchanger (NCX) current

$EC_{50} = 0.1 \text{E}^{-01} \text{ mM}$: RyR Po half point activation by $\text{Ca}^{2+}$ on the cytosolic site

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$k_{f\text{NCX}} = 150 \text{ pA/pF}$: maximal $\text{Na}^{+}/\text{Ca}^{2+}$ exchanger (NCX) current

$EC_{50} = 0.1 \text{E}^{-01} \text{ mM}$: RyR Po half point activation by $\text{Ca}^{2+}$ on the cytosolic site

$E_T$ is “RT/F” factor = 26.72655 mV,

$S\text{LOC0} = 0.1$: minimum RyR sensitivity at 0 luminal $\text{Ca}^{2+}$

$T\text{BIN} = 0.500000 \text{E}^{-01}$: global time step in ms

$T\text{C}_{\text{tot}} = 0.031 \text{ mM}$: Total concentration of the troponin-$\text{Ca}^{2+}$ site.

$T\text{MC}_{\text{tot}} = 0.062 \text{ mM}$: Total concentration of the troponin-$\text{Mg}^{2+}$ site.

$U\text{IC} = 0.35$: RyR unitary current at 1 mM jSR Ca in pA

$U\text{IV} = 0.03 \text{ pA}$: L-type unitary currents at 0 mV

$V_{\text{f,1/2}} = -64 \text{ mV}$: Half activation voltage for $I_{\text{f}}$ current.

$N\text{DIDL} = 2$: major couplon random displacement in # voxels

$N\text{SP} = 2$: spacing of minor couplons in # voxels

$N\text{DIDL2} = 1$: random displacement of minor couplons in # voxels

$K_{\text{oo}} = 5.4$: Extracellular $K^{+}$ concentration.

RyR clustering enables calcium clock