Monopole simulation

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DAMPE Group Meeting

Outline

- Add the physics list of monopole to DMPSW

The possibility of monopole study

Ahlen and Kinoshita calculated the energy deposition model for slow monopoles ($\beta < 10^{-2}$) [8], which is given by:

$$N_e(\text{Scintillator}) = 2.9 \times 10^{23}\text{cm}^{-3}$$

$$\frac{dE}{dx} = aN_e^{\frac{2}{3}}\left[\ln\left(bN_e^{\frac{1}{3}}\right) - \frac{1}{2}\right]\beta \qquad (2.1)$$

N_e : electron density

where N_e is the electron density, which depends on the material. The two other constants (a and b) can be expressed in terms of the following material-independent constants:

$$a = \frac{2\pi g^2 e^2}{\hbar c(3\pi^2)^{1/3}} \qquad b = 2(3\pi^2)^{1/3}a_0 \qquad (2.2)$$

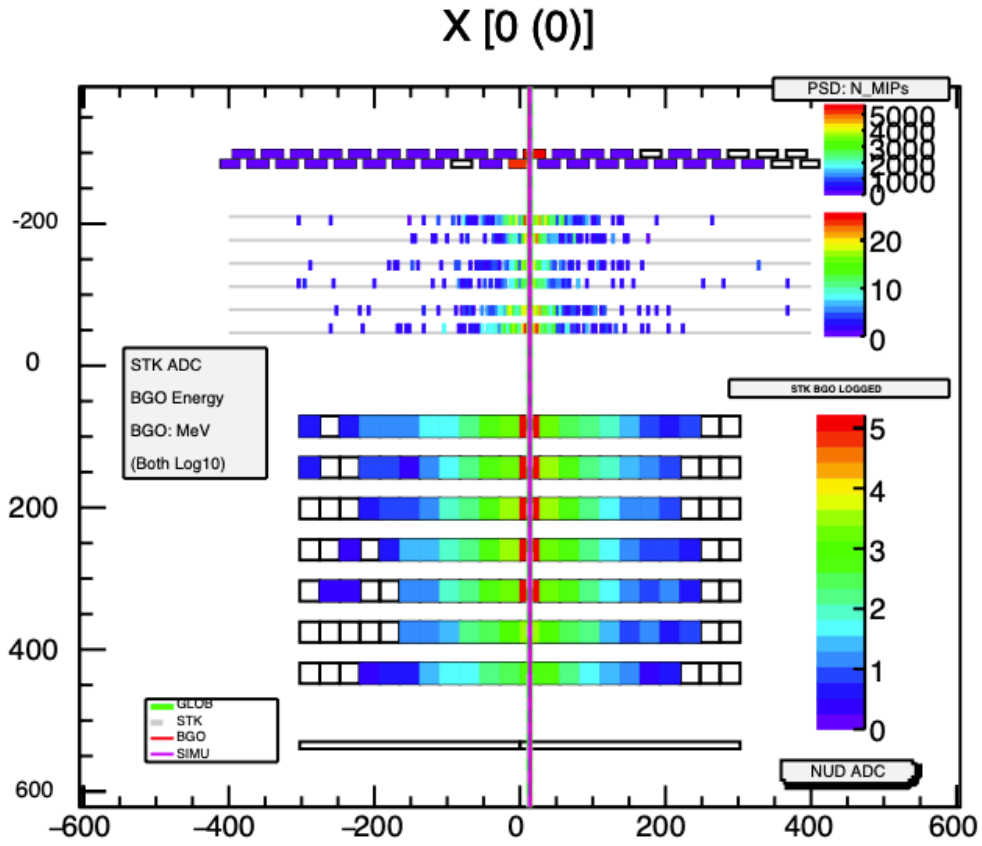
where e is the fundamental charge, $\hbar$ is the reduced Planck constant, c is the speed of light, and a_0 is the Bohr radius. g stands for the monopole charge and it is set to the Dirac charge for this analysis:

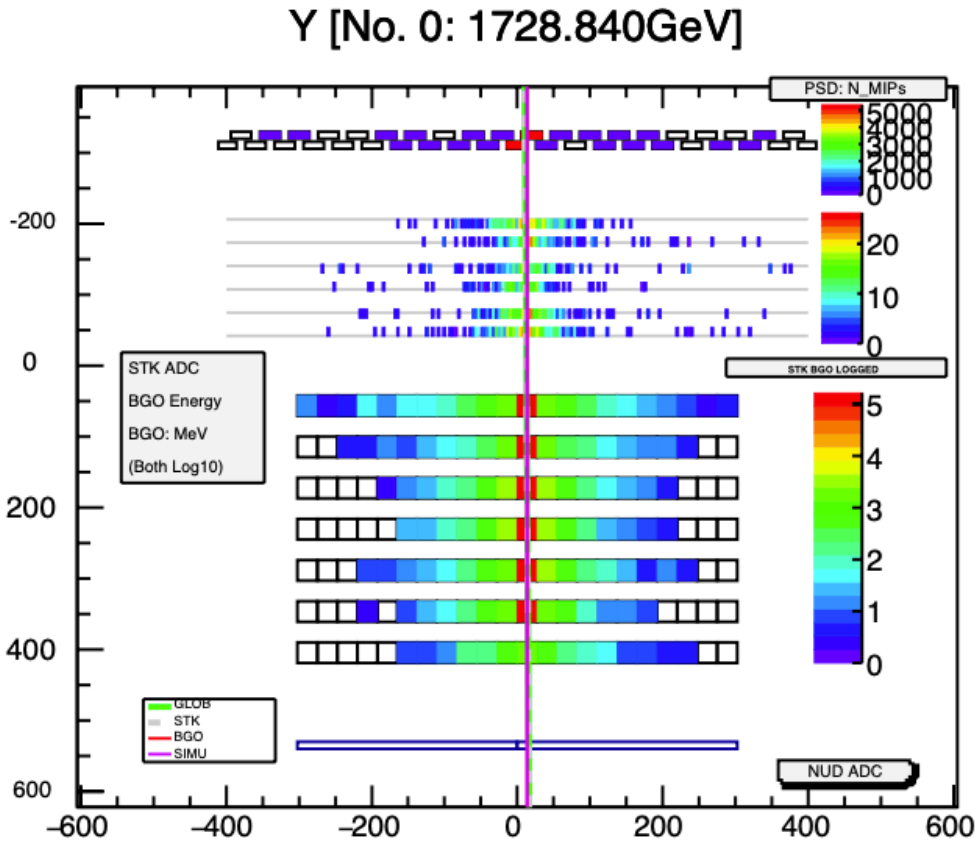
$$g = g_{\text{Dirac}} = \frac{e}{2\alpha} = \frac{\hbar c}{2e} \qquad (2.3)$$

g = 68.5e

where α is the fine structure constant.

Simulation test: large-charged lepton FCP





Particle mass: 10 GeV
Particle charge 68.5
magCharge:0
Kinetic energy: 2 TeV

```
Event ID: 0
TimeStamp: 0 (s), 0 (ms)
TotalEnergy: 1728840.00 MeV, TotalHits (BGO): 239
TotalEnergy (PSD): 42853.14 MeV, TotalHits (PSD): 57
MaxPSDBarEnergy: (X) 11177.57 MeV (Y): 10665.30 MeV
Number of Stk Track(s): 6
Number of Global Track(s): 6
Got Track info from simulation.
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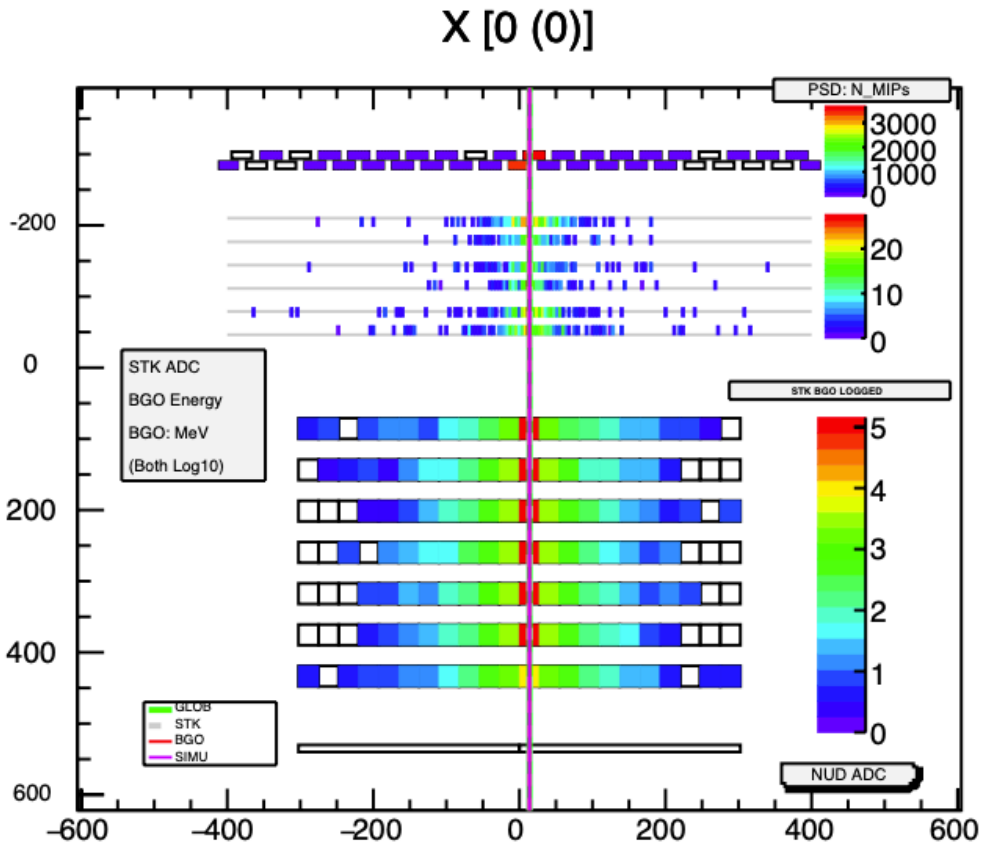
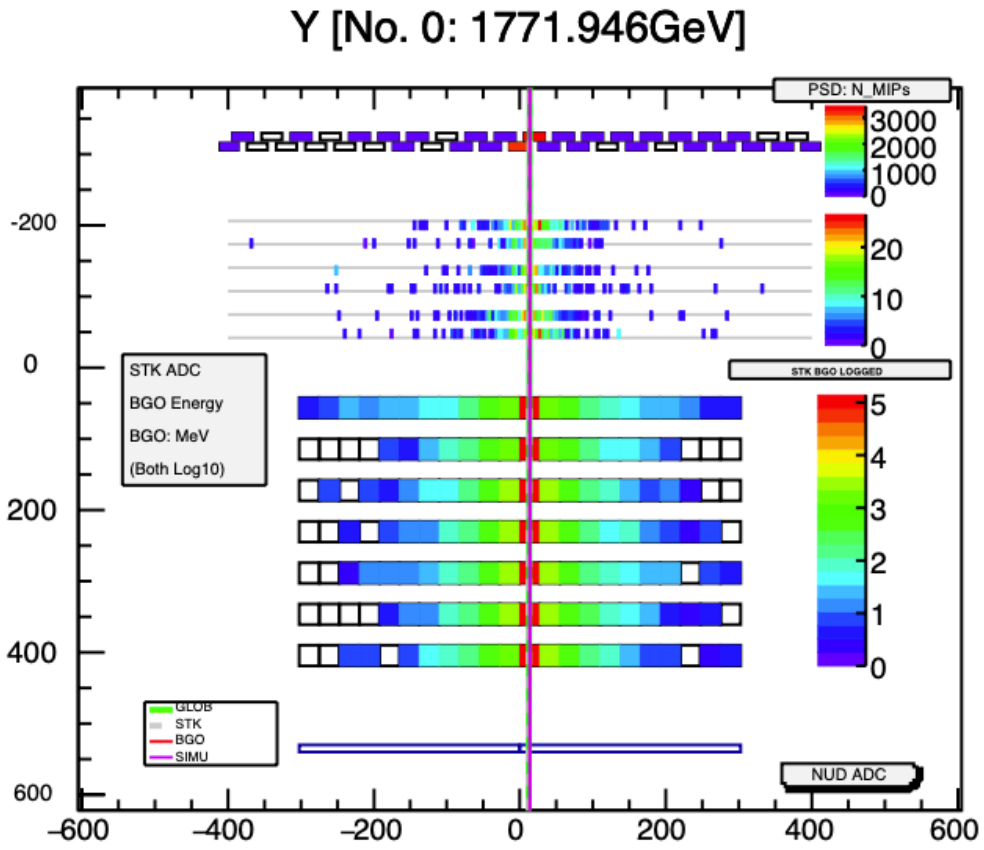
Simulation test: no electric charge monopole





Particle mass: 10 GeV
Particle charge 0
magCharge: 1
Kinetic energy: 2 TeV

```
Event ID: 0
TimeStamp: 0 (s), 0 (ms)
TotalEnergy: 1771946.00 MeV, TotalHits (BGO): 256
TotalEnergy (PSD): 27513.42 MeV, TotalHits (PSD): 59
MaxPSDBarEnergy: (X) 7370.84 MeV (Y): 6888.16 MeV
Number of Stk Track(s): 19
Number of Global Track(s): 19
Got Track info from simulation.
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Next step

- Understand the mechanism of monopole
- Update the simulation