

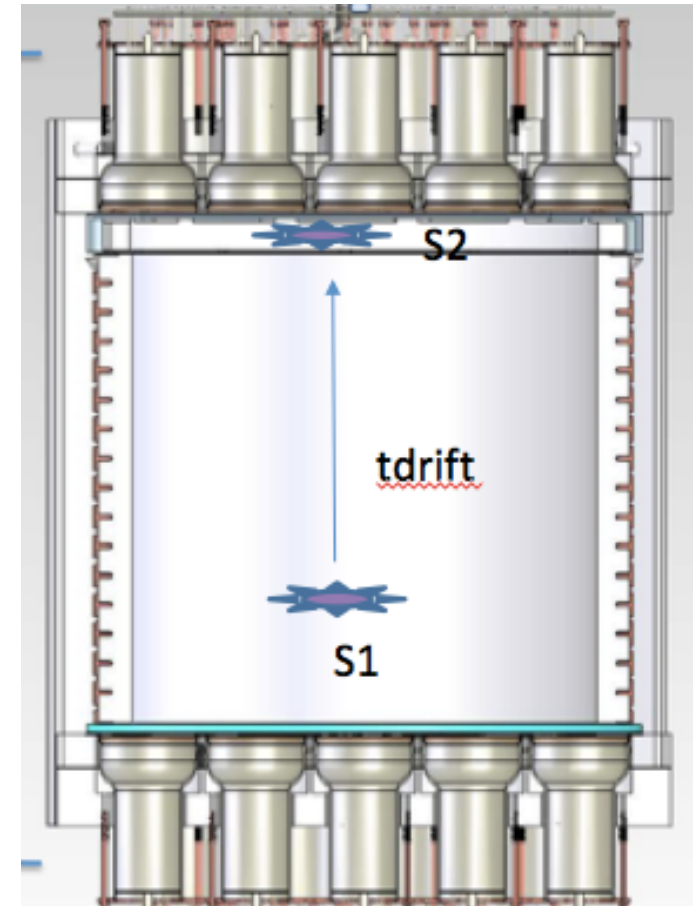
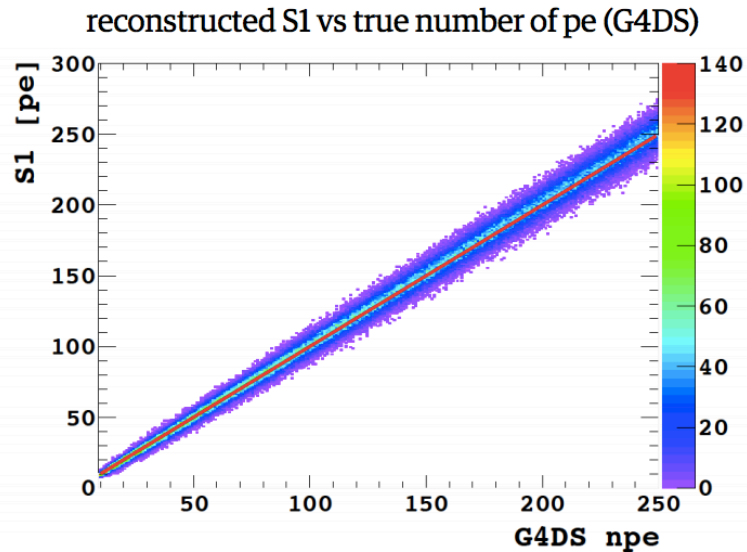
LAr Simulations

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GEANT4 simulations

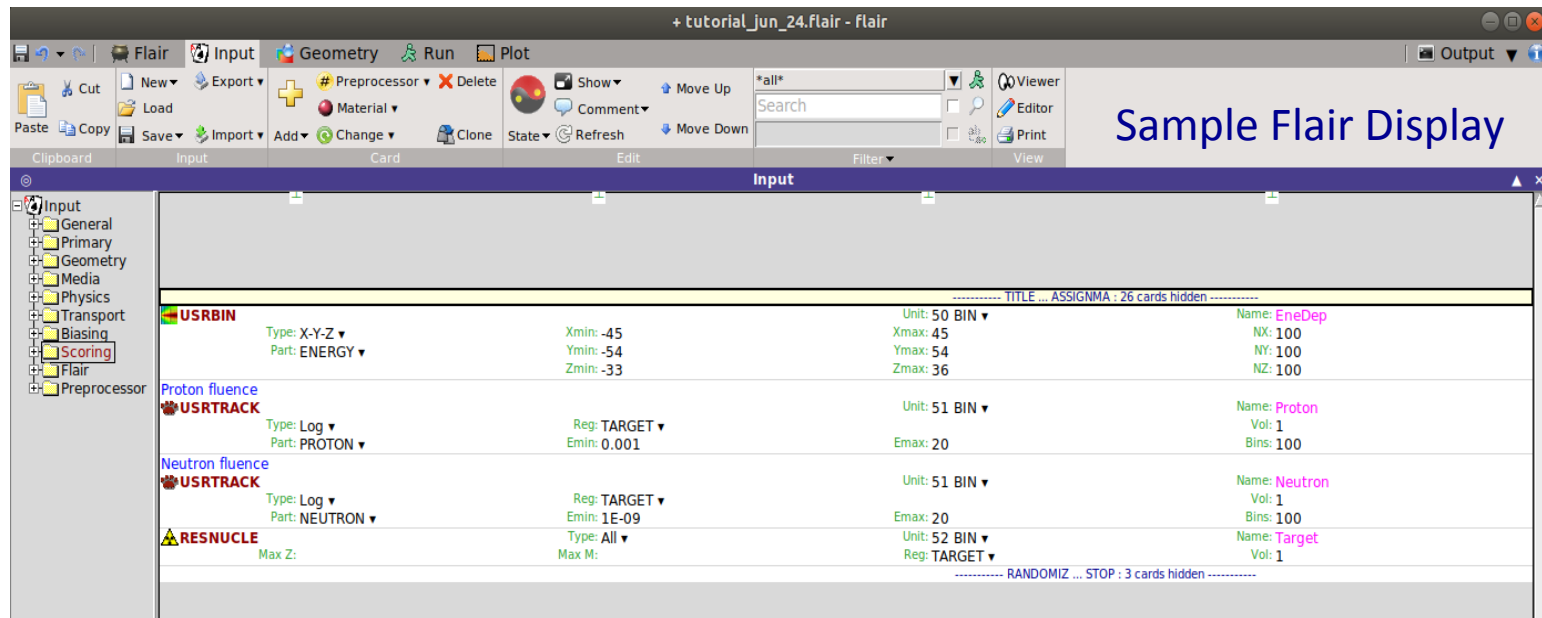
- GEANT4 based Simulation Package [g4ds](#)
- Physical processes embeds
 - G4EmLivermore Physics,
 - High Precision Neutron(HP) for <20 MeV neutrons
 - Precision Argon Response Ionisation and Scintillation (PARIS) for physical processes leading to S1 and S2.



Challenges

- Ability to correctly identify pulses(S1 or S2), multiple S2
- Simulating for S2 photons is computationally extensive. But its important for low mass DM search, better PSD power for upcoming DS detectors
- Simulating β - γ events in S1 as in K-42 decay channel

FLUKA for simulations of muons and cosmogenic neutrons background



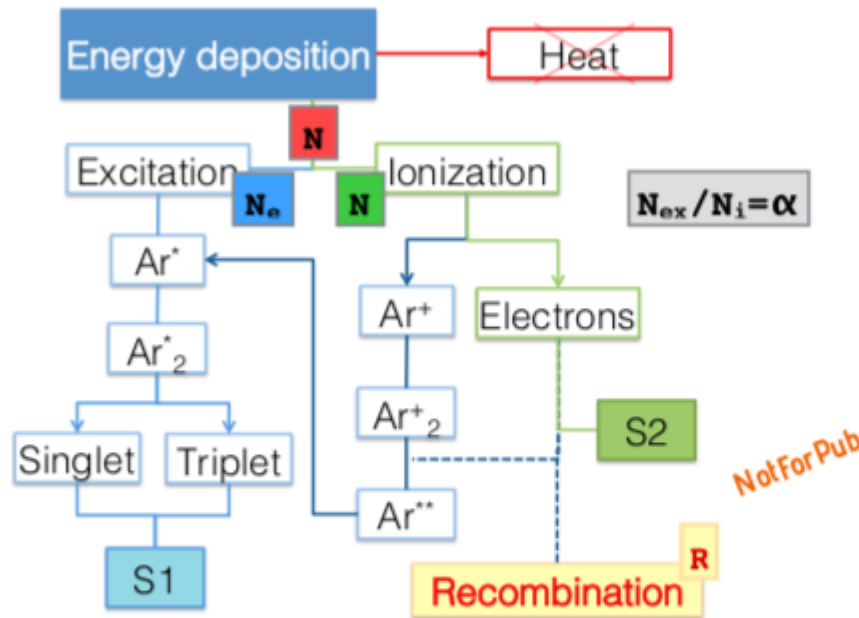
- Right now running FLUKA simulations with Docker Image-to- Singularity Image at Cluster

Challenges with FLUKA

- version conflict, complexity of installing many dependencies(using FLAIR)
- increasingly complex geometry of detectors and computational challenge for longer simulation livetime

The PARIS model

Precision Argon Response Ionization and Scintillation



$$N_q = E / W$$

$$N_i = N_q / (1 + \alpha)$$

$$N_{ex} = N_q - N_i$$

$$N_g = Y_{S1} (N_{ex} + R N_i)$$

$$N_e = N_i (1 - R)$$

fluctuations

$$S1 = g_1 N_g$$

$$S2 = (g_1 Y_{S2}) N_e = g_2 N_e$$

Assumptions:

$$W = 19.5 \text{ [eV]}$$

$$\alpha = 0.21 \text{ (ER)}$$

$$\alpha = 1.00 \text{ (NR)}$$

Constant Y_{S1} (-1) and

Y_{S2} (-200)

(independent on E, field)

NotForPub

The goal is to model **R**
(the recombination probability)
as a function of the **recoil energy** and **drift field**