DUNE PNS meeting

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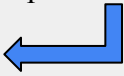
Motivation - Neutron Background in DUNE

Neutrons ⇒ Most important source of background

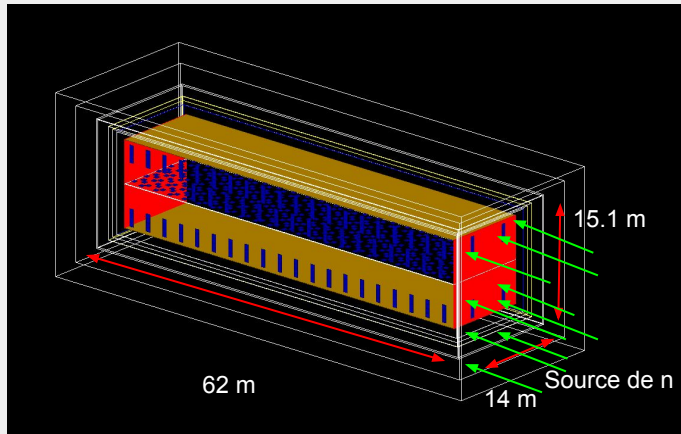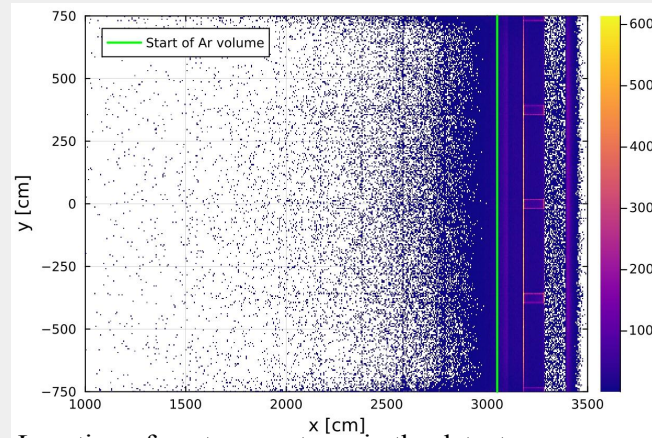- Neutron capture in or out the LAr volume

^{36}Ar ⇒ 8.8 MeV
^{40}Ar ⇒ 6.1 MeV
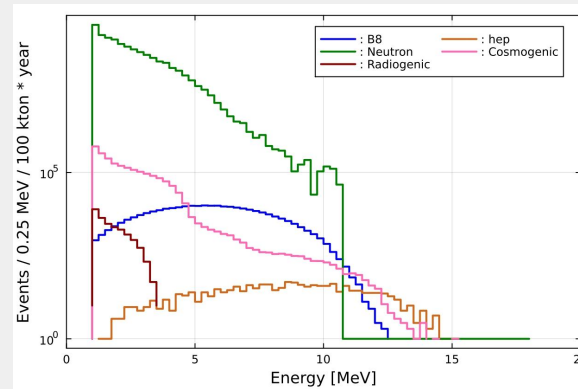
- Estimated number of capture after G4 simulation

Used geometry for the detector

Location of neutron captures in the detector

N captures are mostly :
- at the end of LAr volume
- In the cryostats

Expected energy spectra for different backgrounds and solar neutrinos

Neutron reduced by :

- Shielding
- Fiducialization
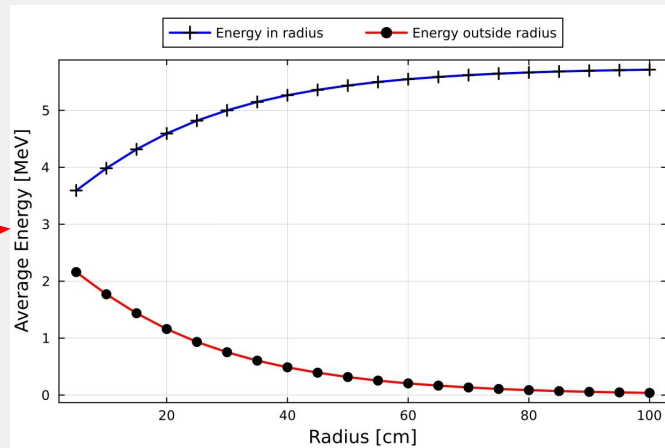
Reconstructed energy

Goal : Determine precisely the energy of a reaction (de-excitation of a N capture)

Method :

- Gather all energy deposits at less than 1 cm $\Rightarrow$ "cluster"
- Select the most energetic cluster as the center of the circle
- Reconstructed energy as a function of radius
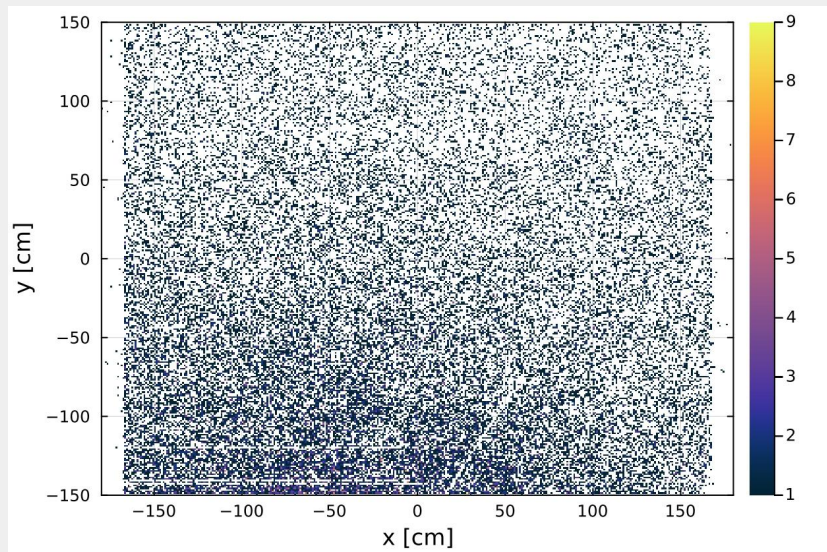

Reconstructed energy (blue) or lost energy (red) according to the selected radius
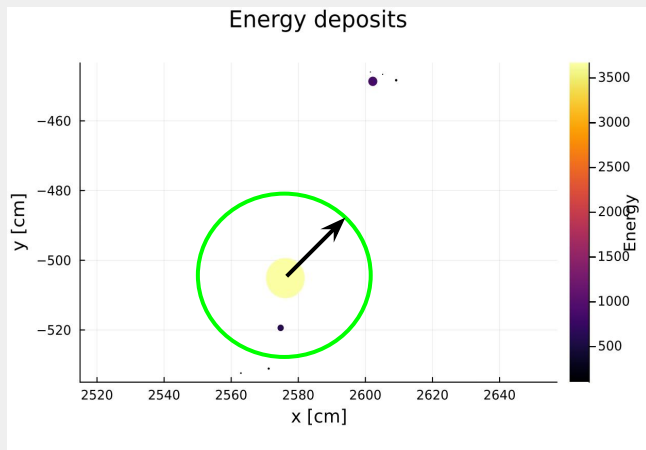
Example of energy clusters for an event [keV]

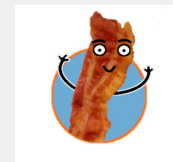**The reconstructed energy is highly dependent on radius.**

$\Rightarrow$ **A high radius is needed to reconstruct the entire de-excitation energy.**

$\Rightarrow$ **Balance to rebuild an event without taking unwanted energy deposits**

Hits in the ColdBox
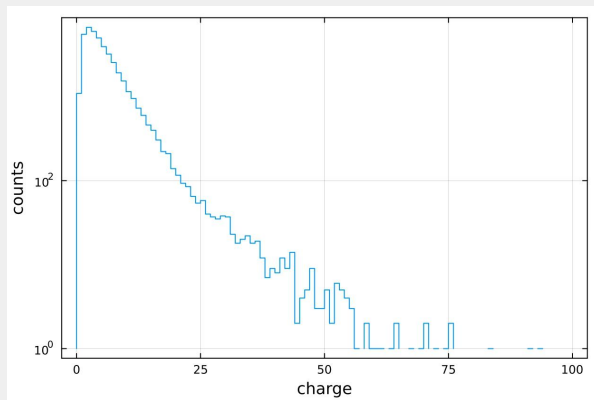

Histogram 2D of single hits from the run 25036

Reconstruction of hits with Lardon

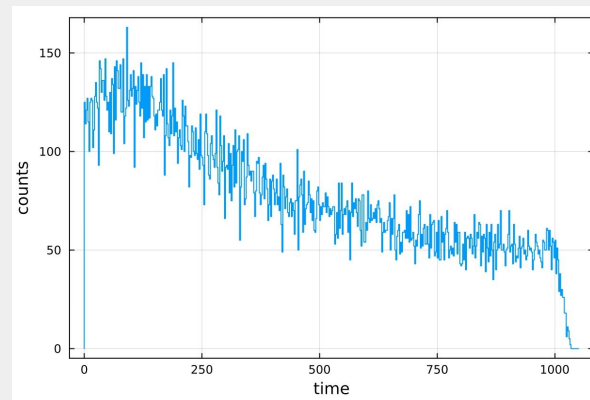$\Rightarrow$ Use of the runs with PNS on (25036)

$\Rightarrow$ Identifying neutron deposits and their features

$\Rightarrow$ Applying the method used for simulations to reconstruct energy
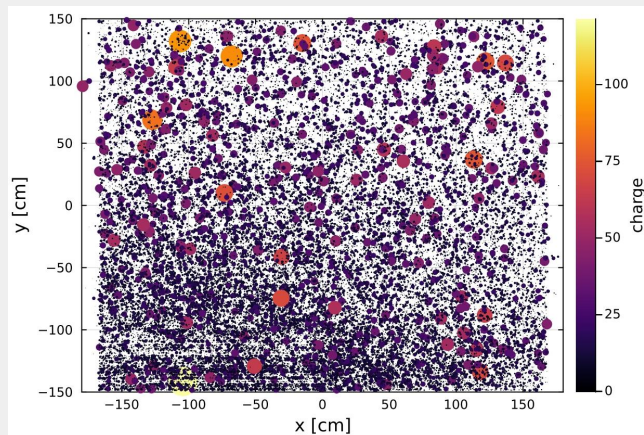
Charge collection and time in ColdBox

Charge collection of single hits from the run 25036

Timestamp of single hits from the run 25036
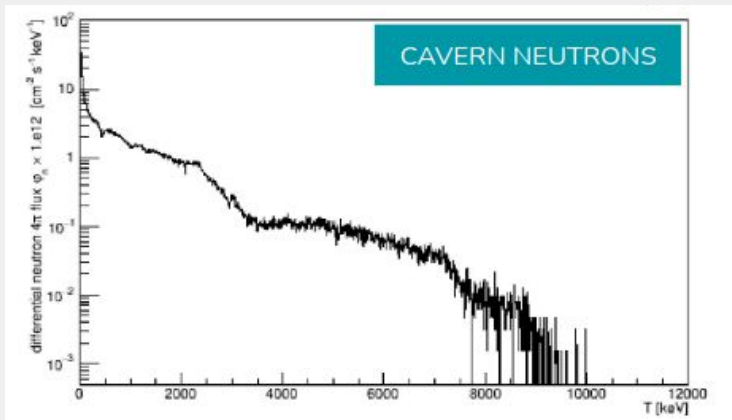
Work on charge and time collection :
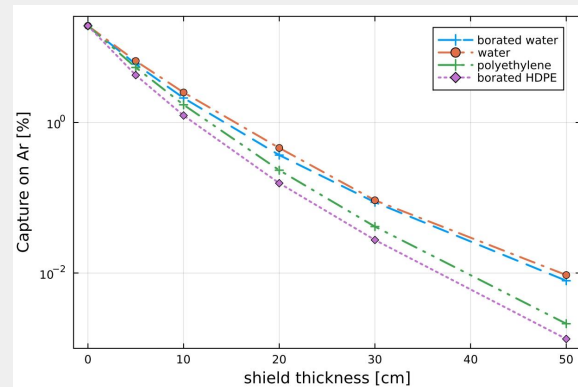
⇒ See if we can identify neutrons thanks to that

Representation of the single hits of the run 25063.
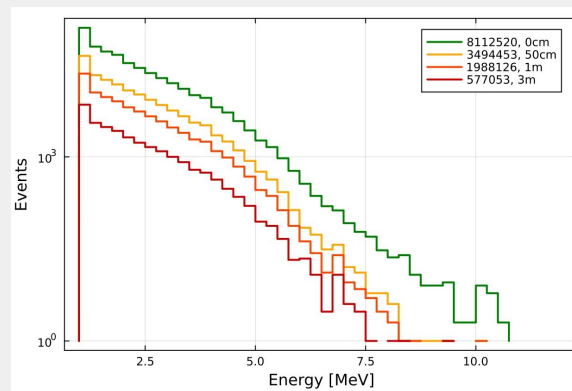The width of the points is proportional to the charge collection

Backup

Evolution of neutron capture in argon

Spectrum of the initial kinetic energy [keV] of the neutrons

- Over **92.9%** of deposits removed with a 3-meter cutoff

Deposited energy by neutrons, according to different spatial cut

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