Multi-Grid on the Simulation Framework

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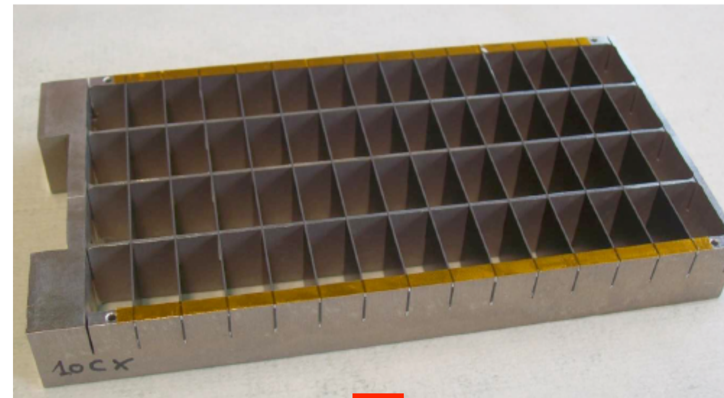
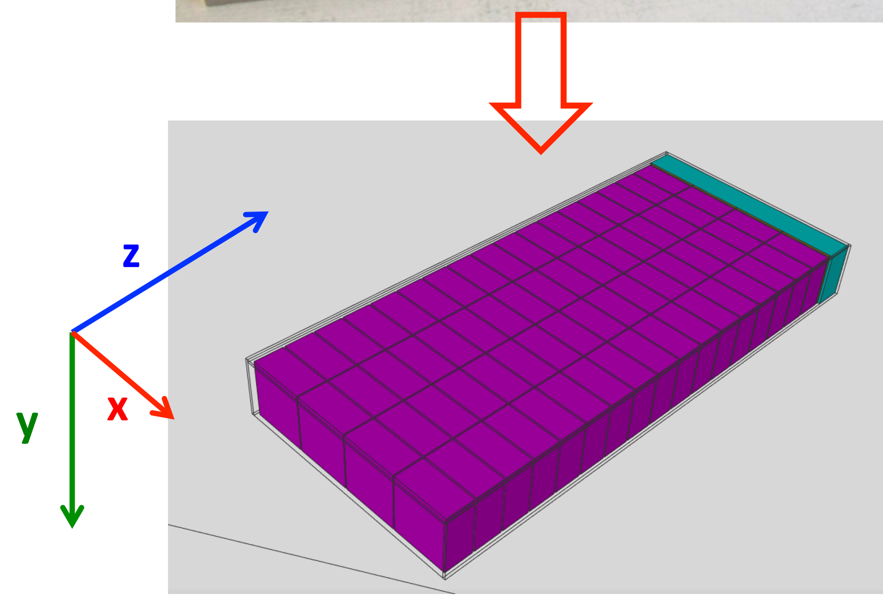
Multi-Grid Simulation

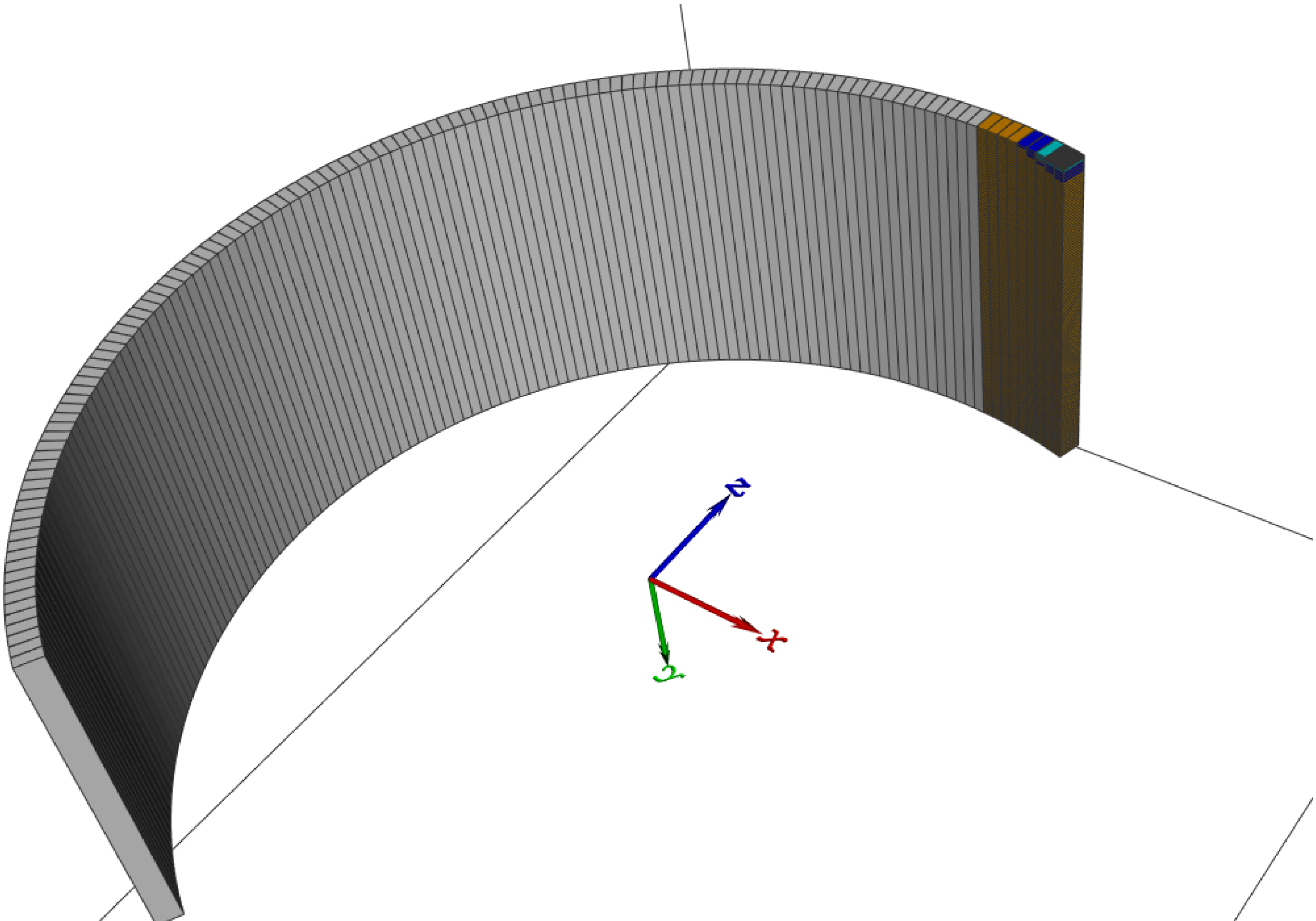
- GEANT4 simulation on Framework:
  - Flexible
  - Parameterized
  - Default settings equal to IN6 grid geometry + realistic full scale instrument geometry
- Additional python scripts for overlay histograms

The Grid

- Grid defined by:
  - 4 X 17 cells (x, z)
    - X = 2.2 cm
    - Y = 2.26 cm
    - Z = 1.1 cm
  - Blades:
    - Entry blade: 1 mm
    - End blade: 11.6 mm
    - Inside blade (x): 0.5 mm
    - Inside blade (z): 0.6 mm
    - Outside blade: 1 mm
  - Boron-carbide:
    - x = 0 um
    - z =1 um
  - End shielding: 1 mm

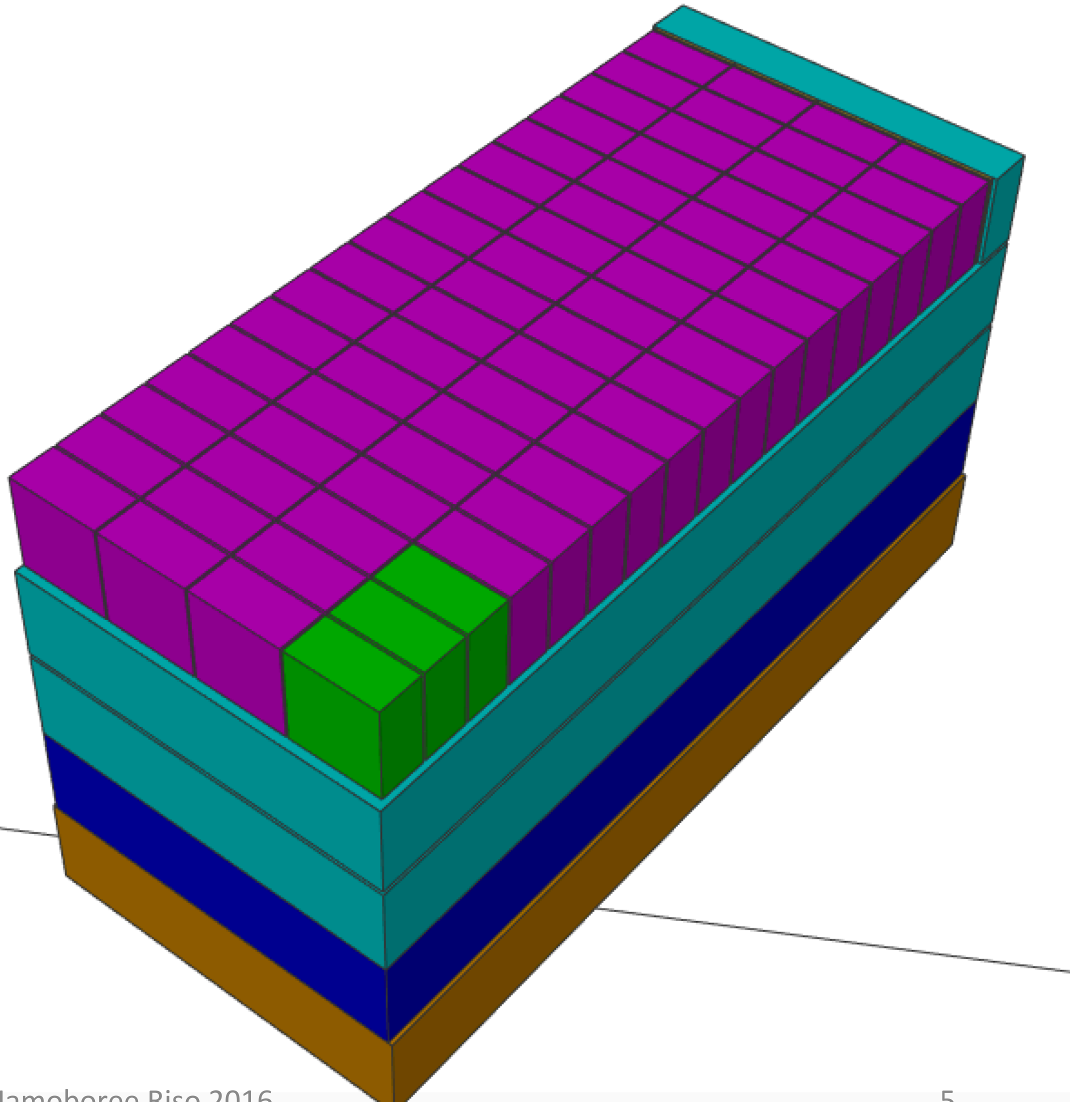




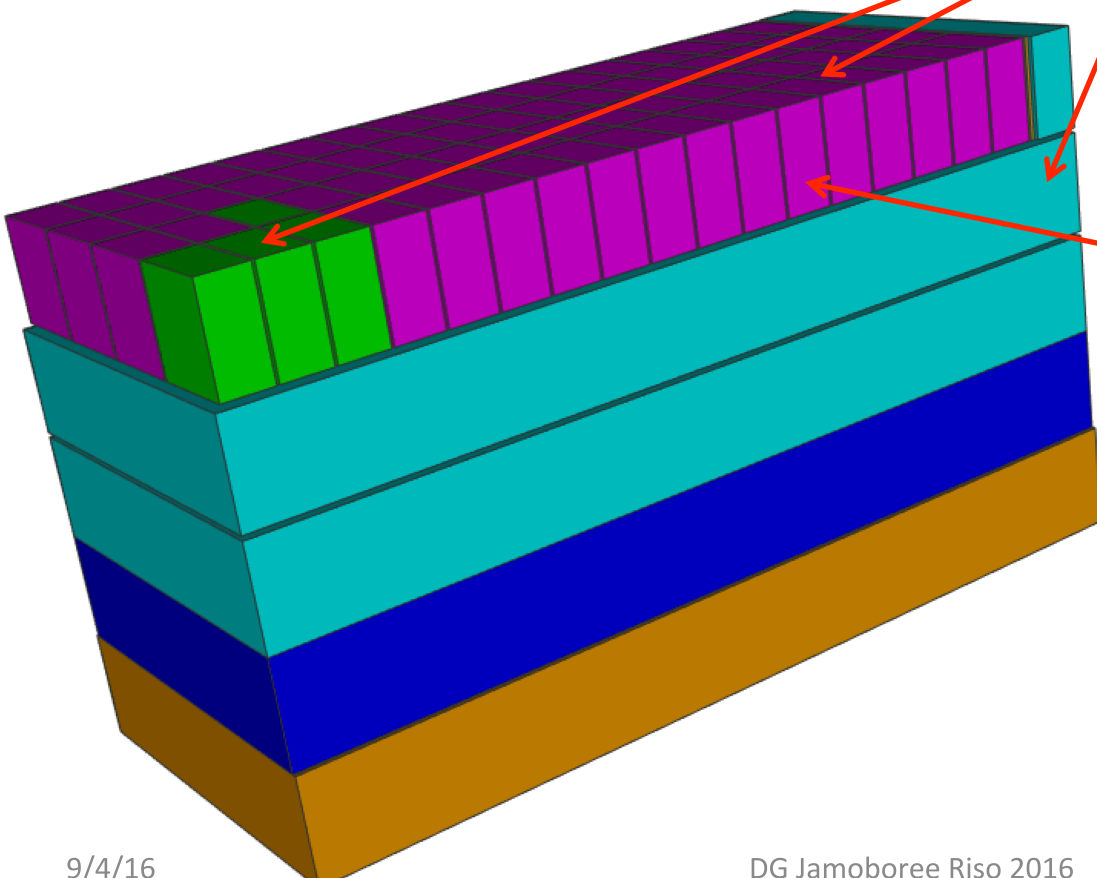

z
x
y

Embedded repetitive structures

- Counting gas
- B_4C
- Al block
  -> frame
- Grid:
  -> gas gap
- Shielded grid:
  -> side shielding



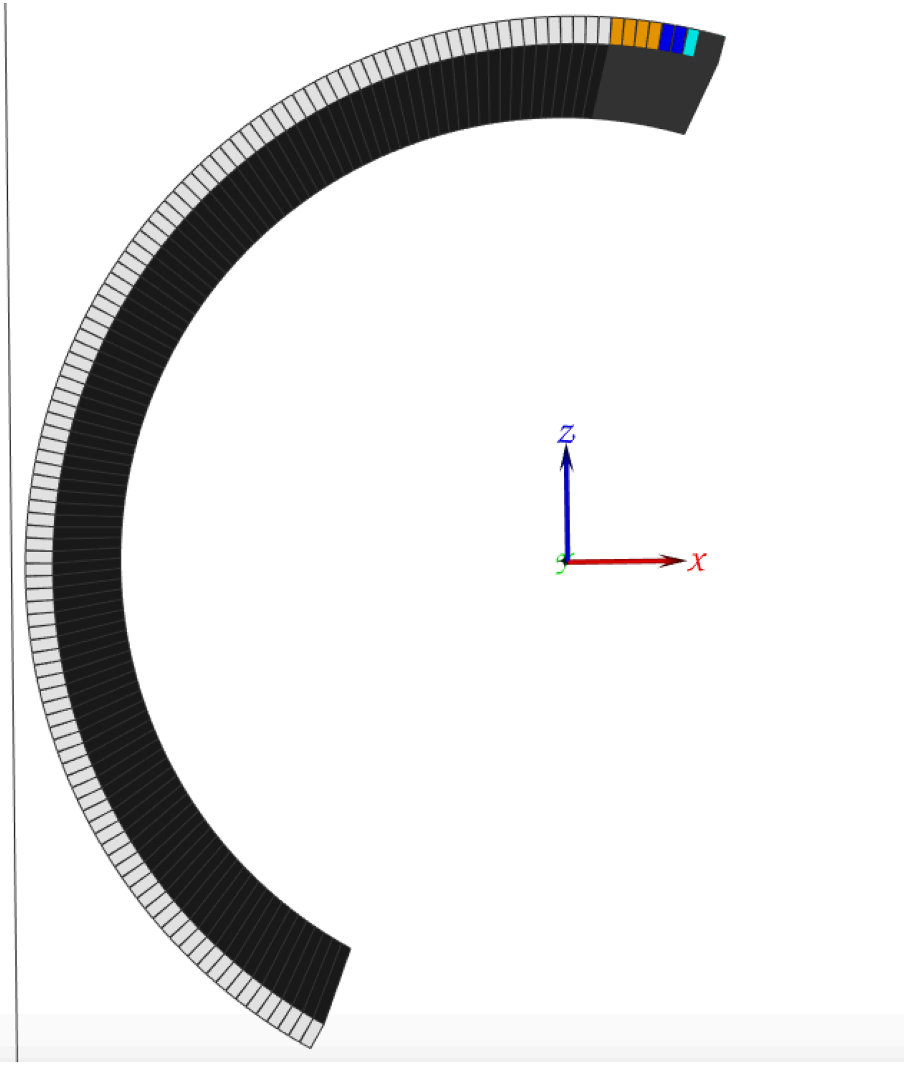
Embedded repetitive structures



- “Place”
- G4Transform3D, G4Rotate3D
- Function: createStack()

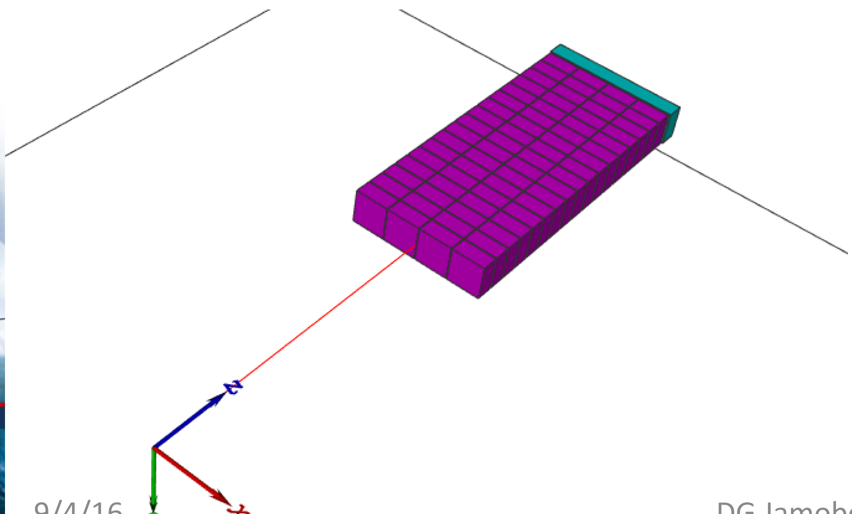
Full scale model

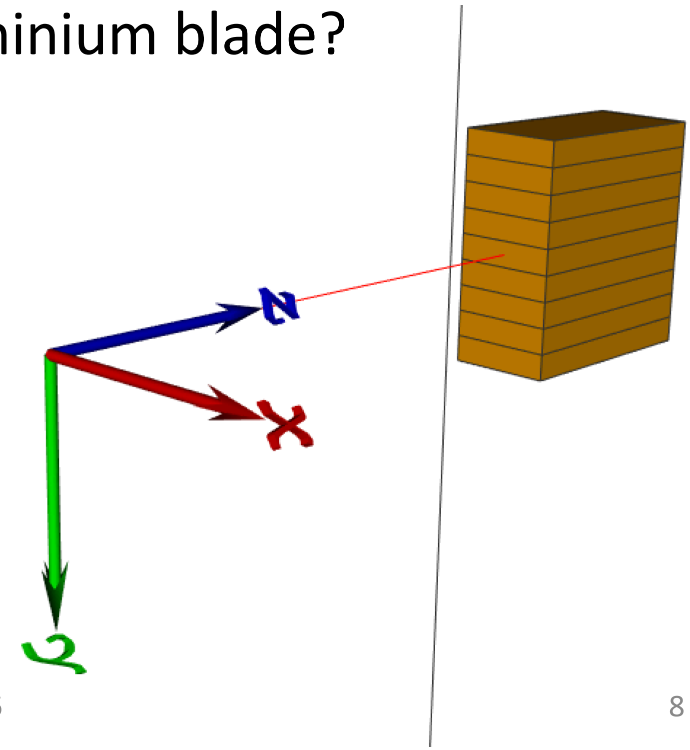
- Stack:
  - number of grids
    h = ~3 m -> 127 grids
- Arc:
  - start angle
  - number of stacks
    from −150° to + 30°
    180° -> 125 stacks
- Sample-detector distance: 4 m



Geometry issues I.

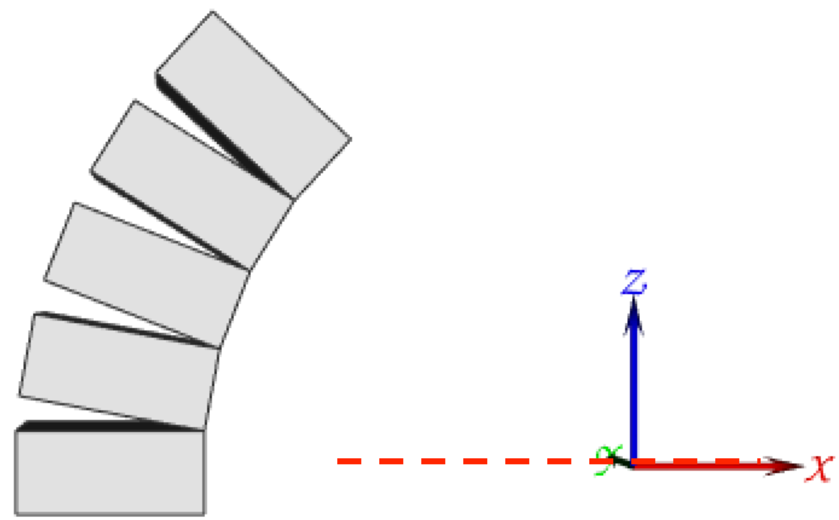
- Warning:
  - – Single grid and single stack are centralized for pencil beam:
    - Hitting gas gap? Hitting aluminium blade?





Geometry issues II.

- Warning:
  - Start angle is at the center of the first stack!

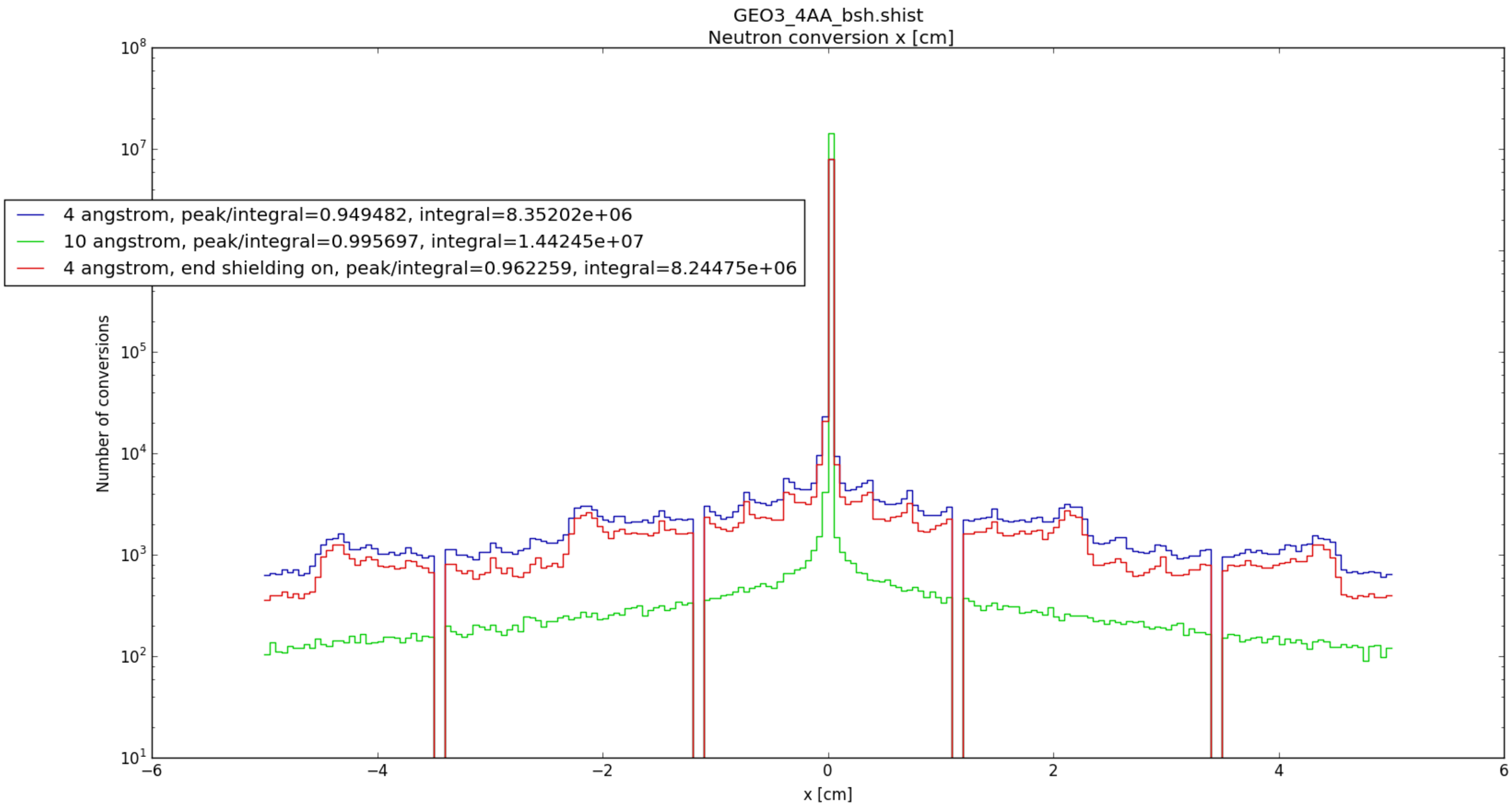


Analysis

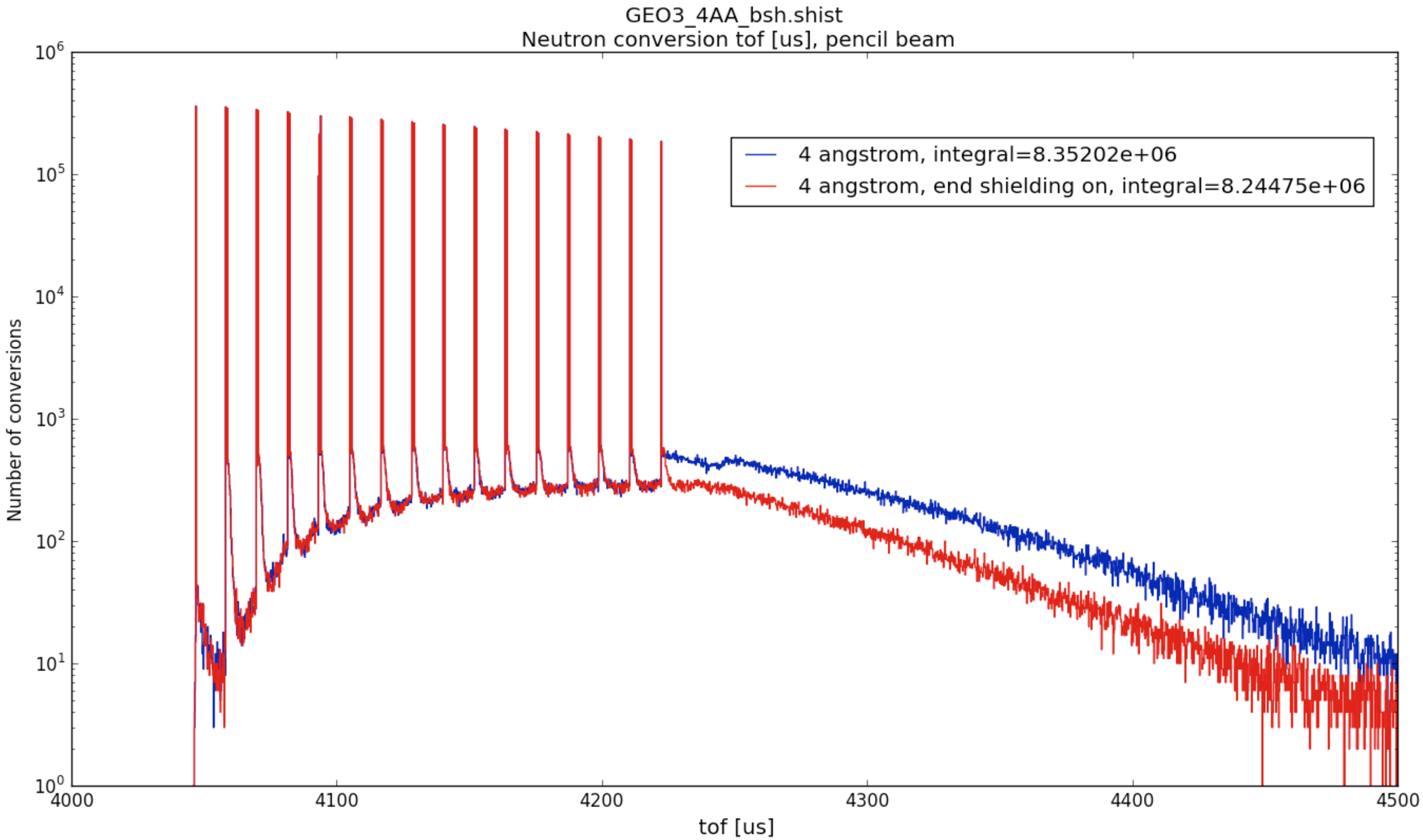
- Aims:
  - Understand scattered neutron background
    - Elastic & inelastic scattering, Bragg-peaks…
  - Optimize SBR & shielding
    - neutron scatter, energy deposition

- Simulation methods:
  Implement 1D and 2D histograms:
  - Neutron conversion (x, y, z, θ, ϕ, E, tof)
  - Neutron escape (x, y, z,… ?)

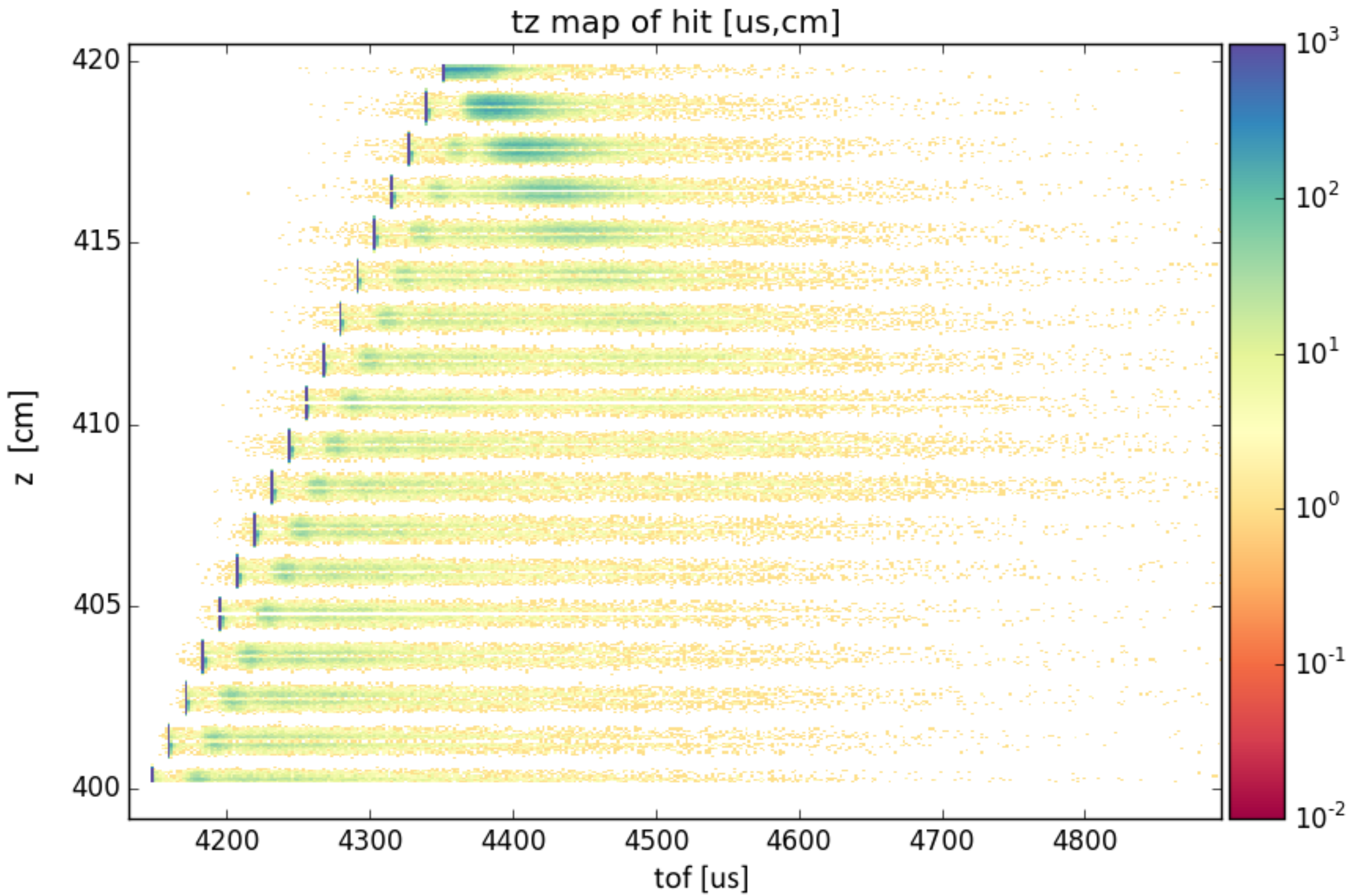
Neutron conversion x coordinates



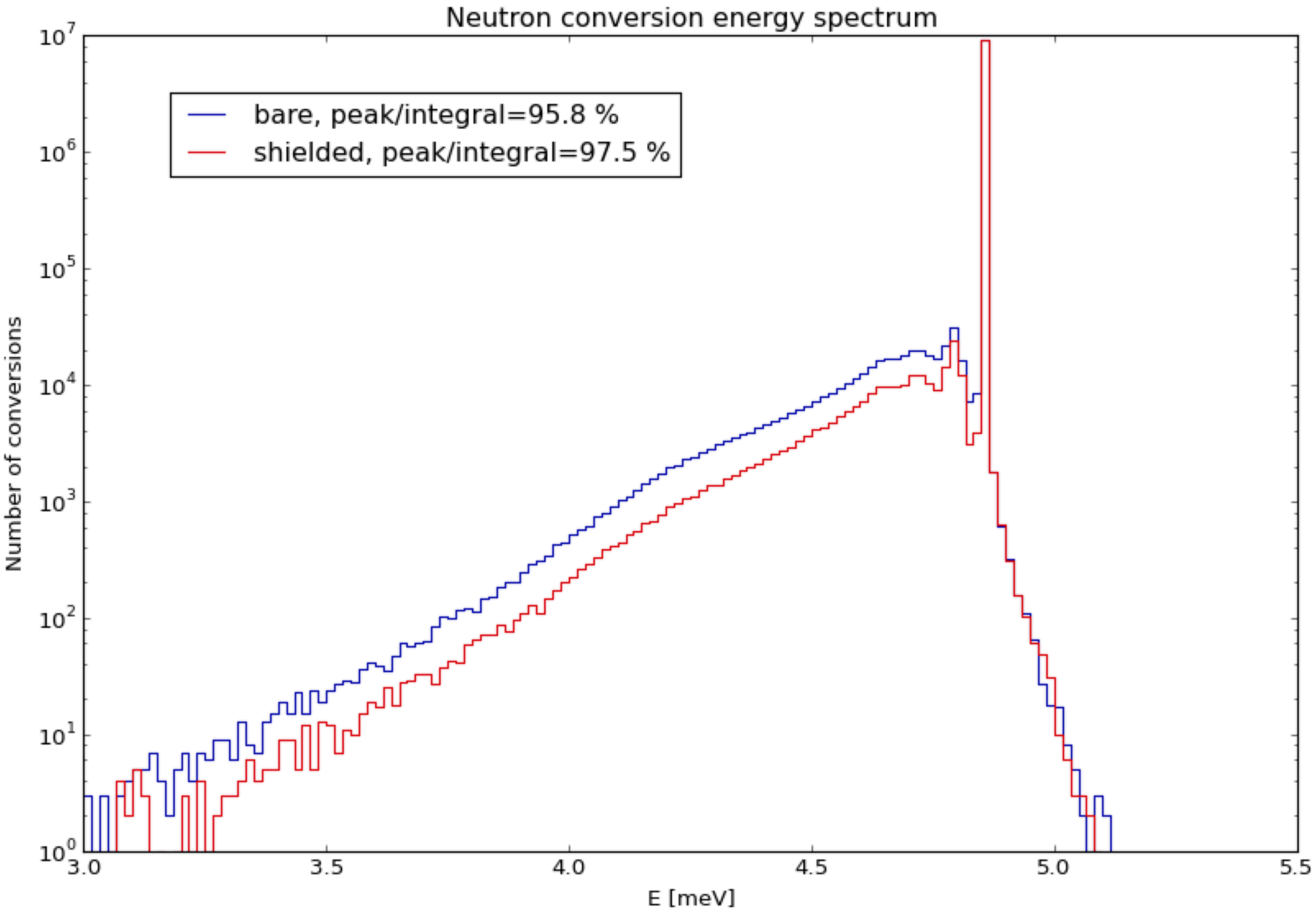
ToF


GEO3_4AA_bsh.shist
Neutron conversion tof [us], pencil beam
4 angstrom, integral=8.35202e+06
4 angstrom, end shielding on, integral=8.24475e+06
Number of conversions
tof [us]
10^0
10^1
10^2
10^3
10^4
10^5
10^6
4000
4100
4200
4300
4400
4500

ToF – depth (IN6)

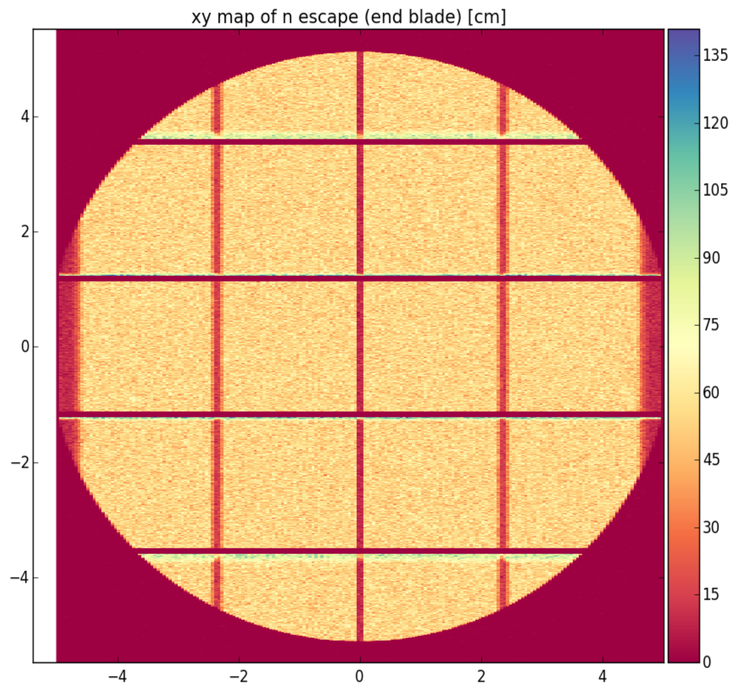


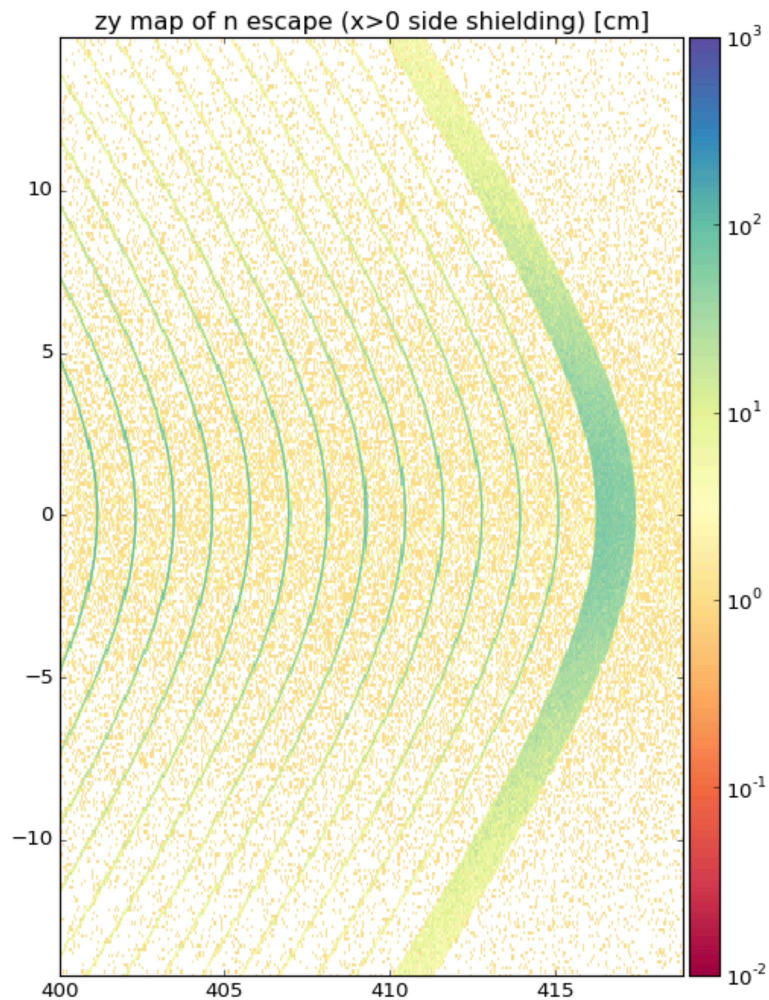
ToF Energy spectra



Side escape

- End escape:
  hardcoded coordinates!





Further steps:

- Parameter scan for side and end shielding:
  - Materials (Cd, Gd + PE)
  - Thicknesses

  -> add analysis, find good beams
- Go for single stack: find good histograms to fill ☺
- Go for full scale: find good histograms to fill ☺
- Clean up hardcoded things
- Run jobs run jobs run jobs…

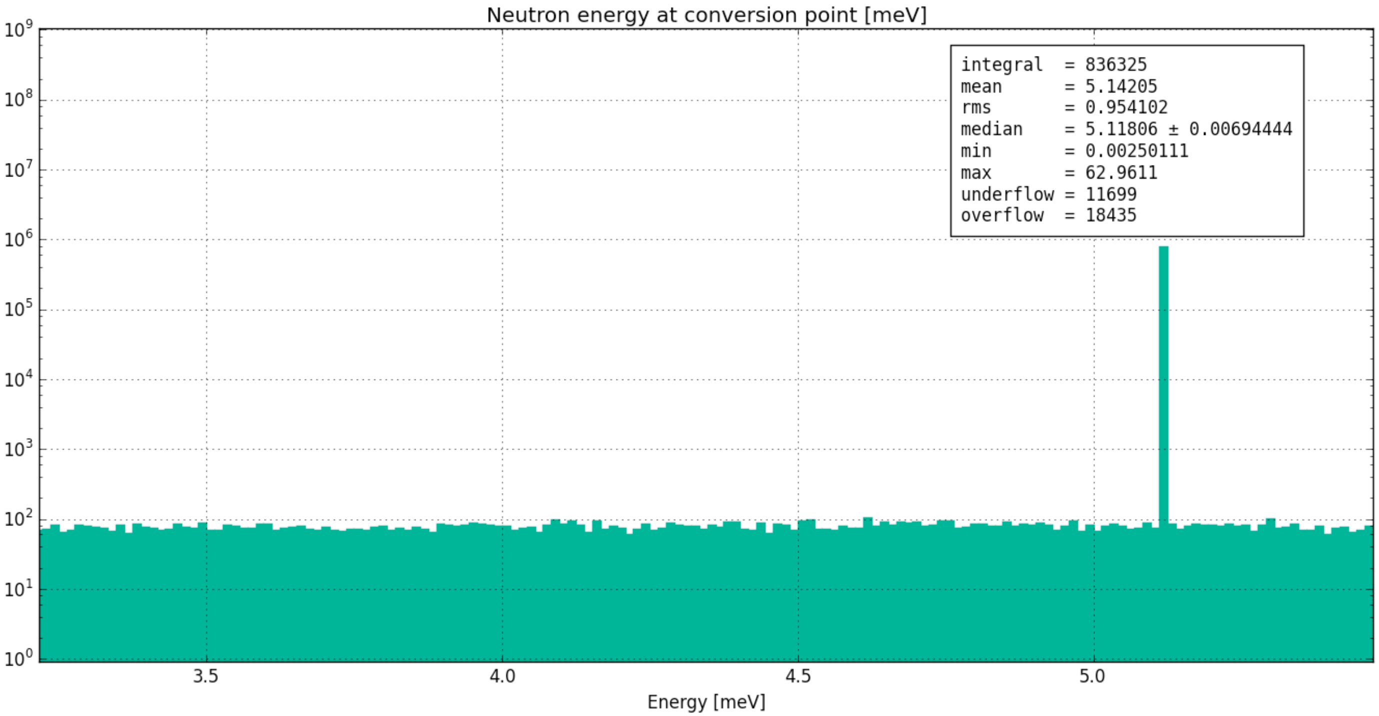
Far more further steps:

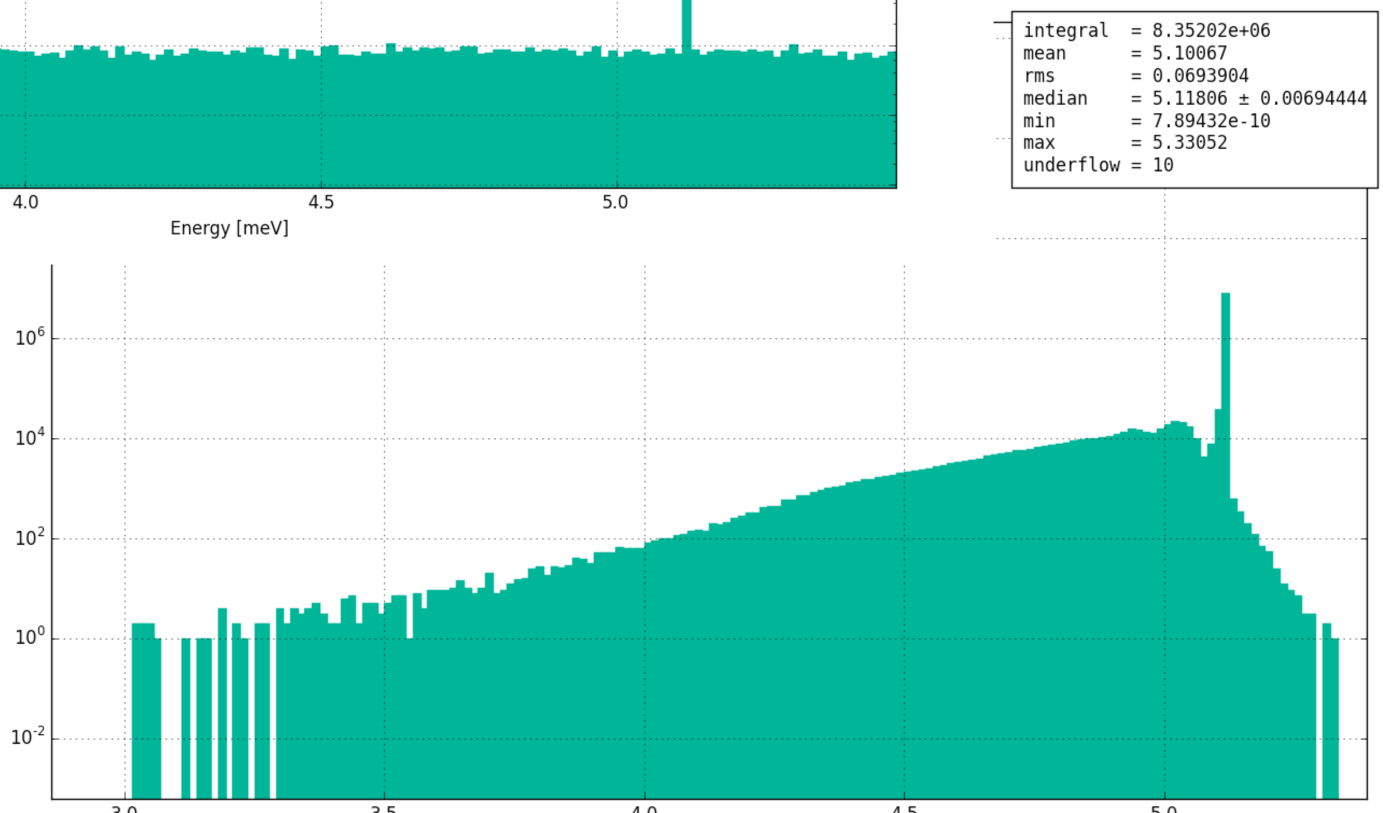
- Go for secondary particles…?

  cp & γ …?

Thank you for your attention!

Questions?


Neutron energy at conversion point [meV]
integral = 836325
mean = 5.14205
rms = 0.954102
median = 5.11806 ± 0.00694444
min = 0.00250111
max = 62.9611
underflow = 11699
overflow = 18435
10^9
10^8
10^7
10^6
10^5
10^4
10^3
10^2
10^1
10^0
3.5
4.0
4.5
5.0
Energy [meV]


integral = 8.35202e+06
mean = 5.10067
rms = 0.0693904
median = 5.11806 ± 0.00694444
min = 7.89432e-10
max = 5.33052
underflow = 10
10^6
10^4
10^2
10^0
10^-2
3.0
3.5
4.0
4.5
5.0