

STAP Meeting / LoKI Progress

Status of Shielding Calculations

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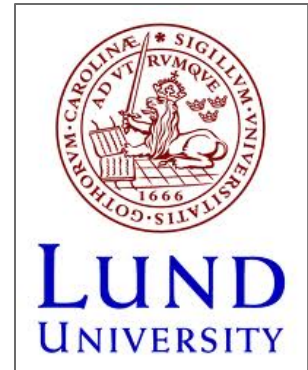
September 17, 2014

- Measurements of radiation backgrounds at facilities
- Background modeling using GEANT4
- Investigations of new shielding solutions
 - Specialized concretes
 - Laminated materials
 - Copper-based shielding
- Measurements with direct photon and neutron beams

Collaboration



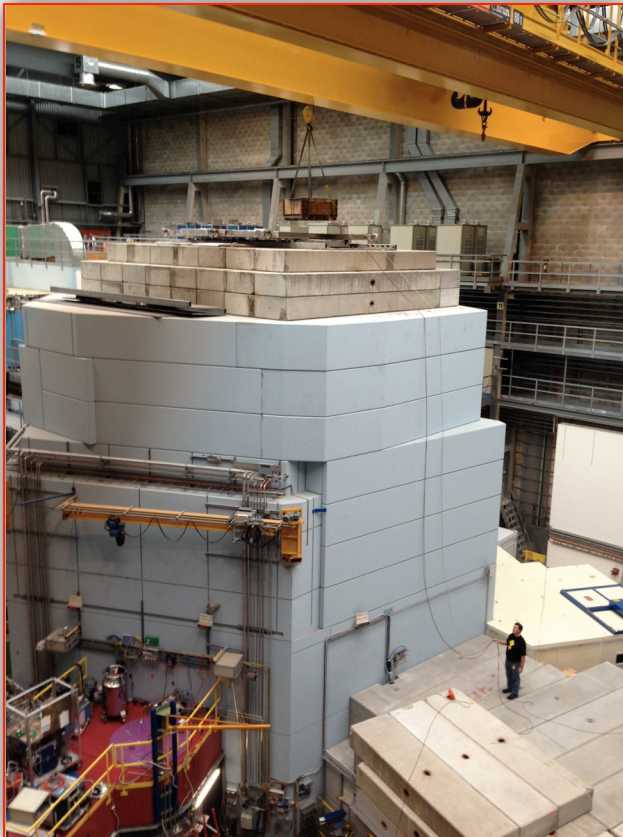
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Background: potential sources

- Accelerator, weak points in the shielding
- A2T region
- Beamline shielding itself
- Sub-optimal target design
- Sub-optimal beam-stop design
- Straight guides with poor shielding

Good news: shielding at ESS



Measurements at SNS and PSI

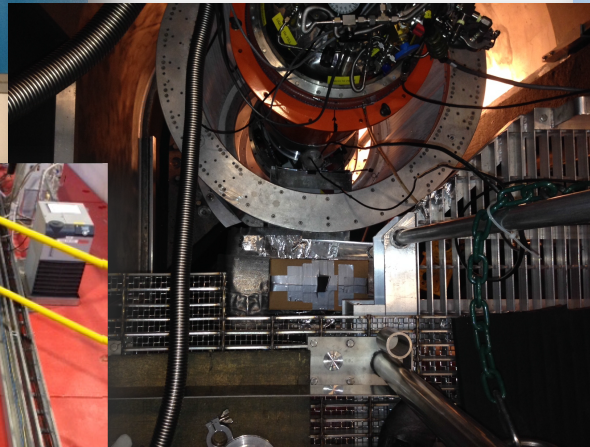
SNS:

- Throughout the experimental hall, on the floor, chopper shelf, and inside the CNCS instrument
- Measurements were carried out with several different detectors
- Also measured the gamma-ray background

PSI:

- Along the monolith wall
- In and around BOA beamline
- On various locations around the experimental hall

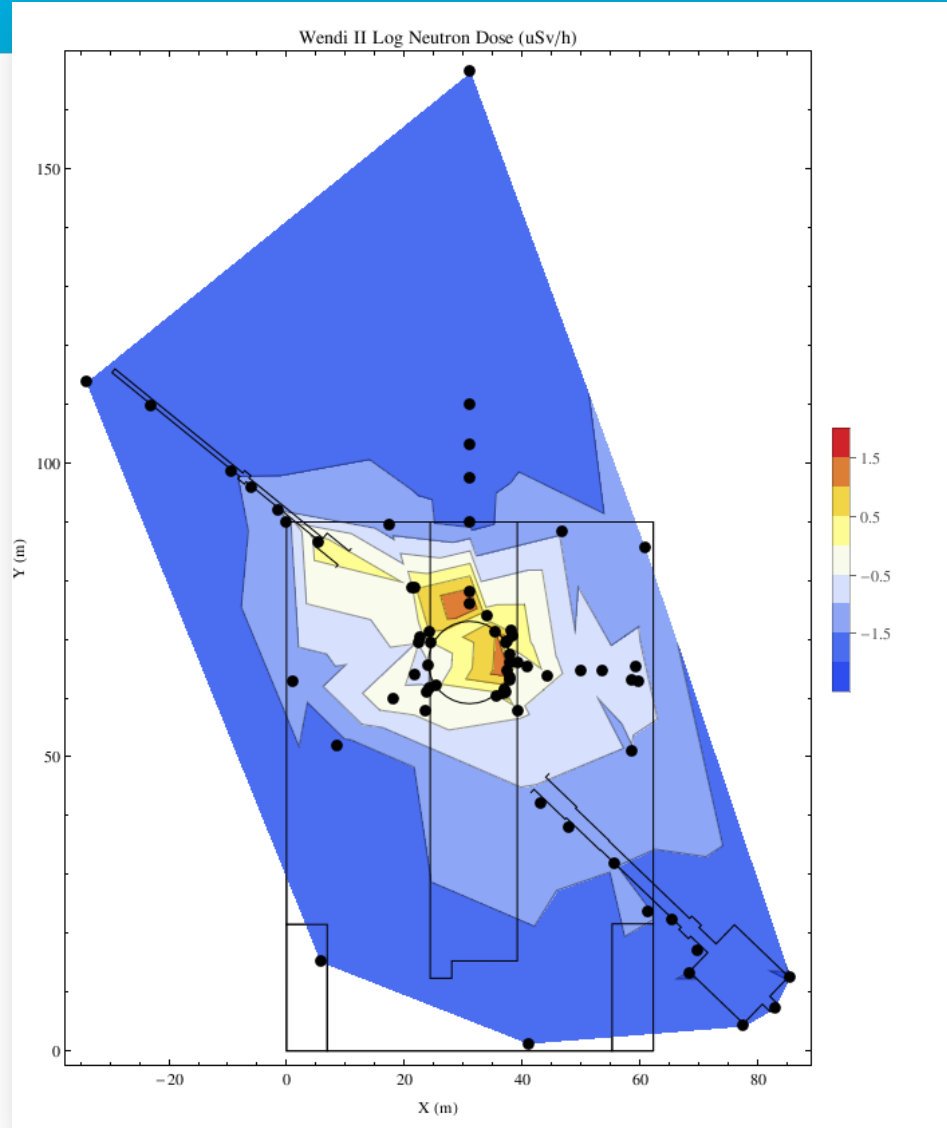
SNS tour



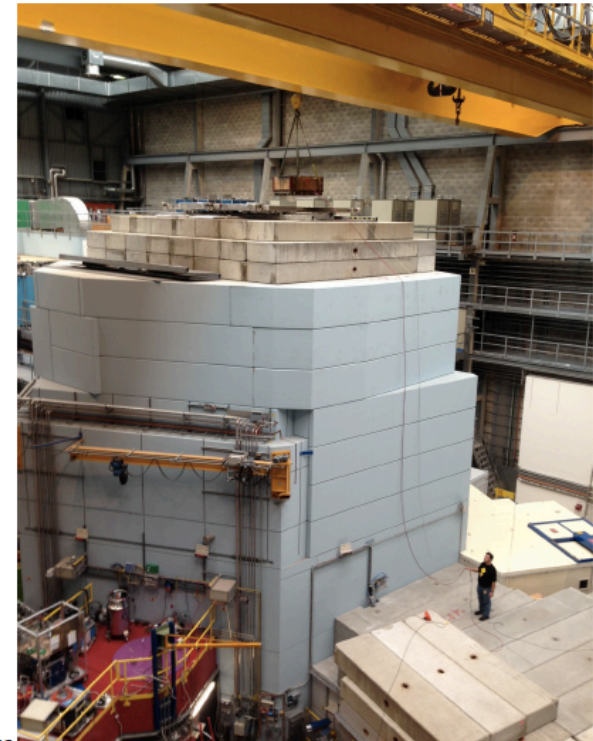
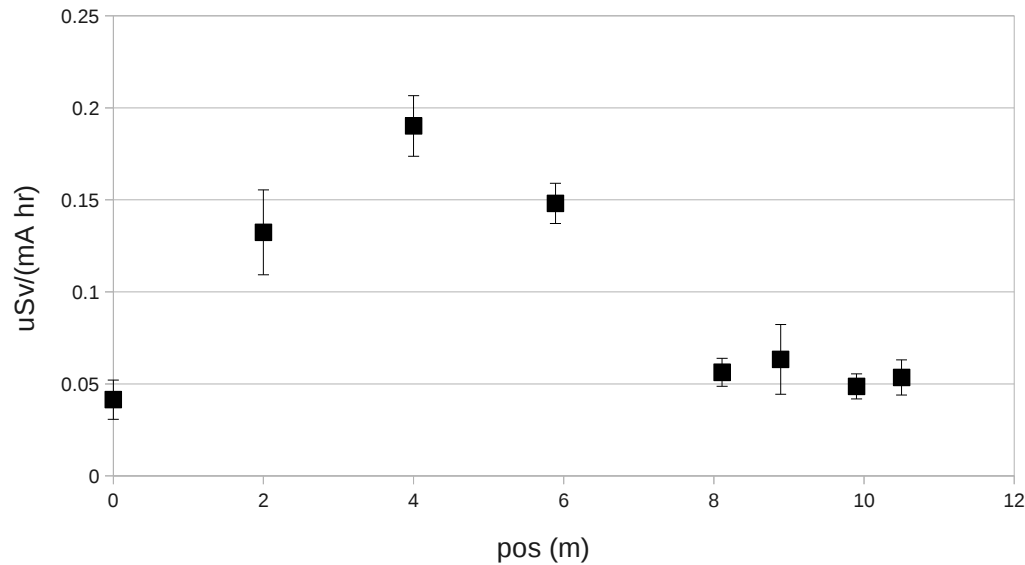
SNS results

- Neutron measurements indicate neutron leakage around gaps near in vicinity of BL14
- WENDI-2 + REMBALL: Highest doses of slow ($<10\text{MeV}$) and fast neutrons ($>10\text{ MeV}$) between BL14-BL16
- MEDIPIX2: Thermal max: above BL 12 and 13, Fast max: between BL13 and 14
- ARKTIS: highest rate BL14

WENDI-II dose map

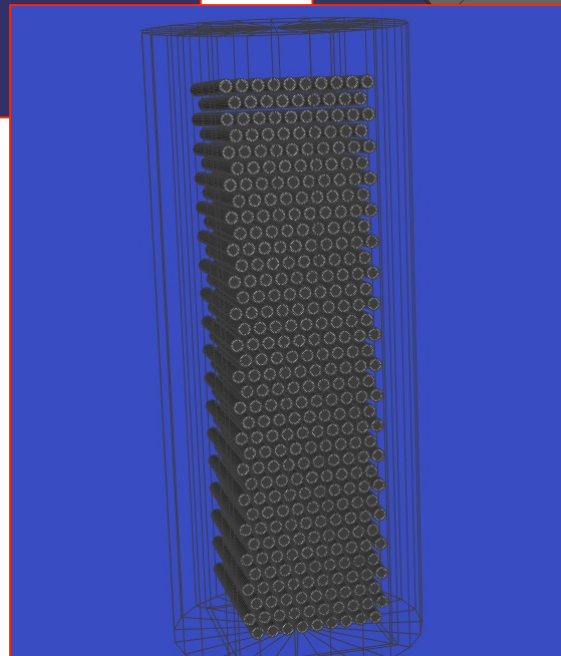
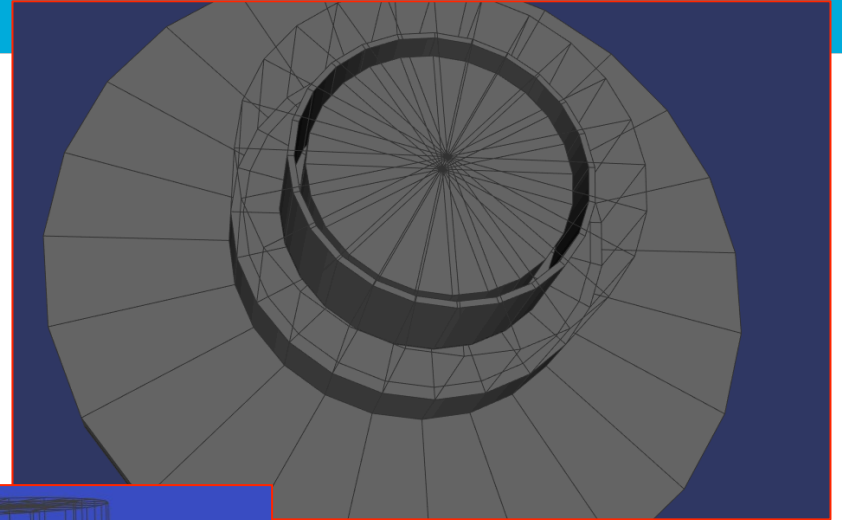
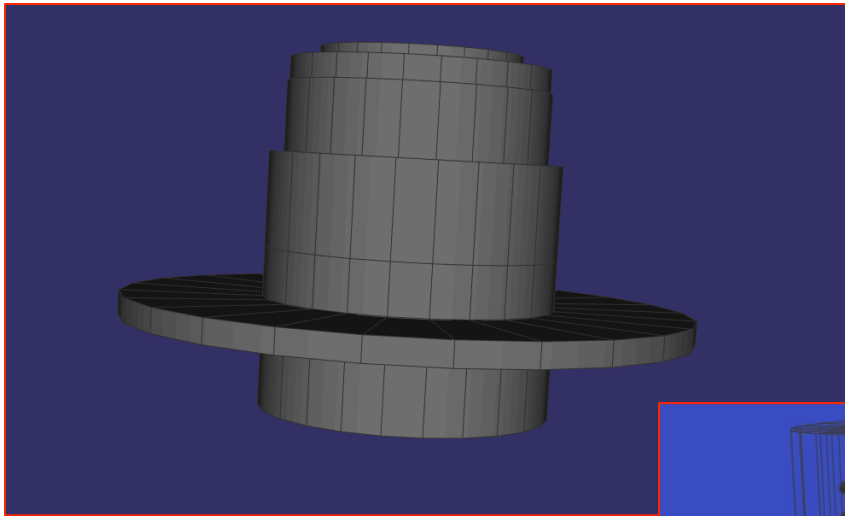


Measurements at PSI (SINQ)

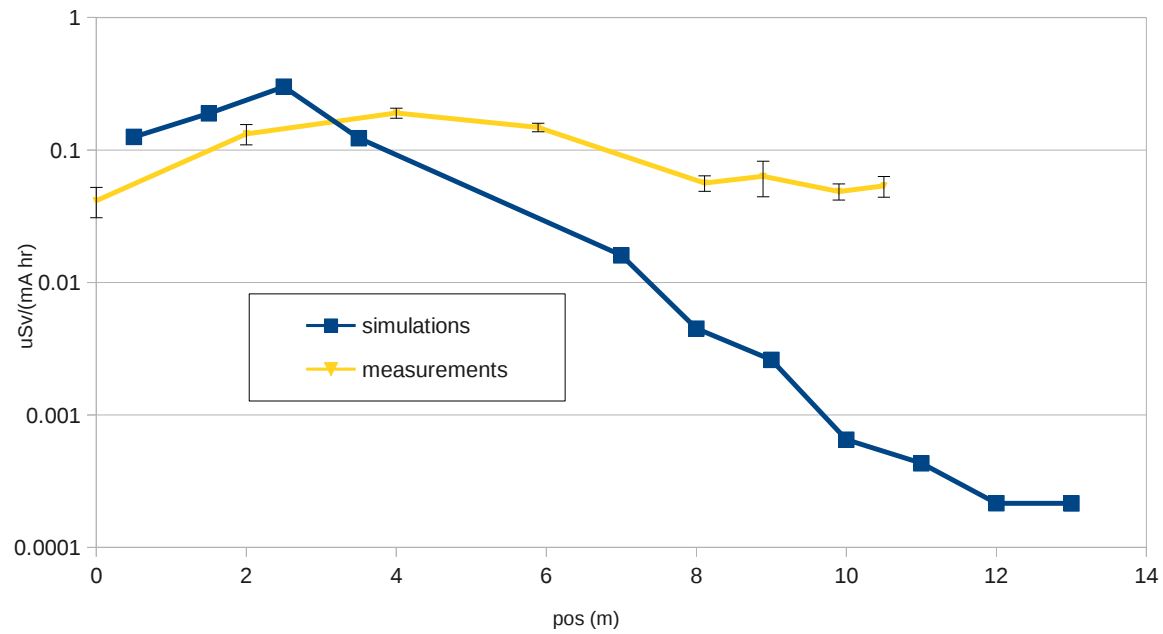


- Pos1: 0 – BOA roof
- Pos2: 2 m Pos6: 8.89 m
- Pos3: 4 m Pos7: 9.9 m + 1 m to center
- Pos4: 5.89 m Pos8: 10.5 m + 1 m to center
- Pos5: 8.11 m Pos9: On top, center

Detailed model



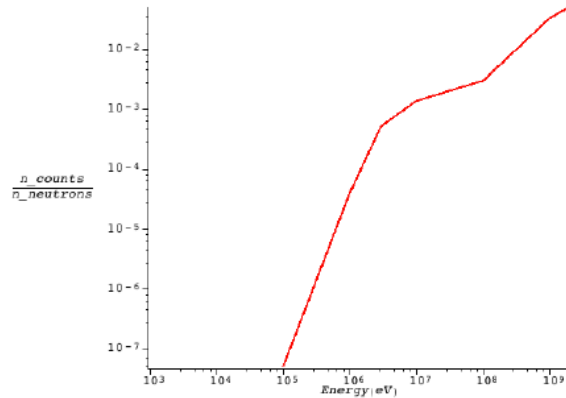
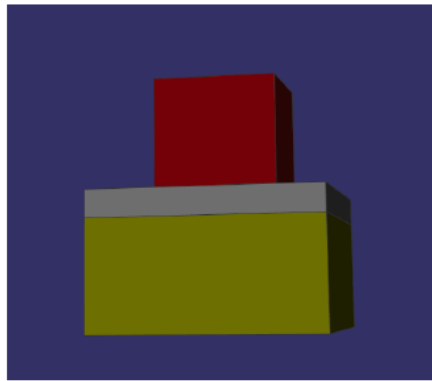
... and simulations



GEANT4 simulations

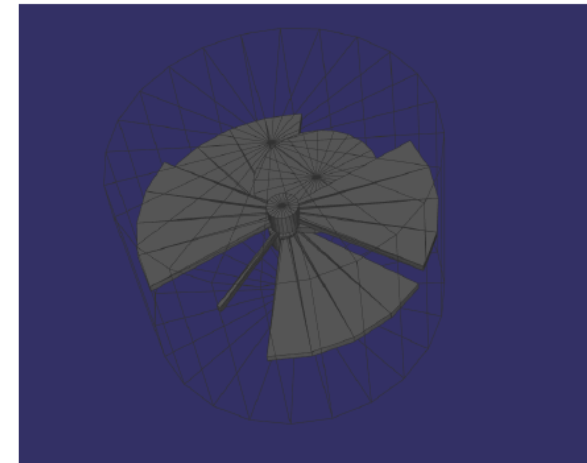
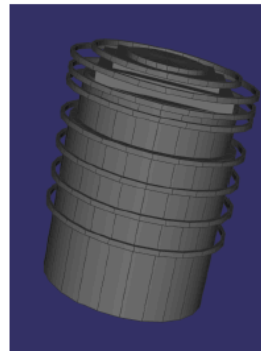
- Heavily using detector group framework

Working close with target group

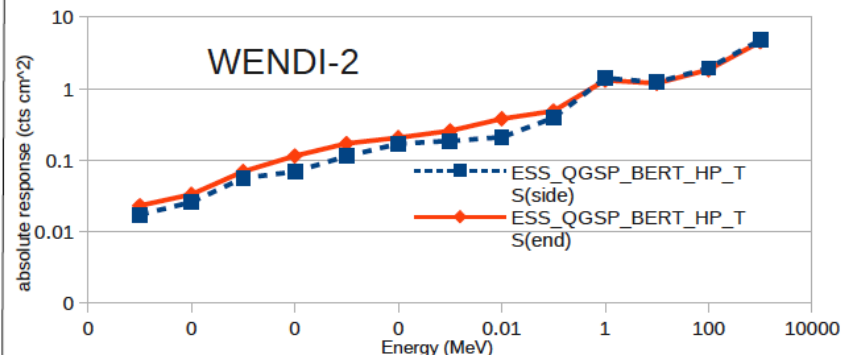


Cave response function
3 cm steel, 40 cm wax

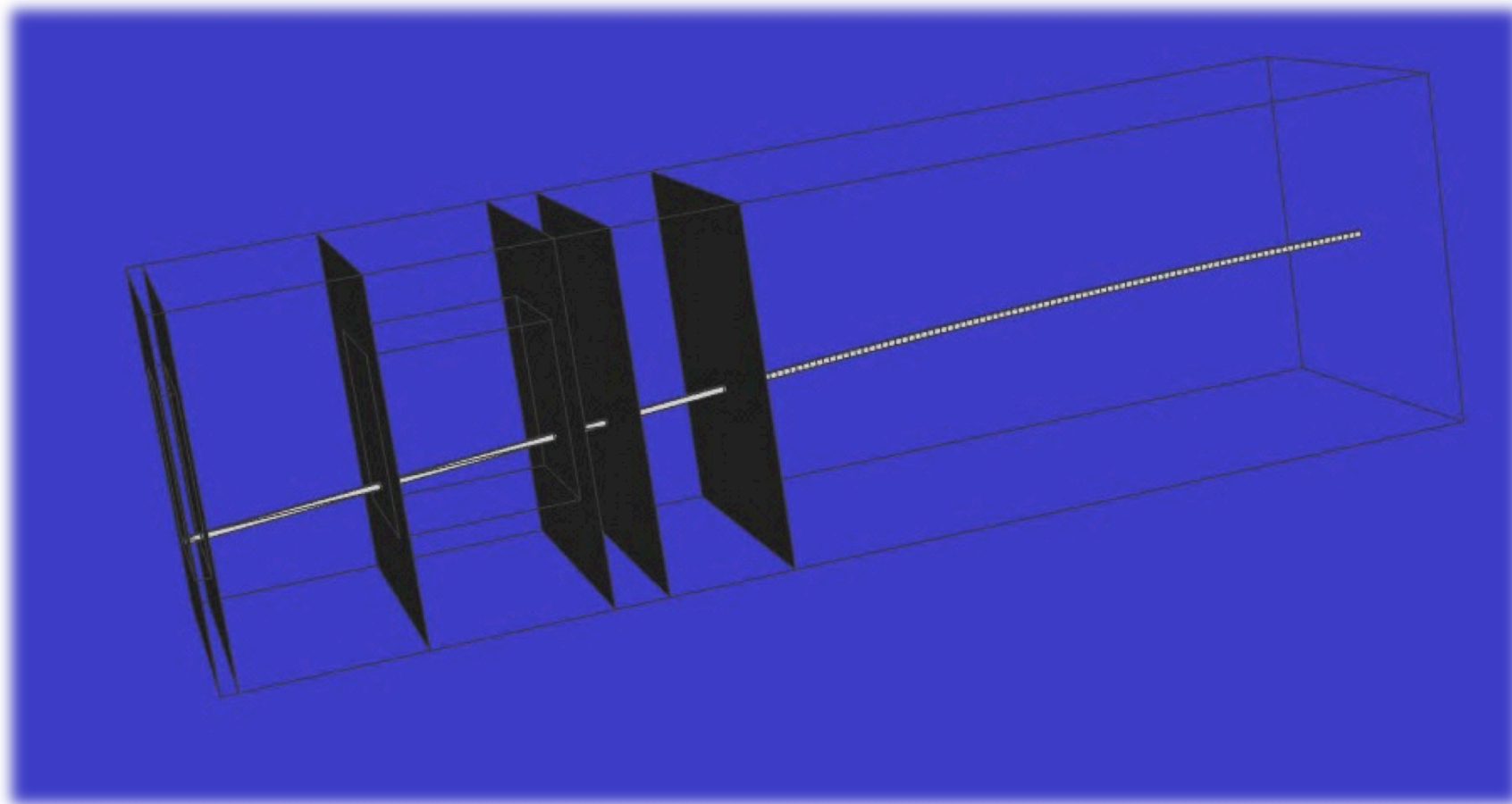
PSI Target



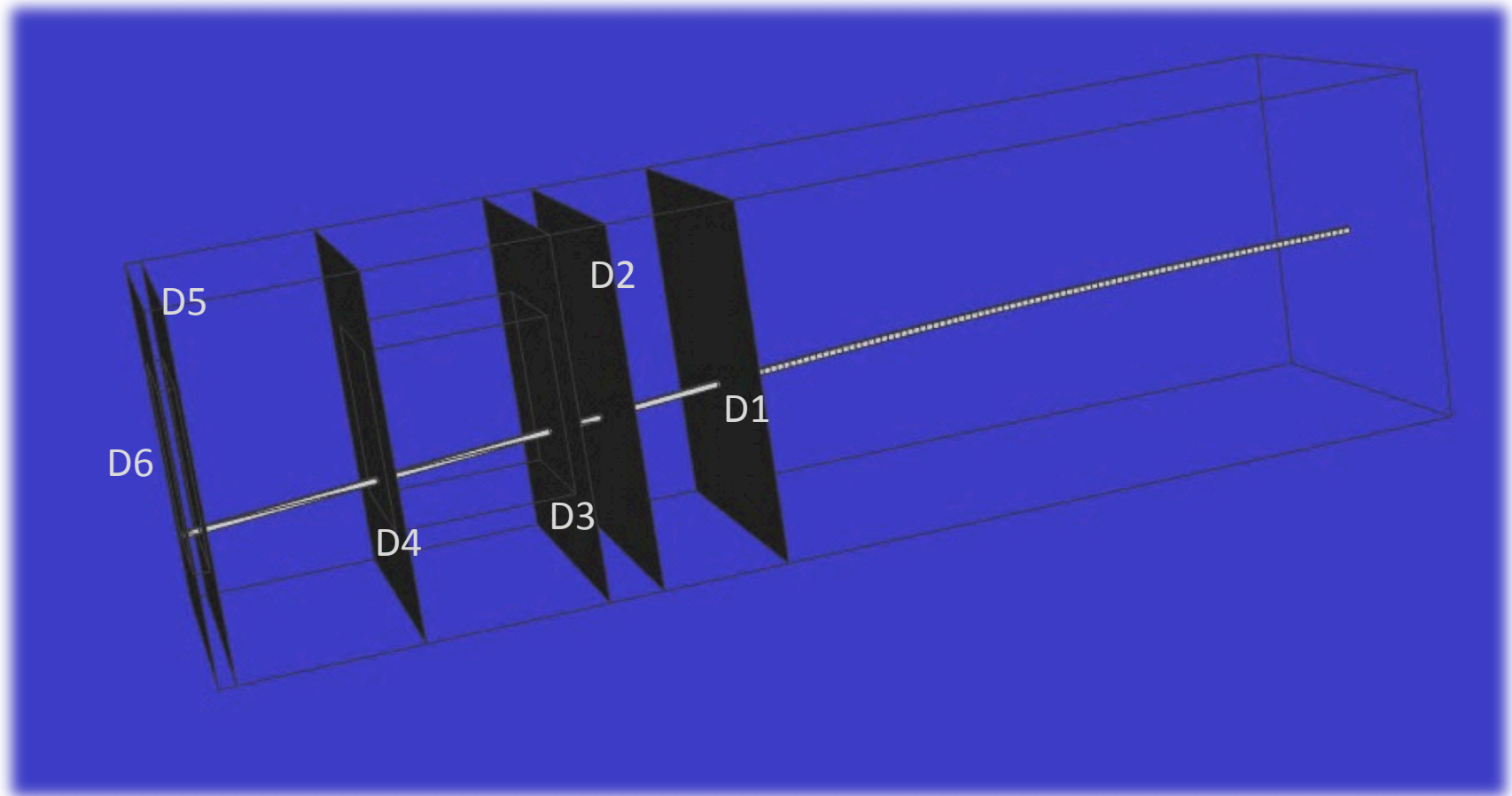
ESS target model



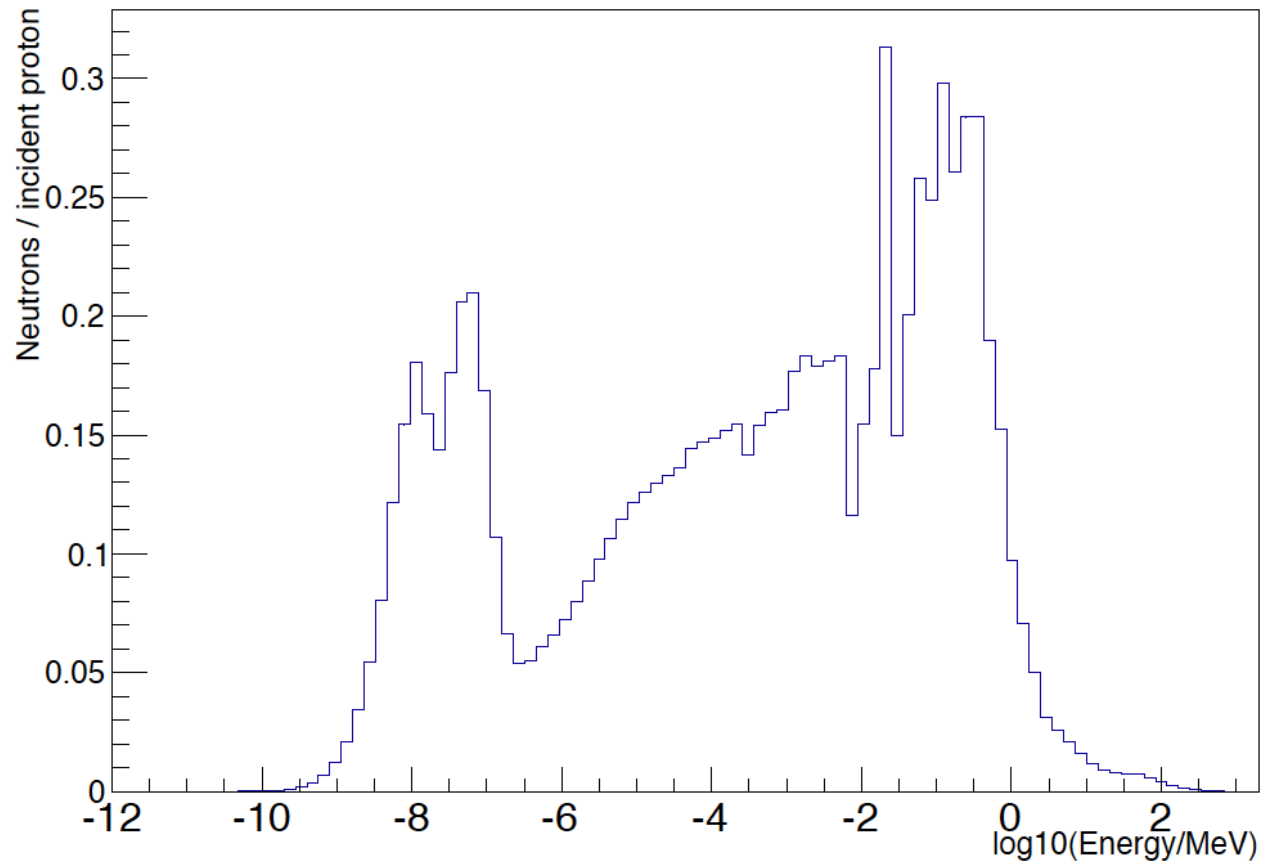
Meeting LoKI



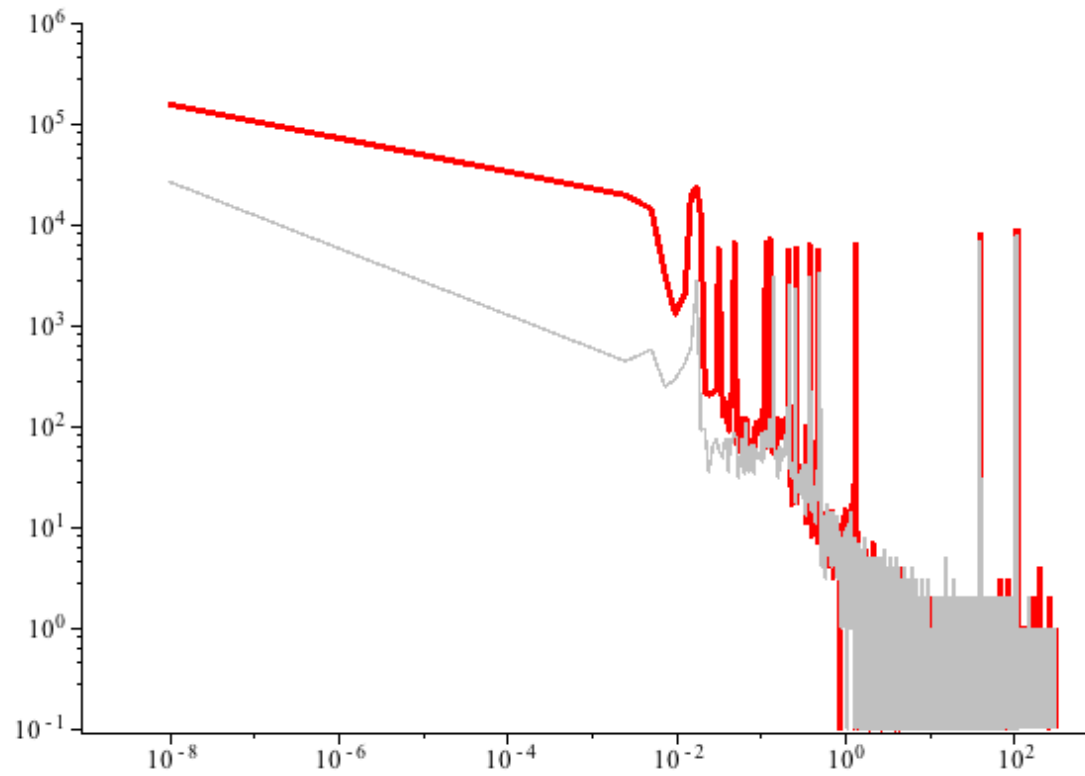
Sensitive volumes as detectors



ESS spectrum

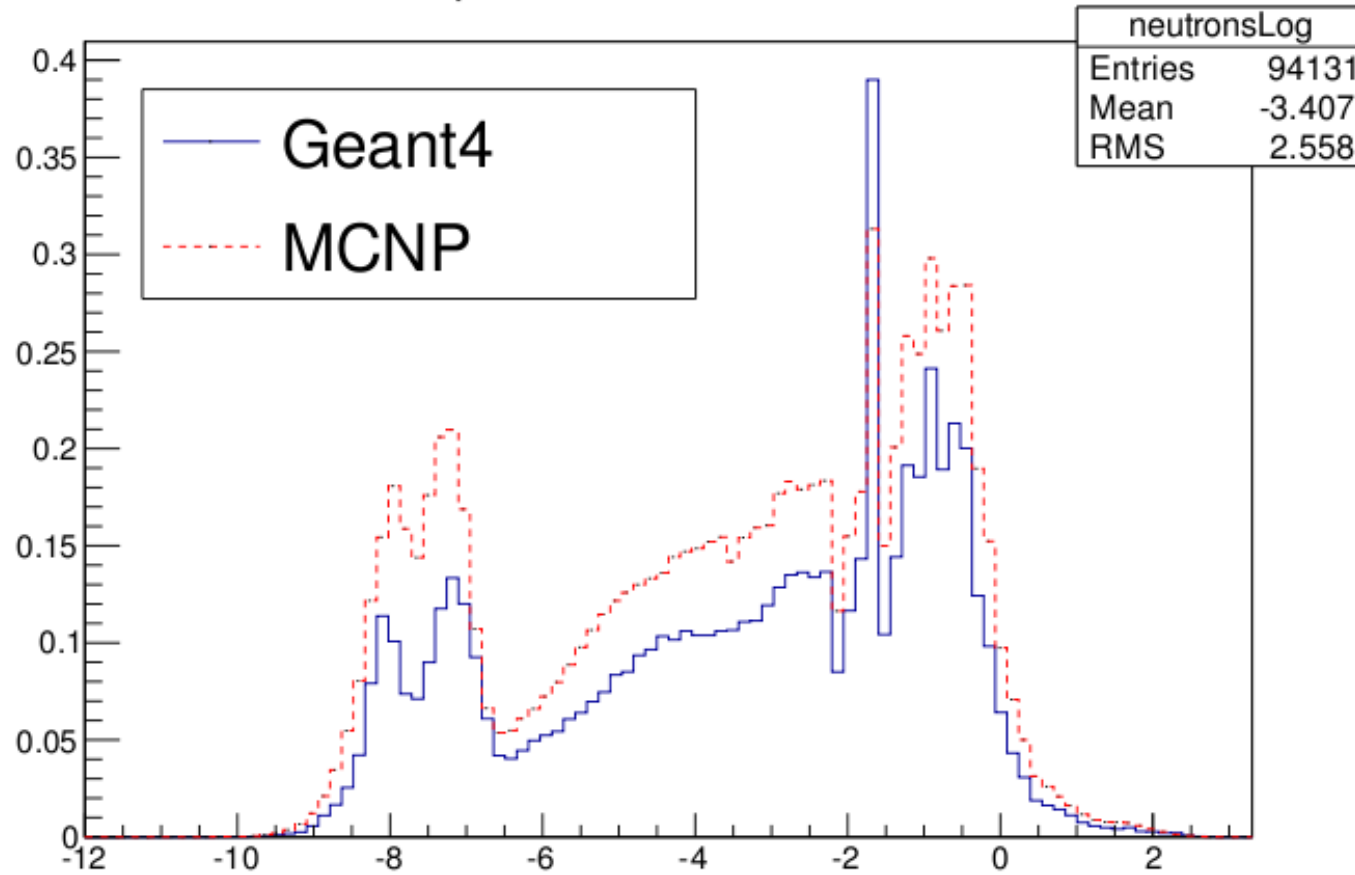


Loki, detector 6

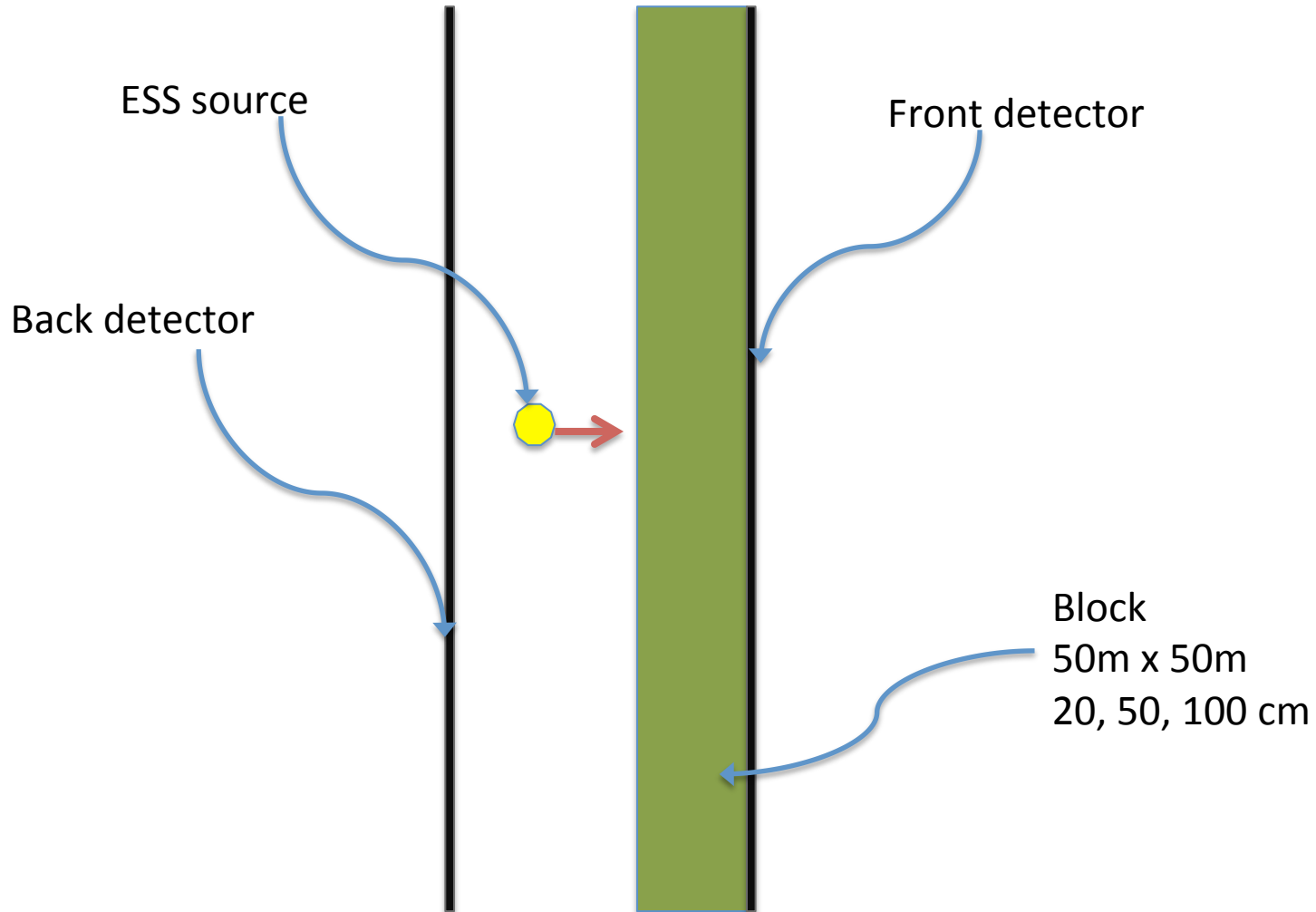


ESS target model

Neutron Spectra at BeamPort Entrances



Simulations setup



Front detector iron and steel

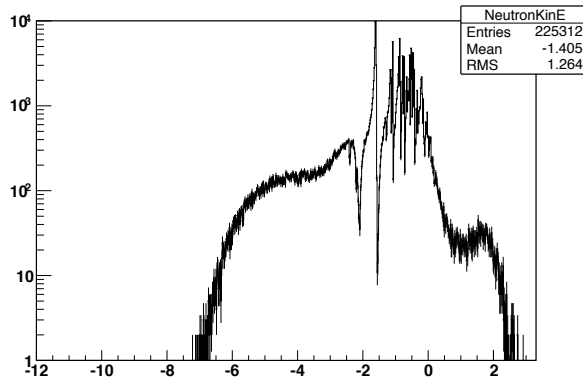
20 cm

50 cm

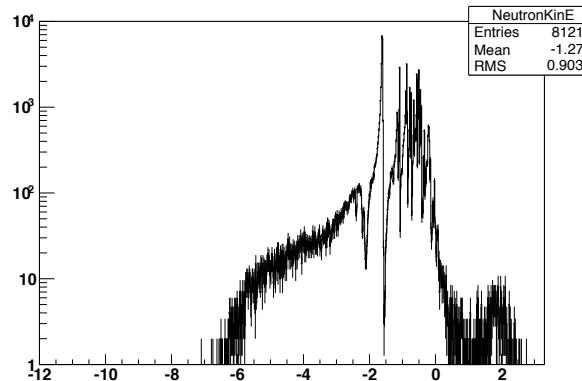
100 cm

Iron

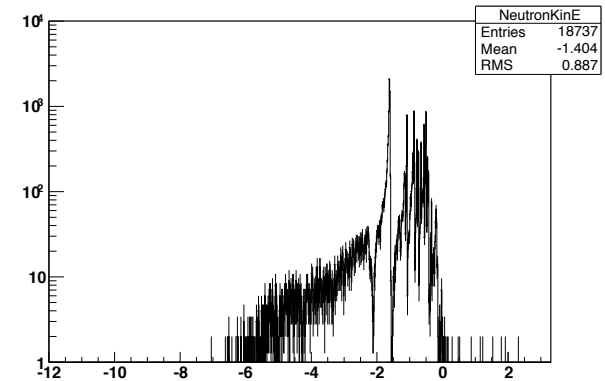
Neutron KE



Neutron KE

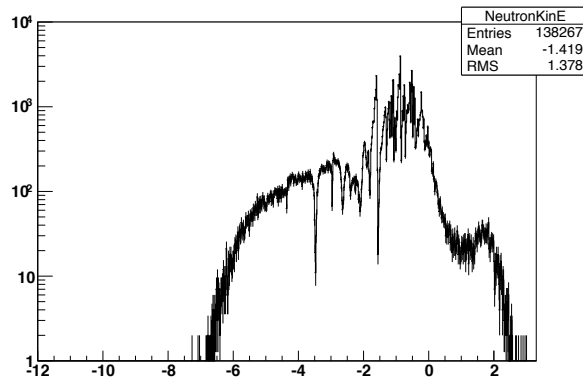


Neutron KE

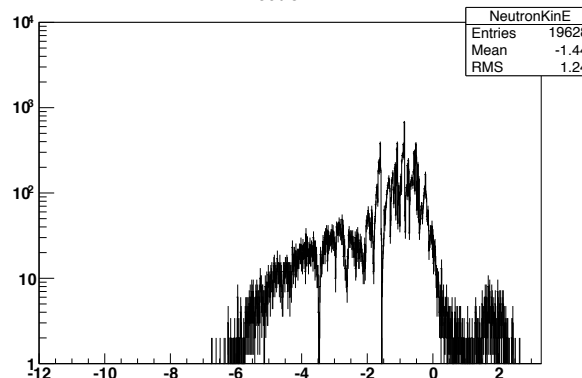


Stainless steel

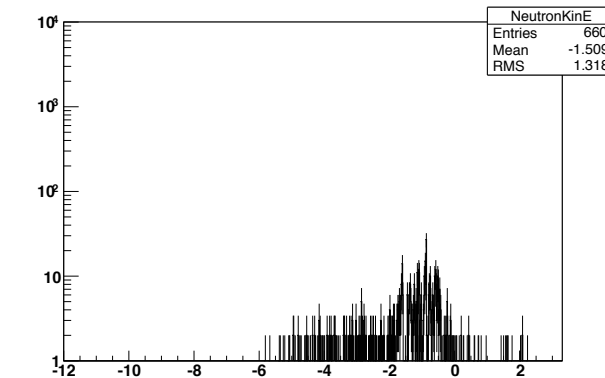
Neutron KE



Neutron KE



Neutron KE



Front detector copper and brass

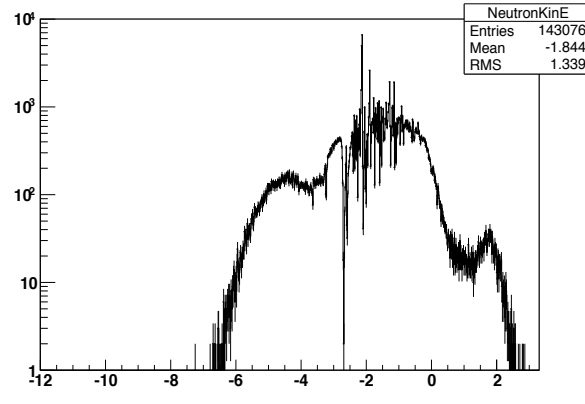
20 cm

50 cm

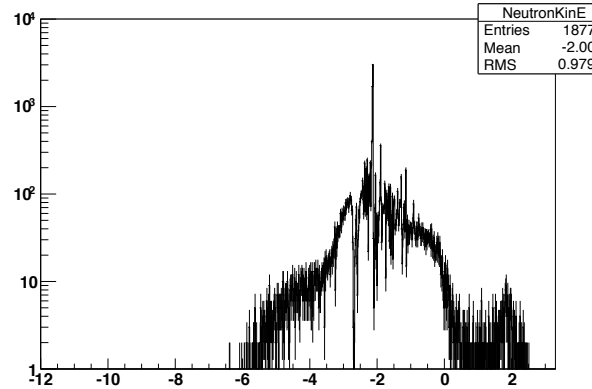
100 cm

Copper

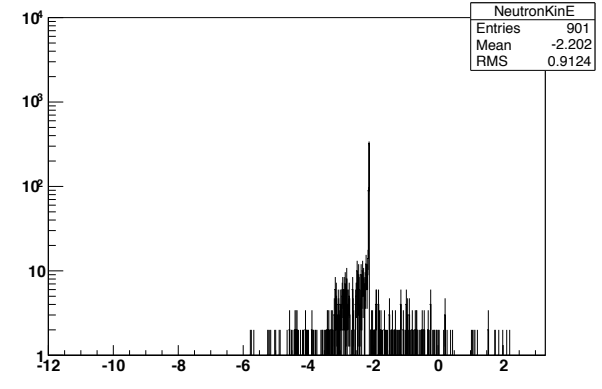
Neutron KE



Neutron KE

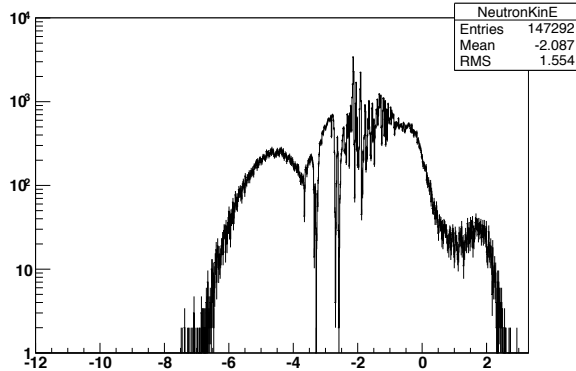


Neutron KE

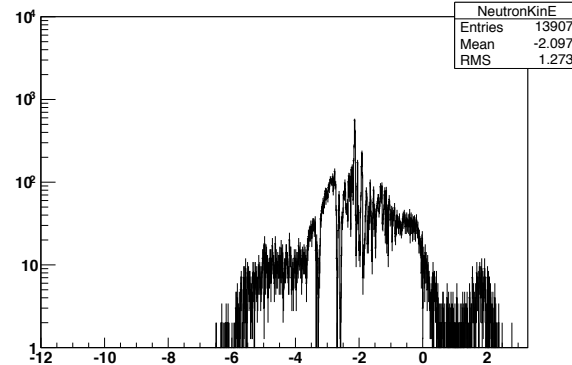


Brass

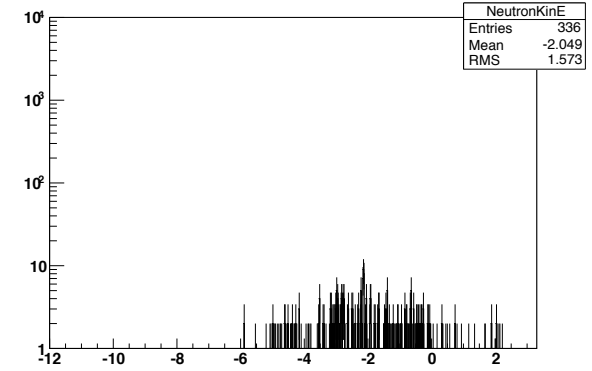
Neutron KE



Neutron KE

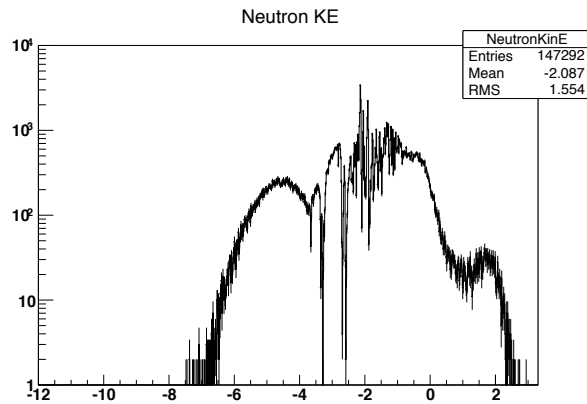


Neutron KE

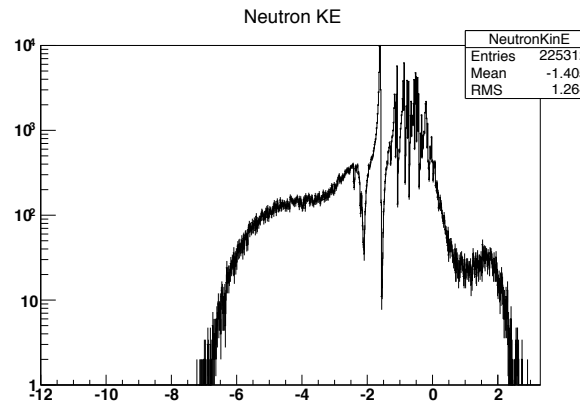


Front detector 20 cm

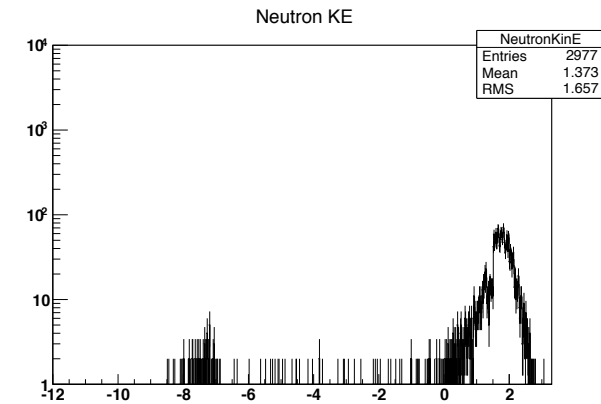
Brass



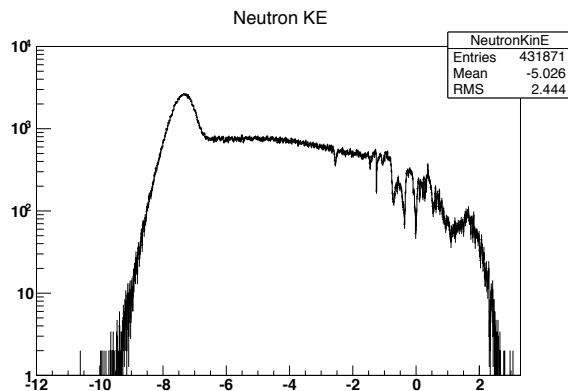
Iron



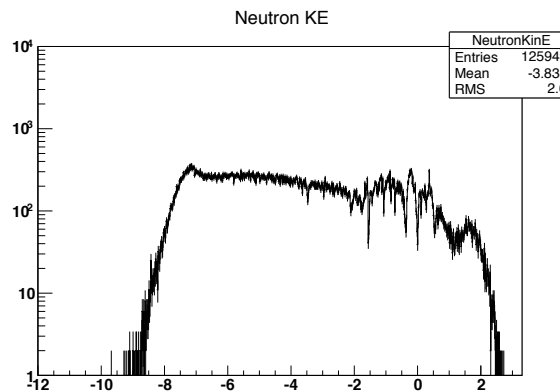
PP



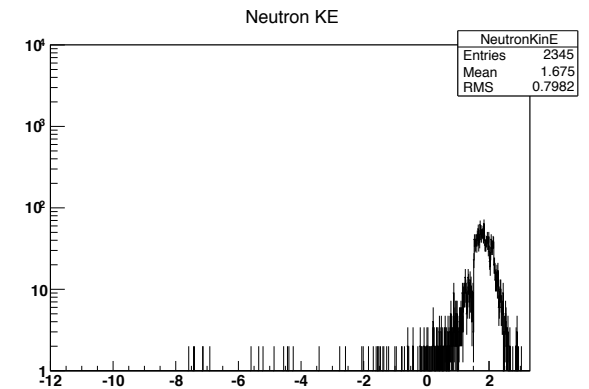
Concrete



Heavy Concrete



PP + Borax



Summary

- Measurements of backgrounds – analyses in progress
- Laminated materials to simulate
- Optimizing material combinations for the best efficiency and price
- Model of LoKI – work in progress

Thank you for your attention!