

Cosmic ray backgrounds at the NNBAR experiment

Sze Chun Yiu

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Introduction

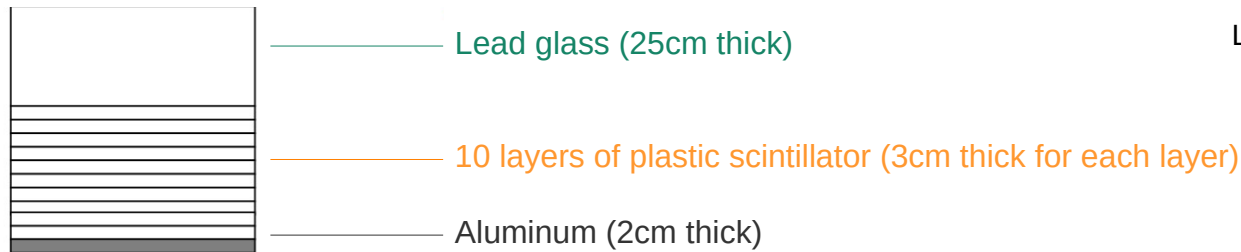
The **cosmic background** was the **dominant background** in the last free neutron search

- Understanding the signatures of the cosmic particles in the nbar detector is crucial
- Study of cosmics allows us to assess the performance of our detector

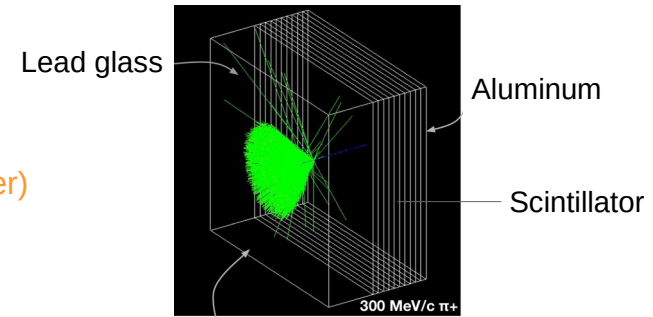
Main task at Stockholm University:

- Developing and simulating the calorimeter prototype of the nbar detector

A sketch of the calorimeter prototype



Detector geometries constructed in GEANT4



Developed by K. Dunne

My task:

- GEANT4 simulation on the Calorimeter Prototype exposed to the Cosmic Ray Background

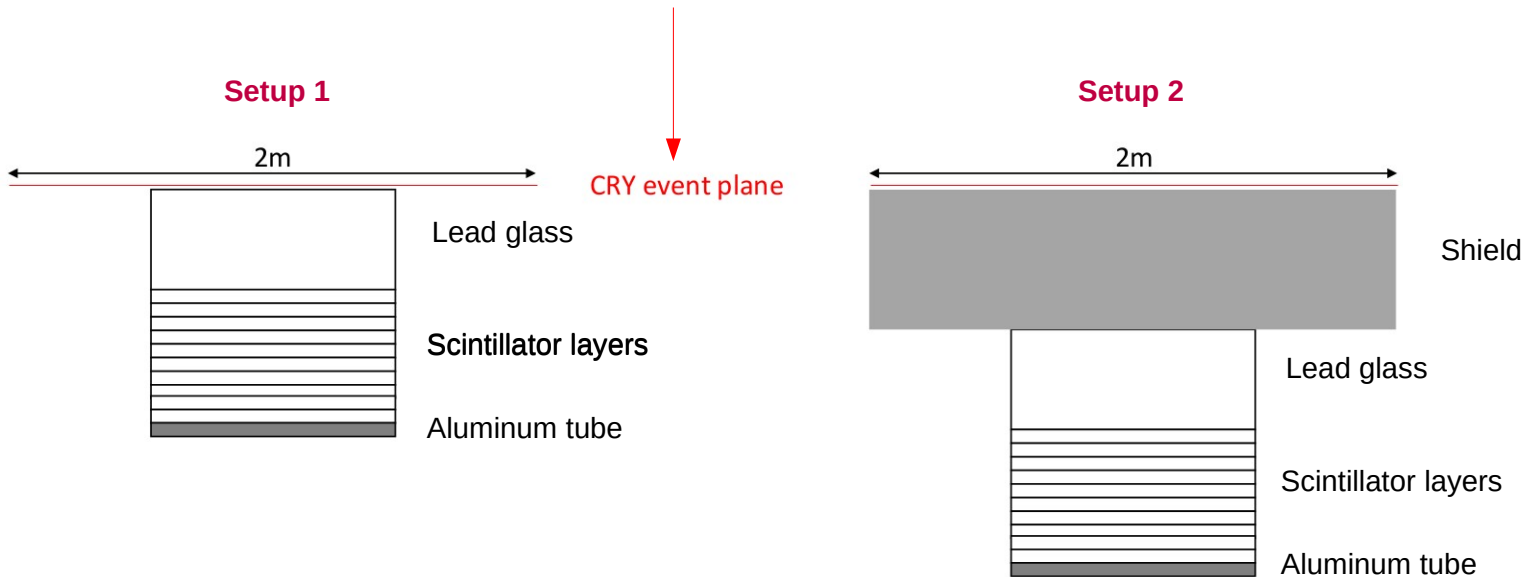


Setup of the simulation



Two setups of the detector prototype (with/without shielding)

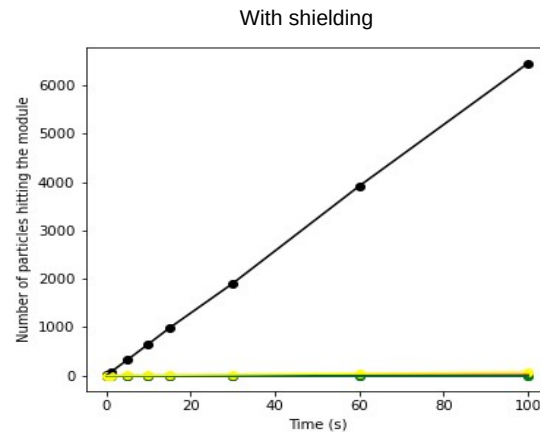
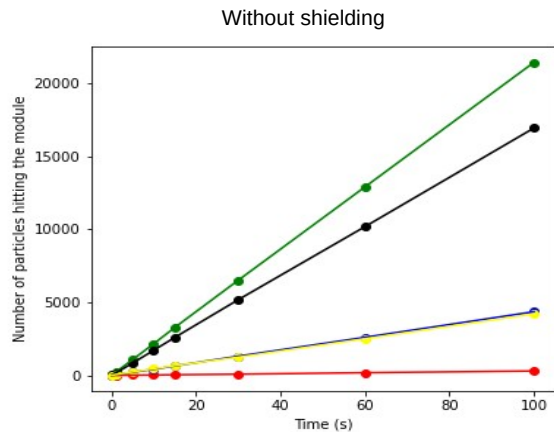
- Shielding composed of 1m heavy concrete (high iron content) + 30 cm of stainless steel
- Cosmics particles are generated by an external library named **Cosmic-ray Shower Library (CRY)**
Ref. for CRY: <https://nuclear.llnl.gov/simulation/>
- Cosmic particles are generated **right above the detector**





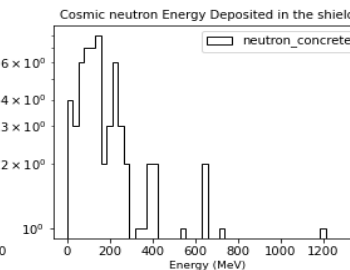
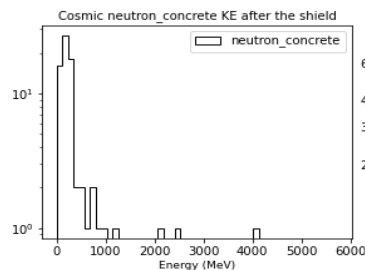
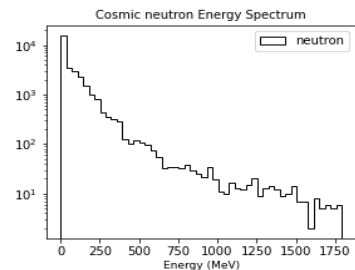
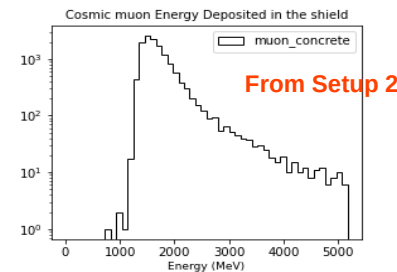
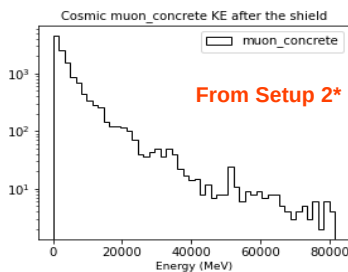
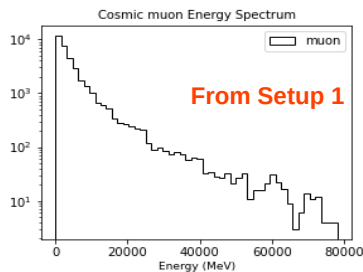
Major results from the simulation

Multiplicity of particles hitting the detector with time



- proton
- electron
- gamma
- muon
- neutron

KE of the cosmic particles before hitting the detector



* particle KE after passing the shield

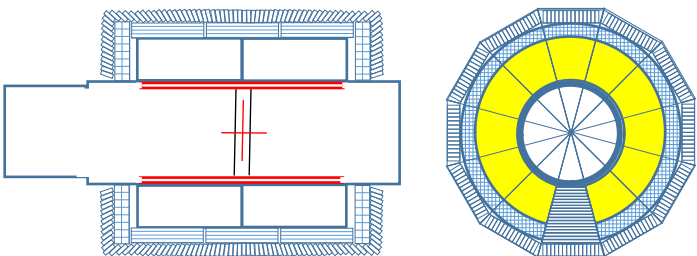


Towards a conceptual design of the full detector

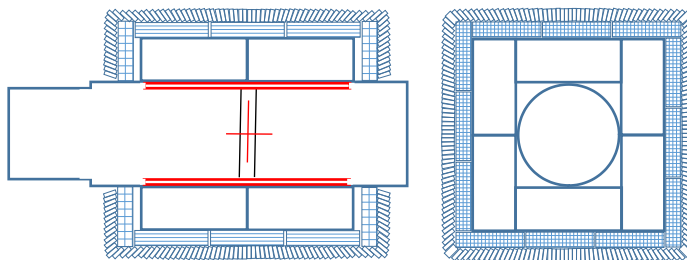
- We now have very first ideas of how the full detector may look like
- The study of cosmics will be extended to these possible designs

First ideas of our full detector by Anders Oskarsson

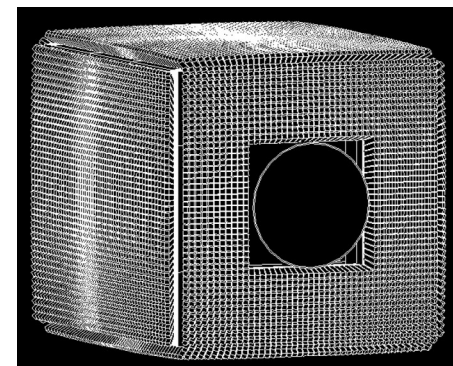
Possible Design 1



Possible Design 2



Design 2 in GEANT4



The End!

Thank you very much