Neutron Backgrounds and R&D Plans for Veto and Measurements

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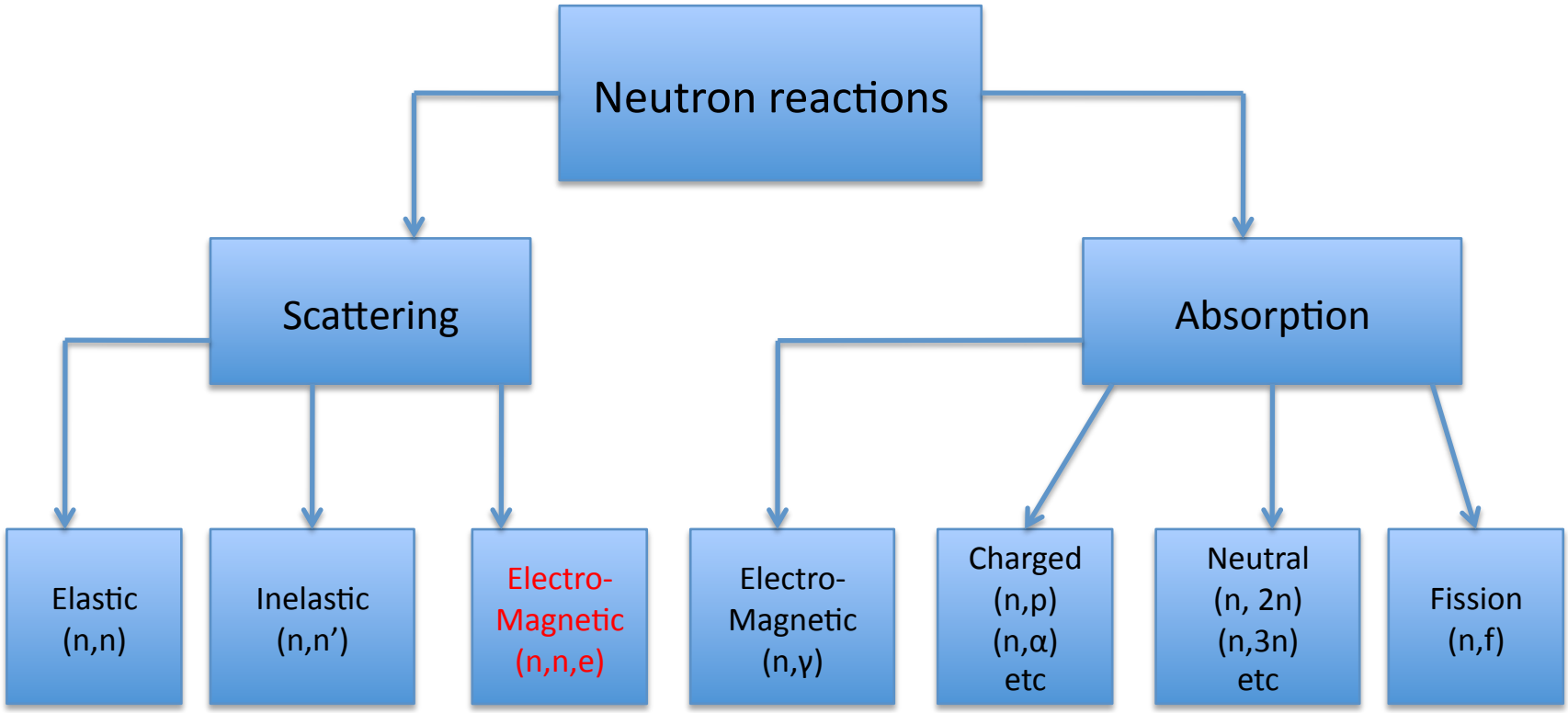
Dongming Mei

The University of South Dakota

Neutrons Reactions



Neutrons are problematic

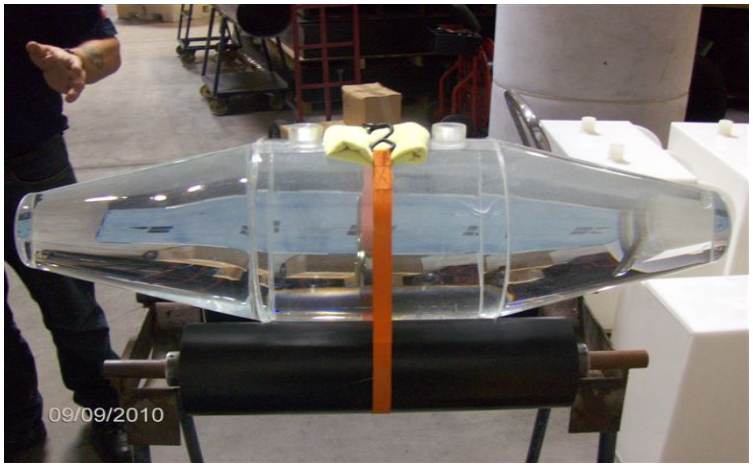
1. Neutrons from natural radioactivity
   a) Flux is on the order of 10^{-6} $cm^{-2}s^{-1}$, gamma-ray flux is a few × $cm^{-2}s^{-1}$
   c) Energy ranges from keV to MeV
   d) Flux annual modulates
   e) Must be measured continuously during the course of DUSEL
2. Neutrons from muon-induced processes
   a) Flux is on the order of 10^{-9} $cm^{-2}s^{-1}$ in the laboratory hall
   b) Energy ranges from keV to Gev
   c) Flux annual modulates
   d) Flux dependence on the targets
   e) Very complicated production process
   f) Very hard to veto
   g) Large uncertainty on the production processes
   h) Difficult to simulate correctly
   i) Must be measured continuously during the lifetime of DUSEL

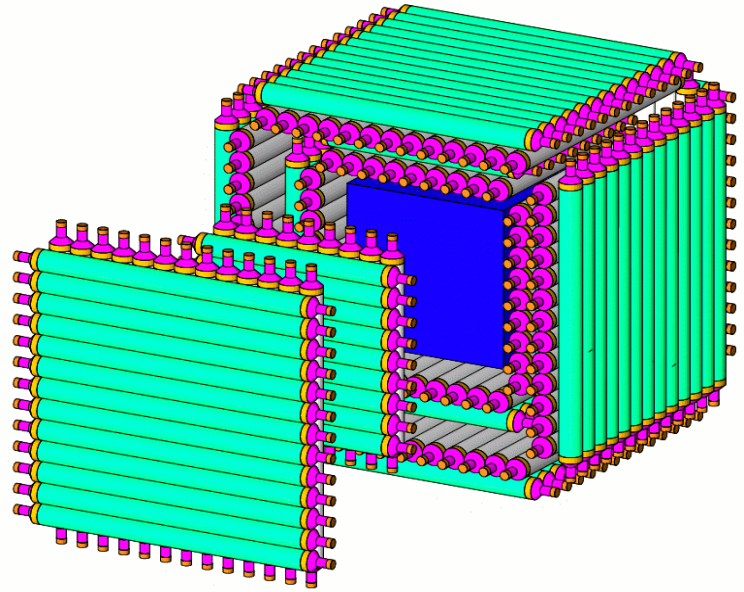
Measuring neutrons

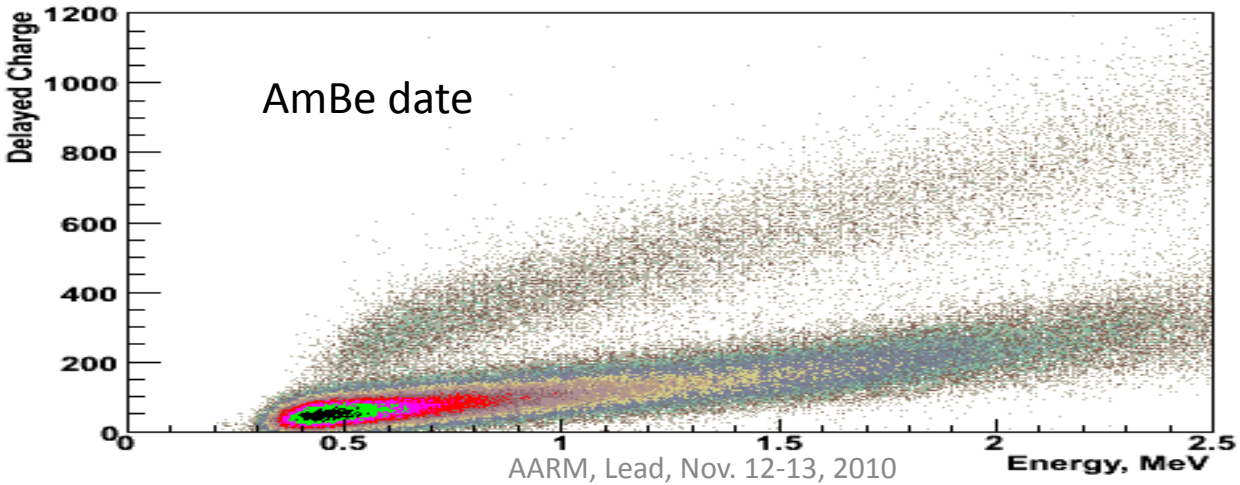
1. Must have n/g discrimination capability
   a) Scinillator, germanium detector, and TOF
2. Must be able to measure high energy neutrons
   a) Neutron attenuation in lighter elements and TOF
3. Must be large enough to measure neutrons
   a) Big detector or detector array
4. Must also measure muons and various showers
   a) Detector array
5. Must also measure the multiplicity
   a) Gd-doped water Cherenkov detector

A hybrid detector array that consists of liquid scintillators and Gd-doped water

Hybrid Detector Array

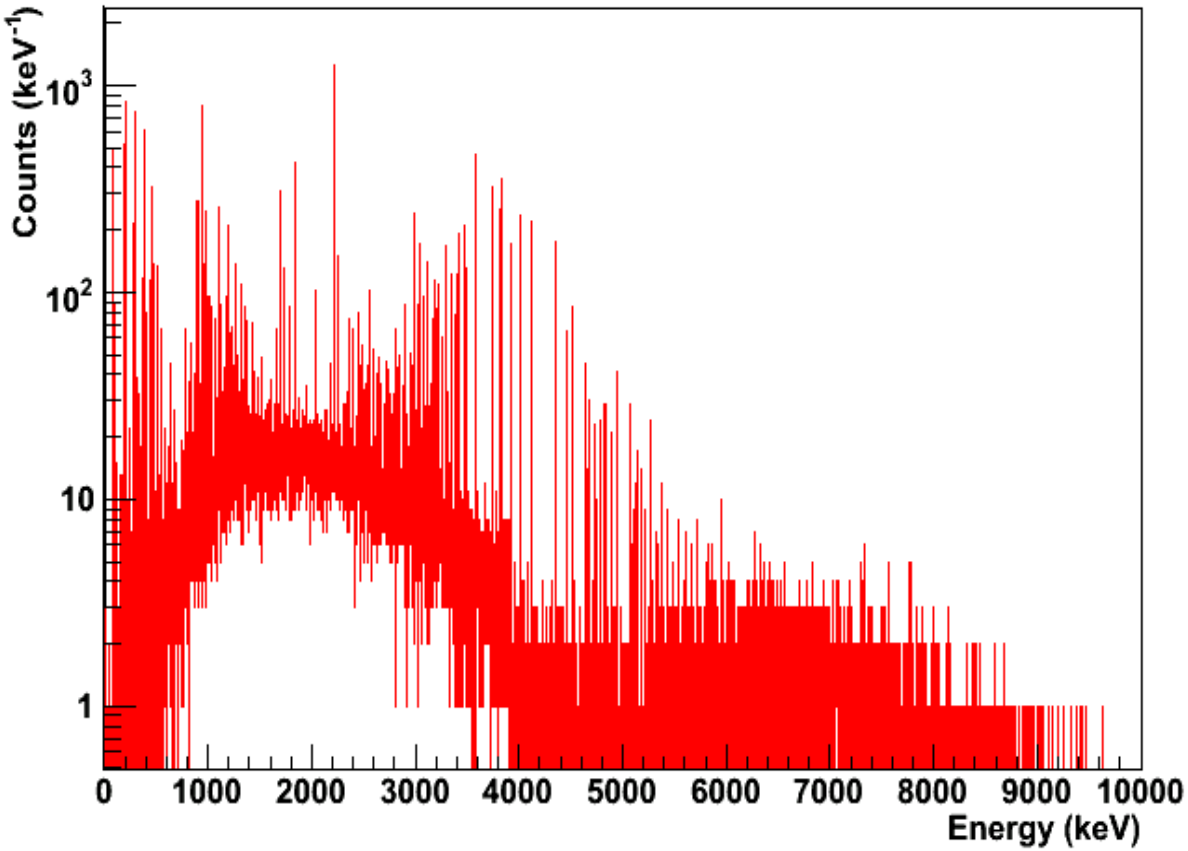






Gd-doped water Cherenkov detector

1. 0.2 % of Gd-doped concentration
2. 46 liters of total liquid volume
3. Acrylic tube



Status of the project

1. The current NSF funding is being implemented and one scintillator is built. One Gd-doped water Cherenkov detector is being built.
2. The renewal NSF funding has been submitted. This proposal will allow us to build 8 more detectors in next three years.
3. A major research instrument proposal is being planned to build 252 detectors in total.
4. The detector array will be in operation at DUSEL in 2016.