Simulation of Neutron Wall and Charged Particle Veto wall

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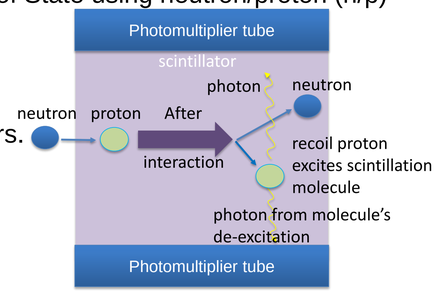
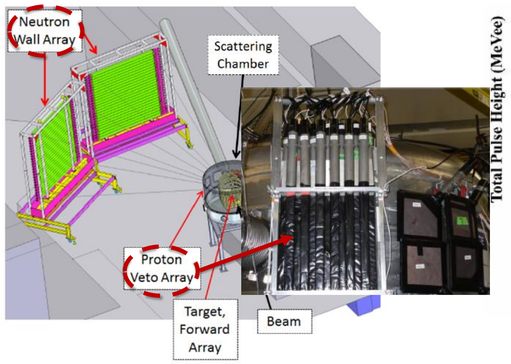
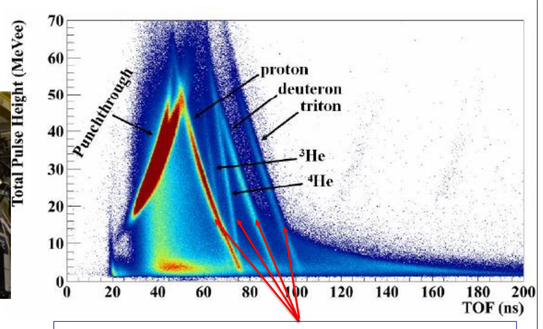
Motivation

- Constrain the stiffness in Nucleus Equation of State using neutron/proton (n/p) emission ratio during Heavy Ion Collision
- Detection of neutrons primarily relies on the detection of the recoiled protons when neutrons scatter off protons in the scintillators. Thus the neutron detection efficiency is low and the neutron detectors are also sensitive to charged particles, which are detected with 100% efficiency



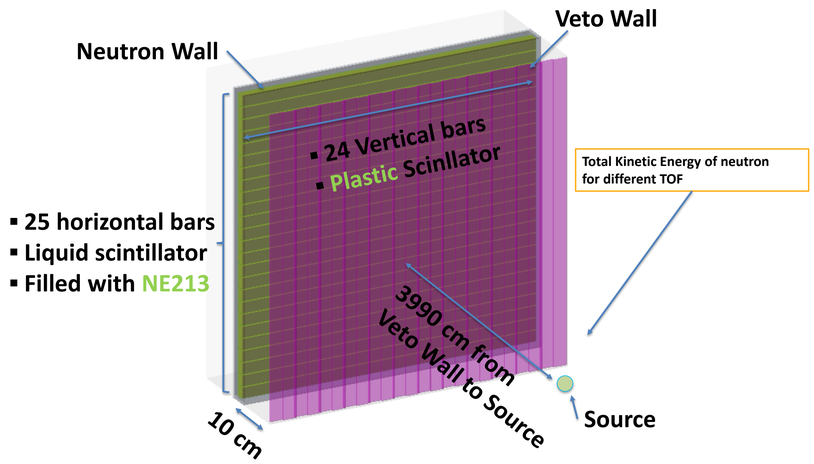
- Charged particles need to be removed for obtaining clean neutron data
- Previous experiment: a small veto array outside reaction (Scattering) chamber, but is unable to veto charged particles with high multiplicity due to the large distance between proton veto array to neutron wall array

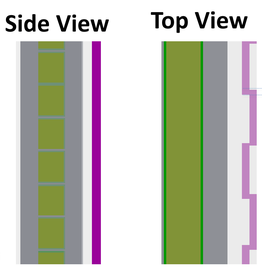




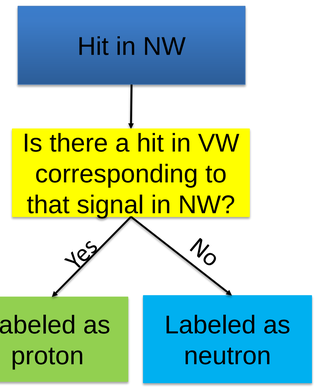
Sharp slanted lines are charged particles which are not completely removed

Veto Wall geometry





3 mm overlap → No gap between veto bars → The Neutron Wall are completely covered by Veto Wall

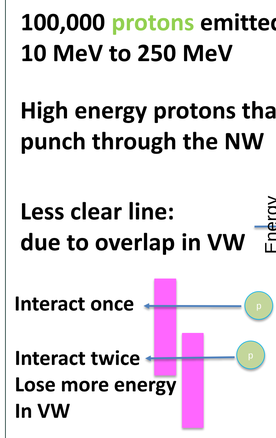


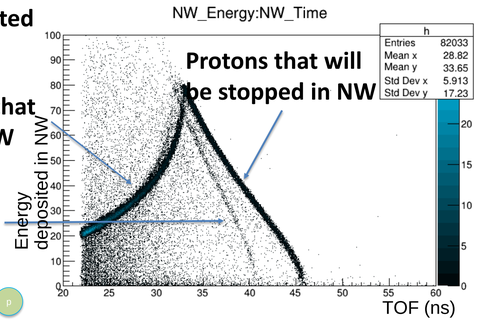
Proton's and neutron's spectrum

100,000 protons emitted
10 MeV to 250 MeV

High energy protons that punch through the NW

Less clear line: due to overlap in VW

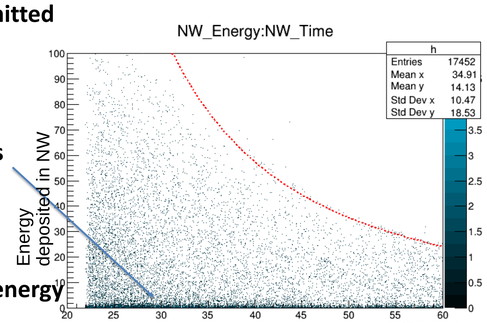




TOF: Time used to travel from source to Neutron Wall
Increase in TOF corresponds to decrease in K.E.

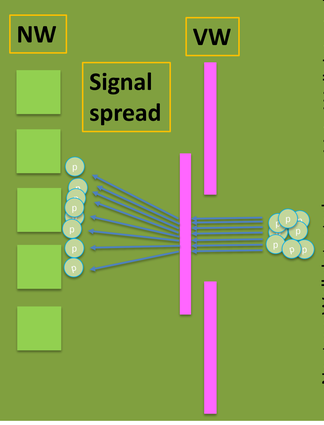
100,000 neutrons emitted
10 MeV to 250 MeV

Most of the neutrons reside at the bottom → They lose very little energy in Neutron Wall

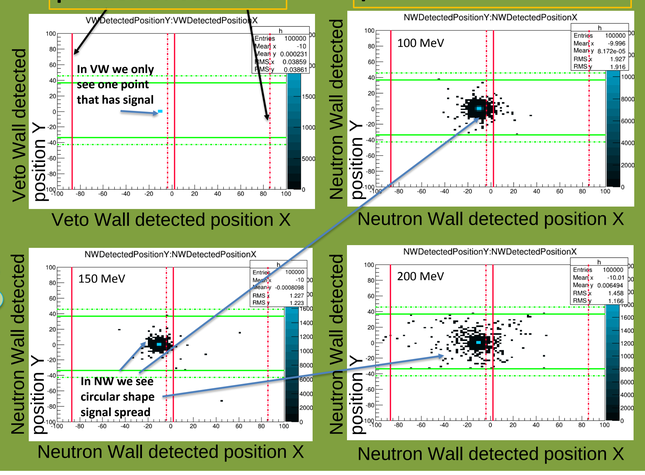


Position Correlation

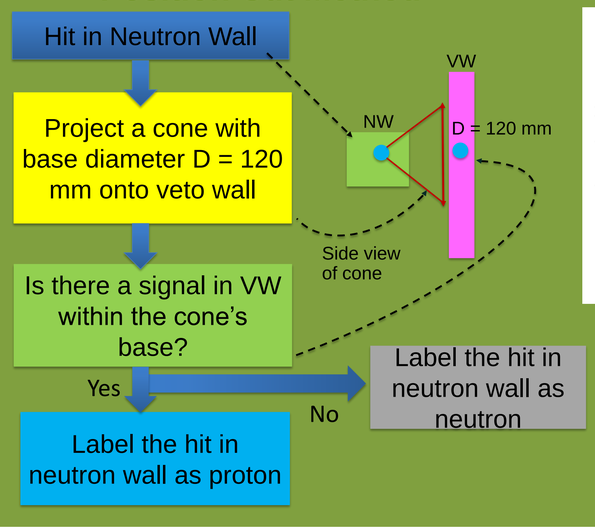
100,000 protons emitted
All beamed at central of NW



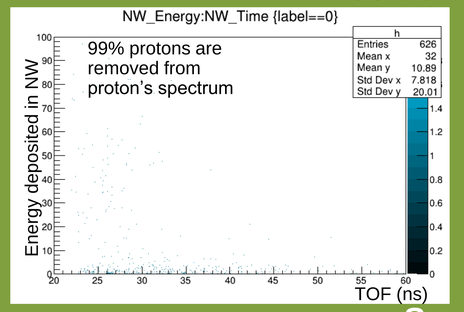
Red line indicating position of Veto Bars
Green line indicating position of Neutron Bars

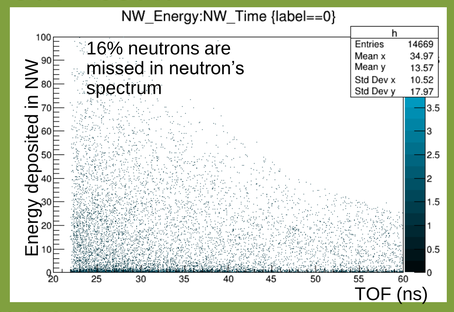


Position Cut Method



Position Cut Result





Summary

- We find a method that could remove protons efficiently from neutron data
- 16% neutrons are missed after applying position cut method, this number provide a crucial information that we need to compensate for neutron data in real experiment

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