

Spallation neutrons in AD1

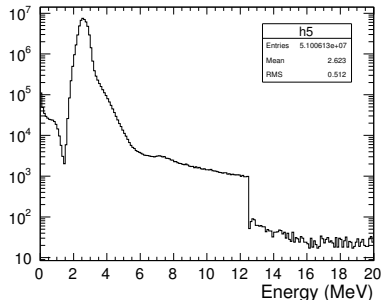
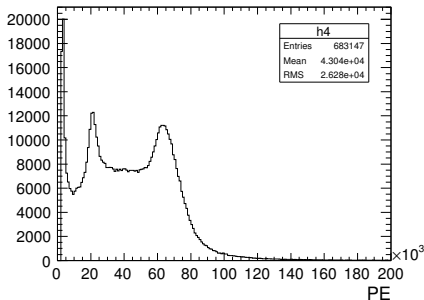
Qing He

Princeton University

Dayabay Collaboration

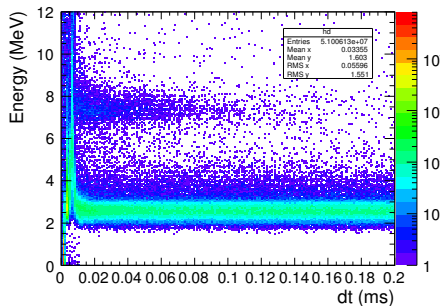
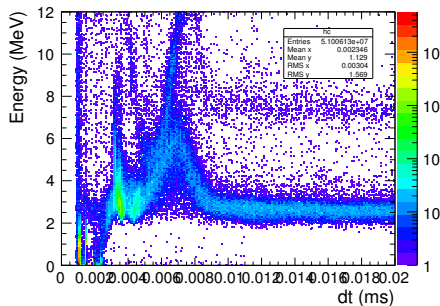
- 8 Hour physics run 10601, NHit threshold: 155, Esum threshold:425

Muon and spallation



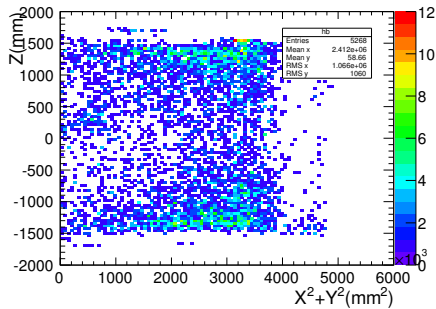
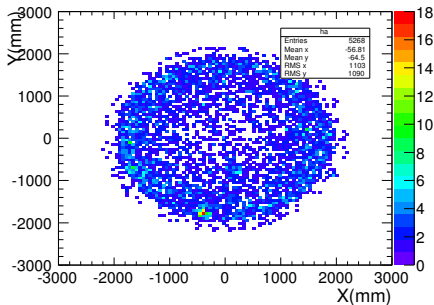
- Left: Muon energy. Right: Spallation energy.
- Muon identification in AD: $N_{PE} > 2500$
- Triggers follow the muon within 0.2 second are considered as spallation events (exclude some muon retriggers).

Δt vs energy distribution



- Some strange structure for $\Delta t < 0.01$ ms
- Most spallation neutrons have $\Delta t < 0.2$ ms

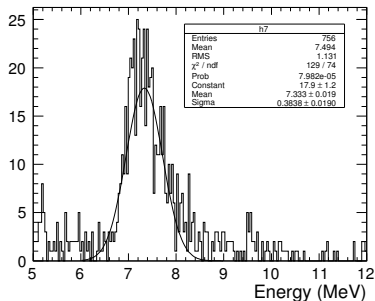
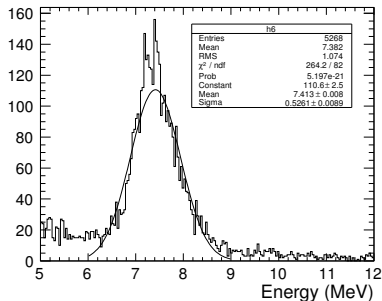
Vertex distribution



Selection cuts:

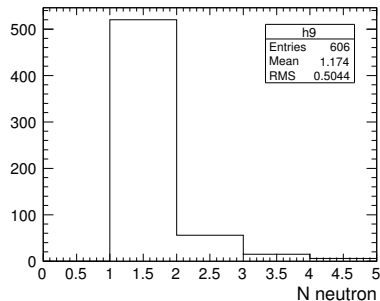
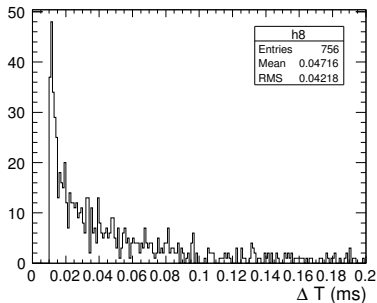
- $6 \text{ MeV} < \text{Energy} < 12 \text{ MeV}$
- $0.01 \text{ ms} < \Delta t < 0.2 \text{ ms}$

Neutron energy distribution



- Fiducial cuts: $Z < 1 \text{ m}$, $X^2 + Y^2 < 2 \text{ m}^2$
- Left: Energy distribution without fiducial cuts
- Right: Energy distribution with fiducial cuts
- Neutron capture mean energy: 7.3 MeV, width: 0.38 MeV
(consistent with $12.5\%/\sqrt{E} \approx 0.36 \text{ MeV}$)

Δt distribution



- Left: Neutron capture time Δt distribution with fiducial cuts
- Right: Number of neutrons in one muon event (indication of multiple neutrons generation)