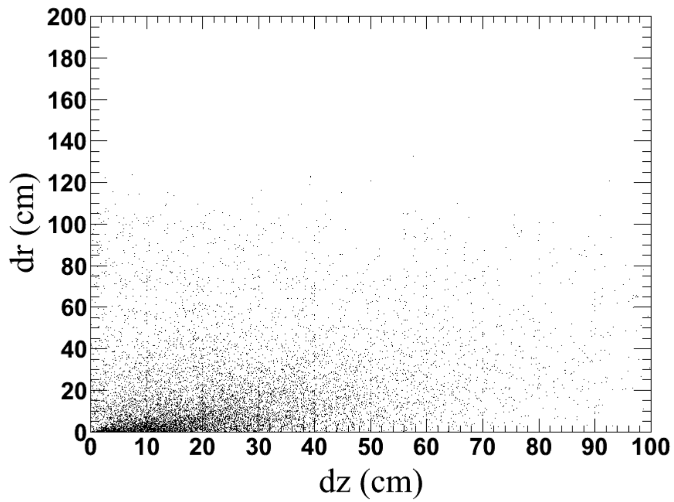
2012_12_13_labmeeting

주은아

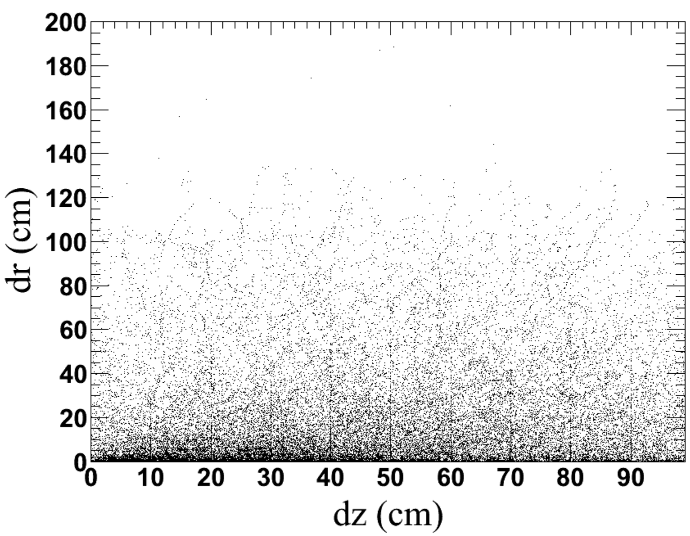
Neutron detector cluster size




```
ratio in_20cm/total : 0.918471
in_20cm : 43384
total : 47235
```

30 MeV

- -10000 events
- -Total means hits over threshold
- -Error at 300 MeV (?)




```
ratio in_20cm/total : 0.915875
in_20cm : 185472
total : 202508
```

150 MeV

```
ratio in_20cm/total : 0.932516
in_20cm : 442833
total : 474880
```

300 MeV

NEDA and NIMROD

- They use ToF to measure the energy of neutron.

At 1m,
20 MeV ToF = 17 ns
10 MeV ToF = 23.5 ns

50 closely packed liquid scintillator detectors of three types: H1, H2, P.

Liquid: BC501A (xylene), total volume 150 litre.

Distance to target: 51 cm; detector thickness: 15 cm.

Detector angles: from 0° to $\simeq 60^\circ$

Neutron energy range: from $\simeq 0.5$ MeV to $\simeq 10$ MeV

- If there is more than one hits with 1n, it is considered as cross-talk. (NEDA)

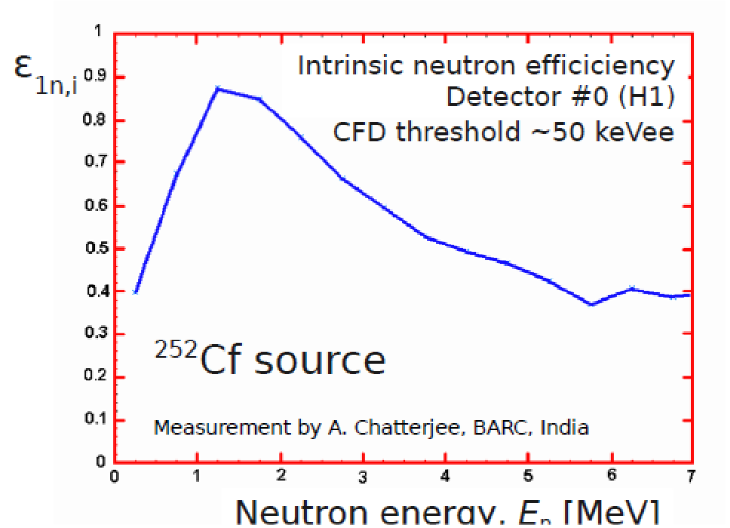
$$P_{1n\rightarrow 2n} = N^{1n}_{d\geq 2}/N^{1n}_{d\geq 1}$$

where $N^{1n}_{d\geq 2}$ is the number of events in which 1 neutron was emitted and at least 2 detector fired. In the following discussion $P_{1n\rightarrow 2n}$ is referred to as *cross-talk*.

Efficiency and energy resolution

Efficiency

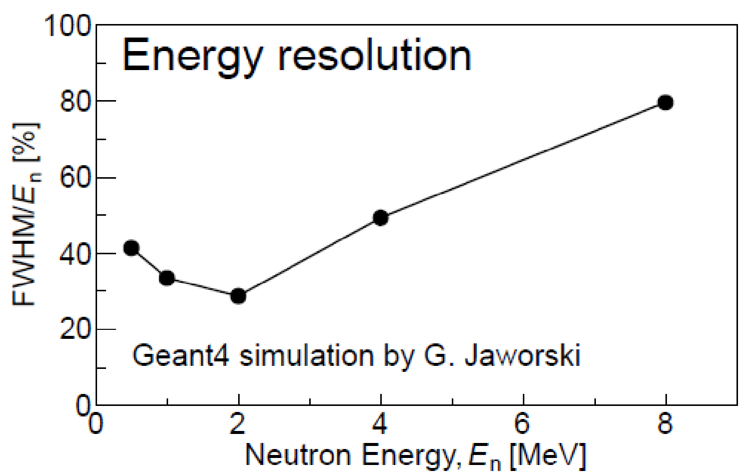
Intrinsic neutron efficiency at $E_n = 2$ MeV: $\varepsilon_{1n,i} \simeq 80\%$



Total Neutron Wall efficiency for symmetric fusion evaporation reactions:

- One-neutron efficiency: $\varepsilon_{1n} = 20\text{-}25\%$
- Two-neutron efficiency: $\varepsilon_{2n} = 1\text{-}3\%$

Energy resolution (Time-of-Flight)

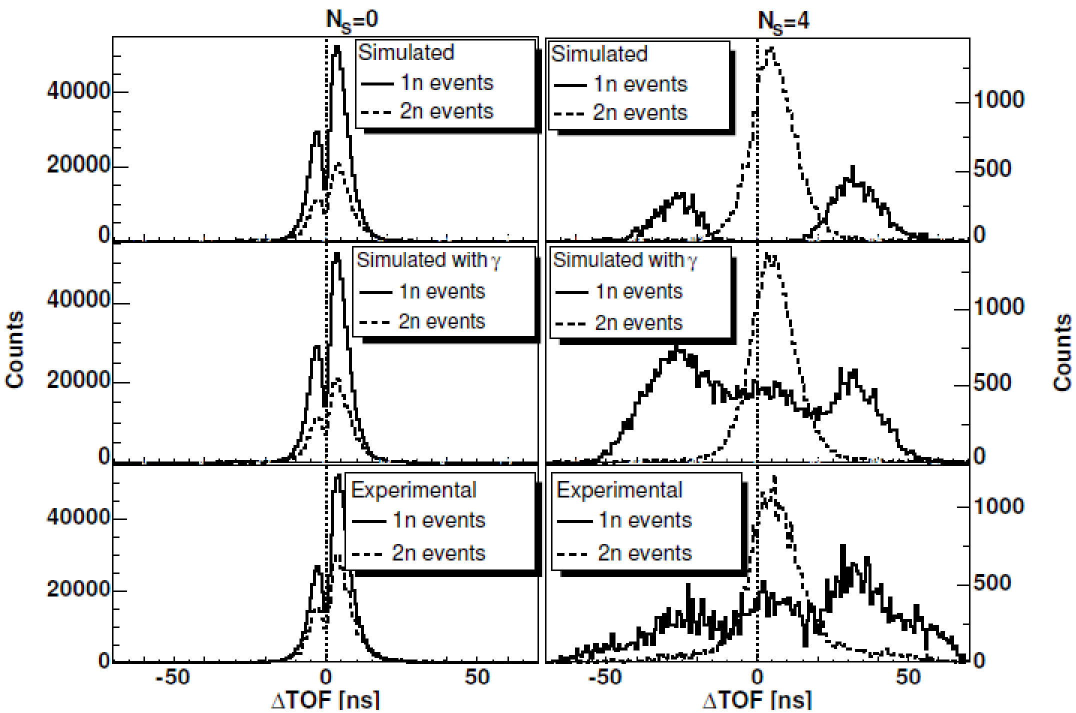


- Distance source to detector front face: 51 cm
- Thickness of detectors: 14.8 cm
- Time resolution of detectors: FWHM $= 1.5$ ns

Neutron scattering

Probability of 1 neutron giving a signal in 2 or more detectors $\simeq 10\%$.

Serious problem in searches for weakly populated $\geq$ 2n reaction channels: scattered neutrons from much stronger 1n channels are mis-identified as being due to 2n, 3n, . . . channels.



J. Ljungvall et al. NIM A528 (2004) 741

Methods to detect scattered neutrons:

- Neighbor rejection.
- ΔToF. J.Cederkäll et al. NIM A385 (1997) 166.

Small amounts of γ rays mis-identified as neutrons reduces dramatically the quality of the neutron scattering reduction