

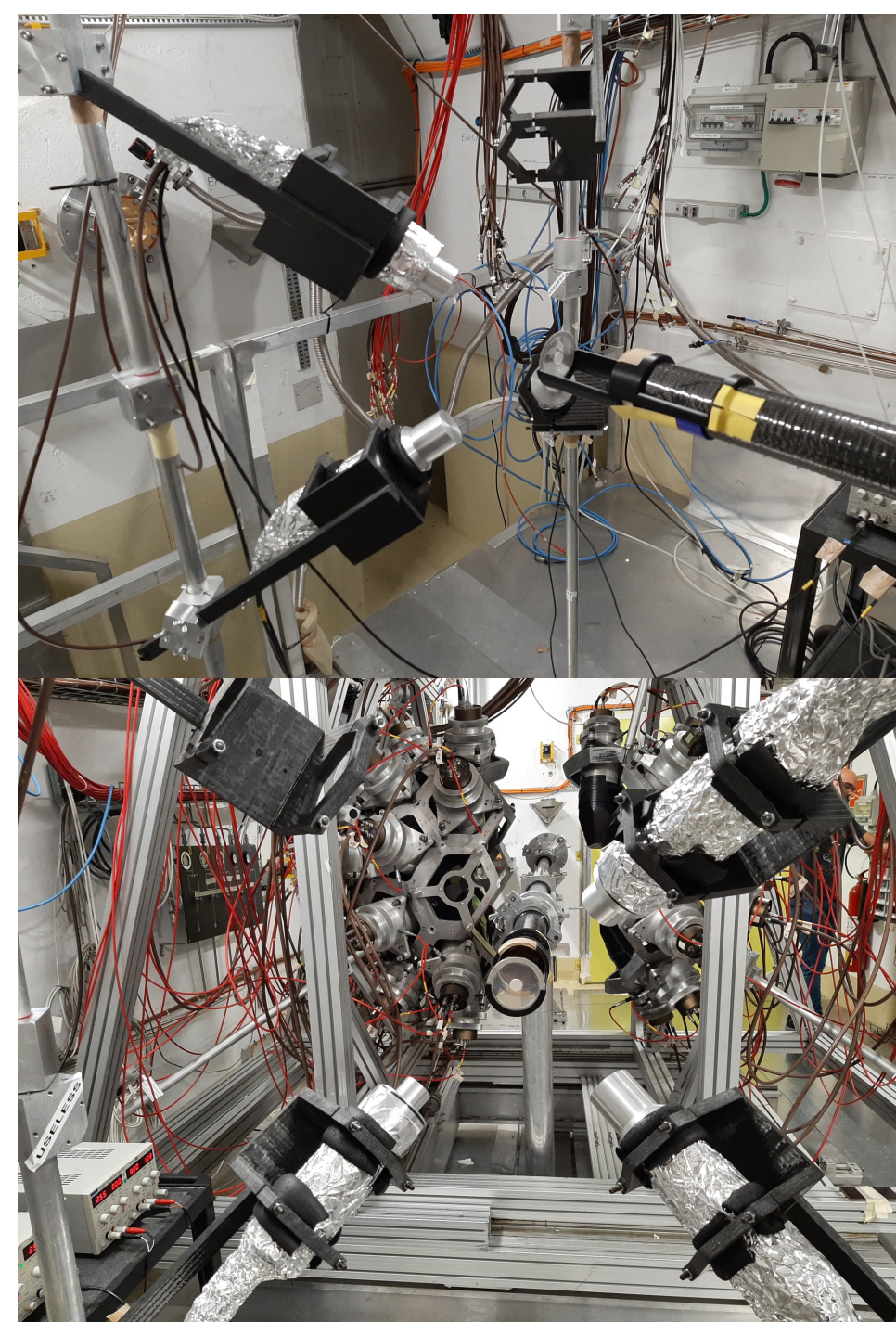
# Preliminary Results for a test of LaBr<sub>3</sub> detectors using an Fe<sup>56</sup> sample at EAR1.

# Motivation

- Interested in performing  $(n, n')$  xs measurements using LaBr3 detectors to utilise their speed  $\rightarrow$  gamma flash recovery.
- This experiment represents a “stress test” for these detectors.
- Fe56 sample due to it being a higher Z than samples of interest, which will result in worse gamma flash scatter.
- This in turn represents a “worst-case scenario” - the real measurements will not scatter gamma flash as much.

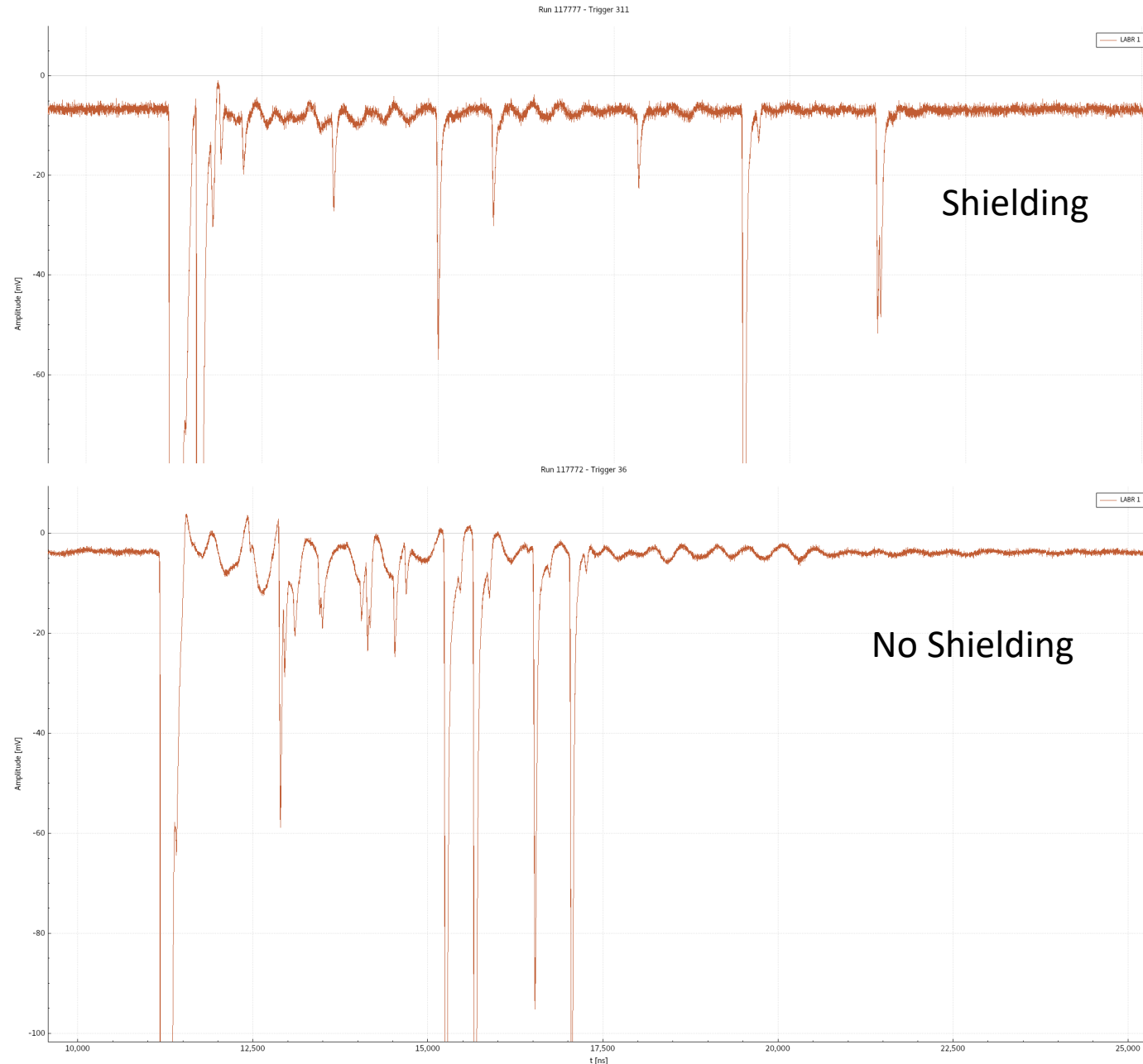
# Experimental Set-up

- Experiment carried out at EAR1 – higher neutron energy resolution but lower flux.
- Source mounted in the middle of 3 differently sized LaBr3 detectors. (1x1, 1x1.5, 1.5x1.5 cm)
- Initially mounted in a backward position (135 degrees from beam direction), Fe54, Au197, LiF, Fe56 samples used. Then moved to 45 degrees with only Fe56



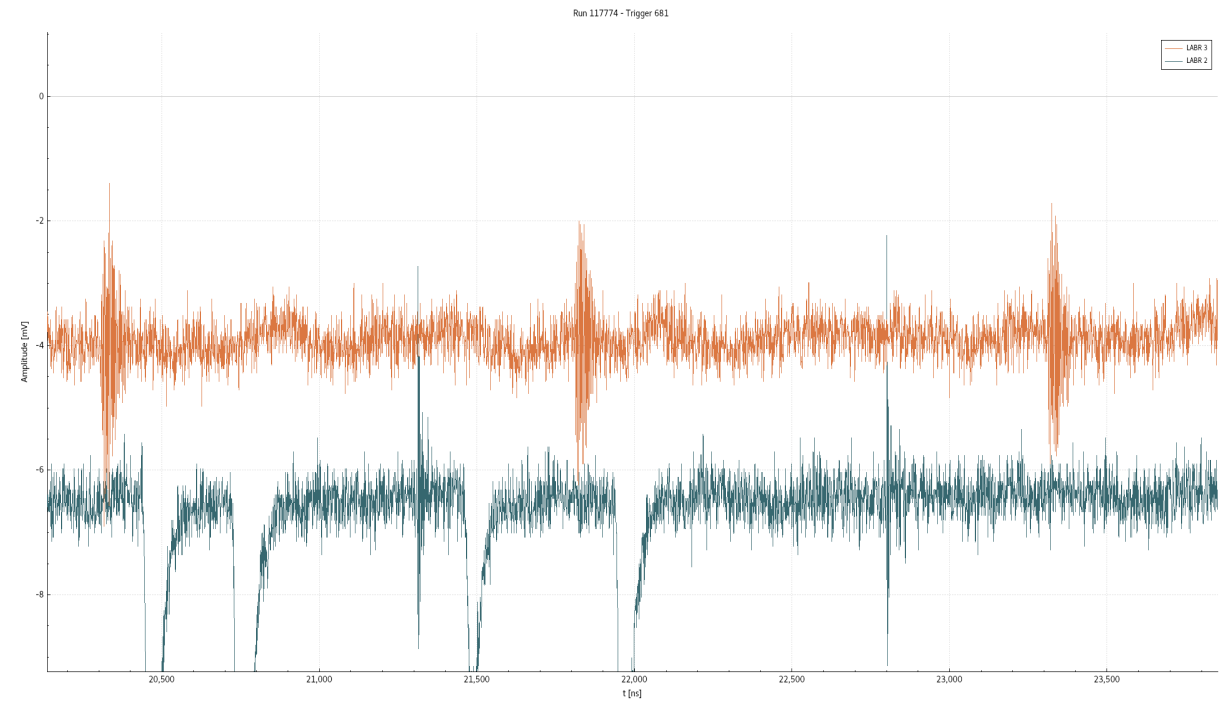
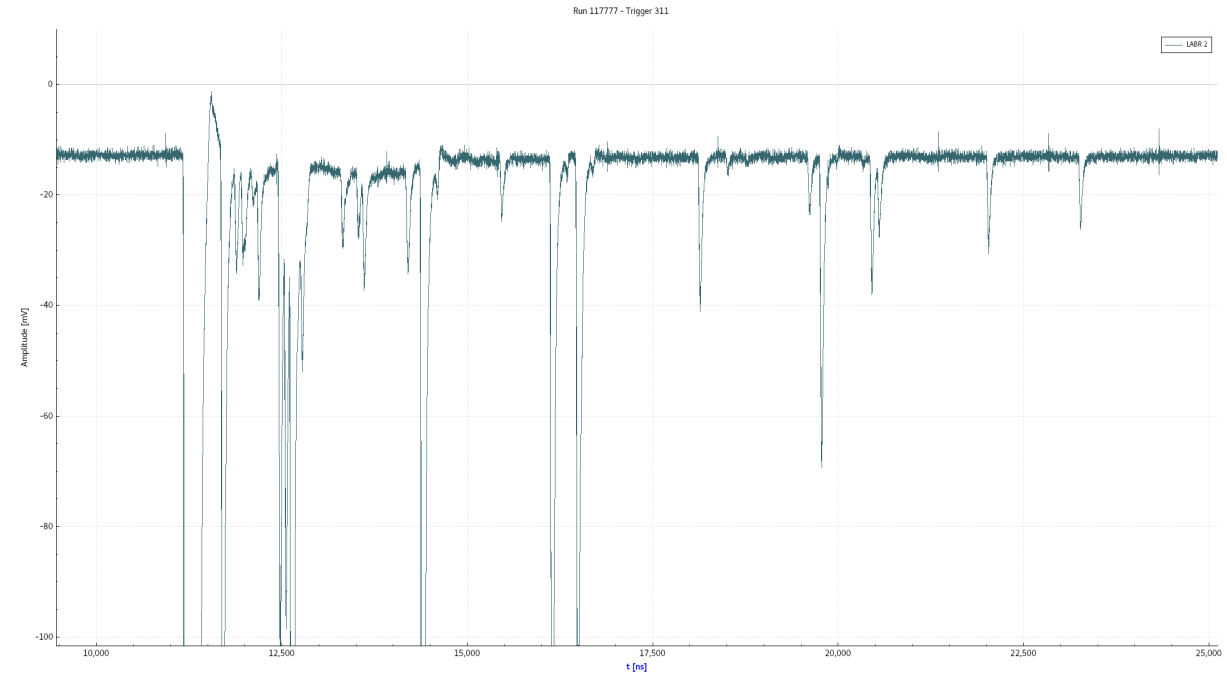
# Signal Issues

- The 3 detectors were shown to have some sort of ringing effect from previous tests
- Ringing present here too in the gamma flash region. Detector 1 worse than 2 and 3
- Parasitic pulses have less ringing than dedicated



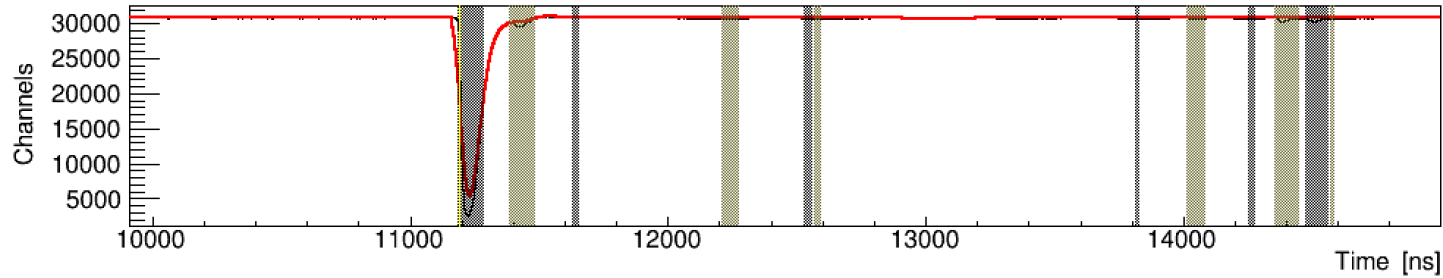
# Signal Issues

- Detector 2 (top right) and detector 3 show much less ringing.
- Detector 2 and 3 show a repetitive signal every 1500ns (bottom left)
- Successfully discriminated against by signal analyser.

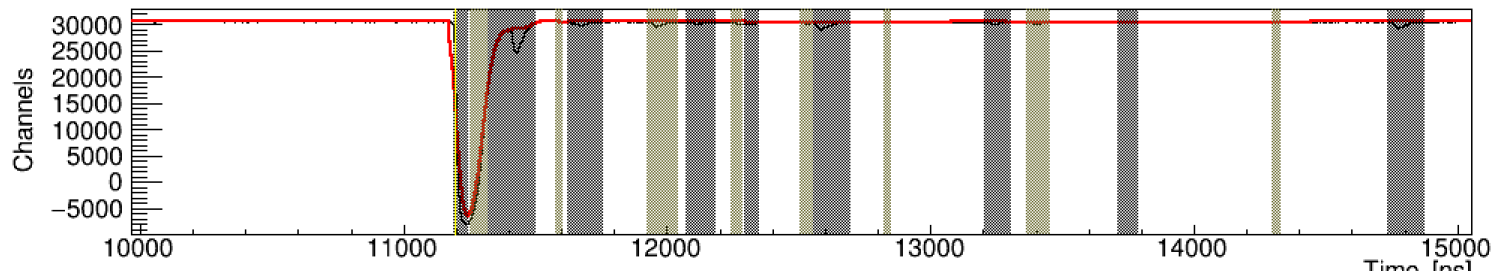


# Flash Recovery

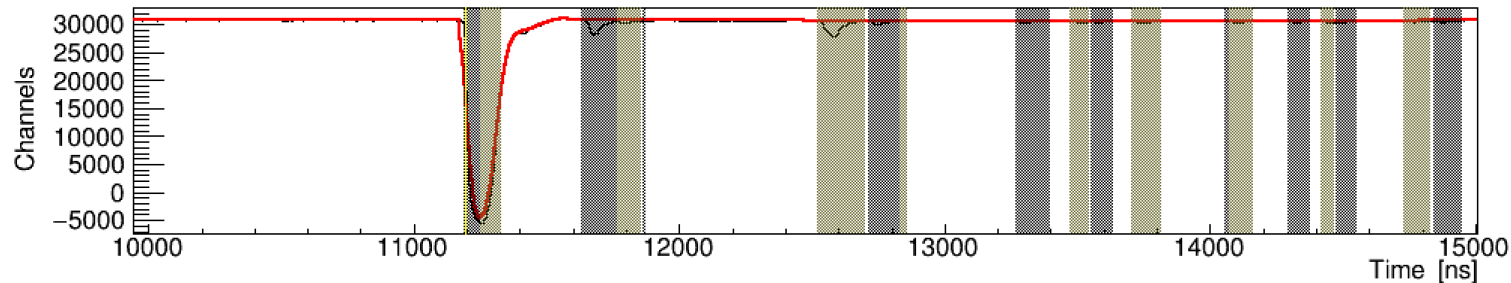
Signal - Event 4 Movie 0 (LABR-1)



Signal - Event 4 Movie 0 (LABR-2)



Signal - Event 4 Movie 0 (LABR-3)



- Flash recovery important for high energy measurements.

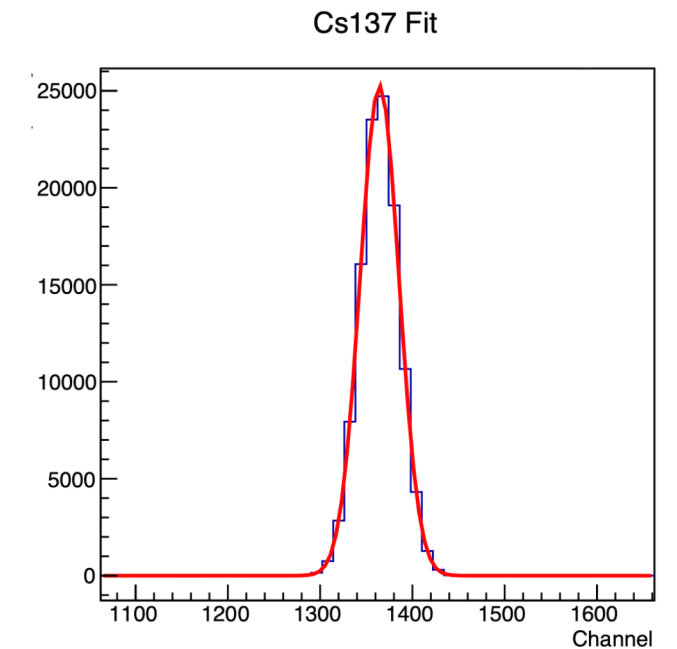
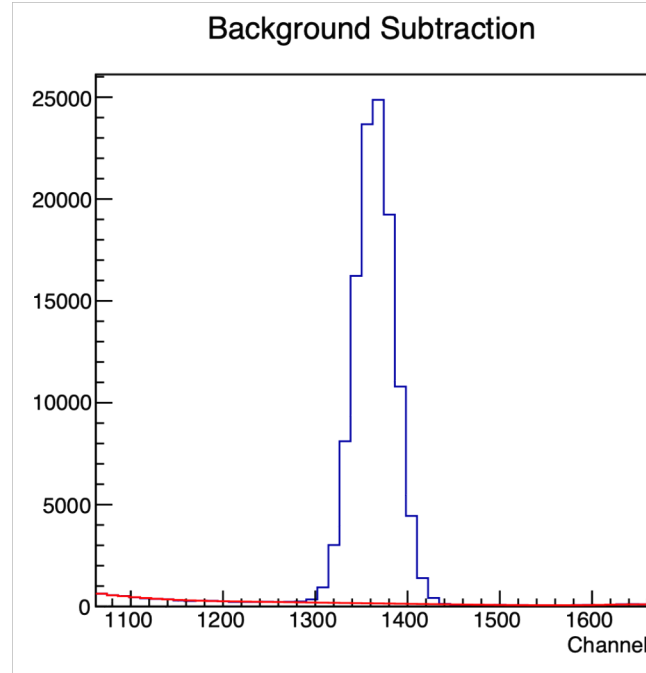
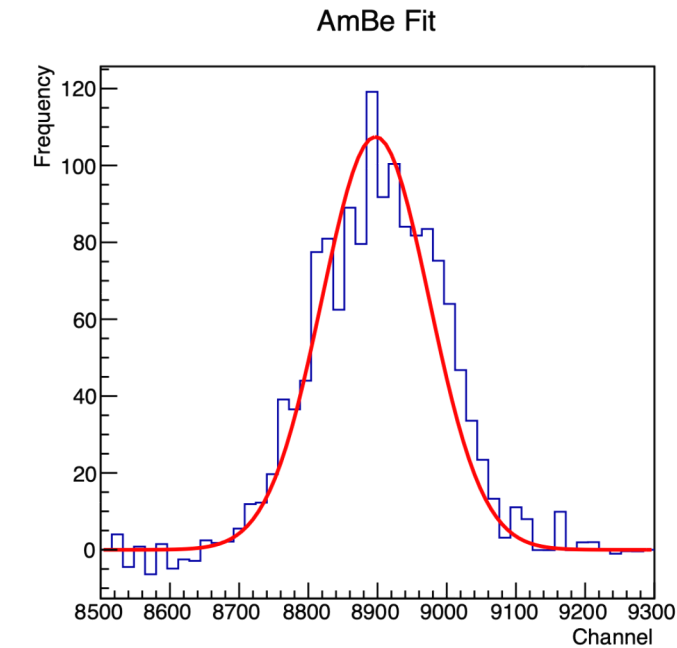
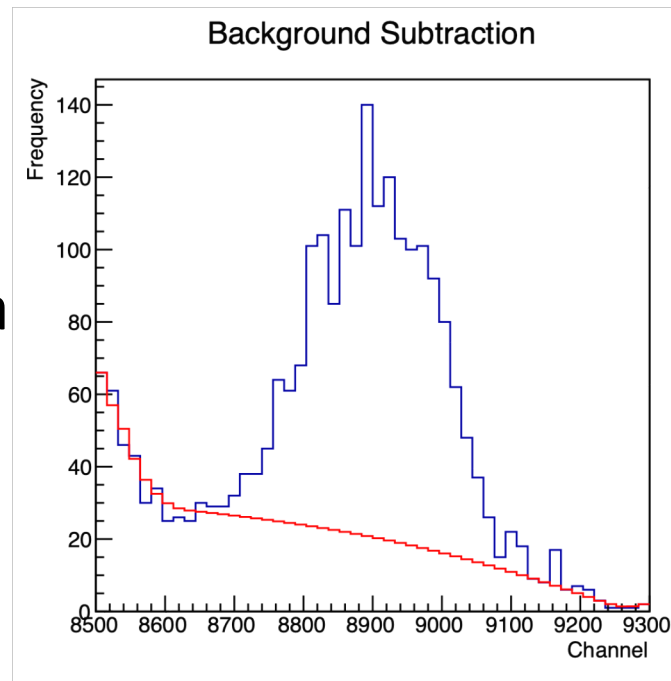
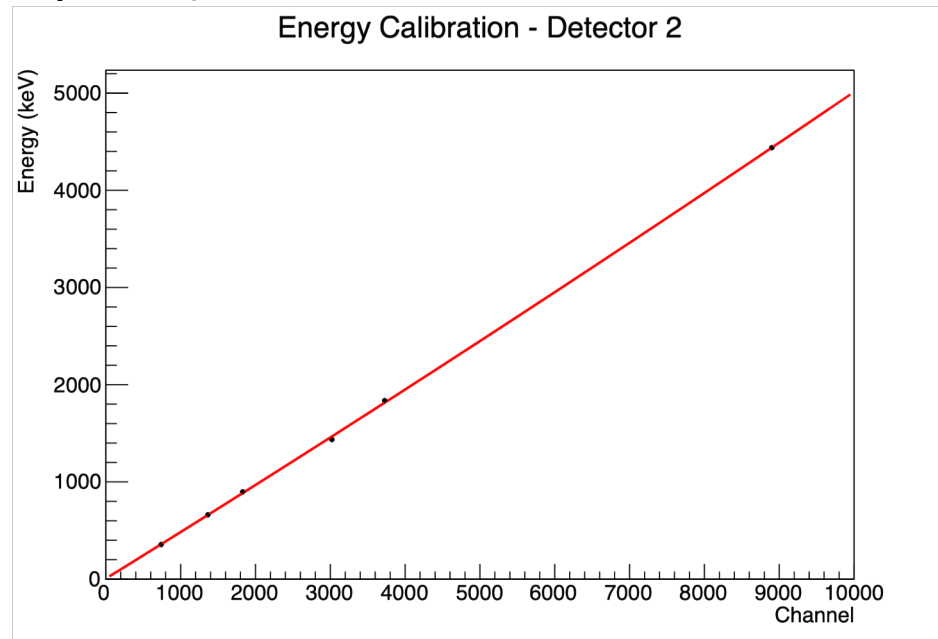
- LaBr3 2 and 3 have a noticeably broader flash.

- More analysis necessary to quantify this.

- Old LaBr3 file used – data has recently been re processed with new user file.

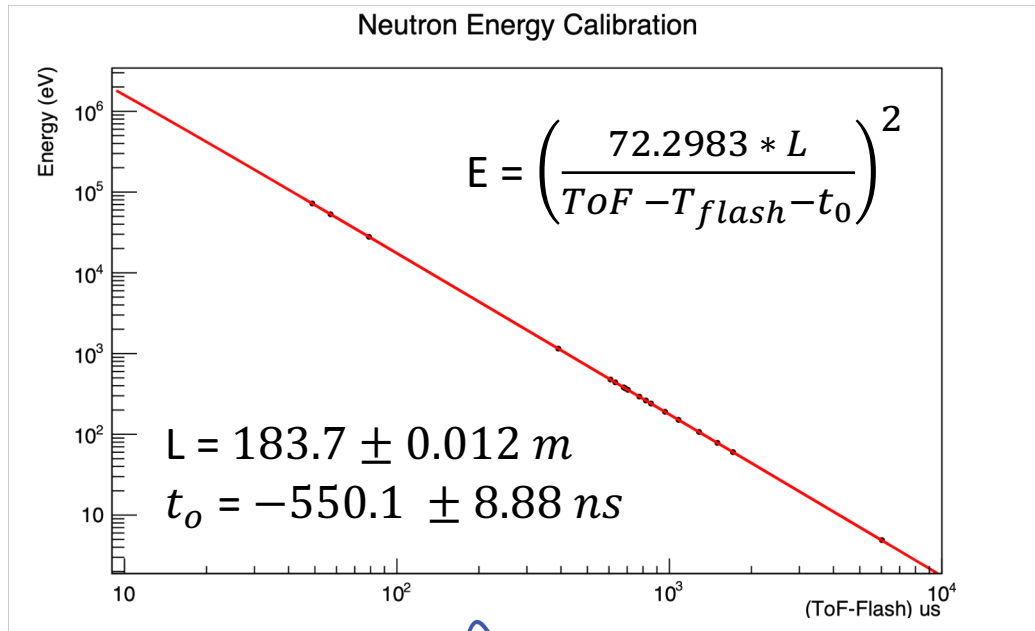
# LaBr3 Calibration

- LaBr3 calibration carried out via a combination of sources (Y88, Cs137, AmBe, Ba133, LaBr3 bg peak)

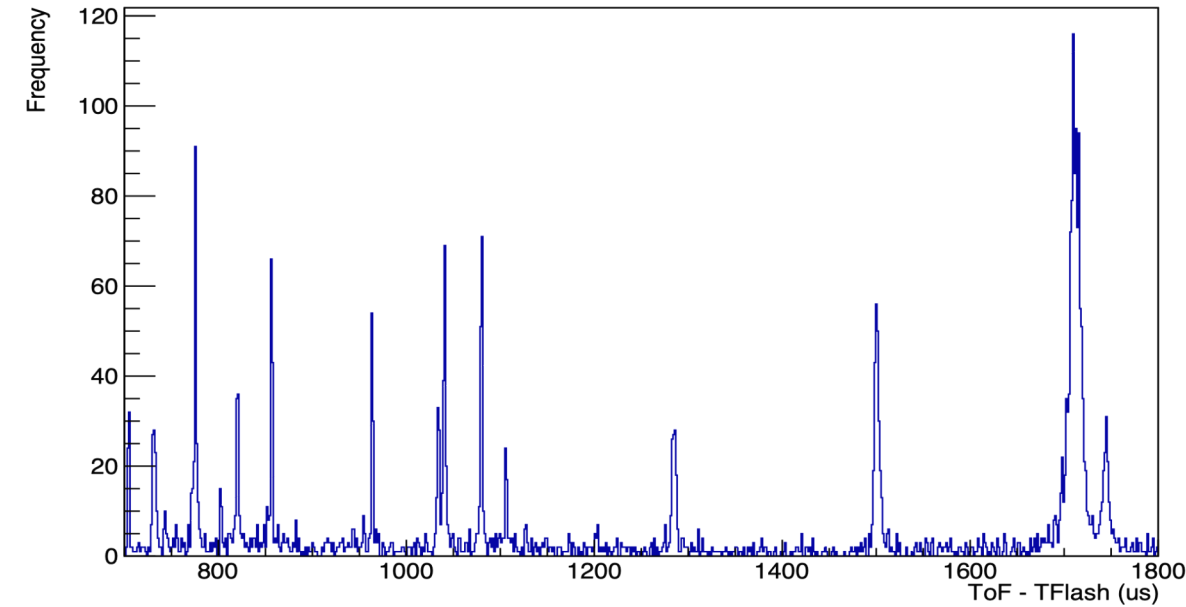


# ToF Calibration

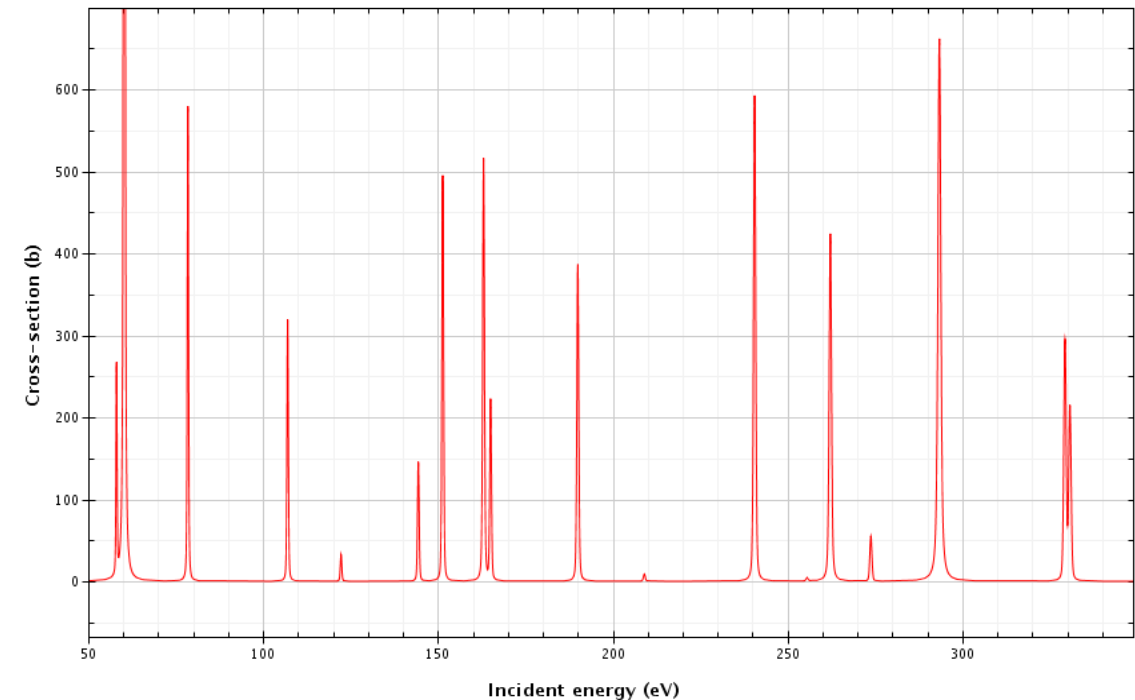
- ToF calibration carried out primarily via resonances within Au197 run at 135 degrees angle.



Gold ToF Spectrum



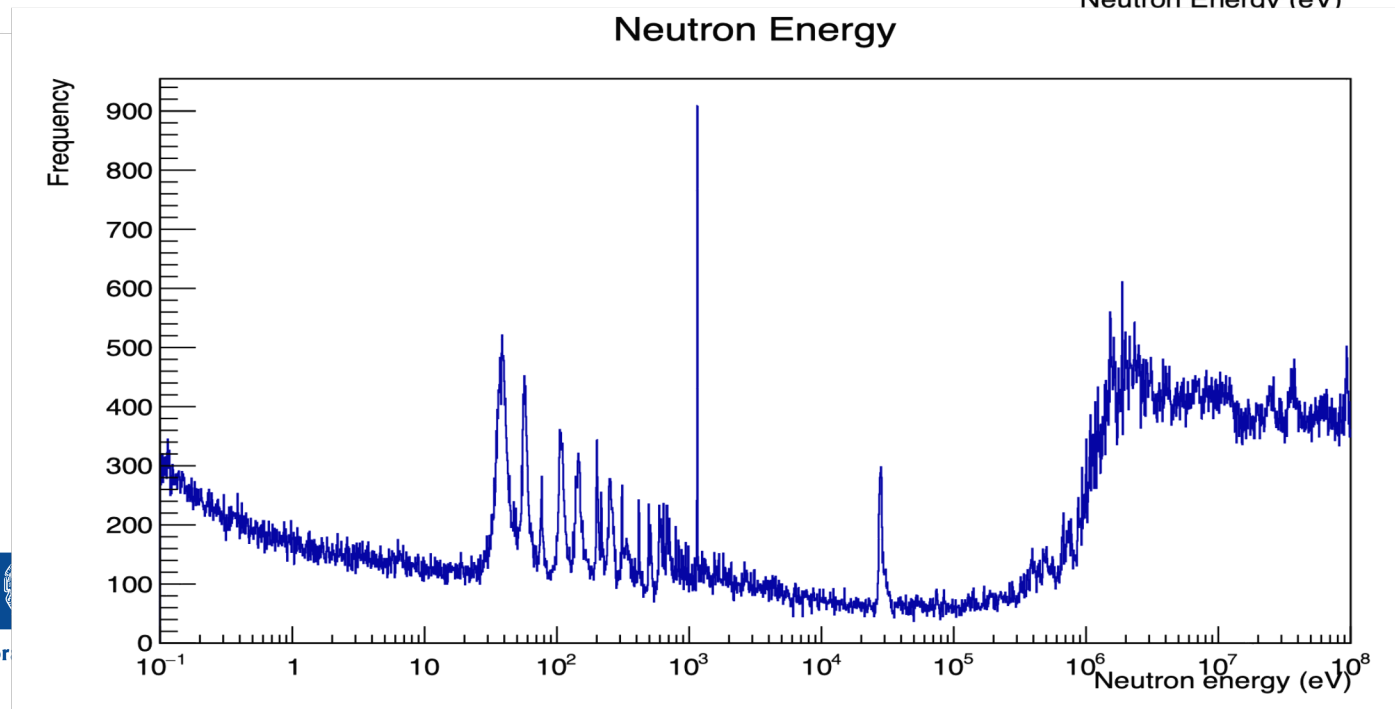
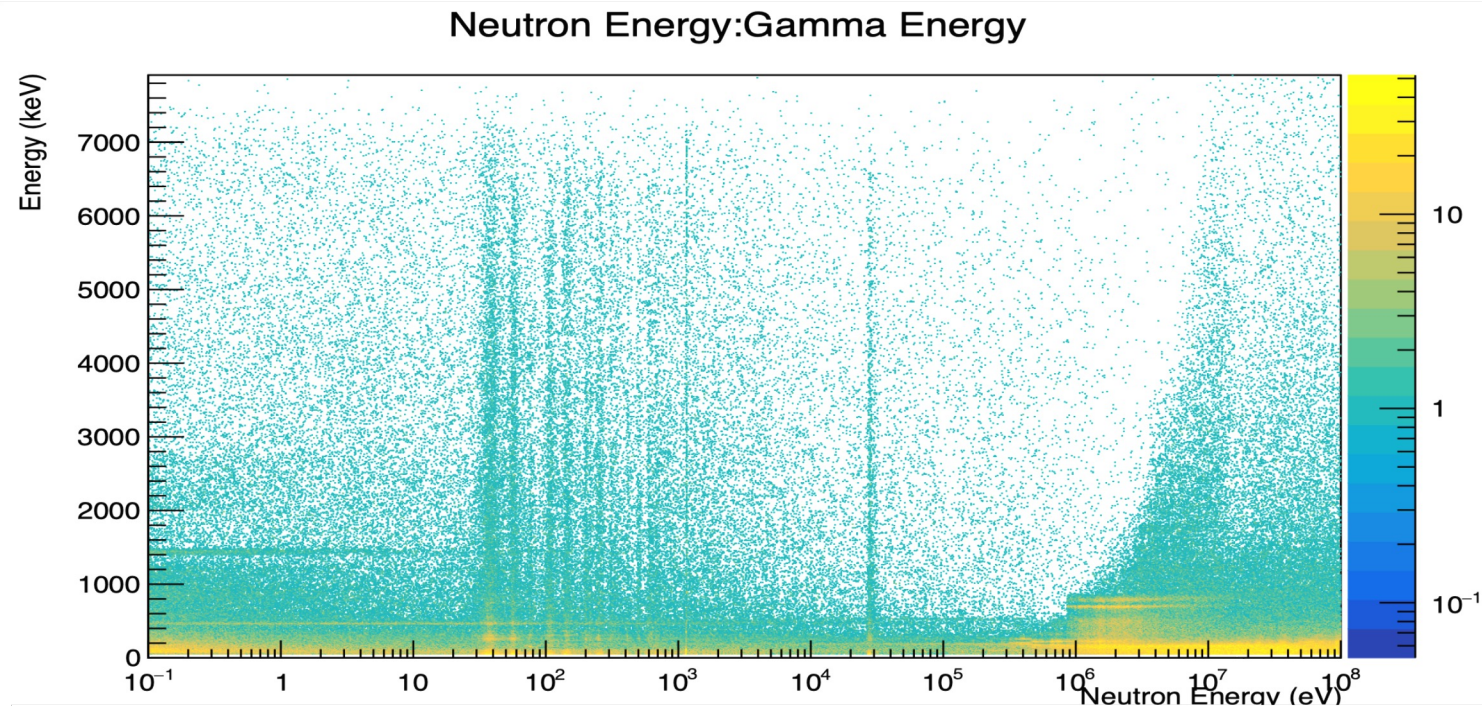
Incident neutron data / ENDF/B-VIII.0 / Au197 / MT=102 : (z,y) / Cross section





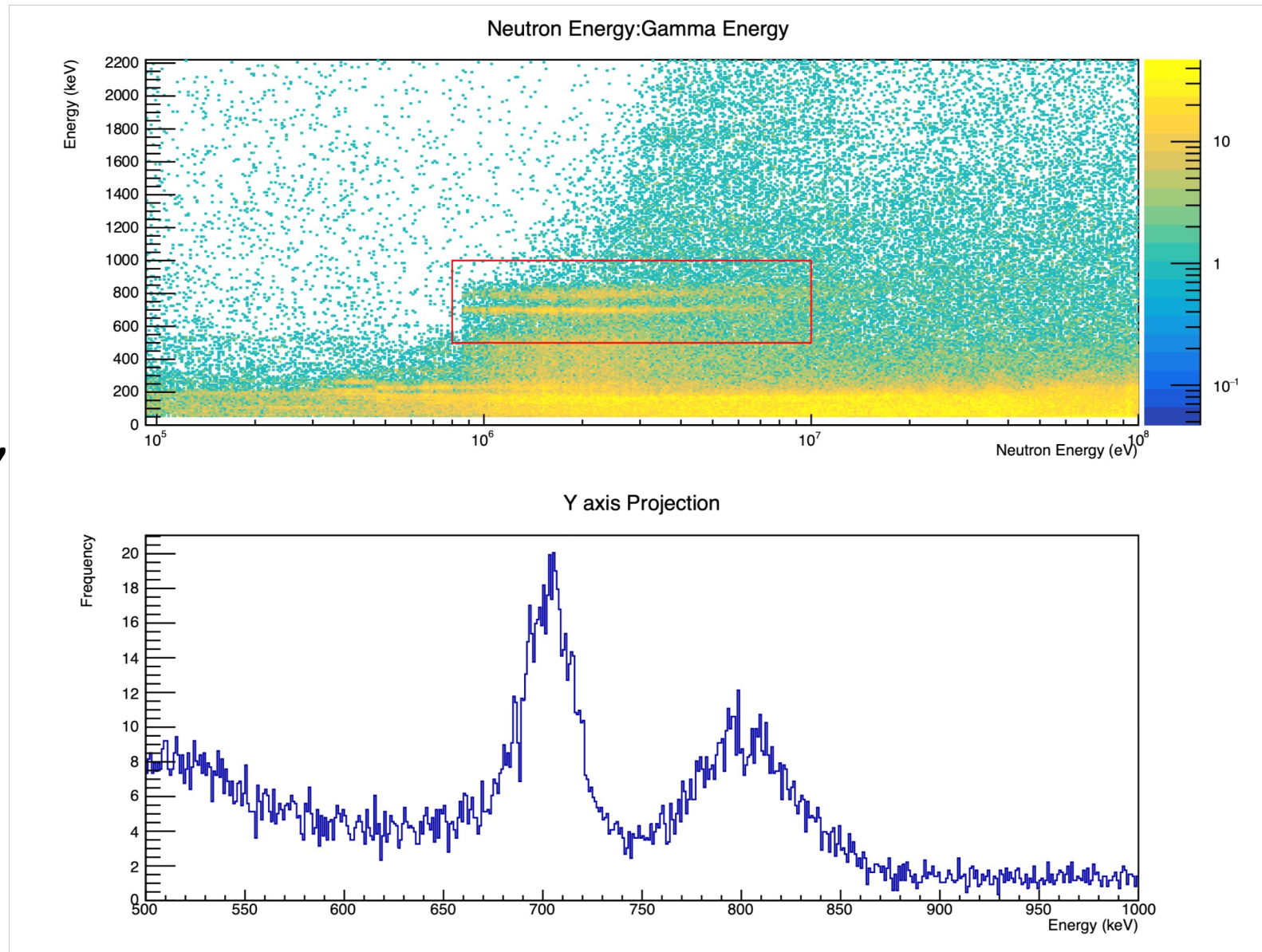
# What we see

- Unexplained resonance region 10 eV – 1 keV neutron energy.
- Very likely (n, n') visible at roughly 1– 10 MeV neutron energy.



# $(n, n')$ gammas

- Inelastic scattering region has 2 (likely more) distinct gammas, but what?
- From Fe56 we expect 846 keV gamma.



Thank you for listening.



The University of Manchester

