

2005 COLLABORATIVE MEASUREMENTS: ORNL & IRMM ORNL & LANL

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Measurement Overview

- ORNL & IRMM

- Fission product (FP) data to support burnup credit (BUC) applications
 - ORNL and IRMM established DOE-EURATOM agreement (EC16) to improve FP for BUC
 - FP of interest: ^{103}Rh , ^{133}Cs , ^{143}Nd , ^{149}Sm , ^{151}Sm , ^{155}Gd
 - September 2005: performed ^{103}Rh measurement at IRMM
- ^{55}Mn to support criticality safety applications
 - Needed to support DOE Nuclear Criticality Safety Program (NCSP) and DOE Environmental Management (EM) applications
 - ^{55}Mn is constituent of structural steel
 - Identified data deficiencies in radiation transport calculations of systems involving ^{55}Mn
 - October 2005: performed ^{55}Mn measurement at IRMM

- ORNL & LANL

- ^{19}F needed to support criticality safety applications
- ORNL recently completed resonance evaluation; however, discrepancy exists for inelastic measurements in resonance region
- Inelastic ^{19}F measurement needed to resolve discrepancy & improve evaluation
- September 2005: performed inelastic ^{19}F measurement at WNR



GELINA

a powerful white neutron source for high-resolution cross section data

High-energy
electron accelerator



- 150 MeV electron accelerator (10 ns, 10 A)
- 800 Hz (100 Hz, 40Hz)
- neutron energy range: thermal – 15 MeV
- $4.3 \cdot 10^{10}$ neutrons / burst

Flight path area

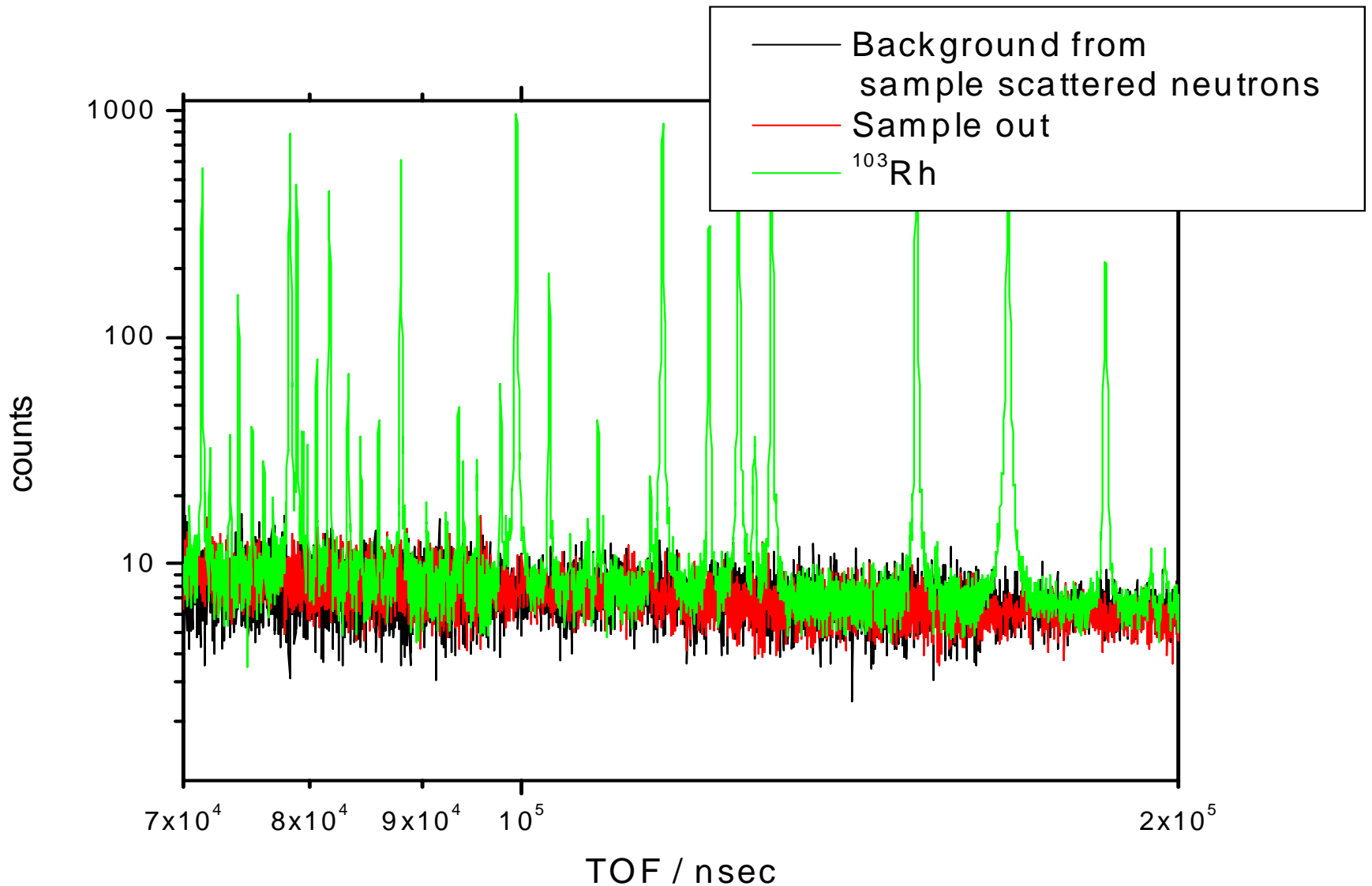


- multi-user facility: 12 different simultaneous experiments
- 24 hours / day basis, 100 h per week

^{103}Rh Experiments at GELINA

- **Experimental Conditions:**
 - Due to cooling problem not full power : **400 Hz** Rep Rate instead of 800 Hz.
 - Pulse width of the neutron beam **1nsec.**
- **Two experiments were performed:**
 - Total cross section (transmission) at 26.45 m flight path with a ^6Li glass detector using a ^{103}Rh sample with 0.00187 at/b.
 - Neutron capture using the pulse height weighting technique with two C_6D_6 detectors at a distance of 28.1m. Sample thickness for ^{103}Rh was 0.000337at/b.
- **Additional run with background filter were performed, as well as sample out runs.**
- **Despite the short flight path the resolved energy range is up to several keV.**

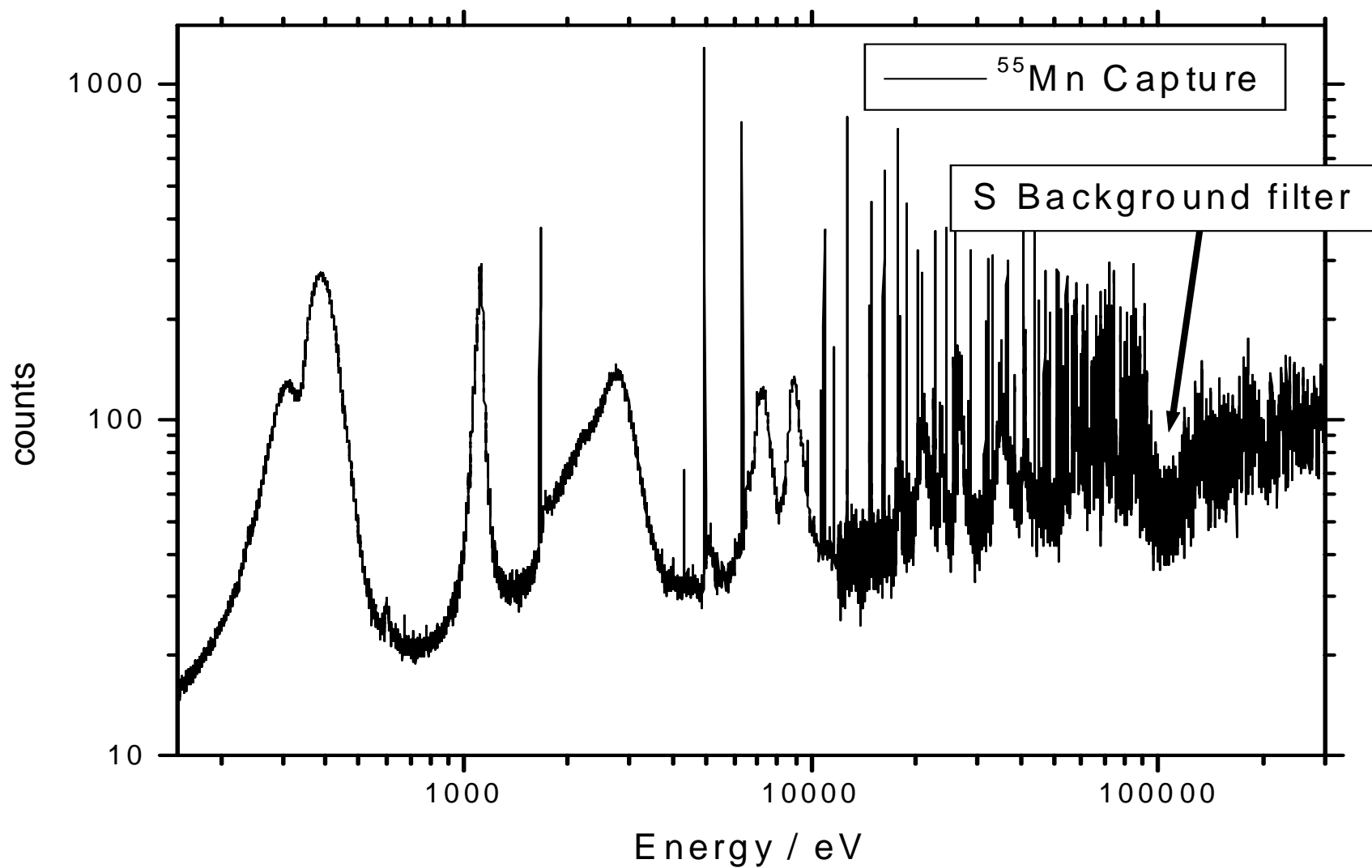
^{103}Rh Capture Data



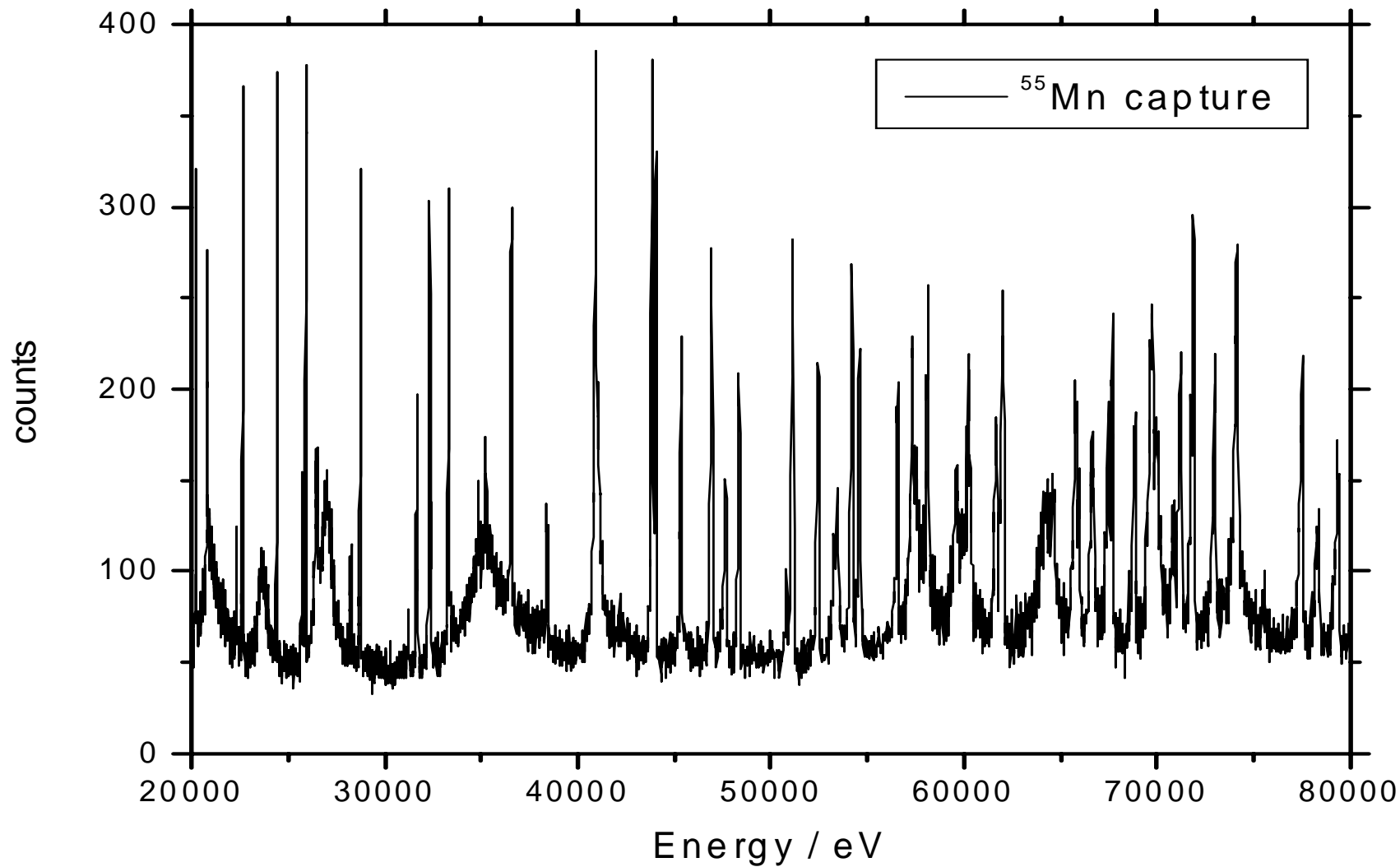
^{55}Mn Experiments at GELINA

- **Experimental Conditions:**
 - Due to cooling problem not full power : **400 Hz** Rep Rate instead of 800 Hz.
 - Pulse width of the neutron beam **1nsec**.
- **Two experiments were performed:**
 - Total cross section (transmission) at 26.45 m flight path with a ^6Li glass detector using a ^{55}Mn sample with 0.118 at/b.
 - Neutron capture using the pulse height weighting technique with two C_6D_6 detectors at a distance of 28.1m. Sample thickness for ^{55}Mn was 0.019 at/b.
- **Additional run with background filter were performed, as well as sample out runs.**
- **Despite the short flight path the resolved energy range is up to 300 keV.**

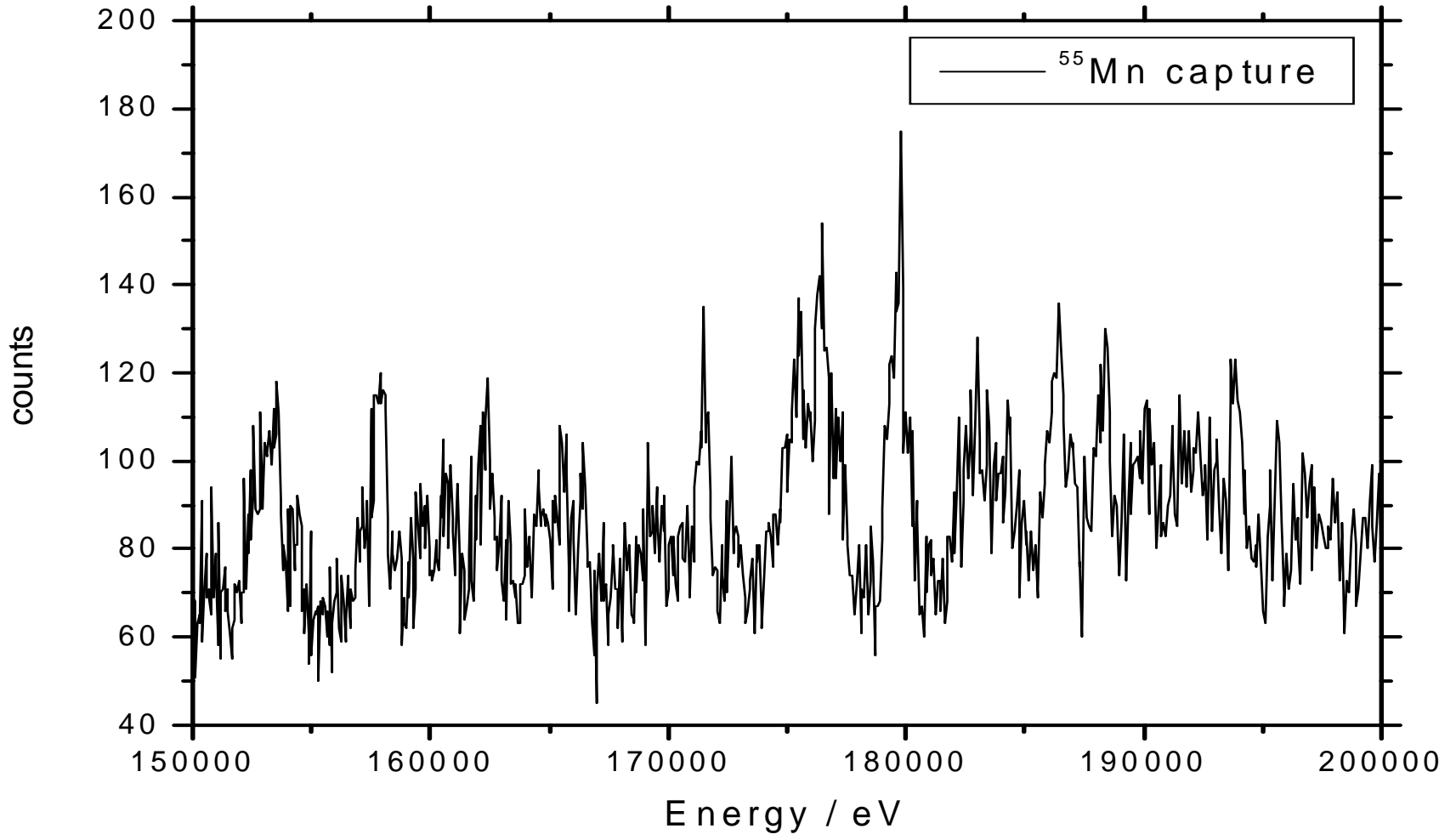
^{55}Mn Capture Data



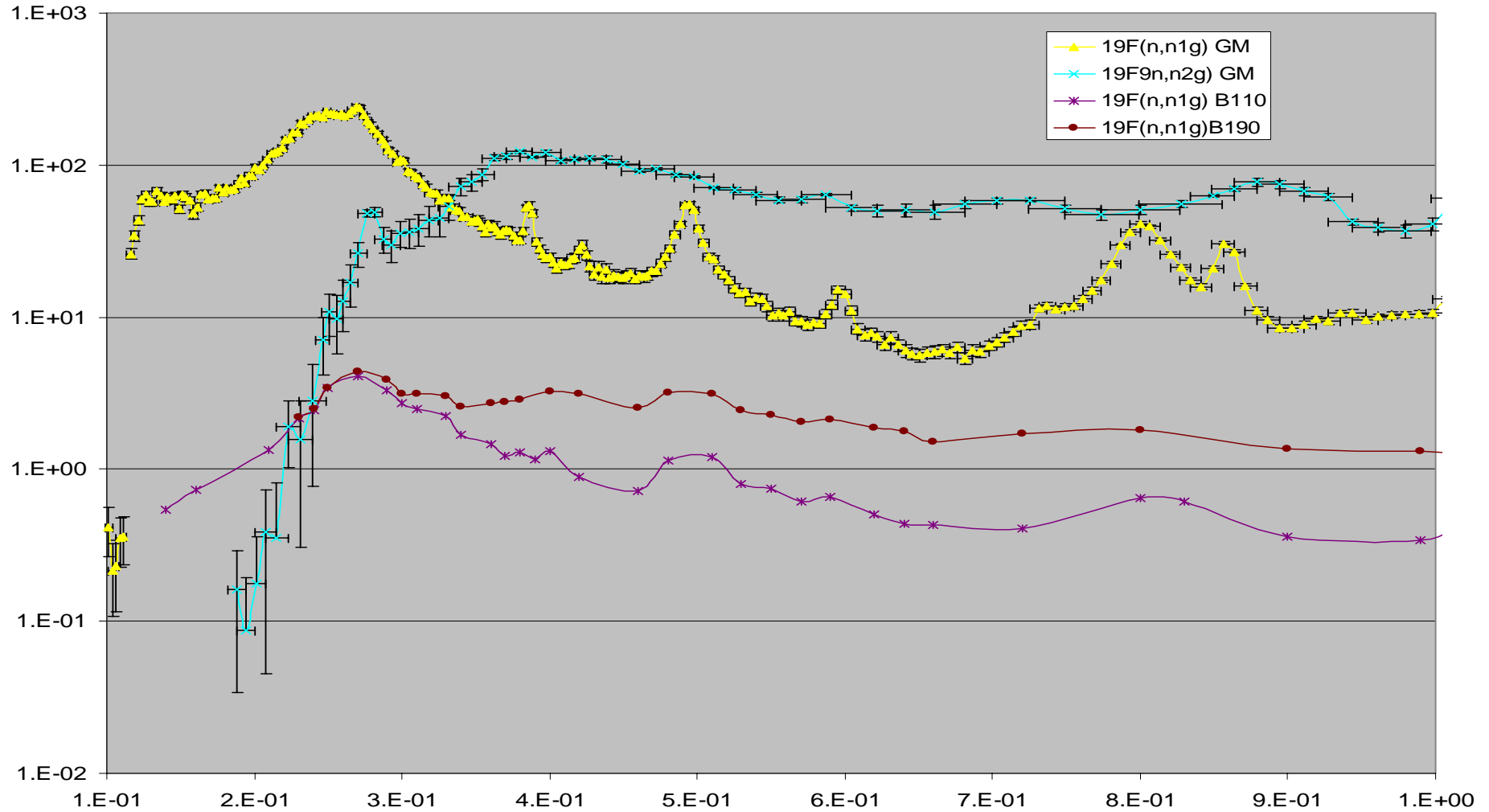
^{55}Mn Capture Data Detail



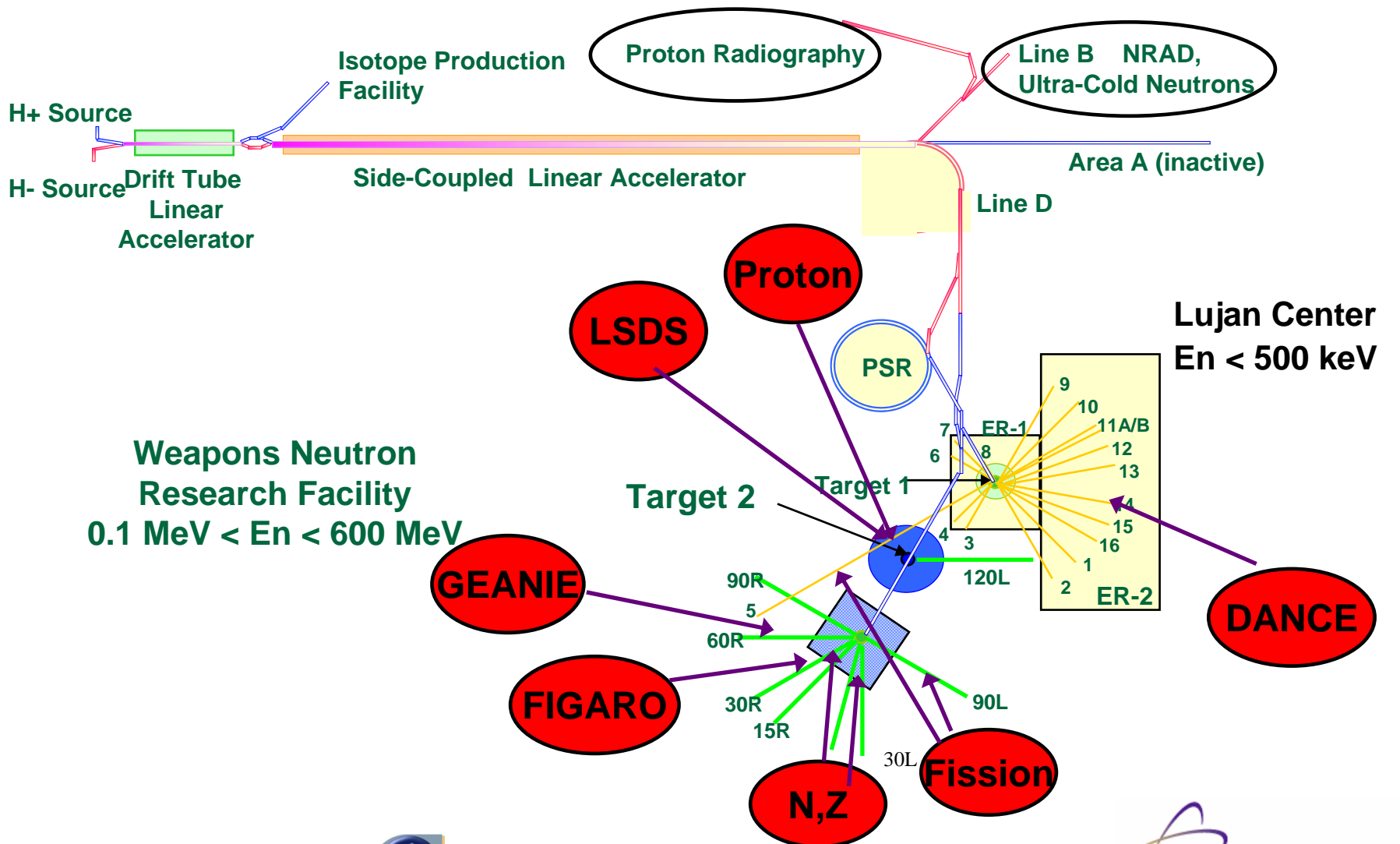
^{55}Mn Capture Data Detail At High Neutron Energies



$^{19}\text{F}(n,n1\gamma)$ Data in EXFOR: two contradicting measurements



Nuclear physics experiments at LANSCE use neutrons at four locations: Line B, Lujan Center, Target 2 and Target 4.



$^{19}\text{F}(n,n1\gamma)$ Experiments using WNR at LANL

- **Experimental Conditions:**

- The GEANIE spectrometer consists of 26 Compton-suppressed, high-resolution germanium y-ray detectors and is located on an approximately 20-m-long FP.
- GEANIE is located at flight path 4, 60° right.

- **Experiments were performed using a Teflon sample**

- **$(n,n1\gamma)$ cross section for the first two excited levels were measured.**

- **Additional sample out runs were performed.**

- **Experimental difficulty is the 90 nsec life time of the second level, which will smear out the neutron energy resolution.**



GEANIE (n,x γ)

