Gamma-ray Tagging with SPIDER

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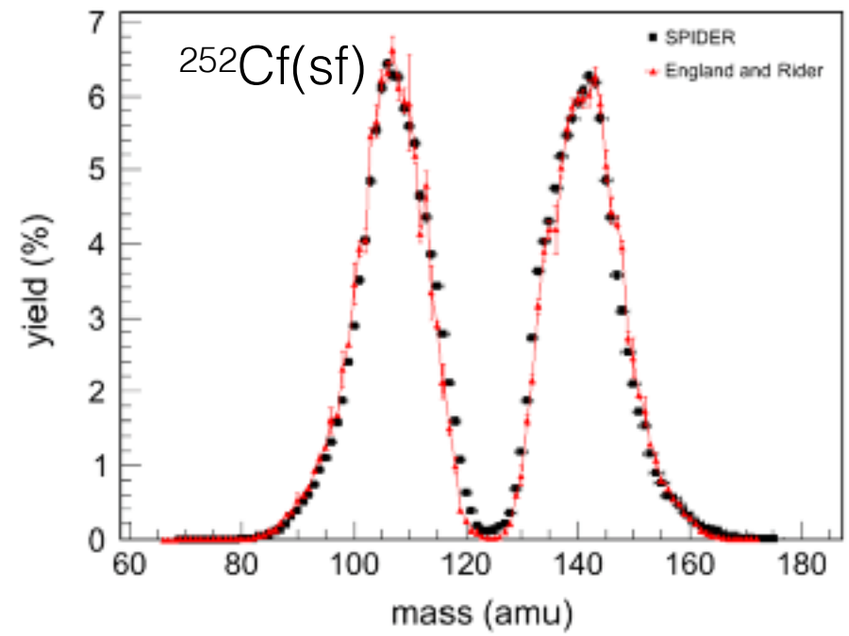
2/3/2021

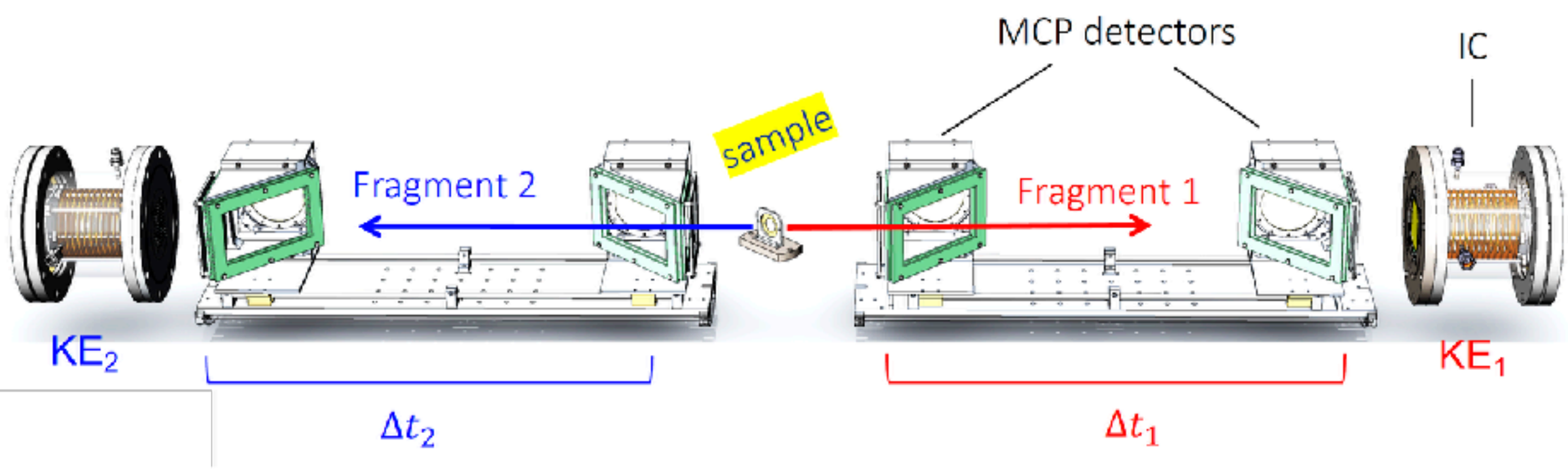
LA-UR-21-20957

What is SPIDER?

- Mass ∝ (E)*(TOF)^2
- Goal: <1 AMU mass resolution, fast neutrons, known uncertainty
- Challenges: Resolution, Calibration



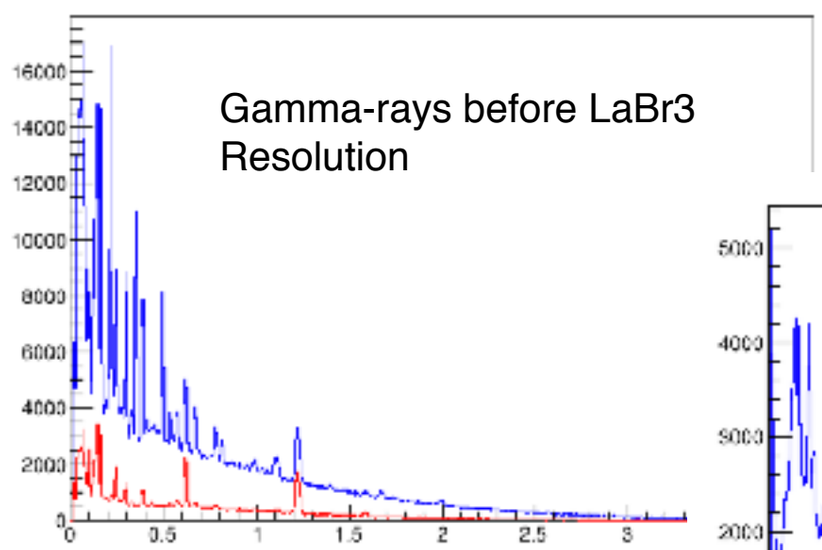
Meierbachtol et al., NIM A 788 (2015) 59-66

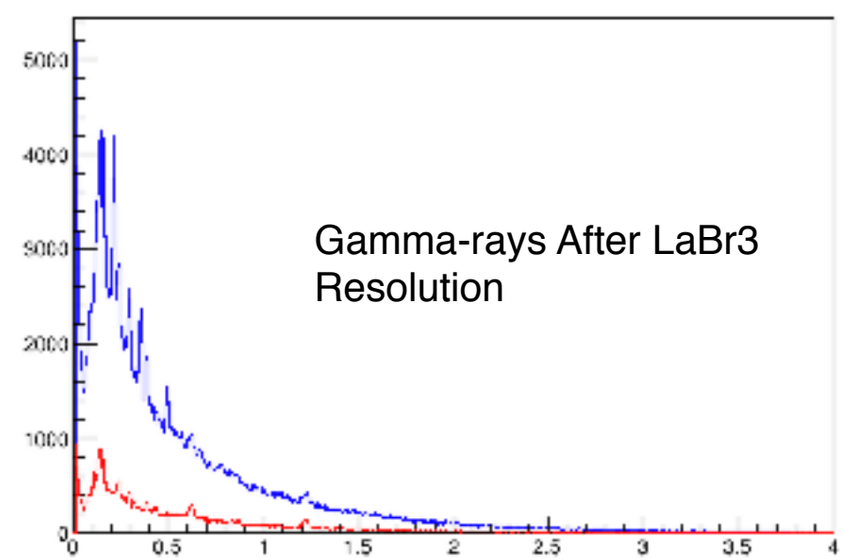


Gamma Ray Tagging (Take One)

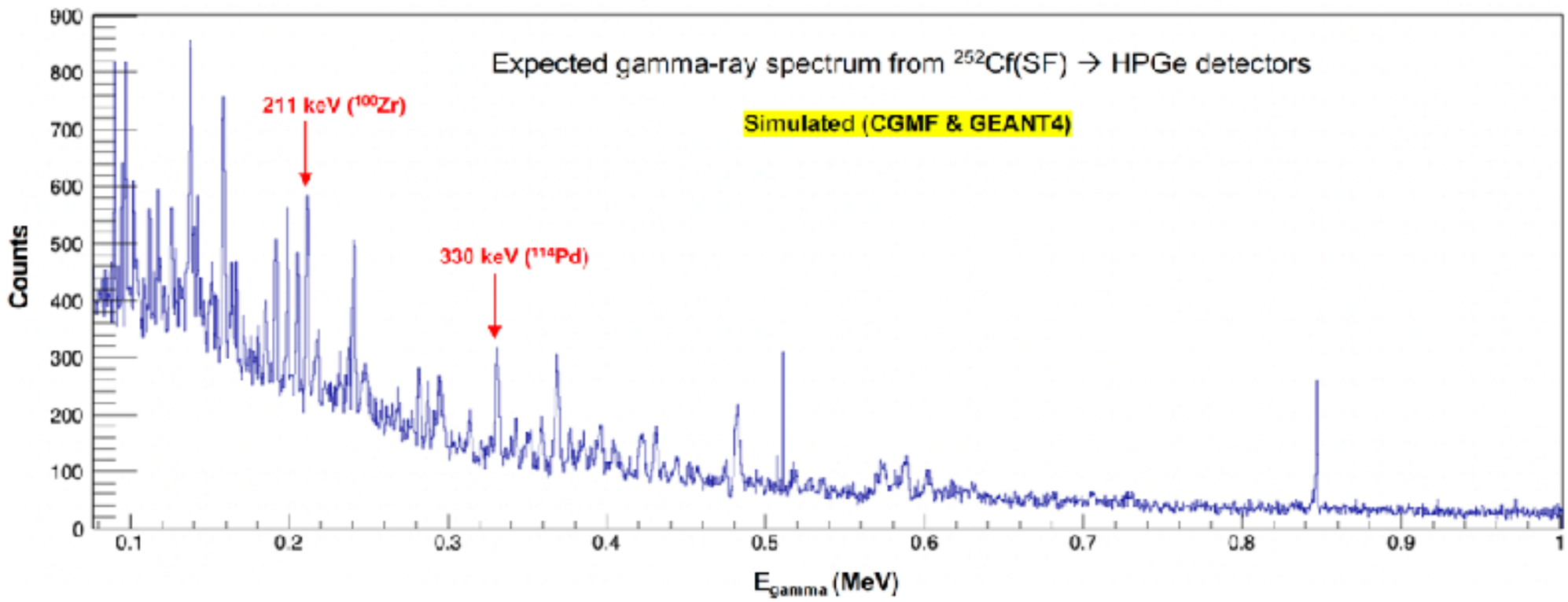
- 2018 NDWG interagency FOA
- Use existing LaBr3
- 1uCi 252Cf(sf)
- Moderately careful simulations
- Inconclusive Data
- -> Procure hpGe

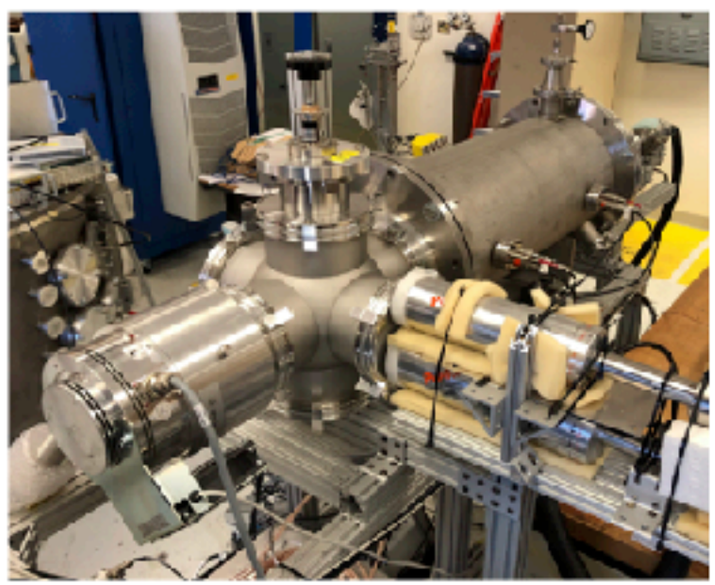
10 days, 10 uCi, 8 detectors

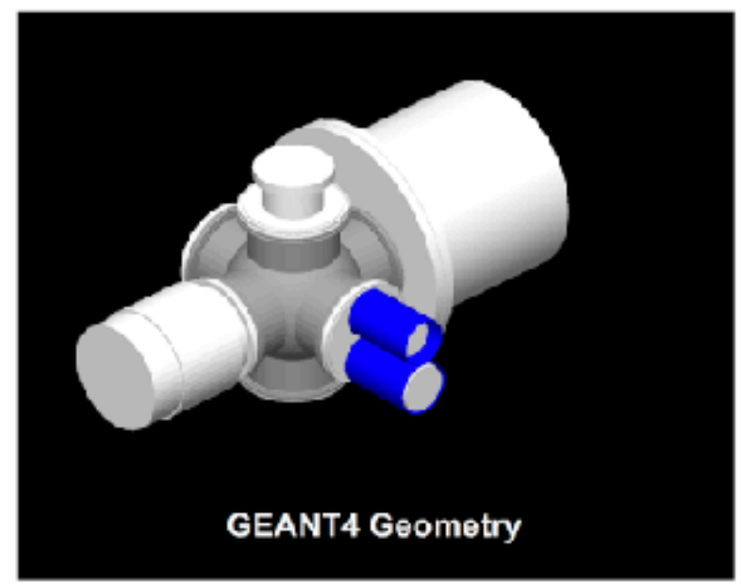




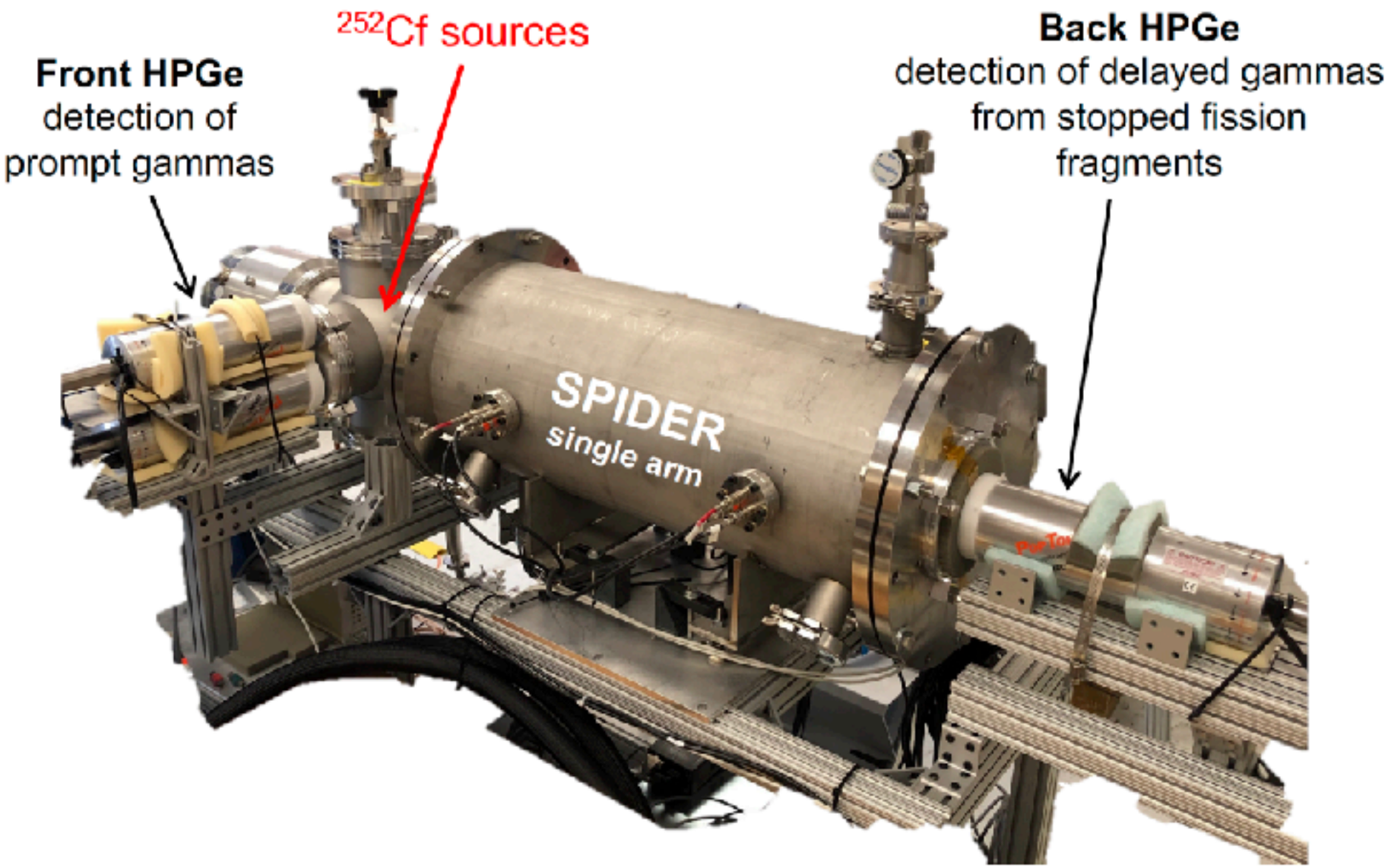
Gamma Ray Tagging (Take Two)





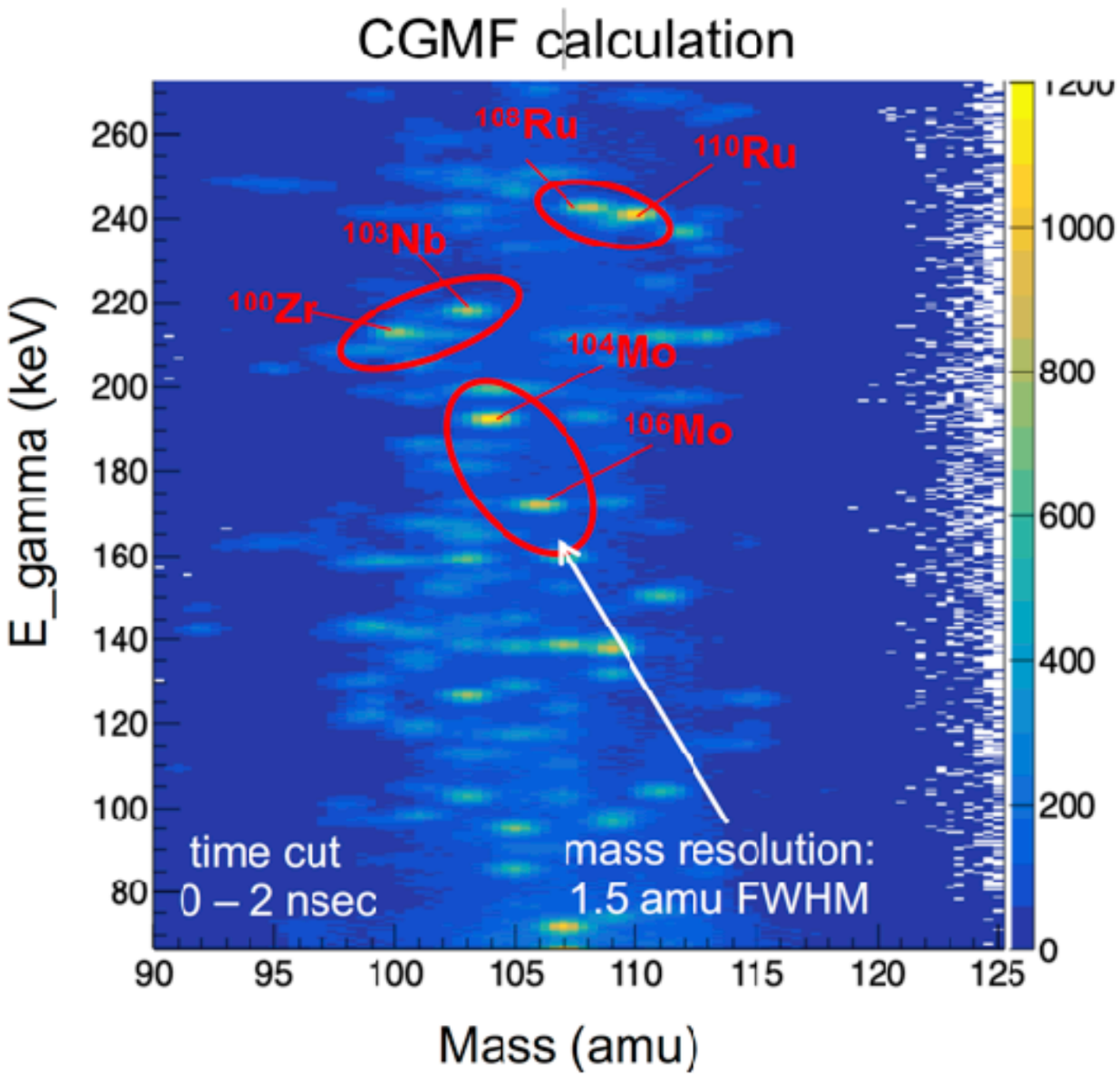


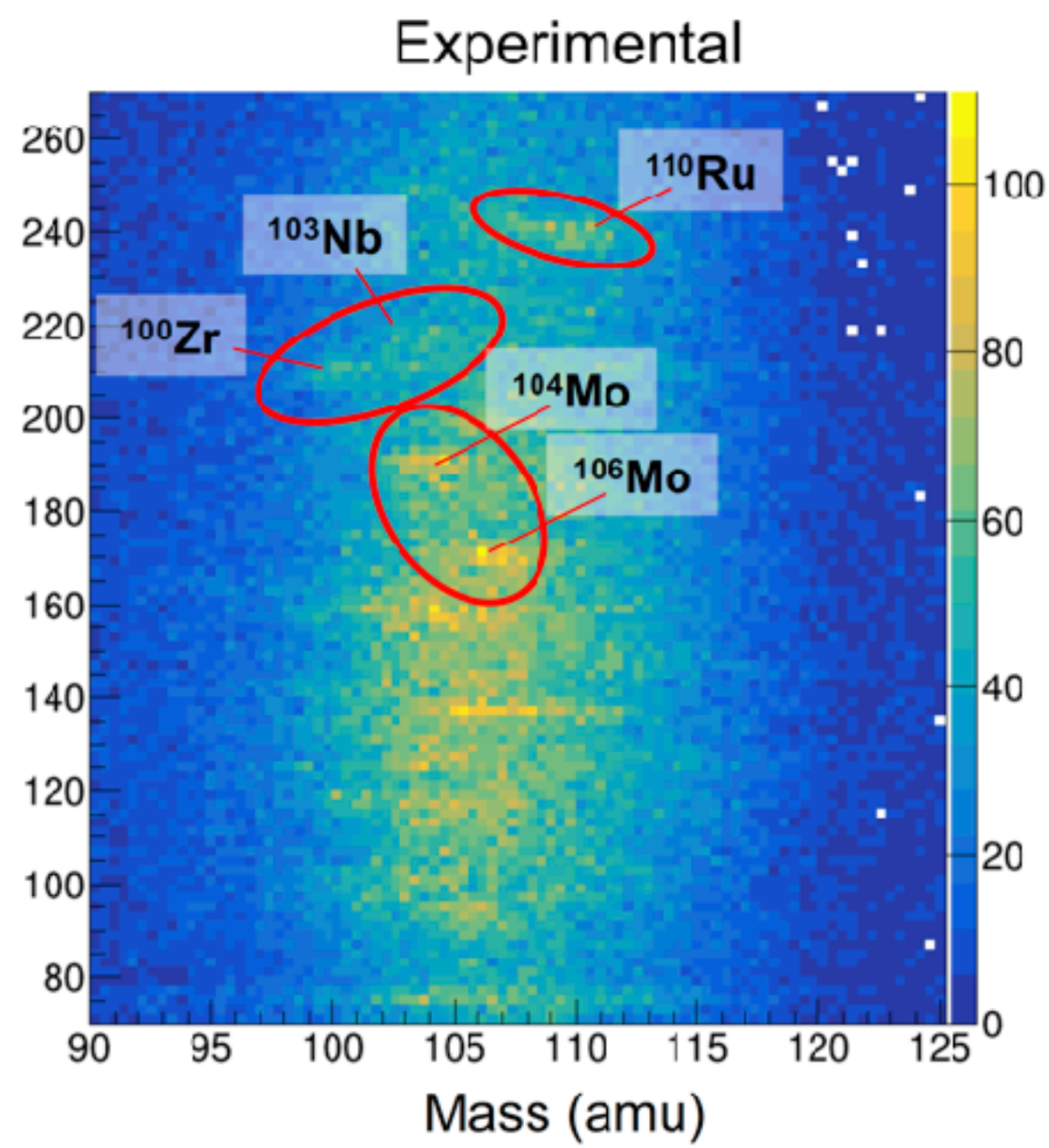
Gamma Ray Tagging (Take Two)



10 uCi 252Cf(sf)

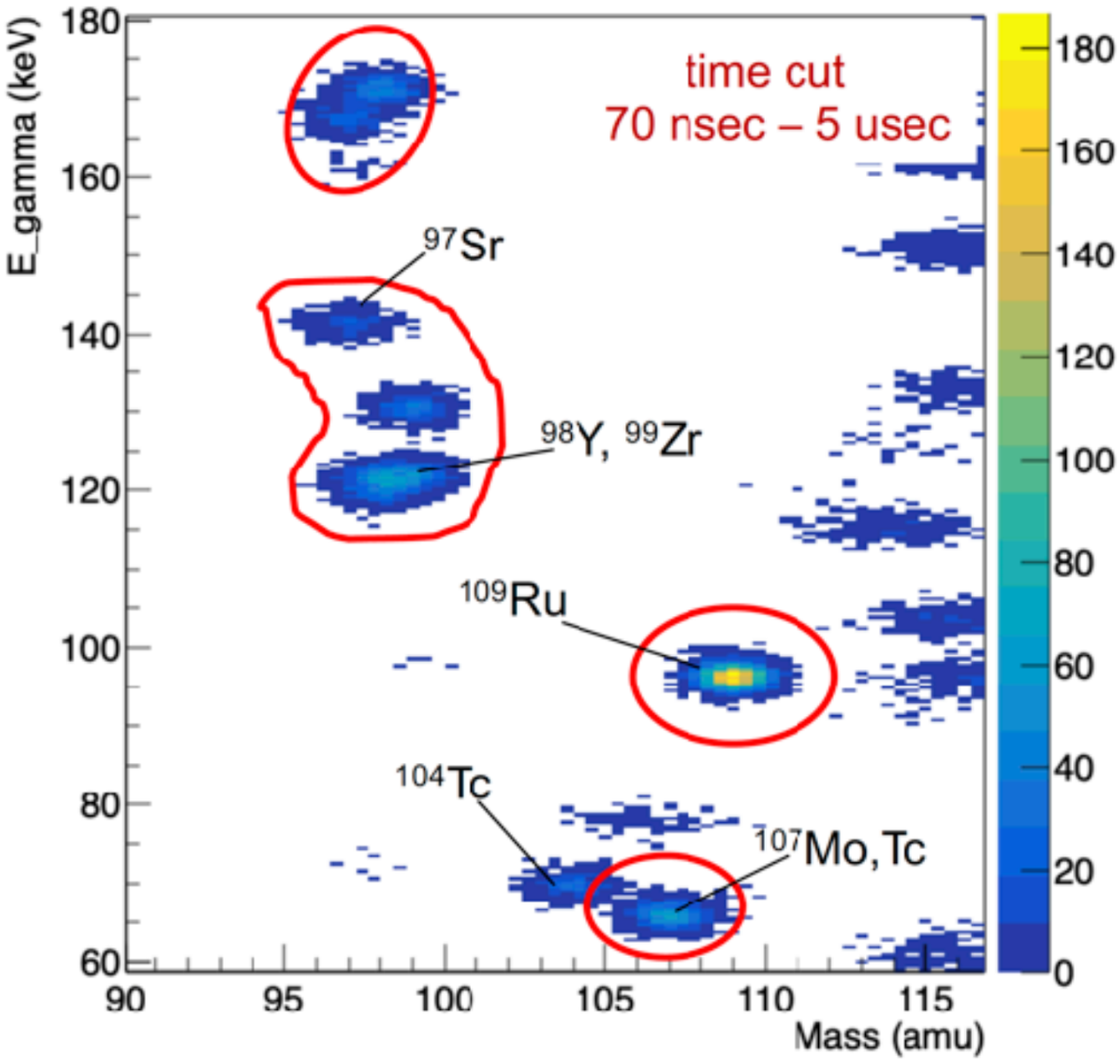
Prompt Gamma Rays



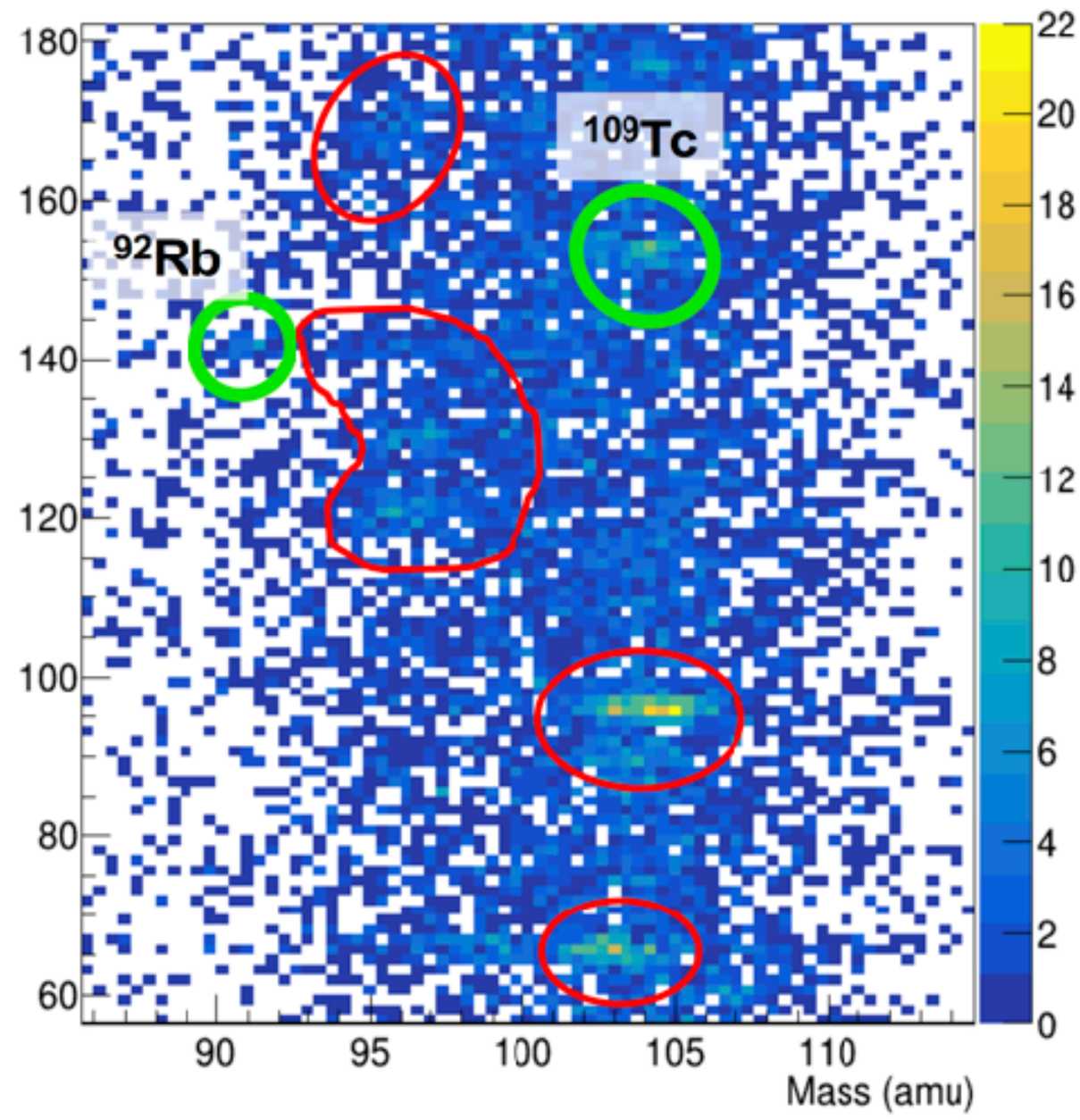


Delayed Gamma Rays

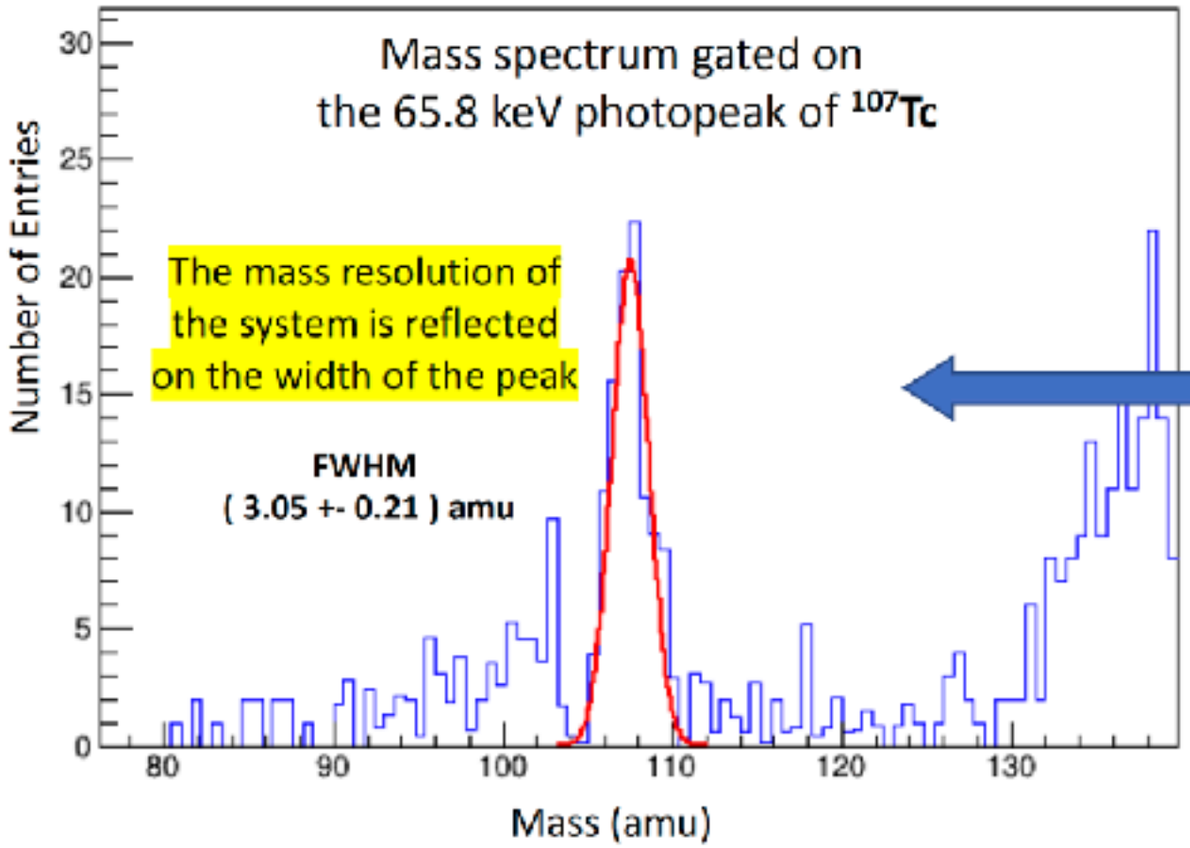
CGMF calculation

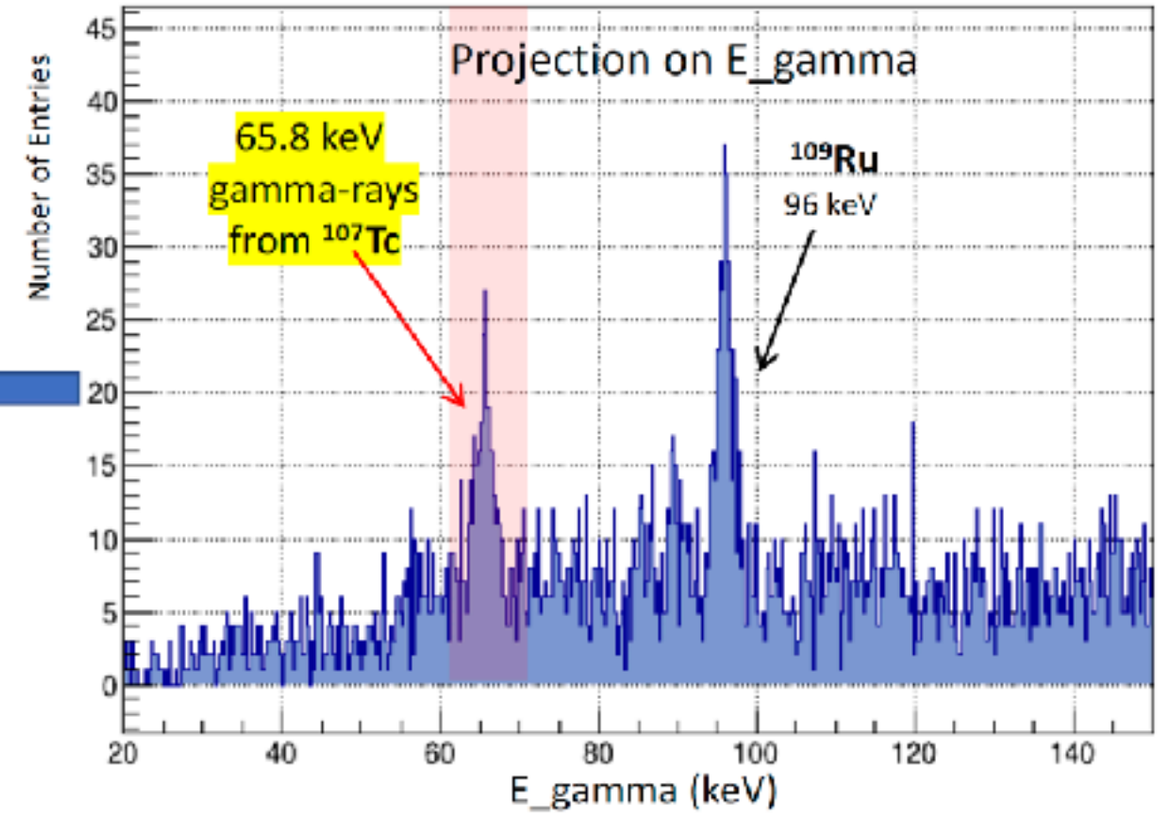


Experimental



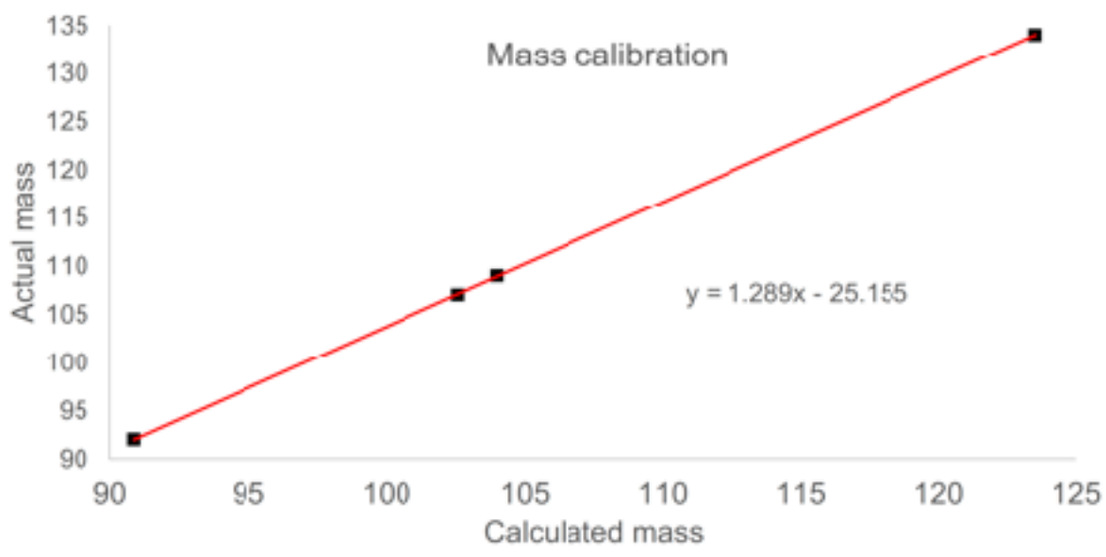
Q: Whats the resolution?



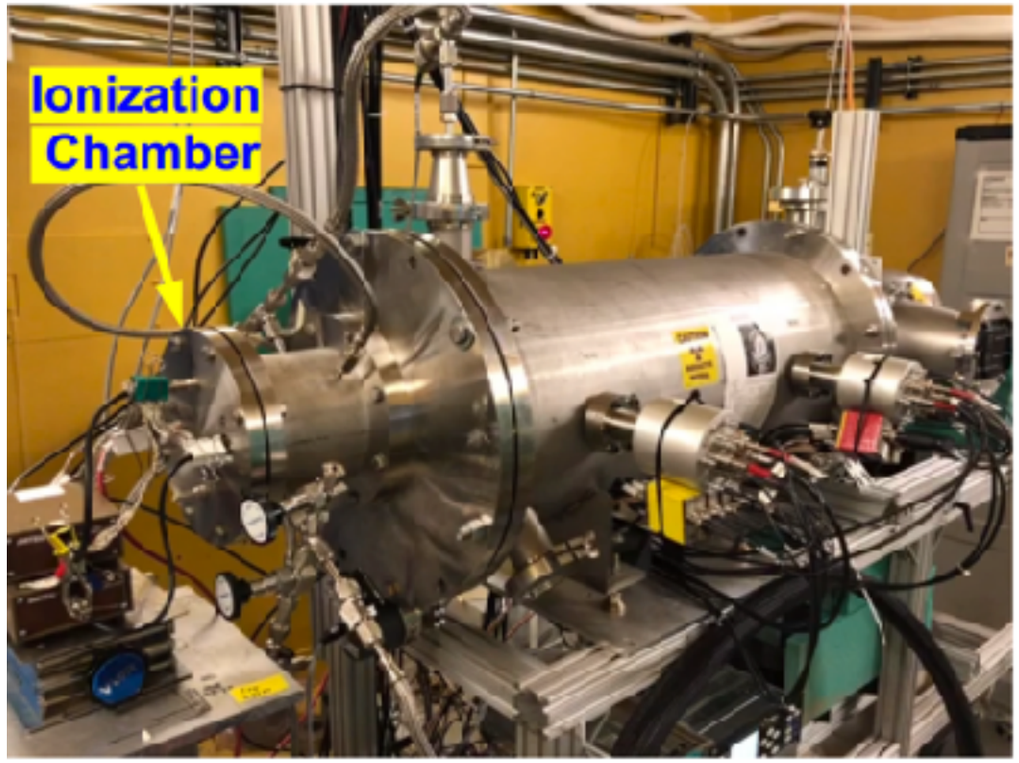


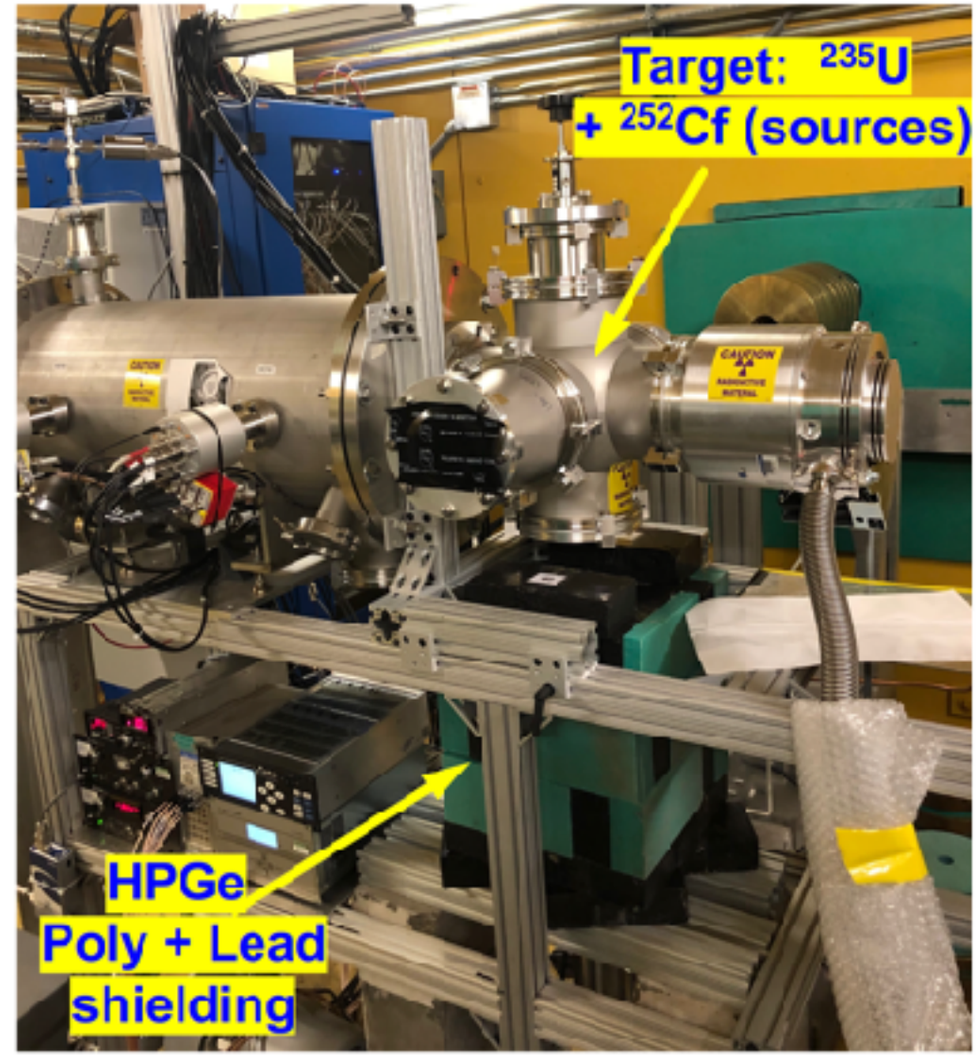
A: ~3.0 mass units (Using Si DSSD)

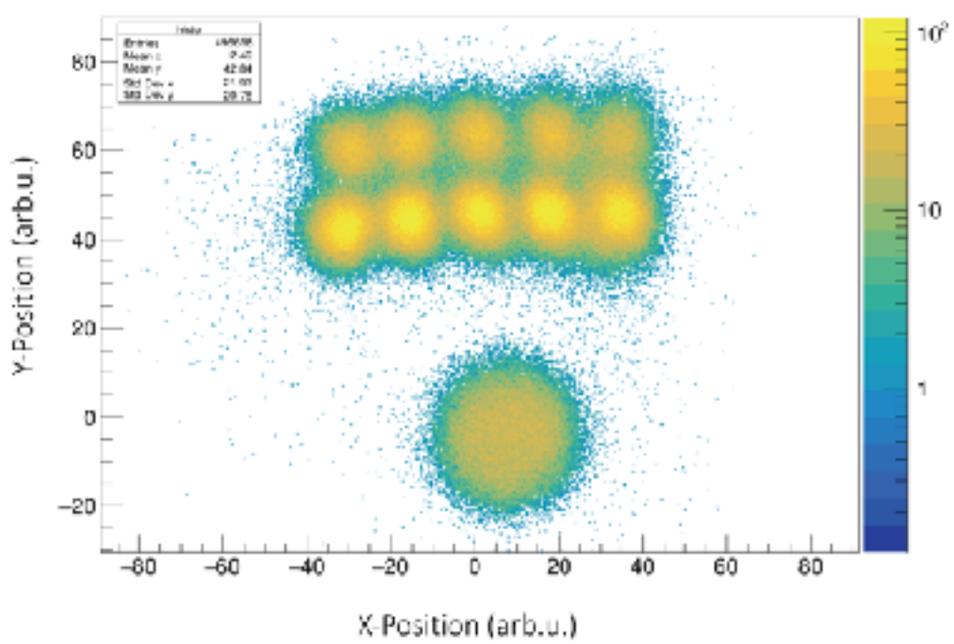
Q: Whats the calibration?

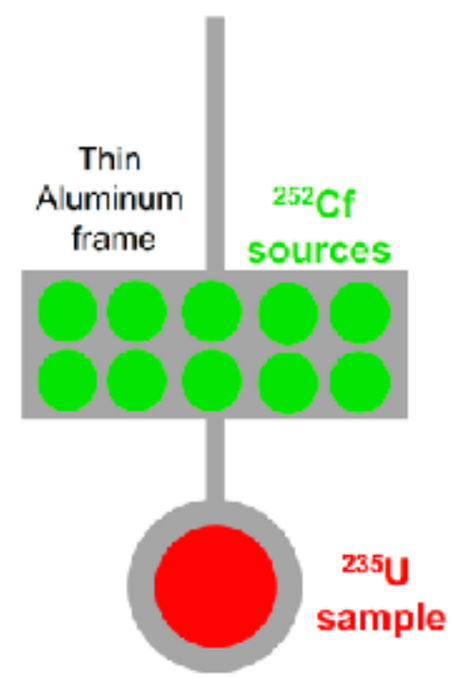


Tagging with (n,f)

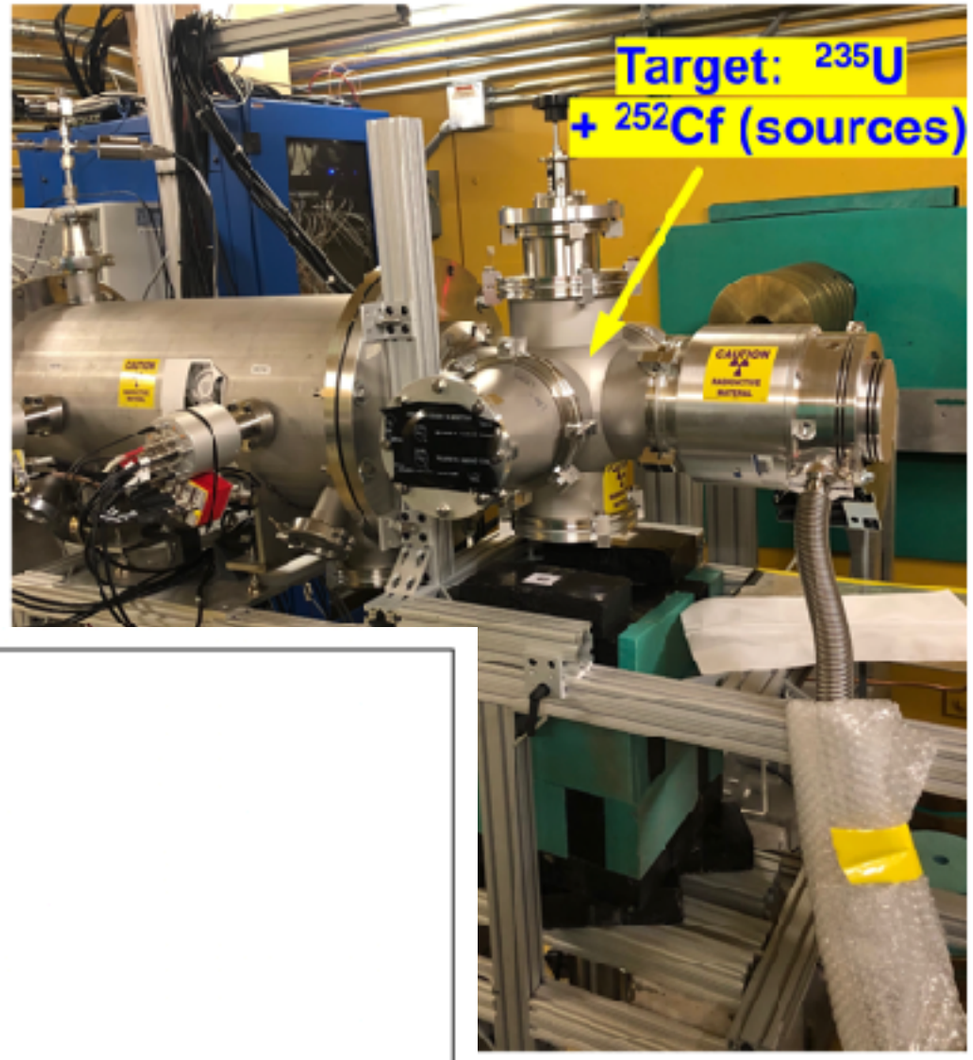


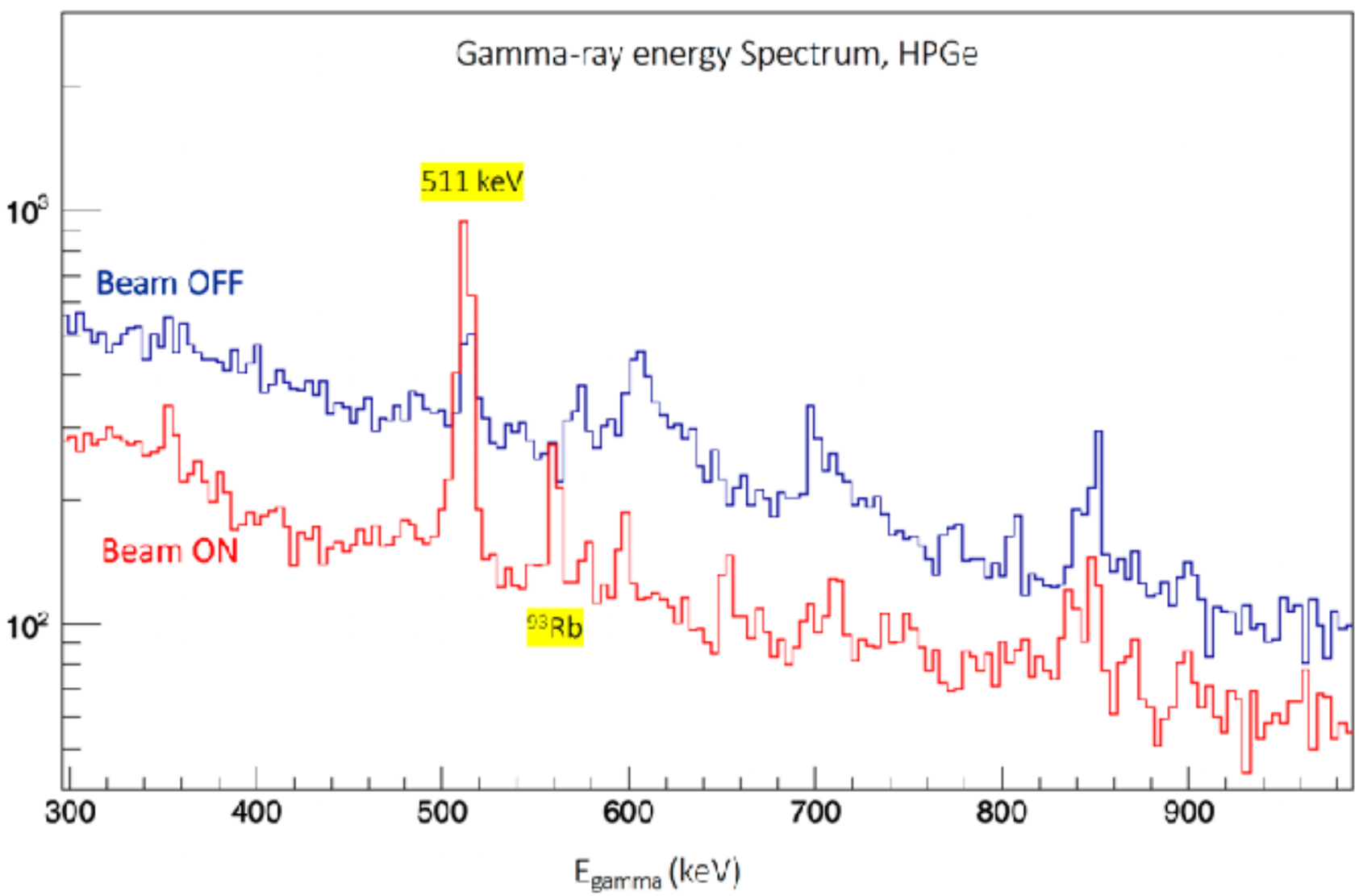




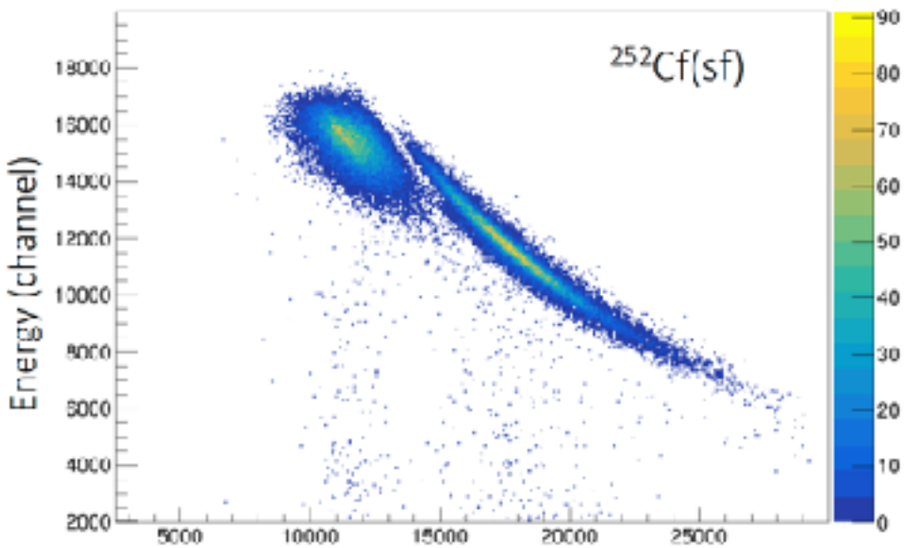


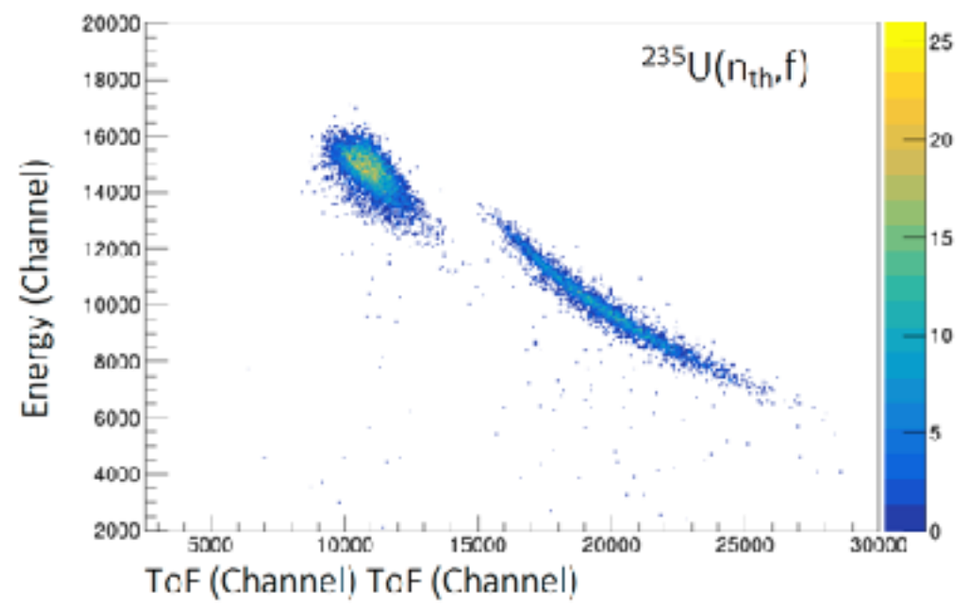
Tagging with (n,f)

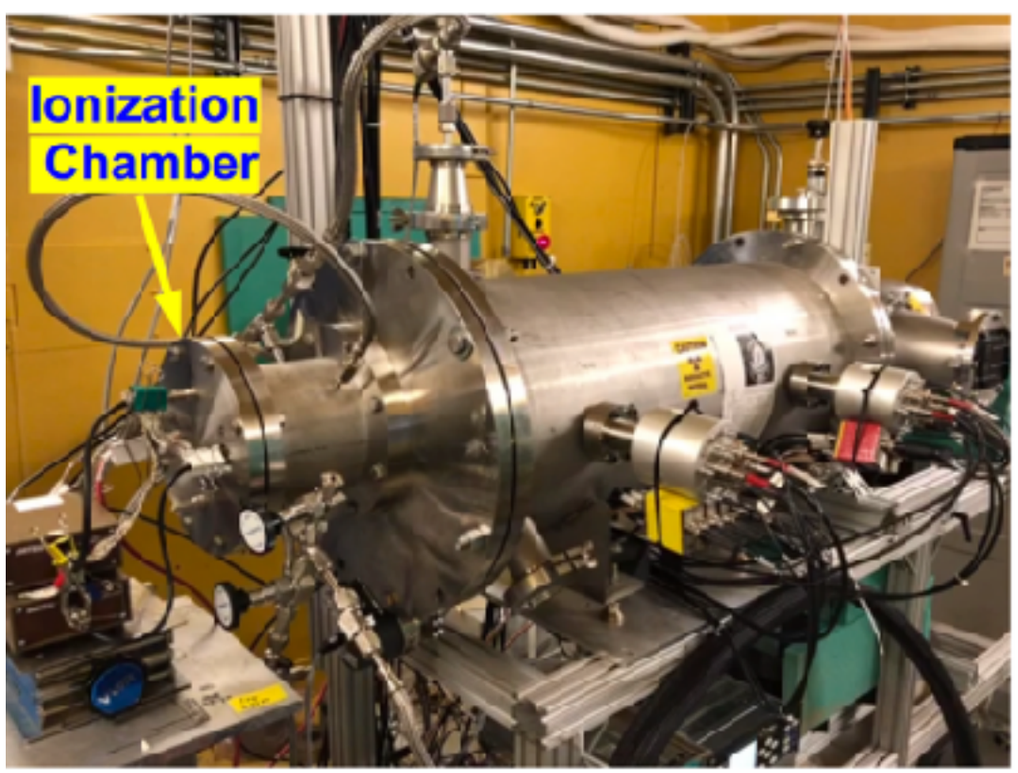




Where are we going from here?



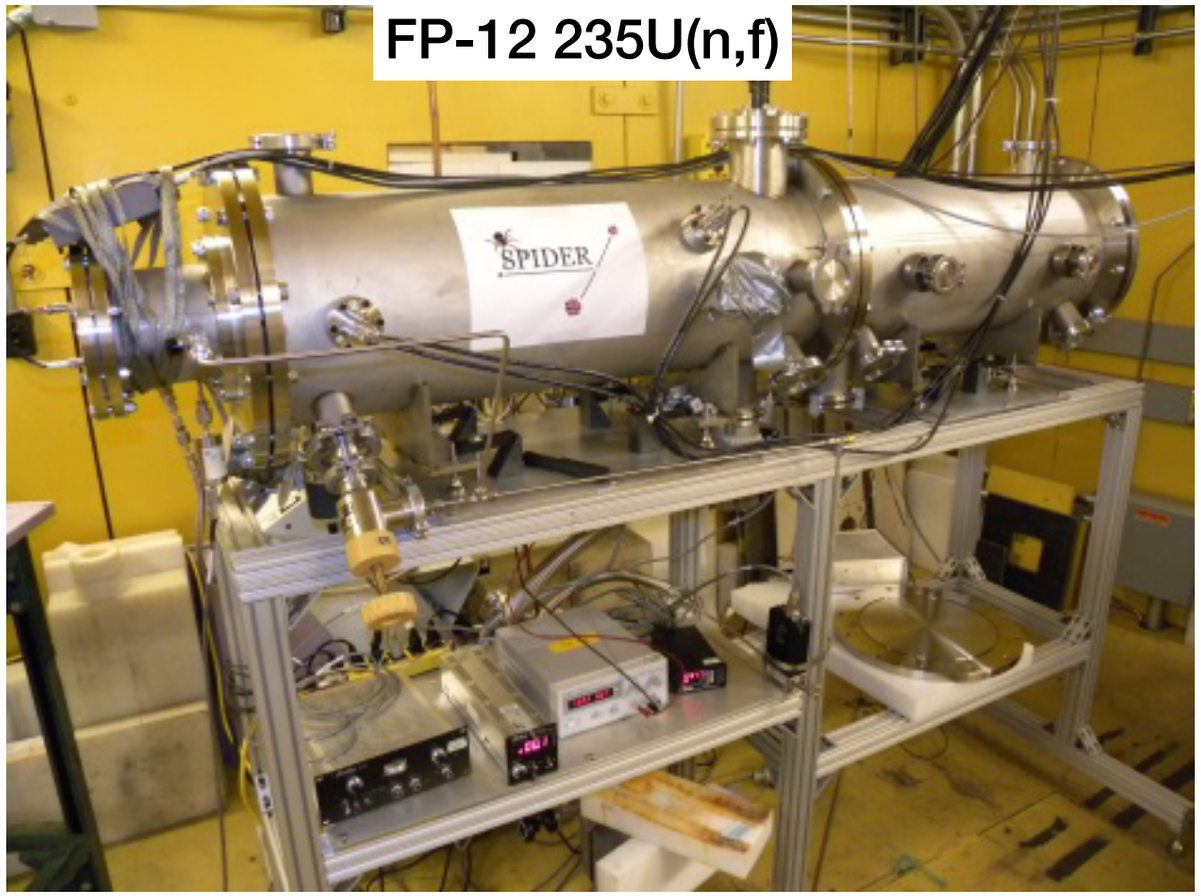


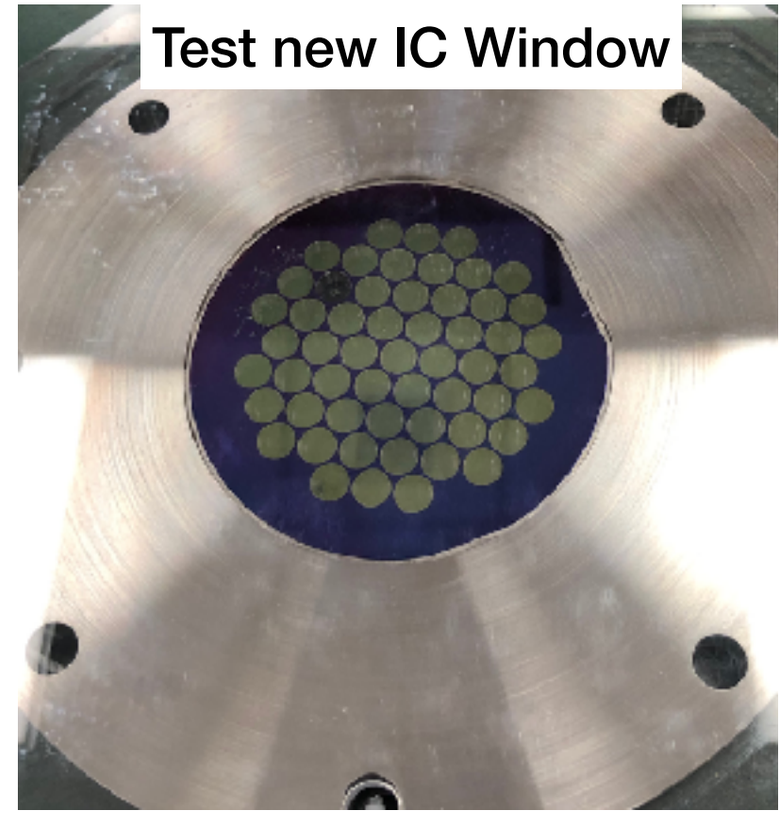


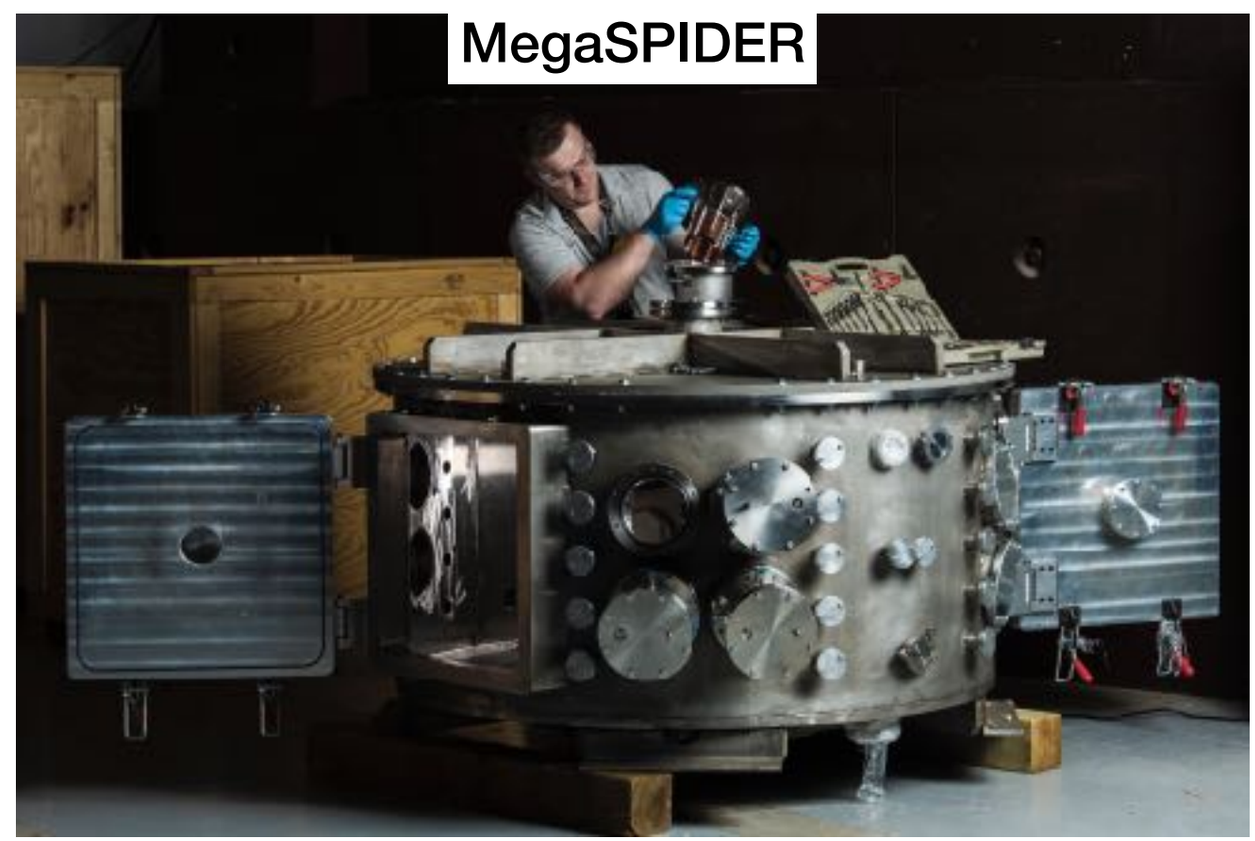
Who did this work?

- Legacy SPIDER: K. Meierbachtol, C.W. Arnold, D. Mayorov, F. Tovesson
- Current SPIDER: J. Winkelbauer (PI), S. Mosby (PL), D. Connolly (PD), P. Gastis (PD), C. Prokop (S), S. Kuvin (S)
- University Collaborations: Adam Hecht (UNM), Uwe Greife (CSM)

Whats next?

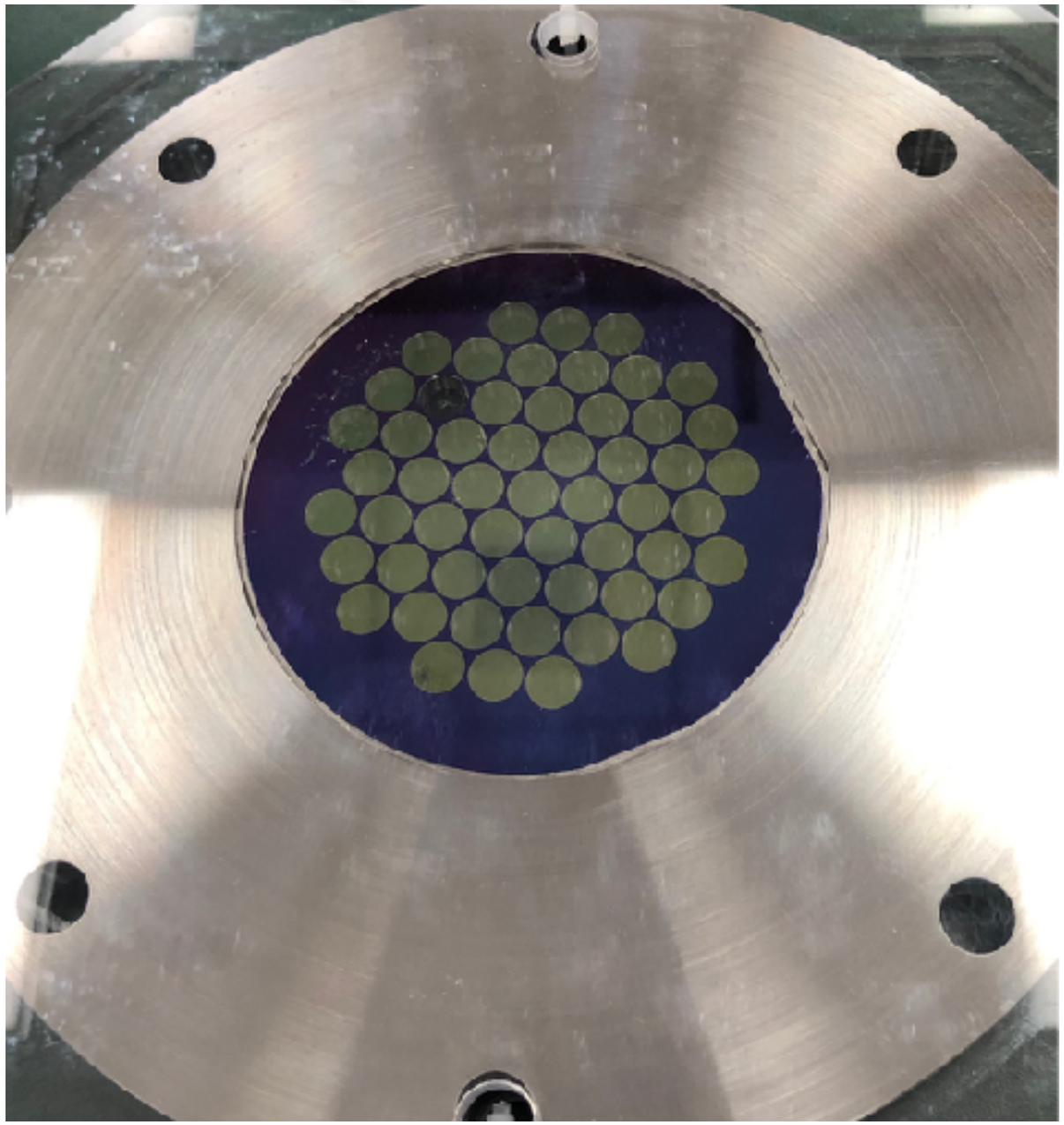


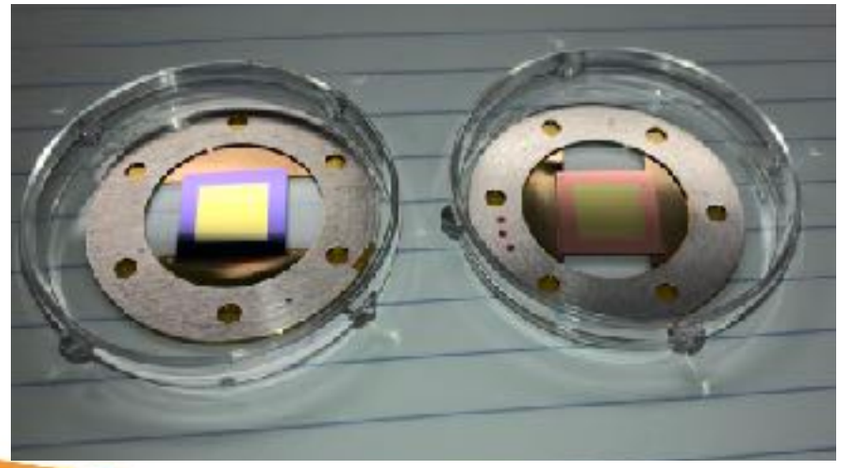




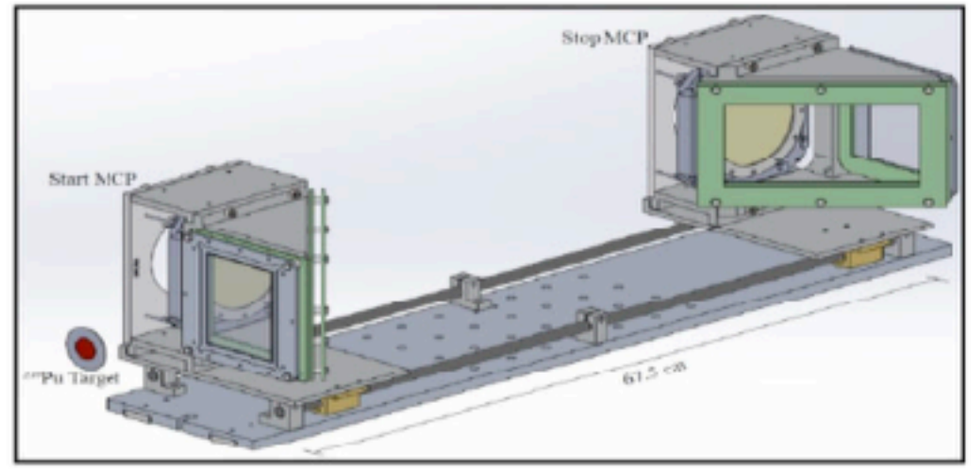
Window Redesign

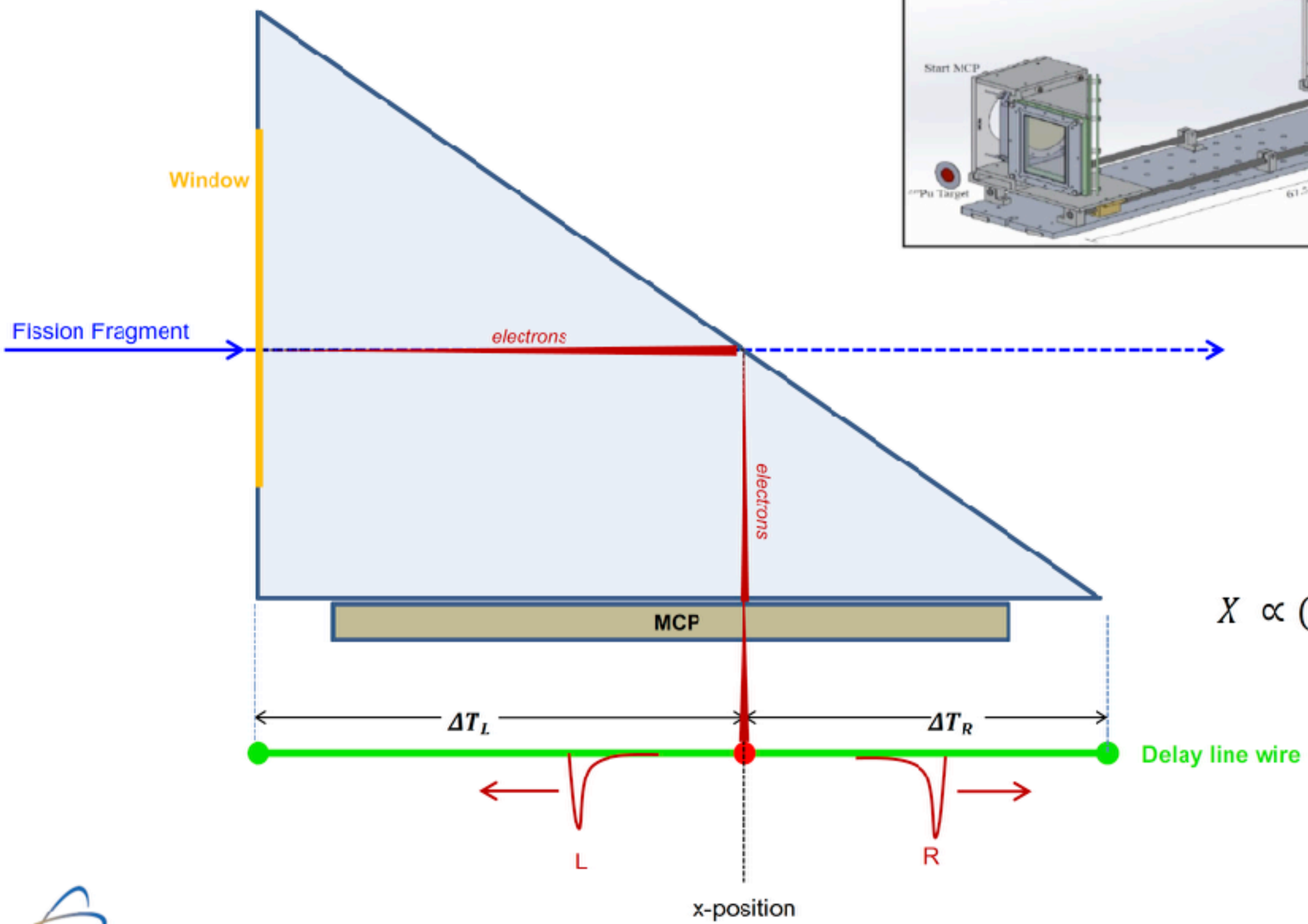
- Circular window cells
- Larger (9mm vs 3.75mm)
- Complete assembly by manufacturer (Norcada)
- Secondary Electrons?





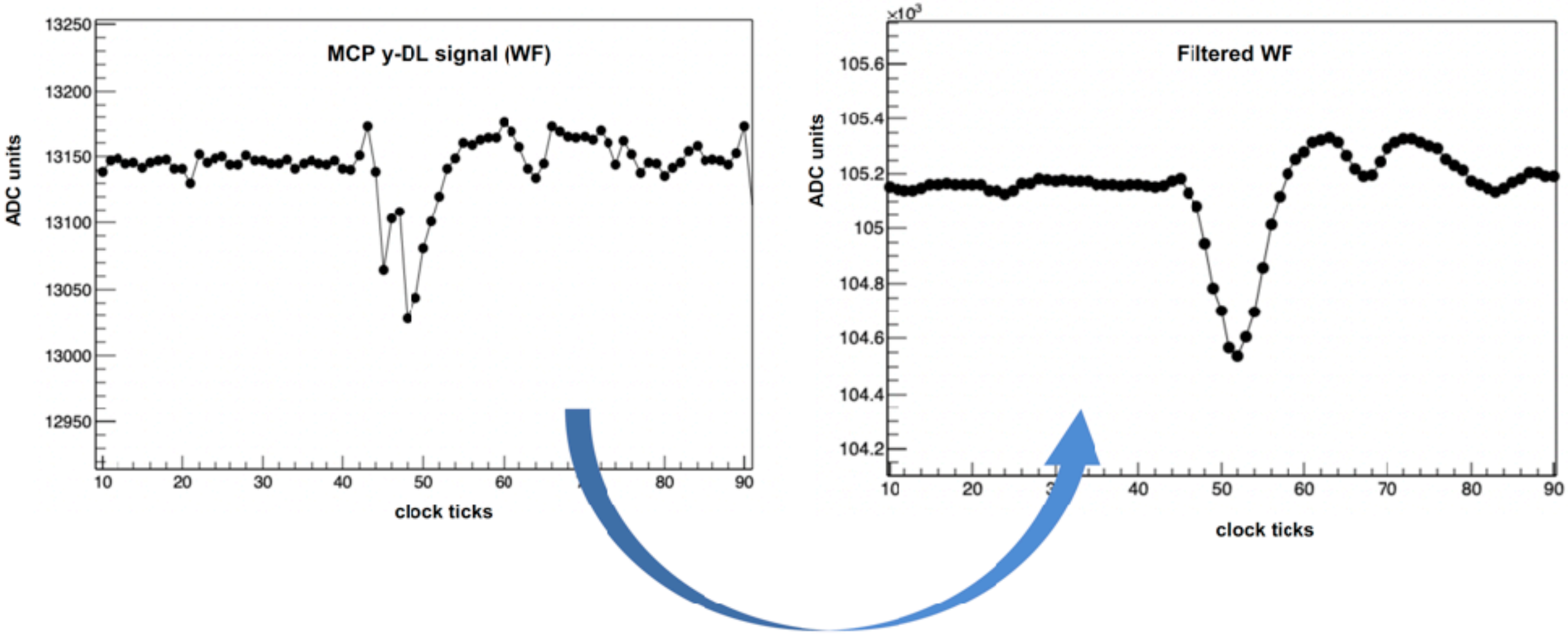
MCP Position Readout





$$X \propto (\Delta T_R - \Delta T_L)$$

MCP Position Readout



See:

S. Lipschutz et al, NIMA 815, 2016

C. Prokop et al, NIMA 741, 2014

Si DSSD

- Position Sensitive
- Marginal Resolution
- Logistically trivial
- Good testbed for Gamma ray tagging