Fast Neutron Spectroscopy with a Novel C^7LYC array

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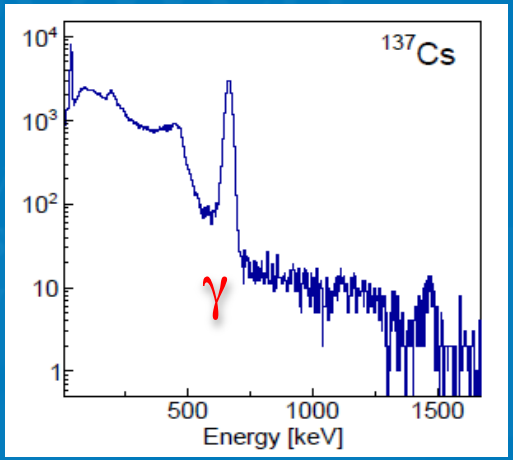
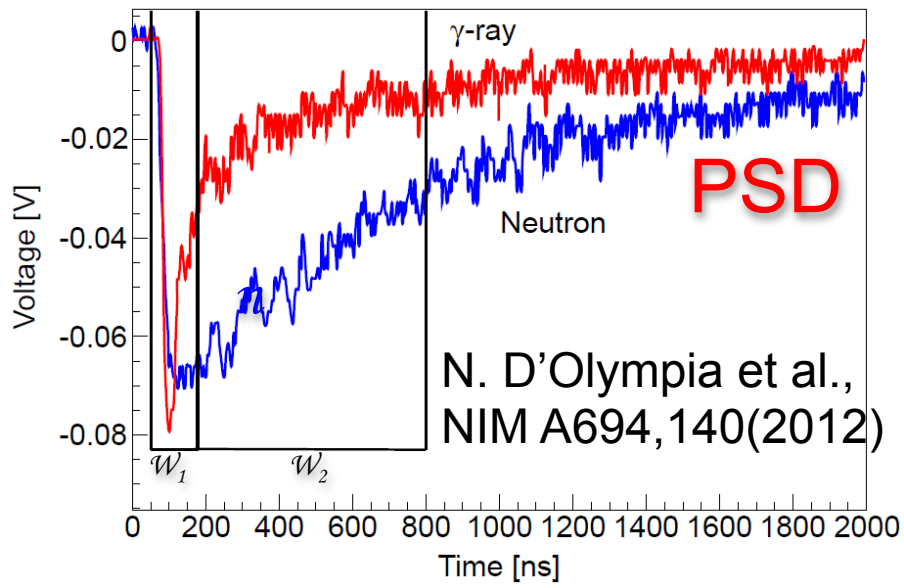
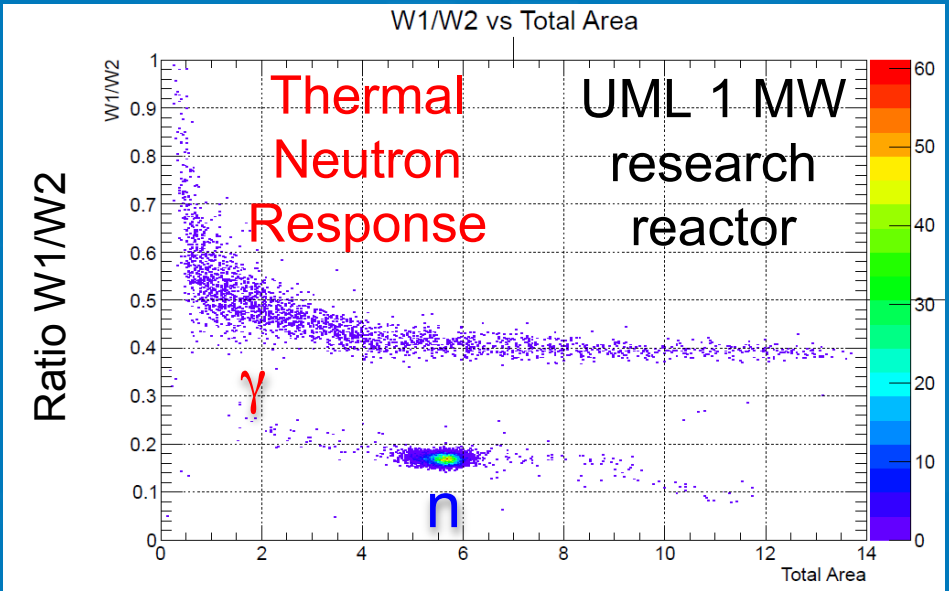
Cs_2LiYCl_6:Ce (CLYC) Scintillator

- dual neutron-gamma response
- n-γ discrimination via pulse shapes
- thermal neutrons via $^6Li(n,\alpha)t$
- Developed by RMD Inc., MA
- DOE-SBIR partner with UML







CLYC : fast neutron response

^{6}Li(n,α) – Thermal/epithermal

Fast Neutron Response

UML 5,5 MV Van de Graaff

^{35}Cl(n,p)^{35}S

0.808 MeV
1.102 MeV
1.640 MeV
1.805 MeV
2.020 MeV

^{6}Li(n,α) – fast

Counts

Energy(MeV)

N. D'Olympia et al., NIM A714,121(2013)

PSD [arb. unit]

Pulse Height [arb. unit]

γ

^{35}Cl(n,p)

^{6}Li(n,alpha)

Proton peak centroid vs. E_n

Linear Response

Centroid (arb. unit)

Incident Neutron Energy (MeV)

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Small CLYC Array for Neutron Spectroscopy

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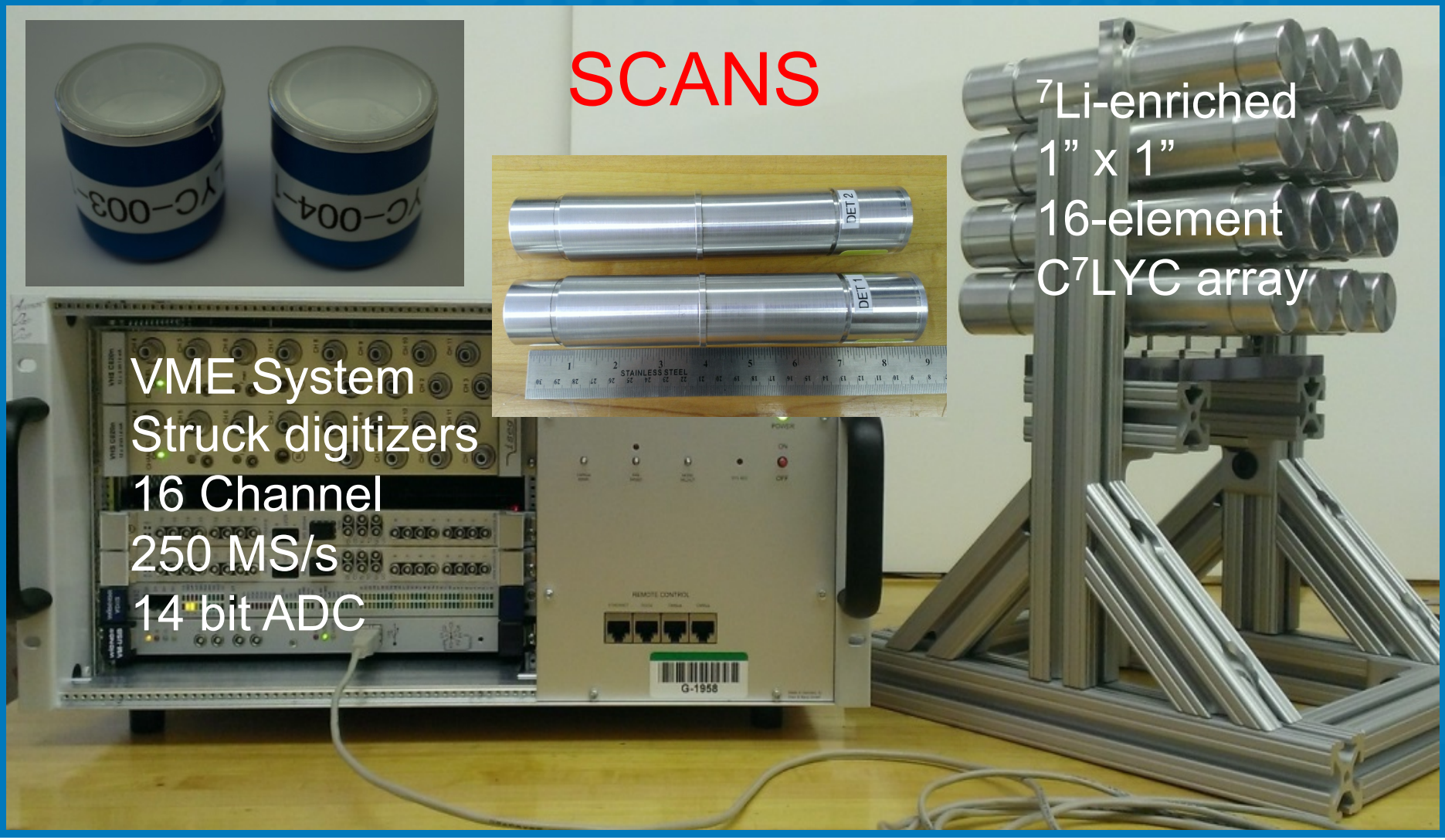
Small CLYC Array for Neutron Spectroscopy



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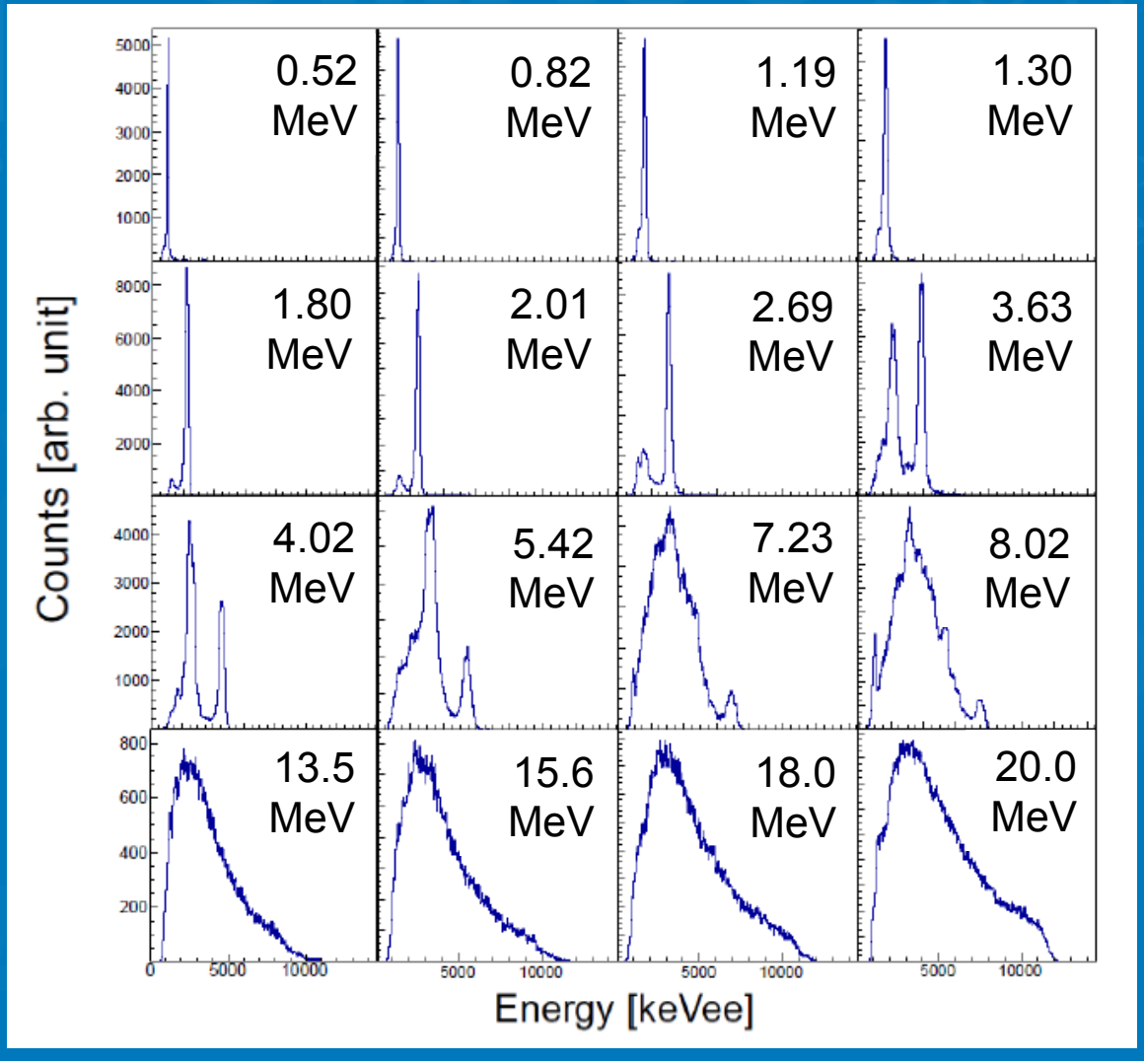
C^7LYC: high energy response



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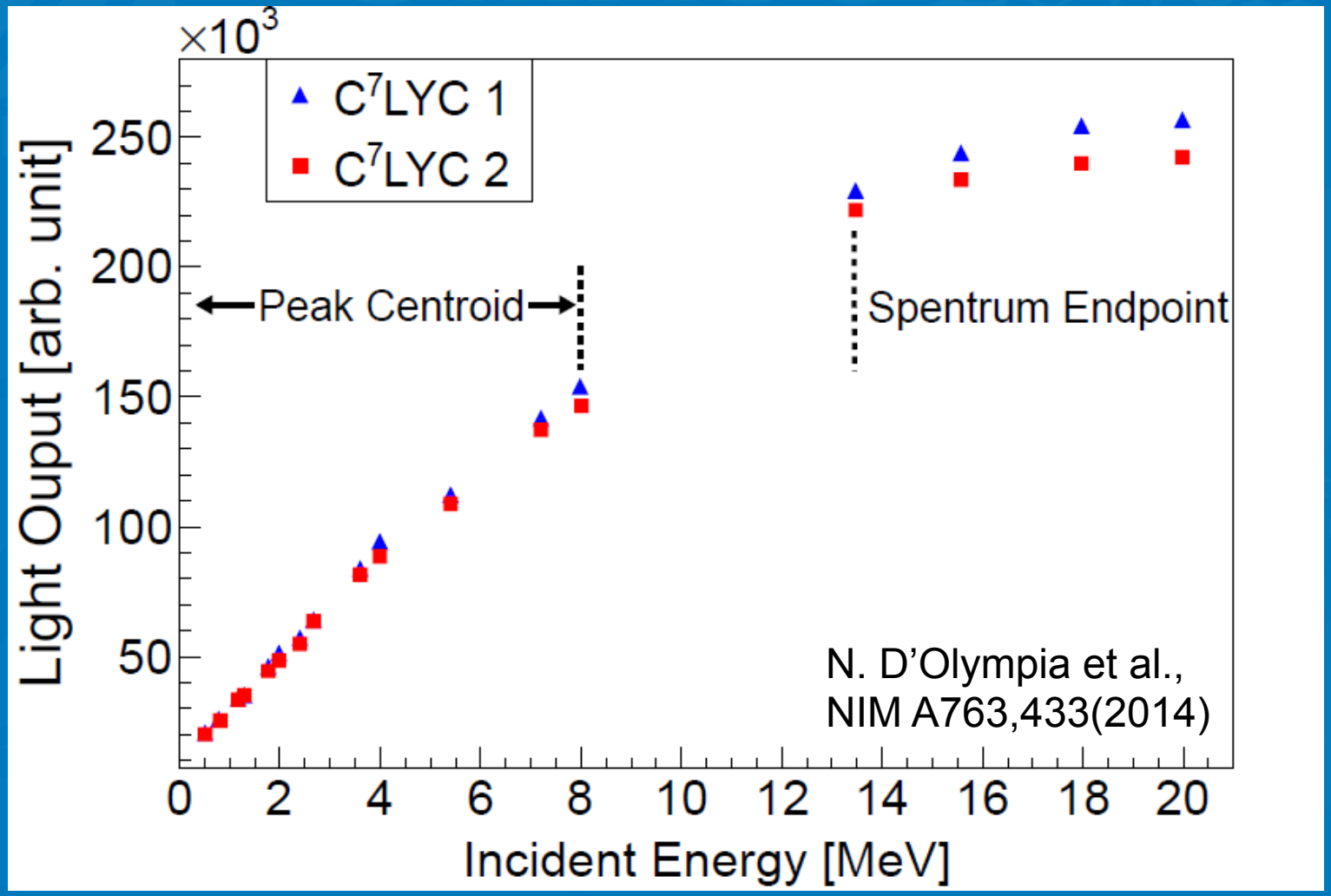
C^7LYC: light output



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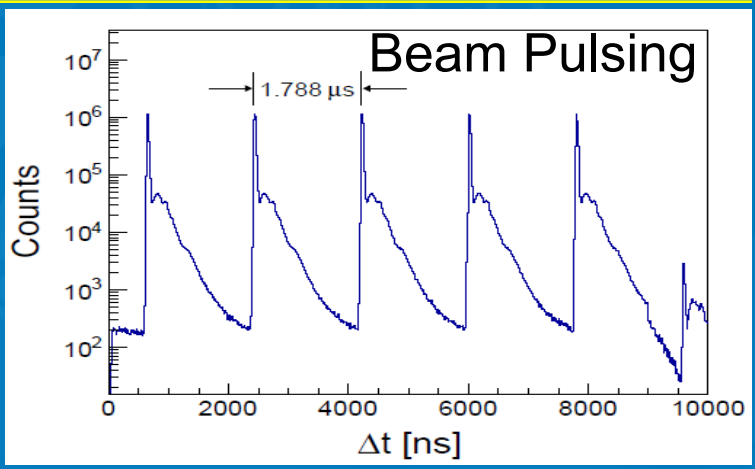
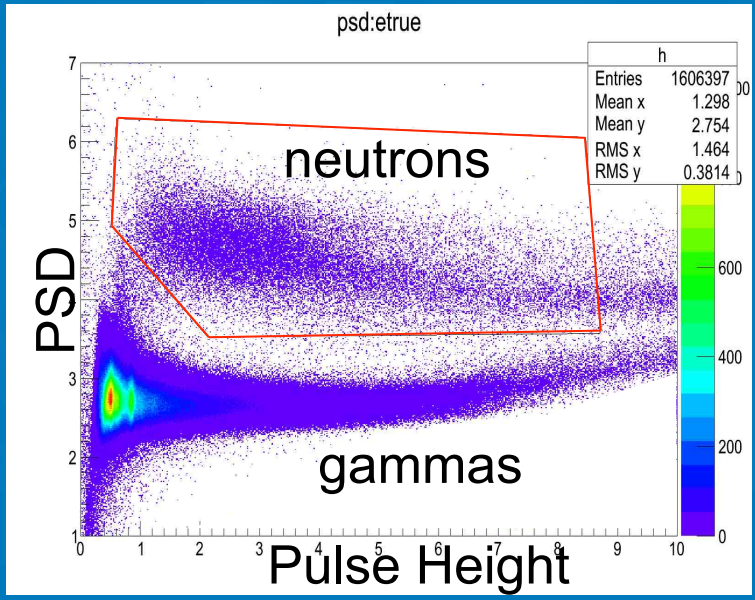
Test experiments with SCANS

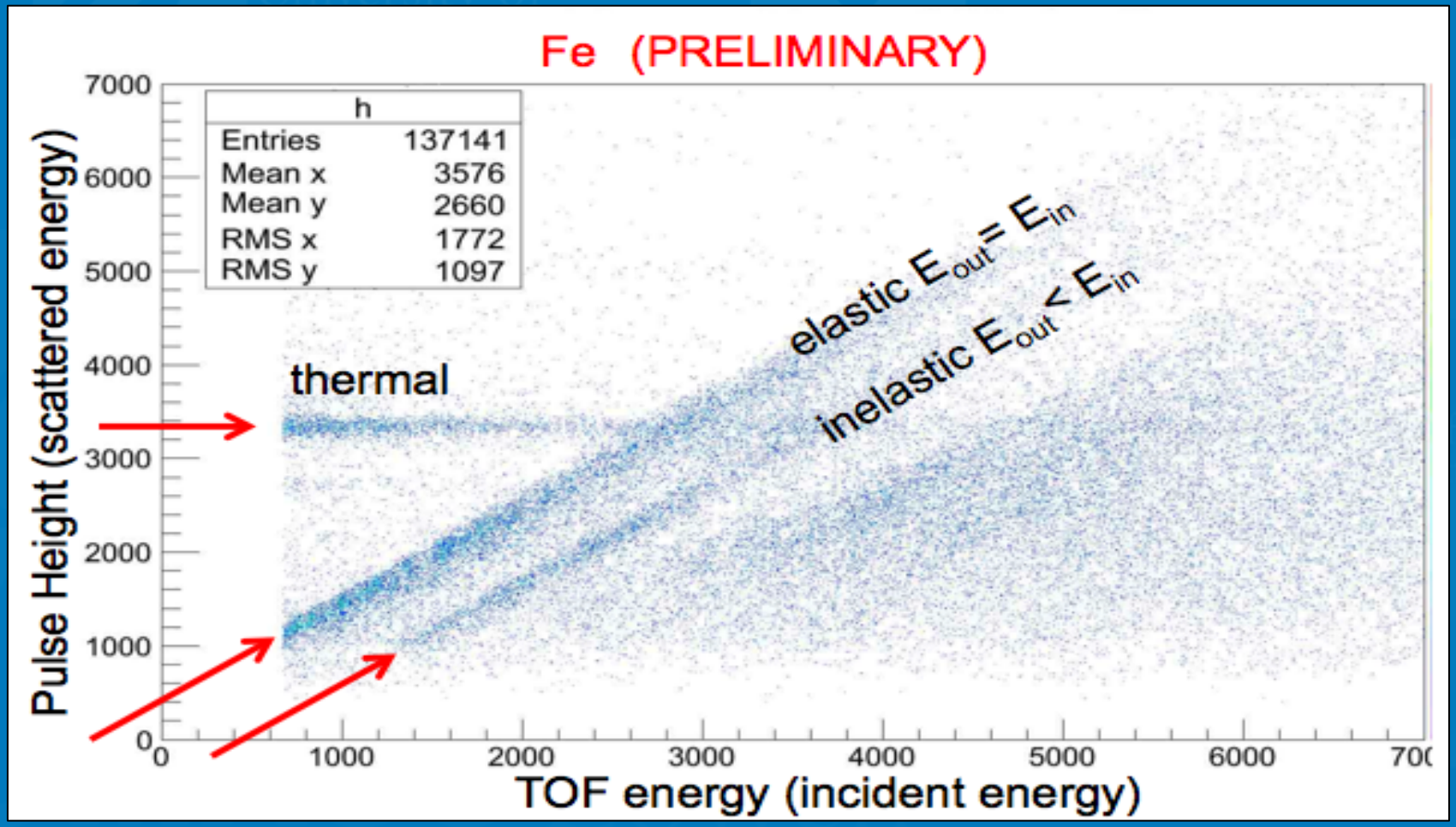
Elastic/inelastic neutron scattering cross-sections (^{56}Fe and ^{238}U) at Los Alamos Neutron Science Center (LANSCE)





- TOF from neutron production target to CLYC (18 m flight path) provides $E_{incident}$
- Pulse height in CLYC provides $E_{scattered}$
- Plot $E_{scattered}$ vs $E_{incident}$

SCANS at LANSCE



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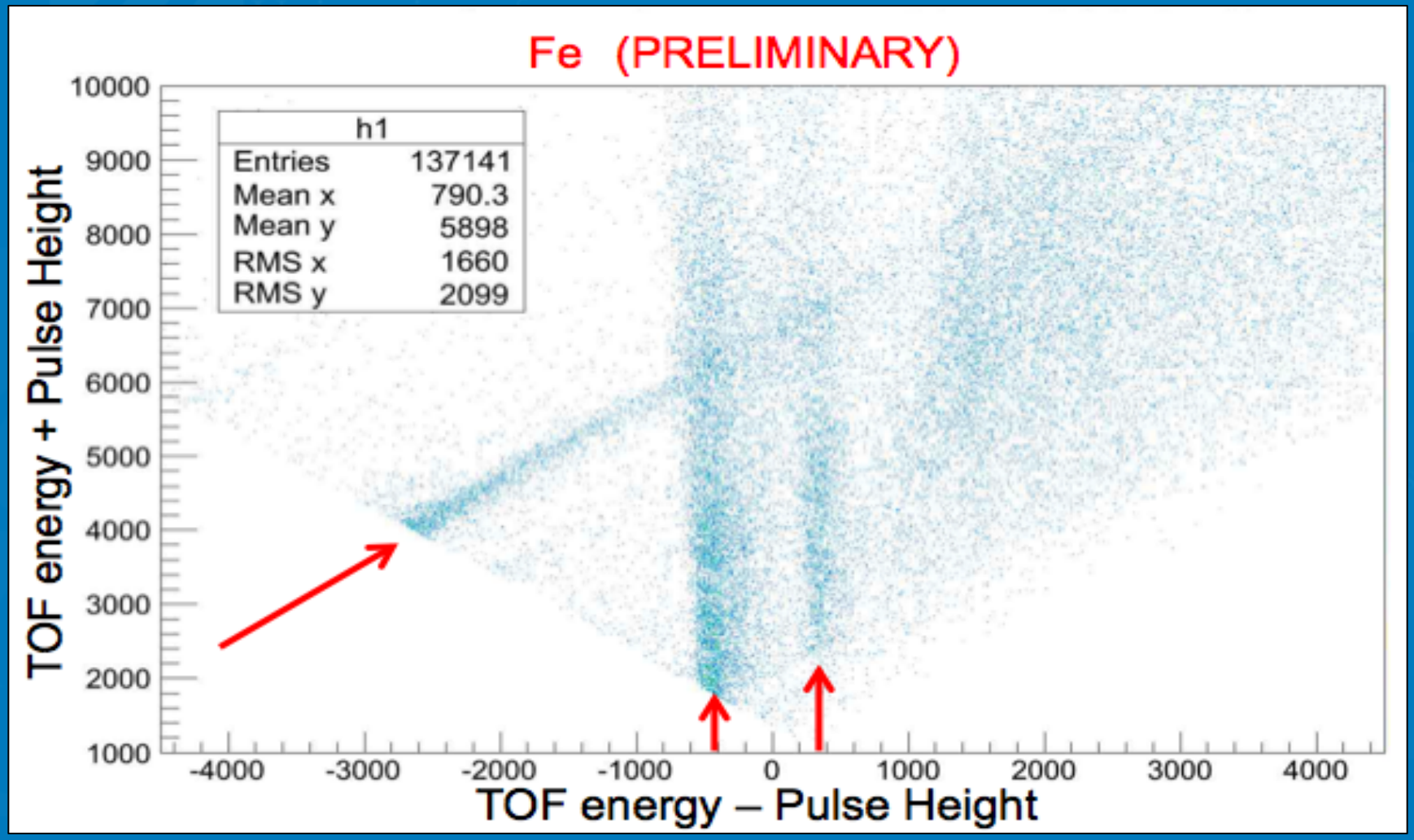
SCANS at LANSCE



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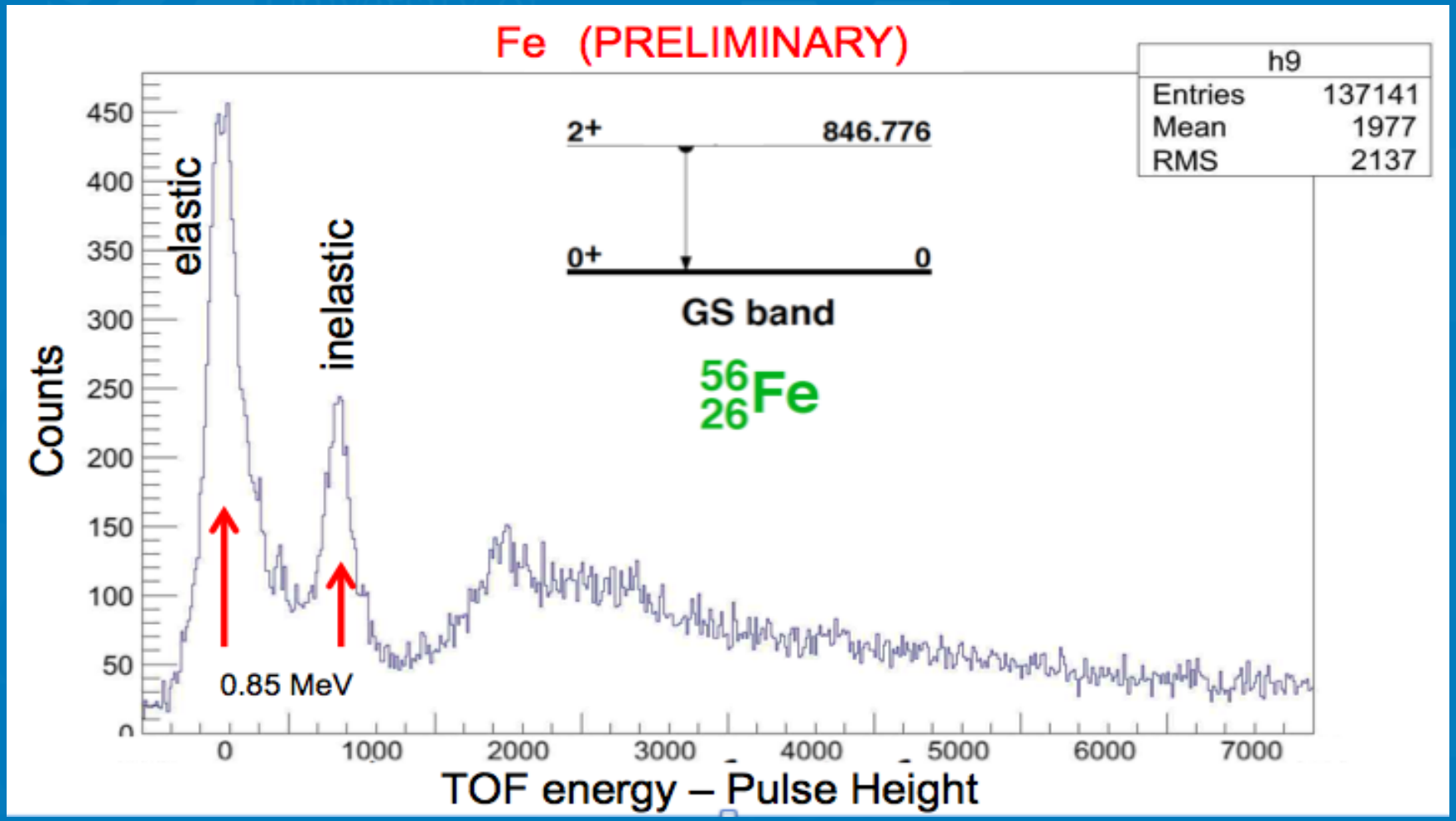
SCANS at LANSCE



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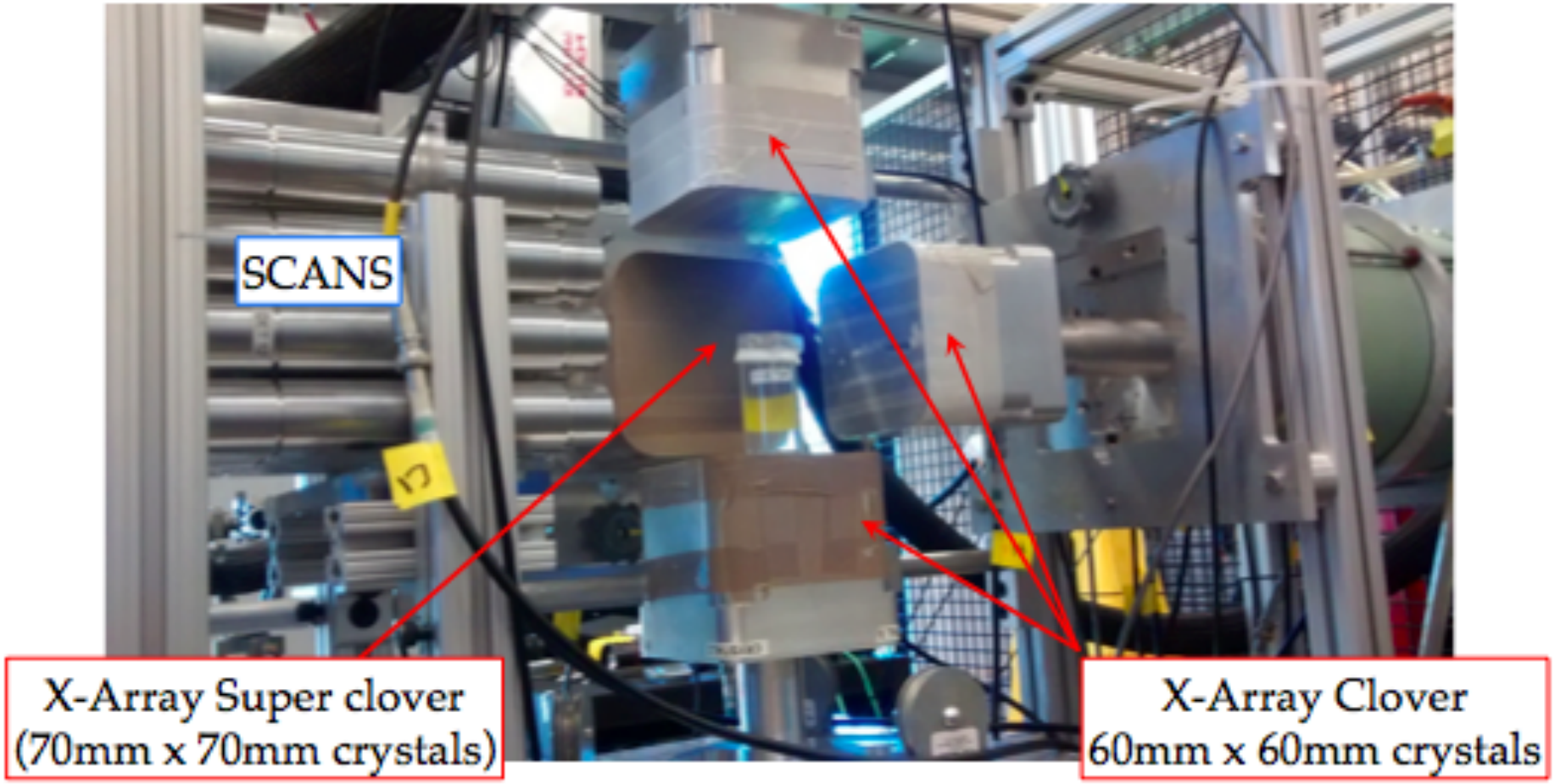
β-delayed Neutrons at CARIBU



^{94}Rb test case: analysis in progress (poster by Gemma Wilson)

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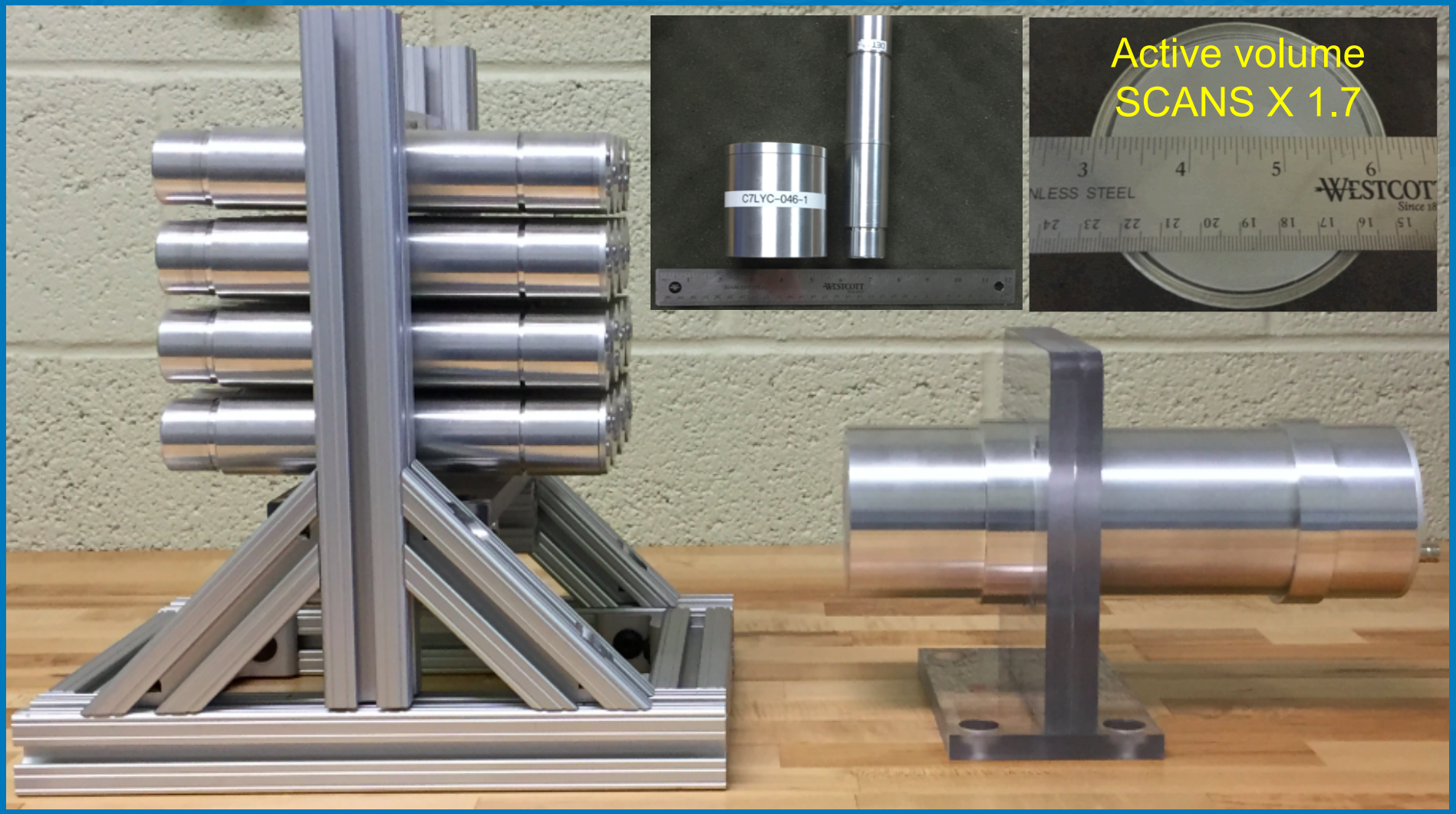
The first 3” x 3” C^7LYC



Summary

Ongoing

Analysis of LANSCE test data on ^{56}Fe and ^{238}U

Analysis of CARIBU expt (β-delayed neutrons: ^{94}Rb decay)

(poster by Gemma Wilson)

New 3-year science proposal funded by NNSA-SSAA

Plans

Characterize and test new 3” x 3” C^7LYC crystal

Second (n,n’) experiment at LANSCE (Fall 2016)

Measure and simulate efficiency

Investigate n-γ coincidences in SCANS

Measure low energy response of C^7LYC

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Teams

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