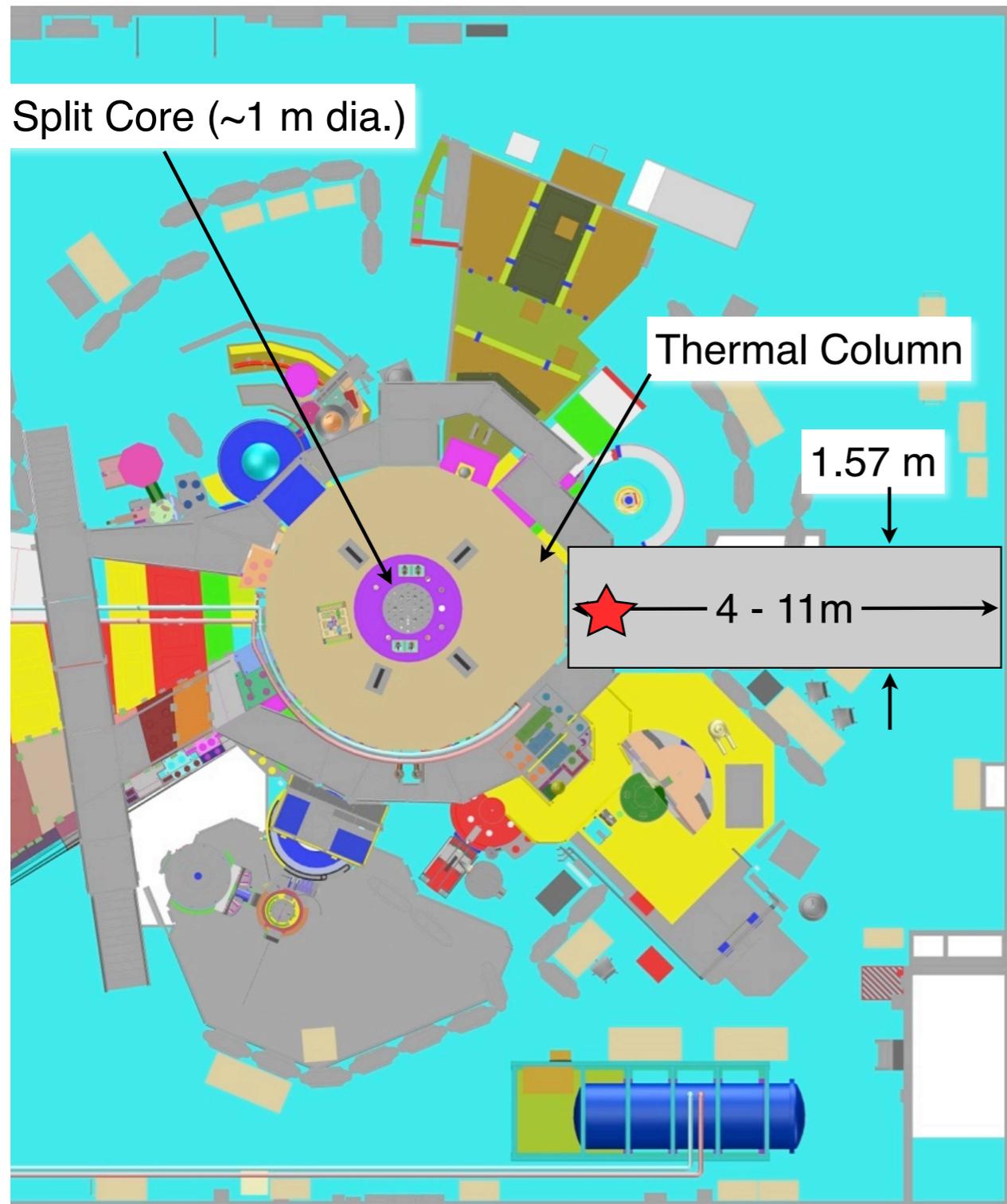


H.P. Mumm

National Institute of Standards and Technology



Background Assessments

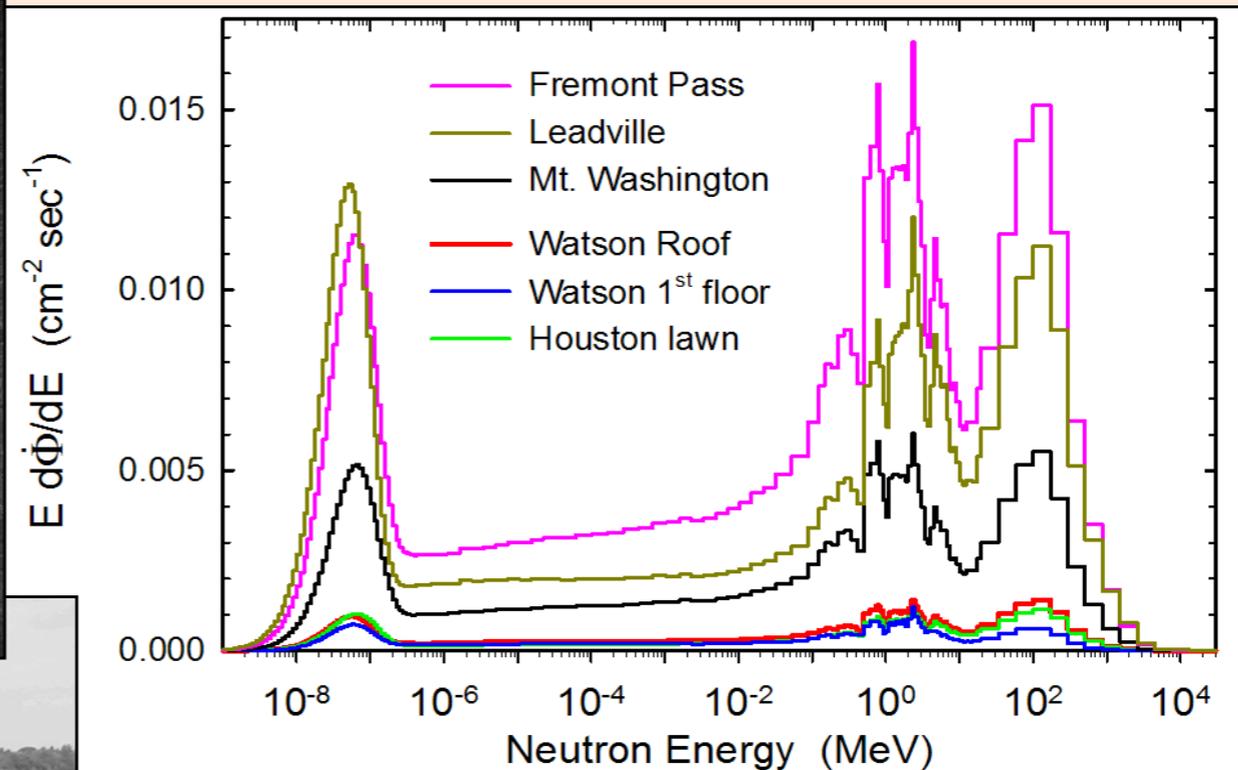
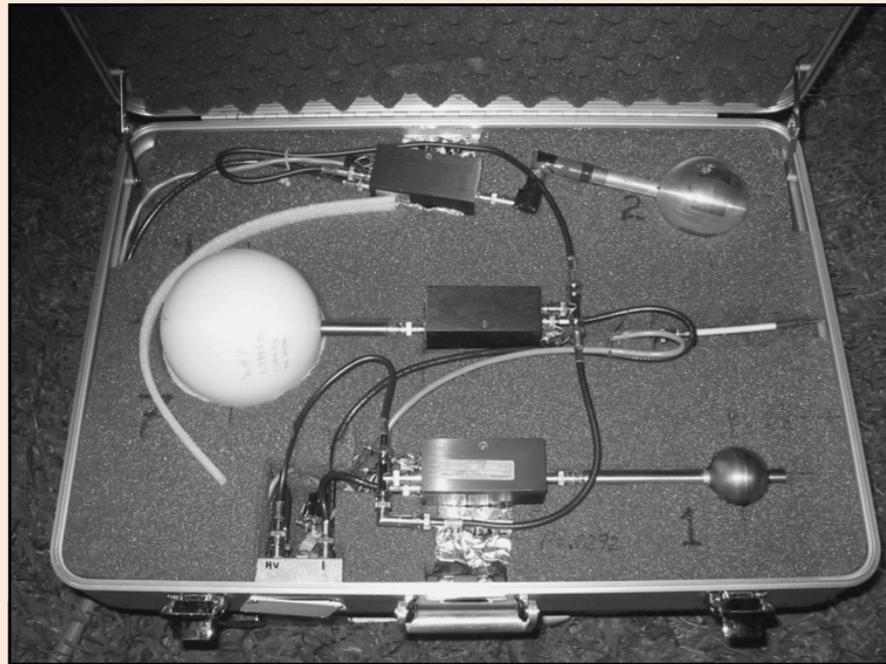


**In a 1 m³ active volume one sees
~100s of neutrino events/day**

Multiple (non-trivial) Sources of Background

- gammas (from reactor and surrounding beams/instruments)
- muons
 - no overburden (NIST: 1m concrete)
 - ~300 Hz
 - probably need ~100 μ s veto -> significant deadtimes
- fast neutrons (from reactor and surrounding instruments)
 - < few MeV
 - Measurements w/ bonner ball: 2-3 cm⁻² s⁻¹ (confirmed with RoSPEC)
 - for a 1m³ detector ~ 1x10⁹/day
- fast neutrons (cosmic)
 - up to very high energies (10⁴ MeV)

Cosmic Ray Induced Neutrons



Houston, TX	14 m
Yorktown Heights, NY	167 m
Mount Washington, NH	1905 m
Leadville, CO	3150 m
Fremont Pass, CO	3450 m

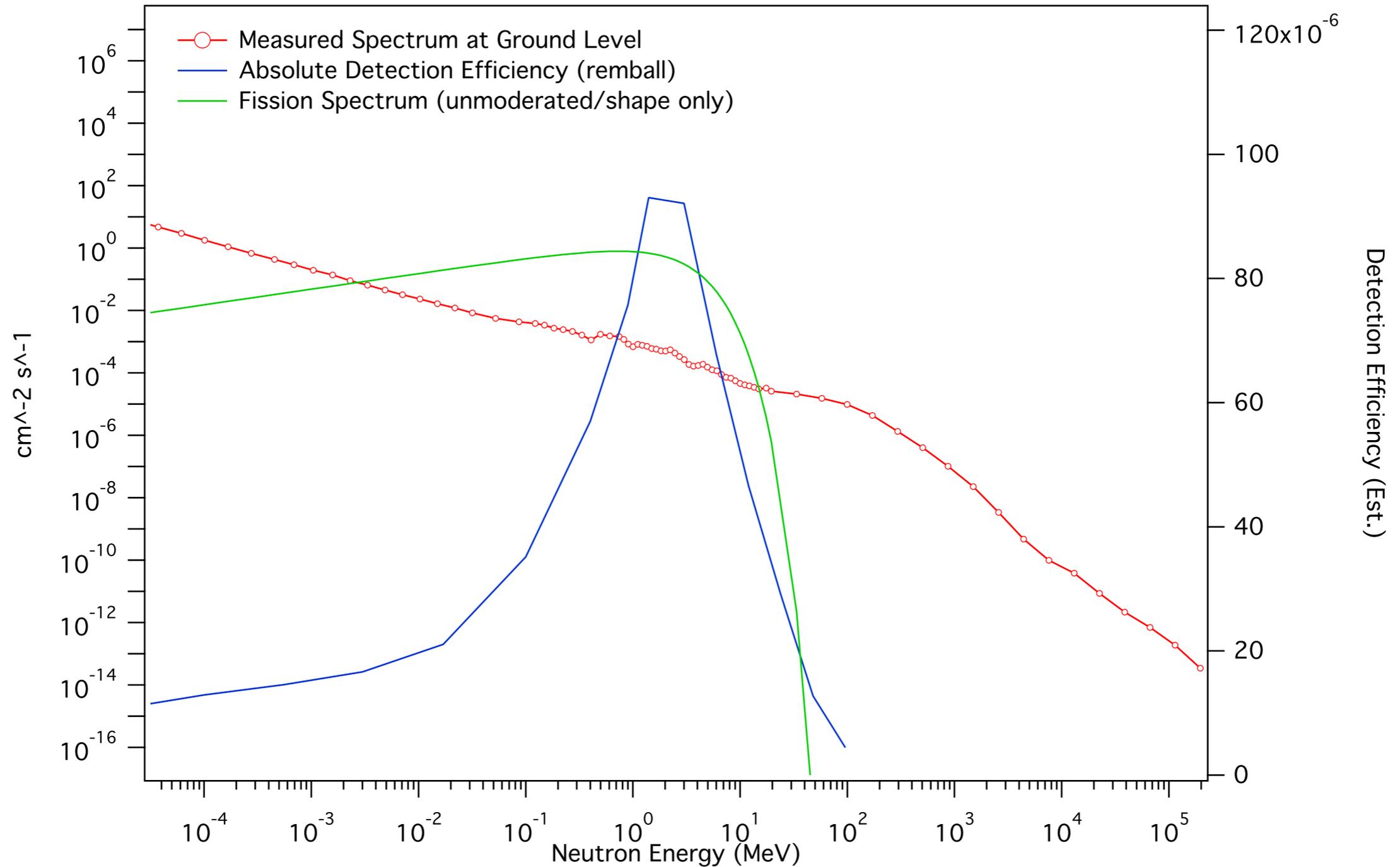
14-element Bonner sphere spectrometer
Goldhagen et al., IEEE Trans 51 (2004)

Indiana University/IUCF/IUCMB

30 Apr 2010

Integrated from 10 MeV up: $0.001 \text{ cm}^{-2} \text{ s}^{-1}$ (for a 1m^3 detector $\sim 1 \times 10^7/\text{day}$)

Cosmic Ray Induced Neutrons



Integrated from 10 MeV up: $0.001 \text{ cm}^{-2} \text{ s}^{-1}$ (for a 1m^3 detector $\sim 1 \times 10^7$ /day)

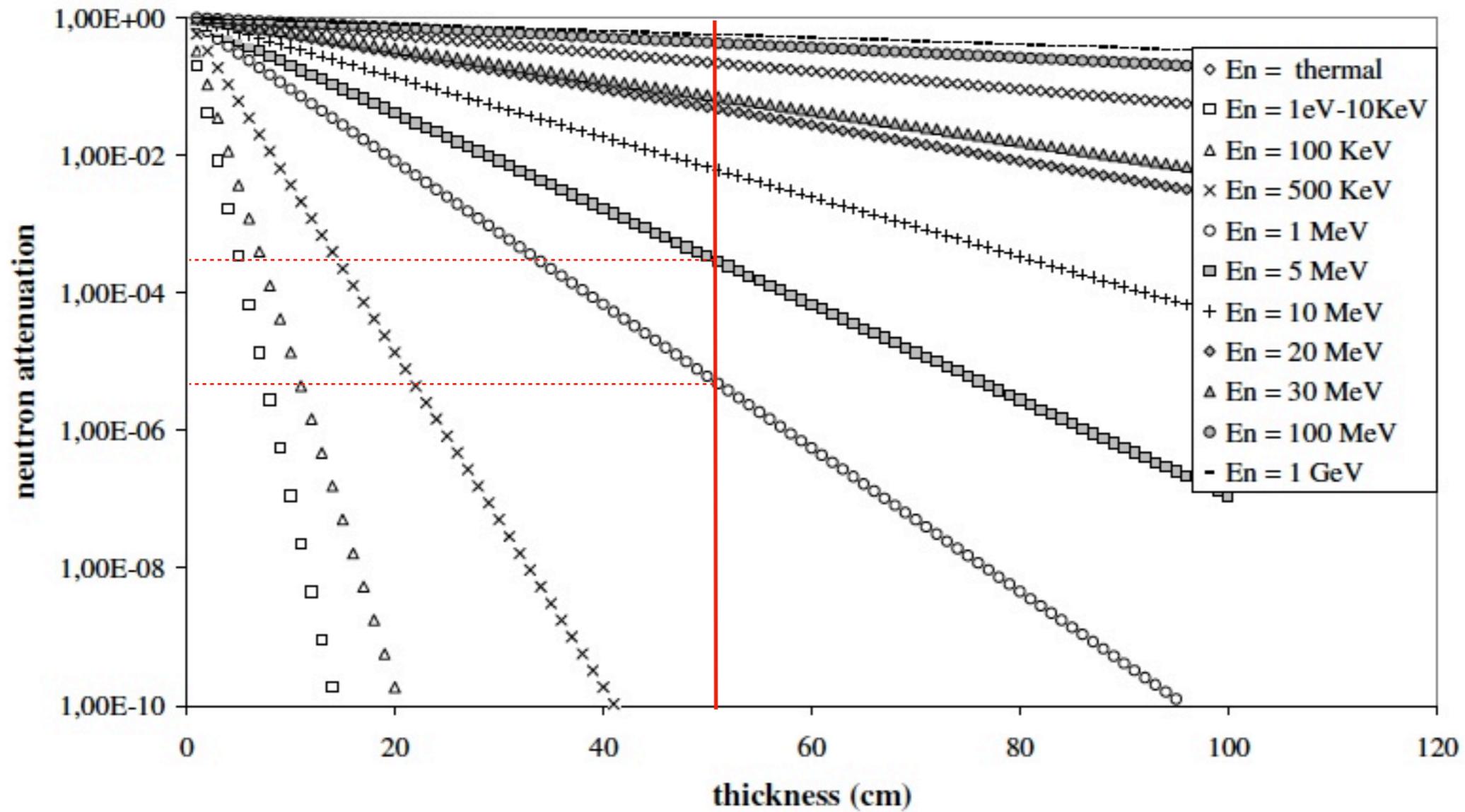
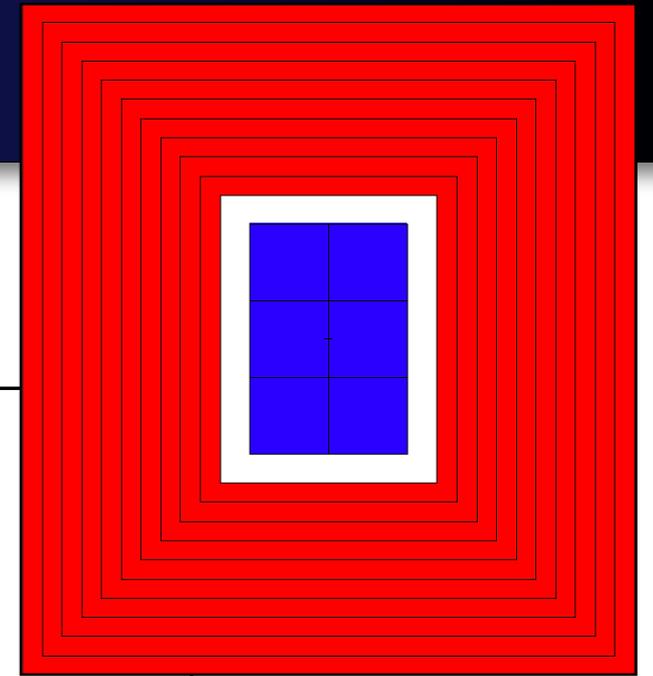
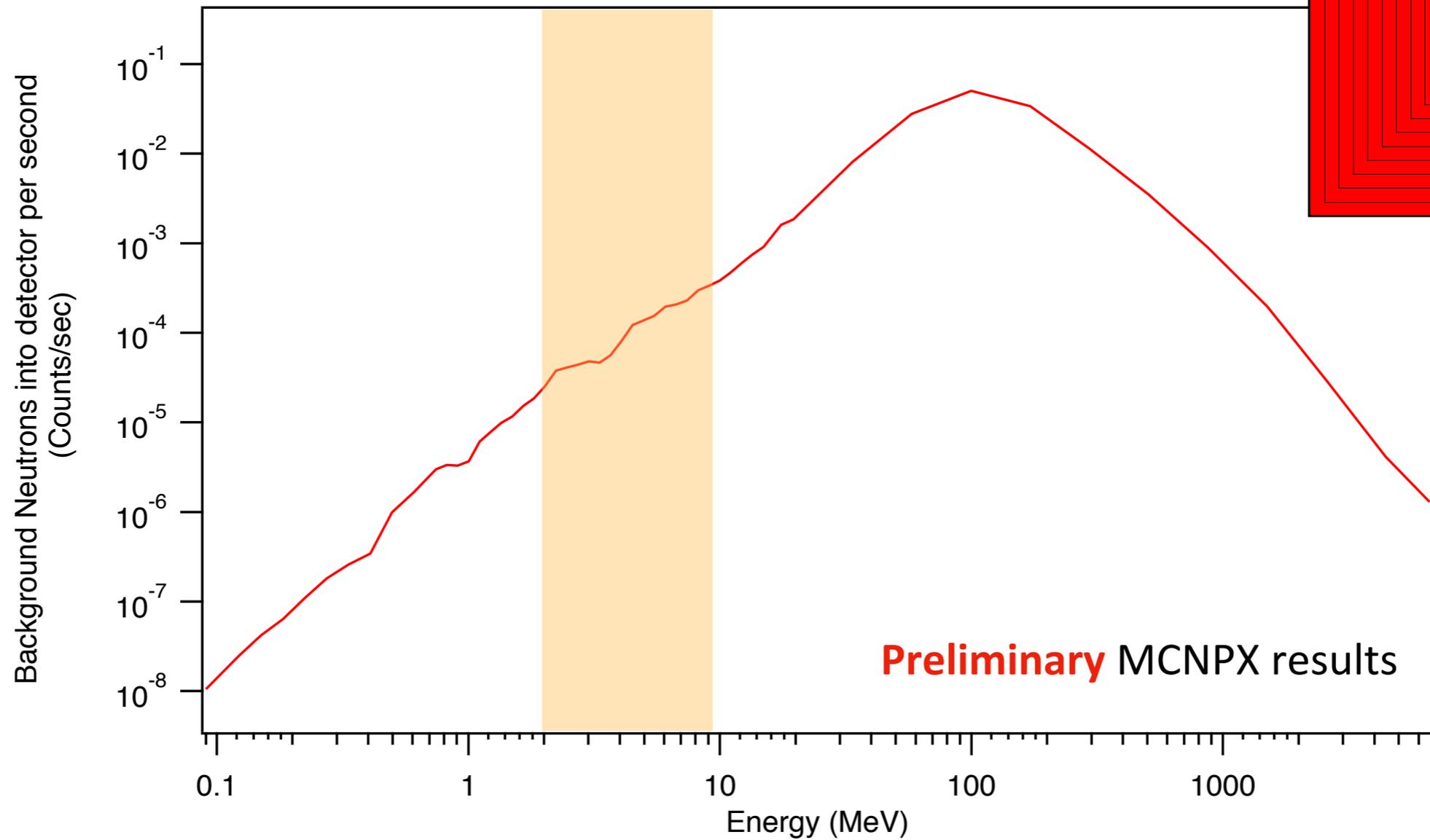


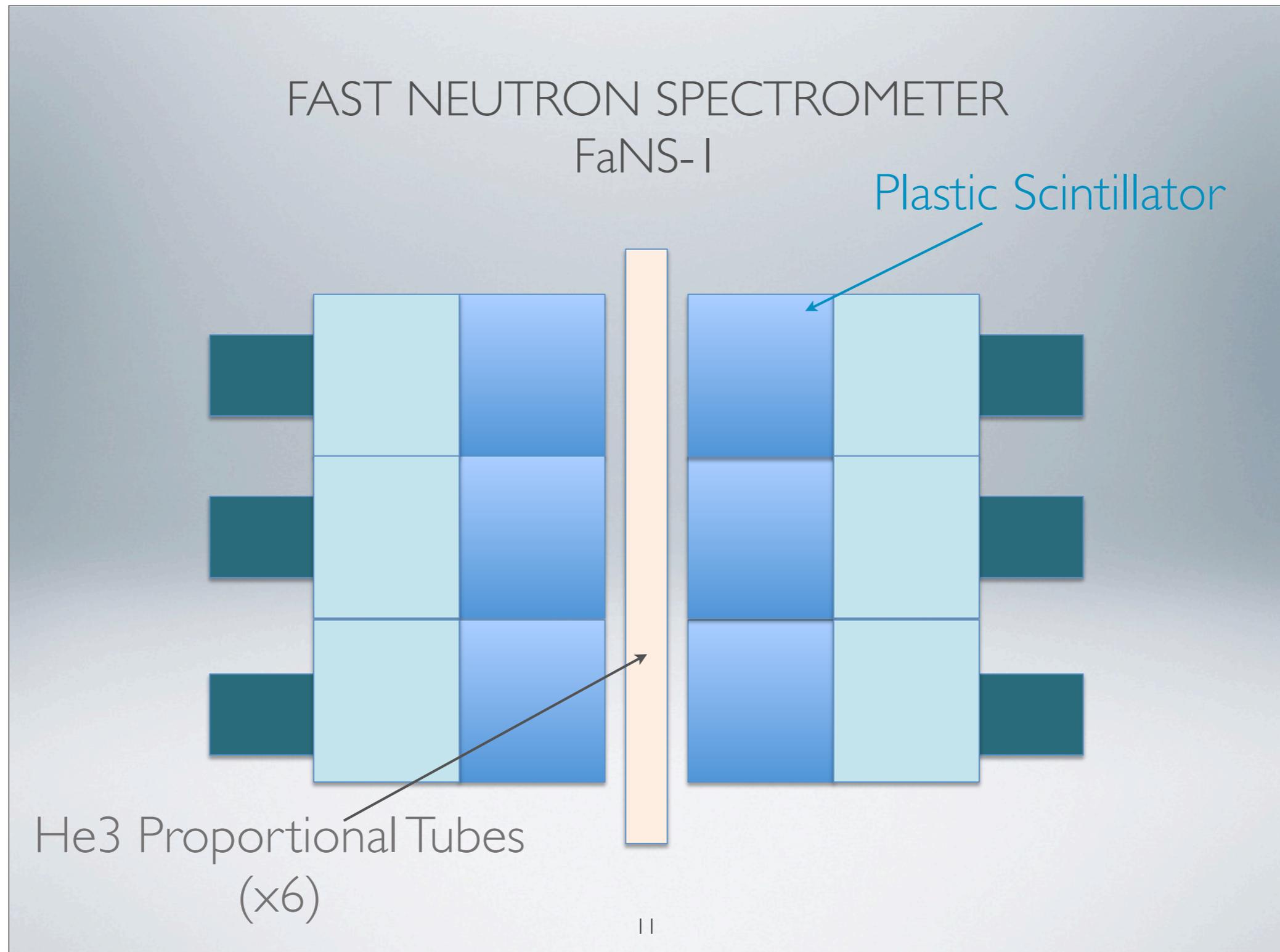
Figure 1. Neutron attenuation in polyethylene moderator

J. Phys.: Conf. Ser. 41 514 (2006)

Shielding (~75 cm borated poly)



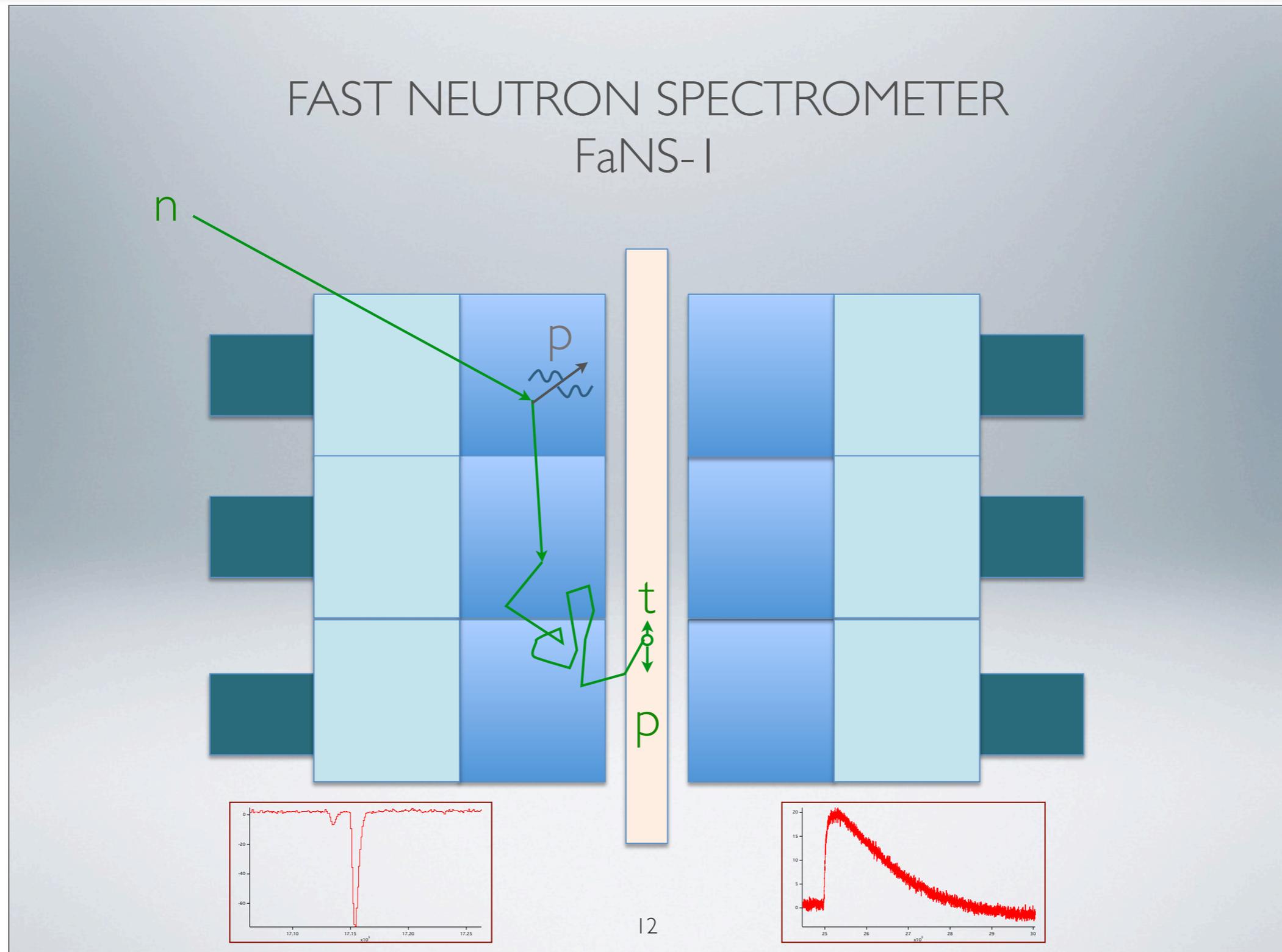
Goldhagen spectrum w/ 75cm borated poly (0.5 m³ detector) ~ 200 cnts/day



Friday, December 7, 12

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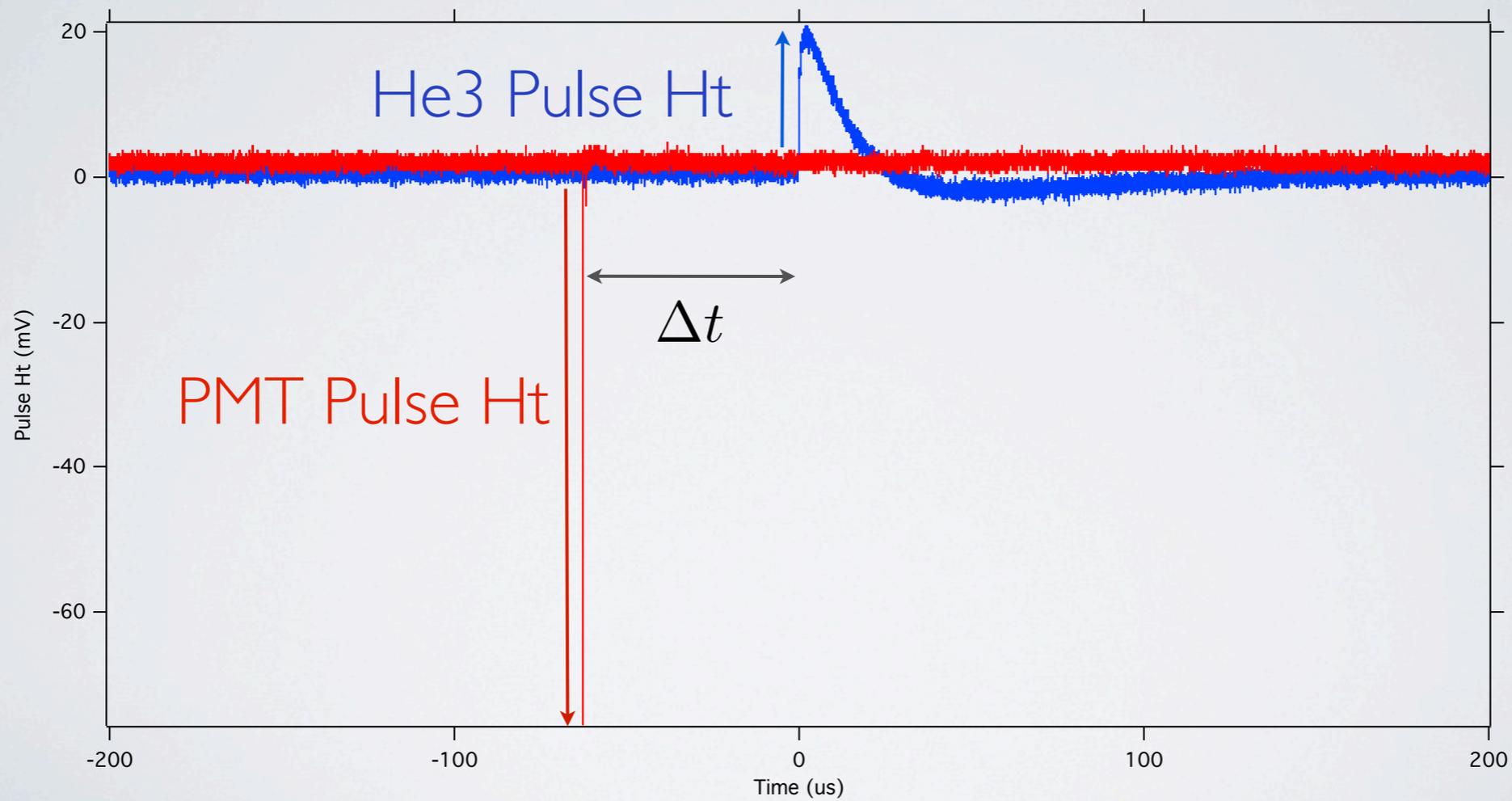
Background Assessments



Friday, December 7, 12

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CAPTURE GATED SPECTROSCOPY



Friday, December 7, 12

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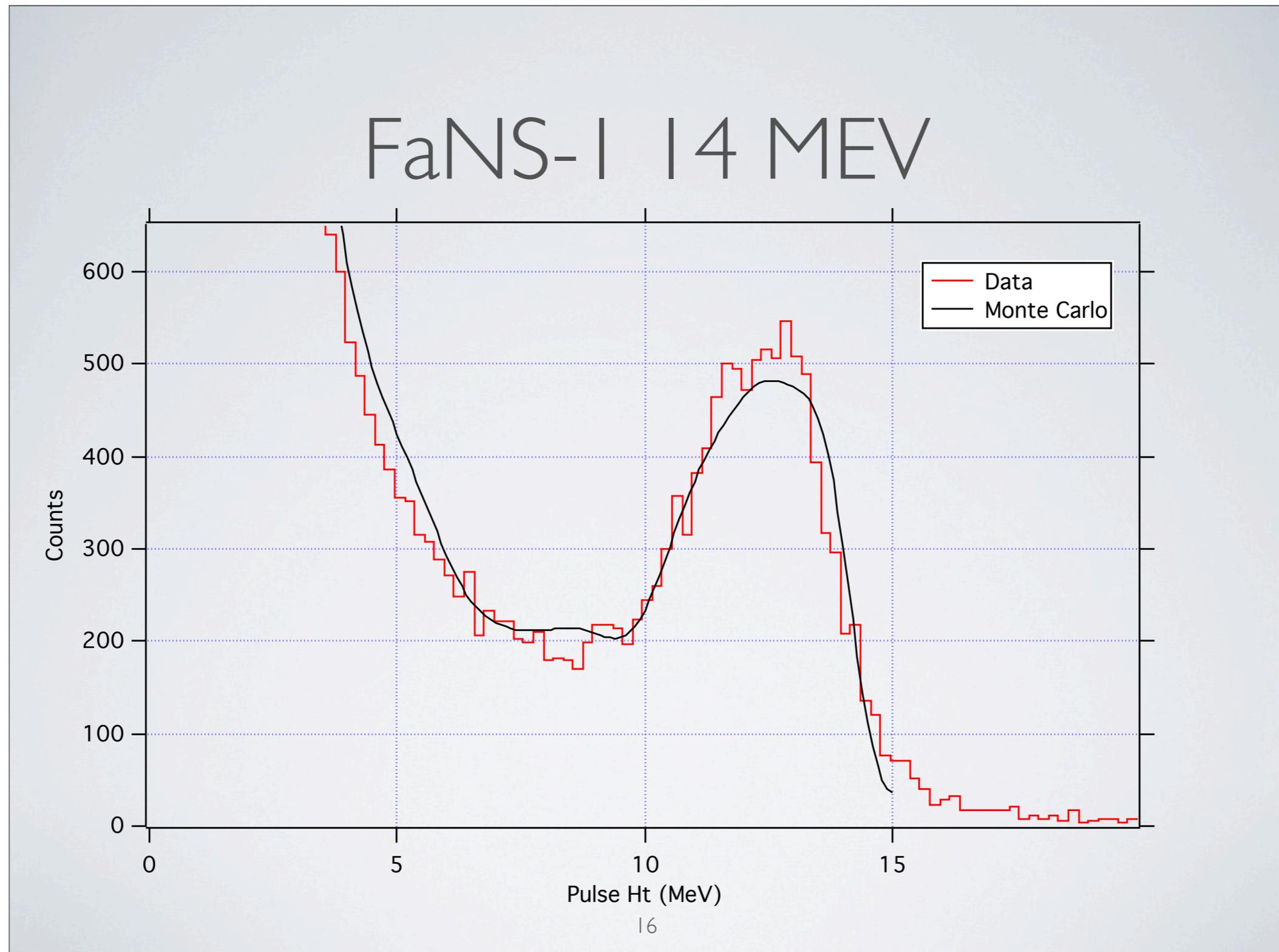
FaNS-I SUMMARY

- Ran at surface for ~1 month
 - Collected neutron events with energies greater than 100 MeV
- Collected monoenergetic neutron data with DD and DT generators
- Ran 1700' underground at the Kimballton Lab in VA
 - Two runs, each lasting about 6 months
 - Collected $> 10^6$ events
 - Primarily fission neutrons, not cosmic ray induced

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Friday, December 7, 12

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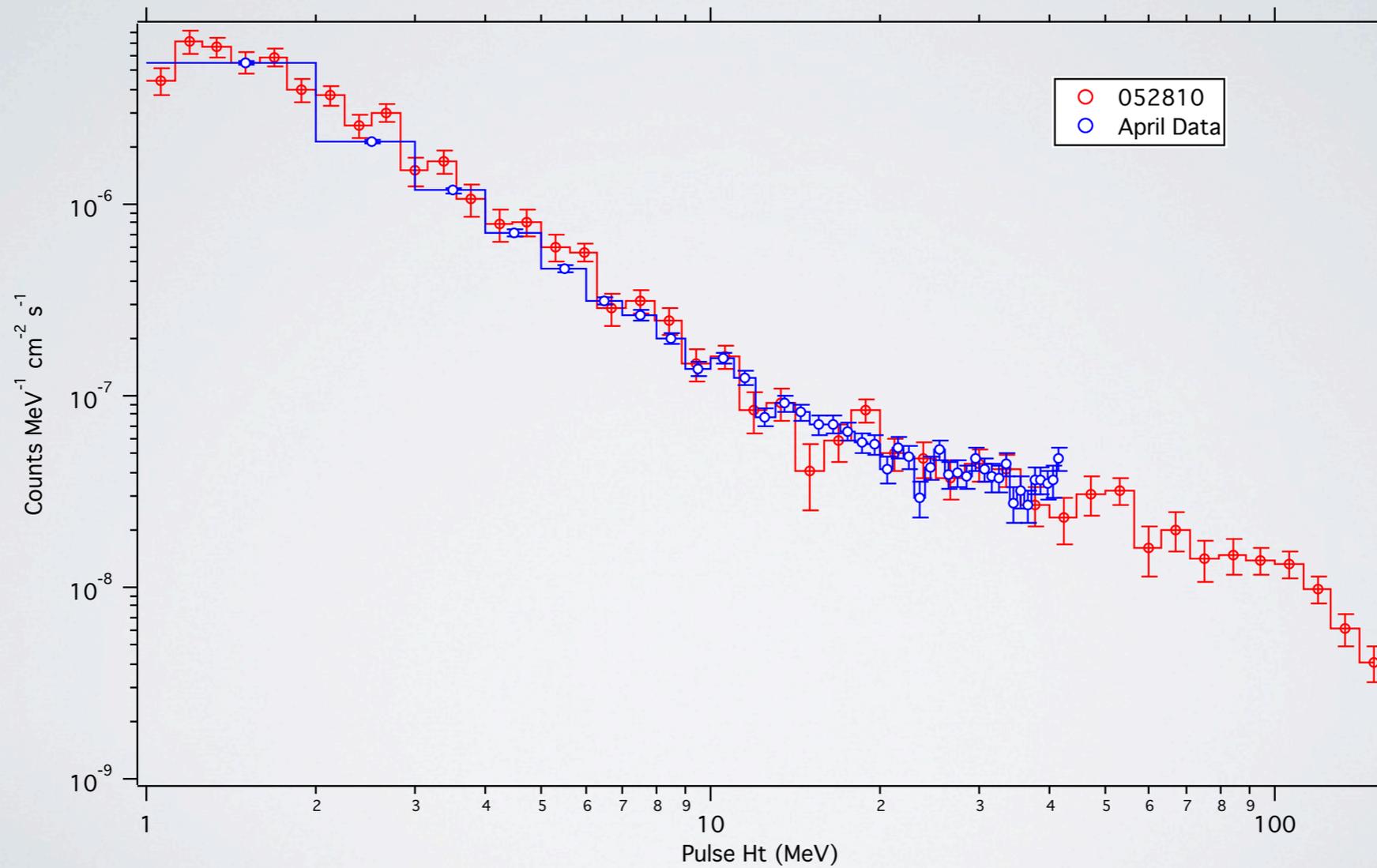


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Slides courtesy of Tom Langford

FaNS-I AT THE SURFACE



Friday, December 7, 12

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Status

Currently we are rebuilding FANS-1

- new PMTs
- new electronics

Plan to run at thermal column in the next 1-2 months

Obviously background mitigation will be critical

- These kinds of fluxes will require ~50cm poly...
- Not a trivial optimization
- Developing MNCP5 models (validate against FANS data)

This level of shielding is doable but non-trivial

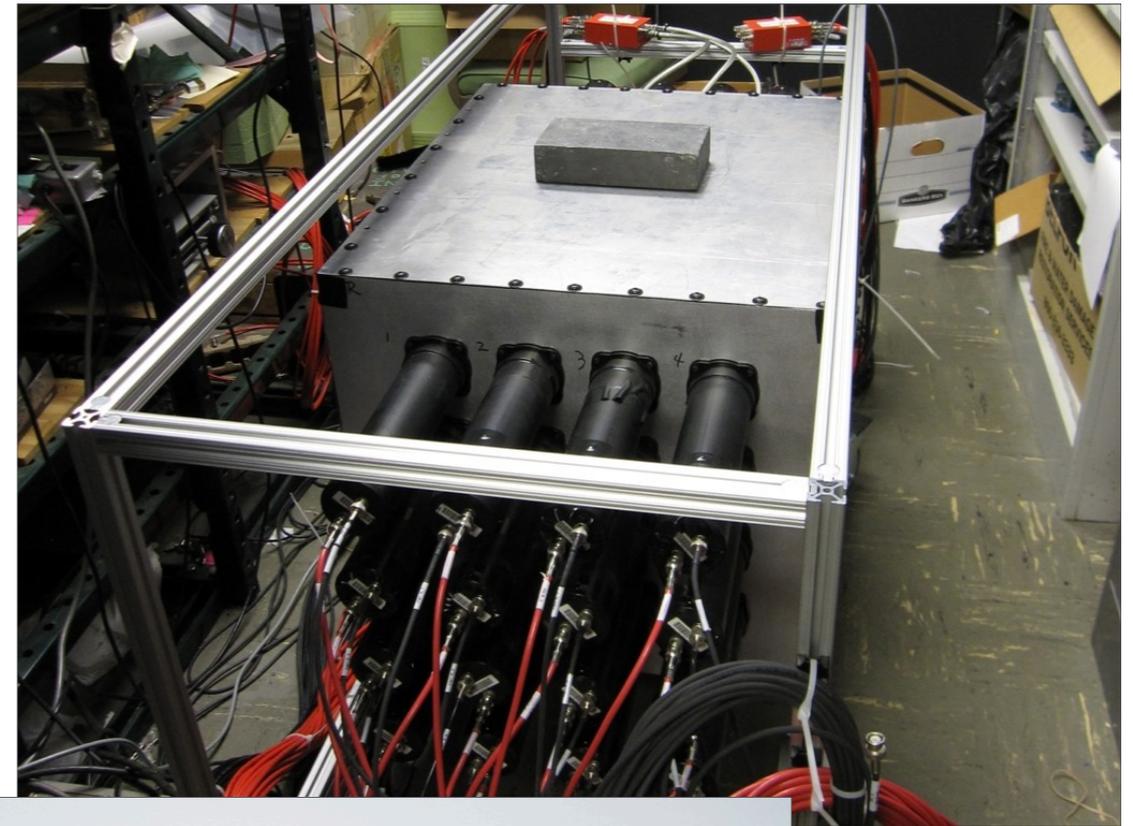
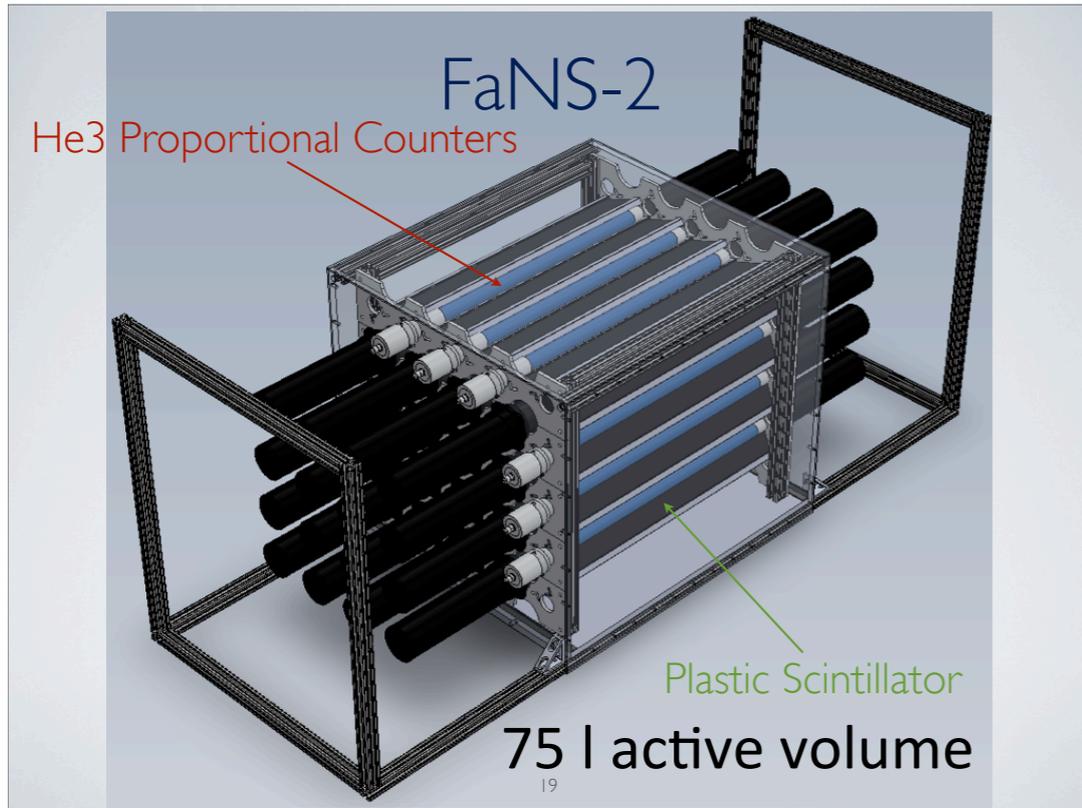
- floor loading, logistics, etc...

MCNPX

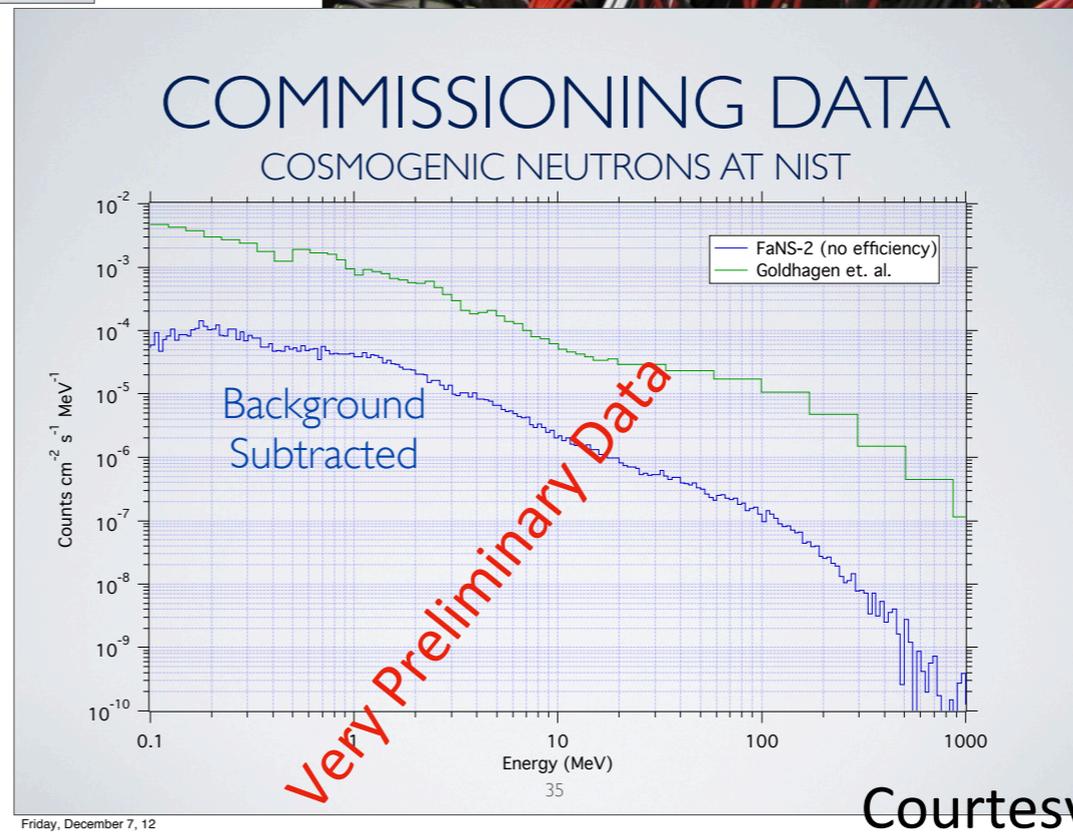
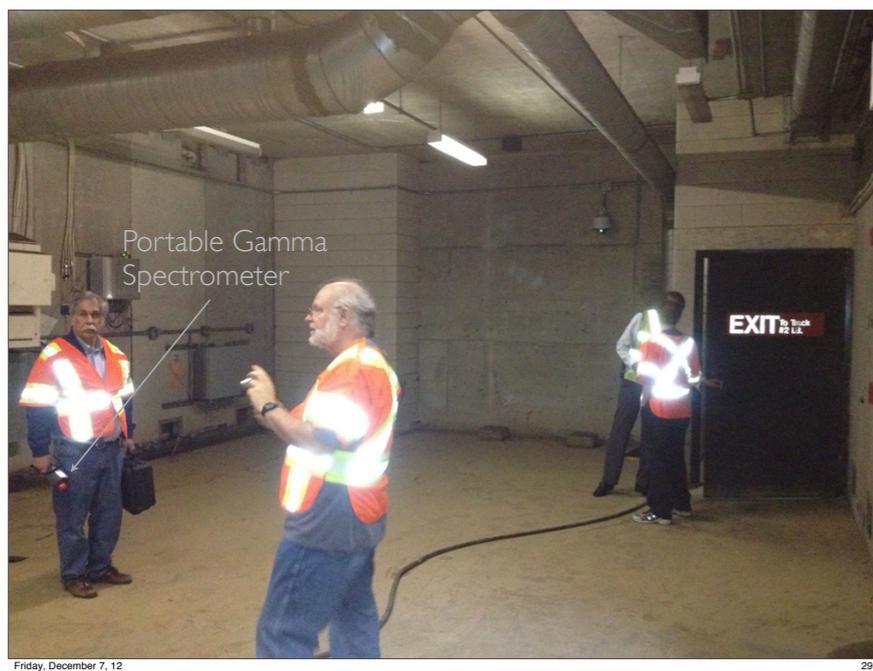
- develop a more realistic model...
- validate against in situ measurements *in situ*

Develop conceptual engineering models

- focused primary on floor loading and deployment logistics



Location in DC metro (~100 m.w.e)



Courtesy Tom Langford