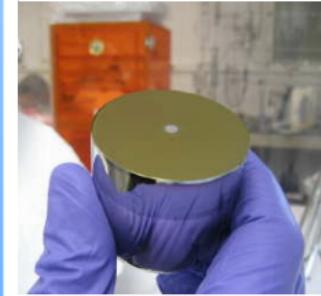
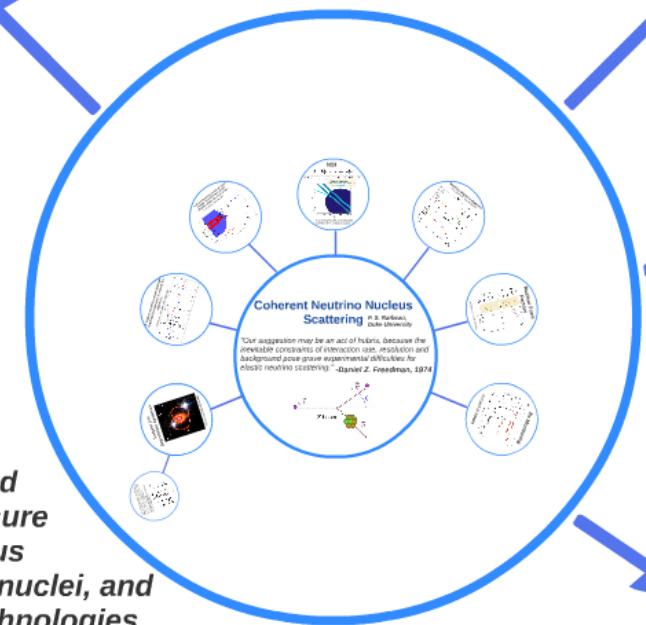


COHERENT SNS

- A collaboration has recently formed from disparate groups to bring together their individually developed detector technologies with the goal of finally measuring the coherent neutrino-nucleus scattering cross-section at the Spallation Neutron Source in Oak Ridge.



- *The collaboration's stated scientific goal is to measure coherent neutrino-nucleus scattering on numerous nuclei, and with several detector technologies with increasing precision in a search for new physics.*



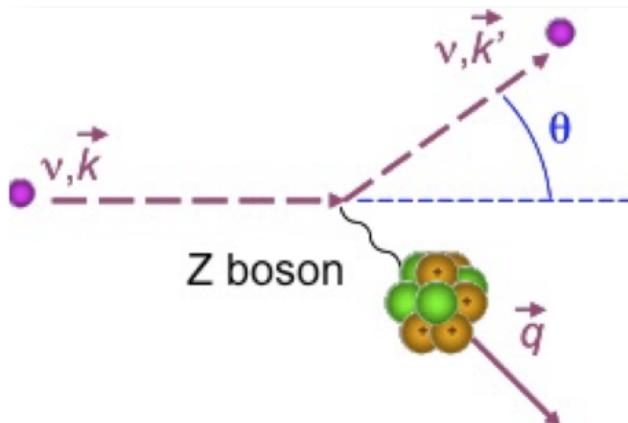
hubris

root

Coherent Neutrino Nucleus Scattering

P. S. Barbeau,
Duke University

"Our suggestion may be an act of hubris, because the inevitable constraints of interaction rate, resolution and background pose grave experimental difficulties for elastic neutrino scattering." -**Daniel Z. Freedman, 1974**

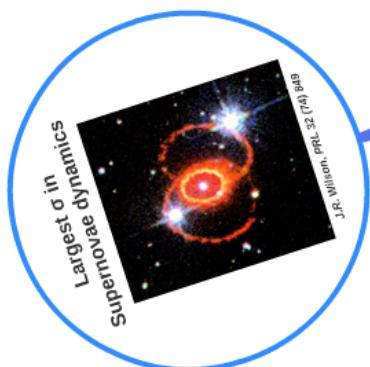
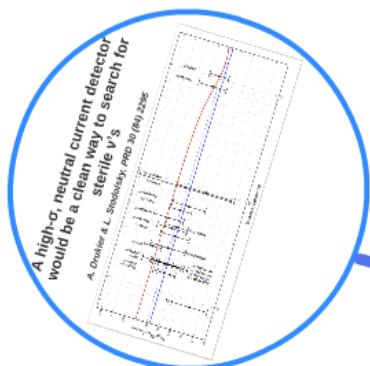
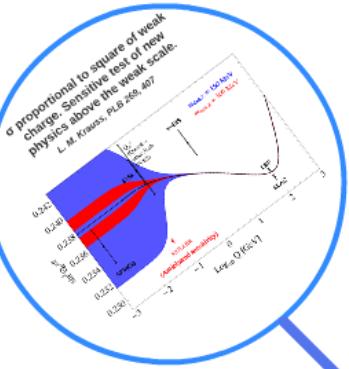
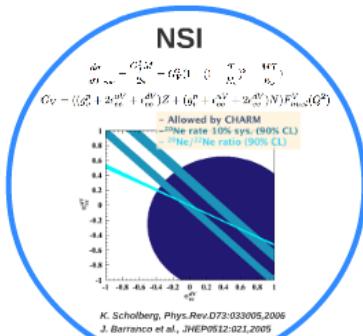
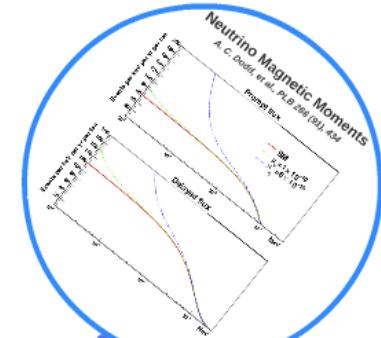
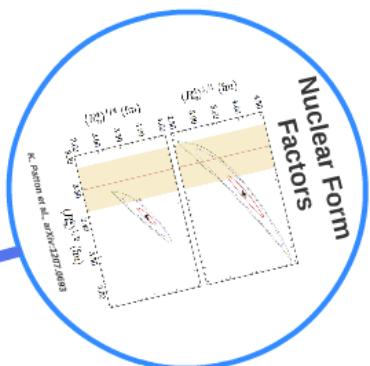
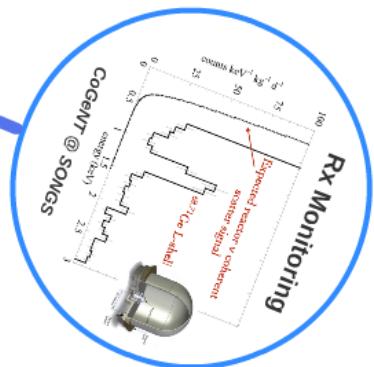
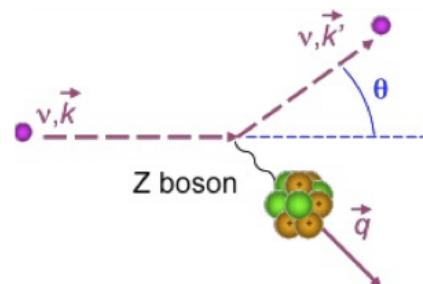


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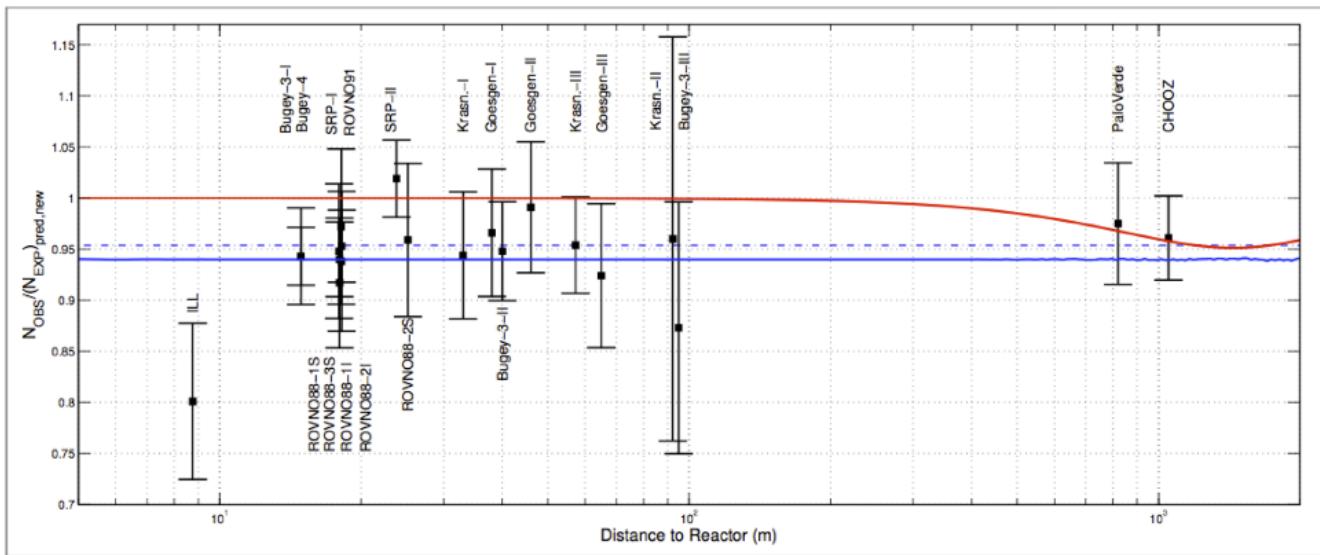
Largest σ in Supernovae dynamics



J.R. Wilson, PRL 32 (74) 849

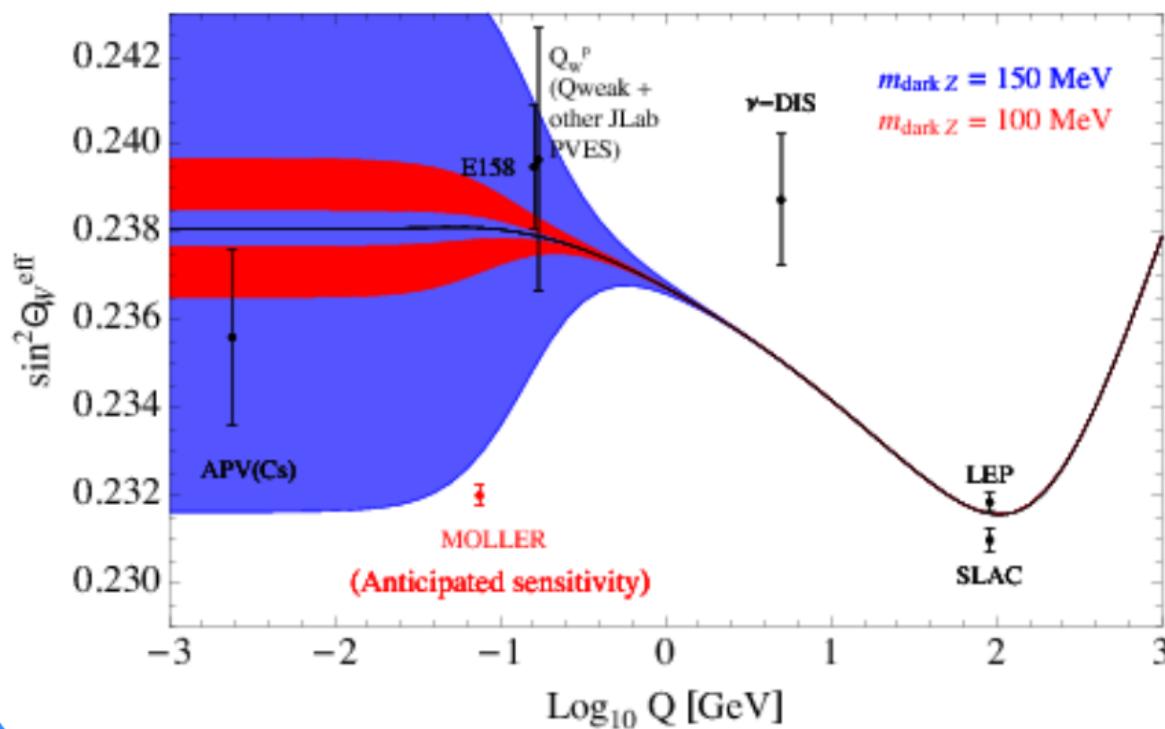
A high- σ , neutral current detector would be a clean way to search for sterile v's

A. Drukier & L. Stodolsky, PRD 30 (84) 2295



$\sigma \propto$ square of weak charge. Sensitive test of new physics above the weak scale.

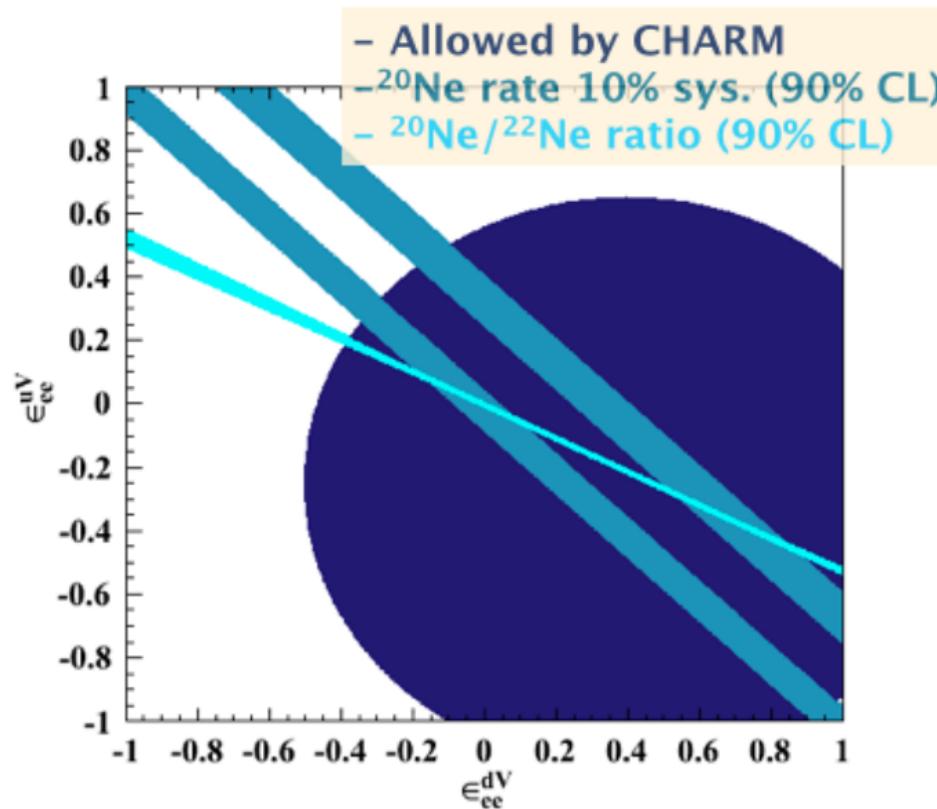
L. M. Krauss, PLB 269, 407



NSI

$$\frac{d\sigma}{dT}_{coh} = \frac{G_f^2 M}{2\pi} = G_V^2 \left(1 + \left(1 - \frac{T}{E_\nu}\right)^2 - \frac{MT}{E_\nu}\right)$$

$$G_V = ((g_v^p + 2\epsilon_{ee}^{uV} + \epsilon_{ee}^{dV})Z + (g_v^n + \epsilon_{ee}^{uV} + 2\epsilon_{ee}^{dV})N)F_{nucl}^V(Q^2)$$

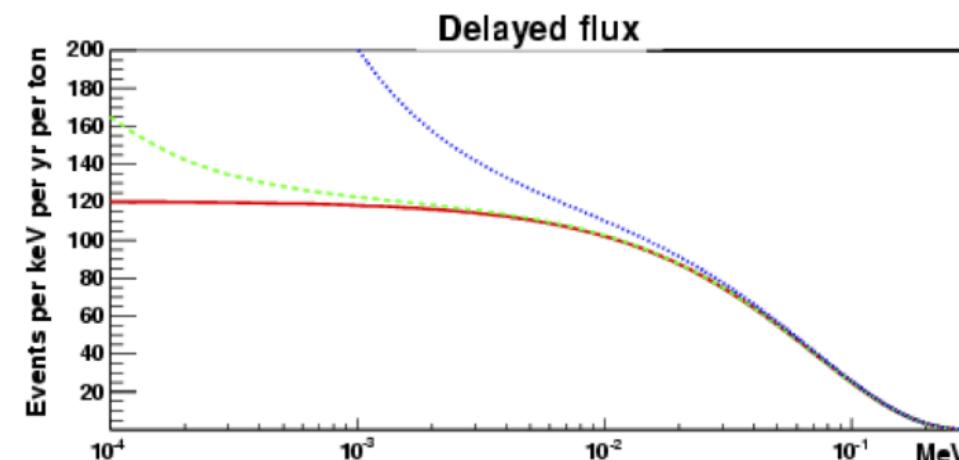
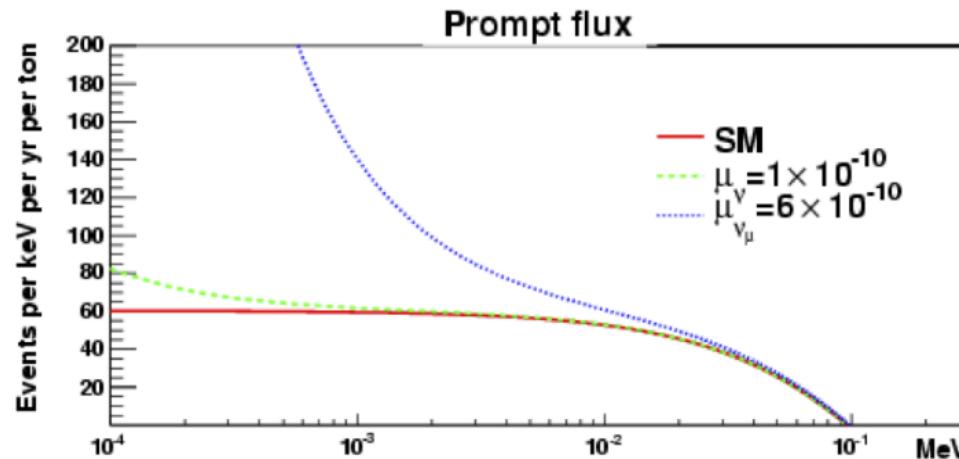


K. Scholberg, Phys.Rev.D73:033005,2006

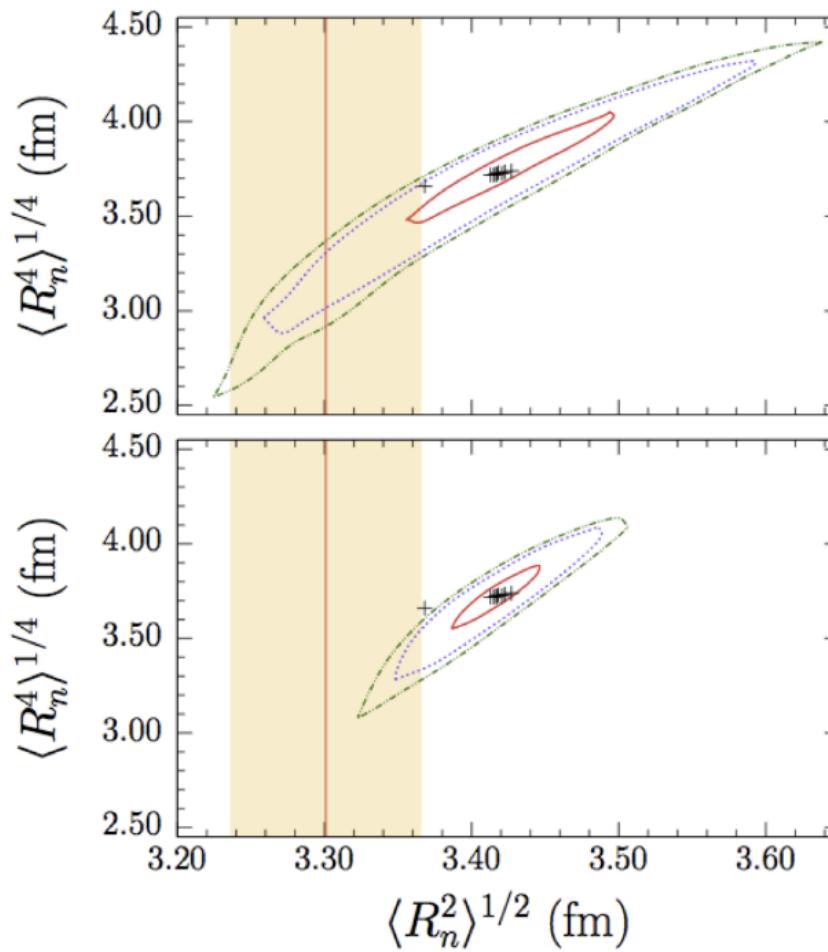
J. Barranco et al., JHEP0512:021,2005

Neutrino Magnetic Moments

A. C. Dodd, et al., PLB 266 (91), 434

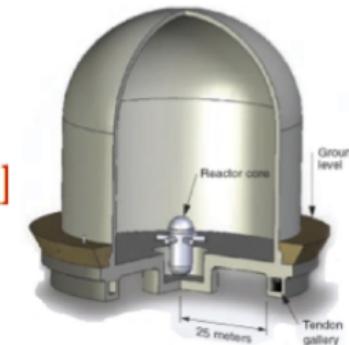
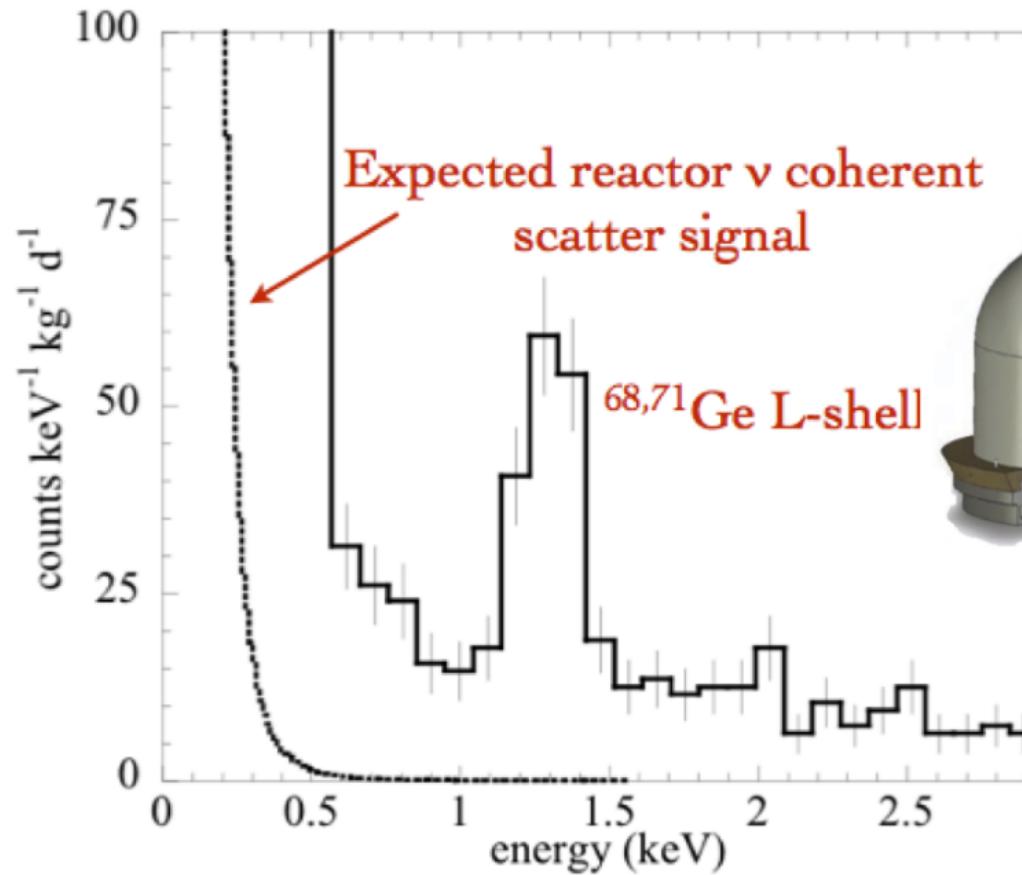


Nuclear Form Factors

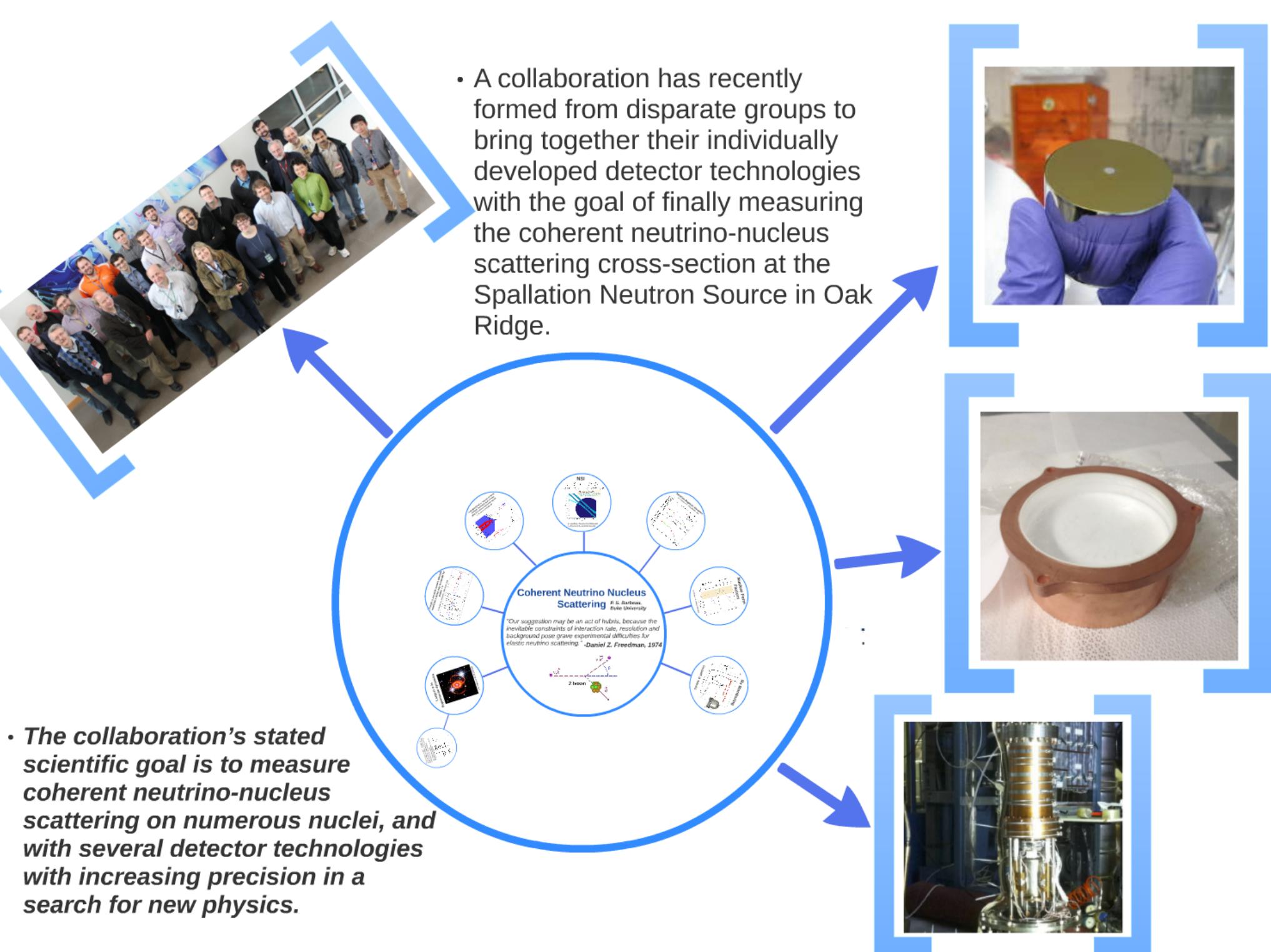


K. Patton et al., arXiv:1207.0693

Rx Monitoring

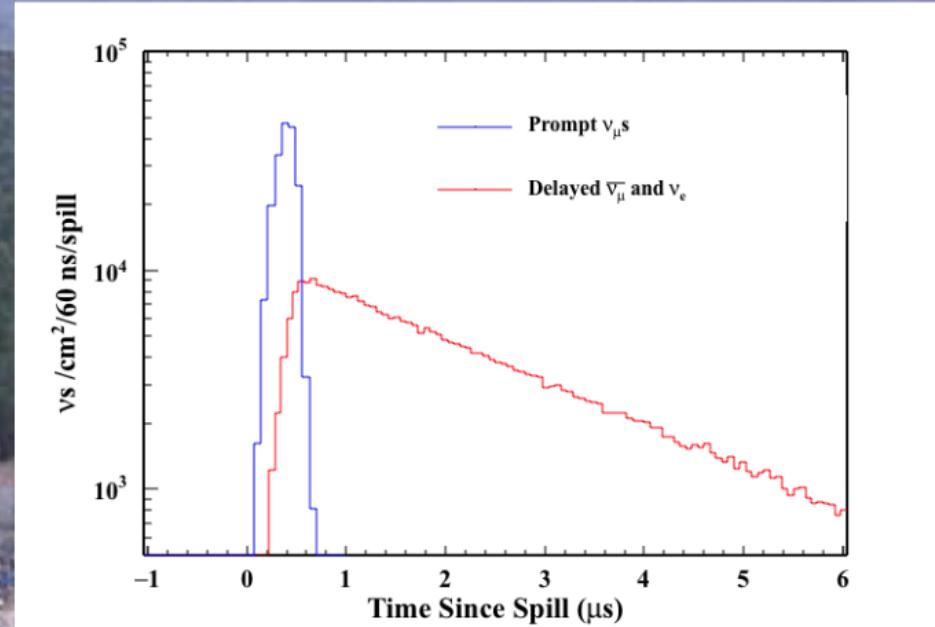
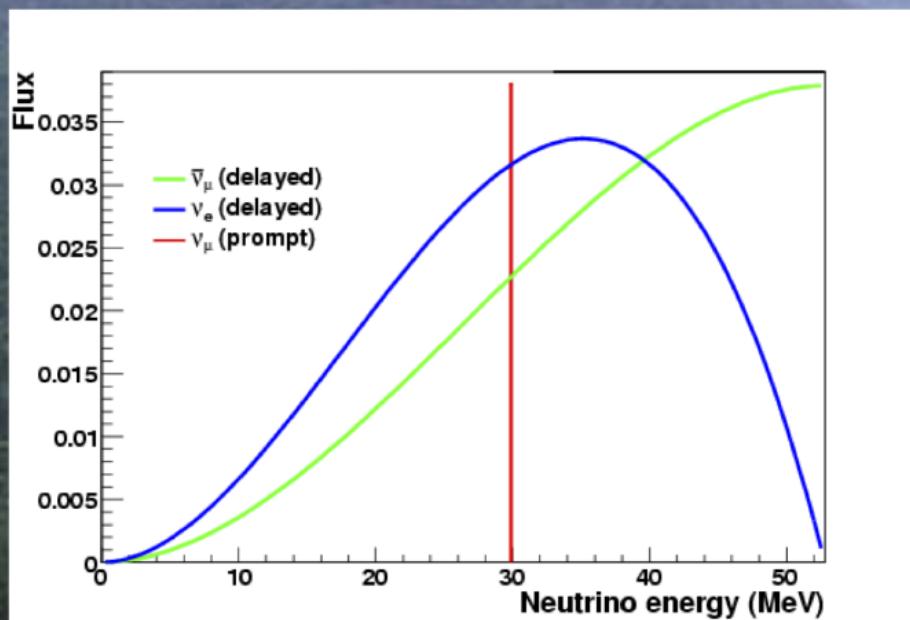


CoGeNT @ SONGS



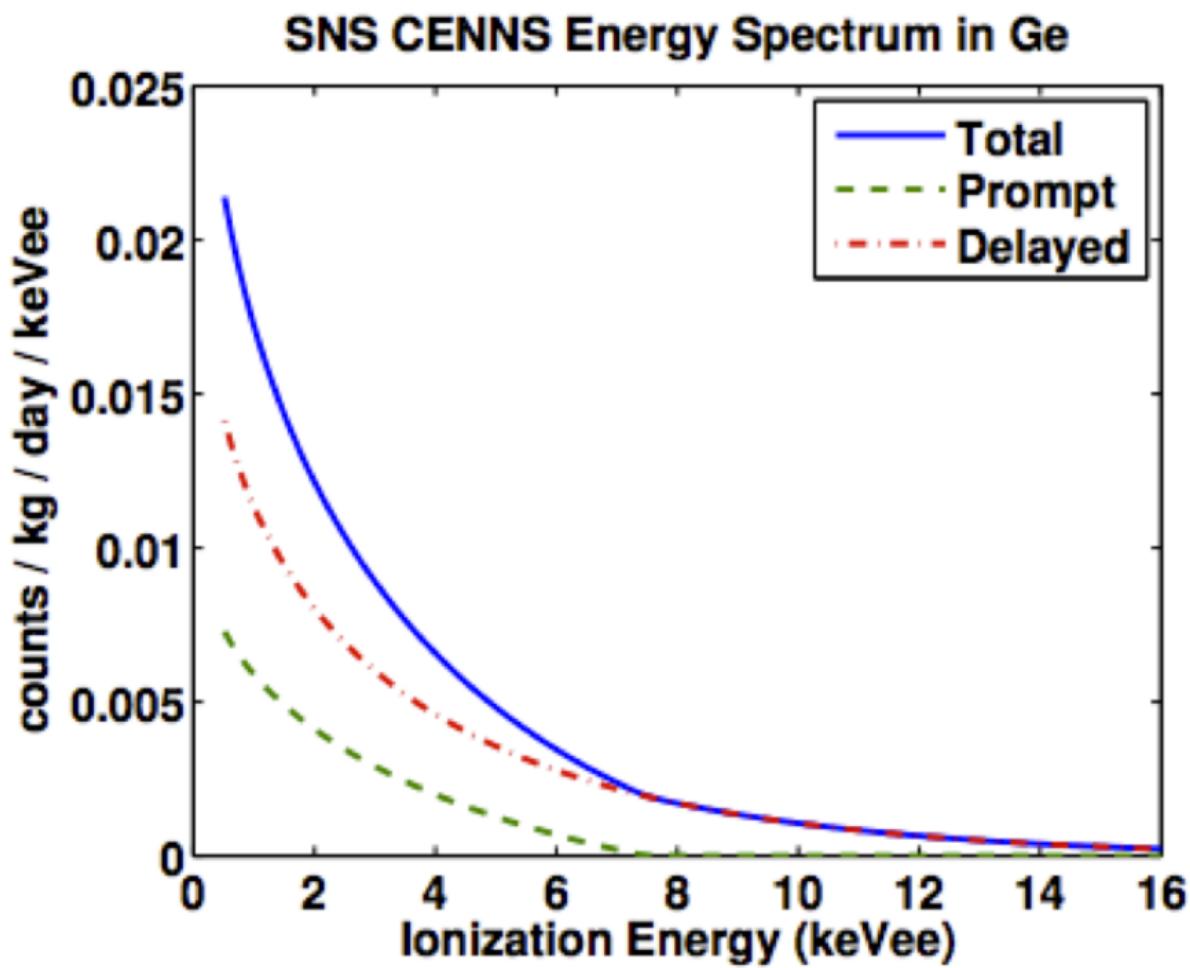
The Spallation Neutron Source

Oak Ridge National Laboratory

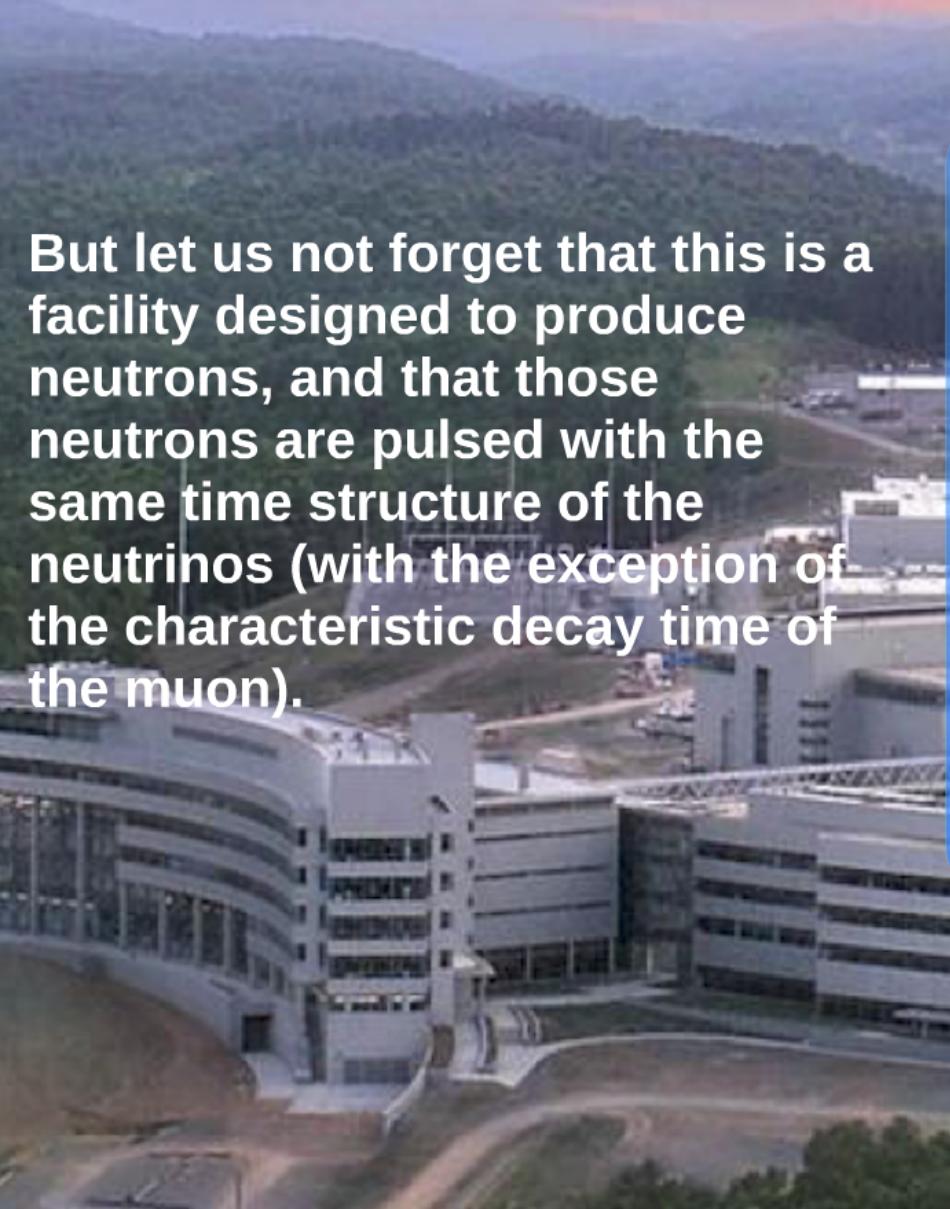


- Decay-at-Rest Neutrino Source
- ν flux $2 \times 10^7 \text{ v}/\text{cm}^2/\text{s}$ at 20 m
- Pulsed: 700 ns width at 60 Hz (background reduction)

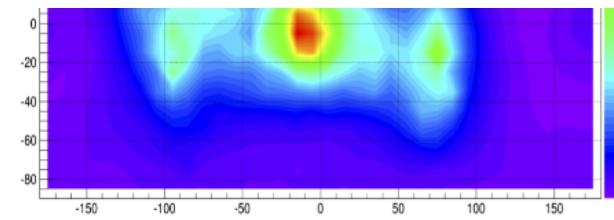
- Recoil spectrum similar to a dark matter detector
- The low duty factor from the beam on target ($\sim 4 \times 10^5$) means that our intrinsic background requirements are much easier to meet.

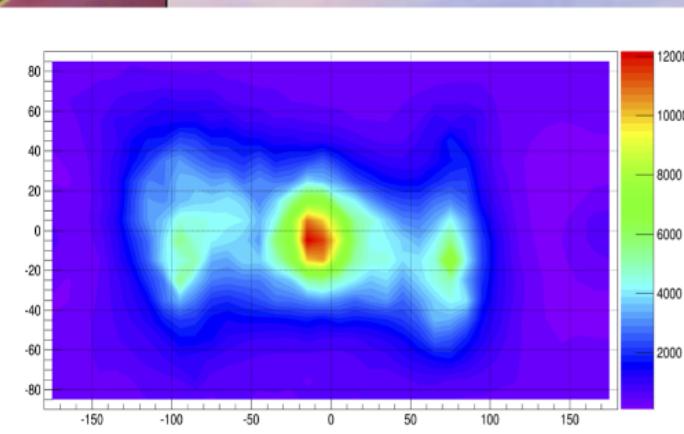


Backgrounds also Pulsed



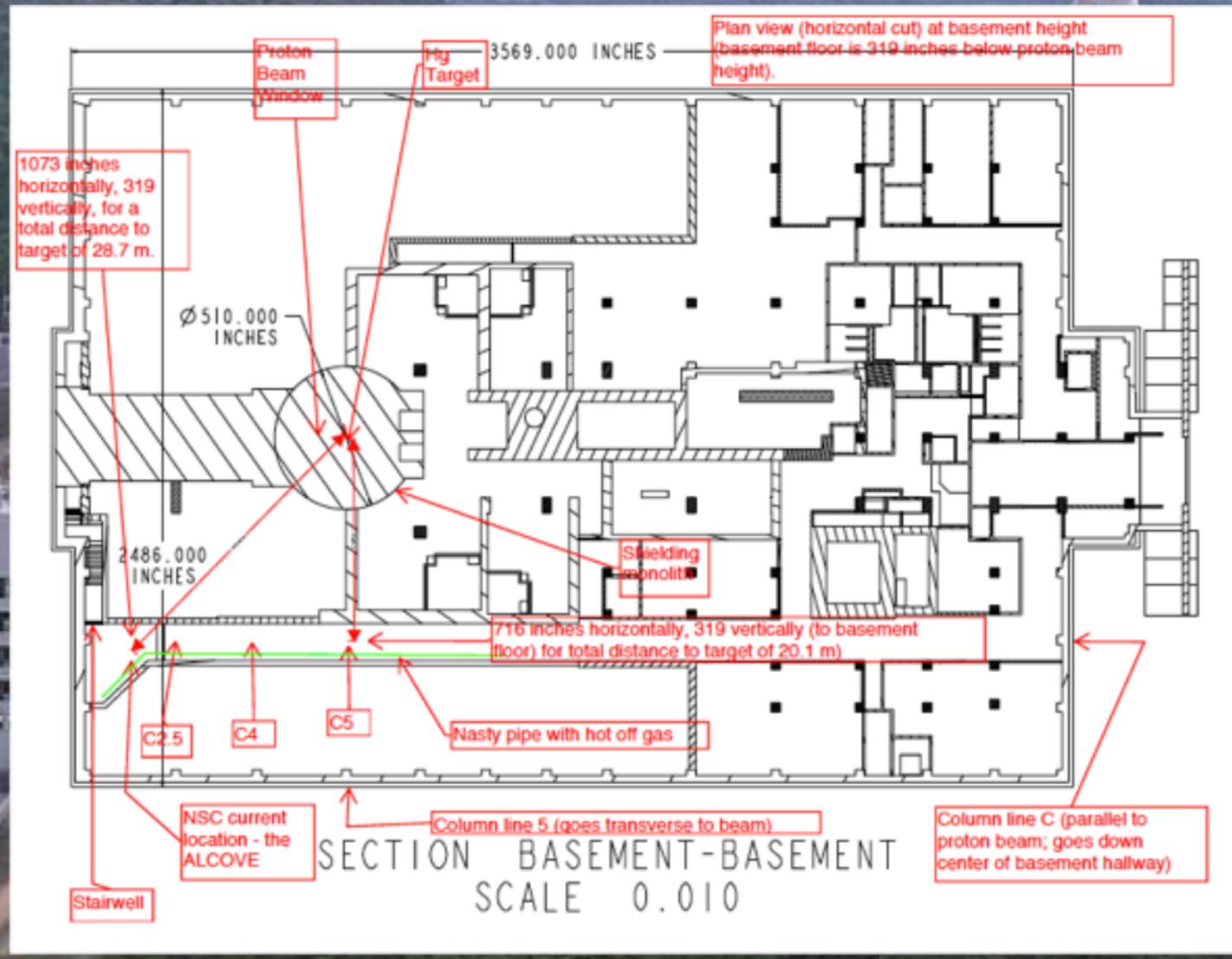
But let us not forget that this is a facility designed to produce neutrons, and that those neutrons are pulsed with the same time structure of the neutrinos (with the exception of the characteristic decay time of the muon).





So far, the basement is the most promising location.

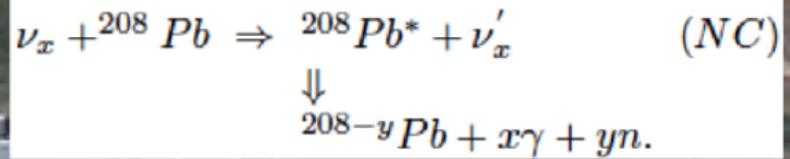
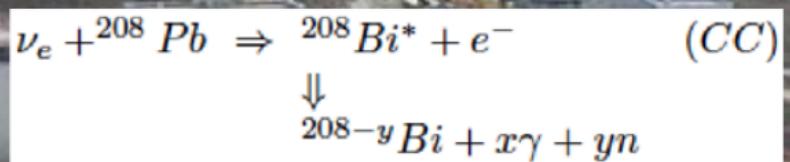
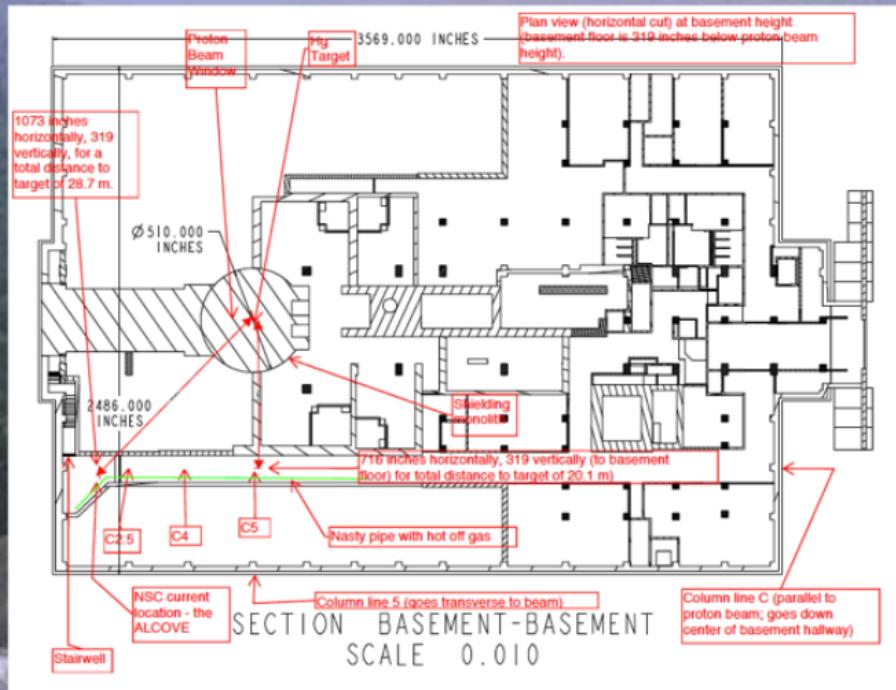
- 20 m from target
- 8 m.w.e.



ν_e

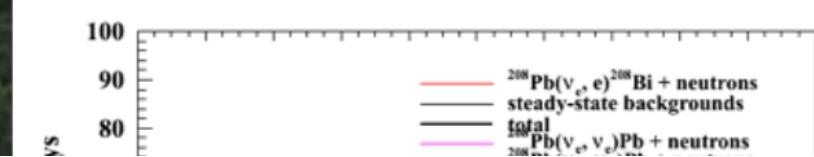
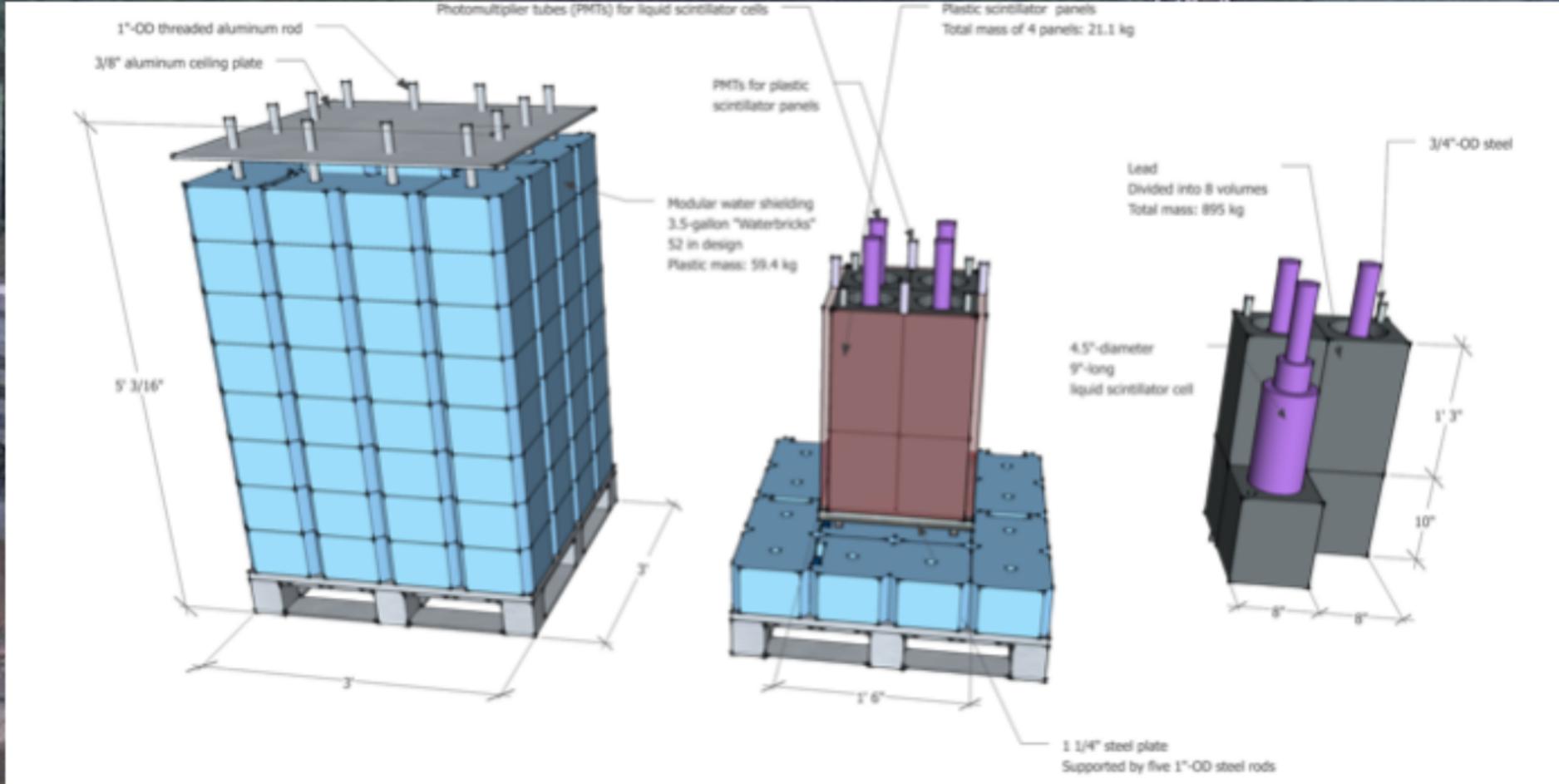
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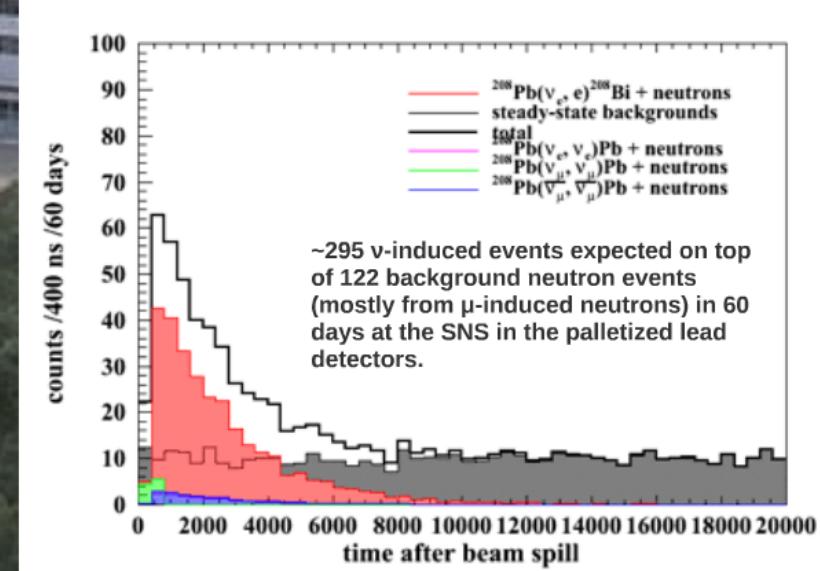
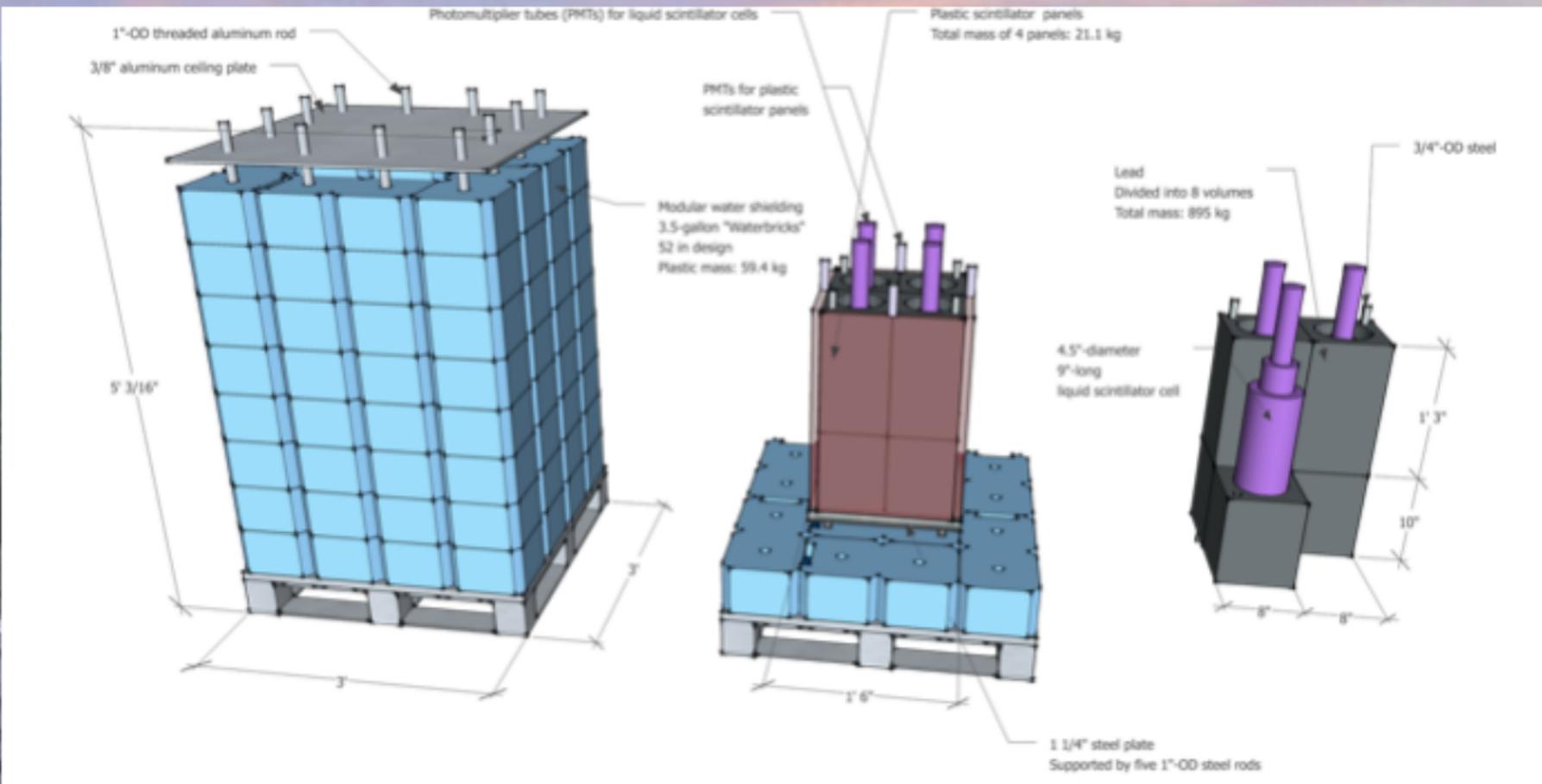
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Yet another background: ν -induced neutrons

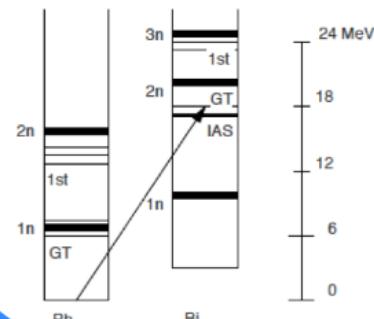
Yet another background: ν -induced neutrons





This is not just academic: interesting measurement for HALO, as well as help in understanding supernovae dynamics and r-process nucleosynthesis.

W.C. Haxton, PRL 60 (1988)
McLaughlin, G. C., Phys. Rev. C 70 (2004) 4
Y-Z. Qian et al., PRC 55 (1997)



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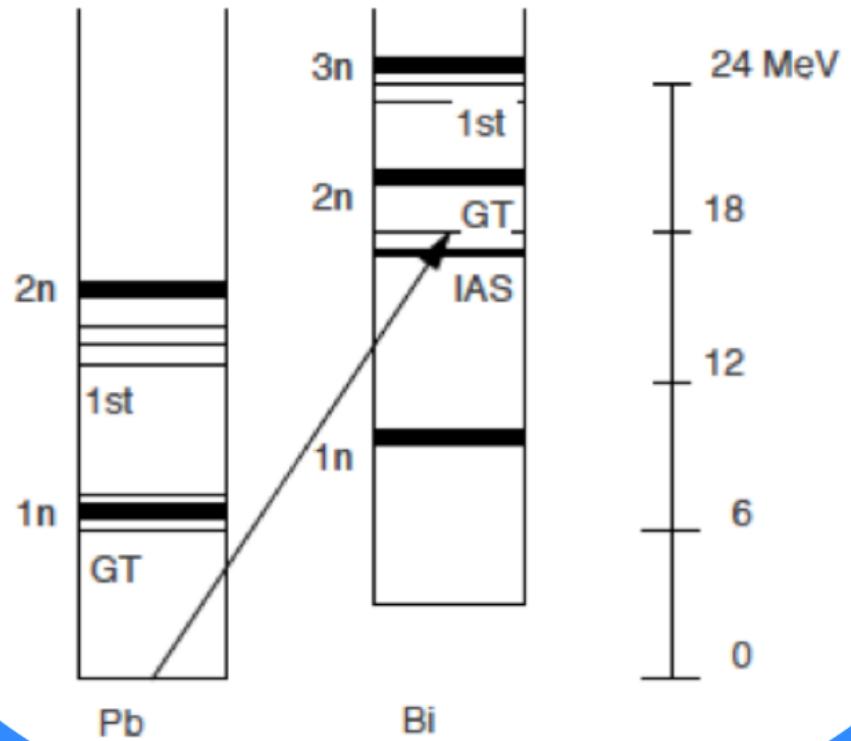
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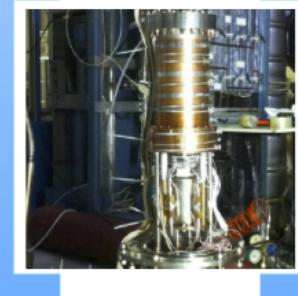
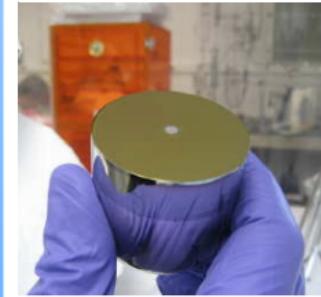
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