NFS of ^{119}Sn

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Tin

- *Sn (stannum)*
- Atomic number 50, a magic number
- Group IV
- Electron configuration, outer shells, $4d^{10}\ 5s^2\ 5p^2$
- Oxidation states, $+2$, $+4$
- Melting point of 505 K, lower than Pb (601 K)
- Bronze age
- Meisener effect, 1933

^{119}*Sn nuclear resonance*

Isotope	E (eV)	Γ (neV)	$t_{1/2}$ (ns)	σ_0 (Mb)	IA(%)
^{119}Sn	23,879.5	25.54	17.86	1.40	8.58
^{57}Fe	14,412.5	4.66	97.81	2.56	2.14

- $1/2+$ to $3/2+$ transition
- $\alpha = 5.12$
- L-fluorescence

^{119}*Sn Mossbauer spectroscopy, NFS*

- 1958 Discovery of the Mossbauer Effrect, ^{191}Ir
- 1959 ^{57}Fe
- 1960 ^{119}Sn
  A Thermal Red Shift of the Recoilless -Emission of ^{119}Sn^{m} (Boyle et al., 1960)
  The Mssbauer Effect in Tin from 120K to the Melting Point (Boyle, et al., 1961)
- 1993 at a SR
  Time resolved nuclear resonant scattering from 119Sn nuclei using synchrotron radiation (Alp, et al., 1993)
  Both coherent and incoherent channels of NRS (Kikuta, 1994)
- 1998 onward, NRIXS of Sn

Coherent and incoherent channels of NRS

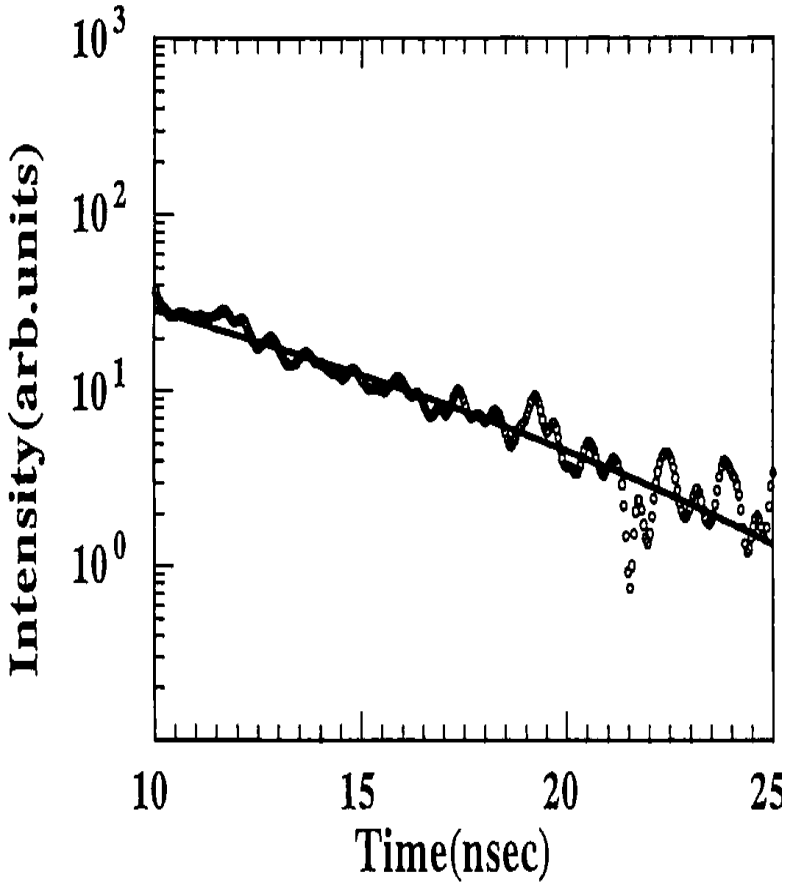


Fig. 4. The time spectrum of nuclear forward scattering by a 44 μ enriched polycrystalline Sn foil. The open circles represent the measu ments and the solid line is the result of a fit described in the te

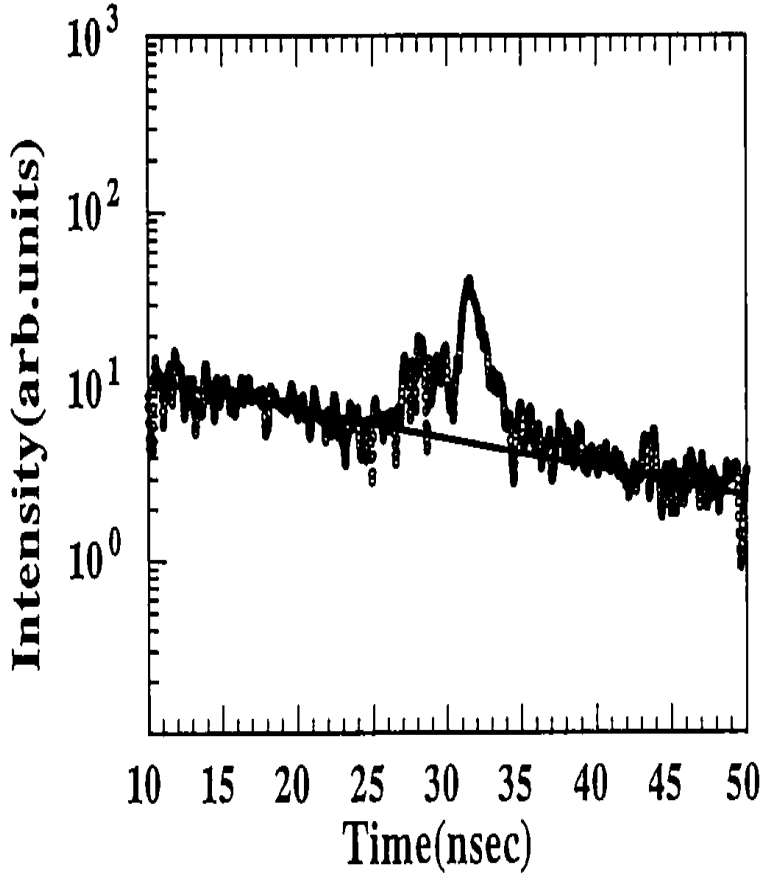


Fig. 5. The time spectrum of nuclear high angle scattering by a 44 μm enriched polycrystalline Sn foil. The open circles represent the measurements and the solid line is the result of a fit described in the text.

S. Kikuta, Hyperfine Interactions 90, 335 (1994)

Nuclear resonant scattering from ^{119}Sn nuclei using synchrotron radiation

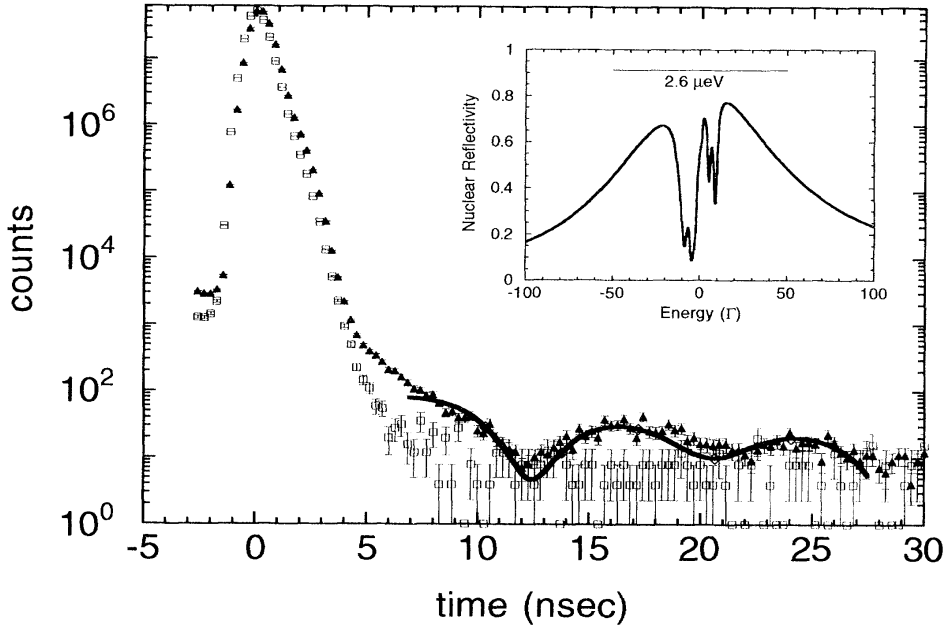


FIG. 5. The time-resolved nuclear resonant spectra of the SnO-containing sample, measured using a high energy resolution crystal monochromator and a SnO_2/Pd GIAR nuclear monochromator. Solid triangles are on-resonant and empty squares are off-resonance spectra recorded over a 2 h period. The solid line is a theoretical fit, providing a new way of performing Sn Mössbauer spectroscopy to measure hyperfine interaction parameters with synchrotron radiation. The inset is the combined response of the GIAR film and the absorber in the energy domain.

Alp et al., Phys. Rev. Lett. 70, 3351 (1993)

NRS facilities at APS

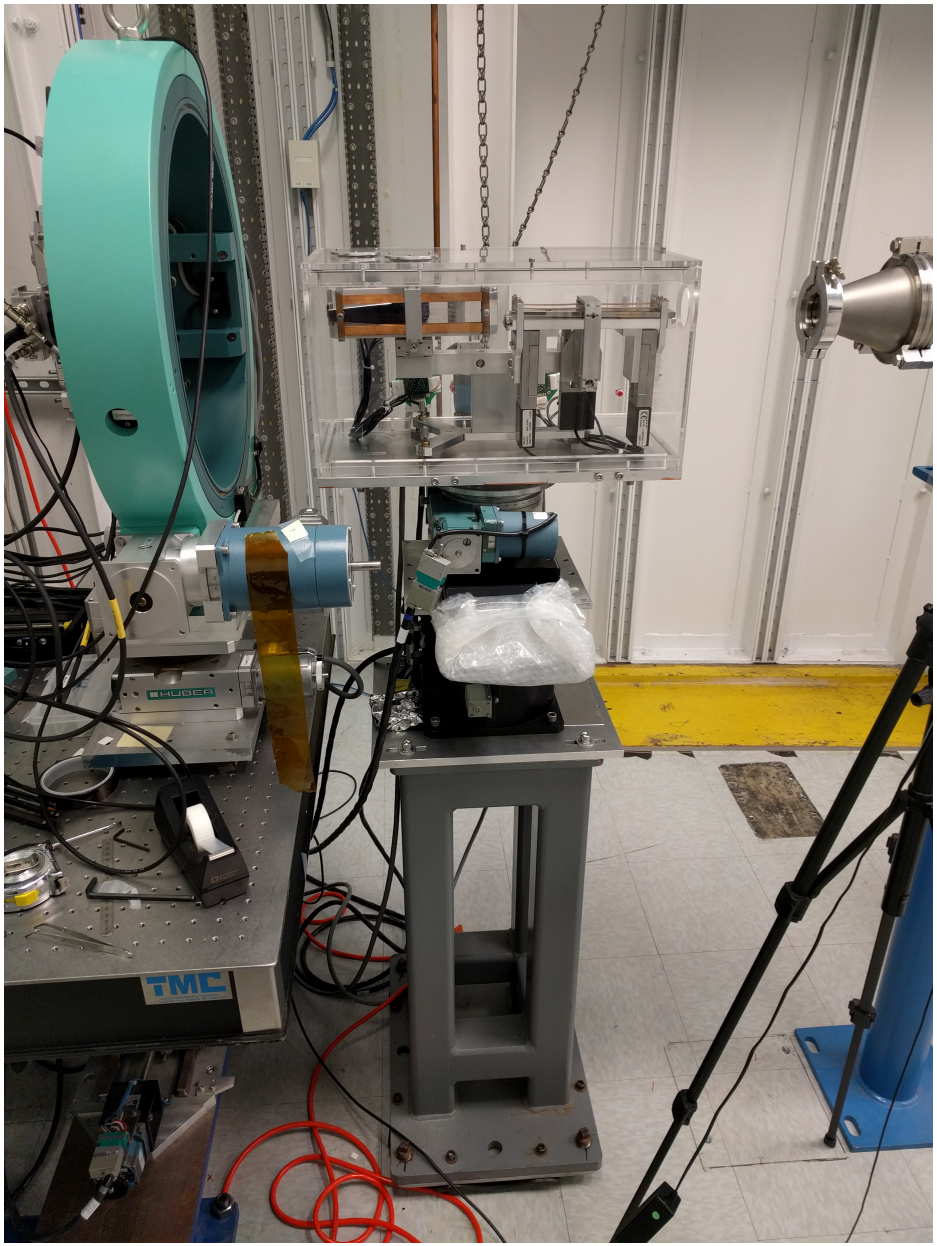
- 3-ID *full time*, **Fe, Eu, ~~Sn~~, Dy, Kr**
- 16-ID *part time*, **Fe**
- 30-ID *part time*, **Sn**
- Mössbauer lab

^{119}*Sn NRS at APS 30-ID*

- HERIX at 23.725 keV; ^{119}Sn NRS at 23.880 keV
- Two undulators, 2.4 m each, 1.72 cm period
  Energy range of 23.5 to 26 keV, first harmonic
- Cryocooled HRM, energy resolution 0.9 meV
- Flux of 4 GHz
- Focusing to 15 x 30 μm^2
- LT, HT, HP
- Accepting GUP

30ID-B

30ID-B



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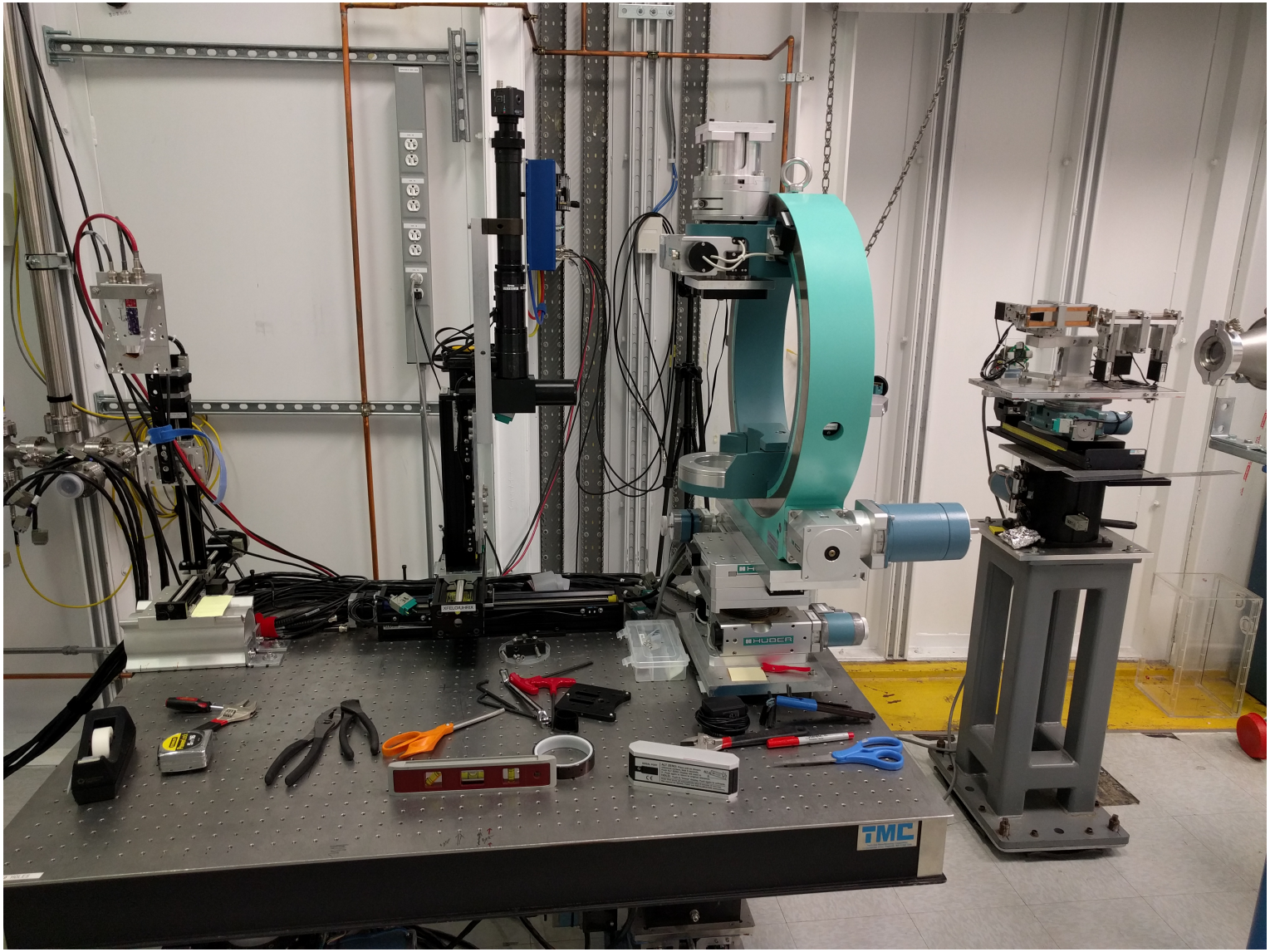

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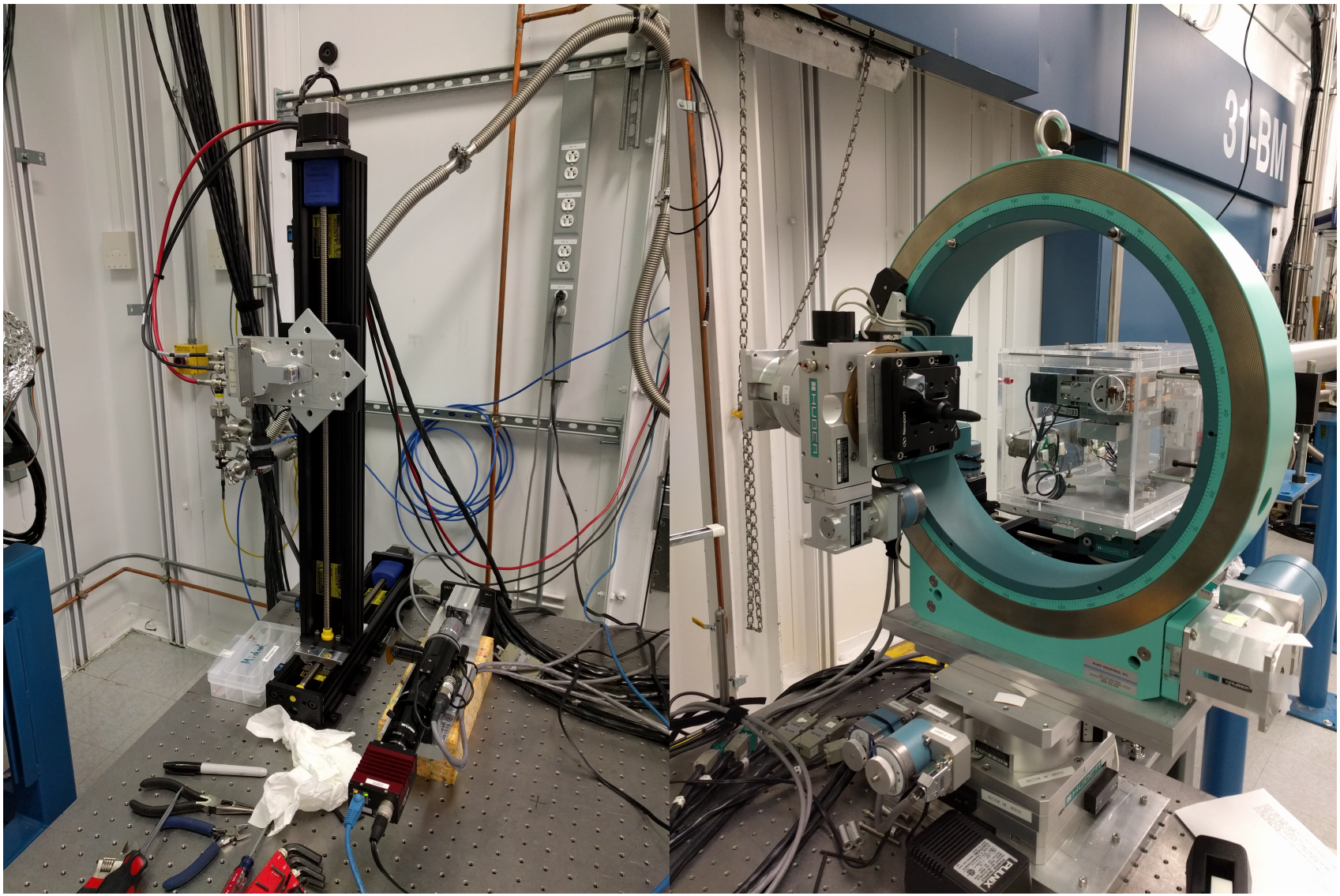
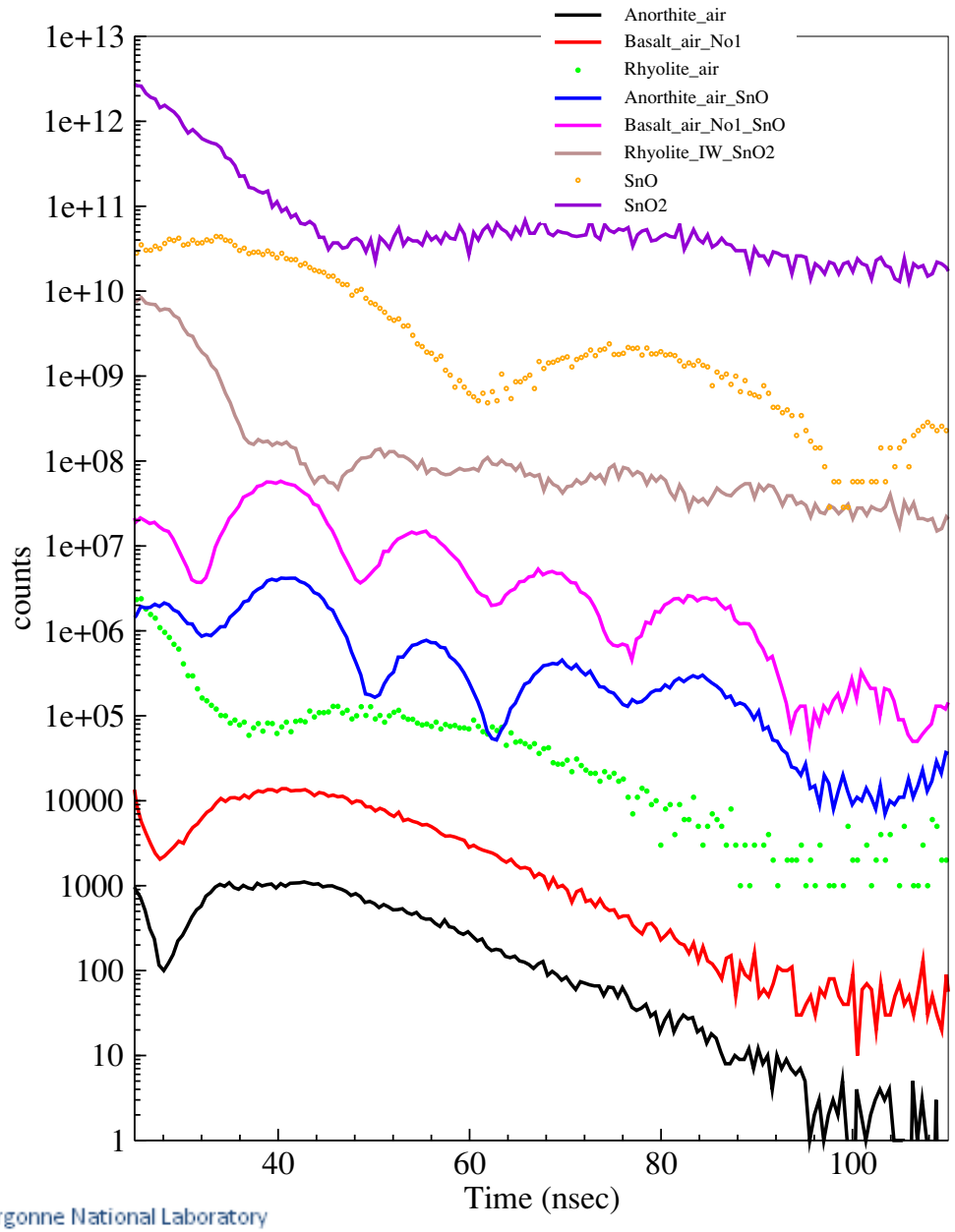


^{119}*Sn NRS at APS 30-ID: Applications*

- clathrates
- molecular solid under pressure
- Sn nano structures
- thermoelectrics, single crystals, HP
- alloys, minerals, glasses
- photovoltaic materials
- thin films, multilayers
- Sn organics

- Sn containing minerals, glasses
- single molecule magnets
- Sn anode materials

NFS of minerals



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Thank you.