

ORNL FY22 NCSP Time-of-Flight Measurements

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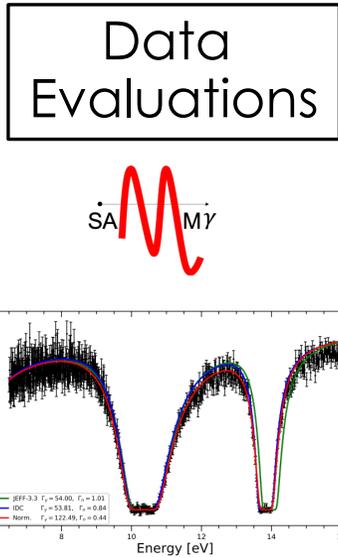
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Technical Program Review – NCSP: Feb. 20-23, 2023

Nuclear Data Cycle: Foundational Measurements



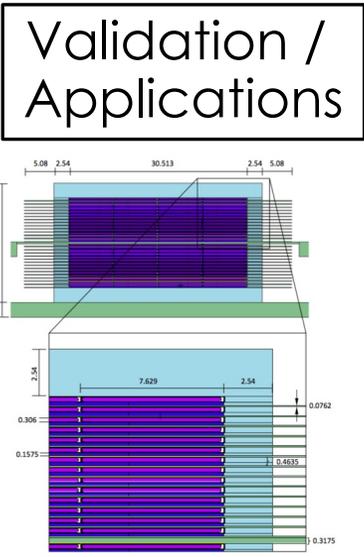
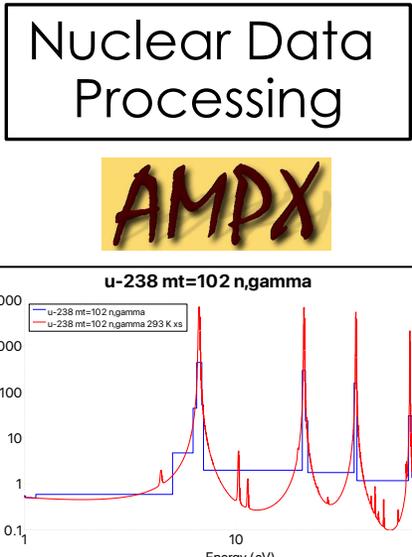
Differential Measurements



Evaluated Nuclear Data Files (ENDF)

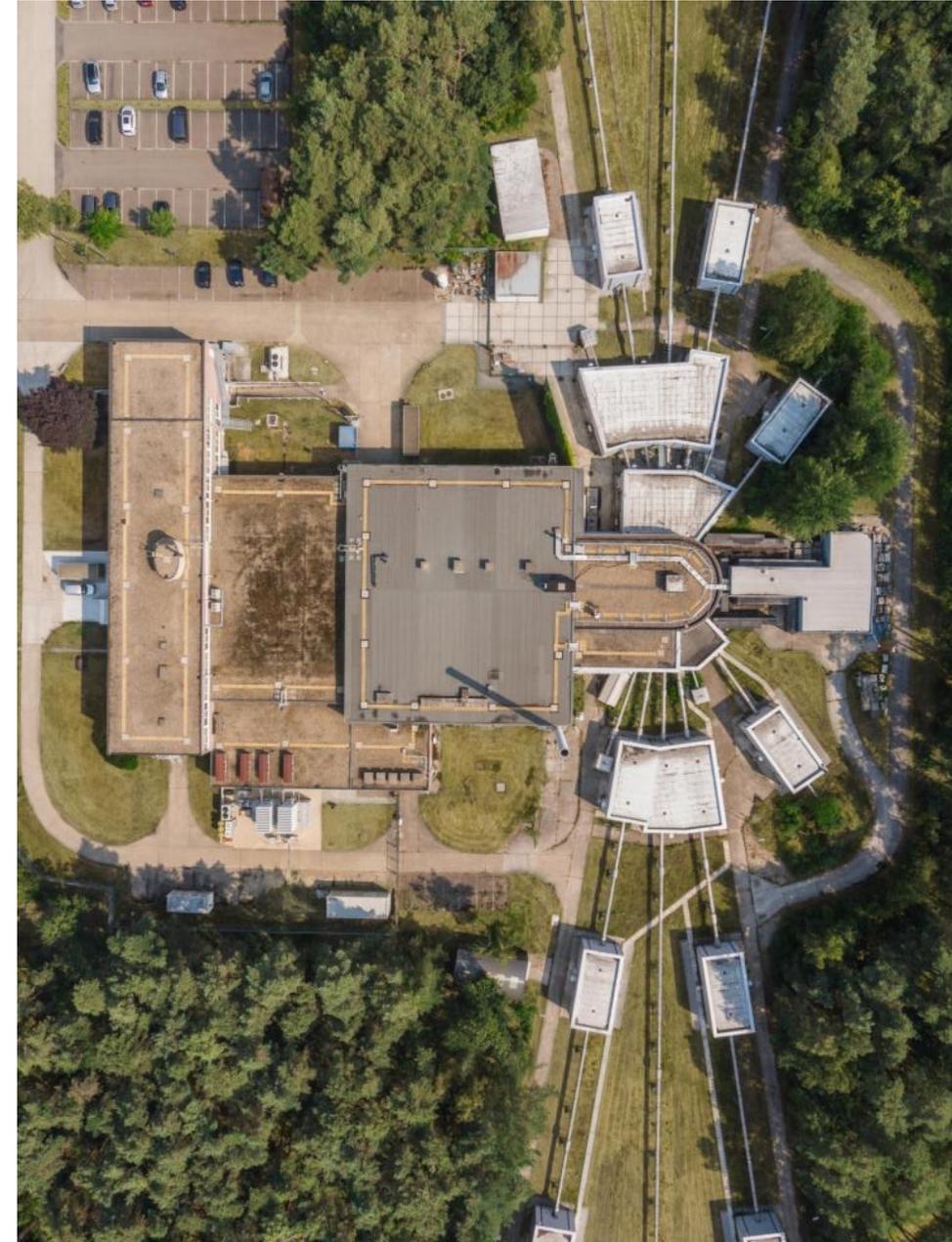
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    1.000000+0 1.500000+0 0 0 10 02034 1451 3
    0.000000+0 0.000000+0 0 0 403 1822434 1451 4
    244-Cr-53 LBNL,ORNL EVAL-OCT97 S.Chiba,M.Chadwick,K.Shibata 2434 1451 5
    CR53 CR53 0157-FEB10 9577 2011022 2434 1451 6
    -----ENDF/B-VII.1 MATERIAL 2434 REVISION 3 2434 1451 7
    -----ENDF/B-VII.1 DATA 2434 1451 8
    -----ENDF/B-VII.1 TITEL 2434 1451 9
    -----ENDF/B-VII.1 2434 1451 10
    -----ENDF/B-VII.1 2434 1451 11
    S. Kunieda (LANL/JAEA) updated the alpha-particle production
    cross sections and energy spectra in MFMTS , based on the
    improved Iwamoto-Harada model.
    (Sep 3,2011) 2434 1451 13
    -----ENDF/B-VII.1 2434 1451 14
    -----ENDF/B-VII.1 2434 1451 15
    -----ENDF/B-VII.1 2434 1451 16
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    -----ENDF/B-VII.1 2434 1451 19
    -----ENDF/B-VII.1 2434 1451 20
    Covariances for Cr-53, S. Hoblit, BNL, Aug. 2011
  
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GELINA experiments

- Energies: sub-thermal to ~ 20 MeV
- Multiple FPs: 10 m to 400 m
- 1 ns burst width
- C_6D_6 capture detector (60 m)
- 6Li -glass transmission detector (25 m)



Isotopic Zr Campaign (ORNL-ND1)

- Goal: improve accuracy of evaluated XSs for $^{90,91,92,94}\text{Zr}$
- Investigating:
 - Comparison to ENDF/B-VIII.0
 - Discrepancies with previous data
- Evaluate using:
 - Harvey/De - 1975 (ORNL transmission measurements)
 - Tagliente – 2008
 - New ORNL/GELINA isotopic Zr measurements

Existing Zr-90 measurements

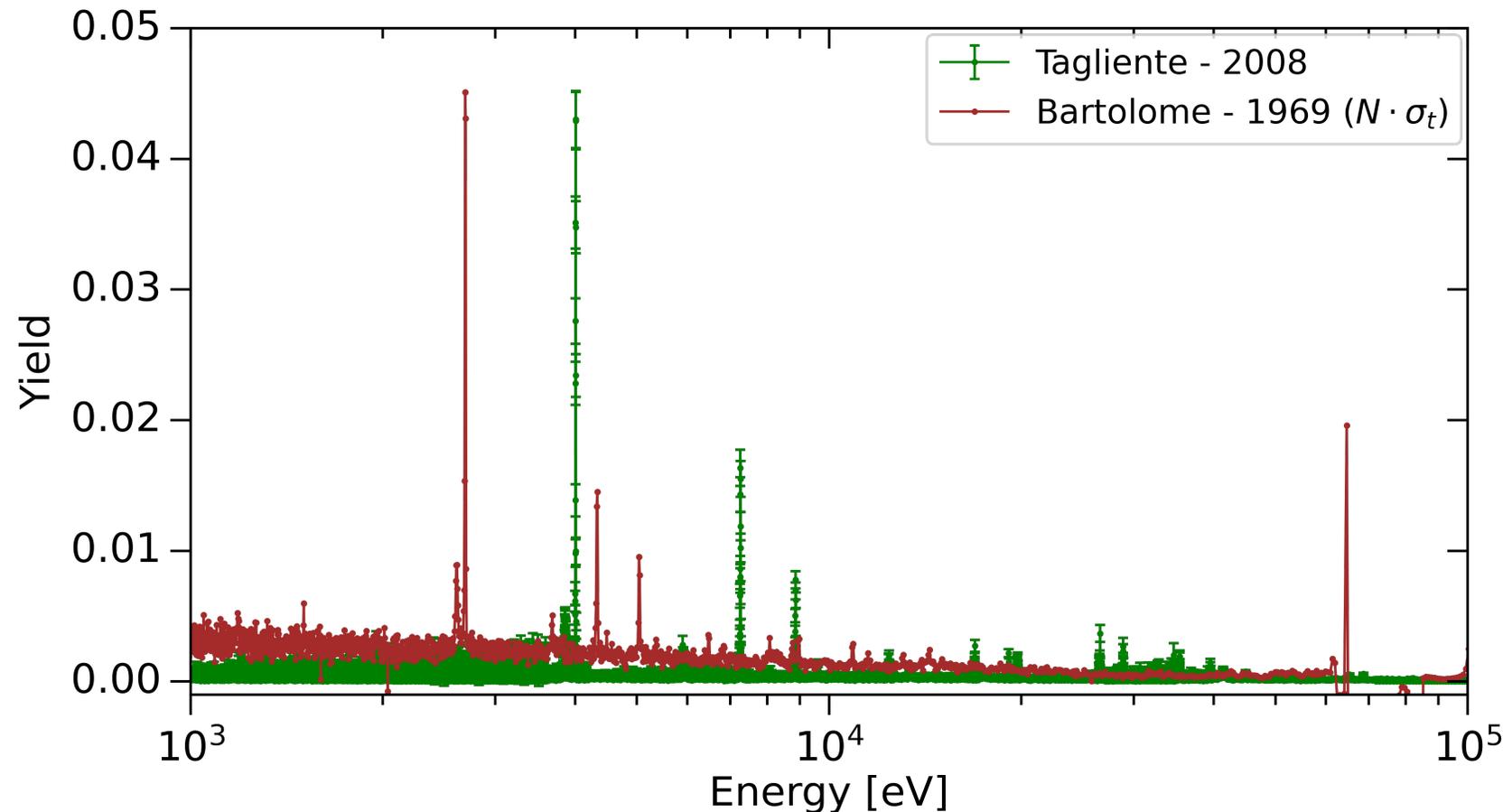
- 2 high-resolution capture measurements

- Tagliente 2008

- ZrO₂ sample
- Enrichment 97%
- $n = 0.0035$ [at/b]
- FP: 185 m

- Bartolome 1969

- ZrO₂ sample
- Enrichment: 97%
- $n = 0.0109$ [at/b]
- FP: 25 m
- *questionable energies*
- *No uncertainty*

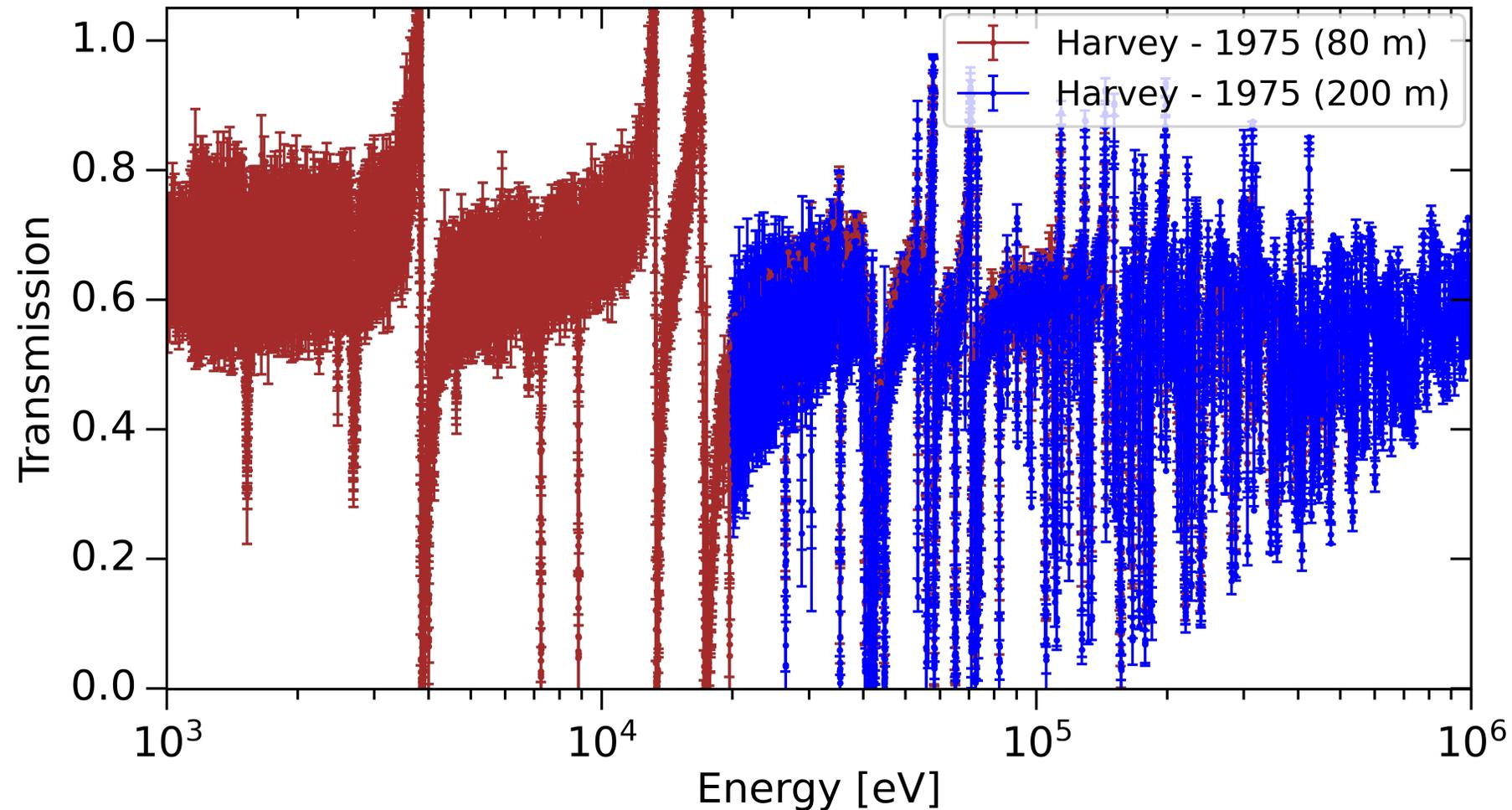


Existing Zr-90 measurements

- 1 set of high-resolution transmission measurements

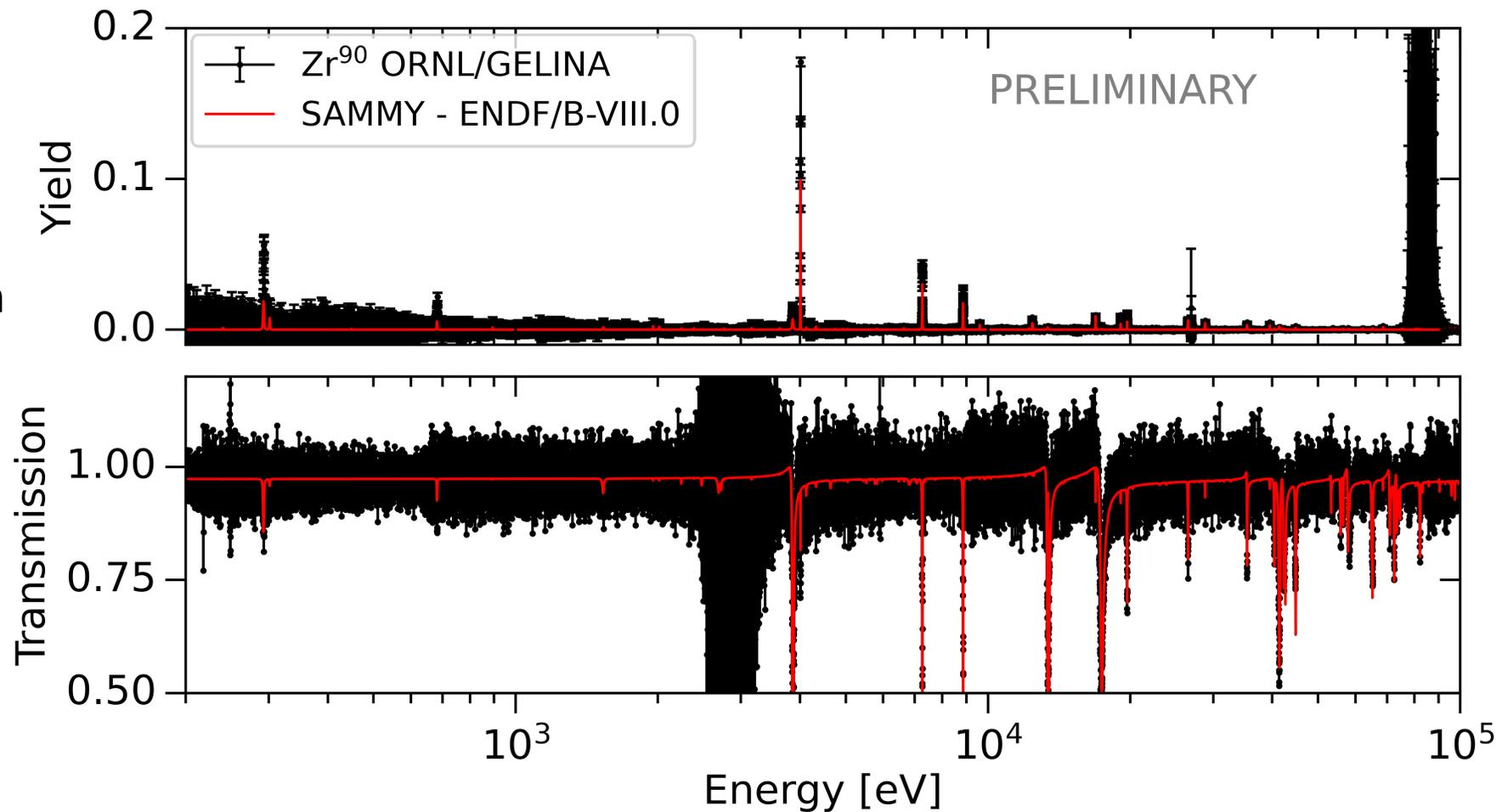
– Harvey/De – 1975

- Metallic Zr
- Enrichment: 97%
- $n = 0.0827$ [at/b]
- 80 m
- 200 m



Zr-90 capture yield

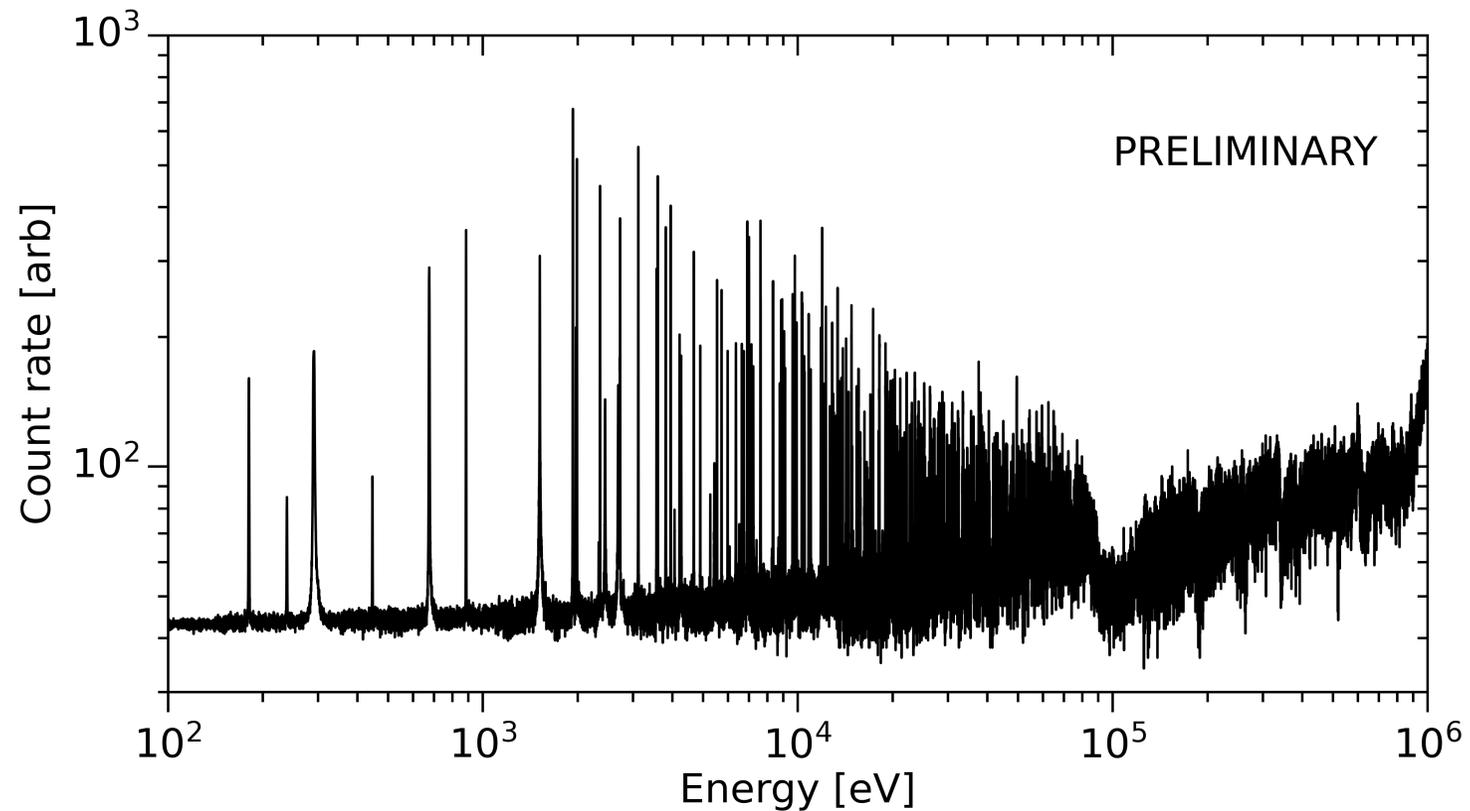
- Metallic Zr
- Enrichment: 97%
- $n = 0.0051$ [at/b]
- FP: 60 m
- C_6D_6 capture system
- Sample thickness: ~ 1 mm



see Greg Siemers talk for more discussion!

Sneak Preview! (FY23)

- Zr-91 capture Nov/Dec 2022

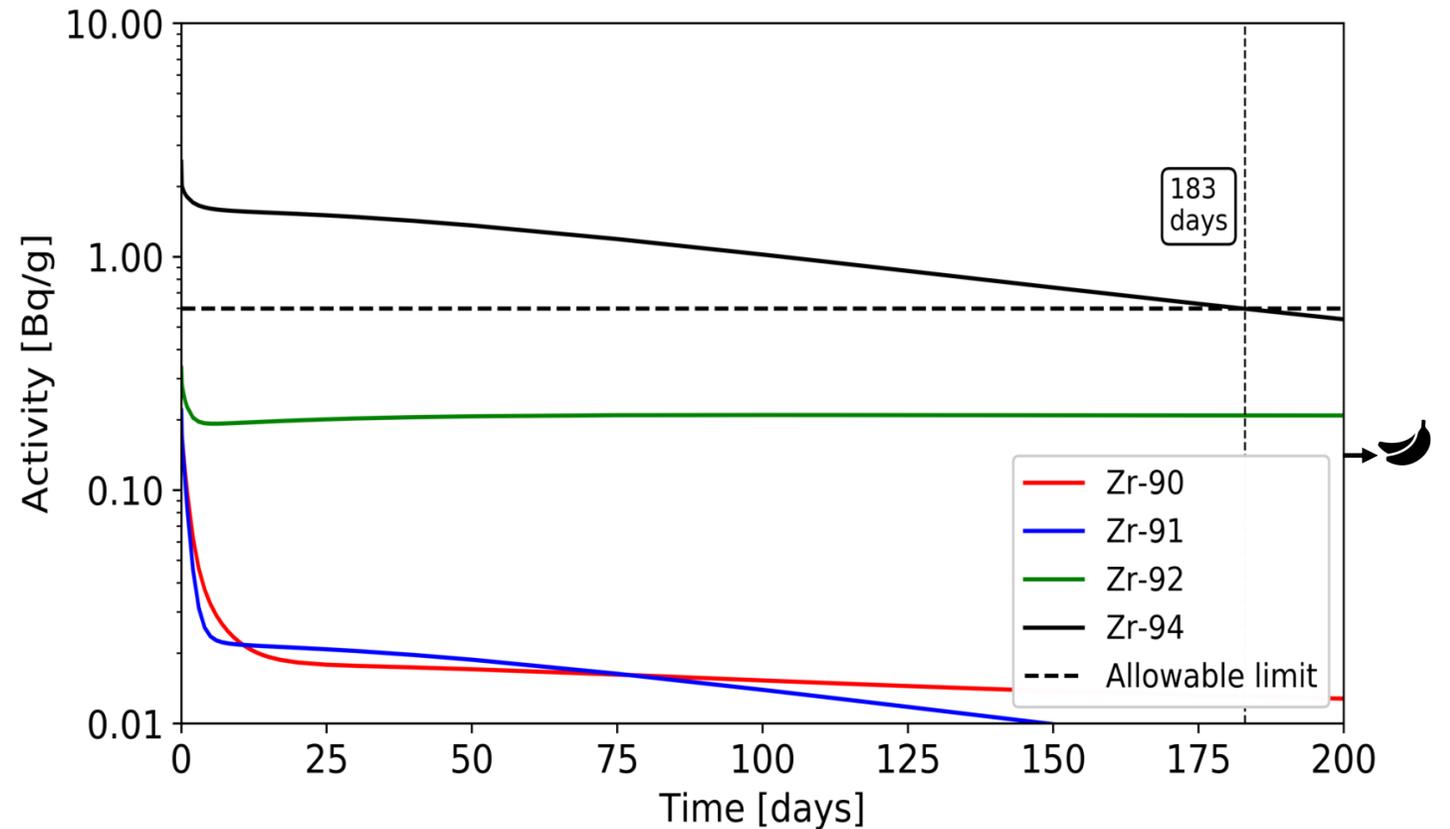


Key take-aways

- First of 4 isotopes (90,91,92,94) to be measured
- To be jointly evaluated with SAMMY
- New data will be used to improve evaluation accuracy, benefitting transport calculations of reactors, waste storage, etc.

Zr-92 Isotope Leasing (ORNL-ND3)

- Sample fabrication ongoing during FY23
- Metallic Zr
- Enrichment: 95%
- $n = \text{TBD}$
- FP: 60 m
- C_6D_6 capture system
- Sample thickness: **TBD**



Key take-aways

- Process initiated in FY22
- Lease starts Mar. FY23 (**delayed**)
- 30% increase in cost to sample fabrication

Acknowledgements

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The entire Nuclear Data Group at ORNL