NCSP Related Nuclear Data Research at RPI

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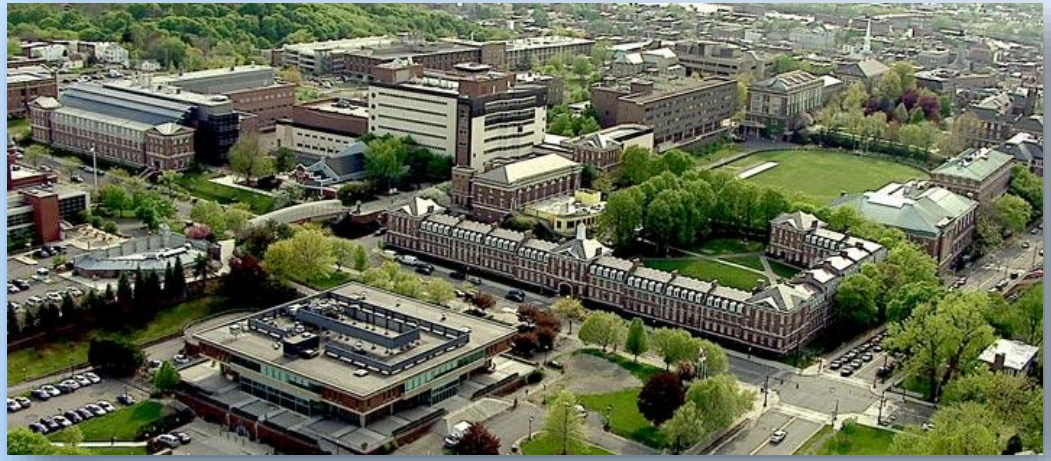

NCSP Technical Program review, Albuquerque, NM, February 21-23, 2023

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Rensselaer

NCSP NUCLEAR CRITICALITY SAFETY PROGRAM

NAVAL NUCLEAR LABORATORY

linac The Gaerttner LINAC Center

RPI Nuclear Data Group

RPI Faculty
Prof. Yaron Danon - LINAC Director

LINAC Technical Staff
Peter Brand - Director, Operations
Michael A. Bretti - Research Support Engineer
John Fava - Research Support Engineer
Matt Gray - Sr. Research Support Technician
Azeddine Kerdoun - Sr. Research Support Technician
Edwin Frank - Research Support Technician
Brian Martindale - Research Support Technician

Graduate Students in 2022
Adam Ney (PhD, graduated)
Dominik Fritz (PhD, graduated)
Sukhjinder Singh (PhD)
Peter Brain (PhD)
Katelyn Cook (PhD)
Benjamin Wang (PhD)
Gregory Siemers (PhD)
Alec Golas (PhD)

NNL
Dr. Tim Trumbull
Dr. Devin Barry
Dr. Michael Rapp
Mr. Brian Epping
Dr. Adam Daskalakis
Dr. Amanda Lewis

Red *= staff, researchers, or graduate students partially supported by NCSP*
Orange = NCSP related work (appendix D)

Overview of FY 2022 activity

- **ND1 – Cross section measurements ($471K, ~$50K CO to FY23)**
  - Fe-54 measurements and evaluation (**Sukhjinder Singh**)
  - Evaluation work on Zr isotopes (**Gregory Siemers**)
  - Improvement to SAMMY URR capabilities (**Alec Golas**)
  - Lead isotopes evaluation (**Peter Brain**)
  - Thermal cross section measurements (**Dominik Frits**)

	Pre-FY2022	FY2022
Iron (^{54}Fe)	RPI	RPI
	IRSN	IRSN

Lead (^{204,206,207,208}Pb)	ORNL	ORNL	ORNL
	RPI	RPI	RPI
	BNL	BNL	BNL
	NNL	NNL	NNL
	IRSN	IRSN	IRSN

Zirconium (^{90,91,92,94,96}Zr)		
		BNL

RPI?

- **ND3 – LINAC refurbishment ($0K + $30.4K CO)**
  - Improve NCSP and NR nuclear data measurement capabilities
    - Major purchases completed or in progress, some delivered (Klystrons, Modulators, Accelerator Sections)
    - Working on onsite testing and deployment.
    - Current completion date is projected to 2025
  - A short update will follow

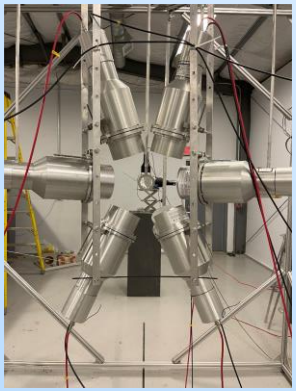
	Pre-FY2022	FY2022
Yttrium Hydride (YH_x)	RPI	RPI

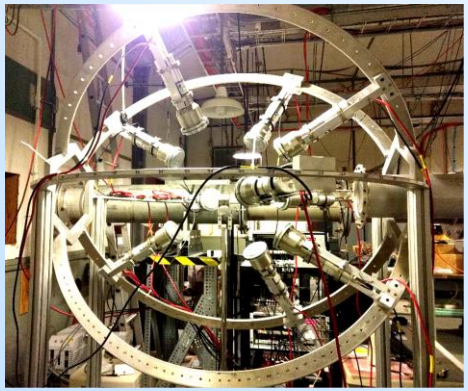
RPI ND-Group Research

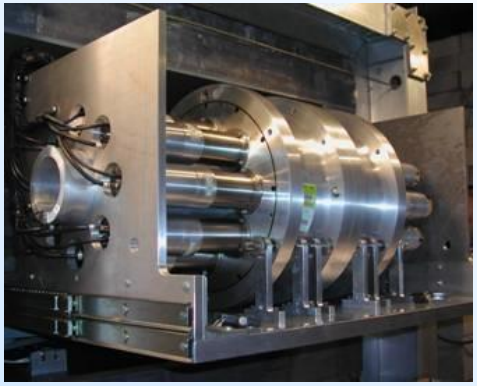
Research topic	Student	Degree
Development of high efficiency (alpha,n) neutron detector	Adam Ney	Ph.D. Graduated
Development of a cold neutron moderator and total cross section measurements	Dominik Fritz	Ph.D. Graduated
Neutron Capture Measurements in the keV energy range (Cr-53, Fe-54)	Sukhjinder Singh	Ph.D.
Improvements of nuclear data evaluations for lead isotopes in support of next generation lead-cooled fast systems	Peter Brain	Ph.D.
Neutron die away experiments	Benjamin Wang	Ph.D.
Neutron induced gamma production measurements in the RRR and URR	Katelyn Cook	PhD.
Evaluation of Zirconium isotopes	Gregory Siemers	PhD.
Improvement to SAMMY for URR evaluation methods	Alec Golas	PhD.

NCSP funded

NCSP related

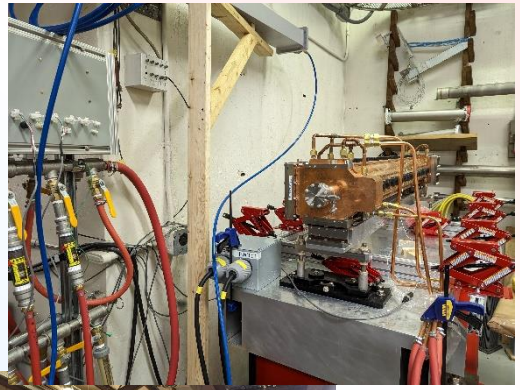




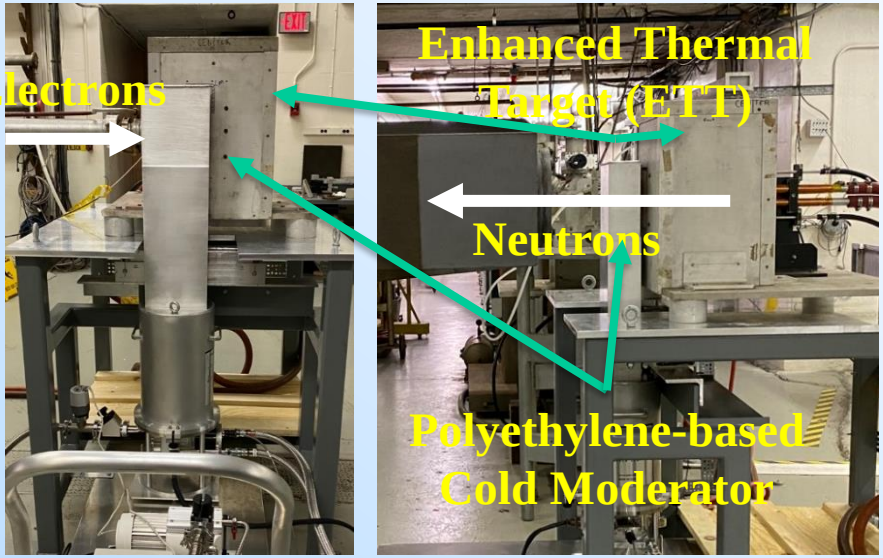


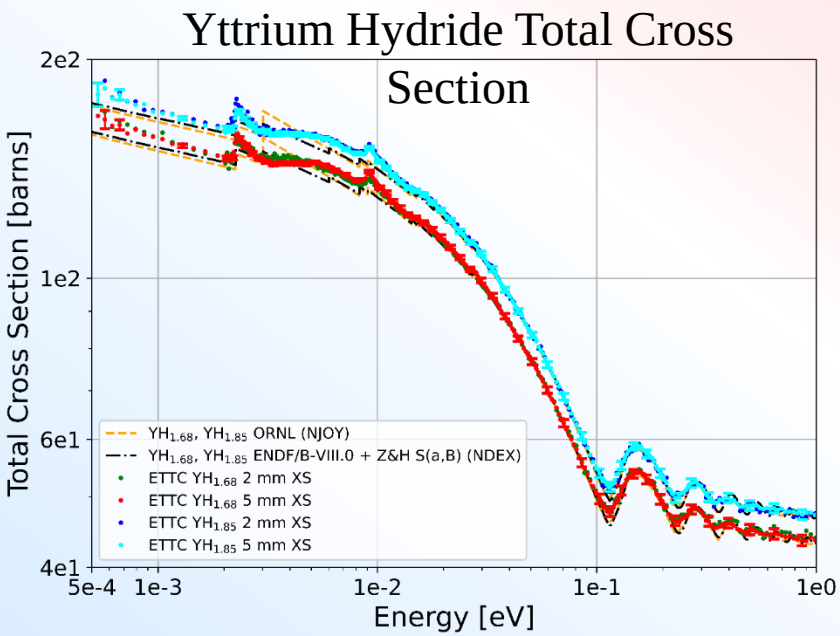
Update on LINAC refurbishment (ND3)

- **Details were given in NR/NCSP review in October 2022**
- Important Dates: Current LINAC shutdown date 10/2023. Complete upgrade in 2025.
- Currently working on
  - Created a standalone modulator + klystron setup to test RF windows
    - Temporary solution for poor vacuum seals.
  - Testing a speed of light accelerating section.
- RPI facilities:
  - Installed new water and high-power electric lines to the 2nd modulator used for RF windows testing.
  - Constructed a new storage building to house some new components and accelerator components removed during LINAC demolition.
  - Removed and old TP storage building and cooling tower to make room for a new one.



ETTC Target System (Dr. Fritz)





Achievements:

- Constructed the Enhanced Thermal Target + Cold Moderator ➔ ETTC. **Net neutron flux improved by up to a factor of 8 below 0.02 eV**.
- **14 new total cross section measurements and covariances submitted to EXFOR** for various moderator materials over the entire thermal energy region (polyethylene, polystyrene, Plexiglas, yttrium hydride).
- Published **3 journal, 2 conference papers, and a PhD thesis**.