

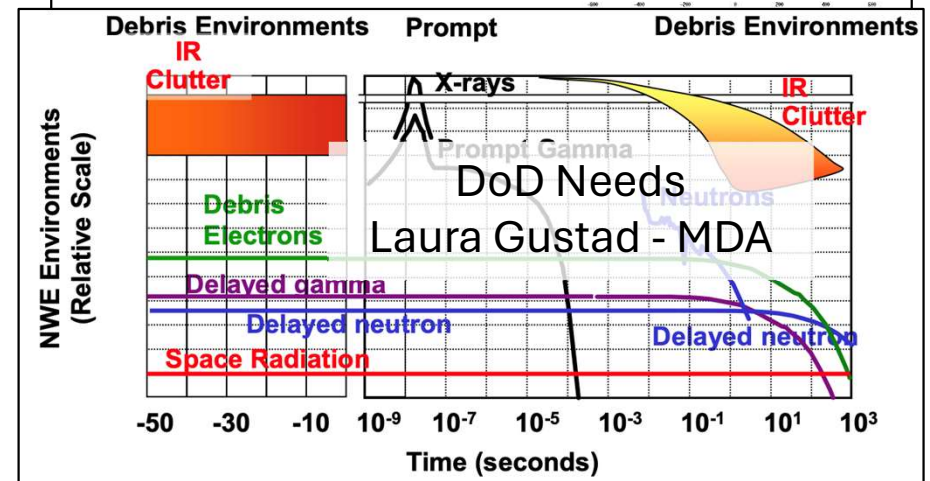
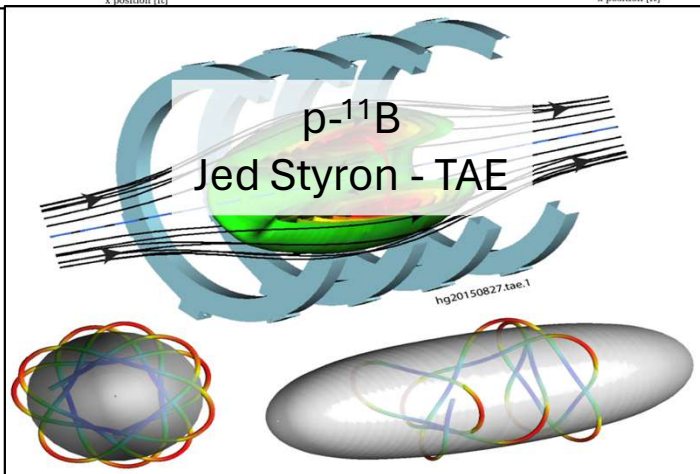
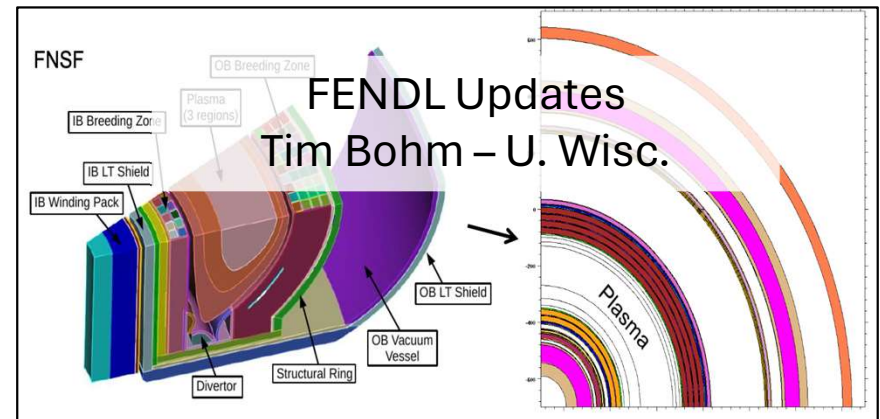
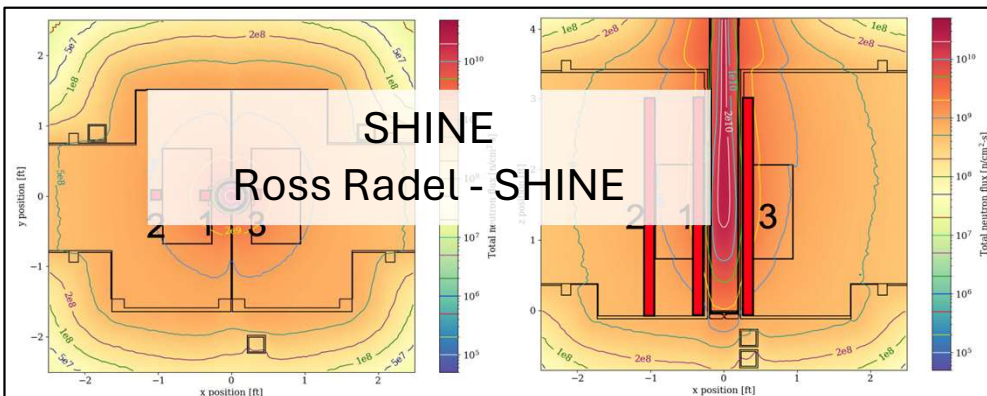
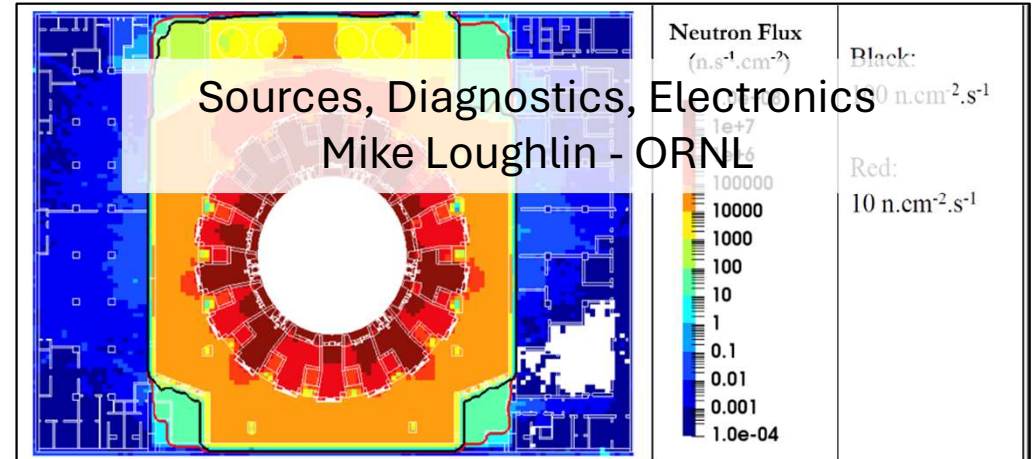
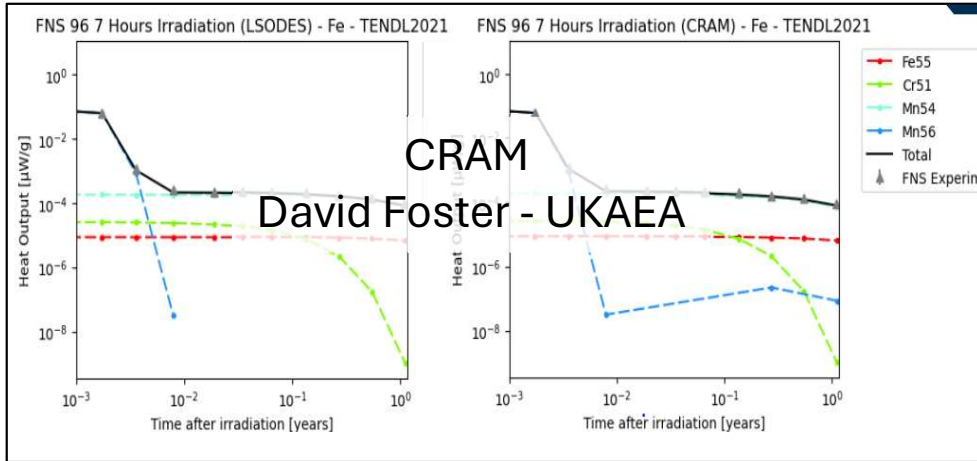
# Fusion Neutronics Session

## Session Overview

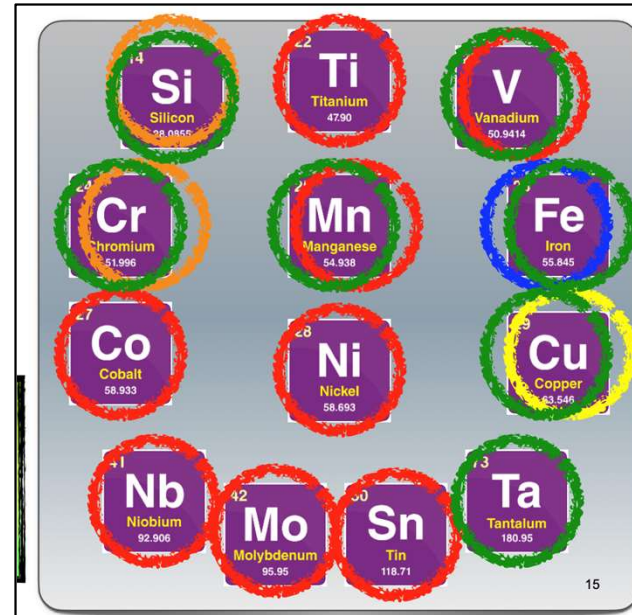
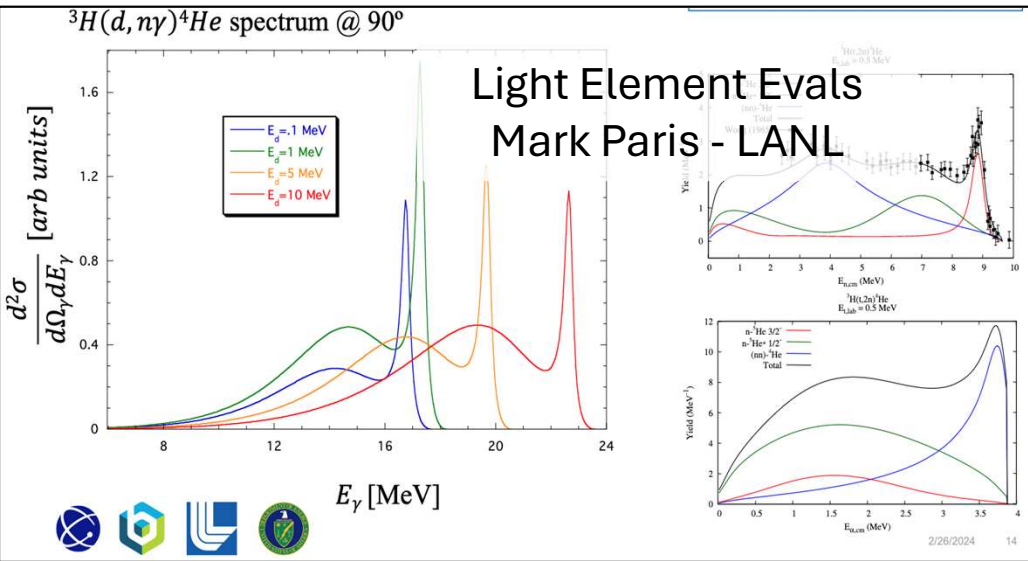
Laura Gustad (MDA)  
Keegan Kelly (LANL)  
Mike Loughlin (ORNL)

1. What are the anticipated reactions for energy production, and do specific data needs exist?
2. What are the products of these reactions, and are there data needs for understanding secondary reactions?
3. Are there gaps in current neutronics code capabilities to accurately model the interactions?
4. ND must accurately predict shielding, activation, dose rates, and neutron diagnostics.
5. What data are necessary to operate neutron sources (IFMIF, FPNS, etc.)?

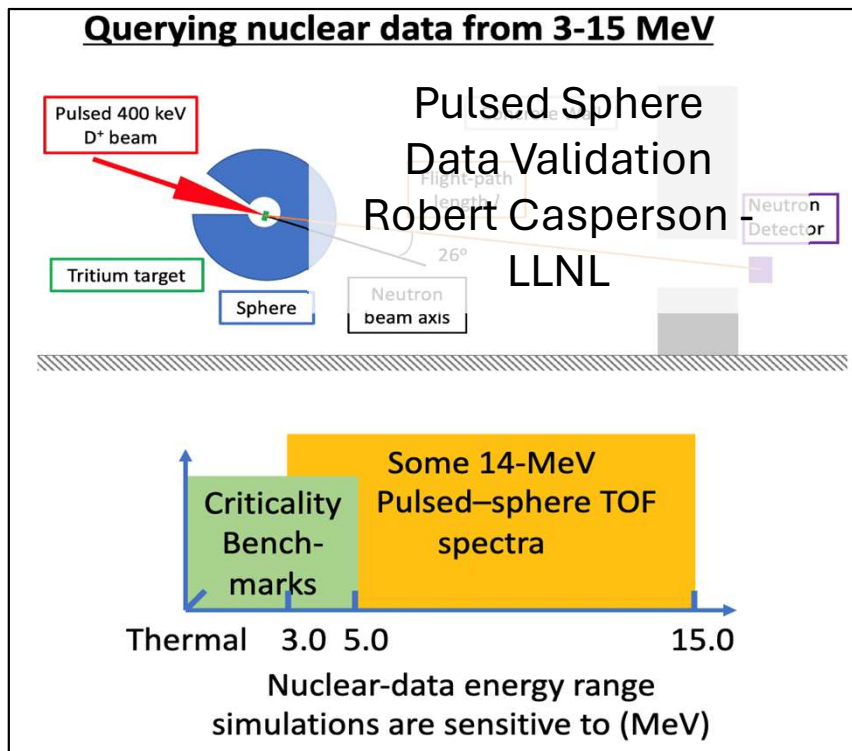
# Application/User Perspective



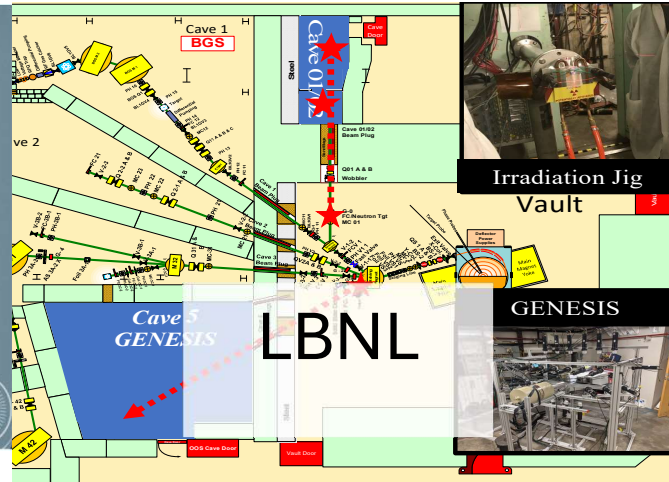
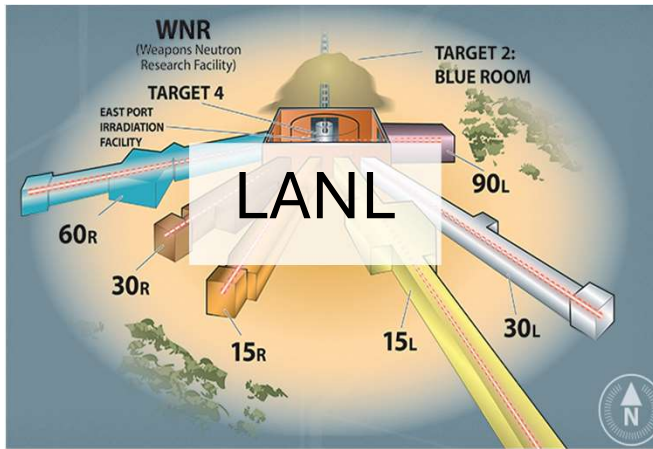
# Nuclear Data Evaluations



Heavy  
Evals  
Gustavo Nobre  
- BNL



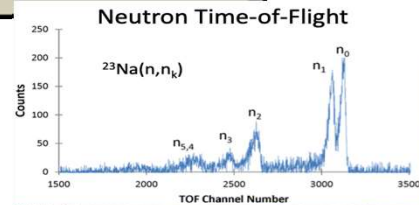
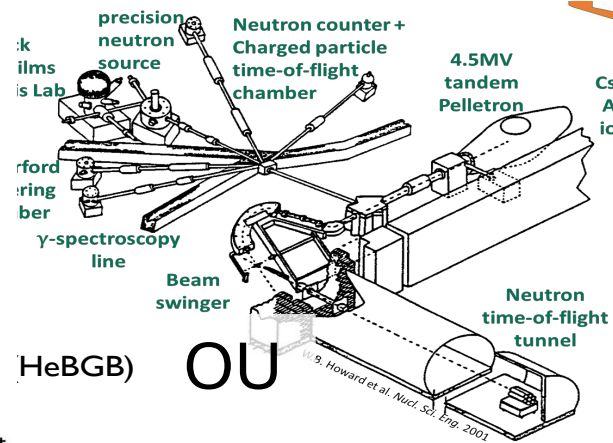
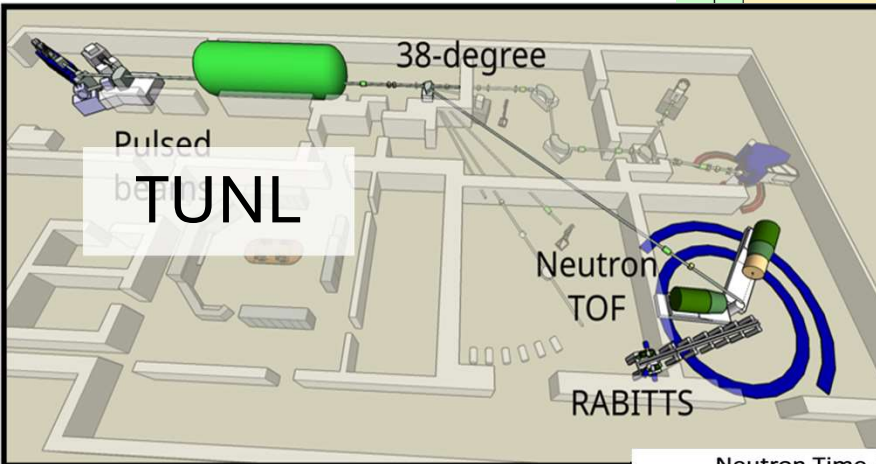
# Experimental Capabilities



Photoneutrons		PN	EJ301 Array
Fission	LSDS fission $\sigma_f$ / fragment dist. / Capture rates	BT	PFNS
	ETT/C Multiplicity Detector	Multiplicity Detector	BBT/PAC
Scattering	BBT	Multiplicity Detector	BT
	Multiplicity Detector	ETT/C	PAC
Capture	BBT/PAC	C, D <sub>e</sub> Capture Detector	
	Multiplicity Detector	Multiplicity Detector	ETT/C
Transmission	BBT/PAC/BBT	PAC	100m LiGlass Detector
	15m LiGlass Detector	25m/30m LiGlass Detector	ETT/C

Neutron Energy [eV]  $10^{-3}$   $10^{-2}$   $10^{-1}$   $10^0$   $10^1$   $10^2$   $10^3$   $10^4$   $10^5$   $10^7$

n-Production Targets  
 ETT - Enhanced Thermal Target  
 ETT/C - ETT + cold moderator  
 BBT - Bare Bounce Target  
 PAC - PacMan Target  
 PN - Photoneutron target  
 BT - Bare Target on Axis



# Fusion Neutronics Session

## Highlights / Take-aways (1)

Laura Gustad (MDA)  
Keegan Kelly (LANL)  
Mike Loughlin (ORNL)

- Path for 14 MeV light ion evaluations has been identified
- Reactor nuclear data needs focus on  ${}^6\text{Li}$ ,  ${}^7\text{Li}$ , Be, structural materials
- Activation of several materials for decay heat, diagnostics, and dosimetry; importance of isomer production
- Isotopes needing attention:
  - ${}^9\text{Be}(n,2n)$  – fundamental for neutron breeding
    - 1.75 MeV (n,2n) threshold accessed by 2.45 MeV D-D and 14 MeV D-T neutrons
  - Modern light element evaluations do not *currently* reach 14 MeV
  - From Pulsed Spheres: Li, C, O, Mg, Al, Ti, Fe, Pb
  - Med/Heavy Evals: Co, Cu, Mo, Nb, Sn, Ni, Mn, Ti, V
- White source, mono-E, and reactor neutron facilities are ready to carry out neutronics measurements of interest.

# Fusion Neutronics Session

## Highlights / Take-aways (2)

Laura Gustad (MDA)  
Keegan Kelly (LANL)  
Mike Loughlin (ORNL)

- Need additional comprehensive sensitivity studies using *reliable* covariances
- Differential measurements are needed at a distribution of energies, *not just at 14 MeV!* – Integral and differential measurements complement each other
- Need survey of nuclei in need of measurements and evaluation, and those in need of just evaluation
- Close communication between evaluators, experiment, and users.
  - Accelerating communication will accelerate the process
- Prospect of building a small-scale fusion device to understand the issues associated with running a functional reactor for energy production

# Recommendations

- Program to prioritize nuclear data needs considering the impact (feasibility, economy) on fusion reactor design
  - Short list of most promising concepts
- Evaluation of the nuclei and nuclear reactions identified in fusion reactor sensitivity studies are (a) in need of new measurements, or (b) in need of a new evaluation
- Coordinate exploitation of various neutron sources to cover range of neutron energies, flux, fluence, integral and differential experiments.
  - Central repository of information on facility capabilities
- Decision on high fluence neutron source
- Work force development, evaluations, neutron sources and fission and fusion facilities.
- Continued exchange of information between ND and fusion communities.

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