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Design of the Fifth-Generation Target-Moderator-Reflector-Shield Assembly

S. Nowicki, M. Mocko

LANSCe Weapon Physics Group

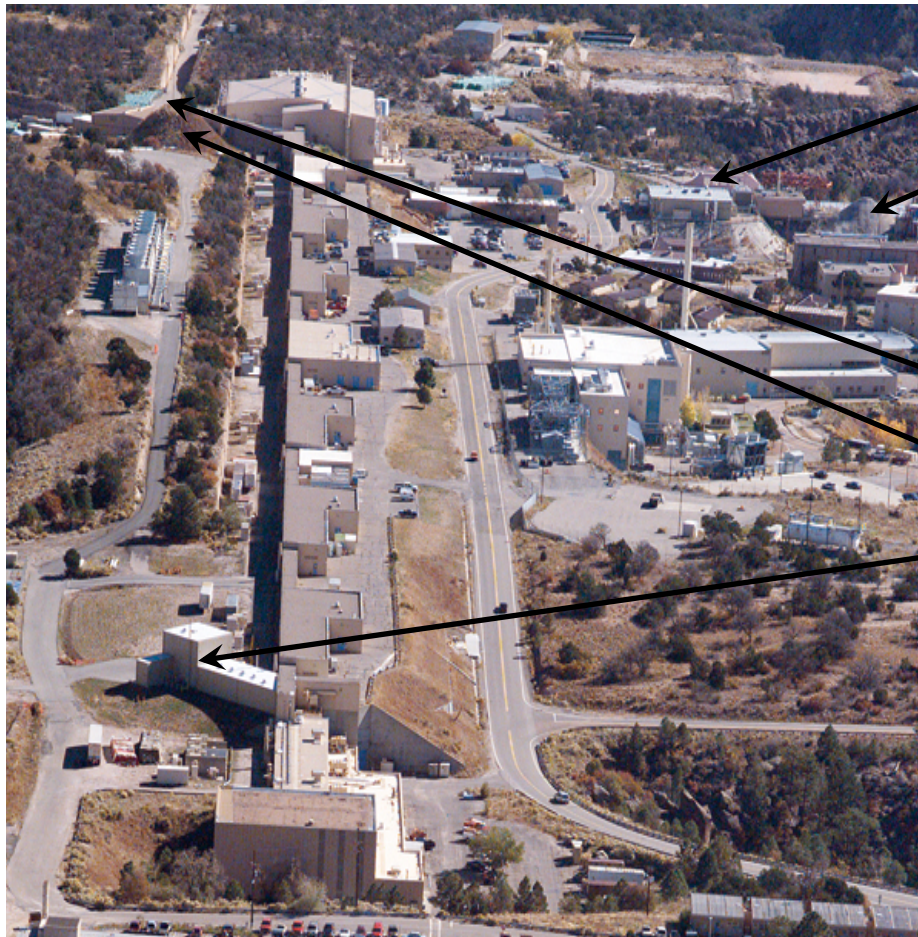
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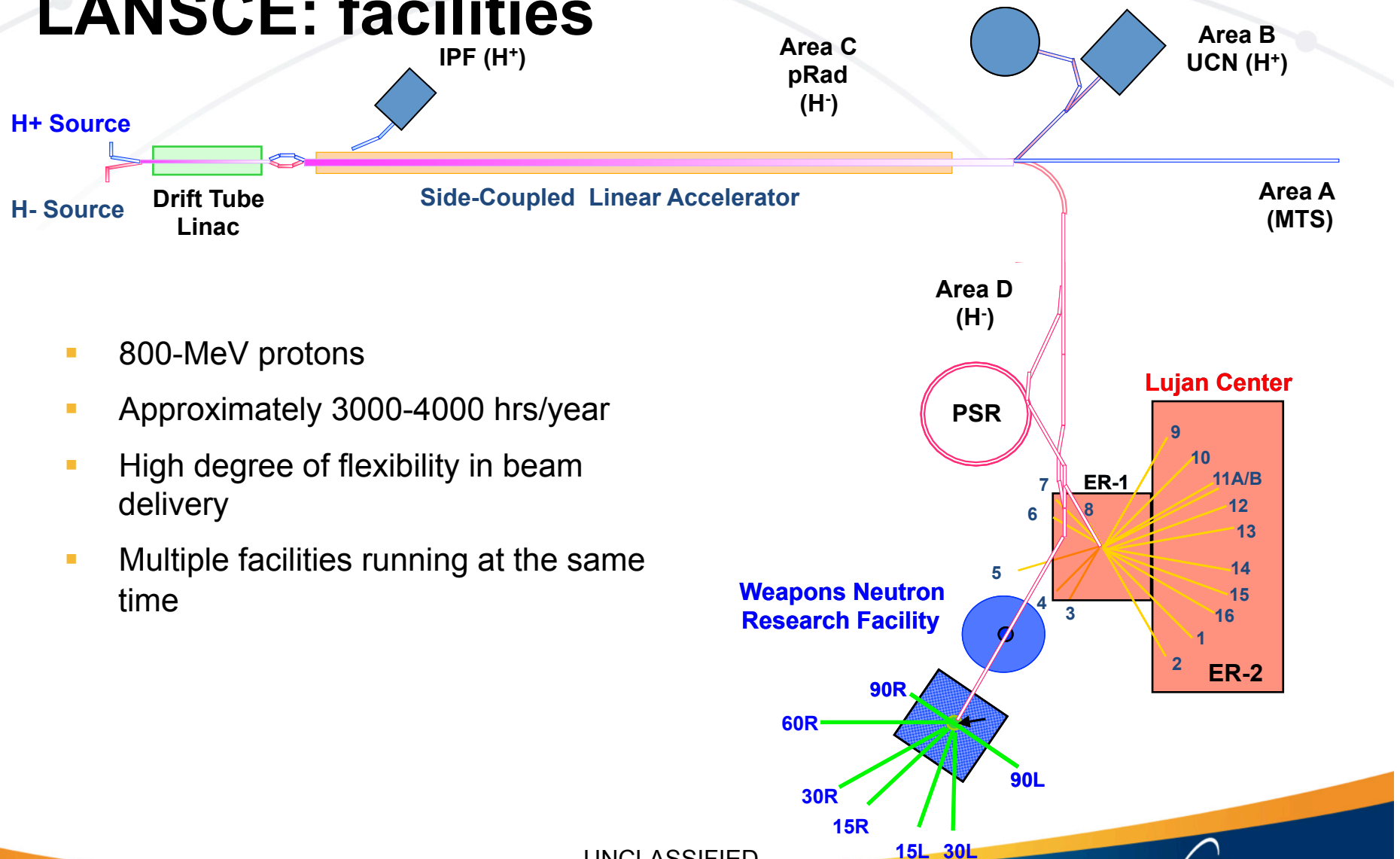
LANSCÉ: introduction



- Los Alamos Neutron Science Center
- Lujan Center
- WNR facility
- Ultra Cold Neutron source
- Proton RADIography
- Isotope Production Facility

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LANSCCE: facilities

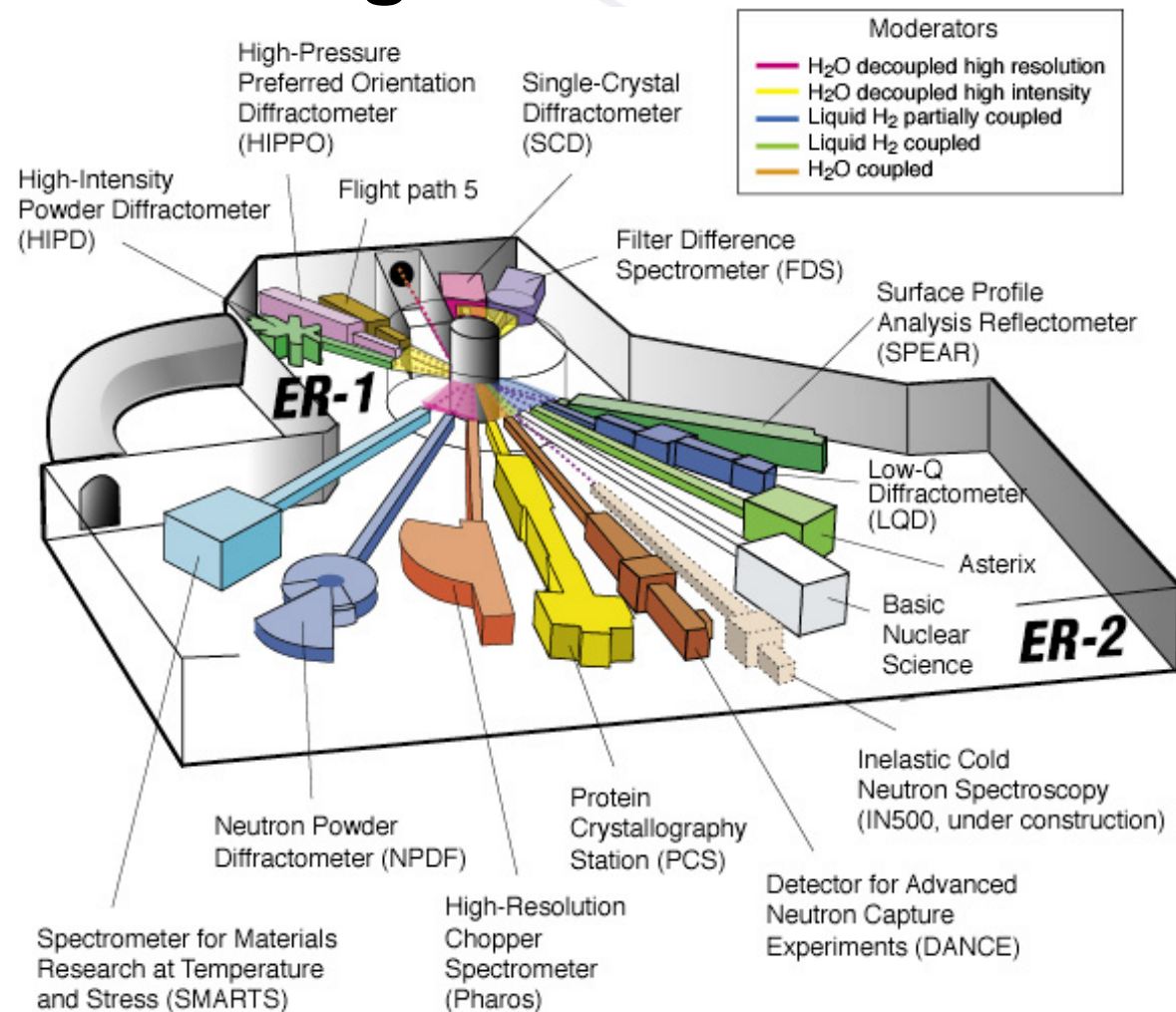


- 800-MeV protons
- Approximately 3000-4000 hrs/year
- High degree of flexibility in beam delivery
- Multiple facilities running at the same time

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Lujan Center: 1L target

- Complex TMRS system
- Split solid tungsten target
- 6 moderators (4+2)
- 16 neutron FPs
- Average 100 μA



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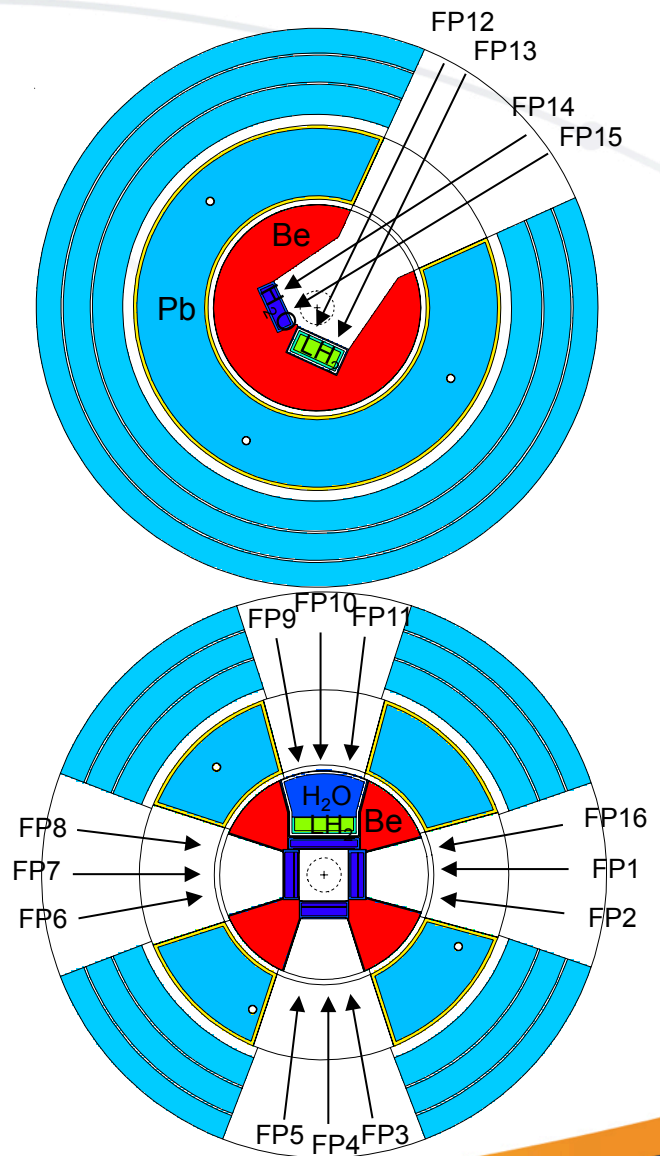
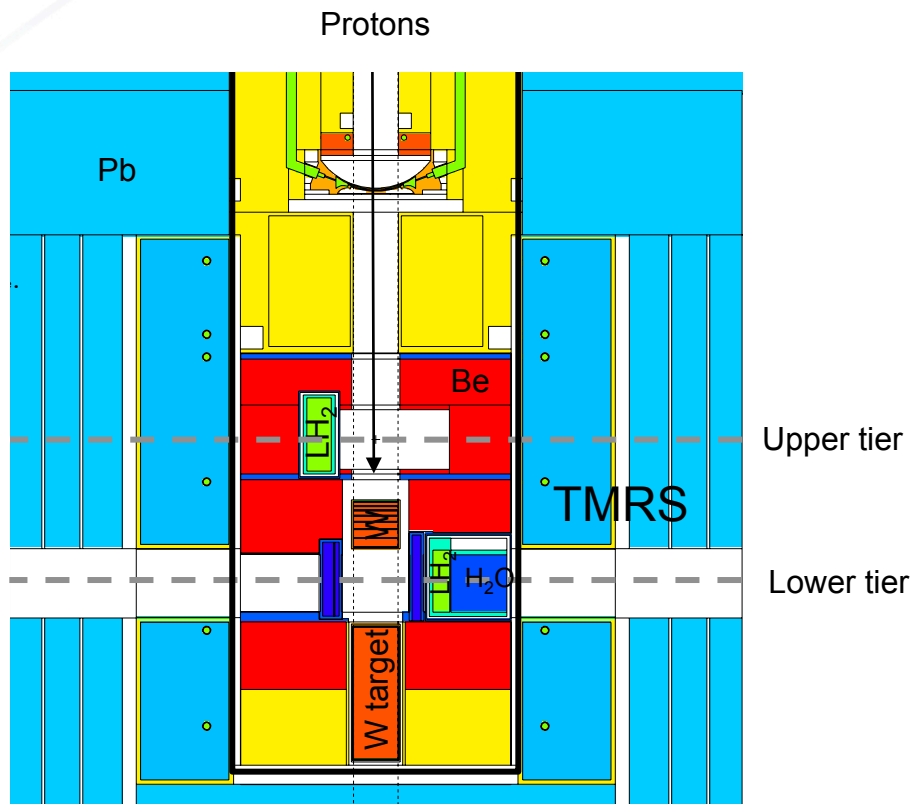
Motivation

- **Change of program direction** from basic energy science to defense program applications such as nuclear science.
- The target is being redesigned so that the Flight Paths (FP) in the **upper tier** provide a **higher intensity** in the **epithermal** and **medium** energy range.

	Energy ranges
Cold neutrons	< 5 meV
Thermal neutrons	5 meV - 0.4 eV
Low energy range	0.4 eV – 100 eV
Epithermal energy range	100 eV -10 keV
Medium energy range	10 keV – 1 MeV
Fast energy range	1 – 100 MeV

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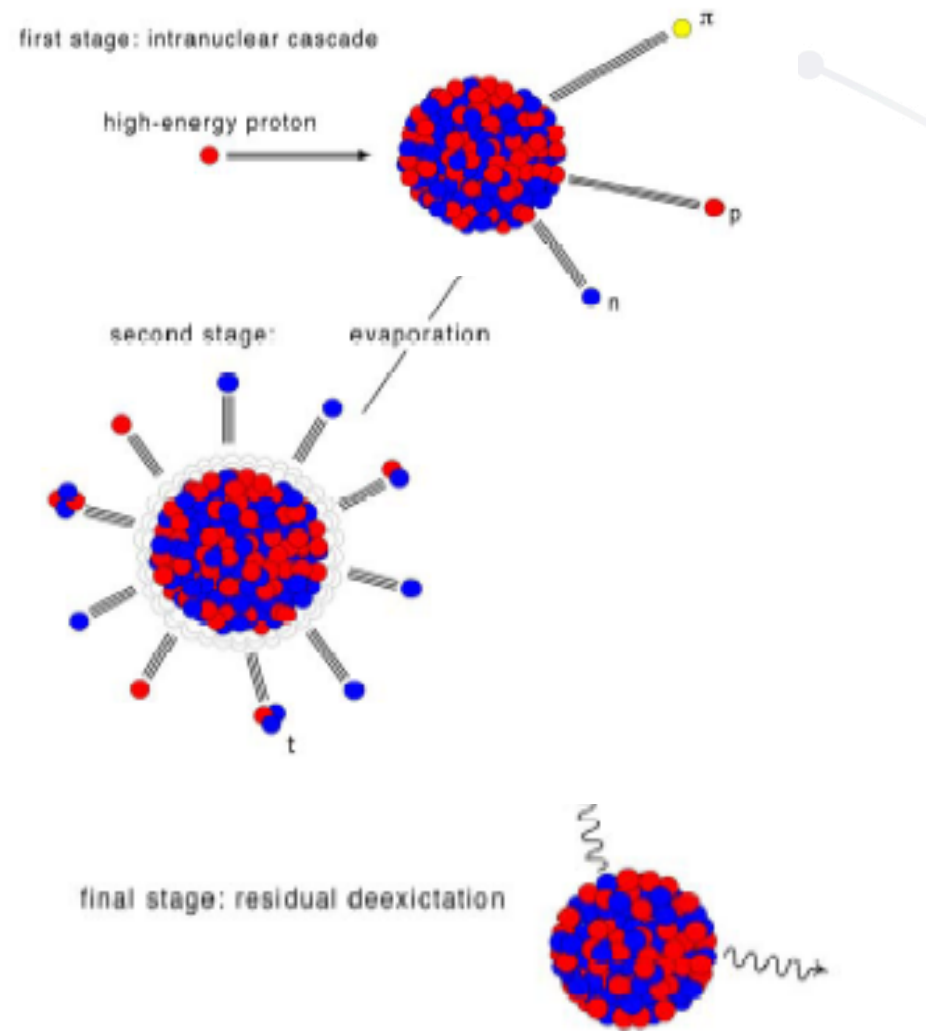
Current design: Mark III



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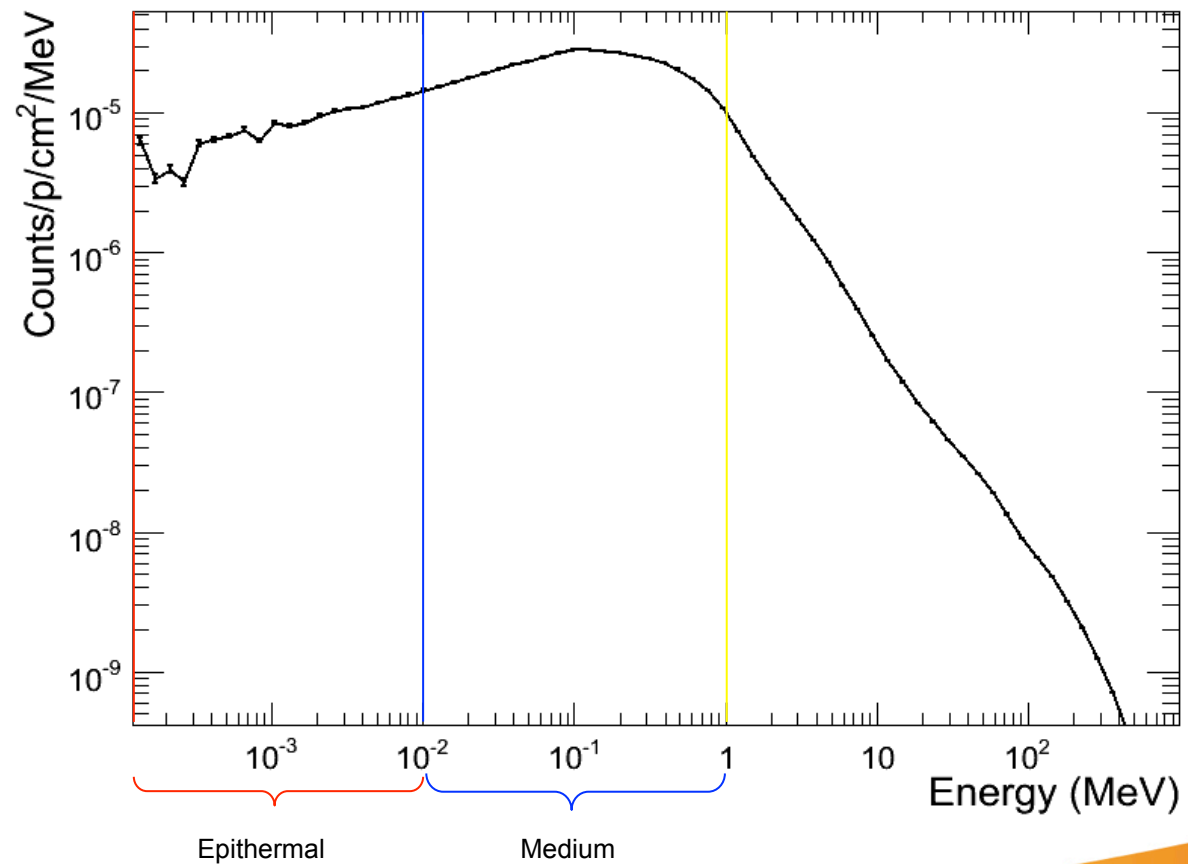
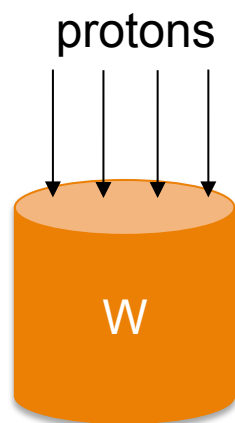
Spallation process

- Typically light energetic projectile impinging onto a heavy nucleus forcing it to disintegrate
 - Neutron production
 - Transmutation (waste or RI production)
- Understanding
 - Projectile nuclear cascade ($\sim 10^{-23}$ s)
 - Evaporation of excited residues ($\sim 10^{-17}$ s)



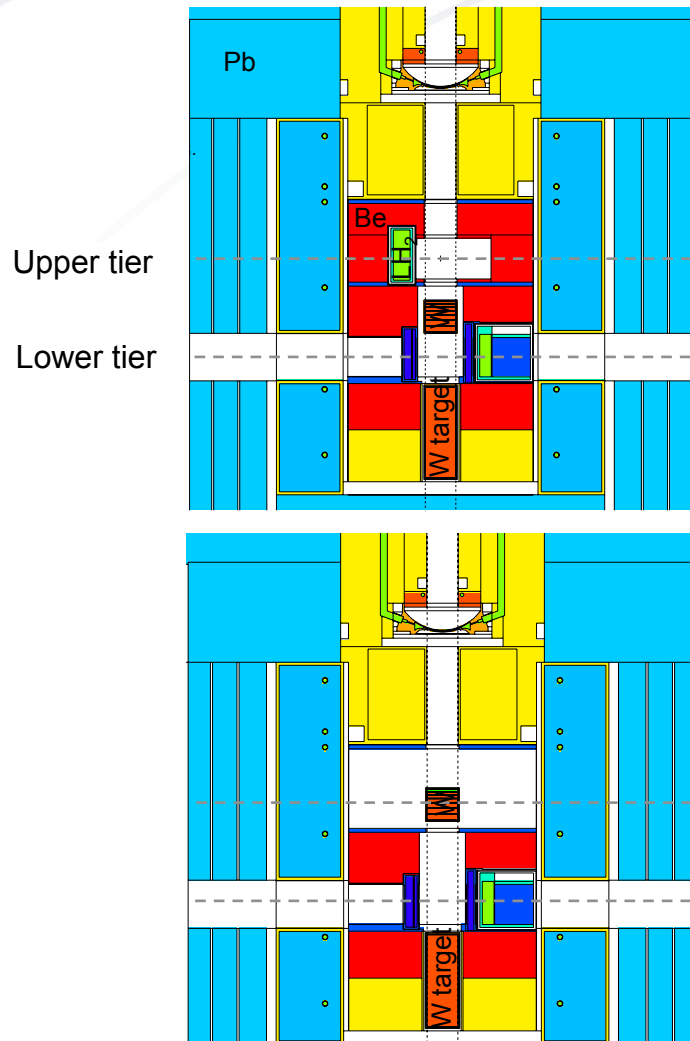
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Raw spallation spectrum

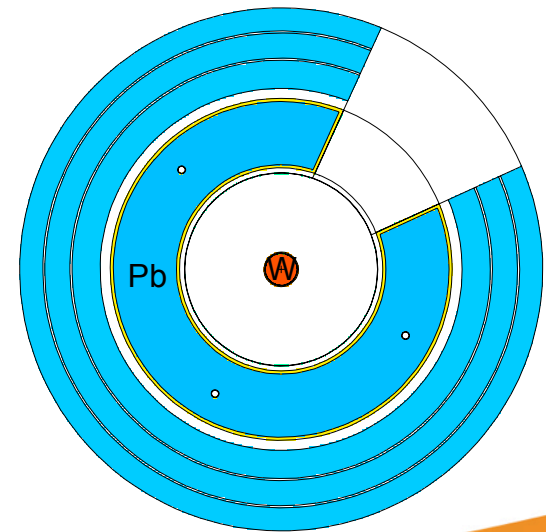
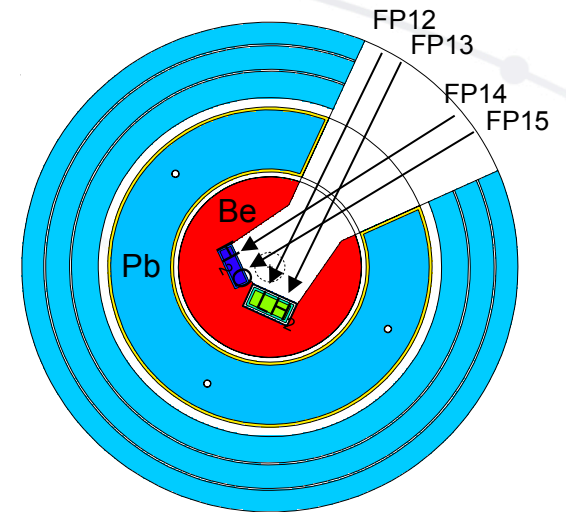


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Proposed Design



Current design

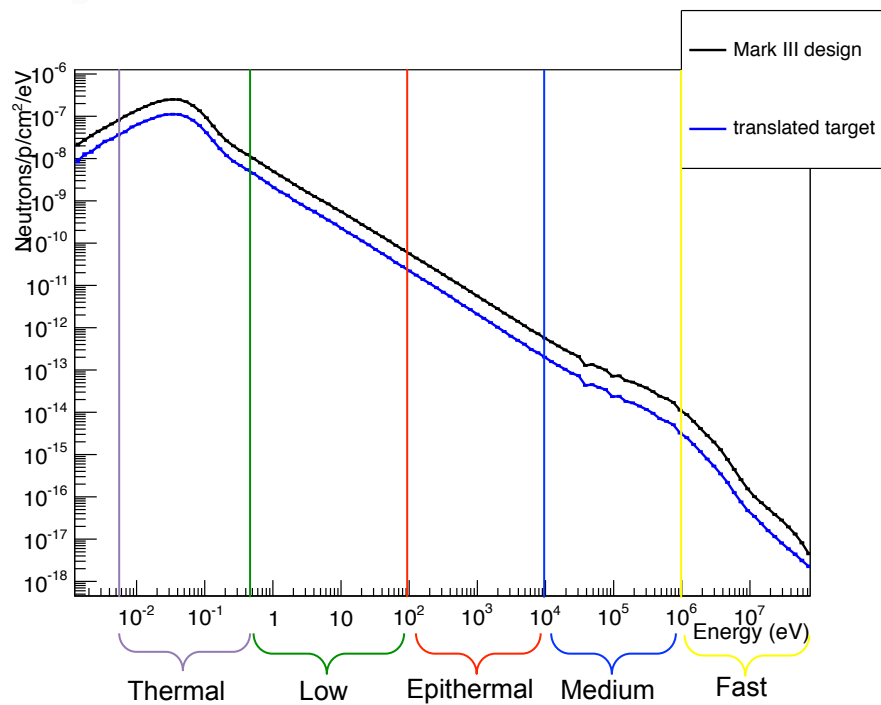


- LH_2 and H_2O moderators removed
- W target was translated

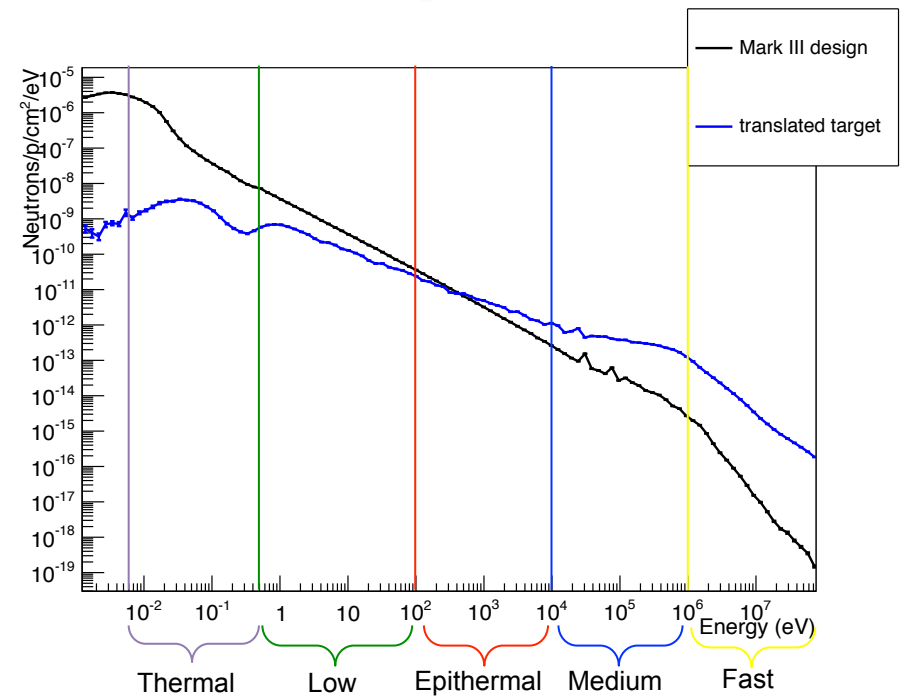
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Neutron intensity results

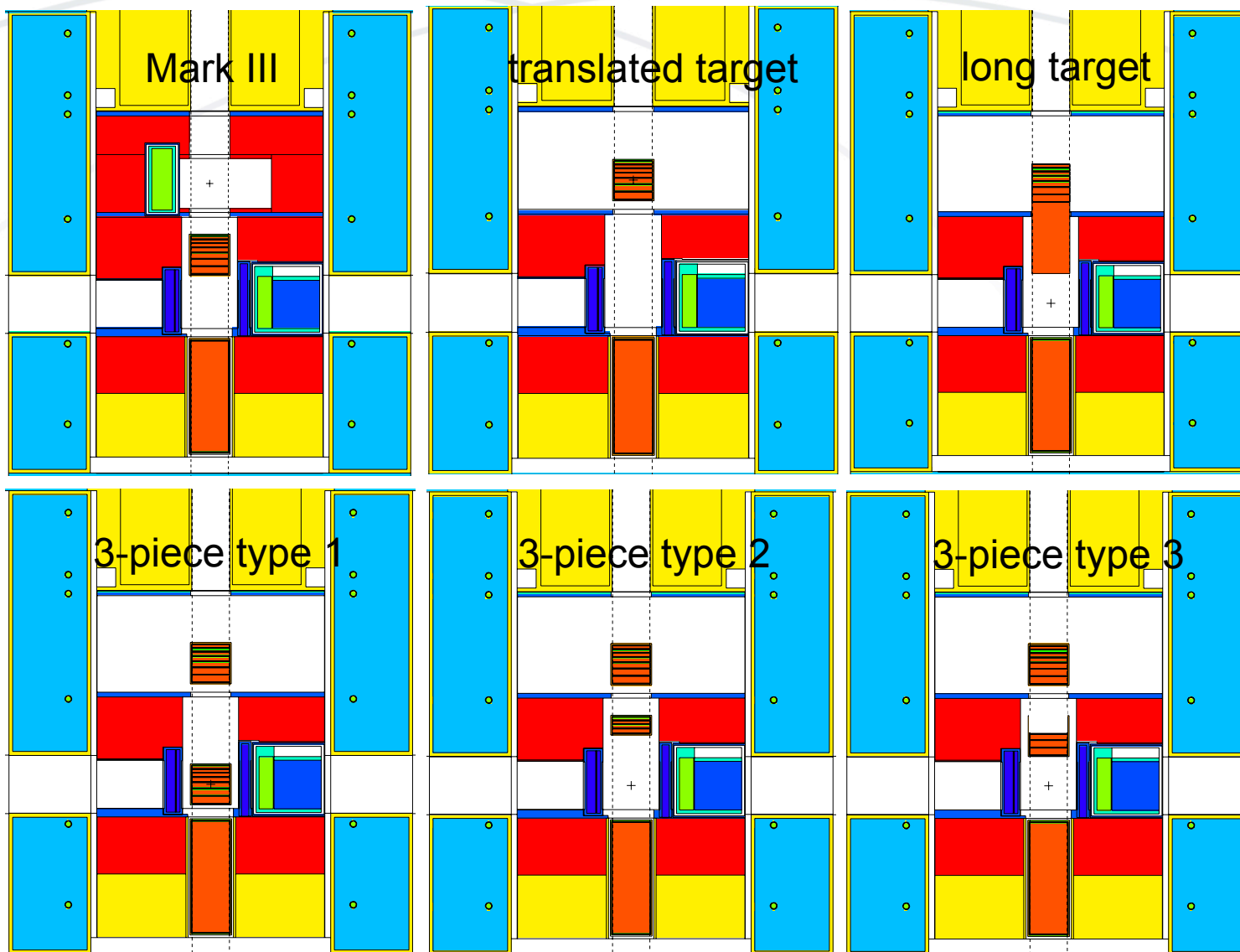
lower tier



upper tier



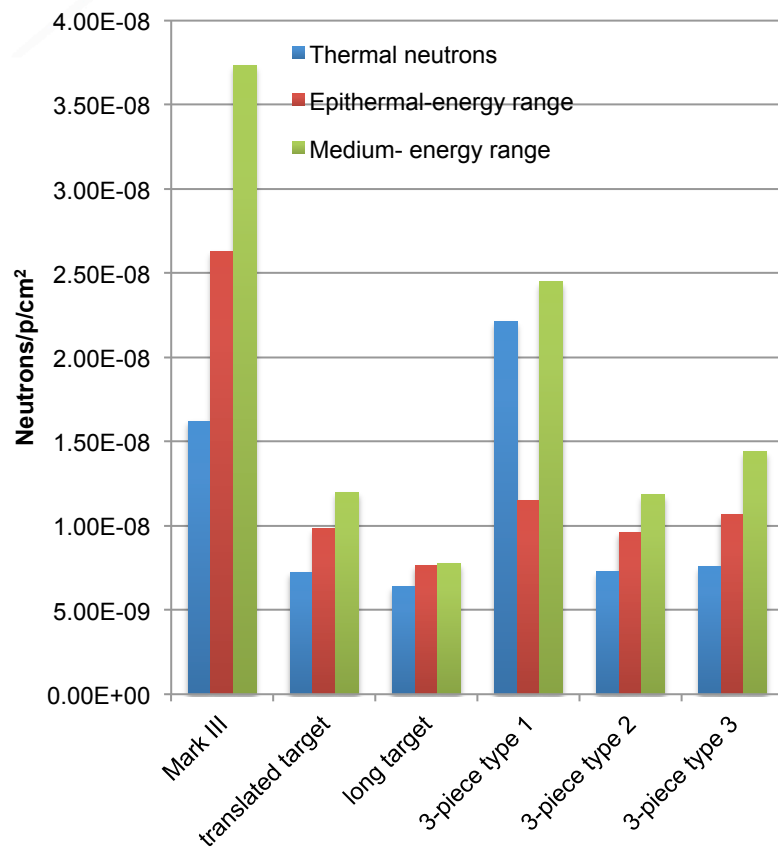
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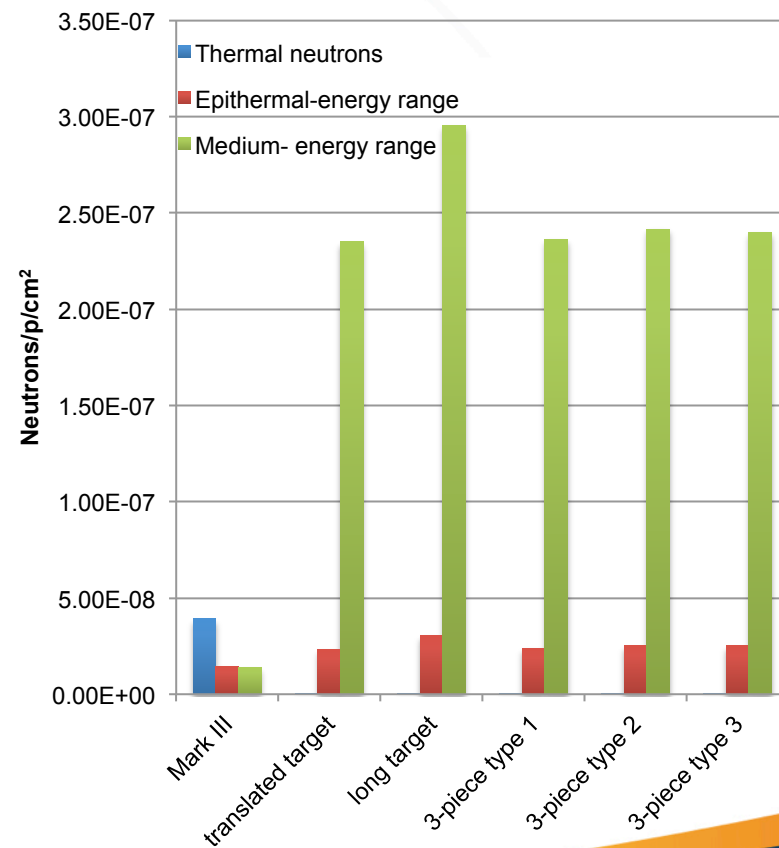
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Integral results

Lower tier



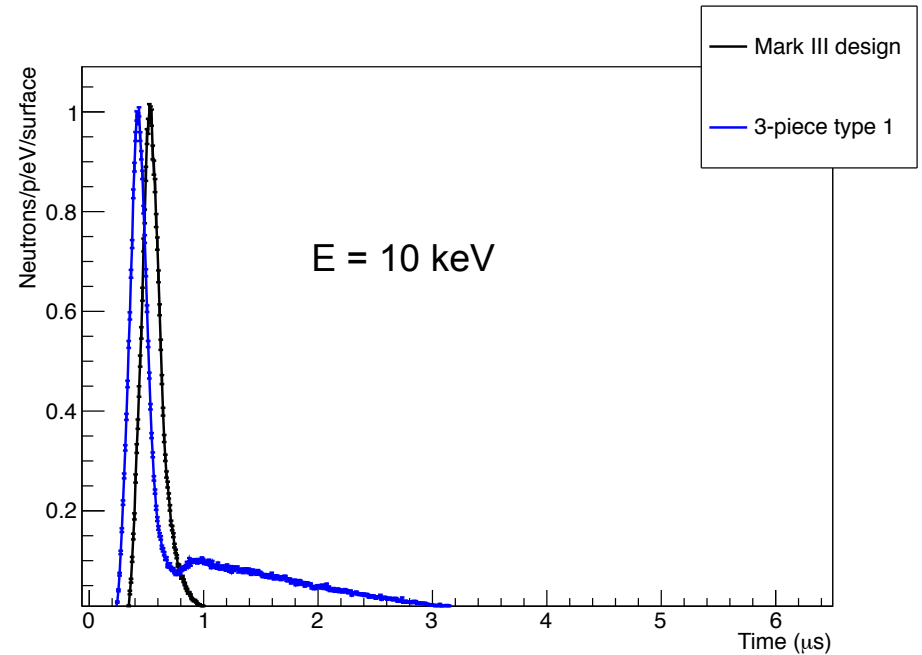
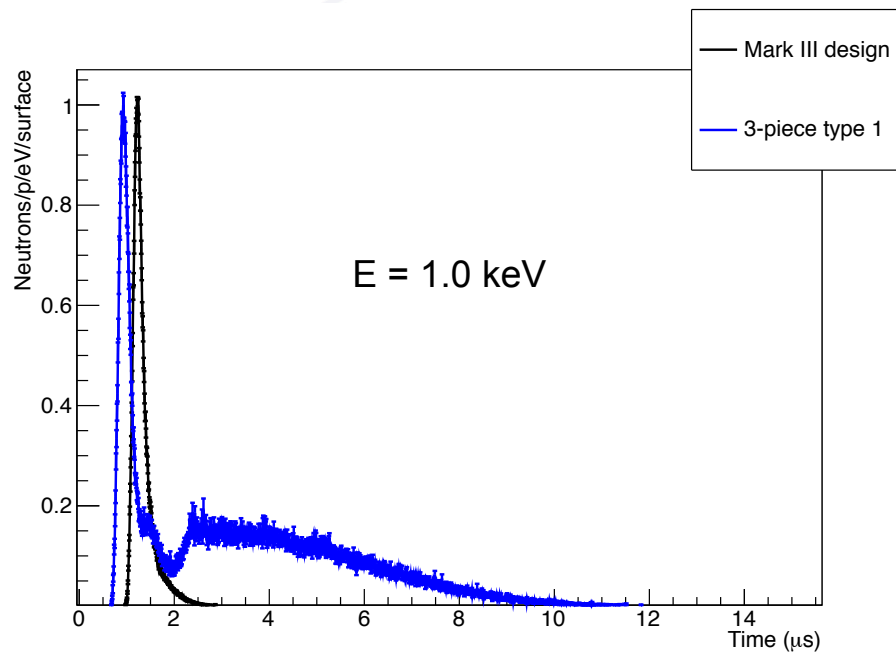
Upper tier



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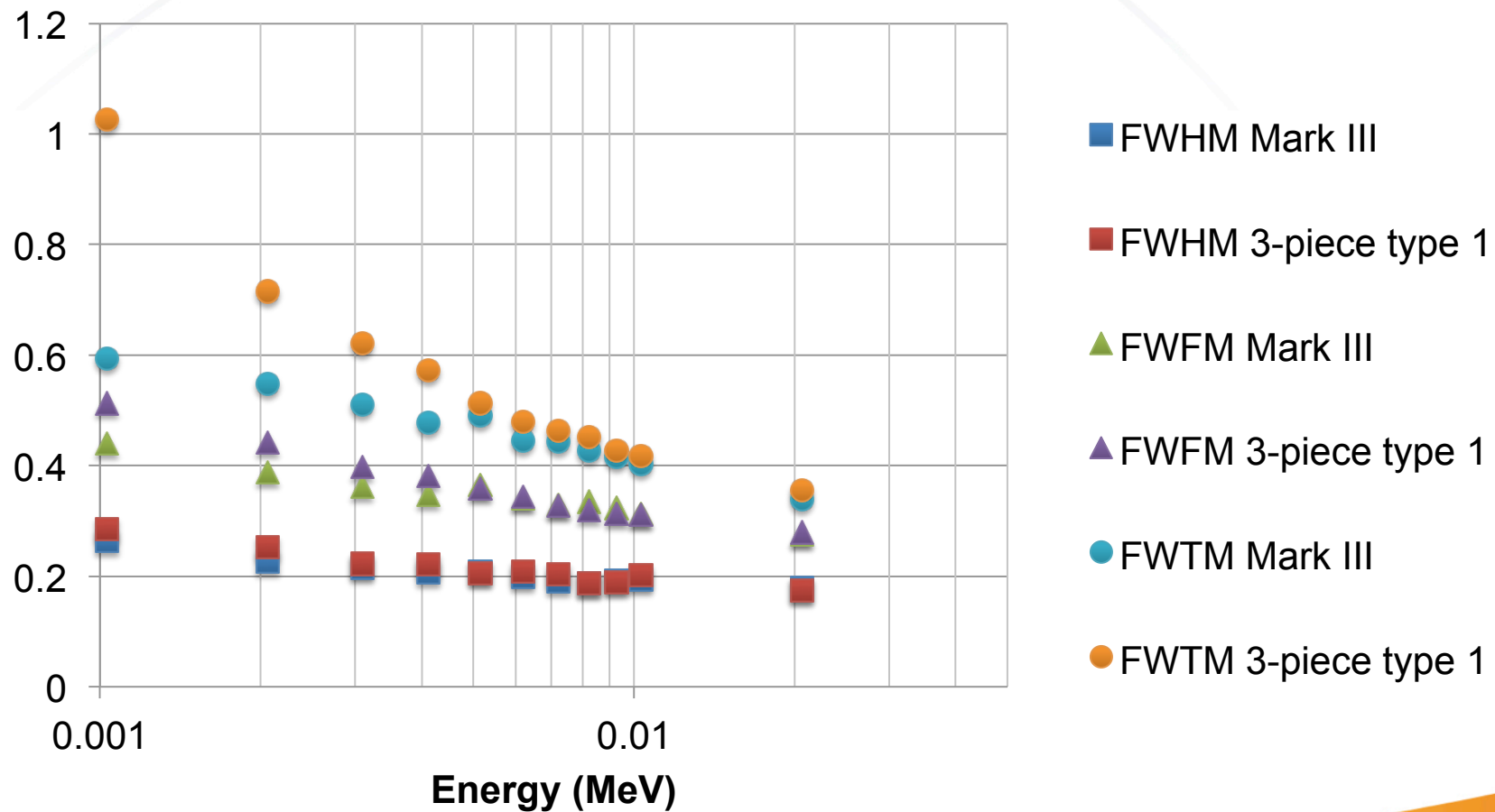
in012 in005 in010

Timing emission spectra



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Analysis



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Conclusion

- 3-piece type 1 design looks **promising**:
 - Intensity in **epithermal** and **medium** energy range in **upper tier** is **an order of magnitude** higher than current Mark III.
 - Intensity in the **thermal** energy range is **higher** in the **lower tier** than current Mark III.
- Time emission spectra show a **bump** due to the scattering of fast neutrons. We are currently investigating that hypothesis.
- Other investigations such as the **addition of wings** around the upper target will be conducted.

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Thank you!

Questions?

Author contact:
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Back up slides

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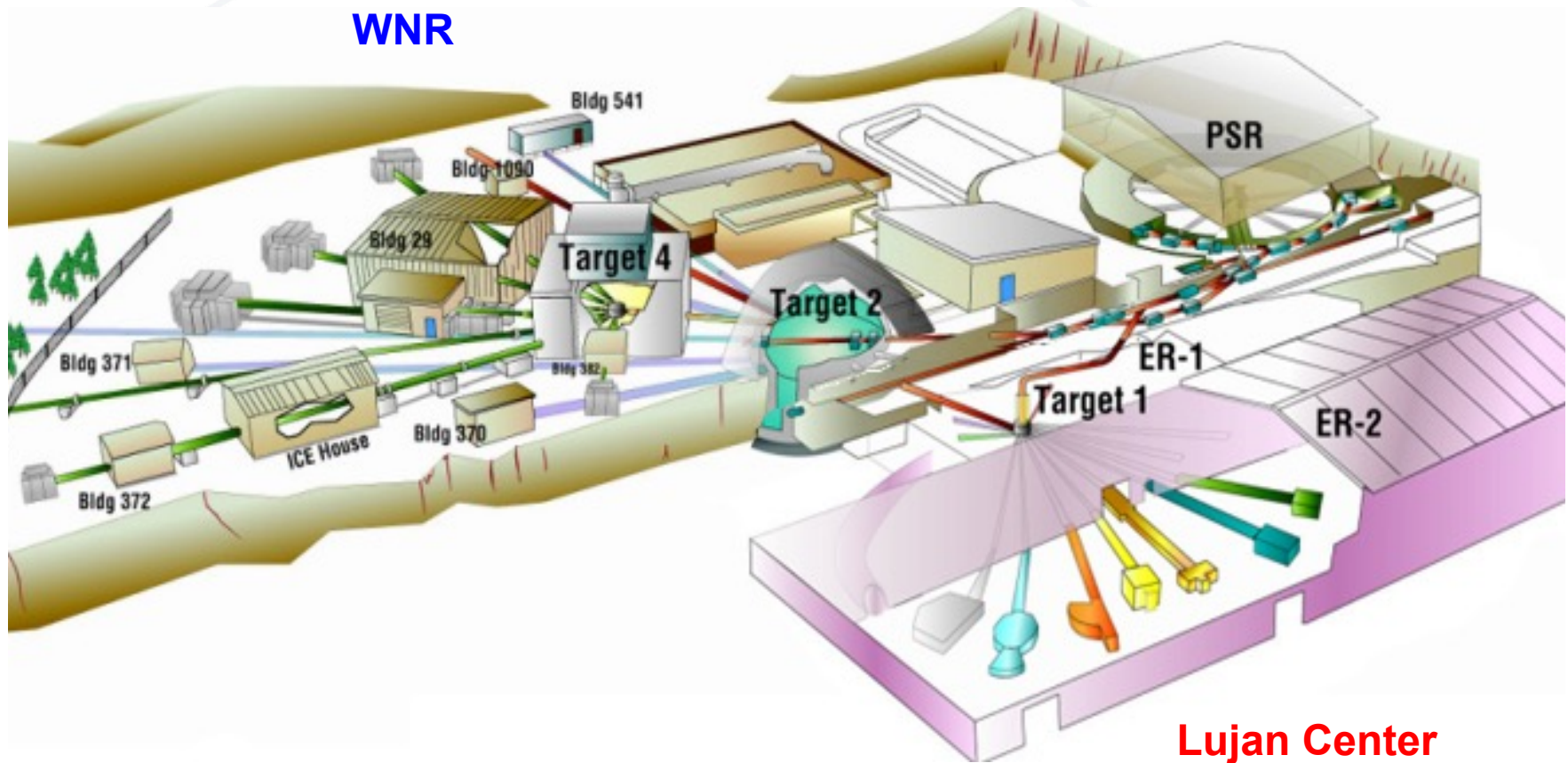
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Lujan Center and WNR facilities

WNR

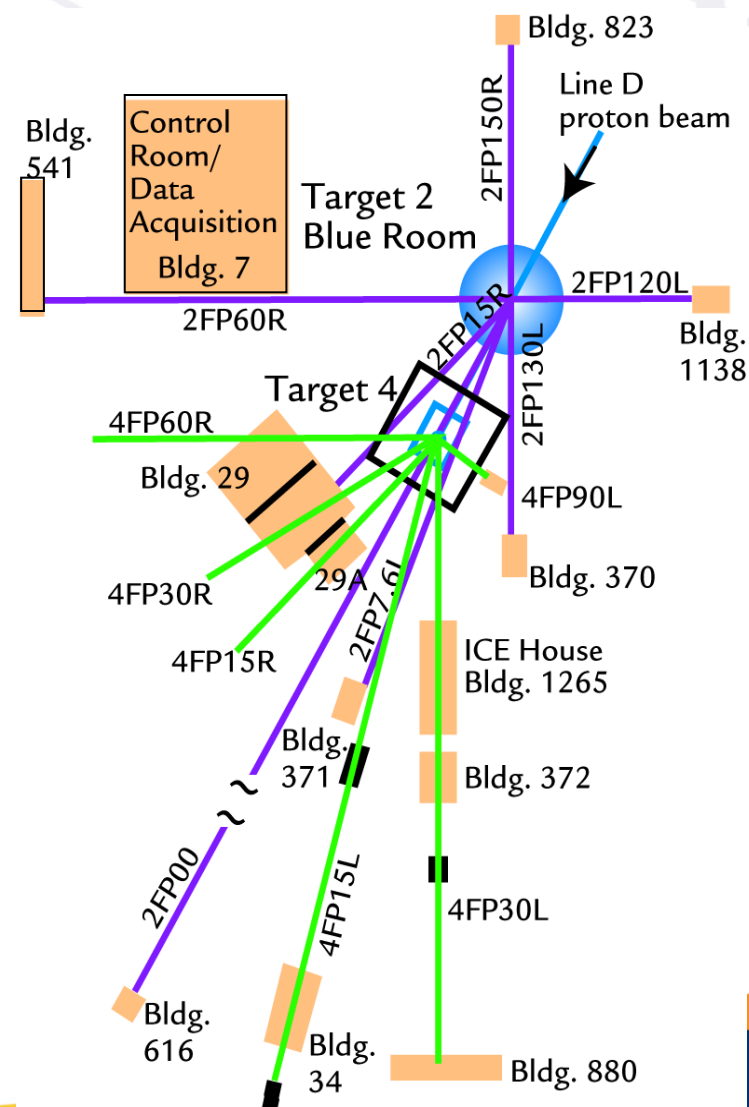


Lujan Center

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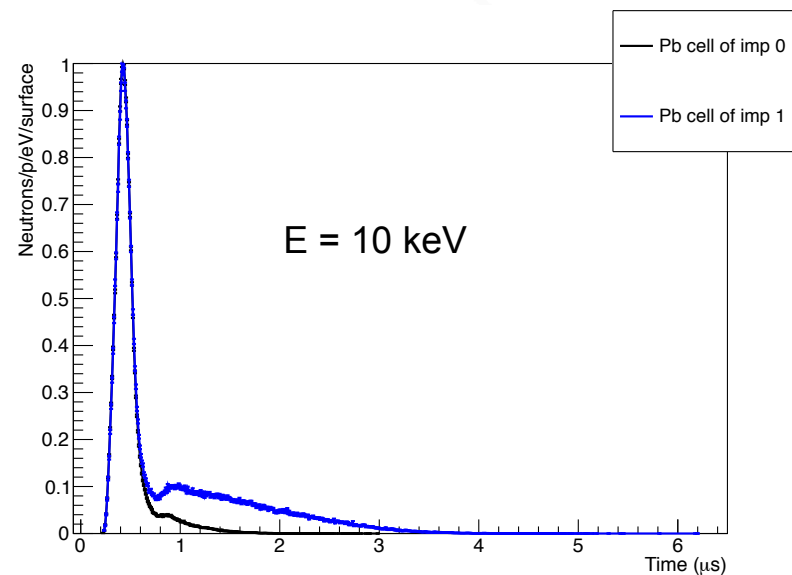
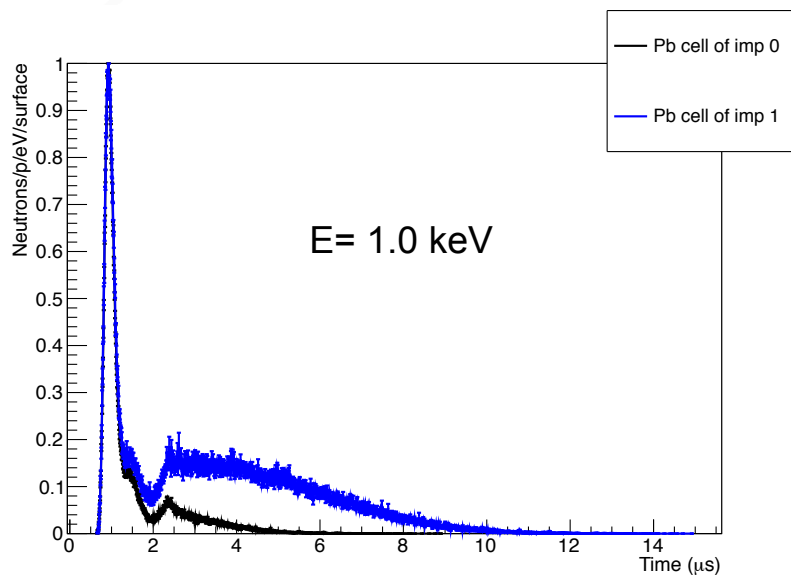
WNR

- Target 2:
 - Access to the proton beam
 - Target/moderator experiments
 - Irradiation experiments
- Target 4:
 - Bare spallation target
 - Neutrons 100 keV - 600 MeV



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Importance set 0 -> bump goes down



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