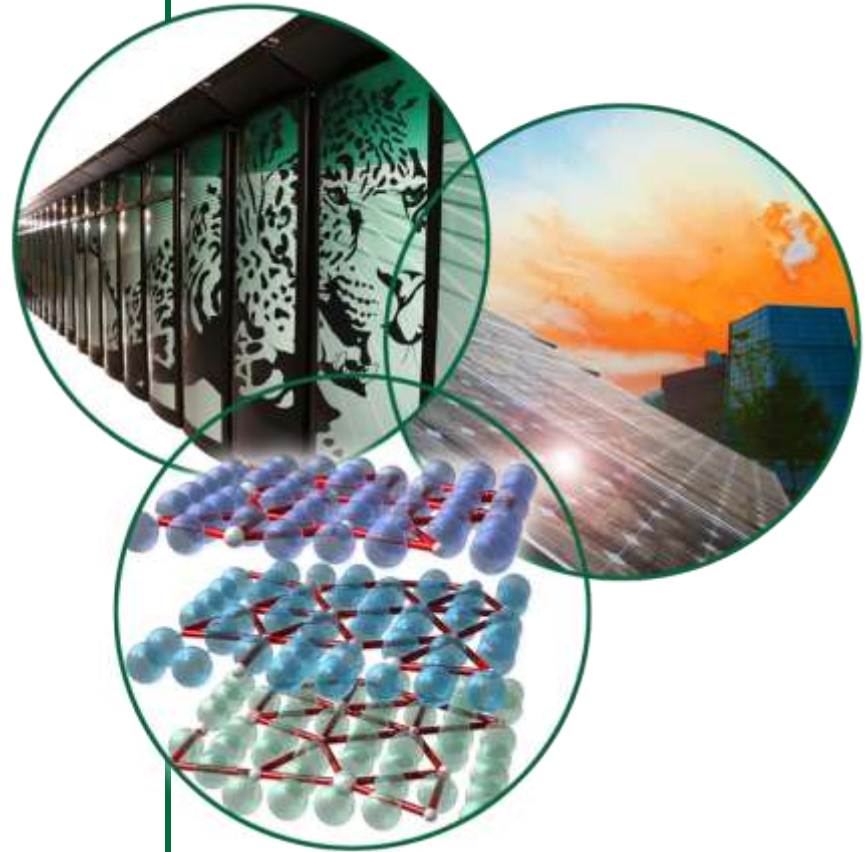


Instrument and Source Design Division Overview and Plans

Accelerator Advisory Committee
January 10-12, 2012

Phil Ferguson



**Instrument and Source
Design Division**
Phil Ferguson

**Neutron Source &
Instrument Design**
Graeme Murdoch

**Instrument System
Development**
Ken Herwig

Project Controls
Barbara Thibadeau

HFIR Instruments
Doug Selby

- **At this level, the division looks the same**
 - Minus John Haines, which is a significant loss
- **Accelerator engineering and development moved to RAD**
- **Target station design, remote handling engineers, & post-irradiation examination (PIE) remain in ISDD**
- **Tom McManamy has retired**
 - Remains available for reviews

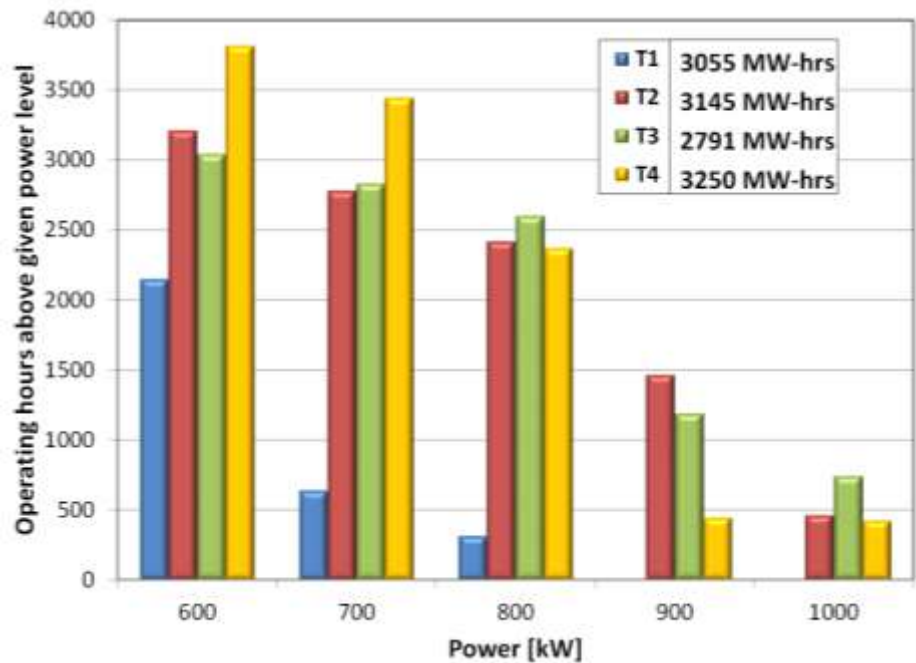
Division mission

- **Ensure quality performance of, and support for, all neutron instrumentation, while building out instrument capability to effectively exploit the neutron source**
- **Support reliable operations through robust target system designs**
- **Actively pursue improvements in target reliability and performance**
- **Maintain the ability to sample and characterize used components, and feed that information back into the design process**

Activities not related to this committee (sample environment, etc.) have been excluded

Target exceeds initial goal

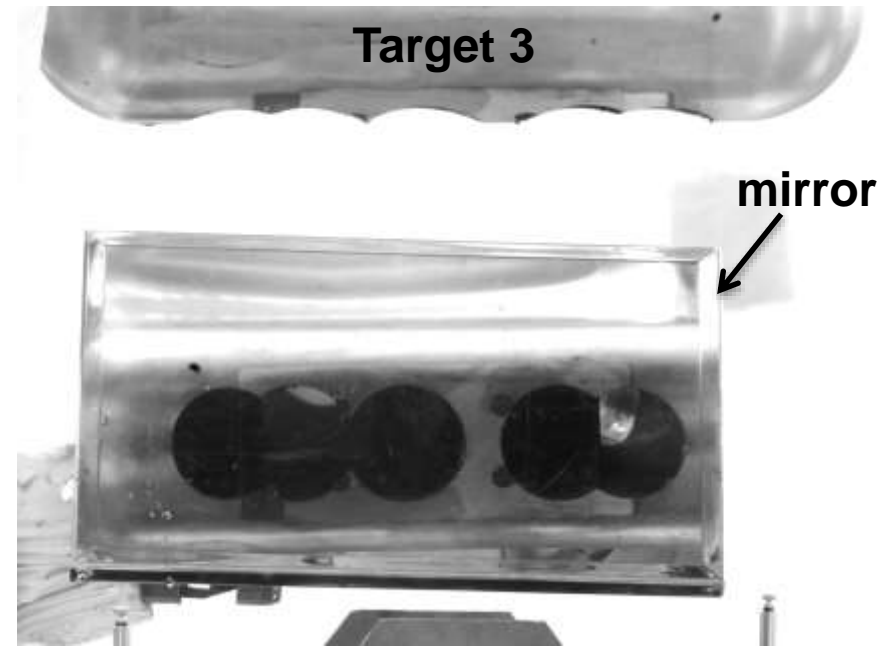
- Initial target design goal was for 1250 hours of operation at 2 MW, or 2500 MW-hours of operation (~5 dpa in steel)
- Every target has exceeded this goal
- Must continue to succeed as average beam power increases



Target #	Integrated power (MW-hours)	Avg power (kW)
1	3055	125
2	3145	434
3	2791	503
4	3250	510

Target experience since last meeting

- Target 3 reached end of useful life on April 3, 2011 during operations
- Target 3 was sampled and studied optically
- Target 4 ran primarily at reduced power (less than 1 MW)
- Efforts have been made to reduce the peak current density on target
- Details from Bernie Reimer & Peter Rosenblad tomorrow



Mirror image of the front of target 3 after sampling

PIE efforts

- Target vessel 1 PIE results from Babcock & Wilcox (B&W)
- Target vessel 2 sampled and sent to B&W
- Target vessel 3 sampled
- Concepts for a bolt-on water shroud are being considered to allow access to the target surface without sampling



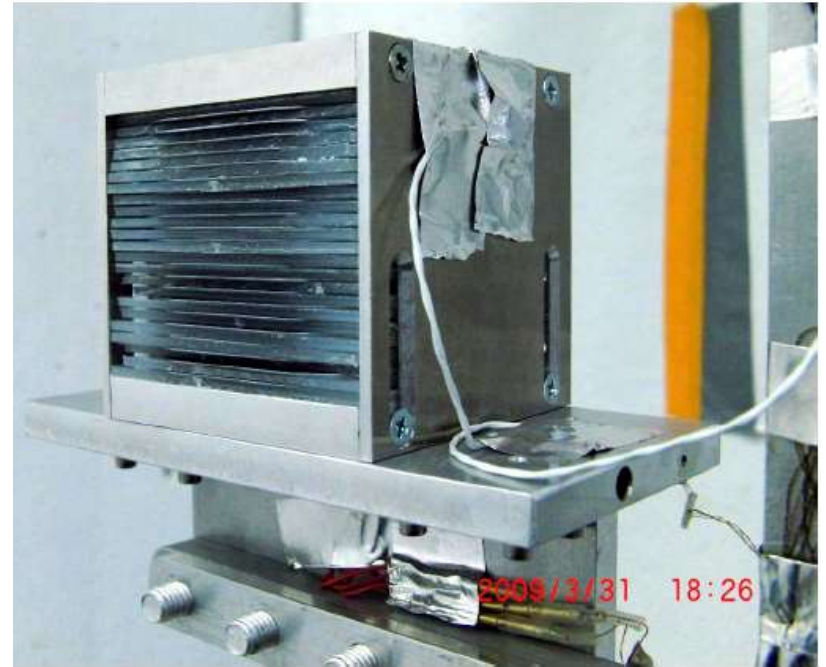
Target 1, center disk
Bulk flow side
After cleaning



Target 2, center disk
Bulk flow side
Before cleaning

Advanced moderator work

- Hosted Stuart Ansell on a sabbatical during 2009-2010
- Completed experiments at Lens based on Stuart's crystal moderator concept
- Worked to isolate effect
 - Primarily geometric
 - Diffraction present, but not significant

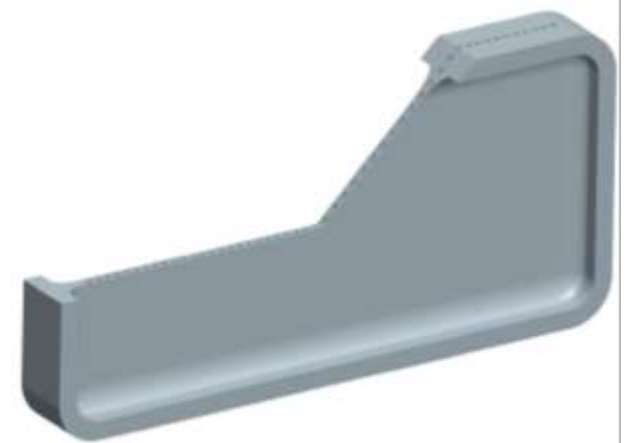


Current target efforts

- Target change out (vessel 4 for vessel 5)
- Design of a jet flow target
- Design of an aluminum proton beam window
 - Improved lifetime and reduced beam loss
- Peter Rosenblad and Mike Dayton will provide details tomorrow



Target change out



Aluminum PBW design

Current target development efforts

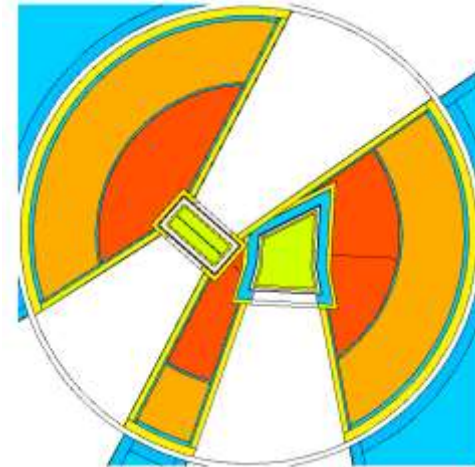
- **Samples from target vessel 2 at B&W**
- **WNR experiment to test a variety of helium bubblers**
 - Collaboration with JPARC
- **Target development will be “paused” after analysis of the WNR experiment**
 - Limited funds, strategically spend on examining irradiated targets
 - Anxiously await target 5 experience at 1 MW



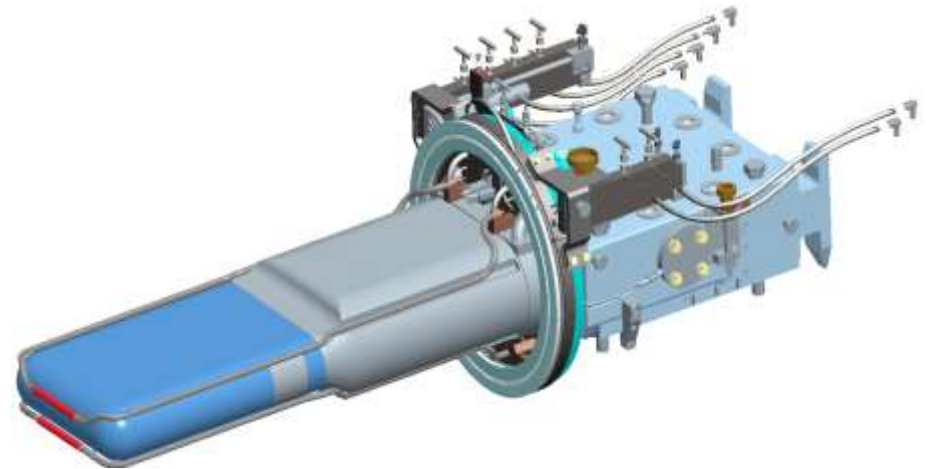
Multi-bubbler test loop in the WNR “blue room”

Neutron source development

- Design of the next generation inner reflector plug (IRP)
 - Improve performance of downstream moderators
 - Implement a better waste handling scheme
- Study options for adding fusion materials irradiations to SNS target system
- Details from Franz Gallmeier & Peter Rosenblad tomorrow



New IRP concept showing larger coupled moderators



Concept for fusion materials testing at SNS

Future plans

- **Advanced moderator collaboration**
 - Coordinated research project sponsored by IAEA
 - Lens experiment using anisotropic scattering materials
- **PIE of target 5 and beyond**
 - Anticipated higher average beam power
 - Our method of feedback for design changes to the target
- **Design review of the next generation IRP in the fall**
 - Installation anticipated in 2016

Challenges

- **Reliable operations during the power ramp**
 - Pitting damage scales nonlinear with peak current density
 - Working with accelerator physics using the target imaging system to broaden the beam
- **Resources**
 - Change in priorities (enhanced focus on instrument performance)
 - Funding for target development
- **Tritium in target vessel**
 - Shared issue with JPARC
 - May limit PIE if contamination cannot be controlled at B&W

Summary

- **SNS targets have exceeded design goals to date**
 - Even the target that leaked mercury exceeded 2500 MW-hours
 - Must demonstrate continued reliability during the beam power ramp
- **PIE is a critical part of the path for target improvement**
 - Currently our only real feedback mechanism
- **Engineering effort on the target system has not stopped**
 - Jet-flow target design effort
 - Next generation IRP design