

The Spallation Neutron Source - The Next Generation of Materials Research

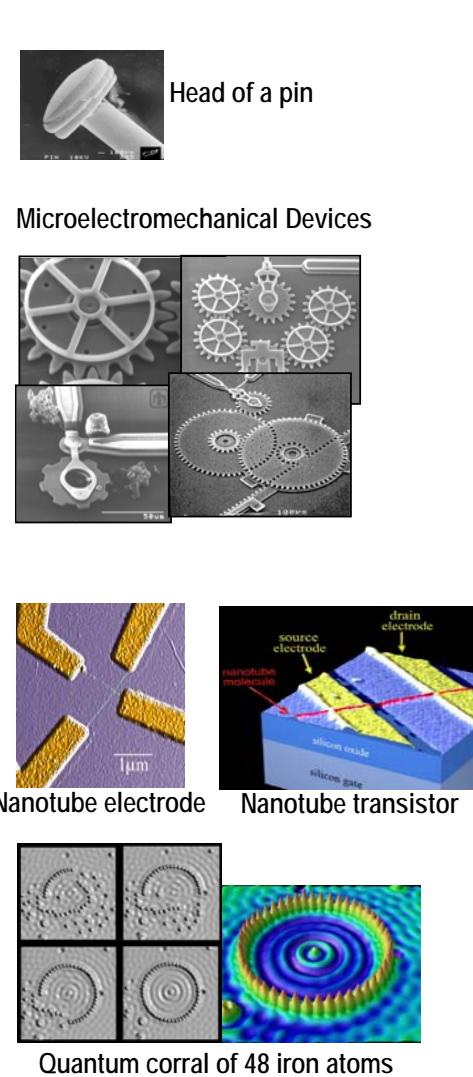
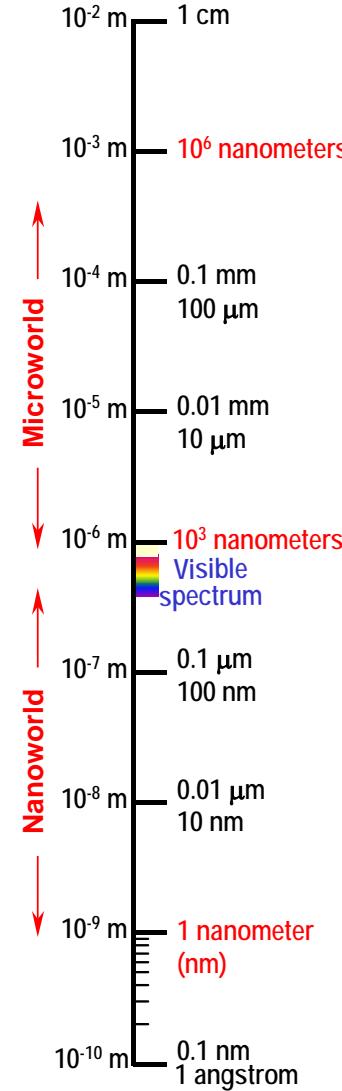
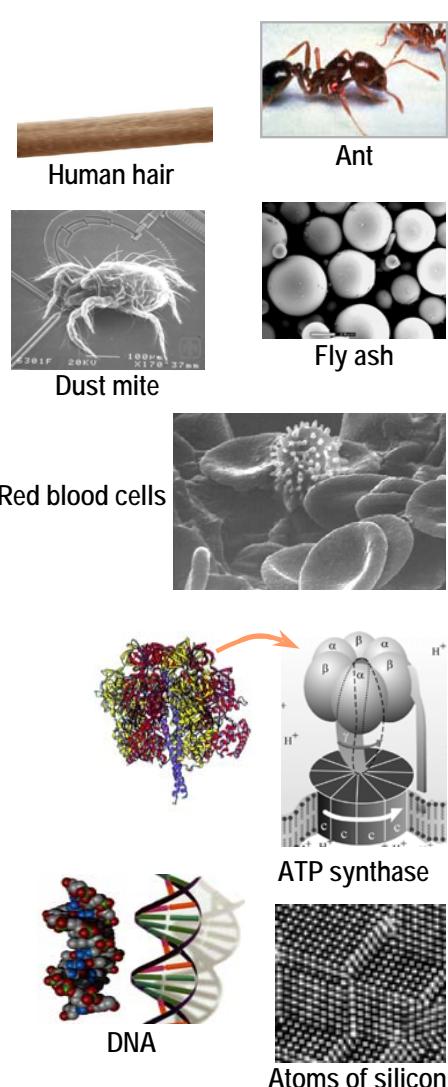
Neutron Scattering Science Division

May 2007



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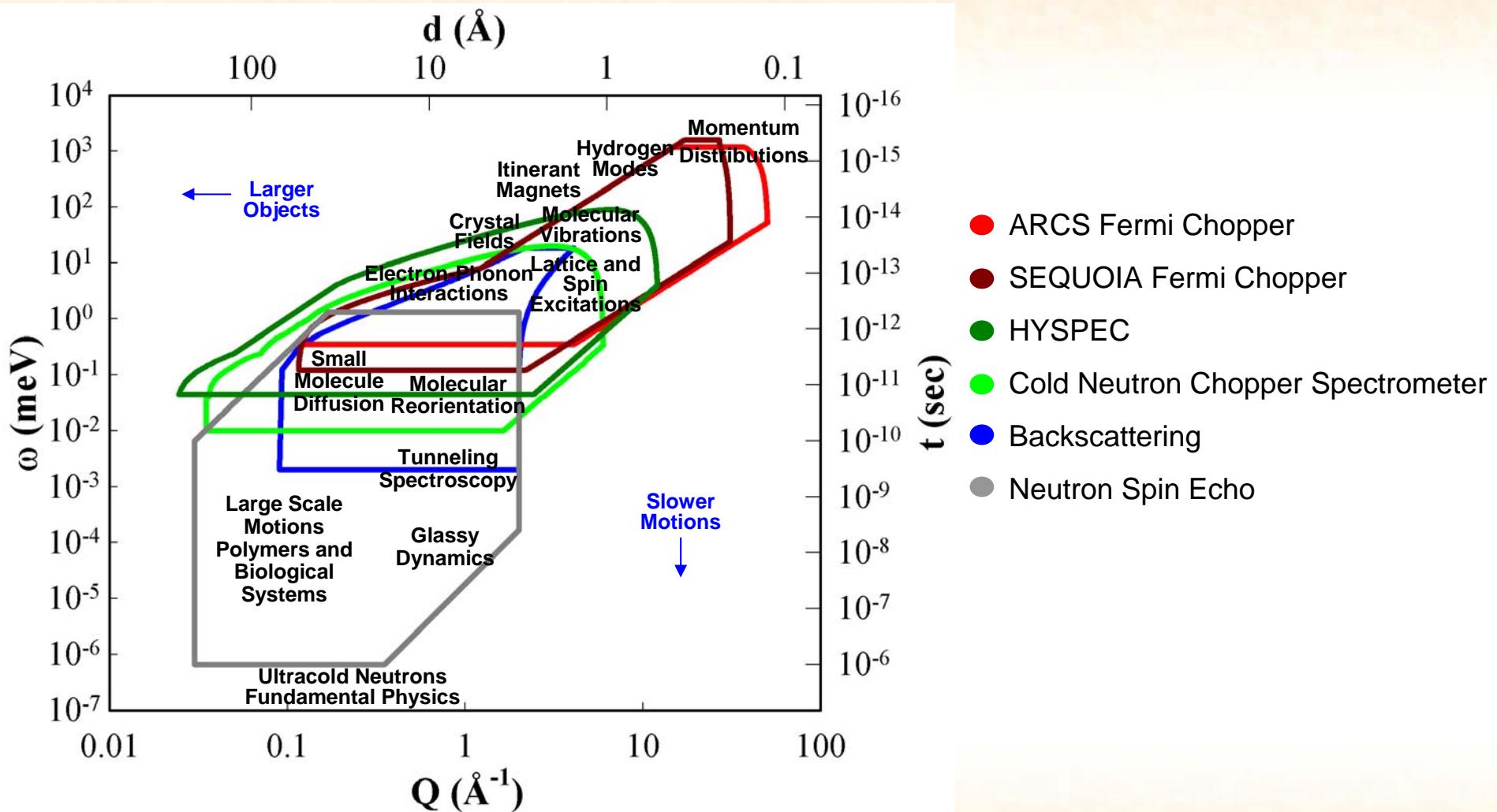
The Size of Things in Perspective!



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UT-BATTELLE

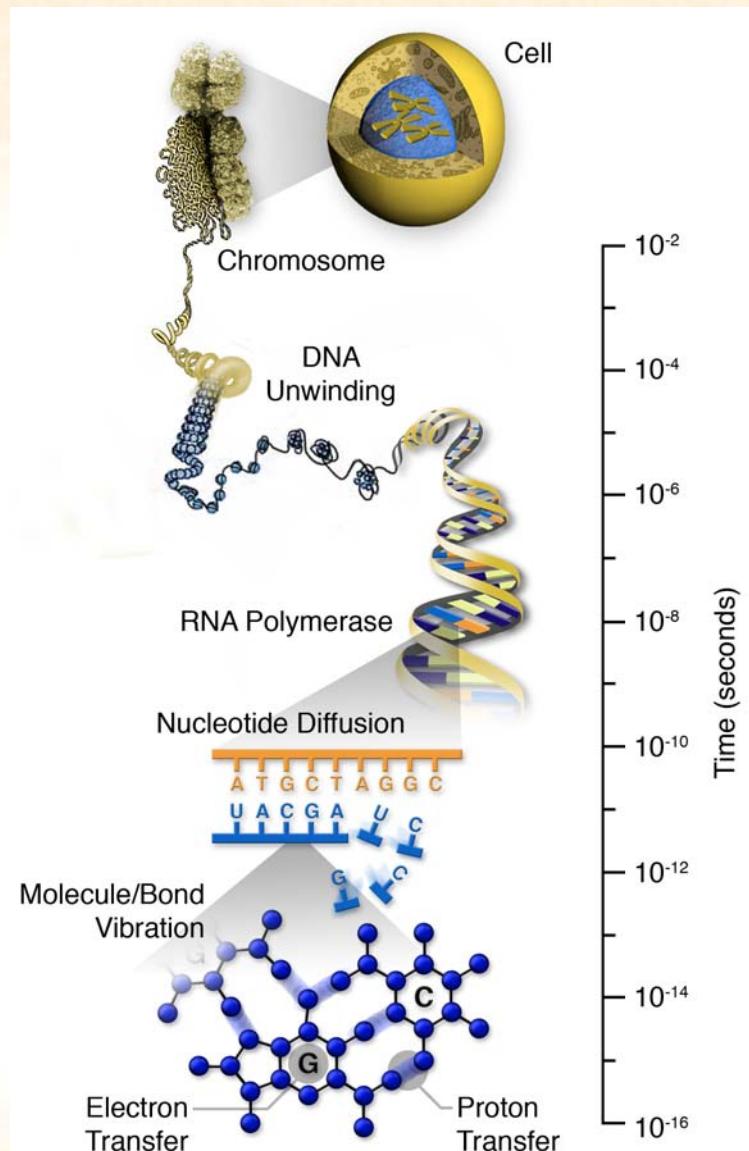
We Get the Dynamics Too!



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- We can also measure how things move!
- No one length scale, or time scale is more fundamental than any other!



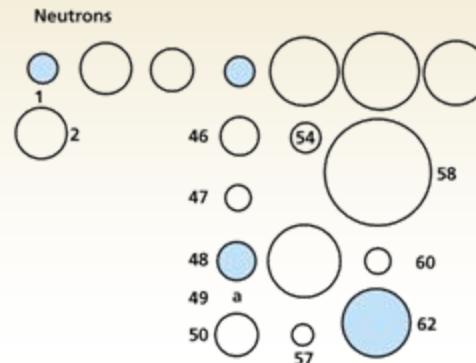
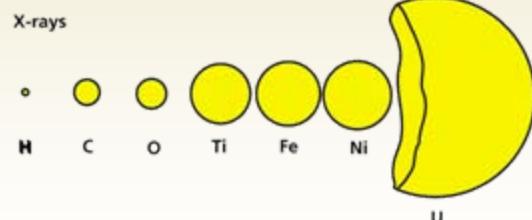
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Neutrons and Neutron Sources

You can easily work in extreme sample environments H,T,P,...) e.g. ^4He cryostat (Shull & Wollan) and penetrate into dense samples

The magnetic and nuclear cross-sections are comparable, nuclear cross-sections are similar across the periodic table



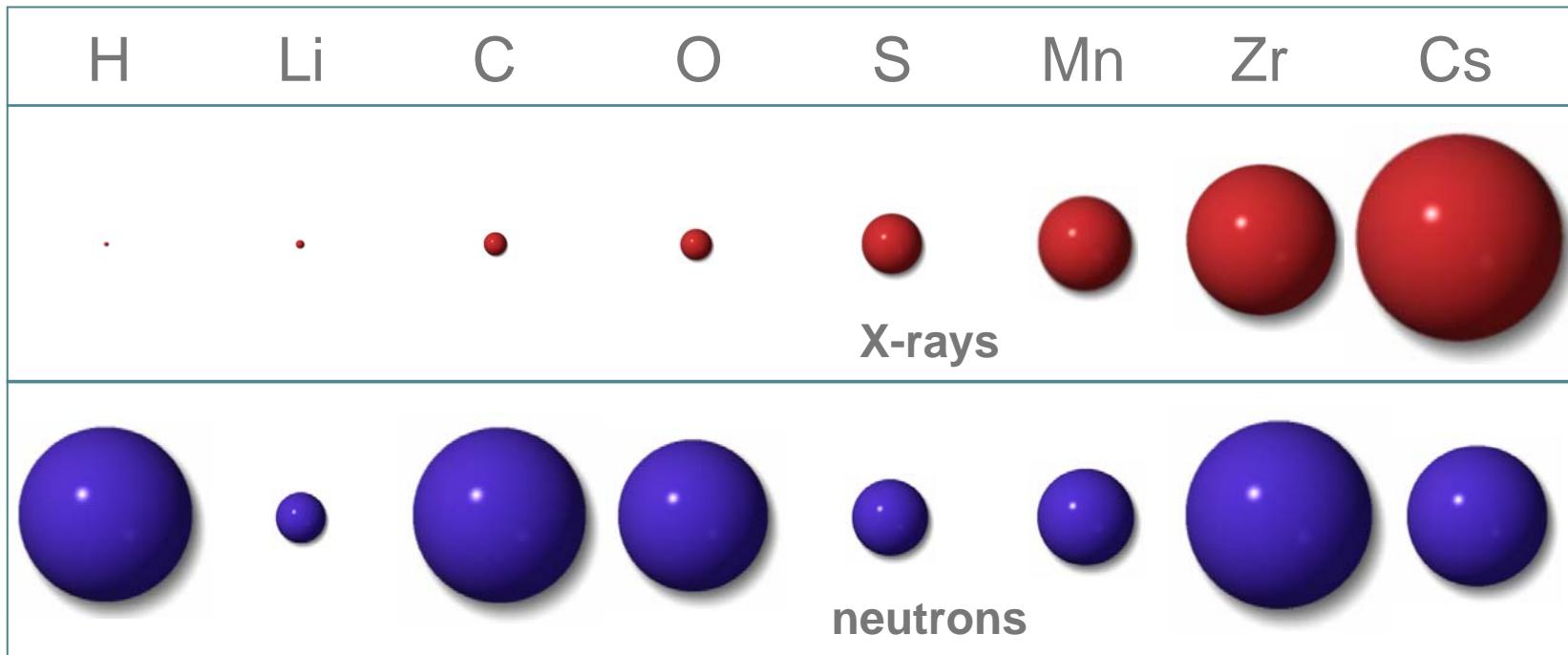
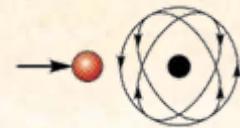
Sensitivity to a wide range of properties, both magnetic and structural



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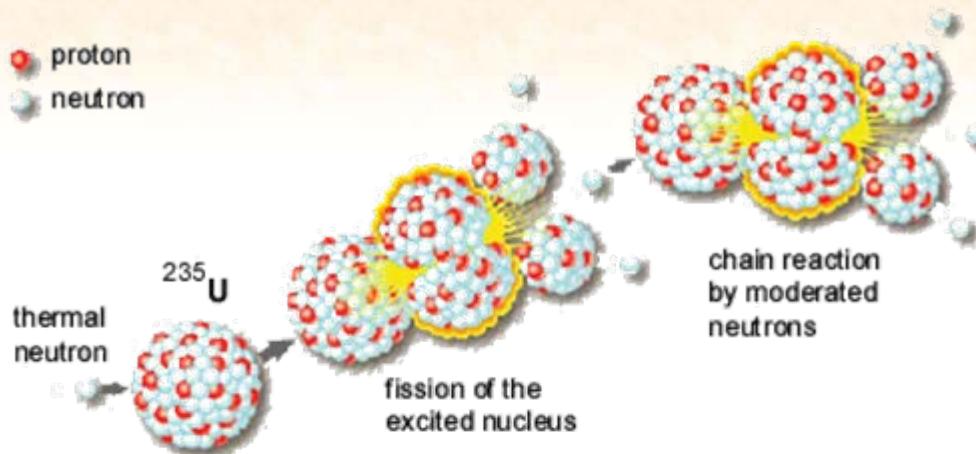
Neutrons "See" The Nuclei



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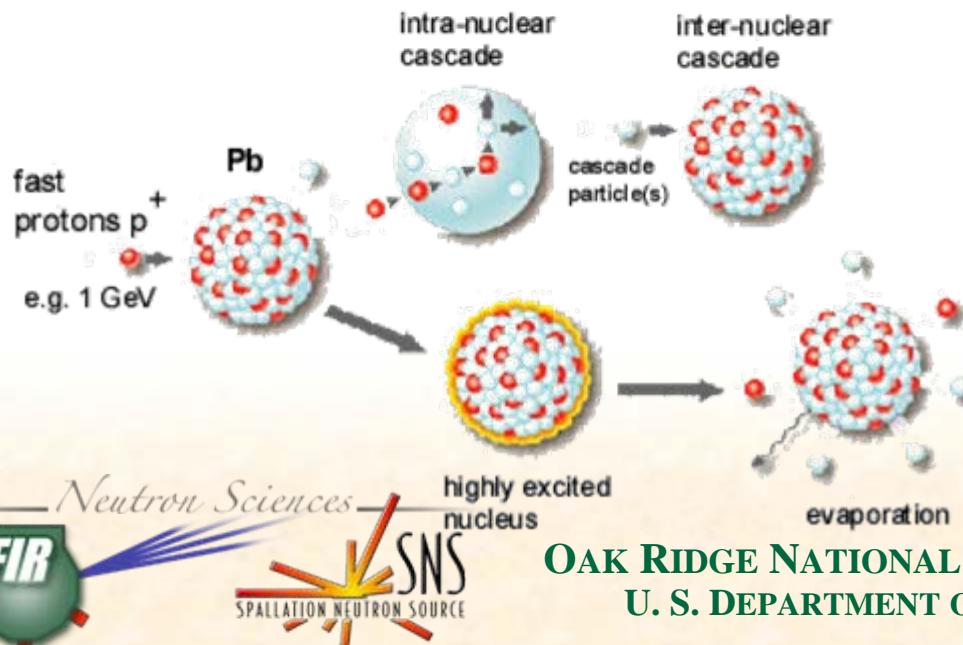


How Do We Produce Neutrons?



Fission

- chain reaction
- continuous flow
- 1 neutron/fission
- 180 MeV/neutron



Spallation

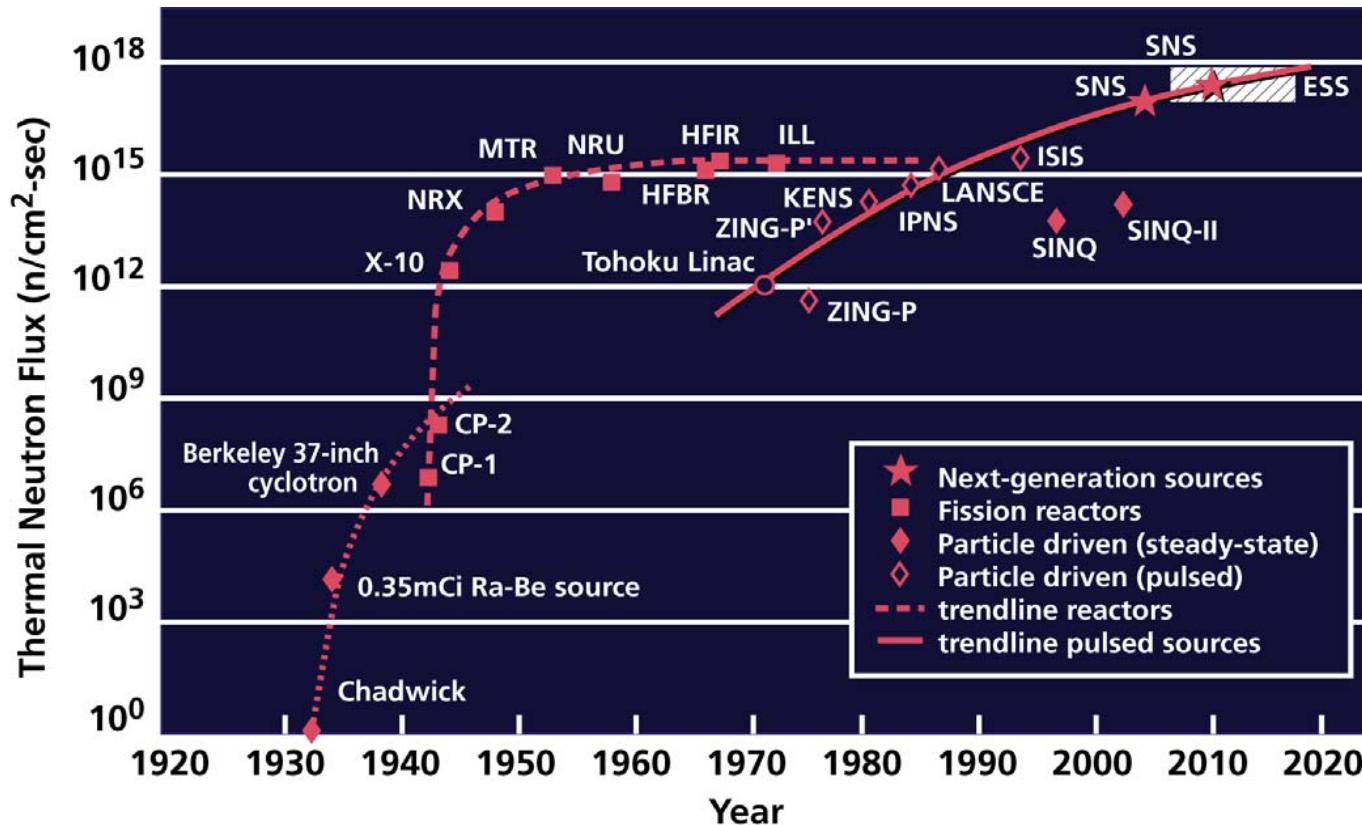
- no chain reaction
- pulsed operation
- 40 neutrons/proton
- 30 MeV/neutron

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Higher Neutron Fluxes?

*Reactors have reached the limit at which heat can be removed from the core
Pulsed sources have not yet reached that limit and hold out the promise of higher intensities*



(Updated from *Neutron Scattering*, K. Skold and D. L. Price: eds., Academic Press, 1986)



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The Spallation Neutron Source

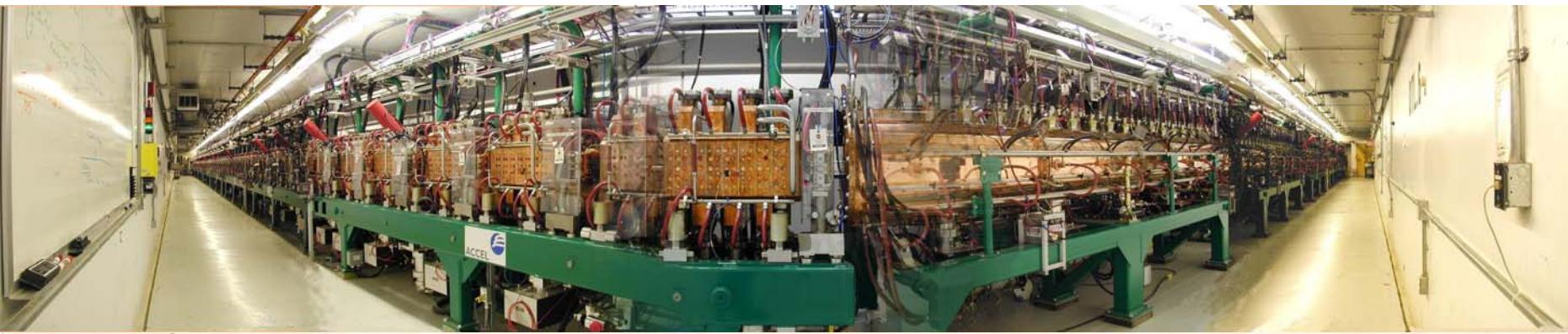
- Construction completed May 2006
- Room for eventual 25 instruments spanning physics, chemistry, biology, & materials science
- SNS will become the world's leading facility for neutron scattering
- Upgradeable to higher power, 2nd target



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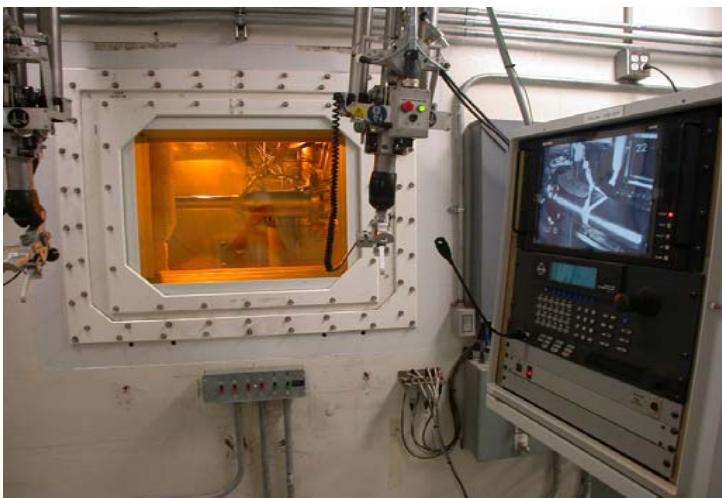
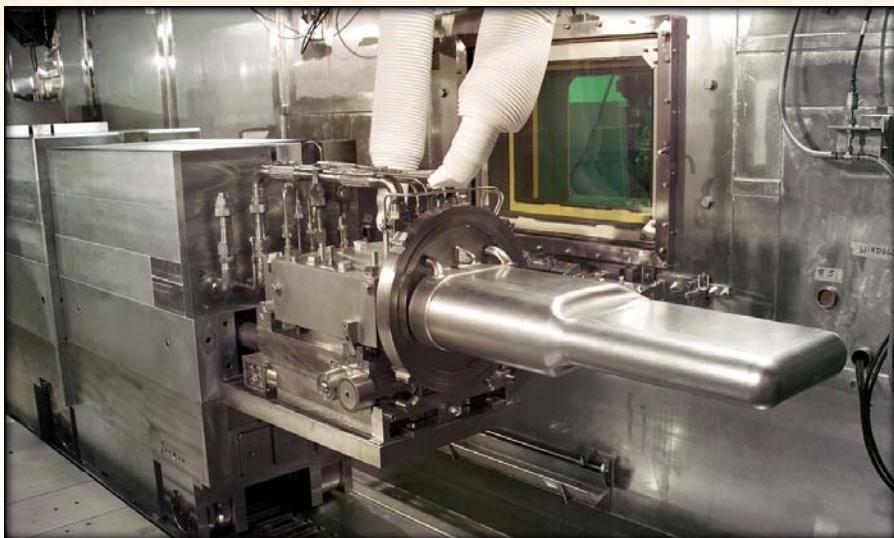
Linear Accelerator



Neutron Sciences
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Mercury Target



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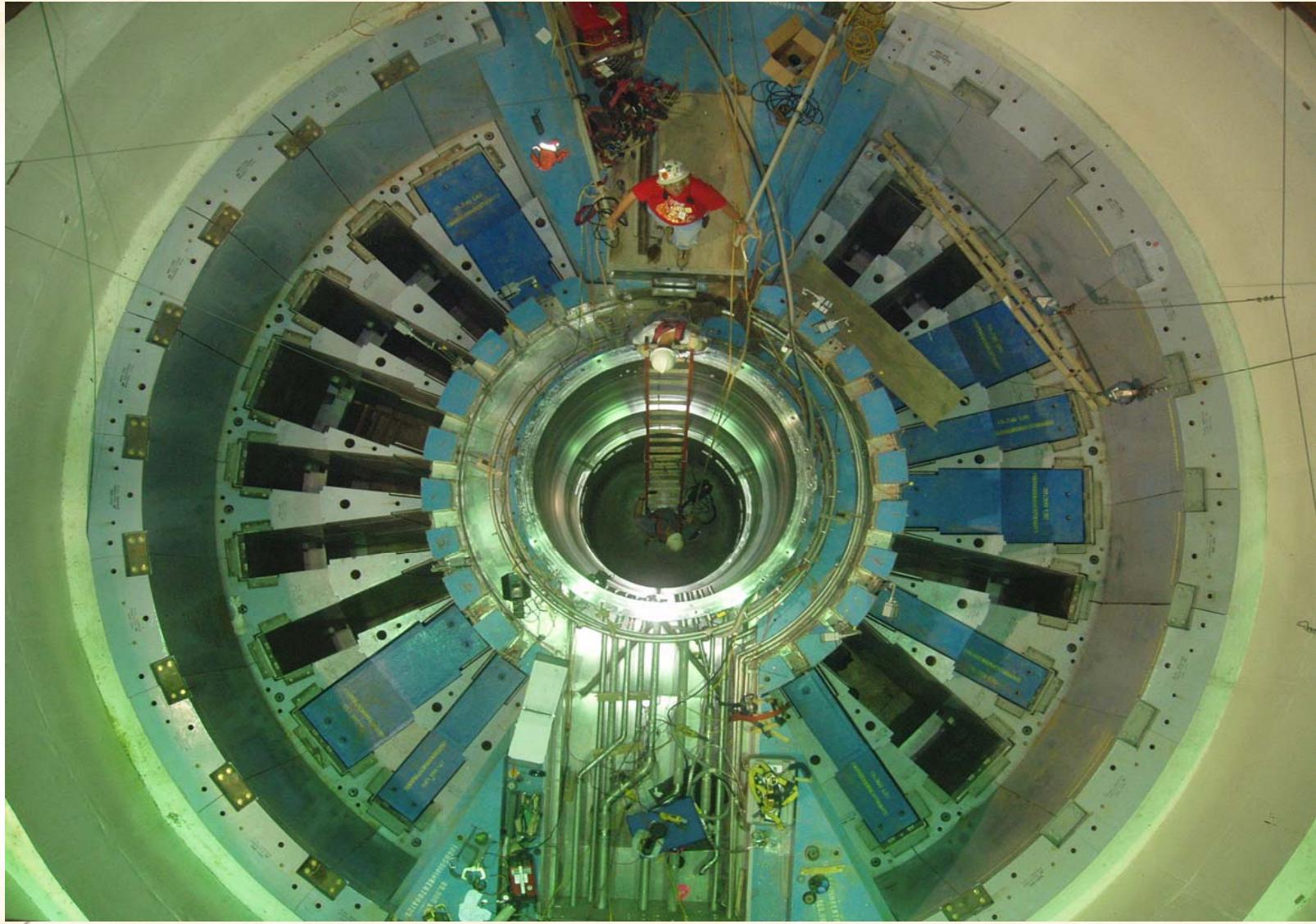
You Can Teach The Robots Anything....



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Monolith - October 2004



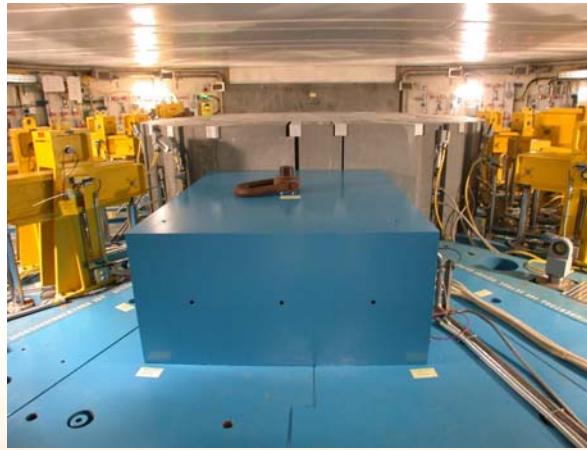
Neutron Sciences



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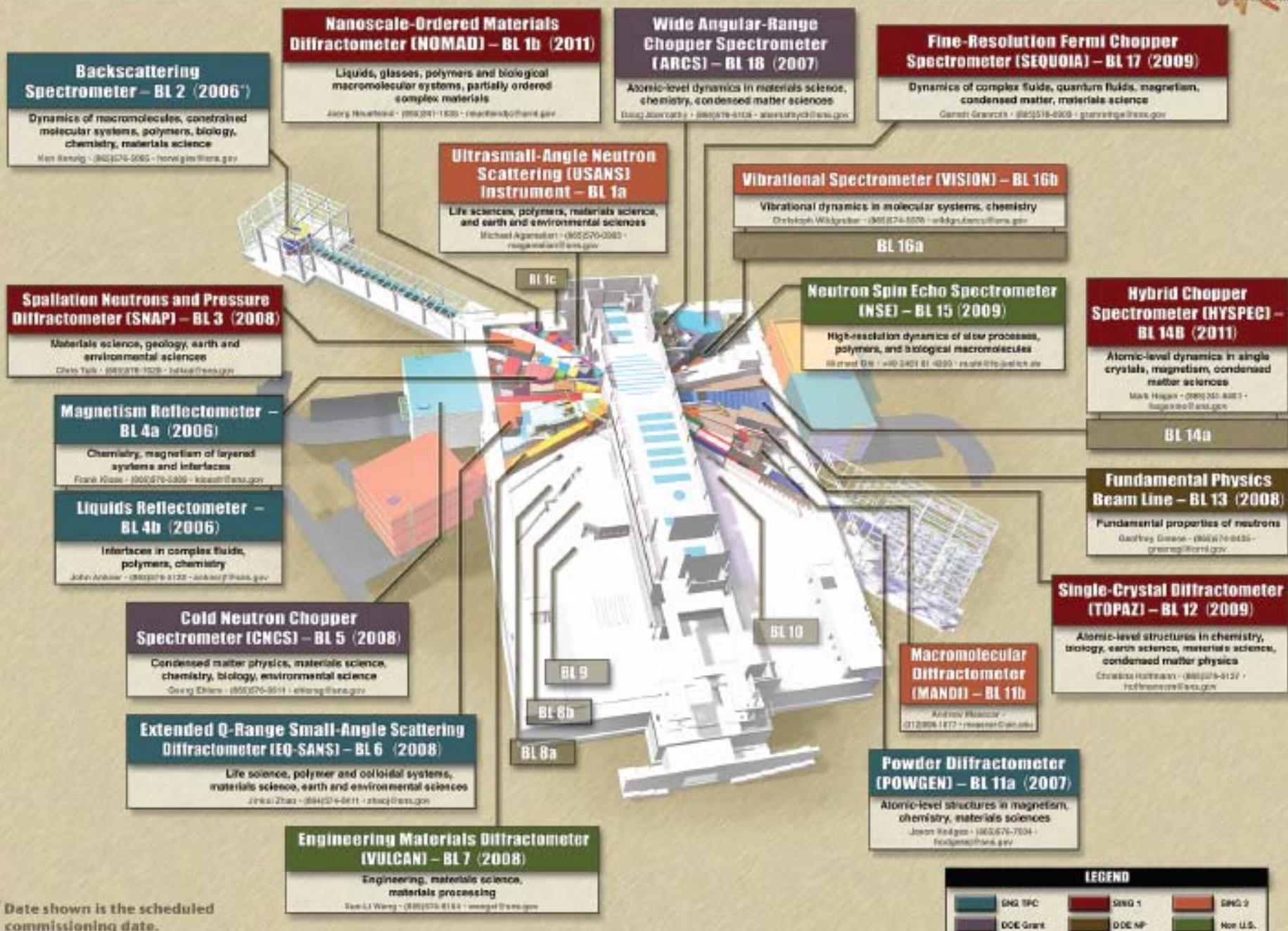
Target – Tennessee Style!



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Spallation Neutron Source



* Date shown is the scheduled commissioning date.

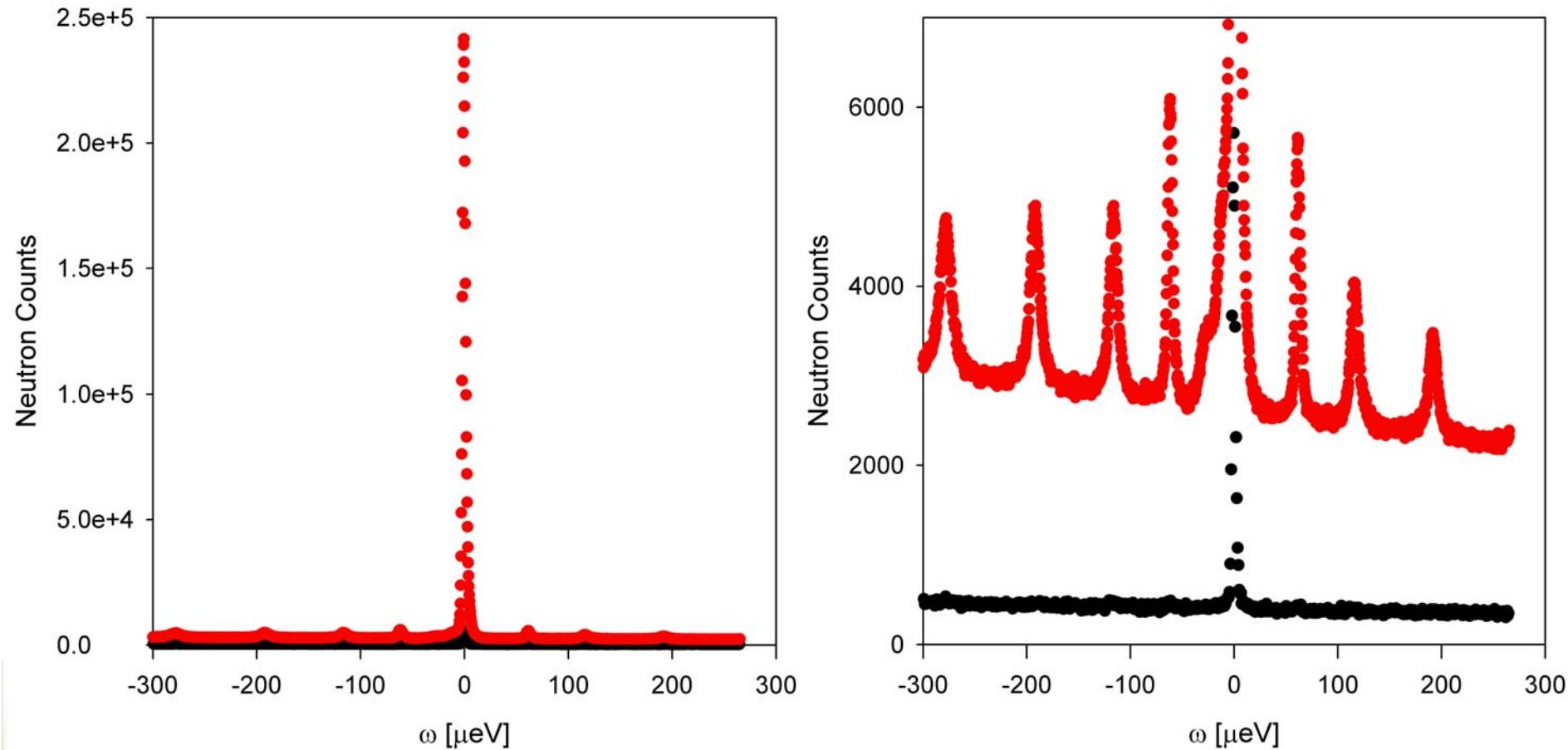
SNS Backscattering Spectrometer



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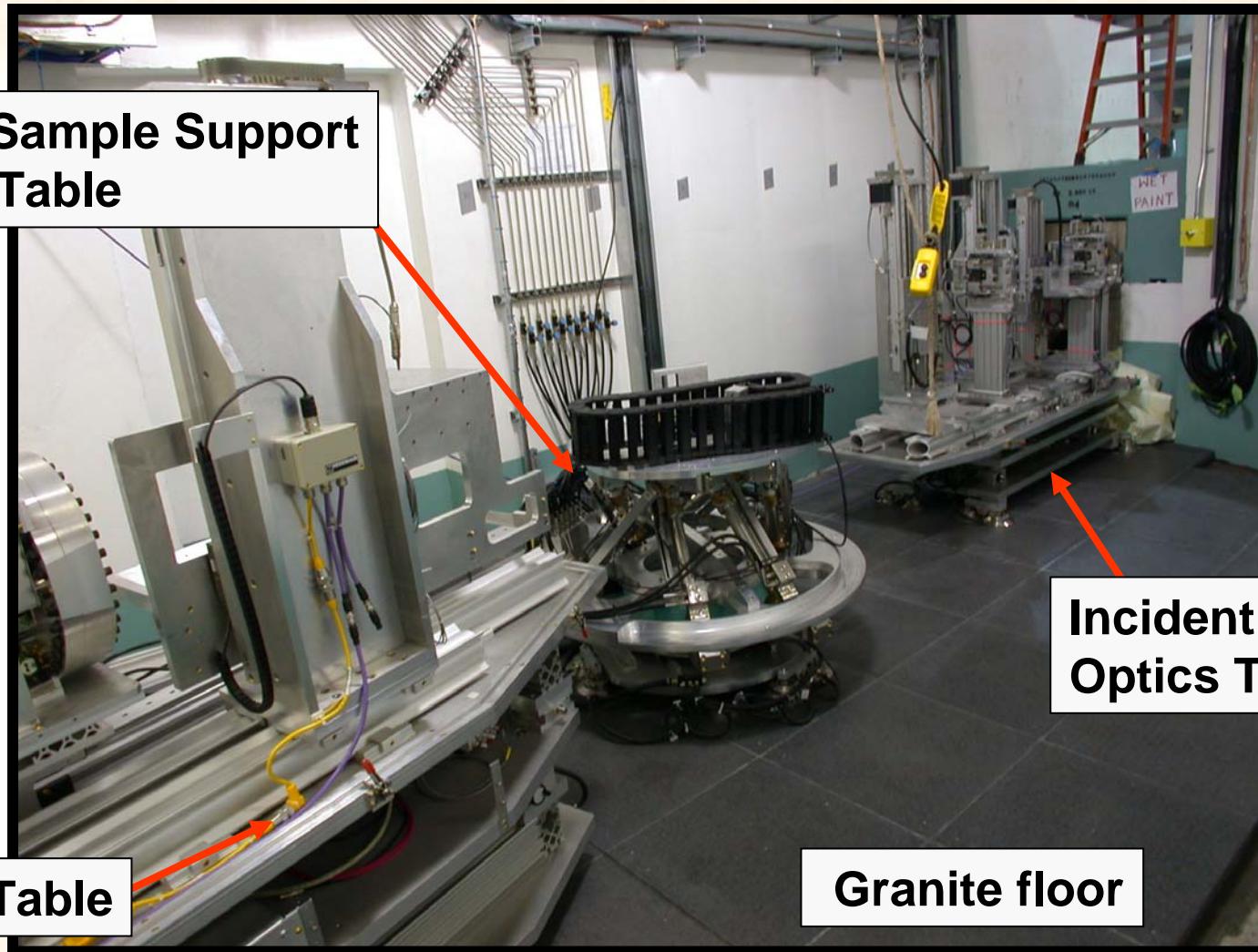
4-methyl pyridine n-oxide, T = 3 K, 27 kWatt



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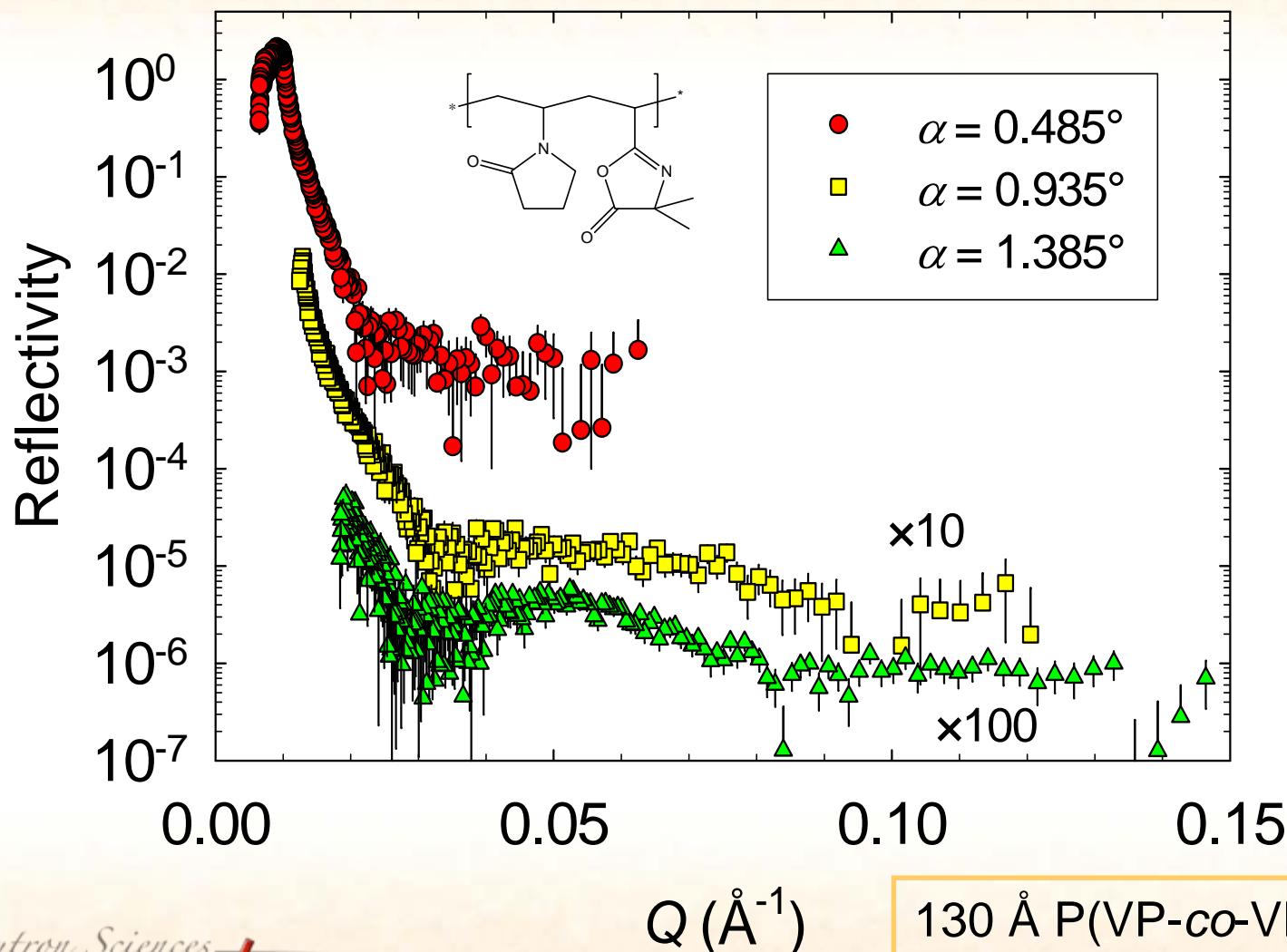
Magnetism Reflectometer



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SNS Liquids Reflectometer – First Data Polymer Scaffolds for Bio-inspired Membranes



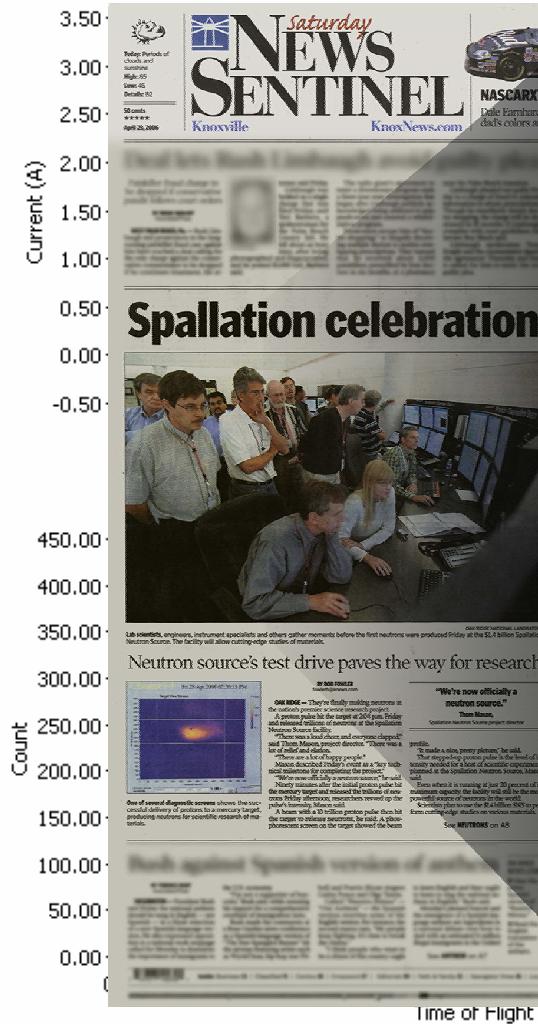
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$Q (\text{\AA}^{-1})$

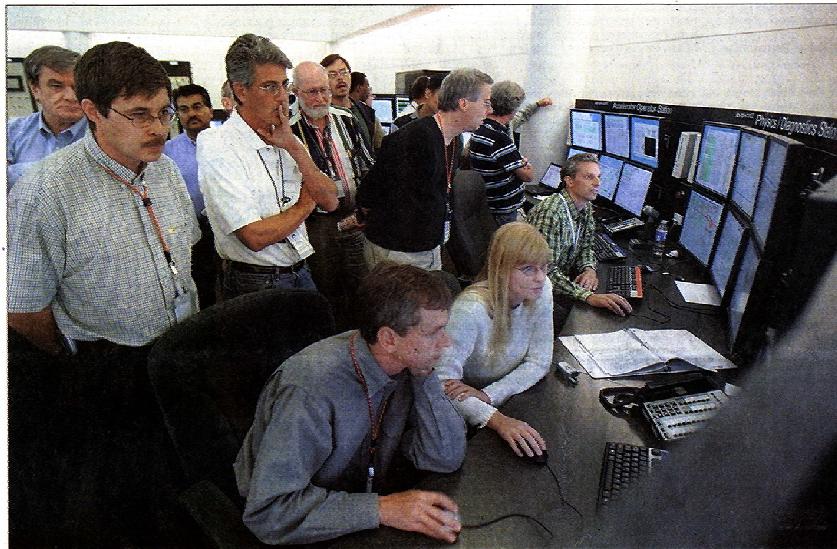
130 \AA P(VP-co-VDMA) / Si

UT-BATTELLE

SNS First Neutrons: April 28, 2006

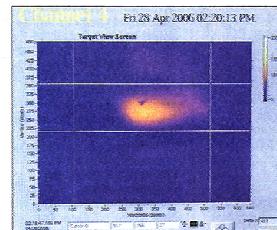


Spallation celebration



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Lab scientists, engineers, instrument specialists and others gather moments before the first neutrons were produced Friday at the \$1.4 billion Spallation Neutron Source. The facility will allow cutting-edge studies of materials.

Neutron source's test drive paves the way for research



One of several diagnostic screens shows the successful delivery of protons to a mercury target, producing neutrons for scientific research of materials.

BY BOB FOWLER
[fowler@knews.com](http://www.knoxnews.com)

OAK RIDGE — They're finally making neutrons at the nation's premier science research project.

A proton pulse hit the target at 2:04 p.m. Friday and released trillions of neutrons at the Spallation Neutron Source facility.

"There was a loud cheer and everyone clapped," said Thom Mason, project director. "There was a lot of relief and elation."

"There are a lot of happy people."

Mason described Friday's event as a "key technical milestone for completing the project."

"We're now officially a neutron source," he said.

Ninety minutes after the initial proton pulse hit the mercury target and released the trillions of neutrons Friday afternoon, researchers revved up the pulse's intensity, Mason said.

A beam of 10 million proton pulses then hit the target to release neutrons, he said. A phosphorescent screen on the target showed the beam

"We're now officially a neutron source."
Thom Mason,
Spallation Neutron Source project director

profile.

"It made a nice, pretty picture," he said. That stepped-up proton pulse is the level of intensity needed for a host of scientific experiments planned at the Spallation Neutron Source, Mason said.

Even when it is running at just 20 percent of its maximum capacity, the facility will still be the most powerful source of neutrons in the world.

Scientists plan to use the \$1.4 billion SNS to perform cutting-edge studies on various materials.

See NEUTRONS on A8

255

165

101

0

06-000735/alarm



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SNS-03671-2005



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