

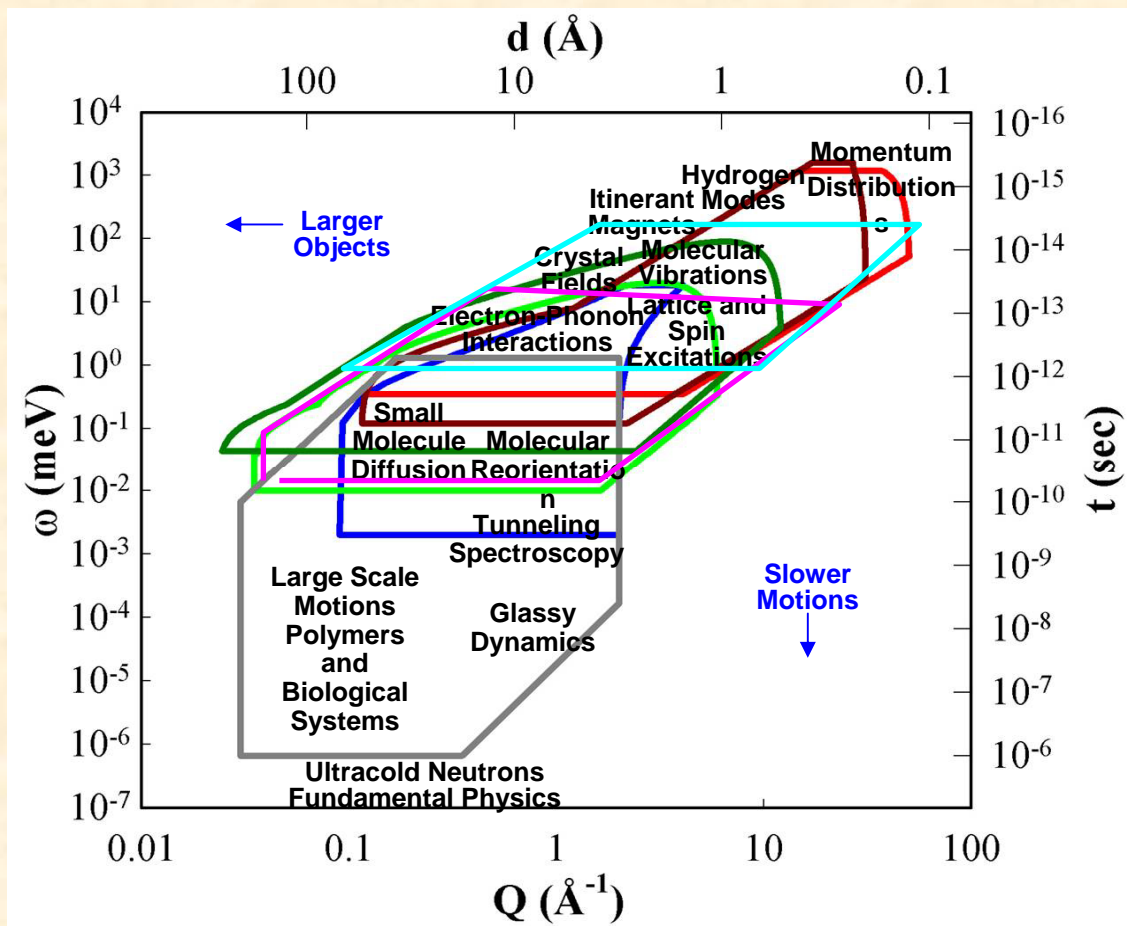
Neutron spectrometry at the High Flux Isotope Reactor and the Spallation Neutron Source

Garrett Granroth
SNS-HFIR users group meeting
Oct 12, 2005

Outline

- **Overview**
- **Classes of instruments**
 - Triple axis spectrometers – HFIR
 - Crystal analyzer spectrometers – SNS
 - Chopper spectrometers – SNS
 - Neutron Spin Echo - SNS
- **Who to contact**
- **Schedule**

Inelastic overview



- ARCS Fermi Chopper
- SEQUOIA Fermi Chopper
- HYSPEC
- Cold Neutron Chopper Spectrometer
- Backscattering
- Neutron Spin Echo
- Cold triple Axis
- Thermal Triple Axis

adapted from "Neutron Scattering Instrumentation for a High-Powered Spallation Source" R. Hjelm, et al., LA0-UR 97-1272

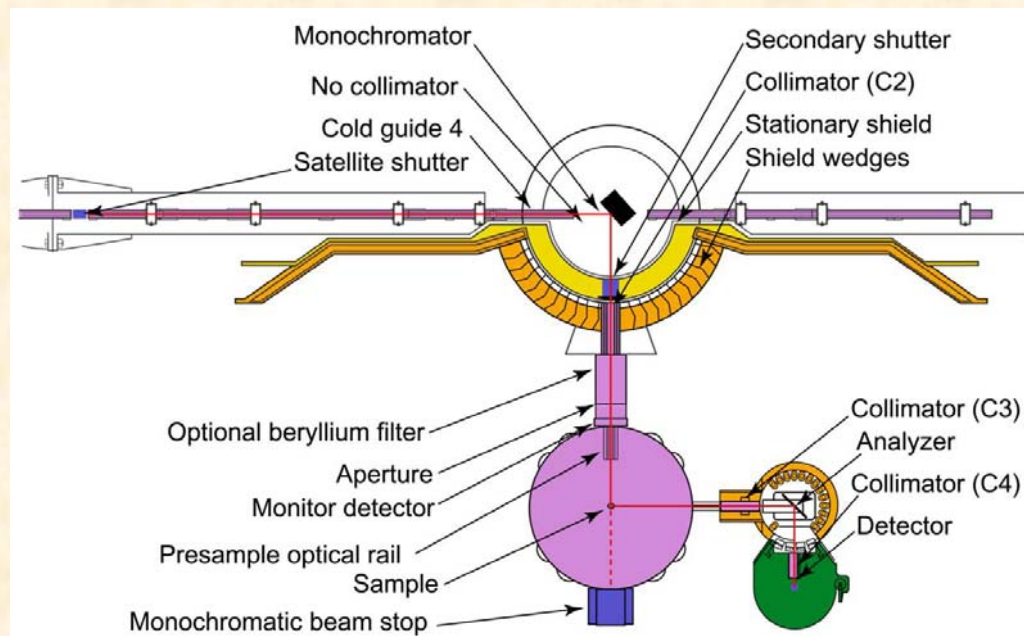
Thermal Triple Axis Spectrometers at HFIR

- HB-1 IS Andrey Zheludev; Stephen Nagler
- HB1-A (Ames Lab, fixed E_i) IS Jerel Zarestky
- HB-3 IS Mohana Yethiraj; Mark Lumsden
- HB-2 (2008) IS Lee Robertson
- Best for measuring localized regions in Q, ω
- Thermal flux $\sim 10^9$ n/cm²/s, $E_i = 5.0$ -100 meV
- HB-1 Polarized beam (2007)
- Can trade resolution for flux with
 - collimation
 - variable focusing monochromator (available next cycle on HB-3 and in June on HB-1)



Cold Triple Axis Spectrometers at HFIR

- **Great for localized regions of Q, ω space**
- **CG-4 US - Japan triple axis IS Barry Winn**
 - $E_i = 2 - 20$ meV
 - Flux = 3×10^7 n/cm²/s
 - BNL
 - 1st neutrons 2007
 - User time 2008
- **CG -1 STAR IS Stephen Nagler**
 - $E_i = 2 - 25$ meV
 - Multi Blade Analyzer
 - 1st neutrons 2008
 - User time 2009



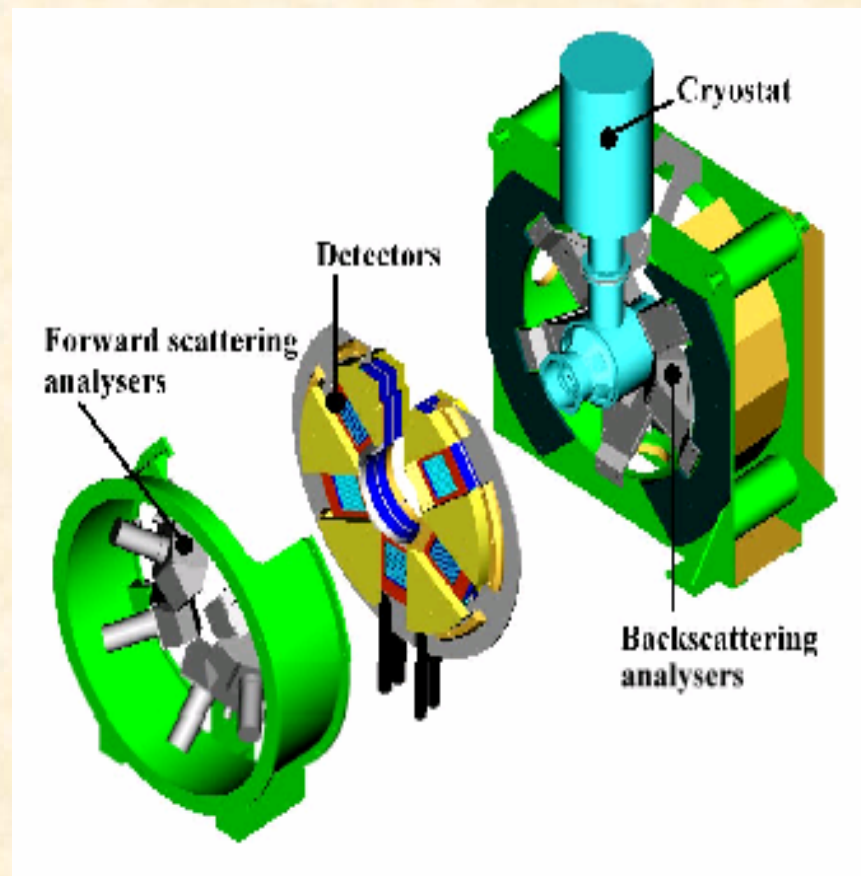
Backscattering Spectrometer

- IS Ken Herwig
- Uses Si (111) Analyzers crystals in near backscattering to achieve 2.2 μeV energy resolution
- Better resolution in energy gain
- 2.0 Sr detector coverage
- 1st neutrons 2006
- General user program 2008
- More info at IAT meeting Wed. 1:30 PM



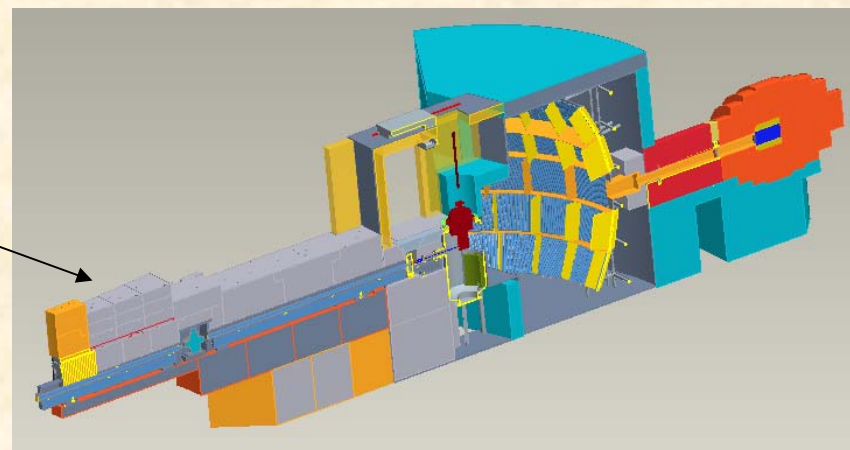
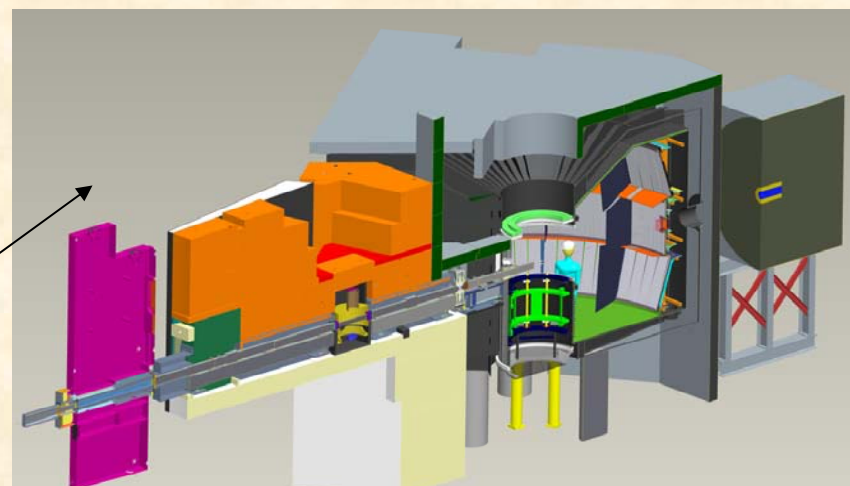
Vision Chemical Spectrometer

- PI John Larese
- $\omega = 0\text{-}500\text{ meV}$ with $90\text{ }\mu\text{eV}$ resolution
- Optimized for vibrational spectroscopy in molecular systems
- Science discussed in Neutrons and nano materials workshop
- Planned for 2010



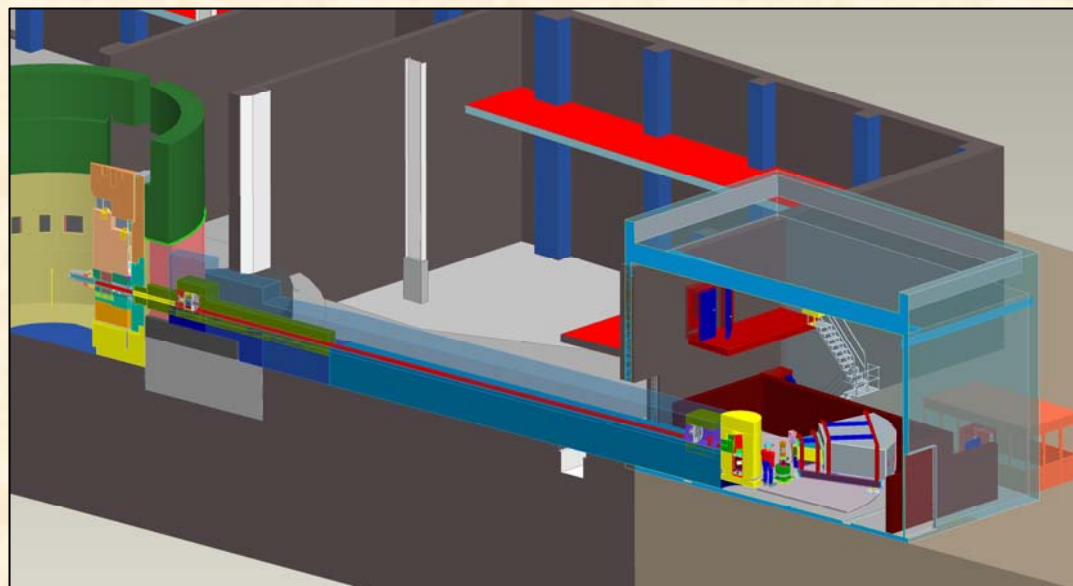
Thermal- Epithermal Chopper spectrometers at SNS

- $E_i = 20 - 2000$ meV
- optimal for mapping large regions of Q, ω space
- Q Integration provides additional gains
- **ARCS**
PI Brent Fultz; IS Doug Abernathy
 - Optimized for Q range
 - Moderate energy resolution $\Delta E/E_i \sim 2.0\%$
 2×10^5 n/cm²/s
 - Detector Coverage 2.7 Sr
 - 1st Neutrons 2007; User time 2008
 - More info IDT meeting Wed. 3:30 PM
- **SEQUOIA**
PI Stephen Nagler; IS Garrett Granroth
 - Optimized for fine energy resolution
 $\Delta E/E_i \sim 1.0\%$ 1×10^5 n/cm²/s
 - Detector coverage 1.1 Sr
 - 1st Neutrons 2008; User time 2009



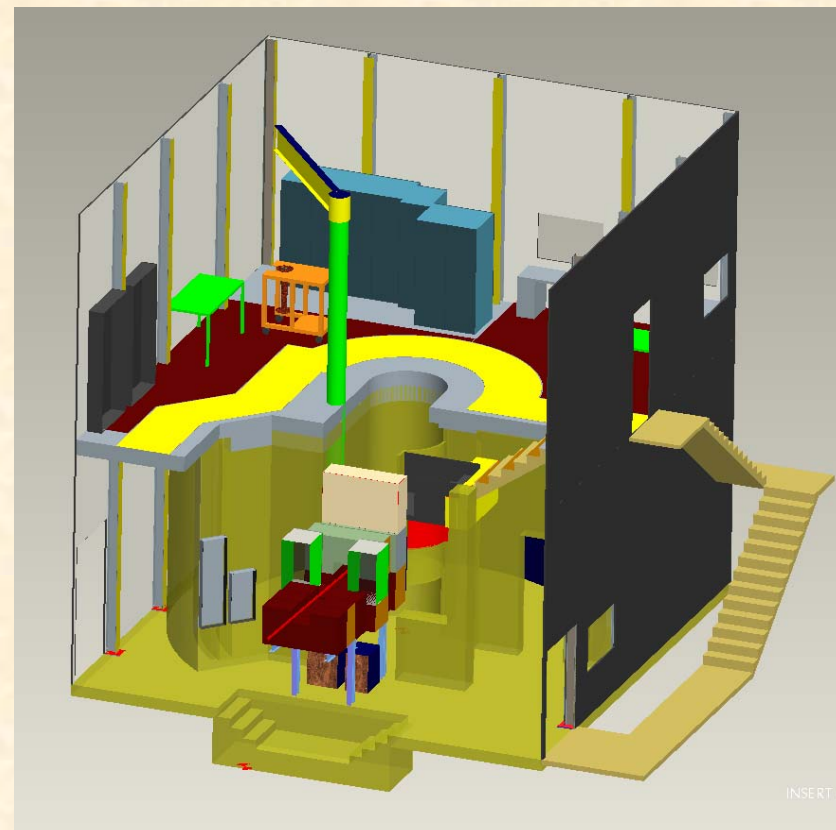
HYSPEC- Hybrid Spectrometer Cold to thermal

- Cold to thermal
- 1×10^7 n/cm²/s at $E_i = 20$ meV for 5% $\Delta E/E_i$
- Trade off vertical ΔQ for flux with focusing monochromator
- Movable detector bank (0.27 Sr) suited to looking at small regions of Q, ω space
- ΔE controlled by choppers
- Polarized
- 1st neutrons 2011; user time 2012
- Pls Steve Shapiro; Igor Zaliznyak; IS Mark Hagen



CNCS - Cold Neutron Chopper Spectrometer

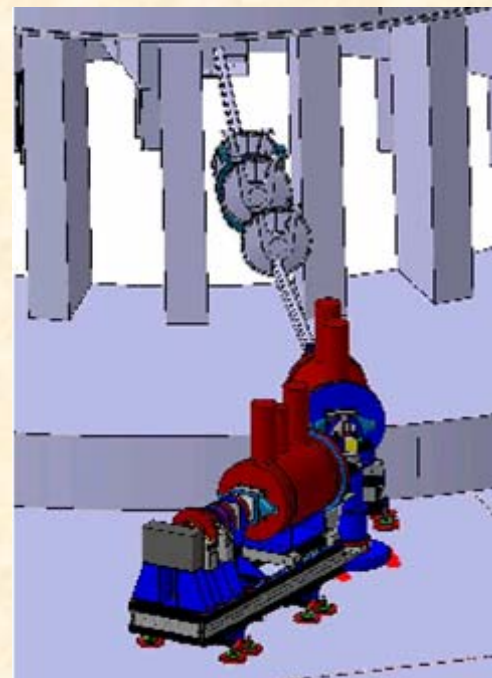
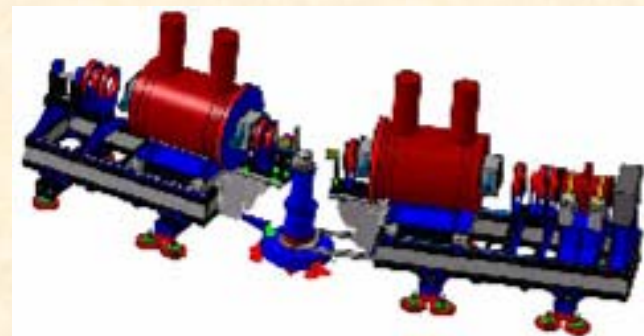
- PI Paul Sokol; IS Georg Ehlers
- Great for mapping regions of Q, ω space
- More gains when large detector bank can be summed
- $E_i = 0.81 - \sim 30$ meV
- Variable ΔE minimum $10 \mu\text{eV}$ at 10 \AA 1×10^5 n/cm²/s
- 2×10^6 n/cm²/s at 3 \AA
- ~ 2.7 Sr of detector coverage
- More info at IDT meeting Wed. 1:30 pm
- 1st neutrons 2007; user time 2008



NSE- Neutron Spin-Echo Spectrometer

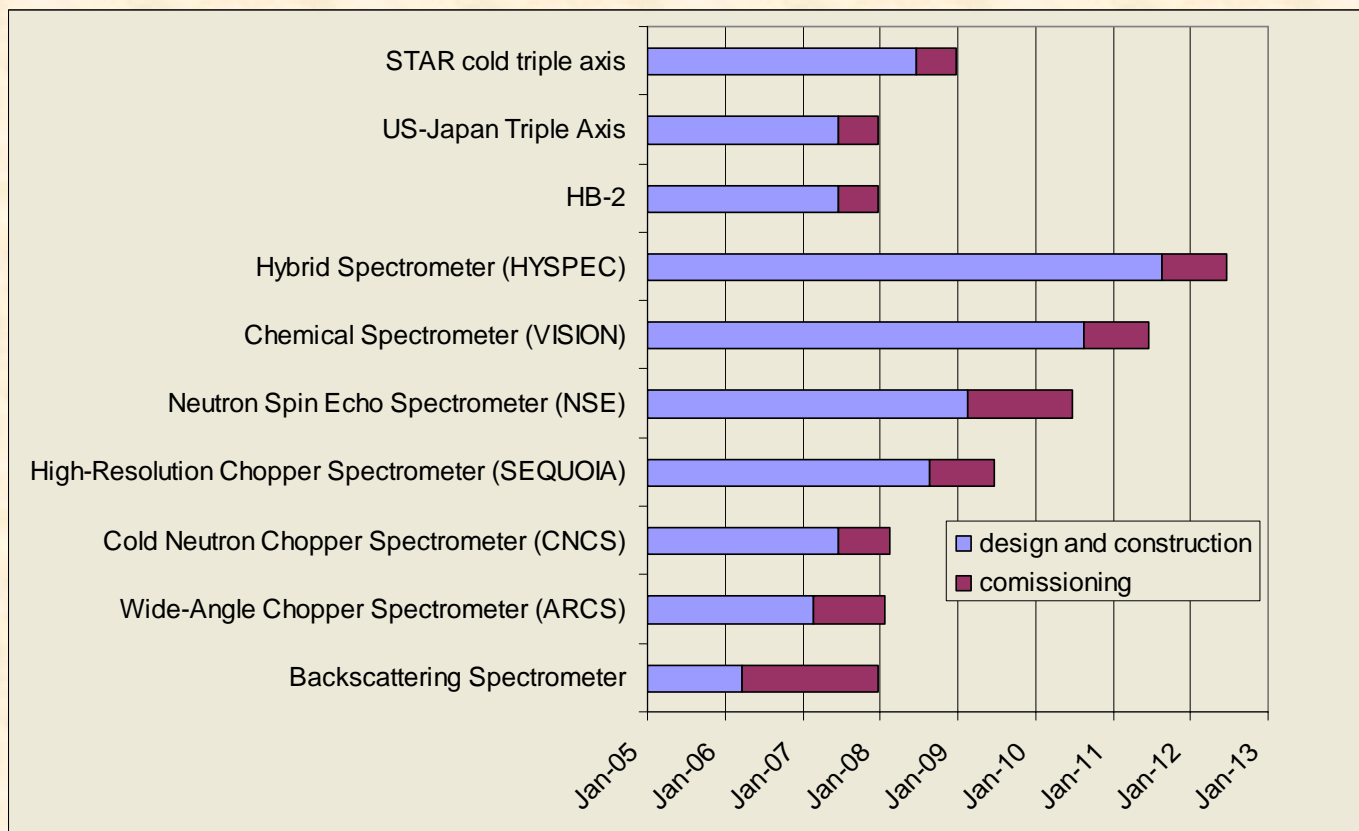
PIs Michael Monkenbusch; Michael Ohl; Dieter Richter (Juelich); Catja Pappas (HMI)

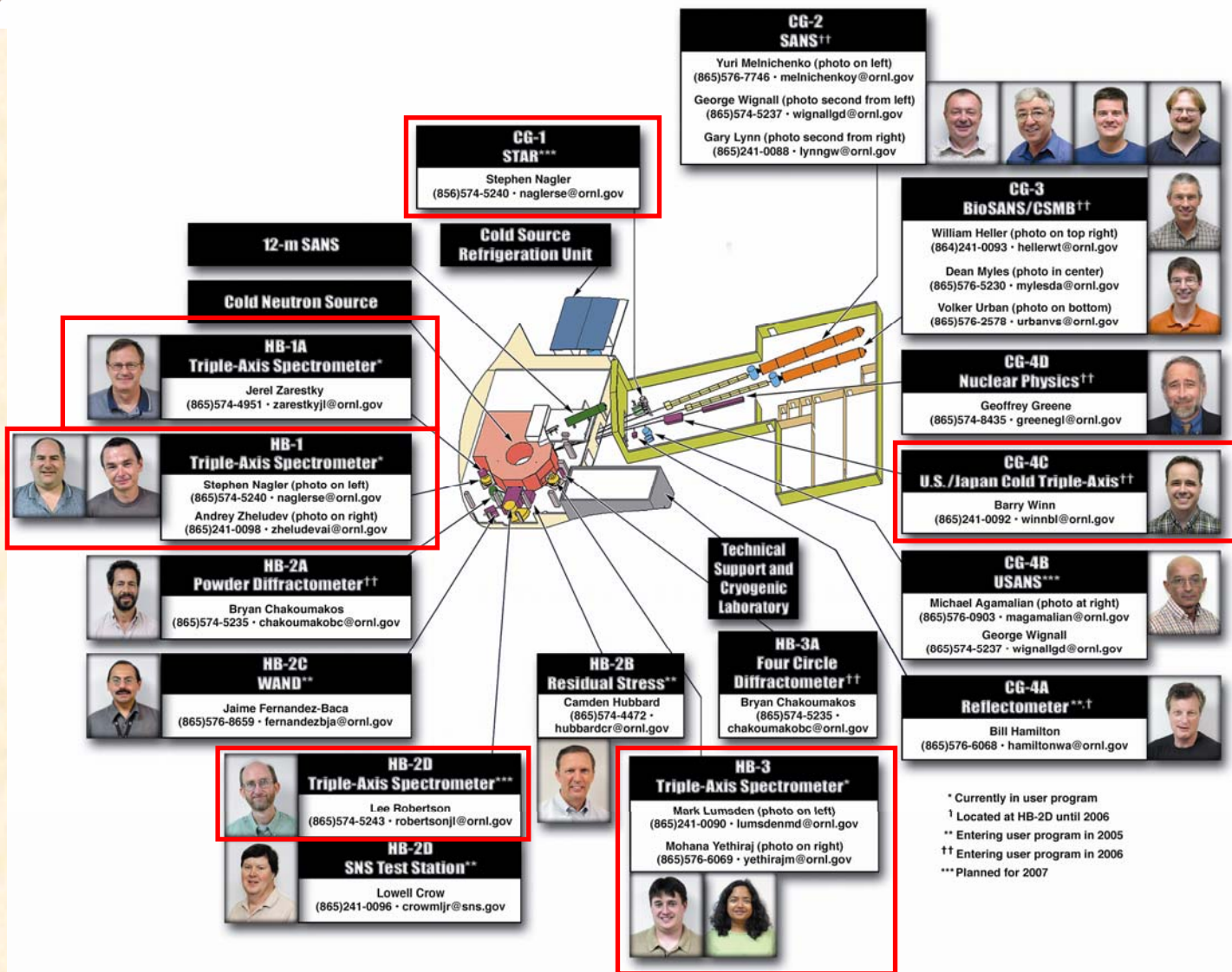
- Uses spin precession of neutrons as TOF clock
- Direct measure of $I(Q,t)$
- Finest resolution
- Optimized for dynamics on mesoscopic scales, particularly for biomolecules, polymers, and other soft matter systems
- 1st neutrons in 2009; user time in 2010
- Joint Juelich-HMI project – German funding



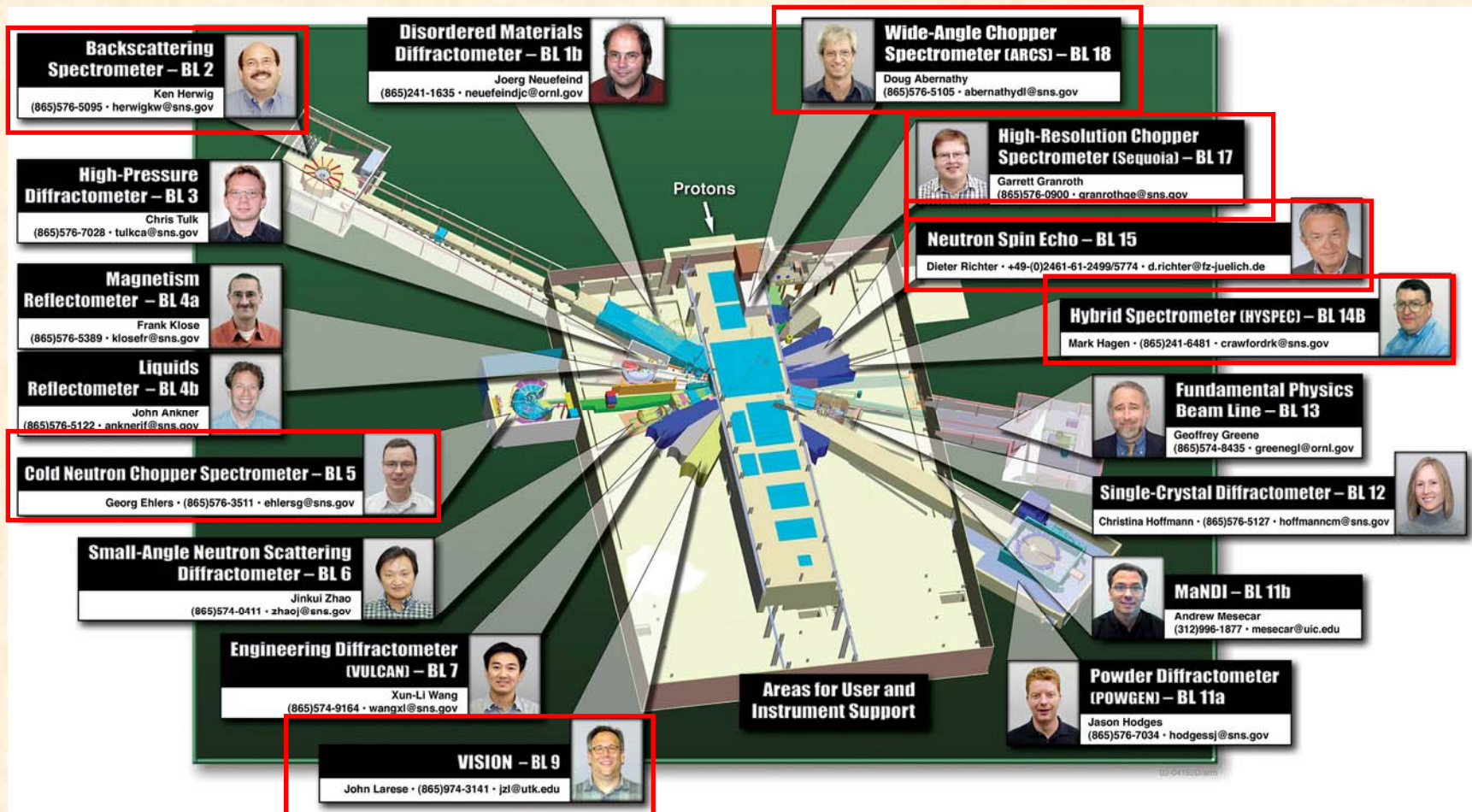
Instrument Schedules

HB-1, HB-1A, HB-3, available now





* Currently in user program
 † Located at HB-2D until 2006
 ** Entering user program in 2005
 †† Entering user program in 2006
 *** Planned for 2007



SUMMARY

- **The completion of a full suite of spectrometers is underway**
- **High Flux thermal triple axis instruments are available at the HFIR today.**
- **Cold triple axis spectrometers will be available at the HFIR soon**
- **The backscattering spectrometer will receive 1st neutrons at the SNS next spring**
- **The remaining instruments in the inelastic suite will enter the user program between 2008-2012**