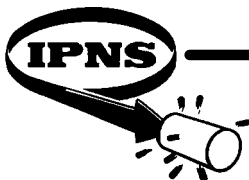


Intense Pulsed Neutron Source (IPNS) Response to BESAC Subpanel Review

**Bruce Brown
Argonne National Laboratory
BESAC Meeting
Feb, 26, 2001**

www.pns.anl.gov

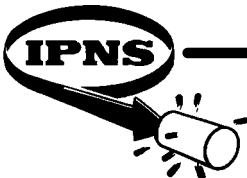


The IPNS Proposal

IPNS is committed to broadening and increasing the user community in preparation for the SNS

We presented a 4-part plan (\$9M/yr) to the subpanel that is the first recommendation in their report

- **Increase operation to 30 weeks/yr**
- **Initiate a maintenance and upgrade plan for the accelerator system that will guarantee at least 10 years of reliable operation**
- **Significantly upgrade all scattering instruments**
- **Greatly increase the ANL research program-coupled with instrument enhancements**

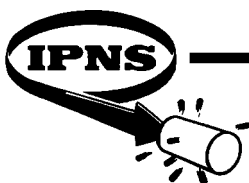


Budget

- Staff for additional operation, users and maintenance **\$3.1M/yr**
- Equipment-accelerator **\$1.0M/yr**
- Equipment-instruments **\$2.5M/yr**
- Research programs **\$2.6M/yr**
- **Total \$9.2M/yr**

In addition, IPNS has submitted a proposal to DOE for \$2.5M/yr to enhance university research in the area of neutron scattering. This is our response to the subpanel's third recommendation and includes:

- Joint faculty appointments
- Faculty leaves
- Post docs
- Graduate students

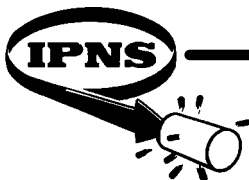


Additional Operation

Increasing operation from 25 to 30 weeks/yr includes

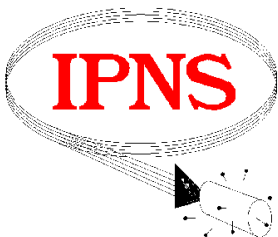
- **Additional accelerator staff**
- **Increases in scientific support for the user program**
- **Electricity, M&S, spare parts**

It has the negative effect of decreasing the time available for maintenance, which requires additional staff increases



IPNS ACCELERATOR ISSUES NEED TO ENSURE AT LEAST 10 YEARS OF OPERATION

- Details in white paper in section 9 "Equipping the Accelerator for the Next Ten Years".
- The linac is 40 years old. The rapid cycling synchrotron (RCS), built in 1979, has delivered 6 billion pulses, more than any p+ synchrotron in the world except ISIS.
- Reliability has been 95%, but some systems must be replaced or upgraded to maintain this.
- Accelerator replacement value is ~\$80M, but for many years, only ~\$140K/yr of equipment funds have been available for all accelerator activities.
- The main operations issue is that there are no replacement parts available for many of the old systems and our spares won't last forever.
- ISIS has begun a similar project, ~\$18M + 29 staff-years over 7 years, including a shutdown of 6 months starting December 2001.
- Along with increased operating hours with high reliability, we plan to increase beam current by 30%, using the second harmonic on the RF.





IPNS Accelerator Improvement Plan

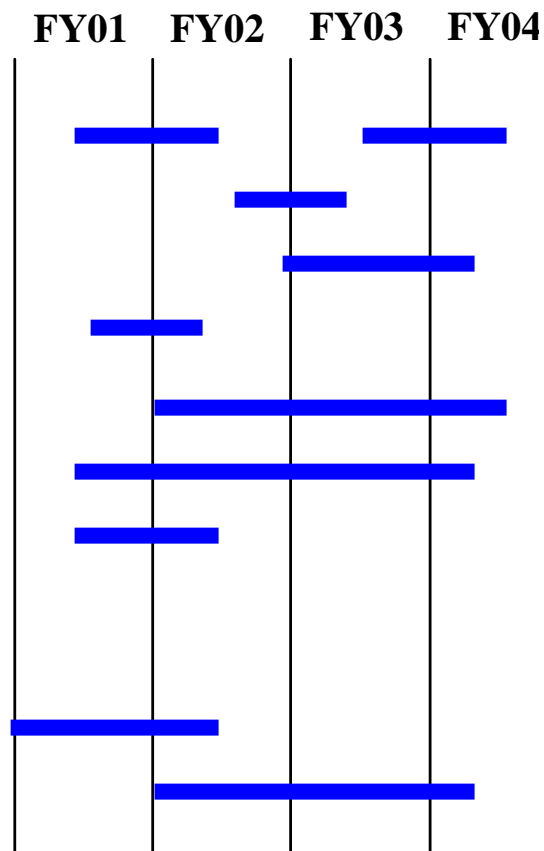
(Assumes ~\$1M/yr increase in accelerator equipment funds relative to FY00)

Replacements / Upgrades

- Beamline components
- Beam scrapers
- Linac boxes
- Magnets
- Amplifiers, rf components
- Vacuum systems
- RCS choke

3rd RCS rf station

- Phase-1
- Phase-2





Instrument Enhancement Plan

(Assumes \$2.5M/yr increase in equipment budget relative to FY00)

Detectors, choppers and optics

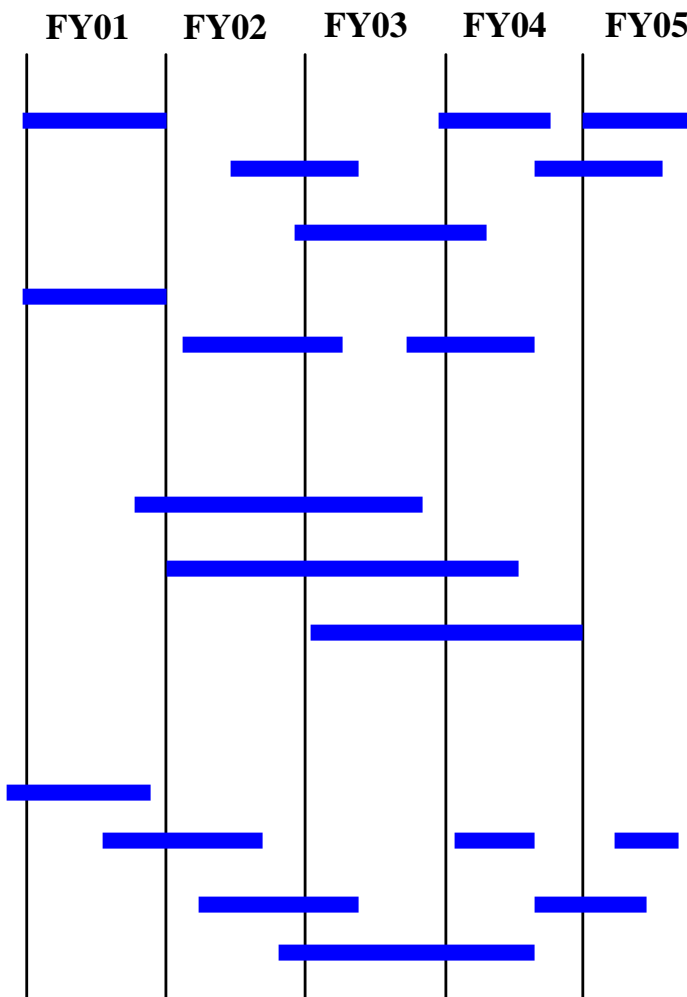
- SCD and SAND area detectors
- LPSD's SEPD and GLAD
- LRMECS dets and SAD area detector
- HRMECS chopper
- Guides - QENS, SEPD

New instruments, major upgrades

- Spin-Echo SANS
- Magnetism Diffractometer (MiDaS)
- Upgraded GPPD

DAS, process control upgrades

- HRMECS
- SCD, SAND, HIPD, POSYII
- LRMECS, SEPD, QENS, CHEX
- SAD, GPPD, GLAD, POSYI





Motivation for Improvements

Increased data rates

- Higher throughput
- Time resolved experiments, smaller samples

New scientific capabilities

- Magnetic and diffuse scattering
- Single crystal inelastic scattering
- Structure and dynamics of biological and polymeric systems
- Complex crystal structures

Anticipation of SNS needs

- Prototype instruments (magnetism diffractometer)
- New instrument concepts (resolution matched powder diffraction, multi-detector single crystal)
- Components - choppers, guides, polarization
- New moderator concepts



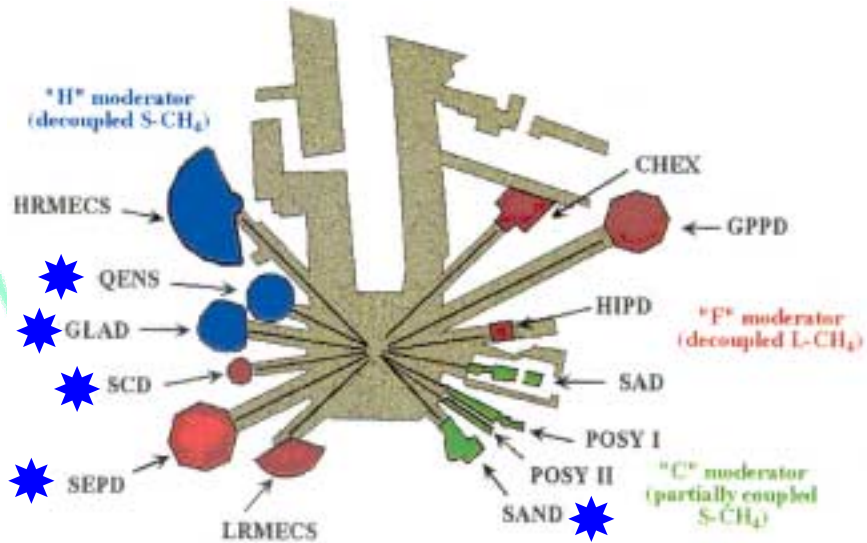
Instrument Enhancements

Drivers: User needs, relevance to SNS, ANL research programs

Data rate gains

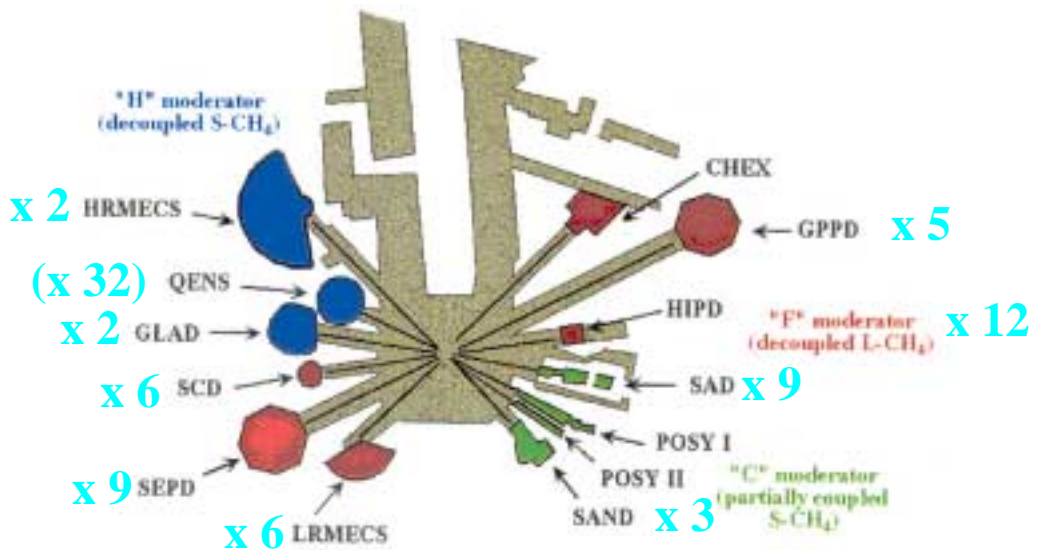
<u>Instrument</u>	<u>Present Plan</u>	<u>To-date</u>
GPPD	5	1.4
SEPD	9	-
GLAD	2	-
HIPD/MiDaS	12	-
SCD	6	-
LRMECS	6	-
HRMECS	2	1.5
QENS	32	10.0
SAD	9	-
SAND	3	1.5

IPNS Instruments

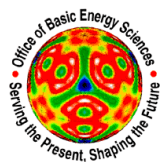


Now -- useful research tools

* World-Class Science



Recommendation → competitive



Increase Research Programs

The purpose is to broaden and increase the user community for SNS via:

- Opening new areas of research**
- Involving new people**
- Create careers in neutron scattering**

Mechanisms:

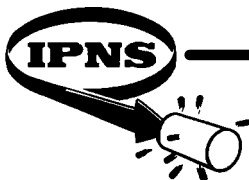
- New MSD research programs (+\$500K)**
- Involve university researchers (+\$100K)**

Visiting professors

Joint post docs

Research students

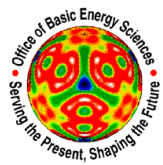
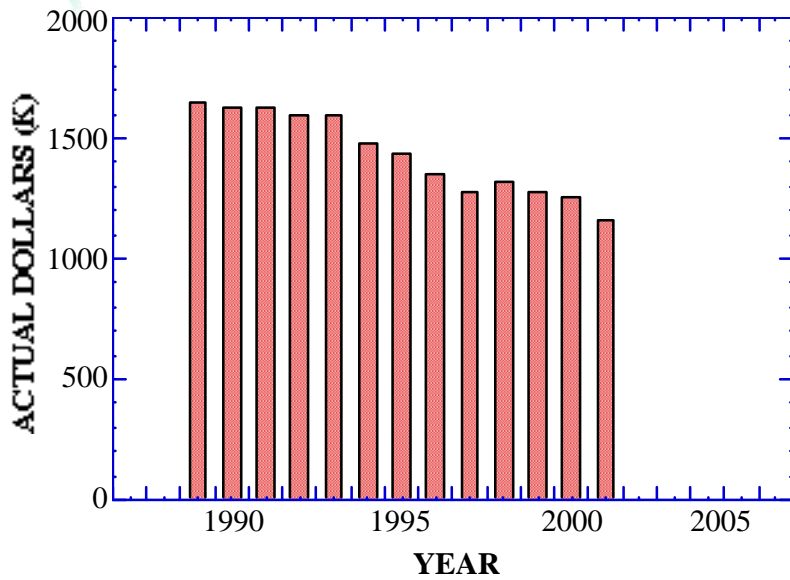
- New areas of research will be closely coupled with the IPNS instrument upgrades**



Evaluation Procedure & User Community

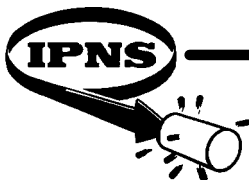
Jack E. Crow

ANL Materials Science Division Neutron Scattering Group Budget



Potential New Research Programs

- Understanding quantum critical phenomena as the fundamental physics underlying a broad range of novel physical behavior.
- Structure and dynamics of soft biological materials, including the extension of isotope substitution methods to carbon isotopes.
- Grazing-incidence small angle scattering from working single biological membranes using spin-echo small angle scattering.
- Structure-function relationships in large-cell structures.
- Magnetic structure of soft and hard magnetic composites, with the object of understanding and optimizing their performance by probing the behavior of nanoscopic hysteresis phenomena.
- Magnetism in complex bulk systems with dilute magnetic constituents.
- Short-length-scale self-organized charge, spin, or structural ordering that controls the macroscopic behavior in bulk systems (e.g., advanced ferroelectrics.)



SNS Summary



ANL, and IPNS in particular, is responsible for the development of a “best-in-class” instrumentation suite for the Spallation Neutron Source (SNS).

This relationship is, and will continue to be, mutually advantageous, and offers many exciting new opportunities.

IPNS-SNS Synergy



Advantages to SNS:

- Access to neutron scattering scientific and technical expertise for providing instrumentation ideas and training SNS staff
- Access to pulsed spallation neutron source facility for testing of prototypes and for scientific research

Advantages to IPNS:

- Infusion of new ideas
- SNS development activities can lead to new IPNS capabilities

Advantages to both:

- Skilled people available to “jump-start” solutions to IPNS enhancement or troubleshooting needs. Such interactions also provide valuable hands-on experience for SNS staff.
- Shared staffing where appropriate

LWTS



- LWTS is proposed for funding by the NSF, but it is possible only because SNS is already being constructed
- ANL-IPNS/MSD is responsible for developing the concepts for the target station and the instruments for LWTS
 - Target station concept driven by science/instrument needs
 - Instrument concepts utilizing the unique properties of LWTS
 - Science case being prepared by the LWTS user community
- ANL resources for LWTS development
 - Scientific and technical expertise
 - Operating facility for development
 - SNS instrument development team

Cold Neutron Chopper Spectrometer

Penn State

MIT

Berkley

Michigan

Missouri

University-National Lab Collaboration

IPNS

NIST

Two Phase Project

- Phase 1 - IPNS
 - Modified Incident Flight Path
 - Horizontal Final Flight Path
 - Operational in three years
- Phase 2 – SNS
 - Full Spectrometer
 - True Day 1 instrument

Advantages

- Commissioning and testing in advance of SNS
- Development of analysis techniques
- High Involvement of Academic Community
- Development of new users in advance of SNS

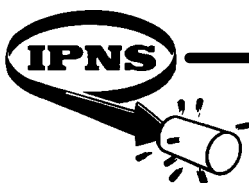
Status

IPNS is ready to move on the \$9M/yr plan that will broaden and increase the user community in preparation for the SNS

MSD received an additional \$600K in Jan. and have begun their program

But, the present IPNS budget will permit no enhancements in FY2001

	Operations Budget	Equipment Budget
FY2000- FY2001	+3.9%	-2.0%
5yrs. since SFI began	+17.9% (+3.3%/yr.)	-7.1%



Summary

Subpanel's findings are:

- **“It is imperative ... to assure that a sufficiently large and well-trained user community exists when SNS is fully operational in ~2008”**
- **“It is essential to substantially increase the user community ...(which) will not occur without an active program”**

IPNS has put forth a cost-effective program to meet these goals, which should be started immediately to maximize its impact.

