# I. PLENARY SESSIONS

Plenary sessions were held during the first day and part of the second morning of ICANS-III. Twelve formal presentations were made during these sessions. The intent of the plenary sessions was to have a representative from each of the laboratories which are formally members of the ICANS (and those laboratories interested in joining the ICANS) summarize the status of the various spallation neutron source projects and related activities. In this way, everyone at ICANS-III could simultaneously be informed, and the knowledge gained would aid in making the remaining sessions of ICANS-III more productive.

Johndale Solem, Alternate Physics Division Leader at LASL, officially welcomed the ICANS-III participants, briefly described LASL, and discussed the role of the Weapons Neutron Research Facility (WNR) as a pulsed-neutron source.

## A. Status of the IPNS Program, N. J. Swanson, ANL

### 1. Overall Summary

During the past year the Intense Pulsed Neutron Source (IPNS) program has been involved in two principal activities. These have been to prepare for the design of the IPNS-I construction work and to operate the ZING-P' prototype facilities. To accomplish both of these main tasks it was necessary to develop an organizational structure and establish policies and procedures under which this organization is to function. The organization encouraged four distinct groups: a) accelerator-systems operations and Research and Development (R & D), b) source and instrument operations, c) applications R & D, and d) IPNS-I project design and construction.

During this period the accelerator completed its first year of operations. Many problems were encountered, some of which were solved and corrected. Some prototype instruments came into operation and these are now producing meaningful data. The IPNS-I construction project was authorized by the Congress and the work on preliminary engineering was begun based on concept design work completed during the past year. IPNS-I is expected to become operational in mid-1981.

## 2. ZING-P'

### a. ZING-P' Operations - 1978

Operation of the ZING-P' began in December 1977. By April 1978, protons were delivered from the Rapid Cycling Synchrotron (RCS) to a tungsten target at a rate of ~ $6 \times 10^{11}$ protons/pulse at repetition rates of about 10 Hz (effective rate of about 7 Hz due to time sharing of the linear accelerator with ZGS). In July 1978, a period of dedicated operation at repetition rates of 15 Hz was provided. In late 1978, with shared operation of the linac, the prototype was operated at 15 Hz (effective rate of about 10 Hz) delivering an average of $8 \times 10^{11}$ protons/pulse. The ZING-P' target/moderator system delivered neutrons through one of the three horizontal-beam tubes to a High-Resolution Powder Diffractometer where meaningful high-quality data was produced. Outfitting of the two remaining horizontal-beam tubes was begun with a Single Crystal Diffractometer and Chopper Spectrometer. A Crystal Analyzer Spectrometer and High-Intensity Diffractometer were installed in the two vertical neutron-beam tubes. The latter was replaced with an Ultracold Neutron Generator towards the end of the year.

Initital operations of the RCS (formerly known as Booster II) revealed excessive proton losses particularly in the extraction system. The high losses led to high-radiation background levels, caused by activation of accelerator components, which severely limited personnel access to those areas where routine access was needed. Therefore, the accelerator was shutdown for two months while additional shielding was installed. This shielding reduced the radiation levels in the areas desired for routine, uncontrolled occupancy by a factor of four. The addition of more shielding is impractical for space and structural reasons. A major attempt is being made to understand and correct the proton loss problem.

### b. ZING-P' Operations - 1979

At the beginning of the year the extraction-septum magnet failed. Radiation levels from proton activation were found to be quite high. After a decay period of about one month, the magnet was removed and replaced with a new unit. The overall shutdown period was seven weeks. Advantage of the

shutdown was taken to prepare for some special experiments. These included the following:

- Target measurements and neutron-beam intensities for the existing tungsten were found to be needed to substantiate calculated estimates. These activities were performed in early March as soon as the accelerator operations were resumed.

- Neutron-flux spectrum and damage-function measurements were made with a tantalum target in a mockup of the IPNS-I Radiation Effects Facility. These are considered necessary as base information to establish the type of target material (tantalum or uranium) to be used in the IPNS-I Radiation Effects Facility target. The measurements were completed in mid-March.

- Neutron-flux spectrum and damage-function measurements are to be made with a uranium target for the same reasons as described above. These measurements will be performed in early April.

- Target-power, temperature-distribution, and beam-intensity measurements on the uranium target will be performed in April or May.

When the above measurements are complete, routine (neutron-production) operations will be resumed using a newly fabricated uranium target which has been clad with Zircaloy-2. These operations will be at a repetition rate of 15 Hz (effective rate of 10 Hz) through September 1979.

In October and November changes will be made in the accelerator to improve its performance, particularly the extraction efficiency and reliability of the extraction septum magnet. The latter includes the replacement of the septum assembly with a newly designed transformer coupled unit. At the end of September the ZGS will be shutdown and phased out. This will permit dedicated operations of the $H^-$ source and linac for the ZING-P' system. When this occurs the repetition rate will be increased to 30 Hz which will also become the effective rate since time sharing with ZGS will no longer be needed. At the higher repetition rate the expected neutron-production rate in ZING-P' (at a delivered charge of $\sim 8 \times 10^{11}$ protons/pulse) will be $\sim 2 \times 10^{14}$ neutrons/s.

c. ZING-P' Operations - 1980

Six months of operation are scheduled for 1980. The operating conditions are expected to be the same as in late 1979, with efforts continued to improve operating efficiency. Late in the year the ZING-P' system will be shutdown and phased out. At that time the construction

needed to route the RCS proton output to the IPNS-I facilities will be undertaken.

### 3. IPNS-I Construction

#### a. System Description

The IPNS-I will use the same $H^-$ source, linear accelerator, and 500-MeV synchrotron which was used for ZING-P'. The design and construction will include the following:

- a 500-MeV proton-beam transport line from the RCS to the IPNS-I targets
- a beam dump to permit tuneup and other accelerator diagnostic work while the IPNS-I targets are being serviced, modified, or otherwise out of service
- a target/moderator/reflector system to produce thermalized neutrons for neutron-scattering experimentation
- a target/reflector system to produce fast neutrons for radiation-damage work
- about five neutron-scattering instruments together with their data acquisition and processing systems
- biological shielding and miscellaneous services for all of the above.

The IPNS-I facilities, for the most part, will be housed in existing buildings and use existing facilities vacated by phase out of the ZGS. The layout of the biological shield for IPNS-I is shown in Fig. I-A.1.

#### b. Design and Construction Schedule

Funds for the IPNS-I Project have been received and the design work has been started. Construction will begin in mid-1979, and be completed in mid-1981, at which time initial operations of IPNS-I are expected to begin.

#### c. Cost-Estimate Summary

The cost estimate for the IPNS-I facilities outlined above is $6.4 M. These funds were authorized for FY-1979. In the President's budget for FY-1980 is an additional $3.0 M for an IPNS-I upgrade. These funds will be used for provision of additional neutron-scattering instruments and for cryogenic systems for the Radiation Effects Facility irradiation thimbles.

#### d. IPNS-I Instruments

The initial complement of neutron-scattering instruments has been selected. Work to develop the design requirements for these instruments will be initiated in April 1979.

### e. Target Systems

Preliminary engineering of the target systems was initiated in March 1979. At present it is expected (contingent upon evaluation of the Radiation Effects Facility mockup measurements) that identical water-cooled uranium targets will be used for both neutron-scattering and radiation-effects systems. A summary of the target activities are the following.

Work Completed

- general analytical study
- target-reference design
- thermal- and elastic-stress analyses
- basic heat-removal analysis
- target-cooling system reference design
- concepts for irradiated targets and moderator/reflector handling
- analysis of ZING-P' uranium target

Work in Progress

- prototype work on cladding techniques
- design and fabrication of uranium target for ZING-P'
- refinement of biological shield design
- reference design for neutron-scattering moderator/reflector assembly
- reference design for radiation-effects reflector assembly.

### f. Long-Range Plans

The IPNS-I is to be a user-oriented national facility. The policies for its operation and use have been defined. Operating programs are now being developed. Design features are being incorporated to assure maximum versatility to accommodate different target/moderator combinations and a full variety of research instruments. In addition, capabilities are included to permit expansion of the operational scope to include such facilities as neutron radiography, proton irradiation, and neutron activation. Considerable effort is being applied to provide features which will assure good operating efficiencies so that users' requirements can be satisfied in a timely manner.

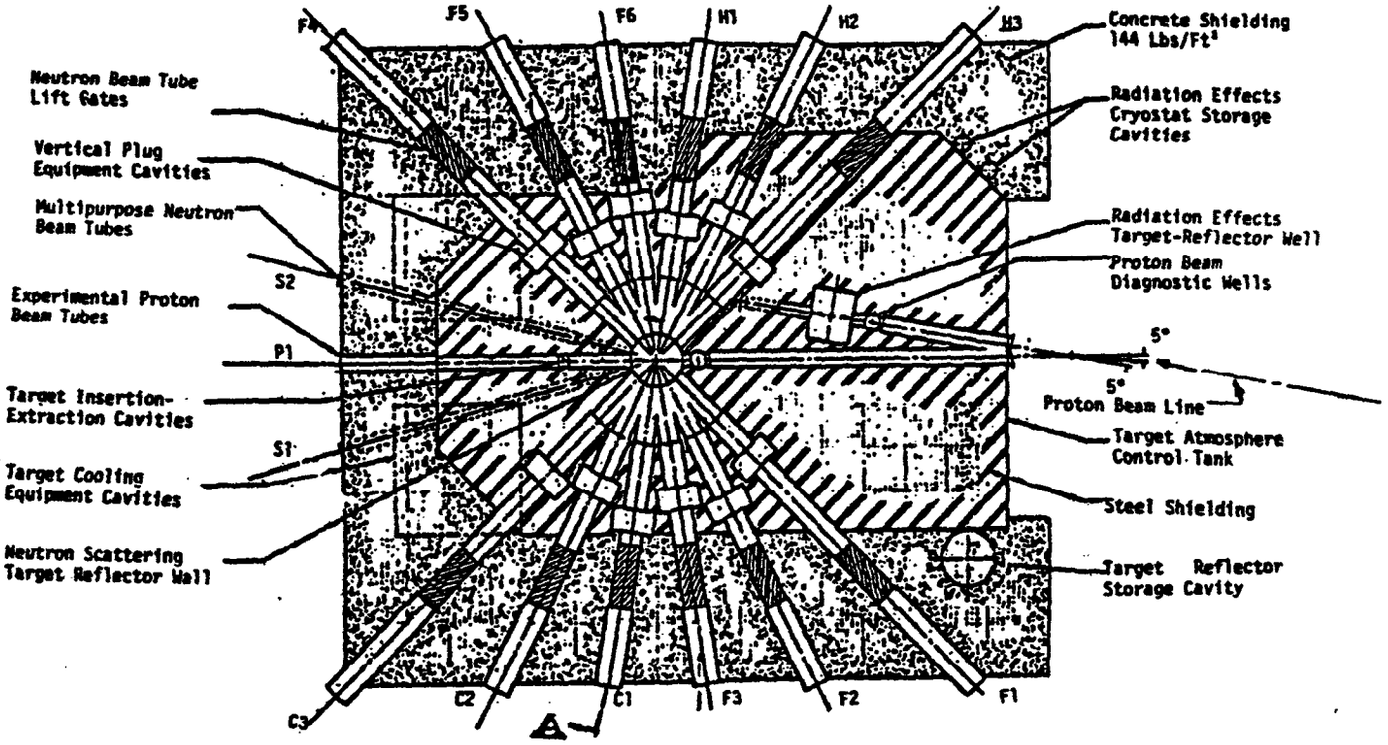


Fig. I-A.1. IPNS-I biological shield layout.

## B. The SNS Project, J. T. Hyman, RL

### 1. General

My intention is to give an overview of the present Spallation Neutron Source (SNS) project in a very general way. Many of the team leaders responsible for the various parts of the machine and experimental facilities are here in person, and it would be most presumptuous of me to go into detail.

You will no doubt remember that just prior to the ICANS-II meeting at Rutherford (July 11-14, 1978), the NIMROD facility had been closed down. Since then, considerable efforts have been under way to strip down the old machine, and to dispose of unwanted material and equipment. This is being offered to universities, schools, or sold as scrap. A firm specializing in reclamation is dismantling the old rotating power supply and associated transformer/rectifier equipment and is still going to pay us a worthwhile sum!