E. Progress - SNS Neutron-Production Targets, R. W. Wimblett, RL

1. Schedule

The program for the provision of the SNS neutron-production target, services, and all associated equipment is:

1978/79	1979/80	1980/81	1981/82	1982/83
Conception & Establishing Parameters	Design	Manufacture	Installation	Commissioning & Operation

From the above schedule it can be seen that from the engineering viewpoint the year 1979 has been a year of schemes and computations to prove the practicability (or otherwise) of the mass of options considered during this period. All of the options were assessed and drawings are available for discussion if required. A decision has been made to use a segmented, doped or alloyed, uranium target using a 4 gap, channeled plate arrangement. The plates are to be cooled by D_2O using transfer of heat by forced convective nucleate boiling.

Next year will see the full detailed design of the target and all apparatus making up the target assembly such as, its services, monitors and controls.

2. Nucleate-Boiling Tests

A large number of nucleate-boiling measurements have been carried out on test elements to examine the sensitivity of "burn-out" to coolant velocity, temperature, and pressure. Of these test parameters, velocity proved to be critically sensitive; temperature and pressure were relatively insensitive in causing premature "burn-out" failure. A large number of tests have also been carried out to establish control and alarm values serving to provide safe operational control for the system. Graphs of the results of these tests are available on request.

3. Water-Flow Test

Water-flow tests have commenced on full-size target channels and these will be continued during the next few months. These tests are being made to:

- examine the shapes of target-plate entry and exit contours and the positioning of flow directors to insure even flow within any four-gap channel
- investigate the conditions applying within gaps and channels due to radiation and thermal cycling swelling in the uranium plates
- determine ways of reducing the pressure drop within the target assembly.

Tests are to be made to gather flow/pressure drop profiles for each of the channels within the target vessel.

4. Monitoring and Control

a. Flow/Pressure Drop Profile

The flow/pressure drop characteristic mentioned above will be used as the main indicator for uranium target-plate swelling in the operational target.

b. "Burn-Out" Warning

The overheating of any target plate will be sensed using noise monitoring. The onset of film boiling leading to "burn out" is accompanied by considerable vibrational noise (the steaming bottle effect) which will be monitored and the signal used to control flow and/or shut off the proton beam.

c. Target Parameters

The target parameters are as follows:

- peak-power density, 940 watts/cm^3
- peak-heat flux, 304 watts/cm^2
- water velocity, 3.2 metres/sec (10 ft/sec)
- water temperature, 38 °C
- pressure drop through plate gap, 0.05 bars (0.75 psi)
- thickness of peak-target plate, 6.5 mm of uranium, 0.25 mm of zircaloy cladding.

F. IPNS-I Target-Station Design and Engineering, J. R. Ball, ANL

The IPNS-I target stations are designed to meet the experimental program goals to the maximum extent possible. The IPNS-I facility consists of two experimental assemblies, one for neutron-scattering research and one for radiation-damage research. It is anticipated that the targets for these two assemblies will be of identical design. However, flux and spectrum measurements are currently being made on IPNS-I mockup assemblies at the ZING-P' facility to determine the most suitable target material for the radiation-effects facility. This summary will describe the design and engineering of the IPNS-I uranium target assembly and the neutron-scattering experimental assembly.