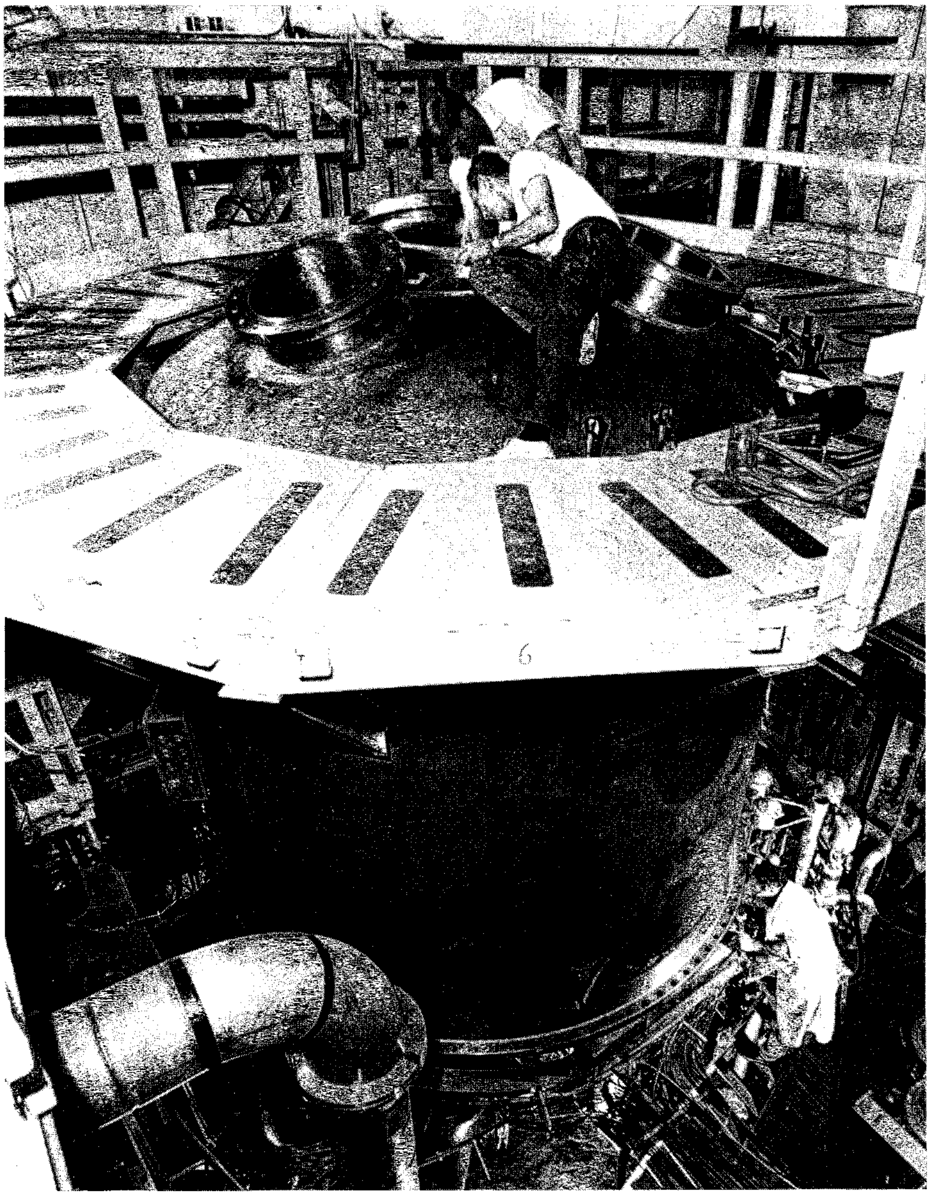
Around the Laboratories

The 7 foot bubble chamber at Brookhaven under construction in 1969. The chamber's life has now come to an end.

(Photo Brookhaven)



BROOKHAVEN
End of bubble chamber era

The 7 foot bubble chamber on the Alternating Gradient Synchrotron at Brookhaven has come to a sudden end. On 18 January a vacuum leak stopped a neutrino experiment with the chamber filled with deuterium for a Brookhaven/Tohoku collaboration. The chamber was warmed to room temperature and the leak was found to be due to a crack through the chamber wall where a large flange was welded to the chamber body.

The flange secured the cover to an instrumentation port at the top of the chamber. The crack was about 40 cm long and penetrated completely through the 1.6 cm thick stainless steel wall. Since the weld had been poorly done by a commercial supplier, it was felt that the only acceptable repair was to machine the flange completely out and weld in one of proper design. Unfortunately this was a larger job than could be completed before the scheduled end of the experiment, and, with the ISABELLE project pressing its need for most of the people on the crew, the chamber was shut down for good.

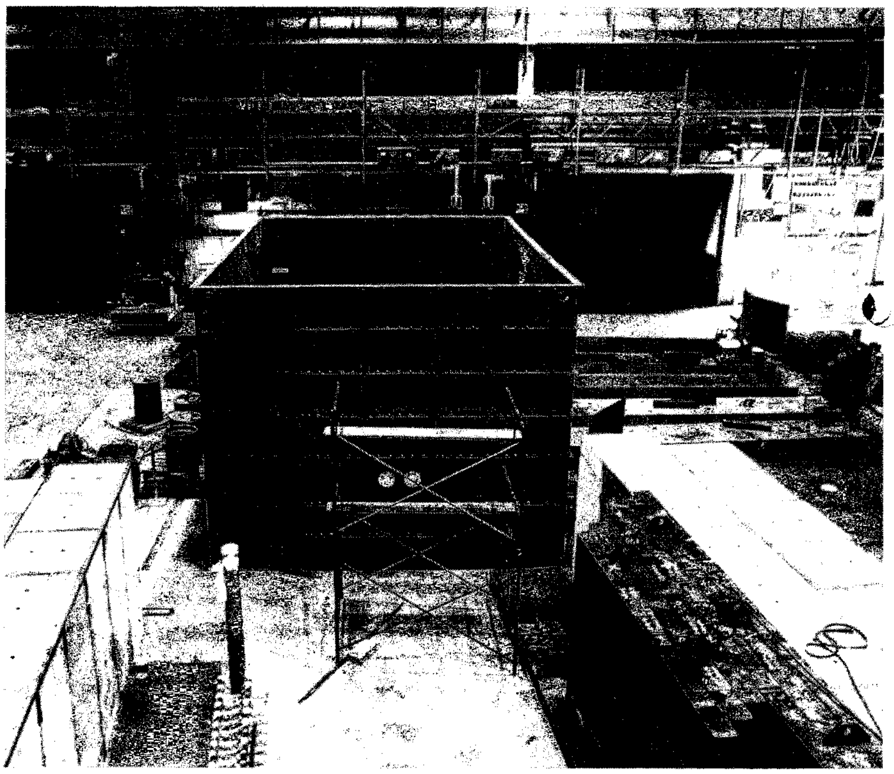
The chamber was located in the neutrino beam. The first tracks were seen in May 1973 and the first physics pictures were taken in November of that year with a filling of hydrogen. In typical bubble chamber fashion, those earliest pictures, taken more in the spirit of chamber testing than physics production, contained the first observation of 'naked charm' (see April 1975 issue, page 108). The second clear example found in this chamber appeared only a half million pictures later (see March 1979 issue, page 111).

The chamber took a total of 3.9 million pictures during its seven-year life and it was expanded 6.7 million times. A little over half the pictures were in deuterium, a third in neon-hydrogen mixtures and about ten per cent in hydrogen. Thirty-one separate cooldowns were made to achieve this, with nine of them aimed at engineering data only, and twenty-two for physics. Although the average number of pictures per cooldown was about 175 thousand, the range stretched from zero to 1.2 million. Therein lies the story of the bubble chamber addict — the highs are so high and the lows so low.

This brings the bubble chamber era at Brookhaven to a close. From the 6 inch in 1957 through the 20, 30, 31 and 80 inch chambers to the 7 foot, Ralph Shutt was the driving force. He and many of those who worked with him through those

Construction of the IPNS-I beamline and target shield is progressing rapidly at Argonne to provide unique facilities for research with neutron beams. Shown here is the steel tank which will enclose the target, plus some of the proton beamline shielding. The final steering magnet will direct the beam either at a neutron scattering target or a radiation damage target through one of the two holes in the front of the tank.

(Photo Argonne)



years have already thrown themselves into the ISABELLE fray, where a good deal of what was learned in bubble chambers is immediately applicable.

ARGONNE Accelerator for neutron research

The shutdown of the Zero Gradient Synchrotron was not as sad an event for scientists involved with the Intense Pulsed Neutron Source as it was for those involved in polarized proton physics. The neutron enthusiasts are now able to get full use of the linear accelerator, which had been time-shared between the ZGS and their neutron source.

The Rapid Cycling Synchrotron, RCS, formerly known as Booster-II, since it was initially intended to increase ZGS intensities, is currently directing its proton beams at a uranium target being used as a spallation neutron source by the proton facility, known as ZING-P', for neutron beam research. Shutdown of the ZGS meant an immediate 50 per cent increase in the available proton beam intensity from the previous 1.5 μA intensity for ZING-P' neutron production. An increase of 300 per cent is expected soon when temperature constraints on target operation are removed, making it possible to increase the operating frequency of the RCS from 10 to 30 Hz. ZING-P' will have five or six more months of operating time before being shut down in preparation for switching to a new target and experimental area being built in one of the former ZGS experimental areas.

The new facility, known as IPNS-I, is scheduled to begin operation in April 1981 and it will be a national facility for the study of condensed matter. Initial construction is being carried out under a $ 6.4 million contract from the Department of Energy; Congress has just approved another $ 2.4 million for an IPNS Upgrade Project. Initial operation is expected to provide 2×10^{12} protons per pulse at an energy of 500 MeV with a 30 Hz repetition rate. This will produce a usable thermal neutron flux equivalent to that from a medium flux reactor, but will produce a usable epithermal neutron flux greater than that available at any reactor in the world. This is expected to open up areas of research hitherto not feasible with reactor neutron sources.

Efforts are already being made to exceed these performance levels by increasing the beam energy and repetition rate. It is expected that the RCS may eventually be able to produce higher energy protons, maybe up to 600 MeV, at 45 Hz with an intensity greater than 2×10^{12} protons per pulse. Many former ZGS staff have come from Divisions involved with the CP-5 reactor which shut down a few days before the ZGS.

Construction for IPNS-I began in the summer of 1979 with the pouring of the massive reinforced concrete slab to support the shielding of the proton transport system.

Zircaloy-clad uranium discs will be used as the neutron-generating target for IPNS-I, giving about fifteen neutrons per incident 500 MeV proton. The neutrons will be moderated by hydrogen-bearing materials which are surrounded by beryllium reflectors to reduce neutron leakage. The reflectors will be decoupled from the moderators by thermal neutron absorbers such as boron or cadmium to preserve the time-resolution of the pulse. Twelve neutron beam tubes have been provided for neutron-scattering instruments.