Linacs at the Rutherford Appleton Laboratory

The first linac at what is now the Rutherford Appleton Laboratory (RAL) was installed in 1957 at the then Rutherford High Energy Laboratory (RHEL), the laboratory of the National Institute for Research in Nuclear Science (NIRNS) set up in 1957. The linac was the Proton Linear Accelerator[1] (PLA), a 50 MeV three-tank machine[2], and at RHEL the PLA produced its first beam in July 1959. Thereafter the PLA ran for ten years for nuclear physics experiments, and was closed down in October 1969.

Tanks 2 and 3 of the PLA were then taken over to form Tanks 2 and 3 of the new four-tank 70 MeV injector for Nimrod, the 7 GeV proton synchrotron which produced its first beam for high energy physics experiments in 1964 (injection was from a single-tank 15 MeV proton linac[3]). Two more tanks[4] were procured to make up the new 70 MeV linac, and were essentially copies[5] of sections of the Fermilab[6] linac. Approval to start construction of the new 70 MeV injector linac[7] was given in 1972, and the new injector delivered its first 70 MeV beam in 1976, but in the meantime a decision had been taken to close down Nimrod in 1978, and so the new injector was never actually used for Nimrod.

In 1977, financial approval was given to convert the old Nimrod facility into SNS, the Spallation Neutron Source, subsequently renamed ISIS. The 70 MeV injector was up-rated from a 1 pps, 50–75 mA, proton linac to a 50 pps, 20 mA, H^- linac to act as the injector to the ISIS 800 MeV proton synchrotron which was built in the hall formerly occupied by Nimrod. ISIS produced its first beam in December 1984, and has gone on to become the world's leading neutron spallation source. A full description of ISIS is given at http://www.isis.rl.ac.uk/.

Since 1984 the ISIS linac has run with increasing reliability. In 1998 and 1999, all the water-to-vacuum O-rings in Tanks 2 and 3 (the PLA tanks) were replaced. In 2004 the 665 kV Cockcroft-Walton preinjector for the 70 MeV linac was replaced by a four-rod, 665 keV RFQ accelerator. Thanks to approval of construction of the ISIS Second Target Station in 2003, the ISIS linac is expected to run to 2020 and beyond, when Tanks 2 and 3, originally constructed as Tanks 2 and 3 of the PLA, will be ~70 years old. Not bad for a working accelerator!

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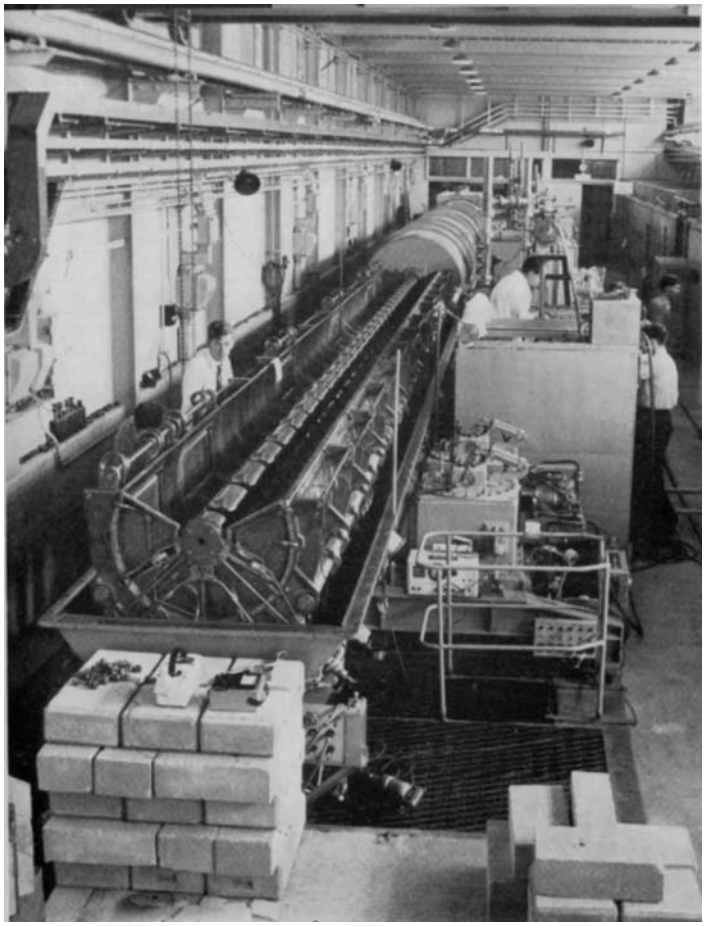
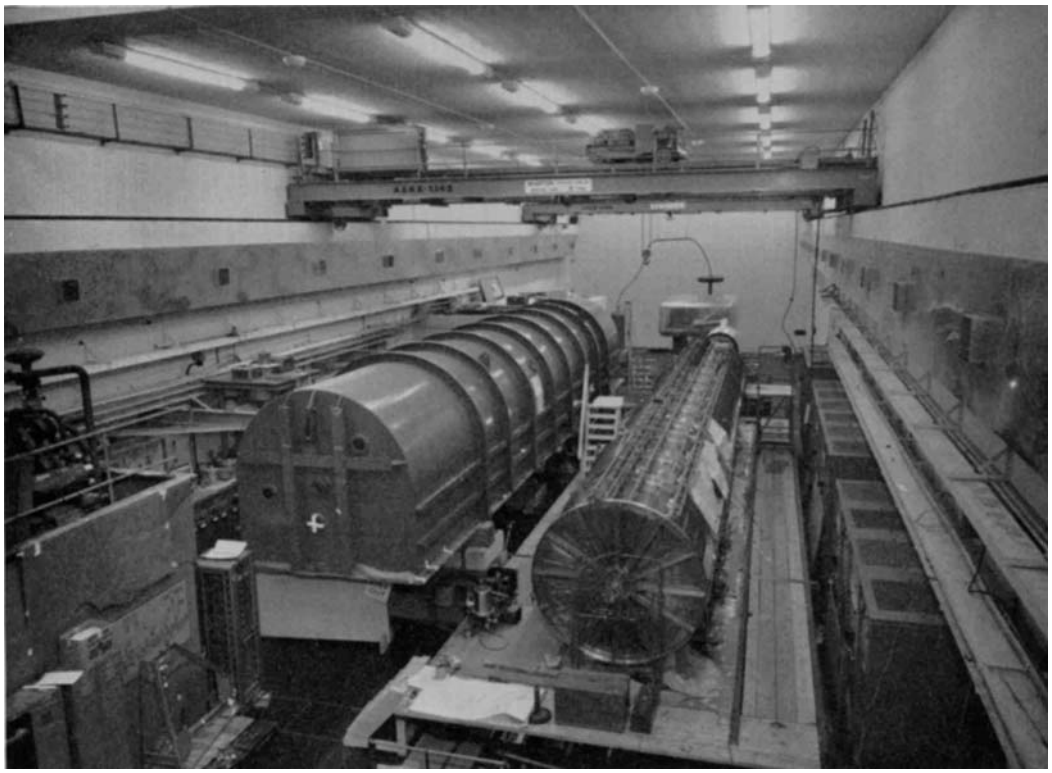
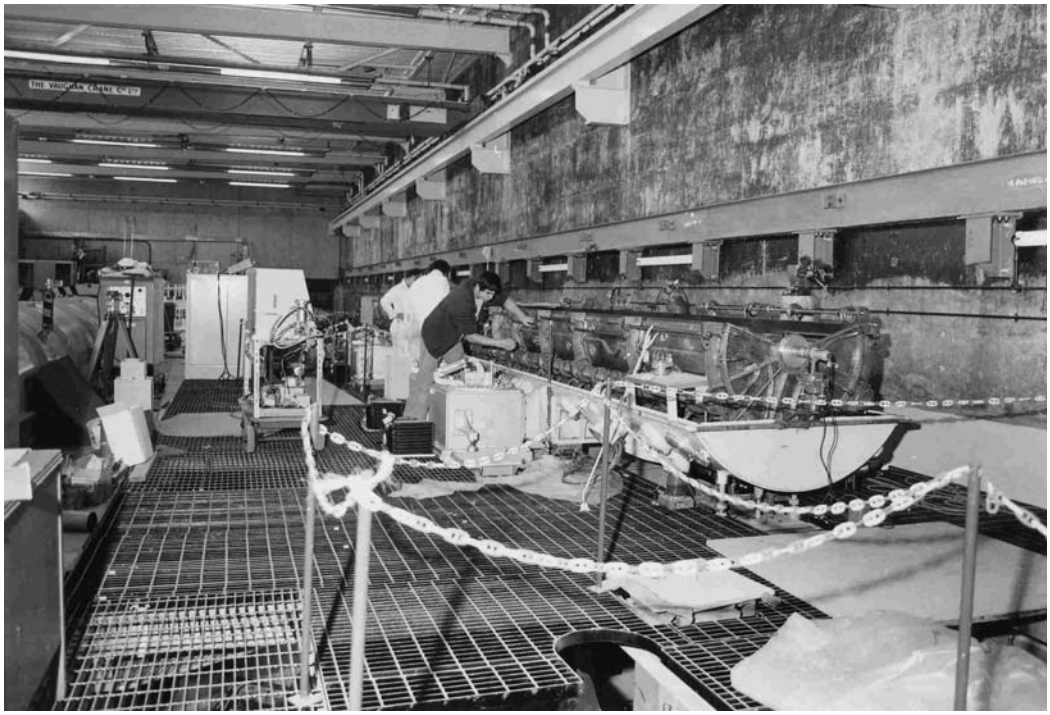
[1] "Type 850", manufactured by Metropolitan Vickers Electrical Co. Ltd., Trafford Park, Manchester.
[2] Tank 1, 0.5 to 10 MeV. Tank 2, 10 to 30 MeV. Tank 3, 30 to 50 MeV.
[3] Located in what is now Building R5.2.
[4] Tank 1, 665 keV to 10 MeV. Tank 4, 50 to 70 MeV.
[5] But scaled to run at 202.5 MHz instead of 201.25 MHz.
[6] Fermi National Accelerator Laboratory, Illinois, USA.
[7] Located in what is now Building R5.1.

Two views of the PLA.





Above, 15 MeV injector for Nimrod. Below, installation of one of the PLA tanks as part of the new 70 MeV injector for Nimrod.



Above, view down north side of ISIS injector. Below, new RFQ preinjector on ISIS.