

§33. Installation of the Silicon Surface Barrier Detector Neutral Particle Analyzer in LHD

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Table I. Comparison between TOF and SD-NPA

	TOF-NPA	SD-NPA
Minimum Energy	0.5 keV	5 keV
Maximum Energy	370 keV	4 MeV
Channel Number	16	512-1024
Energy Resolution	7%(Typically)	1.6-1.7 keV
Ele./Mag. Field	Ele. Field	none
Mass Rejection	1/1000	no separation
Particles	H, D, He ³ , He ⁴	no separation
Weight	350 kg	0.1kg
Size	50cmx70cmx30cm	1cmx1cmx1cm

The neutral particle analyzer by using a silicon barrier-type solid state detector is installed for the purpose which it covers the fault of the the time-of-flight neutral particle analyzer (TOF-NPA). The installation was done as the international joint research with Oak Ridge National Laboratory. The instrument was mainly designed and was manufactured on the side of the United States. The detector vacuum chamber was installed just under TOF-NPA at the 10-O port and is horizontally and vertically observing plasma from under the slant. The comparison with TOF-NPA is listed in Table I. The solid state detector (the surface barrier-type diode U-XXX-025-300-S, which was produced by the ion plantation to the silicon, the area of 25 mm², ORTEC) which has been used for the radiation measurement,) is chosen. It is the special order product with the aluminum coating of 40 μg/cm² instead of 80 μg/cm² for the shading for this purpose. Two rows with each three detector horizontally are mounted in the chamber in order to observe the tangential distribution of the high energy neural particle. Each detector is cooled by the liquid-nitrogen for the noise reduction. The preamplifiers (ORTEC 117) are put just behind the detector out of the detector vacuum chamber. The main amplifier (ORTEC) is placed in the special NIM-bin near the detector. An amplified signal is 150 m transmitted to ADC (Camberra). The pulse height is proportionally to the particle energy. The pulses are counted by each energy channel using the histogram memory (TOYO Technica). It becomes the structure which can go up and down the aperture with the actuator for the scan of the perpendicular direction. Also, the size of the aperture can be replaced to adjust a particle flux. These drive is done using the supersonic motor

and RS-232C are used for the controller of the motor. It is watching over the position of the actuator with the Web camera.

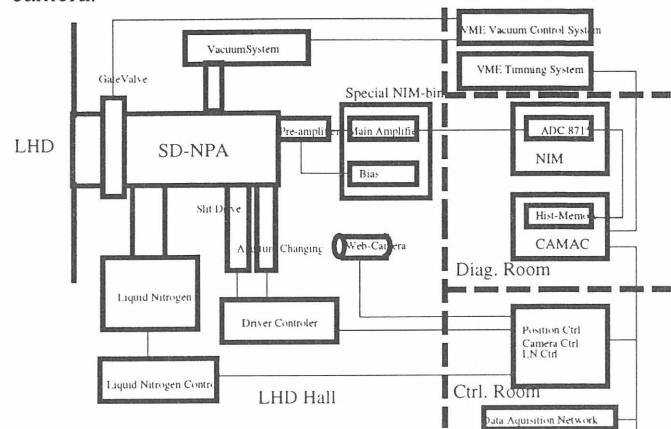


Fig.1. Block diagram of SD-NPA.

The installation in LHD completed and the degree of vacuum reached a rule. It was possible to confirm that the radioactive isotope of iron was installed in one of the aperture lines and that it was working normally in the place to have examined a detector in the early stage operation using this. It planned to do a data processing locally with the Windows NT machine at present and it confirmed the normal operation of the software for its purpose. It plans a data acquisition from the 4th cycle.

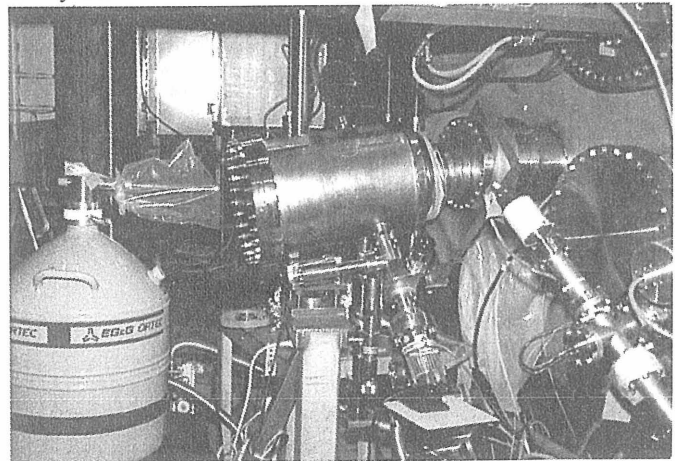


Fig.2. Photograph of SD-NPA.

Reference

- 1) Lyon, J. et al., J.Res. Plasma and Fusion. SERIES, Vol.1 (1998) 358.