OSAKA UNIVERSITY 14 MEV INTENSE NEUTRON SOURCE FOR FUSION STUDIES. (OKTAVIAN PROGRAM)

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Introduction

To provide fairly intense 14 MeV neutron source with currently available technological backgrounds in Japan, a high beam current 300kV Cockcroft-Walton type accelerator, OKTAVIAN, was installed at Suita Campus, Osaka University. With a modified duoplasmatron ion source the accelerator is expected to produce $3 \cdot 10^{12}$ D-T neutrons/second by using a rotating tritium target. Another particular perfomance is the availability of pulsed neutrons with few nano second width by the beam bunching method. Intense light ion beams such as H^+, He^{++} can also be supplied for ion irradiation experiments by this machine. Radiation damage in the surface of fusion reactor materials by 14 MeV neutrons and light ions, tritium production rates in lithium blanket and neutron beam streaming in shielding assemblies should be the major research items for the DC beam line.

The main utilization plans of the pulsed beam line are as follows : the studies of Fusion Neutron transport, single & double differential cross section measurements of fusion reactor materials for D-T neutrons and the developement of new instrument for the measurement of extremely intense pulsed 14 MeV neutrons.

On the way to attain the stable intense neutrons, various technical difficulties must be overriden. The stable operation of a high current duoplasmatron ion source, the beam profile monitoring for high beam currents, especially for nano second pulse beam, diagnosis of target condition under beam irradiation and the developement of long-life rotating targets are the typical R&D items.

In addition to these items, the developement of suitable tritium recovering methods for such an accelerator system, and the tritium monitoring instrumentation against unexpected contamination increase and intense γ-ray backgrounds by induced activity are considered to be essential.

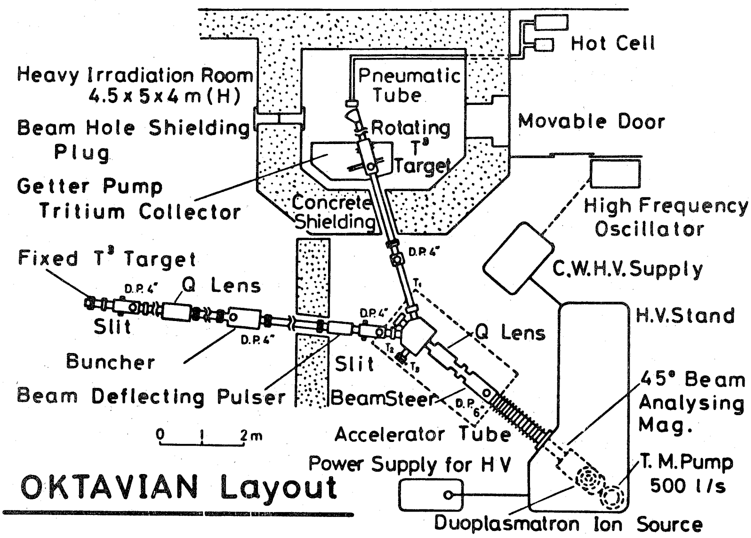
The installation of the accelerator is nearly completed, and the final adjustments and the characterization of specific parameters for operational performance are being carried out now. The neutron production is scheduled at the end of 1980 fiscal year after the completion of two type tritium collector systems. From the beginning of the next fiscal year, it is expected to start the co-operative exteriments with research groups from other national universities, and to keep the annual total operation period over 1800 hrs.

Configuration

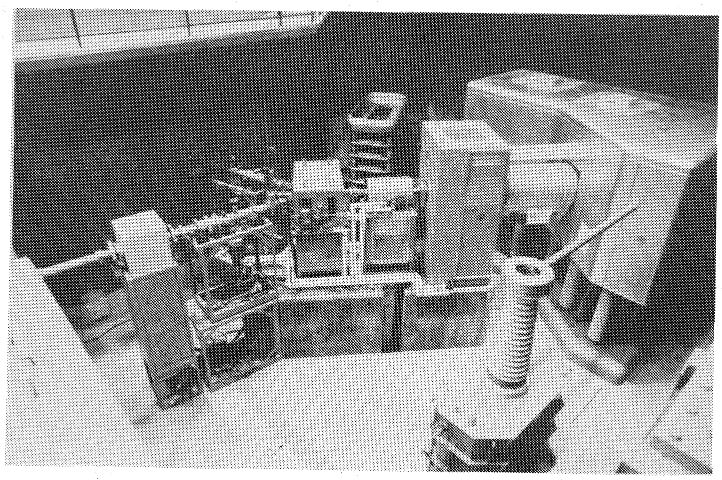
Major parts and their performance characteristics are as follows:

Ion Source: Modified the Type DP 240 Duoplasmatron (H.V.E.Co. Ltd, U.S.A.); extraction lens system was modified to obtain more intense and better focused beam.

Beam Analysing Magnet before acceleration: 45° deflection.
H.V. Supply for Acceleration: High frequency Cock-Croft type with 20 kHz oscillator, 100-300 kV variable, ±0.1 % regulation and 80 mA maximum.
Acceleration Tube: 12 stages and 1200 mm length.
Beam Switching Magnet after acceleration: up to 4000 Gauss, +37.5° for DC beam, -30° for pulsed beam and -90° & 0° for tests and ion beam irradiation.
Q Lens: Before the beam deflection and after the beam bunching.
Nano-Second Pulsing System: 30-50 ns pulses by deflections after acceleration, 3 ns pulse by the bunching after deflections and repetition frequency of 2 MHz to 1 kHz .
Beam Specifications: Beam size at target is around 30mmϕ for the DC operation, 15mmϕ for the pulse operation. Expected D^+ current is 20 mA for DC, 28 mA for pulse.
Rotating Tritium Target: 800 Ci/piece , 200 mmϕ , 1000rpm.



OKTAVIAN Layout



Photographic view of OKTAVIAN