TANDEM ACCELERATOR FACILITY AT INSHAS

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Abstract

A new dedicated ion beam analysis laboratory will be installed at the Inshas site of the Atomic Energy Authority of Egypt north east to Cairo. The concept and layout of the facility is given. According to the present status of the project, the first beam is expected in the fall of 1999 .

1 INTRODUCTION

Many of the accelerators (Van de Graaffs, Tandems, Cyclotrons) formerly used for nuclear physics research are now directed towards applied research [1]. Among the applications, ion beam analysis techniques such as RBS,PIXE,PIGE,ERD have been developed over the years for the use in the field of biosciences, environmental and material sciences.

At Inshas, the Nuclear Reactions Laboratory of the Nuclear Physics Department was engaged in research on nuclear physics and nuclear spectroscopy using a 2.5 MeV Van de Graaff accelerator .

Experiments on elastic recoil and scattering, radiative capture, nuclear reaction mechanisms and polarization were routinely performed over more than 15 years.

In this paper, we aim at presenting to the accelerator community our plans with the establishment of an ion beam analysis laboratory based on a tandem 3 MV machine.

2 THE TANDEM ACCELERATOR

The Inshas tandem facility will be equipped with a 3 MV tandem electrostatic accelerator model 4130 MC+ from High Voltage Engineering Europa (Tandetron) [2] . The high voltage terminal of the accelerator is powered by means of a SF6 insulated parallel fed Cockroft - Walton type solid state power supply capable of providing 350 μA current to the terminal in the range 0.2-3 MV. The high voltage power supply being voltage source equipped with special RF filtering and feedback circuits does not require corona or slit stabilization.

Table 1 : HVEE 4130 MC + Tandetron Main Parameters

-Terminal voltage range, MV		0.2 - 3.0
-Terminal voltage stability, Vpp		300
-Terminal voltage ripple with de- rippling kit, Vpp		30
-Maximum current available from HV terminal power supply, eμA		350
-Beam currents (at the maximum terminal voltage after the high energy switching magnet),eμA		
Ion source Model 358	^{1}H	25^{1+}
	^{4}He	2^{2+}
Ion source Model 860 C	^{11}B	20^{3+}
	^{16}O	40^{3+}
	^{28}Si	40^{3+}
	^{31}P	40^{3+}
	^{58}Ni	8^{3+}
	^{63}Cu	10^{3+}
	^{197}Au	40^{2+}

It also has the advantage of not having moving parts, eliminating vibrations and dusts.

The accelerator is equipped with a high mass resolution injector system consisting of dual injection ion source system of cart design including:

- a duoplasmatron ion source Model 358 for the generation of negative H and He ions .
- a negative ions sputter ion source Model 860 C for heavy ion production .

Ions from either ion source are injected under a small angle into a high mass resolution 90° switching/analyzing magnet, which is able at maximum injection energy to deflect and analyse all elements with ME/Z2= 240 AMU at 37 keV and mass resolution ≥ 1:190.

After mass analysis the ion beam is injected into the low voltage end of the accelerator and focused through the high voltage terminal by means of energy matching lens.

After the high energy acceleration ions are focused by means of an electrostatic quadrupole triplet lens and directed into a switching magnet with five exit ports at +55°,+ 10°,0°, -10°and -35°. Three exit ports of the switching magnet are used for beam lines with the corresponding ME/Z2 values:

at +55°	with 12 AMUMeV
at +10°	with 325 AMUMeV
at -35°	with 27 AMUMeV

Table 1 gives some of the more important accelerator parameters.

3 THE BEAM LINES

The layout of Inshas tandem facility is given in Fig .1. Three beam lines are used after the switching magnet, namely these at -35°, +10°, and +55°.

The beam line at -35° is equipped with an RBS - Channeling end station consisting of a target chamber, computer controlled motorized sample manipulator, target holder with heating and cooling stages, rotatable and fixed ion implanted barrier detectors (two).

The beam line at + 10° is equipped with an end station for PIXE and PIGE analyses. It consists of a target chamber, computer controlled target holder for maximum 25 samples, HPGe PIXE detector with Be entrance window, HPGe PIGE detector .

The beam line at + 55° will be used for fast neutron production. It includes a basic chamber with water cooled target holder, rotatable Faraday cup and neutron detector in the thermal - 15 MeV energy range.

All the above mentioned beam lines are equipped each with electrostatic quadrupole triplet lens, a set of beam defining slits, x-y steerer, non-retractable beam profile monitor, turbomolecular pumping system. The target chambers are equipped each with cold trap for nitrogen cooling .

4 SUMMARY

The tandem accelerator facility planned to be installed at the Inshas site of the Atomic Energy Authority of Egypt is introduced to the accelerator community . The layout and main technical characteristics of the facility as well as its intended use are described .

REFERENCES

[1] M.N.H .Comsan, “Layout of Inshas Cyclotron Complex ”, Egyptian - Russian School and Workshop on Cyclotrons and Applications, Cairo, 23-27 March 1996.

[2 High Voltage Engineering Europa B.V. “Technical Description, Multipurpose System - Tandetron Accelerator Systems. Heavy Ion Accelerator 1.0-4.0 MV/TV”, Amersfoort, 1997.

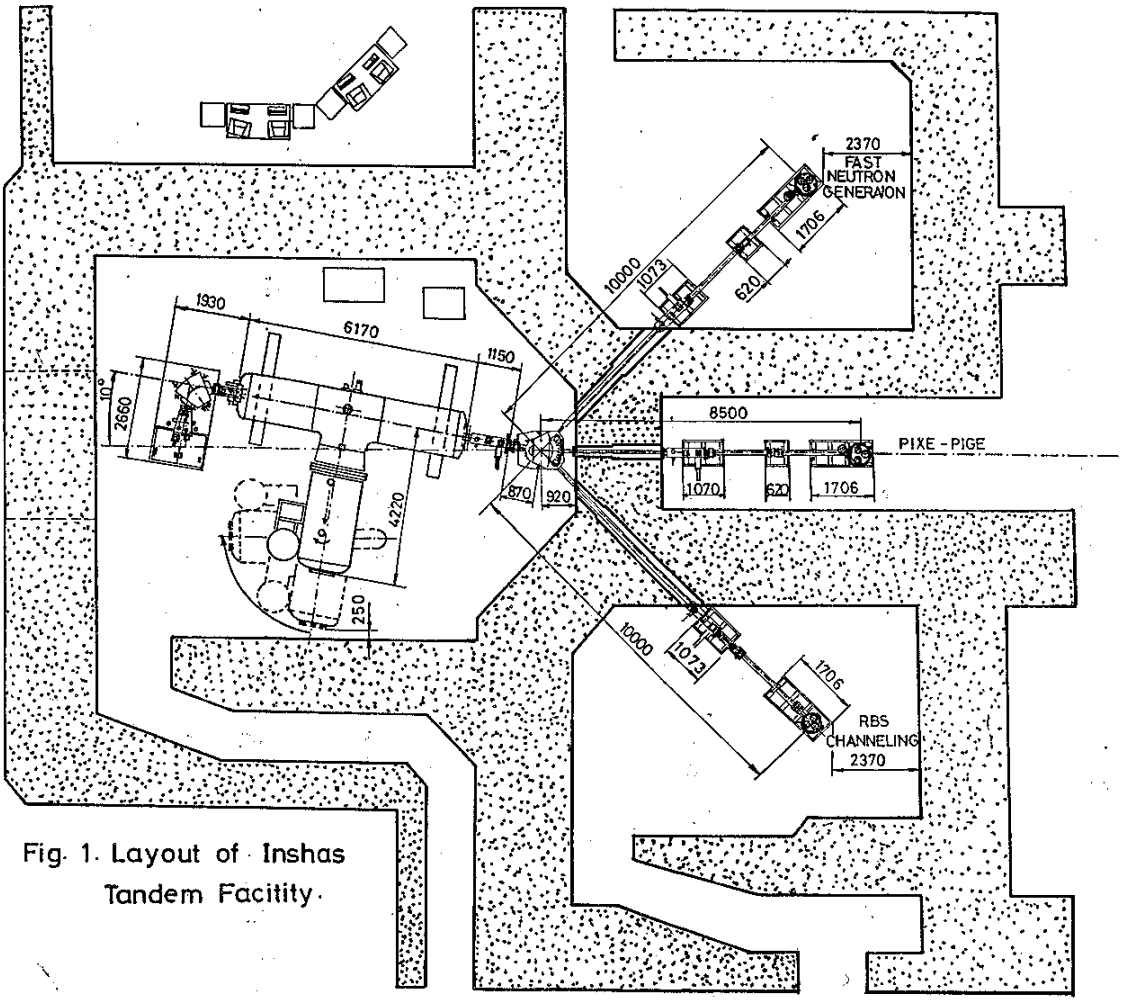

Fig. 1. Layout of Inshas Tandem Facitity.