

## 5. Reports from participating labs

### Status report of the mini cyclotron at the CNR Institute of Clinical Physiology at Pisa

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The installation of the cyclotron at the CNR Institute of Clinical Physiology ( ICP ) was completed during August 1985.

The machine is a Cypris 325 built by CGR-MeV ( Buc, France ). It accelerates protons and deuterons respectively to 16 and 8 MeV ( fixed energy ) with beam intensities more than 50  $\mu\text{A}$  ( extracted beam ).

The cyclotron is installed into an underground vault built closely ( 10 and 20 m ) to the radiochemistry and PET facilities, which are located at the ground floor of ICP.

The shielding of the roof was provided by the concrete frame of the vault ( 1 meter ) and 0.5 m of ground. The maximum value of the dose outside the shielding was detected above the targets and ranged 0.8 to 1 mR/hr ( proton at 50  $\mu\text{A}$  ).

Special construction techniques were required to ensure effective water-tightness of the underground vault due to the presence of soil water at -0.7 m.

The machine is equipped with a rotating target system which can hold up to eight targets. Each target can be selected remotely by the operator at the cyclotron console. The system actually holds seven targets for radionuclide production ( see Table ), the 8<sup>th</sup> position is used for rough beam visualization and cyclotron foil inspection.

Target bodies are of aluminium, with the exception of that for  $^{18}\text{F}$ -production which is of monel; all the targets are water cooled.

The cyclotron's vacuum chamber isolation foil ( 25  $\mu\text{m}$  titanium ) and target entrance foils ( usually 50  $\mu\text{m}$  titanium, 28  $\mu\text{m}$  inconel for  $^{18}\text{F}$  target ) are cooled by a double jet of cooled helium, which is provided by a closed circuit installed below the target set.

A Gas-Processing System (GPS) for the remote loading of targets as well as for the purification and treatment of the radioactive compounds produced ( see Table ) during the bombardment was also provided by CGR. GPS is installed into a shielded hood and can be operated by remote-control through a "radiochemistry console". Both the GPS and its control console are in the hot chemistry laboratory.

A section of the radiochemistry console repeats a few of the controls of the cyclotron ( ON/OFF irradiation, ON/OFF beam current integration, beam current

setting) so that one person can control the bombardment directly from the radiochemistry lab. This is of great utility during continuous radiogas production.

The installation went into operation on September 1985 and the preliminary values of the recovered activities so far obtained are given in the Table.

The installation should be working on routine basis starting summer 1986.

Table

Radionuclide	Labeled product	target no.	target material	recovered activity
Oxygen-15	CO <sub>2</sub>	1	N <sub>2</sub> + 2 % CO <sub>2</sub>	9.2 mCi/μAmin <sup>c,e</sup>
	CO	1		8.6 mCi/μAmin <sup>c,e</sup>
	H <sub>2</sub> O <sup>a</sup>	2	N <sub>2</sub> + 2 % O <sub>2</sub>	not tested
	O <sub>2</sub>	2		10.4 mCi/μAmin <sup>c,e</sup>
Nitrogen-13	N <sub>2</sub>	3	CO <sub>2</sub>	not tested
	NH <sub>3</sub> <sup>b</sup>	4	H <sub>2</sub>	46.5 mCi, EOB+9min <sup>f</sup>
Carbon-11	CO	4		1.8 mCi/μAmin <sup>c,d</sup>
	CO <sub>2</sub>	5	N <sub>2</sub> (O <sub>2</sub> )	2.4 mCi/μAmin <sup>c,d</sup>
	HCN	6	N <sub>2</sub> + 2 % H <sub>2</sub>	not tested
Fluorine-18	F <sub>2</sub>	7	Ne + 1 % F <sub>2</sub>	not tested

a) Catalytic reduction of O<sub>2</sub> with H<sub>2</sub> on Pd/Al<sub>2</sub>O<sub>3</sub> at 150°C;

b) Obtained via DeVarda's reduction;

c) Outlet flow 0.5 l/min;

d) Target pressure 6 bar;

e) Target pressure 0.6 bar;

f) Target volume 20 ml, 15 μA for 20 minutes