



Università "Federico II" di Napoli Dip. Fisica

L. Campajola, F. Di Capua



The "LABORATORIO ACCELERATORE"



 \succ Electrostatic accelerator,

Double stage, belt charging

➤ Two stripper systems: foil

<u>Maximum terminal</u>

Van de Graaff type

voltage: 3,4 MV

system

and gas



The Injector



Sputtering source

35° Injection Magnet



Off-line sources

Used for special purposes



Multisample sputtering source with a home made 90 kV preacceleration

Duoplasmatron source





Current Lay-Out





Beam lines and facilities

Detector test

AMS Ion implantation

Radiation BiophysicsIBA & Nuclear Reactions







Scattering chamber

Wien Filter and Ionization Chamber E-∆E





Research Activities and Education





At present available ion beams

Ion	E	I analysed	E _{max}
	Mev	nA	Mev
$^{1}\mathrm{H}$	6,5	200	6,5
³ He	10	20	10
⁴ He	10	20	10
⁶ Li	13		13
⁷ Li	13	20	13
⁹ Be	13		16
¹⁰ B	13		20
¹¹ B	13		20
¹² C	16	100	20
¹³ C	16		20
^{14}N	13		16
¹⁶ O	16	100	23
¹⁹ F	19	50	23

Electronics and Space Applications Implantation/Total Dose test





Online flux monitoring with back-scattering



Beam uniformity

Beam check with GaF chromic films at 1 Gray



Uniformity checked even at very low flux (<1kHz) with CR39



Beam stability

Measurements done with beam current of 100 nA



Single Event Effect test (1)

Highly-scaled tecnology suffer of SEE induced by low energy protons



- [RD5] B. D. Sierawski, et. al. "Impact of low-energy proton induced upsets on test methods and rate predictions," Trans. Nuc. Sci., vol. 56, no. 6, pp. 3085-3092, Dec. 2009
- [RD6] H. Puchner, J. Tausch, R. Koga, "Proton-induced single event upsets in 90nm technology high performance SRAM memories," proceedings of the Radiation effects data workshop, NSREC, July 2011
- [RD7] C. Weulersse, et. al. "Assessment and comparison of the low energy proton sensitivity in 65nm to 28nm SRAM devices," RADECS proceedings, Sept. 2011
- [RD8] J. A. Pellish, et. al. "Criticality of low-energy protons in single-event effects testing of highly-scaled technologies," Trans. Nuc. Sci., vol. 61, no. 6, Dec. 2014

Single Event Effect test – Additional features



2) Alpha particle beams routinely produced with same quality

Displacement Damage

6 MeV travel path is 300 µm in silicon





Future developments

Pulsed Beam

A first deflector has been inserted in low energy side of the accelerator Pulse duration achived so far is of order of 10 ns







Expected flux: about 10⁵ protons for bunch (measurements is in progress)

Neutron beams

New beam-line under construction Deuterium-deuterium reaction Expected 10⁵ neutrons/cm2/s



Conclusions

- Napoli accelerator suitable for several application fields
- Beam stability makes it very good for material and electronics irradiations for Radiation Hardness Assurance studies
- Routinely produced ions from Hydrogen to Oxigen
- Beam fluxes from few particles/second to 200 nA current

Future

- XY electromagnetic beam scanner to be ripristined for large area irradiations
- Pulsed beam in progress
- Neutron beams in progress