

OPERATING OF THE PROTON IRRADIATION FACILITY - CONCISE SUMMARY

W. Hajdas, K. Thomsen, A. Zehnder (PSI),
R. Harboe-Sorensen (ESA-ESTEC)

In 1999, PIF experiments were conducted in both NA2 and OPTIS areas taking almost 80 shifts. About 35 different experiments were grouped into 23 beam blocks resulting in ca. 50 irradiation days. Proton tests were mainly devoted to qualify devices for very near satellite missions like HESSI, STRV-1c or INTEGRAL.

PIF particle beam experiments in 1999 covered, up to now, the biggest yearly period from 20 January to 14 December. They were arranged into 23 irradiation blocks of variable duration and resulted in ca. 50 days with the beam on target. More than 35 types of irradiation tests by 17 different groups of researchers were performed. In addition to standard PIF tests of electronics and detectors, two institutes used the facility for particle physics studies. Again, the required proton fluxes spanned greatly between 10^4 and 10^{10} /cm²/sec and radial beam profiles covered the full available range from 16 to 100 mm FWHM. As in the 1998, there was a large interest in using the low energy protons in the OPTIS area.

Beam time and test area utilization by PIF

	NA2	OPTIS	⁶⁰ Co	Total
Beam blocks	13	8	2	23
Shifts	65	12	2	79

IRRADIATION EXPERIMENTS

With evolving new technologies and devices, and advanced mission requirements, one can observe significant shift in types of PIF experiments in 1999. Several characteristic groups are shortly described below. The largest amount of beam time for ESA related activities, was used to calibrate and test the RADFET dosimeters. These devices will be used for total dose measurements on boards of e.g. STRV-1c, INTEGRAL and ISS missions. The next type is related with electronic qualification the HESSI satellite. Together with NASA-GSFC and Berkeley University the PSI, represented by Laboratory for Astrophysics, is preparing the HESSI launch in the year 2000. Large amount of the 1999 beam time was taken by particle/nuclear physicists to study the neutron production in Pb-Bi targets with future applications in SINQ. Industrial research teams also carried out two large experiments. The ABB tested sensitivity of power devices for upsets induced by ionizing particles on earth. The SIRA electronics irradiated optical fibers foreseen on telecommunication satellites. Several groups characterized different types of CCDs. They will be used e.g. on the ISS as an astronaut's hand camera or in HESSI's sun/star aspect systems.

Selected PIF experiments:

- RADFET dosimeter radiation response study
- ICARE particle monitor calibration
- SRAM/DRAMs proton SEU characterization

- Radiation damage of various CCDs
- Proton dose effects in photodiodes
- CCD, DSP, ADC total dose and SEE testing
- Damages in encoders and mirror coatings
- Optical fibers rad-hardness determination
- Activation measurement of Ta and Mo plates
- Radiation damage in infrared bolometers
- Radiation effects in power MOSFETs
- Proton production of neutrons in PbBi targets
- Performance studies of BGO veto detectors
- Full characterization of PROBA Star-tracker.

SYNOPSIS OF USERS AND COLLABORATIONS

Table: research groups involved in PIF experiments.

No	Research Institution
1	ESA/ESTEC, Noordwijk
2	PSI/GSFC/Berkeley University
3	LABEN, Alenia Spazio, Milano
4	Bosch-Telecom GmbH, Backnang
5	Carl Zeiss GmbH, Oberkochen
6	Contraves Space, Zürich
7	CNES, Toulouse
8	DIFESA Officine Galileo
9	SIRA Electro-Optics, Kent
10	ONERA-CERT, Toulouse
11	ABB Semiconductors, Lenzburg
12	Kopenhagen University
13	NMRC, Kork
14	SCK/CEN, Mol
15	SOREQ NRC, Yavne
16	SODERN ,Paris

FURTHER FACILITY DEVELOPMENT

- The PIF will move from NA2 to PKC2 area during constructions of the new PROSCAN cyclotron.
- The low energy facility in OPTIS will move into the NE-B area allowing for easier experimentation.
- Development of the new irradiation facility linked to the biomedical cyclotron is in the initial phase.