Institute of Nuclear Research (ATOMKI)

Hungarian Academy of Sciences
Address: Bem tér 18/c., Debrecen, Hungary
Mail: P. O. Box 51 H-4001 Debrecen, Hungary
URL: www.atomki.hu

IRRADIATION FACILITIES

SELECTED PUBLICATIONS

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Equipment, components and materials can be irradiated. The following particles are available: protons, deuterons, $^{3}He^{++}$-particles, alpha-particles, neutrons, gamma photons. The facilities are listed below. The irradiation program is organized and coordinated by the Cyclotron Department of the Institute of Nuclear Research (ATOMKI) Hungarian Academy of Sciences.

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Contact person in radiation damage related issues: **András Fenyvesi**

Irradiation Facilities

Cyclotron laboratory:

Accelerator: MGC-20E cyclotron
Producer: Efremov Institute of Electrophysical Apparatuses
St. Petersburg, Russia
Laboratory: 4 beam lines are available in the radiation shielded area for performing irradiation in vacuum or in free air with extracted beam; some target moving is feasible during irradiation
nuclear analytical measuring site equipped with semiconductor detectors
radiochemical laboratories equipped with hot boxes

Charged particles at the exit of the cyclotron:

Protons:
energy range: 5 – 18 MeV
maximum current at maximum energy: 50 microA

Deuterons:
energy range: 3 – 10 MeV
maximum current at maximum energy: 50 microA

$^{3}He^{++}$-particles:
energy range: 8 – 24 MeV
maximum current at maximum energy: 25 microA

alpha-particles:
energy range: 6 – 20 MeV
maximum current at maximum energy: 25 microA

Neutrons at the cyclotron:

p+Be neutrons:

Neutron energy range:
0 – 16 MeV (continuous spectra)
Maximum intensity at zero degree direction:
$1.5 * 10^{16}$ $sr^{-1}C^{-1}$ (at 18 MeV proton energy)
Typical flux rate at zero degree direction:
$2.5 * 10^{9}$ $cm^{-2}s^{-1}$ (at 18 MeV proton energy)
Maximum flux rate at zero degree direction:
$5.0 * 10^{9}$ $cm^{-2}s^{-1}$ (at 18 MeV proton energy)
Description of the fields:
anisotropic and in-homogenous fields in air with some gamma contribution depending on the irradiation conditions; the fields are not collimated and not filtered; panorama-like irradiation is feasible
Typical gamma contribution:
~ 8 % of the neutron dose absorbed in human muscle equivalent media
Minimum source sample distance: 10 cm
Maximum source sample distance: 150 cm
Metrology background:
ionisation chambers, thermoluminescent ribbons, multifoil activation technique

d+Be neutrons:

Neutron energy range:
0 – 12 MeV (continuous spectra)
Maximum intensity at zero degree direction:
$0.8 * 10^{16}$ $sr^{-1}C^{-1}$ (at 10 MeV deuteron energy)
Typical flux rate at zero degree direction:
$1.5 * 10^{9}$ $cm^{-2}s^{-1}$ (at 10 MeV deuteron energy)
Maximum flux rate at zero degree direction:
$3.0 * 10^{9}$ $cm^{-2}s^{-1}$ (at 10 MeV deuteron energy)
Description of the fields:
anisotropic and in-homogenous fields in air with some gamma contribution depending on the irradiation conditions; the fields are not collimated and not filtered; panorama-like irradiation is feasible
Typical gamma contribution:
~ 8 % of the neutron dose absorbed in human muscle equivalent media
Minimum source sample distance: 10 cm
Maximum source sample distance: 150 cm
Metrology background:
ionisation chambers, thermoluminescent ribbons, multifoil activation technique

Gamma photons:

Source:
Co-60
Photon energies:
1.172 MeV and 1.332 MeV
Activity:
8.55 TBq (T_{ref} = 12:00 GMT 16 October 2002)
Typical dose rate:
258 Gy/h (at 10 cm distance measured from the center of the source at T_{ref} = 12:00 GMT 16 October 2002
Description of the field:
anisotropic and in-homogenous field in air; the fields are not collimated and not filtered; panorama irradiation is feasible around the remote controlled electro-pneumatic system used for controlling the source;
Minimum source sample distance: 5 cm
Maximum source sample distance:500 cm
Metrology background:
ionisation chamber, thermoluminescent ribbons

Selected Publications

J. Molnár, A. Fenyvesi, G. Dajkó, J. Végh et al: Radiation tolerance tests of components for the FERMI microchip module; Nucl. Instr. Meth. B 143, pp 536-546 (1998)

A. Fenyvesi, J. Molnár, D. Sohler et al: Results on photon and neutron irradiation of semitransparent amorphous-silicon sensors; Nucl. Instr. Meth. A 455, pp 361-368 (2000)

A. Fenyvesi, J. Molnár, D. Sohler et al: Pulse height distribution and radiation tolerance of CVD diamond detectors; Nucl. Instr. Meth. A 447, pp 244-250 (2000)

J. Molnár, A. Fenyvesi et al: Improvement of the dosimetric properties of chemical-vapor-deposited diamond films by neutron irradiation; Appl. Phys. Lett. Vol. 81, No. 2, pp. 298-300 (2002)