

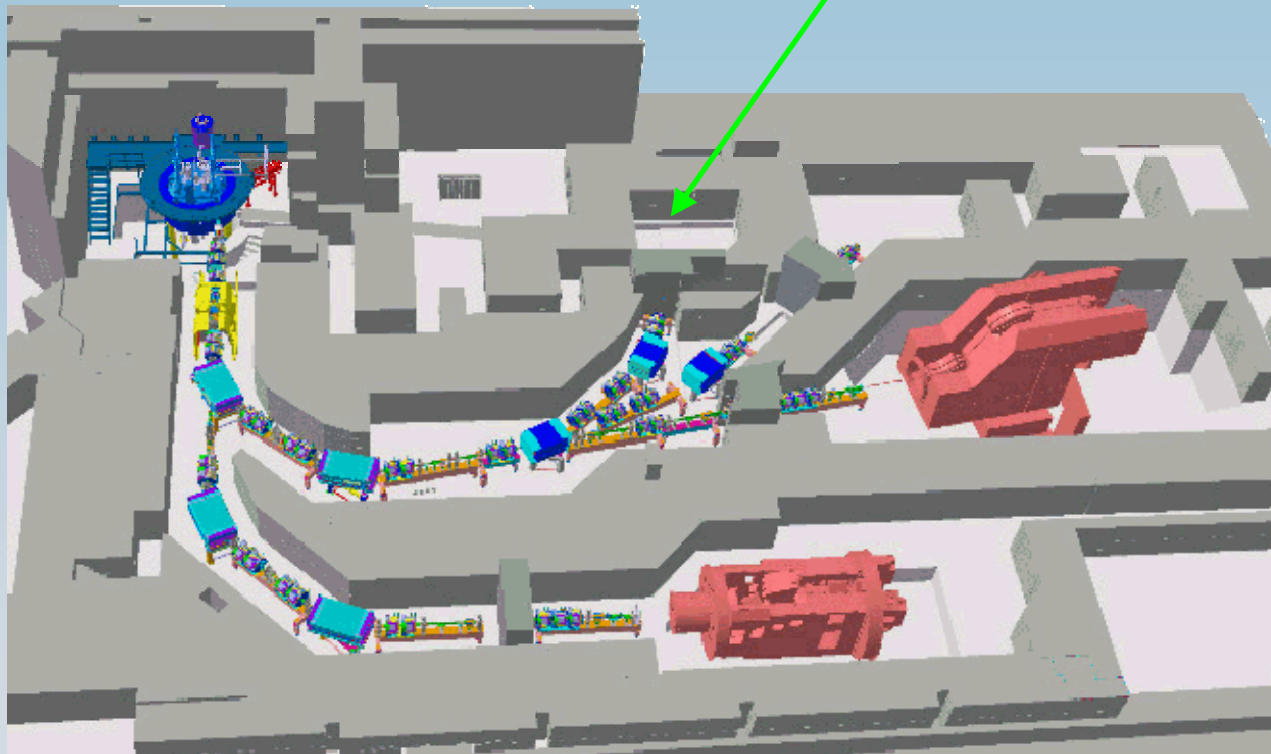
PROTON IRRADIATION FACILITY STATUS REPORT

Wojtek Hajdas PSI TEM

- PIF features at PROSCAN
- Operation 2008
- Tests Highlights

PIF AT PROSCAN

Experimental Area
New PIF

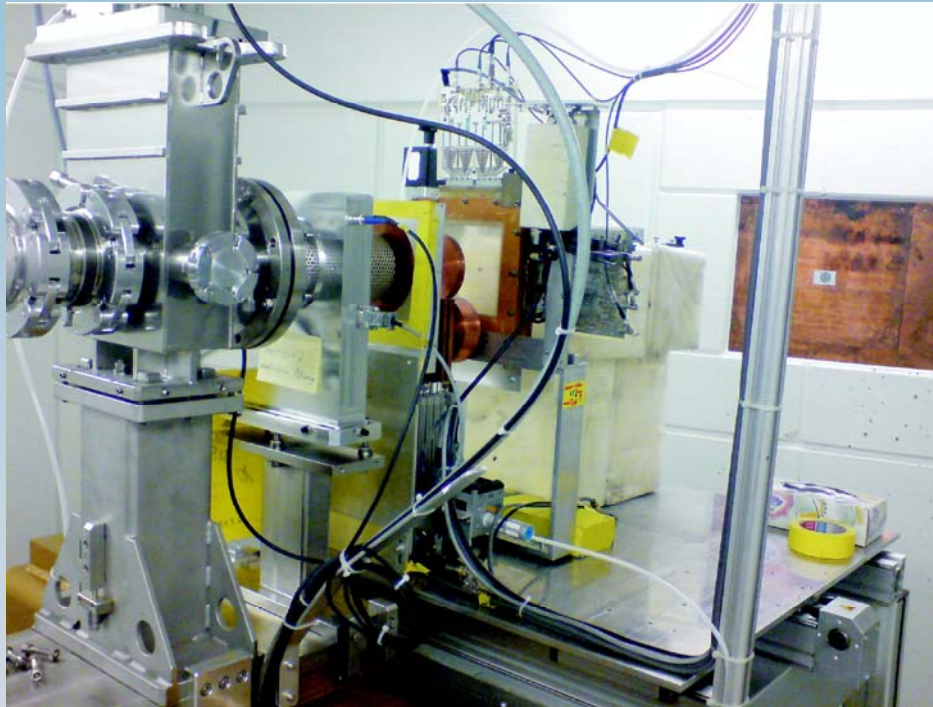


PROSCAN Area Layout

MAIN FEATURES

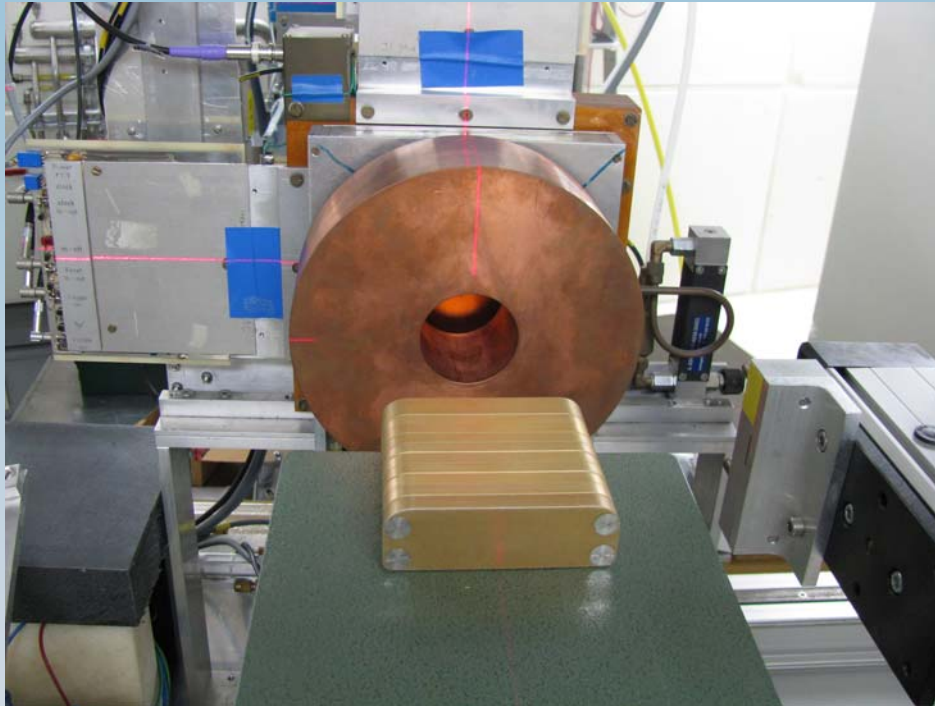
Preselected initial energies	(250), 235, 200, 150, 100, 70 MeV
Energies with local degrader	Ca. 10 to 235 MeV
Intensity ($E > 200$ MeV)	2 nA
Intensity ($E < 100$ MeV)	10 nA
Max. flux at primary energy	$2\text{-}5 \cdot 10^8$ p/cm ² /s (wide beam)
Beam profile (wide beam)	Gaussian, FWHM \approx 7-10 cm
DUT frame	25 x 25 cm ² (ECIF standard)

EXPERIMENTAL SETUP



PIF area looking downstream:
the last beam profile monitors, ionization chambers,
degrader and XY-table and beam dump.

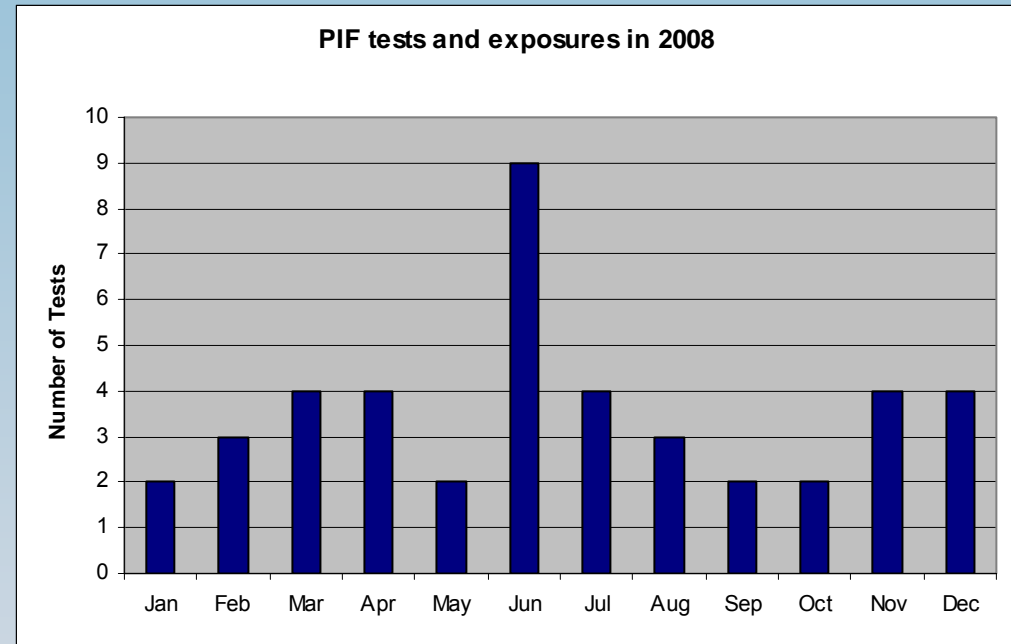
DUT, CENTERING AND COLLIMATION



PIF area looking upstream:
DUT on stage, Copper collimator, last wire chamber.
Vertical and horizontal traces of centering laser are seen

OPERATION STATISTICS - 2008

- Irradiation period:
January – December
- Researches from
2 groups in NEB
21 groups in PROSCAN
- User exposures in 28 beam blocks
- Beam utilization over 66 days



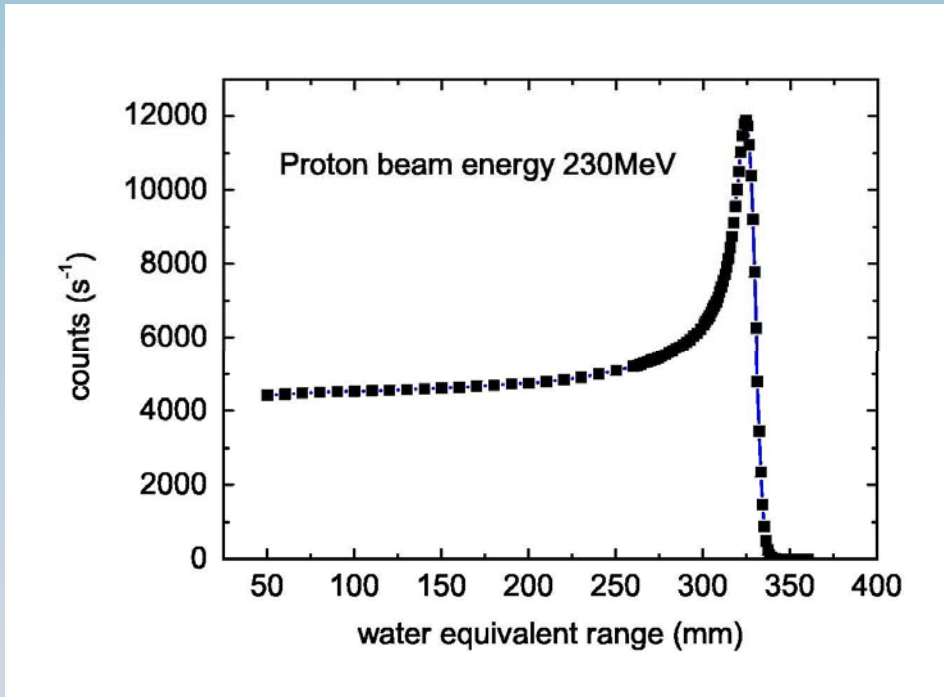
Beam Time and Test Area Utilization

Area	PROSCAN	NEB	Total
Shifts	98.5	6	104.5

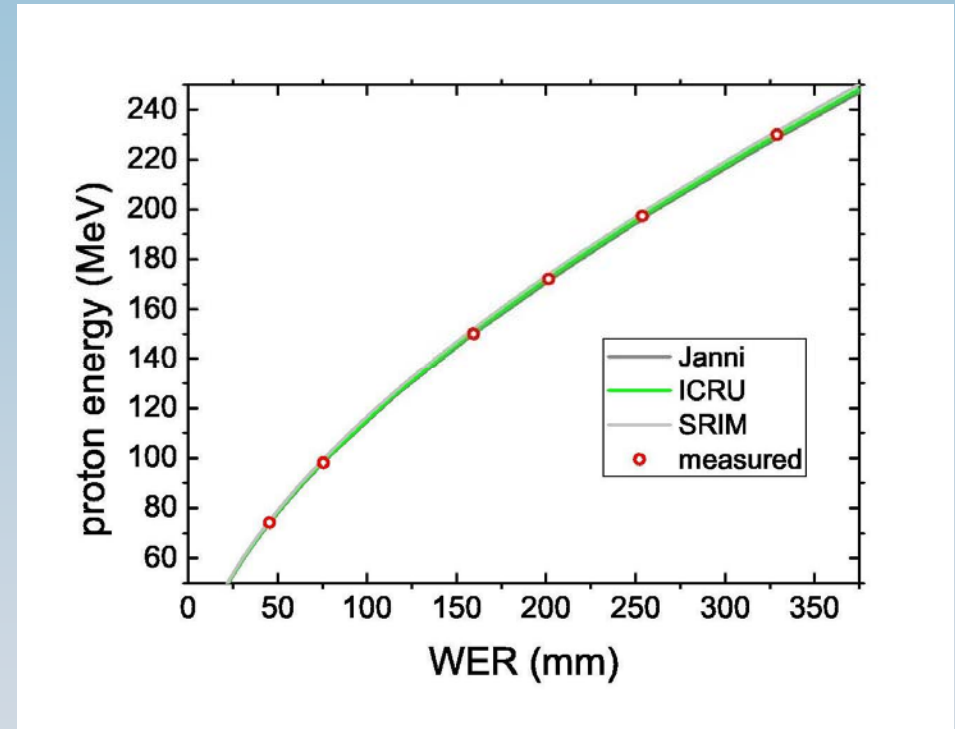
EXPERIMENTS HIGHLIGHTS

- INFRARED DETECTORS
- RADIATION MONITORS
- MEMS
- FPGAs
- HIGH POWER RECTIFIERS
- DCDC CONVERTERS
- OpAmps
- ASICS
- CCD SENSORS etc.er

ENERGY CALIBRATION

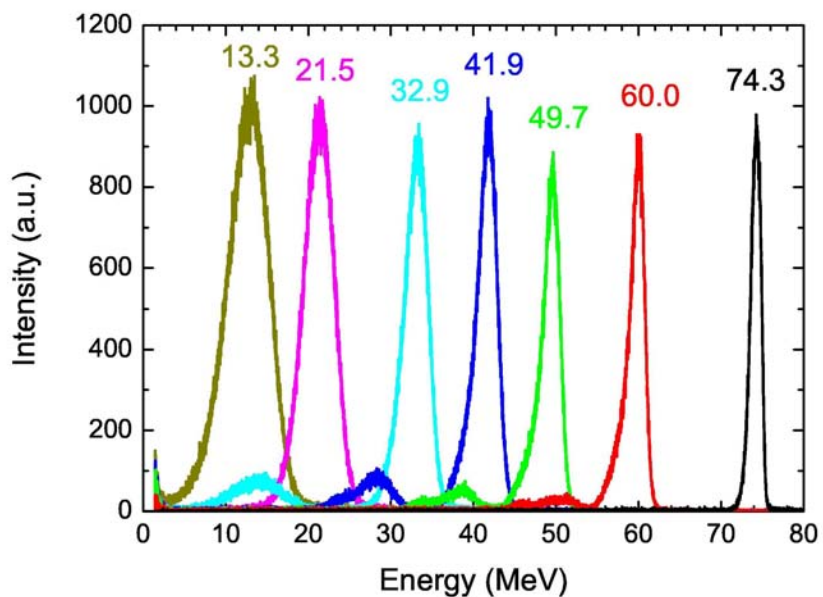


Range curve from Water Phantom tests

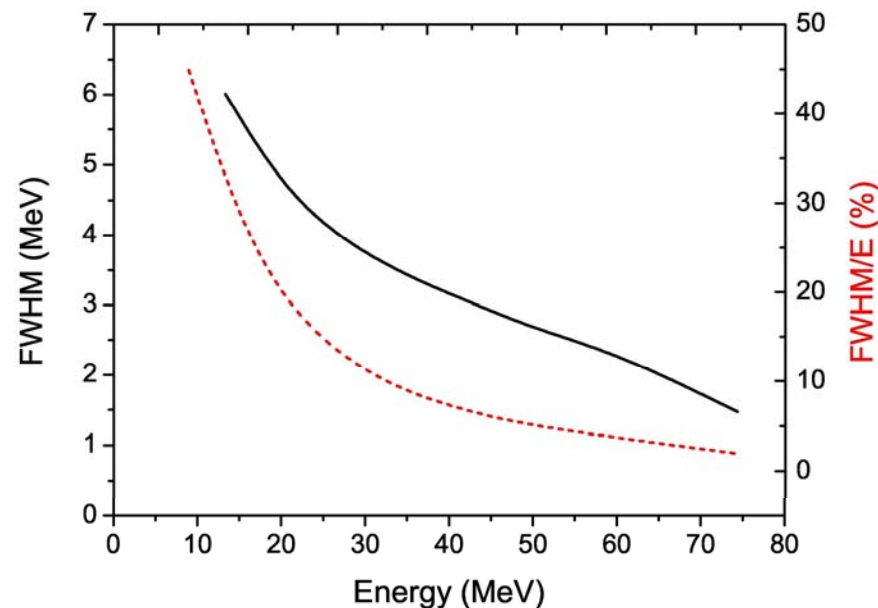


Energy calibration using water equivalent range for different codes

ENERGY STRAGGLING

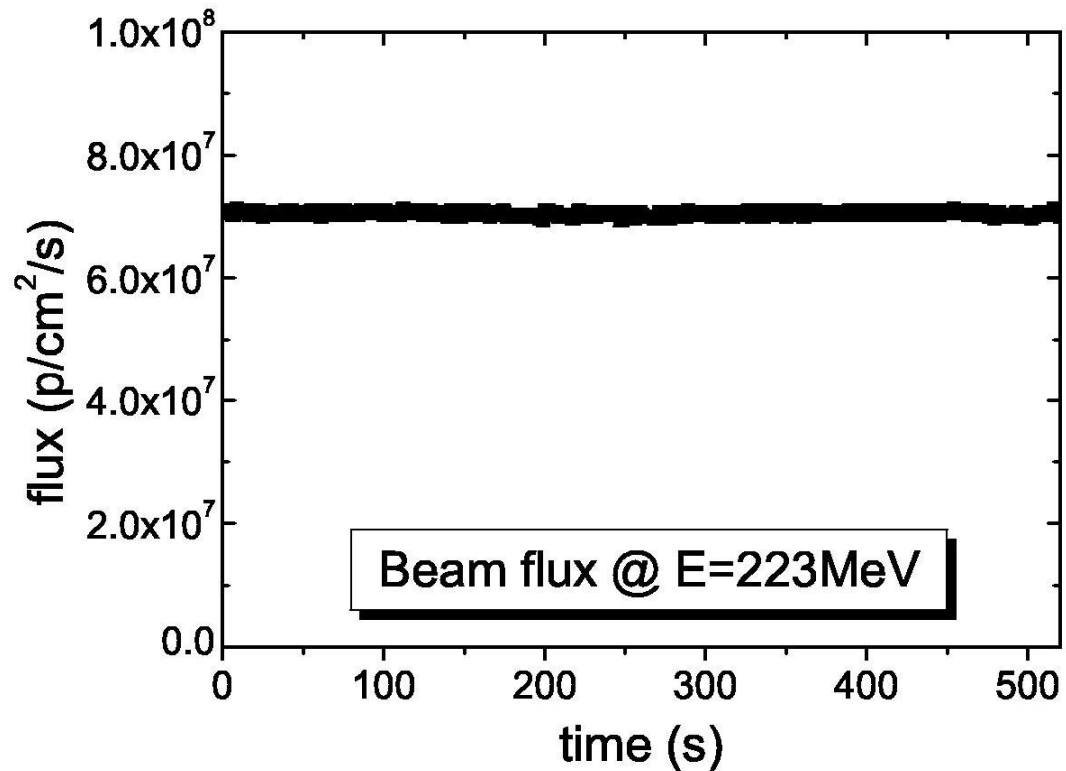


Proton energy spectra measured with NaI(Tl)



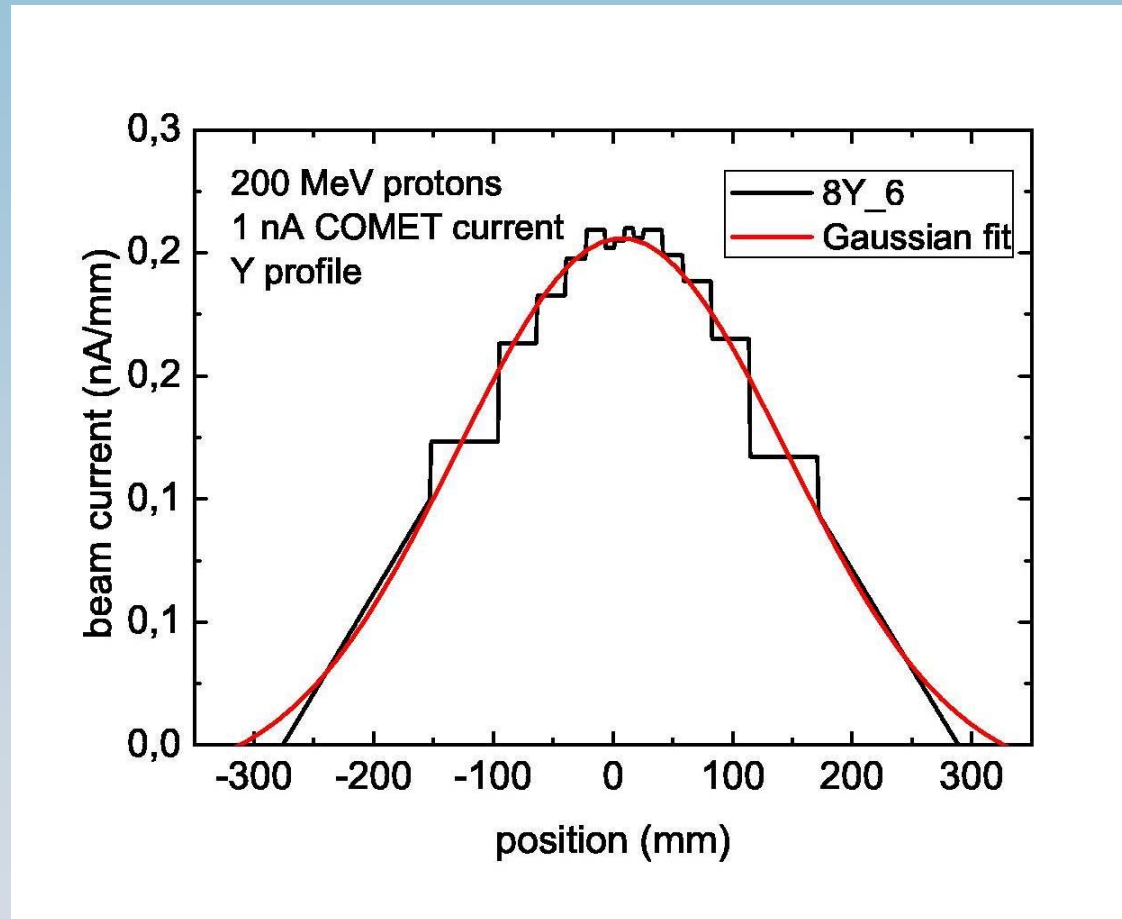
Proton energy FWHM vs beam energy

HIGH BEAM STABILITY



Example of the beam intensity vs.time

BEAM WIDTH / PROFILES



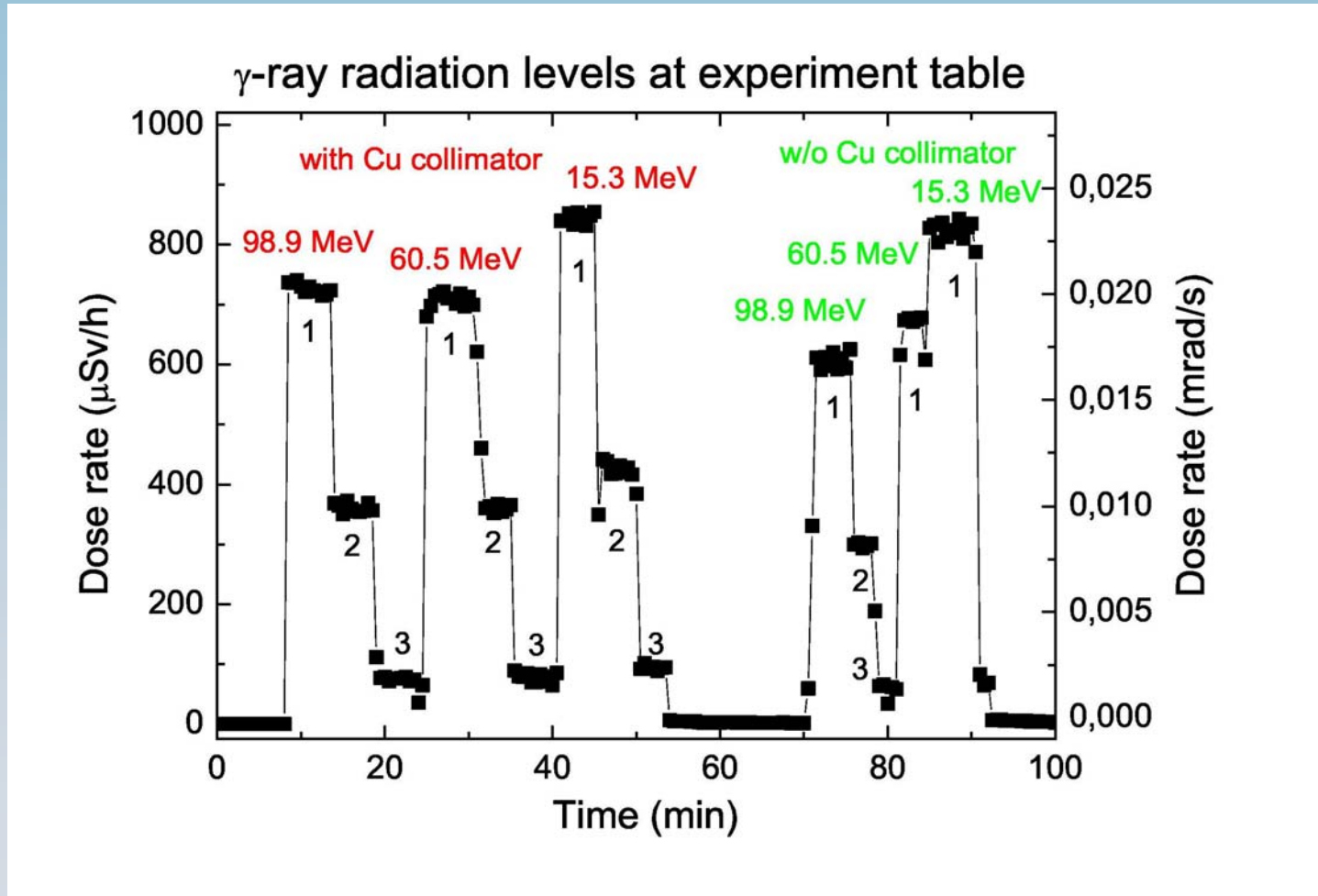
Beam profile measured with beam profile monitor before DUT

SECONDARY RADIATION

Proton energy	Flux at DUT	Neutron dose	γ -ray dose DUT	γ -ray dose table	Collimator. Cu-pipe
MeV	p/cm ² /s	mSv/h	mSv/h	mSv/h	cm
15.3	1.5e7	35.8	1.35	0.84	5
60.5	4.9e7	35.3	5.42	0.71	5
98.9	7.5e7	41.9	11.52	0.73	5
150.3	7.1e7	104.8	19.51	6.5	5
199.3	7.9e7	75.2	27.51	1.8	5
15.3	1.5e7	31.9	3.85	0.83	No
60.5	4.8e7	23.2	4.60	0.67	No
98.9	7.5e7	14.9	(24.8)	0.61	No
150.3	6.8e7	66.6	(254)	6.5	No
199.3	7.7e7	35.6	13.7	1.4	No

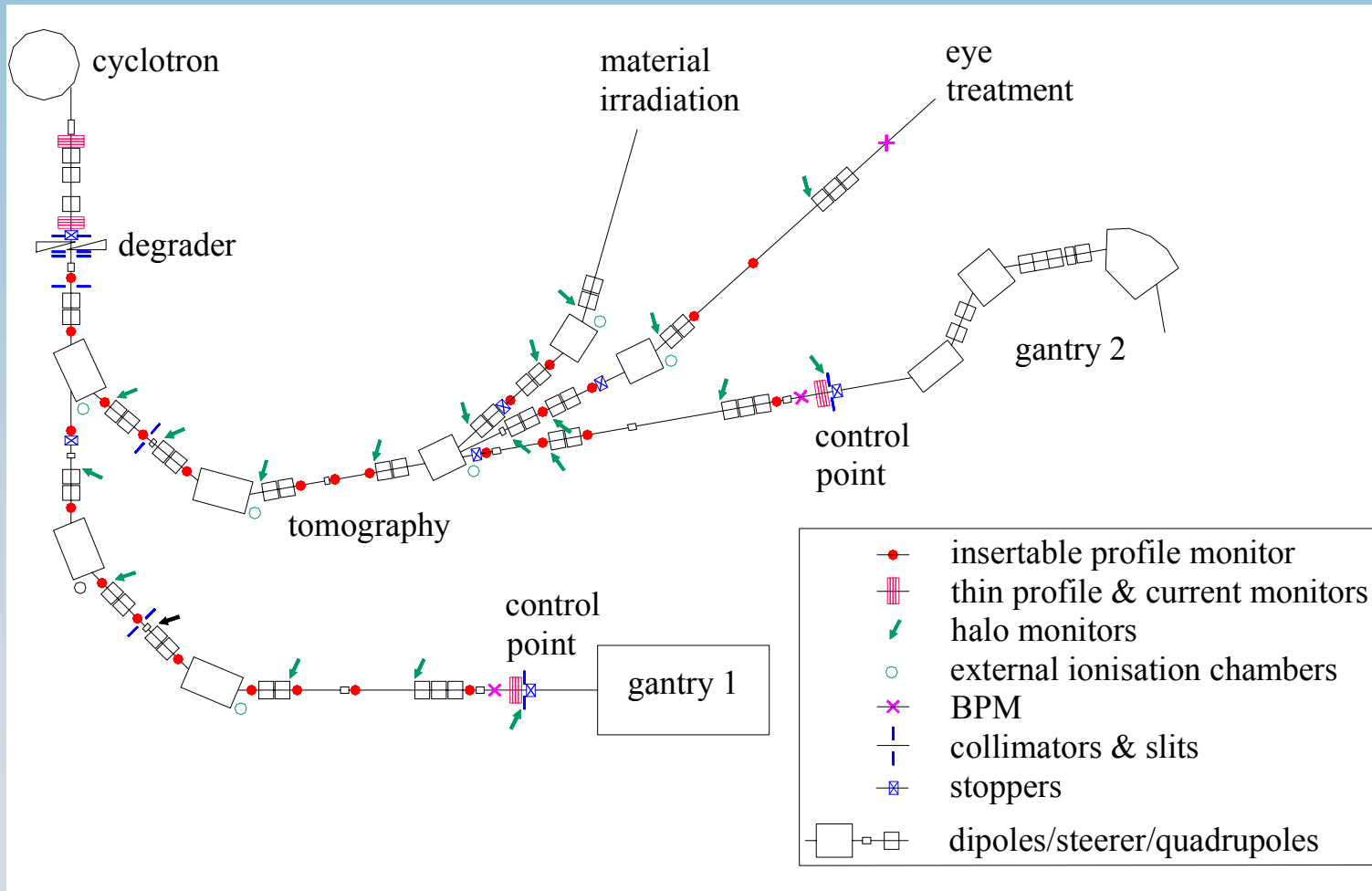
Extra dose negligible; worst case < 0.5% of the main proton dose

SECONDARY RADIATION - GAMMA



Secondary radiation scaled down with beam intensity / factor 1:2:10

PROSCAN BEAM DIAGNOSTICS



SUMMARY

- New Proton Irradiation Facility operates for 1 year at PROSCAN.
- Beams energies between a few MeV (~ 10) to 250 MeV.
- Intensities up to 10 nA at $E < 100$ MeV.
- Intensities up to 2 nA at $E > 200$ MeV.
- Fluxes for a wide beam of $2\text{-}5 \cdot 10^8$ p/cm²/sec.
- Wide beam profiles uniform with FWHM ≈ 10 cm.
- Focused beams with FWHM ≈ 6 mm.
- PIF included in PSI Digital User Office
(apply online for access badges, dosimeters, accommodation in the PSI guest house).