

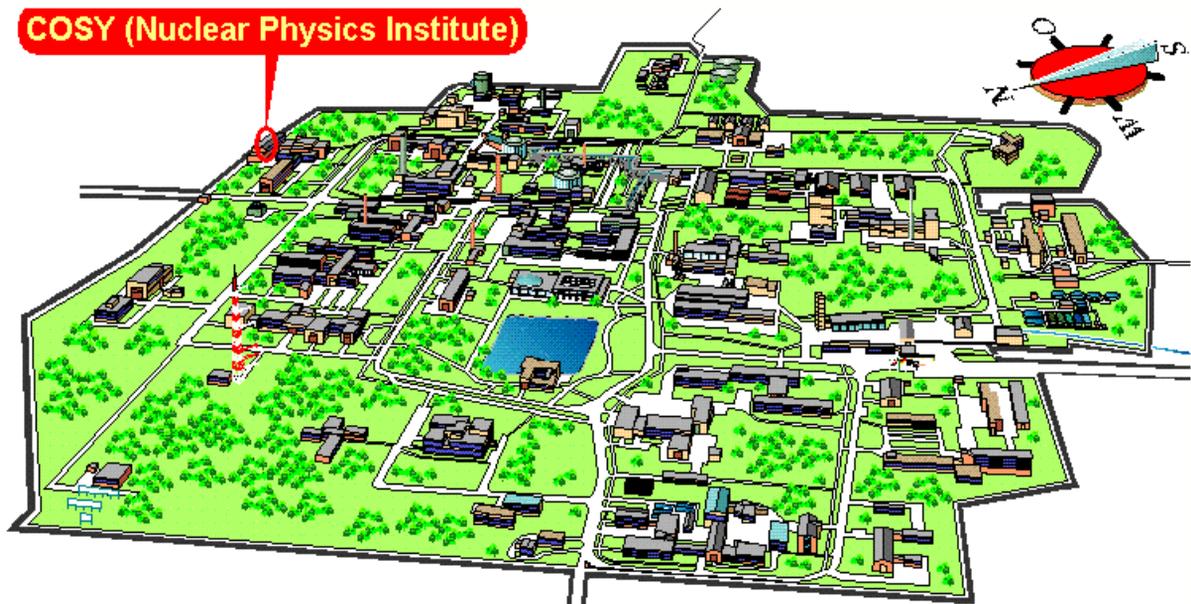


Nondestructive beam profil monitoring at COSY Juelich - Design and Experience

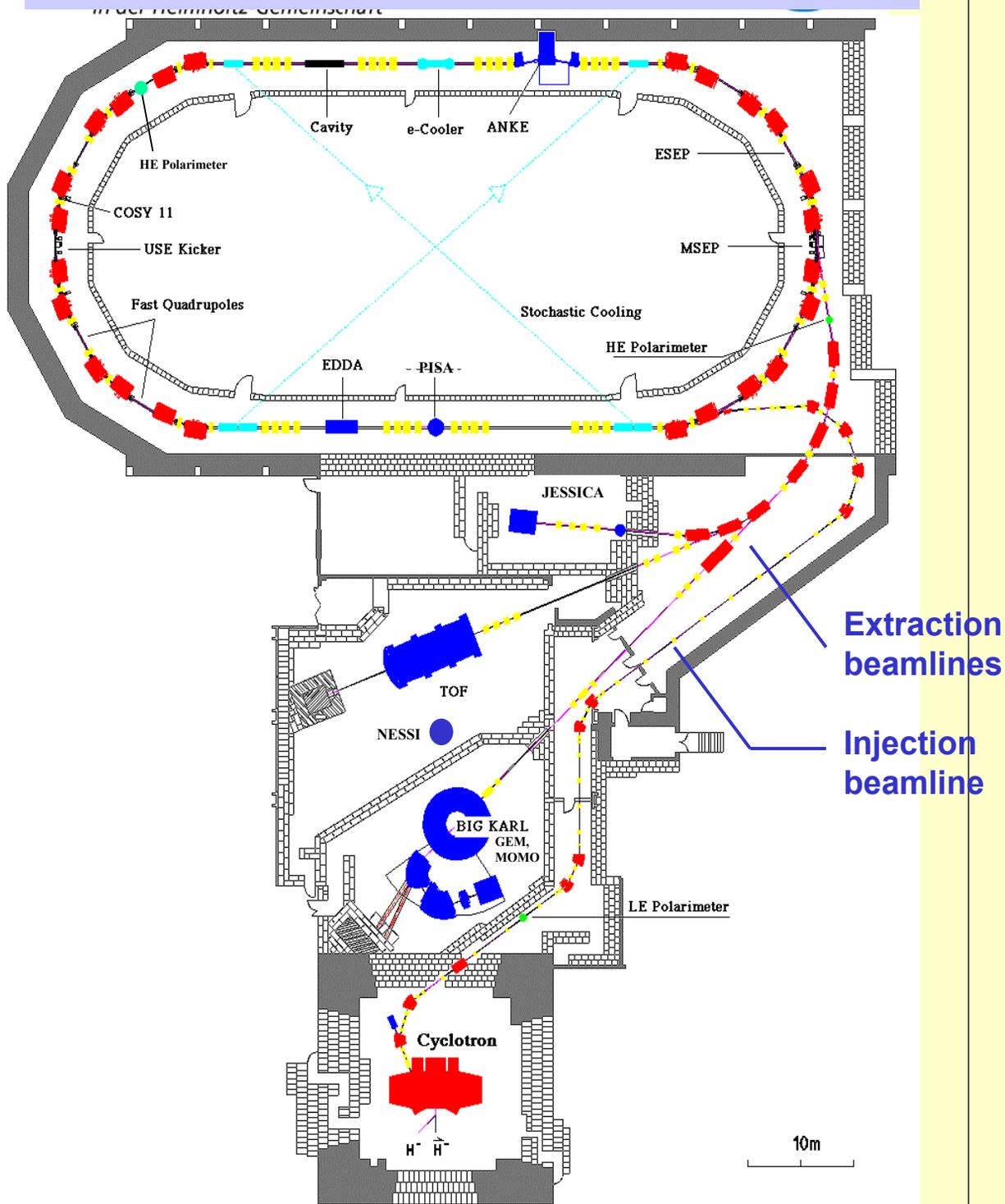
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COOLER-SYNCHROTRON COSY



Ions: (pol.) p and d

Momentum Range: 300 - 3650 MeV/c (p)

540 - 3650 MeV/c (d)

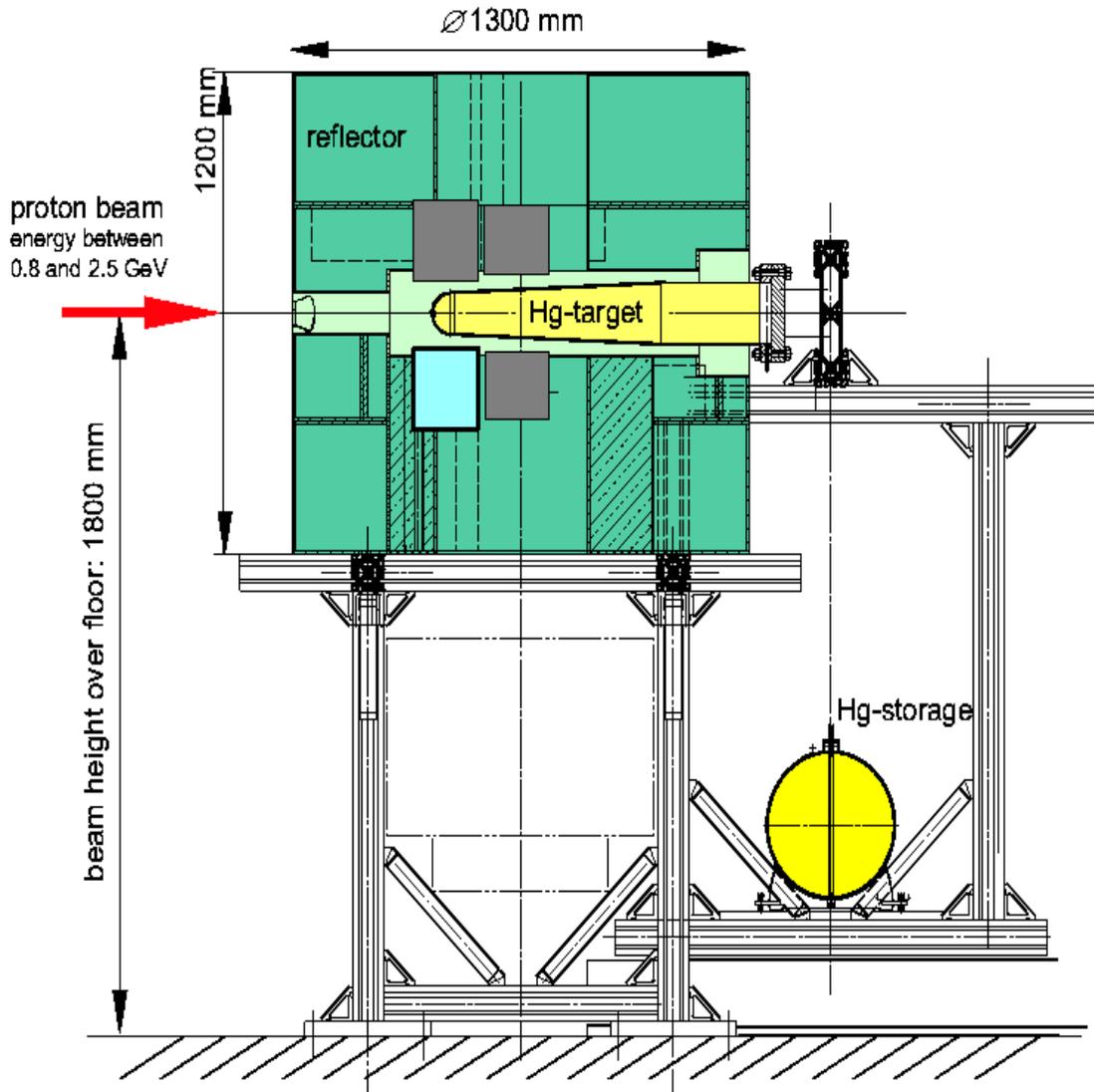
Particle numbers $< 2 \cdot 10^{11}$ p

Ring Circumference 184 m, Vacuum $< 10^{-10}$ hPa

Experimental areas: 4 internal, 3 external



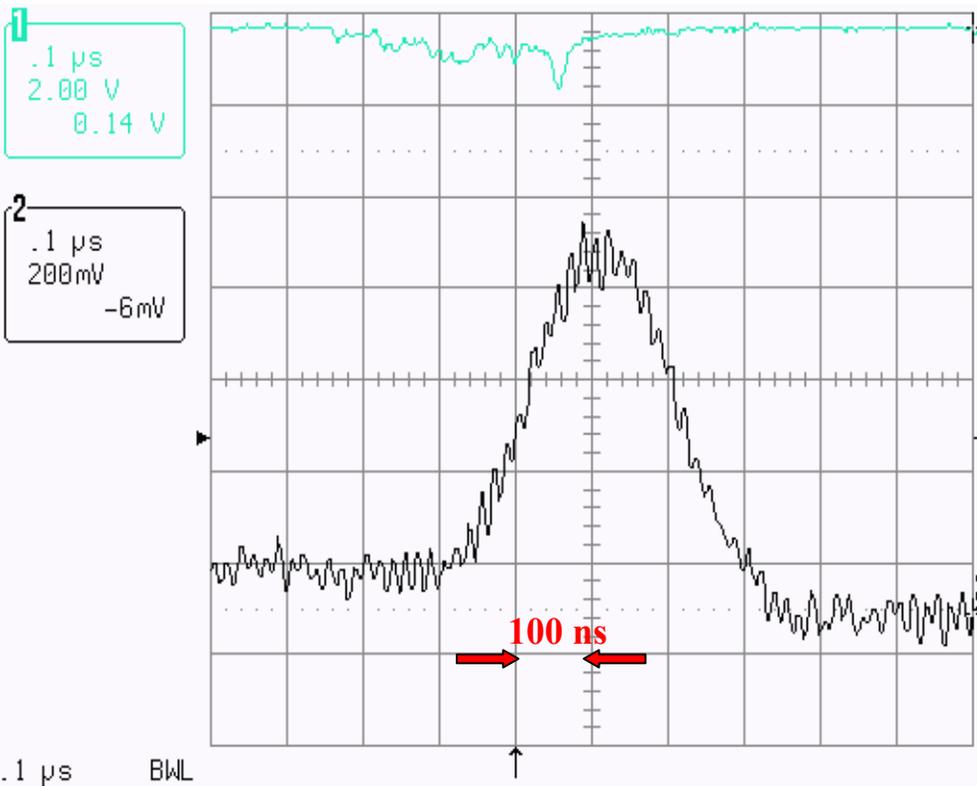
Jülich Experimental Spallation Target Setup in Cosy Area
ANL, FZ-Jülich, JAERI, KEK, LANL, ORNL, PSI, RAL, Univ. Hokkaido





J.Dietrich
IKP-COSY
24.10.2000

COSY - Fast extraction NEMP, 1.3 GeV



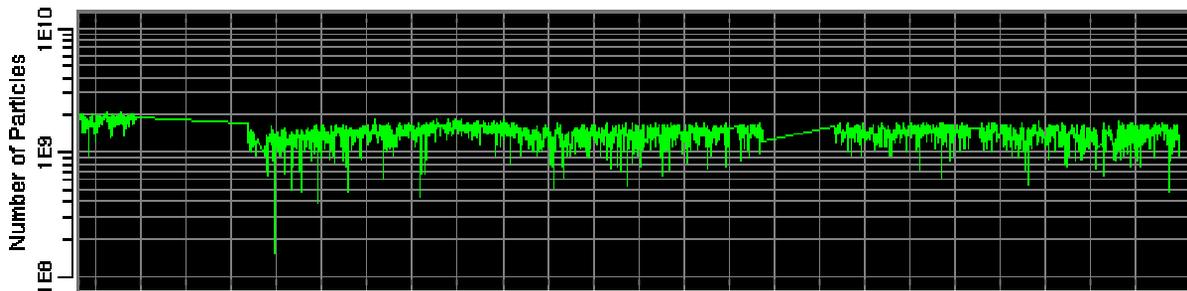
Szintillator in MWPC1.1
(out of beam)

Wall Current Monitor

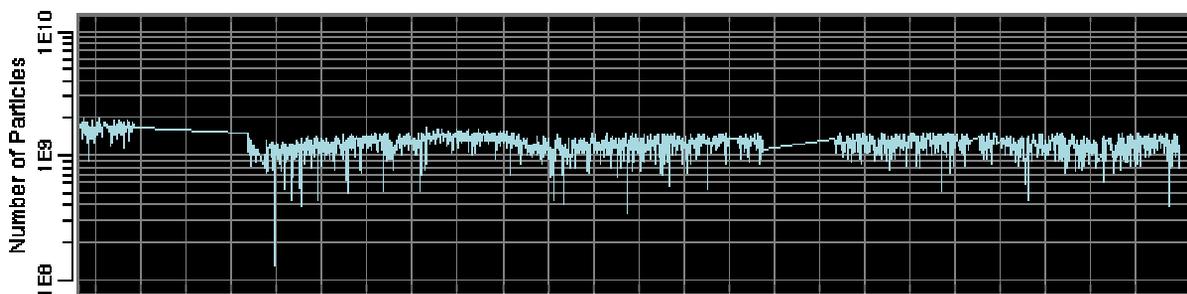
$2 \cdot 10^9$ p



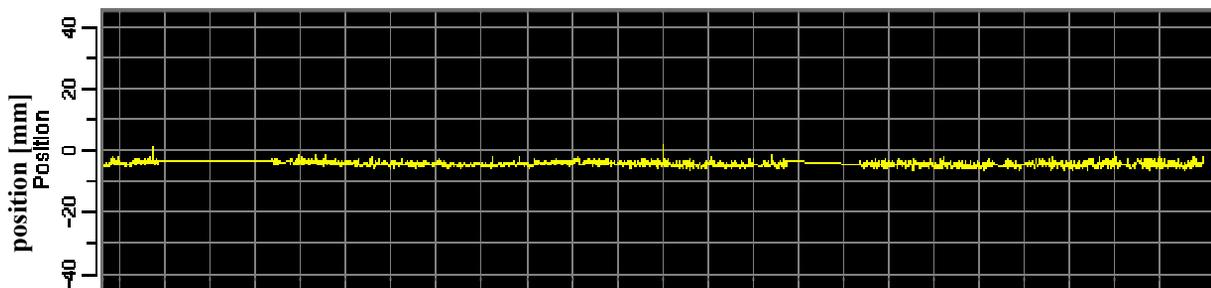
JESSICA Horizontal Intensity Plot



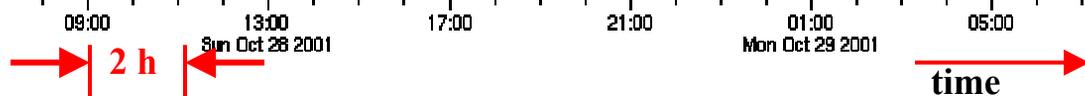
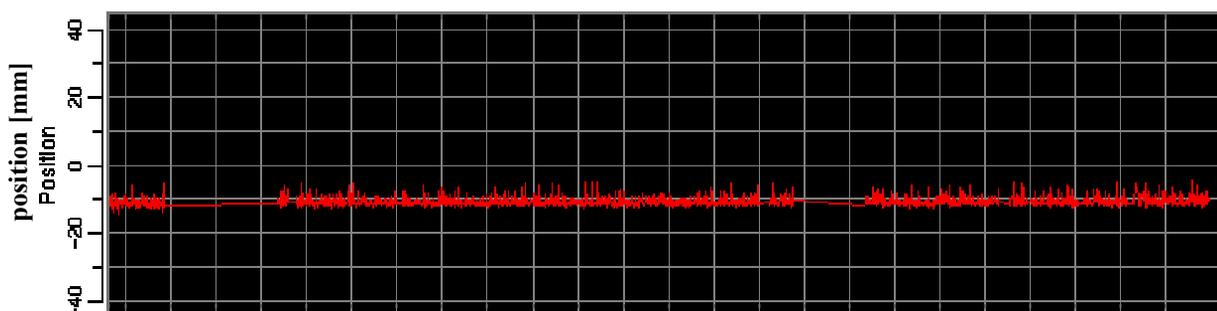
JESSICA Vertical Intensity Plot



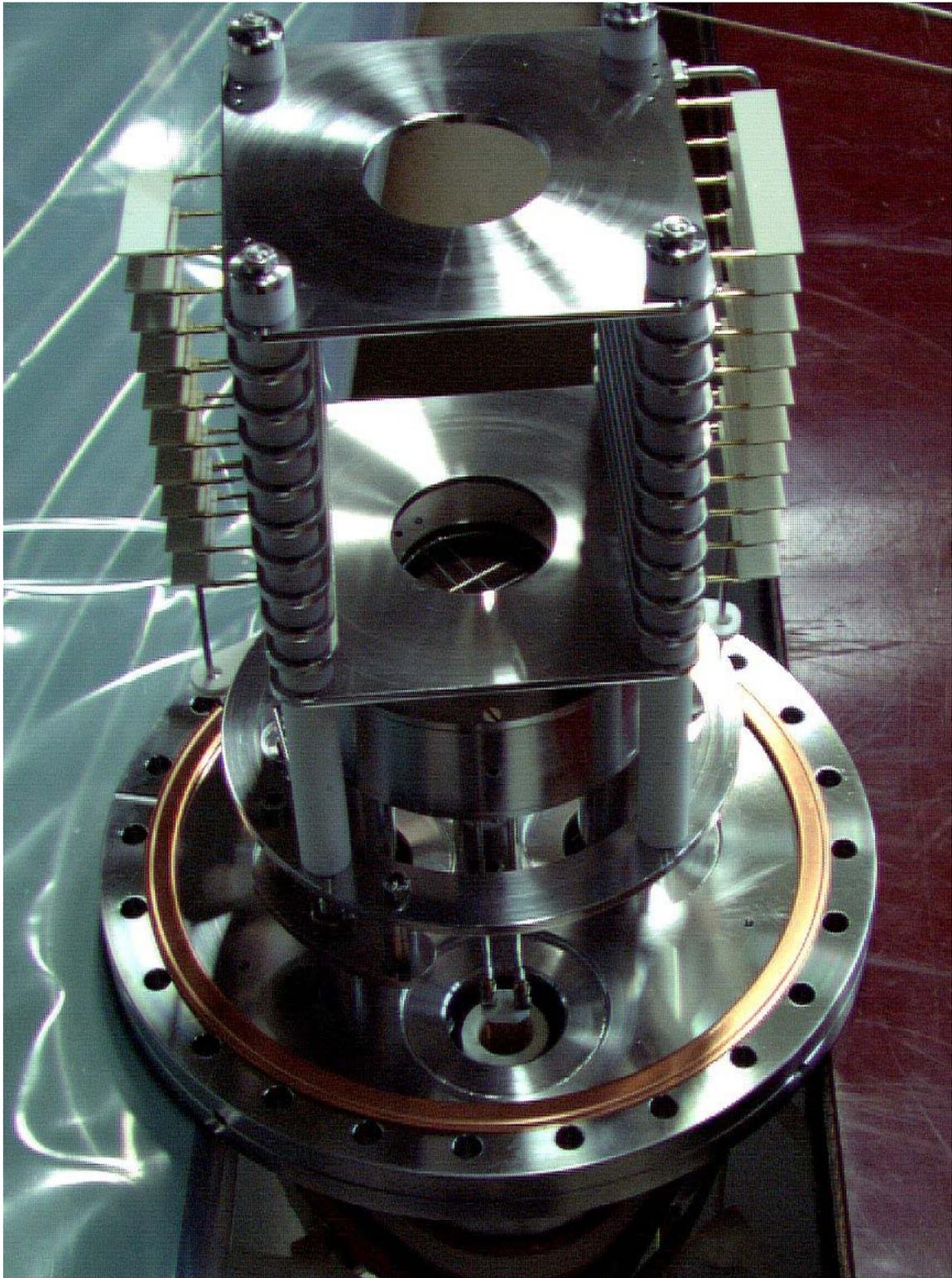
JESSICA Horizontal Position Plot



JESSICA Vertical Position Plot

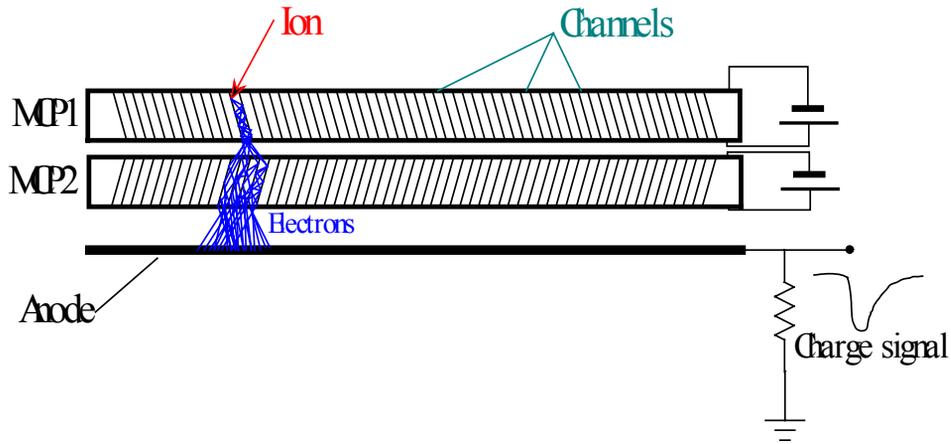


Drift Field Electrodes

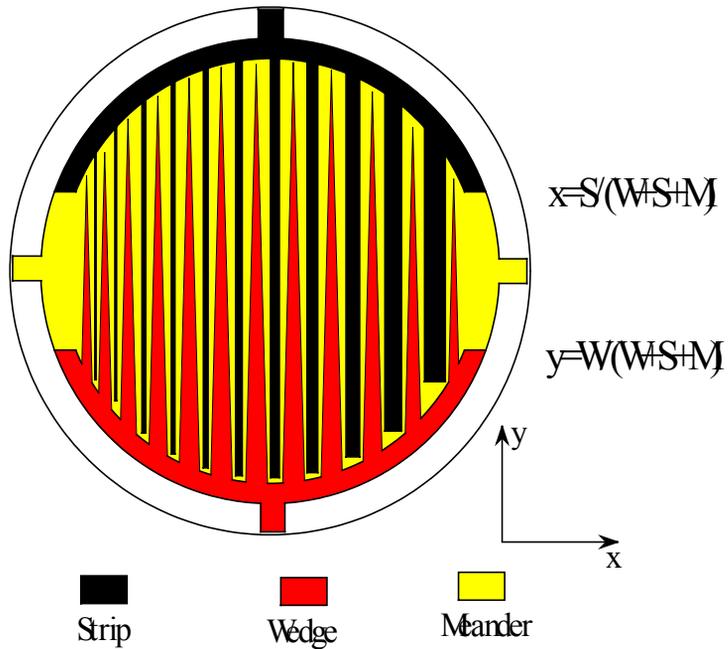




MCP in Chevron Geometry and W&S Anode



MCP in Chevron Geometry



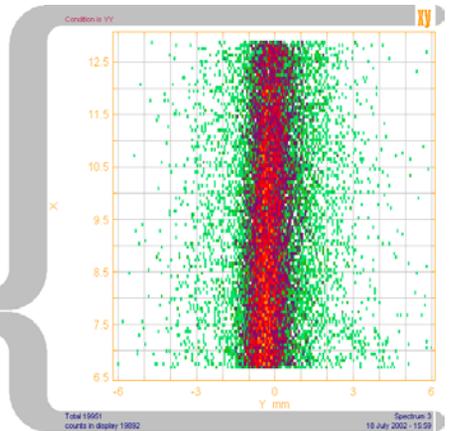
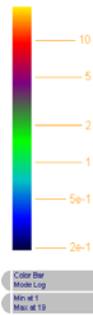
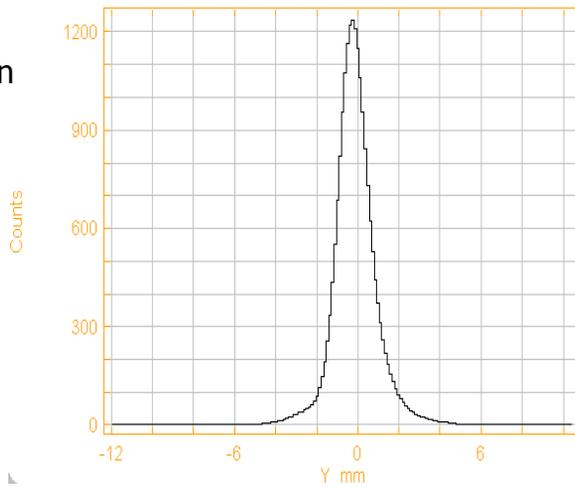
W&S Anode



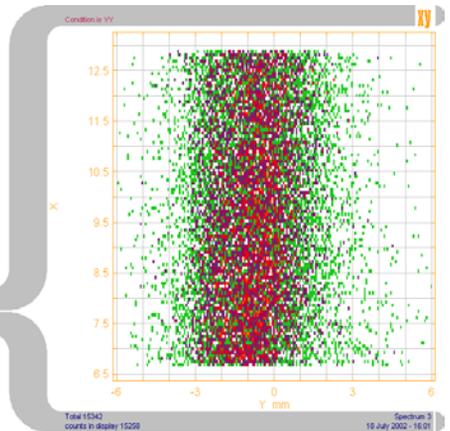
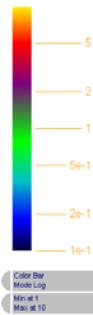
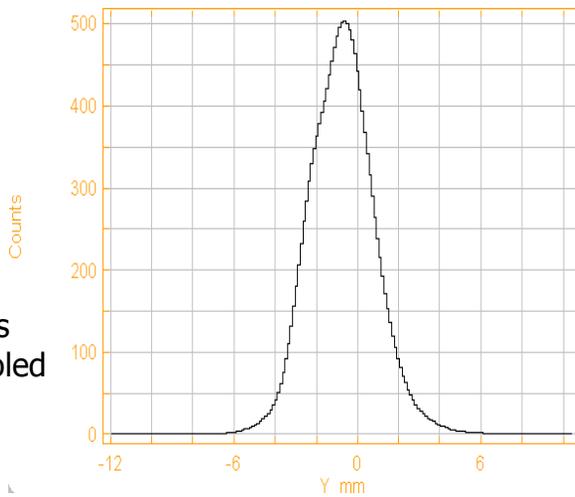
Results

Profile measurement

Electron cooled proton beam



The proton beam is not cooled

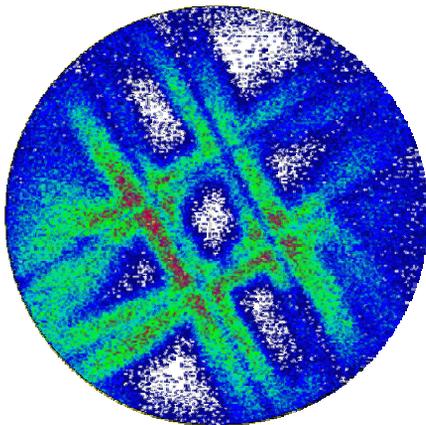


1,3·10⁹ particles in the ring, 45 MeV.

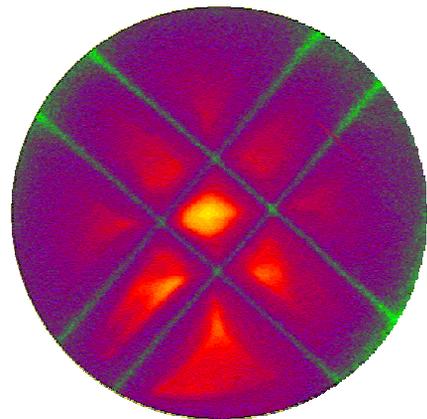


Experience

- MCP can be damaged in case of high intensity beams.
(See 2D image. Detector is irradiated with α -particles)
- Pneumatically driven protection screen is installed to prevent detector irradiation during the routine operation of the accelerator.
- The MCP voltage is switched on only during the measurement (typically a few seconds).
- Profile measurements have been carried out for proton beam intensities up to 10^9 particles in the ring and residual gas pressure of about 10^{-9} mbar.



Damaged MCP



New MCP



Conclusions

The ionisation beam profile monitor is used in routine operation.

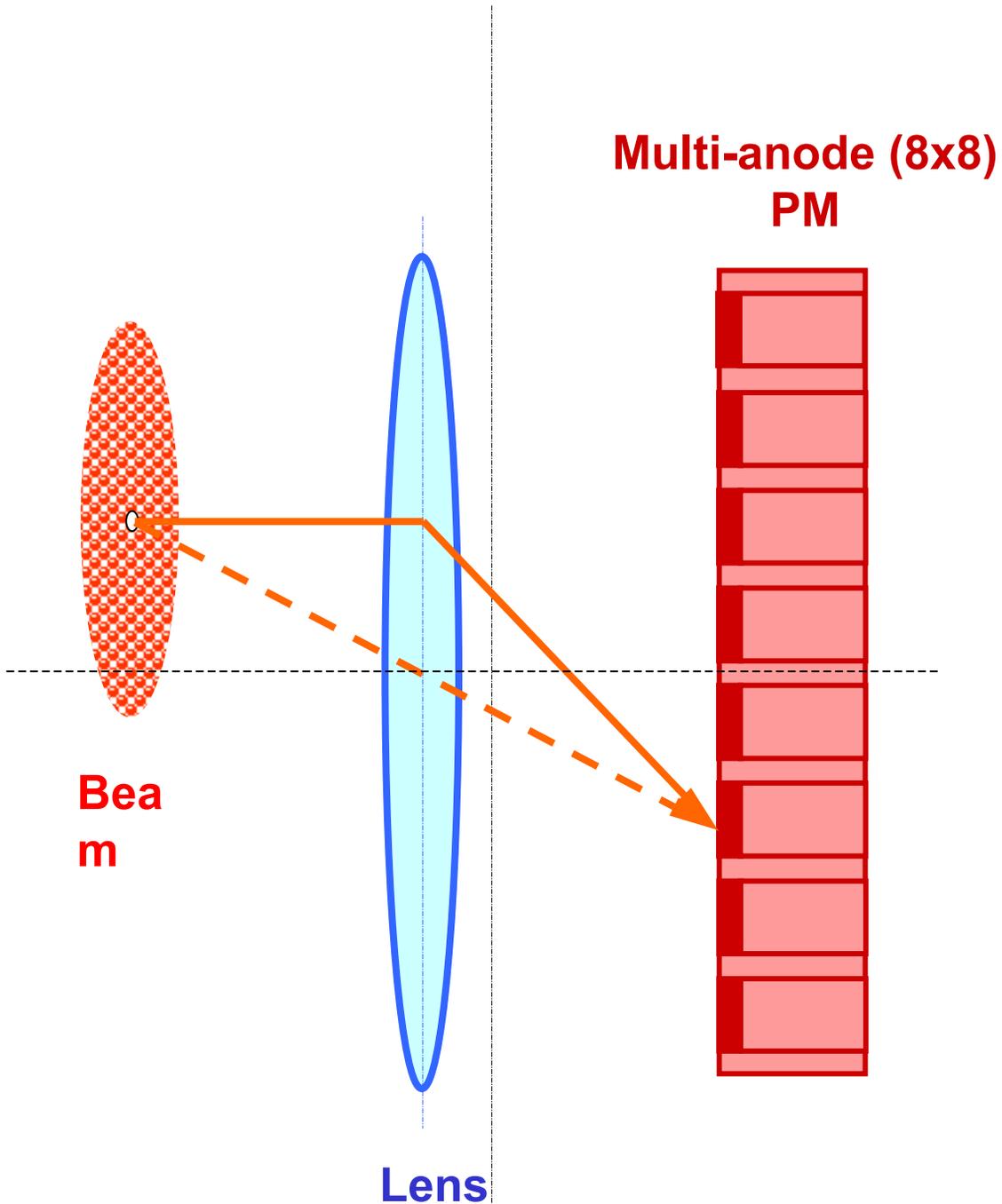
The lifetime of the channel plates and the event rate are crucial issues for the measurement of intense proton beams.

Therefore the monitoring of the sensitivity distribution of the channel plates, for example by illuminating with an radioactive source, is important. The life time of the MCP could be extended by triggering the high voltage and mechanical screening.

By the interpretation of the measured beam profile the ion optics of the system has to be taken into account.



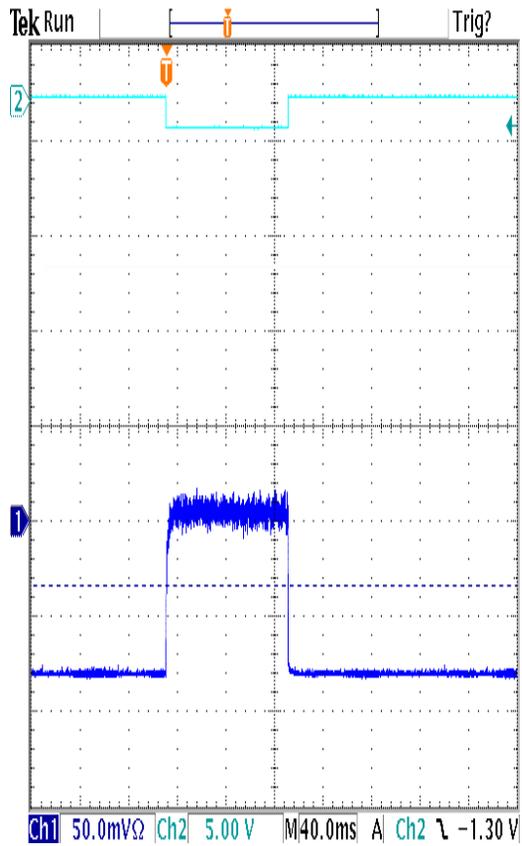
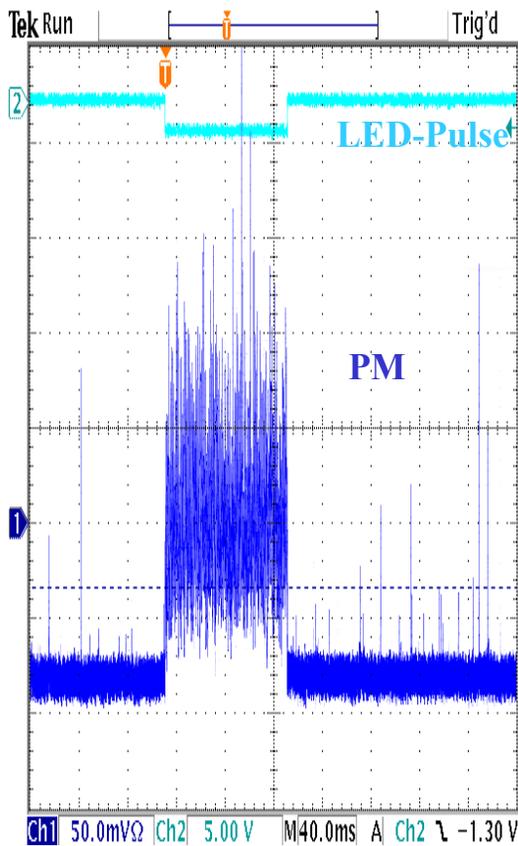
Residual gas fluorescence profil measurement





Determination of the photomultiplier zero line.

The (red) LED is pulsed operated.



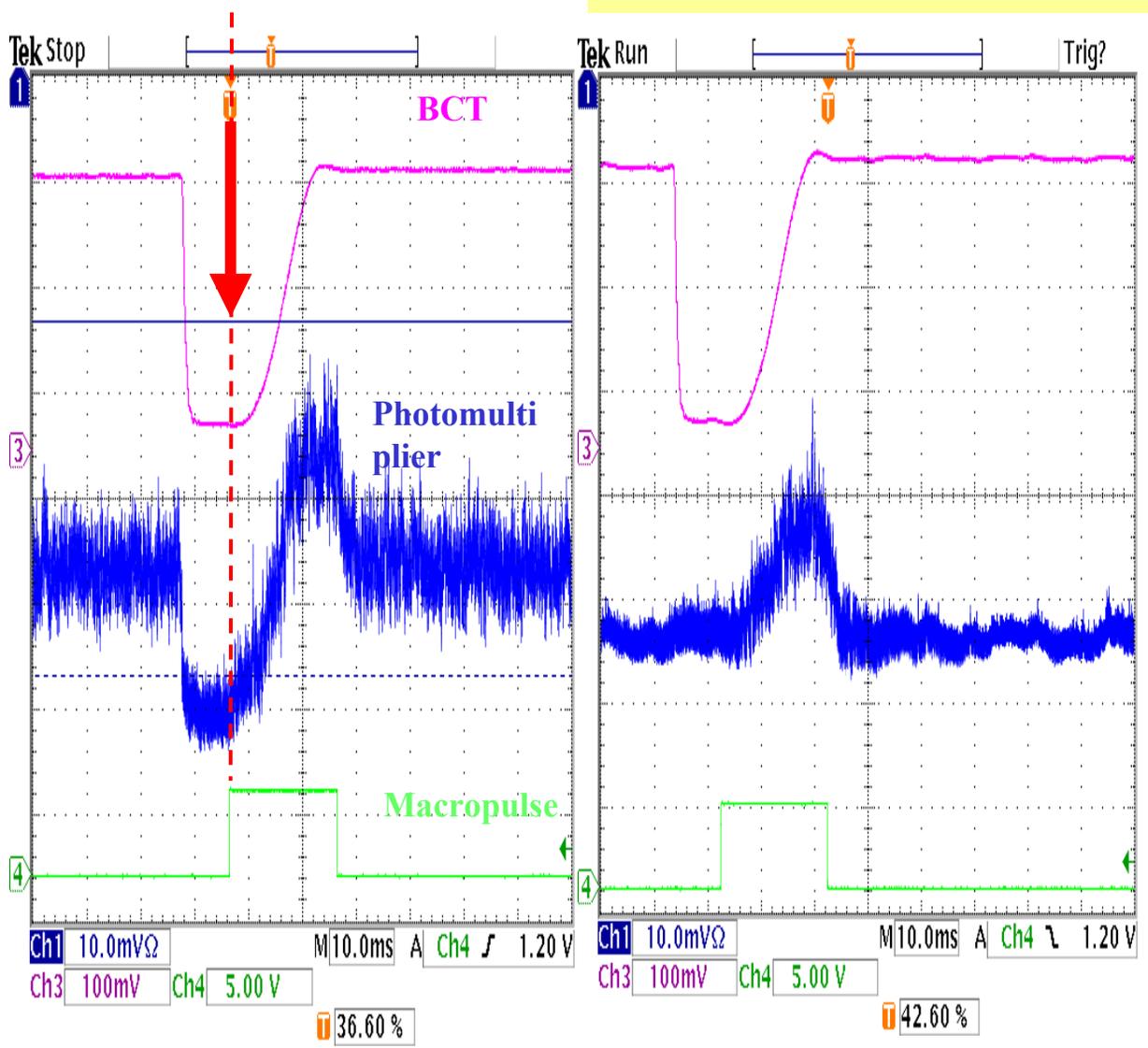
Messungen vom 26.07.2002



Injection energy 45 MeV, protons, $3.6 \cdot 10^{10}$ p , $5 \cdot 10^{-8}$ mbar

Injection

Shielding of the photomultiplier with black



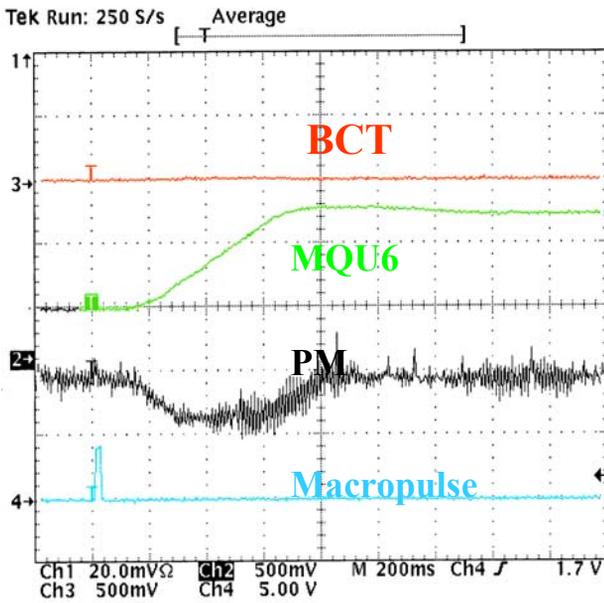
Injection 45 MeV, protons, $2 \cdot 10^{-10}$ p, 10^{-10} mbal Acceleration up to 835 MeV/c

FB5-cup in (no beam)

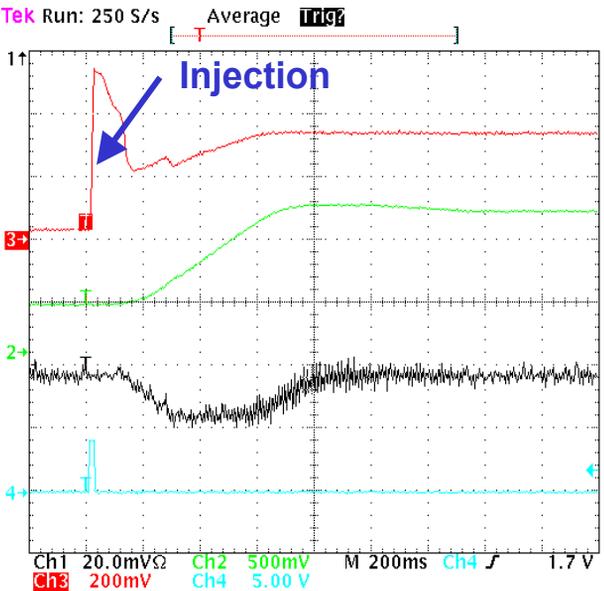
BCT Beam Current Transformer

MQU6 Quadrupole

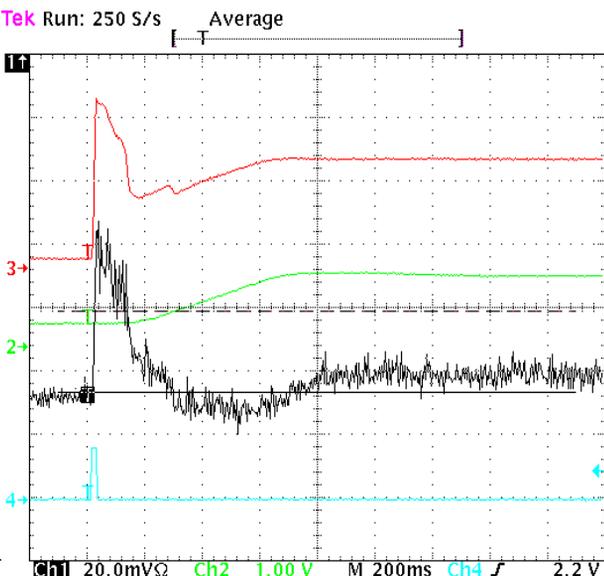
PM Photomultiplier



Photomultiplier shielded with black paper



Photomultiplier unshielded



Proposed scheme of the beam profile monitor

