Front-End Electronics Radiation Tests 2012

COSY Beam Test in August 2012

GSI *GRISU* SEE Test ASIC

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20th CBM Collaboration Meeting / FEE Session
September 27th, 2012

Agenda

- News / Updates from COSY since last beam time
- COSY 08/2012 Experimental Setup
- GSI Beam Diagnostic devices
- A new passive beam profile measurement possibility
- Summary of GSI GRISU test setup and results

News / Updates from COSY

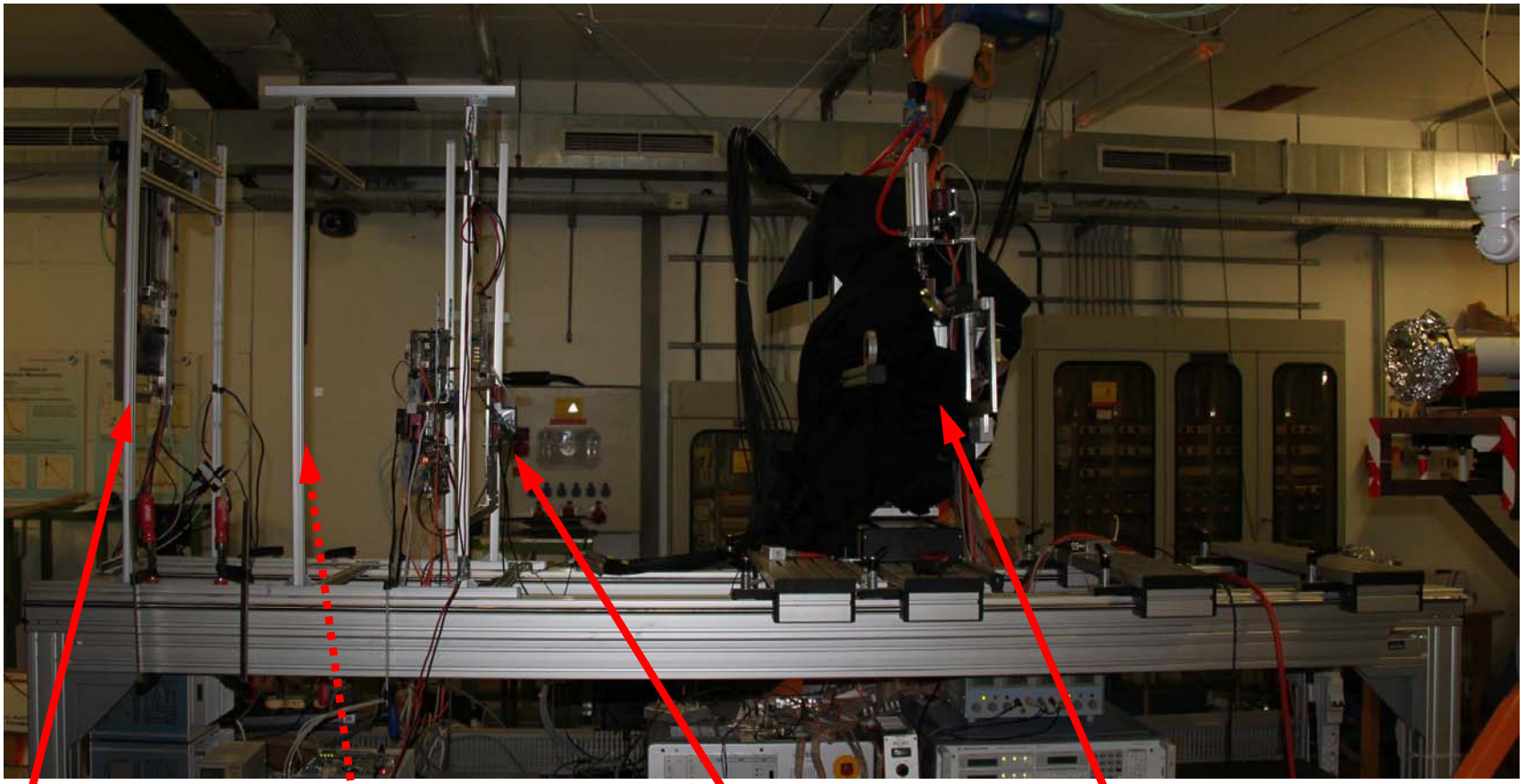
Updates of the infrastructure since last beam test (12/2011) at COSY / JESSICA cave:

- now 20 CAT6 cables are permanently installed from cave to network junction point in front of the counting room
- Several 10 GB fibers from cave to network junction point
- 10 CAT6 cables from network junction point to counting room
- 2 GB-switches are installed
- Network is organized as a private net
- Gateway-PC installed to manage private net <-> internet
- Access from outside possible

Beam Parameter

- Location: FZ Jülich / COSY / JESSICA cave
- Beam:
  - ~ 2 GeV protons
  - 10^8 to 10^9 protons per second
  - spill repetition rate 36 resp. 60 seconds
  - promised beam diameter 1cm (3mm sigma)
- Beam time: 6. to 9. August 2012
- Participants:
  - IRI Frankfurt
  - FH Köln
  - ZITI Mannheim
  - GSI Darmstadt

Experimental Setup - Overview



Beam

MDC
FH Köln

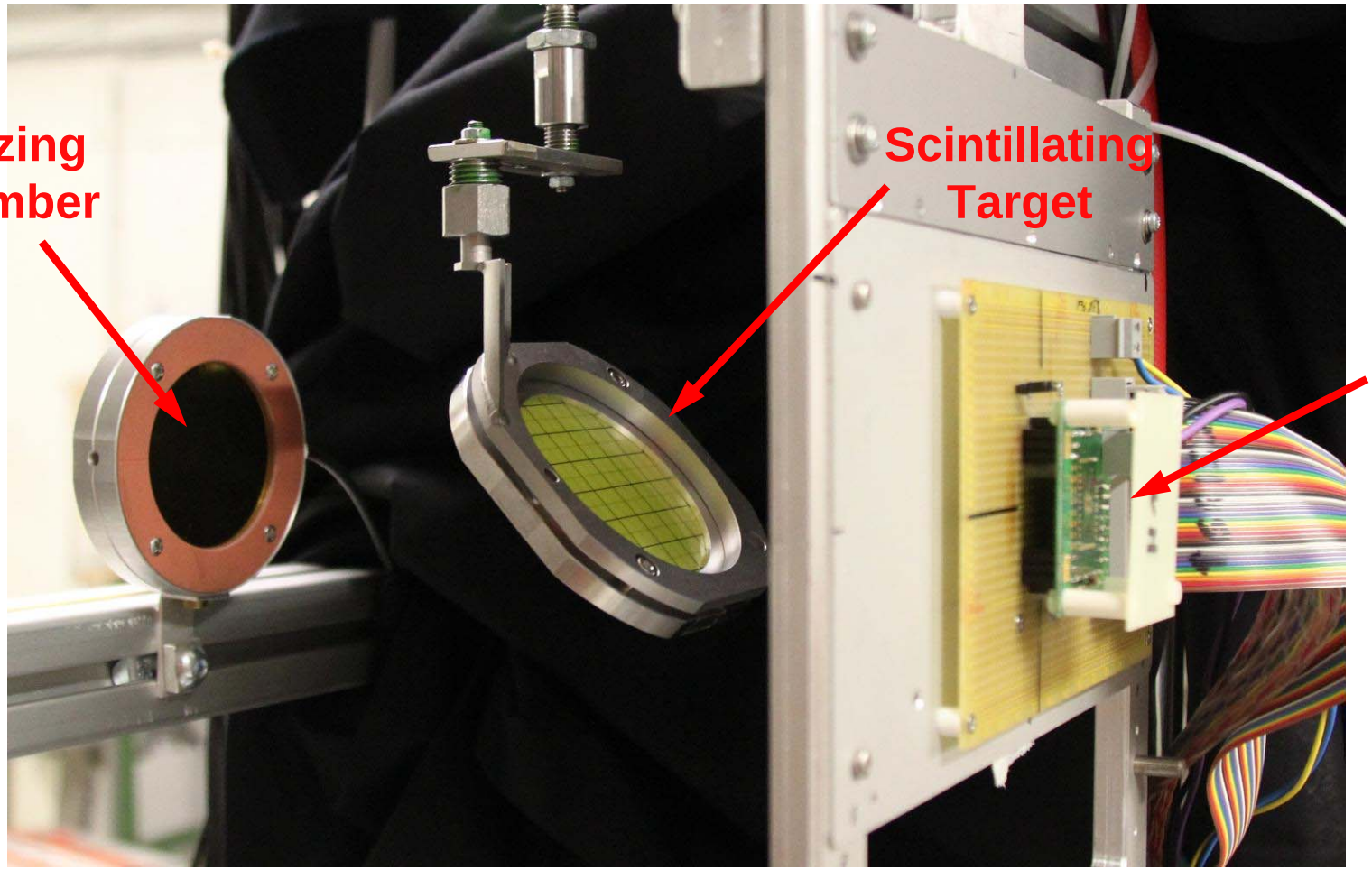
ZITI Mannheim
not yet installed as picture was taken

Syscore Setup
IRI Frankfurt

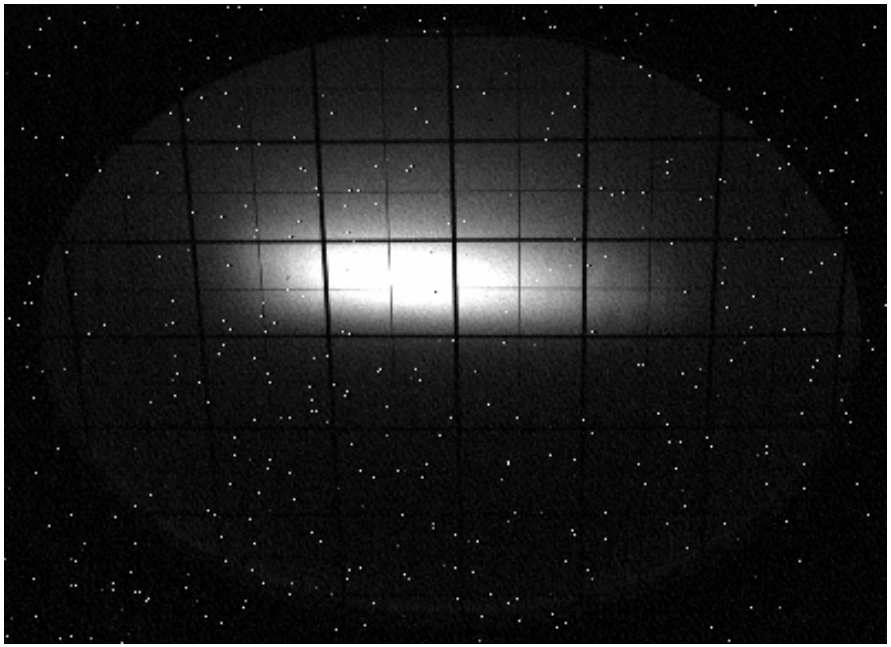
GRISU Setup
GSI Darmstadt

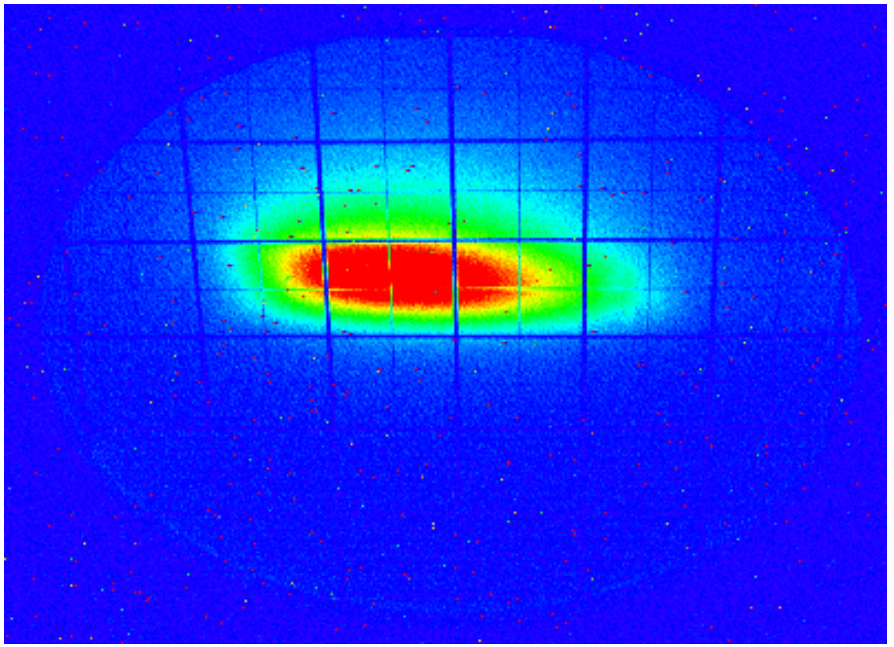
Beam Diagnostic (I)

GSI beam diagnostic devices for independent measurement of **beam alignment** and **beam fluence rate**.



Beam Diagnostic (II)





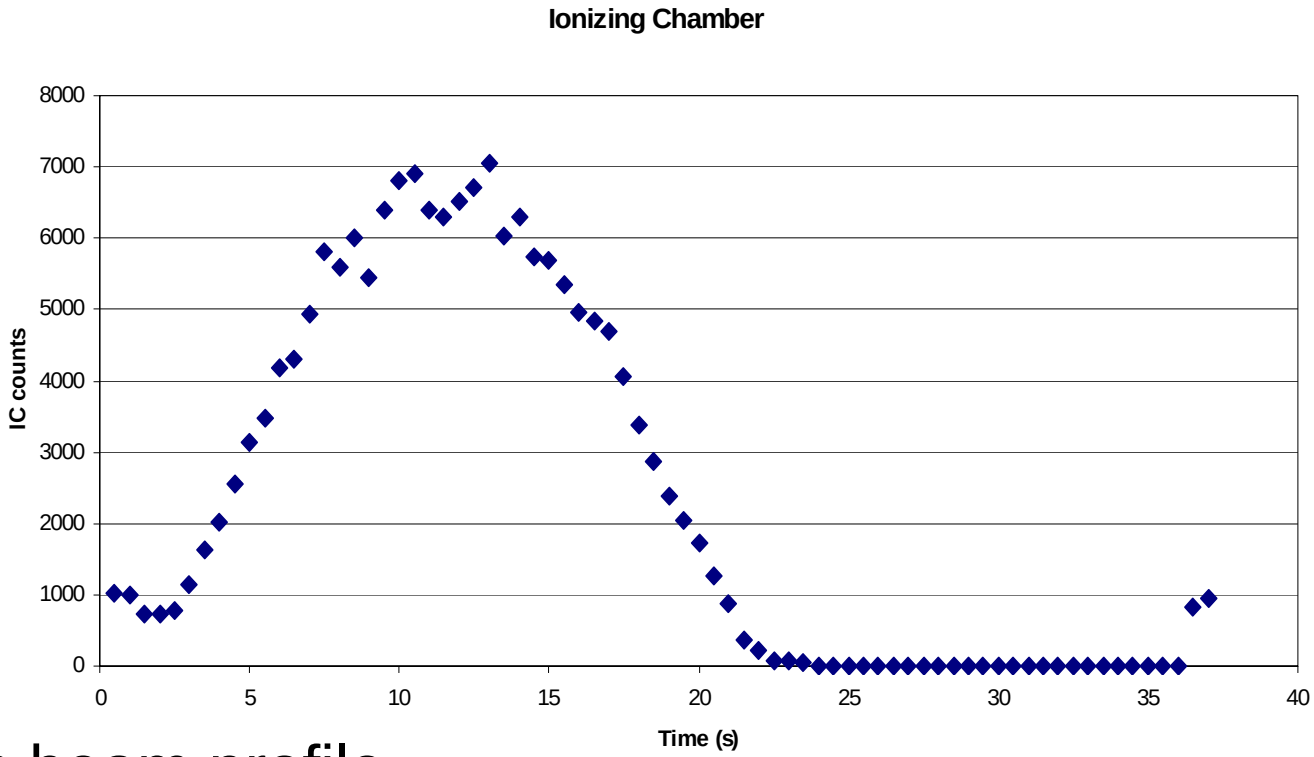
- Online system for beam profile measurement
- Scintillating target is remotely removable from beam
- 1s exposure of camera can detect 10^7 protons @ 2GeV

Thanks to GSI Beam Diagnostic Department for supporting this

Beam Diagnostic (III)

Ionizing Chamber
(from GSI Detector-Lab Department)

- Biased with 1kV
- Readout with QFW ASIC (Current-Frequency-Converter from Experiment Electronic Department)



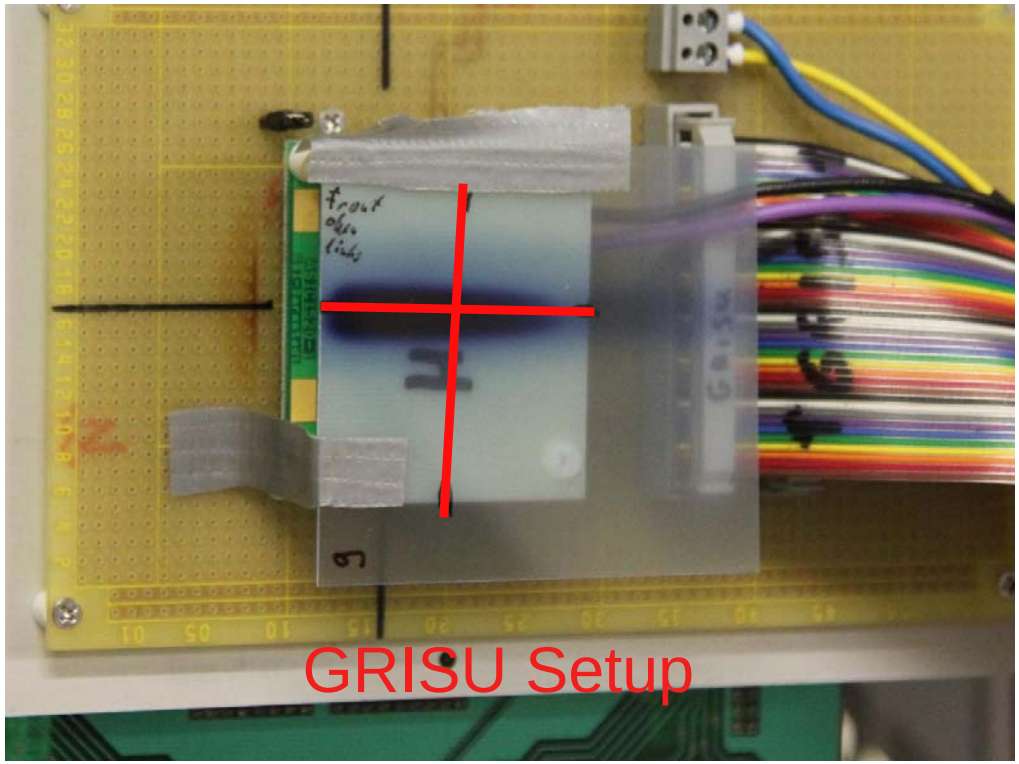
Typical COSY extraction beam profile

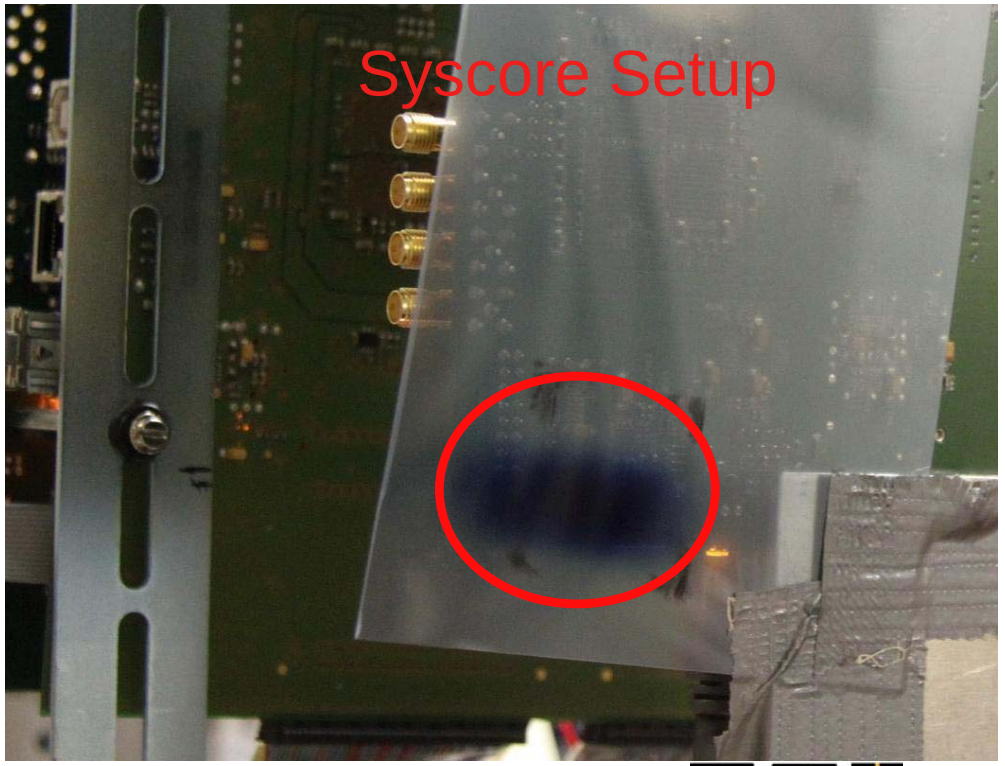
- 22s beam extraction
- 14s break (for refill synchrotron)

Passive Beam Diagnostic (I)

Beam diagnostic via passive, self-developing film (GAFCHROMIC EBT)

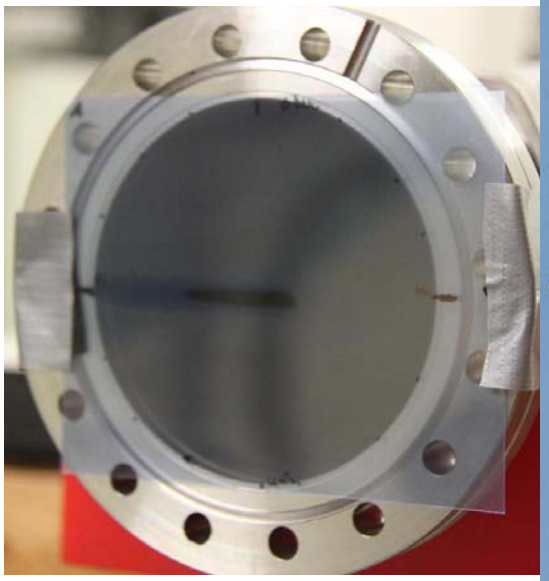
- Sensitivity: 1cGy to 800cGy
  ➔ from calculation: 10^8 protons @ 2GeV deposit roughly 3cGy !!!
- Easy to mount, easy to check if DUT is “hit”



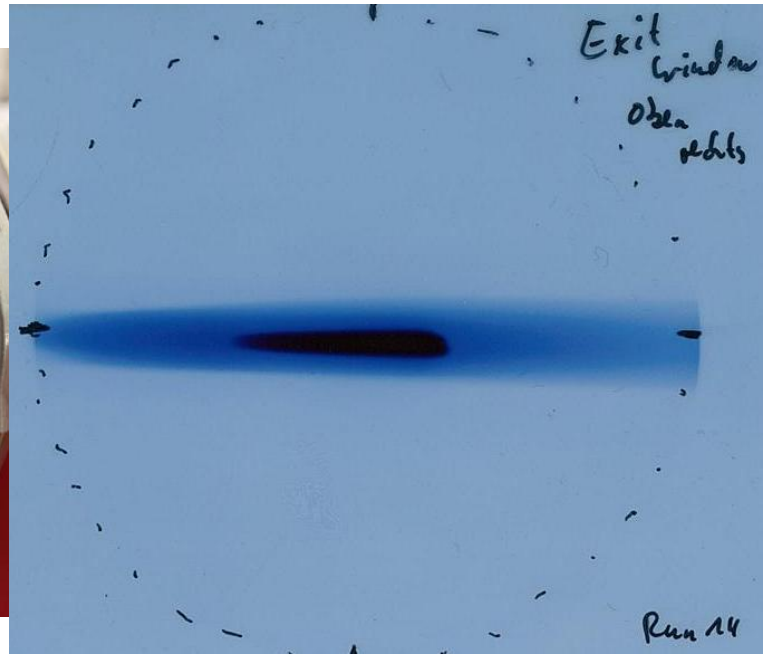


Passive Beam Diagnostic (II)

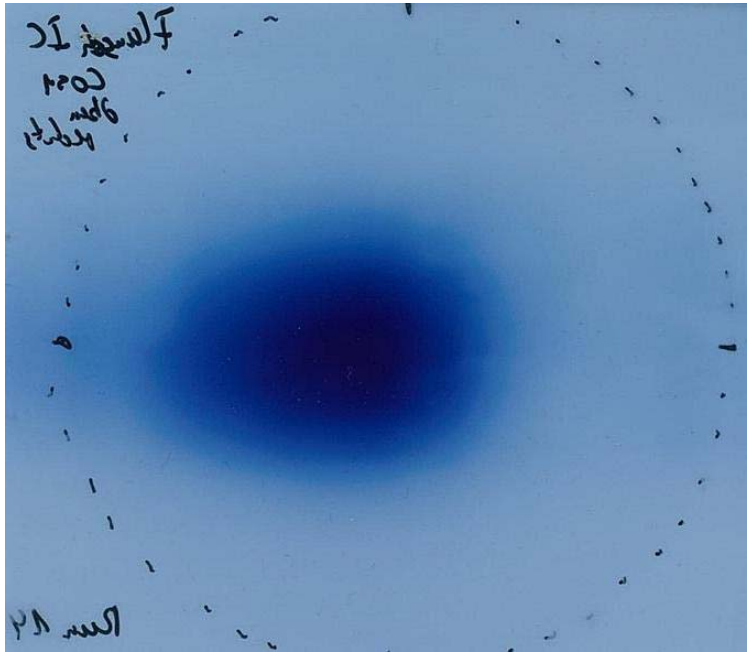
Further examples of film radiation:



Beam exit window with film



Film of beam exit window



Film at the end of our experimental setup
(3.66m after exit window film)

Results for GRISU Test Setup

Because of my holiday immediately after the beam test until last week, no detailed analysis is done right now. But...

In 2 1/2 days of testing the GRISU chip:

- 456 SEE were measured
- All diagnostic devices worked excellent
- ~ $1.8 \cdot 10^{12}$ protons were measured via GSI IC (very preliminary)
  ➔ geometry of IC has to be cross-checked again for calculating the number of protons for 1 charge count of the QFW ASIC
- Beam profile at the position of the GRISU is not yet analyzed
  ➔ ~ 3..4 cm² of main beam
  ~ 12 cm² of halo

After detailed analysis of IC and beam profile: SEU and SET cross-section can be estimated

Results will be presented at the next CBM meeting