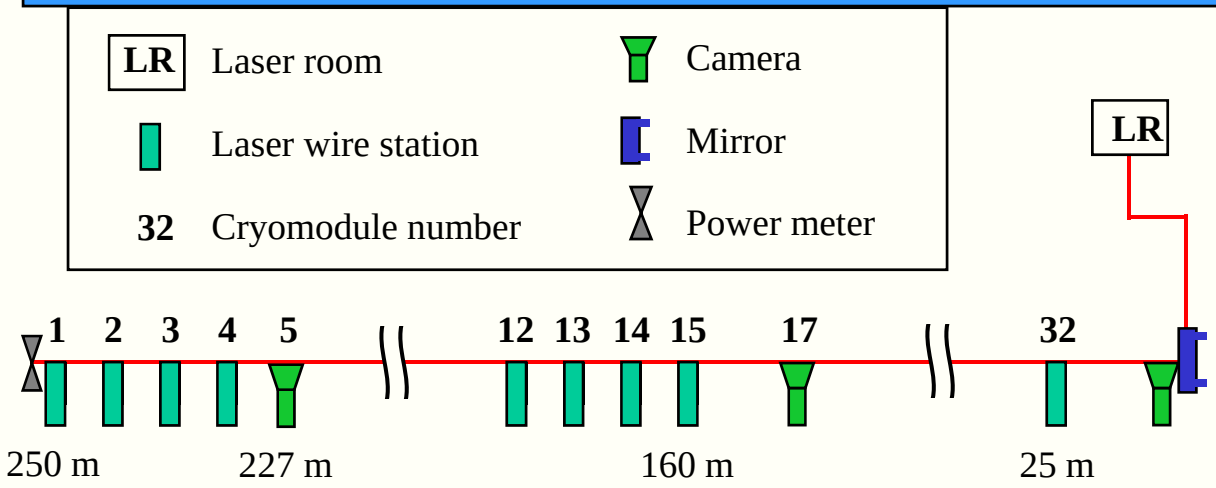
Working Group F: Diagnostics and Instrumentation for High-Intense Beams – Summary –

Manfred Wendt
for the Working Group F contributors

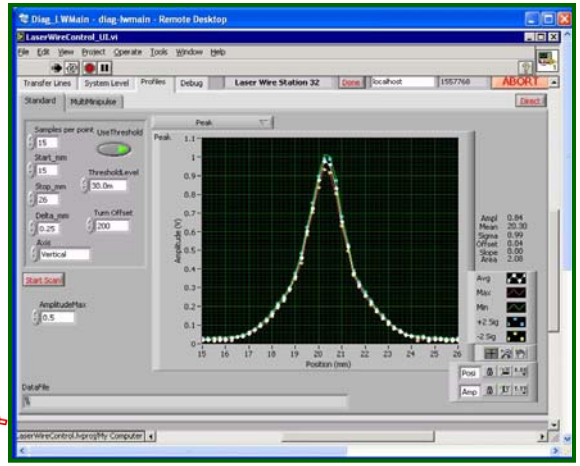
WG F: Overview

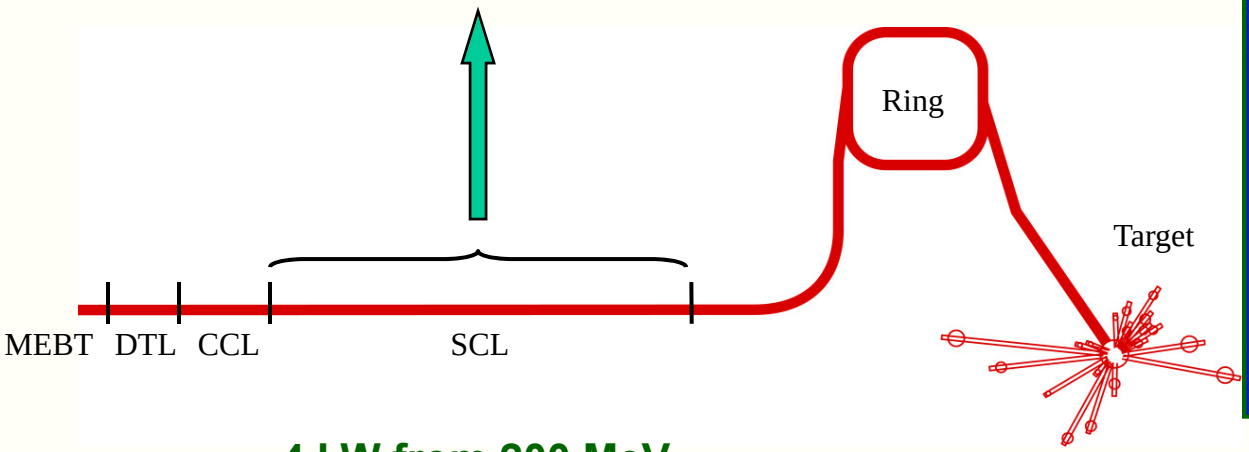
- **Presentations and Discussion:**
  - 3 sessions, 330 min total
  - 13 presentations.
    Thanks to the speakers(!), and to all participants!
  - Discussions between presentations
  - Joint discussion with Working Group D: Operations
- **Hot Topics:**
  - Beam loss monitoring (10^{-6}-10^{-7}) and MPS!
  - Transverse beam profile / emittance measurement
  - Novel, non-invasive beam monitors
    (e.g. IPM, H^- laser wire, e-beam profile monitor)
  - Transverse and longitudinal beam halo / tails
  - Save and reliable operation of high intense beam.
  - Overview on beam diagnostics of current, and future facilities.

S. Assadi: SCL Laser Wire System



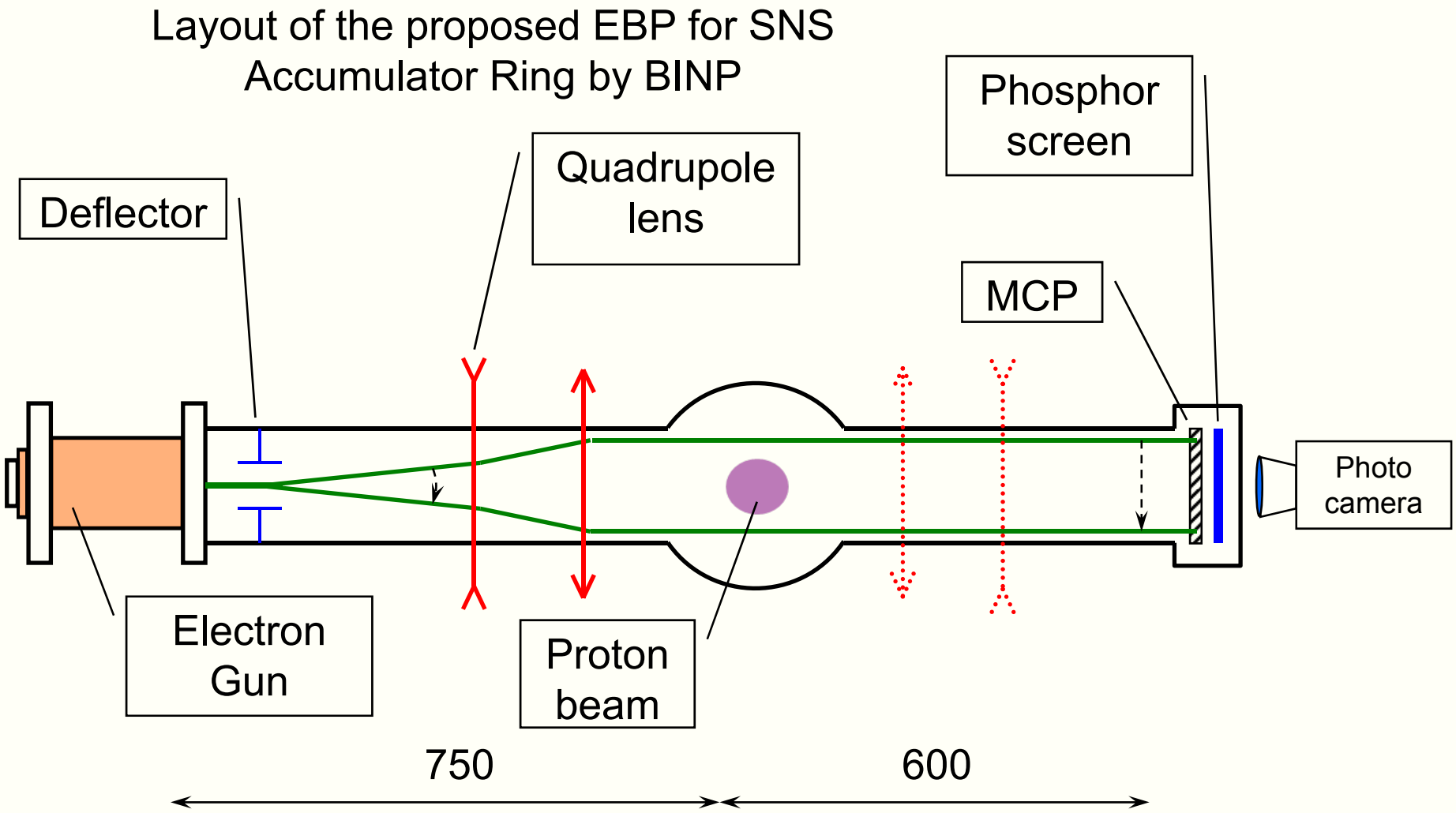




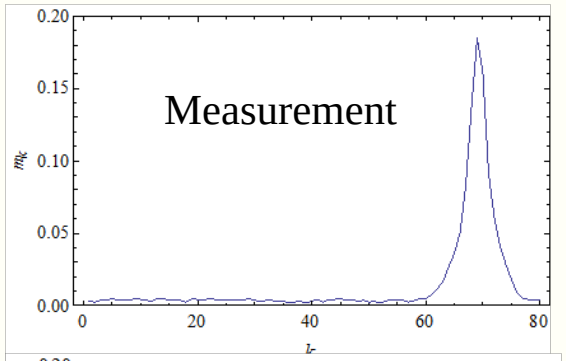


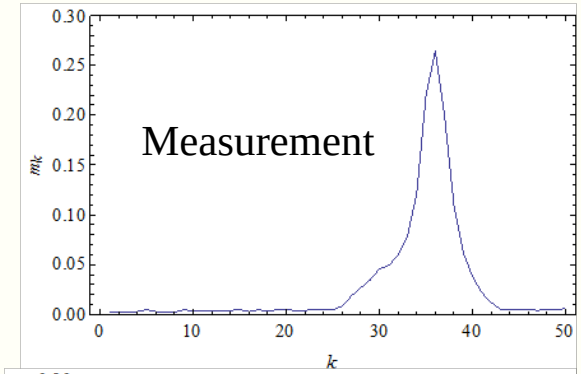
- 4 LW from 200 MeV
- 4 LW from 450 MeV
- 1 LW at 1 GeV

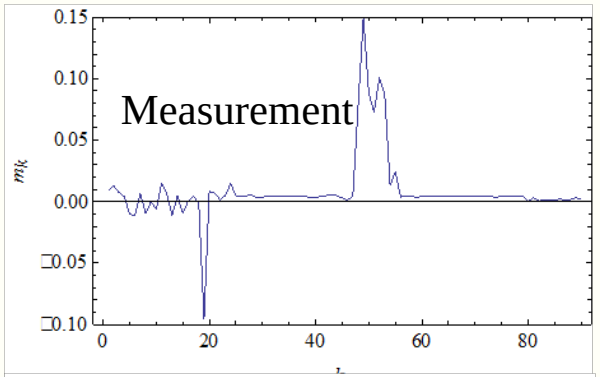
S. Assadi: e-Beam Profile Monitor

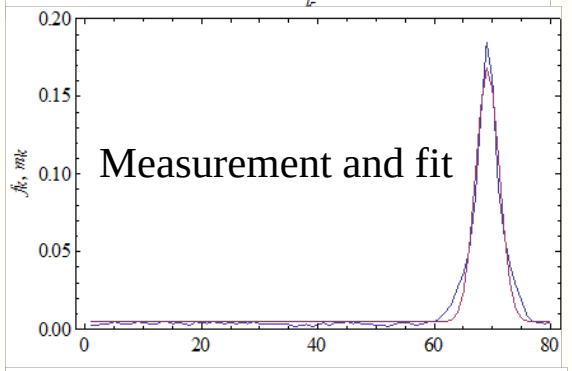


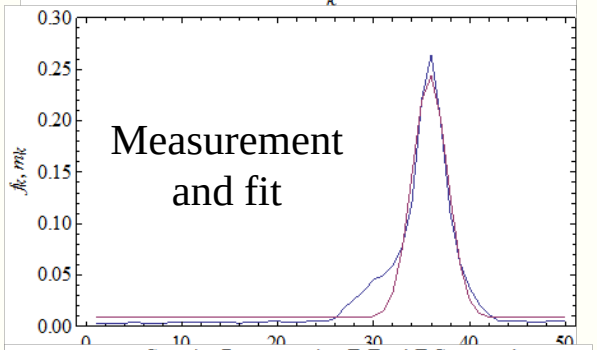
C. Allen: Noisy Wire Profiles

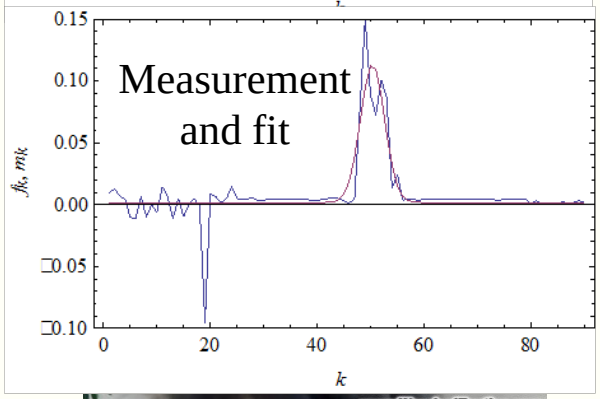


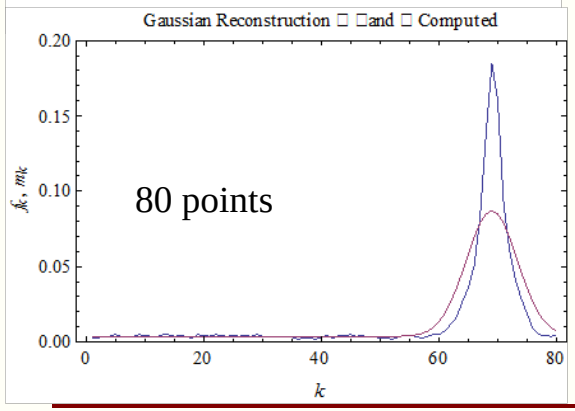


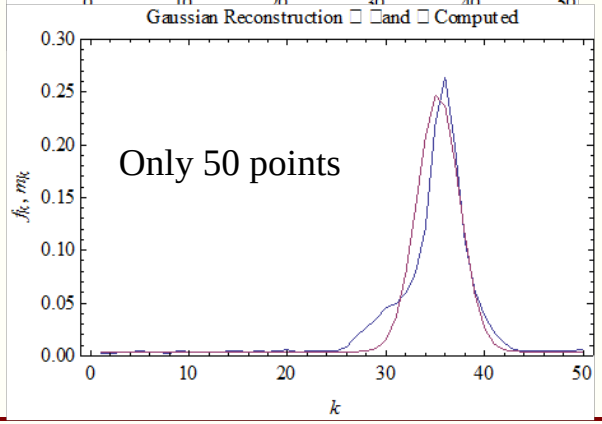






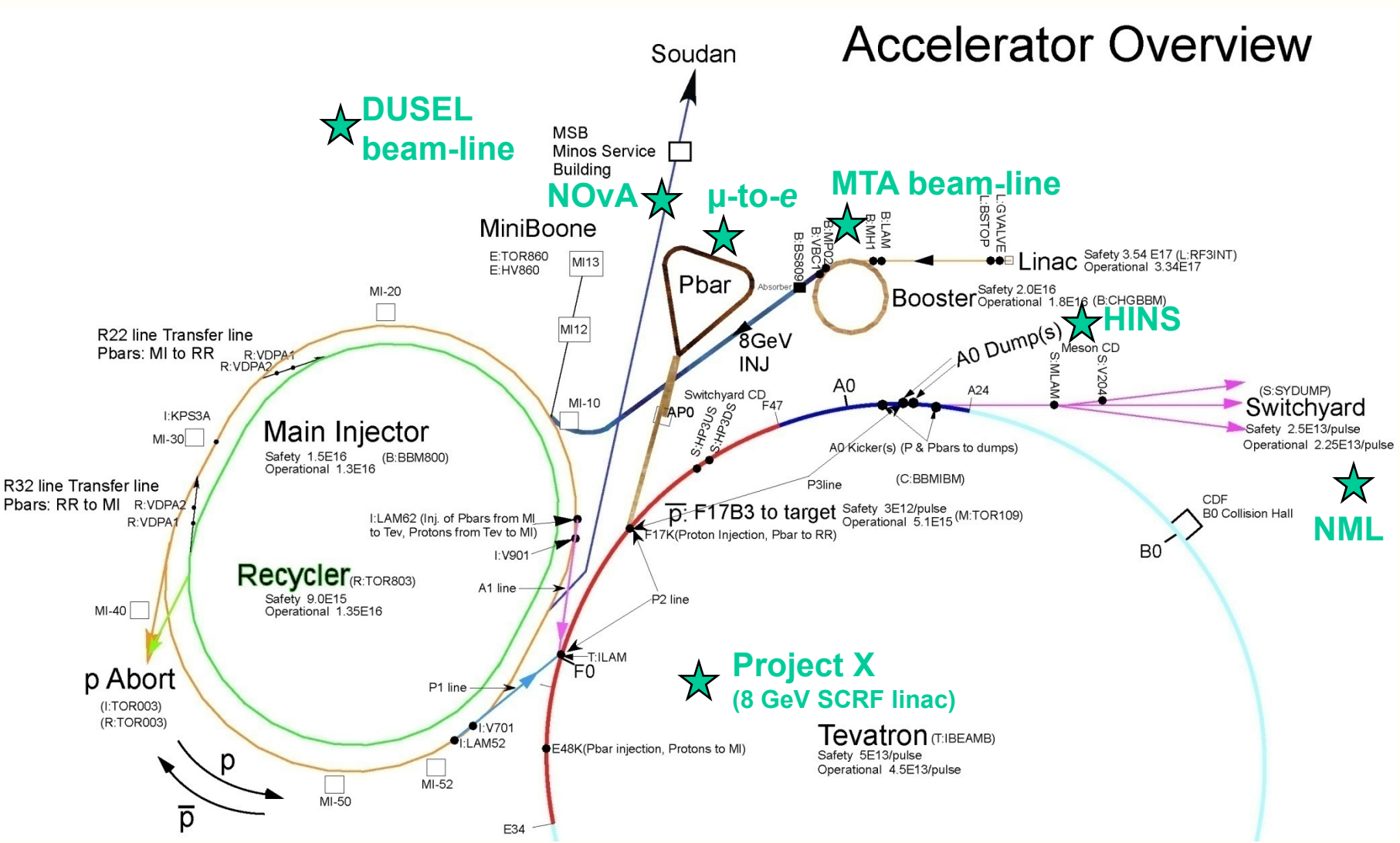






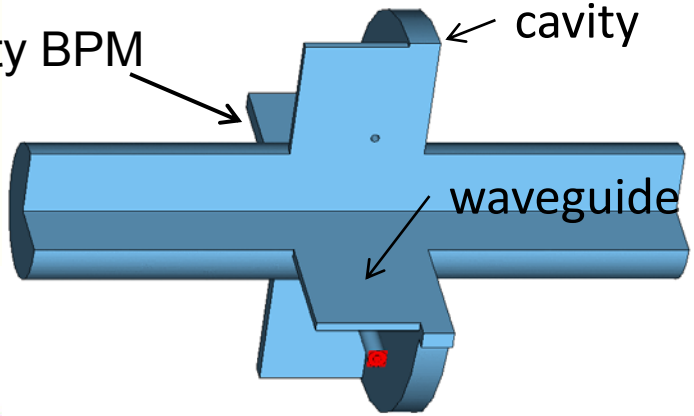


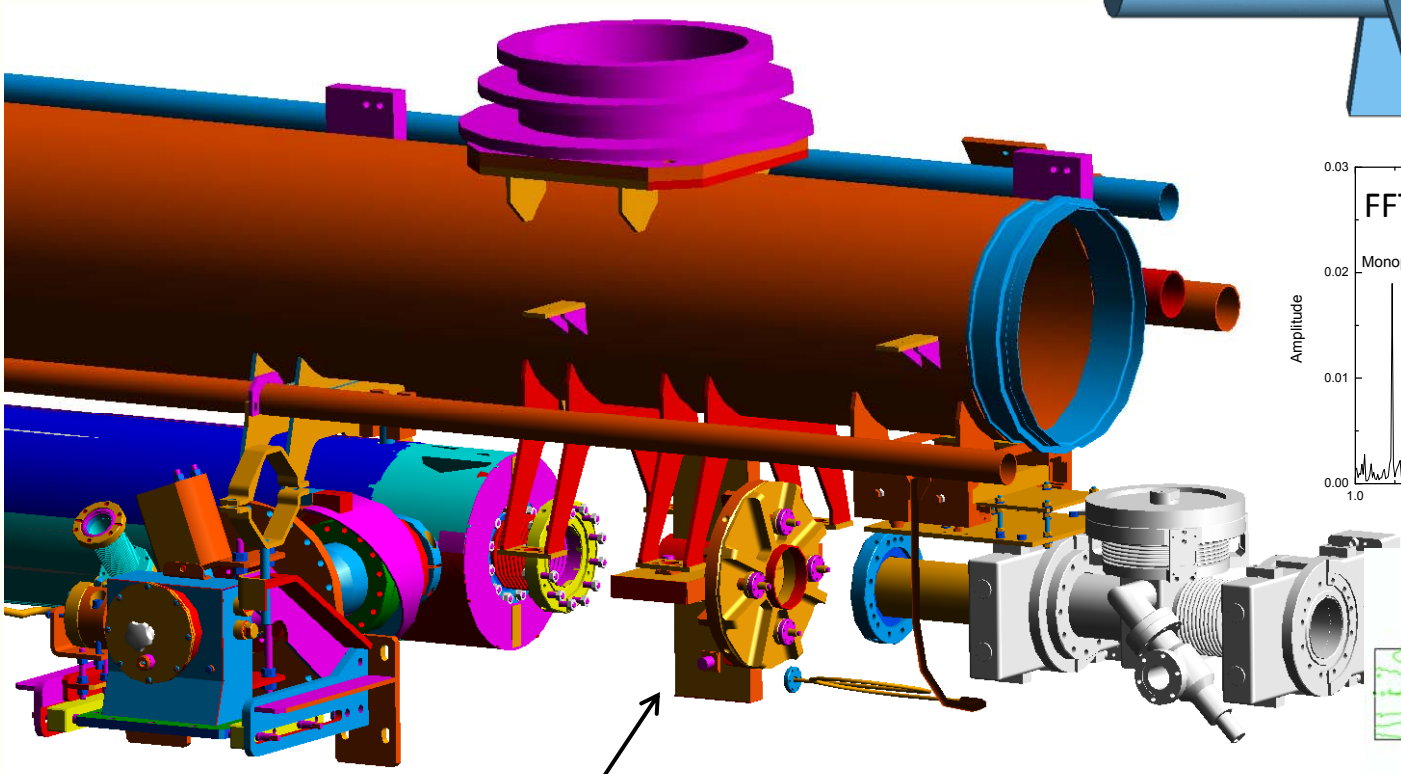
M. Wendt: Future Accelerator Diagnostics

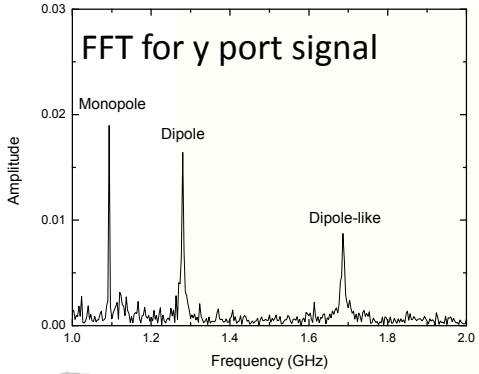


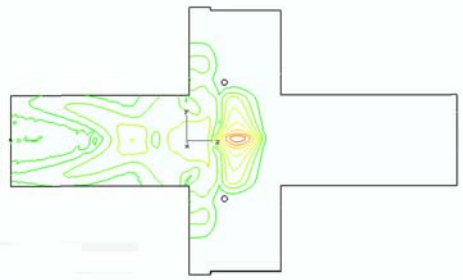
Cold BPM for the Project X Cryomodule

Project X / NML type cold CM-free L-Band cavity BPM



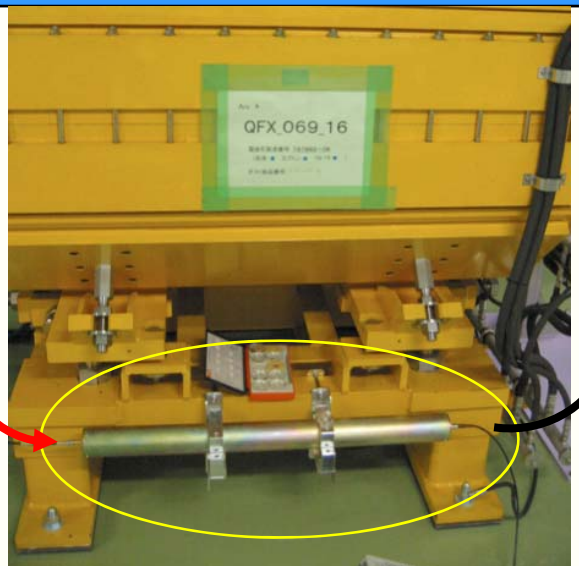


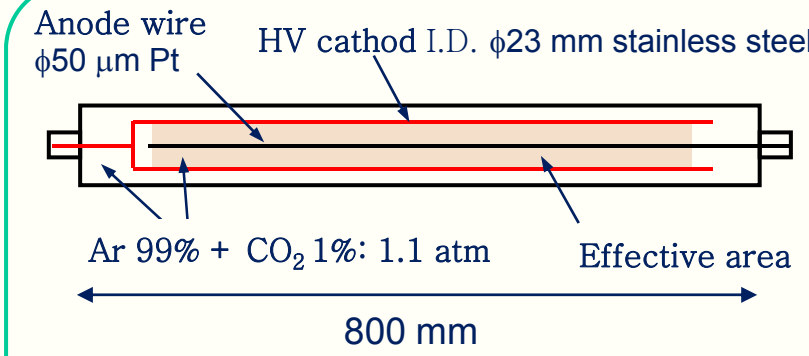




ILC type cold CM-free L-Band cavity BPM

T. Toyama: PropChamber Loss Monitors

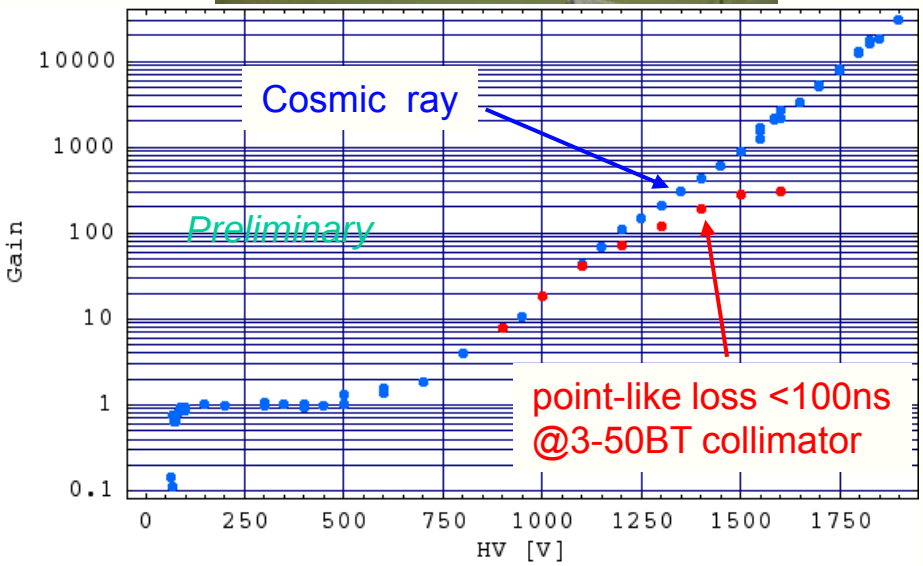


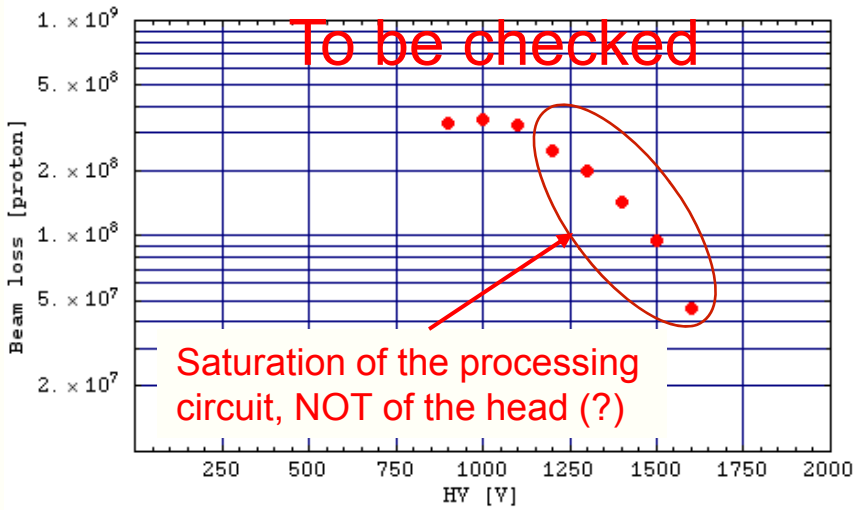


Sensitivity

200 nC / rad x gain (calculation)

gain ~ 60000 (~2 kV)

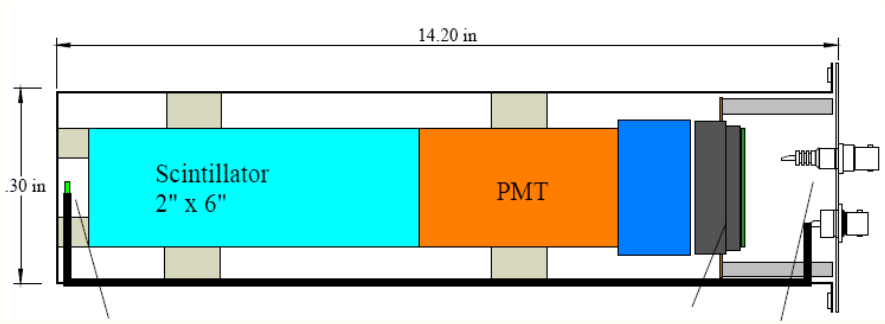




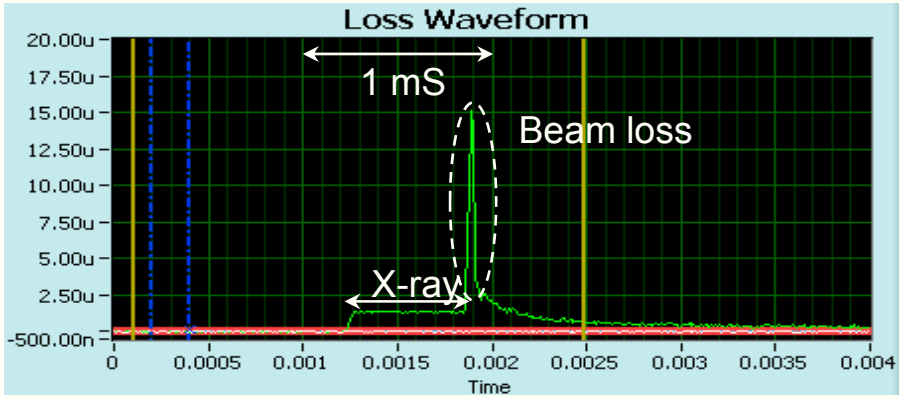
A. Zhukov: SNS BLM System



- Argon filled, 113 cc volume, 2 kV bias.
- Response 70 nC/Rad
- Slow ~1 μS (charge collection)



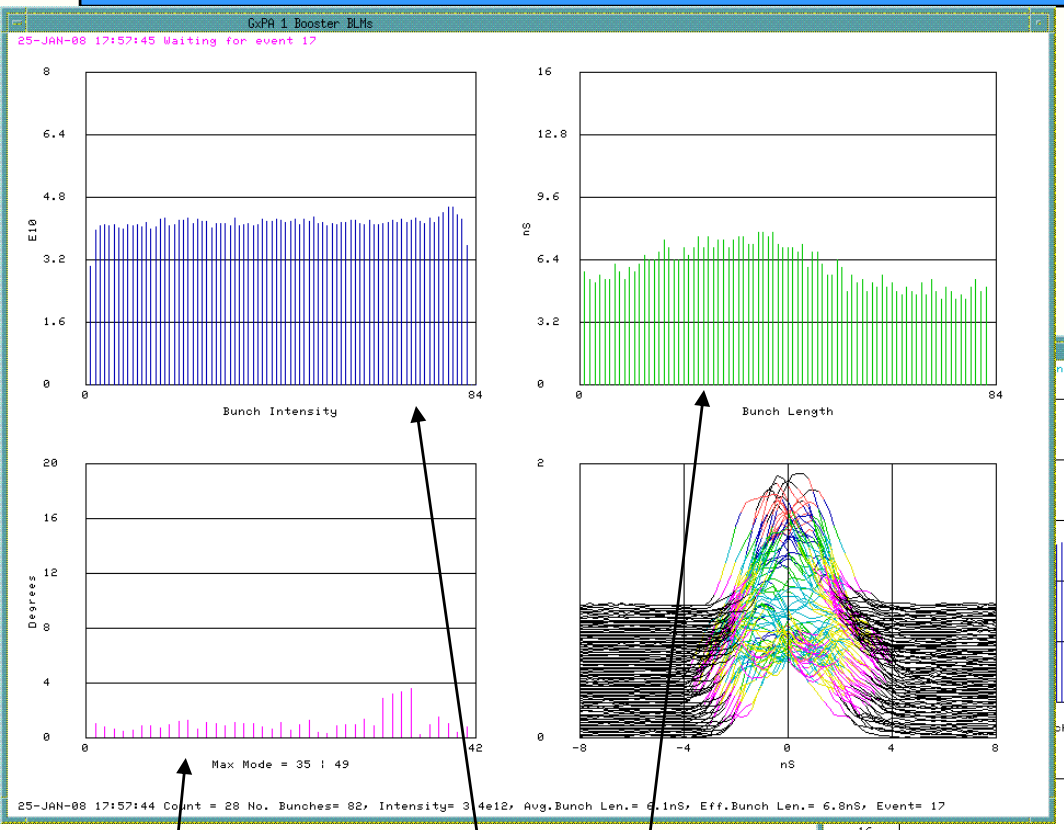
- Scintillator
- PMT
- Response 50 pC/MeV
- Fast ~10 nS

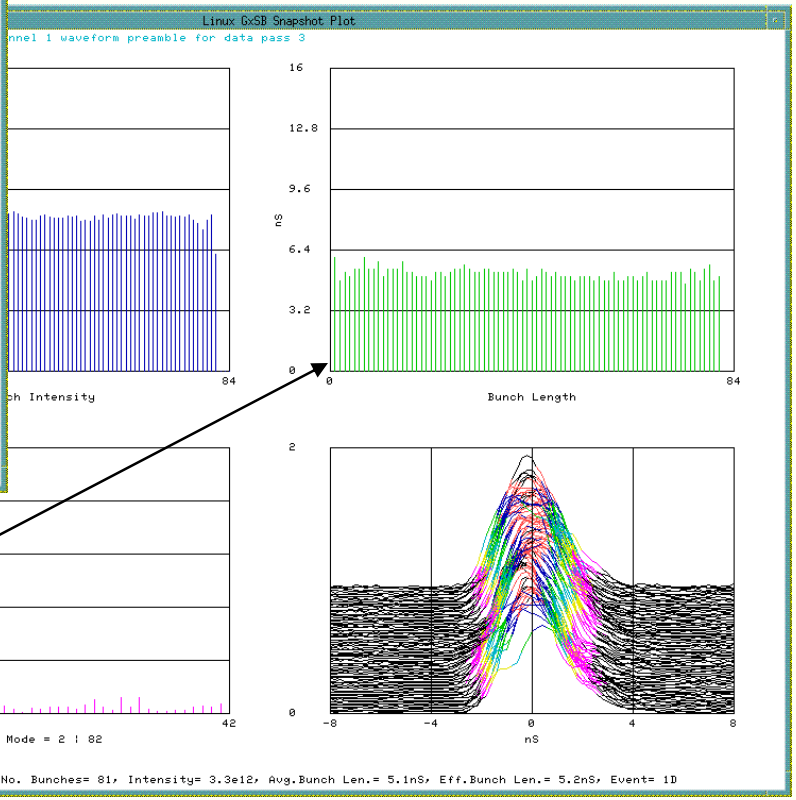


- Scintillator / PMT
  - For low use at beam energies
  - Cavity X-ray sensitive
- Noise Problems with BLM signals

B. Pellico: Fermilab Booster Diagnostics

- MI-8 beam-line WCM & fast scope
- Data analysis software provides
  - Bunch intensity, length, phase
  - Longitudinal modes
  - Mtn. range, contour, xy-plots



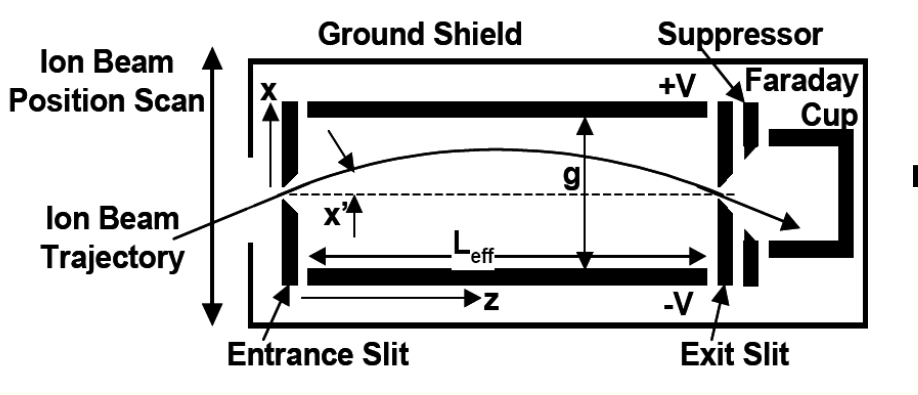


Mode Line

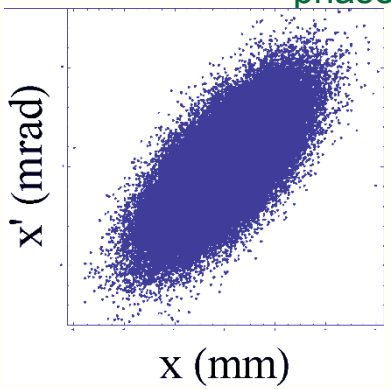
Bunch Intensity

Bunch Length

T. Gorlov: SNS Allison Scanner



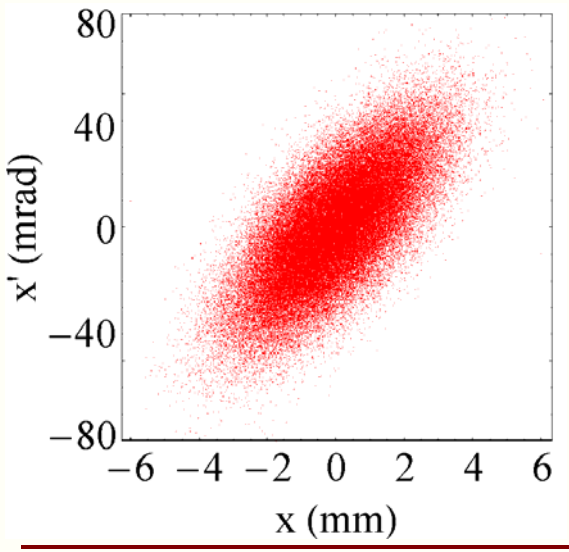
I(x,x')



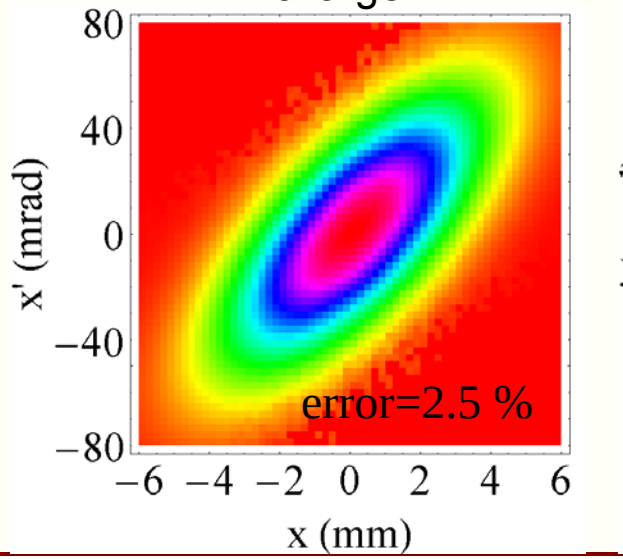
Distribution of current in phase space obtained by the scanner

Measurements of rms emittance and Twiss parameters

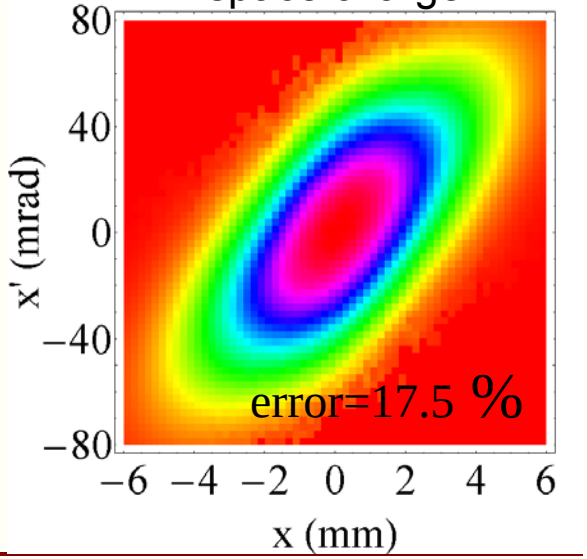
Original Gaussian emittance distribution



Computation without space charge



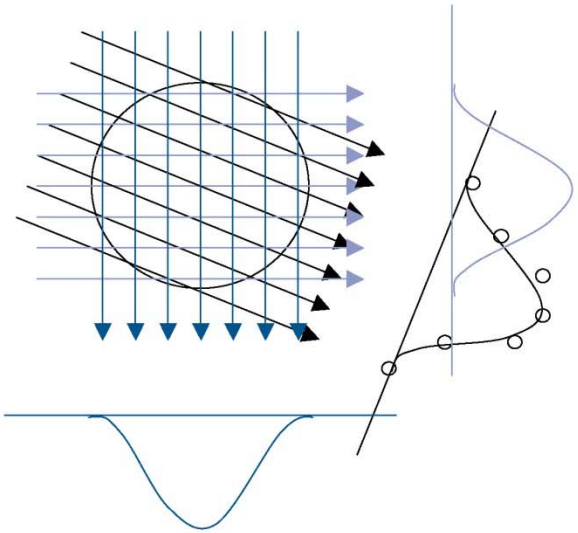
Computation with space charge

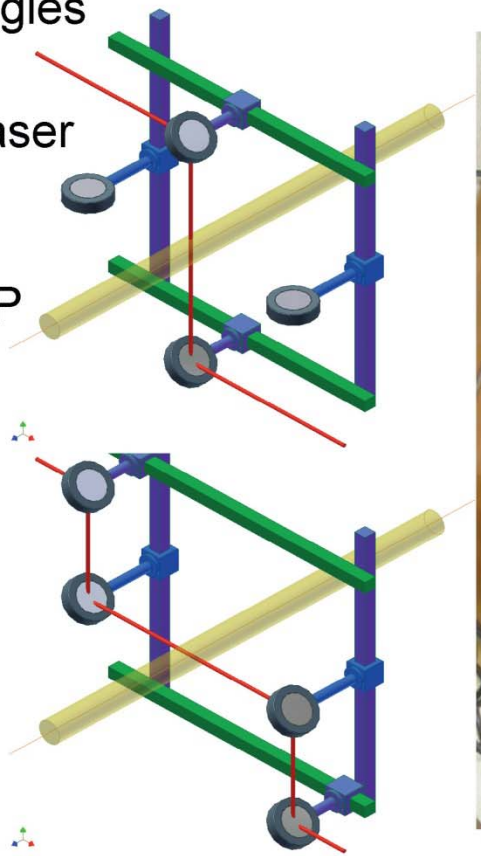


J. Pozimski: Beam Diagnostics at RAL

H^- beam tomography using laser detachment

- Beam profiles for different angles have to be taken.
- requires the ability to move laser beam around the ion beam.
- 2 D density profile can be reconstructed using ART or FBP



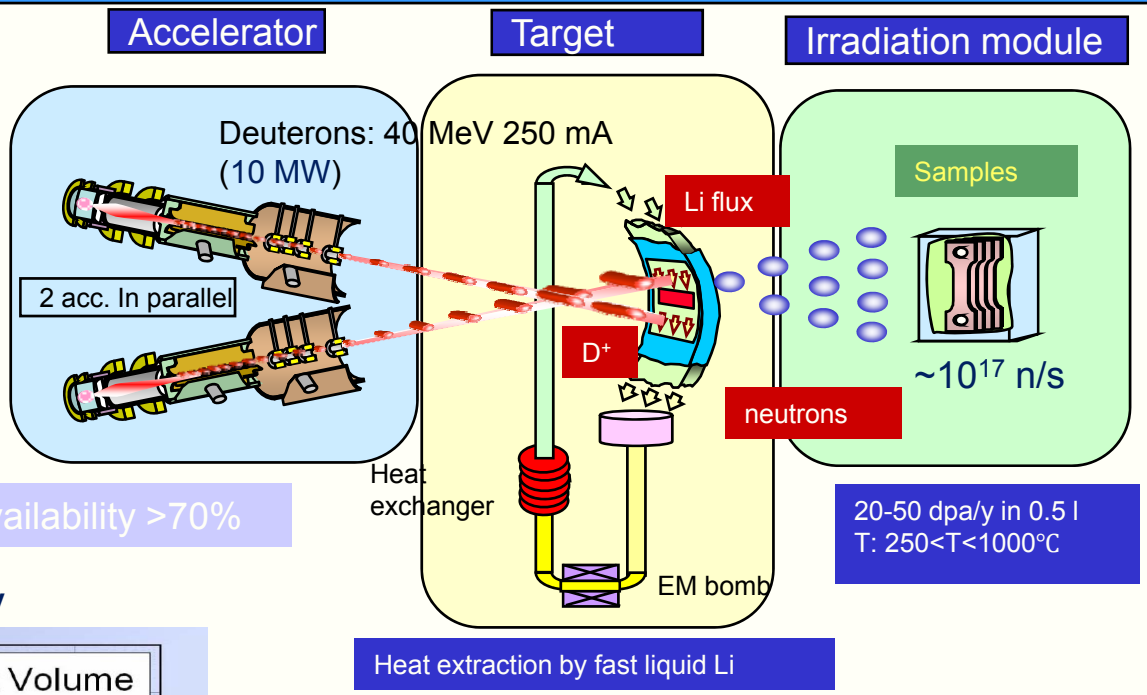




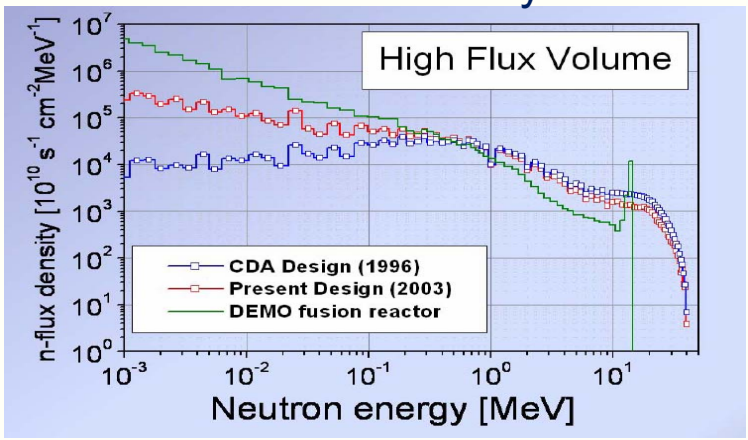
J. Pozimski, 42nd ICFA Beam Dynamics Workshop on High-Intensity, High-Brightness Hadron Beams, August 24-29, 2008 Nashville

I. Aliseda: HEBT Diagnostics for IFMIF

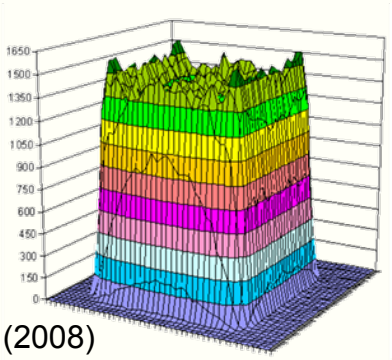
- **International Fusion Materials Irradiation Facility**
  - **Characterization of materials**
  - **High neutron flux (10^{18} n/m^2/sec)**
  - **Early design stage**

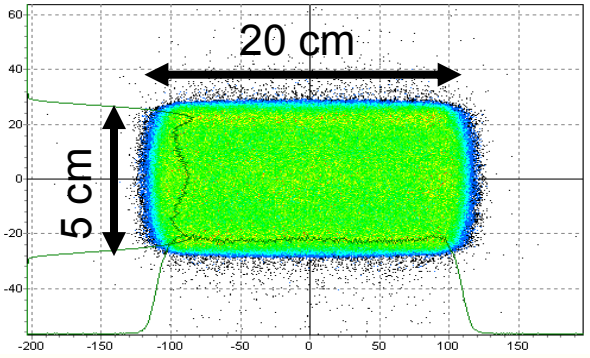


Neutron flux density



Beam footprint at interaction point

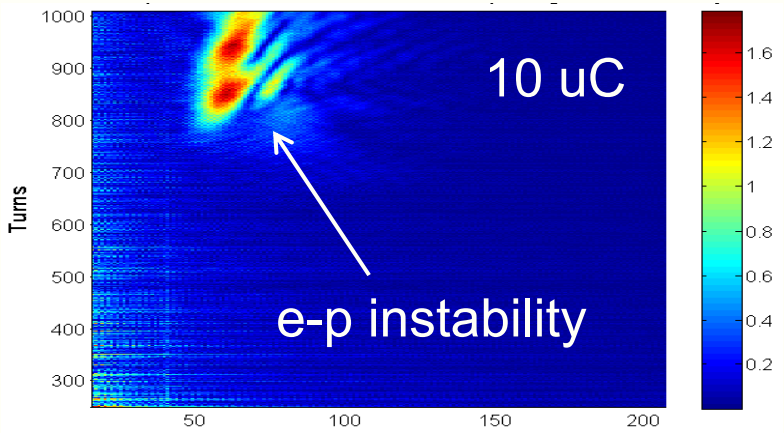


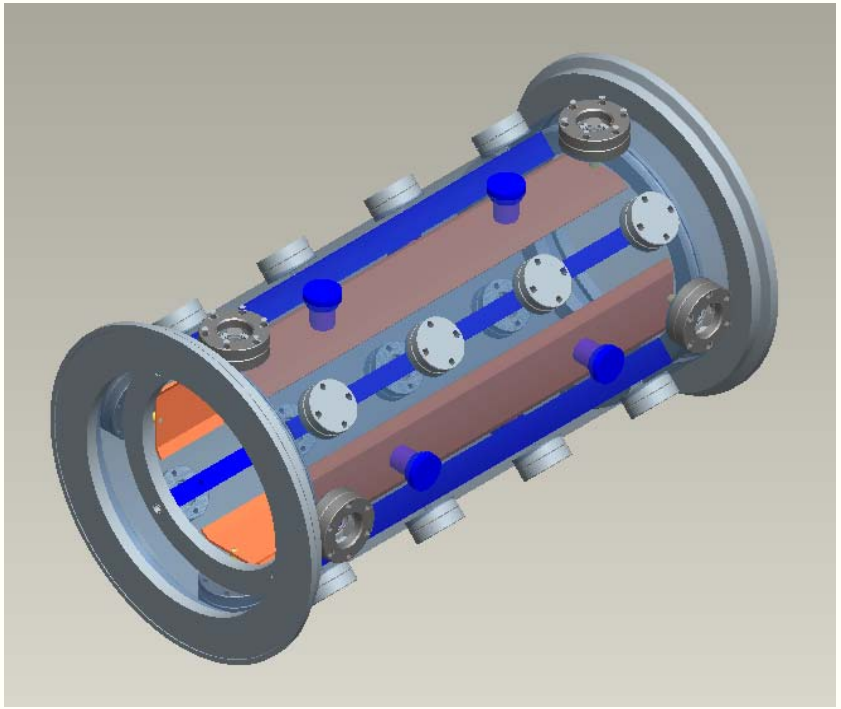


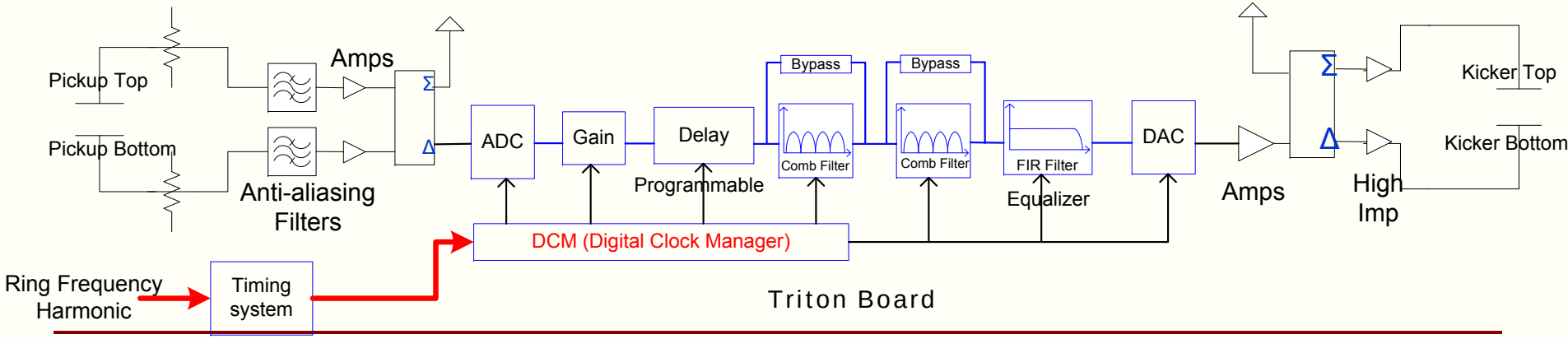
P. Garin, *IFMIF: status and developments*, EPAC08, p. 974 (2008)

C. Deibele: SNS Wideband FB System

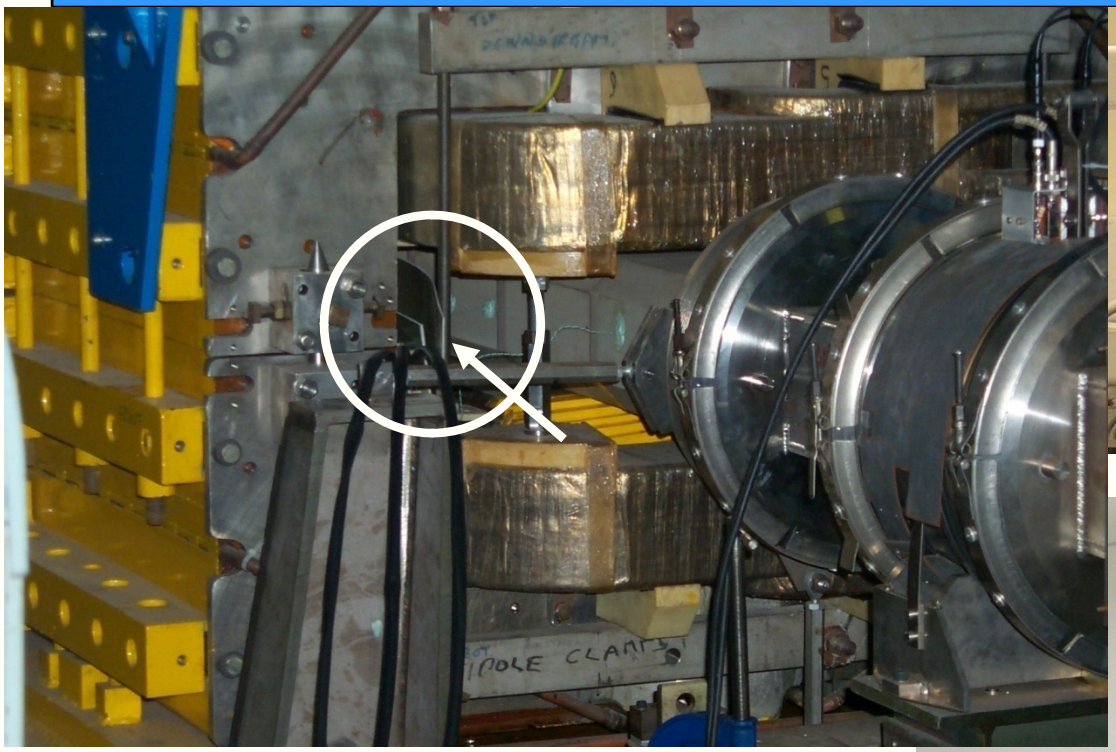
- **PA: 1-300 MHz, 400 W, class A**
- **Stripline kicker, pickup**
- **Digital FB electronics**



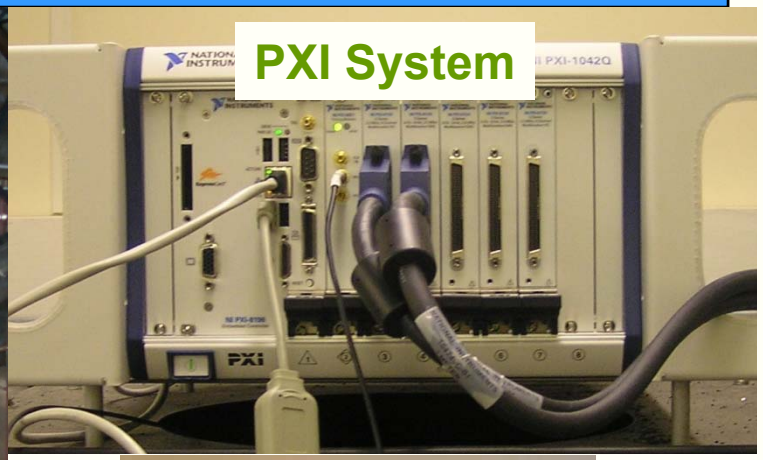




S. Payne: Beam Diagnostics at ISIS

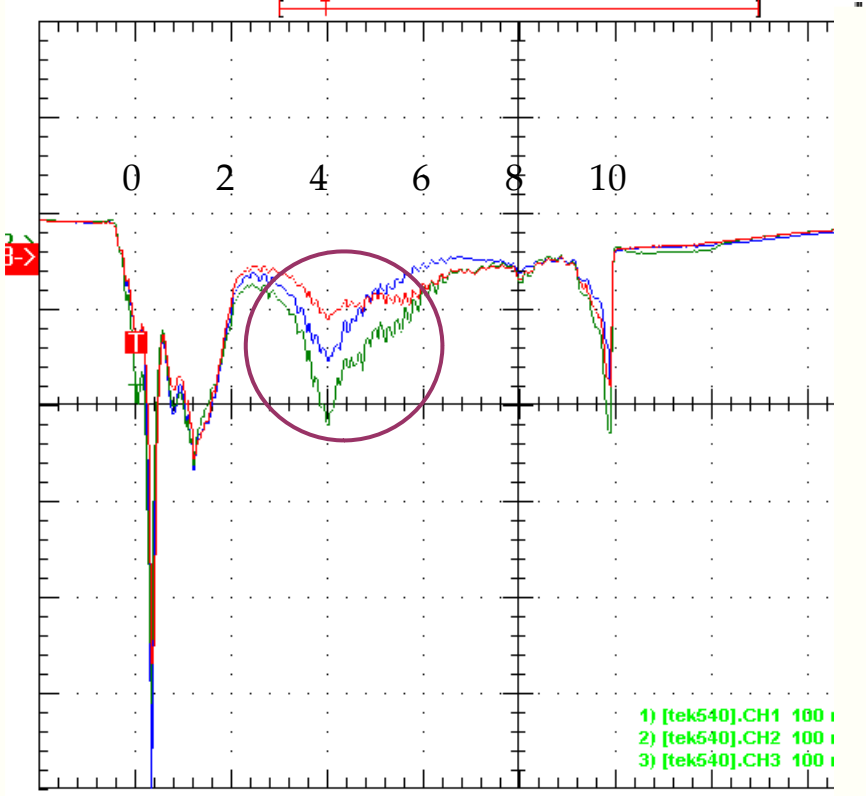


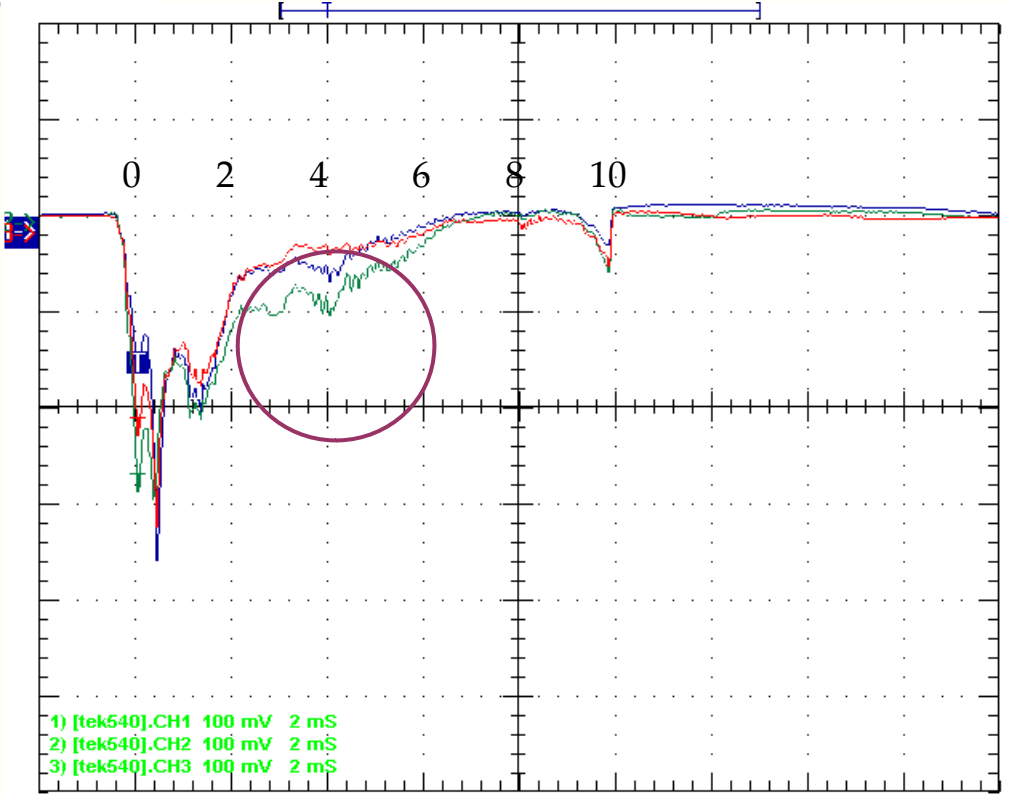
Fibre bundles

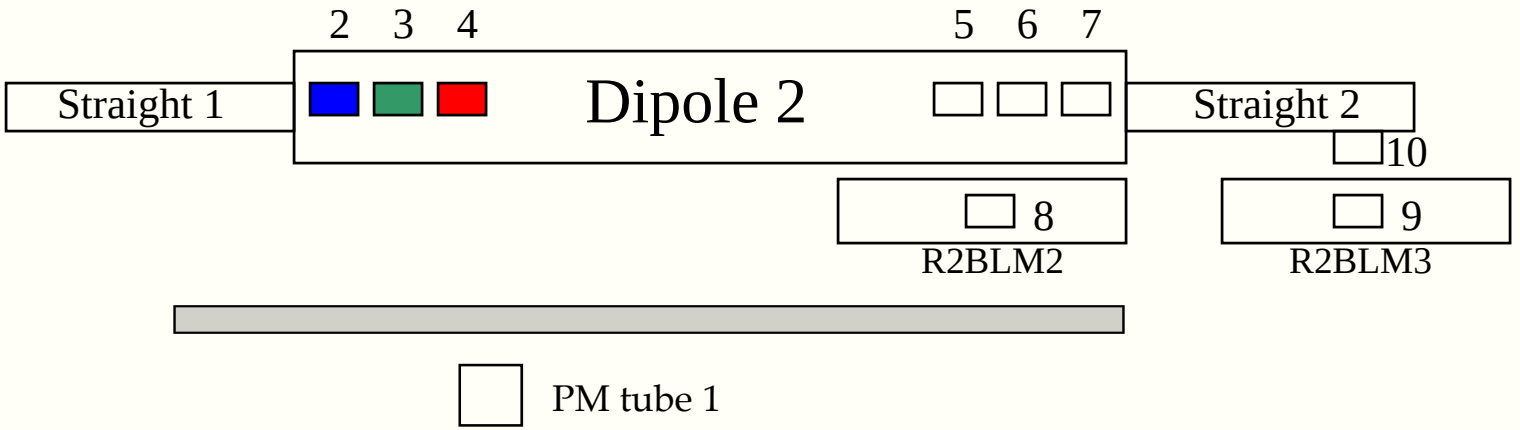




- **Commercial read-out hardware**
  - **Reliability issues**
  - **Hard disk locks up**

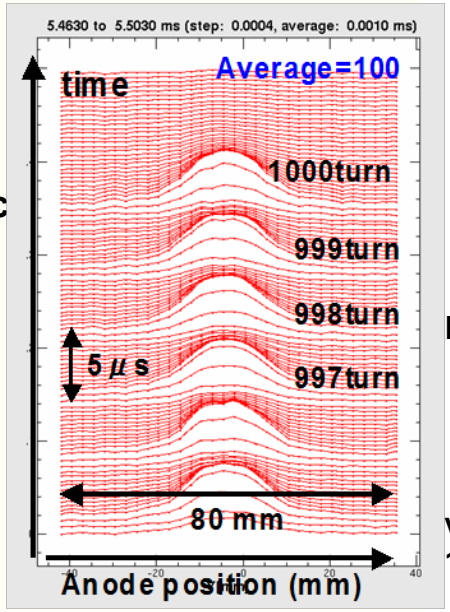

0 2 4 6 8 10
1) [tek540].CH1 100
2) [tek540].CH2 100
3) [tek540].CH3 100

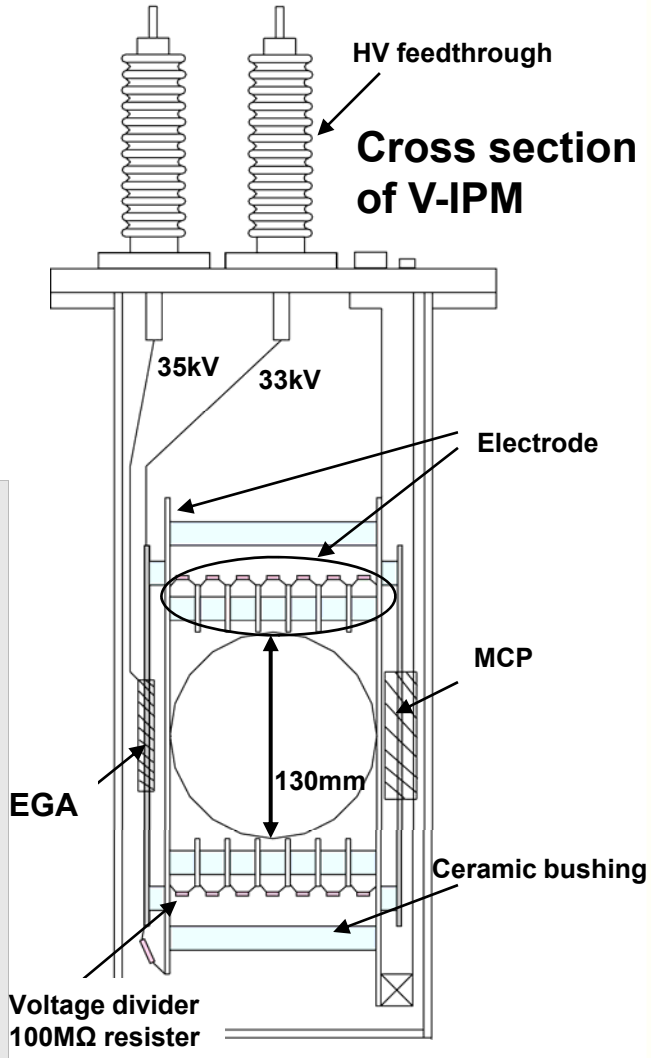

0 2 4 6 8 10
1) [tek540].CH1 100 mV 2 mS
2) [tek540].CH2 100 mV 2 mS
3) [tek540].CH3 100 mV 2 mS


2 3 4
5 6 7
Straight 1
Dipole 2
Straight 2
10
8
9
R2BLM2
R2BLM3
PM tube 1

K. Satou: J-PARC MR Diagnostics (IPM)

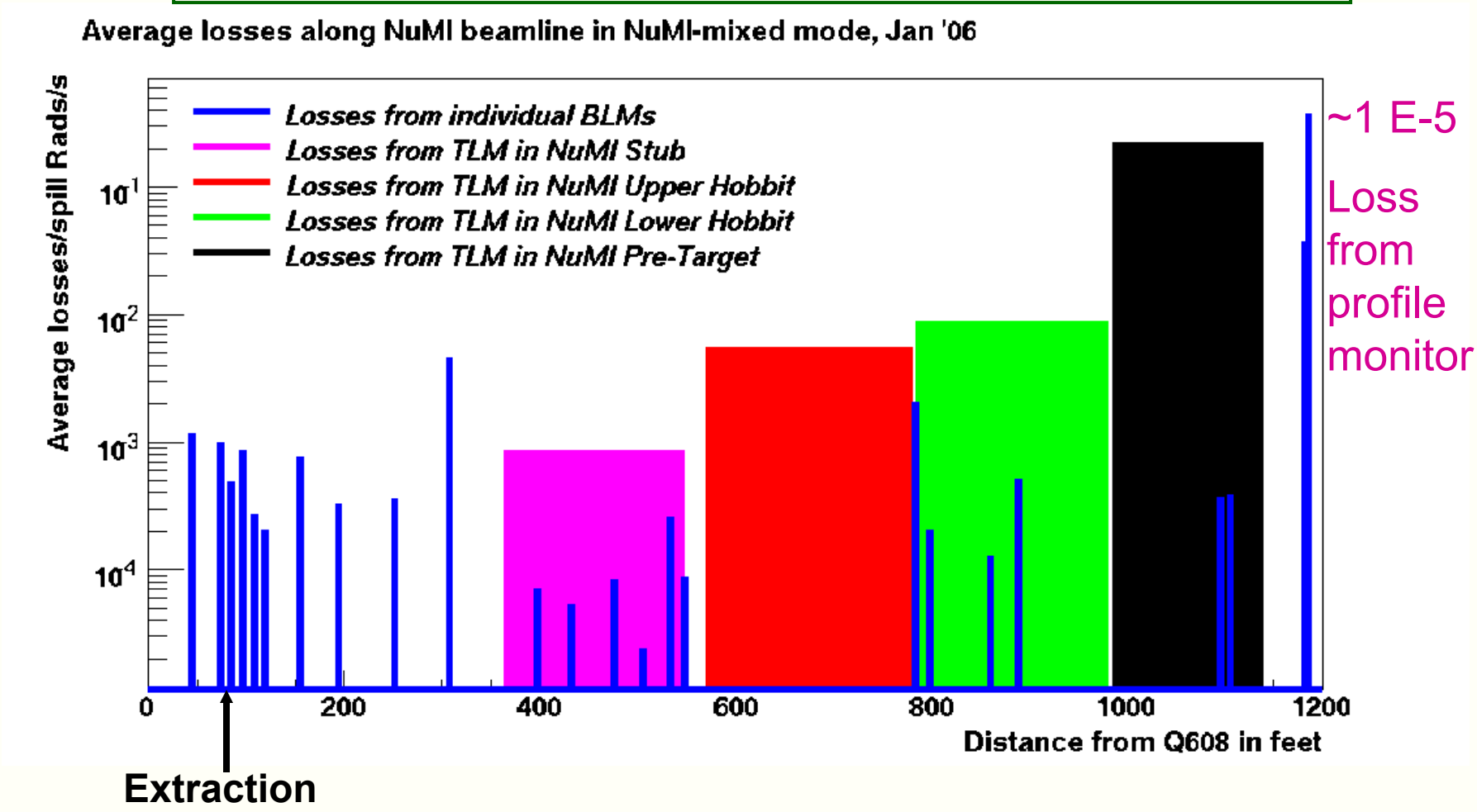
- Ion collection with HV
  - 35kV for day-one ⇒ will be upgraded to 50kV
- Electron collection with magnetic field
  - Require for 0.75MW beam profile measurement ⇒ future plan
- Micro Channel Plate (MCP) for signal read out device
  - 2 stage MCP assembly with 32 ch strip anode
  - Active area: 31 × 81 mm^2
  - Width of each anode: 2.5 mm
  - Gain: ~10 ^{6}
- Calibration devise to check MCP gain
  - Electron generator arrays ⇒ Photonis Ltd.
- Need averaging to reduce the statistic of detected ions
  - Number of ions is about a several 10000 per bunch for designed beam, that is only a several hundreds for day one beam
  - Even for designed beam, we need averaging to measure beam tail region in good resolution





S. Childress: Beam Diagnostics for 2 MW 120 GeV

- **Primary Beam Loss – Mixed Mode (NuMI beam ~300 kW)**
  - Average per pulse for one month



WG D & F: Joint Discussion

- Recording of Radiation dosimetry from machine startup
  - Compare BLMs and TLDs
- Beam loss monitoring
  - BLM coverage
  - Compare BLMs and power losses
  - Calibrate BLMs with tiny beams under controlled, forced beam loss conditions
  - Monitoring of the beam on the target
    - High radiation levels, camera lifetime
    - Phosphor coating (non-linearites), tungsten mesh, thermal imaging
- Beam halo
  - IPMs (J-PARC) with dedicated MCPs for beam core and tails, 10^{-4} sensitivity
    - IPM issues: e-cloud, upstream beam losses
  - Crawling wire and BLM
  - Crystal collimator (bending, reflection of beam halo)
  - BLM calibration using thin multiwires in the 10^{-6} – 10^{-7} regime
- Longitudinal bunch distribution, phase space measurements
  - Wire at fixed position (resolve arrival time), electro-optical sampling(?)
- Beam gap monitoring (10^{-9}, beam gap extraction -> BLM)
- Long term stability of BPM data (automatic calibration systems)