Diagnostics Development at ISIS

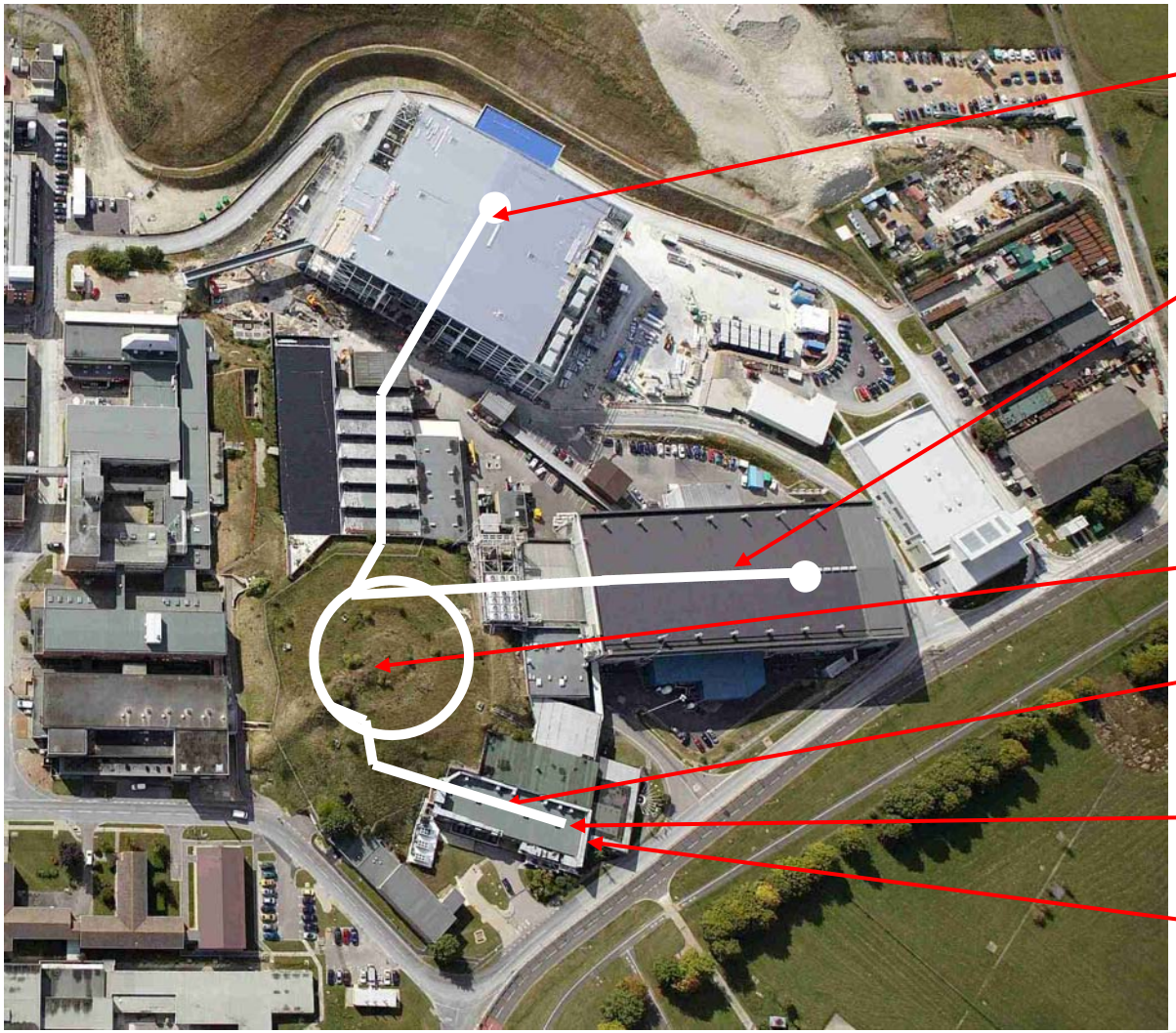
S.J.Payne

presenting the work of ISIS Diagnostics Section

P Barnes, G M Cross, A H Kershaw, N Leach, A Pertica
S A Whitehead, Di Wright

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ISIS & second target station



ISIS Diagnostics Development - 2nd Harmonic RF system & future upgrades…

Better beam loss protection

- additional beam loss monitoring installed

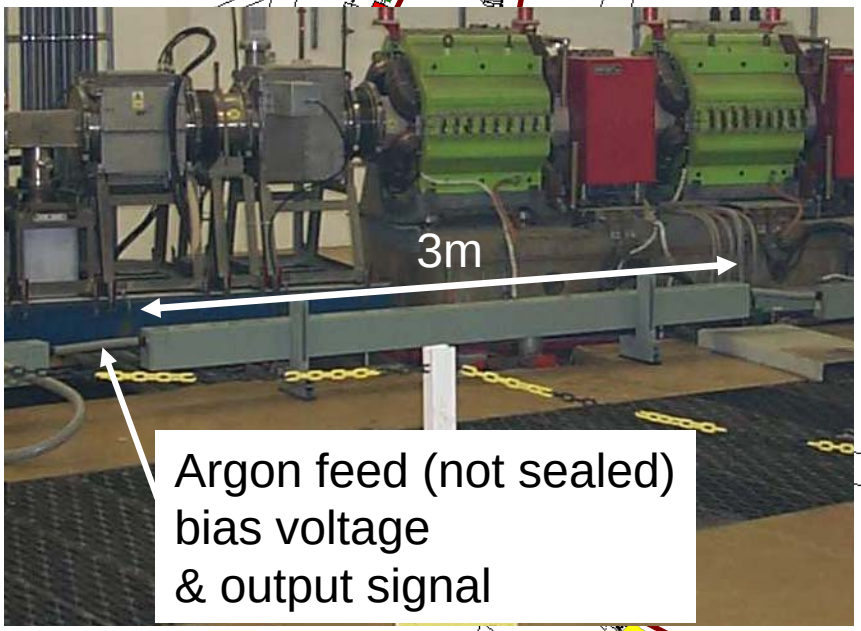
Understanding beam physics

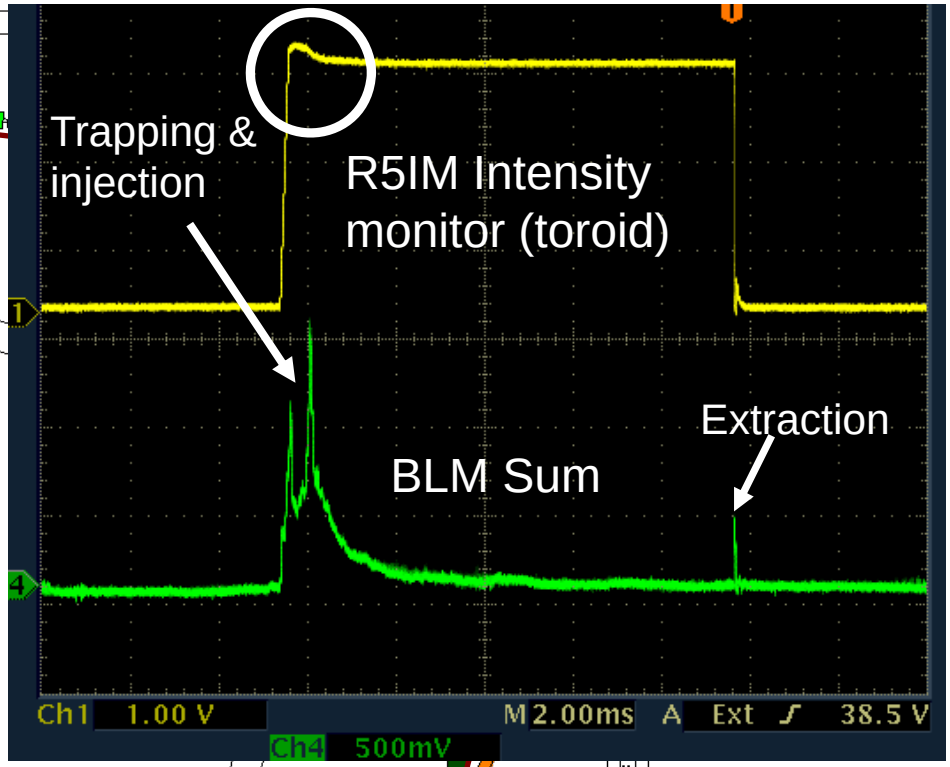
- more detailed beam profile data

Faster more accurate Data Acquisition System

- latest technology (PXI / LabView) vs. radiation

Beam Loss Monitors





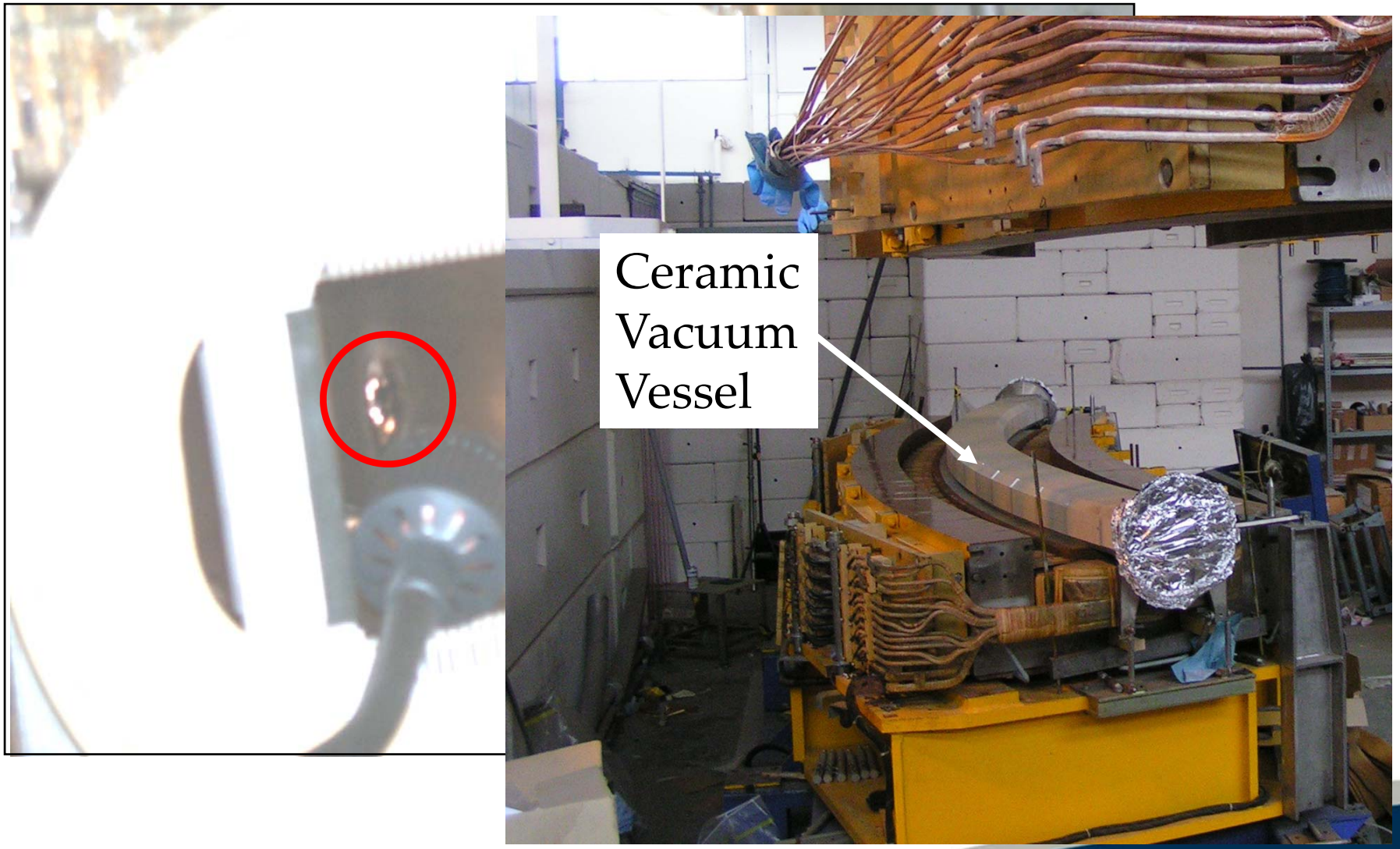
Ionisation tubes not calibrated
Q. Can we do this in situ.

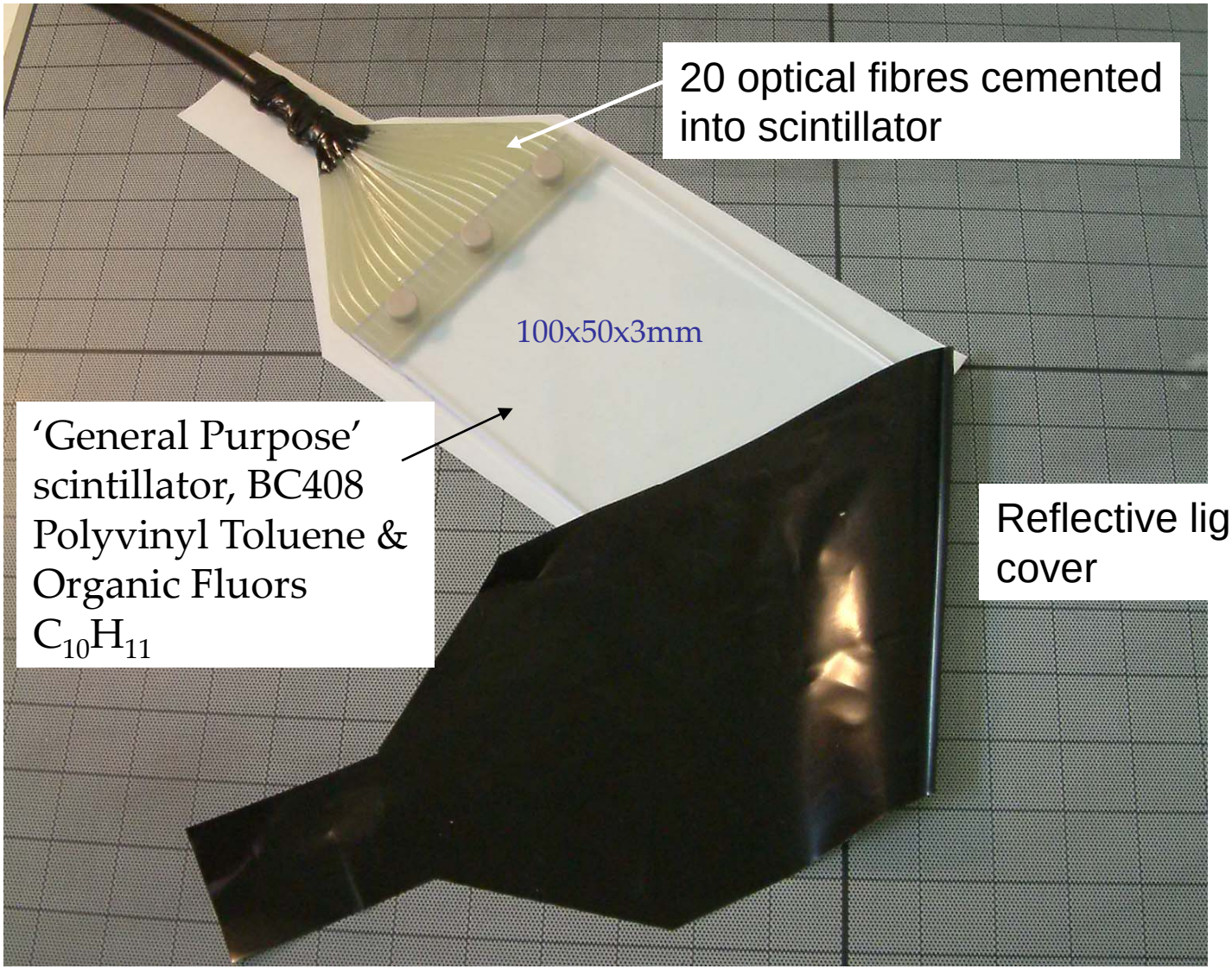
If all tubes hold the same amount of argon, at the same pressure, does calibration matter?

TS1

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Dipole 2 RF shield




20 optical fibres cemented into scintillator
100x50x3mm
'General Purpose' scintillator, BC408 Polyvinyl Toluene & Organic Fluors $C_{10}H_{11}$
Reflective light-tight cover



Interconnection box

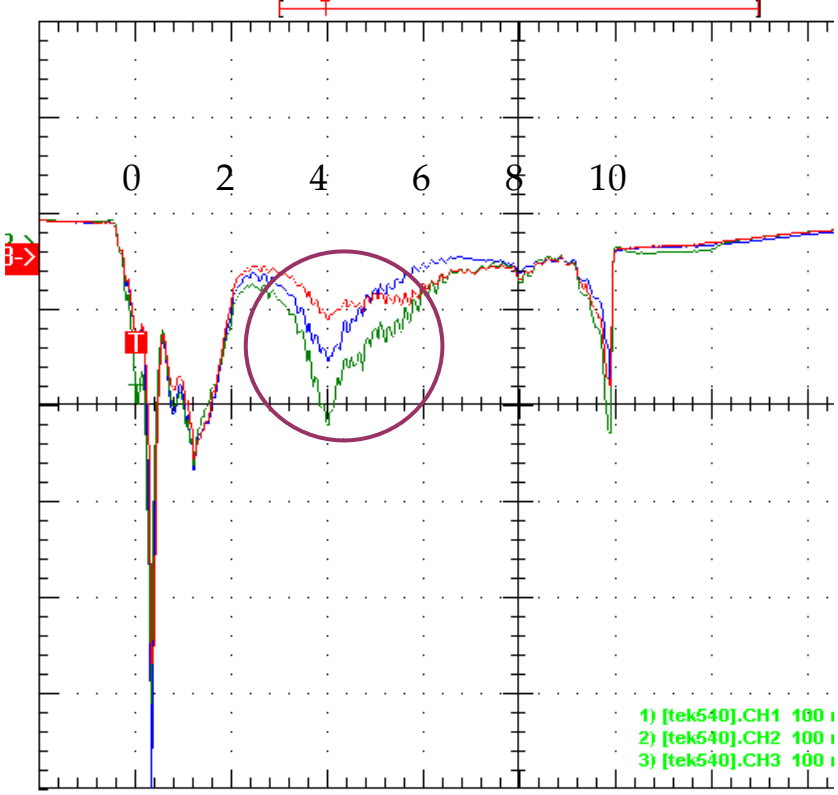


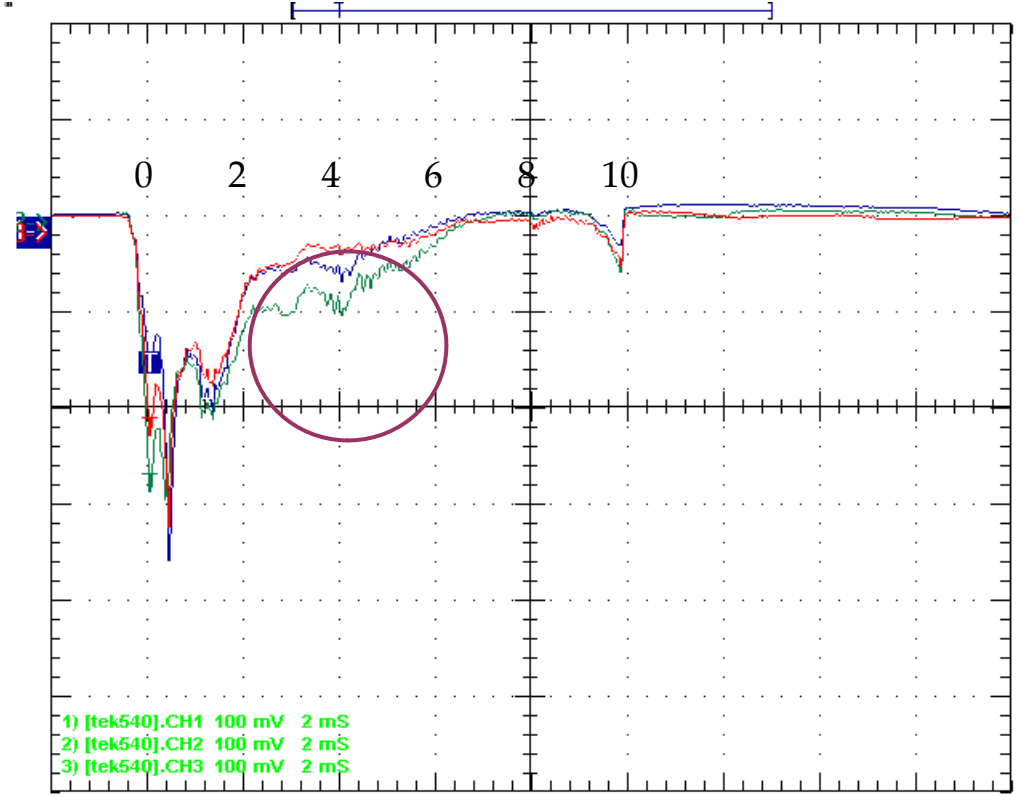


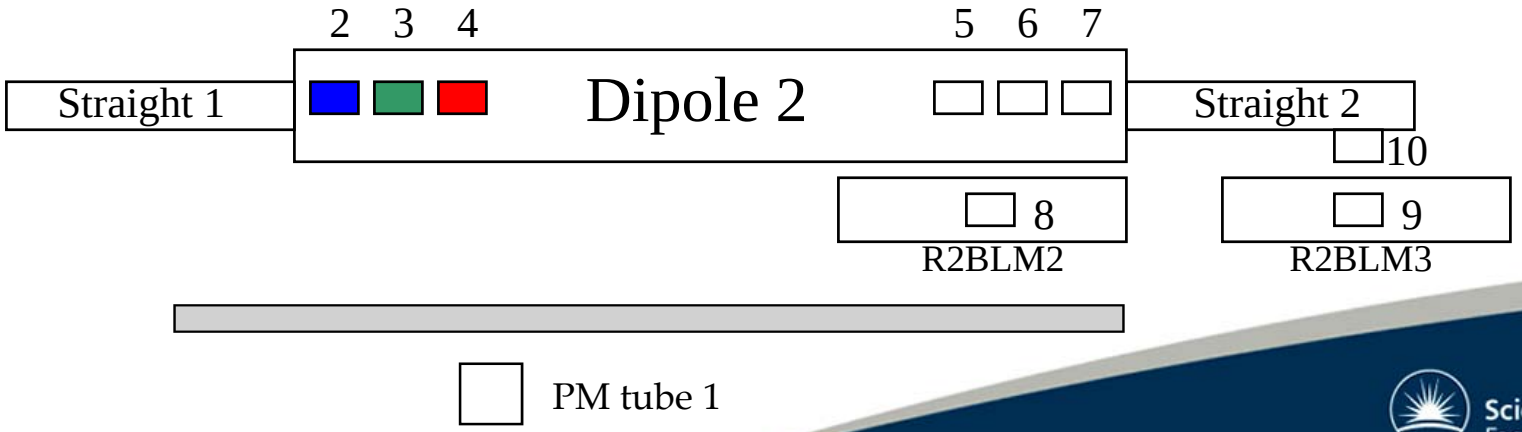


Fibre bundles

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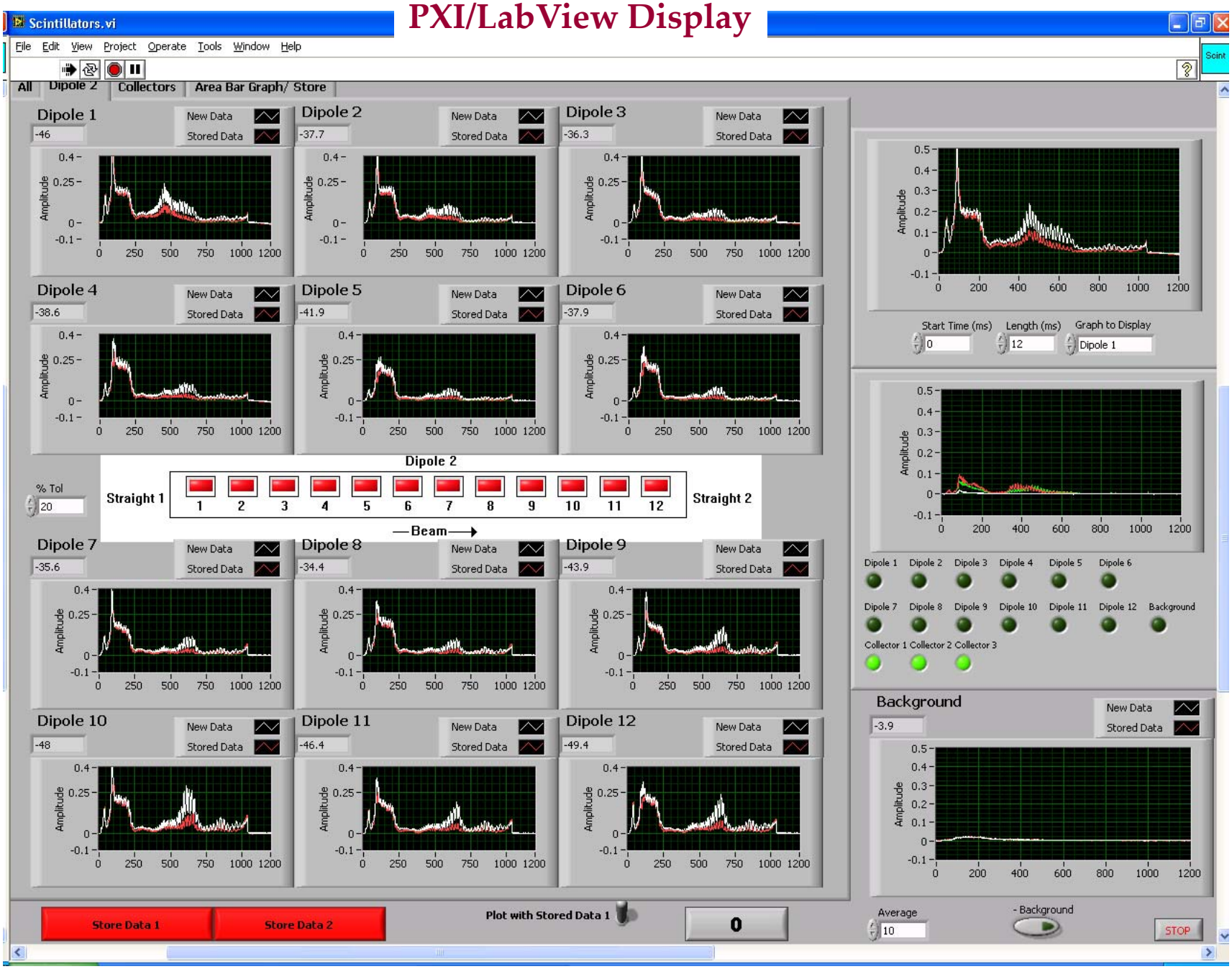






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PXI/LabView Display



beam loss…

damage to machine components

machine activation (maintenance issues)

Q. what about electronics?

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ISIS Data Acquisition

Becoming PXI based…

State of the art electronics

Easy to programme

Wide range of control cards

Good various training courses

Multiple failures in synchrotron environment
Systems lasting less than 1 hour.



shielding

EP data

Profile monitor

From LINAC

TS2

TS1

3

4

5

6

7

BUNG

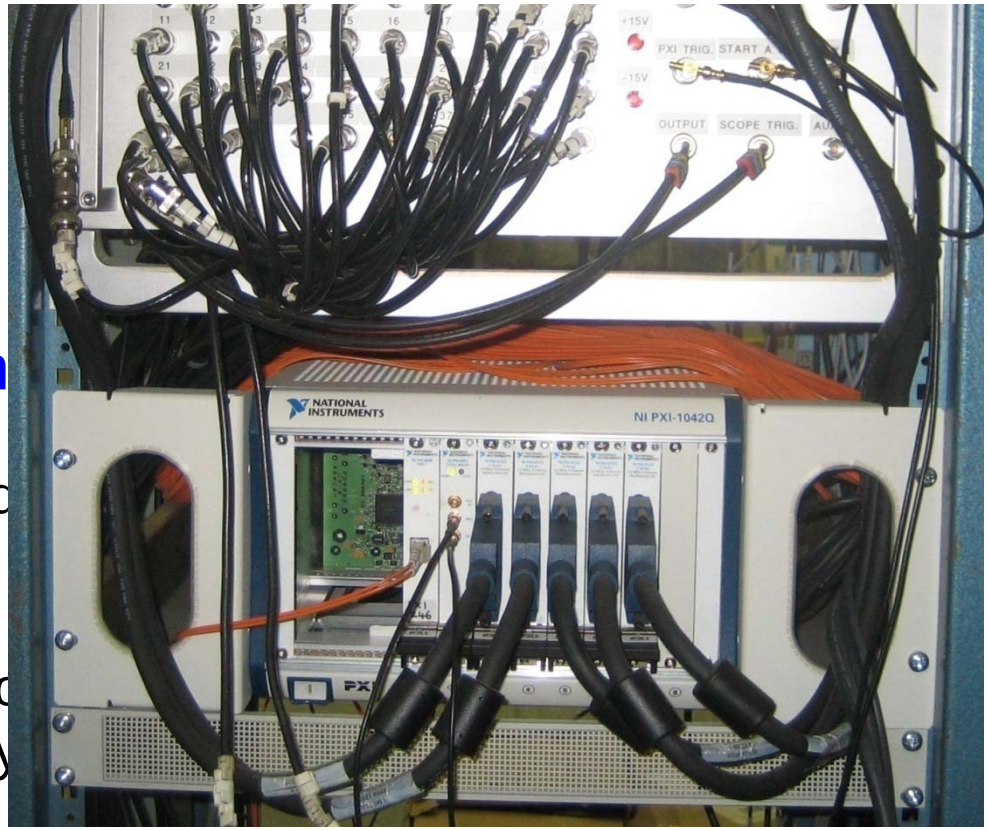
Problem:

Hard drive crashing

Two current ‘solution

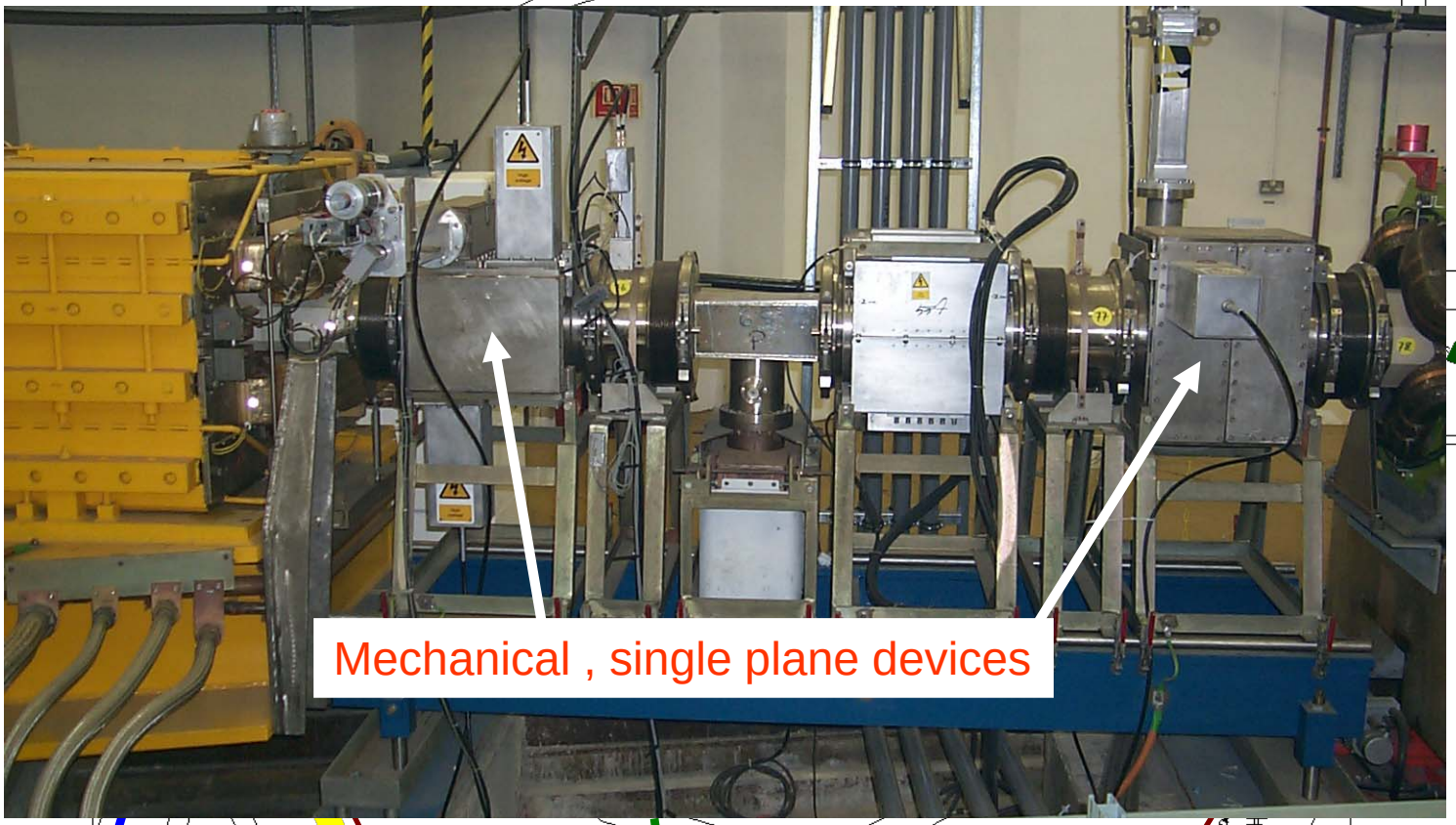
1) Fugitsu drive swopped

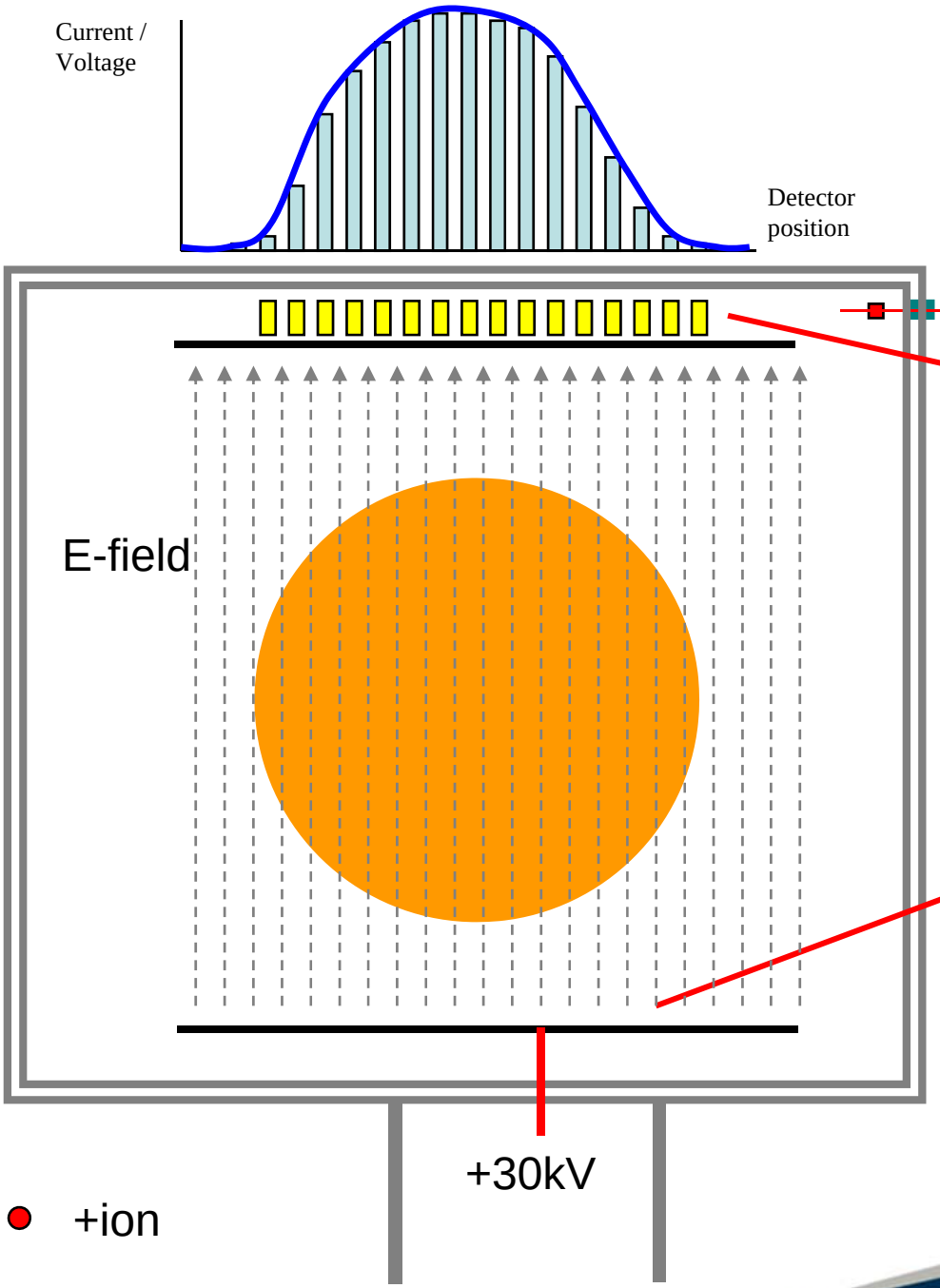
2) PXI crate connected to
using MX-4 fibre cable sy

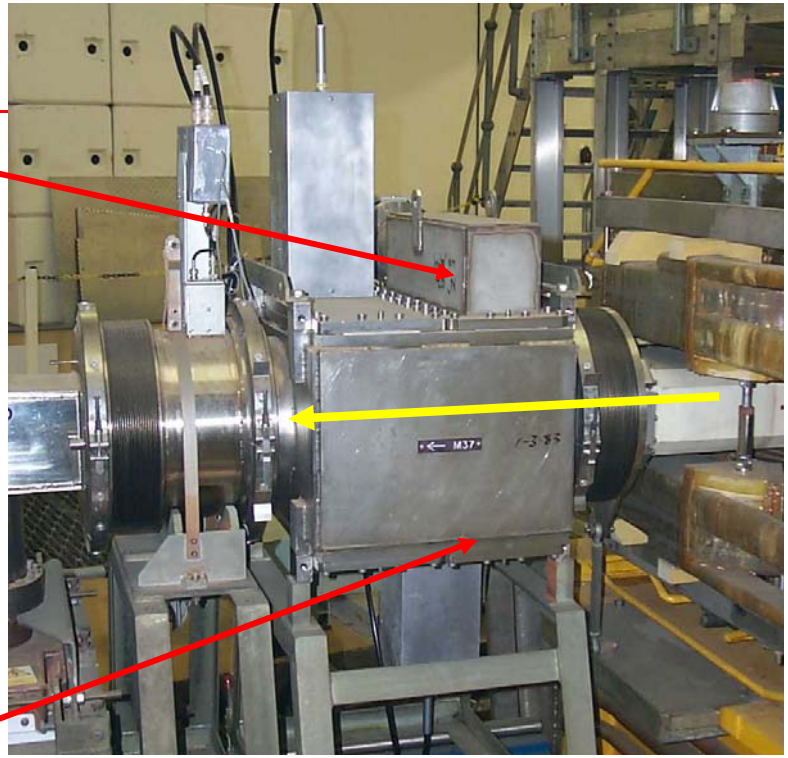


Are these Long term solutions? Depends on whether it is a radiation problem and if so is it affecting the rest of the PXI system.

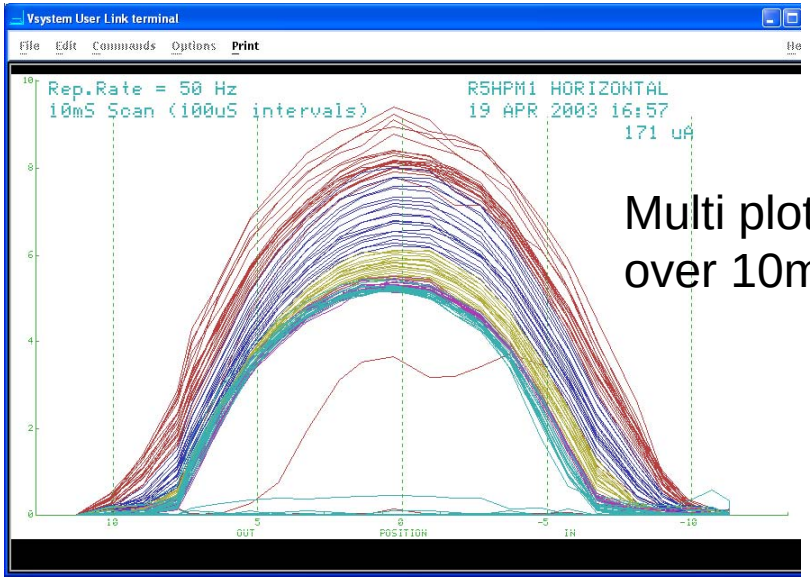
800MeV Accelerator Ring



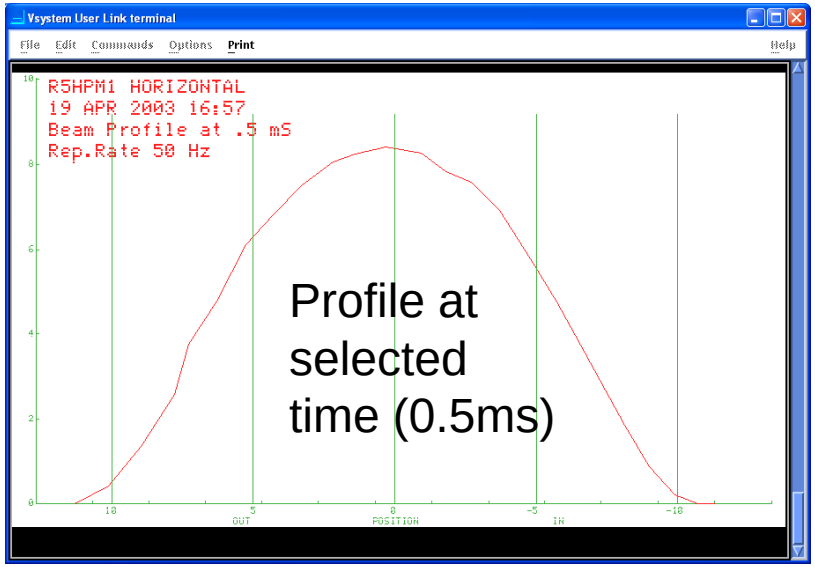




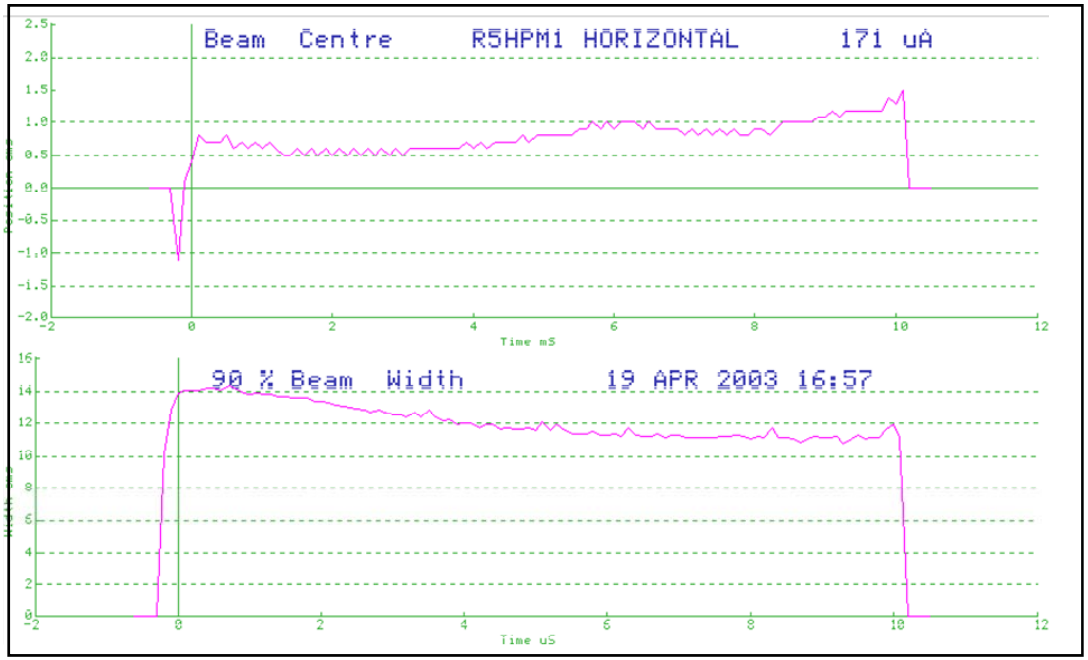
Non-destructive Beam Profile monitor in ISIS accelerator ring (Horizontal plane)



Multi plots over 10ms



Profile at selected time (0.5ms)

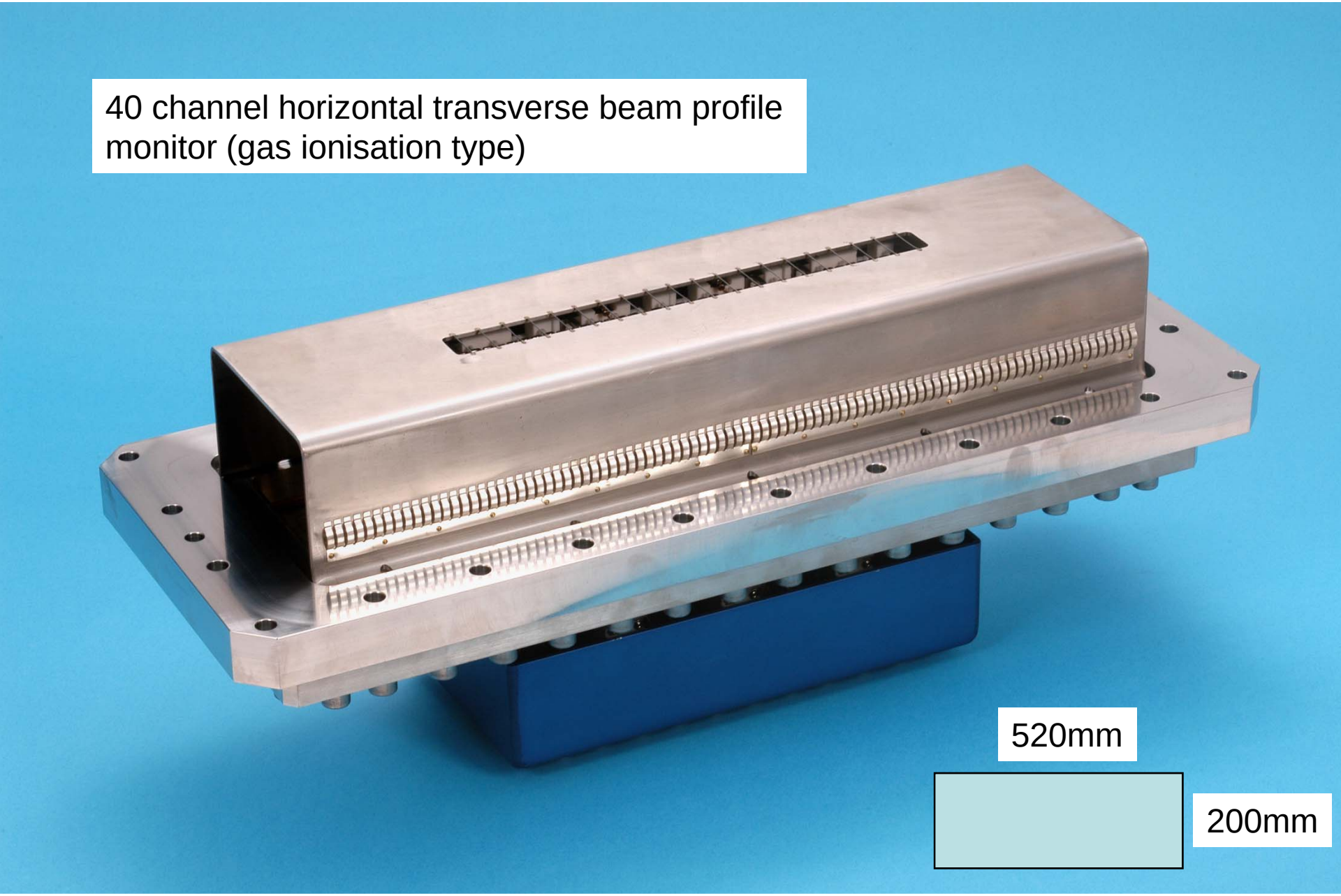


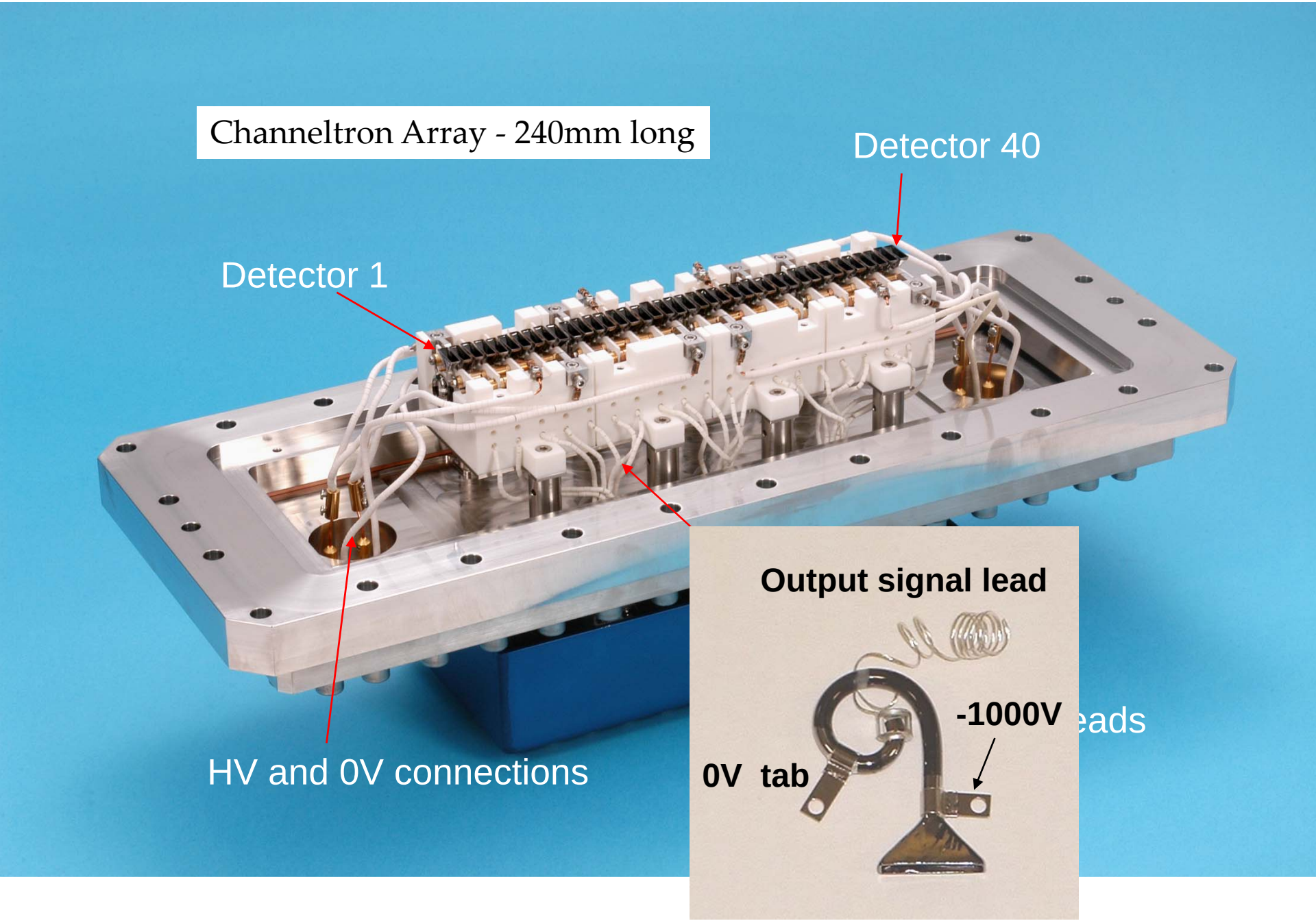
Problem…profile takes 3 minutes to collect therefore no real time studies of the beam possible..

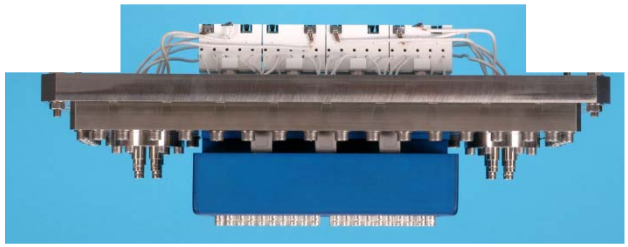
Beam centre / position data

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40 channel horizontal transverse beam profile monitor (gas ionisation type)




Channeltron Array - 240mm long
Detector 40
Detector 1
HV and 0V connections
Output signal lead
-1000V
0V tab
eads

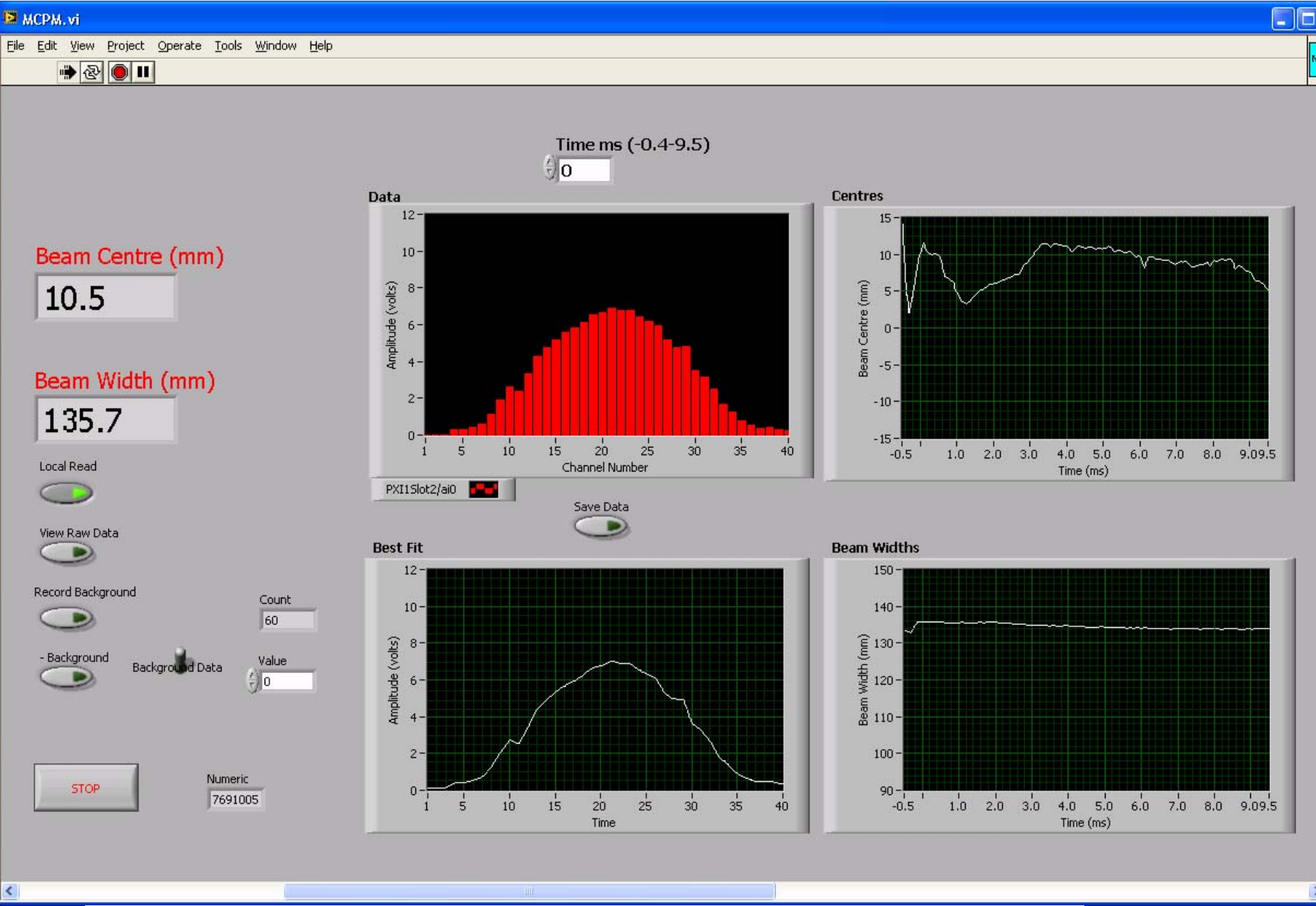


+ions

+ions

BEAM

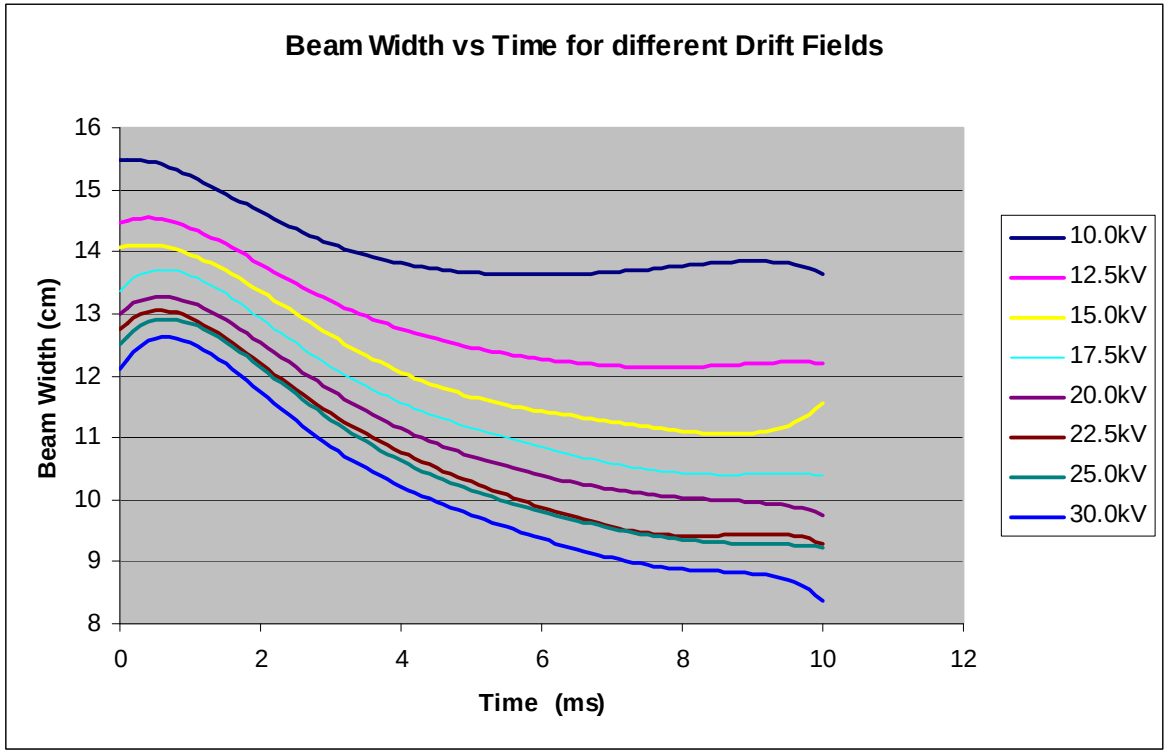
Blanking plate - position for new profile monitor)

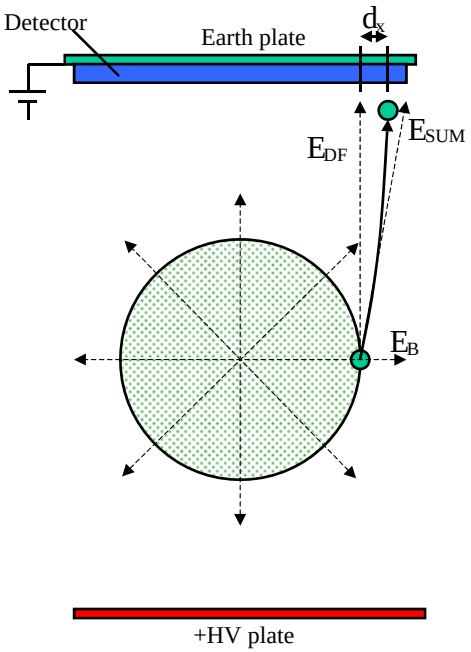


Still some control system / PXI issues to be sorted

Q. are gas ionisation monitors accurate?

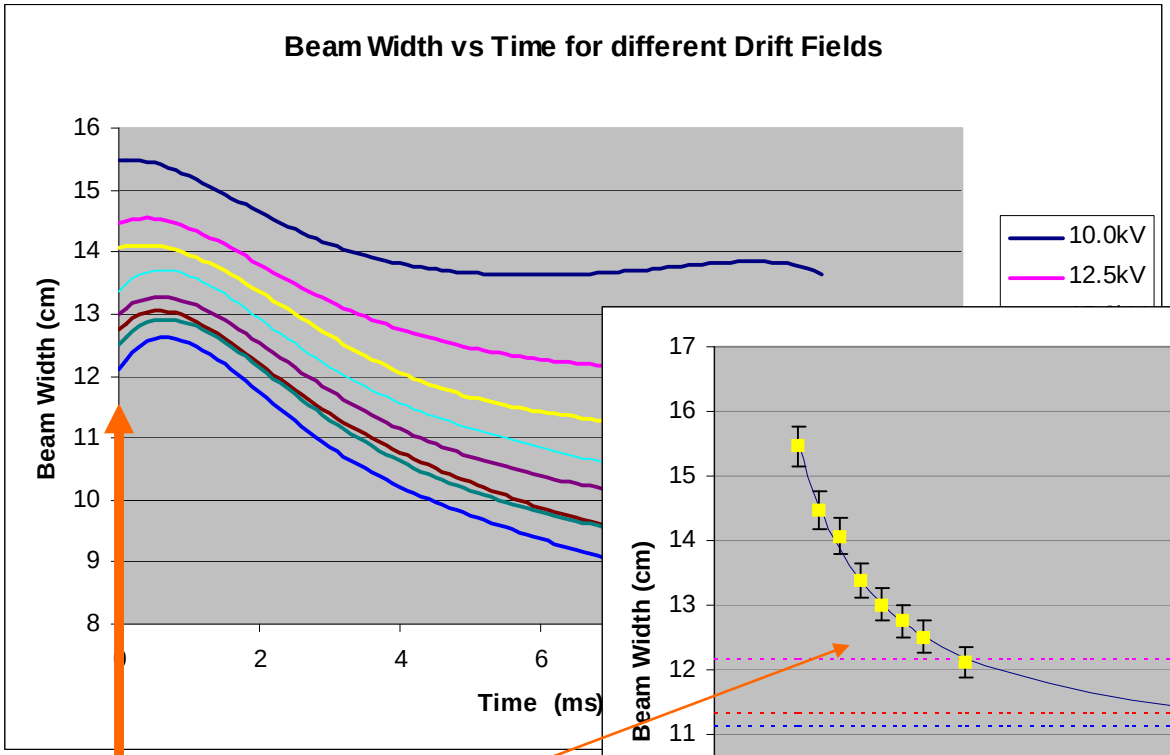
Width of beam depends on drift field!

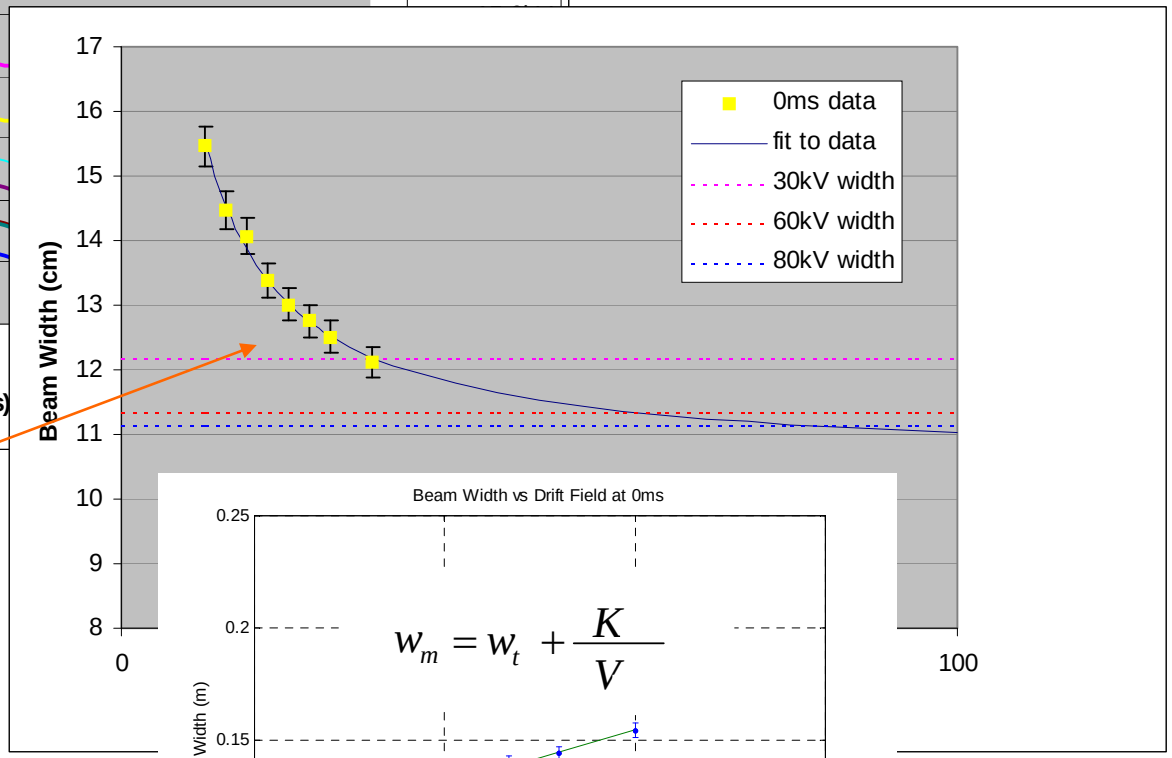




Variations of beam width with drift voltage is a result of space charge associated with beam.

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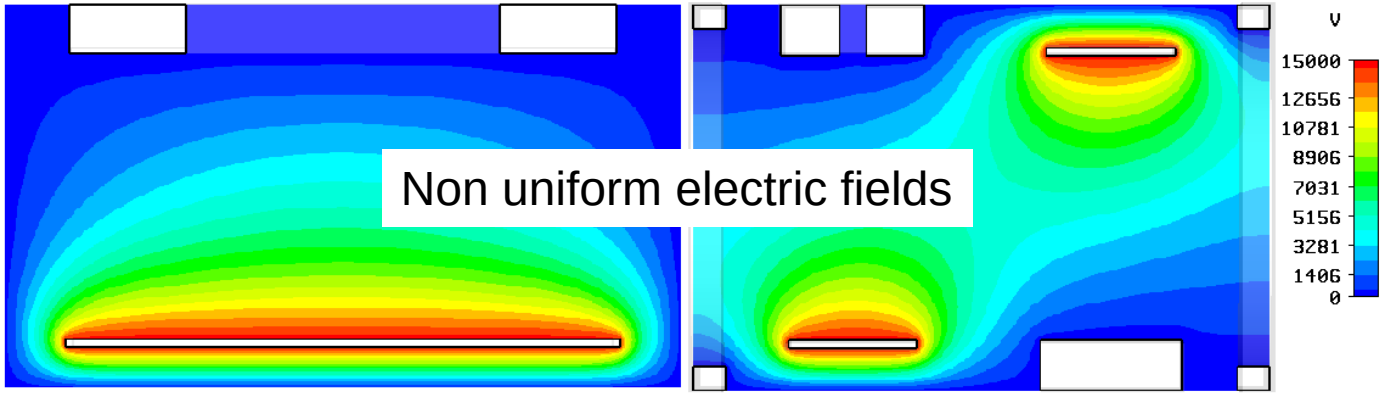


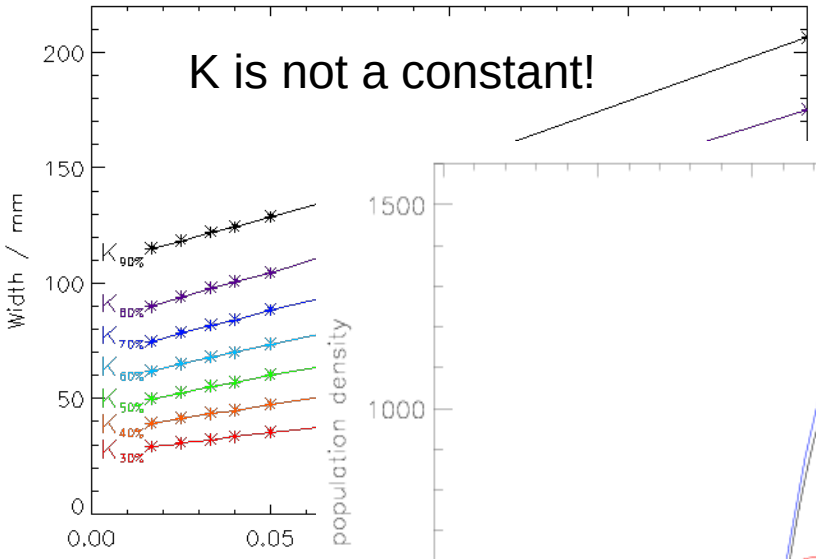


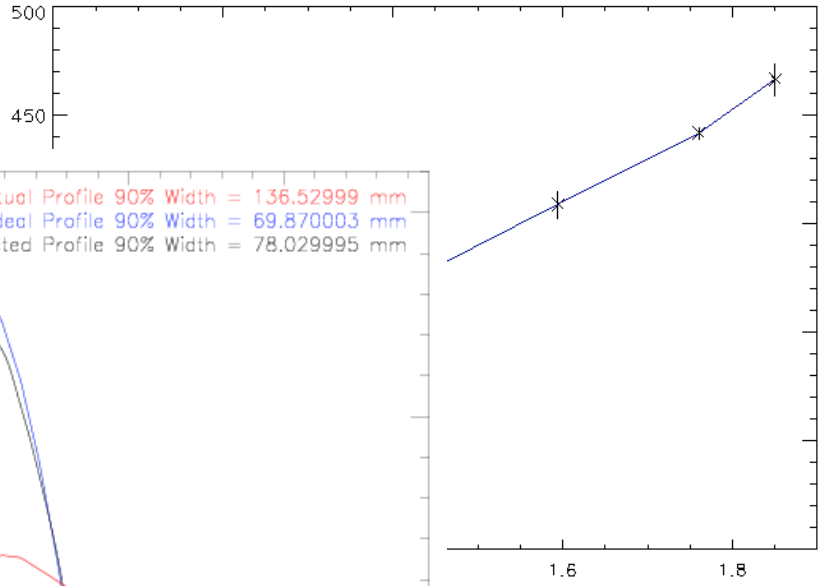
0ms data

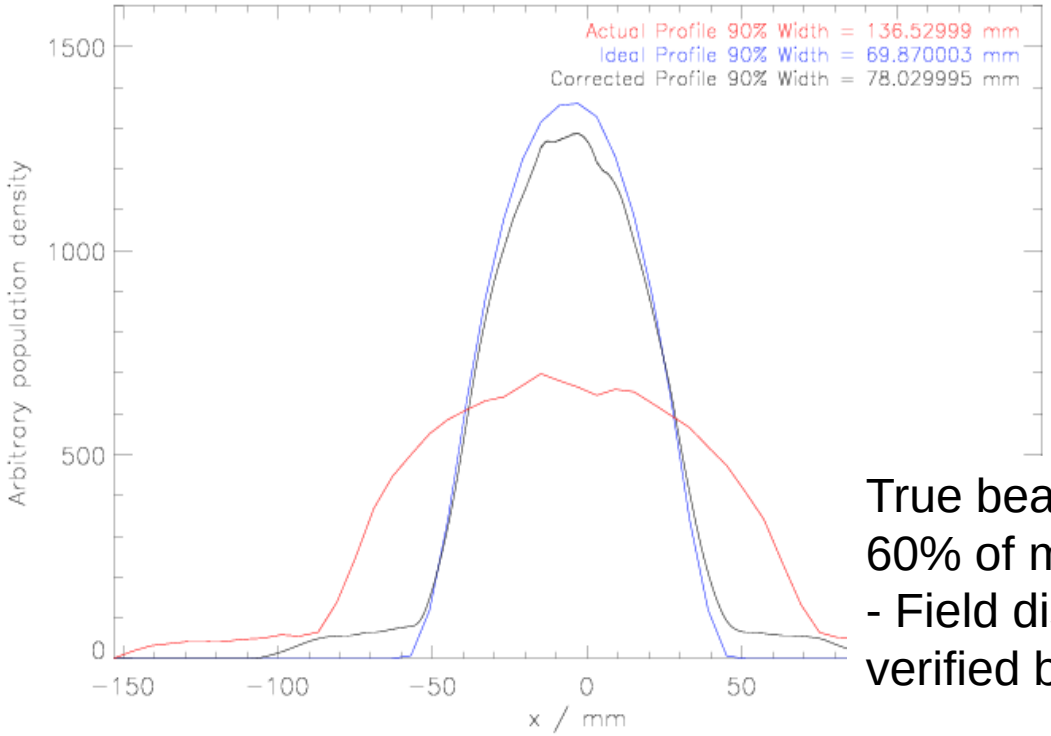
Knowing K means the true beam width can be calculated …except its not really a constant!

Chris Warsop, Rob Williamson, Ben Pine – ISIS Accelerator Physics









True beam width can be 36 to 60% of measured beam width!
- Field distribution to be verified by measurement

Summary

Developed high resolution beam loss capability.

Fast non destructive profile monitor now operational in both planes.

Investment in PXI data acquisition is basically sound (with some radiation induced operational hiccups that need to be sorted).

Non destructive profile monitors for Linac and EPB in design stage.

Electron cloud detector under commissioning to look for signs of E cloud instabilities at ISIS .