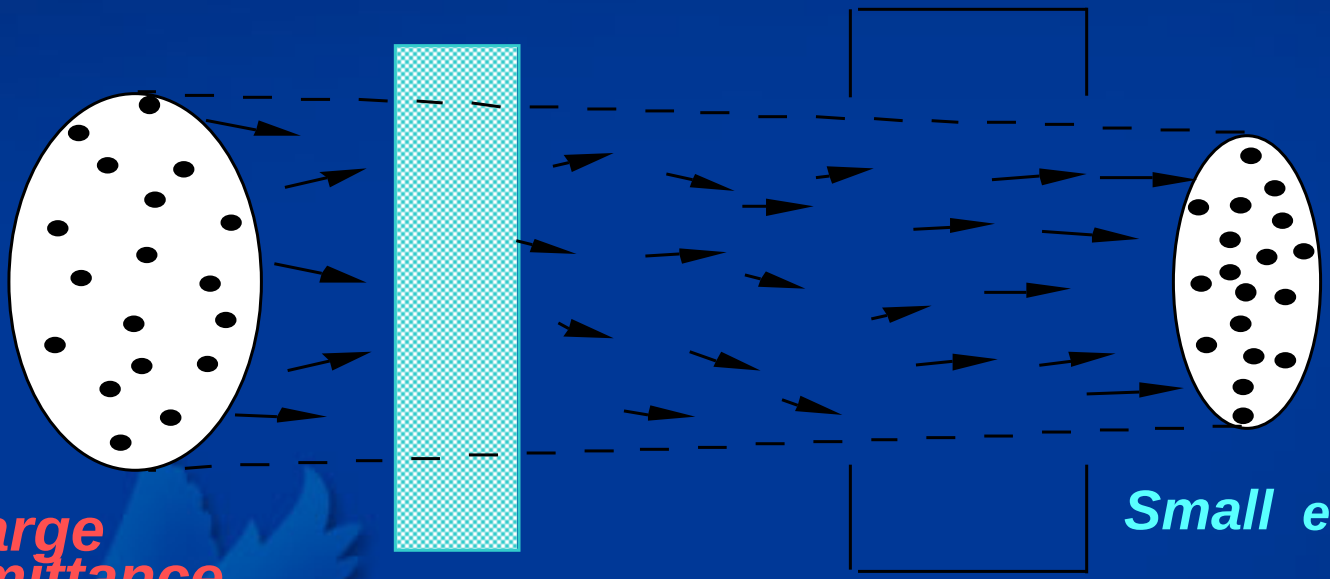
The International Muon Ionization Cooling Experiment

Aim: to demonstrate the principle of ionization cooling as well as the ability to safely operate a cooling channel.

Ionization Cooling - Theory



Large emittance

Small emittance

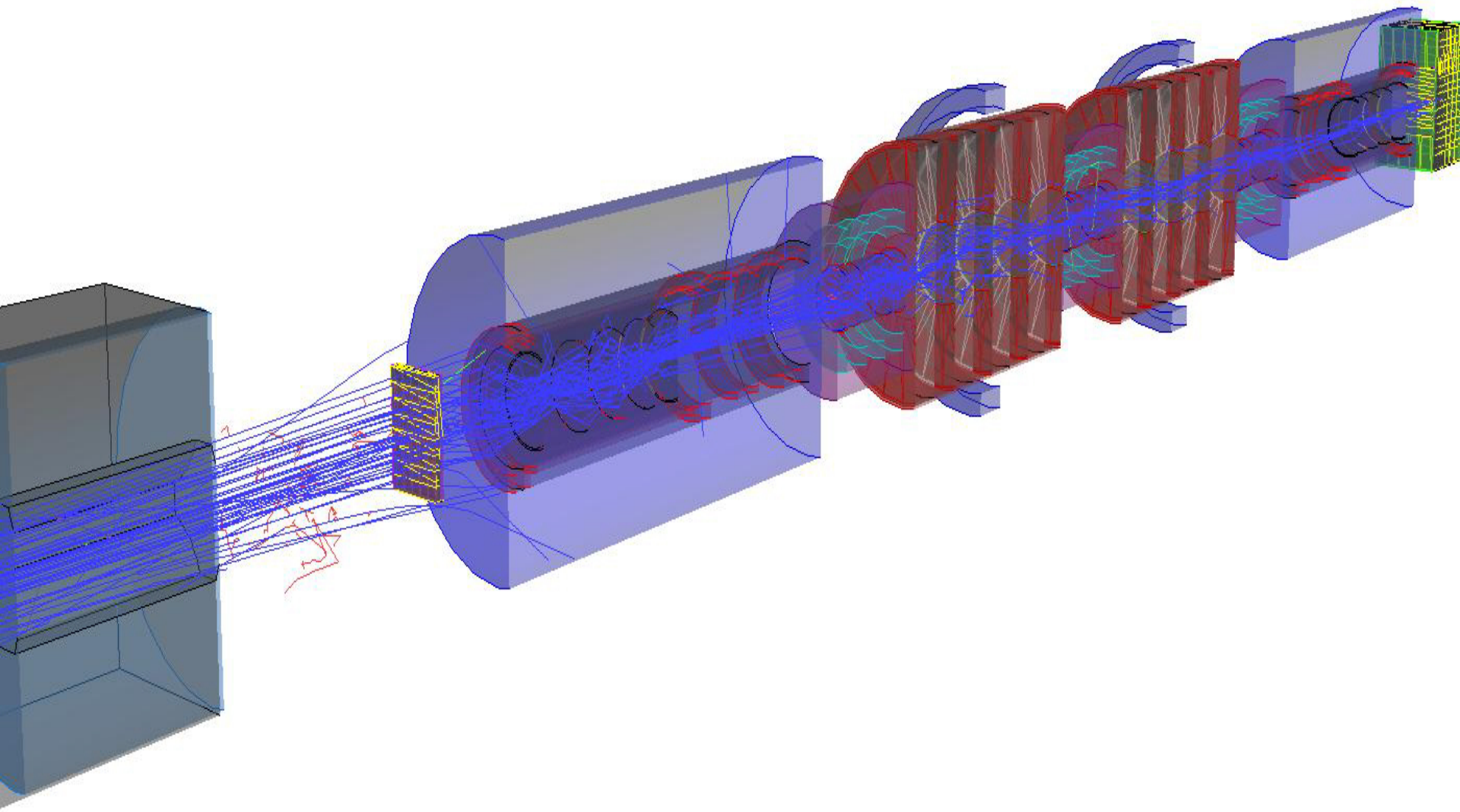
Absorber

Momentum loss is opposite to motion, p, p_x, p_y decrease

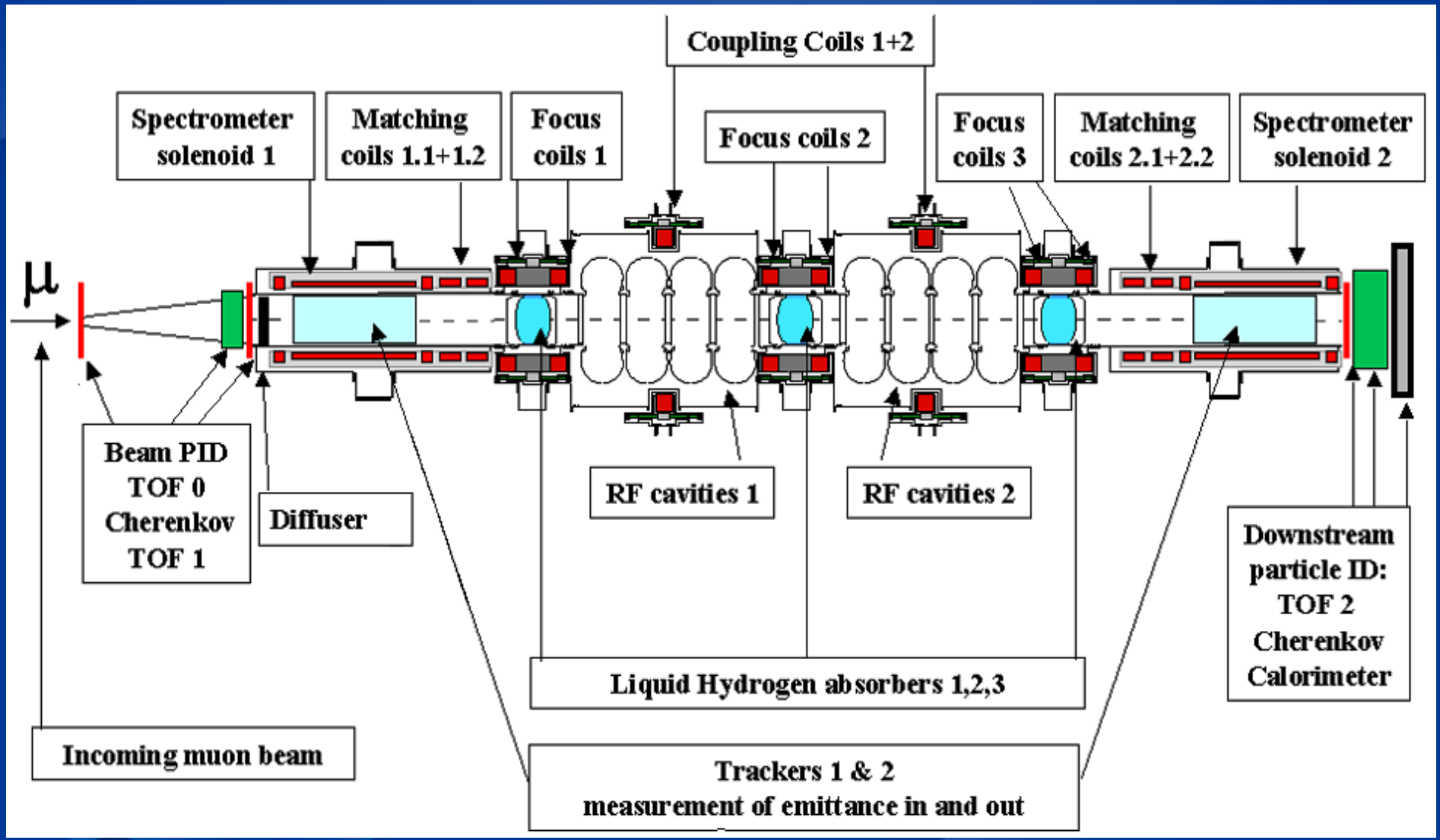
Accelerator

Momentum gain is purely longitudinal

Ionization Cooling - MICE



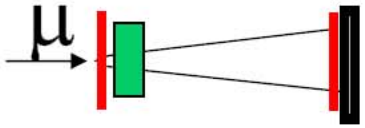
MICE Final Layout



Challenges

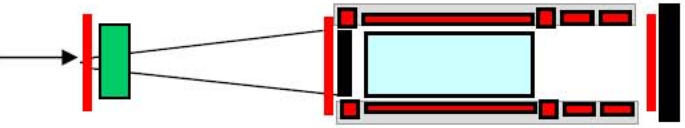
- Cooling channel is predicted to produce ~ 10% cooling.
- We would like to measure this to ~ 1%.
- Require an emittance measurement resolution of 0.1%
- Timing wrt RF phase from TOF.
- Operate RF cavities in magnetic fields.
- Hydrogen safety (LH_2 in proximity to RF cavities!)

Aspirational MICE Schedule as of April 2008



STEP I

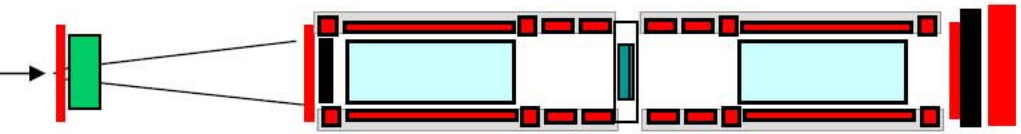
Febuary-July 2008



STEP II

UK PHASE I

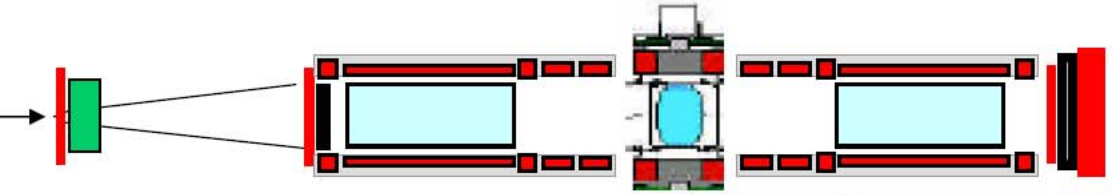
September 2008



STEP III/III.1

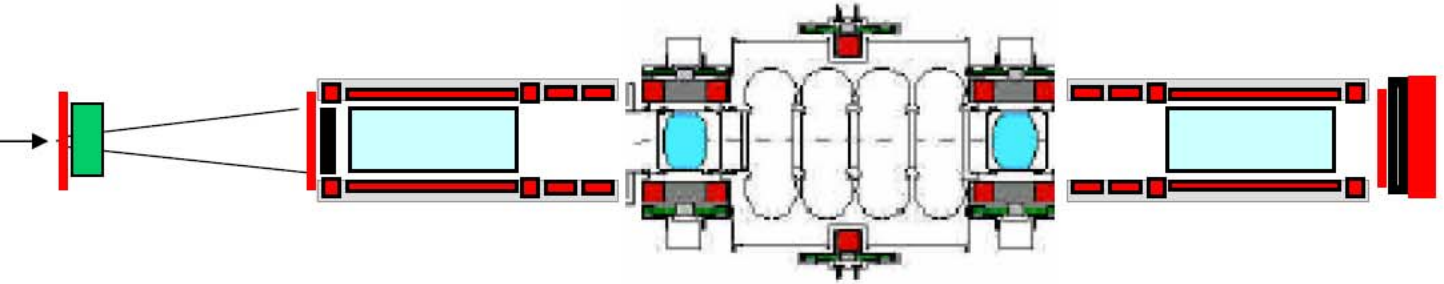
November 2008
to summer 2009

UK PHASE II



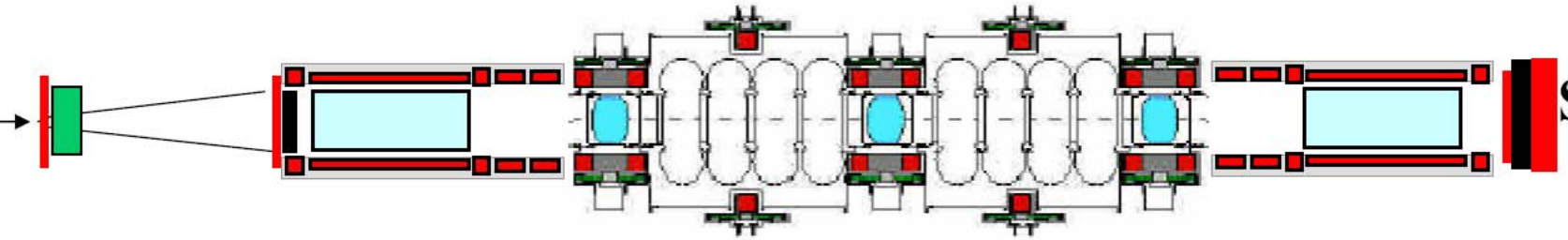
STEP IV

Delivery of 1st FC
october 2009!



STEP V

spring 2010



STEP VI

Q4 2010
-2011

Organisation

- Spokesmouse – A. Blondel (Geneva)
- Deputy Spokesmouse – M. Zisman (LBNL)

- Executive Board
- Technical Board
- Collaboration Board
- Editorial Board
- Speakers' Bureau

- WBS structure:

Muon Ionisation Cooling Experiment: WBS -- Draft 18Oct07

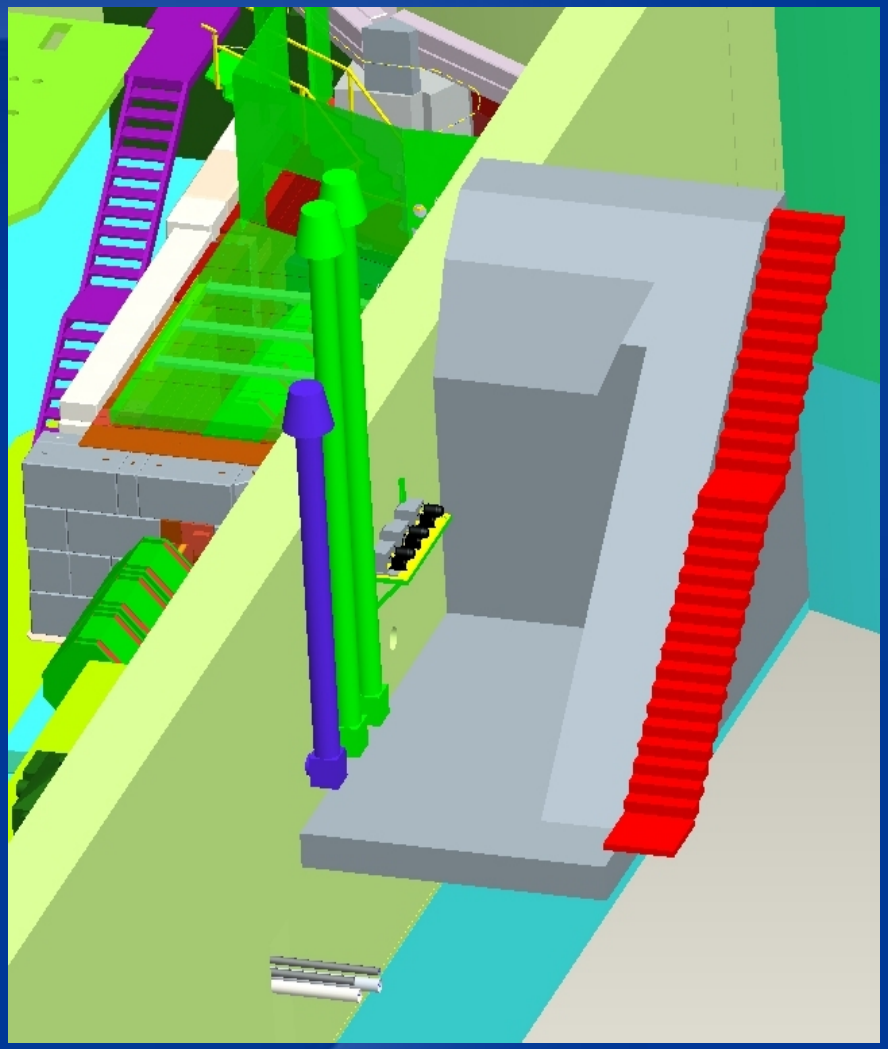
MICE	Level 2	Level 3	Level 4	Apsimon/Nichols
	2.0-MICE-Muon-Beam			Long
		2.0.1 Upstream beam line		Long
			2.0.1.1-Target	Booth
			2.0.1.2-Vacuum-vessels	Kearsley
			2.0.1.3-Vacuum-services	Hughes, Shaun
			2.0.1.4-Electrical-services	Hughes, Martin
			2.0.1.5-Water-services	Govans
			2.0.1.6-Alignment	Loughry
		2.0.2-Downstream-beamline		Long
			2.0.2.1-Q35-refurbishment	Spensley
			2.0.2.2-Linde-refrigerator	Courthold
			2.0.2.3-PSI-solenoid	Courthold
			2.0.2.4-Q4--9-installation	Spensley
			2.0.2.5-Water-services	Govans
		2.0.3-Beam-monitors		Tilley
			2.0.3.1-Monitors	Sellberg
			2.0.3.2-Installation-upstream	Kearsley
			2.0.3.3-Installation-downstream	Spensley
		2.0.4-XMas2007-shutdown		Hayler
	2.1-MICE-Hall and infrastructure			Hayler
		2.0.2.1-Magnetic-shielding-walls		Hayler
		2.0.2.2-MICE-Hall-floor		Hayler
			2.0.2.2.1-plinth	Hayler
			2.0.2.2.2-false-floor	Hayler
		2.0.2.3-Rolling-platforms		Hayler
		2.0.2.4-Water		Govans
		2.0.2.5-Air-conditioning		Govans
		2.0.2.6-Power		Griffiths
		2.0.2.7-Liquid-hydrogen-system		Ivanyushenkjov
		2.0.2.8-MLCR		Kyberd
		2.0.2.9-Networking		Brandwood
		2.0.2.10-Cabling		Griffiths
		2.0.2.11-PPS		Alexander
	2.2-MICE-Instrumentation:			Bross
		2.2.1-TOF		Bonesini
		2.2.2-CKov		Cremaldi
		2.2.3-Spectrometer-solenoid		Virostek
		2.2.4-Tracker		Long
			2.2.4.1-Mechanical	Barber
			2.2.4.2-VLPC-system	Bross
			2.2.4.3-Electronics	Hart
			2.2.4.4-DAQ	Yoshida
			2.2.4.5-Software	Ellis
			2.2.4.6-Slow-control	Leaver
			2.2.4.7-Trigger-distribution	MacWaters
		2.2.5-CKOV/TOF0 stand		Nichols
		2.2.6-Cal		Chimenti
		2.2.7-DAQ		Graulich
		2.2.8-Integration test		MacWaters
	2.3-MICE-Cooling-Channel:			Zisman
		2.2.1-Absorber-focus-coil-module		Lau
			2.2.1.1-Absorber	Ishimoto/Cummings
			2.2.1.2-Focus-coil-module	Lau
		2.2.2-RF-cavity-coupling-coil-module		Li
		2.2.3-Vacuum-system		Lau (TBC)
		2.2.4-RF-power		Moss

Project Management

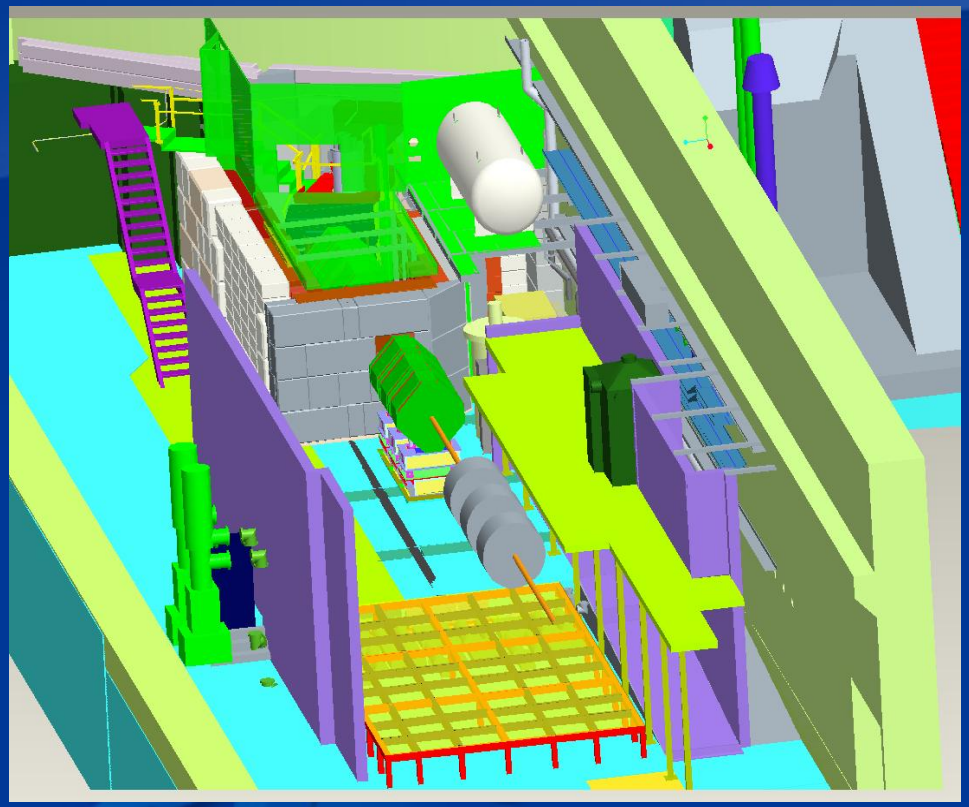
- Project Management Team:
  - Project Manager: R. Apsimon
  - Technical Coordinator: A. Nichols
  - Hall Manager: W. Spensley
  - Hall Foreman: A. Jamdagni, P. Flower
  - ISIS Liason: C. Rogers
  - MICE Operations Manager (rotating position)
- Project on good footing, however:
  - R. Apsimon & P. Flower have been granted retirement.

Technical Coordination

- Big-ticket items committed:
  - South shield wall support structure
  - Air conditioning units
  - Concrete floor removal
- Design work almost complete:
  - False floor
  - North wall shield support structure
  - DSA roofing and walkways
- Remaining design work:
  - MICE hall roof layout
  - Installation drawings for CDM records



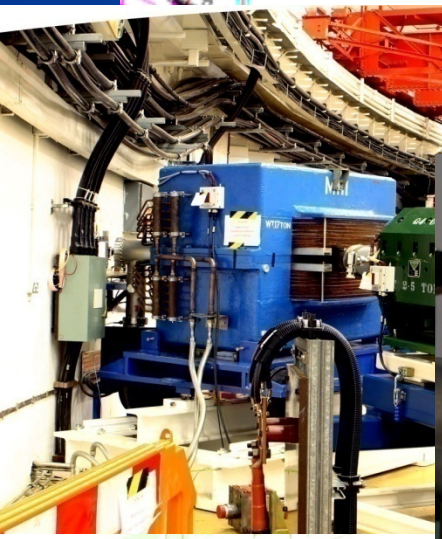
Magnetic Shielding

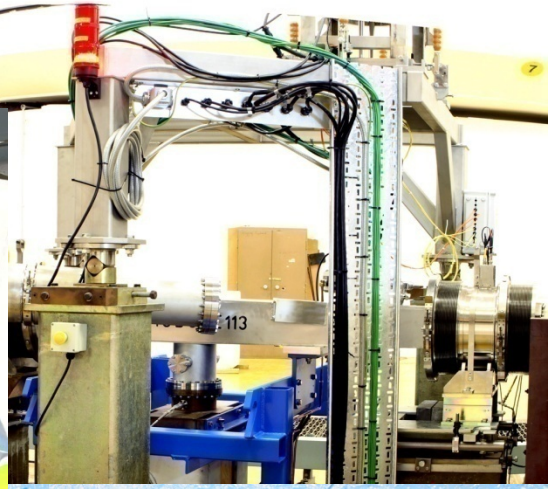


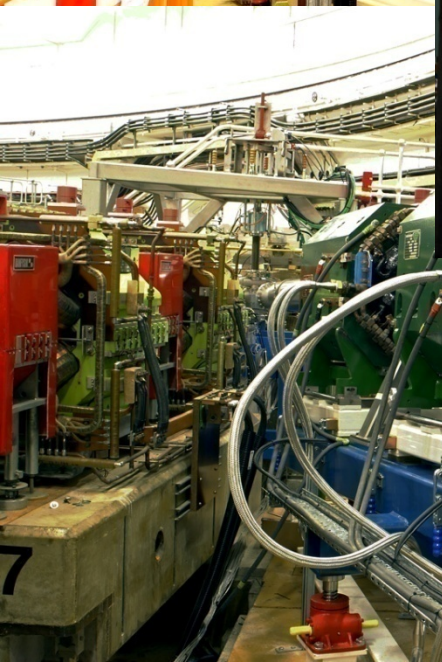
- Design complete for complex south wall.
- North wall design underway.
- Final quote for magnetic steel plates.
- Big impact on other work and operation of experiment.
- Mezzanine closely coupled to walls.
- Part of H_2 system.
- Needs to be built with walls.

- Maximised the net benefit to the experiment.
- Can run Step I and complete the construction.

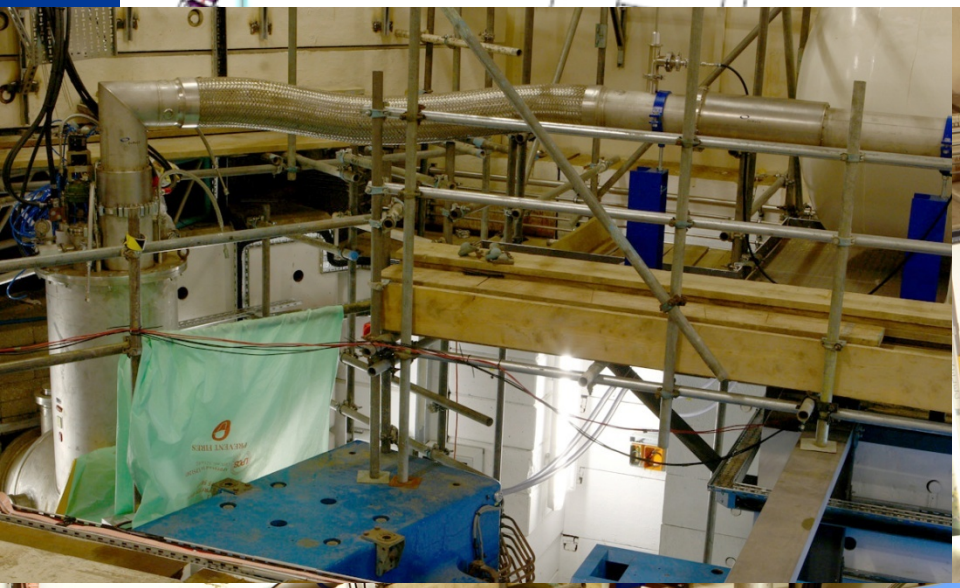
MICE Beam Line

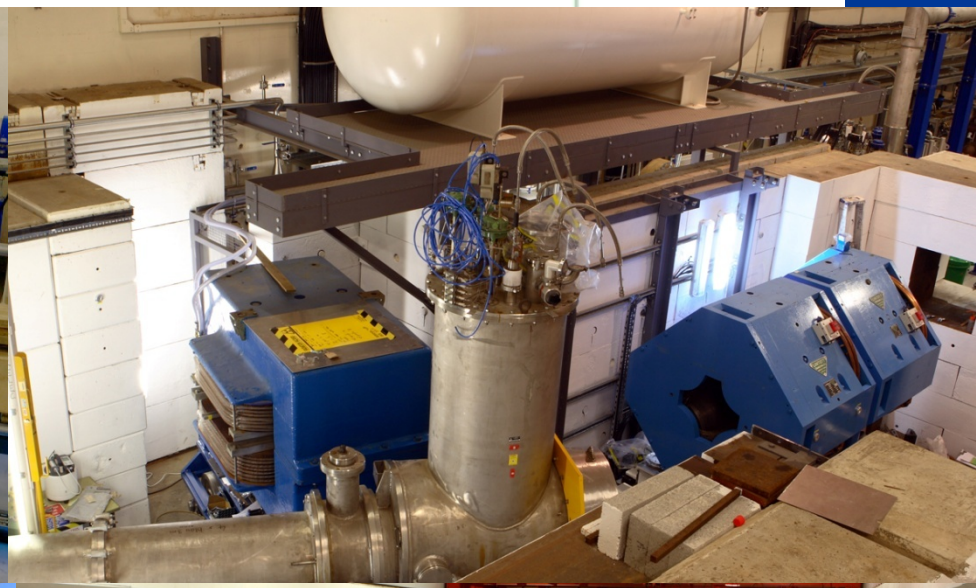


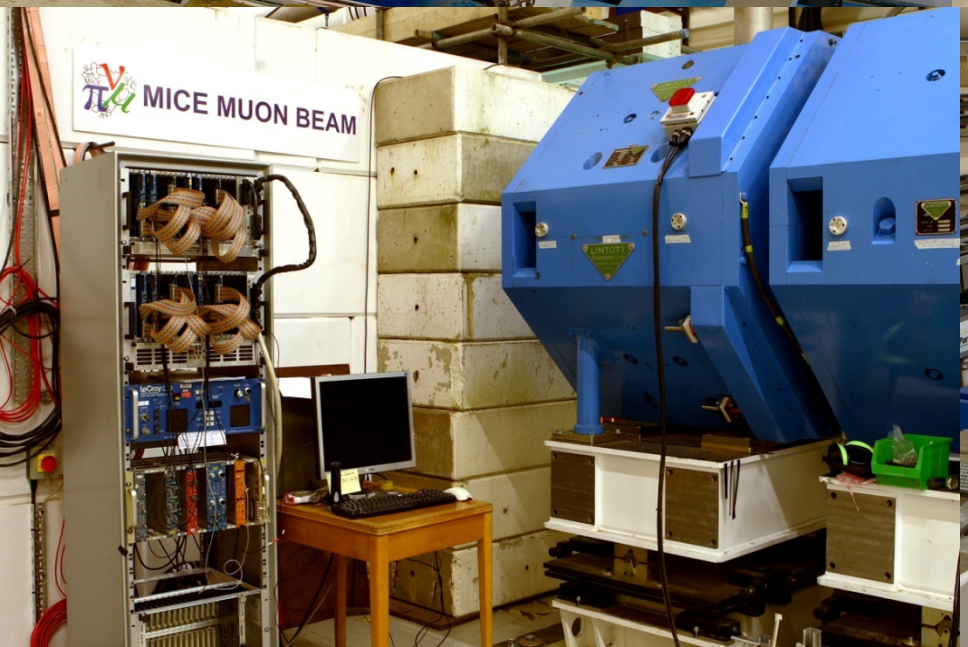




MICE Beam Line







Beam Line Status

- Permission obtained to use target in ISIS for three runs over the past week.
- Mechanical installation of decay solenoid complete – not tested yet, problems with the refrigerator
- All quadrupoles and dipoles installed.
- Some power supply and water problems to be fixed on a few quadrupoles.

Decay Solenoid

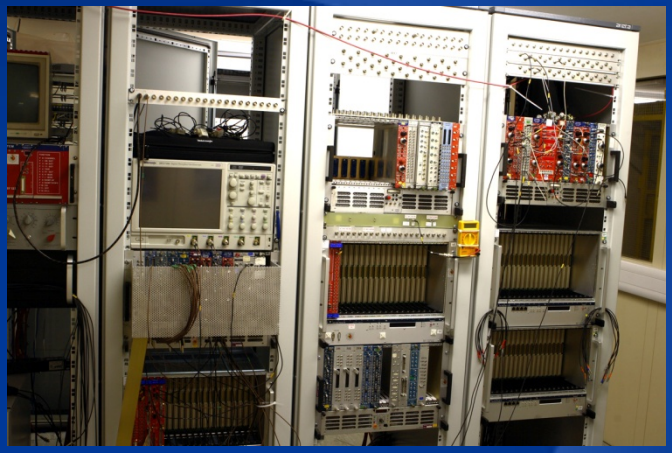
- Transfer line is connected and has checked out OK.
- The electrical connections to the solenoid are done and most of the pipe work is done.
- The remaining pipe work does not require access to the DSA and will be complete in the coming weeks.
- Plan to start a cold test on 14th April and arrangements are being made for the relevant experts from Linde and PSI to be present to support this test.

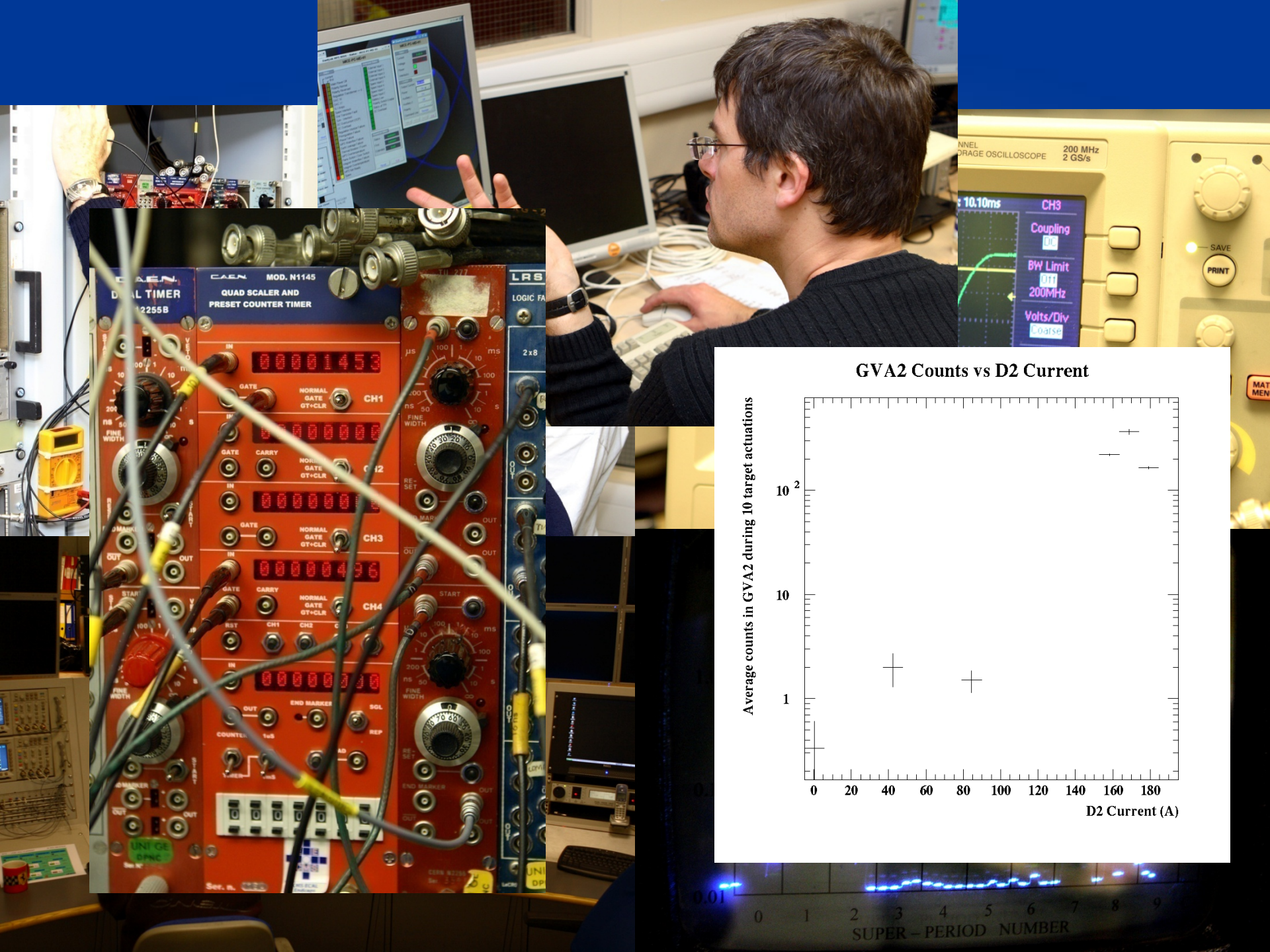
Second Target

- Before we can bring the target that is in ISIS into routine operation, a second target operating elsewhere at RAL is required.
- Second target is due to be complete on 15th May.
- Poor QA in the previous manufacturing process has been identified and corrected.
- ISIS are becoming more comfortable with the target operation and so far have consistently increased our budget of “dips” as we approach the previous limit.

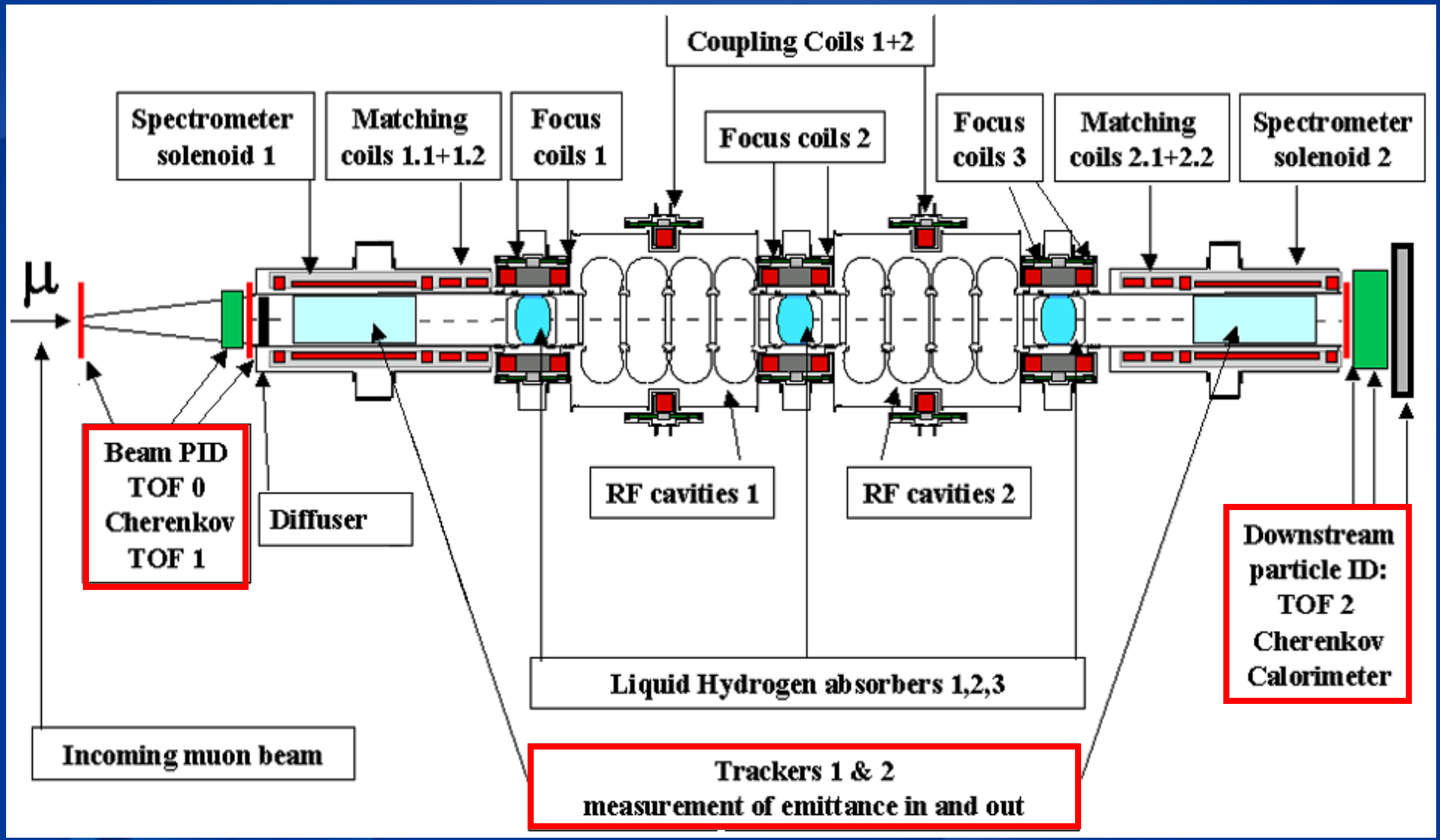
MICE Control Room

- Almost complete.
- DAQ racks filling up, cabling has begun.
- Slow controls, DAQ and target PCs installed and used for data taking.
- PPS racks complete and installed.
- Network in place, further work still required.



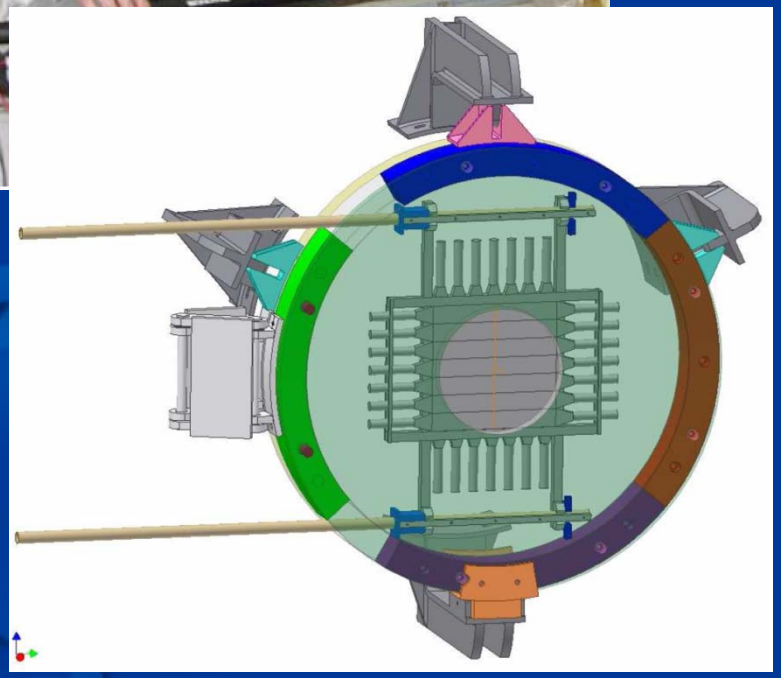

CAEN
MOD. N1145
QUAD SCALER AND
PRESET COUNTER TIMER
LRS
CH1
CH2
CH3
CH4
GVA2 Counts vs D2 Current
Average counts in GVA2 during 10 target actuations
D2 Current (A)
0
20
40
60
80
100
120
140
160
180
1
10
10 2
SUPER – PERIOD NUMBER
CH3
Coupling
DC
BW Limit
200MHz
Volts/Div
Coarse
SAVE
PRINT

MICE Detectors



Italy

TOF System

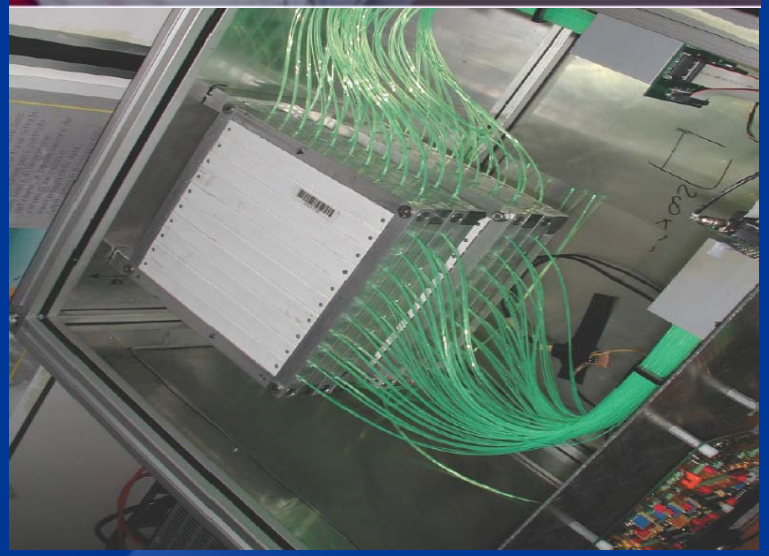


- PMT assemblies show an increasing rate of failure under heavy testing.
- 8 tubes returned to Hamamatsu.
- Expected delivery at RAL in early May.

Italy

KL, SW Calorimeters

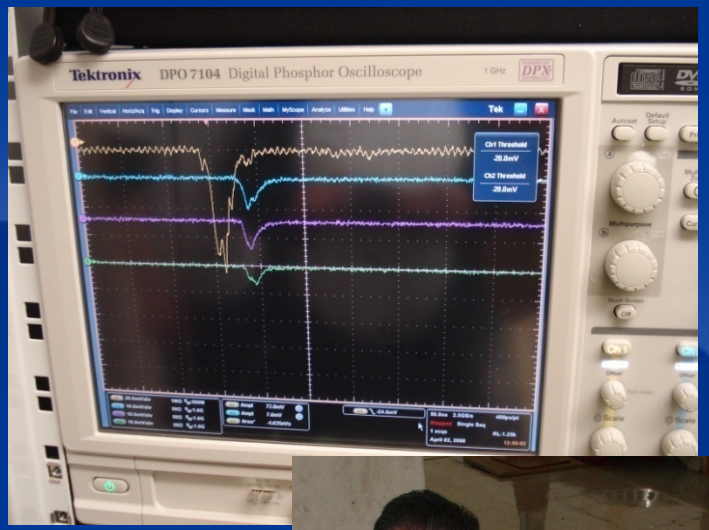
- Tests and calibrations of the KL are ongoing.
- Trigger counters with magnetic shielding have been built.
- Test and calibration runs of the KL have begun.
- Construction & testing of SW prototype successful.



USA

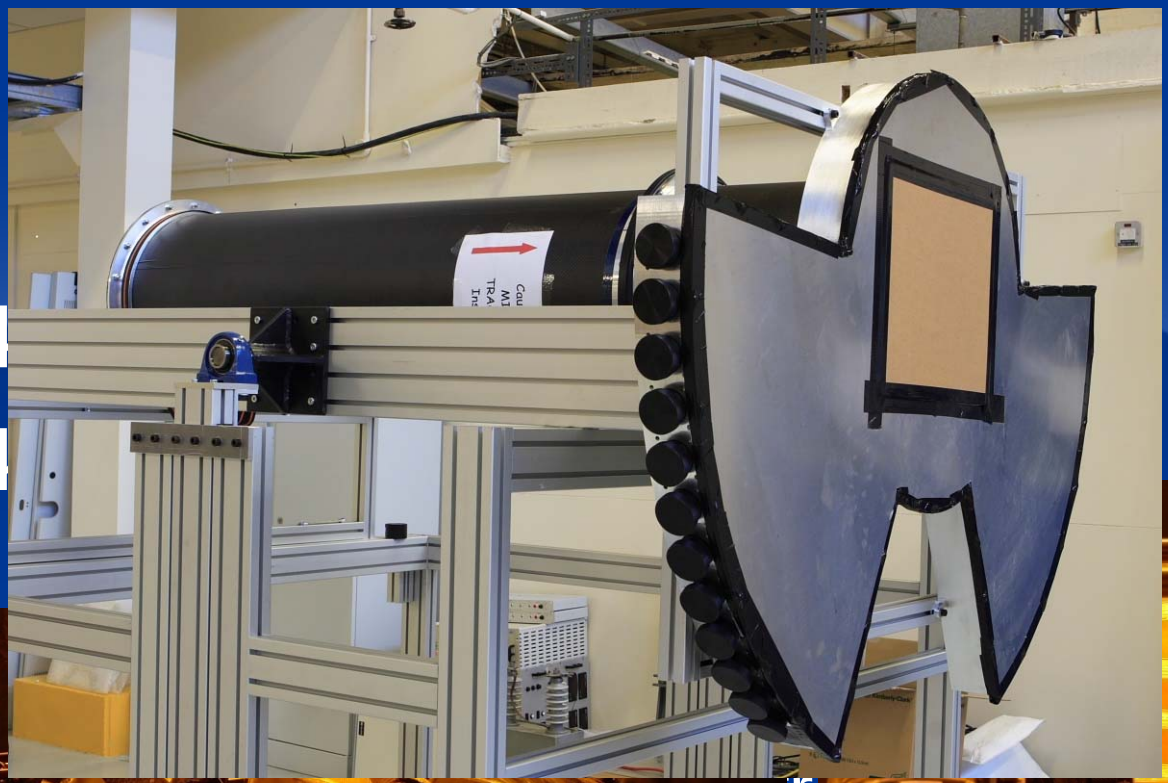
CKOV

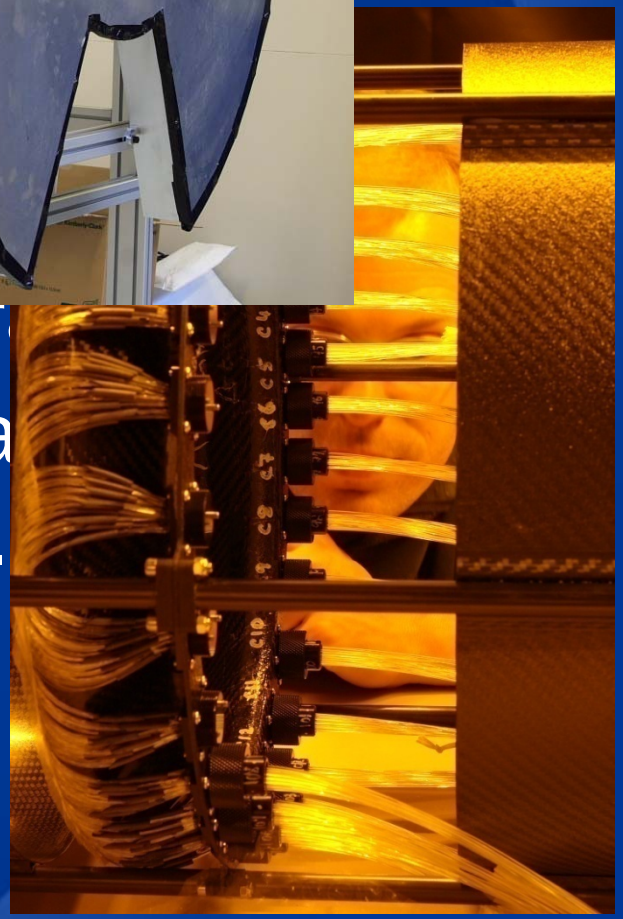
- Both CKOV detectors have been installed at RAL.
- First pion signals were observed in the past week.



US, UK, Japan

- Tracl
- Tracl
  - All



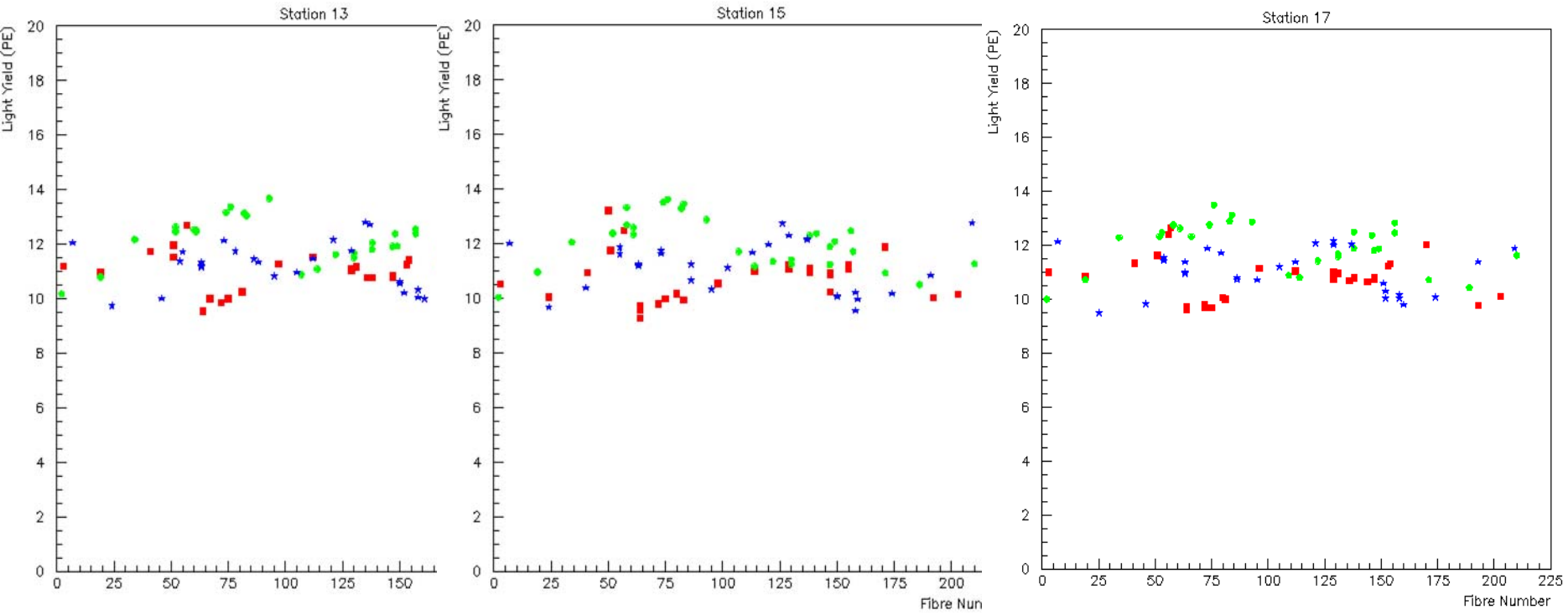


Software

- G4MICE (MICE Simulation, Reconstruction and Analysis software) continues to be developed and is now also used for MANX studies.
- MICE now has a Virtual Organisation on the GRID.
- Tracker Station QA data analysis was performed on the GRID.
- Monte Carlo studies are ongoing.

TrackerQA Analysis

- Data from 12 Stations (6-17) analysed.
- Total of 12,389,135 events processed.
- 167 of 173 files transferred (6 failures



Funding Agencies Committee

- MICE spokesperson and project manager.
- ISIS Director
- Representatives of each funding agency.
- Terms of reference:
  - Receive reports from MICE Project Board and monitor progress of international MICE project.
  - Receive and review reports from each funding nation on contributions to the overall project.
  - Consider cost and schedule issues for the project.
  - Monitor risk and approve contingency.
  - Review and endorse management structure.
  - Prepare the funding and financial aspects of the international project for phase 2.
  - Agree the annual budgets, future profile and schedule.
- Next meeting: 11th April

UK Funding Situation

- STFC funding short fall of £80M announced at the end of 2007.
- Given permission to negotiate the coil contract.
- The target date for letting contract is 11th April.
- This is a bit optimistic, but should still be possible in April.
- Consequence is step IV is late compared with the previous schedule.
- UKNF has been asked to present a 3 year plan with budget guidance.
- This is very good news – we can make a plan not just stumble through another financial year.

ISIS User Runs

- To date we have been operating the target during machine development periods.
- We have demonstrated the ability to run parasitically (the normal mode of operation for MICE).
- Once ISIS/RPA are convinced of the radiation and operational safety, MICE will be able to operate during ISIS user runs.
- It may be necessary for ISIS to cancel one user run. With warning it may be possible for us to mitigate the effect on the schedule.

Conclusions - Status

- Step I of MICE has started!
- Both dipoles have been powered and particles observed by beam line instrumentation and the CKOV detectors.
- Need to successfully operate the second target, install TOF0 and TOF1 and KL and to complete the false floor and iron shield in order to complete stage 1.

Conclusions – Planning

- Step two should occur in the September-October run after the spectrometer magnet arrives (August).
- Step three should occur late 2008 or early 2009.
- Focus pair order has been agreed, with first delivery expected in October 2009.
- Coupling coils and RF cavities are consistent with this.