MICE OVERVIEW

MICE web site http://mice.iit.edu

MICE news: http://mice.iit.edu/news/weeklydigest.html

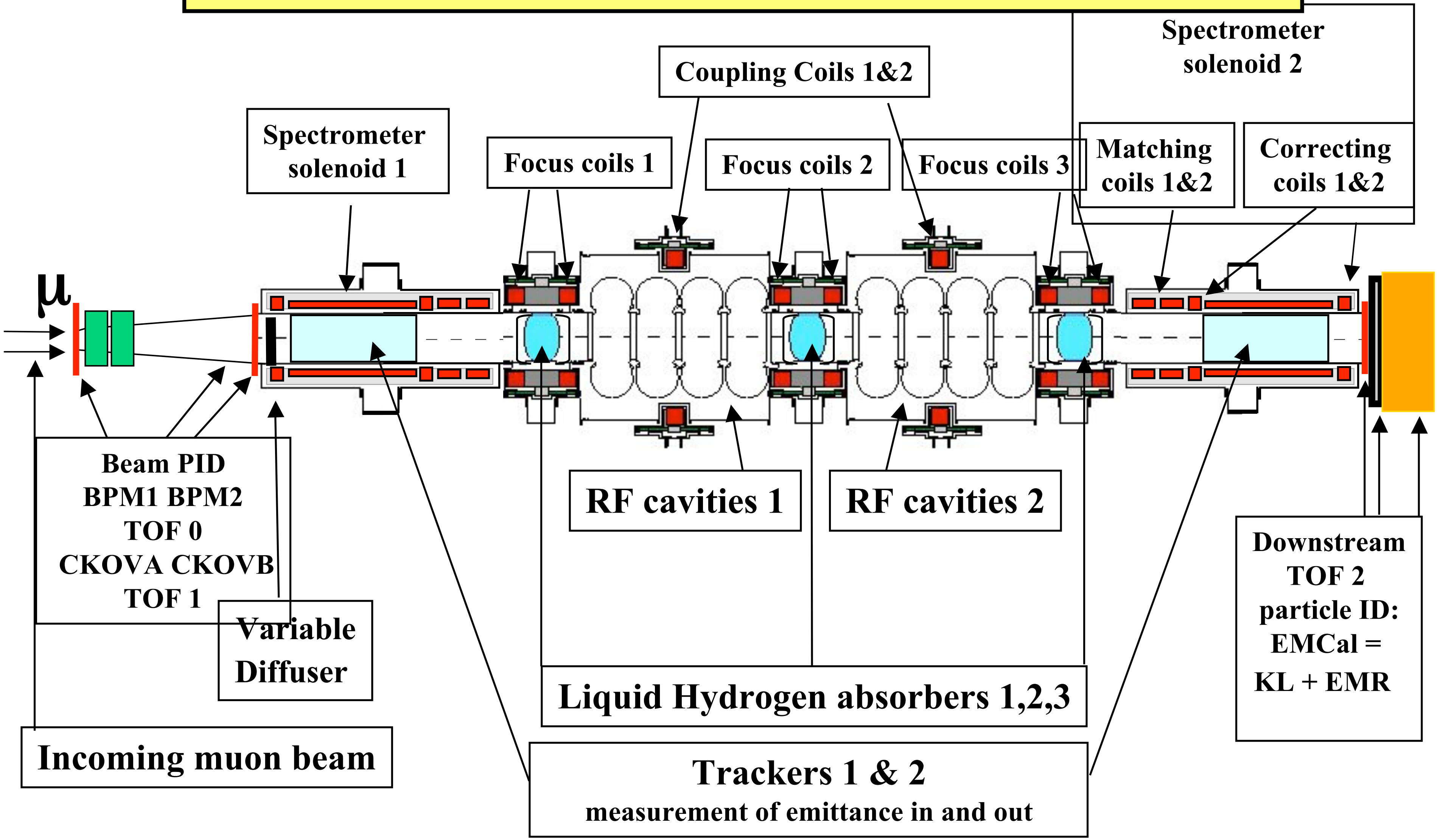
MICE webcam: http://mice.iit.edu/mico/webcams/

MICE note 230 and MICE collaboration meetings

single particle measurements =>

measurement precision can be as good as $\Delta(\varepsilon_{out}/\varepsilon_{in}) = 10^{-3}$

never done before



THE MICE COLLABORATION -128 collaborators-

Some new since last year

University of Sofia, Bulgaria

The Harbin Institute for Super Conducting Technologies PR China

INFN Milano, INFN Napoli, INFN Pavia, INFN Roma III, INFN Trieste, Italy

KEK, Kyoto University, Osaka University, Japan

NIKHEF, The Netherlands

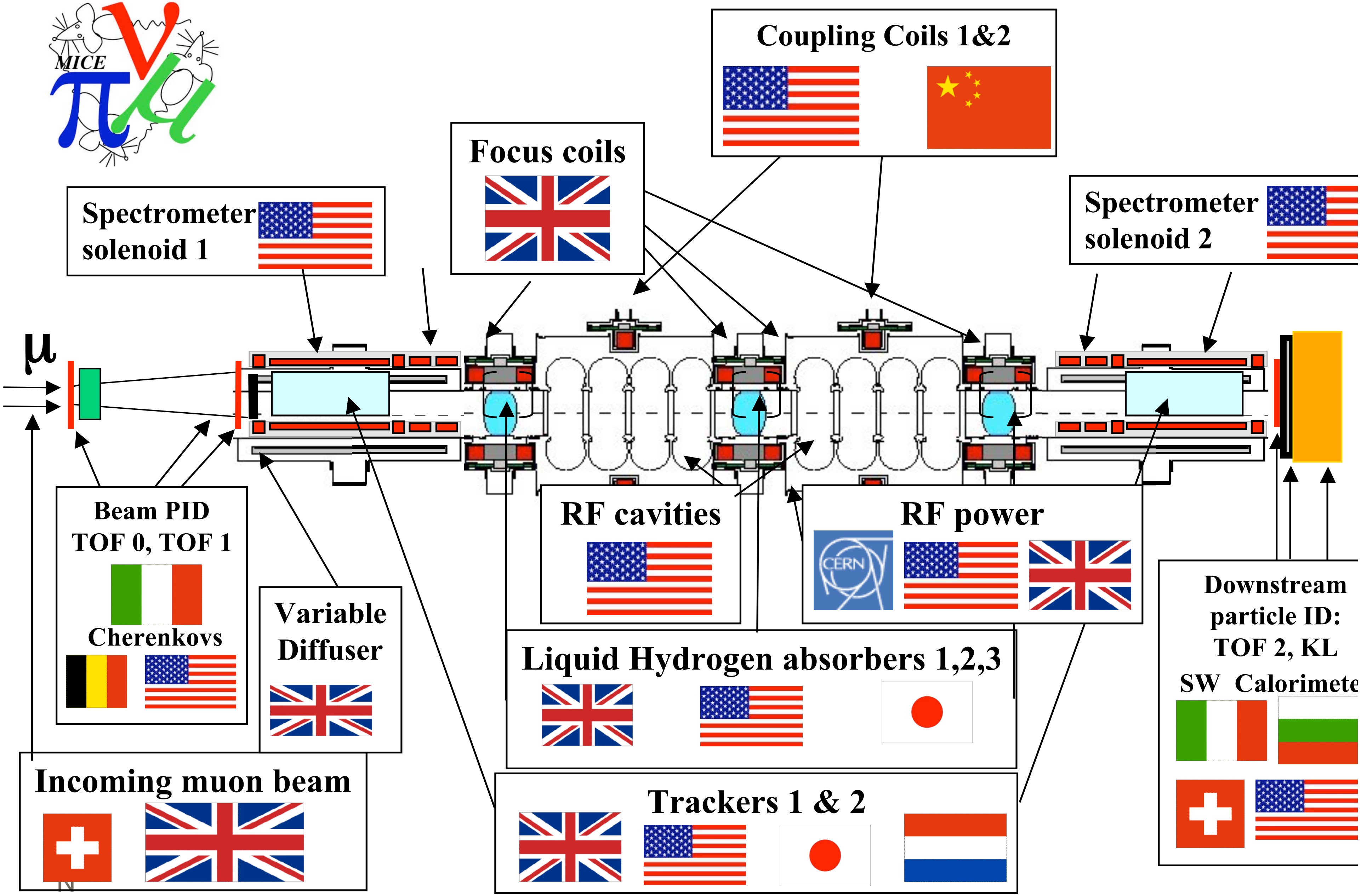
CERN

Geneva University, Paul Scherrer Institut Switzerland

Brunel, Cockcroft/Lancaster, Glasgow, Liverpool, ICL London, Oxford, Darsbury, RAL, Sheffield, Warwick UK

Argonne National Laboratory, Brookhaven National Laboratory, Fairfield University,
University of Chicago, Enrico Fermi Institute, Fermilab, Illinois Institute of Technology,
Jefferson Lab, Lawrence Berkeley National Laboratory, UCLA, Northern Illinois University,
University of Iowa, University of Mississippi, UC Riverside,
University of Illinois at Urbana-Champaign, Muons Inc. USA

MICE Collaboration across the planet



Challenges of MICE:

(these things have never been done before)

1. Operate RF cavities of relatively low frequency (201 MHz) at high gradient (nominal 8MV/m in MICE, 16 MV/m with 8 MW and LN2 cooled RF cavities) in highly inhomogeneous magnetic fields (1-3 T)
   dark currents (can heat up LH_2), breakdowns

2. Hydrogen safety (substantial amounts of LH_2 in vicinity of RF cavities)

3. Emittance measurement to relative precision of 10^{-3} in environment of RF bkg requires
   >> low mass (low multiple scattering) and precise tracker
   >> fast and redundant to fight dark-current-induced background
   >> precision Time-of-Flight for particle phase determination ($\pm 3.6^0$ = 50 ps)
   >> complete set of PID detectors to eliminate beam pions and decay electrons

and…

4. Obtaining (substantial) funding for R&D towards a facility that is not (yet) in the plans of a major lab

Emittance measurement

Each spectrometer measures 6 parameters per particle

$x \quad y \quad t$

$x' = dx/dz = P_x/P_z \quad y' = dy/dz = P_y/P_z \quad t' = dt/dz = E/P_z$

Determines, for an ensemble (sample) of N particles, the moments:

Averages $\langle x \rangle$ $\langle y \rangle$ etc...

Second moments: variance(x) $\sigma_x^2 = \langle x^2 - \langle x \rangle^2 \rangle$ etc...

covariance(x) $\sigma_{xy} = \langle x.y - \langle x \rangle \langle y \rangle \rangle$

Covariance matrix

$$M = \begin{pmatrix} \sigma_x^2 & \sigma_{xy} & \sigma_{xt} & \sigma_{xx'} & \sigma_{xy'} & \sigma_{xt'} \\ \cdots & \sigma_y^2 & \cdots & \cdots & \cdots & \sigma_{yt'} \\ \cdots & \cdots & \sigma_t^2 & \cdots & \cdots & \sigma_{tt'} \\ \cdots & \cdots & \cdots & \sigma_{x'}^2 & \cdots & \sigma_{x't'} \\ \cdots & \cdots & \cdots & \cdots & \sigma_{y'}^2 & \sigma_{y't'} \\ \cdots & \cdots & \cdots & \cdots & \cdots & \sigma_{t'}^2 \end{pmatrix}$$

Getting at e.g. $\sigma_{x't'}$ is essentially impossible with multiparticle bunch measurements

Evaluate emittance with:

$$\varepsilon^{6D} = \sqrt{\det(M_{xytx'y't'})}$$

$$\varepsilon^{4D} = \sqrt{\det(M_{xyx'y'})} = \varepsilon_\perp^2$$

Compare ε^{in} with ε^{out}

Requirements on detectors for MICE:

1. Must be sure to work on muons
   - 1.a use a pion/muon decay channel with 5T, 5m long decay solenoid
   - 1.b reject incoming pions and electrons
     - TOF over 6m with 70 ps resolution+ threshold Cherenkov
   - 1.c reject decays in flight of muons
     - downstream PID (TOF2 + calorimeter set up)

2. Measure all 6 parameters of the muons x,y,t, x', y', β_z=E/Pz
   tracker in magnetic field, TOF

3. Resolution on above quantities must be better than 10% of rms of beam at equilibrium emittance to ensure correction is less than 1%.
   + resolution must be measured

4. Detectors must be robust against RF radiation and field emission

Design of MICE detectors and beam test results have satisfied the above requirements

NB: Although MICE does not perform longitudinal cooling, the MICE detectors are designed to measure 6D emittance

OUTLINE

Globally MICE is doing very well, progress is visible everywhere

++ Hall infrastructure, detectors, beam commissioning
++ Phase II construction started

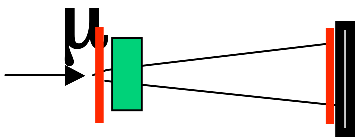
BUT:

Technical issues: (develop as the project goes!)
-- Decay solenoid
-- Target
-- spectrometer solenoid

Scientific issues
-- electron emission by RF cavities in magnetic field

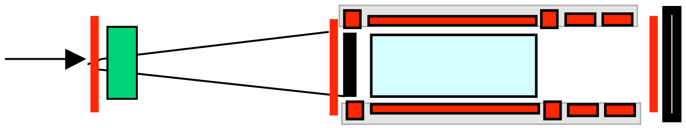
Funding issues
-- Electron Muon Ranger (EMR, former "sandwich" or SW) funding at INFN
-- PHASE II manpower for RF infrastructure
-- STEP VI is not funded in UK
-- Scientific Manpower (especially accelerator physicists) is on the short side

MICE ASPIRATIONAL SCHEDULE



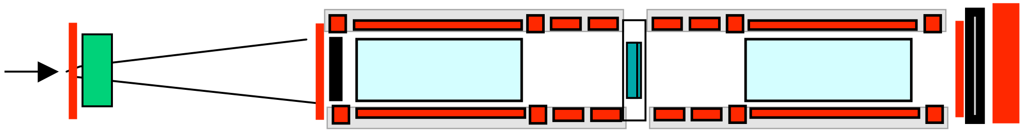
STEP I

Repair DKsol Q1 09
Run May09



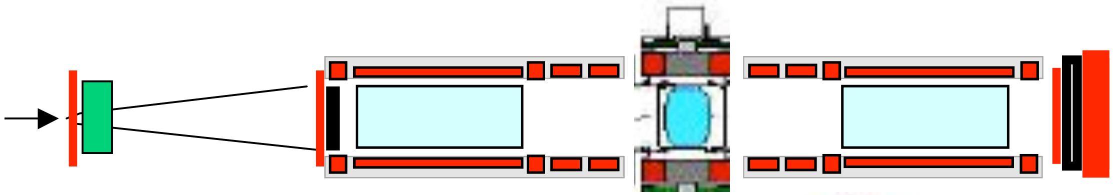
STEP II

Deliv SSI Apr09
Run July09



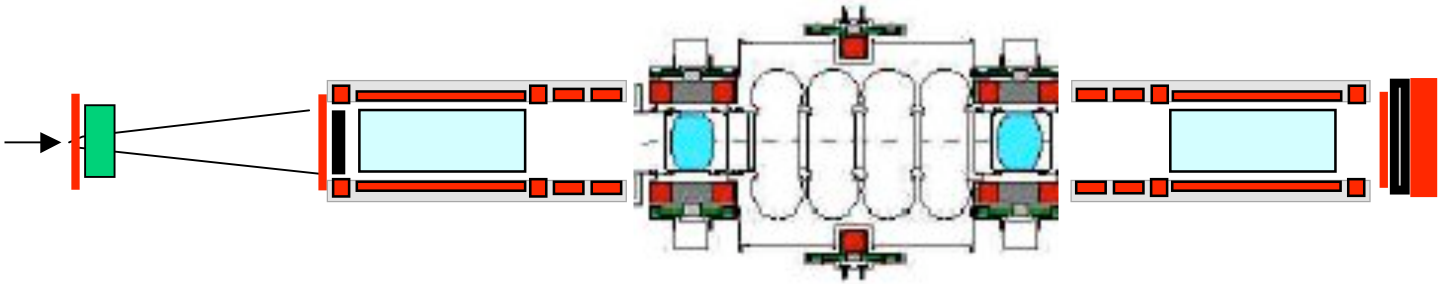
STEP III/III.1

Deliv SSII Aug09
Run Dec09



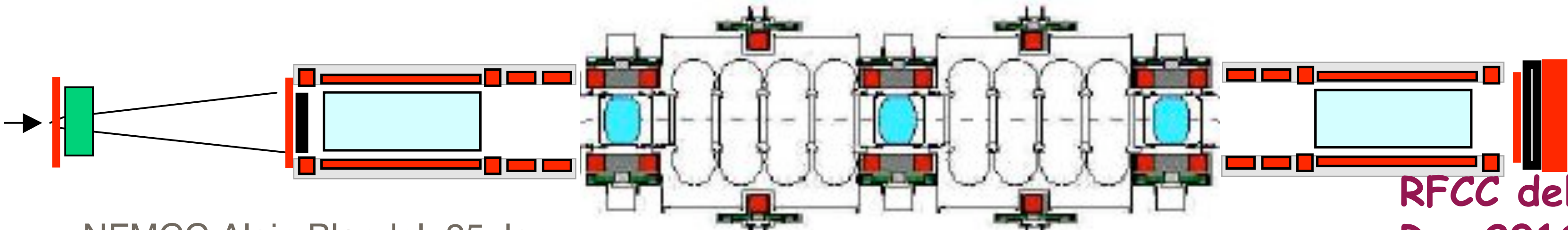
STEP IV

Deliv FCI Jan10
Run Spring 2010



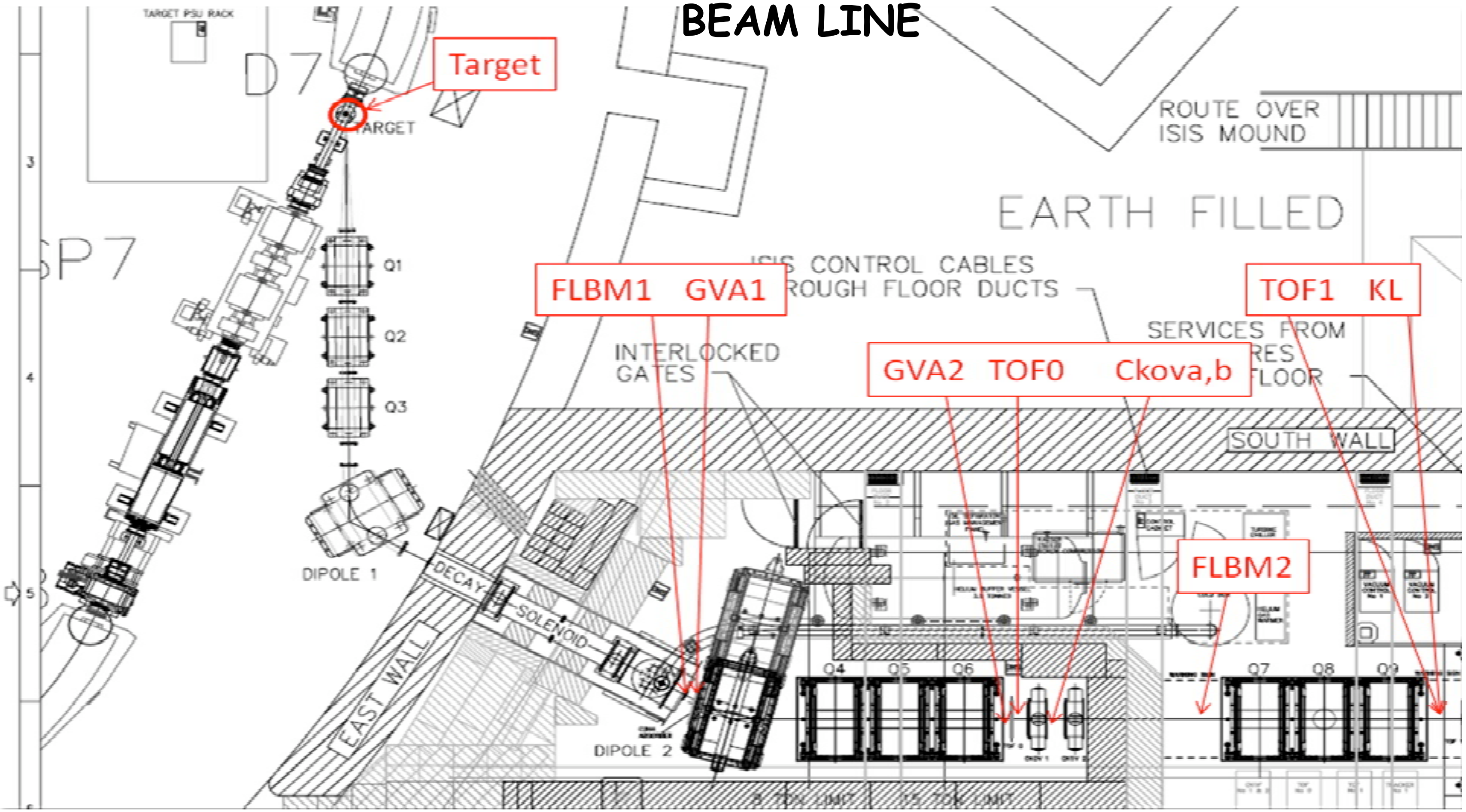
STEP V

RFCCI deliv Apr10
Run Sep10

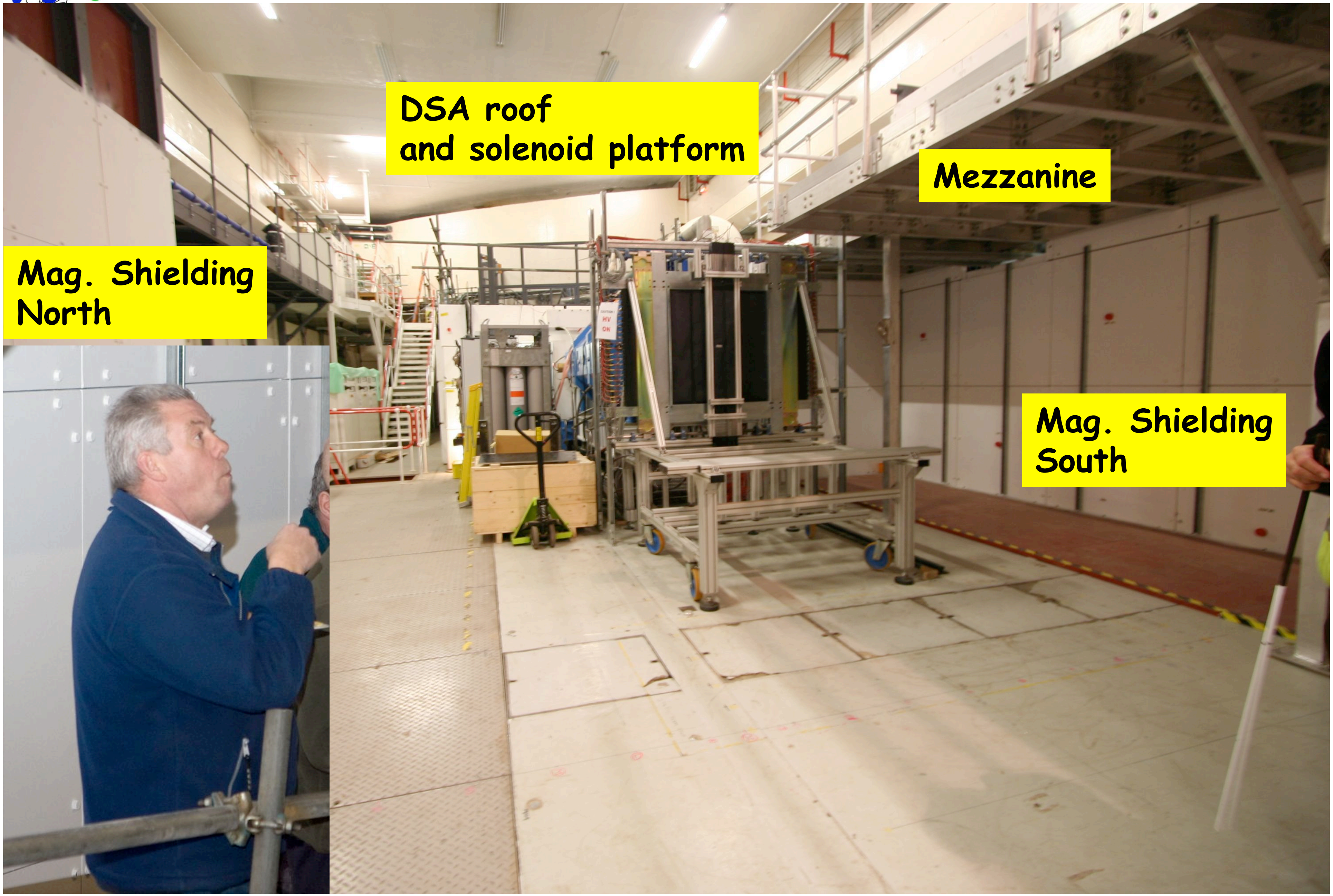


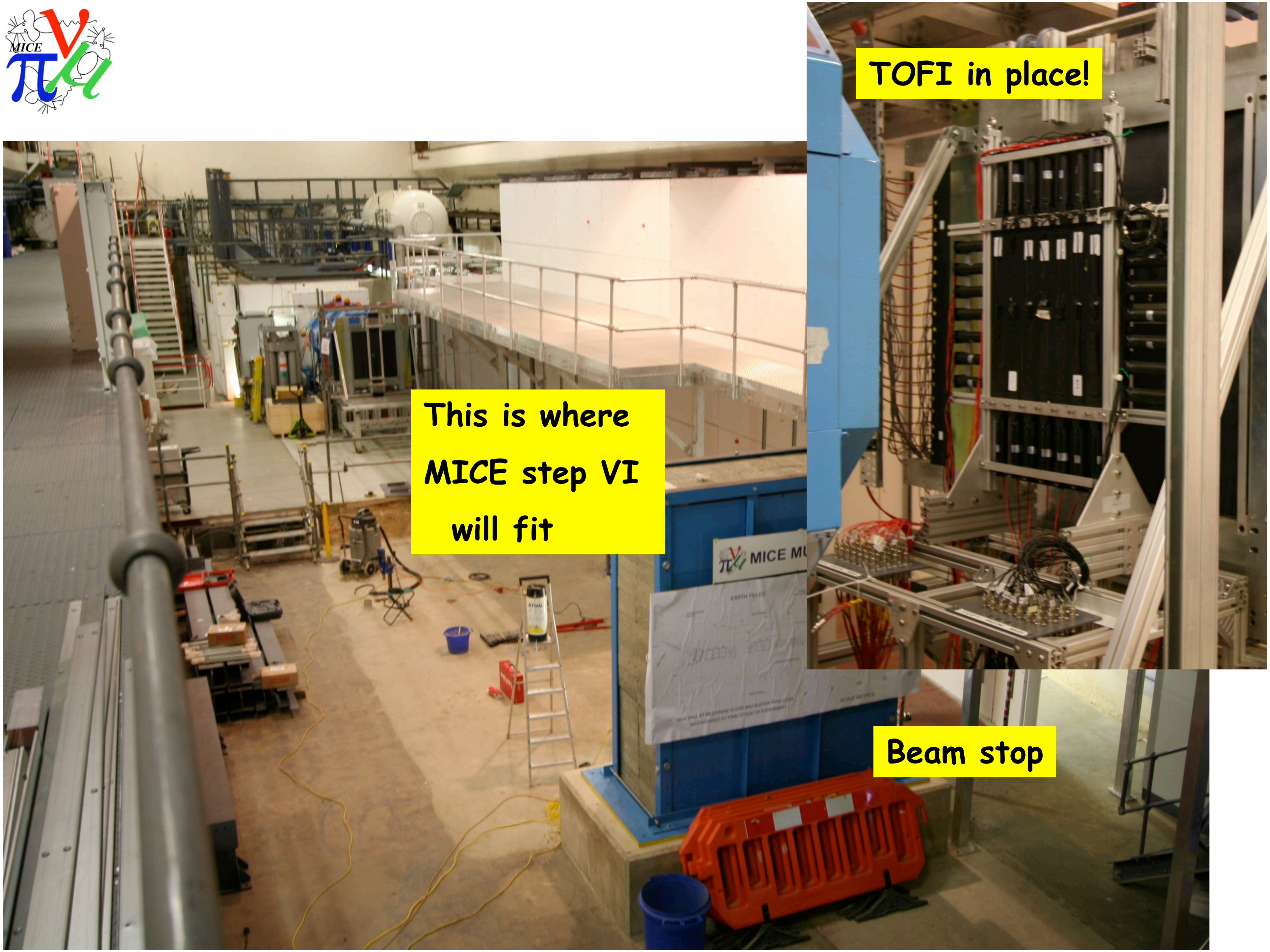
STEP VI

RFCC deliv Q4 2010
Run 2011

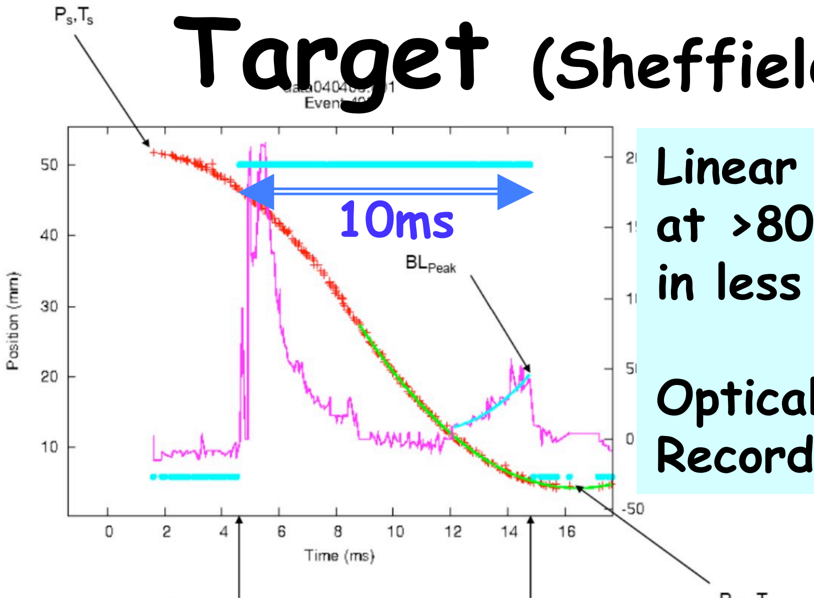

BEAM LINE
Target
TARGET
D7
SP7
Q1
Q2
Q3
DIPOLE 1
DECAY SOLENOID
EAST WALL
DIPOLE 2
FLBM1 GVA1
INTERLOCKED GATES
ROUTE OVER ISIS MOUND
EARTH FILLED
ISIS CONTROL CABLES ROUGH FLOOR DUCTS
SERVICES FROM RES FLOOR
TOF1 KL
GVA2 TOF0 Ckova,b
SOUTH WALL
FLBM2
Q4
Q5
Q6
Q7
Q8
Q9

Huge progress in the hall !



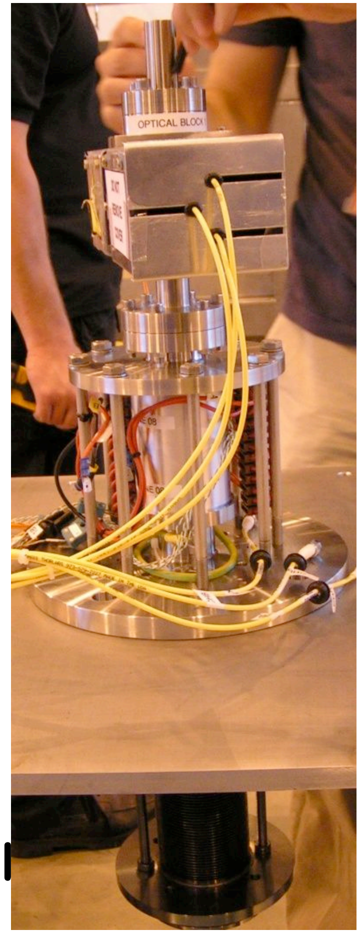

TOFI in place!
This is where MICE step VI will fit
Beam stop

Target (Sheffield/RAL)



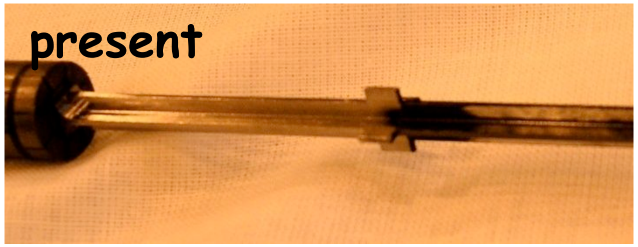
Linear motor sends target in beam at >80g into beam and back in less than 30ms.

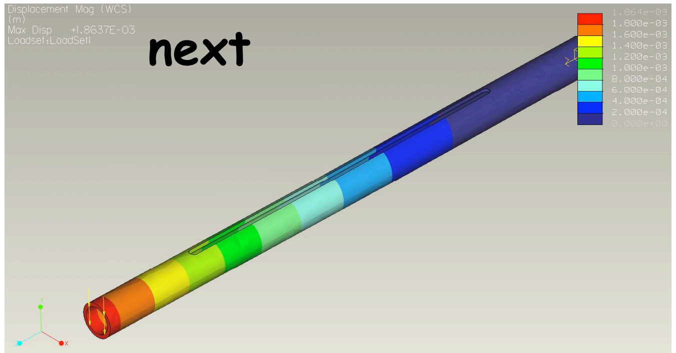
Optical measurement of position;
Record of ISIS beamloss monitors



Target0 installed in Xmas07; operated very well in 2008
Spare target1 failed in Jul08 after 350k pulses.
Target0 failed on 19Dec08 after 179K pulses.

Improved design worked out for two new targets
(cylindrical and lighter shaft) To be tested/ready in March-April

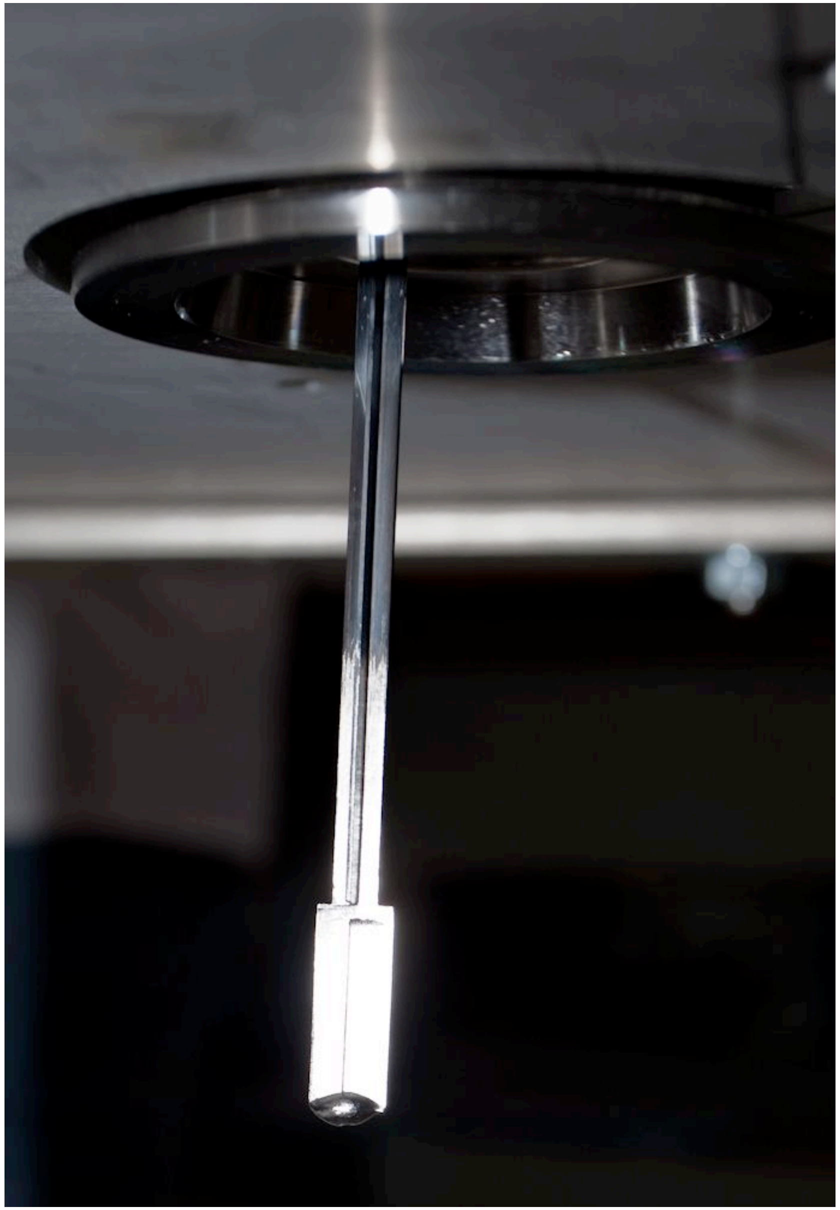




In memoriam of the 2008 target which allowed us to do so much!

Postmortem diagnostic is ongoing.

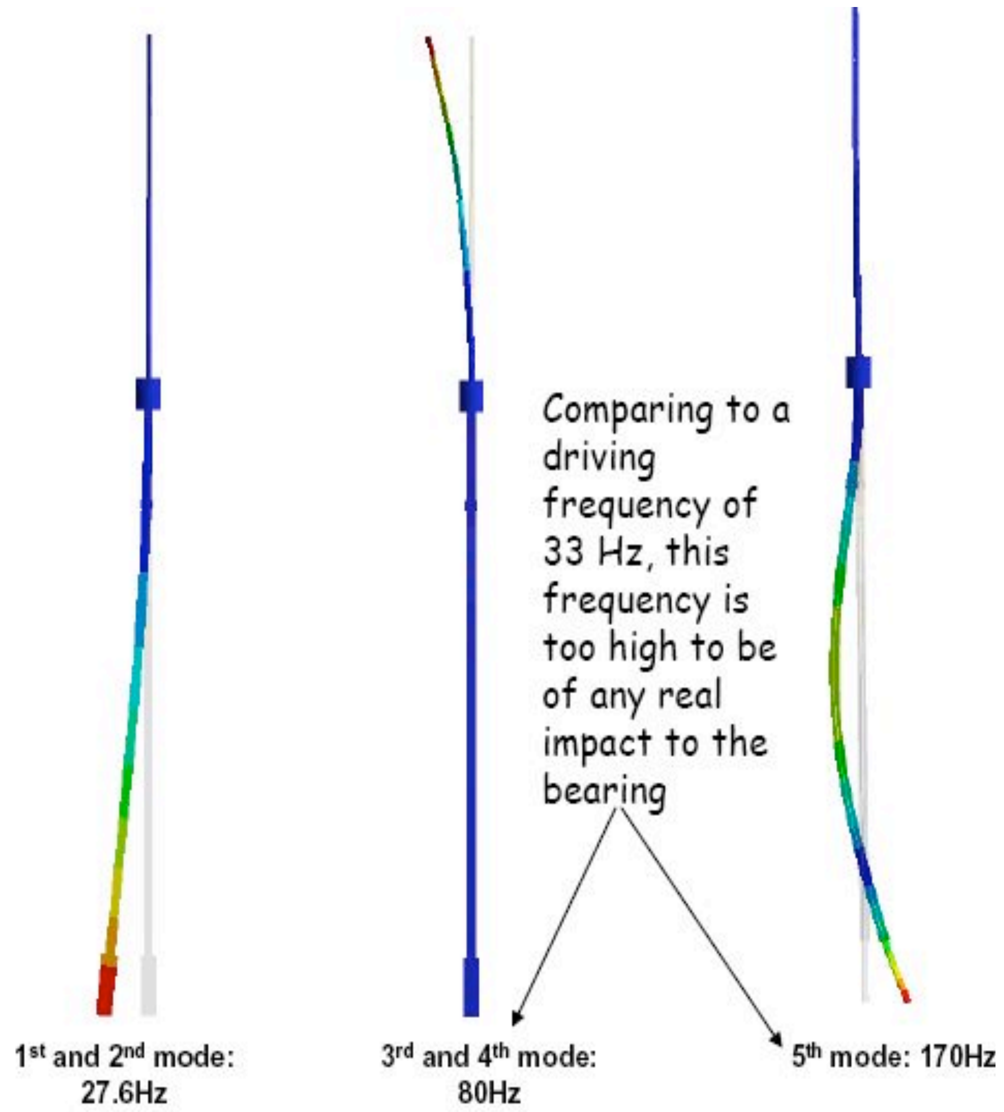
The tip was melted and the axis bent!
Different pattern of failure than for the offline target:
-- no particular wear of the bearings
-- a steel collar seems to have broken loose (the next design does not have this)
-- still puzzled as to why target melted ; the next design will try to include monitoring of temp of tip.



Dynamic distortion of shaft

Distortion of shaft ?

- Stephanie Yang/
  Wing Lau modelled behaviour under acceleration.
- ~30 Hz mode found (c.f. 30 ms acceleration period in operation.
- High speed camera data also shows "wagging" motion at similar frequency.
- (No evidence from camera that Sheffield shock-absorbing mounting is significant.)



Surface coating problems

Poor Diamond-Like Carbon (DLC) coatings ?

Sheffield & RAL team visited coating company (TecVac), who had examined failed parts.

Likelihood of adhesive failure due to presence of cleaning or polishing materials, or oxidation due to wire erosion of bearings.

Sharp edges give electropotential leading to uneven coatings.

Surface quality pre-coating was also probably inadequate. (Recommend 0.1 to 0.02 Ra compared with current 1.6 Ra.)

Adequate surface finish difficult to achieve with present machined cruciform shaft.

New Mechanical Design

Jason Tarrant producing revised mechanical design.

More rigid stator assembly.

New flanges with bearings machined in situ.

- Improved alignment, reduced tolerances.

Radically different shaft design to improve rigidity, ease of construction, surface finish.

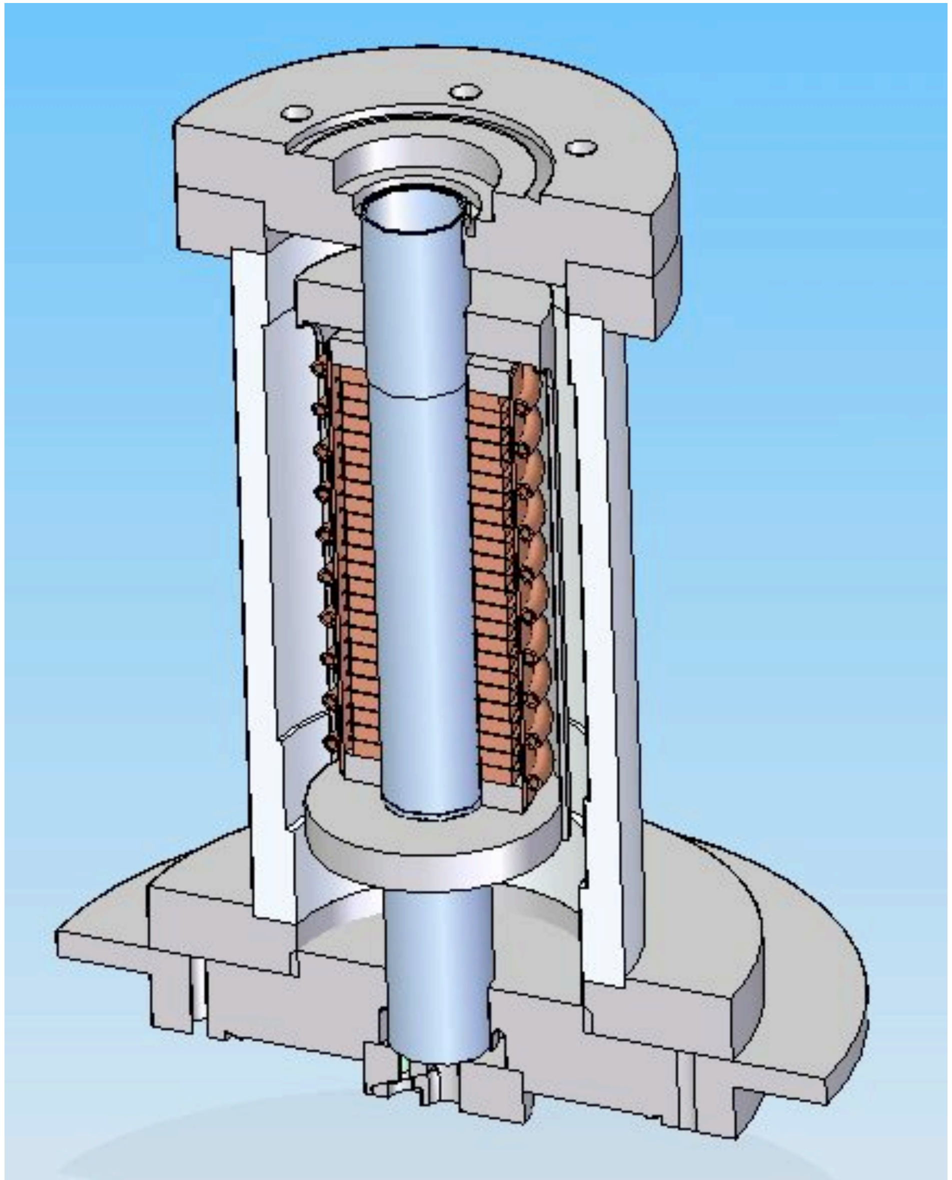
- Tubular lower section (not cruciform)
- ~ same mass/length as at present
- Flat on upper cylindrical section, with anti-rotation piece on bearing.

Shorter shaft by reducing flange; revised bearing positions.

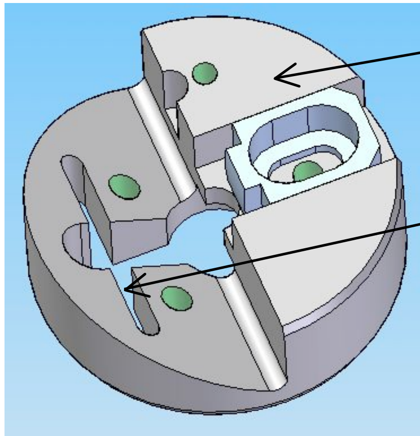
In first instance, Titanium tube will be dipped directly in beam.

Future improvements can be implemented: a target head of specific shape (flat parallel or perpendicular to beam,or ball shaped) or material (Berylium/Carbon) can be fitted to the end of the tube

Revised stator body

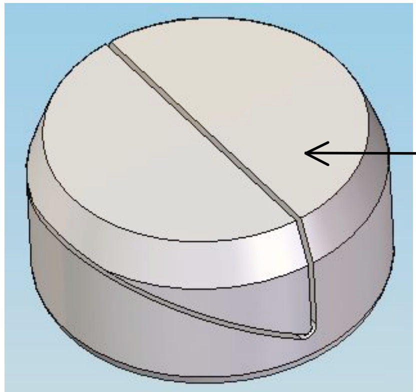


Upper Bearing Design



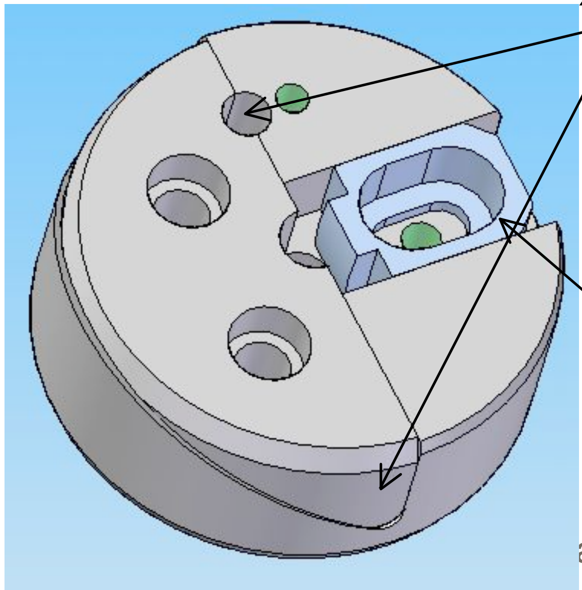
Single piece main body

Clearance for vane (potential risk if adding vane later otherwise simpler bearing)



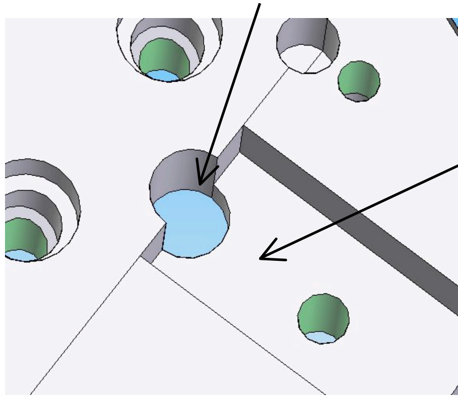
Wire cut from single piece for accurate wedge fit

Wedge & dowel for full x,y,z location of clamp



Anti rotation Feature (rounded or flat bearing face options)

Full bearing merges into section for anti-rotation



M/C with block in place to prevent tool wander

Conclusions of Target Workshop 8Jan09

Timescale very tight.

Drawing up documents for review.

Key materials (Ti tube) should be ordered now.

Baseline target is continued 6 mm tube

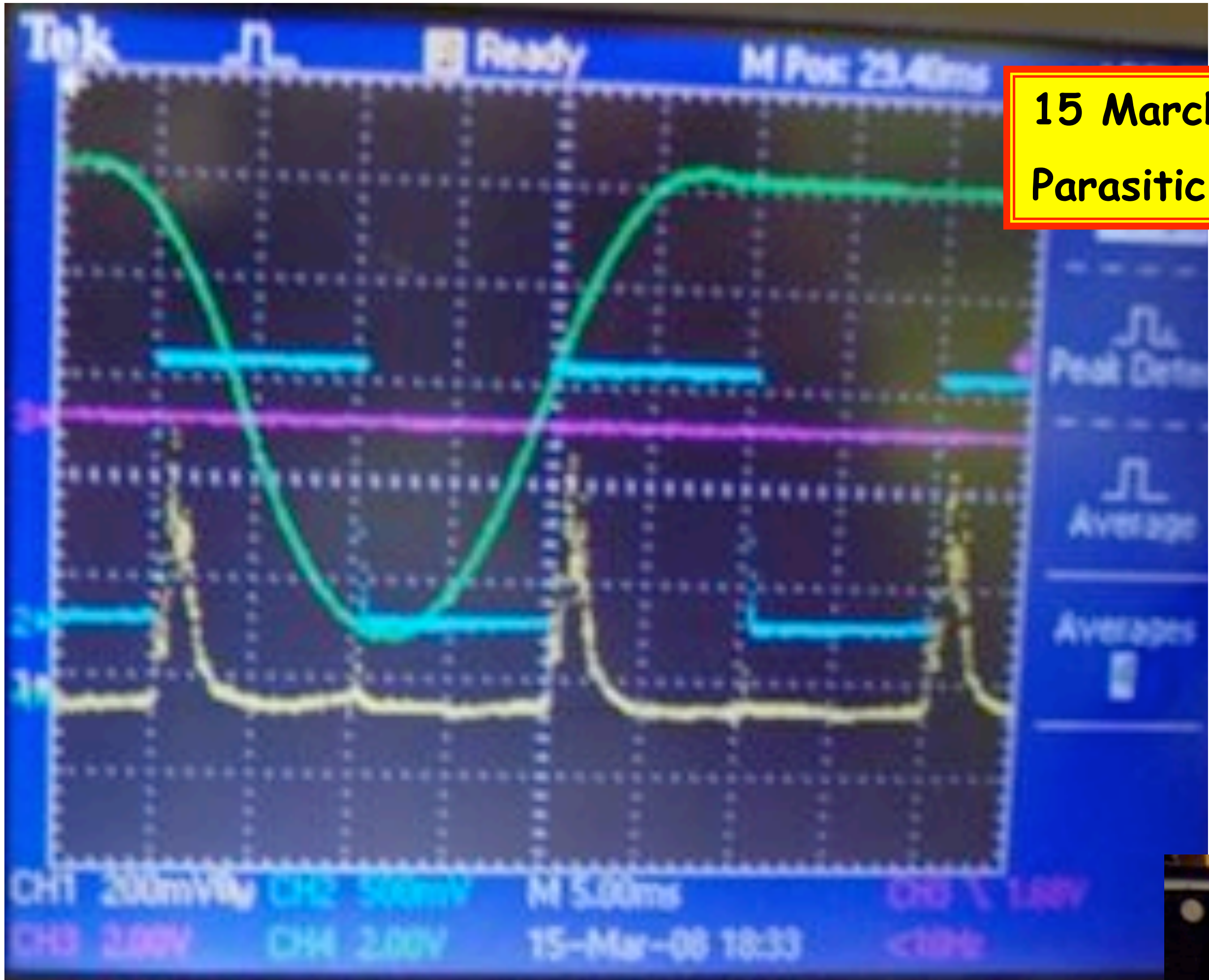
- Other geometries/materials may have particle production advantages
- Must not delay installation of next target

Baseline coating is DLC

- Other coatings (HIPIMS, WS_2, WS_2 over DLC) may have advantages.
- Investigation will be left for subsequent targets.

Informally, ISIS representatives are happy with design.

Must have two drives ready for Demonstrator and installation in ISIS during April shutdown.



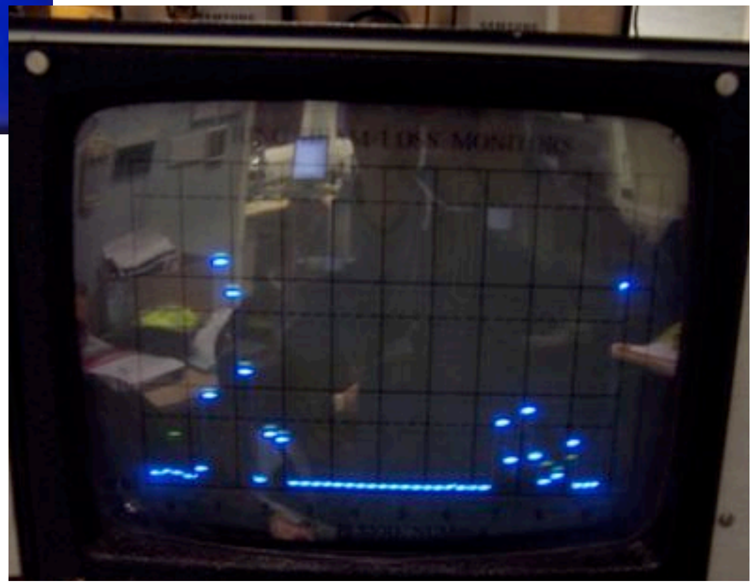
15 March 2008

Parasitic target operation demonstrated

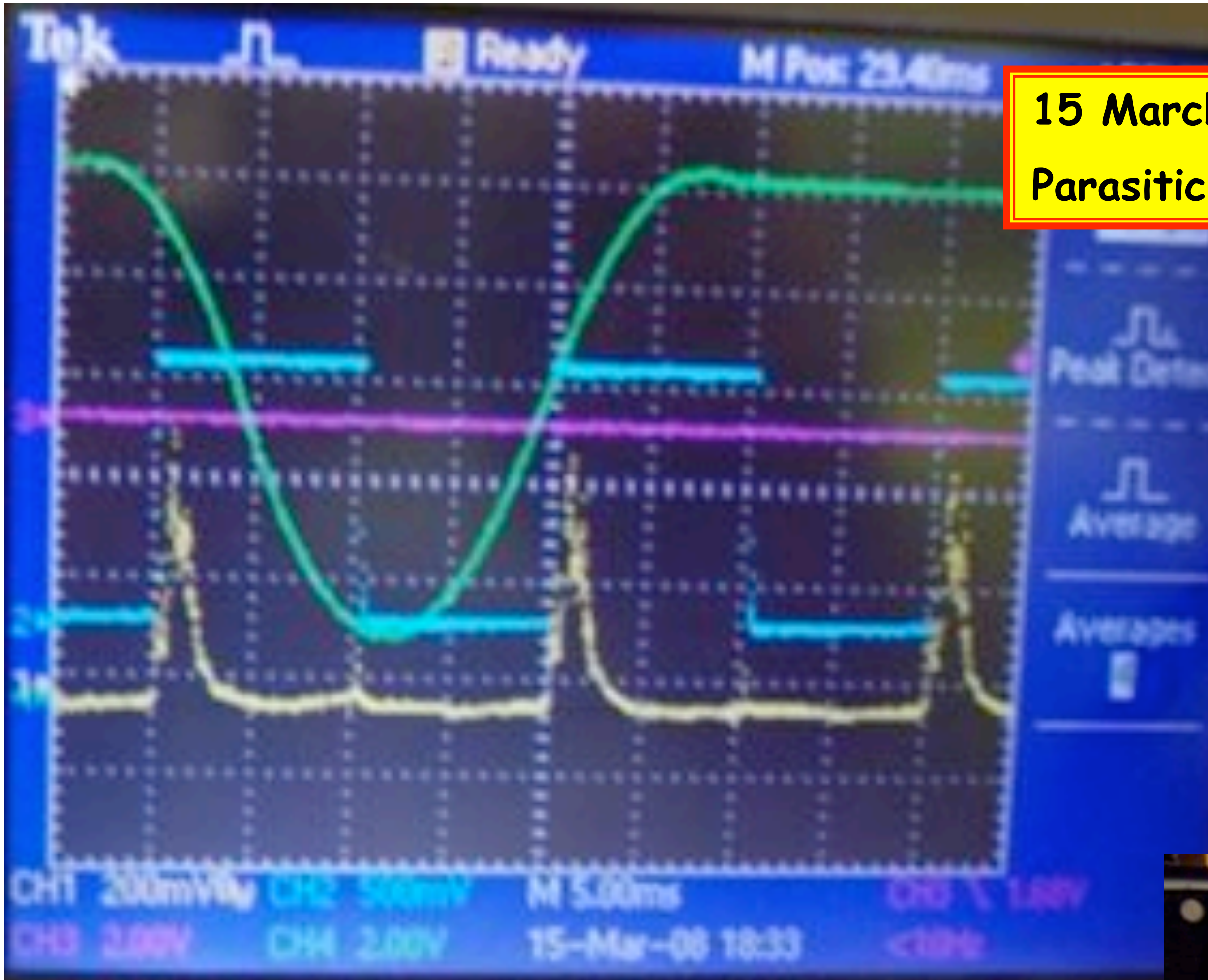
Beam current

Target dip

Beam loss monitor



Able to operate ISIS at 50 Hz
and target at 50/64 Hz
with beam loss visible but OK
without scraping next spill



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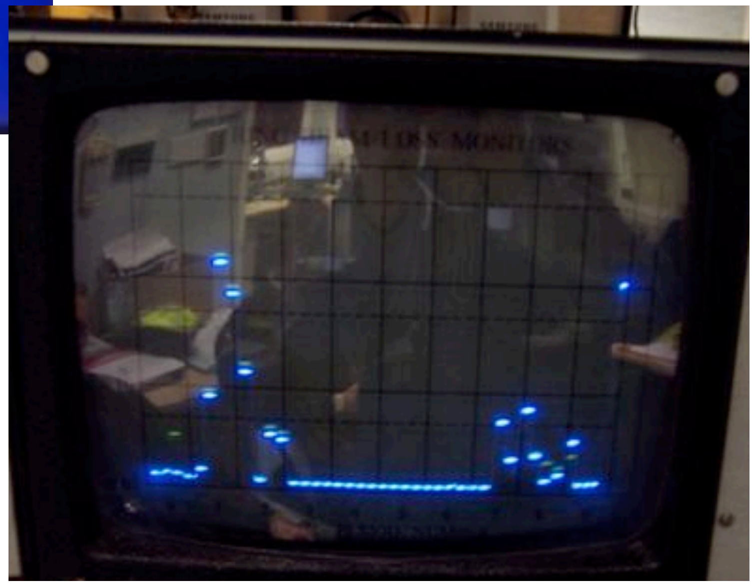
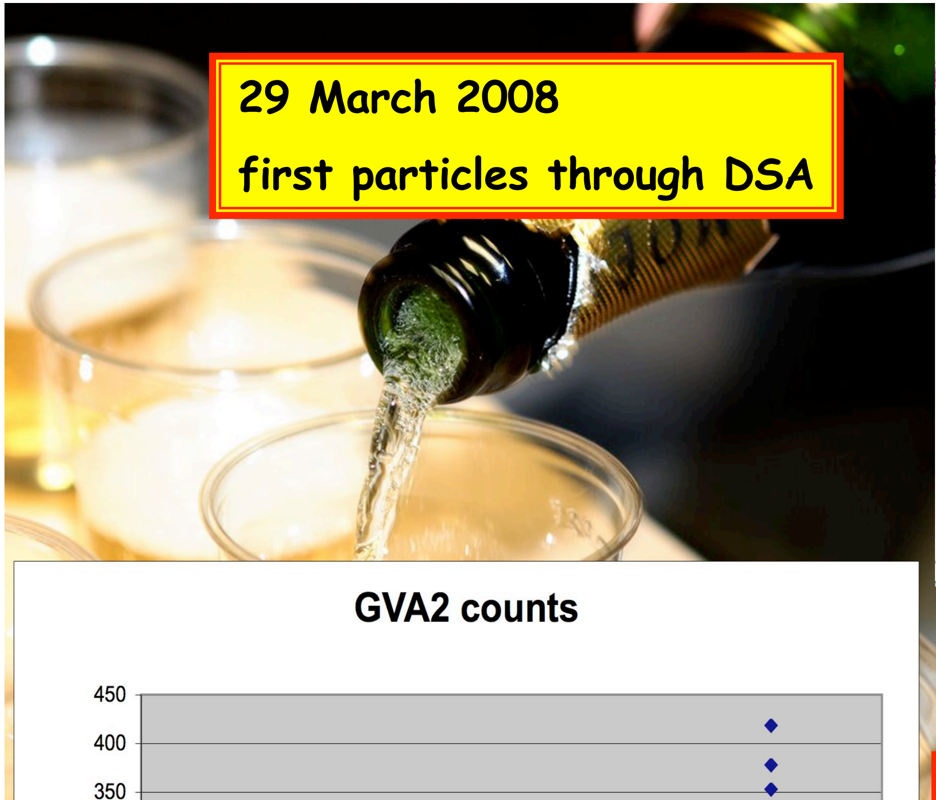
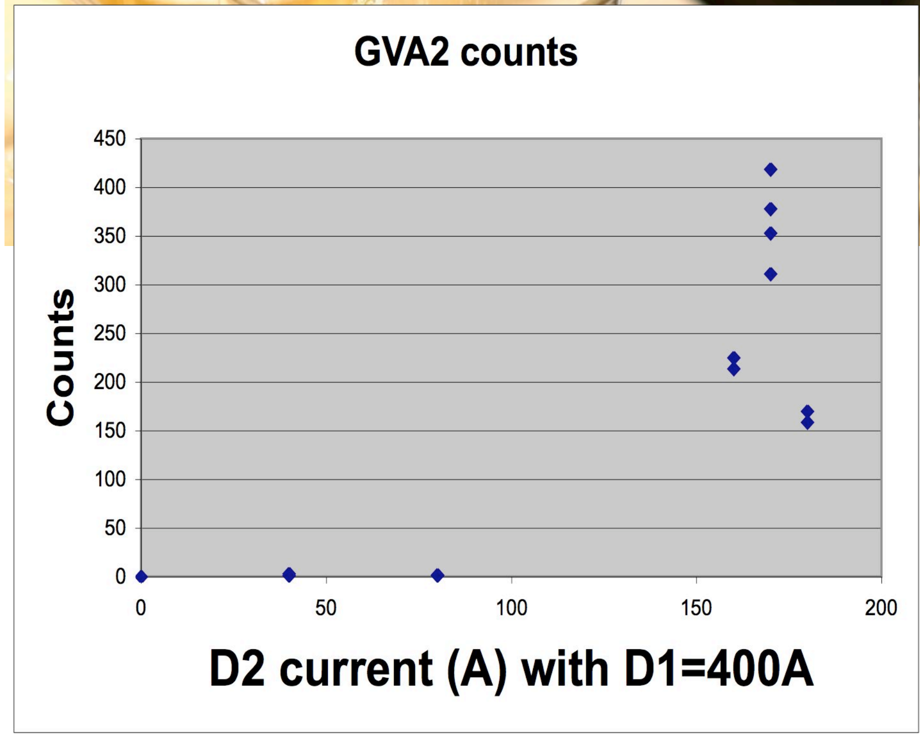


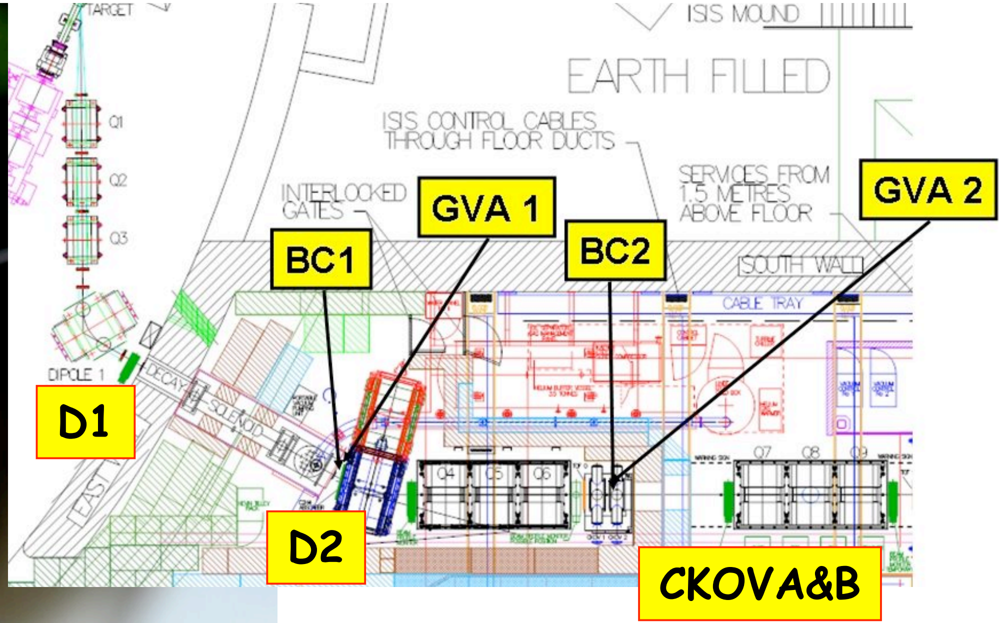
Able to operate ISIS at 50 Hz
and target at 50/64 Hz
with beam loss visible but OK
without scraping next spill

29 March 2008

first particles through DSA







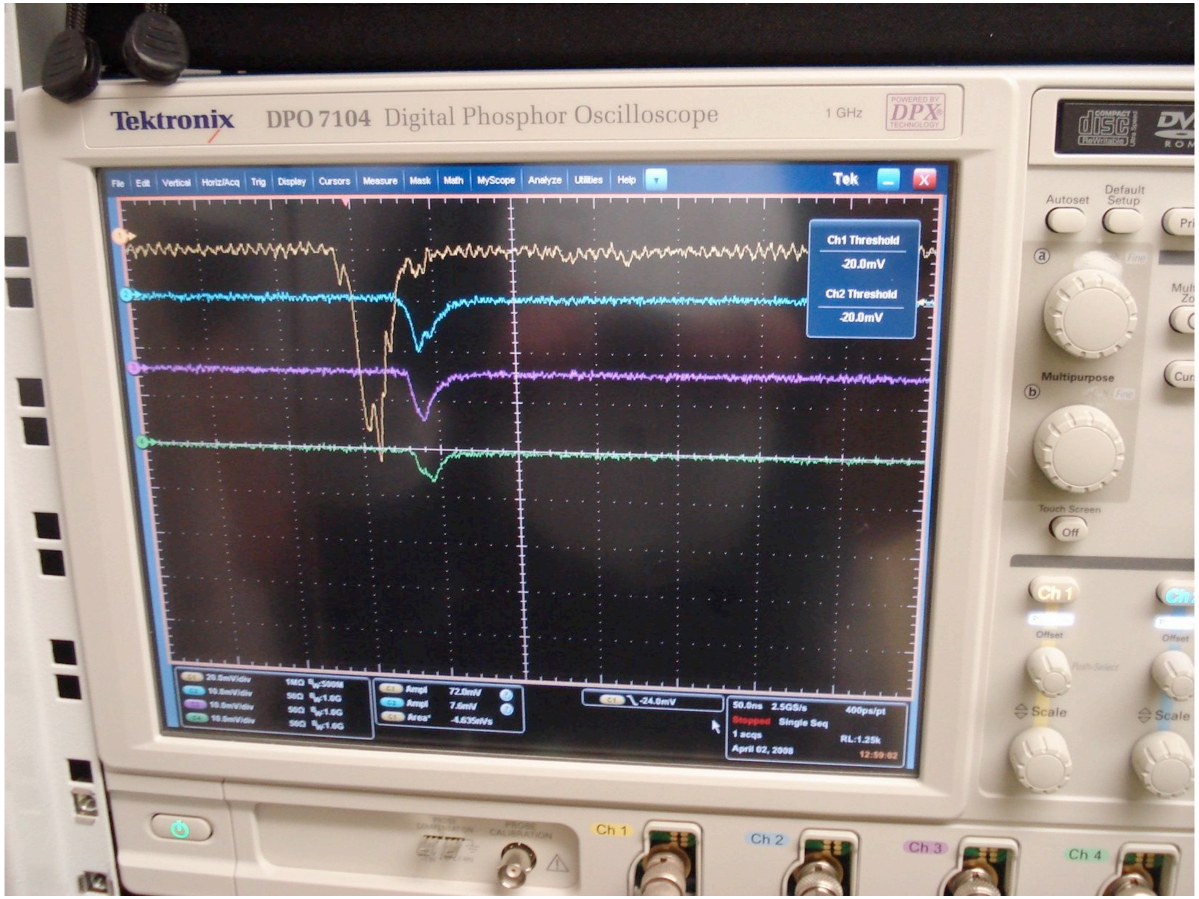
Beam line with D1 D2 powered only
Target activated at 50 mV beam loss
D1 set to 480 MeV/c
Scan D2 and measure rate in GVA2 counter.
35 particles per spill
infer 2 10^9 protons on target
(want 1.7 10^12 out of 2 10^13 in ISIS)

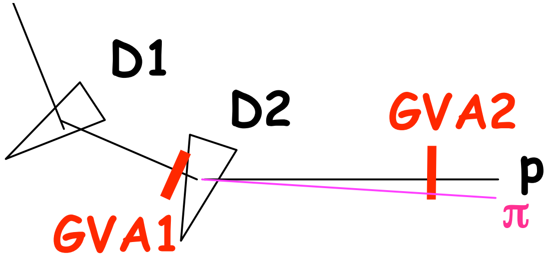
April 2 2008 FIRST PIONS SEEN IN MICE!

The two Cherenkovs (Mississipi) situated at the end of controlled area were powered on April 2.
Threshold 240 and 280 for pions respectively. 480 is well above.

A few pions were seen!

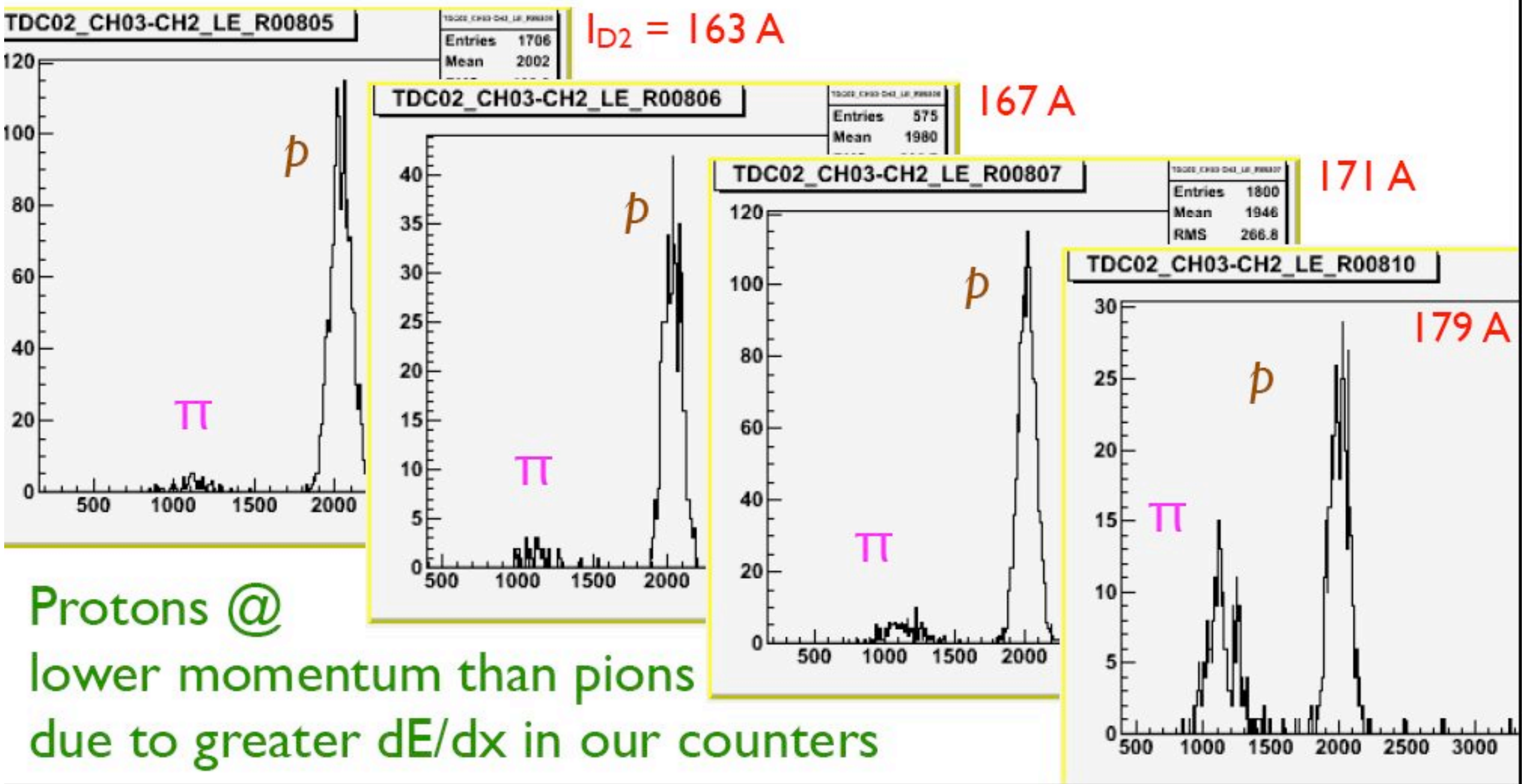
GVA2 scint
CKOV2 PM1
CKOV2 PM2
CKOV2 PM3





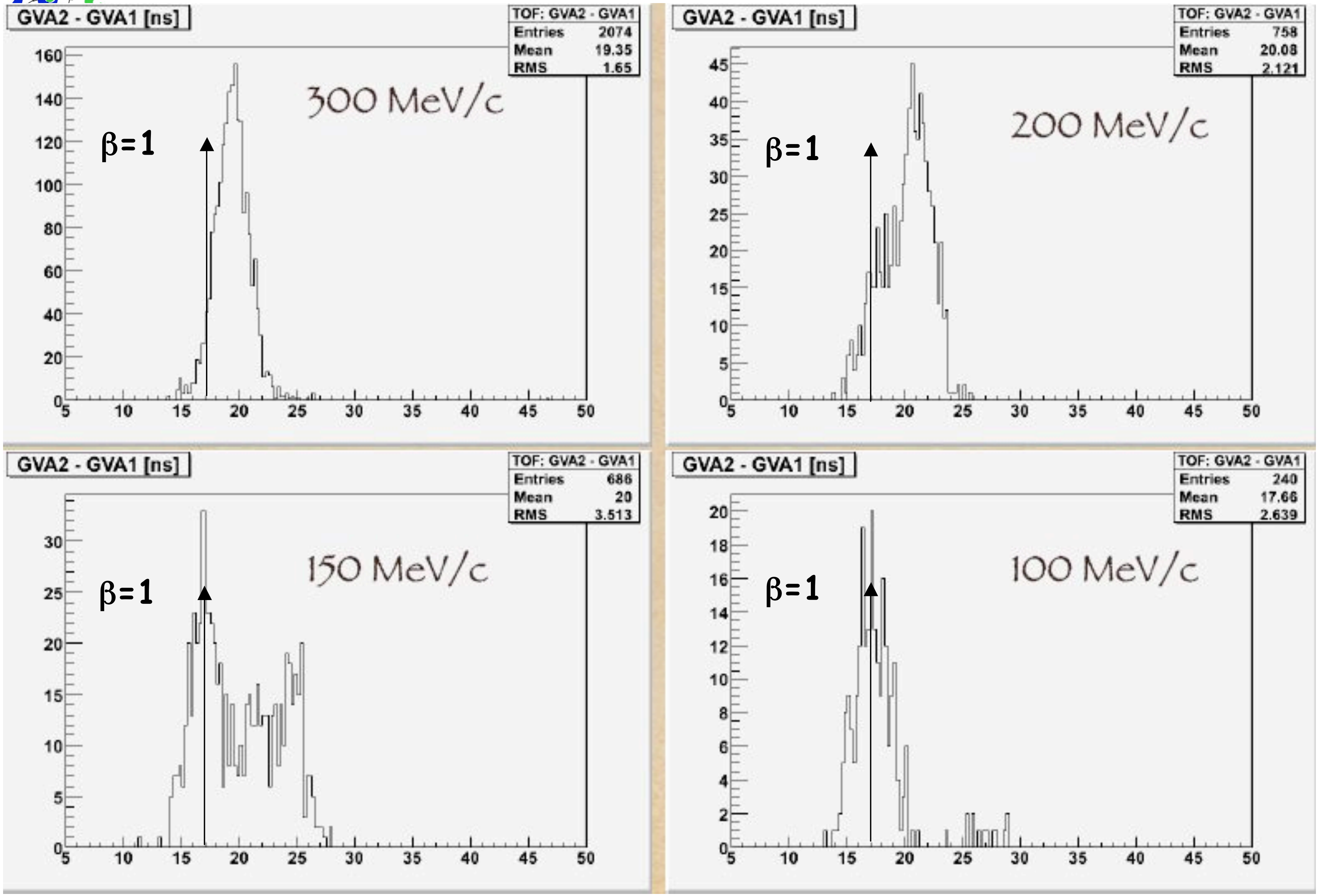
Momentum Scans

- Example @ 460 MeV/c (on-line histograms):

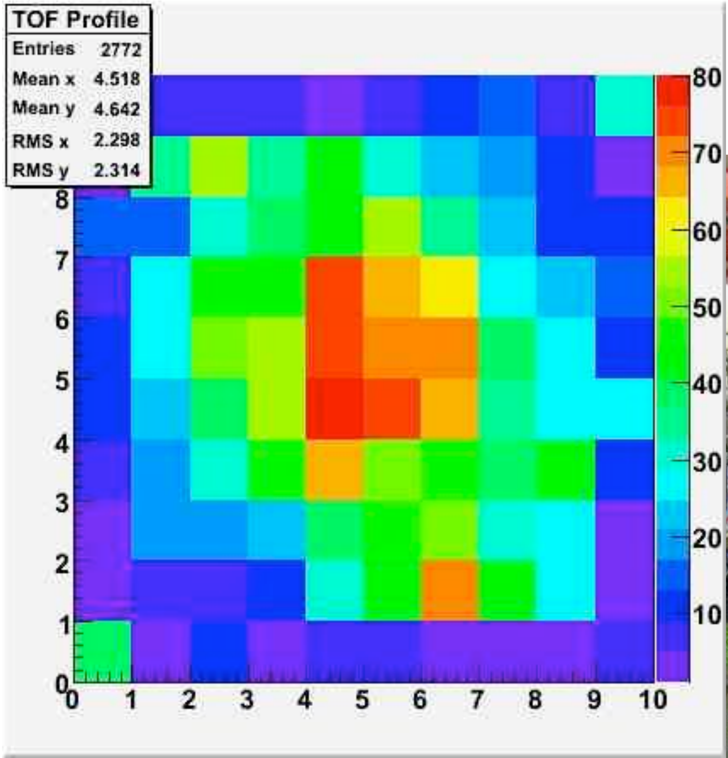


Protons @
lower momentum than pions
due to greater dE/dx in our counters

From pions to electrons (Oct08)



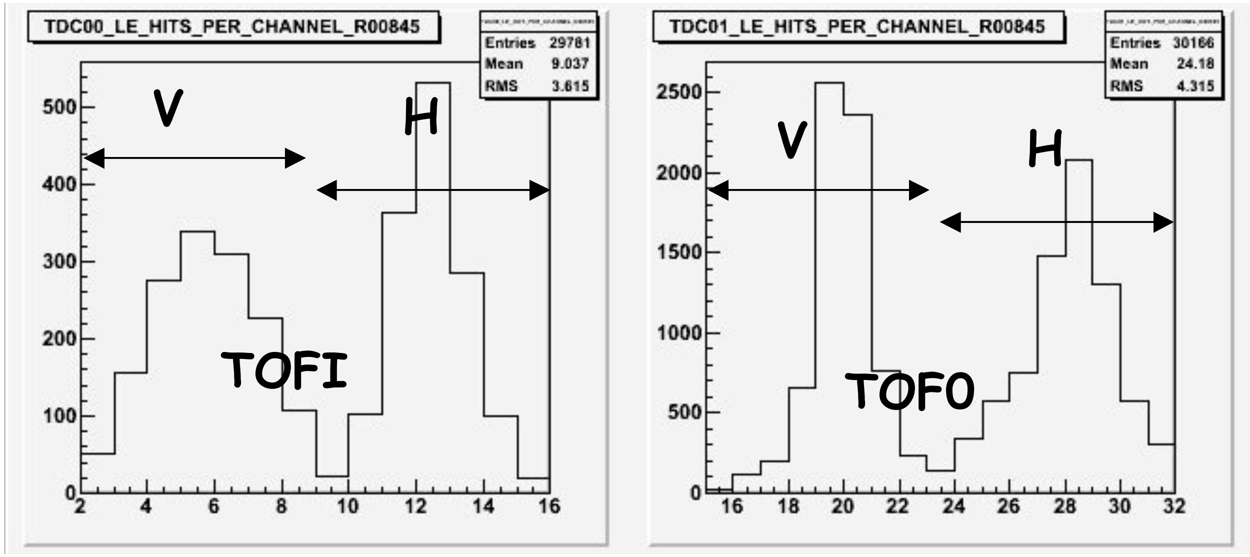
TOF0 and TOF1
Next is TOF2….



‘online reconstruction”
of beam 2D profile
at TOF0

TOF0 and TOFI are now producing
-- beam profiles
-- time and position info on particle by particle basis.

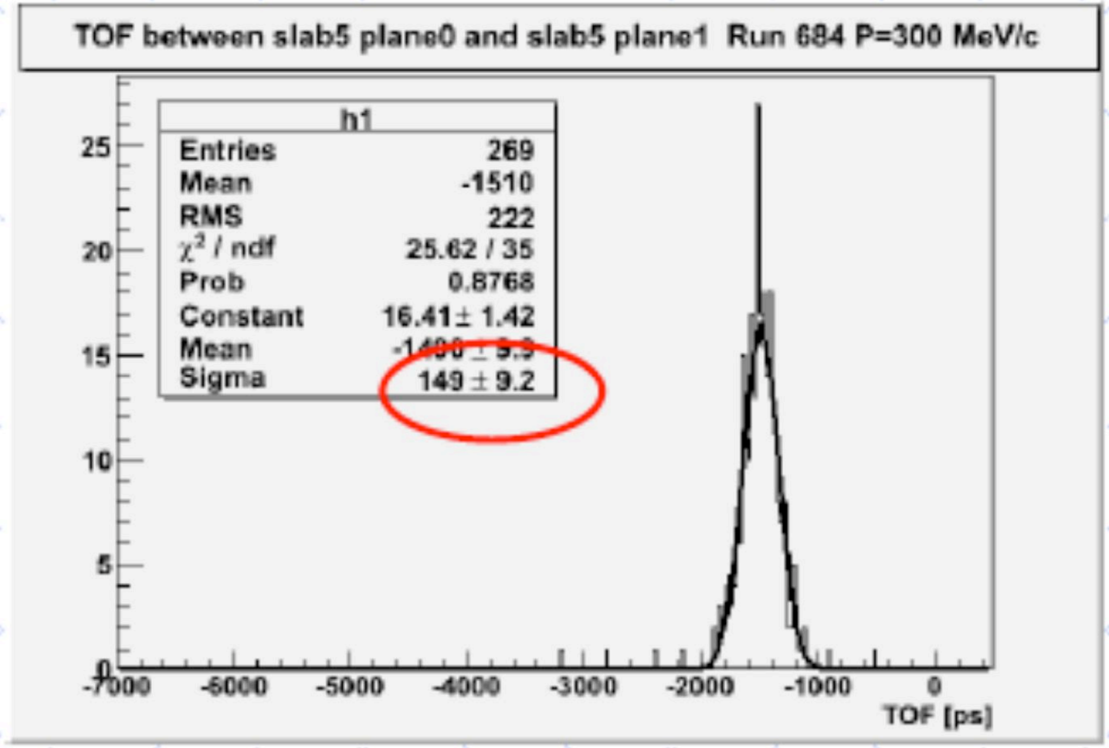
Ex. run 845 online monitoring plots (300 MeV/c pions)



Left : vertical (7 bins) and horizontal (7 bins) beam profiles in TOF1
Right : vertical (8 bins) and horizontal (8 bins) beam profiles in TOF0

Difference in shape is to be explained by beam optics
==> offline analysis

TOF resolution measured from data by comparing plane 1 and plane 2 in same detector

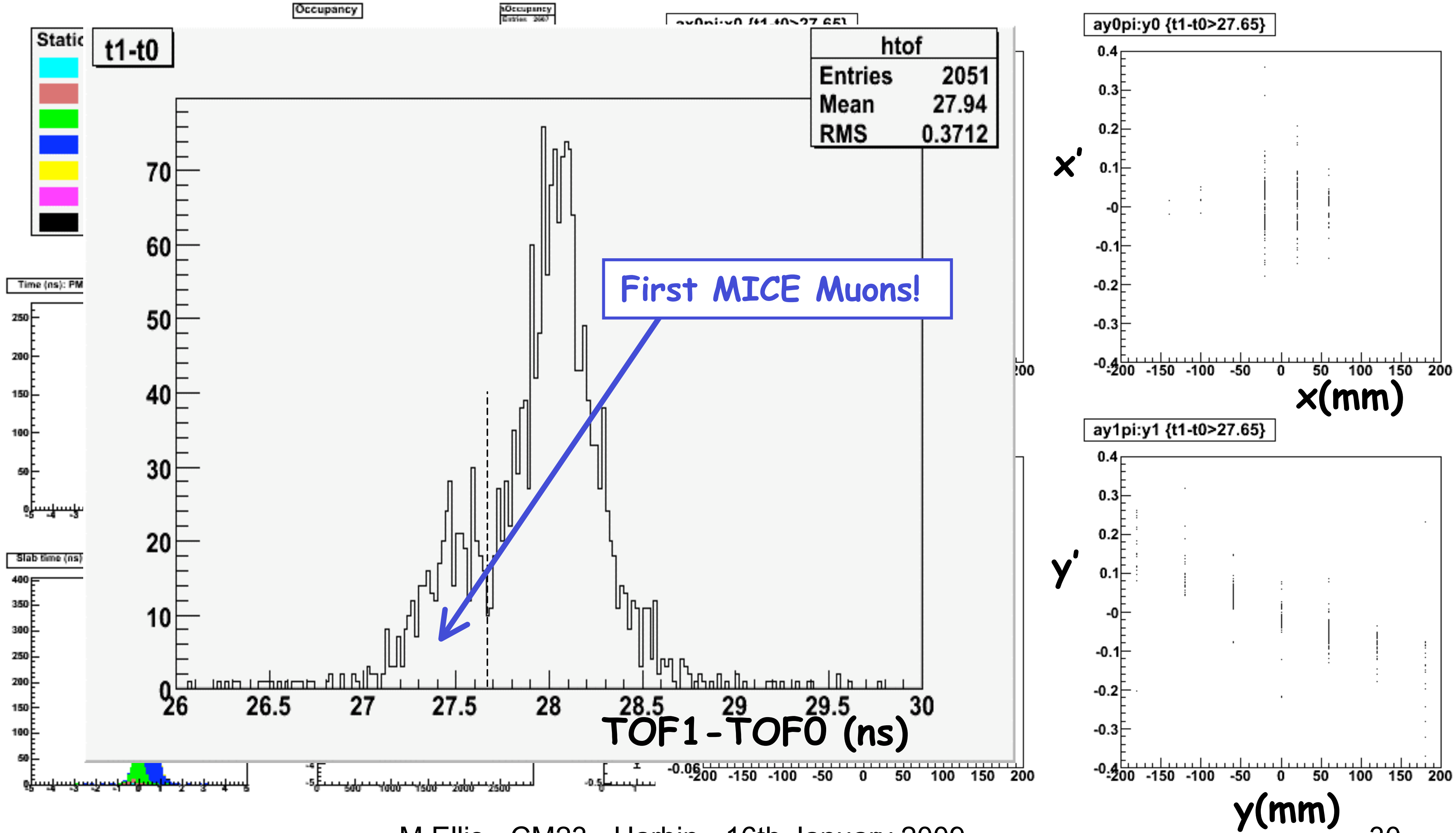


=>Each detector (average of two planes) has resolution of 70ps
Amplitude correction will improve this to <50ps

Combination of TOF0 and TOF1
Provides
x,x', y,y', p, t
⇒Measurement of beam size
⇒and emittance

First run with TOF0&TOF1 on 12-13 Dec08

First x-x', y-y' measurements!



M.Ellis - CM23 - Harbin - 16th January 2009 30

MICE beam intensity

Target dip in the beam is limited by resulting beam loss in ISIS. At start, limit was set to 50mV on beam loss monitor situated in Section 7-8 where MICE is.

Particle production at 50mV	2-3 10^{9} protons on target per dip
MICE proposal performance	1.7 10^{12} protons on target per dip
Total number	2 10^{13} protons in ISIS

Factor 500 to gain! Goal for Phase I: gain factor 50 (2.5V)
Goal for Phase II: gain factor 500

Old HEP target ran at 200mV at 50 Hz, MICE runs at 50mV at 0.4 Hz
Factor 500 is simply there. But instantaneous rate is VERY different

-- excellent runs on 18-19 Oct08 & 8 Nov08 to investigate beam loss issues
Ran up to 0.5 V on BLM for 16 hours with no noticeable increase of radiation
-- We were authorized to try -->2V on 19Dec08 when target failed!
-- ISIS beam loss monitors now recorded in MICE target DAQ
-- Simulations of beam losses in ISIS ongoing (A. Dobbs) to understand:
> Possible effect on pion/losses of target shape and material
> Distribution of losses around the ring

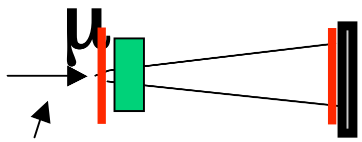
-- we may need a MICE luminosity monitor (small project - 4 tubes?)

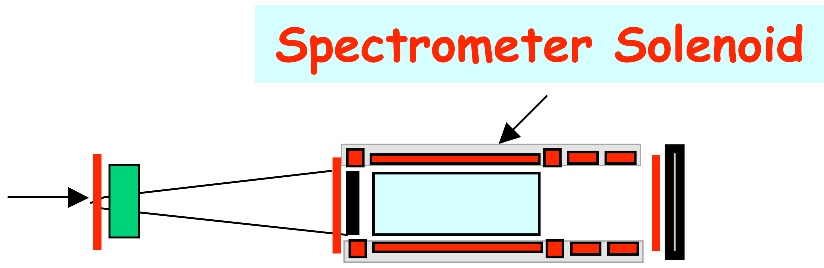
We welcomed two new groups

-- University of Warwick (Steve Boyd, James Black, David Adey)
==> software, beam line

-- INFN Pavia (Giorgio Cecchet)
==> TOF

Both groups are already contributing





STEP I

All instrumentation is there
Conventional magnets OK
Infrastructure getting there
Still much to do on:
- Controls & online reconstruction
- Progress on intensity

Defining items:

-- Decay solenoid
-- Target

Run: May-June 2009

STEP II

Tracker is ready ready ready!
TOF2 will be there

Defining item:

-- Spectrometer Solenoid

Run: Jul09-Sep09

Beam line commissioning summary

-- Transported particles to the end of MICE beam line

-- No decay solenoid so far. Set p(D1) ~= P(D2).

-- operated all conventional magnets routinely

-- used scintillators slabs for counting and time-of-flight (GVA1&2)

-- three regimes overved and used

>> above 350 MeV/c: many protons + pions (and a few muons!)

>> 200-350 MeV/c pions mostly (protons are stopped in material)

>> 100-150 MeV/c electron beam (pions are stopped)

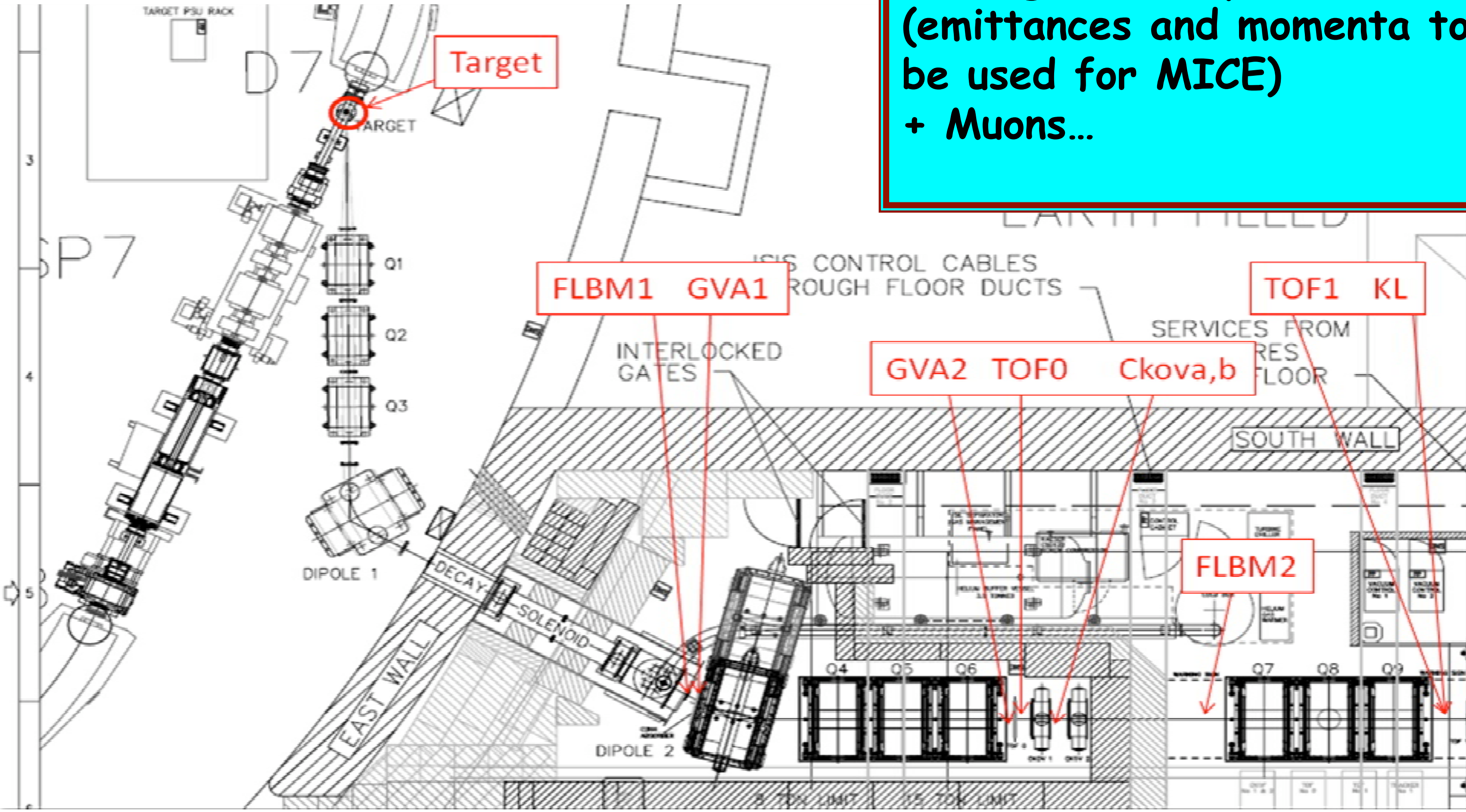
-- overall rates normalization evaluated.

-- DAQ and monitoring working. Several independent systems so far.

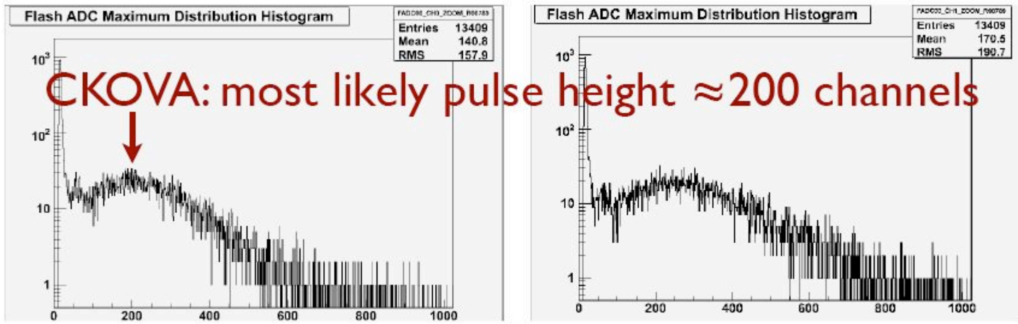
Online group

Commissioning of beam line has continued.
Pion and Positron beams achieved … essential for TOF and KL calibrations !

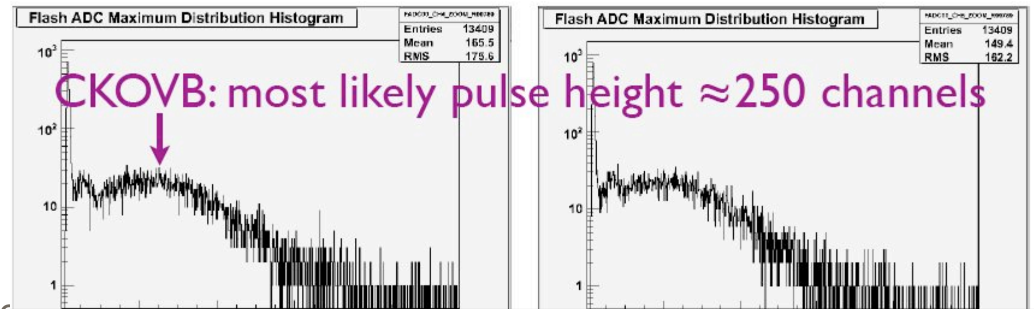
Missing: beam optics matrix (emittances and momenta to be used for MICE)
+ Muons…



Cherenkov

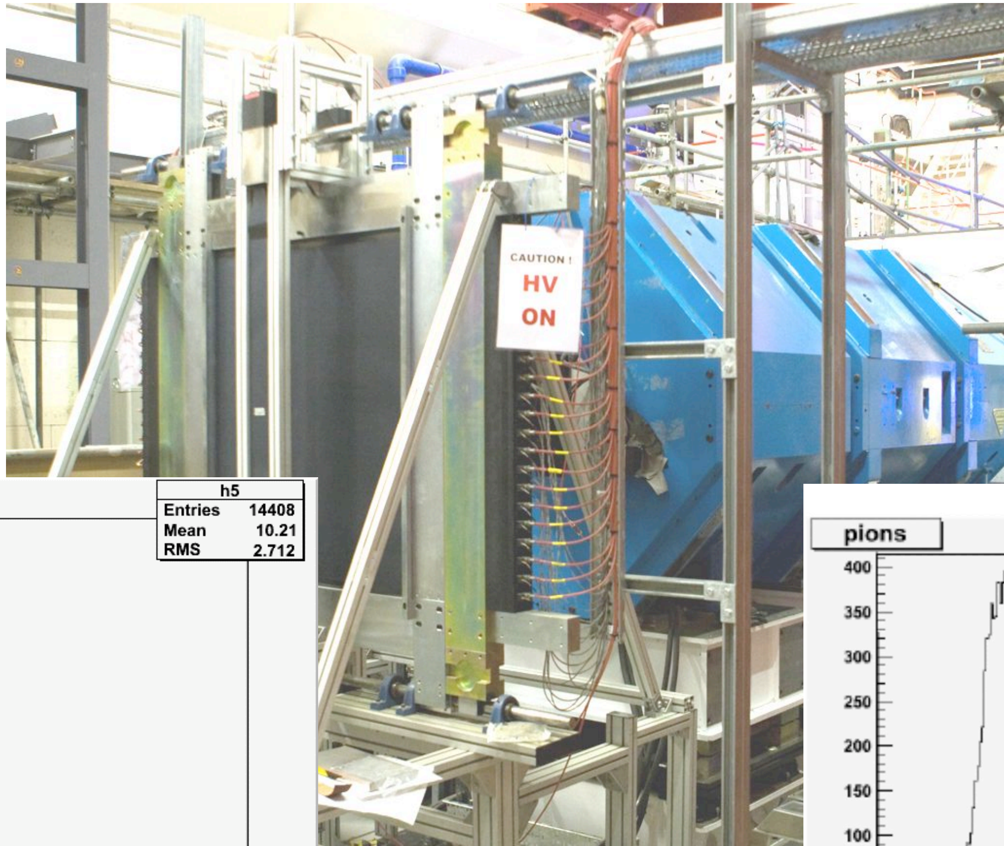


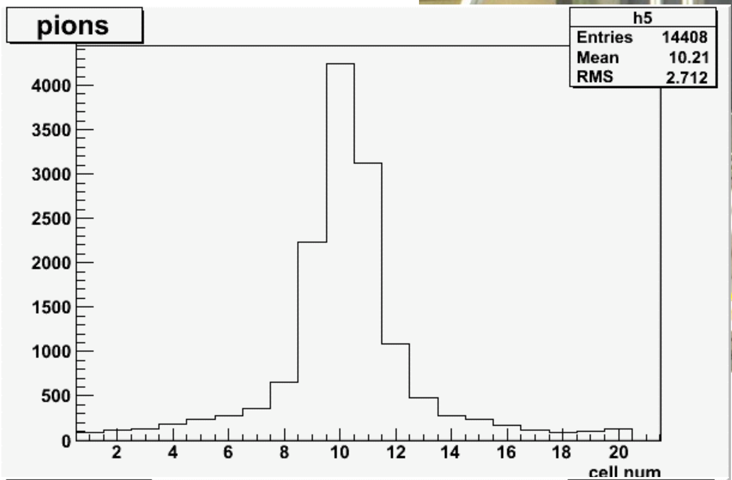
CKOVA: most likely pulse height ≈200 channels

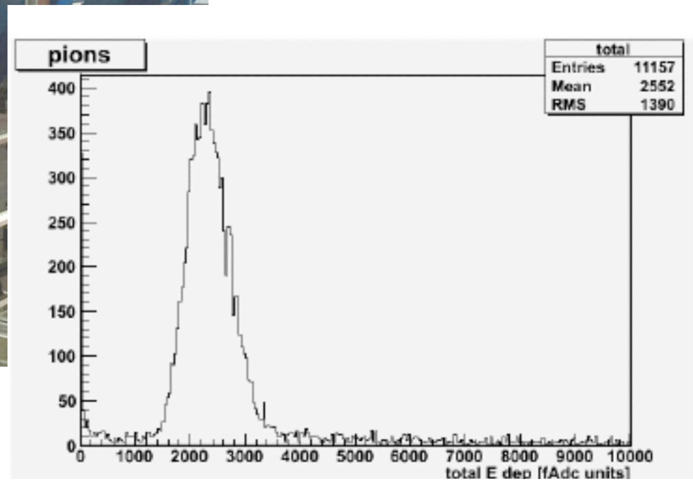


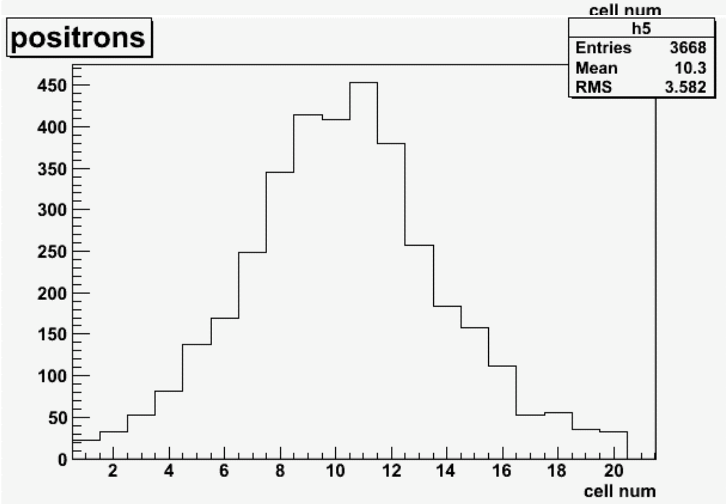
CKOVB: most likely pulse height ≈250 channels

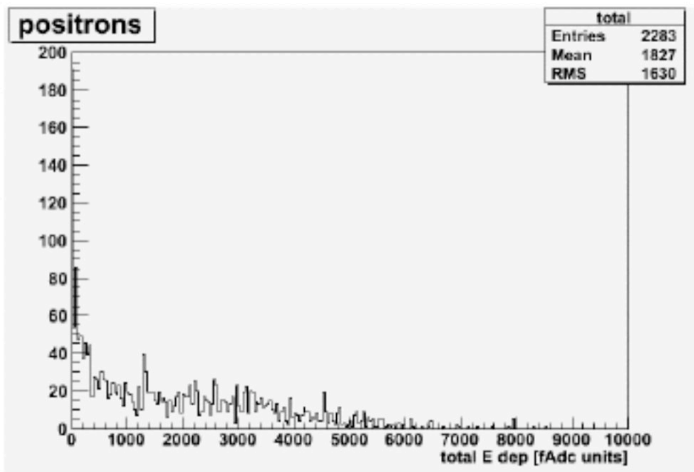
KL calorimeter





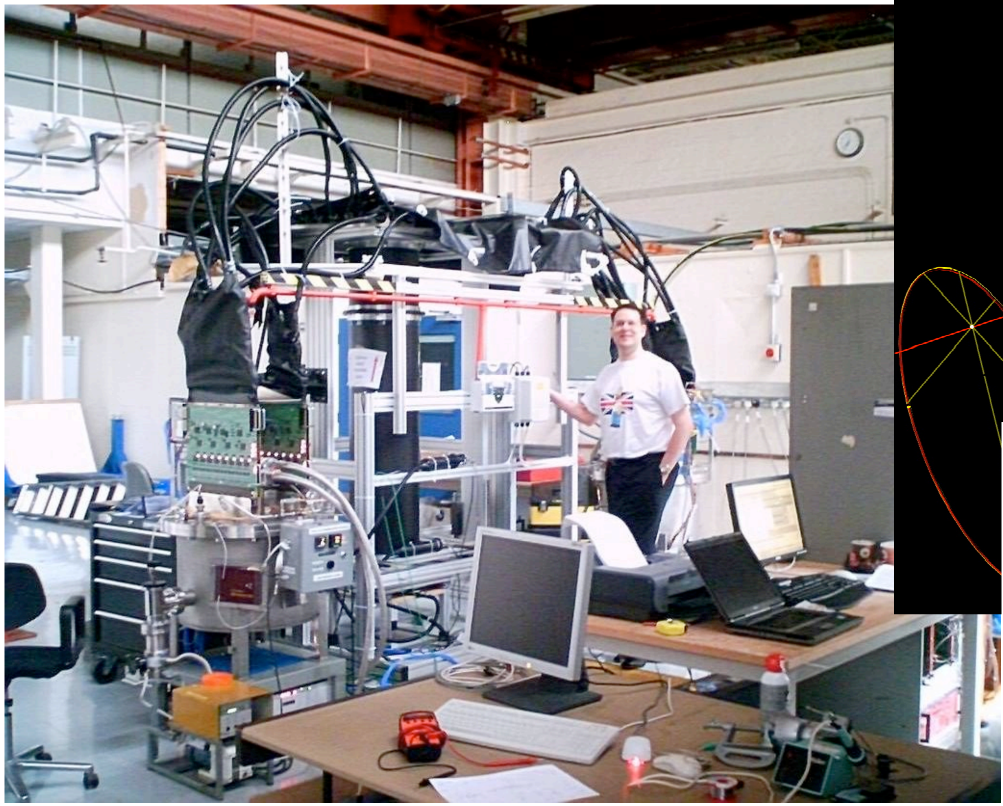


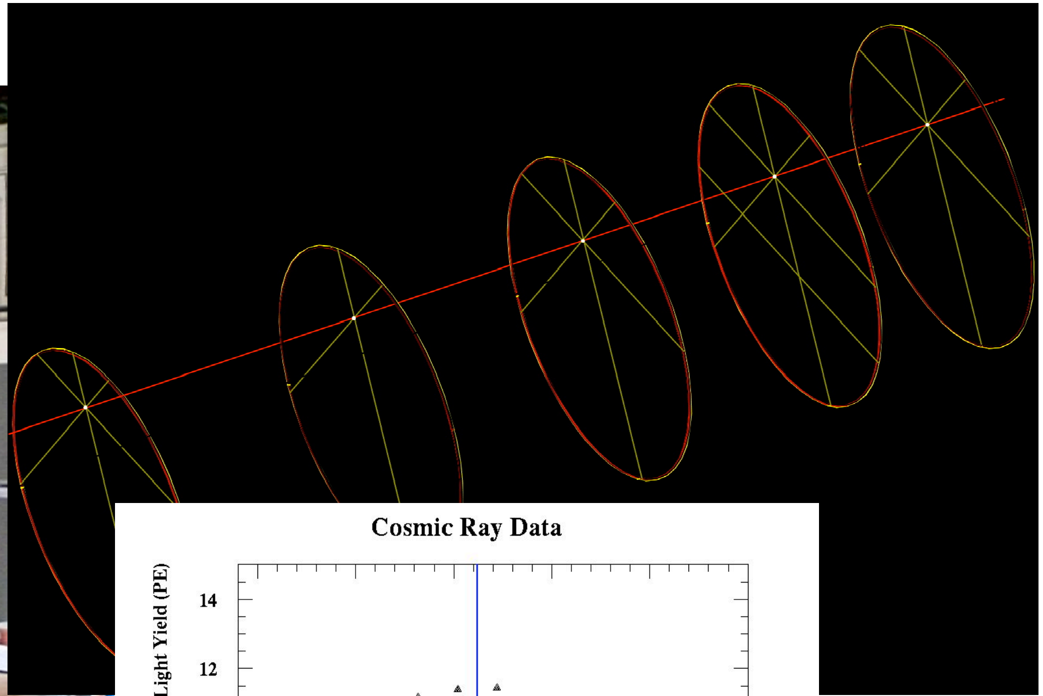


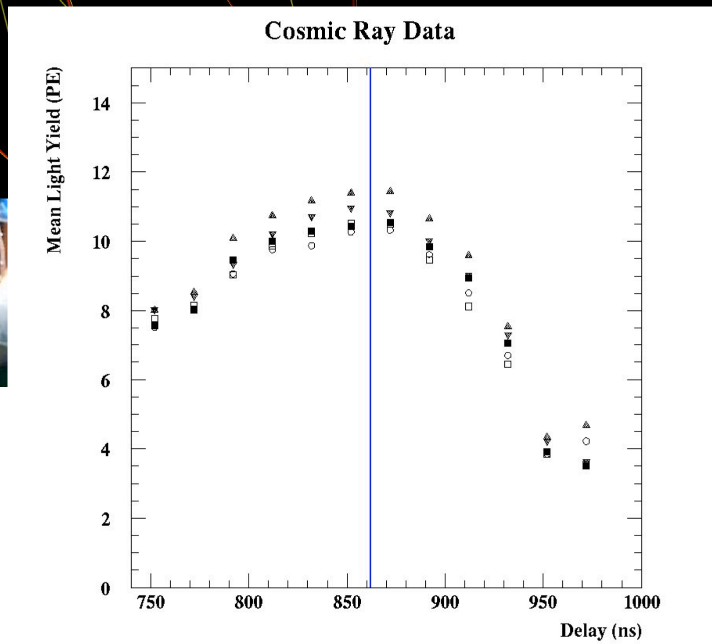


Tracker

Completed production of all stations
Tracker has been ready taking cosmics since summer 2008 in R8
Moved to Lab7 at RAL.







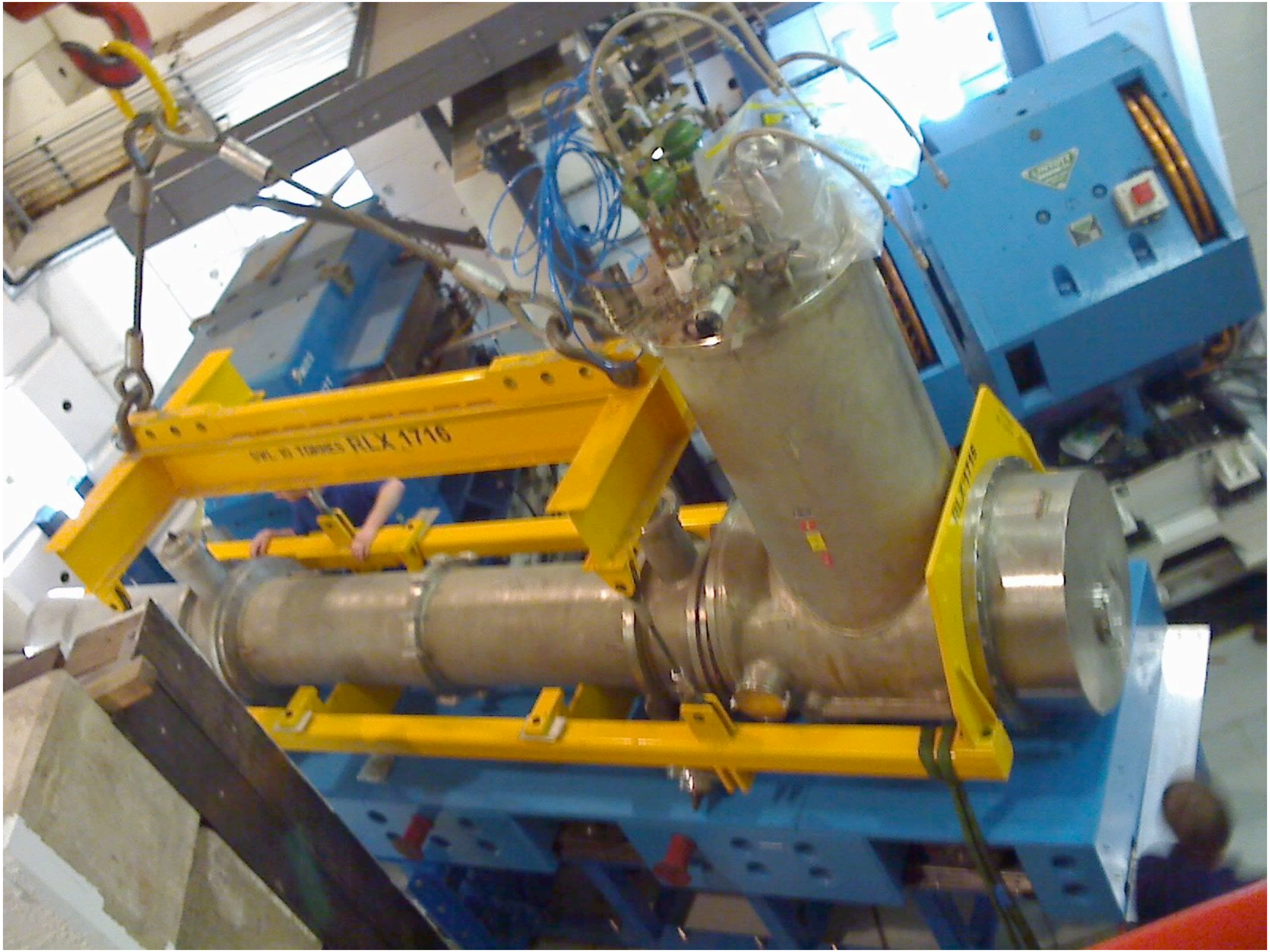
Decay solenoid

Did not cool properly -- coil 10 (out of 10) at first did not get supra
Further temperature probes were installed in Oct08 shut down.
Magnet is cold since 15 Dec08.
Observe quench at 180-280A (Nominal is 850A) depending on heater conditions; quench starts from coil 10.
Seems to point to heat losses or insufficient cooling in the region of the magnet near the leads. No obvious anomaly in the coils. Need to add more superinsulation?

5Jan09 Install shielding in the vault to allow access to DKsolenoid even when ISIS runs -->

This will allow repair during ISIS run in Feb09-Mar09, must be finished by 1May09.

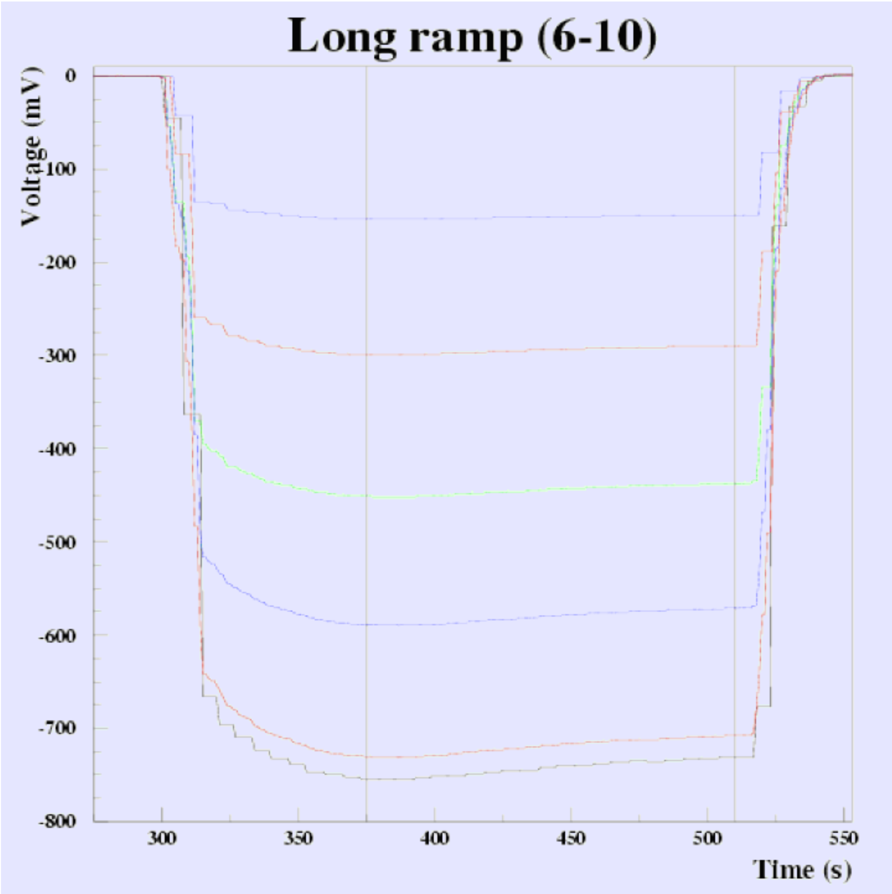
Will wait until solenoid is cooled and operated properly to consider it fixed.
No running in Feb-Mar09. This repair has absolute priority.

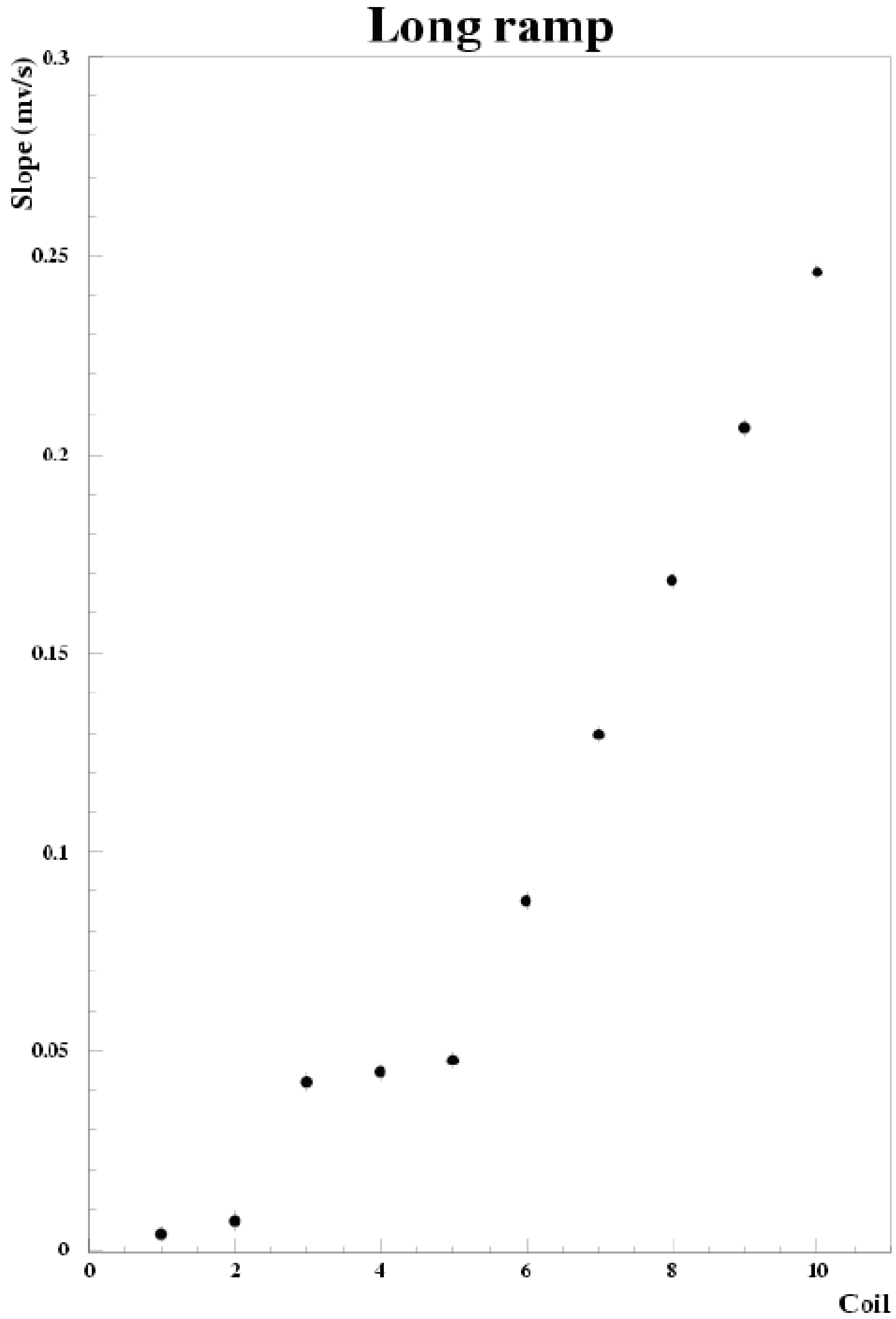

RLX 1716


MHI

Working hard to understand what's wrong with the decay solenoid

Ramping slowly and evaluating cols resistance from Kerchoff's law.





Spectrometer solenoids

First magnet completed; testing revealed several issues

> Frozen N_2 in cold mass helium lines prevented proper operation (mainly procedural, partially design issue)

> Inadequate thermal connection between 1st stage of cold heads and cold mass radiation shield

> No direct cooling of radiation shield (long cooldown)

> Venting of cold mass during quench is not sufficient due to crowding of vent line with instrumentation wires

Second magnet now in final assembly w/improvements to fix problems encountered on first magnet.Will become Spectrometer Solenoid I (SSI)

After which 1st magnet will be modified and tested.

- completing the first unit (Magnet #2) including cooldown and test ==> Feb09
- Add two months for shipping magnetic measurements at FNAL and ship to RAL
- Add 6-8 weeks for assembly at RAL --> operational mid June
- Run step II in July
- Magnet #1 should follow two-three months later.

Second Magnet Assembly

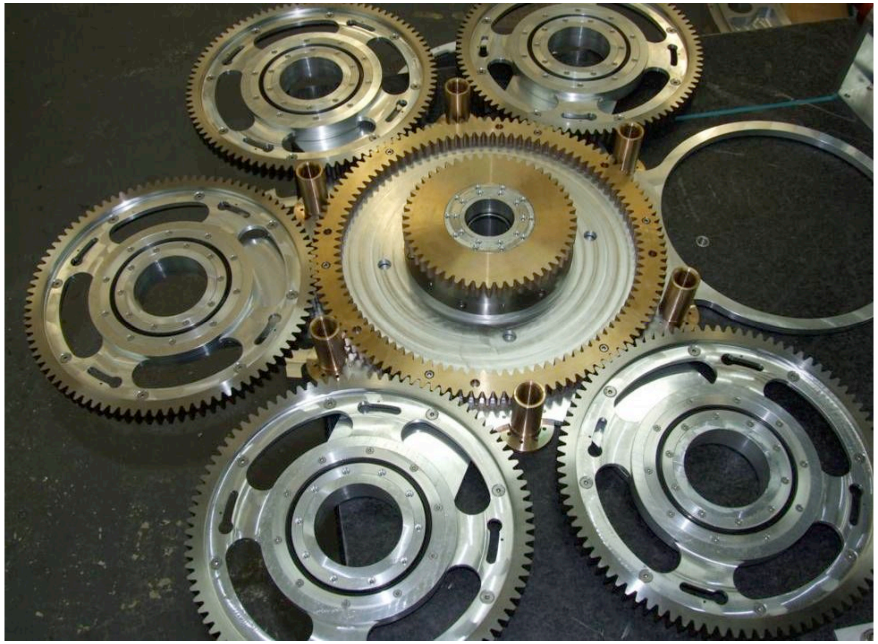
- Second magnet nearly ready for final assembly
- Improved thermal shield connection incorporated
- Second cryostat vent tube added
- LN reservoir complete and ready to install
- Cooling circuit mod to be completed soon

<==
Completed magnet I

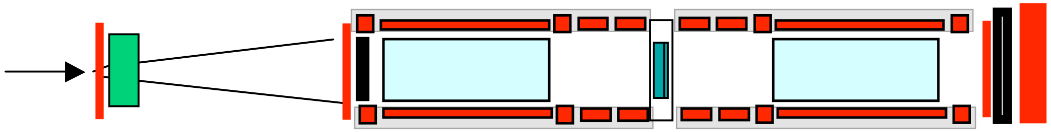
Magnetic measurement gear at Fermilab (Zip track) ==>

Diffuser

Emittance in MICE is generated by beam size (quad trimming)
Times angular divergence (a piece of lead)
In order to be able to change remotly the diffuser thickness to study different emittances, a delicate mechanics has been designed (and is being constructed) at Oxford to place a 0-4 X_0 piece of lead Inside the spectrometer solenoid I.



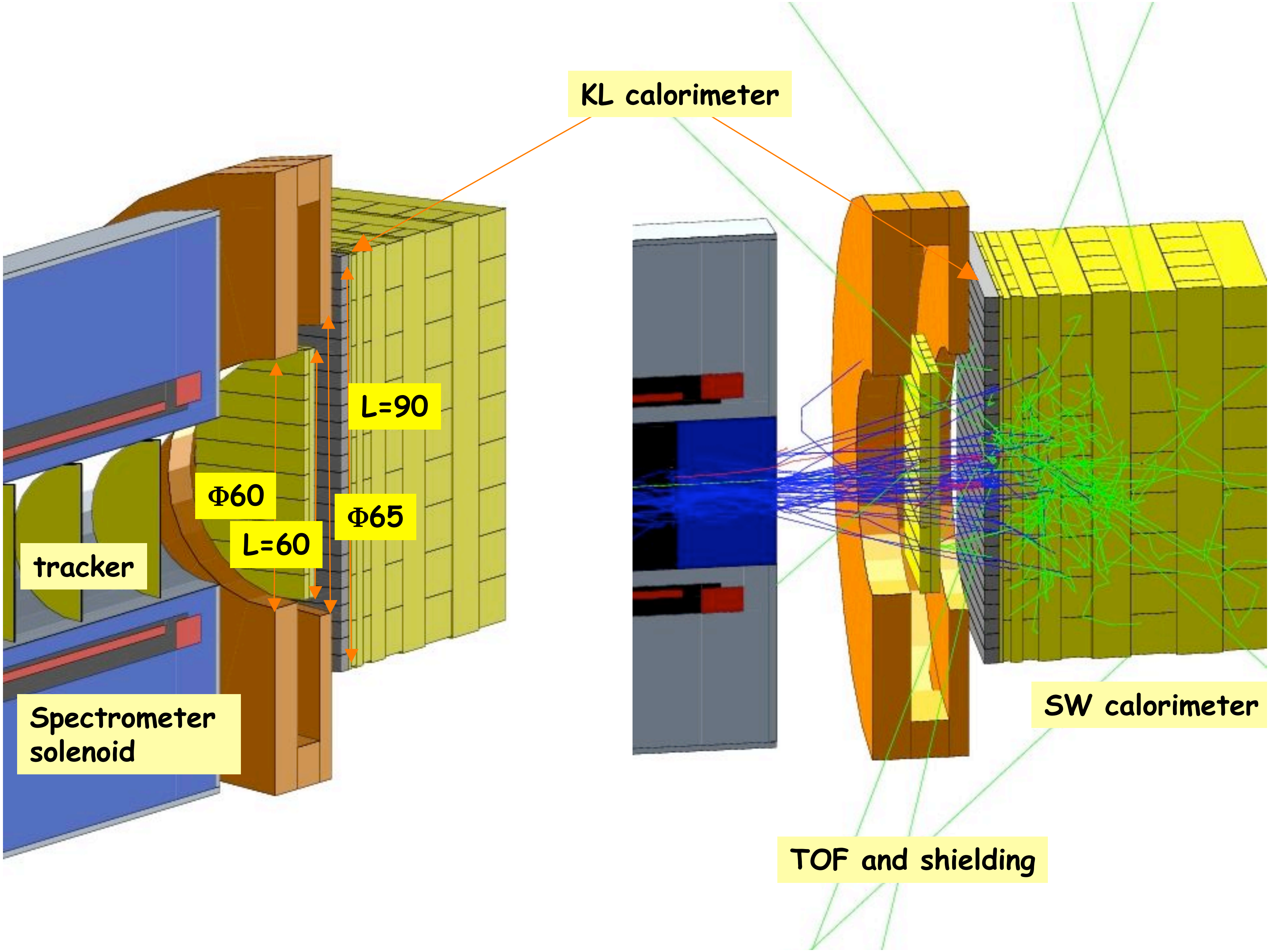
Quench test of solenoid
with diffuser in place
will be required
Before we install the tracker!



STEP III/III.1

Need
Second spectrometer (should arrive at RAL in Jul09)
TOF2 (aim is jun09)
Tracker2 (OK)
Spool piece with mounting for solid absorber (OK)
Absorber (for step III.1)

LiH (lithium Hydride) absorber being prepared by Fermilab
Will also test all materials that are in the path of muons
in a neutrino factory front end. Aluminum, beryllium, copper….


KL calorimeter
L=90
Φ60
Φ65
L=60
tracker
Spectrometer solenoid
SW calorimeter
TOF and shielding

Electron Muon Ranger

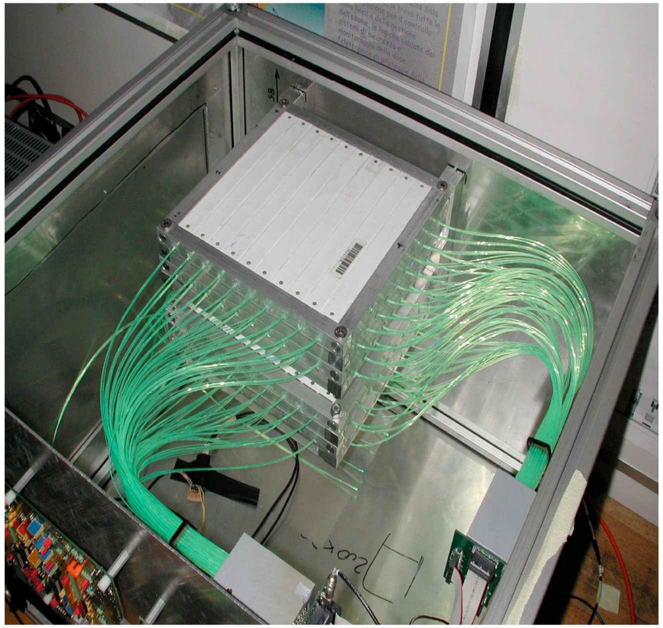
Trieste + Geneva+ Fermilab

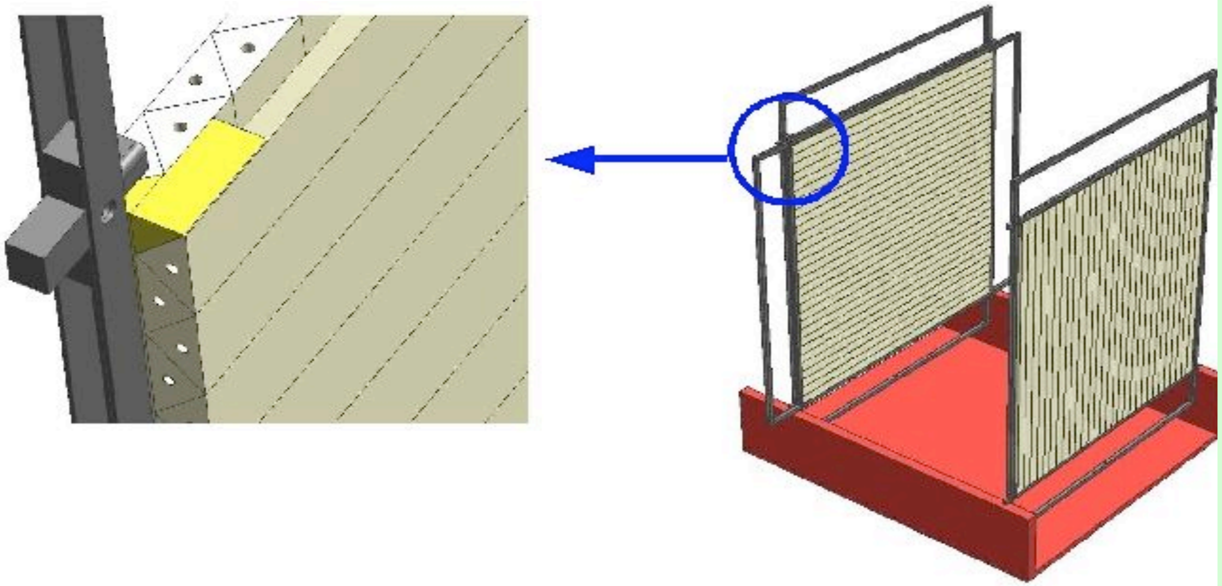
Prototype test successful

Design complete

Scintillator in order at Fermilab

Electronics in order at Geneva



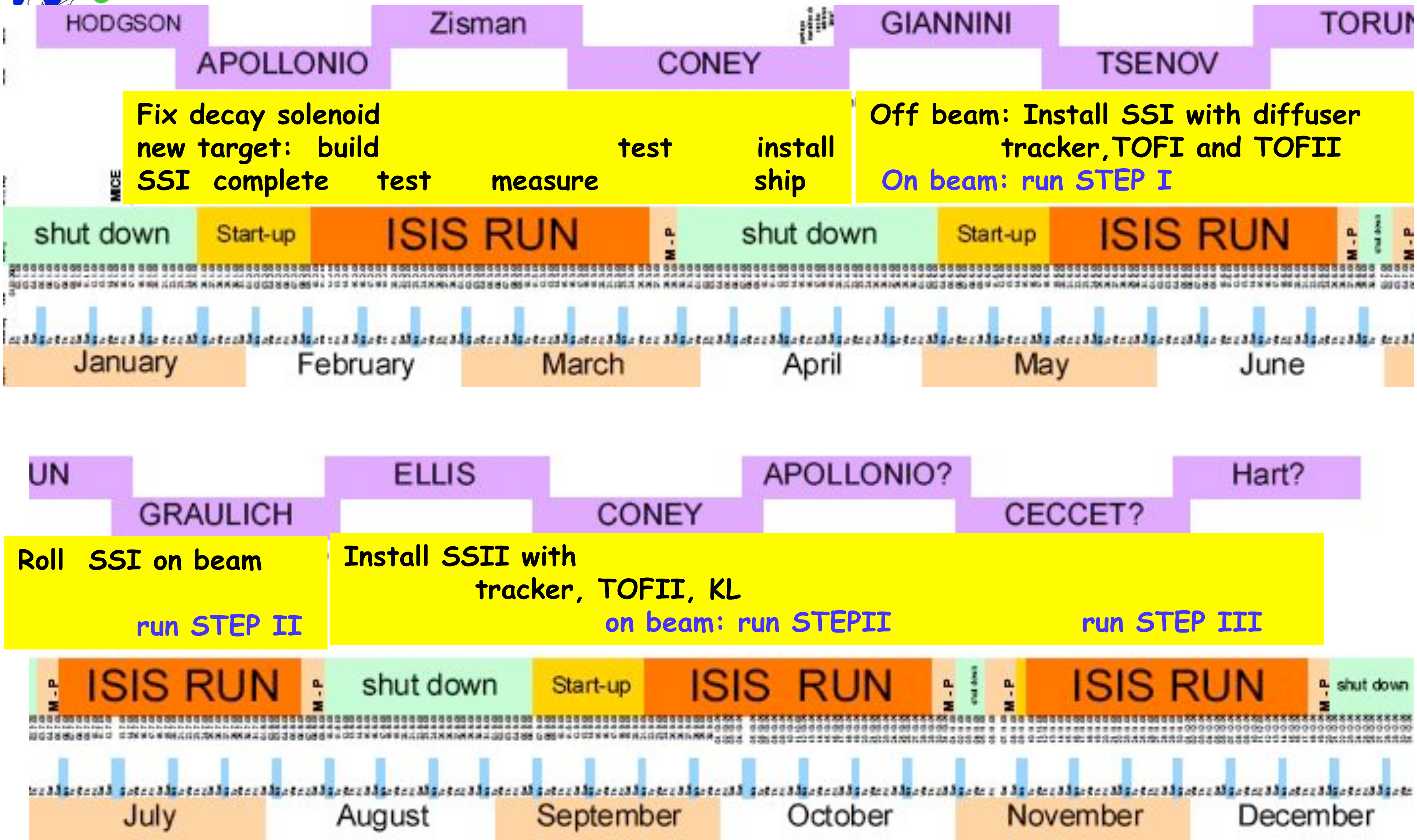


"If INFN funding comes through
We will have EMR in oct09" (Dec. 2008)

Otherwise Q1 2010

Well… INFN did not come through…
we are reorganizing ourselves

2009 operations:



Phase II

-- AFC module production is progressing (W. Lau)
Expected delivery date --> Jan10

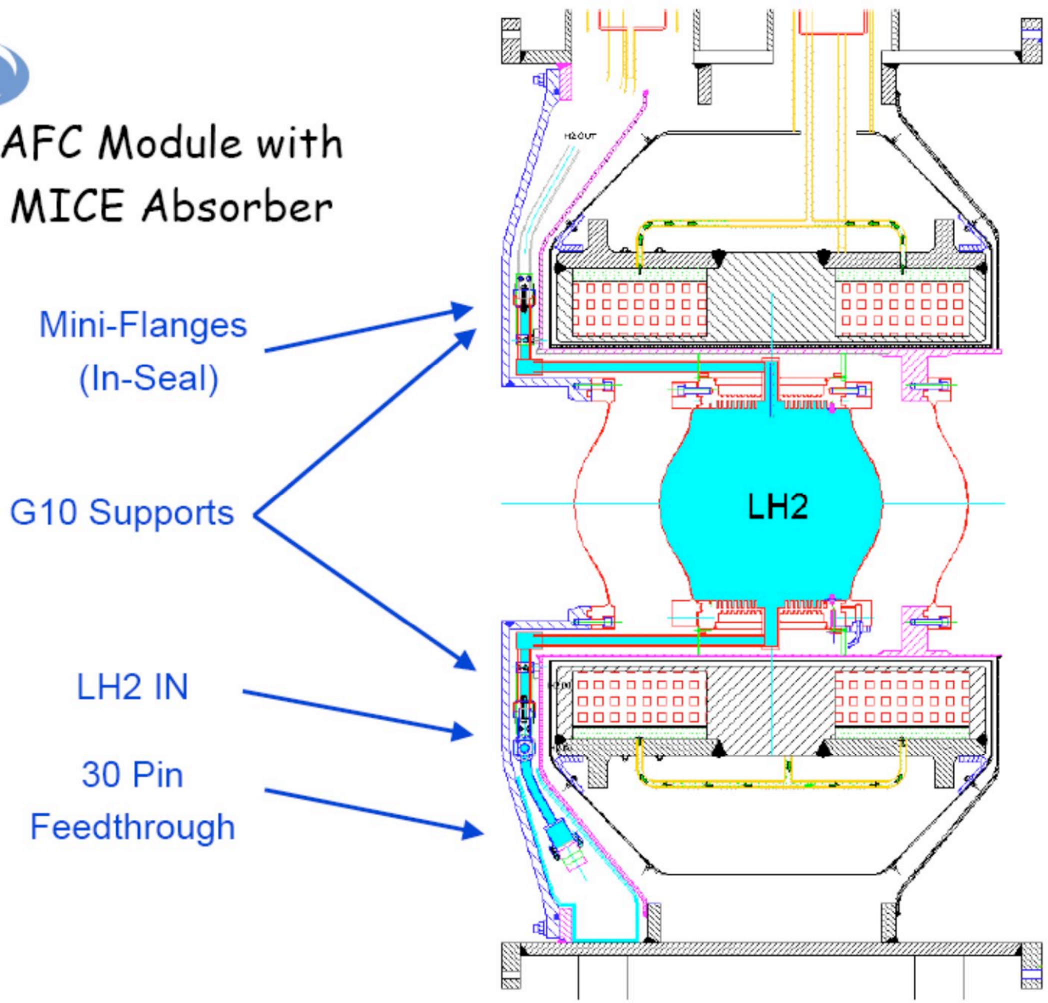
-- RFCC module reviewed on 21 October (LBNL, Harbin):
approvision of TWO modules (for step V and step VI)
contract with Harbin for construction of 3 coils
some hick-ups in Harbin now fixed and construction well underway

-- LiqH2 test system however is getting close to critical:
manpower at RAL is lacking due to need to concentrate on DK solenoid!

-- RF power stations Andy Moss (Daresbury) reviewed on 22 october
Good progress. Will use RF from CERN asap.
Some issues with personnel will need to be solved but this part of the project is not seen as critical.

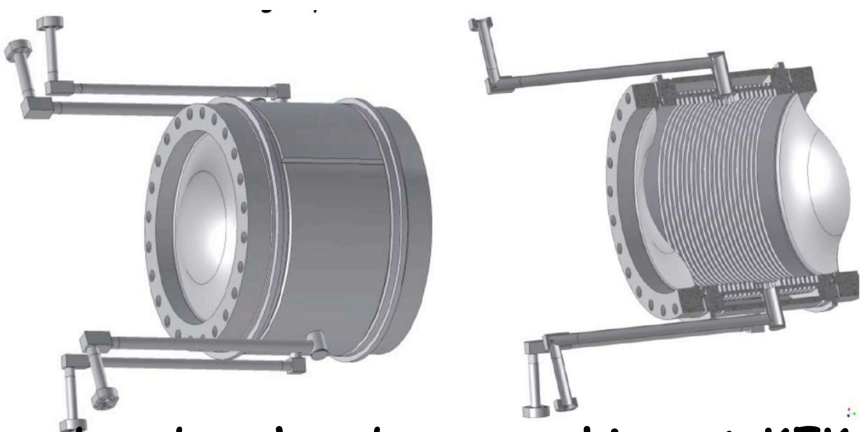
-- review revealed that manpower for RF installation at RAL will be critical and in present funding scheme will delay the schedule significantly!

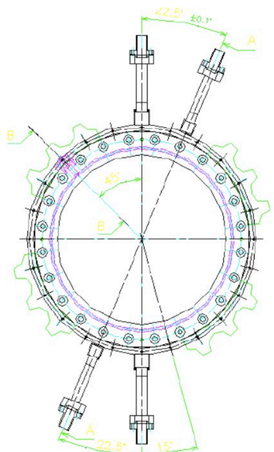
AFC Module with MICE Absorber



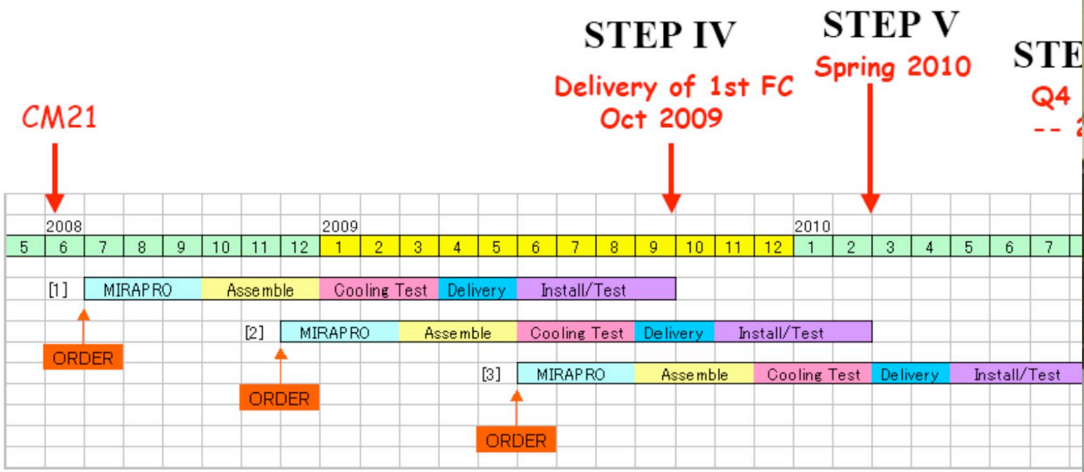
Focus coils: contract with Tesla signed 18Jun08
PRR on 5 november-- a number of issues to solve. Ongoing.
First coil-pair delivery Jan10
Second six month later.
Third in option -- pending stepVI approval.

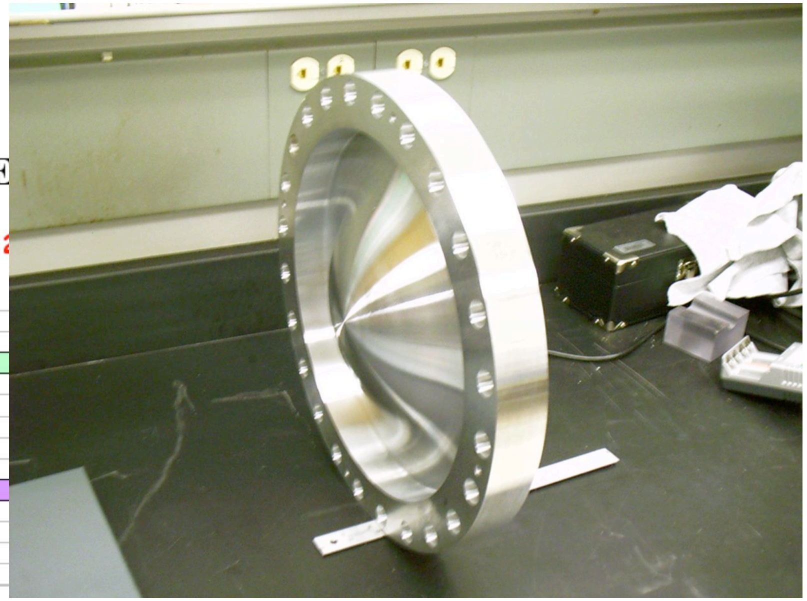
Absorbers (Ishimoto, KEK) and windows (Mississipi)



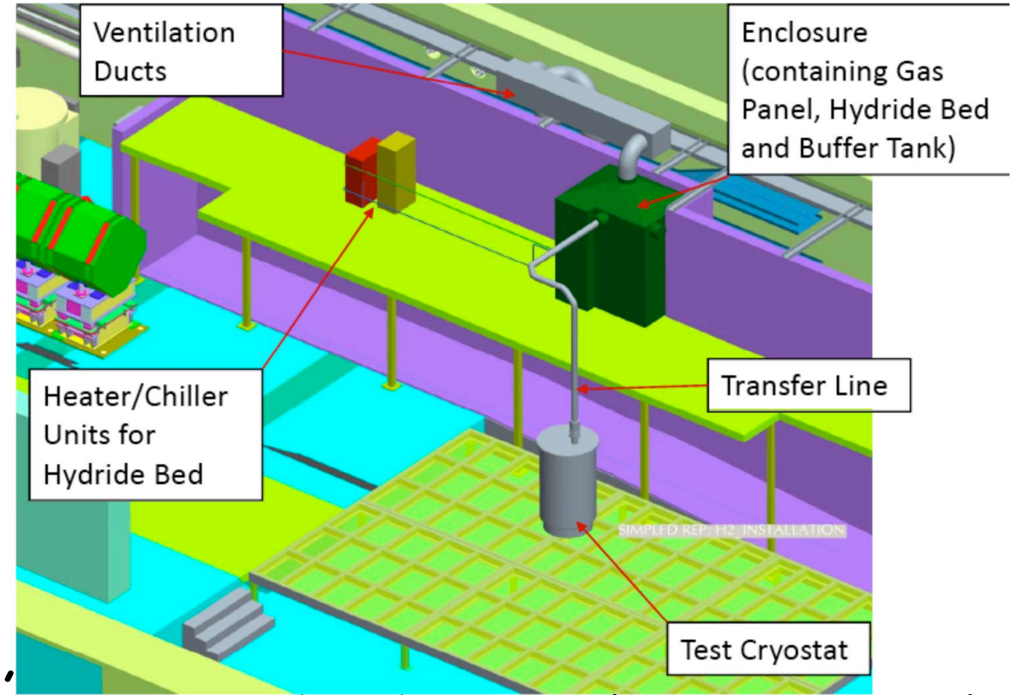


Prototype absorber has been working at KEK for a long time.
Funding in Japan OK now for construction of absorber.
Design and construction by MIRAPRO company schedule matched to MICE.
Windows fabricated at Mississippi. -- First window complete





Liquid hydrogen infrastructure

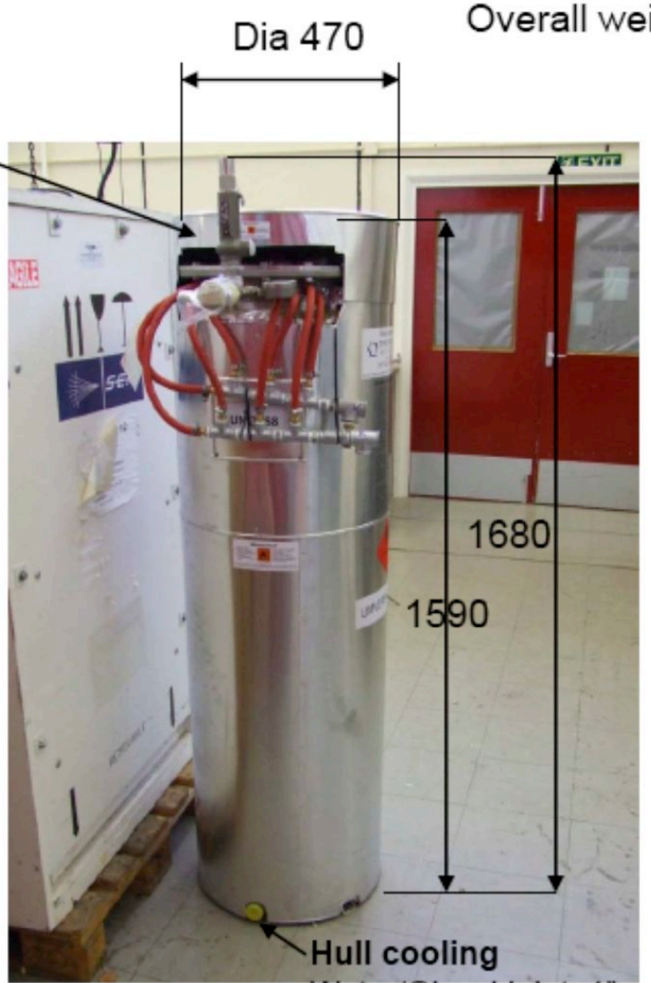


At hand: metal hydride storage tank, chiller unit, cold head and compressor, AS Scientific currently assembling the cryostat, absorber, condensing pot, and buffer volume.
Design of gas panel complete.
Design of ventilation system, external pump housing control and safety systems (DL) is advancing well.
safety and HAZOP reviews early in 2009.

This part of the project has been significantly delayed by the fact that most effort of the MICE cryo-engineering team at RAL has been extremely busy with the decay solenoid. The problem has been identified and recruitment is underway.

Nominal capacity: 2450 g (27 Nm^3) H_2
Volume of overall storage tank: 250 litres
Overall weight: 375 kg

Top removable thermal
insulation cover



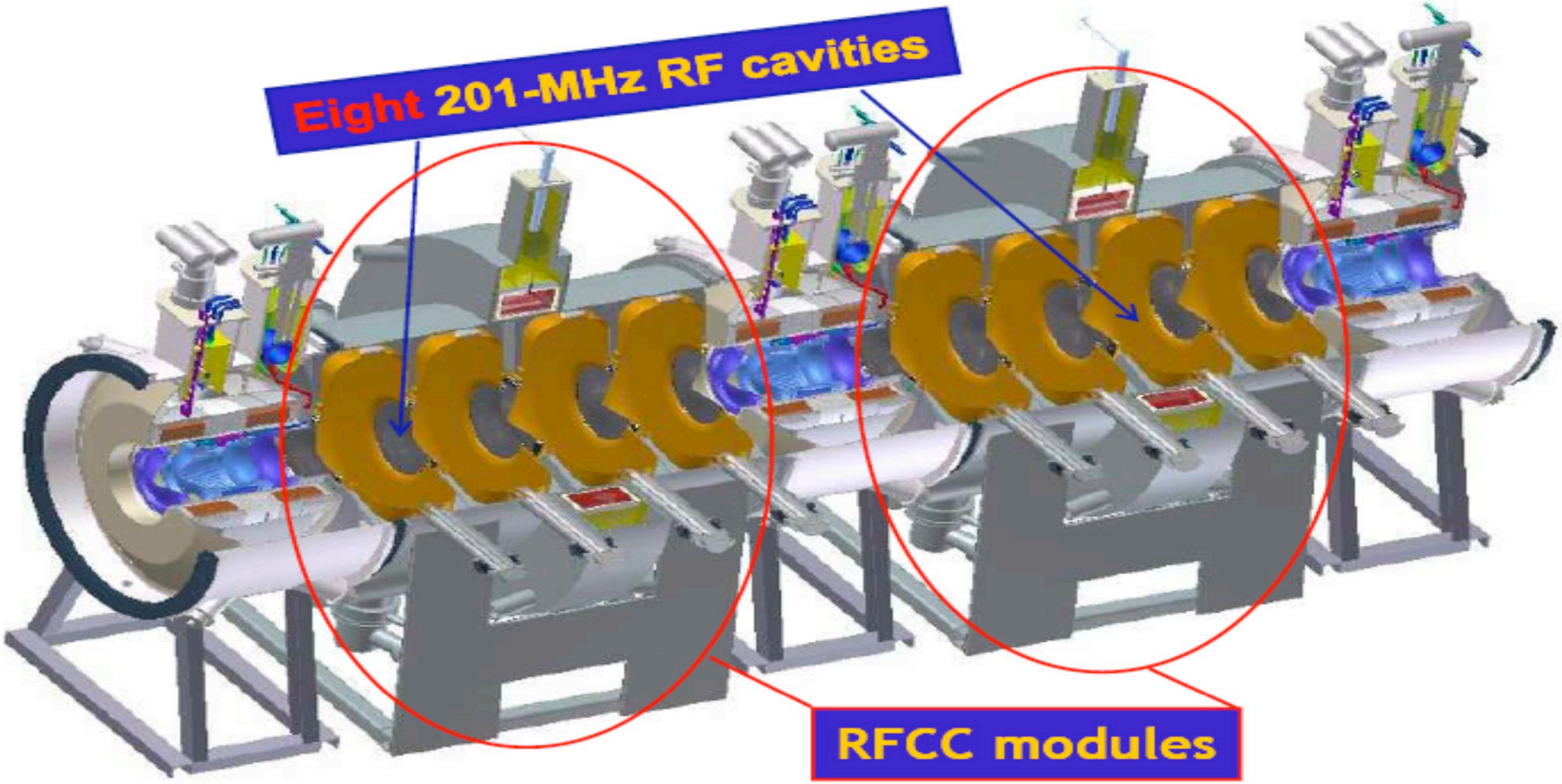
Hull cooling
Water/Glycol Inlet, 1"

Hydrogen connection
with shut-off valve and
safety valve

Hull cooling
Water/Glycol Outlet, 1"

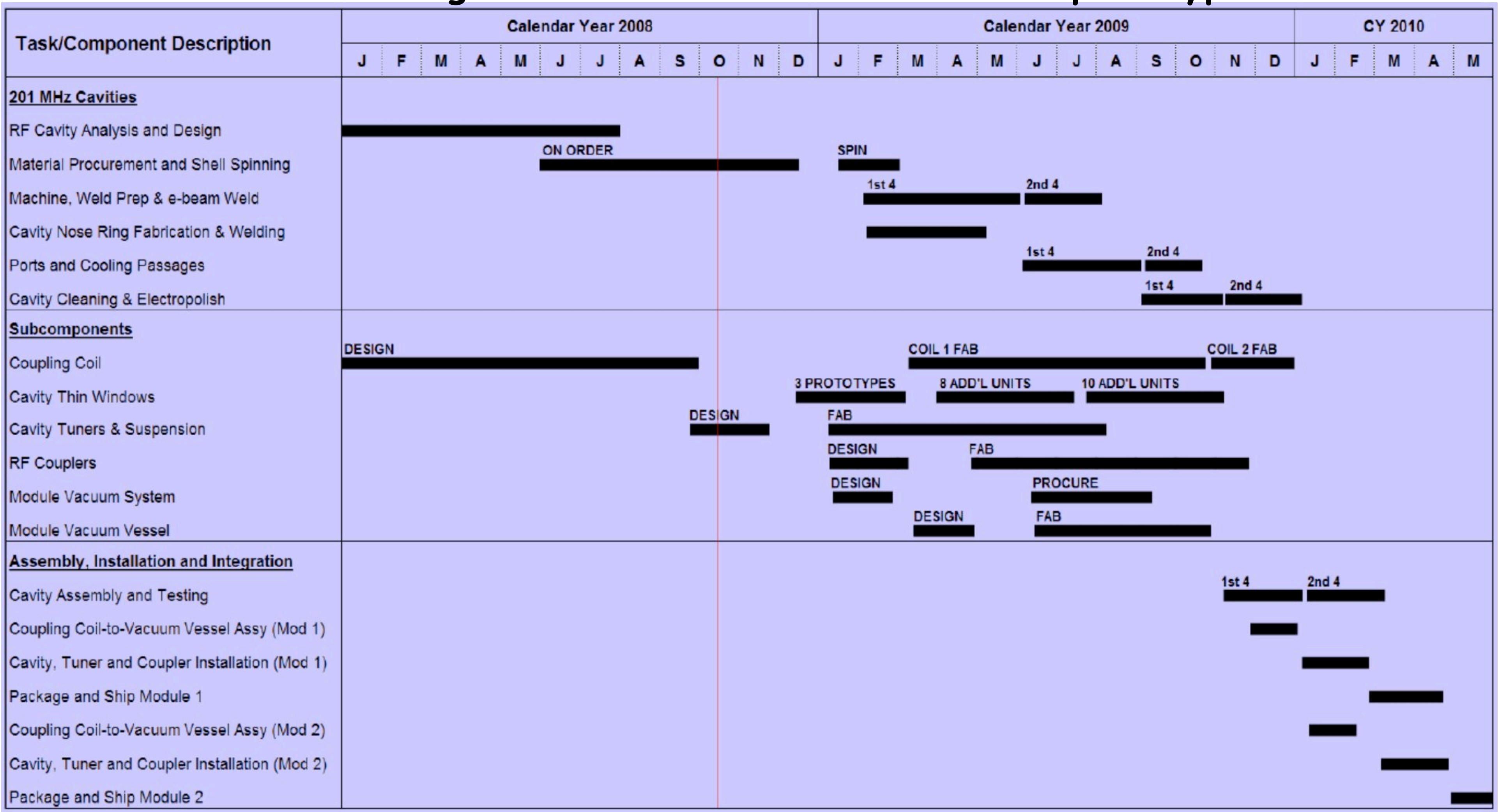
Internal cooling
Water/Glycol
Inlet/Outlet

RFCC module

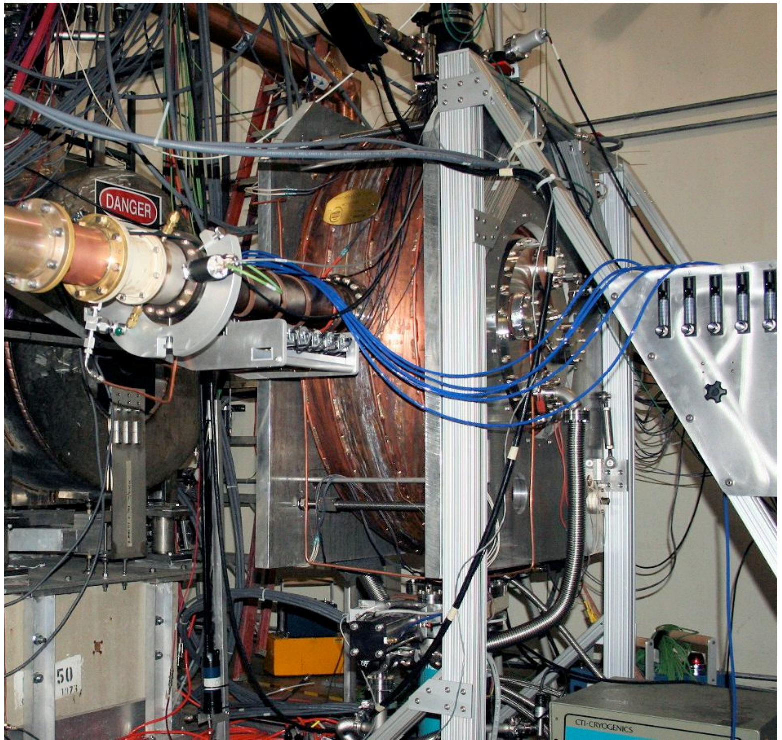


RF cavities

Design review on 23 Oct08. All seems OK.
Will follow design and construction of successful prototype

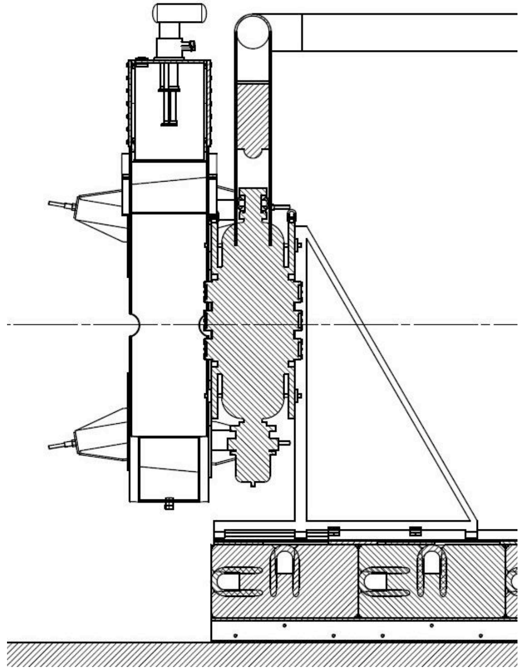


Module delivery at RAL: April 2010

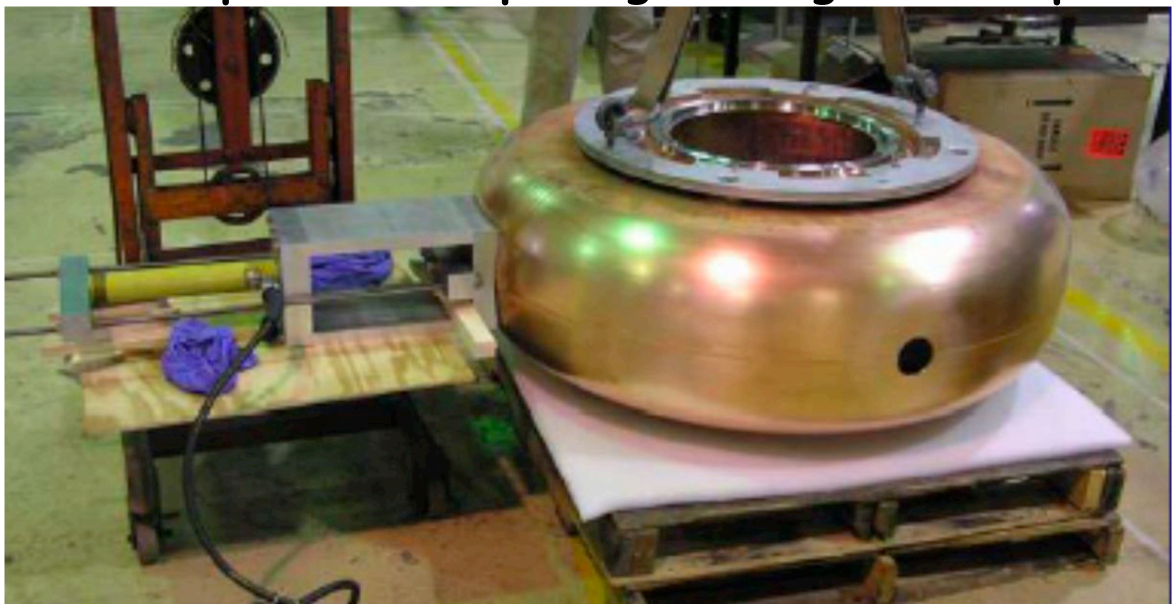


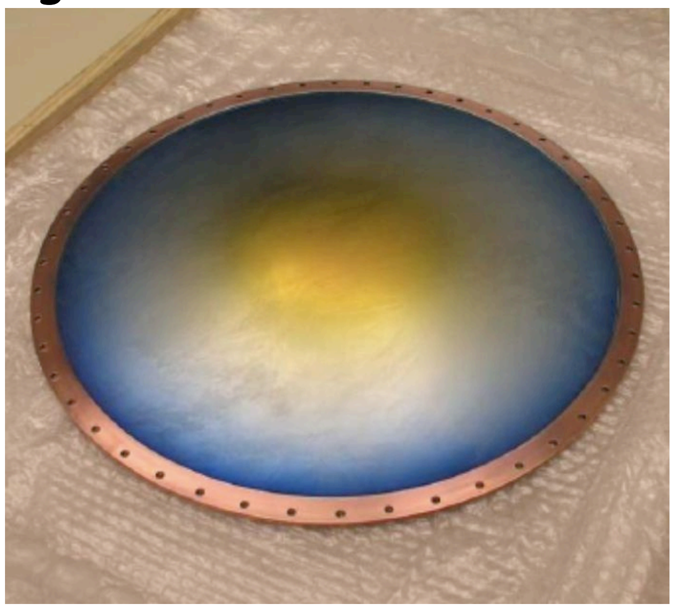
The test cavity at Fermilab will be tested with coupling coil in 2009

RF cavity construction



Procurement for cavities and windows has begun
Companies for spinning welding electro-polishing have been identified





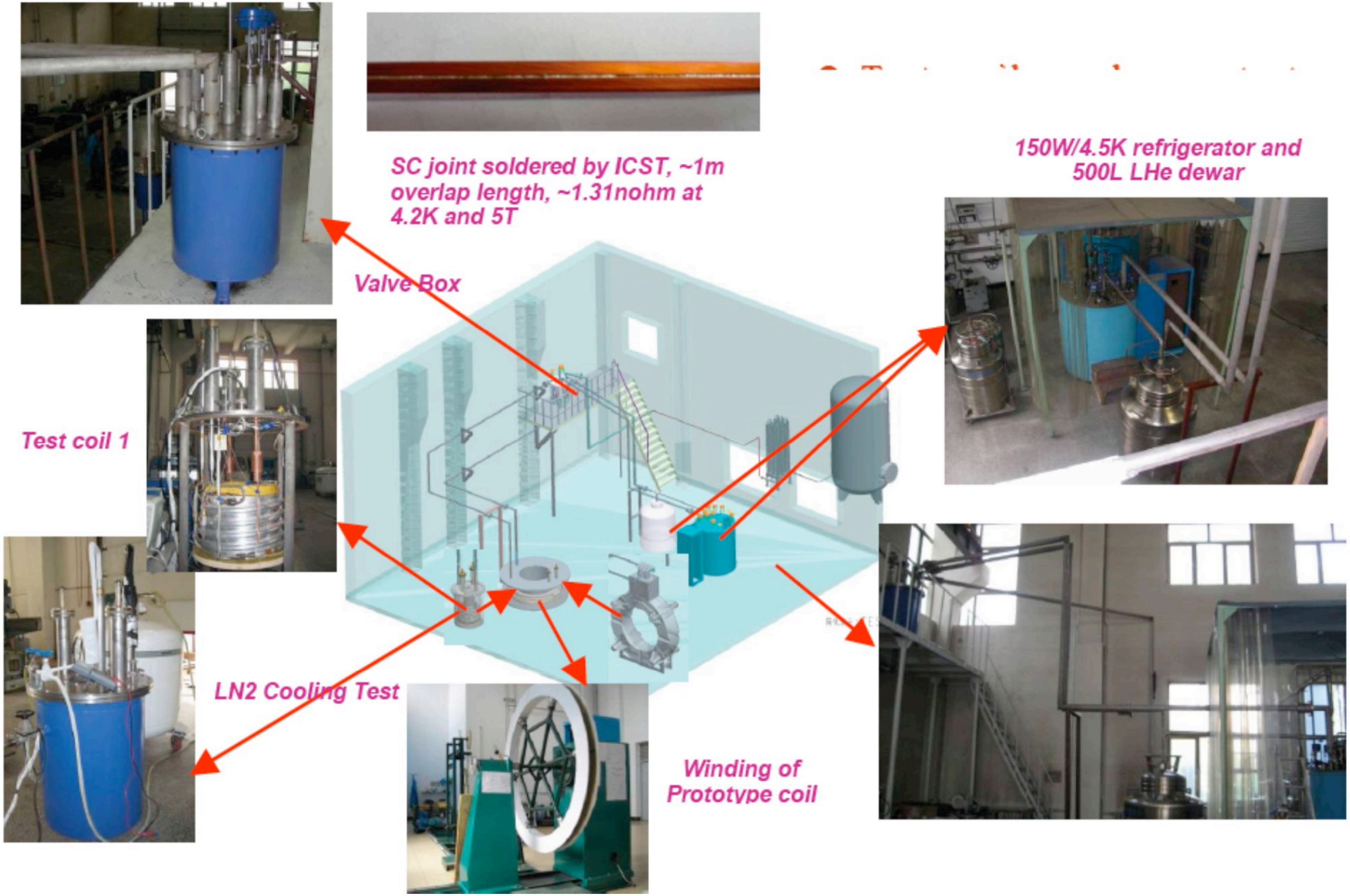
Coupling coils Harbin ICST -- overview by LBNL (Zisman)

Design for coupling coil essentially complete at ICST

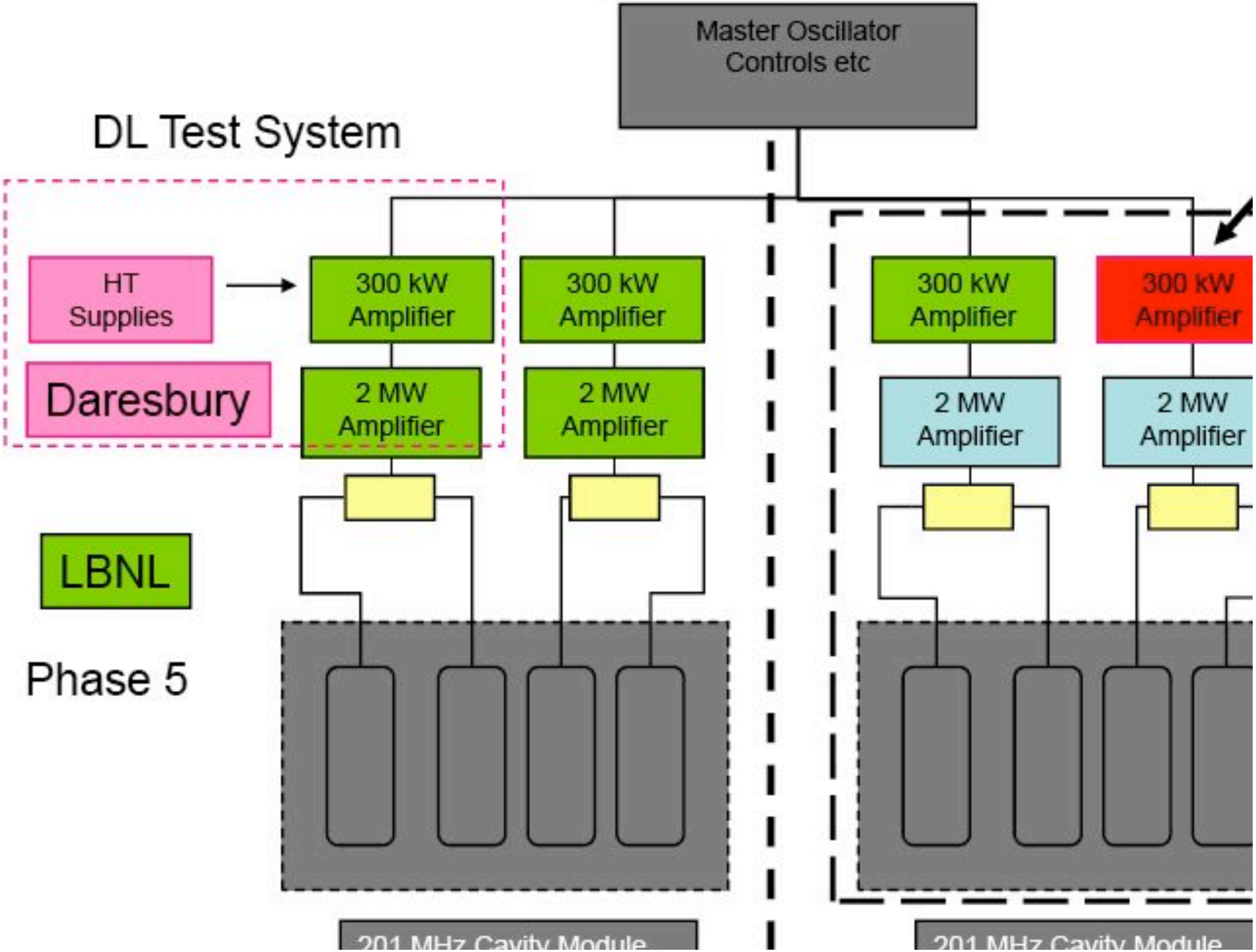
- review in December uncovered no significant technical issues
- large test coil fabrication now complete
  - testing will start in Mar09
    - permission to commence with winding of first "real" magnet (for MuCool R&D program) will be based on large coil test results
    - Expected delivery of CC0 for MUCOOL end of 2009, MICE CC1 in spring 2010.

Large Test Coil

Large Test Coil Vacuum Vessel


SC joint soldered by ICST, ~1m overlap length, ~1.31nohm at 4.2K and 5T
150W/4.5K refrigerator and 500L LHe dewar
Valve Box
Test coil 1
LN2 Cooling Test
Winding of Prototype coil

RF System for MICE



Refurbishment of power amplifiers from LBNL (at DL)

And CERN equipment
(work is completed at CERN: now packed and arrived to DL)

Test stand at DL operational first half 2009

Will start with CERN stuff -- tests in 2009

Ship and install in 2010. Lots of RF piping etc…

Beyond PHASEII -- Ideas for « Phase III »

ONCE PHASEII will be completed, having equipped the MICE hall with
-- spectrometers, TOF and PID able to measure emittance to 10^{-3}
-- 8 MW of 201MHz RF power
-- 23 MV of RF acceleration
-- Liquid Hydrogen infrastructure and safety

MICE can become a facility to test new cooling ideas.

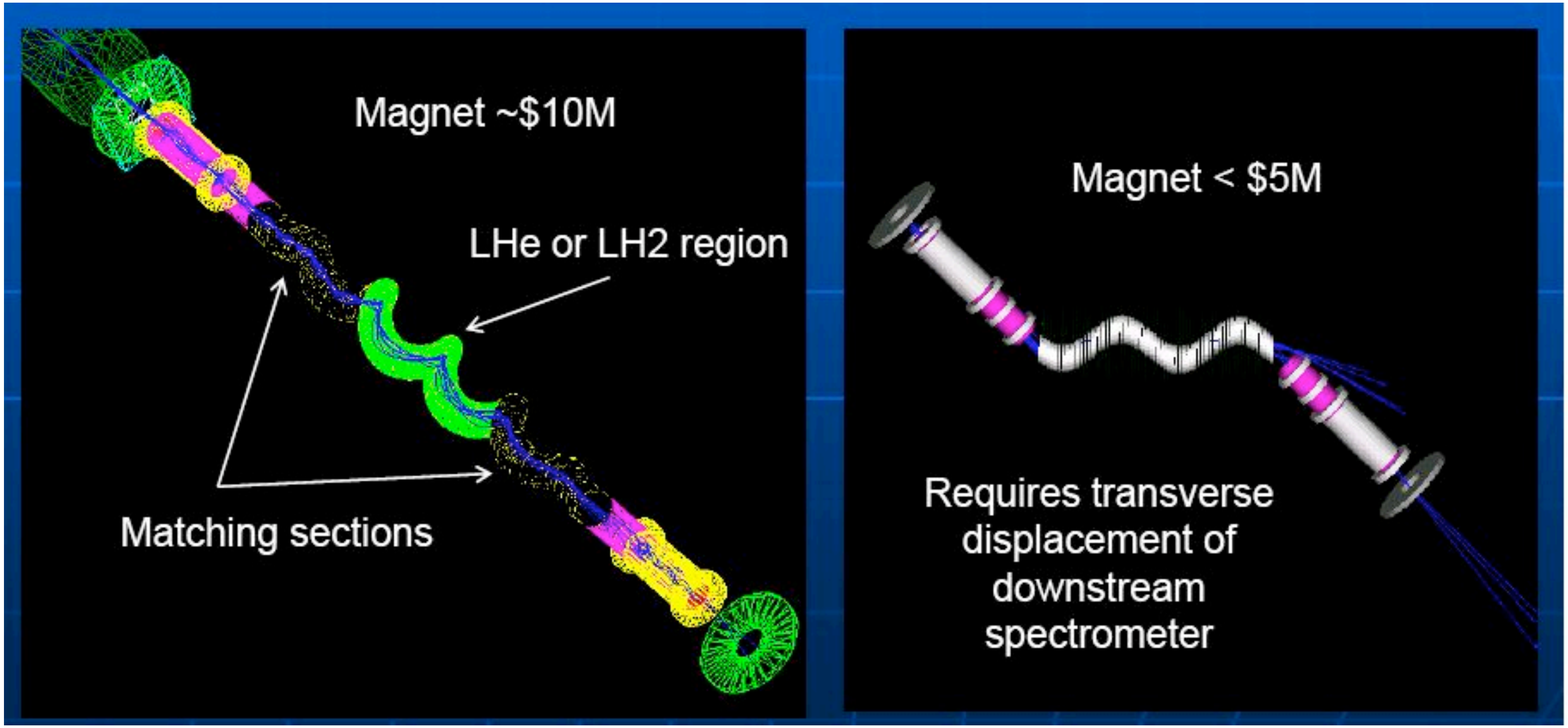
Such ideas were proposed:

A. with the existing MICE hardware to test optics beyond the neutrino Factory study II:
non flip optics,
low-beta optics (down to 5 cm vs 42 cm nominal)
other absorber materials He, Li, LiH, etc..
LN2 cooled RF cavities

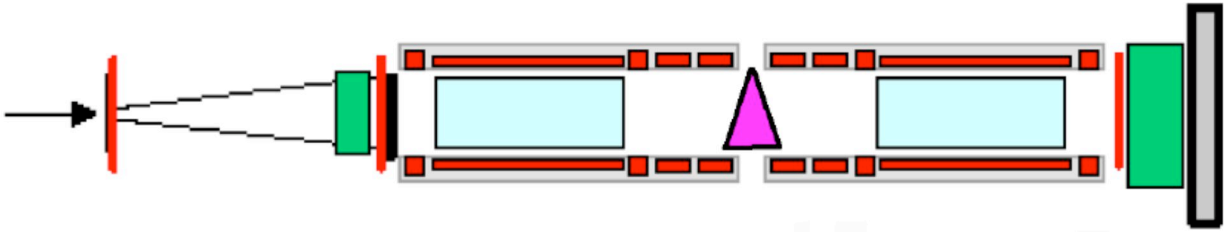
B. with additional hardware:
-- A. Skrinsky to test a lithium lense available at Novosibirsk
-- Muons Inc. to test a section of helicoidal channel (MANX)
-- B. Palmer proposed a poor man's concept of 6D cooling

PHASE III?

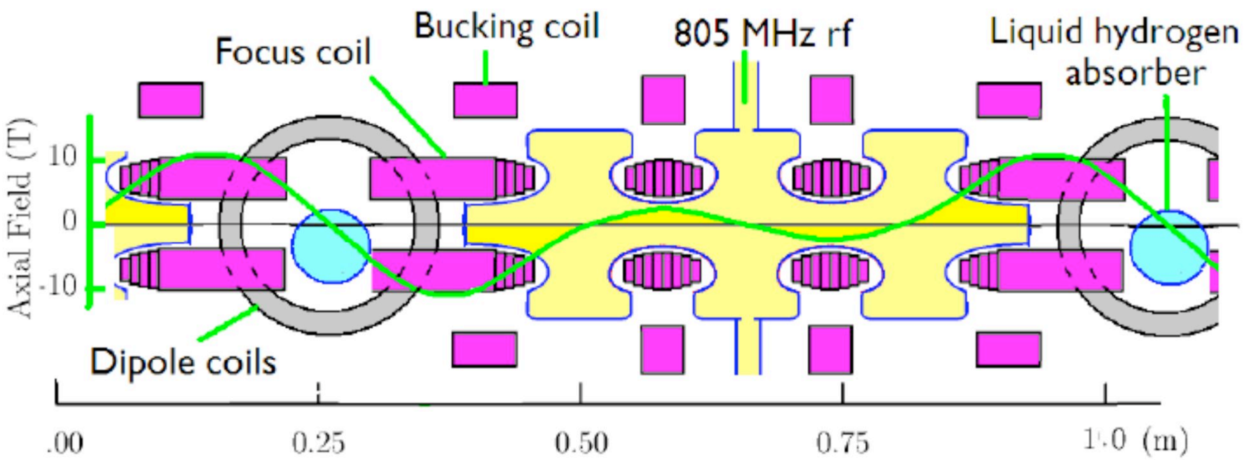
We had presentations by Rol Johnson (Muons Inc.) on MANX, a possible 6D cooling experiment using an helicoidal solenoid



B. Palmer's ideas



"Poor mice" cooling channel -- a step III.2 or IV.1?



A MICE coouling section with dispersion and small coils allowing containment of electron radiation

Conclusions

Looking back a year ago…. See a difference?

DATA! -- MICE IS A RUNNING EXPERIMENT!

Significant progress on commissioning beamline, DAQ, operations and detectors.
Still… schedule has slipped considerably, due to
>> decay solenoid,
>> target,
>> spectrometer solenoid.

Detectors ready to measure beam emittance and to develop optics

Goal of 2009 is to put a big dent into step III and begin to address systematic errors. + Publishable physics results.
Goal of 2010 is to demonstrate ionization cooling (Step VI & Step V)
Goal of 2011 is to study various optics and configurations (Step VI)

We are confident that the overseas contributions can be delivered by 2010

We would like to support very strongly the efforts of our UK collaborators
To secure funding for sufficient infrastructure support for STEP V
and approval for STEP VI!