MICE Project board 3

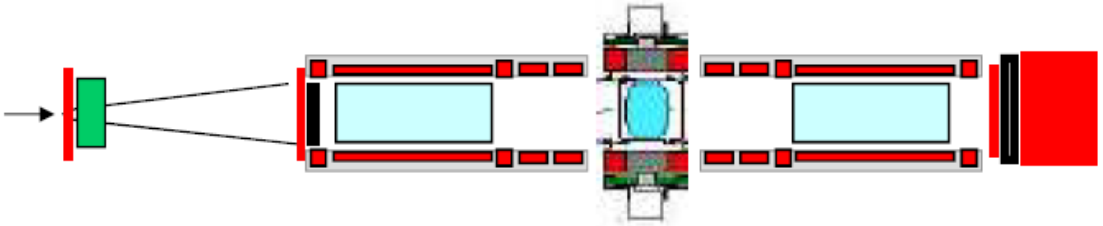
- MICE Status
- Responses to MPB2 recommandations

MICE SCHEDULE
update February 2012 V1

Run date:

STEP I

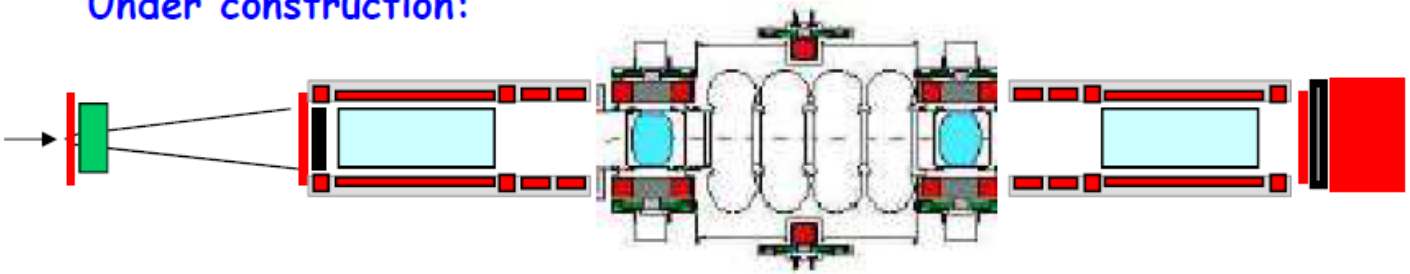
EMR run Q2 2012



STEP IV

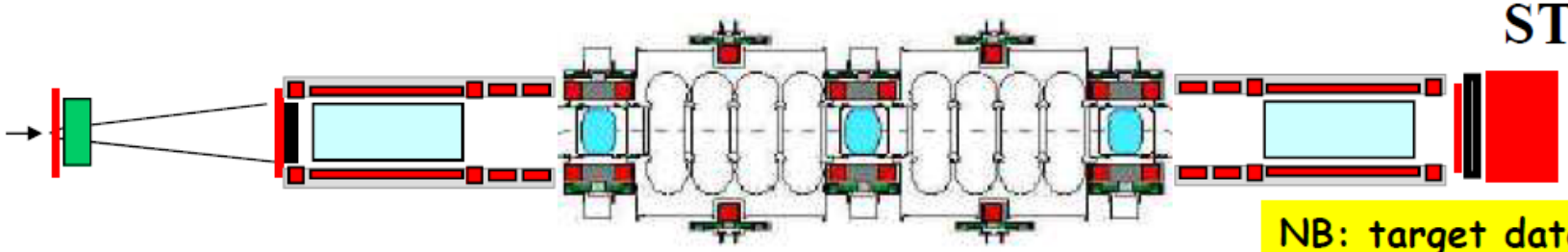
Q1 2013

Under construction:



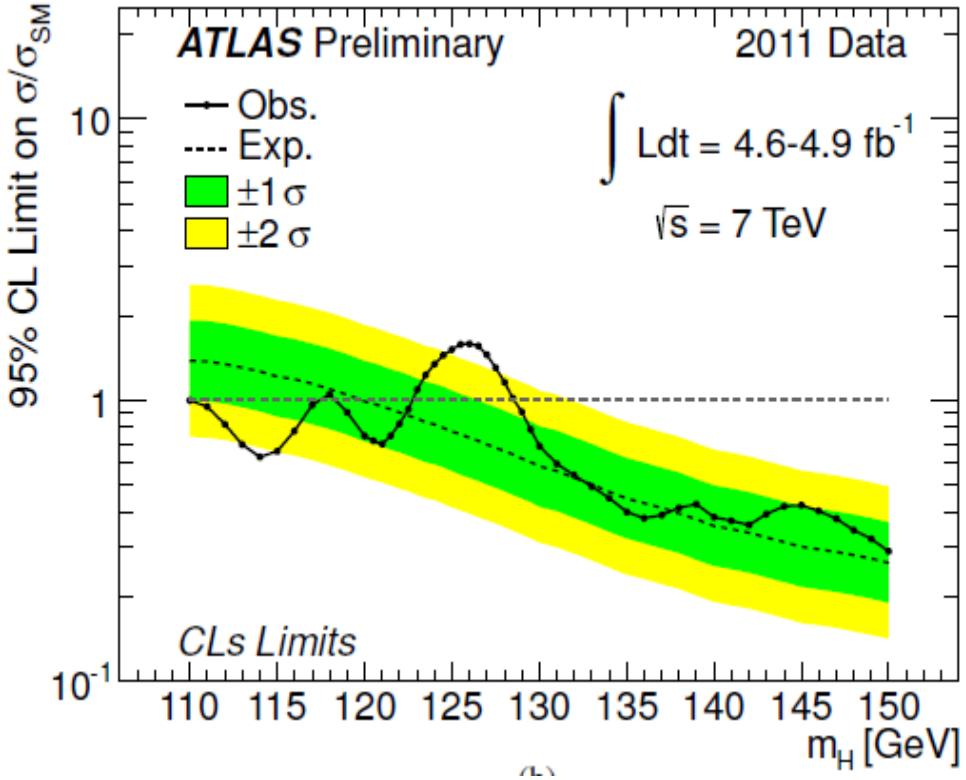
STEP V

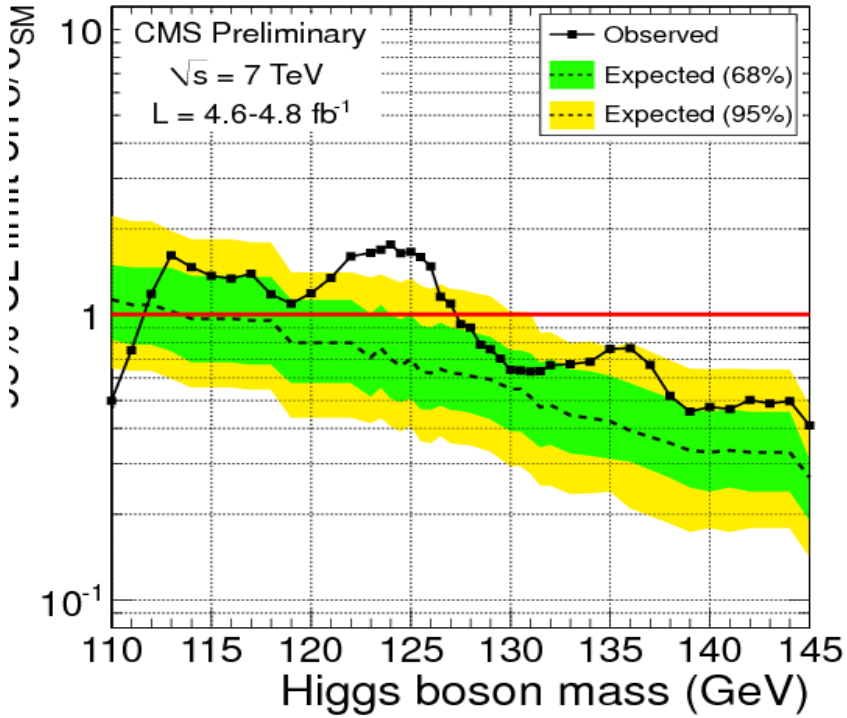
STEP VI



NB: target date 2016

Latest news

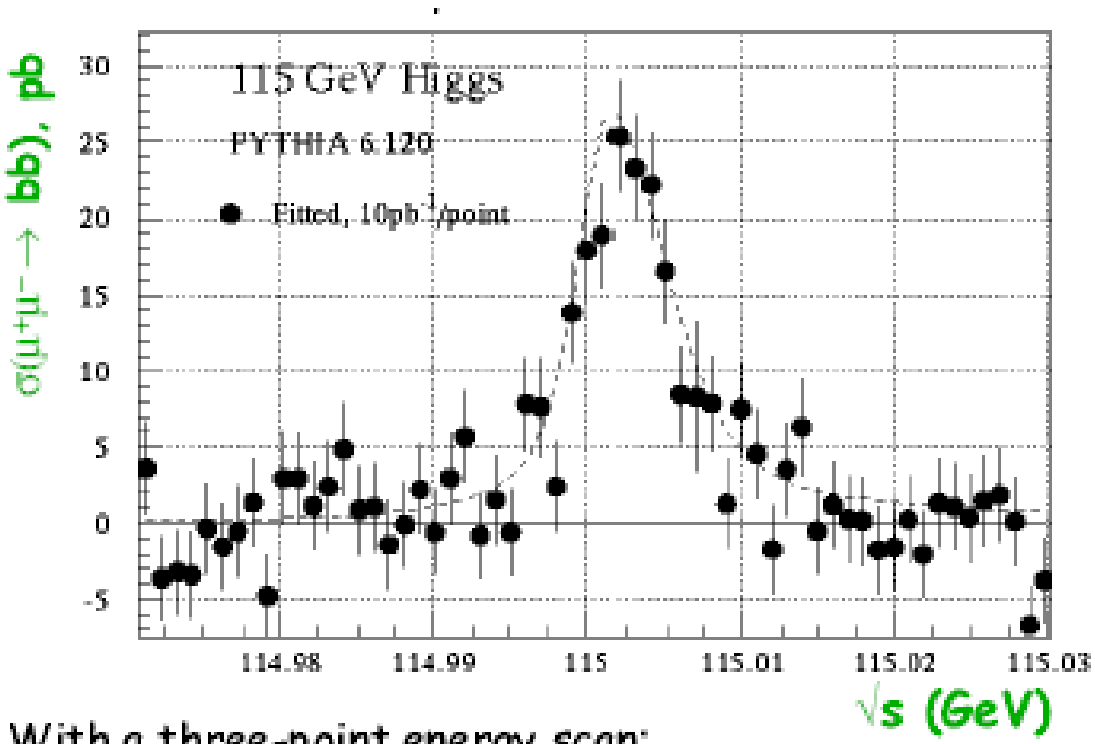




Both ATLAS and CMS experiments exclude a SM scalar boson (Brout Englert Higgs) everywhere except in a narrow mass range (117-129 GeV) where they see an excess at 2.5-2.8 σ at 125-126 GeV/c²)
Too soon to claim discovery but 'who would bet against a Higgs boson at 125 GeV?'

This is ideal mass range for a Higgs–dedicated muon collider (63 GeV/beam)

Muon collider



With a three-point energy scan:

Observable	With 100 pb^{-1}	With 2.5 fb^{-1}
Mass	± 0.1 MeV/c^2	± 0.05 MeV/c^2
Width	± 0.5 MeV	± 0.1 MeV
σ_{peak}	± 1 pb	± 0.2 pb

Statistics limited !

Still to be tried:

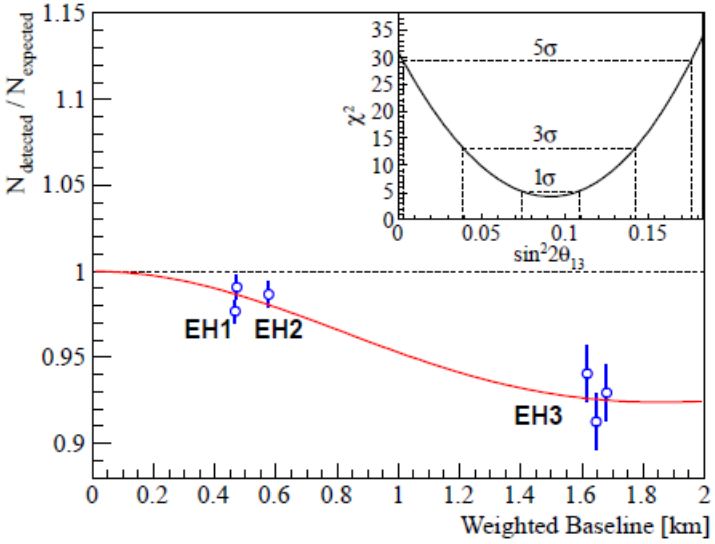
A scan in $\delta E/E$

Daya Bay nuclear reactor disappearance experiment

$$\sin^2 2\theta_{13} = 0.092 \pm 0.016(\text{stat}) \pm 0.005(\text{syst})$$

ADs. The fast-neutron and ^{9}Li/^{8}He backgrounds were site-wide correlated. In the worst case where they were correlated in the same hall and uncorrelated among different halls, we found the best-fit value unchanged while the systematic uncertainty increased by 0.001.

Fig. 4 shows the measured numbers of events in each detector, relative to those expected assuming no oscillation. The 6.0% rate deficit is obvious for EH3 in comparison with the other EHs, providing clear evidence of a non-zero θ_{13}. The oscillation survival probability at the best-fit values is given by the smooth curve. The χ^2 versus $\sin^2 2\theta_{13}$ is shown in the inset.



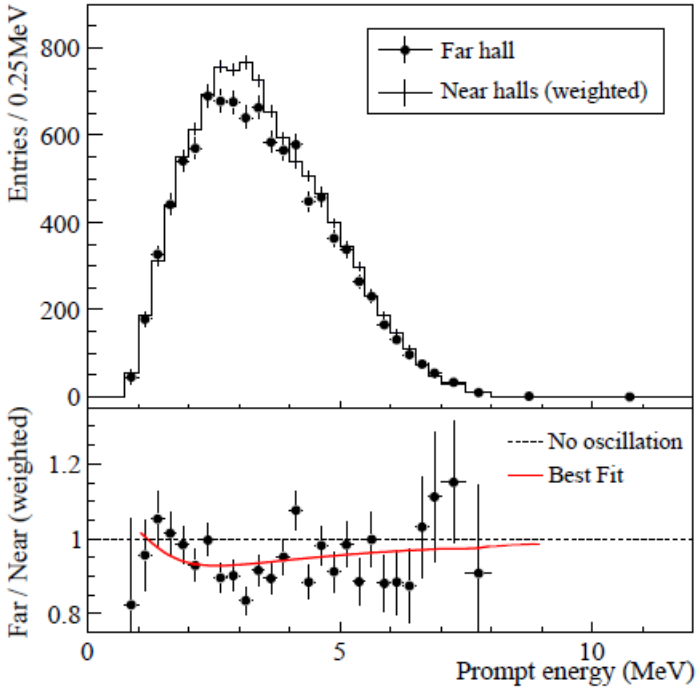


FIG. 5. Top: Measured prompt energy spectrum of the far hall (sum of three ADs) compared with the no-oscillation prediction from the measurements of the two near halls. Spectra were background subtracted. Uncertainties are statistical only. Bottom: The ratio of measured and predicted no-oscillation spectra. The red curve is the best-fit solution with $\sin^2 2\theta_{13} = 0.092$ obtained from the rate-only analysis. The dashed line is the no-oscillation prediction.

Large value of theta_13 ➔ mass hierarchy easier, CP asymmetry smaller, systematic errors crucial. Precision measurements will require a neutrino factory

MICE Status

1. STEP IV

1. Collaboration is now focused on preparations for step IV

2. Spectrometer Solenoids and Focus Coil magnets are close
   to cool down and testing within next 2 months.
   Controls and magnetic measurement device are ready

3. Liquid Hydrogen system has undergone LHe testing, safety review,
   and will be tested with hydrogen in April 2012. (will block the hall for 4 weeks)

4. Target replacement was smooth, diffuser construction is well advanced

5. Detectors are ready. Single station tracker test in beam in May.
   EMR in full construction, electronics and all equipement now purchased.

6. Operations improved with beam bump (nice, flat, beam delivery)
   PPS system operational, superb run took place in December 2011.
   High pressure on controls and monitoring

7. Analysis runs online with new MICE software package, 'MAUS'

8. Step IV run plan being elaborated (see report).
   Lots of important and fun measurements ahead of us!

Some Collaboration News

1. Andy Nichols (MICE project manager) backed up by
MICE-UK Project Manager Alan Grant (Daresbury)
MICE Integration Engineer Jason Tarrant (RAL)
Schedule Coordinator Gail Hanson (U. Cal. Riverside)
MICE (CDM) Principal Contractor, Stewart Greenall

2. New deputy spokesperson Alan Bross (Fermilab)

3. Strong reinforcment of team at LBNL

4. New collaborators from the Atoms Beams and Plasmas (ABP) research laboratory at the *University of Strathclyde*. *Kevin Ronald* et al
to play a major role in the MICE RF project.

5. New Collaboration Board Chair Yagmur Torun (IIT & Fermilab)

6. New MAP project director (Mark Palmer)

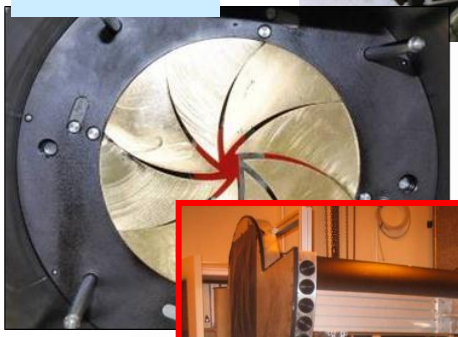
7. Interest of CERN via Ilias Efthymiopoulos & student + ATLAS magnet team.

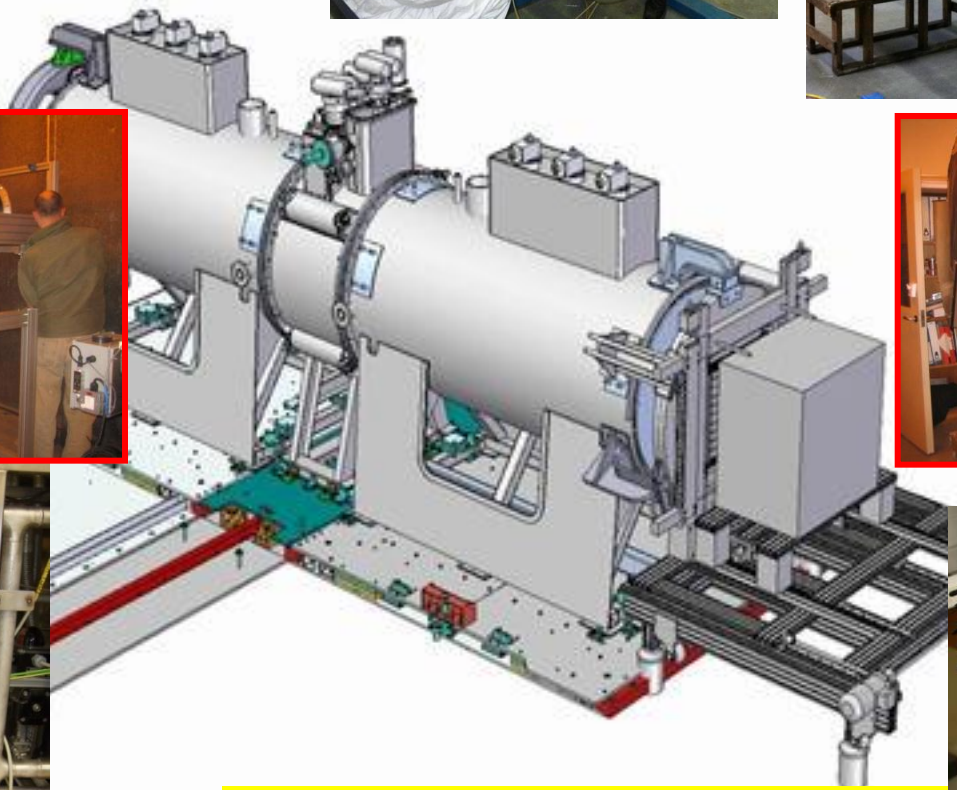
8. After departure of Marco Apollonio (RAL→ Diamond) , Maria Leonova (Fermilab) to join for beam line expertise, and support for analysis of magnetic field maps.

STEP IV

MAGNETS!

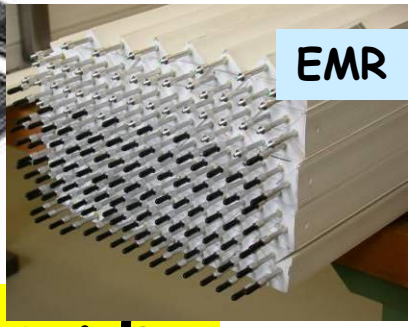
diffuser





2trackers

LH2 system



EMR

Make this a photograph by the end of 2012!

MICE Status

2. Towards STEP VI

1. Delay in step IV and in Coupling Coils has made it now impossible to contemplate the assembly of step V before the Aug 2014 shut down

2. Thus go to fall-back solution of assembly of experiment directly in step VI configuration as soon as possible.

3. Progress in Coupling Coil has been considerable… although slower than expecteed at MPB2.
-- first coil produced at Qi Huan (beijing) arrived at Berkeley 14 October 2011;
-- review of the cryostat design, (summer 2011) → 29 February 2012;
-- test of the first coupling coil (end 2011) → summer 2012 at the earliest

4. Progress in understanding CC construction process.
   -- realistic scenario by June 2012
   -- and full step VI plan by end of 2012.

5. RF power and LLRF needs has been reviewed. Clearly not ready.
   MICE-wide RF project (including cavities and beam/detector physics) will aim at definition of specs for RF power station and LLRF better definition of RF test plan and RF system test

6. RF system test has a good time window in MICE in 2014.

7. → Target date is 'start running MICE step VI in 2016'.

RESPONSES TO MPB RECOMMENDATIONS OF JUNE 2011

1. Maintain an increased level of scientific supervision of the spectrometer solenoid project, and pressure on Wang NMR, with the aim of getting the first spectrometer solenoid to RAL in March 2012.

done.

See 'spectrometer solenoids' of the report.
LBNL brought increased technical staff (up to three technicians) in the project at WANG NMR
Mechanical engineer Roy Preece, was detached from RAL to LBNL til June 2012.

Limited schedule slip occurred nevertheless,
(March 2012) → June 2012.

2 Increase supervision of the coupling coil project, perhaps by engaging Fermilab to test the first coil. Carefully review the coupling coil cryostat design. Present first coupling coil test results at the next MPB meeting (~ February 2012).

There has been considerable progress in this direction, see the narrative in the section 'coupling Coils' of the report and S. Gourlay's presentation later today.

-- first coil produced at Qi Huan (Beijing) arrived at Berkeley 14 October 2011;
-- review of the cryostat design, (summer 2011) → 29 February 2012;
-- test of the first coupling coil (end 2011) → summer 2012

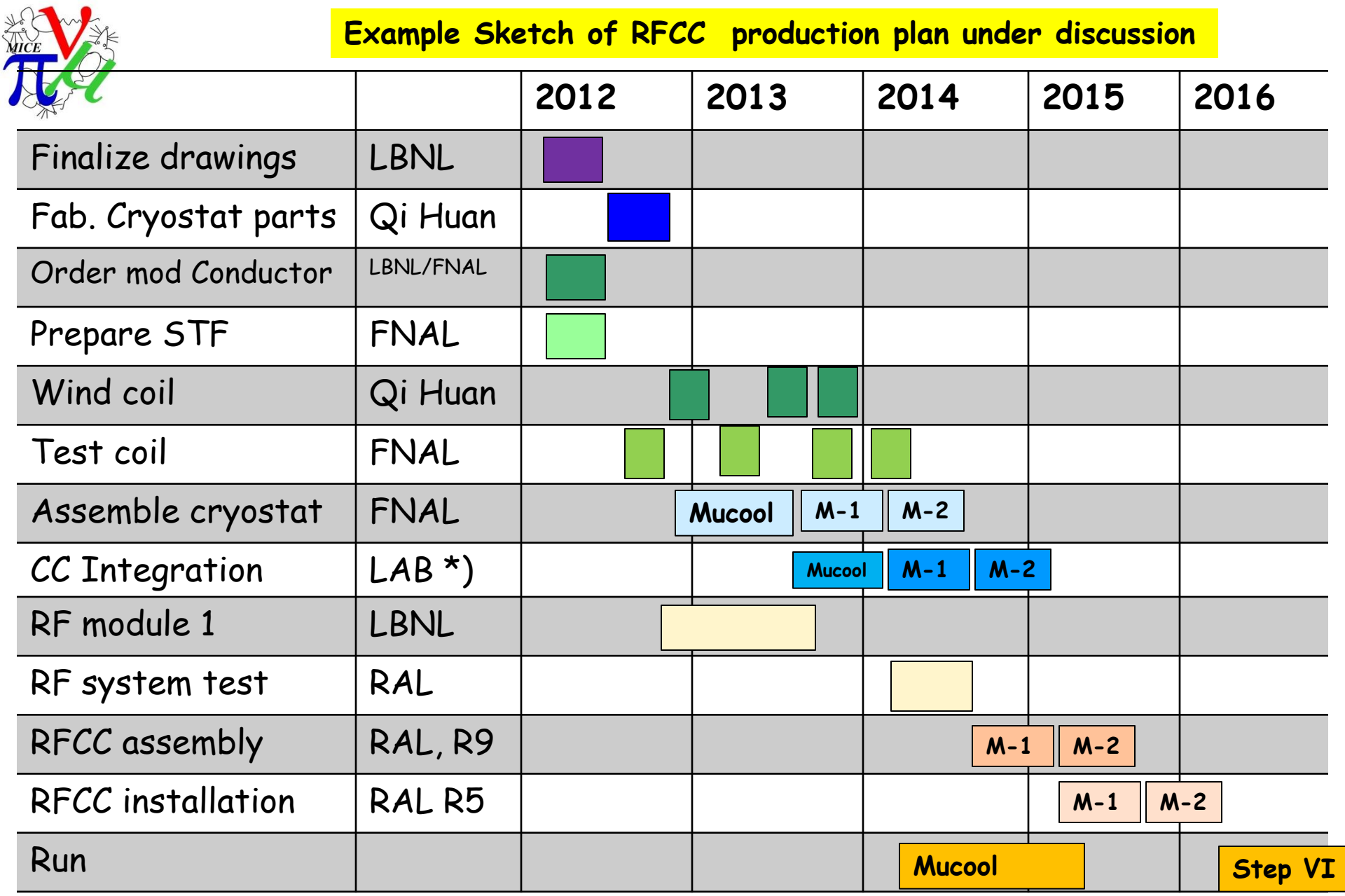
➔ impossible to assemble step V before the shut-down in August 2014.
➔ alternative = assemble the experiment directly in step VI configuration.
➔ begin the MICE step VI run in ~2016.

➔Our aim:
1. to converge to scenario for the MICE coupling coils by June 2012 and
2. construct a detailed step VI project schedule by the end of 2012.

Discussions towards a production plan have made progress, involving LBNL, Fermilab and CERN, (and RAL of course) leading to the following time estimates:

2-3 months to make cryostat drawings ready for production
4 months for production of parts at Qi Huan (but this process requires full time supervision)
15 months for construction of 3 cryostats from the parts under supervision by Fermilab (estimate from Meier tools, requires constant supervision)
4 months for winding and training for further coils.
18 months for integration and test of 3 trained coils into cryostats including instrumentation and controls.
6 months for assembly of one RFCC module from Coupling Coil, RF cavities and vacuum vessel.
6 months for installation and commissioning of one RFCC module in beam position in MICE.

Example Sketch of RFCC production plan under discussion



*) LAB could be LBNL, CERN, FNAL … under discussion. Single place best.

3.Promote progress in the RF testing programme for power sources, cavities, LLRF, controls and couplers, in order to reduce schedule risk.

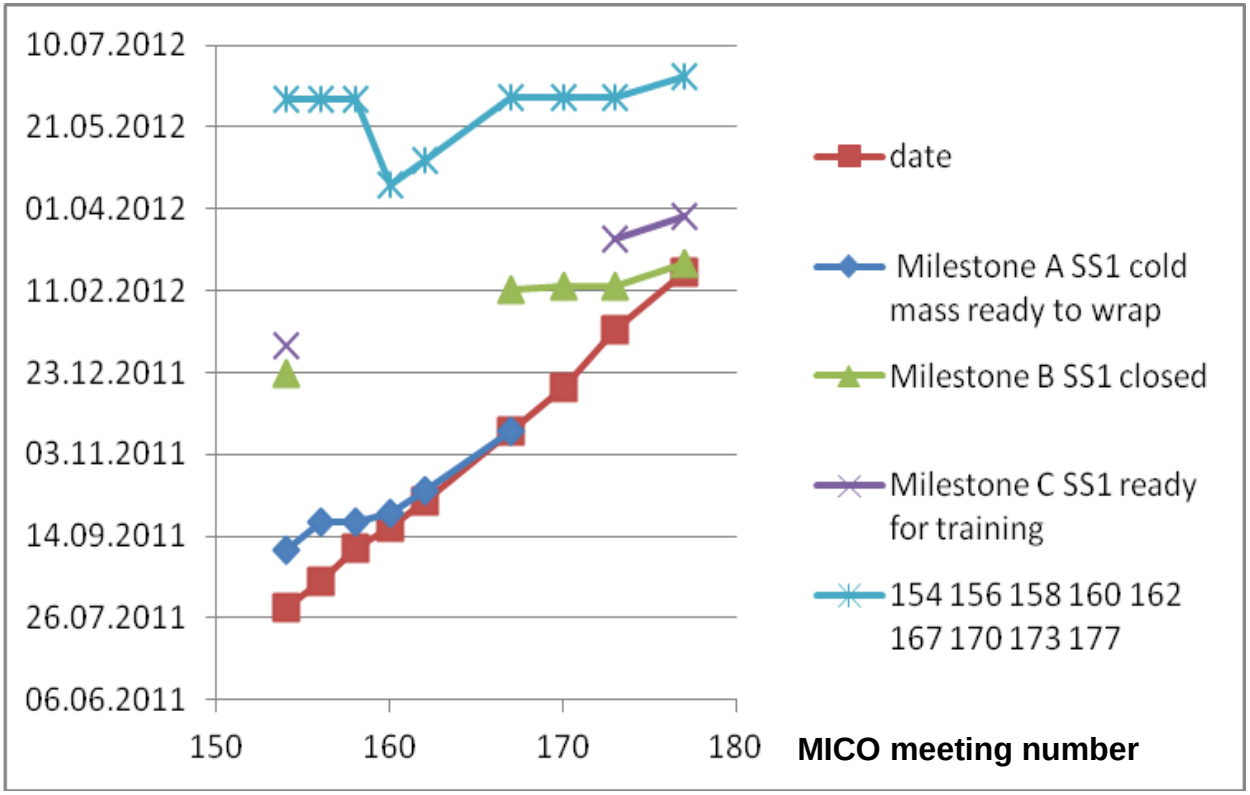
4.Consider soak-testing the high-power sources in order to minimize the chances of problems arising when they are brought into use for Step V.

A design review of the RF power source took place on 7 December 2011.
https://indico.cern.ch/conferenceDisplay.py?confId=162178.
Responses in preparation.
Reviewers made a number of suggestions described in the "RF Power Stations" part of the report.
-- emphasized the need for a system test
-- need unified effort btw RF power and RF cavities.
➔MICE RF task force + 1stdedicated MICE RF session CM32 9 Feb 2012.
➔Dedicated RF workshop 16-17 April 2012 @ Daresbury

The tests recommended by the reviewers can be partially addressed at the MTA at Fermilab for the components, but the MICE RF power system will need to be tested both at Daresbury and, for the full system test, in situ.

The aims of the workshop will be to complete the answers to the review, define the RF system specification in more detail, and define the full RF system test, its scope and its scheduling well ahead of the commissioning of MICE step VI.

Monitor the level of achievement of key milestones in 2011 and report on the implications for future planning in the next MPB meeting (~ February 2012).



Some SS1 milestones at MICO meetings

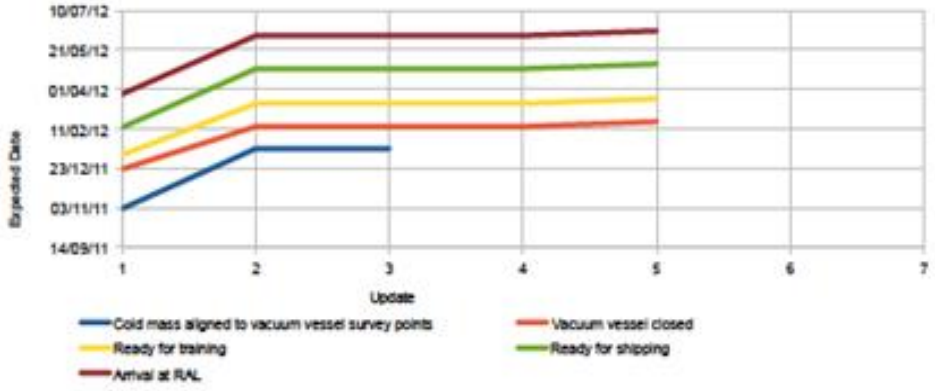
	11/10/11	11/01/12	18/01/12	25/01/12	01/02/12	08/02/12	15/02/12
Upstream							
Cold mass aligned to vacuum vessel survey points	02/11/11	17/01/12	17/01/12				
Vacuum vessel closed	22/12/11	14/02/12	14/02/12	14/02/12	20/02/12		
Ready for training	09/01/12	14/03/12	14/03/12	14/03/12	20/03/12		
Ready for shipping	13/02/12	27/04/12	27/04/12	27/04/12	03/05/12		
Arrival at RAL	26/03/12	08/06/12	08/06/12	08/06/12	14/06/12		
Downstream							
Cold Mass on support beam	02/11/11	17/01/12	17/01/12				
Assembly starts	21/12/11	28/02/12	28/02/12	28/02/12	16/03/12		
Cold mass aligned to vacuum vessel survey points	16/02/12	27/03/12	27/03/12	27/03/12	13/04/12		
Vacuum vessel closed	09/03/12	18/04/12	18/04/12	18/04/12	07/05/12		
Ready for training	13/04/12	18/05/12	18/05/12	18/05/12	06/06/12		
Ready for shipping	25/05/12	03/07/12	03/07/12	03/07/12	20/07/12		
Arrival at RAL	03/07/12	14/08/12	14/08/12	14/08/12	31/08/12		

Change since last update	
Reduction	Date
No Change	Date
1 – 2 week extension	Date
2 – 4 weeks extension	Date
1 – 2 month extension	Date
2+ months extension	Date

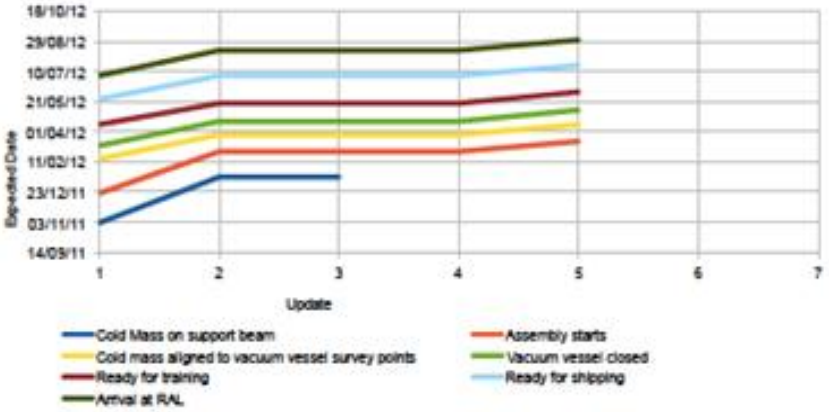
Baseline	Date

Complete	Date

Upstream Milestone Tracker

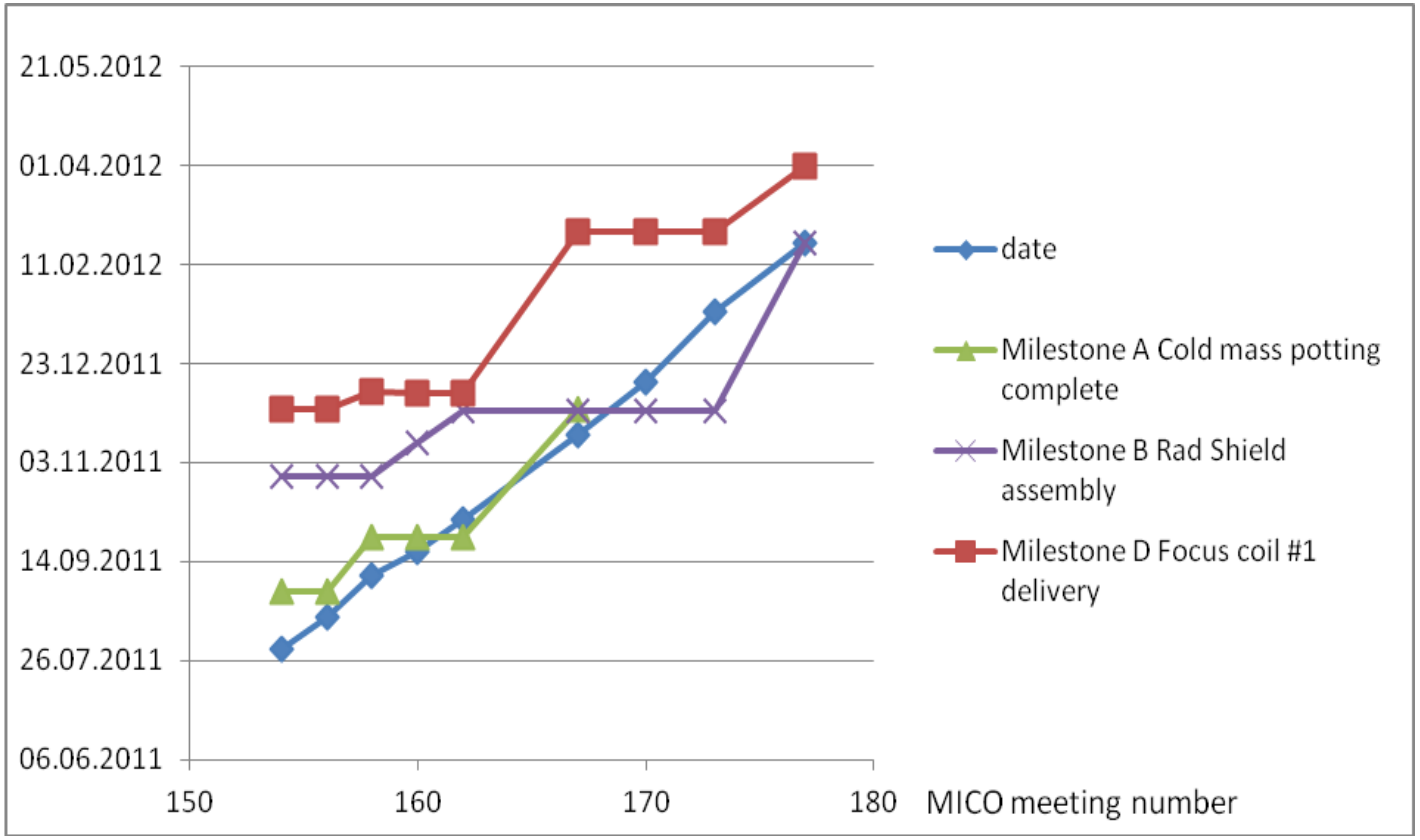


Downstream Milestone Tracker



Work Completed
Cold Mass bore covered with Aluminized Mylar to give added thermal efficiency
Radiation Shield bore installed, end plates of the Radiation shield fitted and welded into place
Cooler tower placed into position and tack welded. Cooler stub tubes welded to the main cooler inlet tubes on the cold mass
Instramentation from the radiation shield, cold mass supports, cold mass wired to the feedthrough
All radiation shield pentration holes for the cold mass supports have been covered to prevent stray thermal radiation transfer
Vacuum Vessel end plates have been aligned to the cold mass bore and fixtures welded

ToDo in next 2 week period	*Scheduled*	*Days*	*Resource*
Fit the end plate MLI to the radiation shield	01/02/2012	2	LBNL
Fit the warm bore	13/02/2012	1	WANG
Weld the Virostek plate bracket pads to the outside of the vacuum vessel. Pads are to be surveyed into position using the tooling ball positions on the outside of the vacuum vessel	08/02/2012	2	LBNL Survey / WANG Welding
Weld the Suuport feet into position on the outside lower section of the vacuum vessel	10/02/2012	2	LBNL Survey / WANG Welding
Weld the vacuum chamber end plates	16/02/2012	3	WANG Welding
Fit MLI to the upper and lower sections of the cooler tubes, outside of the first stage copper plates	07/02/2012	2	LBNL
Weld side to the cooler towers	14/02/2012	2	WANG Welding
Finalise all instrumentation	16/02/2012	2	LBNL



Some AFC milestones as shown at MICO meetings

Coupling coil project had a few important milestones:

delivery of the first wound coil at LBNL took place in 14 October 2011;

the review of the cryostat design, programmed for summer 2011 in the previous report, has taken place on 29 February 2012;

the test of the first coupling coil programmed for end 2011 as of MPB2 has now shifted to summer 2012 at the earliest, but the plans have become much more concrete and reliable.

It is clear that, while Fermilab is progressively taking responsibility in this test, the MICE magnet experts have been more dedicated to the spectrometer solenoids, which had priority

Evaluate the minimum data-taking time in Step IV in order to achieve Step V before the long shutdown of ISIS that is scheduled to begin in August 2014.

This is described extensively in section 'step IV'. (see V. Blackmore's talk)

Three ISIS running periods are needed to execute the highest priority items.

-- MICE empty: commissionning, alignement and optics.
-- MICE with liquid absorber: measurement of CMS and straggling, cooling.
-- MICE with solifd absorber – ibid.

The full solid absorber program including an emittance exchange demonstrator with a wedge LiH absorber will extend this to a year.

<u>Comments:</u>
This will be very demanding on MICE scientists; online reconstruction essential

It is no longer possible to achieve running of step V before August 2014, therefore any scheduling conflict has disappeared.

The remaining time in 2014 will be a good 'window' for the RF system test under consideration.

Maintain the recent progress of milestone oversight and understand critically the resource implications that may become schedule drivers. Report back for the next MPB in February 2012.

An extended step IV installation scheduling meeting took place on 3 February 2012. general plan is solid and well supported

--weakness: manpower supervising the construction and commissioning of the superconducting solenoids may be double counted in summer 2012,
First solenoid is at RAL
Second one will be under completion at LBNL.

This has been communicated to Steve Gourlay project leader in LBNL.

The same burden is likely to make it difficult to ensure supervision of the coupling coil project simultaneously. If unsolved this issue may cause some delay to the start of step IV, as well as to the testing of the first coupling coil magnet.

Starting in summer 2012, the experiment will enter a very active phase with installation and commissioning of the step IV components. This period will be followed by an intense period of beam commissioning and data taking.
This is exciting!
But there are concerns that US scientists might not be supported at a level allowing sufficient presence at RAL for this important period.

MPB 3 agenda

Status report and responses to MPB-2 recommendations	A. Blondel
Physics program and runs: autumn 2011 and step IV	V. Blackmore
Schedule, milestones and step IV installation	A. Nichols
Magnet Integration	M. Courthold
Beam line and trackers	K. Long
Liquid hydrogen system: infrastructure and operations	S. Watson
RF project and progress towards step VI	A. Bross
Spectrometer solenoid, coupling coils	S. Gourlay