Imperial College London

Science & Technology Facilities Council

Welcome and introduction

K. Long, 6 October, 2016

Plan

- Summer conferences
- Highlights of 2016/02
- Papers
- Summer shutdown
- Commissioning and operations
- Moving forward
- CM46

Welcome and introduction

SUMMER CONFERENCES

38th INTERNATIONAL CONFERENCE ON HIGH ENERGY PHYSICS

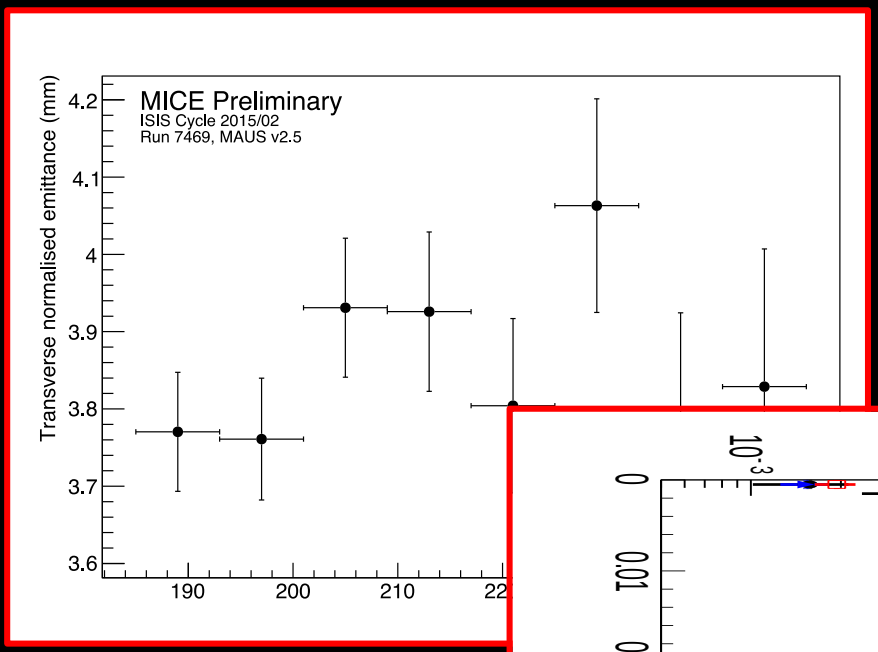
AUGUST 3 - 10, 2016
CHICAGO

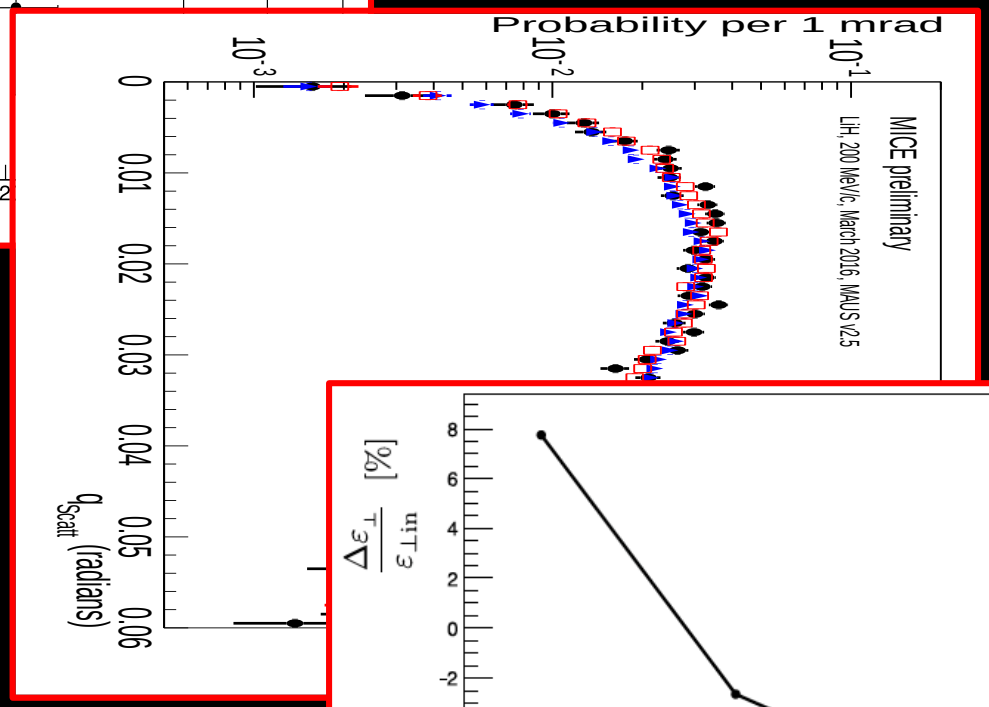
12th Rencontres du Vietnam

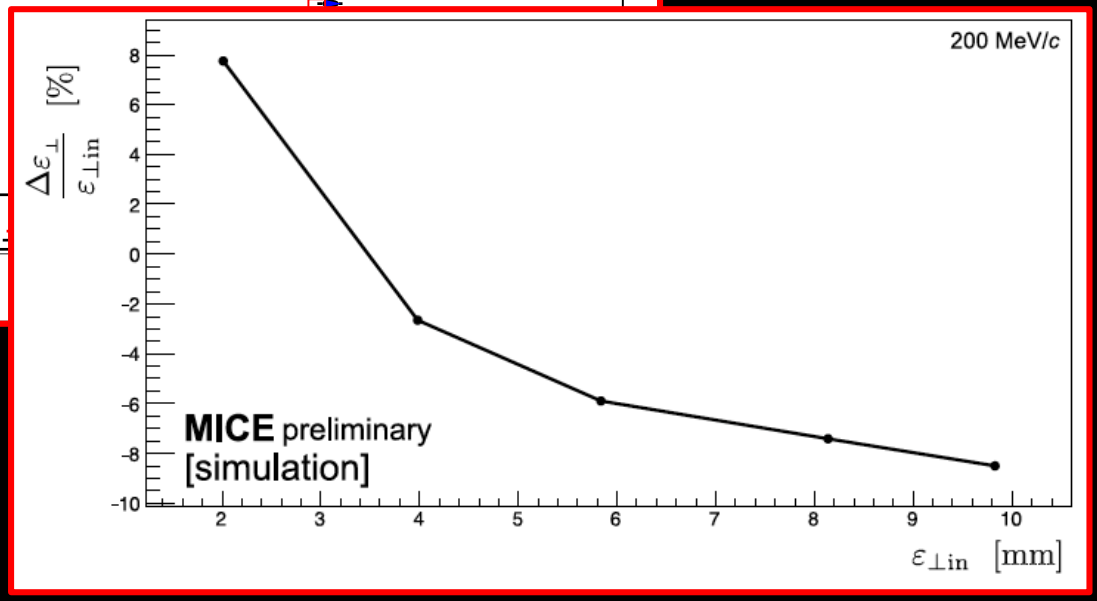
Aug 21-27

ICISE

NuFact 2016


MICE Preliminary
ISIS Cycle 2015/02
Run 7469, MAUS v2.5
Transverse normalised emittance (mm)
4.2
4.1
4
3.9
3.8
3.7
3.6
190
200
210


Probability per 1 mrad
10^{-3}
10^{-2}
10^{-1}
MICE preliminary
LiH, 200 MeV/c, March 2016, MAUS v2.5
θ_{Scatt} (radians)
0
0.01
0.02
0.03
0.04
0.05
0.06


200 MeV/c
$\frac{\Delta\varepsilon_\perp}{\varepsilon_{\perp in}}$ [%]
8
6
4
2
0
-2
-4
-6
-8
-10
MICE preliminary
[simulation]
2
3
4
5
6
7
8
9
10
$\varepsilon_{\perp in}$ [mm]

A successful summer!

- **Presentations of uniformly high quality:**
  - **ICHEP:**
    - **Parallel-session presentation: Steve Boyd (Warwick)**
    - **Posters: Victoria Blackmore (Imperial) and Tanaz Mohayai (IIT)**
  - **NuFact:**
    - **Parallel-session presenters: Francois Drielsma (Geneva), Ryan Bayes (Glasgow) and Yordan Karadzhov (Geneva)**

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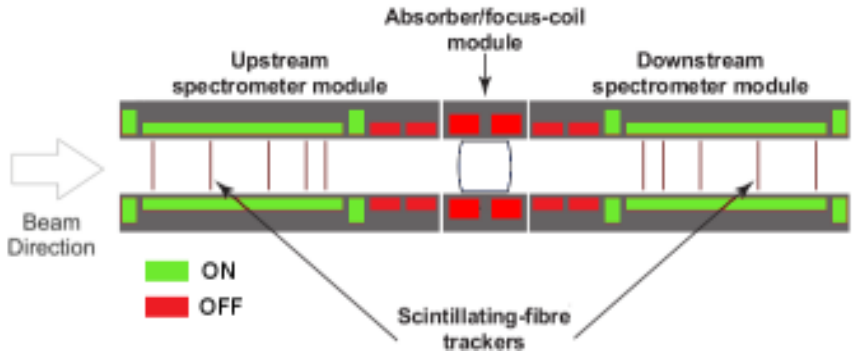
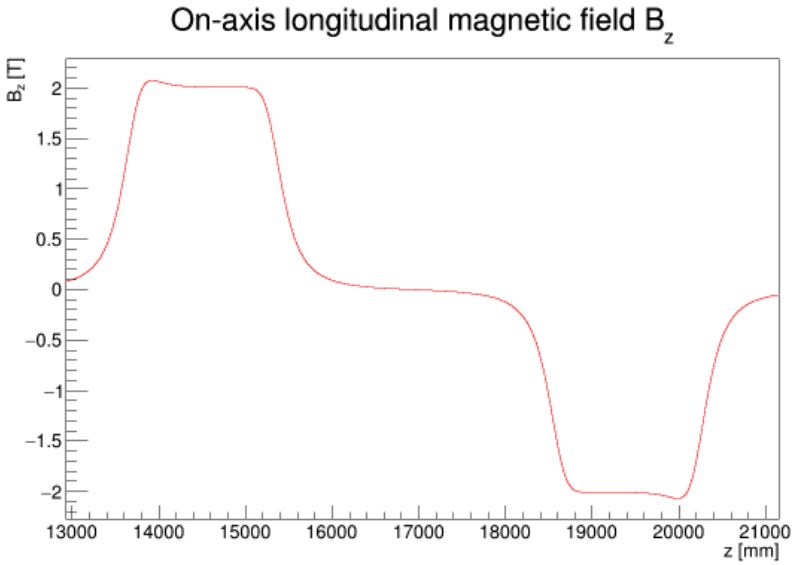
HIGHLIGHTS OF CYCLE 2016/02

ECE(140)+ECE(140) field-on data taking

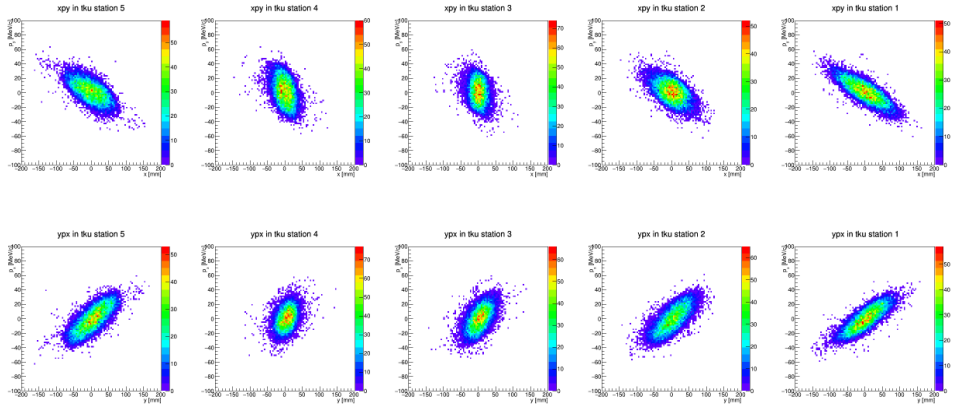
- Both spectrometers ECE coil triples were powered at 140 A, which corresponds to $\sim$2 T in each tracker
- Flip mode, downstream ECE negative polarity
- A 3 mm-200 MeV/c input beam was used, empty absorber module
- Run 8070, 366392 TOF1 triggers in 1 hour 30 minutes

$\rightarrow$ First look at muons that made it through the entire MICE channel





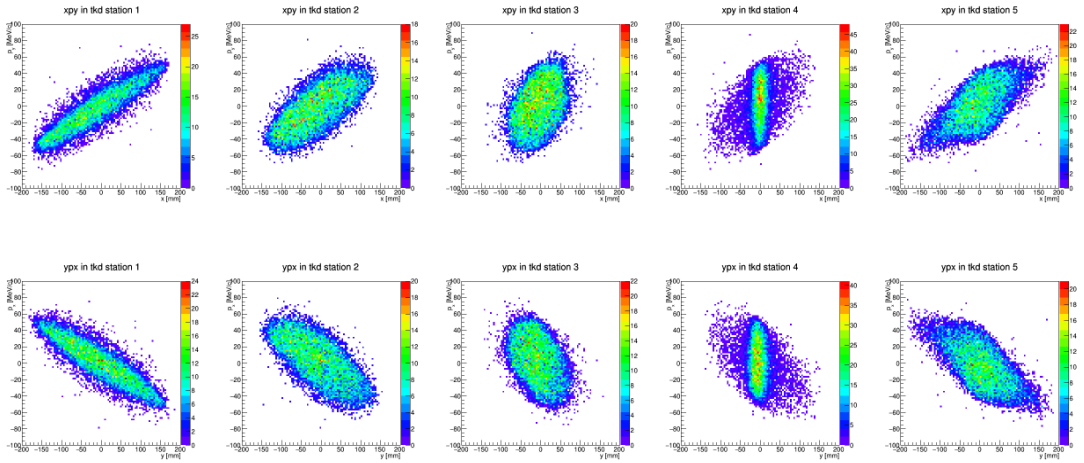
Polarity in the upstream tracker



$$\hat{L} = \langle xp_y \rangle - \langle yp_x \rangle < 0 \qquad (1)$$

→ Anticlockwise rotation, **normal** polarity

Polarity in the downstream tracker



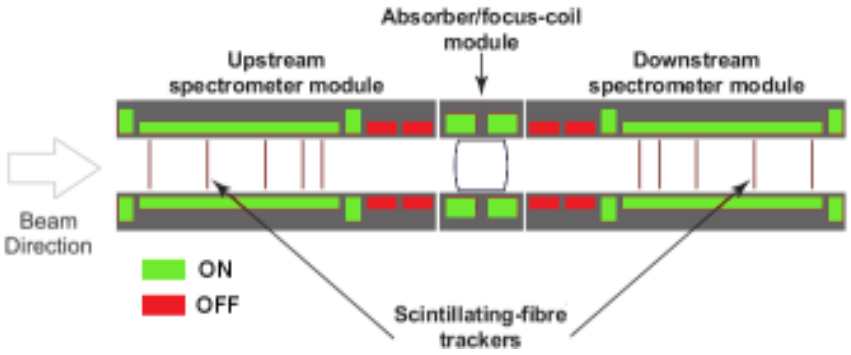
$$\hat{L} = \langle xp_y \rangle - \langle yp_x \rangle > 0 \qquad (2)$$

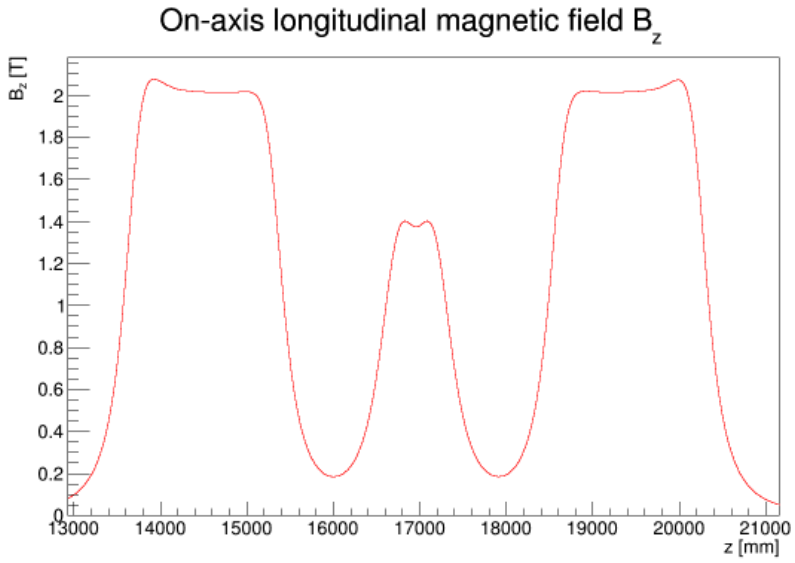
→ Clockwise rotation, **flipped** polarity

ECE(140)+FC(50)+ECE(140) field-on data taking

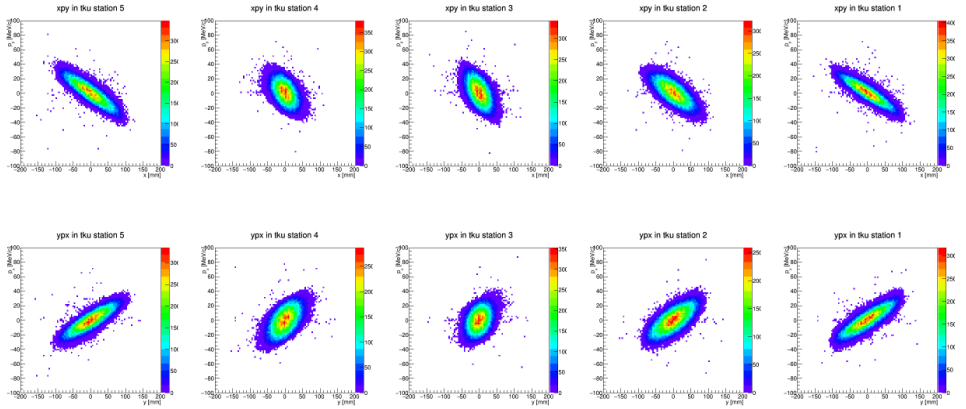
- Both spectrometers ECE coil triples were powered at 140 A, which corresponds to ∼2 T in each tracker
- The focus coil was powered at 50 A together with the spectrometers
- A 3 mm-140 MeV/c input beam was used, empty absorber module
- Run 8155, 262786 TOF1 triggers in 2 hours

→ First look at muons that made it through the entire MICE channel





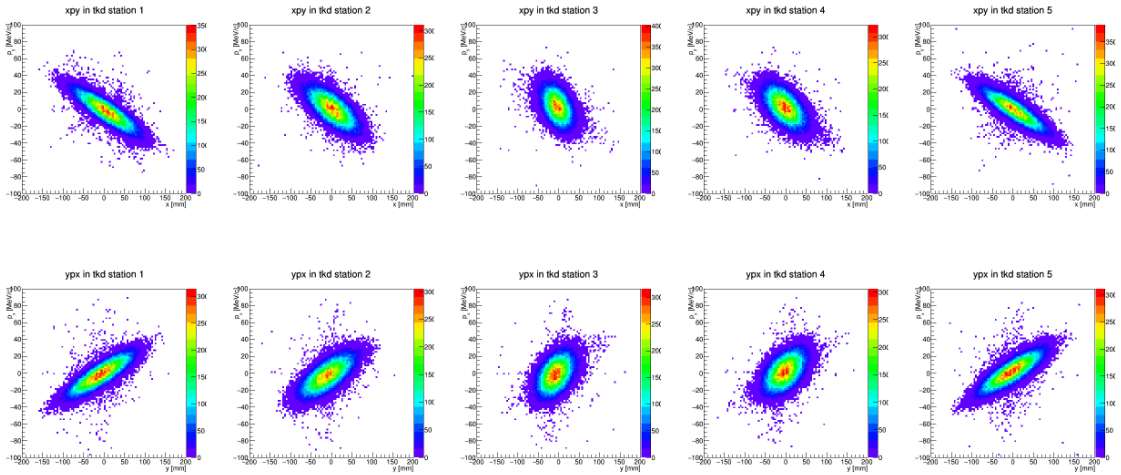
Polarity in the upstream tracker



$$\hat{L} = \langle xp_y \rangle - \langle yp_x \rangle < 0 \tag{3}$$

→ Anticlockwise rotation, **normal** polarity

Polarity in the downstream tracker



$$\hat{L} = \langle xp_y \rangle - \langle yp_x \rangle < 0 \tag{4}$$

→ Anticlockwise rotation, **normal** polarity

Welcome and introduction

PAPERS

Papers in progress

Title	Contact	Comment
Step IV physics		
First measurement of emittance in Step IV	V. Blackmore	**Preliminary results made public.** Results being finalised so publication can be prepared.
Measurement of scattering distributions in MICE	R. Bayes	**Preliminary results made public.** Results being finalised so publication can be prepared.
Ionization cooling demonstration		
Design and expected performance of the MICE demonstration of ionization cooling	J.B. Lagrange	**Draft with collaboration.** Paper being prepared for arXiv/journal

Title	Contact	Comment
Technical		
The design construction of the MICE Electron Muon Ranger	F. Drielsma	**arXiv:1607.04955**
The Reconstruction Software for the MICE Scintillating Fibre Trackers	A. Dobbs	**Being prepared for arXiv/journal submission** One plot to be revised. Final editing pass underway
The MICE Analysis and User Software framework	D. Rajaram	**In preparation**

- **Pressure:**
  - **Complete present publications**
  - **Bring forward technical contributions from last Cycle**
    - **Beam-based alignment**
    - **Verification of channel optics**
  - **Keep balls in the air for the field-on scattering programme**

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SUMMER SHUTDOWN

Summer shutdown

- Planned work and prioritisation tracked at:
  - http://micewww.pp.rl.ac.uk/projects/operations/wiki/_StepIV_Shutdown_Summer_

- Principal items:
  - Separation of demin and inhibited water circuits:
    - Complete, but:
      - Issues remain in cold-water supply from water system “on the roof”
  - Maintenance of Linde refrigerator:
    - Complete, but:
      - Compressor maintenance caused an air-leak into He circuit
      - Contractor (HPC) accepted responsibility and expedited remedial work
    - Dksoln now cold once more
  - Further remedial work on magnet power systems:
    - Complete

- Controls and monitoring:
  - Issues:
    - Communications with equipment:
      - A. Oates (DL) visit next week; seek to develop M. Courthold (RAL) as local expert
    - Run Control and Alarm Handler:
      - Operating for experiment
      - Some improvements to be made;
      - “Robustification” for smoother operation and ease of maintenance
    - A. Kurup (Imperial) has joined P. Hanlet to help with the software development

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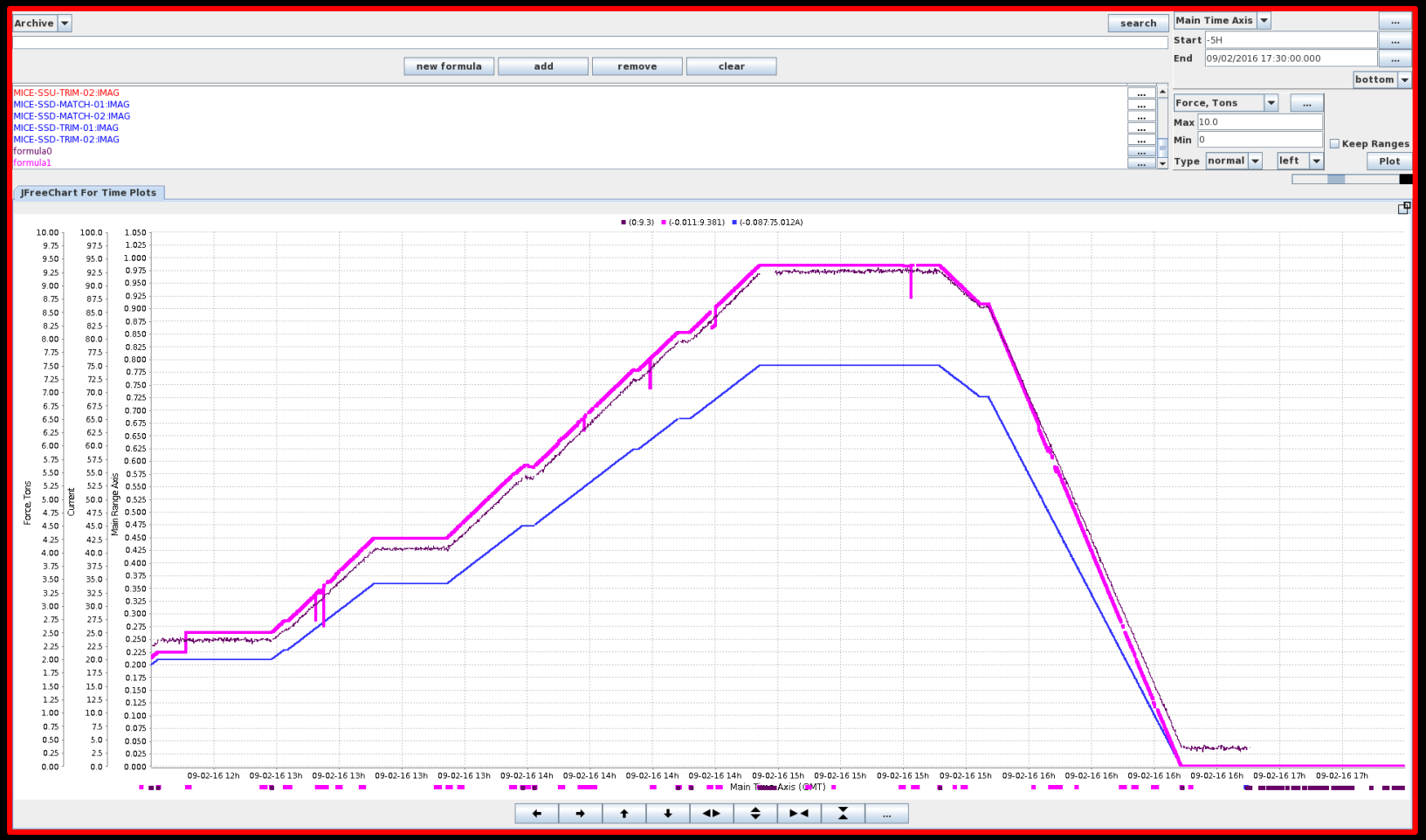
COMMISSIONING AND OPERATIONS

Magnet commissioning

- Combined operation of SSU and FC established, 02Sep16:
  - Demonstrated that forces are “OK” in the case of an asymmetric quench



- Combined operation of SSU, FC and SSD established, 16Sep16
  - Configuration typical of those required for Step IV scattering programme

Magnet commissioning continued

- Down-stream spectrometer solenoid:
  - Successful test performed without “end” coils
    - And without M2
  - During commissioning a resistive path to ground developed that caused noise in one of the voltage taps
    - With this additional path to ground, can not run E-coil power supplies as they have a 100 Ohm path to ground
  - Presently excludes operation of end coils on SSD
- 48-hour soak test of magnetic channel (22-24Sep16):
  - SSD[ECE(3T), M1, M2] + FC + SSD[ECE(3T)]
  - Stable operation almost to the end
  - Trim supply to E1 ramped to zero:
    - Target current reset to 0A
    - Exposed issues in:
      - Stability of trim power supply:
        - » Possibly connected to the communications issue
      - Handling of state changes/alarms in the CAM system`:
        - » Being addressed as part of the robustification
- Decision:
  - Operate without trims in SSU
  - Minor impact on measurement (see A.Dobbs)

Operations

- Cycle 2016/03 (14Sep—28Oct 2016):
  - Priority given to completing field-on, LiH scattering
  - Run plan posted at:
    - http://micewww.pp.rl.ac.uk/attachments/7308/2016-08-25_run-settings-v6.pdf
    - Continuing to take a conservative approach:
      - Commission to current/force sufficient for next measurement
    - Implies absorber change around 10Oct16
- Cycle 2016/04 (15Nov—16Dec 2016):
  - Keep LiH absorber in place
  - Complete scattering programme or move to study of reduction of normalised emittance
    - Requires settings that will generate larger forces
    - Decision to be taken over the coming month

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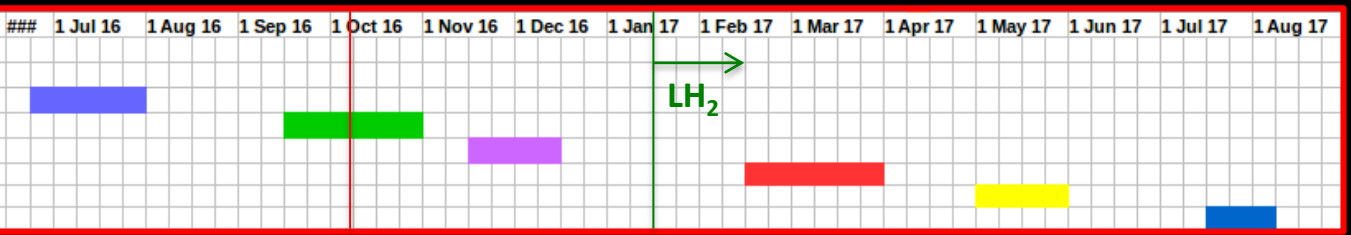
MOVING FORWARD

Scientific programme

Step IV:
Material properties of LH_2 and LiH that determine the ionization-cooling performance
Observation of $\epsilon_{\perp}^{n}$ reduction
MICE demonstration of ionization cooling:
Observation of $\epsilon_{\perp}$ reduction with re-acceleration
Observation of $\epsilon_{\perp}$ reduction and $\epsilon_{\parallel}$ evolution
Observation of $\epsilon_{\perp}$ reduction and $\epsilon_{\parallel}$ and angular momentum evolution†

† Requires systematic study of "flip" optics.

ISIS Cycle	Date From	Date To	# Days
2015/04	16 Feb 16	25 Mar 16	46
2016/01	12 Apr 16	20 May 16	38
2016/02	28 Jun 16	29 Jul 16	31
2016/03	13 Sep 16	28 Oct 16	45
2016/04	15 Nov 16	16 Dec 16	31
2016/05	14 Feb 17	31 Mar 17	45
2017/01	2 May 17	2 Jun 17	31
2017/02	11 Jul 17	4 Aug 17	24

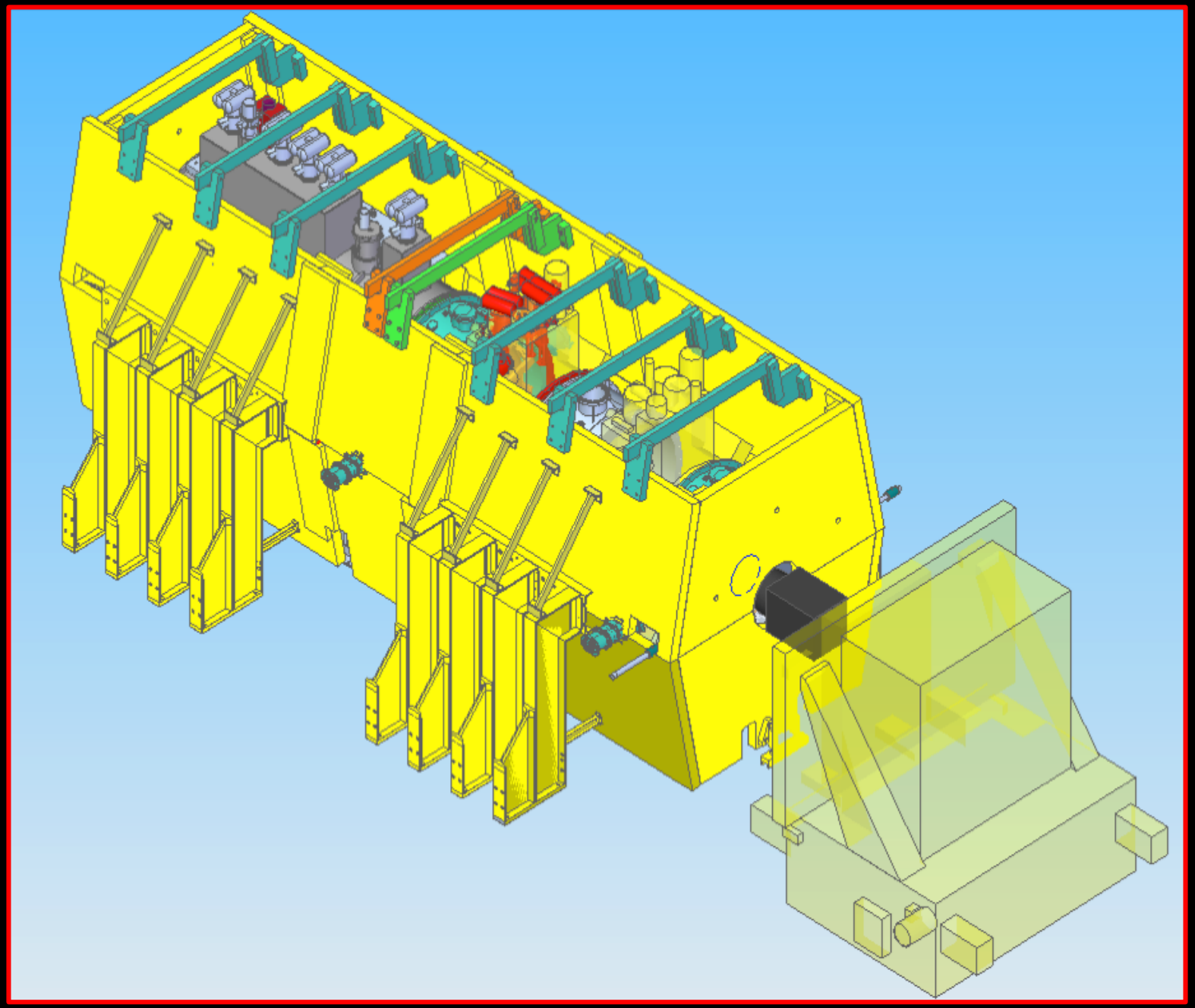


Execution of Step IV

- Underway!
  - Primary focus:
    - Developing procedures, experience
    - Successful!
- Scattering programme:
  - LiH:
    - Field off:
      - First paper in preparation;
      - Much more data to publish than in the ICHEP/NuFACT contributions
    - Field on:
      - Empty-channel data being taken now
  - LH2:
    - Will start Jan17
- Study of normalised emittance reduction:
  - Requires “more aggressive” focussing
  - Balance of gain versus risk

Towards a descoped cooling demo

- CB consensus at CM45:
  - Seek to create conditions that will allow a descoped cooling demonstration to proceed
- MICE-UK not funded for (descoped) cooling demo:
  - But, allocation to Laboratories and grants to universities now being put in place
- International collaboration:
  - Bulgaria have made application for additional support
  - NIKHEF have offered to construct precision tracker
  - UNIST (Korea) have confirmed continued interest
  - …
- What if analysis …
  - Move efficiently to descoped cooling demo should the need arise
    - Tacit permission to explore from UK OsC [Paul Soler]



Descoped cooling demonstration

- Study performance, cost, schedule and risk:
  - Be ready to open discussion ~Jan17
- Appropriate priority:
  - Execution of Step IV top priority
  - Study of descoped demo by exploiting work on Step IV
- Consider “affordable” preparatory steps:
  - Hardware preparations?
  - Distribution of resources across collaboration

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CM46

CM46

- **Very much looking forward to our meeting …**