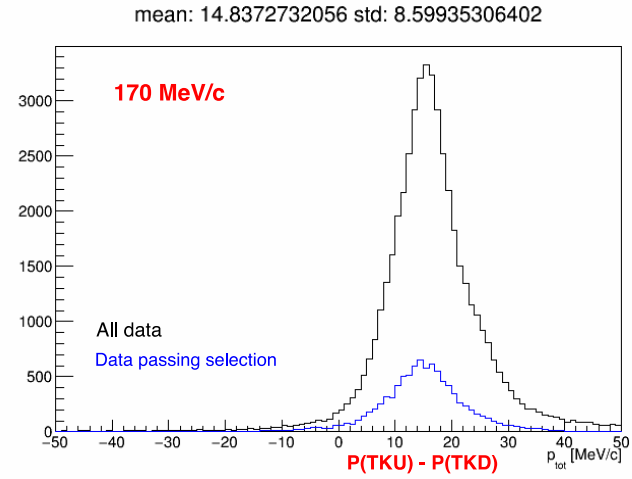
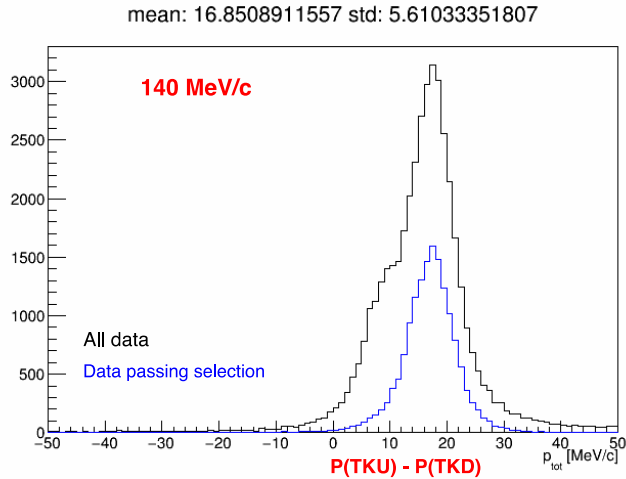


# Spokesman's update

# Contents

## Data taken 25Oct16



Spokesman's update

**STATUS OF EXECUTION  
OF STEP IV PROGRAMME**

# Scientific programme

## Step IV:

Material properties of LH<sub>2</sub> 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<sup>†</sup>

<sup>†</sup> Requires systematic study of “flip” optics.

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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															█

Cancelled!

# Goals for 2016/03; CM46

CM46

Operations

Success:

- Field-on LiH data taken
- MMB tuning
- Effect of diffuser

Moving forward:

- Study of normalised transverse emittance

- **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](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

# Choice of lattice

CM46

Step IV; LiH

Towards a 2016/04 run plan:

- Alignment and calibration
- Study of evolution of normalised emittance:

- Variety of settings
- Map change vs emittance, momentum, ...

- Choice of settings:

- Benefit versus risk

- Process:

- C.Rogers coordinating collection of settings
- Advice on risks in operation MIPO; next Tuesday
- Then, decide on run plan

Momentum scan with high acceptance for material physics

Setting	Emittance	p	FC beta	FC alpha	Accept.	E2	CC	E1	M2	M1	FC	M2	E1	CC	E2	TOF2 Triggers
6.1.1	3	140	1384.08	0.54	95.49	183.00	206.04	184.02	172.11	99.78	40.61	0.00	208.56	207.11	181.04	200k
6.1.2	3	170	1580.64	0.39	121.17	183.02	206.00	184.29	166.35	101.91	49.10	0.00	208.23	207.05	181.10	200k
6.1.3	3	200	1794.32	0.69	144.74	183.14	205.91	183.07	173.04	107.58	59.74	0.00	207.82	206.98	181.19	200k
6.1.4	3	240	1813.17	0.59	161.42	183.82	205.53	173.66	247.81	99.83	72.00	0.00	207.31	206.89	181.29	200k

Possible emittance reduction

Setting	Emittance	p	Transmission to absorber	Transmission to TKD	Nominal emittance change on absorber	E2	CC	E1	M2	M1	FC	M2	E1	CC	E2	TOF2 Triggers
6.2.2	3	140	99%	84%	-0.40%	177.552	177.552	177.552	240.85	141.98	46.39	0	178.1	178.1	178.1	200k
6.2.2	3	200	96%	76.60%	-0.14%	180.84	180.84	180.84	191.22	148.65	45.6	0	180.018	180.018	180.018	200k
6.2.3	3	240	97.50%	64.10%	-0.16%	178.922	178.922	178.922	178.12	201.4	36.07	0	195.91	195.91	195.91	200k

Current scans for alignment

Setting	Emittance	p	FC beta	FC alpha	Accept.	E2	CC	E1	M2	M1	FC	M2	E1	CC	E2	TOF2 Triggers
6.3.1	3	140	-	-	-	184.98	184.98	184.98	247.81	99.83	72.00	0.00	206.89	206.89	206.89	50k
6.3.2	3	140	-	-	-	164.42	164.42	164.42	247.81	99.83	72.00	0.00	206.89	206.89	206.89	50k
6.3.3	3	140	-	-	-	205.53	205.53	205.53	223.03	99.83	72.00	0.00	206.89	206.89	206.89	50k
6.3.4	3	140	-	-	-	205.53	205.53	205.53	198.25	99.83	72.00	0.00	206.89	206.89	206.89	50k
6.3.5	3	140	-	-	-	205.53	205.53	205.53	247.81	109.82	57.60	0.00	206.89	206.89	206.89	50k
6.3.6	3	140	-	-	-	205.53	205.53	205.53	247.81	119.80	57.60	0.00	206.89	206.89	206.89	50k
6.3.7	3	140	-	-	-	205.53	205.53	205.53	247.81	99.83	64.80	0.00	206.89	206.89	206.89	50k
6.3.8	3	140	-	-	-	205.53	205.53	205.53	247.81	99.83	57.60	0.00	206.89	206.89	206.89	50k
6.3.9	3	140	-	-	-	205.53	205.53	205.53	247.81	99.83	72.00	0.00	186.20	186.20	186.20	50k
6.3.10	3	140	-	-	-	205.53	205.53	205.53	247.81	99.83	72.00	0.00	165.51	165.51	165.51	50k

Emittance scan with good focus for cooling

Setting	Emittance	p	FC beta	FC alpha	Accept.	E2	CC	E1	M2	M1	FC	M2	E1	CC	E2	TOF2 Triggers
7.1.1	3	200	496.84	-1.29	61.07	189.75	205.5	175.5	173.5	277.46	98.78	0	175.5	205.5	189.75	1000k
7.1.2	6	200	496.84	-1.29	61.07	189.75	205.5	175.5	173.5	277.46	98.78	0	175.5	205.5	189.75	1000k
7.1.3	10	200	496.84	-1.29	61.07	189.75	205.5	175.5	173.5	277.46	98.78	0	175.5	205.5	189.75	1000k

Momentum scan for cooling

Setting	Emittance	p	FC beta	FC alpha	Accept.	E2	CC	E1	M2	M1	FC	M2	E1	CC	E2	TOF2 Triggers
7.2.1	6	140	503.18	-1.02	51.19	189.75	205.5	175.5	168.47	200.91	72.2	0	175.5	205.5	189.75	1000k
7.2.2	6	170	497.42	-0.82	54.41	189.75	205.5	175.5	169.01	237.32	88.5	0	175.5	205.5	189.75	1000k
7.2.3	6	240	503.34	-0.1	56.81	189.75	205.5	175.5	246.79	276.47	112.37	0	175.5	205.5	189.75	1000k

Beta scan for cooling

Setting	Emittance	p	FC beta	FC alpha	Accept.	E2	CC	E1	M2	M1	FC	M2	E1	CC	E2	TOF2 Triggers
7.3.1	6	200	396.52	-0.5	48.82	189.75	205.5	175.5	172.76	260.98	113.95	0	175.5	205.5	189.75	1000k
7.3.2	6	200	604.02	-1.47	69.38	189.75	205.5	175.5	212.54	276.44	91.97	0	175.5	205.5	189.75	1000k
7.3.3	6	200	799.67	-0.21	72.11	189.75	205.5	175.5	252.44	187.5	69.81	0	175.5	205.5	189.75	1000k
7.3.4	6	200	995.18	0.14	83.84	189.75	205.5	175.5	223.55	160.12	61.17	0	175.5	205.5	189.75	1000k

Emittance scan with negative polarity beamline

Setting	Emittance	p	FC beta	FC alpha	Accept.	E2	CC	E1	M2	M1	FC	M2	E1	CC	E2	TOF2 Triggers
7.4.1	3	200	496.84	-1.29	61.07	189.75	205.5	175.5	173.5	277.46	98.78	0	175.5	205.5	189.75	1000k
7.4.2	6	200	496.84	-1.29	61.07	189.75	205.5	175.5	173.5	277.46	98.78	0	175.5	205.5	189.75	1000k
7.4.3	10	200	496.84	-1.29	61.07	189.75	205.5	175.5	173.5	277.46	98.78	0	175.5	205.5	189.75	1000k

# Please volunteer for shifts!

- S.Boyd is doing an excellent job organising the shift roster ... but he needs volunteers, particularly in the early part of the cycle:

Shift block	Start date	# current shifters
1	18th Nov	2
2	23rd Nov	1
3	28th Nov	5
4	3rd Dec	3
5	8th Dec	6
6	13th Dec	6

Spokesman's update

# STATUS AND UPDATE



# Absorber change and commissioning

- First extraction of FC after operation of channel
  - Inter-module forces  $\sim 7.5T$  in routine operation
- After extraction, SSU and SSD “relaxed”:
  - Movement towards absorber; significant
    - Had to re-separate magnets to allow FC to be re-installed
    - Absorber change took a week
- Commissioning and re-commissioning of SSs:
  - Much work done to debug:
    - Power system and communications in RR2
    - Controls, monitoring and alarms
  - Excellent! [DL, FNAL, DCs, PMH, CW, JG, PF, ...]
  - SSU(M1): trip due to noise in ramp:
    - Investigated and appropriate action taken to allow operation
  - SSD(ECE): evidence of intermittent ground fault
    - Work around; warm power feed-throughs before ramp

Conservative approach:

- Maintain operability for next Cycle
- Investigate/remediate issues when they arise

- **Water:**
  - **Operational, but:**
    - **Remaining issue with water plant on roof:**
      - Install new “manager”; requires procurement and planning
- **Decay solenoid:**
  - **Now operational**
- **Magnet power-system:**
  - **Undesired opening of contactors:**
    - **Opening of contactors on one of SSU/SSD can cause contactors on the other SS to open:**
      - Cause of FC and SSD quench at the end of the last Cycle
  - **Decision [recall FC recovery from quench takes 2—3 days):**
    - **Ramp UP SSU/SSD to current then FC**
    - **Ramp DOWN FC then ramp down SSU/SSD**
- **Communication in RR2:**
  - **Data-flow management (AO, PMH) has produced significant benefit**
    - **Additional investigation planned**
- **Re-torque bolts on magnet and PRY**

Spokesman's update

**SAFETY**

# Safety

- **Electrical safety issue during absorber installation**
  - **Electrical work:**
    - Carried out under “Authorisation to work”
    - Safe operation of PS with PRY open requires isolation of magnets (locked off or shorted)
      - Mis-judgement led to low current operation of SSU(M2) when PRY was open and personnel were in Hall
  - **Classed as “Serious or Potentially Serious” by SHE Group**
- **Actions taken:**
  - **Standing instructions modified/being modified to define precisely an electrical “Test Permit”;**
  - **Description of work, and conditions for work, made more precise and complete on all future ATWs**
- **Re-iteration of the management of work on the experiment:**
  - **The Duty Coordinator is in charge of all work in the Hall:**
    - His/her instructions must be followed; no exceptions, no arguments
    - He/she has the authority to stop work until satisfied that it is safe to continue
    - If there are issues to be addressed, these will be discussed and appropriate steps agreed before work continues
- **Controls and monitoring code freeze:**
  - **Development of the controls and monitoring software in parallel to the operation of the magnets was found to be a contributory cause of the incident**
  - **Therefore, the CAM code (including RunControl) will be *frozen* in advance of future magnet operations**

Spokesman's update

**PAPERS**

# Papers in progress

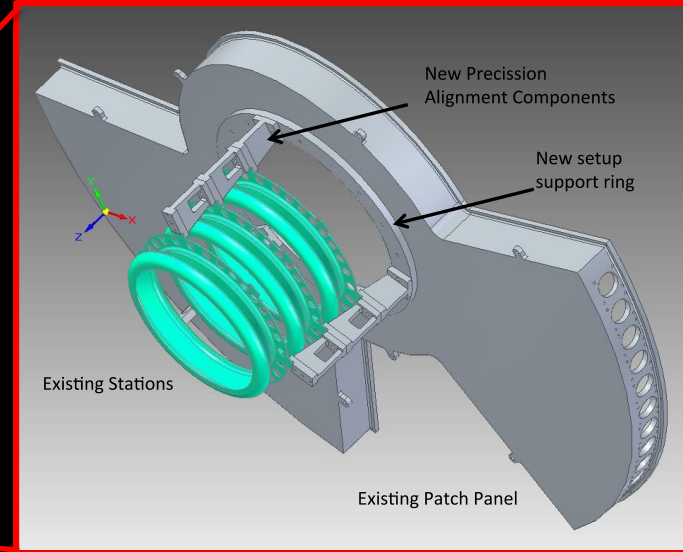
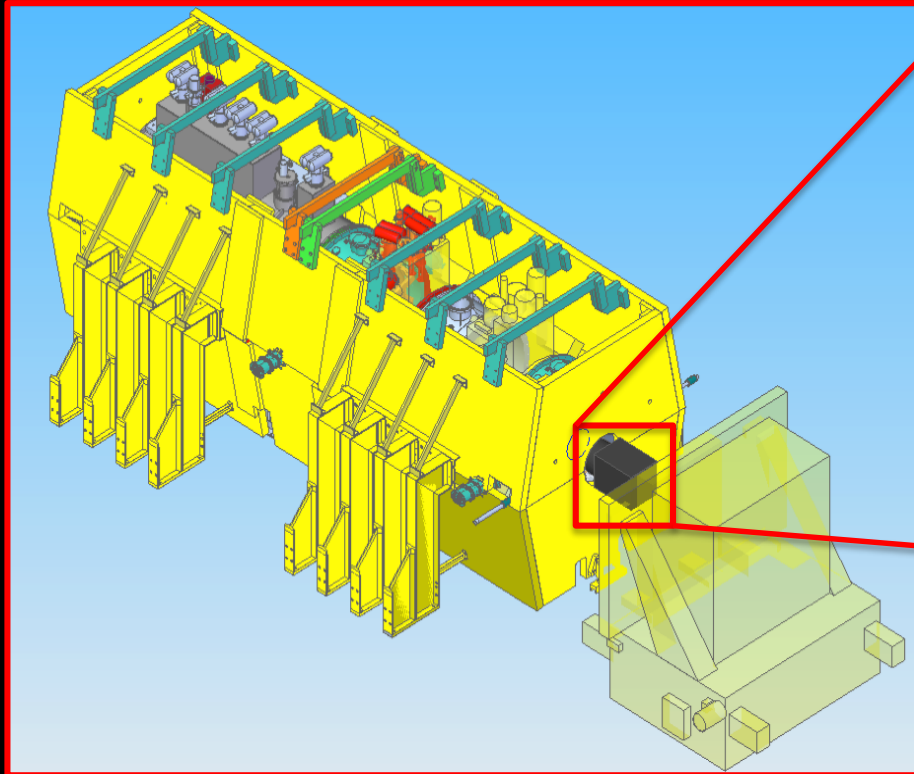
Title	Contact	Comment
<b>Step IV physics</b>		
First measurement of emittance in Step IV	V. Blackmore	<b>Preliminary results made public.</b> Results being finalised so publication can be prepared.
Measurement of scattering distributions in MICE	R. Bayes	<b>Preliminary results made public.</b> Results being finalised so publication can be prepared.
<b>Ionization cooling demonstration</b>		
Design and expected performance of the MICE demonstration of ionization cooling	J.B. Lagrange	<b>Revised draft in preparation.</b> Will be circulated once more before submission.

Title	Contact	Comment
<b>Technical</b>		
The design construction of the MICE Electron Muon Ranger	F. Drielsma	<b>arXiv:1607.04955</b>
The Reconstruction Software for the MICE Scintillating Fibre Trackers	A. Dobbs	<b>arXiv:1603.07143</b>
The MICE Analysis and User Software framework	D. Rajaram	<b>In preparation</b>

Spokesman's update

**UPGRADE TO DEMO**

- MICE-UK OsC:
  - Tacit permission to minimise impact of principal risks to science output



- Design: Geoff Barber
- Simulation/design finalisation: Adam Dobbs
- Manufacture: Filthaut et al NIKHEF



Spokesman's update

**... AND FINALLY**

# Scientific programme

## Step IV:

Material properties of  $\text{LH}_2$  and  $\text{LiH}$  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<sup>†</sup>

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Cancelled!