

# Closing remarks

# CM50: analysis

- Excellent progress:

- Amplitude evolution:

- Results look promising:

- Push to prepare for IPAC18

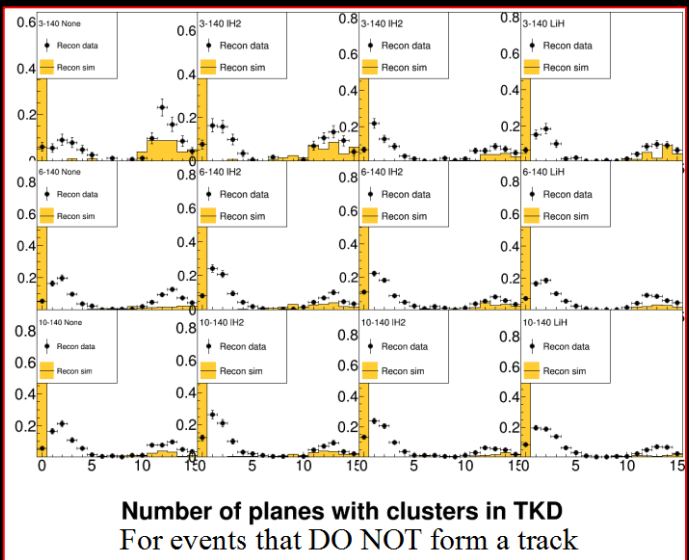
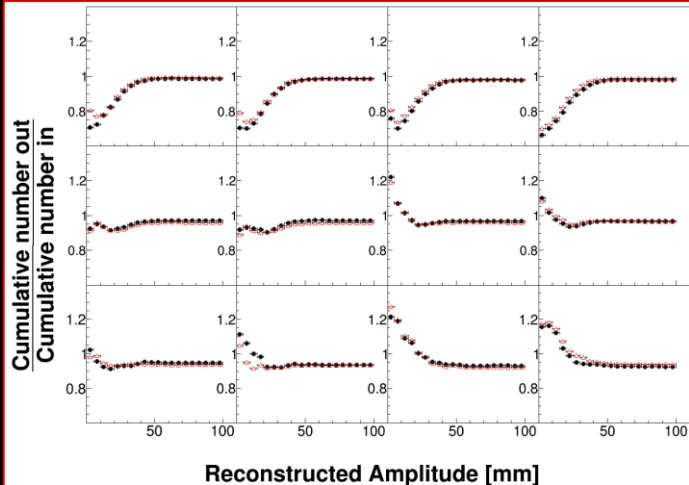
- Still some issues:

- E.g. clusters not assigned to tracks

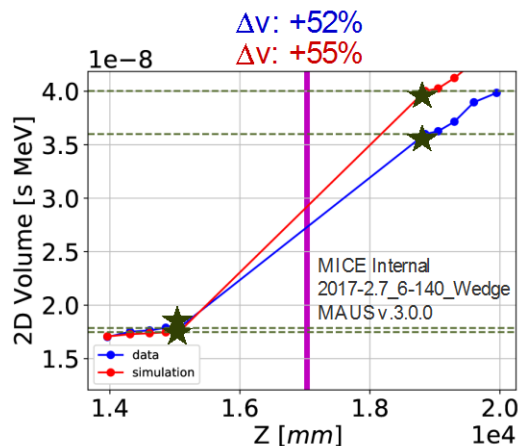
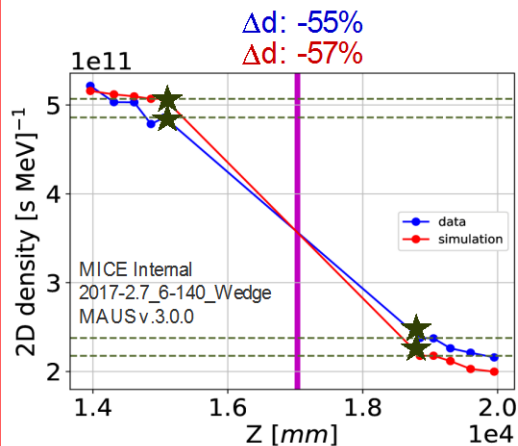
- Systematic uncertainties

- Fixed points:

- VC 05Apr18 and analysis w/s 12/13 Apr18



- $\varepsilon_{\perp}$ : 6 mm;  $p_{ref}$ : 140 MeV/c
- 2D coordinates:  $\Delta t$ ,  $\Delta E$
- KDE-based density and volume of the 24<sup>th</sup> percentile contour ( $\sim 1\sigma$  of 2D distribution)
- Density  $\downarrow$ , Volume  $\uparrow$ : **reverse emittance exchange**



- **Excellent progress:**
  - **Emittance exchange:**
    - KDE looks like a good tool to demonstrate effect
    - Need to:
      - Demonstrate beam selection;
      - Move to MAUS simulation

# CM50: analysis

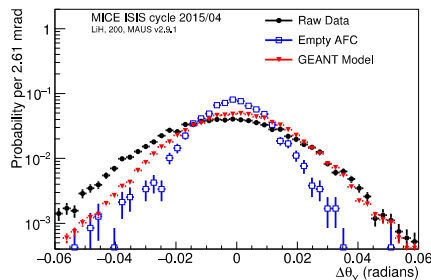
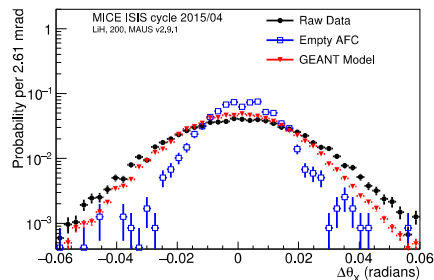
- **Excellent progress:**

- **Scattering:**

- Beam selection and analysis detail looking solid;

- **Some issues remain:**

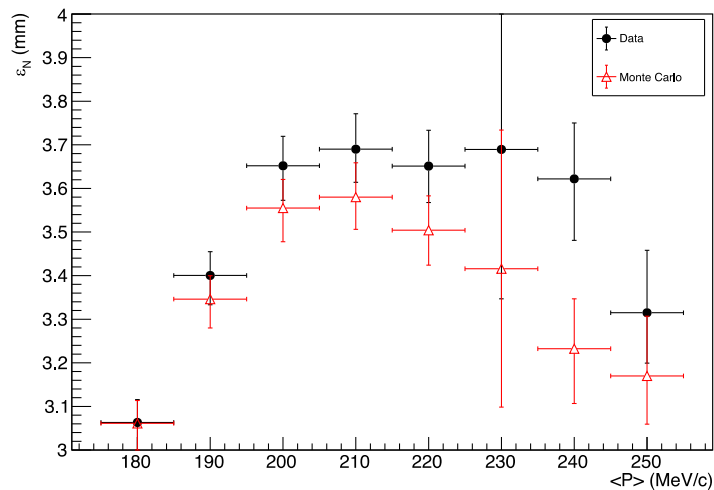
- Asymmetry in scattering distributions;
    - Stability of deconvolution



- Discussed asymmetries on Monday - investigating geometries that were used for reconstruction

# CM50: analysis

- Excellent progress:
  - Emittance measurement:
    - Many issues addressed!
      - Beam selection;
      - Emittance calculation with (some) systematic errors
    - Some issues that remain:
      - Beam simulation:
        - » Good enough?
      - Systematics on mmtm/field
        - » Dependence on MAUS version
      - Still some details:
        - » '230 MeV bin' issue



29/30

## UNCERTAINTY CALCULATIONS

Beam selection: Dominant contribution from diffuser aperture cut

Table 3: Statistical and systematic uncertainties on the measured emittance as a function of  $p$ .

Source	$\langle p \rangle$ (MeV/c)							
	180	190	200	210	220	230	240	250
Measured emittance (mm rad)	3.06	3.40	3.65	3.69	3.65	3.69	3.62	3.31
Statistical uncertainty	$\pm 0.03$	$\pm 0.04$	$\pm 0.04$	$\pm 0.05$	$\pm 0.05$	$\pm 0.07$	$\pm 0.08$	$\pm 0.09$
Beam selection	$+0.05$ $-0.04$	$+0.05$ $-0.04$	$+0.06$ $-0.05$	$+0.06$ $-0.05$	$+0.05$ $-0.05$	$+0.04$ $-0.1$	$\pm 0.1$	$+0.05$ $-0.1$
Binning in $p$	$\pm 0.02$	$\pm 0.02$	$\pm 0.02$	$\pm 0.02$	$\pm 0.03$	$\pm 0.33$	$\pm 0.04$	$\pm 0.05$
Non-uniform magnetic field	$\pm ???$	$\pm ???$	$\pm ???$	$\pm ???$	$\pm ???$	$\pm ???$	$\pm ???$	$\pm ???$
Low $p_z$ tracks	$\pm ???$	$\pm ???$	$\pm ???$	$\pm ???$	$\pm ???$	$\pm ???$	$\pm ???$	$\pm ???$
Tracker-field misalignment	$\pm ???$	$\pm ???$	$\pm ???$	$\pm ???$	$\pm ???$	$\pm ???$	$\pm ???$	$\pm ???$
Magnetic field scale	$\pm ???$	$\pm ???$	$\pm ???$	$\pm ???$	$\pm ???$	$\pm ???$	$\pm ???$	$\pm ???$
Tracker resolution	$\pm 0.00$	$\pm 0.00$	$\pm 0.00$	$\pm 0.00$	$\pm 0.00$	$\pm 0.01$	$\pm 0.01$	$\pm 0.01$
Total systematic uncertainty	$+0.06$ $-0.04$	$+0.06$ $-0.04$	$+0.07$ $-0.05$	$\pm 0.06$	$\pm 0.06$	$\pm 0.34$	$+0.11$ $-0.10$	$+0.07$ $-0.11$
Total uncertainty	$+0.07$ $-0.05$	$+0.06$ $-0.05$	$+0.08$ $-0.07$	$\pm 0.08$	$\pm 0.08$	$\pm 0.34$	$+0.14$ $-0.13$	$+0.12$ $-0.14$
Total uncertainty (%)	$+2.14$ $-1.71$	$+1.98$ $-1.60$	$+2.17$ $-1.85$	$+2.06$ $-2.20$	$+2.29$ $-2.25$	$+9.29$ $-9.31$	$+3.89$ $-3.54$	$+3.49$ $-4.32$

Suspicious bin – big track error outliers?

## Papers in progress

Title	Contact	Comment
<b>Step IV physics</b>		
Direct measurement of emittance using the MICE scintillating-fibre tracker	V. Blackmore	<b>Preliminary results public.</b>  <b>Move to preparation for publication at CM50.</b>
Measurement of multiple Coulomb scattering of muons in lithium hydride	J. Nugent	<b>Preliminary results public.</b>  <b>Move to preparation for publication at CM50.</b>

# Papers

## Field-on papers

Title	Contact	Comment
<b>Step IV physics</b>		
Phase-space density/emittance evolution; rapid communication	C. Rogers	<b>Preliminary results made public at IPAC17.</b>  <b>Decision: updated/new results for IPAC18.</b>
Measurement of energy-loss distributions	S. Wilbur	<b>First preliminary results made public at IPAC17.</b> Results may be presented in the system-performance paper.
Field-on measurement of multiple Coulomb scattering	A. Young	Analysis underway
Beam-based alignment	To be assigned	Analysis underway
Phase-space density/emittance reconstruction	To be assigned	Analysis underway
Phase-space density/emittance evolution review paper	To be assigned	Analysis underway

## Papers in progress

Title	Contact	Comment
<b>Technical</b>		
The MICE Analysis and User Software framework	D. Rajaram	<b>In preparation</b>
<b>Performance of the MICE diagnostic systems</b>	S. Wilbur	<b>May include validation of energy-loss simulation.</b>
	P. Franchini	
Muon Ionization Cooling Experiment	C. Whyte	<b>First section (TOF) in hand.</b>
	P. Franchini	
The MICE RF system	K. Ronald	<b>Builds on conference publications.</b>
The MICE magnetic channel	A. Bross, J. Cobb	<b>Builds on conference publications.</b>
The MICE liquid-hydrogen absorber	J. Boehm, M. Tucker	<b>Drafting underway.</b>

- Completion of “milestone papers” will require completion of a number of detailed analyses, e.g.:
  - Transfer matrix approach to magnetic alignment;
  - Study of effect of non-linear terms in the Hamiltonian (field) expansion;
- Each of these analysis may warrant a paper of its own.

**Important decision: cooling signal for IPAC18?**

**Yes! Push for it.**

# Decommissioning plan

			January				February				March			
			Mon	Mon	Mon	Mon	Mon	Mon	Mon	Mon	Mon	Mon	Mon	Mon
			08/01/2018	15/01/2018	22/01/2018	29/01/2018	05/02/2018	12/02/2018	19/02/2018	26/02/2018	05/03/2018	12/03/2018	19/03/2018	26/03/2018
CM50										CM50				
Survey	Magnets	SSU			DSA/Sync Complete	Survey complete								
Decision on data							Decision							
Magnet Mapping		EMR/KL/ToF2 move back to beamstop												
		Survey TKD in place												
		Extract TKD and survey hall probes												
		Survey TKU in place												
		Extract TKU and survey hall probes												
		Install mapper and map SSD												
		Install mapper and map SSU												
De-commissioning	PPS	week 8 <sup>th</sup> Jan		Complete										
	Magnets and cryogenics	SSU&D												
		FC												
		DS												
	Detectors	ToF									Detector Owners - MICE Hall			
		EMR												
		Cherenkov												
		Trackers												
	Gases	Nitrogen												
	Electrical power	Supercon magnets												
		Rack room												
	Water and Cooling													
	Air-Con													
	Vacuum	Tracker cryo												
		interspace												
		SSU												
		SSD												
		FC												
Didcot		Clear - ship / Hall												
Daresbury		Tidy and ship												
Computing		Move.												

# Future collaboration meetings

- 2018:
  - CM50 1<sup>st</sup> – 2<sup>nd</sup> March 2018
  - CM51: plenary sessions; 27Jun—28Jun
  - Week of: 08Oct—12Oct

Extended analysis workshops:

- Analysis workshops:
  - 12<sup>th</sup> – 13<sup>th</sup> April, Glasgow
  - 15<sup>th</sup> – 16<sup>th</sup> May, Warwick
- Video conferences:
  - 05Apr18, 03May18



# Thanks to:

- You all for coming, presenting and arguing!
- The local team:
  - Gill, Debbie, Rose
- See you at CM51 at RAL in Jun18
- ... my best wishes for a safe journey home ...

