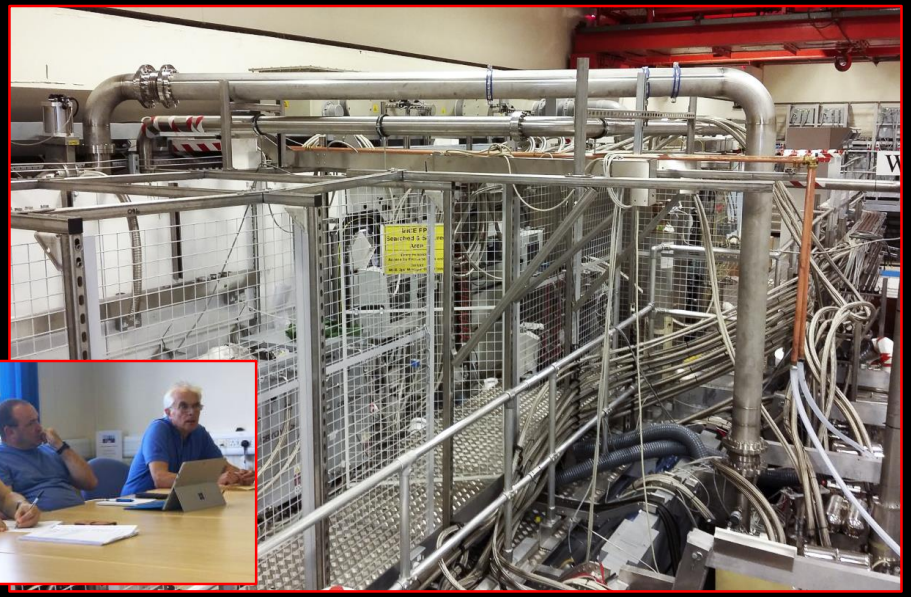
Imperial College London

Science & Technology Facilities Council

Welcome and introduction

K. Long, 1 March, 2018

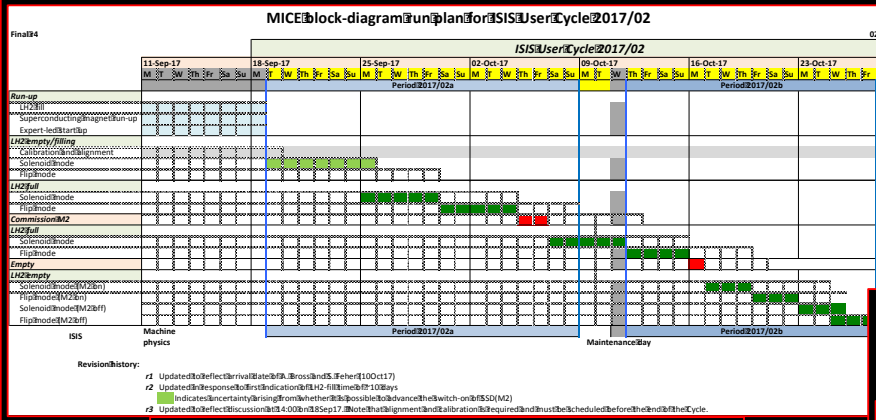


Introduction

PROGRESS SINCE CM49

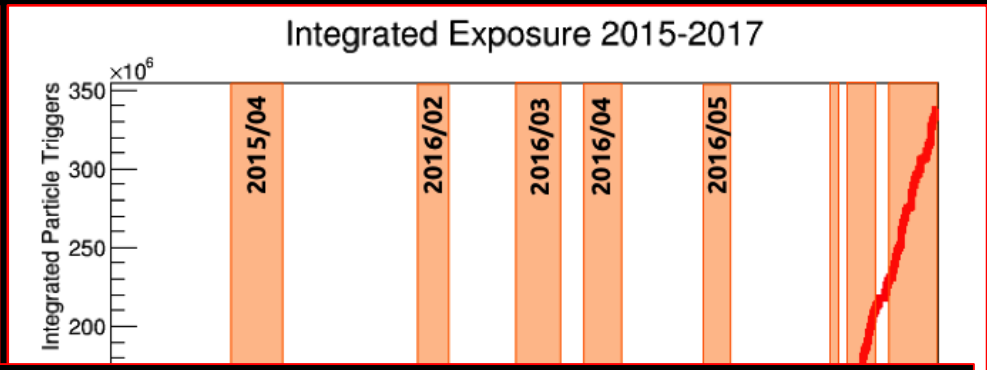
OCT17

Modified run plan for Cycle 2017/02



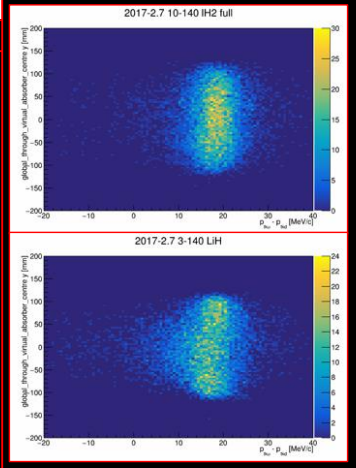
CM49: part-way through first LH_2 running

- Wealth of data:
  - LiH:
    - Field off; full/empty
    - Field on; full/empty
    - SSD(M2) on and SSD(M2) off
  - LH_2:
    - Field off; full/empty
    - Field on; full/empty
    - SSD(M2) on and SSD(M2) off
  - Wedge:
    - Field on, various settings:
      - Full and empty

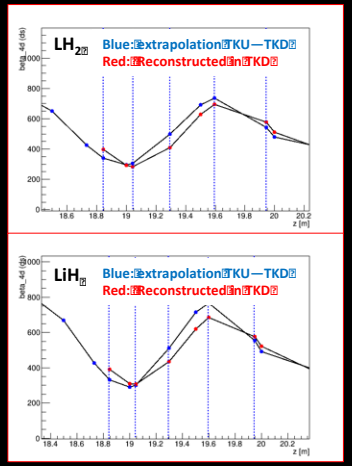


New, summative, information

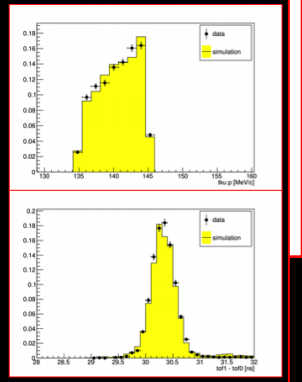
Energy lost in absorber



4D beta function



Data/MC comparison



Rogers: amplitude analysis

Decision: magnetic survey rather than more data taking

Papers

Papers in progress

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

Field-on papers

Title	Contact	Comment
Step IV physics		
Phase-space density/emittance evolution; rapid communication	C. Rogers	Preliminary results made public at IPAC17. Decision: updated/new results for IPAC18.
Measurement of energy-loss distributions	S. Wilbur	First preliminary results made public at IPAC17. 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	Analsis underway
Phase-space density/emittance reconstruction	To be assigned	Analsis underway
Phase-space density/emittance evolution review paper	To be assigned	Analsis underway

- Completion of "milestsone 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.

Papers in progress

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

Update this slide in meeting summary!

New & updated results for IPAC18

- Emittance evolution paper:
  - Rogers et al: cooling signal for IPAC18?
- LiH scattering paper:
  - Nugent et al: final results for IPAC18?
- System performance paper:
  - Wylbur, Franchini et al: results could be included at IPAC18
- Field-on scattering:
  - Young, Rajaram et al: results for IPAC18?
- Emittance exchange:
  - Mohayai et al: results for IPAC18?
- Diffuser and other contributions:
  - Uchida, Pec, Lord, Langlands et al: results for IPAC18
- Emittance measurement:
  - Blackmore, Hunt et al: final results for IPAC18?

Review during CM50.

Publication planning; A critical issue for CM50

Streamlining the analysis:

- Standardisation:
  - Cuts, cut methodology
    - Defined in VB emittance note;
  - Systematic uncertainty evaluation
    - Defined in VB emittance note;
  - Plotting style
    - Defined by VB and JN emittance and scattering papers:
      - Root macros will be provided
      - Examples follow

MAUS Work Specification Document

Change History

Version	Changes	Author	Date
1	First draft	C.Rogers	01/10/2018

Project Summary

Project Title	Cuts structure update
Main Issue	
Subtask Issues	
Project Lead	
Project Supervisor(s)	C. Rogers
Associated Manpower	

Kurup: in progress

Justification of cuts

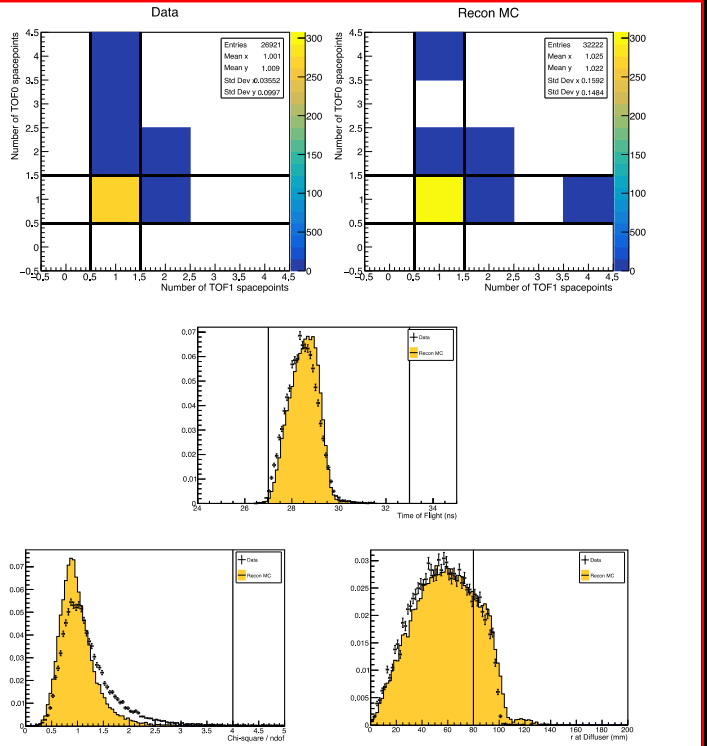


Figure 3: Distribution of the quantities used to select the sample used to reconstruct the emittance of the beam. Top left: the number of space-points in TOF1 plotted against the number of space-points in TOF0; Top right: distribution of t_{01}; Bottom left: distribution of $\frac{\chi^2}{N_{\mathrm{DOF}}}$; and Bottom right: distribution of R_{diff}. In each case the data is shown as the solid circles or, in the case of the space-point distributions in TOF1 and TOF0, the black squares and the distribution obtained with the MAUS simulation is shown as the solid yellow histogram. The solid black lines indicate the position of the cuts made on the various quantities. Events enter the plots if all cuts other than the cut under examination are passed.

Data/MC comparison

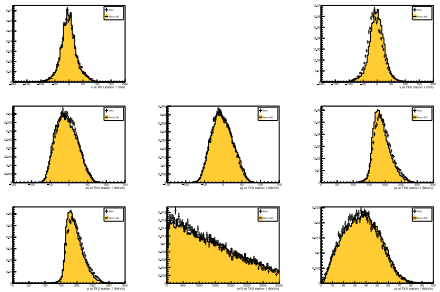


Figure 5: Position and momentum distributions of muons reconstructed at the reference surface of the upstream tracker. The top left and top right panels show the distributions of x and y respectively. The distributions of components of the muon momentum are shown in the middle row; p_x in the left-middle panel, p_y in the centre middle panel and p_z in the right-middle panel. The distribution of the total momentum, p, is shown in the bottom-left panel. The distributions of the transverse momentum squared, $p_\perp^2 = p_x^2 + p_y^2$, and $p_\perp$ are shown in the bottom-middle and bottom-right panels respectively. The data is shown as the solid circles while the results of the MAUS simulation are shown as the yellow histogram.

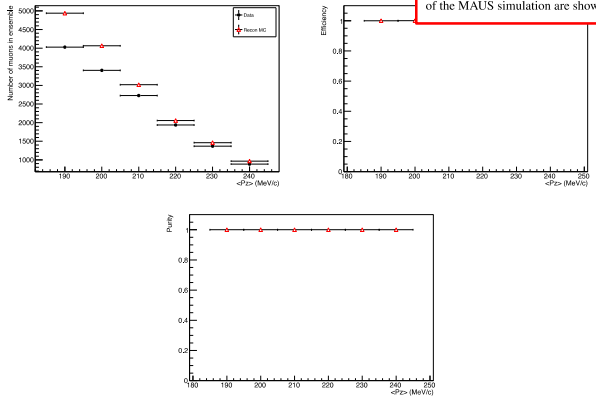


Figure 9: Top left: The number of muons in each momentum bin in data (black, circle) and reconstructed Monte Carlo (red, triangle). Top right: Reconstructed Monte Carlo selection purity as a function of p_z. Bottom: Reconstructed Monte Carlo selection efficiency as a function of p_z.

Systematic uncertainties

7.3 Systematic uncertainties

Systematic uncertainties related to the beam selection were estimated by varying the cut values by an amount corresponding to the RMS resolution of the quantity in question. Systematic uncertainties related to possible biases in calibration constants were evaluated by varying the calibration constant in line with its resolution. Systematic uncertainties related to the reconstruction algorithms were evaluated using the MAUS simulation. The positive and negative deviations from the nominal emittance were added in quadrature separately to obtain the total positive and negative systematic uncertainly. Sources of uncorrelated and correlated uncertainties are discussed in detail below.

7.3.1 Uncorrelated systematic uncertainties

- Systematic uncertainties related to beam selection have been estimated by varying the cut values according to the RMS resolution of the cut variables. The overall uncertainty due to beam selection is summarised in table 2.

7.3.2 Correlated systematic uncertainties

Systematic uncertainties correlated with p_z are:

- Non-uniform magnetic field across the tracking region gives a bias in $p_\perp$ and p_z reconstruction. This uncertainty will be evaluated using a MAUS simulation comparing the expected non-uniform field with a uniform field.
- Time-of-flight and track reconstruction are combined to improve reconstruction of tracks with low $p_\perp$. The uncertainty on the time-of-flight is $\sim$ 70 ps.
- Tracker to field misalignment.
- Field magnitude. A MAUS model will be studied with the modelled (non-uniform) field scaled to the values measured by the Hall probes during the period over which data was taken. The field will be scaled above and below this value by an amount equal to the variation in the Hall probe readings.
- The measured value of p_z dictates the momentum bin a muon is assigned to for the emittance calculation. The uncertainty on each bin associated with this has been evaluated by allowing each muon's p_z to fluctuate around its measured value according to a Gaussian of width equal to the measurement uncertainty on p_z. The uncertainty due to this binning is summarised in table 2.
- Energy loss and multiple scattering estimates between TOF1 and the tracker are expected to contribute a small bias to the emittance measurement. These will be evaluated using a MAUS simulation.

Table 2: Statistical and systematic uncertainties on the measured emittance as a function of p_z.

Source	$\langle p_z \rangle$ (MeV/c)					
	190	200	210	220	230	240
Measured emittance (mm rad)	3.65	3.76	3.79	3.78	3.95	3.74
Statistical uncertainty	± 0.04	± 0.05	± 0.05	± 0.06	± 0.08	± 0.09
Beam selection	$^{+0.01}_{-0.03}$	± 0.02	± 0.02	$^{+0.00}_{-0.06}$	$^{+0.07}_{-0.04}$	$^{+0.03}_{-0.07}$
Binning in p_z	± 0.02	± 0.03	± 0.04	± 0.05	± 0.06	± 0.08
Non-uniform magnetic field	?	?	?	?	?	?
Low $p_\perp$ tracks	?	?	?	?	?	?
Tracker-field misalignment	?	?	?	?	?	?
Magnetic field scale	?	?	?	?	?	?
Energy loss and multiple scattering	?	?	?	?	?	?
All	± 0.05	± 0.06	$^{+0.06}_{-0.07}$	$^{+0.08}_{-0.10}$	$^{+0.12}_{-0.11}$	$^{+0.13}_{-0.14}$

- **Of course:**
  - **One size does not fit all:**
    - **But, at least in the areas outlined the issues are common and a 'house style' will:**
      - **Ease explanations and enhance clarity in conference contributions; and**
      - **Reduce time spent in the editorial process**
- **Still some gremlins to sort out:**
  - **E.g. marker size …**
  - **Engage now, we're setting policy!**

Introduction

DECOMMISSIONING

Pre-decommissioning work

Analysis of MICE Step IV Equipment following end of Data-Taking

Author	Version	Changes	Date
C. Rogers	1	Initial draft	2017-12-06
C. Rogers	2	Add diffuser check and solenoid check	2018-01-04
C. Rogers	3	Add details about field measurements	2018-01-08
C. Rogers	4	Add plots for	

Introduction

Following the end of data taking the collaboration seeks to make a detailed measurement of the MICE apparatus as installed in the MICE hall. This measurement will support analysis of the MICE data.

Measurements

The following measurements will be made:

- The longitudinal position. on-axis thickness and composition of all windows in the beamline will be measured. Thickness should be measured to 100 micron precision. Visible misalignments should be measured and reported.
- The longitudinal position of the upstream tracker station will be measured (precision 100 micron). A visual inspection of the trackers will be made indicating any physical damage/etc.
- The longitudinal position and radius of any apertures will be measured, including the length of the aperture and composition of the material used to make the aperture. If the aperture is not cylindrically symmetric, then an indicative geometry (precision 1 mm) of the aperture will be measured.
- The position of the hall probes will be measured. A visual inspection of the hall probes will be made indicating any physical damage/etc.
- The position of SSU and SSD survey artefacts should be measured.
- The position of the target frame, quadrupoles Q1-3 and D1 should be surveyed.
- The position of the decay solenoid, beamline quadrupole magnets Q4-9 and D2 should be

- **Mechanical survey:**
  - **All instrumentation**
  - **SSU, FC and SSD**
  - **LiH absorber (at FNAL)**
  - **LH2 absorber (at RAL)**
- **Magnetic survey:**
  - **D2 (now), D1 in shutdown**
  - **SSU and SSD:**
    - **CERN field mapping team**
    - **To start 19Mar18**

Hall schedule

			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-commisssioning	PPS	week 8th Jan		Complete										
	Magnets and cryogens	SSU&D												
		FC												
		DS												
	Detectors	ToF								Detector Owners - MICE Hall				
		EMR												
		Cherenkov												
		Trackers												
		KL												
	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.												

- More detail from C. Whyte
- D. Rajaram has prepared a ‘sister’ plan for the S/w&C

MICE equipment

- MICE/ISIS Safety Committee:
  - Formal sign-off that equipment is safe in quiescent state:
    - To be completed by 31Jan18
  - Plan is in hand; no big issues foreseen.
- MICE has agreed (MICE Collaboration Board):
  - All MICE equipment will remain in place at RAL until Jun18 so that checks can be made should issues arise.
- After Jun18, equipment can be taken back to the owner's institute:
  - C.Whyte and EB will be working to identify the equipment that must be repatriated and to make the necessary arrangements.
- Already started, but, important for this CM:
  - Equipment owners must liaise with C. Whyte on repatriation of equipment:
    - While UK has no budget for repatriating equipment, can liaise to expedite return
  - ***Particular issue R9:***
    - Pressure to vacate R9 will soon become very strong
    - Most equipment of value has been moved to MICE Hall in anticipation
    - Please take the time to visit R9 with C. Whyte or J. Govans to check your equipment is safe

Status of MICE

POLITIX AND DOMESTIC

Close-out and lessons learnt

- **STFC is organising an 'MPB'-style Close-out meeting:**
  - **This will include a 'lessons-learnt exercise':**
    - ***… this will be done in an open and discursive way, underpinned with a no-blame culture, …***
  - **17—18 April 2018**

- **Please feed-in your thoughts and opinions:**
  - **To me, Colin or a member of the EB**
  - **Exact terms-of-reference for the meeting are not yet available, but, I expect to start formal preparations on 16Mar18**

February 2018

European Strategy Update

Contact:
EPPSU-Strategy-Secretariat@cern.ch

Guidelines for submitting input for the 2020 update of the European Strategy for Particle Physics

Cover page (1 page)
Each document submitted should carry a single cover page containing no more than the title, the contact person(s) and an abstract.

Comprehensive overview (maximum 10 pages)
This core part of the document must be no more than 10 pages long (excluding the cover page) and must provide a comprehensive and self-contained overview of the proposed input. It should address:

- scientific context,
- objectives,
- methodology,
- readiness and expected challenges.

Addendum
A separate addendum is to be provided addressing the following topics (where relevant):

- interested community,
- timeline,
- construction and operational costs (if applicable),
- computing requirements.

Format and deadline for submission
The cover page and the comprehensive overview are to be submitted as a single file, the "main document", in portable document format (pdf) by 18 December 2018. The addendum is to be submitted as a separate file by the same deadline. A dedicated submission portal will be available on the EPPSU website as of October 2018, once the Strategy update has been formally launched by the Council at its September 2018 Session. The link to the EPPSU website will appear on the CERN Council's web pages - https://council.web.cern.ch/en - and be widely communicated through the appropriate channels.

Distribution
Both documents submitted (main and addendum) will be passed on to the Physics Preparatory Group (PPG) and the European Strategy Group (ESG). Unless explicitly requested otherwise, they will also be made public. The option not to make either document public will be available upon submission via the dedicated portal.

Deadline 18Dec18

MICE office move

- RAL must make substantial modifications to the site:
  - E.g. demolition of R12 (main w/s)
- This has required a ‘domino-style’ rearrangement of office and lab space
- MICE is required to move from the present open-plan office
- New location will be in a smaller open-plan space on the top floor of R1 east immediately adjacent to the present office space
- Time table for move:
  - ‘Within the next two weeks’:
    - Unclear when the two weeks starts (or started)
    - More news as soon as I know

Introduction

CM50

MICE CM50

26 February 2018 to 2 March 2018
Other Institutes
Europe/London timezone

Search...

MICE Admin

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+44 1235 446129
+44 1235 445216

The 50th Muon Ionization Cooling Experiment (MICE) Collaboration Meeting will be held at the Rutherford Appleton Laboratory from Thursday 1st to Friday 2nd March 2018 inclusive.

Registration: £45 **Collaboration Dinner: £35**

Payment method: NO CASH - Bucksnet Payment on registration form

Starts 26 Feb 2018, 09:00
Ends 2 Mar 2018, 18:00
Europe/London

Other Institutes
Conference Room 3, R61
STFC, Rutherford Appleton Laboratory
Harwell Oxford Campus
Chilton
Oxfordshire OX11 0QX UK

www.stfc.ac.uk

Please note: There is a small block of rooms available at Ridgeway House.

Registration
Registration for this event is currently open.

29 Register now >