

# Spokesman's introduction



**Happy New Year!**

- **Publication update**
- **Analysis update and paper planning**
- **Upcoming meetings**

Spokesman's introduction

# **PUBLICATION UPDATE**

RAL-P-2018-007

## MAUS: The MICE Analysis User Software

R. Asfandiyarov,<sup>a</sup> R. Bayes,<sup>b</sup> V. Blackmore,<sup>c</sup> M. Bogomilov,<sup>d</sup> D. Colling,<sup>e</sup> A.J. Dobbs,<sup>e</sup> F. Drielsma,<sup>a</sup> M. Drews,<sup>h</sup> M. Ellis,<sup>c</sup> M. Fedorov,<sup>e</sup> P. Franchini,<sup>f</sup> R. Gardener,<sup>g</sup> J.R. Greis,<sup>f</sup> P.M. Hanlet,<sup>h</sup> C. Heidt,<sup>c</sup> C. Hunt,<sup>c</sup> G. Kafka,<sup>h</sup> Y. Karadzhov,<sup>g</sup> A. Kurup,<sup>e</sup> P. Kyberd,<sup>g</sup> M. Littlefield,<sup>g</sup> A. Liu,<sup>j</sup> K. Long,<sup>c,m</sup> D. Maletic,<sup>k</sup> J. Martyniak,<sup>c</sup> S. Middleton,<sup>c</sup> T. Mohayai,<sup>g</sup> J.J. Nebrensky,<sup>g</sup> J.C. Nugent,<sup>h</sup> E. Overton,<sup>l</sup> V. Pec,<sup>l</sup> C.E. Pidcott,<sup>l</sup> D. Rajaram,<sup>h,i</sup> M. Rayner,<sup>m</sup> I.D. Reid,<sup>c</sup> C.T. Rogers,<sup>h</sup> M. Savic,<sup>k</sup> I. Taylor,<sup>j</sup> Y.T. Torun,<sup>h</sup> C.D. Tunnell,<sup>h</sup> M.A. Uchida,<sup>e</sup> V. Verguillov,<sup>h</sup> K. Walaron,<sup>h</sup> M. Winter,<sup>h</sup> S. Wilbur<sup>l</sup>

<sup>a</sup>DPNC, section de Physique, Université de Genève, Geneva, Switzerland

<sup>b</sup>School of Physics and Astronomy, Kelvin Building, The University of Glasgow, Glasgow, UK

<sup>c</sup>Department of Physics, Blackett Laboratory, Imperial College London, London, UK

<sup>d</sup>Department of Atomic Physics, St. Kliment Ohridski University of Sofia, Sofia, Bulgaria

<sup>e</sup>Radboud University of Nijmegen, Netherlands

<sup>f</sup>Department of Physics, University of Warwick, Coventry, UK

<sup>g</sup>Brunel University, Uxbridge, UK

<sup>h</sup>Physics Department, Illinois Institute of Technology, Chicago, IL, USA

<sup>i</sup>University of California, Riverside, CA, USA

<sup>j</sup>Fermilab, Batavia, IL, USA

<sup>k</sup>Institute of Physics, University of Belgrade, Serbia

<sup>l</sup>Department of Physics and Astronomy, University of Sheffield, Sheffield, UK

<sup>m</sup>Department of Physics, University of Oxford, Denys Wilkinson Building, Oxford, UK

<sup>n</sup>STFC Rutherford Appleton Laboratory, Harwell Oxford, Didcot, UK

E-mail: [durga@fnal.gov](mailto:durga@fnal.gov)

**ABSTRACT:** The Muon Ionization Cooling Experiment (MICE) collaboration has developed the MICE Analysis User Software (MAUS) to simulate and analyze experimental data. It serves as the primary codebase for the experiment, providing for offline batch simulation and reconstruction as well as online data quality checks. The software provides both traditional particle-physics functionalities such as track reconstruction and particle identification, and accelerator physics functions, such as calculating transfer matrices and emittances. The code design is object orientated, but has a top-level structure based on the Map-Reduce model. This allows for parallelization to support live data reconstruction during data-taking operations. MAUS allows users to develop in either Python or C++ and provides APIs for both. Various software engineering practices from industry are also used to ensure correct and maintainable code, including style, unit and integration tests, continuous integration and load testing, code reviews, and distributed version control. The software framework and the simulation and reconstruction capabilities are described.

**KEYWORDS:** MICE; Ionization Cooling; Software; Reconstruction; Simulation

<sup>1</sup>Corresponding author.

## MAUS paper:

- RAP-P-007 and arXiv:1812:02674
- DR in process of submitting to JINST

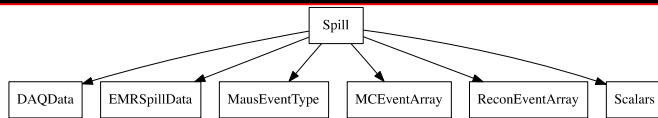


Figure 4. T

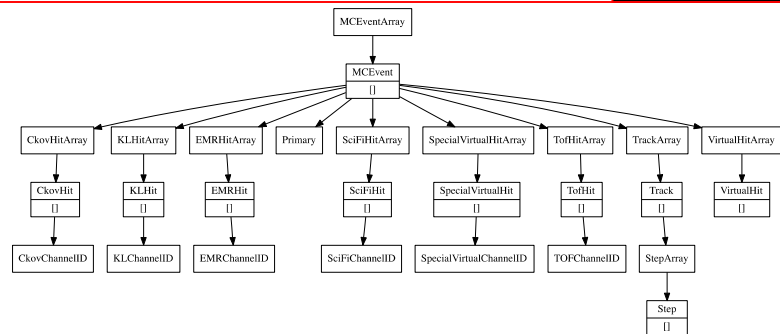
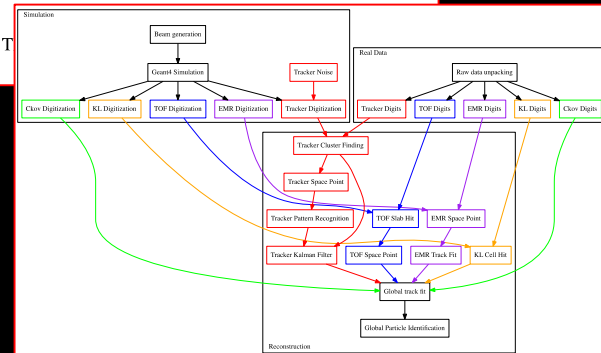


Figure 5. The MAUS data structure for MC events. T indicates that child objects are array items.



Spokesman's introduction

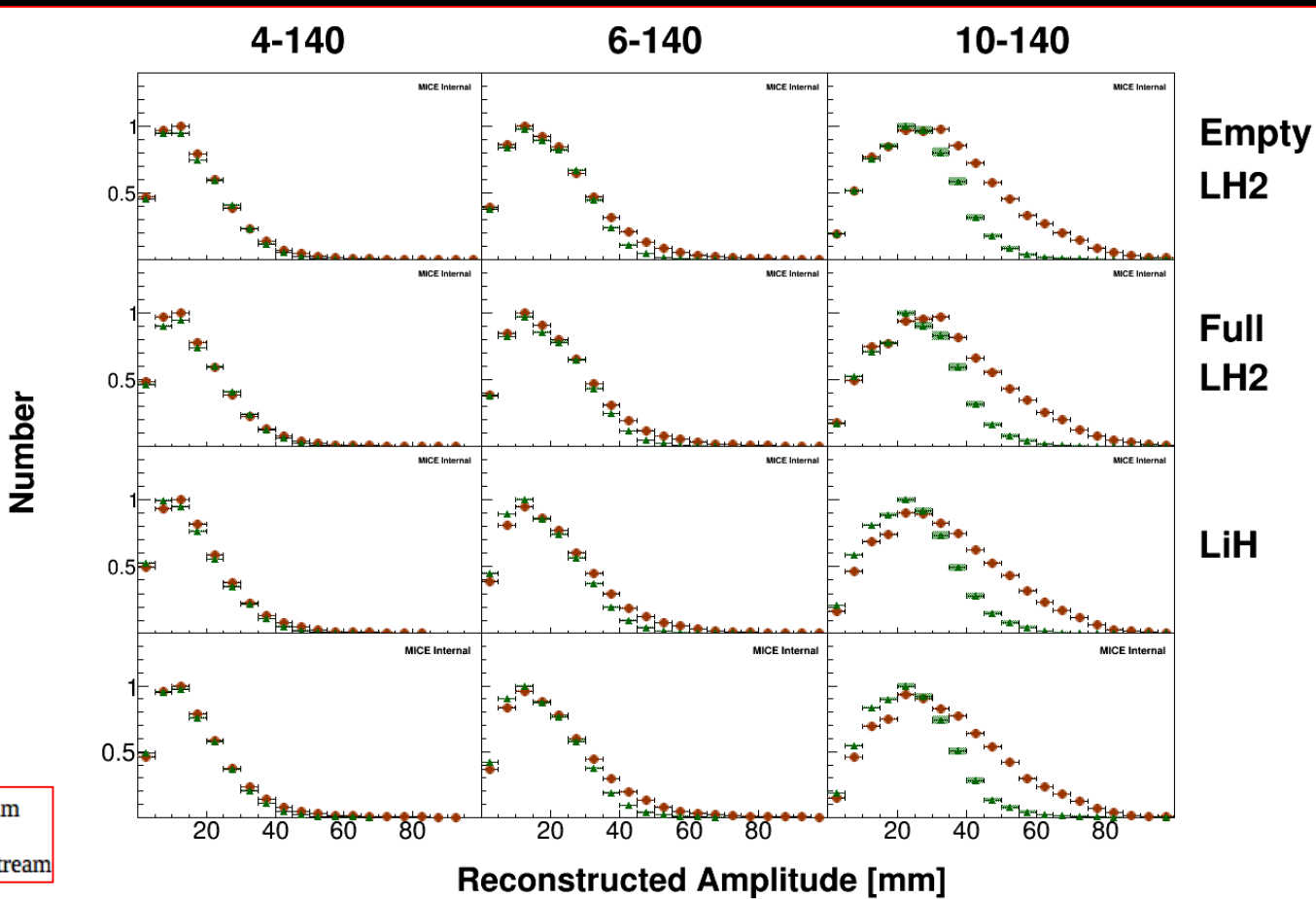
# **ANALYSIS UPDATE AND PAPER PLANNING**

# Amplitude evolution

- Chris Rogers and Francois Drielsma:
  - Jobs completed since last VC
    - Track inefficiency has been associated with poor track- $\chi^2$  at low pt
      - Chris Hunt investigating refinements in processing
    - In the mean time;  $\chi^2$  cut has been opened up
  - TOF momentum vs tracker momentum cut added:
    - Improves data/MC comparison in 'control' plots
  - Added plots showing 4D beta function
  - More detailed studies of systematic uncertainties
- Status of progress through referee process:
  - 2 referees' meetings to date:
    - At most recent meeting; authors encouraged to begin to draft paper
  - Doodle for 3<sup>rd</sup> referees meeting before end Jan19 'out'

# Update of amplitude distributions

Data

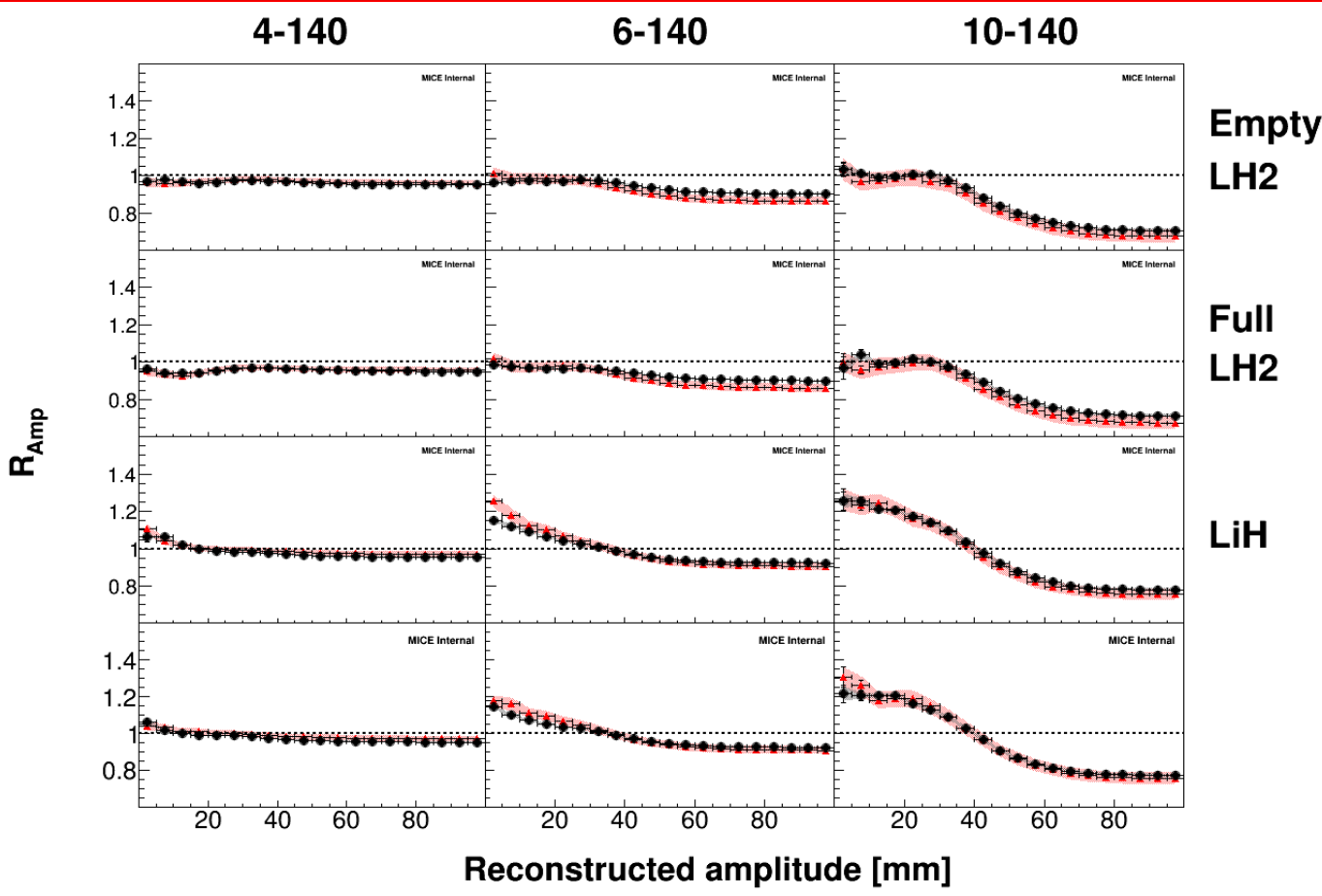




# Update of CDF ratio plot

Data

Monte Carlo



# Publication planning

Title	Contact	09-Jan-19		v12	2019 refresh
		Target date		Final	Comments Jan-19
		Preliminary			
Phase-space density/emittance evolution; rapid communication	C. Rogers	Apr18 w/s	Apr19		Looking for date for 3rd referees meeting before end Jan19
Measurement of multiple Coulomb scattering of muons in lithium hydride	J. Nugent	Jun18; CM51	Apr19		Unfolding issues; pick up now that JN is back from Japan
Performance of the MICE diagnostic systems	P. Franchini	Feb19; CM53			Almost complete draft
Phase-space density/emittance evolution review paper	C. Hunt	TBD			Analysis now advancing
Phase-space density/KDE/6D-emittance evolution	C. Brown	TBD			Thesis published on initial analysis; taken over by C.Brown
Measurement of multiple Coulomb scattering of muons in LH2	J. Nugent	TBD			Awaits completion of LiH paper
Field-on measurement of multiple Coulomb scattering	A. Young	TBD			Analysis underway
Beam-based alignment	TBD	TBD			
Direct measurement of emittance using the MICE scintillating-fibre tracker	V. Blackmore		Jun18, CM51		Submitted to EU J C; awaiting referees comments
The MICE Analysis and User Software framework	D. Rajaram	May18 w/s	Jun18, CM51		RAL-P-2018-007; 1812.02674; submission to JINST in progress

- **Spotlight from January 2019:**
  - **Amplitude evolution rapid communication**
  - **LiH scattering paper**
  - **System-performance paper**
  - **Emittance evolution review paper**
  - **LH2 scattering paper**
  - **Emittance exchange paper**
  - **Other papers noted on previous slide**

Spokesman's introduction

# UPCOMING MEETINGS

# MICE Analysis Workshop - Imperial

24-25 January 2019

Blackett Laboratory

GMT timezone



Overview

Timetable

Contribution List

Registration

Participant List

The analysis workshop will be at Imperial College. Please **register** using the link in the menu to the left.

The [usual phone line](#) will be available.

The meeting room is Room 532 in the Blackett Laboratory on Prince Consort Road. Please see [here](#) for [maps and directions](#). For details about accommodation, please see [here](#).



**Starts** 24 Jan 2019, 13:00

**Ends** 25 Jan 2019, 22:00

GMT



Blackett Laboratory

532

Imperial College



**Registration**

Registration for this event is currently open.

[Register now >](#)

21-22 February 2019

Other Institutes

Europe/London timezone



Overview

Timetable

Participant List

MICE Admin

✉ [miceadmin@stfc.ac.uk](mailto:miceadmin@stfc.ac.uk)

☎ +44 1235 445509

The 53rd Muon Ionization Cooling Experiment (MICE) Collaboration Meeting will be held at the Rutherford Appleton Laboratory on Thursday 21st and Friday 22nd February 2019.

The MICE Analysis will precede this and will be held on the 19th and 20th February 2019 in the PPD Meeting Room, R1 2nd Floor.

**Registration: £45**

**Collaboration Dinner: £35**

**Payment method: Overseas attendees cash only**



**Starts** 21 Feb 2019, 08:00

**Ends** 22 Feb 2019, 17:00

Europe/London



**Other Institutes**

Conference Rooms 12 and 13 Building R68

STFC, Rutherford Appleton Laboratory

Harwell Oxford Campus

Chilton

Oxfordshire OX11 0QX UK

[www.stfc.ac.uk](http://www.stfc.ac.uk)



Attendees from outside of the UK please bring cash to pay for CM53 as there are no electronic payment facilities.

**Phone conference information:**

The usual MICE phone-conference connection will be used. Please see:

[MICE phone bridge](#)