



Report on WP6: MICE Transnational Access (TA)

Norman McCubbin¹
Particle Physics Department, STFC

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¹ Retired as of July 2011, but still looking after some EU/MICE business.

MICE, ICTF and TA (1)

- MICE = Muon Ionisation Cooling Experiment
- Key step for feasibility of neutrino factory and μ -collider.
- MICE is installed at the Ionisation Cooling Test Facility (ICTF) at STFC's Rutherford Appleton Laboratory.
- The ICTF comprises a specially developed target and beam-line at the ISIS proton synchrotron (800 MeV), and installations to supply radio-frequency (RF) and liquid hydrogen (LH2).
- The beam-line provides μ , p , π , e at 100 MeV/c to 400 MeV/c. It has been operational for several years, though intensity continues to increase.
- The RF and LH2 installations will become available from 2012 onwards.
- Transnational Access (TA) under EuCARD supports access to the ICTF.

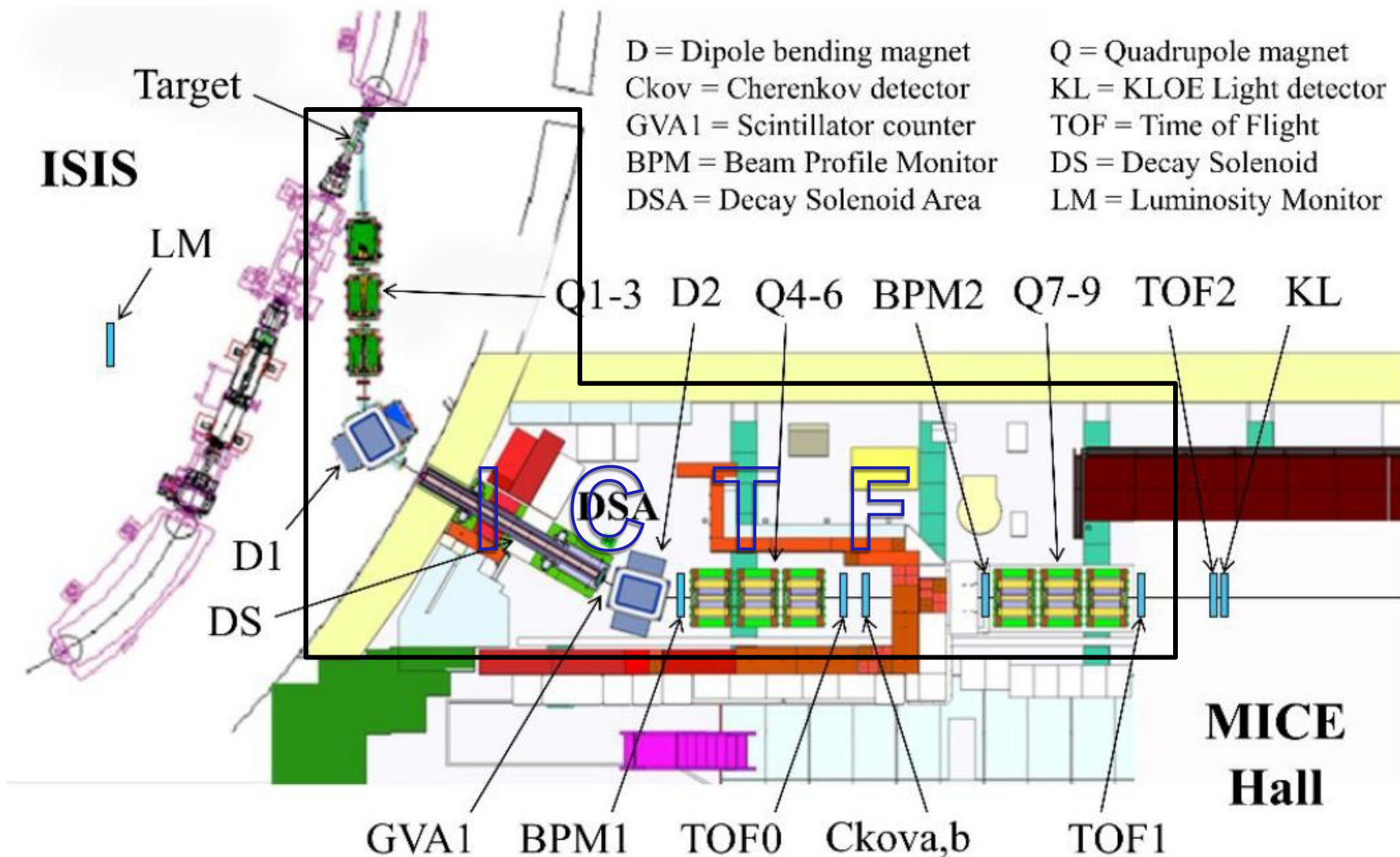
MICE, ICTF and TA (2)

- “Terminological history:”
- The word ‘MICE’ has been used to refer both to the ‘experiment’ and to the ‘facility’, and this occasionally caused confusion, not least for the TA programme.
- We have now introduced the term ‘ICTF’ to identify clearly the facility.
- This terminology was already used for EU support under TIARA, and in the EuCARD-2 bid.
- So... there has been no real change of substance, but the terminology has changed, deliberately. 😊

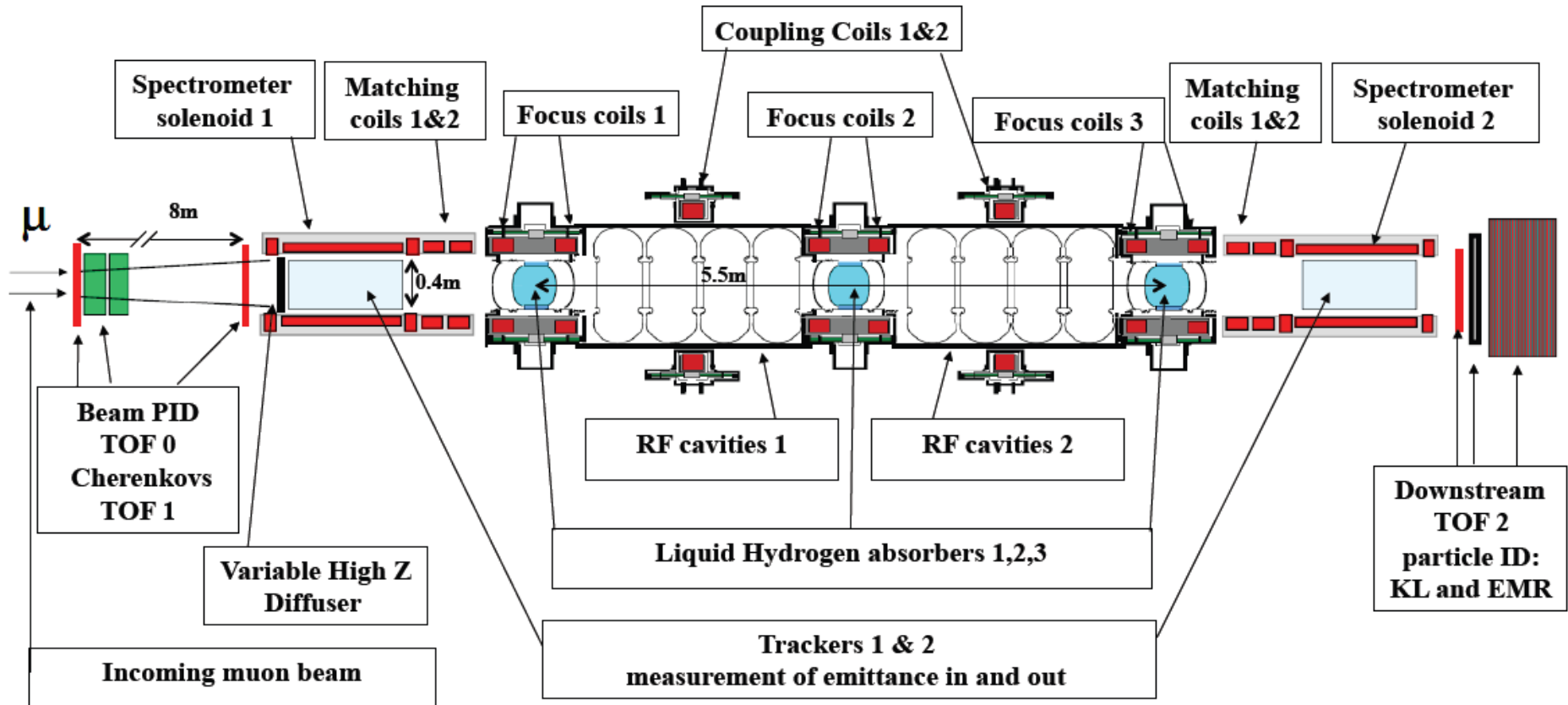


ISIS

MICE Hall
R5.2

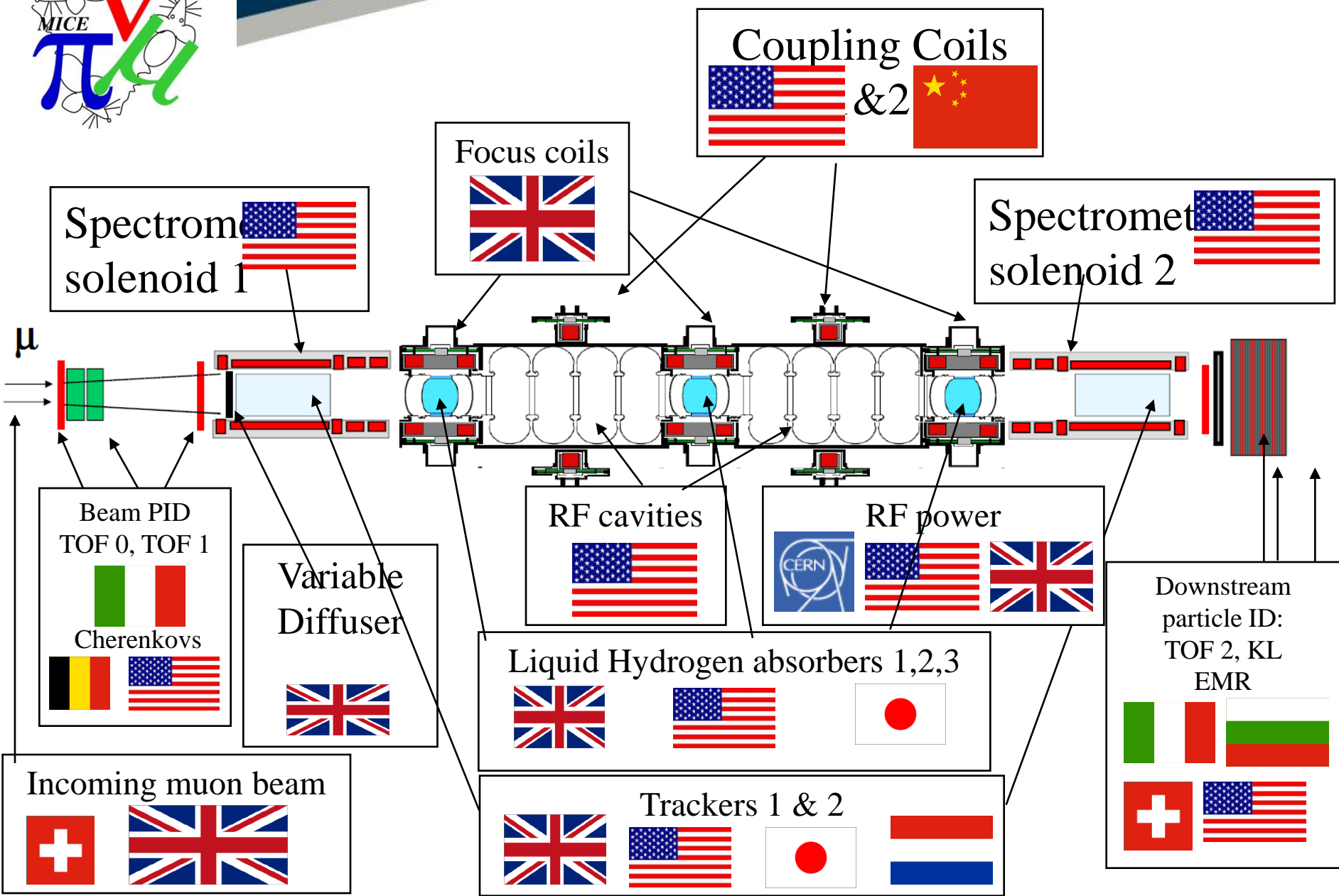
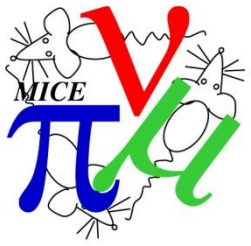


MICE : Muon Ionization Cooling Experiment



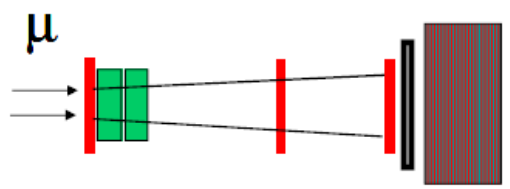
Particle by particle measurement $\rightarrow \Delta[(\epsilon^{\text{in}} - \epsilon^{\text{out}})/\epsilon^{\text{in}}] = 10^{-3}$

MICE Collaboration across the planet



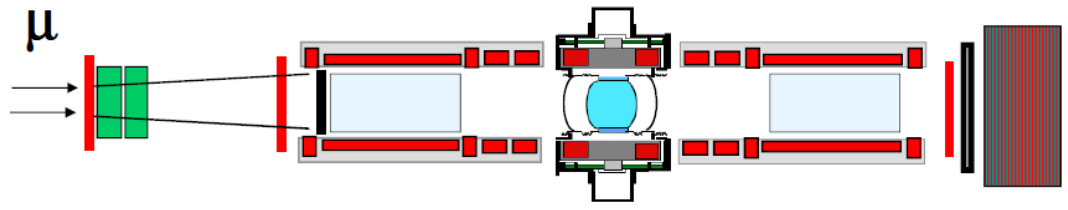
MICE SCHEDULE update February 2012

Run date:



STEP I

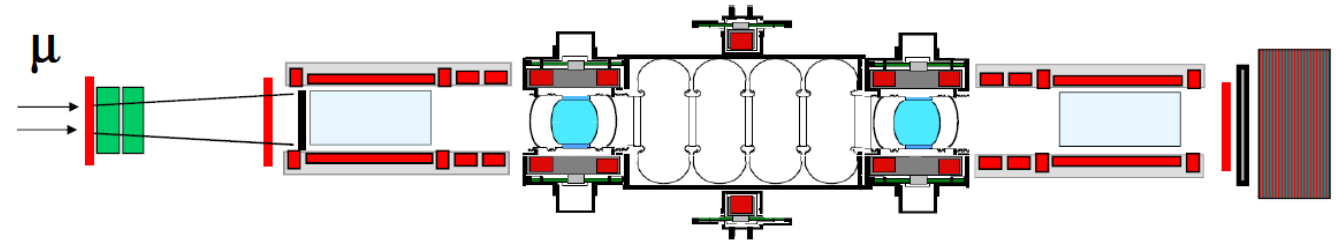
Completed, submitted to publication
(Tracker station and EMR run in 2012)



STEP IV

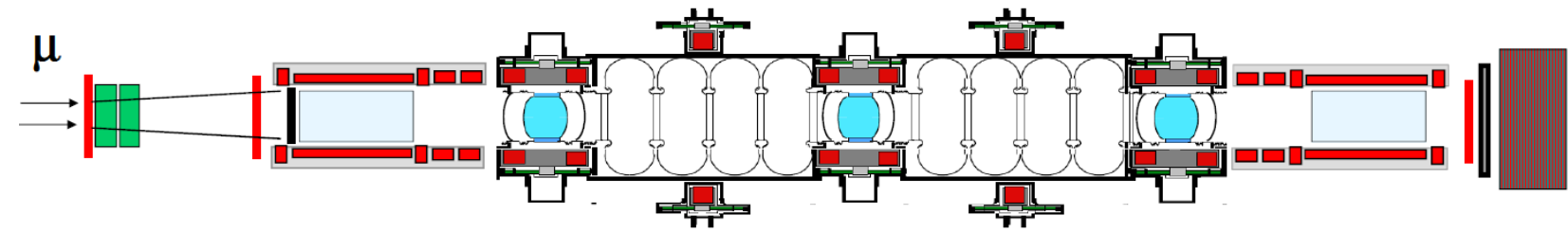
Q1 2013

Under construction:



STEP V

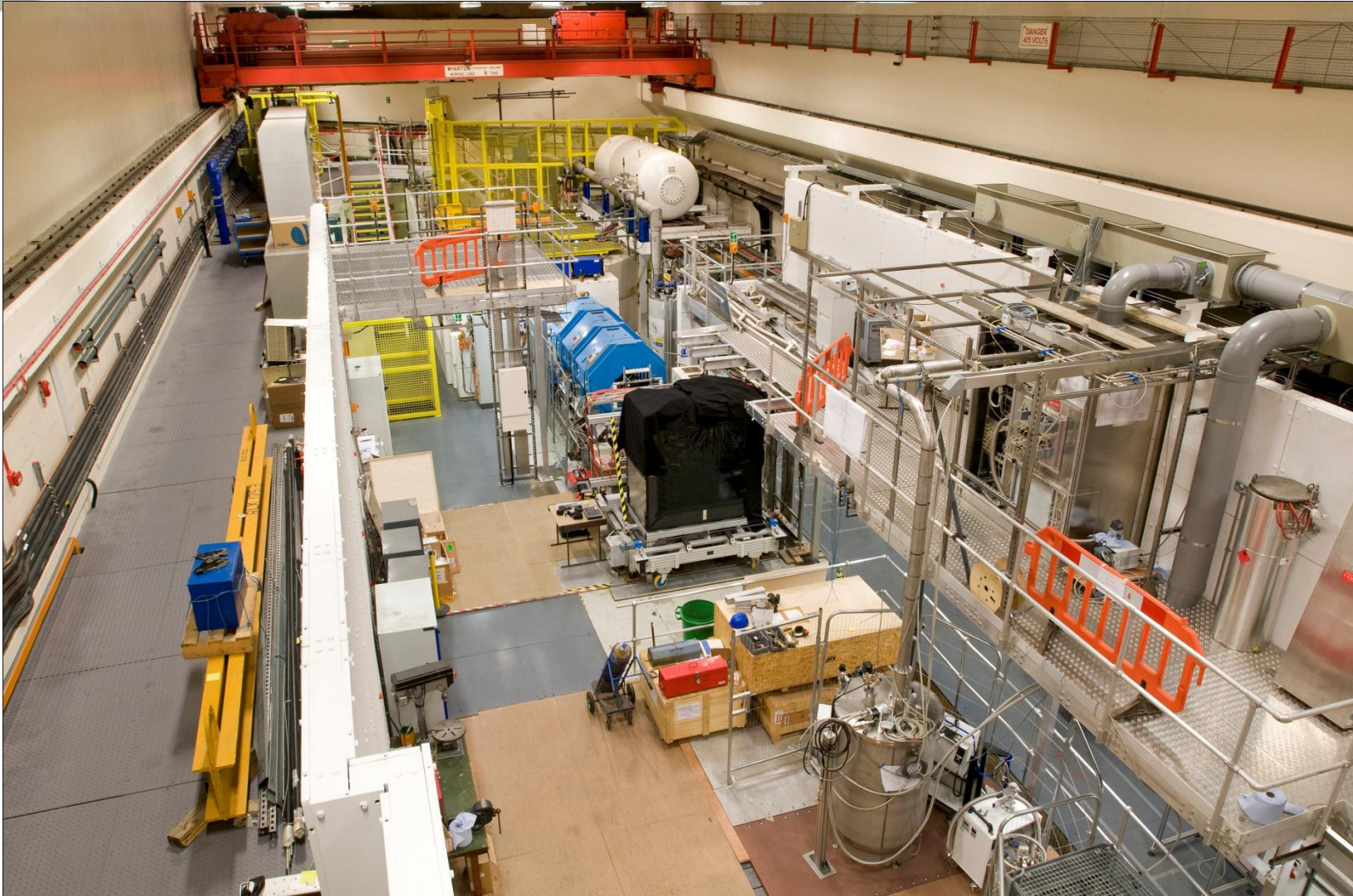
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STEP VI

NB: target date 2016

MICE Hall, June 2011



So far....

- Large and continuing investment in both the ICTF and MICE.
- Detailed characterisation of the beam has been carried out by the MICE collaboration, including a first measurement of emittance.
- Substantial preparatory work to provide dE/dx (eventually ~60 litres of liquid hydrogen) and acceleration (RF) has been completed.
- Substantial programme of work lies ahead for several years. (Step VI in 2016)

STEP I : first results (submitted for publication)



The MICE Muon Beam on ISIS and the beam-line instrumentation of the Muon Ionization Cooling Experiment

The MICE Collaboration

M. Bogomilov, Y. Karadzhev¹, D. Kolev, I. Russinov, R. Tsenov, G. Vankova-Kirilova
¹ Department of Atomic Physics, St. Kliment Ohridski University of Sofia, Sofia, Bulgaria
² Now at DPNC, Université de Genève, Geneva, Switzerland

L. Wang, F.Y. Xu, S.X. Zheng
³ Institute for Cryogenic and Superconductivity Technology, Harbin Institute of Technology, Harbin, PR China

R. Bertoni, M. Bonesini, F. Ferri², G. Lucchini, R. Mazza, F. Paleari³, F. Strati
⁴ Sezione INFN Milano Bicocca, Dipartimento di Fisica G. Occhialini, Milano, Italy
⁵ Present address DSM/IRFU, CEA/Saclay, Gif-sur-Yvette, France
⁶ Now at Quanta Systems, Solbiate Olona, Varese, Italy

V. Palladino
⁷ Sezione INFN Napoli and Dipartimento di Fisica, Università Federico II, Complesso Universitario di Monte S. Angelo, Napoli, Italy

G. Cecchet, A. de Bari
⁸ Sezione INFN Pavia and Dipartimento di Fisica Nucleare e Teorica, Pavia, Italy

M. Capponi, A. Cirillo, A. Iaciflano, A. Manfredini, M. Parisi, D. Orestano, F. Pastore, A. Tonazzo⁹, L. Tortora
¹⁰ Sezione INFN Roma Tre e Dipartimento di Fisica, Roma, Italy
¹¹ Present address APC, Université Paris Diderot, Paris, France

Y. Mori
¹² Kyoto University Research Reactor Institute, Osaka, Japan

Y. Kuno, H. Sakamoto, A. Sato, T. Yano, M. Yoshida
¹³ Osaka University, Graduate School of Science, Department of Physics, Toyonaka, Osaka, Japan

S. Ishimoto, S. Suzuki, K. Yoshimura
¹⁴ High Energy Accelerator Research Organization (KEK), Institute of Particle and Nuclear Studies, Tsukuba, Ibaraki, Japan

F. Filthaut⁵
¹⁵ NIKHEF, Amsterdam, The Netherlands
¹⁶ Also at Radboud University Nijmegen, Nijmegen, The Netherlands

R. Garoby, S. Gilardini, P. Gruber, K. Hanke, H. Haserath, P. Janot, A. Lombari, S. Ramberger, M. Vretenar
¹⁷ CERN, Geneva, Switzerland

P. Bene, A. Blondel, F. Cadoux, J.-S. Graulich, V. Grichine⁶, E. Gschwendtner⁷, F. Masciocchi, R. Sandstrom, V. Verguioiu, H. Wisting
¹⁸ DPNC, Section de Physique, Université de Genève, Geneva, Switzerland
¹⁹ Also at Lebedev Physical Institute, Moscow, Russia
²⁰ Now at CERN, Geneva, Switzerland

C. Petitjean
²¹ Paul Scherrer Institut, Villigen, Switzerland

R. Seivour
²² The Cockcroft Institute, Daresbury Science and Innovation Centre, Daresbury, Cheshire, UK

J. Alexander, G. Charnley, N. Colomb, S. Griffiths, B. Martlew, A. Moss, I. Mullacrae, A. Oates, P. Owens, C. White, S. York
²³ STFC Daresbury Laboratory, Daresbury, Cheshire, UK

D. Adams, R. Apsimon, P. Barclay, D.E. Baynham, T.W. Bradshaw, M. Courthot, P. Drumm⁸, R. Edgecock, T. Hayler, M. Hills⁹, Y. Ivaniouchenkov, A. Jones, A. Lintern, C. MacWaters, C. Nelson, A. Nichols, R. Preece, S. Ricciardi, J.H. Rochford¹⁰, C. Rogers, W. Spensley¹¹, J. Tarrant, K. Tilley, S. Watson, A. Wilson
²⁴ STFC Rutherford Appleton Laboratory, Harwell Oxford, Didcot, UK
²⁵ Now at Space Research Centre, Department of Physics and Astronomy, University of Leicester, Leicester, UK
²⁶ Now at Mullard Space Science Laboratory, University College London, Dorking, Surrey, UK
²⁷ Now at Global Research Centre, General Electric, Albany, NY, USA
²⁸ Now at MANTEC SYSTEM Ltd, Newcastle Upon Tyne, UK

D. Forrest, F.J.P. Soler, K. Walaron¹²
²⁹ School of Physics and Astronomy, Kelvin Building, The University of Glasgow, Glasgow, UK
³⁰ Also at Imperial College London, London, UK

P. Cooke, R. Gamet
³¹ Department of Physics, University of Liverpool, Liverpool, UK

A. Alekou, M. Apollonio¹³, G. Barber, D. Clark, I. Clark, A. Dobbs, P. Dornan, A. Fish¹⁴, R. Hare, S. Greenwood, A. Jamdnagni, V. Kasey, M. Khaleeq, J. Leaver, K. Long, E. McKigney¹⁵, T. Matsushita¹⁶, J. Pasternak, T. Sashalmi, T. Savidge, M. Takahashi¹⁷
³² Department of Physics, Blackett Laboratory, Imperial College London, London, UK
³³ Now at Diamond Light Source, Harwell Science and Innovation Campus, Didcot, Oxfordshire, UK
³⁴ BC asset management Ltd, BC House, Poole, Dorset, UK
³⁵ Now at Los Alamos Nat. Lab., Los Alamos, USA
³⁶ Now at Kobe University, Faculty of Science, 1-1 Rokkodai-cho, Nada-ku, Kobe-shi, Japan
³⁷ Now at Department of Physics, University of Manchester, Manchester, UK

V. Blackmore, T. Carlisle, J.H. Cobb, W. Lau, M. Rayner¹⁸, C.D. Tunnel, H. Witte¹⁹, S. Yang
³⁸ Department of Physics, University of Oxford, Denis Wilkinson Building, Oxford, UK
³⁹ Now at DPNC, Université de Genève, Switzerland
⁴⁰ Now at Brookhaven National Laboratory, Upton, NY, USA

C.N. Booth, P. Hodgson, L. Howlett, R. Nicholson, E. Overton, M. Robinson, P. Smith
⁴¹ Department of Physics and Astronomy, University of Sheffield, Sheffield, UK

D. Adey, J. Back, S. Boyd, P. Harrison
⁴² Department of Physics, University of Warwick, Coventry, UK

M. Ellis²⁰, P. Kyberd, M. Littlefield, J.J. Nebresny
⁴³ Brelmel University, Uxbridge, UK
⁴⁴ Now at Westpac Institutional Bank, Sydney, Australia

A.D. Bross, S. Geer, D. Neuffer, A. Moretti, M. Popovic
⁴⁵ Fermilab, Batavia, IL, USA

M.A.C. Cummings, T. J. Roberts
⁴⁶ Muons, Inc., Batavia, IL, USA

A. DeMello, M.A. Green, D. Li, S. Virostek, M.S. Zisman
⁴⁷ Lawrence Berkeley National Laboratory, Berkeley, CA, USA

B. Freemire, P. Hanlet, D. Huang²¹, G. Kafka, D.M. Kaplan, P. Snopok, Y. Torun
⁴⁸ Illinois Institute of Technology, Chicago, IL, USA
⁴⁹ Now at Shanghai Synchrotron Radiation Facility, Shanghai, PR China

S. Blot, Y.K. Kim
⁵⁰ Enrico Fermi Institute, University of Chicago, Chicago, IL, USA

U. Bravar
⁵¹ University of New Hampshire, Durham, NH, USA

Y. Onel
⁵² Department of Physics and Astronomy, University of Iowa, Iowa City, IA, USA

D. Cline, Y. Fukui, K. Lee, X. Yang
⁵³ Department of Physics and Astronomy, University of California, Los Angeles, CA, USA

R.A. Rimmer
⁵⁴ Jefferson Lab, Newport News, VA, USA

L.M. Cremaldi, G. Gregoire²², T.L. Hart, D.A. Sanders, D.J. Summers
⁵⁵ University of Mississippi, Oxford, MS, USA
⁵⁶ Permanent address Institute of Physics, Université Catholique de Louvain, Louvain-la-Neuve, Belgium

L. Coney, R. Fletcher, G.G. Hanson, C. Heidt
⁵⁷ University of California, Riverside, CA, USA

J. Gallardo, S. Kahn²³, H. Kirk, R.B. Palmer
⁵⁸ Brookhaven National Laboratory, Upton, NY, USA
⁵⁹ Now at Muons, Inc., IL, USA

Main result: matched beams over a matrix of emittance/momentum points in pure muon beam – MICE allowed to run 4V over 2 ms beam bump @ 0.5Hz
 → >~ 30 μ⁺/ V.ms or... (since we are allowed 4V over 2ms every ~2.5 sec)
Achieved: > 10⁵ per hour = make a 10⁻³ cooling measurement at Step IV

ϵ_N (mm rad)	μ^- rate (muons/V · ms)			μ^+ rate (muons/V · ms)		
	p_z (MeV/c)			p_z (MeV/c)		
	140	200	240	140	200	240
3	4.1±0.2	6.3 ±0.2	4.9±0.2	16.8±1.8	33.1±3.2	33.0±2.6
6	4.1±0.4	4.8±0.2	4.5±0.2	17.8 ±1.8	31.0±2.0	31.7±2.0
10	4.6 ±0.2	5.4±0.2	4.4±0.1	21.6±2.2	34.0±2.5	26.1±1.5

TA (WP6) background

- Transnational Access (TA) to the ICTF is a good fit to the EuCARD aim of supporting the development of a European Research Area in accelerator science and strengthening collaboration among European partners.
- TA provides financial support for travel and subsistence for “eligible researchers” (= at non-UK European institution)
- The TA award to STFC is 222k€ (Euro), of which 180k€ is to be used for funding TA directly and the rest is a contribution to the management and associated costs of the scheme.
- Scheme runs for 48 months starting 1 April 2009.
- TA funding is to be used:
 - to support detector commissioning, data-taking and analysis;
 - testing detectors using the low-energy beam; and
 - development of new ideas for particle cooling.
- The scheme supports access to the **facility**, and includes support for work on MICE at the ICTF.

TA (WP6): application process

- Applications are assessed by TA Panel: *Steve Geer (FNAL)*, *Ken Peach (Oxford, Chair)*, *Francesco Terranova (INFN)*, plus technical (MICE) and administrative (FP7) input as needed.
- Panel works on cycle of two calls per year, advertised on the web pages of:
 - EuCARD (<http://eucard.web.cern.ch/eucard/activities/access/WP6/>),
 - STFC (<http://www.scitech.ac.uk/ResFac/LargeFac/contents.aspx>)
 - MICE (<http://mice.iit.edu>)and email to Neutrino community.
- EU has urged widest possible advertising of TA. So, for the January 2011 call, the Research Directors (or equivalent) at KEK, PSI and TRIUMF were emailed, and asked to advertise TA access to their user communities. (No applicants, but note restriction on “eligible researchers”.)

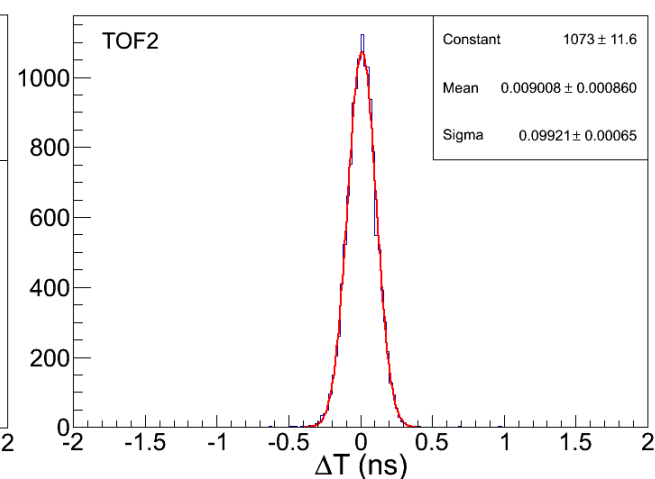
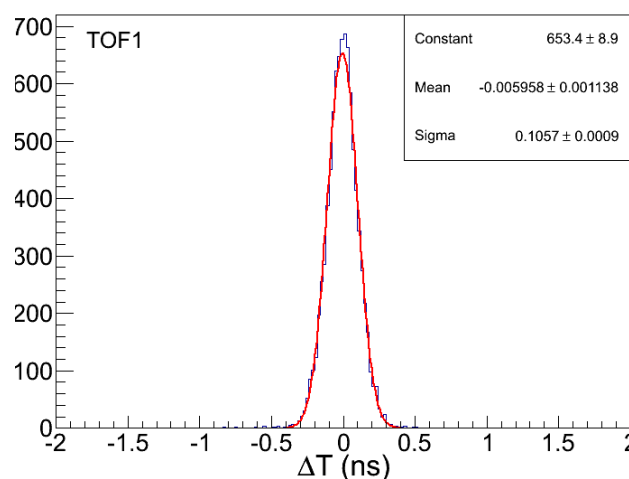
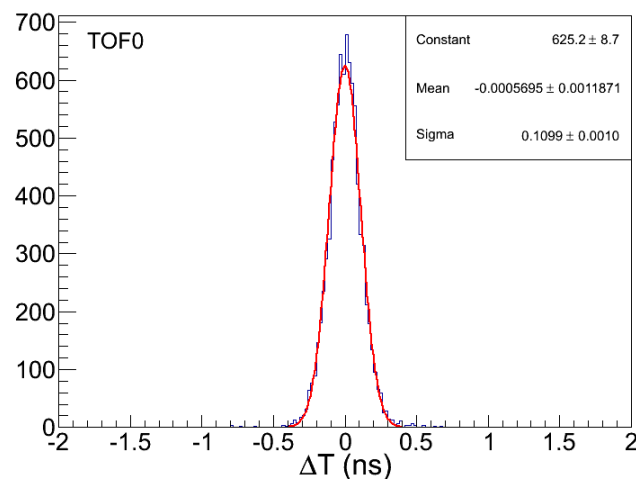
TA (WP6): awards (1)

- TA Awards have been made to groups from:
 - INFN Milano Bicocca/Pavia /Roma Tre
 - University Insubria (not a member of MICE) collaboration)
 - University of Sofia
 - University of Geneva
- These awards have supported in particular work for the Electron Muon Ranger (EMR), Particle Identification and TOF systems for MICE.
- Details have been given in the EuCARD Period 1 and Semester 4 reports, and in the EuCARD Newsletter #9 (June 2011). More in the upcoming Period 2 report.
- The TA-supported work has also been prominent in the overall MICE work reported at conferences.

- Identifying time & particle species depends on timing resolution of TOFs.
 - TOF0: 55 ps
 - TOF1: 60 ps**
 - TOF2: 50 ps

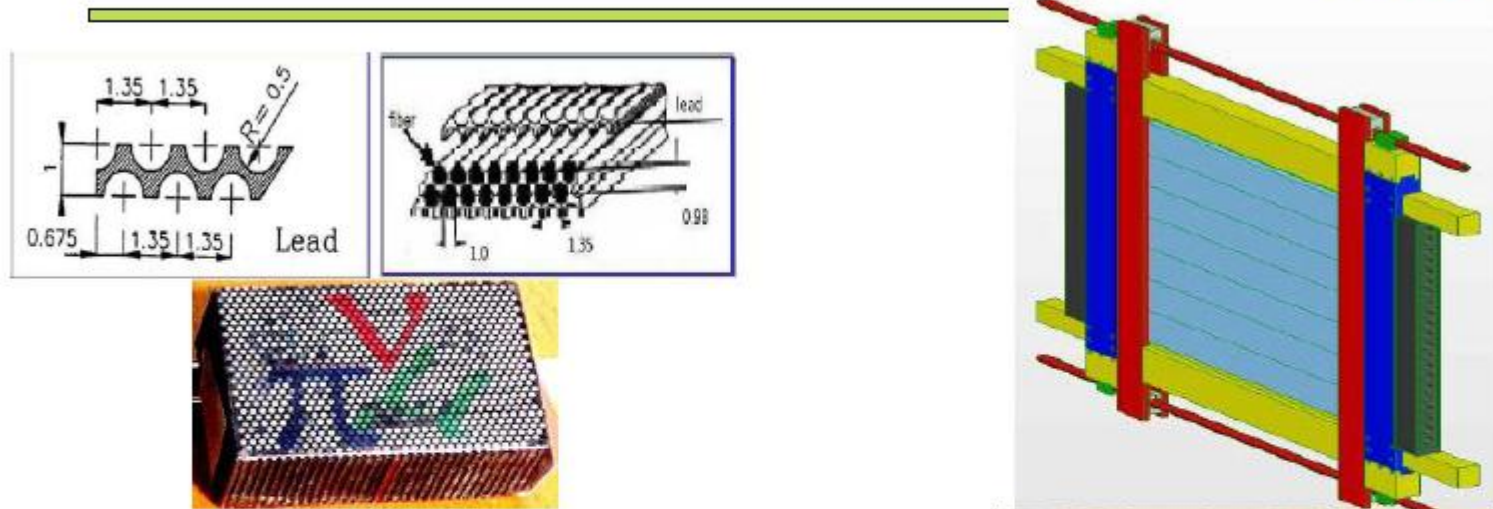
} rebuilt

- New calibration (Dec 2011):
 - TOF0: 55 ps
 - TOF1: 53 ps**
 - TOF2: 50 ps



TA-supported: KL

KL calorimeter



**Schematic layout of KL
extruded fibers and lead**

**Installation in temporary
position after Q9 at RAL**

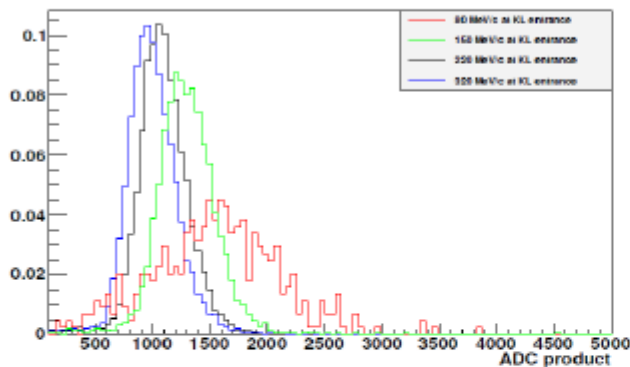


TA-supported: KL

KL performances

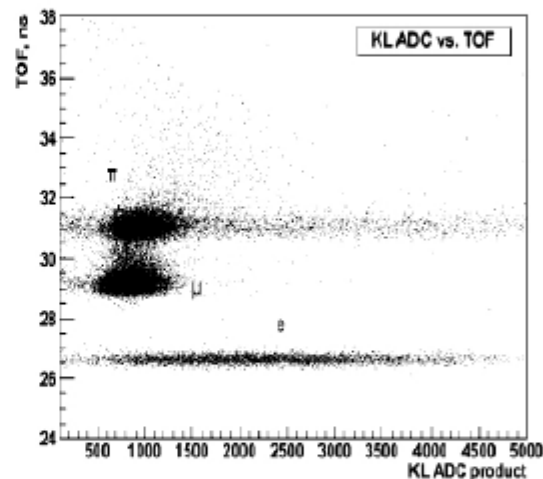
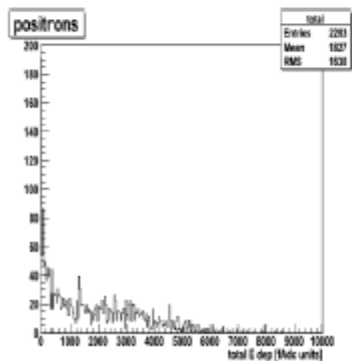


Muons



KL response to muons

positrons

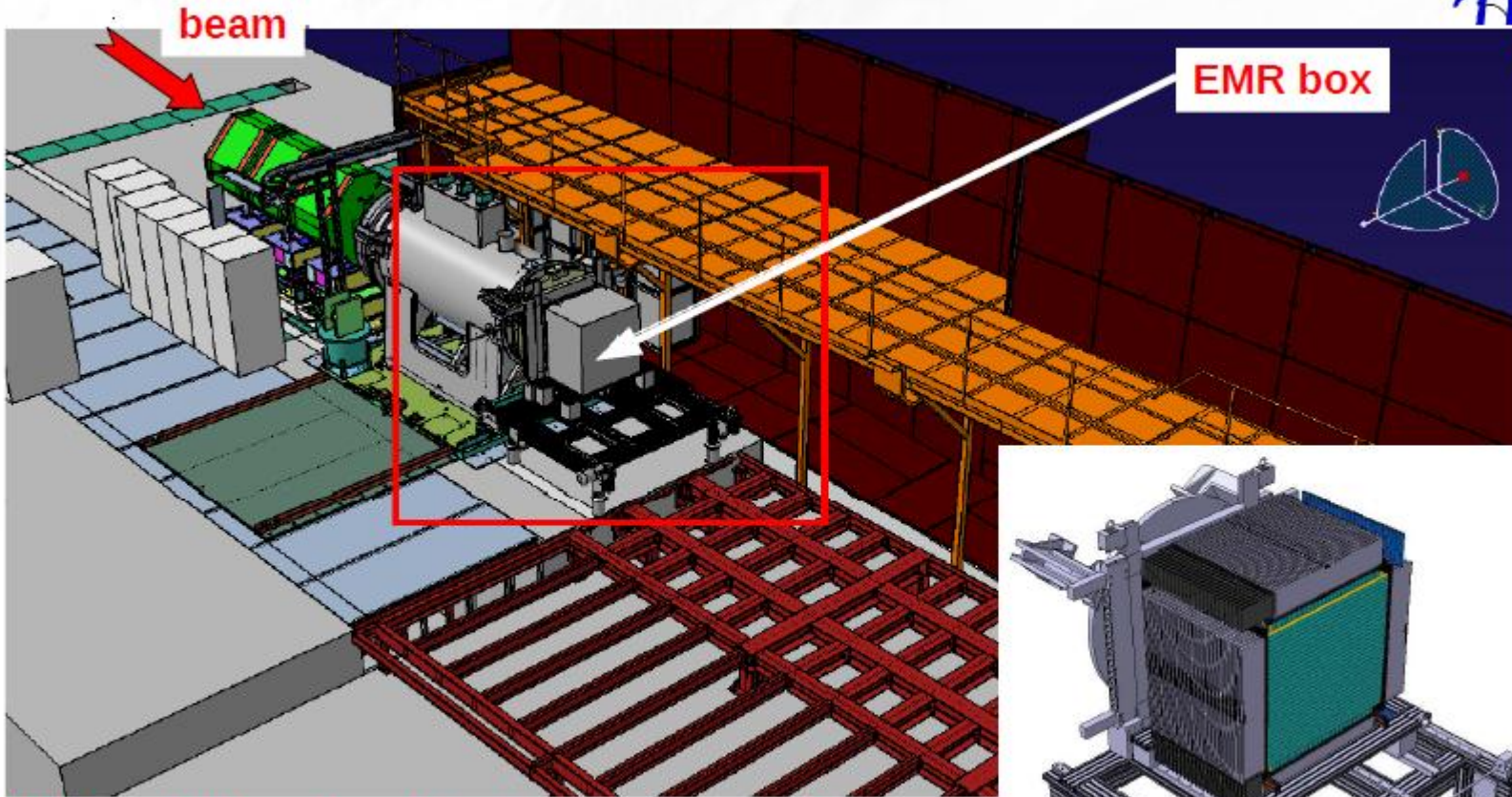


KL response to 100MeV e⁺ beam



TA-supported: EMR

Electron Muon Ranger: where and why



EMR is a fully active detector (tracker+calorimeter) whose aim is (together with TOF and KL) to distinguish electrons from muons

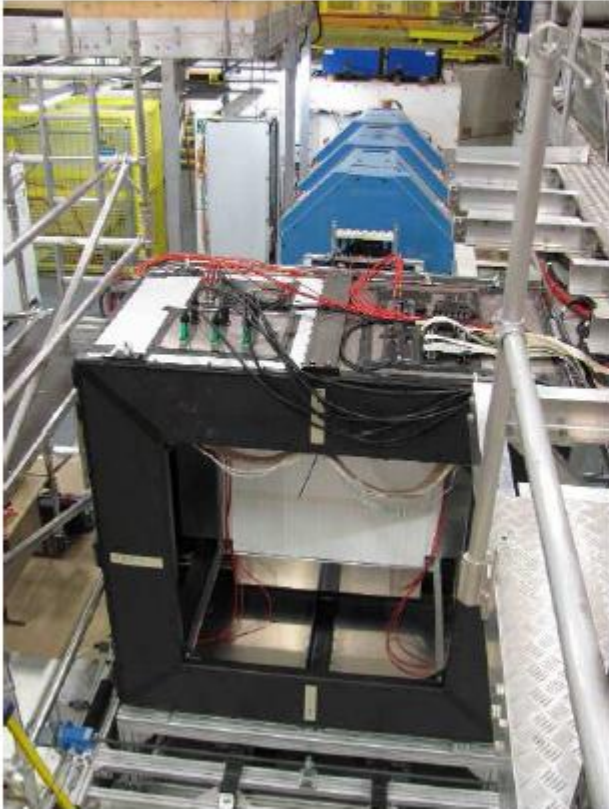




TA-supported: EMR

Six planes at RAL

Six planes installed on the MICE line for the July data taking period



TA (WP6): awards (2)

- The TA Panel convened a special meeting in Dec 2011 to hear reports and plans from the groups in receipt of TA awards.
- This informed the allocation of the final tranche of TA in February 2012. (TA support must all be used by end March 2013.)
- Have now allocated a total of ~150 visits and 1400 “visitor-days”. (to end March 2013)
- This translates into nearly 6000 “access units”, which is well in excess of the minimum of 3384 access units specified in the FP7/EuCARD Annex I. ☺)
- As of end March 2012, ~100 visits and ~800 v-days have been used.

TA in EuCARD-2

- The TA programme has been, and will continue to be, extremely beneficial in supporting access to the ICTF at RAL, furthering excellent pan-European collaboration.
- Without this TA support the access to ICTF would have been much more constrained, or, in some cases, not even possible.
- A 4-year (April 2013 to March 2017) continuation of TA to ICTF was part (WP8) of the EuCARD-2 bid, and we are of course encouraged by the positive signals from EC about that bid.
- During the EuCARD-2 period the facility will reach its full potential, and we will seek to widen the usage as much as possible.