

**Status report for MPID
TA project (INFN MiB,Na,Pv,Rm3)
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Sezione INFN Milano Bicocca**

INFN groups activity



- The MPID activity mainly concerns the PID detectors (TOF system, KL system): both construction, installation in the MICE Hall and their commissioning & running
- The availability of TA funds has helped greatly for this: due to the many steps of MICE and ... delays ... we have many changes to implement in the Hall (detector position, installation layout, cabling/recabling) that involve a lot of technical interventions

Activity on TOF : TOF0+TOF1 refurbishing



- many PMTs of TOF0 are old (2006-2007) and have a preliminary design of the active divider and the valve insulation from mu metal, giving a lot of problems (spikes ...). Hamamatsu Japan kindly agreed to refurbish them (kapton insulation/new active divider) if back to firm before 31/12/2010: after it they say it would be OUR problem
- TOF0 has been refurbished in September 2010 and put back in DSA with newer PMTs (about 20 out of 40) , TOF1 was refurbished in Milano in spring 2011 and put back in DSA in June 2011 Maybe this will solve the pending issue of the little worse resolution (60 ps) as compared to TOF0/TOF2 (~50 ps).



The usual TOF performance plots

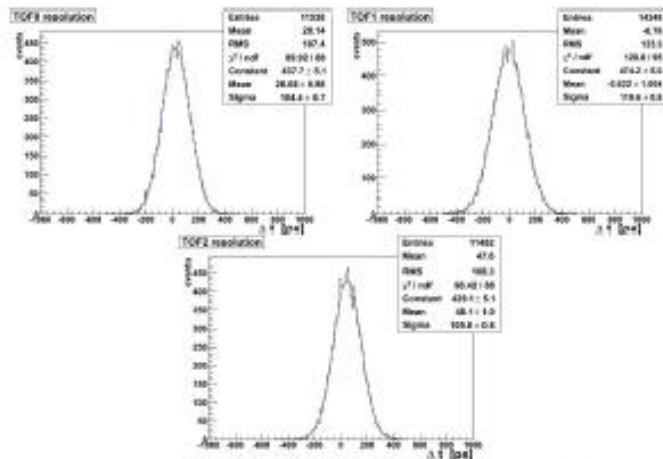


Fig. 9. Time difference Δt_{xy} between vertical and horizontal slabs in TOF0, TOF1 and TOF2. Trigger is on TOF1.



Fig. 10. Time of flight between TOF0 and TOF2 for muon (left) and electron (right) beam.

- Time resolution after calibration:
- TOF0 - 51ps;
- TOF1 - 58ps;
- TOF2 - 52ps.

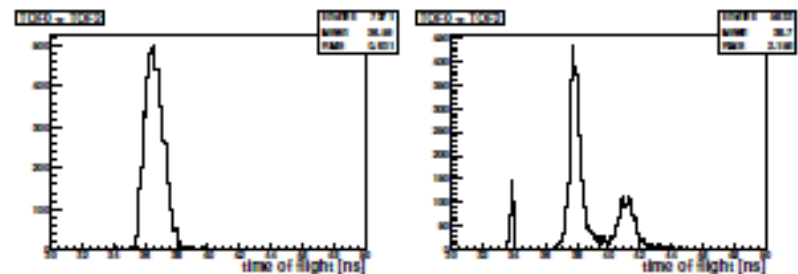
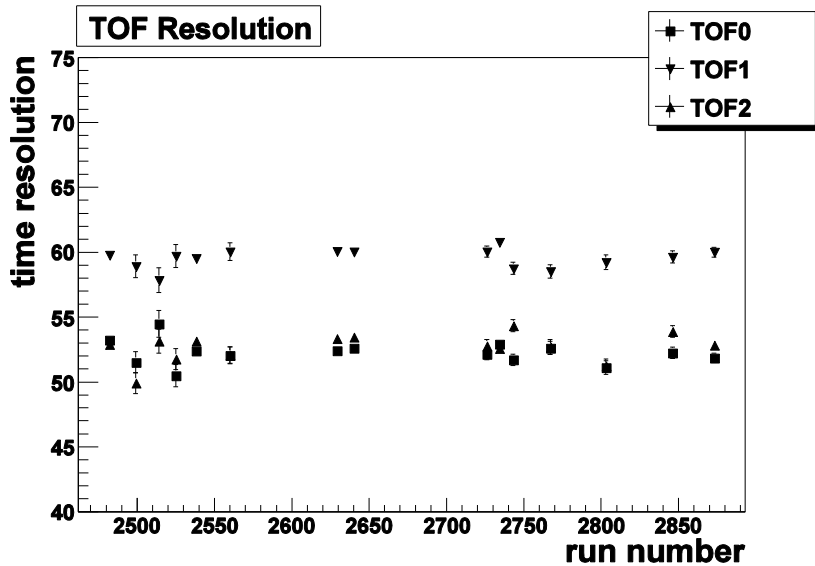


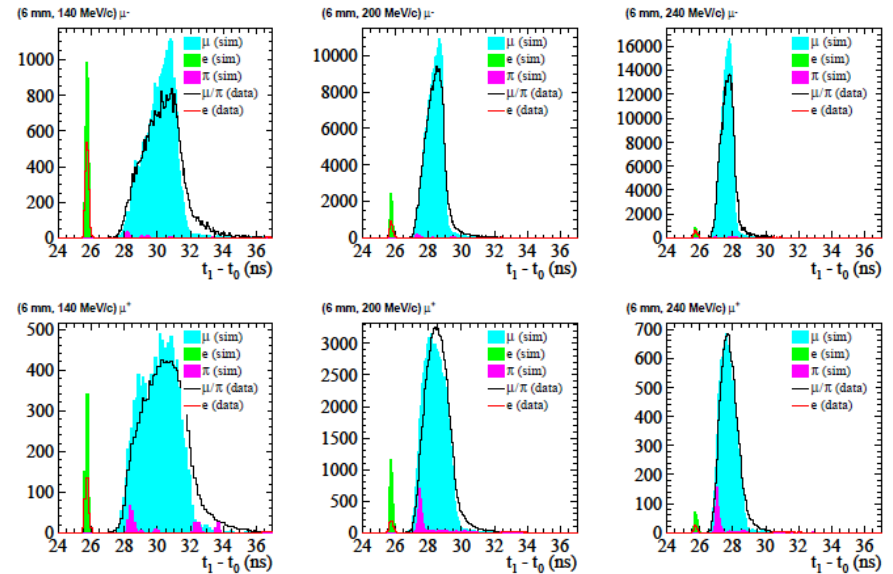
Fig. 11. Time of flight between TOF0 and TOF2 for muon (left) and electron (right) beam.

More on TOF detectors

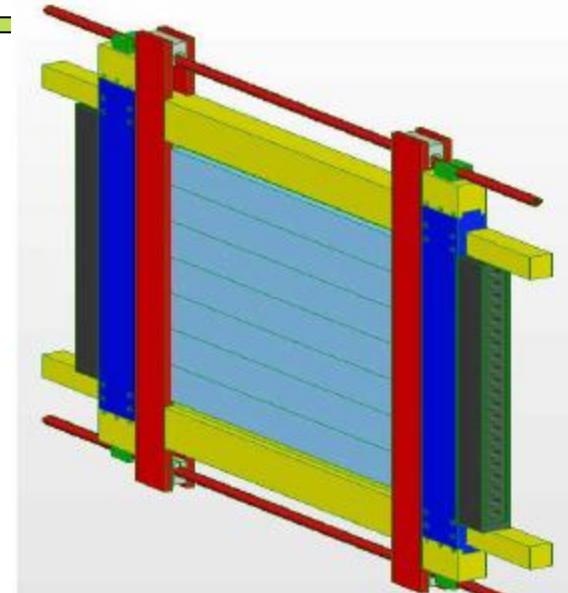
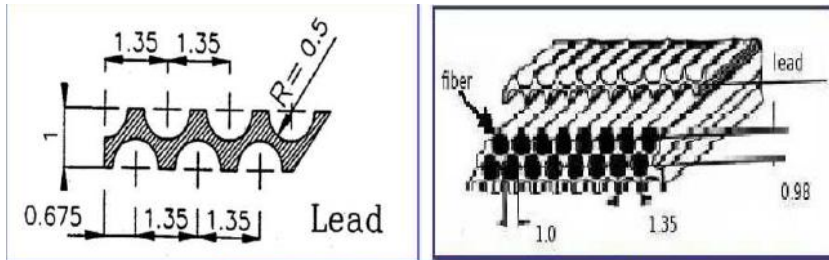


1 month data taking

- Stability of TOF stations resolution



KL calorimeter



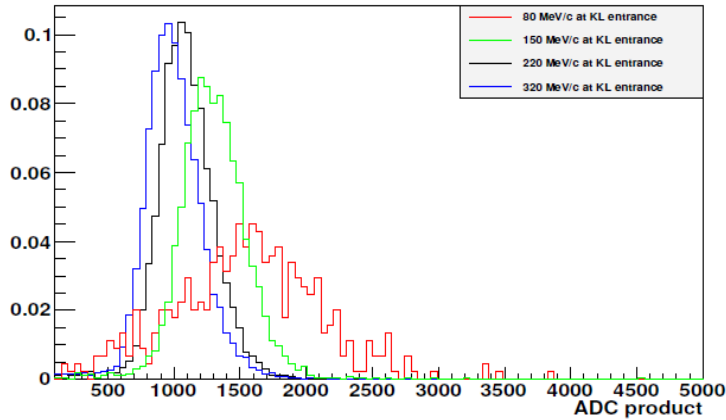
**Schematic layout of KL
extruded fibers and lead**

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

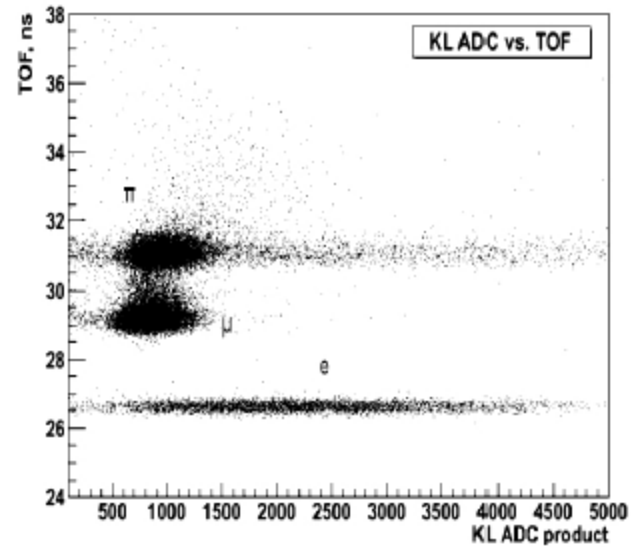
KL performances



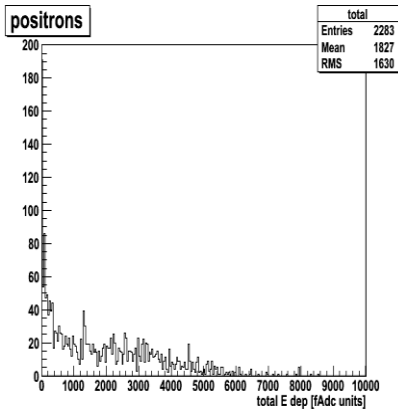
Muons



KL response to muons



positrons



KL response to 100MeV e⁺ beam

Some applications for TOF and KL

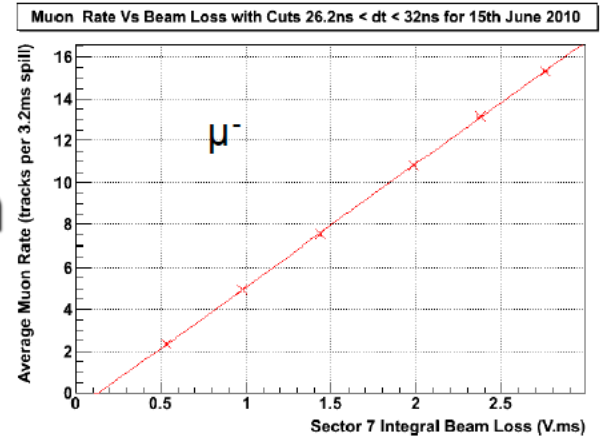


1. Beamline commissioning (a paper for JINST is in preparation)
2. Beam emittance measurement with TOF system only (another paper is in preparation)

Beamline commissioning



- The beamline has been operated over a range of p , producing e, π, μ
- TOF detectors used for PID & beam profiles
- TOF have been used for a preliminary measure of emittance



Momentum (MeV/c)

	140		200		240	
3	39	80	58	171	57	237
6	98	207	112	527	85	198
10	95	183	78	200	89	174

μ rate related to ISIS beam losses

Data collected in STEP I (in 1keV) (+ve in black)

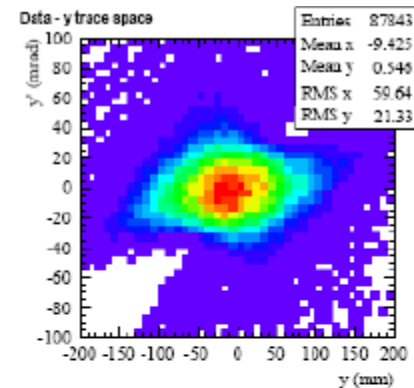
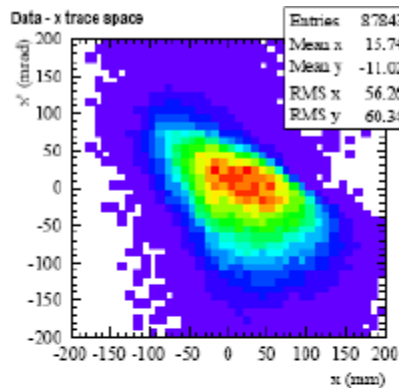
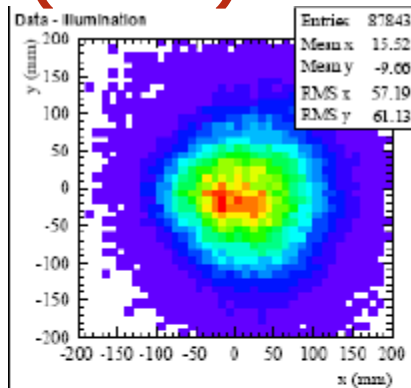
emittance

Emittance measurement with TOF

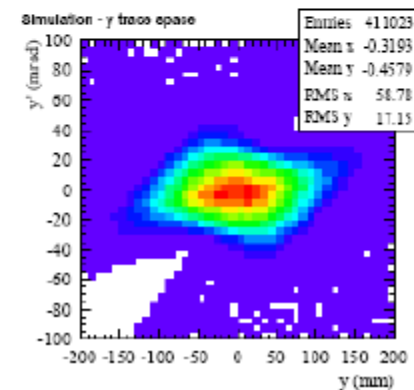
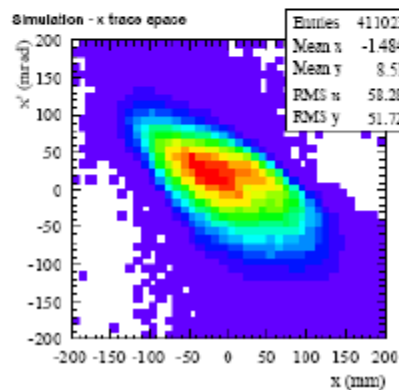
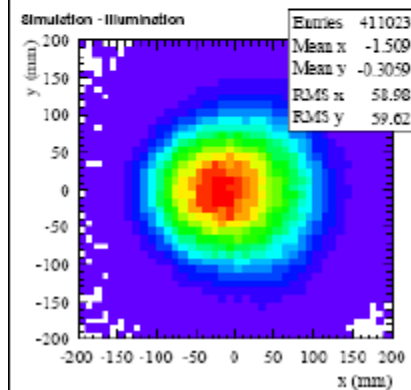


Reconstructed transverse phase space of the baseline MICE beam (6-200) at TOF1

data



MC



y(mm) vs x(mm)

x' (mrad) vs x (mm)

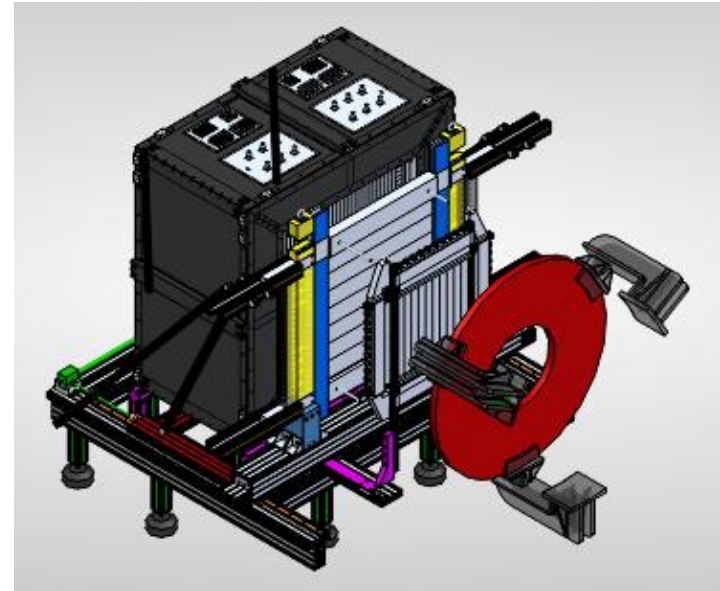
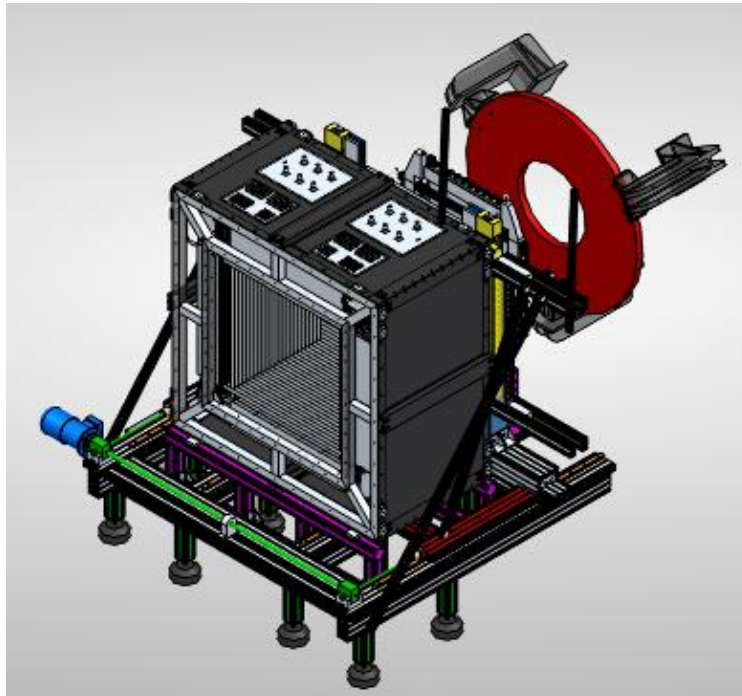
y'(mrad) vs y (mm)

Foreseen future activities (2012)



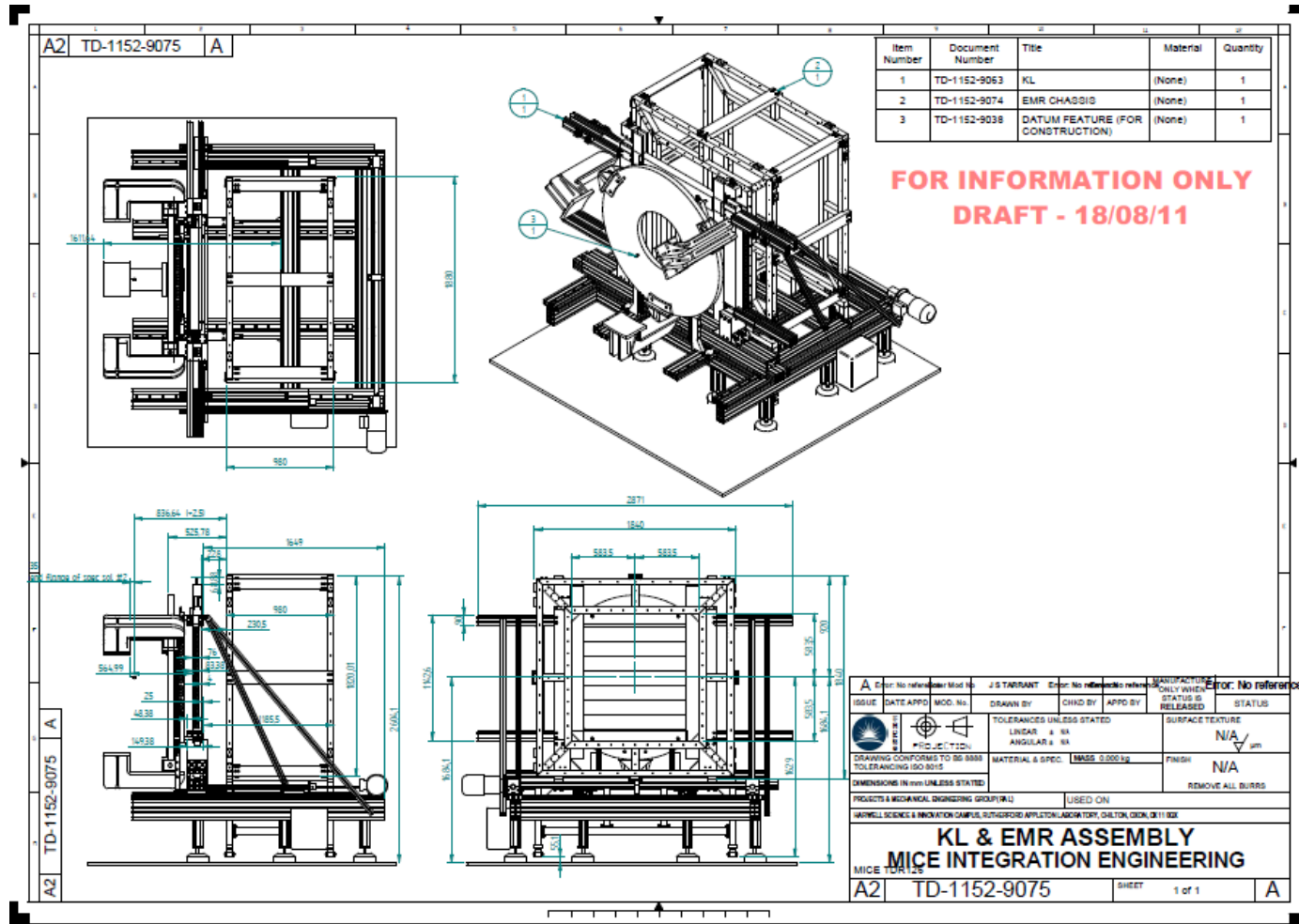
- TOF + KL must follow the STEPIV-... gymnastics
- This means a lot of hardware intervention in the MICE Hall moved to 2012 due to schedule delays (this partly explains unspent TA funds and need of carry-over + integration for trips in 2012)
- Main points:
 - Downstream platform + integration
 - PMTs shielding (mainly TOF)
 - Monitor of detector performances

Activity in MICE engineering Integration

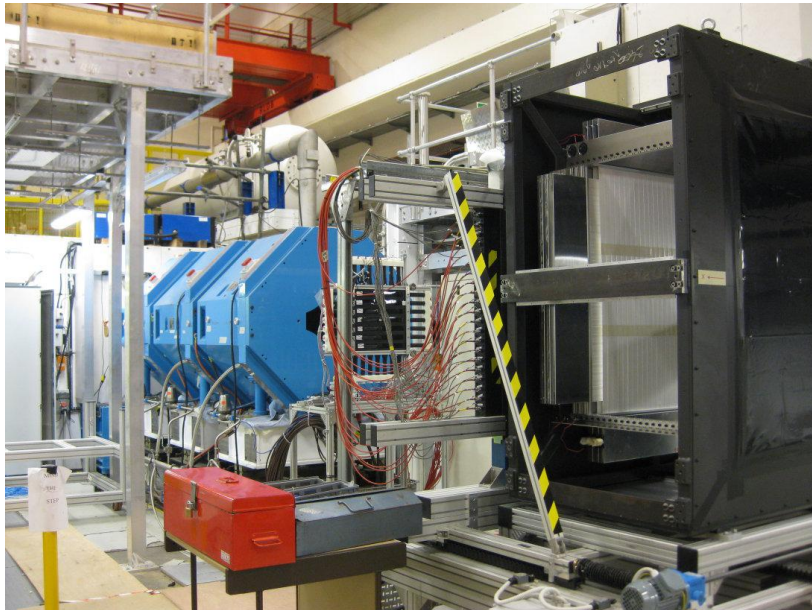


Integration on downstream PID (a lot of contacts with UniGE people + RAL people)

Downstream PID integration

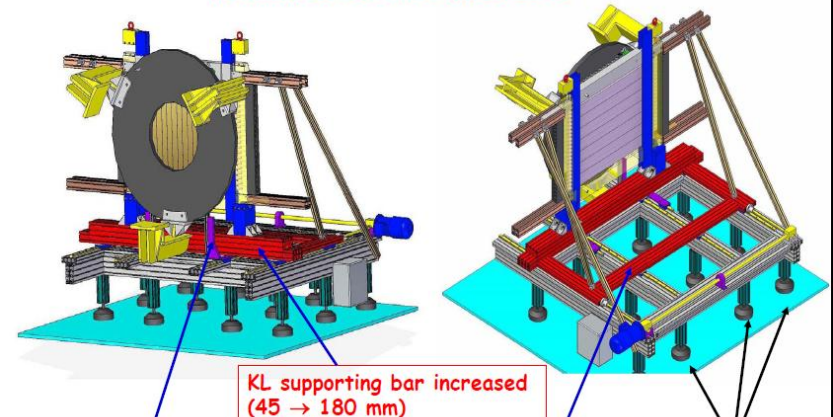


Refurbishing of downstream platform to accommodate EMR



Downstream PID trolley - Update

(partially done in november 2010)



TOF2 sliding system repositioned | EMR sliding system removed | feet shortened

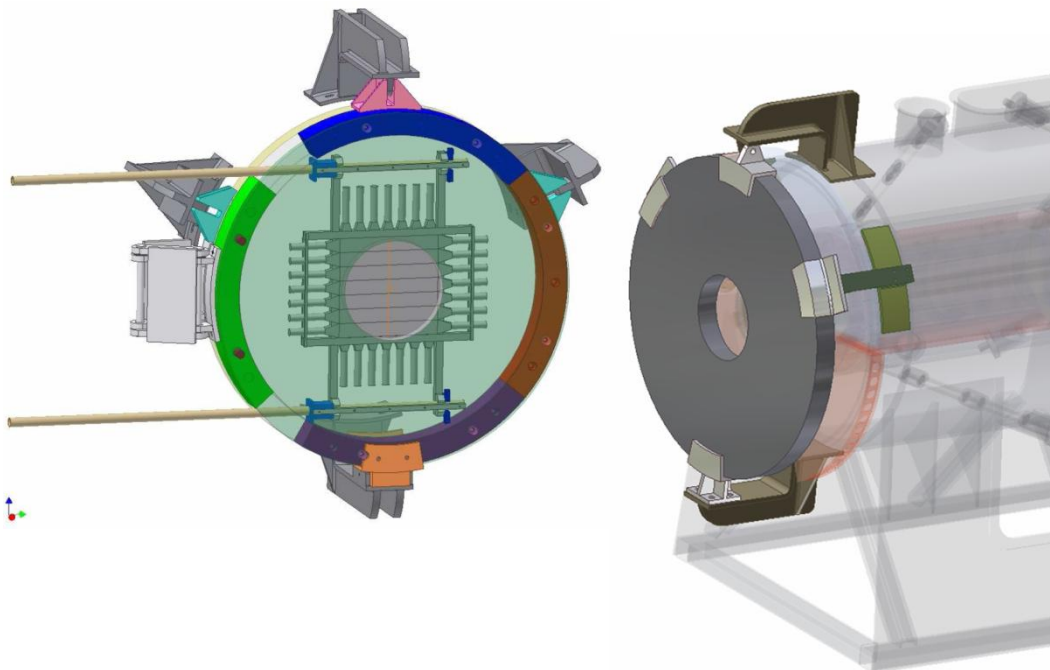
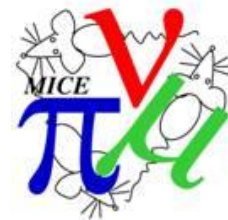
Ludovico Tortora
INFN - ROMA TRE

MICE CM29 RAL 15-18 Feb 2011

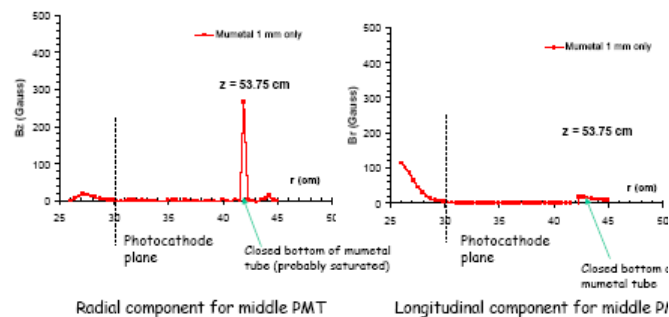
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- Some interventions done in by INFN Rm3 +MIB team, after discussions with UniGE people (F.Cadoux)
- But some issues still pending that will imply hardware work in 2012

Tof1 shielding



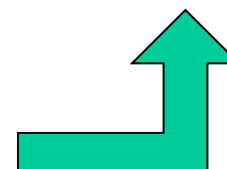
 TOF1 field components along PMT axis - UCL



Central hole diameter = 420 mm
1-mm mumetal only

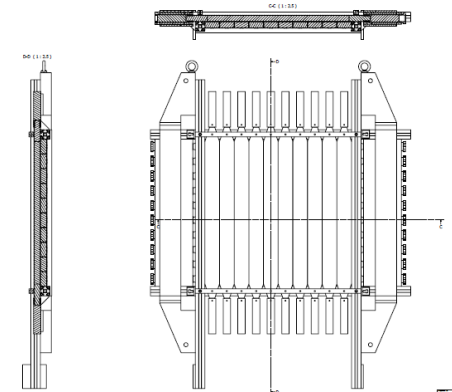
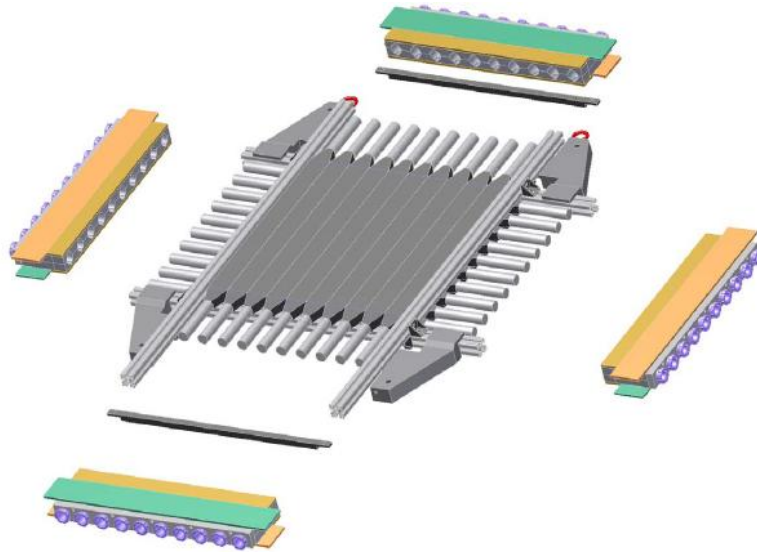
2D computation!

7

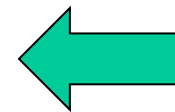


With an external cage B field is reduced to tolerable levels for conventional R4198 PMTs (solution adopted for TOF1). A lot of installation work will be needed in 2012.

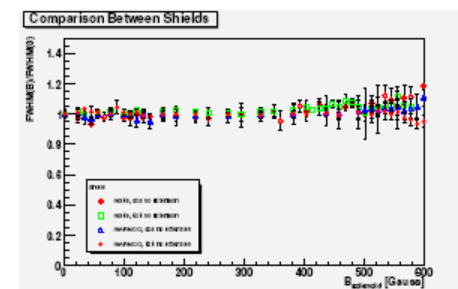
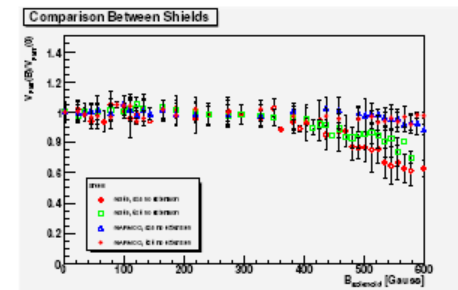
Tof2 shielding



- for TOF2 **massive box ARMC0 local shielding (D0-like)** solution



- PMT lab studies show solution is adequate..
- But we may be required for interventions, extra shieldings ... in case simulations were not adequate

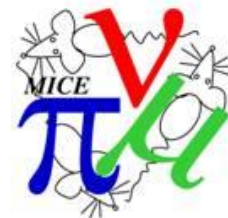


Documentation on the work done in 2011



1. R. Bertoni, M. Bogomilov, M. Bonesini, A. deBari, G. Cecchet, Y. Kharadzov, D. Orestano, F. Pastore, L. Tortora, R. Tsenov, `` Analysis of PID detectors (TOF and KL) performances in the MICE 2010 run'', MICE-NOTE-DET-201,2011
2. R. Bertoni, M. Bonesini, A.deBari,G. Cecchet `` The Refurbishing of MICE TOF0 and TOF1 detectors'', MICE Note in preparation
3. M. Bonesini `` The MICE Beamline instrumentation for a precise emittance measurement'', contribution to IEEE 2011, Valencia
4. M. Bonesini,Y.Kharadzhov `` The Particle Identification System for the MICE Beamline Characterization'', paper TUPC142, IPAC 11 San Sebastian, 2011.

From Norman e-mail on TA funding



	acronym	lead	Allotted trip/days	Used to 30/9/10	Estimated usage to 1/10/11	Unused (%)
INFN	MPID	M.B.	35/300	14/84	23/106	110 (36%)
Sofia	BGMICE	Tsenov	16/275	5/95	3/63	117 (43%)
UniGE	MICE- UniGE	Blondel	55/425	17/135	22/188	101 (24%)
Como Uni	ECP	Prest	9/90	1/4	1/10	76 (86%)

- we are short on travels (we will need some top-up 2012)
- numerous percipients involved from INFN (see next slide)

INFN percipients



	position	Main area
M. Bonesini	INFN Senior researcher	TOF
R. Bertoni	INFN engineer	TOF
G. Cecchet	INFN Senior researcher	TOF
A. DeBari	Uni Staff researcher	TOF
L. Tortora	INFN Senior researcher	KL
V. Palladino	Uni Full Professor	
M. Bogomilov (2009-2010)	INFN postdoc	KL
A. Iaciovano	Head Technician (mechanics work. Rm3)	Mechanics / integration
M. Capponi	technician	Mechanics/Integration
V. Penna	technician	Mechanics
A. Gizzi	technician	Mechanics

Usage of TA funds



- Maintenance at RAL of TOF and KL detectors (involves technician)
- Hardware upgrades of TOF/KL system at RAL
- Integration work at RAL
- MOM shifts / experts presence at RAL
- Participation to MICE collaboration meetings (VP is speaker's bureau chair, MB editorial board chair)

Requests up to October 2012



- A modest integration of subsistence days (we estimate 80 left now) to 120 days
- Additional 10-15 trips to RAL

Conclusions



- 2012 will be a year with a lot of hardware interventions for TOF+KL (the main workhorses of MICE since 2009)
- Just a few:
 1. TOF1 in the cage before the first solenoid
 2. TOF2+KL to be moved and reassembled downstream
 3. Downstream platform not to interfere with EMR
 4. Integration in the MICE Hall

Support from TA will be needed in 2012 (especially to guarantee the presence of technicians at RAL)