MICE PID
Detectors & Shielding

MICE CM20, RAL Feb 13, 2008

V. Palladino, Univ & INFN Napoli

for the small PID team

Bonesini, Chimenti, Cremaldi, Giannini, Graulich,
Gregoire, Kaplan, Karazdov, Orestano, Reja, Rusinov,
Sandstrom, Summers, Torun, Tortora, Tsenov,
and more

PID Agenda

MICE-CM20 @ RAL, 2008-Feb-11

Last TOFI piece, the cage, has landed (Ghislain)

Downstream design items being finalized

shielding scheme of TOF II, KL, SW (Ludovico, Maurizio)

the all of SW …. Its building … its funding (Gianrossano)

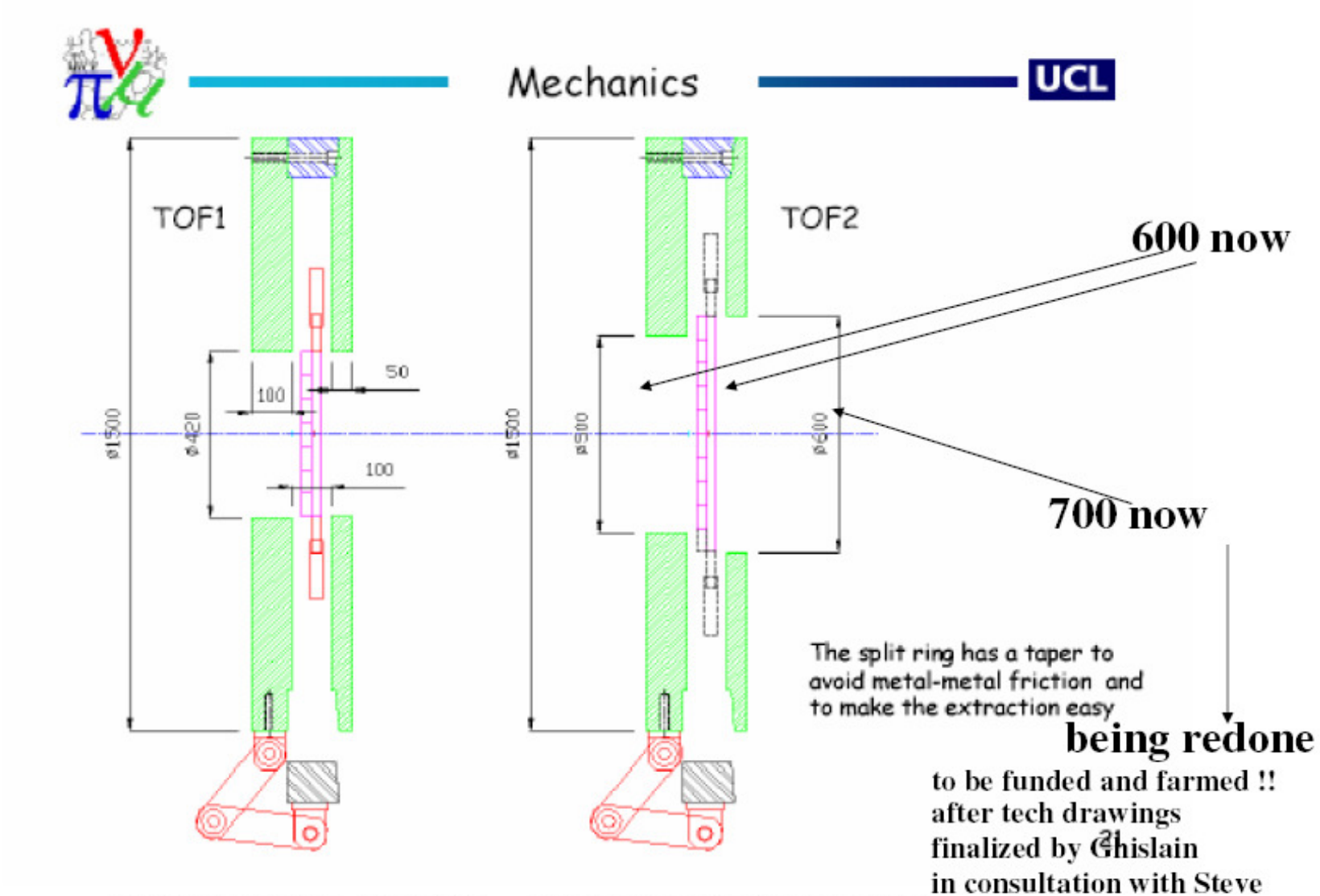
PID ADC Shaper for TOFs/KL and eventually SW (Ilko)

PID Software ….. will soon be…….. “the thing”

CKOV (Yordan)

TOF’s (Mark)

TOF II global shield, Ghislain



More local PMT shield needed

Conclusions (1)

UCL

Facts The scintillating bars for TOF1 have already been ordered.

The active TOF1 area is thus 42 cm x 42 cm. Let's assume it cannot be changed ...

Results

1. Upstream shielding cage with a central hole of **600 mm**

   • Advantage of being similar to the downstream cage (within the present knowledge of acceptable beam scraping)

   • But, the PMTs of TOF1 have to be shielded locally with a **double** layer of 5-mm iron + 1-mm mumetal.

   A single layer of mumetal is clearly not sufficient to keep very low stray fields for PMTs.

2. Upstream shielding cage with a central hole of **420 mm**

   • It makes the whole MICE setup not « upstream/downstream » symmetric

   • But, the shielding of the PMTs could be slightly simpler in principle ...

3. Main conclusion: the hole(s) in the shield must be inscribed in the active area of the TOFs

Final word from Milano's mag test stand

MICE CM17, CERN, 24 Feb 2007 V. Palladino PID Detectors & shields

TOF I cage at EB late Nov 2007

Decision to add a cage to the iron donut **Feb07, CERN**

Only proven solution available at the time

Now local shields are proven OK, at least for TOF II

Confirmed at CM18 at RAL (TB) **Jun07, CERN**

Exec drawings available **Ghislain+Wing** **Summer 07**

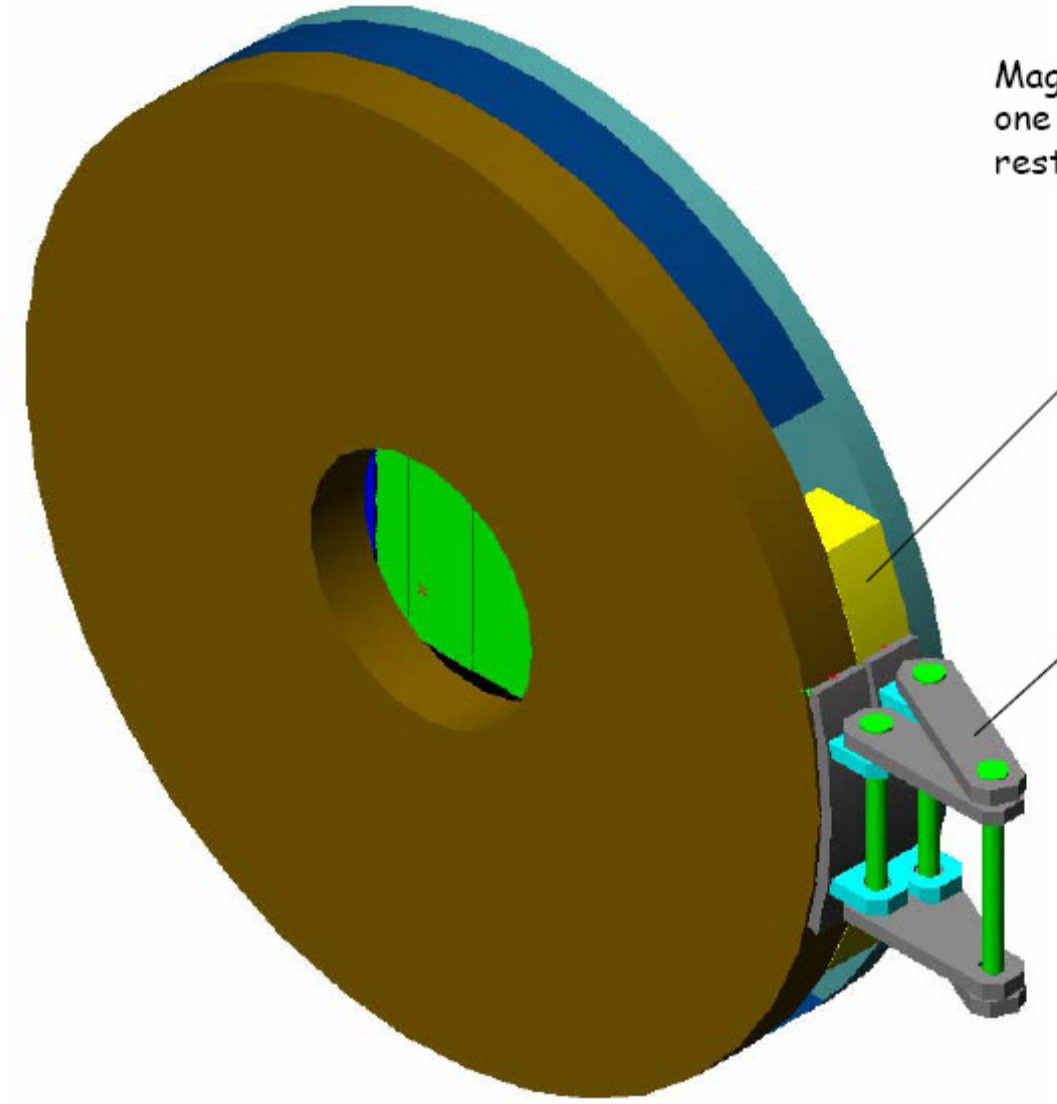
Request to TB for construction approval (PPR) **5 Sep 07**

Expensive quotes around Fermilab **Alan** **< CM19**

Last discussed at CM19 **PID, VP slides**

must converge

TOF1 maintenance



Magnetic linking ring (blue) has one movable part (yellow). The rest is completely closed.

Weight ~ 60 kg

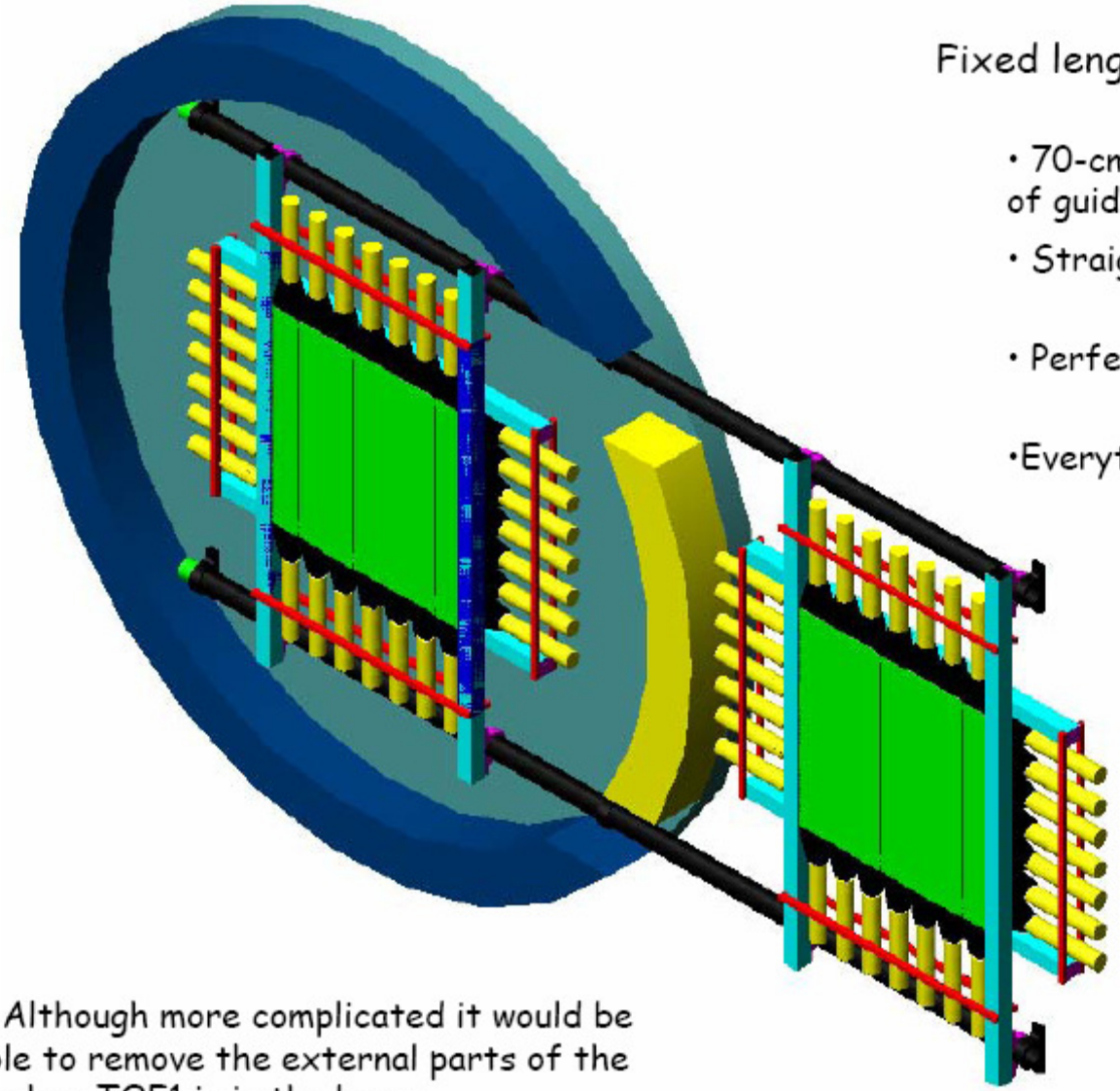
3-axis hinge mechanism (shown here without stiffeners)

Axes are provided with conical roller bearings

Motion is easily done hand !

2

TOF1 displacement mechanism



Fixed length guide tubes

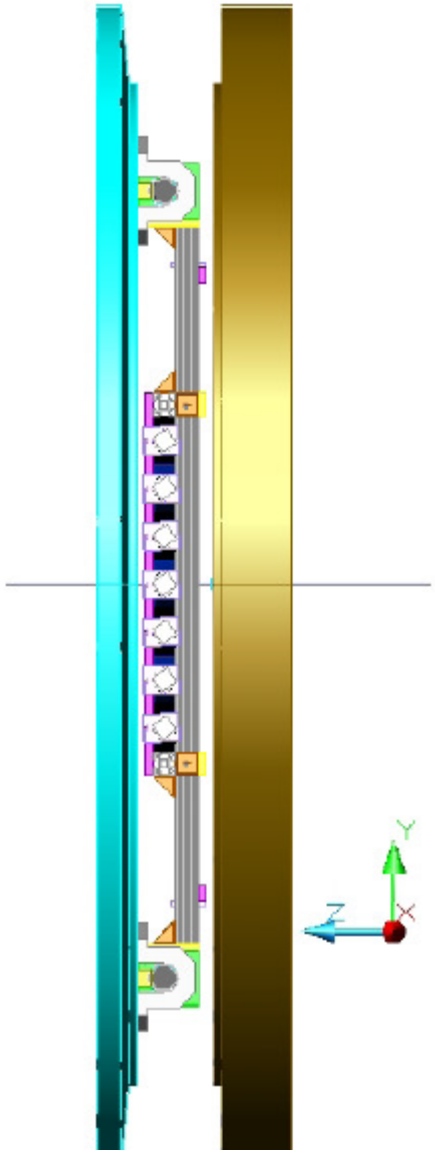
- 70-cm wide permanent extension of guide tubes outside shield
- Straightforward to construct
- Perfect stability at all positions
- Everything in aluminium or plastic

Note. Although more complicated it would be possible to remove the external parts of the tubes when TOF1 is in the beam

Side view of TOF1 inside cage

TOF1 is 82 mm thick (along z)

It is hung in the middle of the 100-mm gap between Virostek and closing flange



Decisions, budget and management

- Quotation from Louvain accepted by the Executive Board (end of Jan)

- Louvain agreed (Feb 01)

1. To construct the hinge mechanism (« operation costs »)	8 -9 k€
2. To subcontract the other large pieces in the industry (closing flange, split ring)	Contributed by Geneva
3. To charge myself with the management of the construction	0 €
4. To freely contribute to MICE with the manpower costs	5-6 k€

- Other expenses: packaging and transport to RAL not included in the quotation

Downstream: TOFII and more

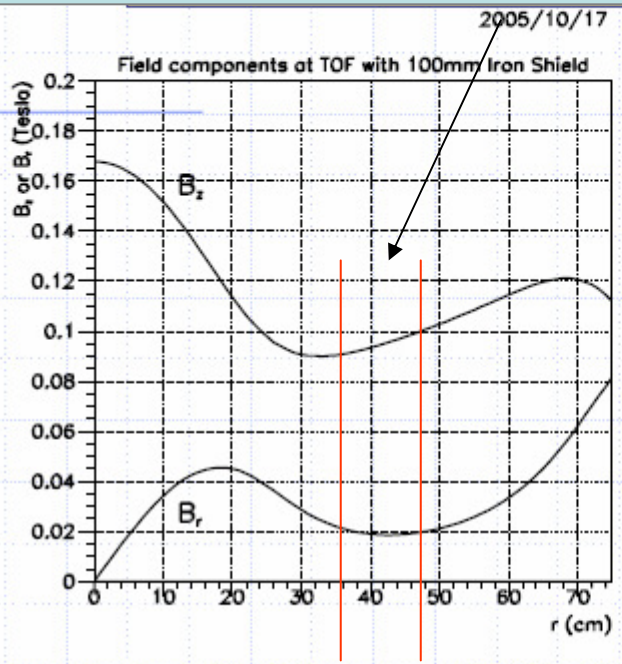


Figure 6: Radial and longitudinal field components at TOF2 (z=664 cm) as a function of r with 100 mm thick iron shield.

1000 g transverse to PMT axis suppression can be weaker

position)

200 g along to PMT axis must be kept real low!

e shielded MTs shields, iming

properties

- **this point to 2nd shield, but we will try to test PMTs**

"exotic shieldings" by building a 400 G lab solenoid

BUILT: coil with 5 windings for fields up to 700-800 G

M. Bonesini - MICE CM20 RAL 5

can we do w/o Cage II ?

multi-cm Iron

Box shielding

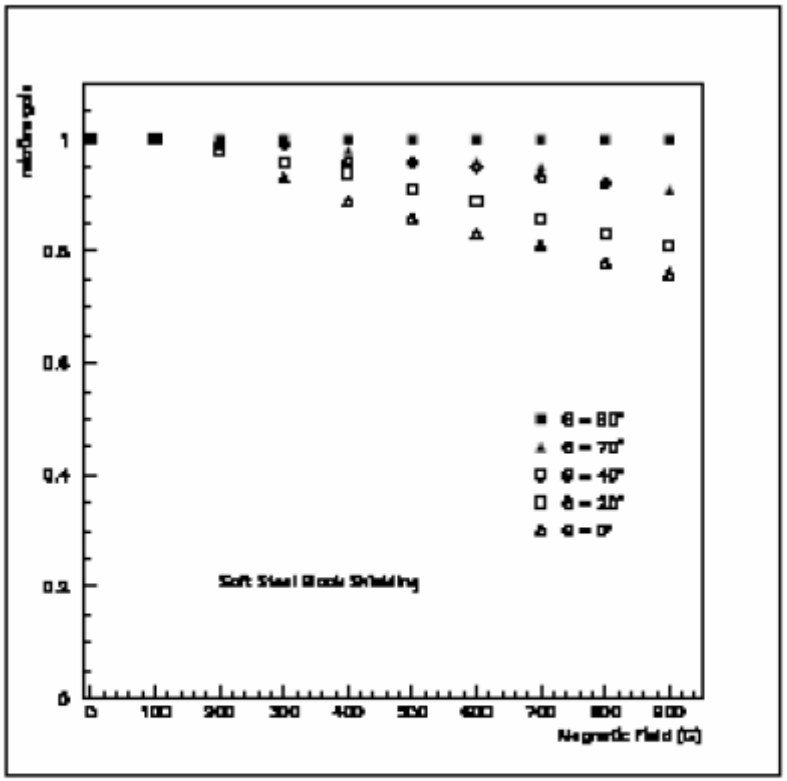


Figure 2: The relative PMT gain as a function of magnetic field strength for various angles of orientation using a soft steel block for shielding plus a single thick μ-metal shield.

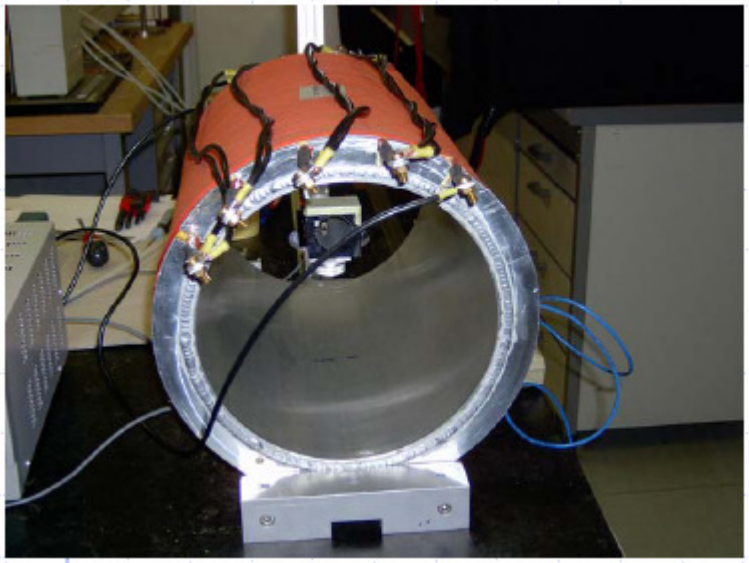
D0 tests (note # 2706) (brought to our attention by Ludovico)

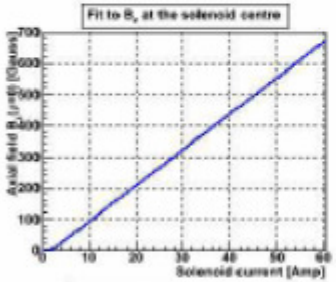
explicitely stating the need to focus on the field component on PMT axis

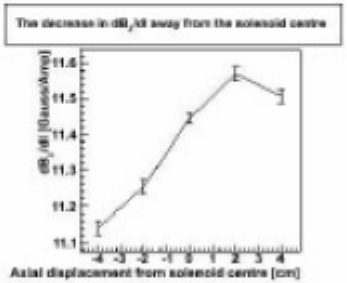
- It will work for R4998 1" PMTs?
- Tests to be done for Gain + timing

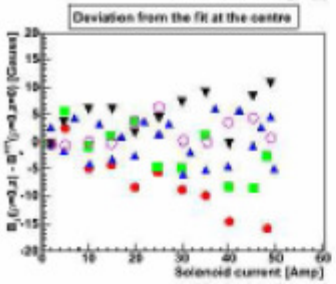
See results later

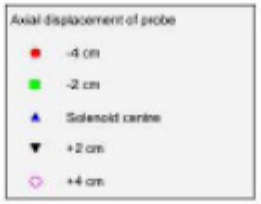
Used test solenoid











- Laser source (Nichia Blue laser diode + up to 1MHz Avtec fast pulser: signals 100 ps- 2 ns)
- field up to 600 G
- Use of different shieldings: mu-metal only, additional Fe shielding, ...

MICE Note 201

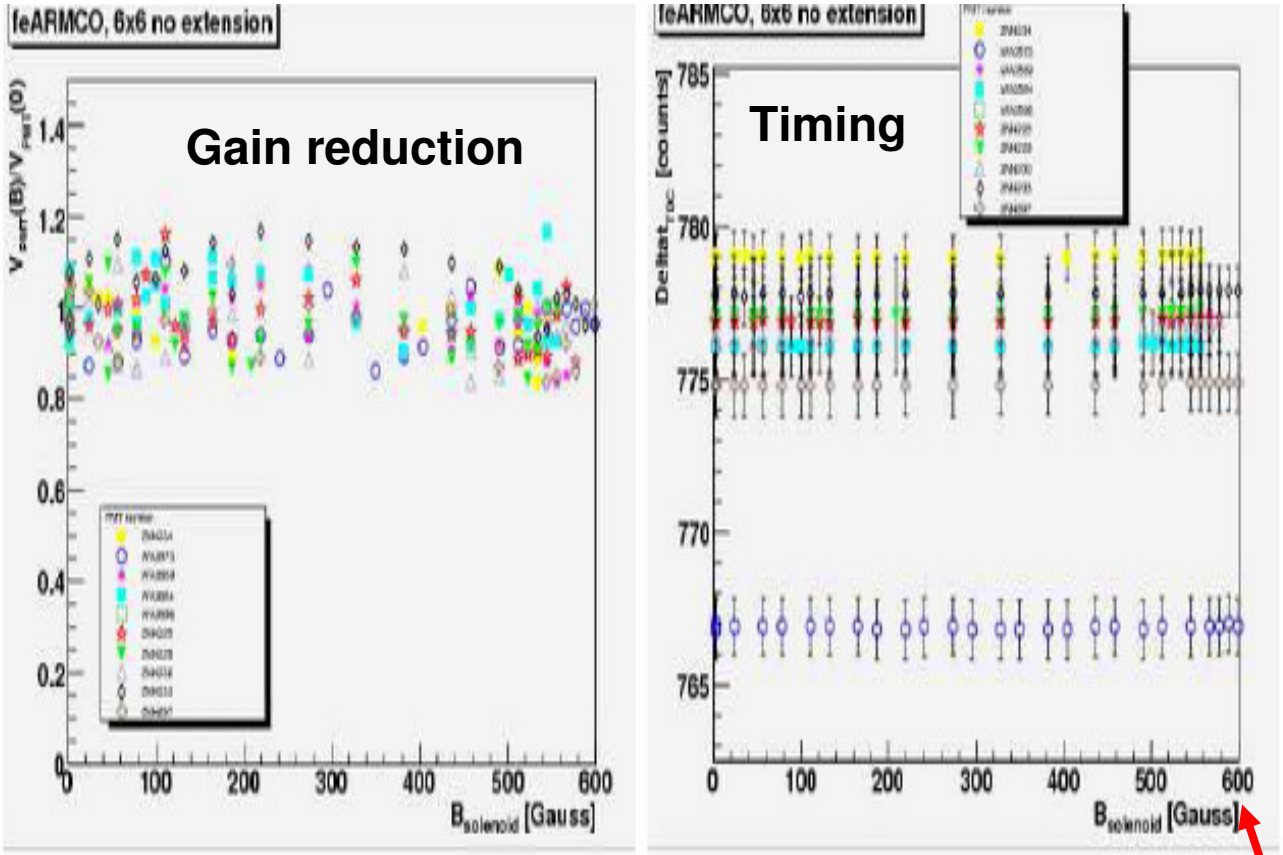


Fig. 15. Signal ratio at field B and B=0 G and timing difference Δt as a function of field B and, measured with an ARMCO iron box shieldings (transverse area $6 \times 6\ cm^2$) in addition to the the mu-metal one extending 0 cm beyond the end of the mu-metal shielding. The B field is along the PMTs axis. The plots are for a set of ten R4998 PMTs.

1000 Gauss would be nicer

Present baseline scheme for TOF II, 60 mm* 60 mm boxes

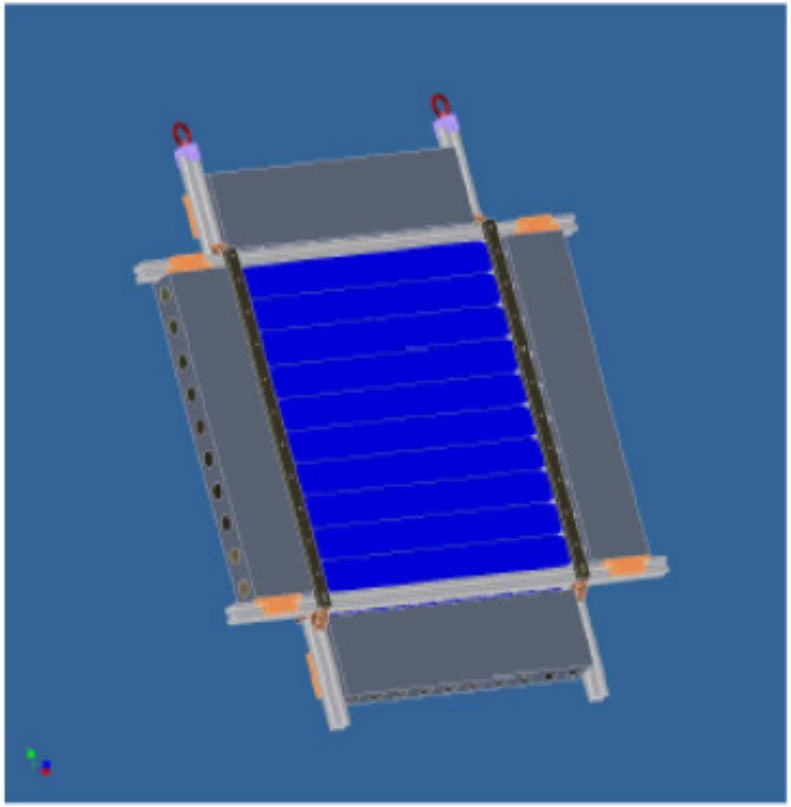


Fig. 18. CAD drawing of TOF2 with local shieldings for PMTs, using a single bar of ARMCO 6 cm thickness for each side.

Sketch of TOF2 local shielding

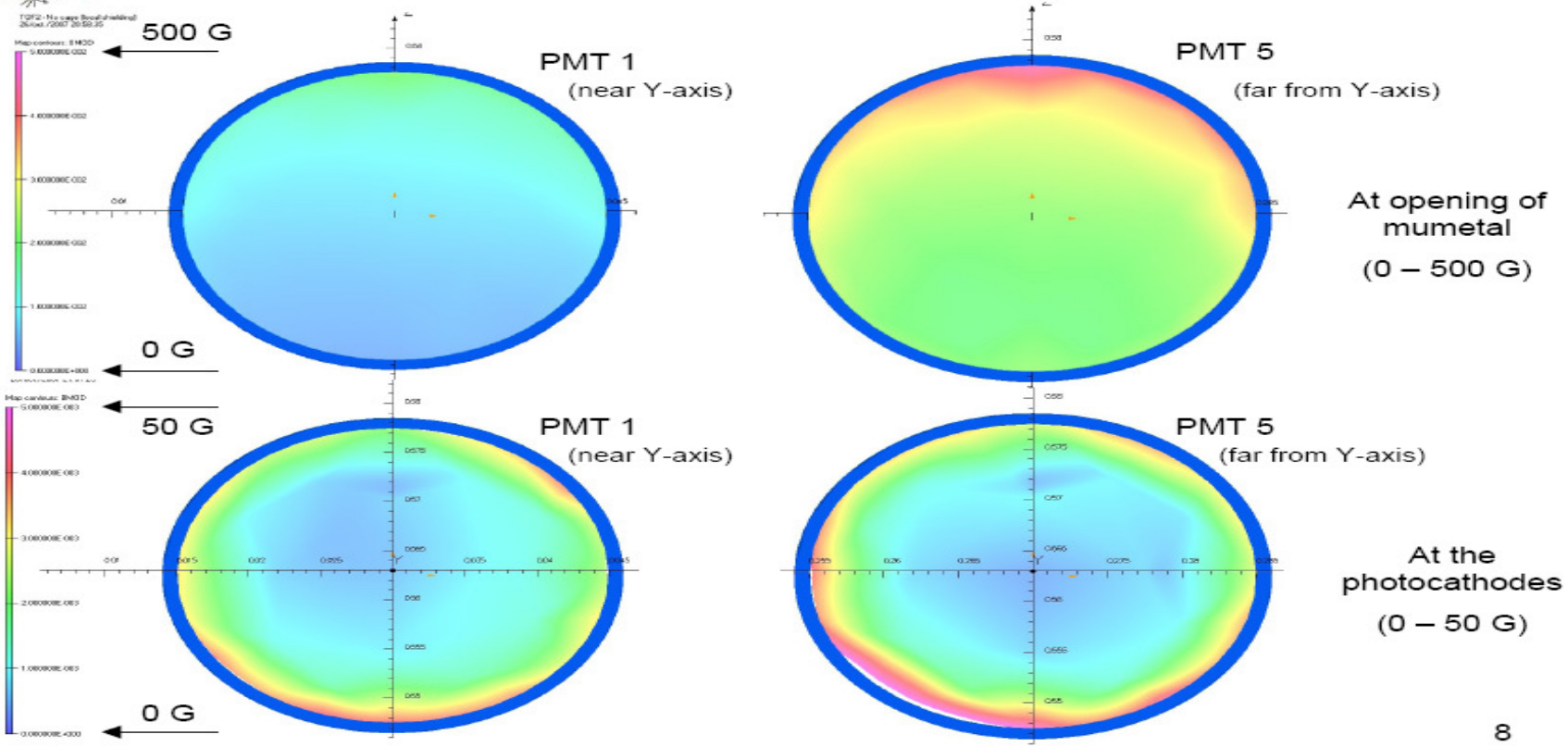
1. Final design to be dictated by shielding + mechanics
2. A final single PMT shielding will be tested before production of local shielding

similar **76 mm** solution exists **built in** KL …. would be adopted for SW

Complementary approach …… TOSCA 3D calculations

of fields at photo-catodes
of forces, on final configuration

Field uniformity



8

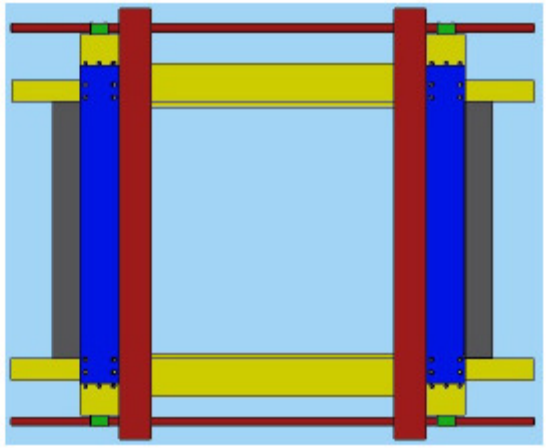
TOF II and SW OK, KL to improve,

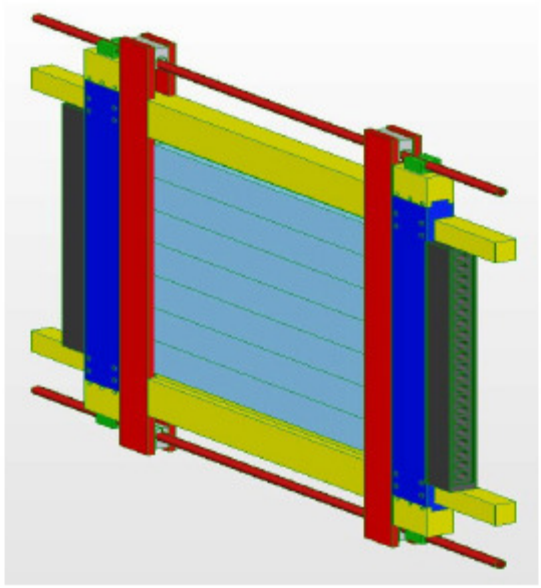
downstream geometry only approximative, however

News & Progress since ins7 on:

- Matching of TOF2 & KL shields
- Design of supporting trolley for TOF2 & KL & SW

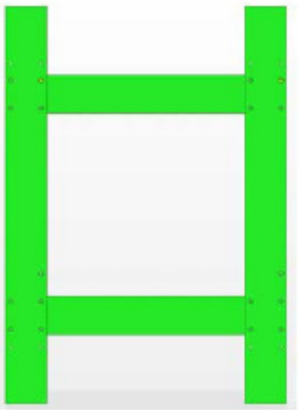
Overlapping of TOF2 & KL Iron Shieldings

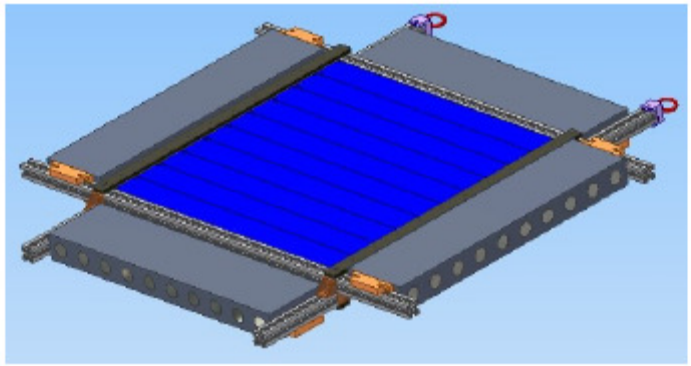




76,5 mm

Nominal sizes along Z





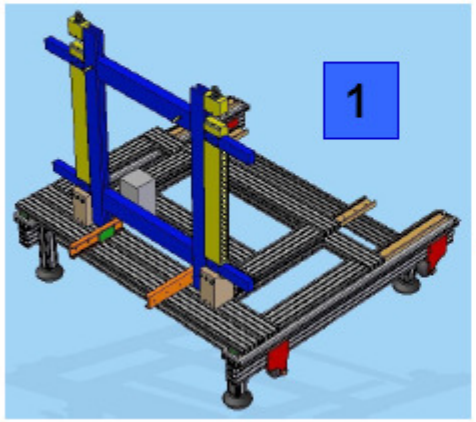
105 mm

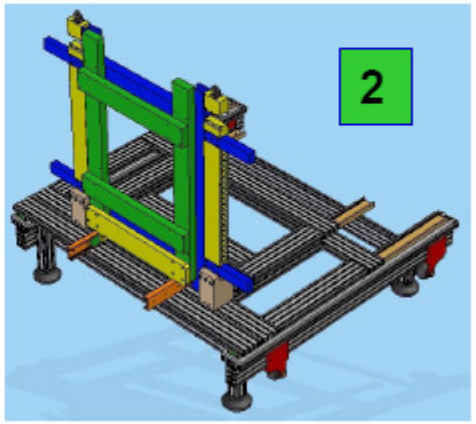
Ludovico Tortora - INFN Roma III

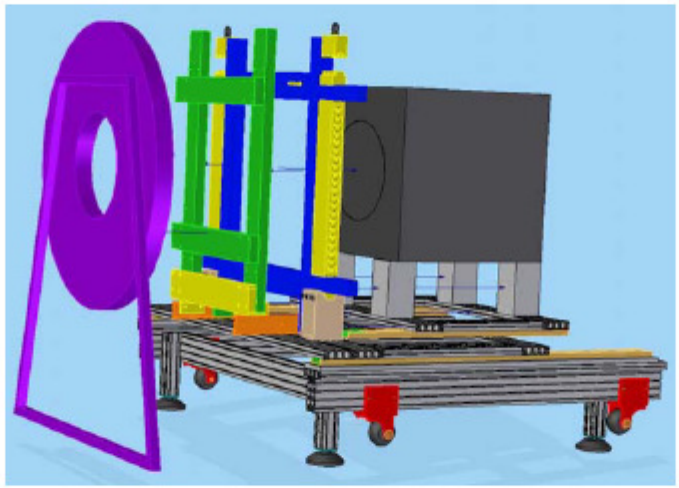
2

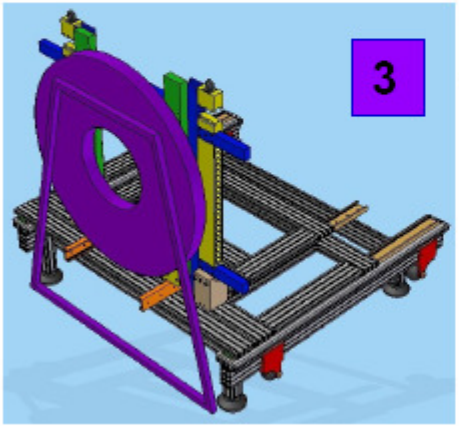
Assembling sequence of Downstream PID Detectors

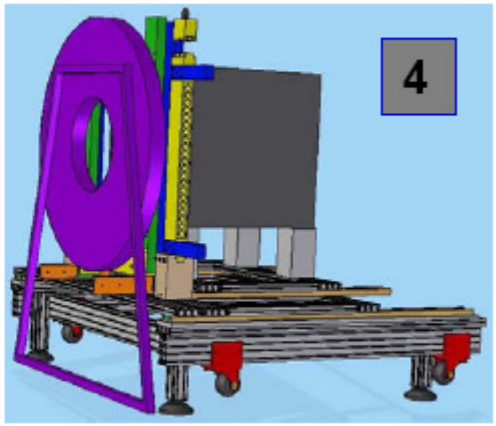
(Frames only are shown)











Most of materials needed for trolley construction is already available

Baseline established and promising …….next steps agreed

Discussions in progress …. with Andy ……. with Steve
….. at home ……..

As soon as dust settles, agree final configuration at PID Phone Meet

run TOSCA calculations

of **fields at photo-catodes**, final

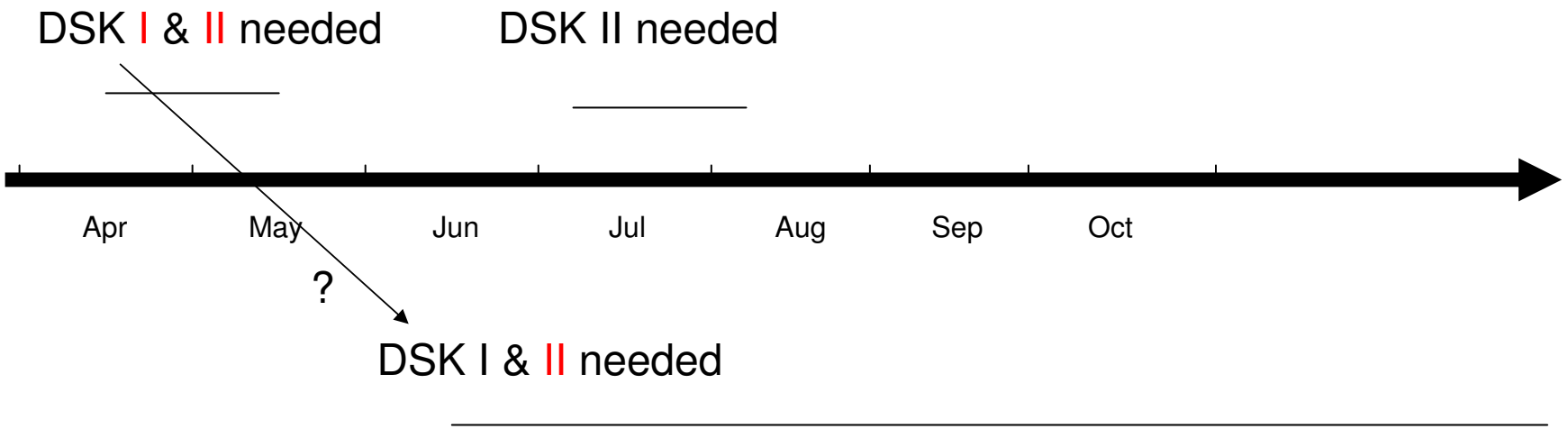
of **forces**, last but not least

As soon as time can be taken from TOF0

extend measurements to 1000 Kgauss

How many Virostek plates? Built where?

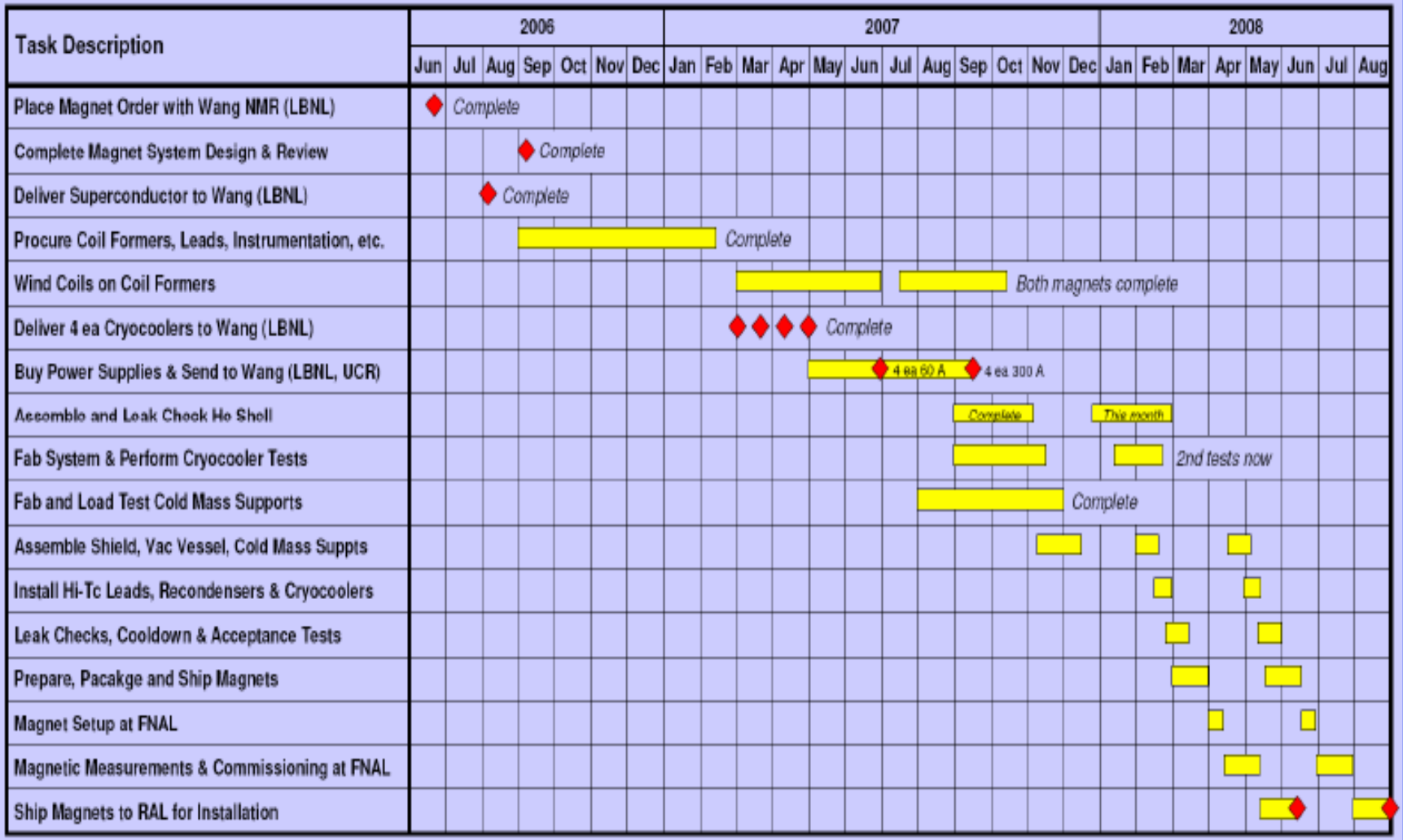
Fermilab



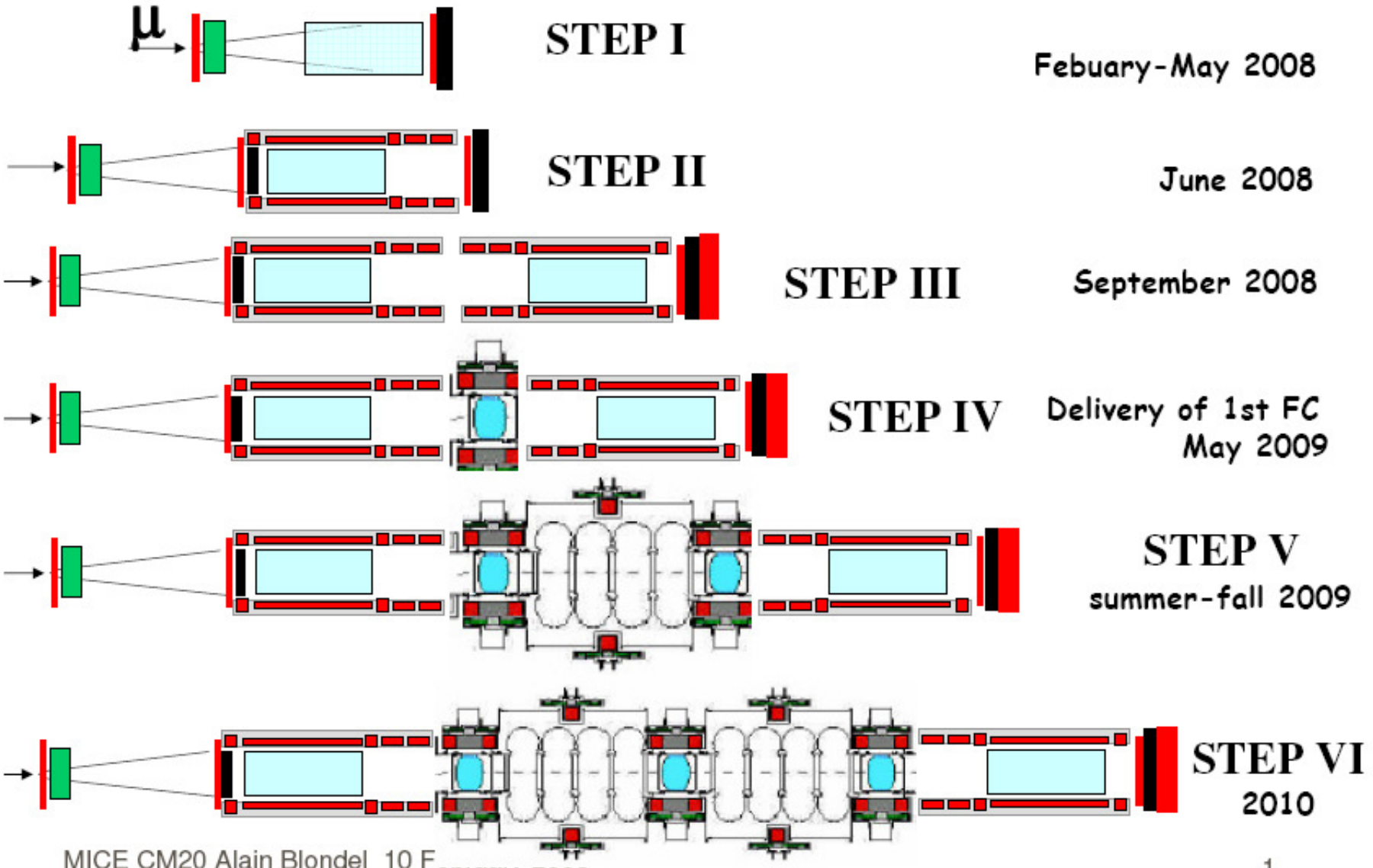
RAL

if assumptions remain valid

Updated Schedule Summary



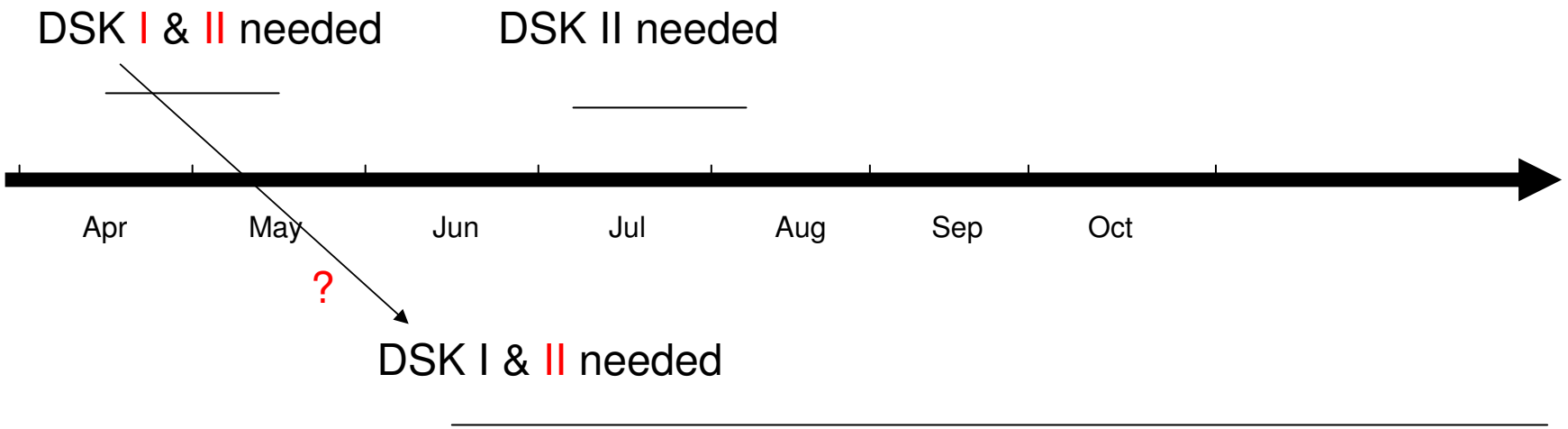
Aspirational MICE Schedule as of January 2008



How many Virostek plates? Built where?

NB Disk I and Disk II are different!

Fermilab



RAL

if assumptions remain valid

NB funding issue again

Status and prospects for SW

Gianrossano Giannini, Pietro Chimenti,
Erik Vallazza, Stefano Reia, Dario Iugovaz

Trieste INFN and
Trieste University- Physics Department

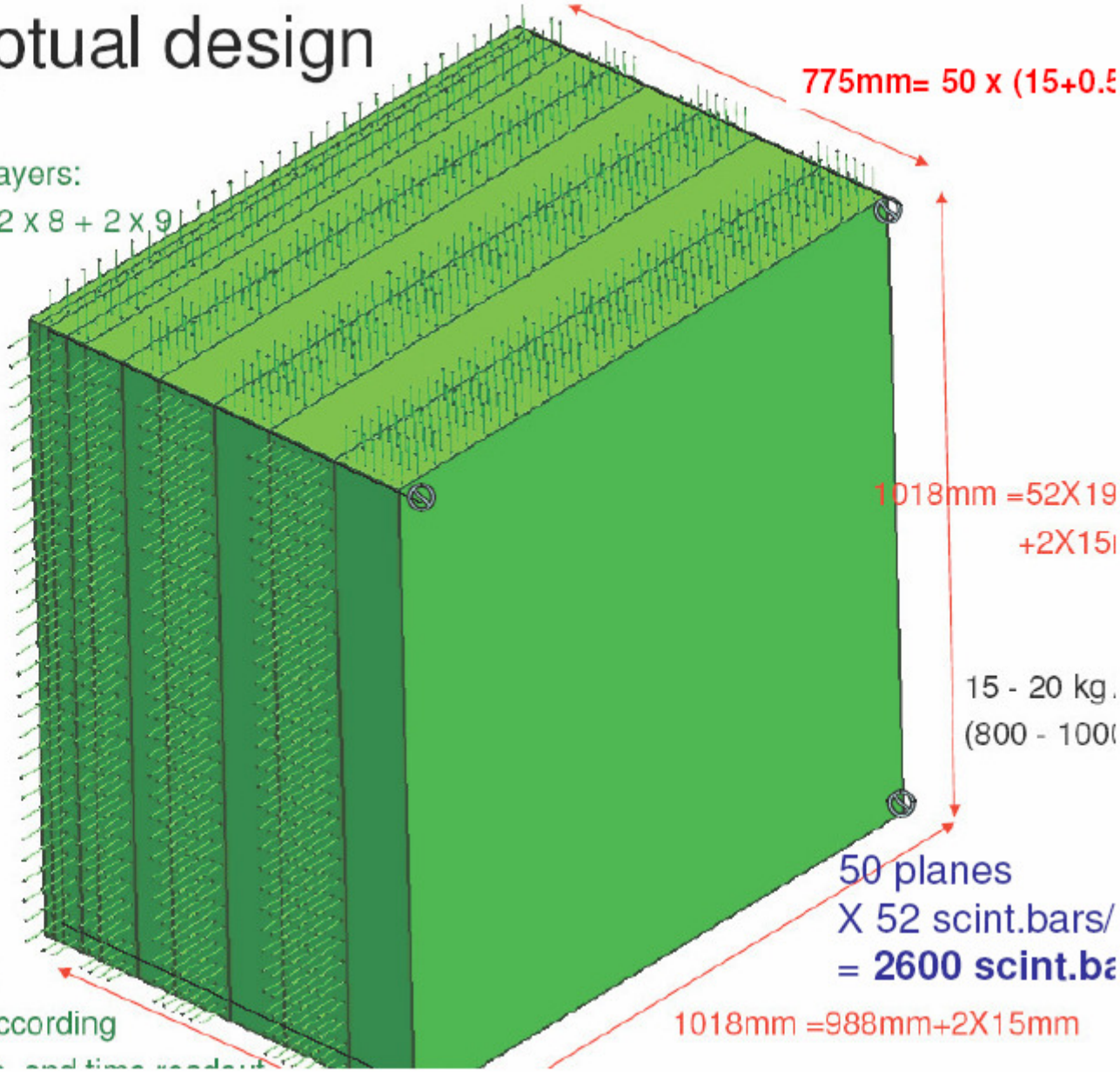
MICE-CM20 @ RAL, 2008-Feb-11

Conceptual design

50 planes in
10 variable thickness layers:
2 x 1 + 2 x 2 + 2 x 5 + 2 x 8 + 2 x 9

Lateral segmentation according to rate!

Time measurements MAY help with coordinate reconstruction.



Flexible fiber bundling
Number of channels according

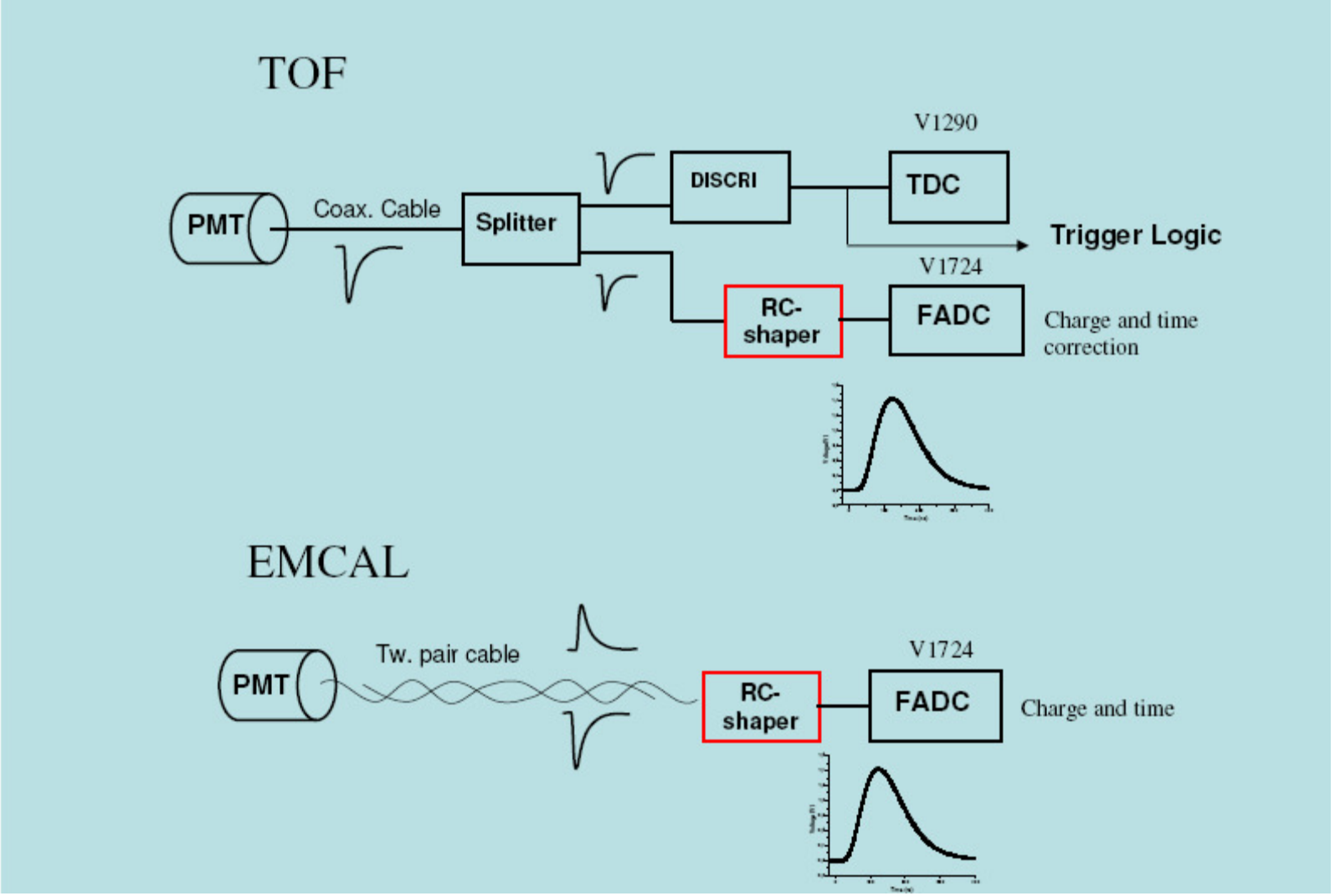
Collaboration Trieste Femilab Geneva ……

- Fermilab scintillator & fibers
- Trieste assembly, mechanics, PMTs
- Geneva electronics

At RAL in the first part of 2009

Prototype in 2008

PID ADC Shaper for TOFs/KL and eventually SW (Ilko Rusinov)



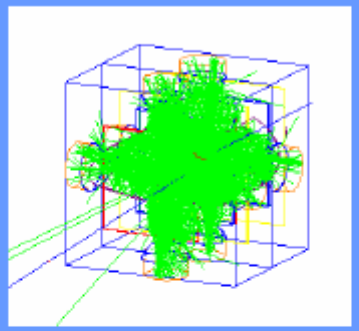
Current status

- 10 boards produced with SMD components machine-soldered
- 7 modules have been assembled in Geneva
- 3 in Sofia
- Currently 5 modules are tested and tuned (+ 2 modules of earlier versions available)
- Preparation of doccumentation in progress

17 needed in total
500 Euros per module

Quite a few more eventually for SW

Sofia university “St. Kliment Ohridski” Yordan Karadzhov



1. At present in G4MICE CVS repository a simplified Geant4 simulation exists with very poor definitions of the materials.
2. A much more detailed simulation exists but only in my computer because of bugs in Geant4 that make the simulation unstable (the process drops into an infinite loops). Committing of this code can compromise the whole G4MICE simulation.

Bugs found in Geant4 till now:

1. In the class G4EllipticalCone – according to the Geant4 team this bug has been fixed in the last release of Geant4 that is not included yet in G4MICE.
2. In the process (class) G4OpBoundaryProcess – infinite loop caused by an error in the class G4Sphere. The bug is temporally fixed by me.
3. A problem in the optical photon navigation caused by an infinite loop in the class G4SubtractionSolid. It is temporally fixed by me.
4. We can not expect to have a patch by the Geant4 team of problems 2 and 3 soon.

With the temporary patches of the problems 2 and 3 the simulation is now stable.

Measuring momentum using TOF0 and TOF1

How well can we do using a simple method?

Mark Rayner (Oxford/RAL)

CM20 analysis session 12th February 2008

PID Agenda

MICE-CM20 @ RAL, 2008-Feb-11

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the all of SW …. Its building … its funding (Gianrossano)

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TOF’s (Mark)

THE END