DT CHAMBERS AND ALIGNMENT

DT:

DT High Voltage Boards story&status
Chamber production
Minicrates
Installation

ALIGNMENT:

Barrel,Endcap and Link status
Preparation for calibration at ISR & Magnet Test

THE HIGH VOLTAGE BOARDs SAGA

As announced in March few High Voltage Distribution Boards (HVB) failed in January in 24 DT chambers ready for the first installation in the YB+2 Yoke

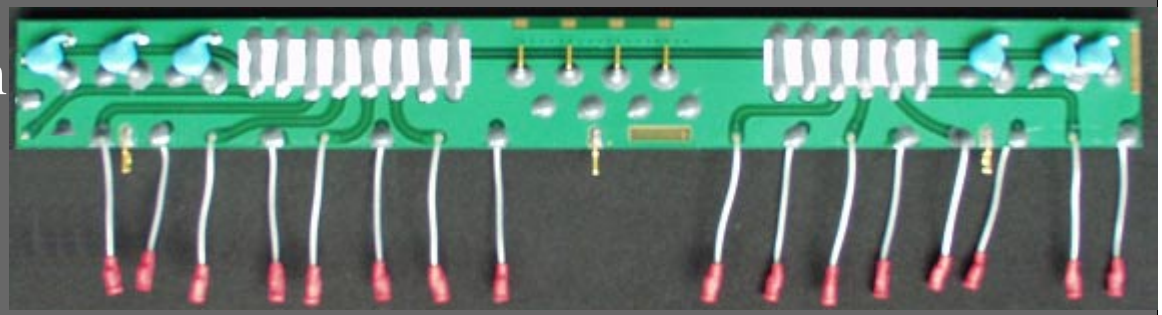
The reason of the failure of 8 out of 1080 HVB was a breakdown of HV insulation in the outer layers of the HVB PCBs.

Installation in the Iron Yokes was delayed waiting for an explanation of the failure mechanism .

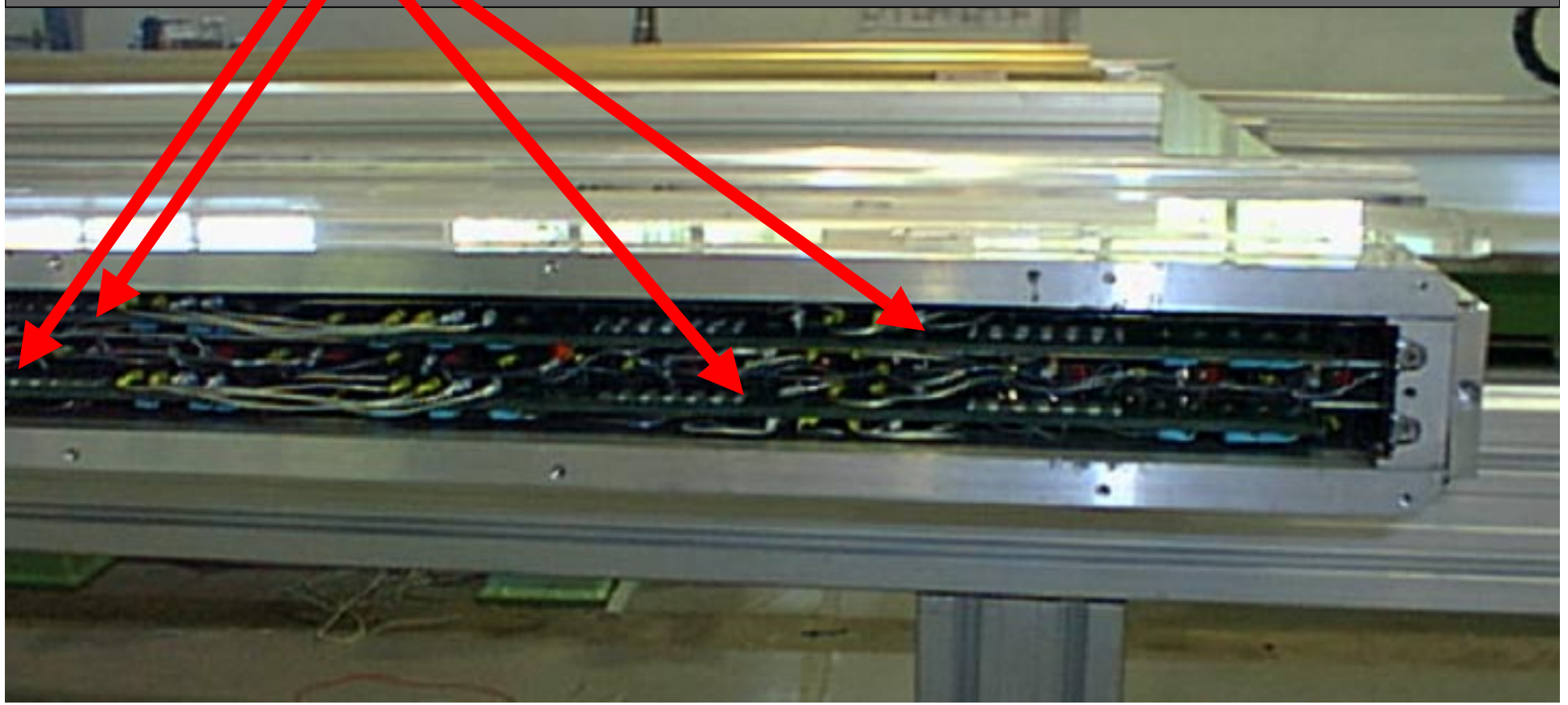
Electronics. HV Side

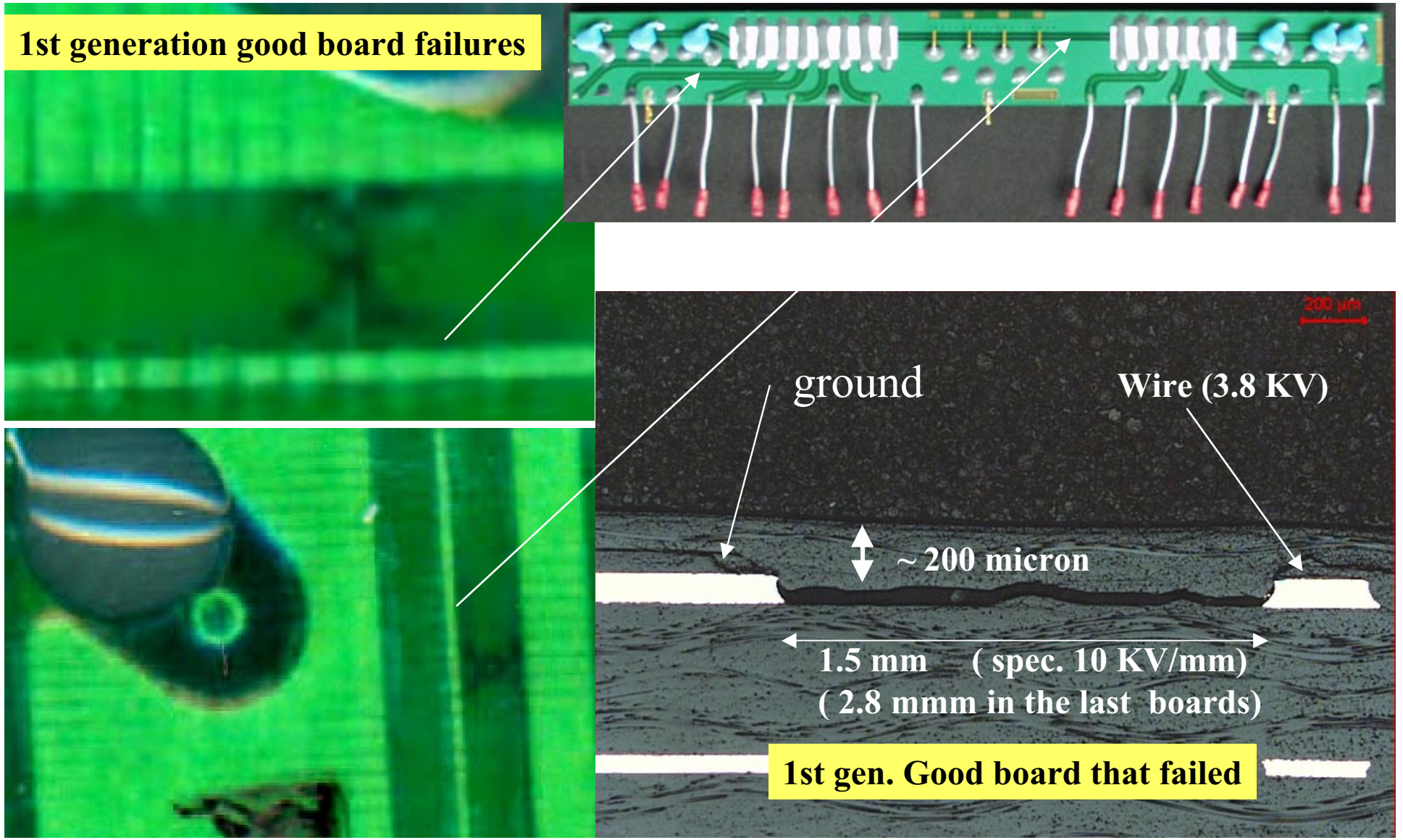
32 cm

4 cm



Two arrays of HVB
One for layers 1 and 2
One for 3 and 4HVB




1st generation good board failures
200 µm
ground
Wire (3.8 KV)
~ 200 micron
1.5 mm (spec. 10 KV/mm)
(2.8 mmm in the last boards)
1st gen. Good board that failed

The total number of HVB for the Barrel DT is 10850

1080 of them equipped the first 24 chambers to be installed in January in the YB+2 Yoke.

8 of them (0.7 %) failed at the switch on of the HV in the last test before Installation after a successful long tem HV test of 3 months and 4 months under Gas flow.

This fraction is very high and expected to be reached only after several years of operation.

The failure of the 8 HVB was unexpected and prevents any safe estimate of their long term behavior. TOO RISKY.

Conclusion:

1) **Delay installation (simple !!!!)**
2) **Understand why the boards failed**
3) **Design and produce new safer PCB and find a way to assemble in a short time some 10000 HVB**

2) and 3) were done in three months of hard work

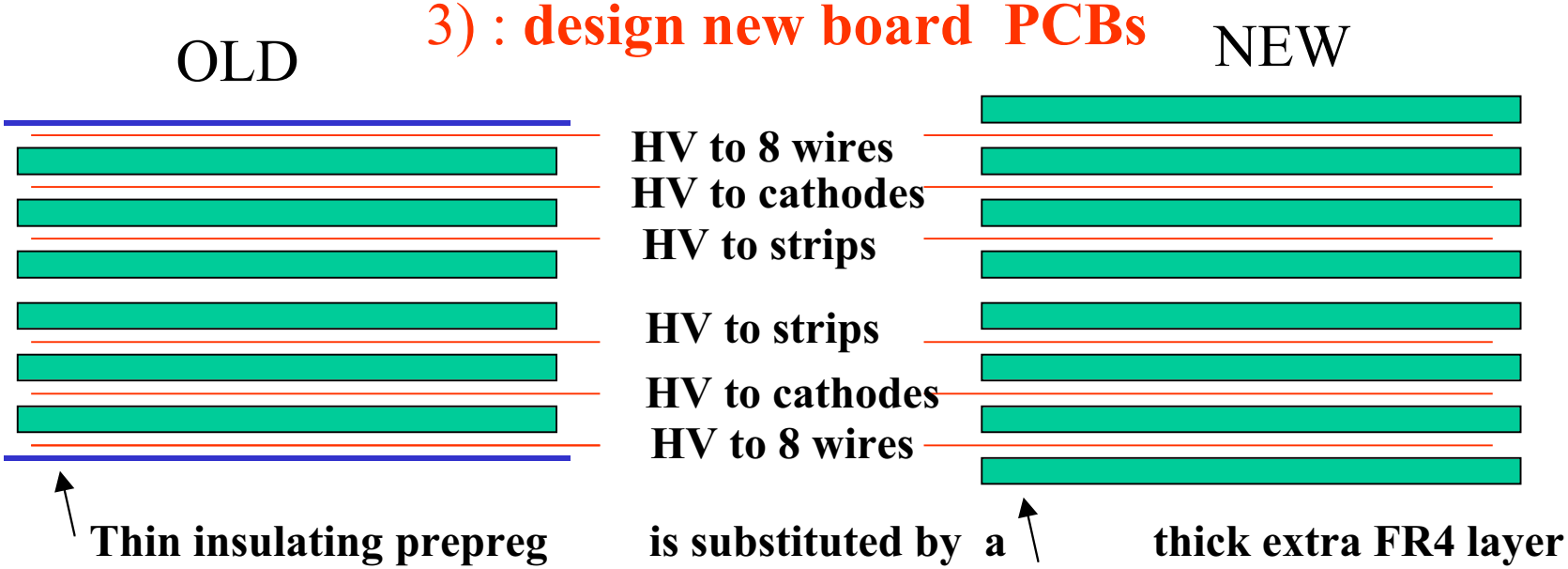
2) Careful inspection and tests showed that

- **all the failures happened in the outer layers of the PCBs**
- **they are due to a detachment of the last thin layer of insulator from the FR4 PCB (proven by mechanical section of failed boards)**

- **the material used for it is not fully homogeneous to the normal FR 4: there is a problem of adhesion, it allows in very few cases that empty microcavities are left at the interface with FR4 (proven in few cases by section)**

- **in the long term the microcavities could be filled by the chamber gas: they can degenerate into discharge channel (proven putting 100 boards in a pressure vessel at 3 bar of Ar/CO2 for two months,4 failures, (for this test visibly defective boards were selected))**

3) : design new board PCBs



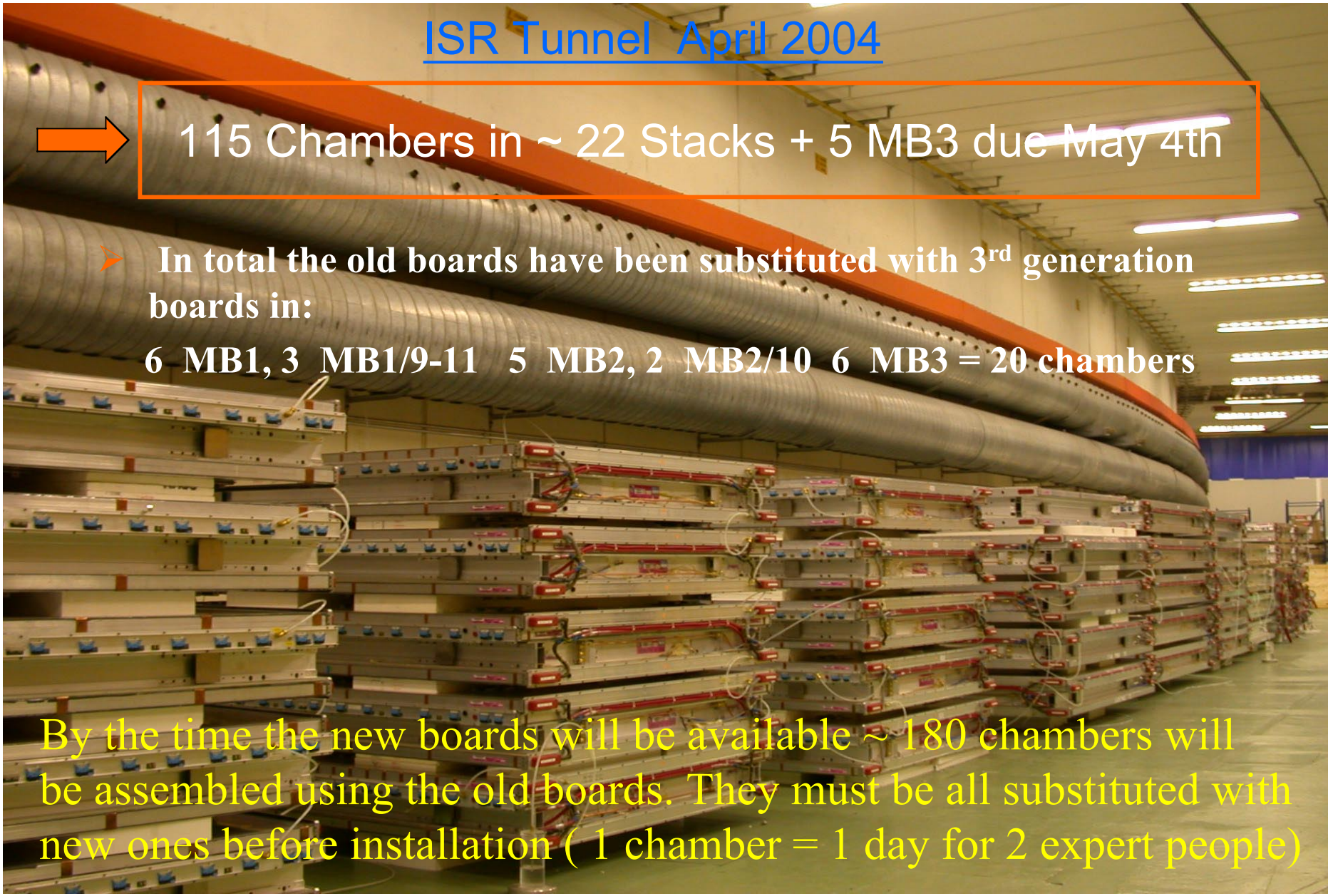
(very roughly,in reality more complicated)

First NEW HVB PCB (400) should be available in few days for basic qualification tests and first small pilot assembly in Legnaro and Aachen.

IHEP Beijing is making a large effort to improve tools and instrument to start mass assembly of the NEW Boards at very high rate (~ 1200/month).

First boards from IHEP should be available at end of September, full production completed in ~ one year.

First installation in YB+2 end of June/beg July with selected 3rd gen. HVB…..
Installation in YB+1 in fall 04 with NEW BOARDS



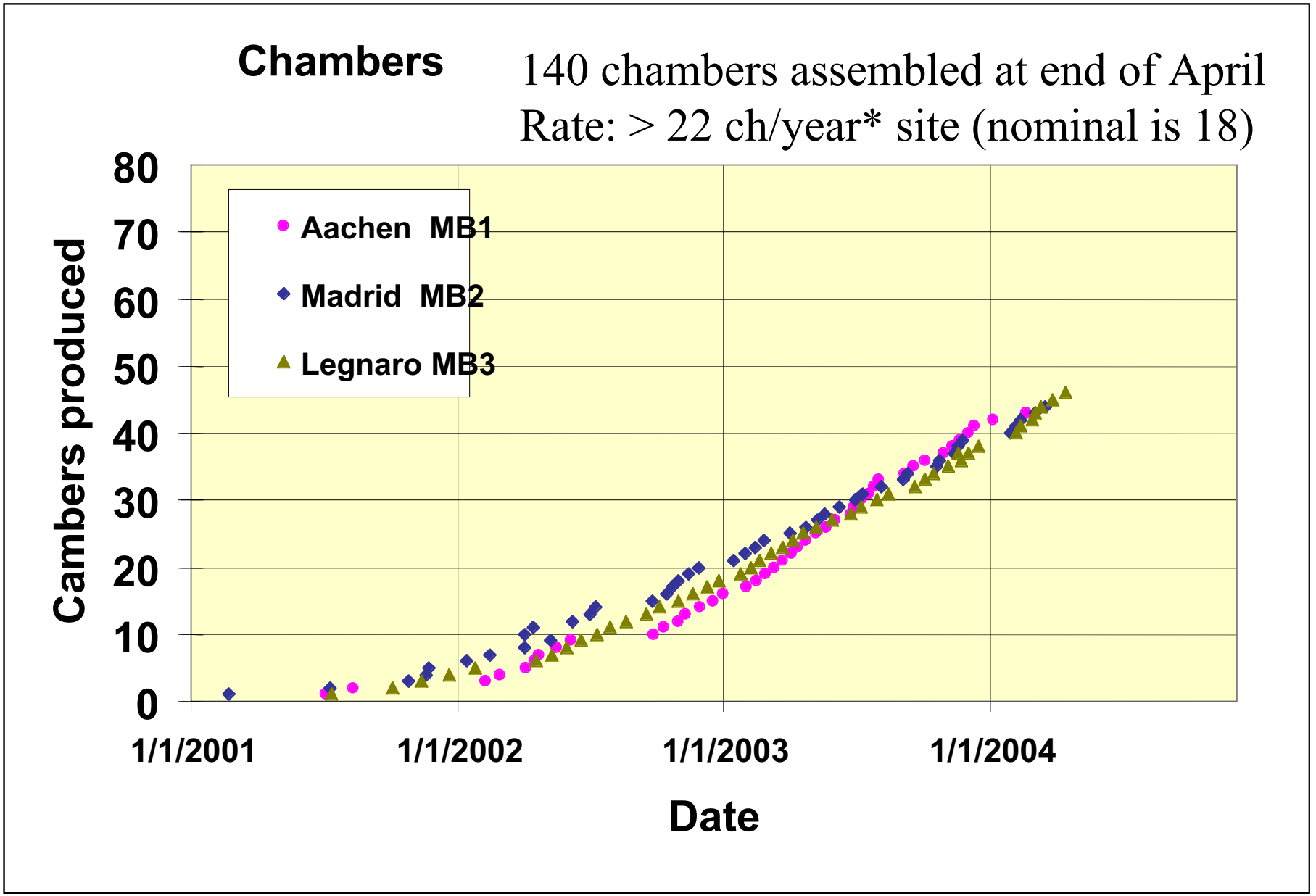
ISR Tunnel April 2004

115 Chambers in ~ 22 Stacks + 5 MB3 due May 4th

- **In total the old boards have been substituted with 3rd generation boards in:**

6 MB1, 3 MB1/9-11 5 MB2, 2 MB2/10 6 MB3 = 20 chambers

By the time the new boards will be available ~ 180 chambers will be assembled using the old boards. They must be all substituted with new ones before installation (1 chamber = 1 day for 2 expert people)


Chambers
140 chambers assembled at end of April
Rate: > 22 ch/year* site (nominal is 18)
Cambers produced
80
70
60
50
40
30
20
10
0
Aachen MB1
Madrid MB2
Legnaro MB3
1/1/2001
1/1/2002
1/1/2003
1/1/2004
Date

TORINO SITE for large MB4

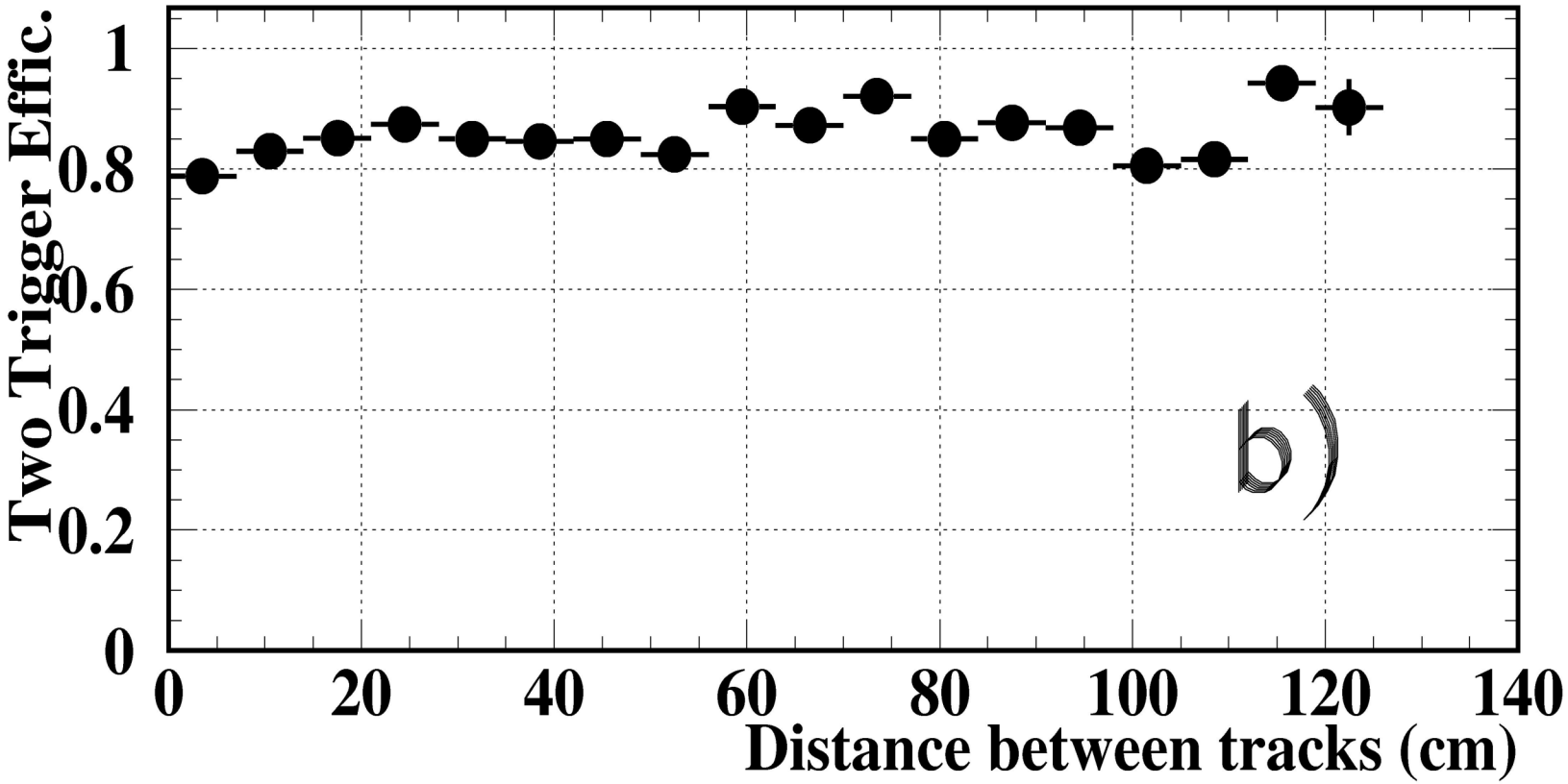
40 chambers (80 Superlayers, of the largest MB4) have to be produced in Torino.

A first dummy Superlayer was successfully assembled in March/April

A first "good SL" is finished and a 2nd should be finished by mid June
The second assembly table (and related tools) operational by end June

The minimum goal compatible with CMS installation schedule is to produce 5 chambers in 04 and reach by end 04 the rate of 2 ch. /month.(actual rate in the operational sites)

DT TRIGGER :test beam may 04
MB1 Minicrate on MB3 chamber
Double track trigger efficiency (one Mu station)
In function of track separation



TEST BEAM MAY 03

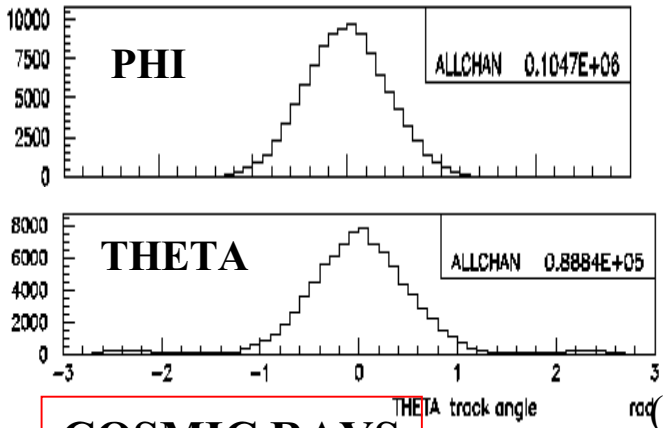
(Travaglini)

MINICRATE Autotrigger with cosmic rays:

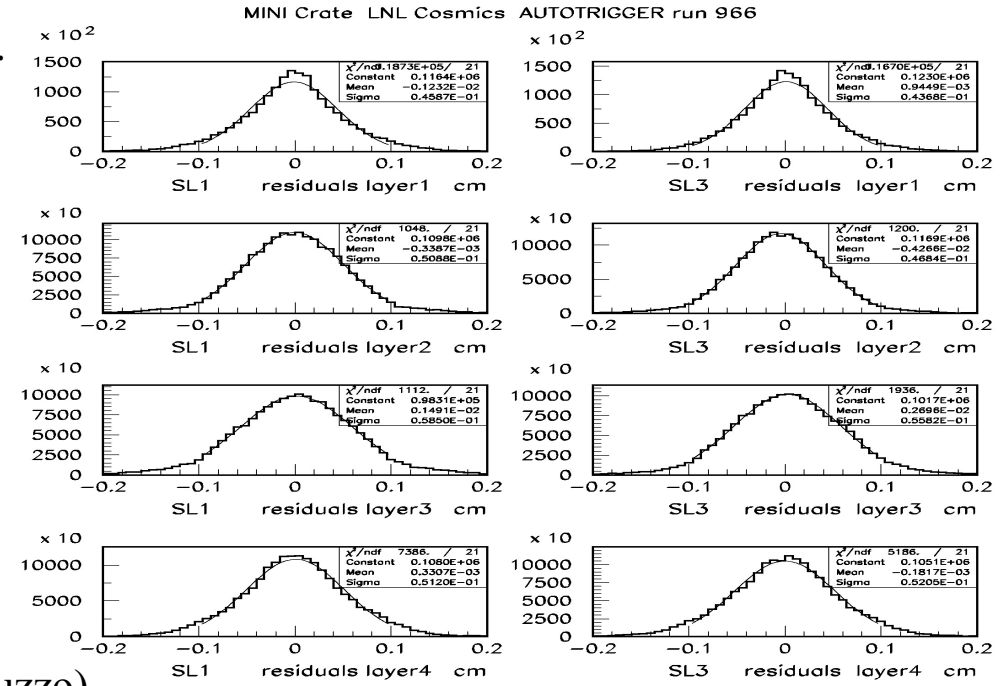
The MC can generate a Level 1 Accept Trigger in standalone mode The feature was tested in Legnaro with cosmic rays. The MC clock is free running at 40 MHz
The cosmic tracks are randomly distributed in time.
The TDCs are stopped by the MC L1Accept Trigger with an error of +- 1 clock wrt the time of passage of the track : 25 nsec/sqrtf 12 = ~ 8 nsec = 400 micron
That,unless corrections are introduced, will dominate the final chamber resolution
That moves from 250 to about 500 micron.

Track reconstruction efficiency for High Quality Trigger is larger than 99%

angle distribution of the tracks reconstructed in the event



Residual 7 point fit ~ 500 μm resolution



COSMIC RAYS

(Meneguzzo)

MINICRATES STATUS:

Minicrates readout assembly is going on in CIEMAT (8 MC are already in Legnaro)

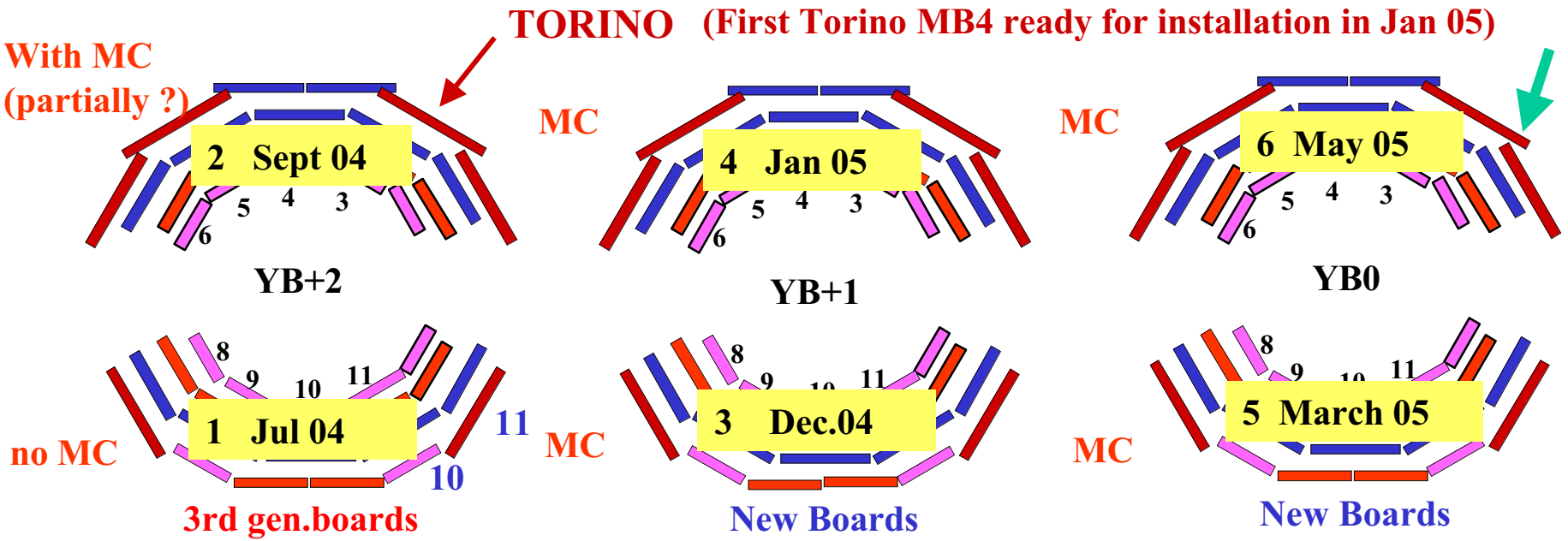
Minicrates complete assembly/test is making the first steps in Legnaro

In September a second assembly/test site in Bologna (Bo+LNL = 8+8 MC/month in Oct.)

Under two optimistic (but reasonable) assumptions:
Control Boards and Trigger boards are available in sufficient quantities by beginning of September.

Two stands for Minicrates test should be operational at CERN:
One at ISR at end July (for reception and installation in chambers)
One in SX for test on installed chambers.

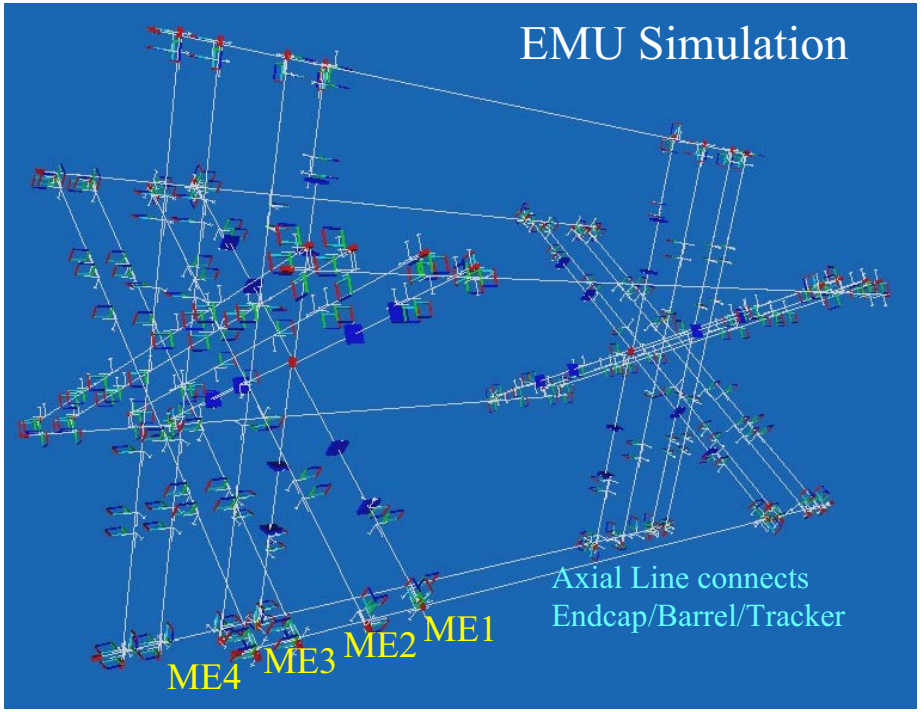
THE INSTALLATION SEQUENCE from now to the Magnet test July 05

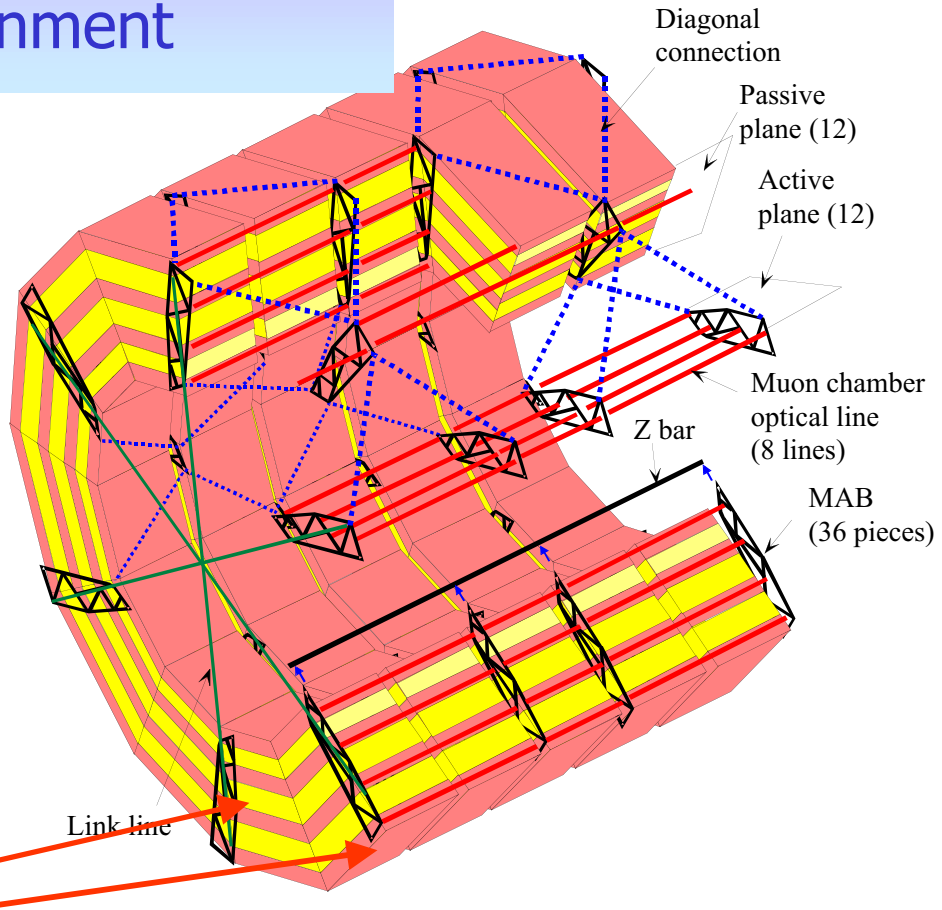


+ sector 10 and 11 in wheels –1 and-2 to check Alignment in the Mag.Test

This week : review and finalization of the strategy for chamber installation (that include ch, dressing,HVB substitution, minicrates handling and installation,cabling etc…)

MU Alignment





For the magnet test:

BARREL - Sectors 10-11 equipped with DT chambers

- 10 (+4) MAB structures instrumented (out of 36 = full system)

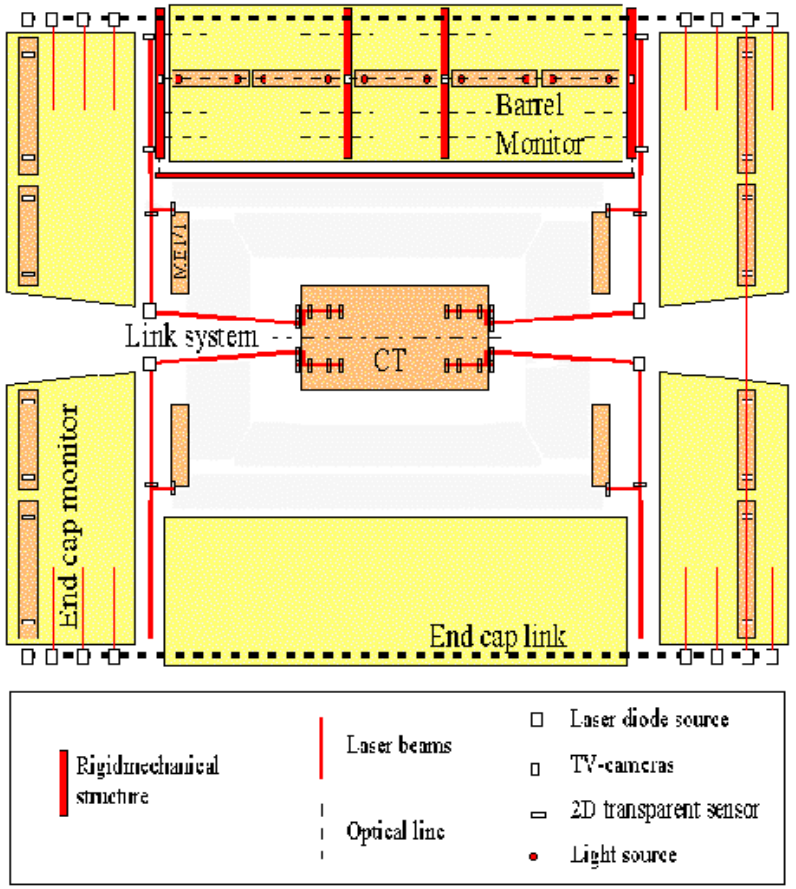
ENDCAP - 2 Φ-planes (out of 3= full system) both Z sides

- ME2 layer and ME1 (equipped with alignment chambers)
- Cosmic data runs during Magnet Test

Link with Tracker

Elements of the system:

- Rigid structures (2 Align. Ring, 2 LinkDisc)
- Laser system + optics: 670-690 nm (36 units)
- Photodetectors: 96 units
  (on MAB and ME1 CSC layer)
- Analog sensors: Tiltsensors (20),
  Distance sensors (54), Temp & B probes
- Mechanical parts: Transfer plates & mounts
- Readout electronics: LEB and ELMB



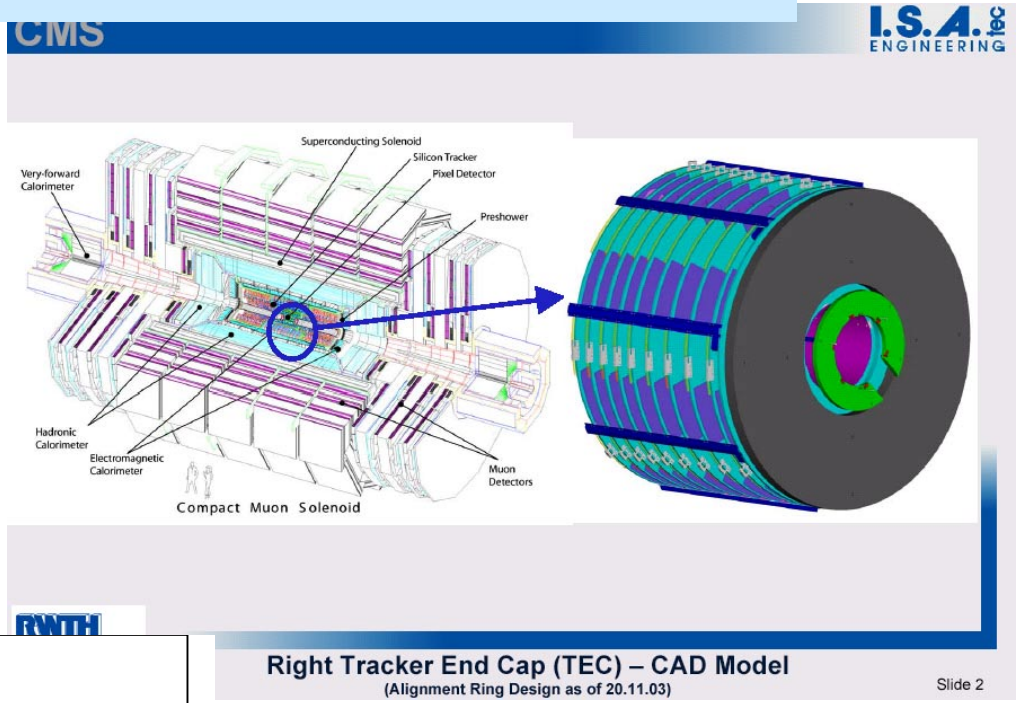
For the magnet test:

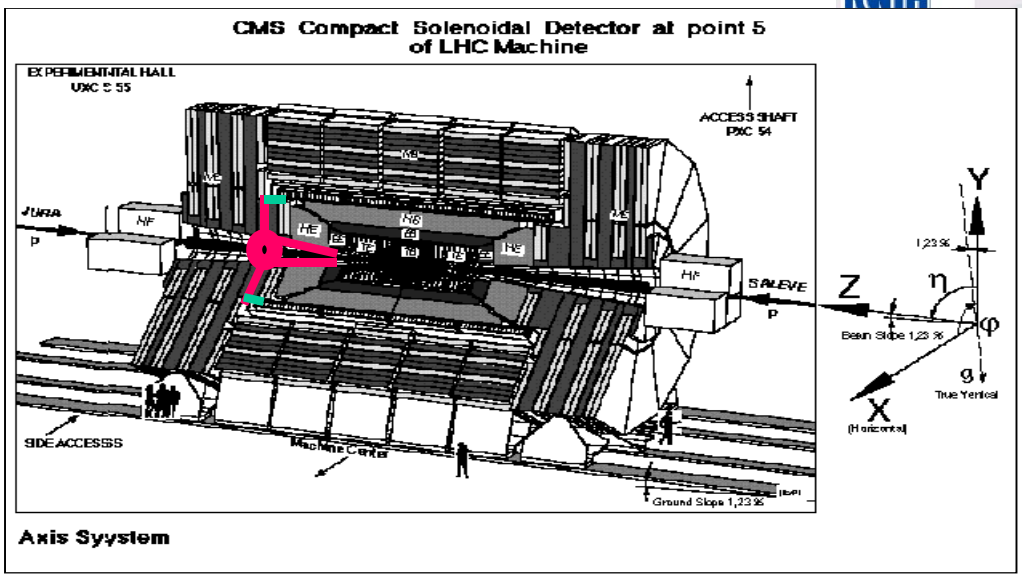
- 2 Φ-planes (out of 3= full system) both Z sides

Link w/ Tracker principle

1) TK BackDisc (disc-10) is mechanically connected to Alignment Ring (AR at room T).

2) Laser beams from the AR, traveling thought $\eta = 3$ cone and bended at the LinkDisc, are seen by Photo-detectors housed at the Mabs.





Carbon-Fiber structures

LinkDisc: 2 CF discs built at FVT
Delivery to CERN end of June
→ Assembly and calibration for MTest

Dimensions: OR ~ 650 mm, IR ~ 500 mm
Total weight: ~10 Kg
3 kinematical supports on YN1
Components: Optics & collimators every 60 º

Dimensional stability (FEA) ~ 30 μm, ~ 50 μrad

Calibration of the instrumented AR & LD structures:

Combines survey/PG and laser measurements: (survey setup dimensions defined to reach ~ 20 μrad – already achieved in other setups)

Calibration steps:

1) Adjustment of AR collimators orientation (combine meas with PG and LT)
2) Adjustment of LD optics wrt AR in nominal positions
3) Relate the 6 laser beams: requires 3-4 calibration positions

→ Start setting up the calibrations bench by end of summer at ISR

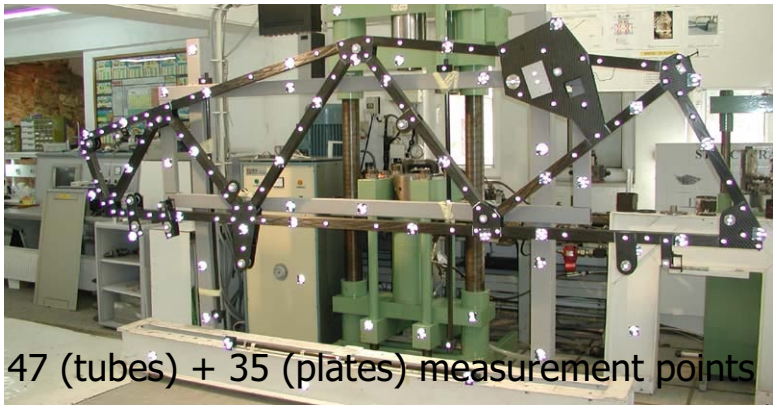
MAB production

H. Gerwig and Survey group

The MABs are manufactured at the Institute of Mechanics of Materials & Geostructures (IMMG), Greece

20 MABs have been made (out of 36 total units)

Production completed by September (or earlier)



47 (tubes) + 35 (plates) measurement points

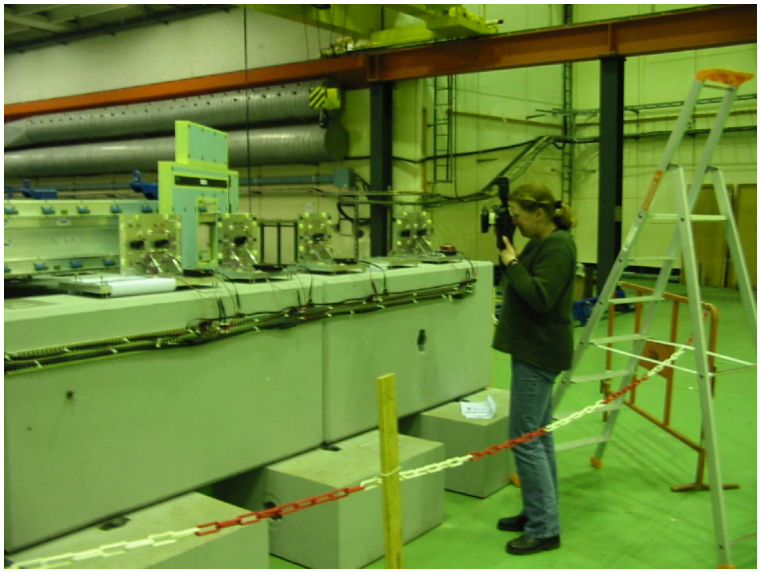
Once at CERN:

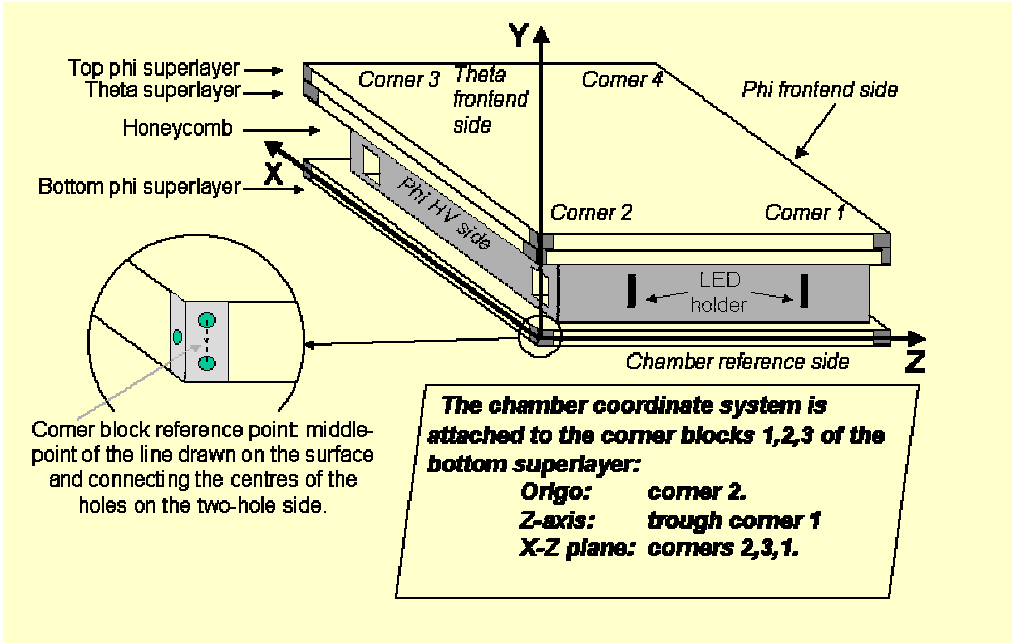
Calibration of the equipped MAB at the ISR

- Re-design some components to cope with fabrication tolerances
- Repair some MAB units if needed (develop procedure, tooling)

Chamber calibration procedure

Z. Szillási April 28, 2004





1) Photogrammetric measurement
   - Provides the Corner Block target positions in the Lab reference frame
2) Fork LED measurement with cameras
   - Provides the fork LED centroid positions in the Lab reference frame
3) Analysis – Calculation of
   a. Corner Blocks in the SuperLayer Reference frame
   b. SuperLayers in the Chamber Reference frame
   c. Fork positions in the Chamber Reference frame

Fork(LED) → Superlayers → Corner Blocks → Wires

⇒ 104 chambers measured (out of 115 at the ISR)

Endcap system - Status

D. Eartly April 12, 2004

DCOPS & ANALOG SENSOR ELECTRONICS

Production, dynamic and burn-in testing completed:

DCOPS & ANALOG SENSORS

DCOPS sensor parts at FNAL - will need to derive optical filters, develop calibration

Test of a complete SLM at FNAL. Calibration will start in June

All ANALOG sensors have been procured, mechanical mounts are in fabrication.

Calibration will be done at Florida Institute of Technology

SLM & XFER- MECHANICAL

CSC sensor mounting hardware & Transfer Plates in Fabrication

IN DISCUSSION THIS WEEK

-a coherent assessement of the instrumentation ready -for each subsystem-
-for the Magnet Test, with a coordinated and matching calibration timetable.
-
-Elaborate a list of goals and requirements needed to run at the surface.
- (List to be discussed with A. Gaddi as soon as possible, before next CMS).
-
-Start actions for preparation of part calibration at ISR in the summer