



# **DT Quality Control Status in Torino 6<sup>th</sup> December 2004**



## **QC on incoming material:**

**Al-Plates**

**HVC,HVB**

**Test HV on strips of Al plates**

## **QC during SL mechanical construction:**

**Tension, position, capacity, electrical contacts, planarity**

## **QC at completed SL so far in Torino:**

**gas tightness/Oxygen content**

**HV test in air**

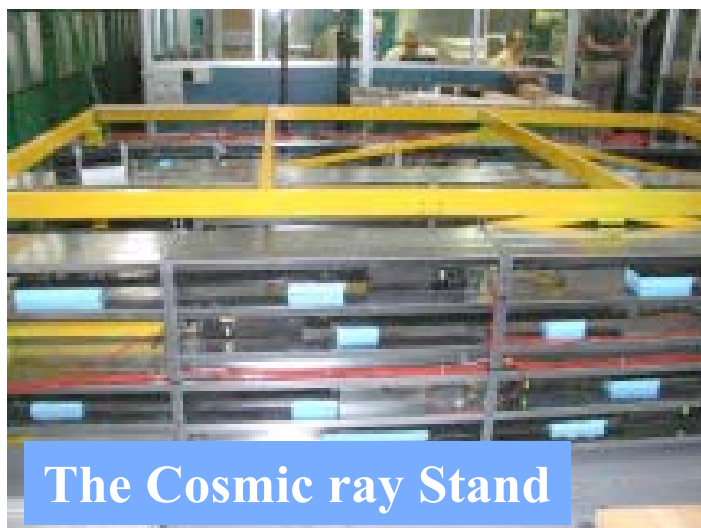
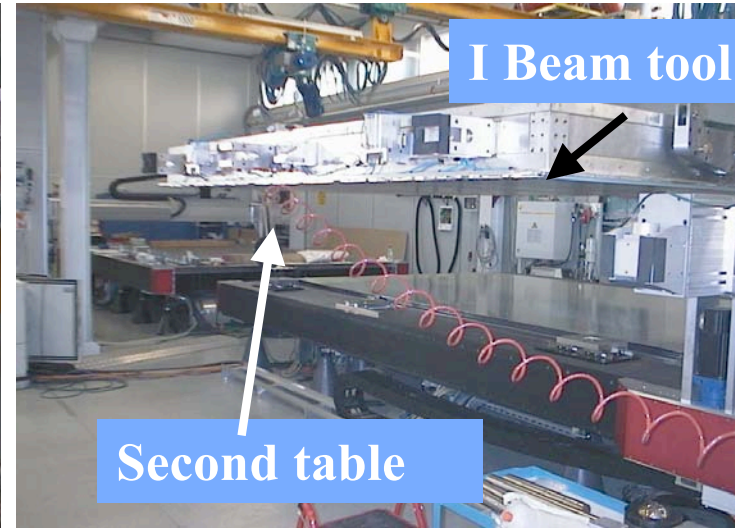
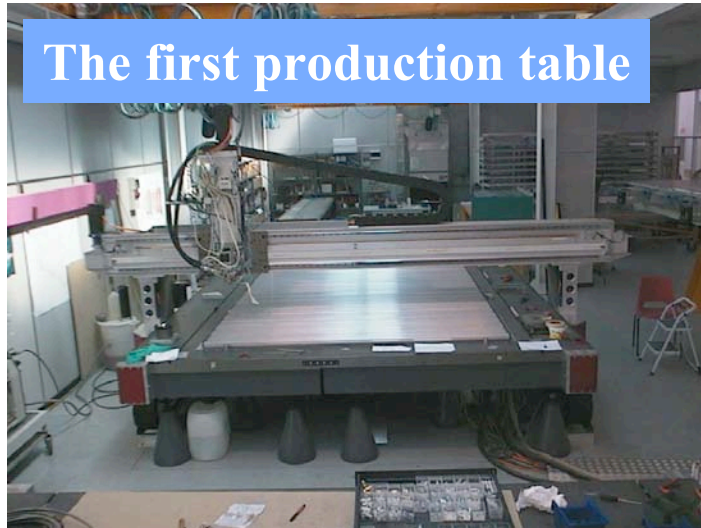
**HV in gas**

**Noise in air, Noise in HV and gas**

**Test pulse**

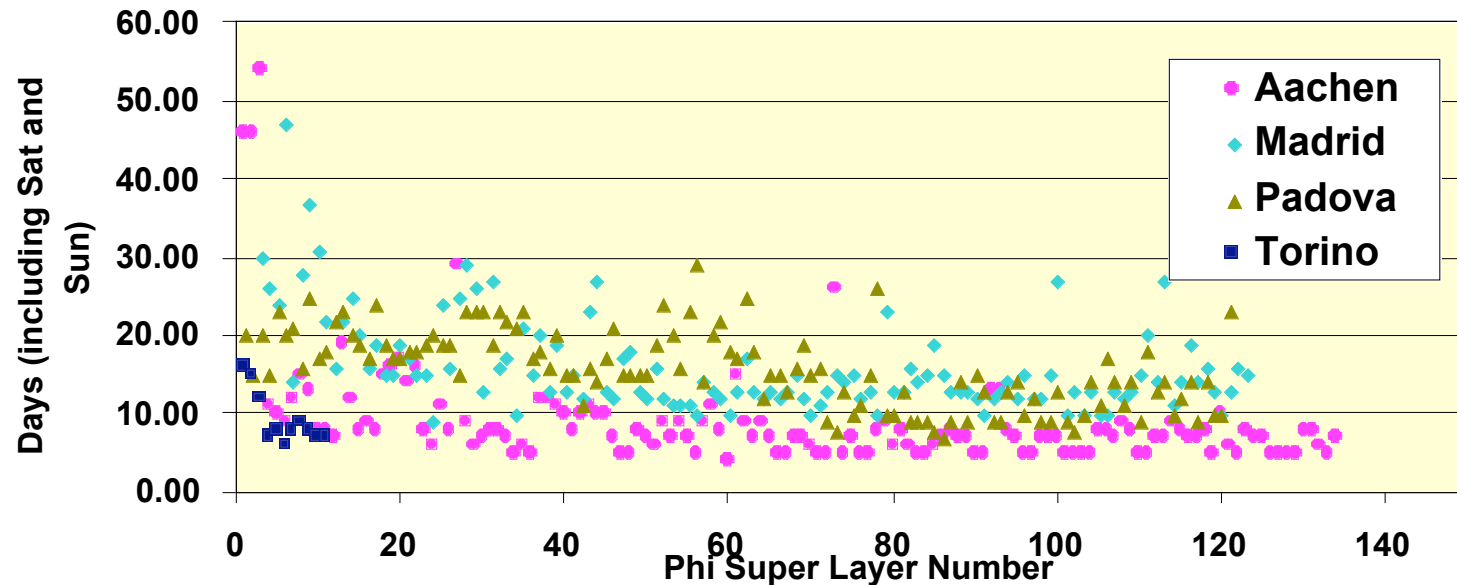


# DT Assembly Hall in Torino





# Torino DT Production Status



	Sept 2004	Nov 2004	Jan 2005
<b>Mechanics</b>	7	11	15
<b>HV assembly</b>	5	8	12
<b>FE assembly</b>	5	8	12
<b>Assembly of HV and FE covers</b>	80 HV (100 %) 40 FE (50%)	80 and 40	80 and 40
<b>QC on finished SL</b>	In progress	3 + 4 in progress	8 complete + 4 in progress



# Test HV on strips of Al plates additional QC test



-HV test on the strips of the upper face of Al plates on all 4 layers (only 50% of the strips)

-4000 V fast test to see trip

-Eventually exchange strips





# Quality Control During Assembly

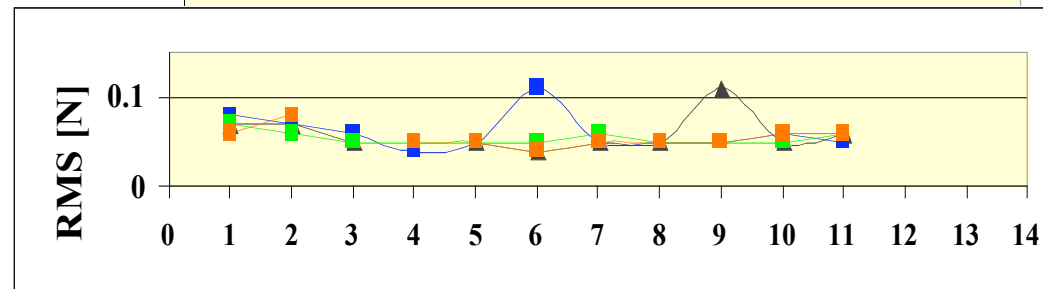
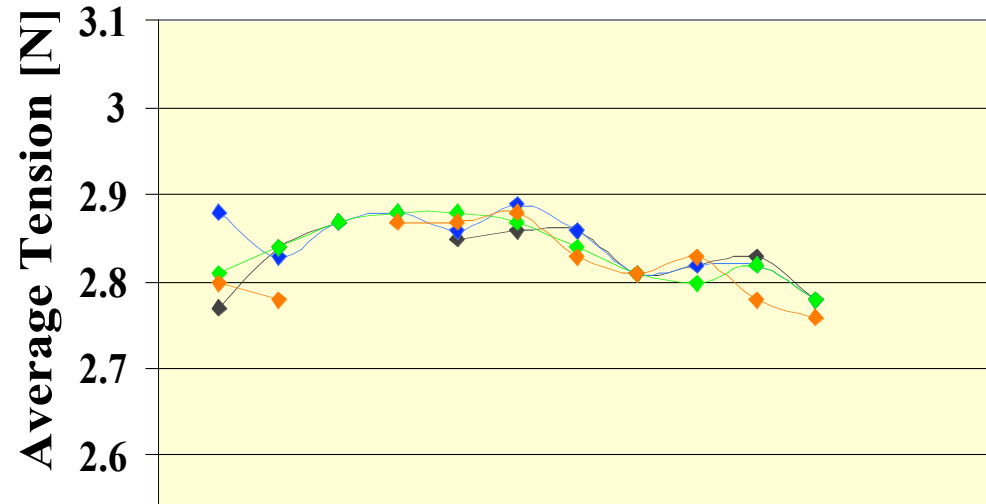


## Average Wire Tension

Frequency range 79.3 –83.3 Hz (phi)

Wires with frequencies outside this range get adjusted or eventually replaced

Output: Wires are measured and stored in local file -> Local Data Base



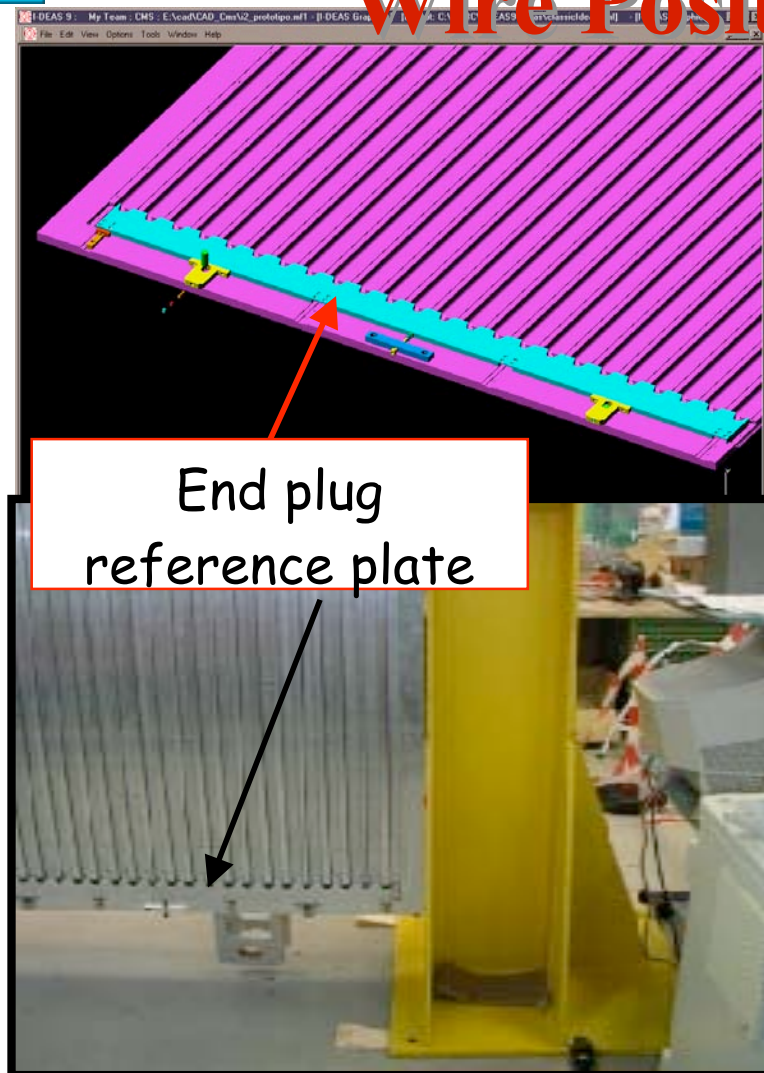
**QC requirement:** measure individual wires before closing the layer, allowed range 230 –325 gr.





# Quality Control During Assembly

## Wire Position – the tooling





# QC During Assembly

## Wire Position – the measure



**SL001-SL002-SL003 endplugs  
reference on Ibeam tool out of position**

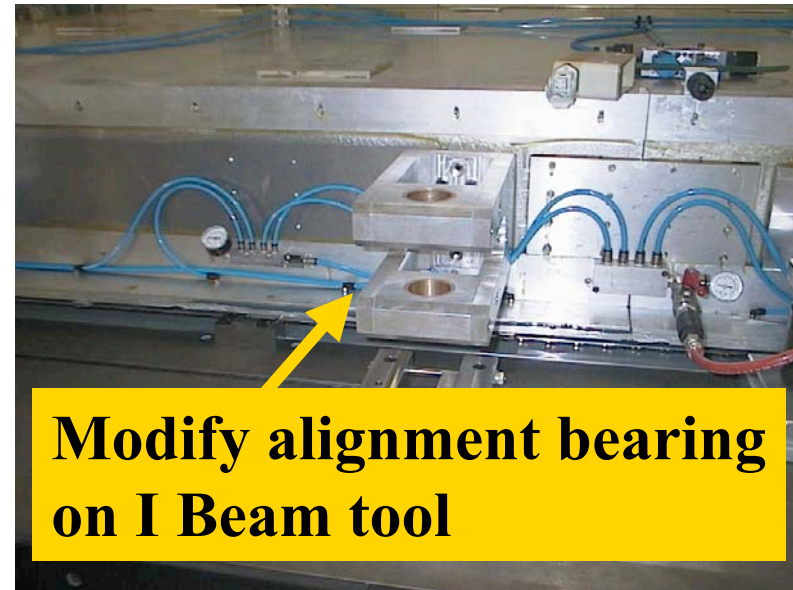
**SL004- SL005-SL006: I Beam tool  
alignment problem.**

**Tuning of positioning the alignm. bar**

**SL007- SL008-SL009-SL010: still I Beam  
tool positioning problems (absolute  
avarage mean position)**

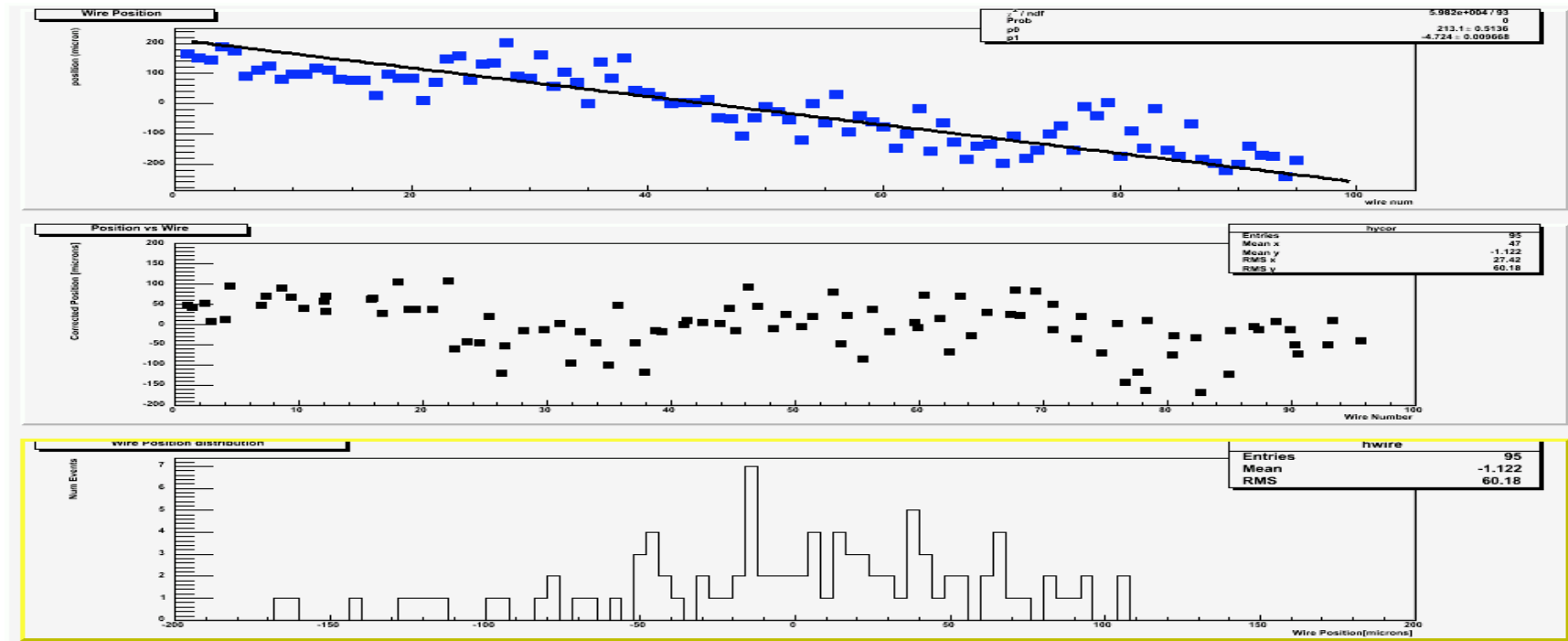
**➡ Comparator**

**SL011 Avarage absolute wire position still to  
be corrected but under control with  
comparator. Much better alignment among 4  
layers**





# QC During Assembly Wire Position



Output: Wires are measured and stored in local file -> Local Data Base

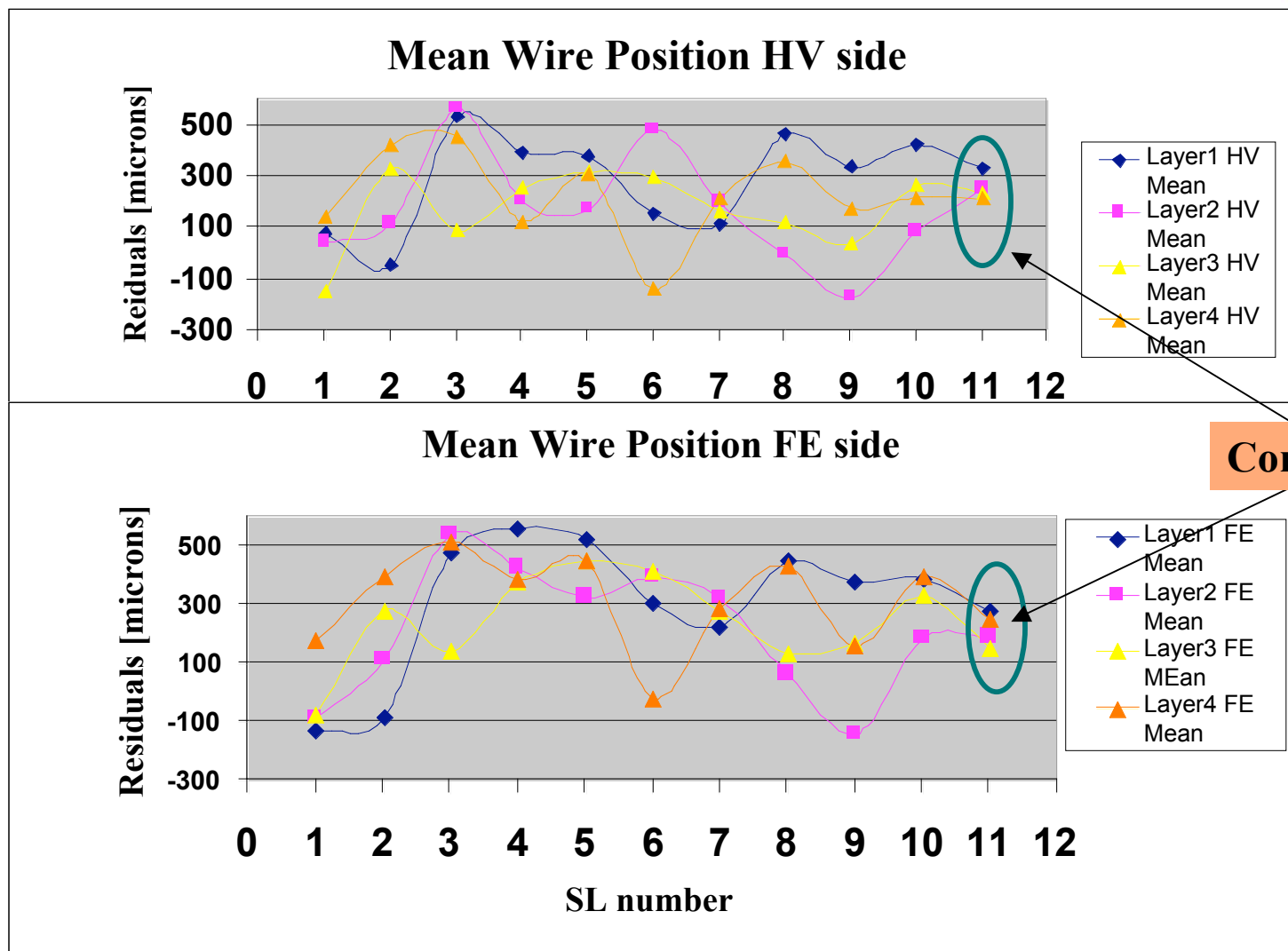
QC requirement: 100 microns during assembly/500 microns for trigger





# QC During Assembly

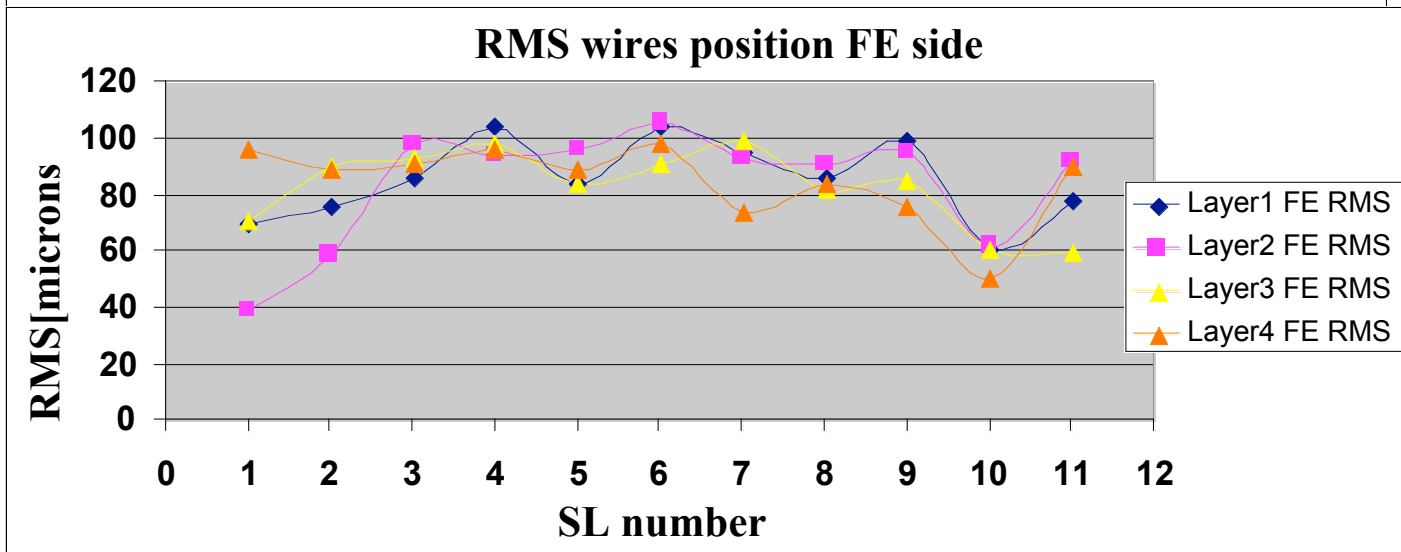
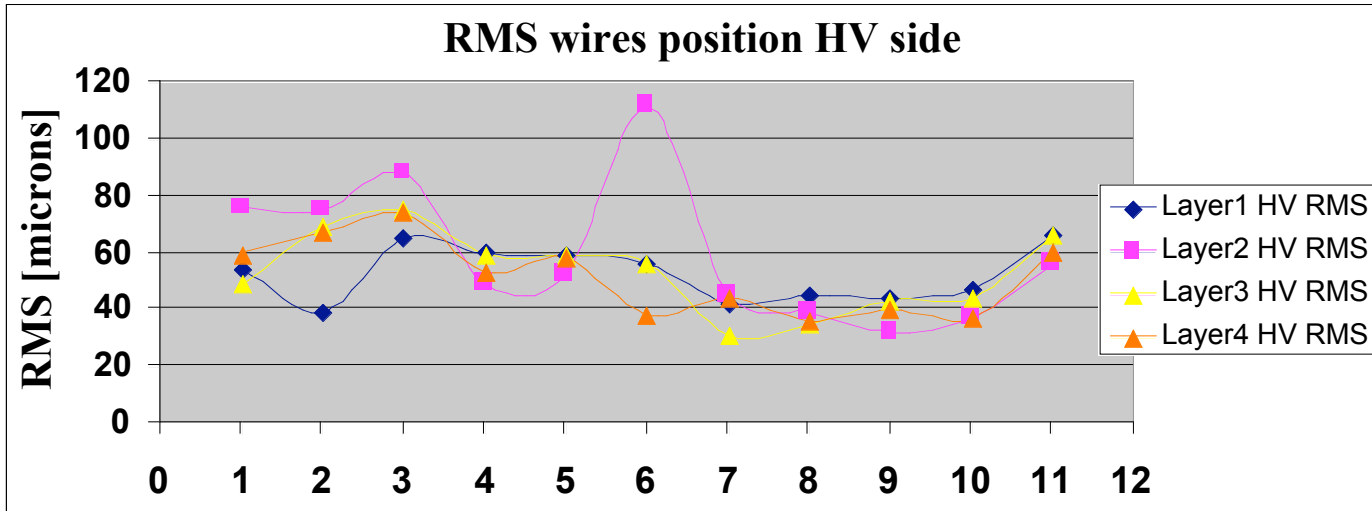
## Wire Position – the measure





# QC During Assembly

## Wire Position – the measure





# QC During Assembly

## Summary on Wire Position



**Wires and I Beams positioned relatively to each other within 150 microns (shown in plots stored in local DB).**

**Alignment of Ibeam tool and alignment of endplugs: fluctuation of ~ 200 microns in alignment between the 4 layers ( change alignm. bearing).**

**Application of a comparator during Layer gluing**

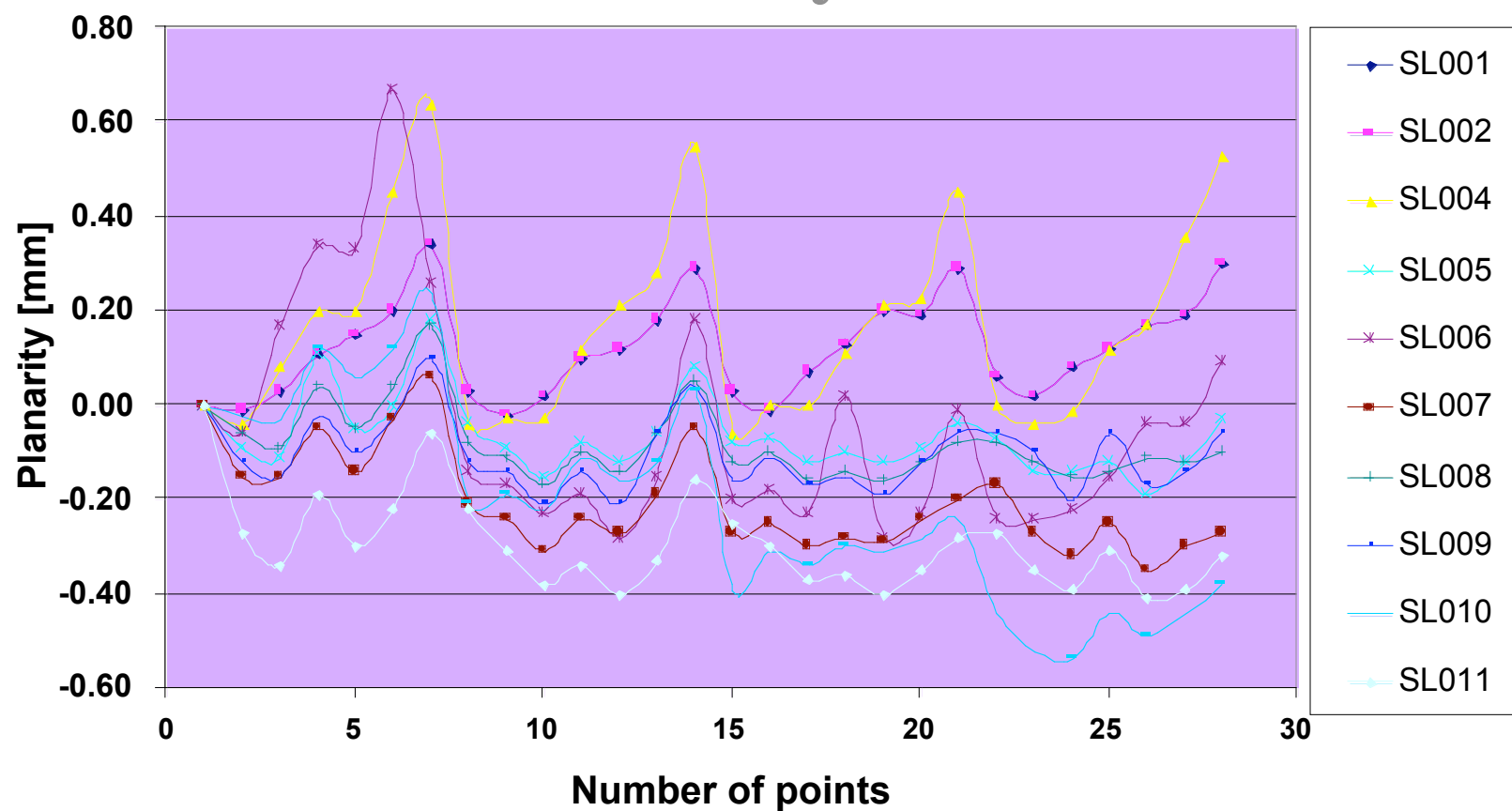
- better alignment between layers**
- possibility to correct absolute average position**

**Still wire position less accurate on FE side wrt to HV side ( ???)**



# QC Test during assembly

## Planarity



**Average planarity in latest SLs within 400 microns**



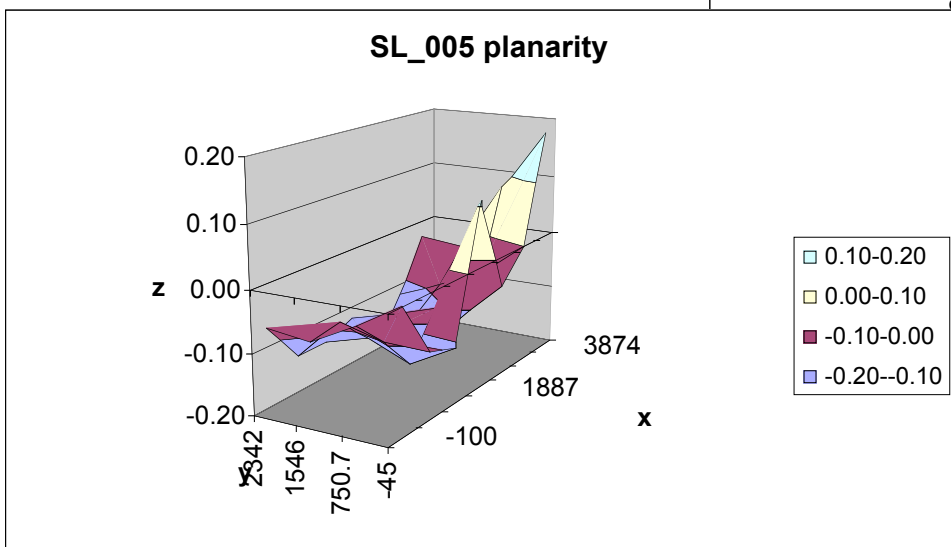
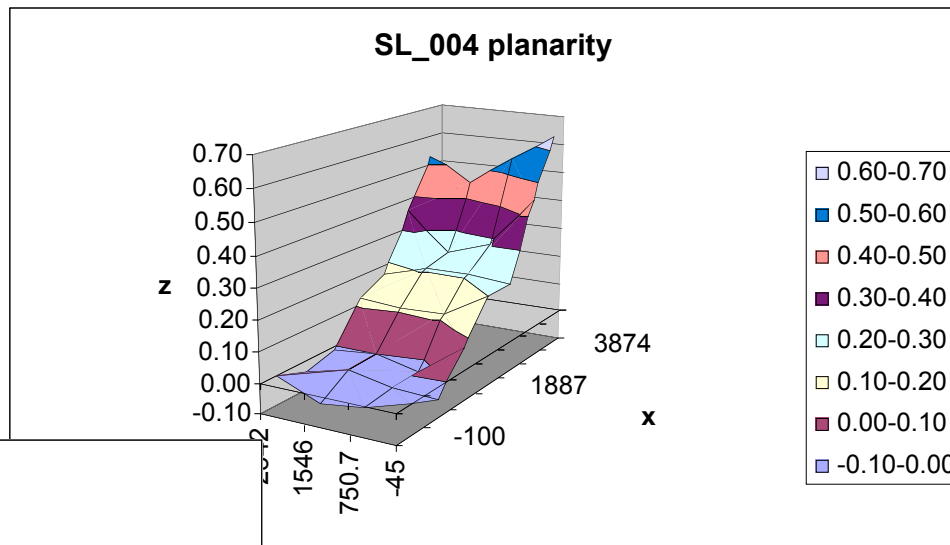
# QC Test during assembly

## Planarity



mm

SL004 □



□ SL005





# Quality Control on Finished SL

## Gas Tightness test

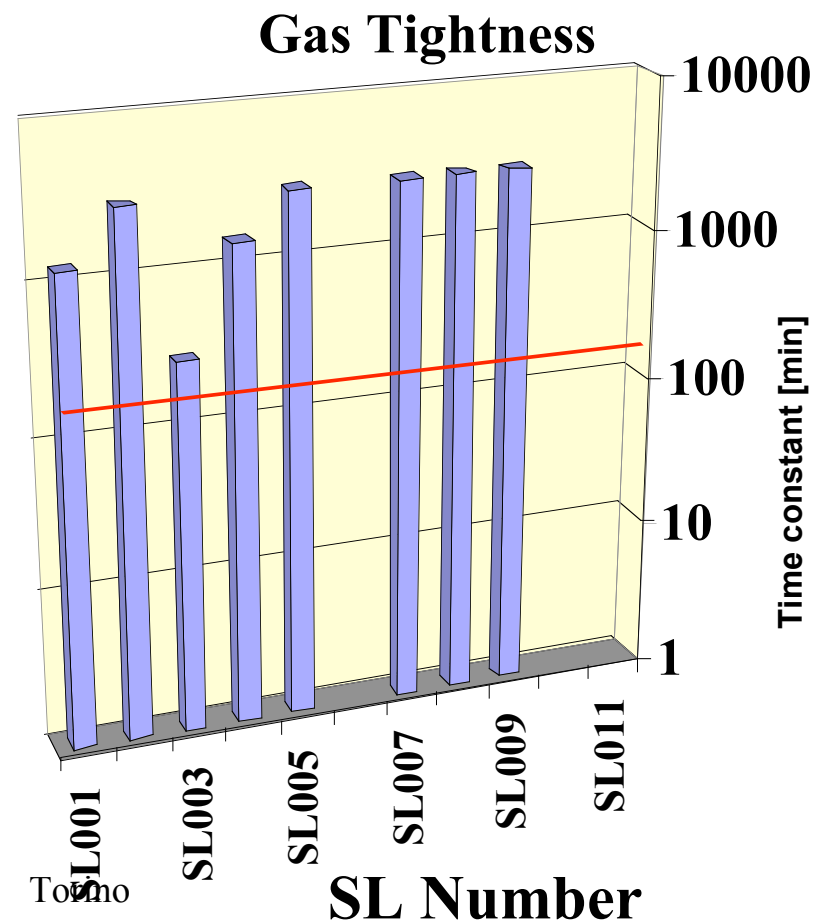


Gas tightness measured with final Configuration: HV + Fe covers

Duration of the Test: 1 hour

SL No.	t[ <i>min</i> ]	Additional Sealing
001	1322	Yes
002	Inf	Yes
003	296	Yes
004	1536	-
005	Inf	-
<b>006</b>	<b>Unglued the last plate</b>	
007	Inf	No
008	Inf	No
009	Inf	No

140 min





# Quality Control on Finished SL Oxygen Content



**All tested SL reach Oxygen concentrations below 500 ppm,  
independent from gas tightness.**

**500 ppm reached after ~4 volume exchanges with  
150 l/h flux.**



# QC on Finished SL

## First HV test in Air



Procedure:

- Visual test of HVC and HVB before mounting
- Measure capacity for strips and cathodes on Daisy chains
- CAEN SY527 + filter RC 20 nA resolution
- Rump up 50 V/sec

**SL001, SL002, SL003, SL004, SL005**  
**SL007 tested in air:**

HV values:  $V(\text{wire}) = 3900 \text{ V}$

$V(\text{strip}) = 1900 \text{ V}$

$V(\text{cathodes}) = -1900 \text{ V}$

**Typical currents observed:**

$I(\text{wire}) < 20 \text{ nA} / 8 \text{ wires}$

$I(\text{strip}) < 300 \text{ nA} / 16 \text{ strips}$

$I(\text{cathodes}) < 200 \text{ nA} / 16$

cathodes



# QC on Finished SL HV test in Air



## **Observations:**

- 2 disconnected cells (one in SL003, one in SL004) because of strip holes**
- High current in 2 channels (1 wire in SL003 exchanged, 2 HVB exchanged in SL001, SL005)**



# QC on Finished SL

## HV test in Gas (3600/-1200/1800 V)



Flux SL at least for 3 days  
(150 l/h) – Gas distribution  
in SL very slow

Rumping up slowly 20 V/s  
and in steps, monitoring rest  
currents

If problem:

- exchange HVB, checking also crimping blocks of each wire
- check DC connections
- Identify (eventually disconnect) cell

Very time consuming

**SL001, SL002, SL003, SL004, SL005** tested in Gas

**4 HVB exchanged, no additional disconnected cells**

**On average reopen SL 3-4 times and reflux with gas.**

**Rest current after few days of run is 0 for wires/cathodes/strips**





# QC on finished SL Noise and Test Pulse



**SL001, SL002, SL003 tested Noise and Test pulse with scaler**

**in air:**

**no HV cable connected**

**15mV and 10 mV threshold**

**0 Hz noise on all channels L2, L3, L4 (10 mV)**

**few Hz on L1**

**grounding following suggestion of  
Franco/Matteo visit in Torino**

**First MB4 Chamber**

**in gas and HV:**

**50-100 Hz noise on  
average (more noise in L1)**

**First Tests of Noise in Cosmic  
Stand, in gas and HV:**

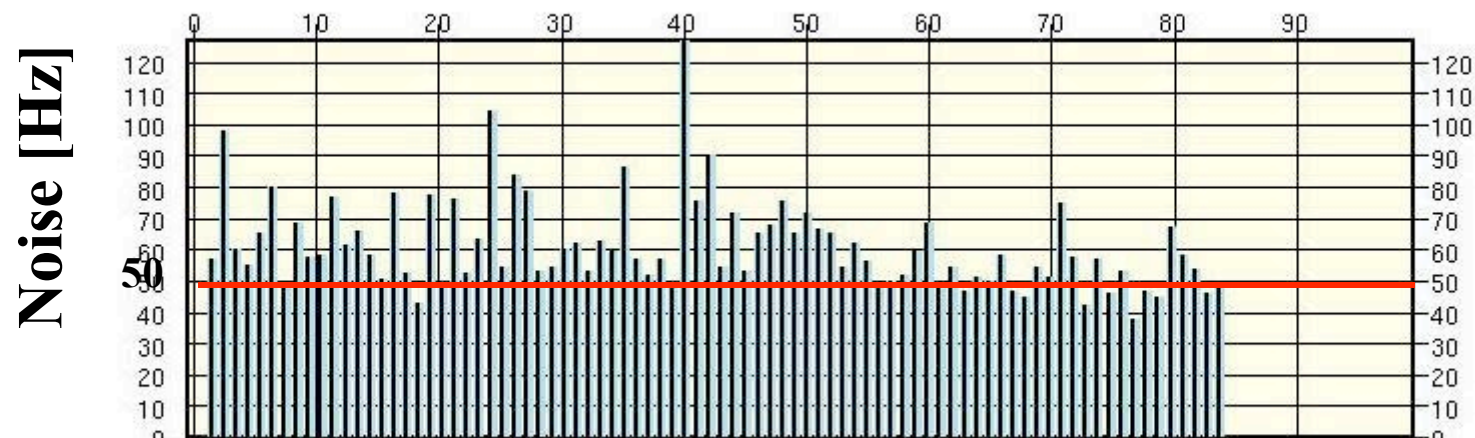
- 50-60 Hz noise on average  
on **SL002 and SL003**
- 2 not responding channels



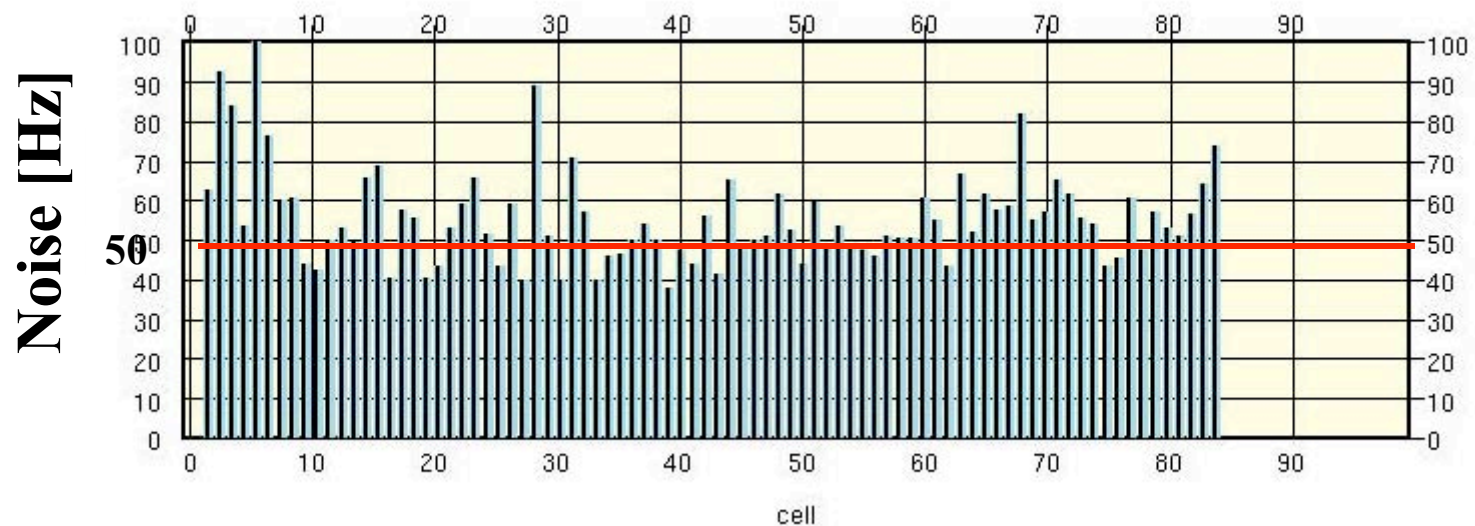
# QC on finished SL Noise and Test Pulse



*SL 0 layer 0*



*SL 0 layer 1*

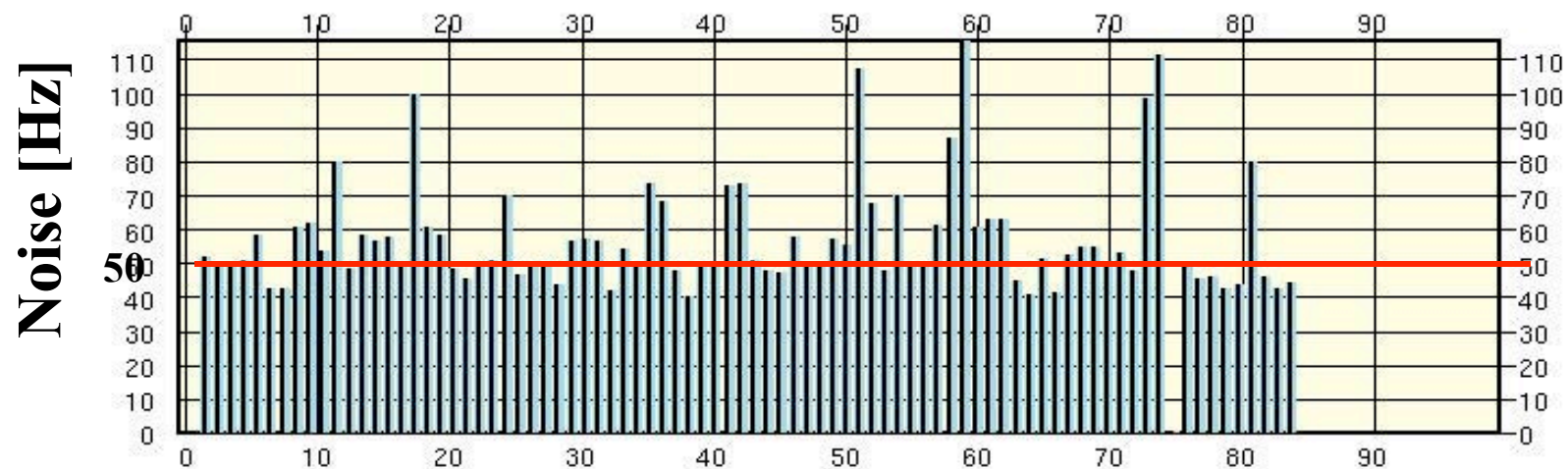




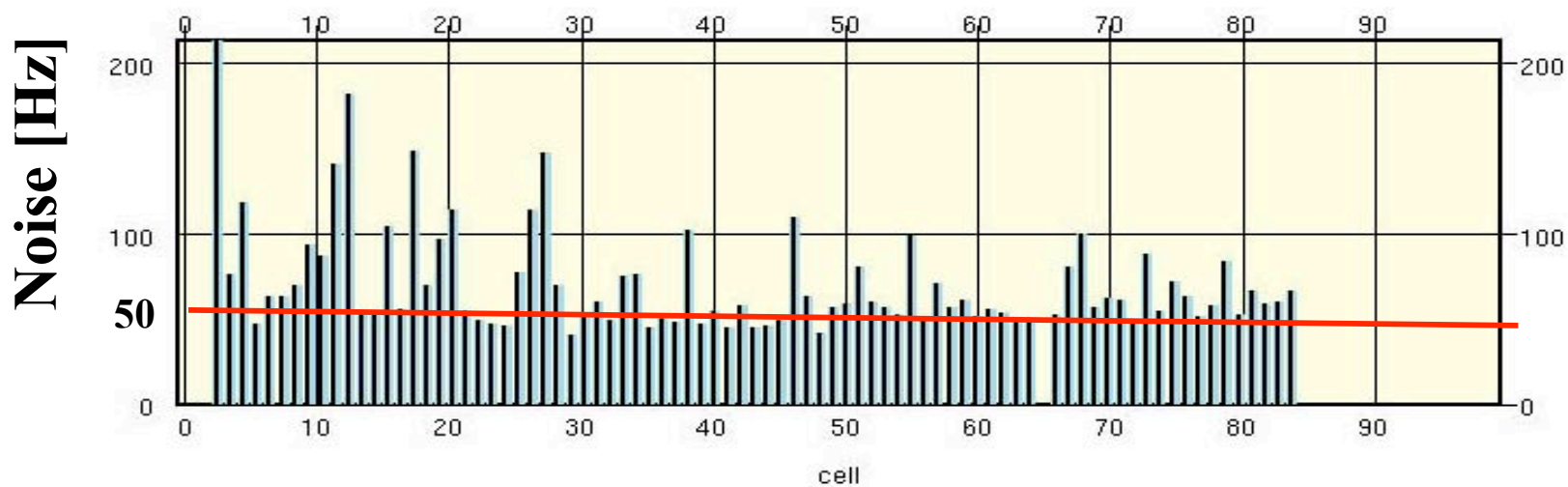
# QC on finished SL Noise and Test Pulse



*SL 0 layer 2*



*SL 0 layer 3*





# Torino Production and QC Data Base



<http://tok17w2.to.infn.it/mb4dev>

Address <http://localhost/mb4dev/> Go Links »

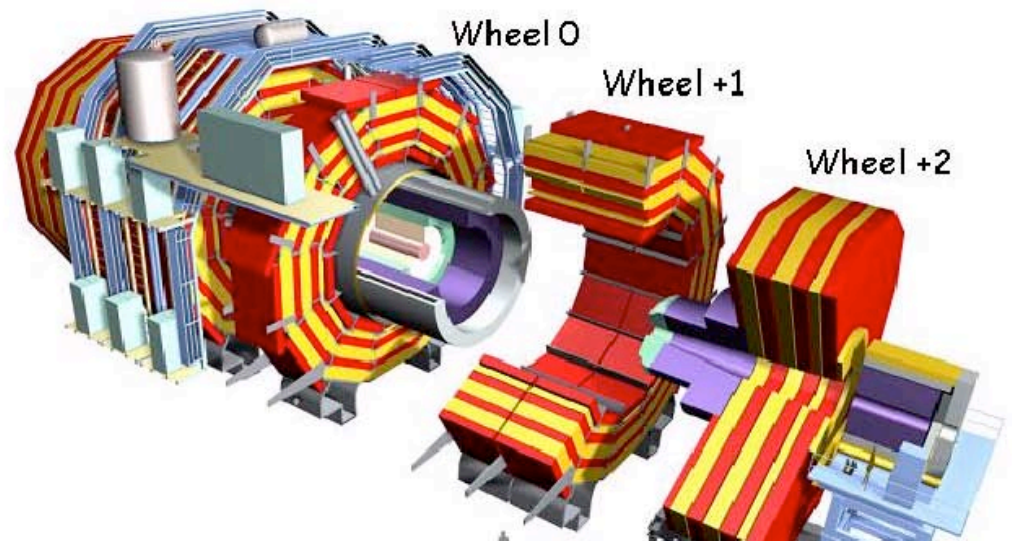
## CMS Muon System in Torino

Welcome To the MB4 Construction Management System

Click on a name of a Wheel to find out information about installed Chambers.

Click on one of the left items to navigate into assembled Chambers, SuperLayers, Covers and Material Store.

Wheel -2Wheel -1Wheel 0Wheel +1Wheel +2



**MB4 Assembly**

- [MB4 Home](#)
- [Chambers](#)
- [SuperLayers](#)
- [Covers](#)
- [Store](#)