

# RPC readiness for Installation: ISR test activity

A.Colaleo- Aachen Muon Week 28-30/4/2004



## Chamber delivering at ISR

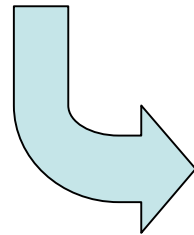
Bari

8-10 chambers/month

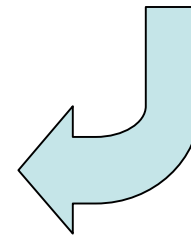


Pavia

9 chambers/ 2 months



ISR



**116 chambers are at ISR on special stoking trolleys**  
**65 chambers have been tested:**

<b>59</b>	<b>accepted</b>
<b>1</b>	<b>under observation</b>
<b>5</b>	<b>rejected</b>

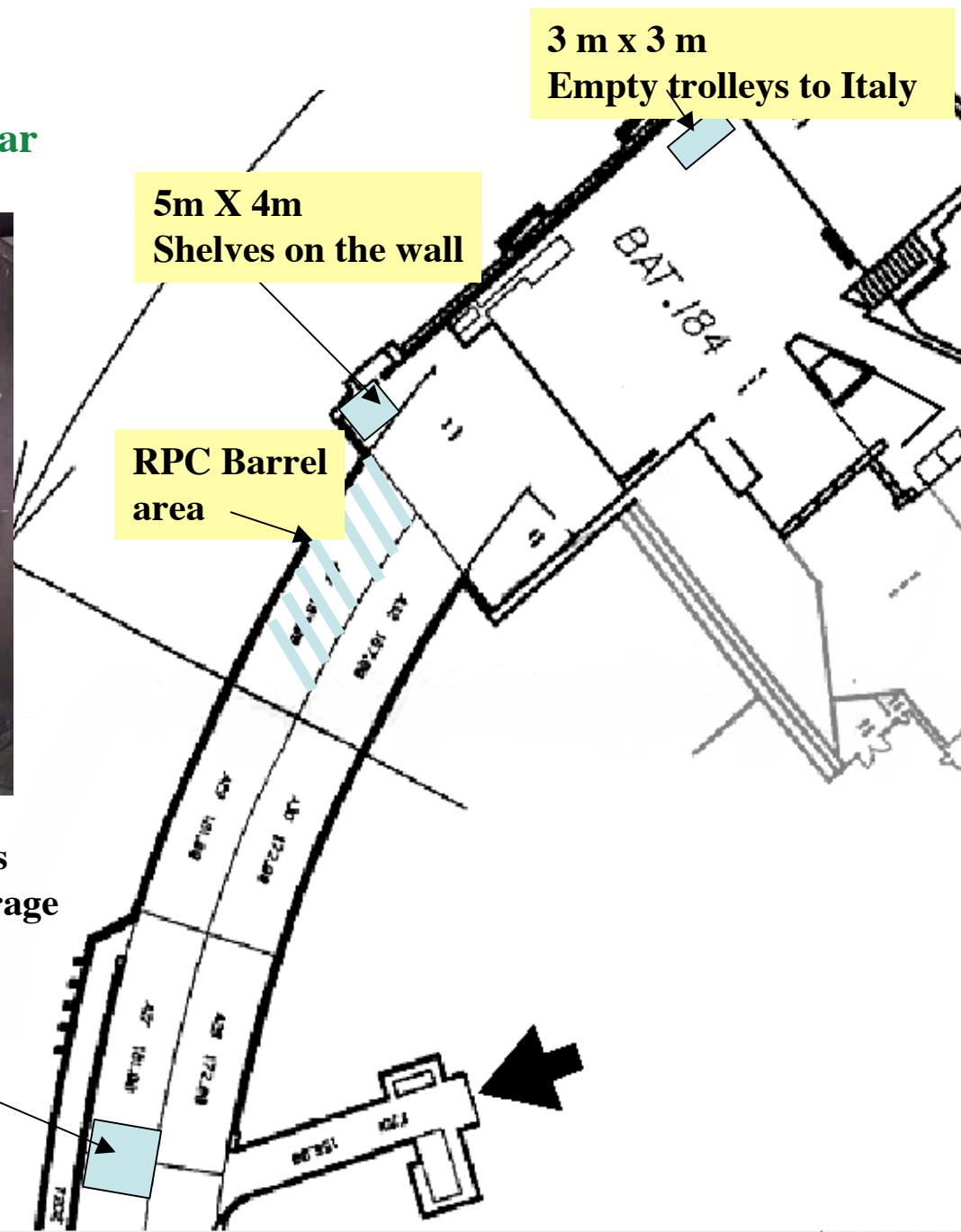
# Space in ISR

Foreseen 160 chambers for the end of year



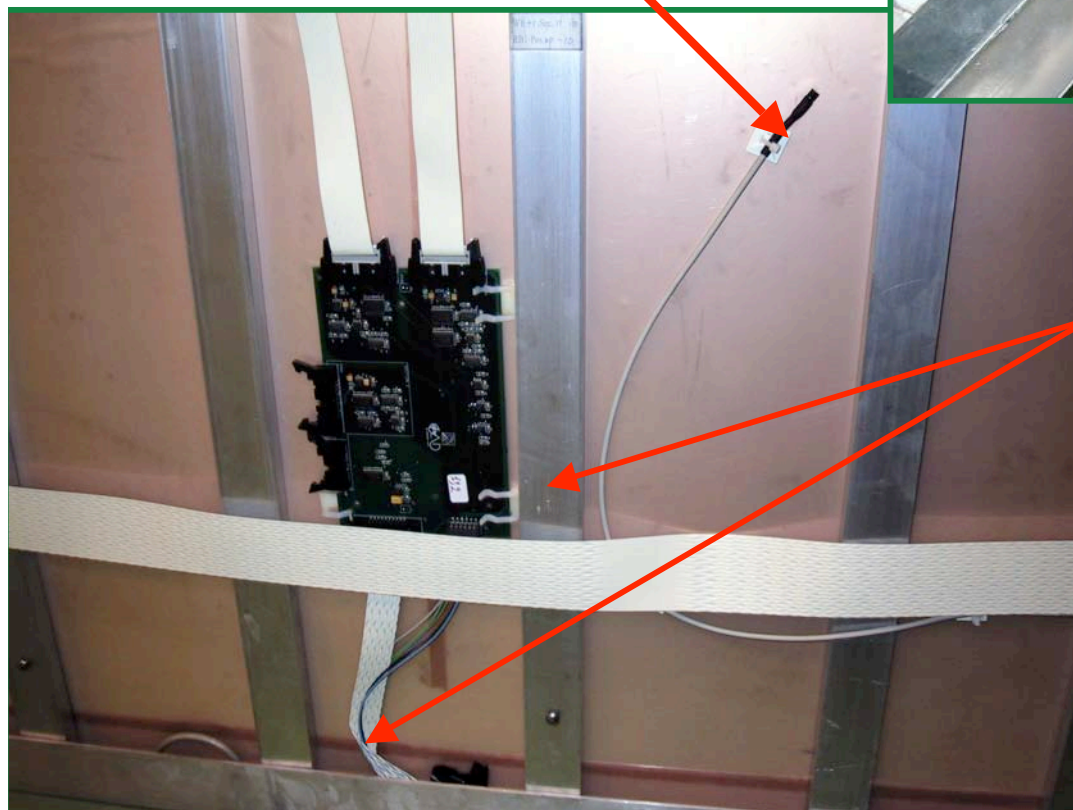
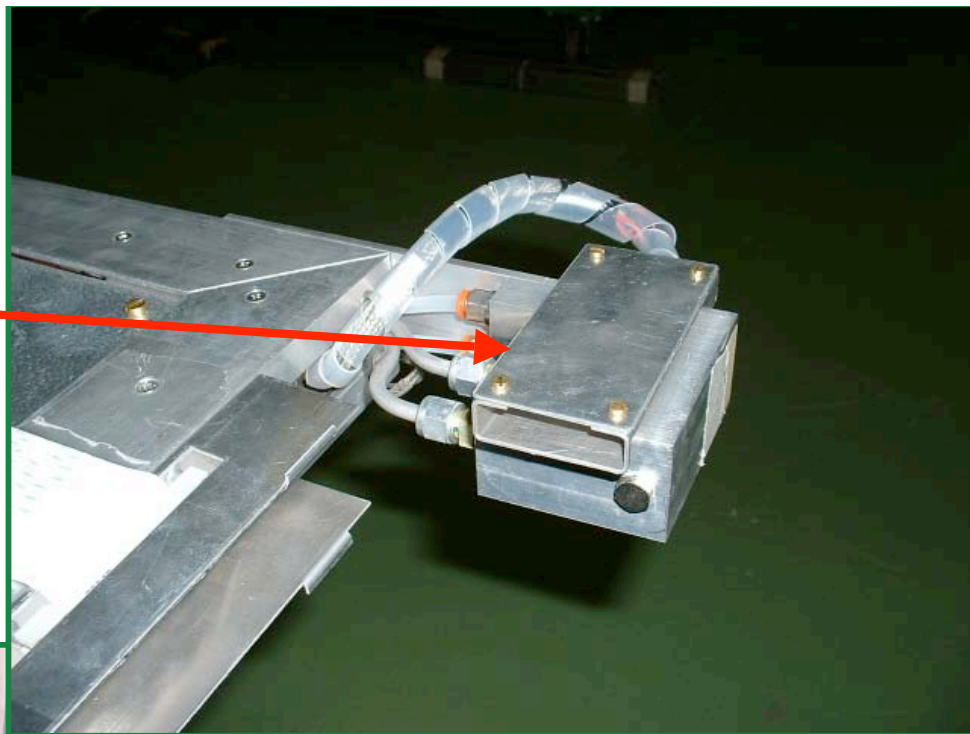
We have put wheels on all our stoking trolleys in order to move them easily in dedicated storage

**11m X 7 m  
CHAMBER STORAGE AREA**



## Work on chambers arriving at ISR

- HV final connectors on some chambers
- Temperature Sensors



- Control board - cable often need to be changed after the transport.
- Found 2/65 chambers with disconnected signal cables

## ISR test setup

### ISR is a fully operational test site

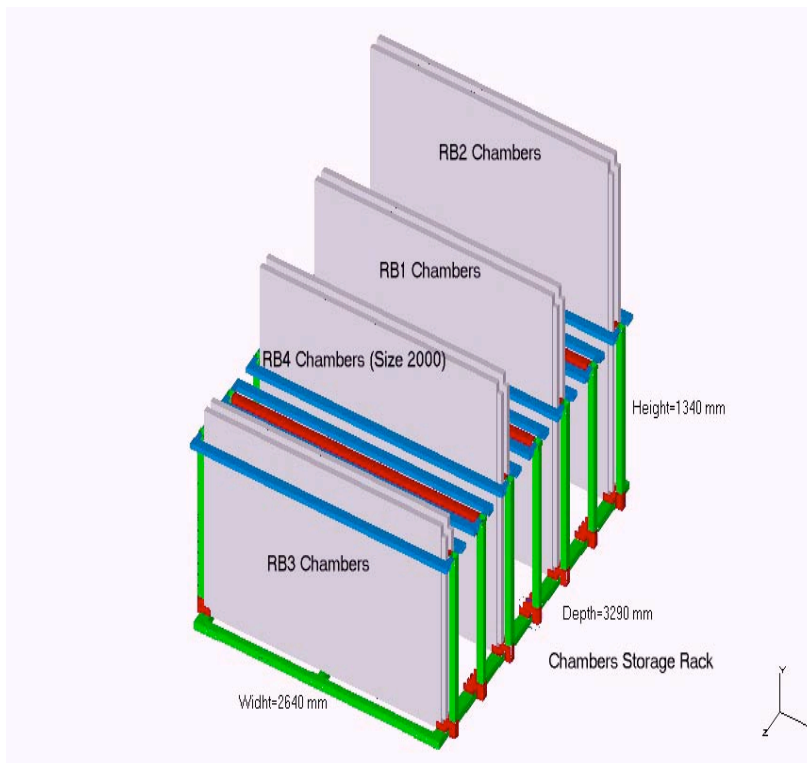
- **2 test trolleys with overall 30 gas lines and 44 HV lines (22 chambers) are in operation.**

- **Assembly table available**

- **The gas system can provide up to 200 l/h flux with controlled humidity. Pressure and Temperature are also monitored**

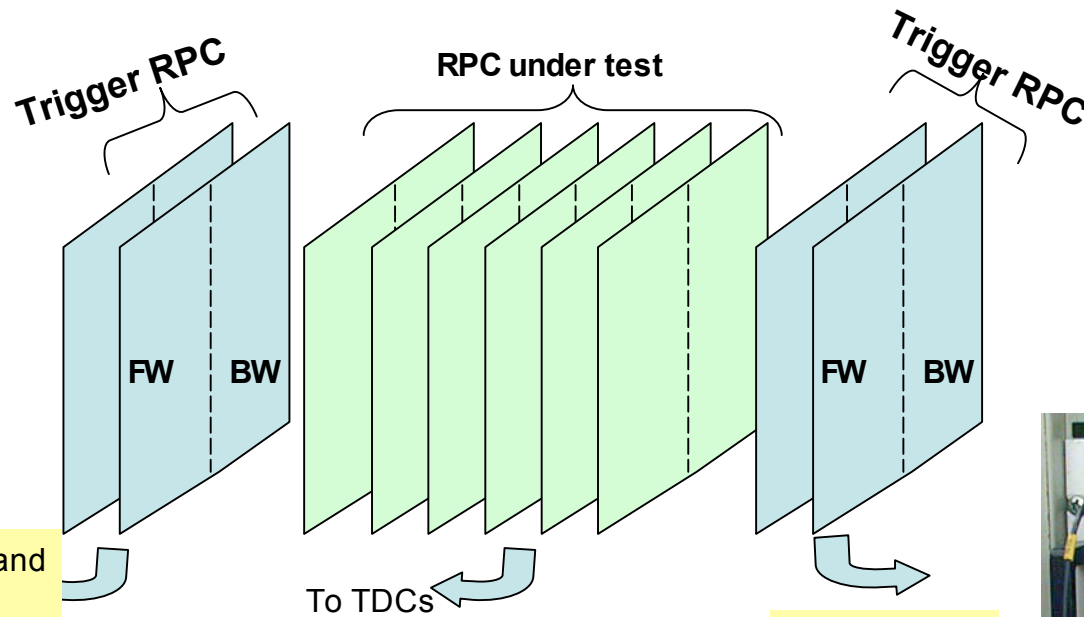
- **During data taking up to 4 chambers can be fully read-out. Upgrade at 11 chambers is ready in May**

- **A self trigger electronics will be installed in May to test cosmic rays performance**



# Test setup upgrade :data taking and trigger

- 132 SIGNAL CABLES → 11 or more chambers can be tested at the same time
- The RPC performances will be checked by triggering with cosmic rays.



The 8 home made NIM modules are interconnected with I<sup>2</sup>C bus driven by the Special Board

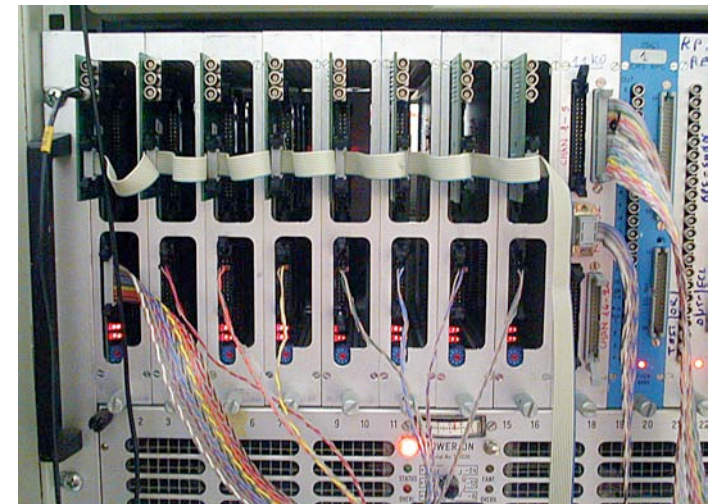
To TDCs and Trig. logic

To TDCs

To TDCs and Trig. logic

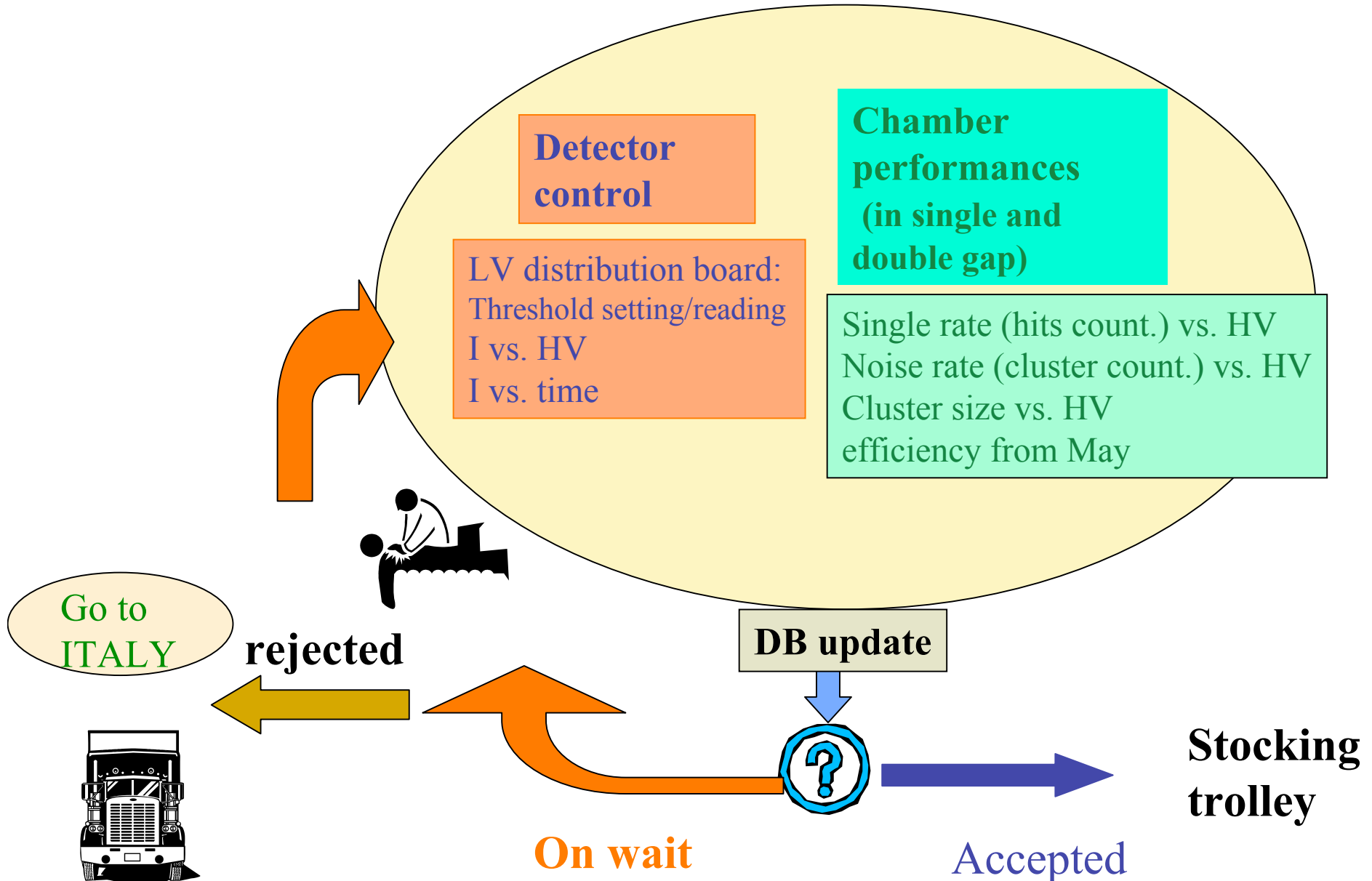
## NEW NIM Module

- OR of 96 strips on NIM and LVDS
- Mask noisy channels
- Majority level selectable on the front panel
- NIM Trigger output - NIM Veto input



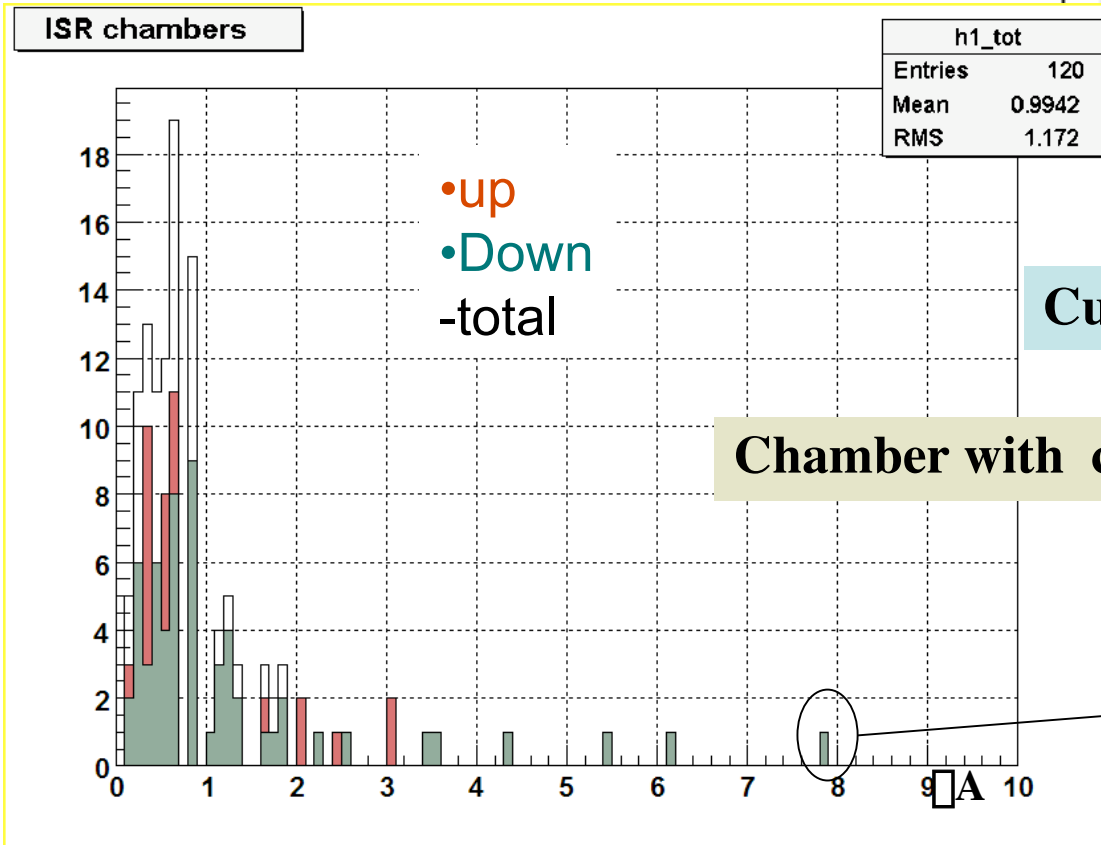
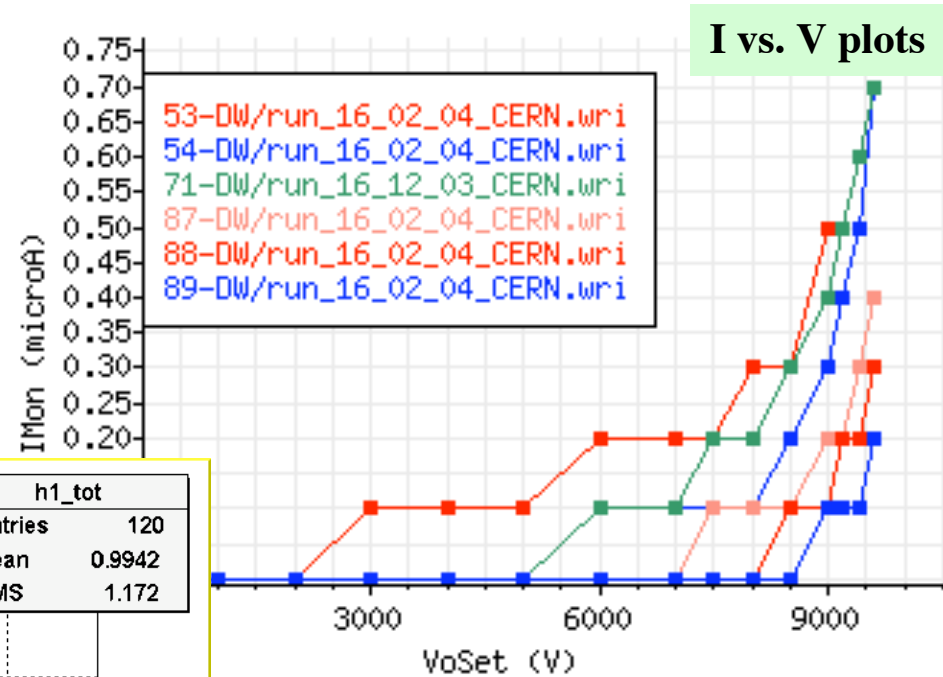
System ready in May

# Test procedures at ISR



# Results: Currents

- I vs. V plots during the tests
- Current stability for ~15-20 days
- Chambers suspicious have been monitored for > 1 month



Current@9400 V

Chamber with current/layer > 10  $\mu$ A are rejected

Chamber ID 102: suspicious!  
Long time monitoring...



# Results: Currents vs Time

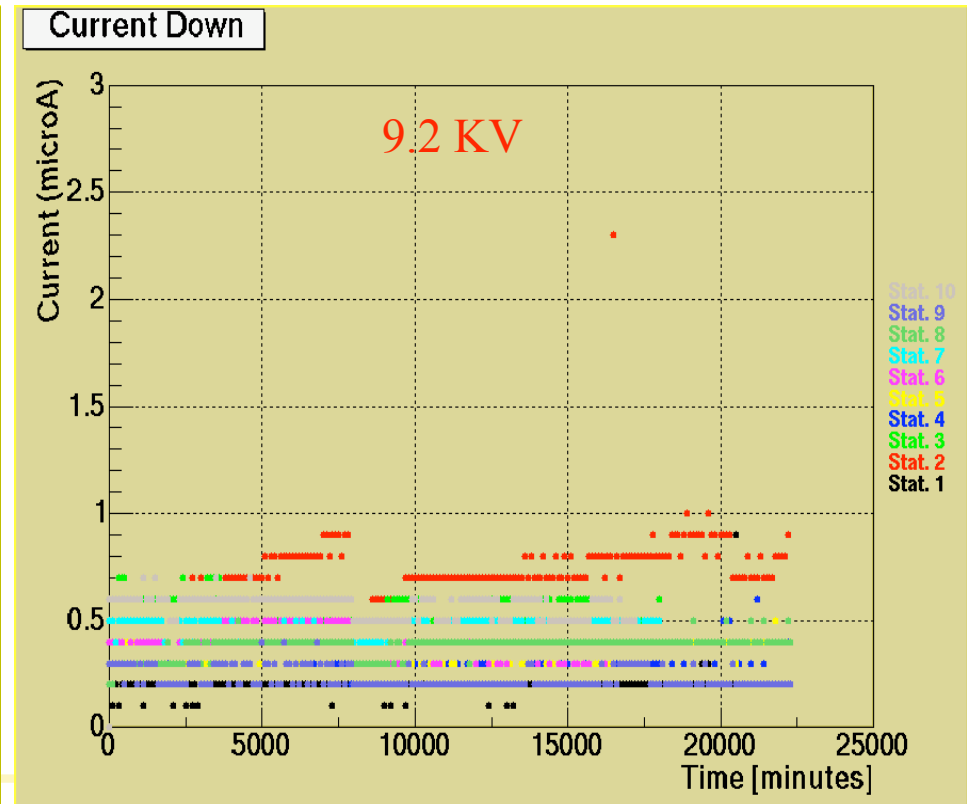
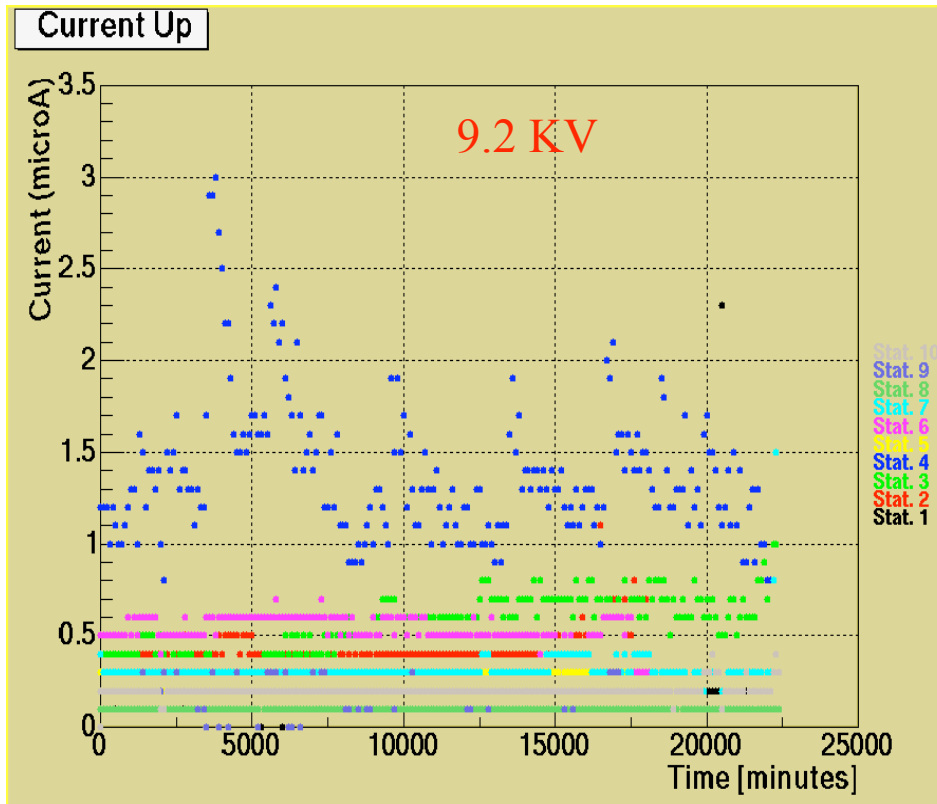
Monitor the current stability @ 9200 V vs time for at least 15 -20 days



On the test trolley for about 1 month

10 Chambers: LAYER UP

10 Chambers: LAYER DOWN

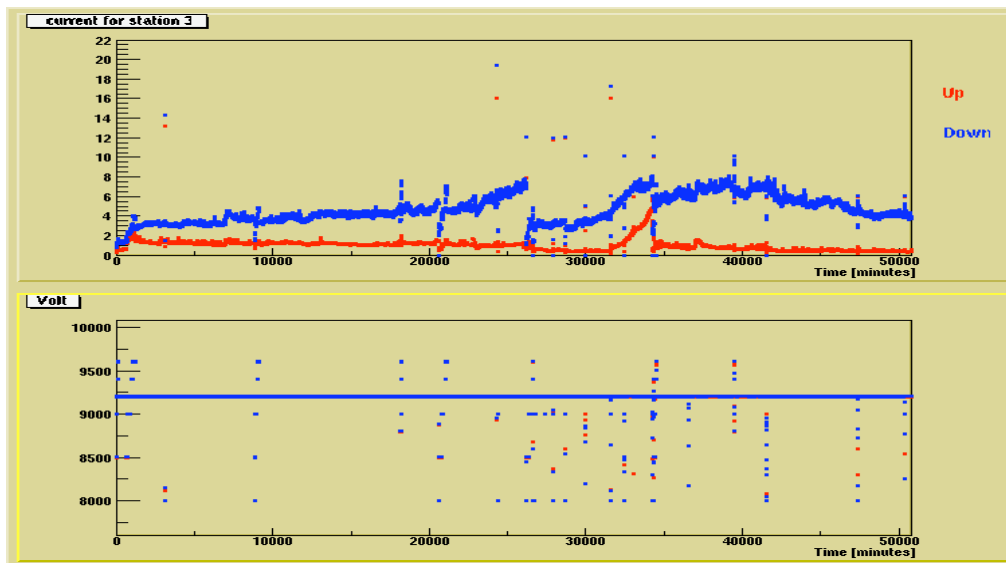


## Results: Currents vs. Time

5 rejected for steady increasing of current : chID 98 57 58 61 120

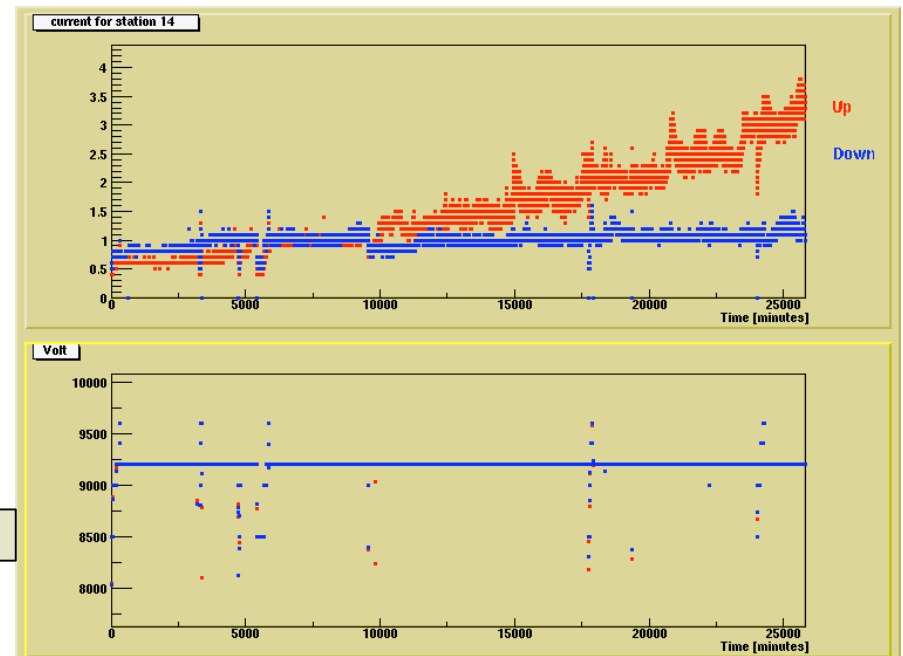
**Suspicious:** HV was switched ON too early

**New procedure since december:** flush with final gas mixture for at least 5 day before switching ON the HV.



ChID 102 under test since Nov.

Long term test OK



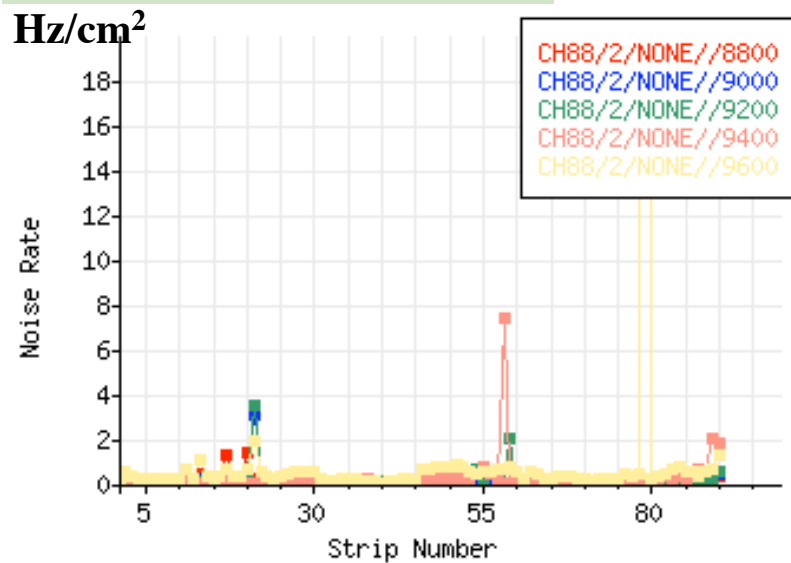
ChID 50 now under observation

## Results: noise rate

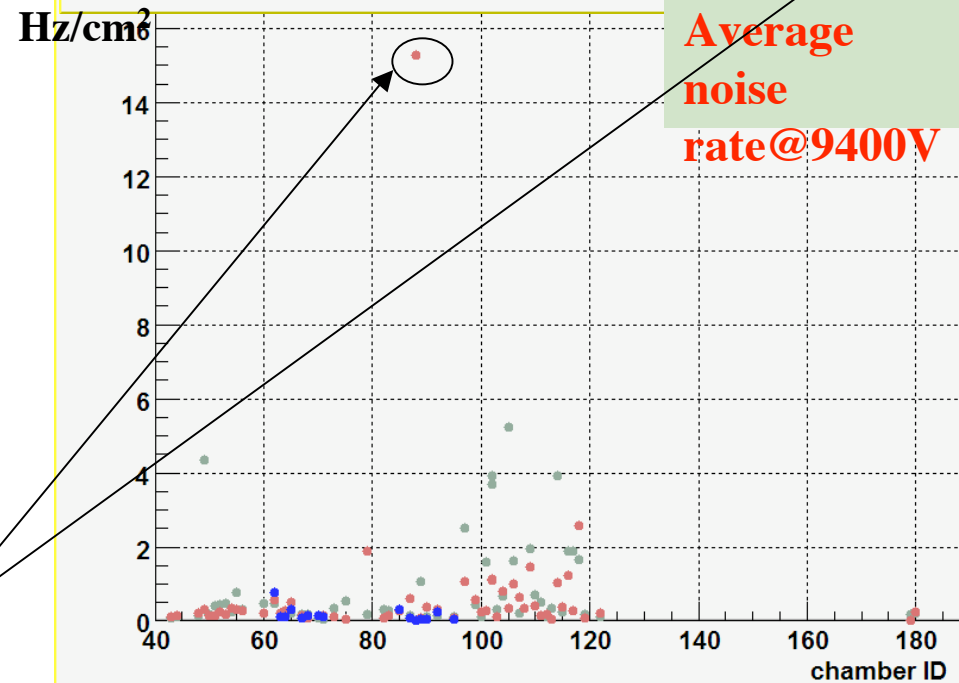
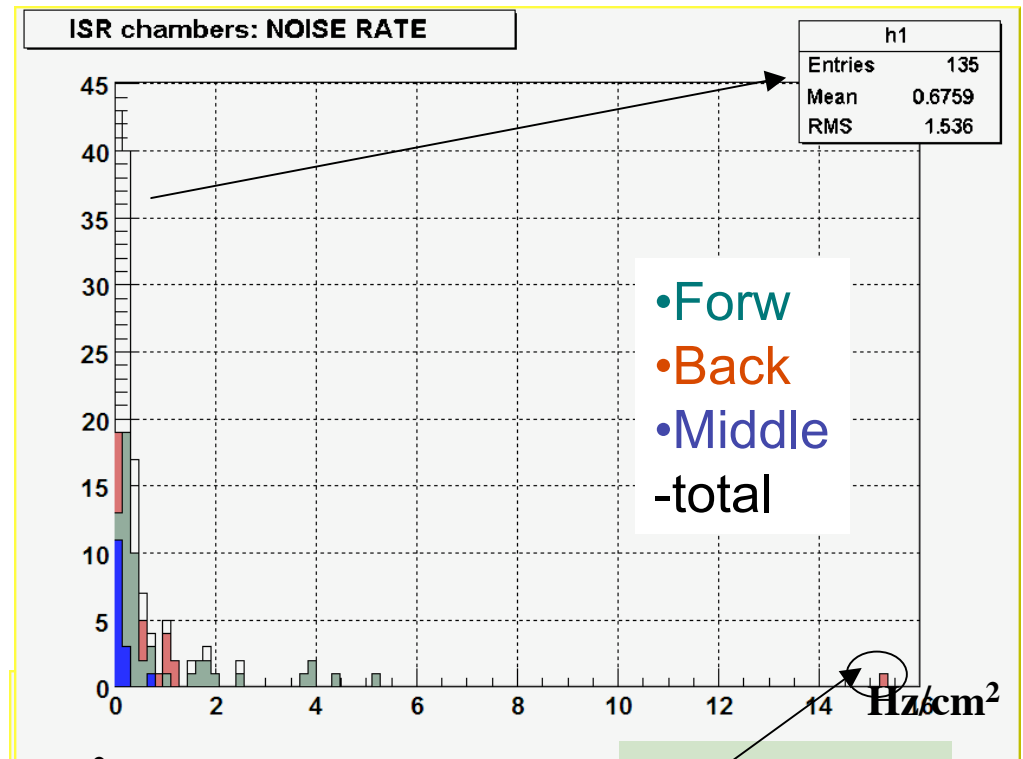
Random trigger runs in single and double gaps

- Hit rate profile: noise, dead strips
- Average noise rate by cluster counting

Hit rate profiles chID 88 between 8.8-9.6 kV



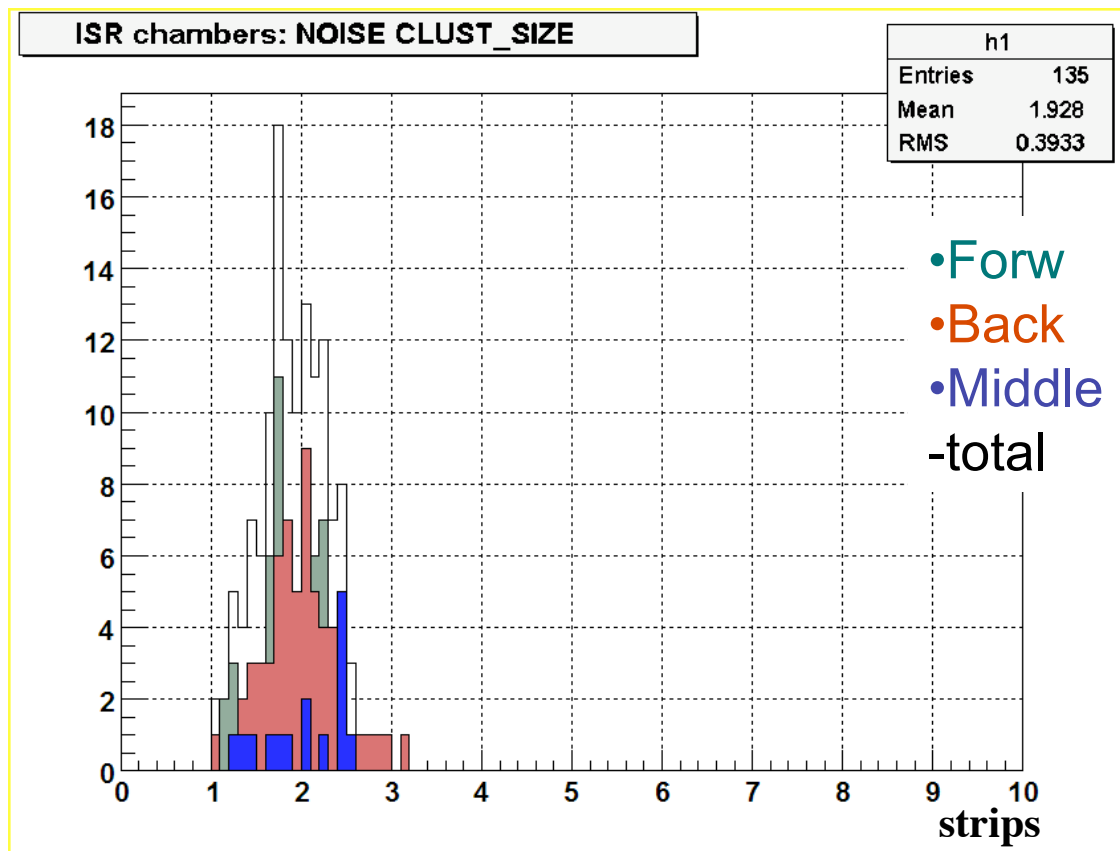
Single run with few, not continuously, noisy strips are accepted



# Results: cluster size

## Random trigger runs: cluster size in noise events

60 Forw + 60 Back + 15 Middle



## Additional work in ISR

**Known problem in first production chambers.**



**Discharge** found between the gap edge and copper ground plate. Bad soldering of the termination resistor.

An additional “C” made of PET has been added in all new production chambers

→ Copper ground plate

**20 RB3 chambers have been dis-assembled, sent in GT for the modification and re-assembled at ISR**

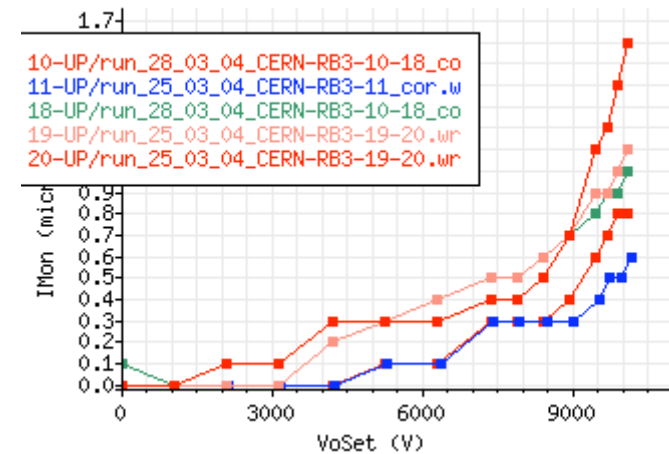
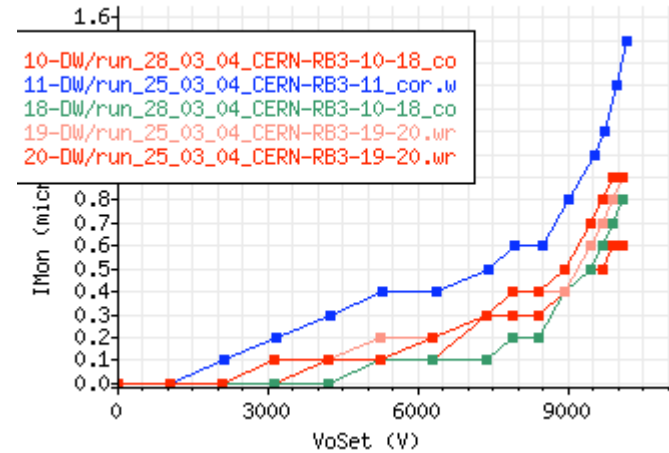
New gas “custom T junctions” in polycarbonate have been also inserted during the reassembling



## Fast tests on the 20 assembled chambers

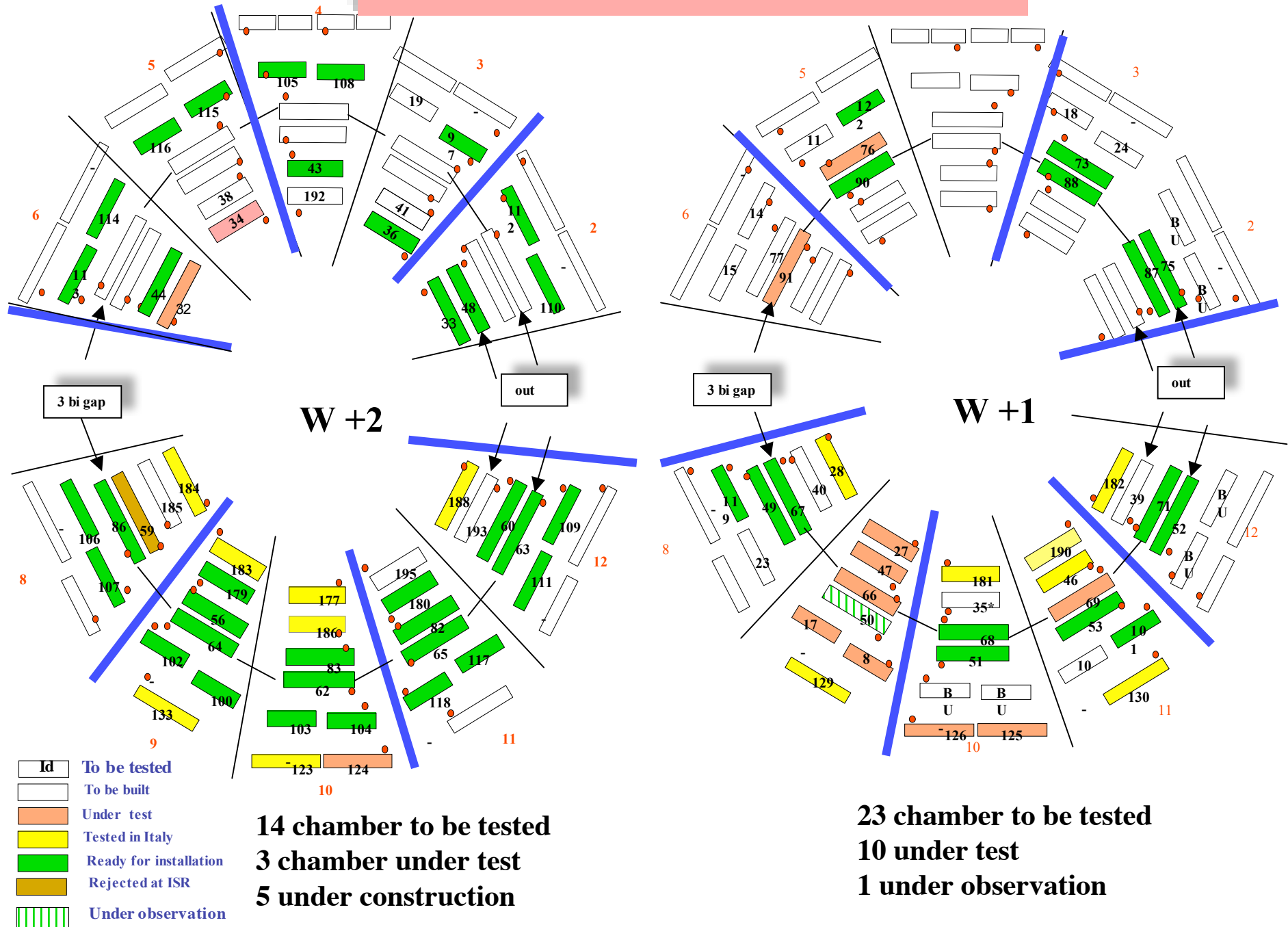
At ISR:

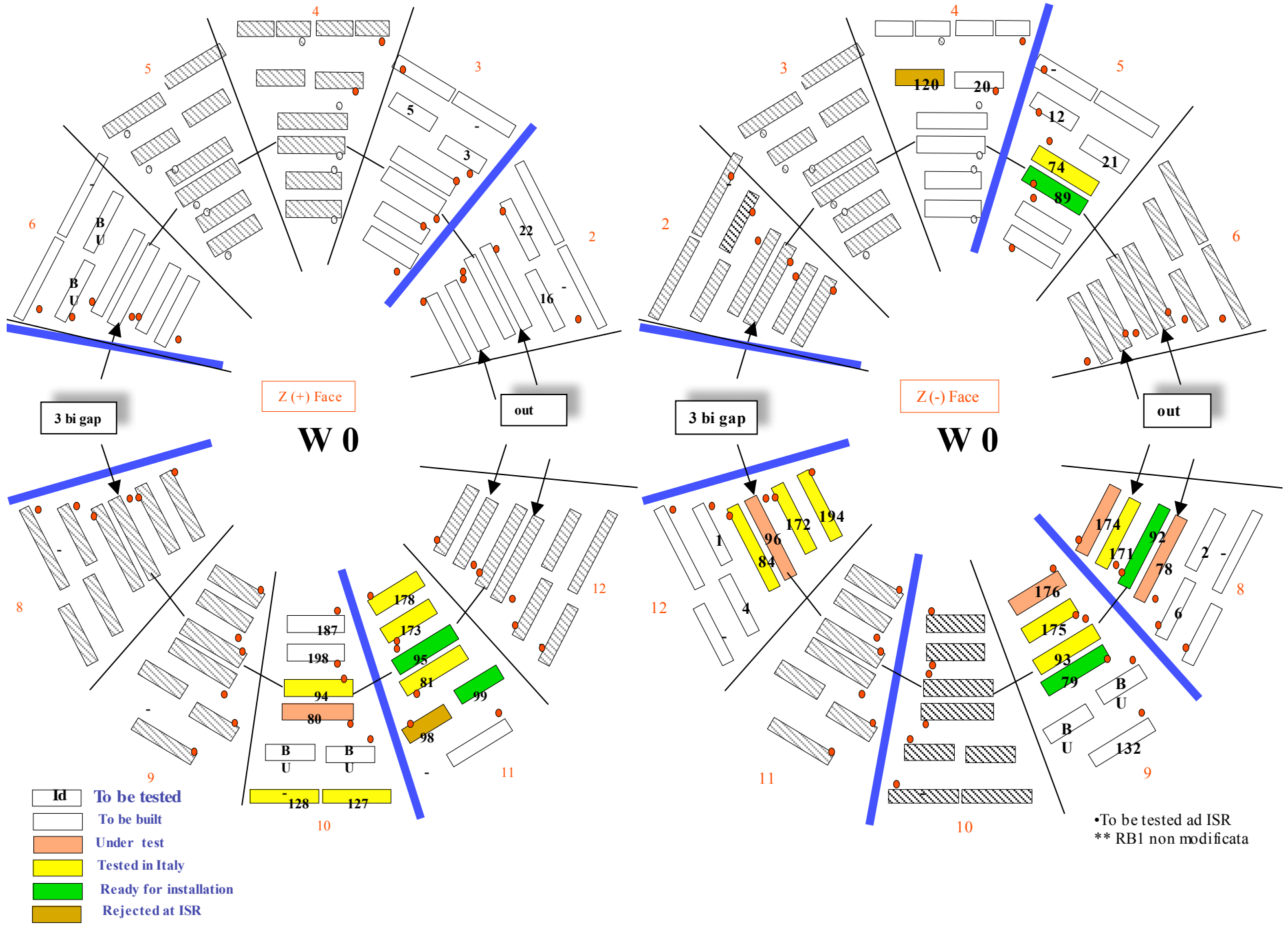
- LV+ CONTROL BOARD CARD
- I vs V plots



- 8 chambers are now under the cosmic test in Bari.
- 12 chambers will be fully tested at ISR

# RPC readiness for the installation

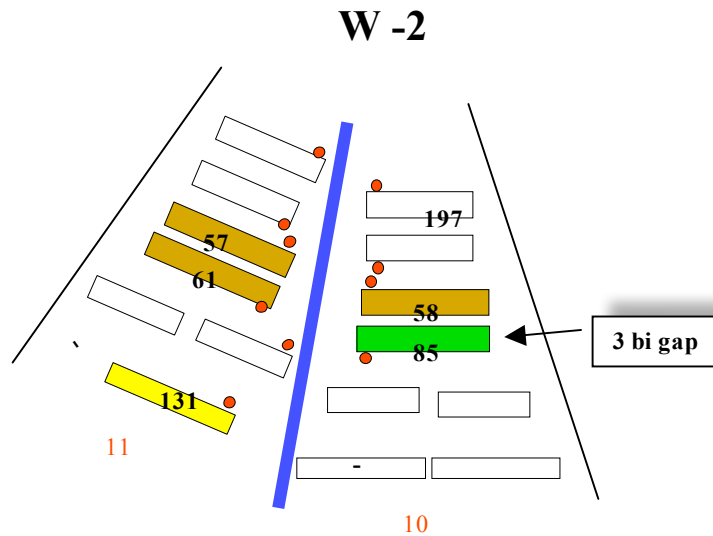






# Comments

## W+2



- W0 RB1 chamber will be modified at ISR to be used in W+2

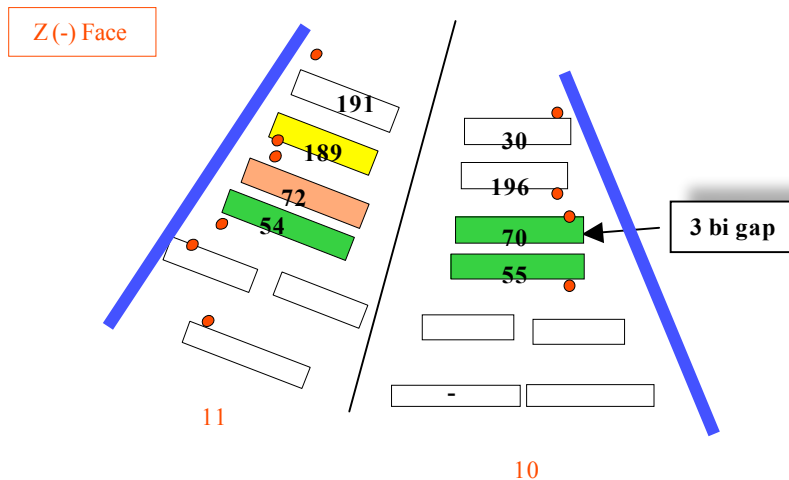
- The test of some RB1s at ISR is delayed because of HV connector need to be installed. Test foreseen to start middle/end of May

- All the remaining RB1 chambers are under test in Pavia

- RB4/sect.11-4 under construction

- 2 RB4 tested but still in Bari

- Rejected chamber chID 59: new chamber has been assembled in Bari



## W+1

- 6 RB3 have been assembled and under test in Bulgaria and 8 RB3 under test in Bari

- 4 RB1 under test in Pavia

**All missing chambers for first installation in W+2 must stay at ISR within end of May**

## Final work before coupling

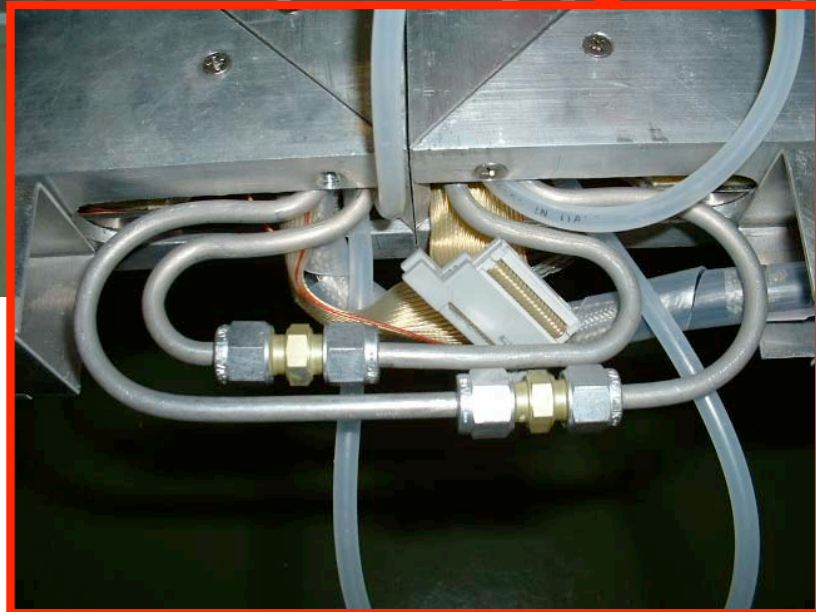
Chamber passing the tests are **ready for installation**

- Grounding straps
- Cable covers



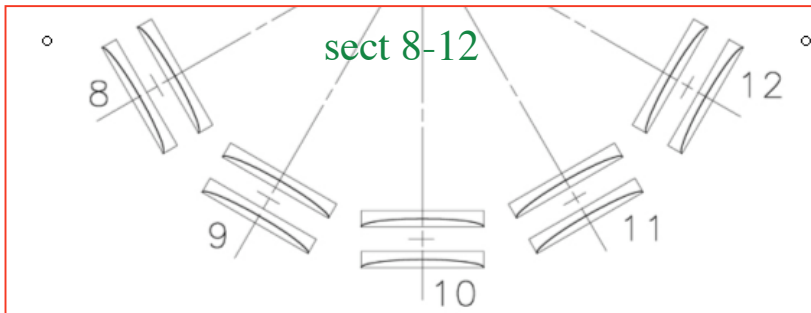
- Cooling system test with final connectors

**The two RB3 will be jointed (gas & cooling pipes, LV cables) on the MB3**



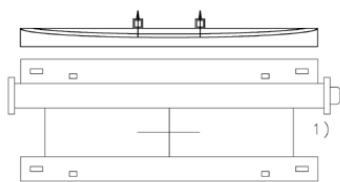
**Full RB3: jointing zone  
gas and cooling pipes**

# RPC coupling to DT and pre-load compensation



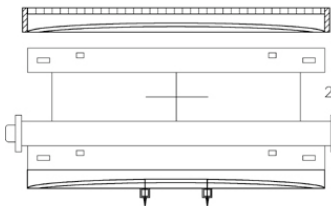
ASSEMBLAGGIO RB-DT  
dal settore 8 al 12

## 1st step



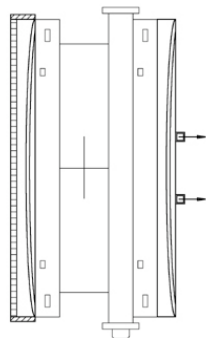
- 1) Posizionare e agganciare RB OUT su DT dopo aver preventivamente fissato le barre di trazione sulle barre precaricate.

## 2nd step



- 2) Dopo aver ruotato la stazione di 180°, posizionare e agganciare RB IN su DT. Montare pannelli di contenimento delle barre precaricate.

## 3rd step



- 3) Ruotare la stazione di 90°. Trasportare alla zona di montaggio.



**3 compensating planes needed for each RPC-DT-RPC system (MB1-MB2-MB4 stations)**

**24 compensating planes available for RB2 chambers**  
**24 planes for RB1** } **Ready end of May**

## Test before installation

After the coupling need to check incidental problems:

- **Major gap problem**

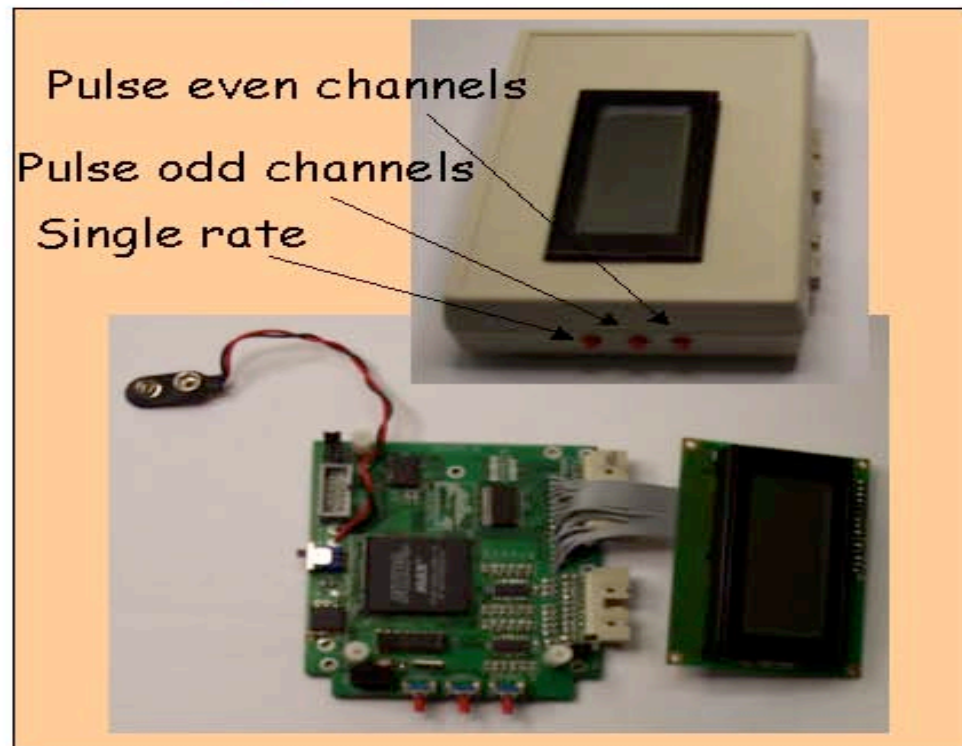
gas line to check if gas is flushing

- **Major electrics problem : shorts circuits etc**

Fast check of current: HV  
(2000-3000 V) & LV

- **Strip connectivity and FEBs**

288 channels frequency-meter  
realized by Naples group:  
Fast test of all the electronic  
channels of the chamber.



**Need to repeat the same checks at SX5 after the transport**

## Conclusions

- **116 chambers in ISR**
- **65 fully tested**
  - **59 chambers ready for installations**  
very good performance in term of currents – noise rate and profile–  
cluster size
  - 5 chambers rejected due to high current**
  - 1 under observation**

**Big effort is requested in all test site to finish the tests of all chambers for the first installation in June.**

**In ISR system upgrades allow to improve the quality and speed up the tests:  
Many gas and HV, LV lines, new trigger system**

**ISR test site Goal > 15 chamber/ month**

**After the coupling and after the transport at SX5 it is mandatory the checks of HV, LV and strip connectivity.**