

Cosmic ray test certification of the first 100 CMS endcap RPCs and the corresponding construction database

On behalf of

A. Ball, J-P. Chatelain, I. Crotty, A. Sharma, W. Whitaker
CERN CH 1211, Geneva, Switzerland

Y. Ban, J. Cai, H. Liu, S. Qian, Q. Wang, Y. Ye, J. Ying
Peking University, Beijing, China

B. Hong , S. J. Hong , K. S. Lee, S. Park, K. S. Sim,
KODEL, Seoul, S. Korea

W. Van Doninck¹,
Vrije Universiteit Brussel, Brussels, Belgium

S. Akimenko¹
IHEP, Protvino, Russia

A. Marinov¹
University of Sophia, Sophia, Bulgaria

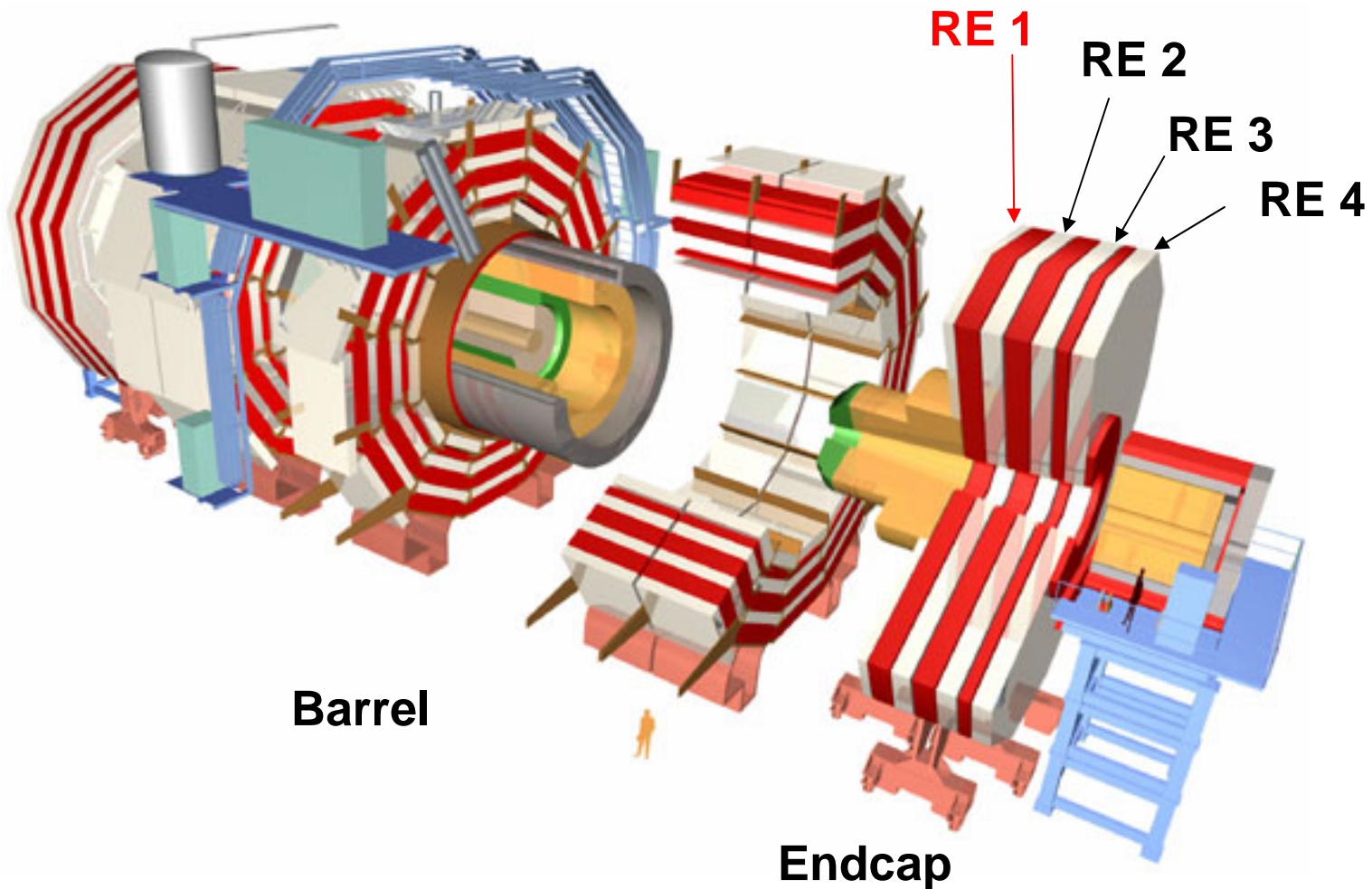
Z. Aftab, M. S. Khan, T. Solaija
Pakistan Atomic Energy Commission, Islamabad, Pakistan

A. Colaleo, G. Iaselli, F. Loddo, M. Maggi
INFN Bari, Italy

¹ presently at CERN

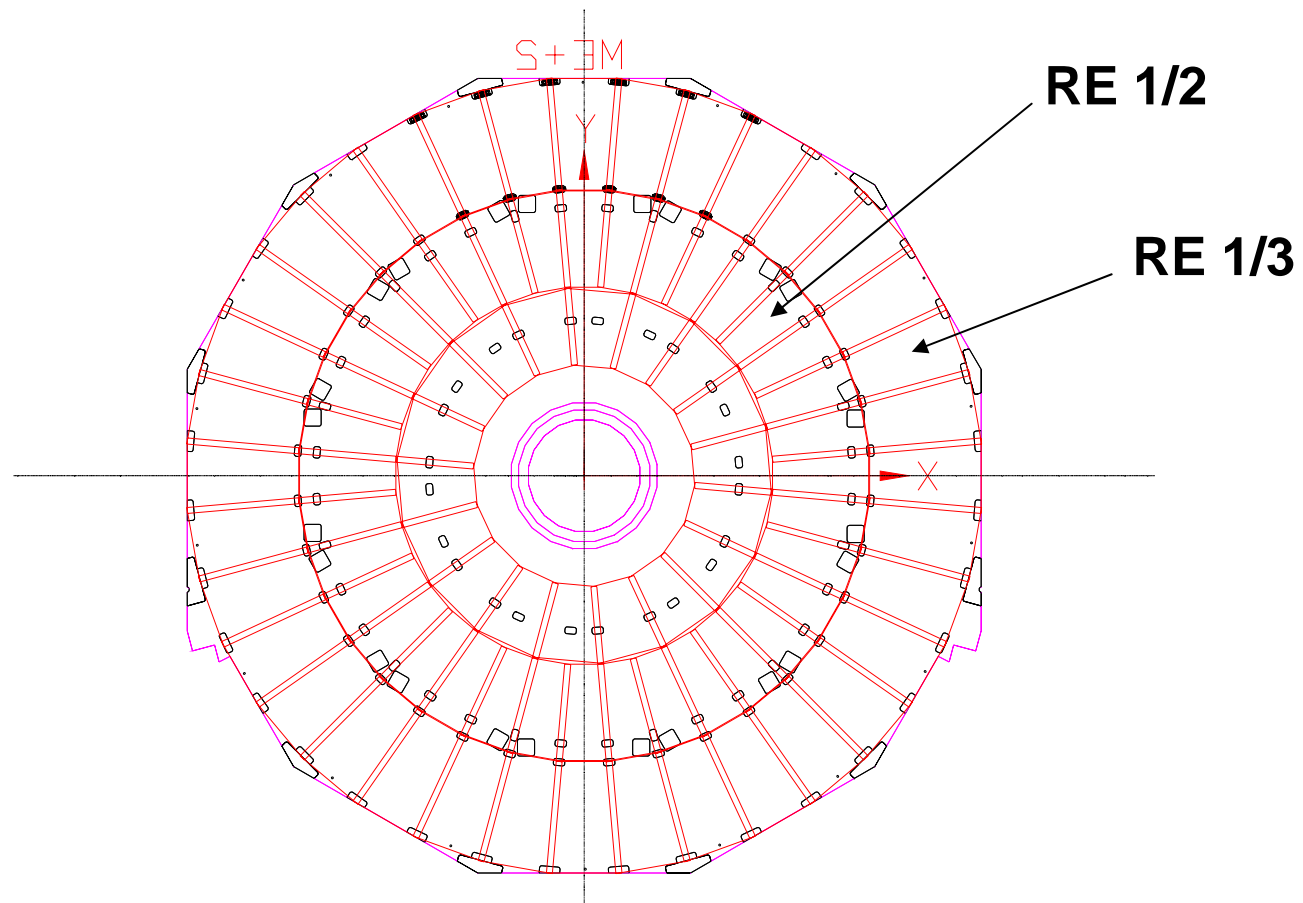
CMS Experiment

RPC construction and testing are divided into barrel and endcap regions

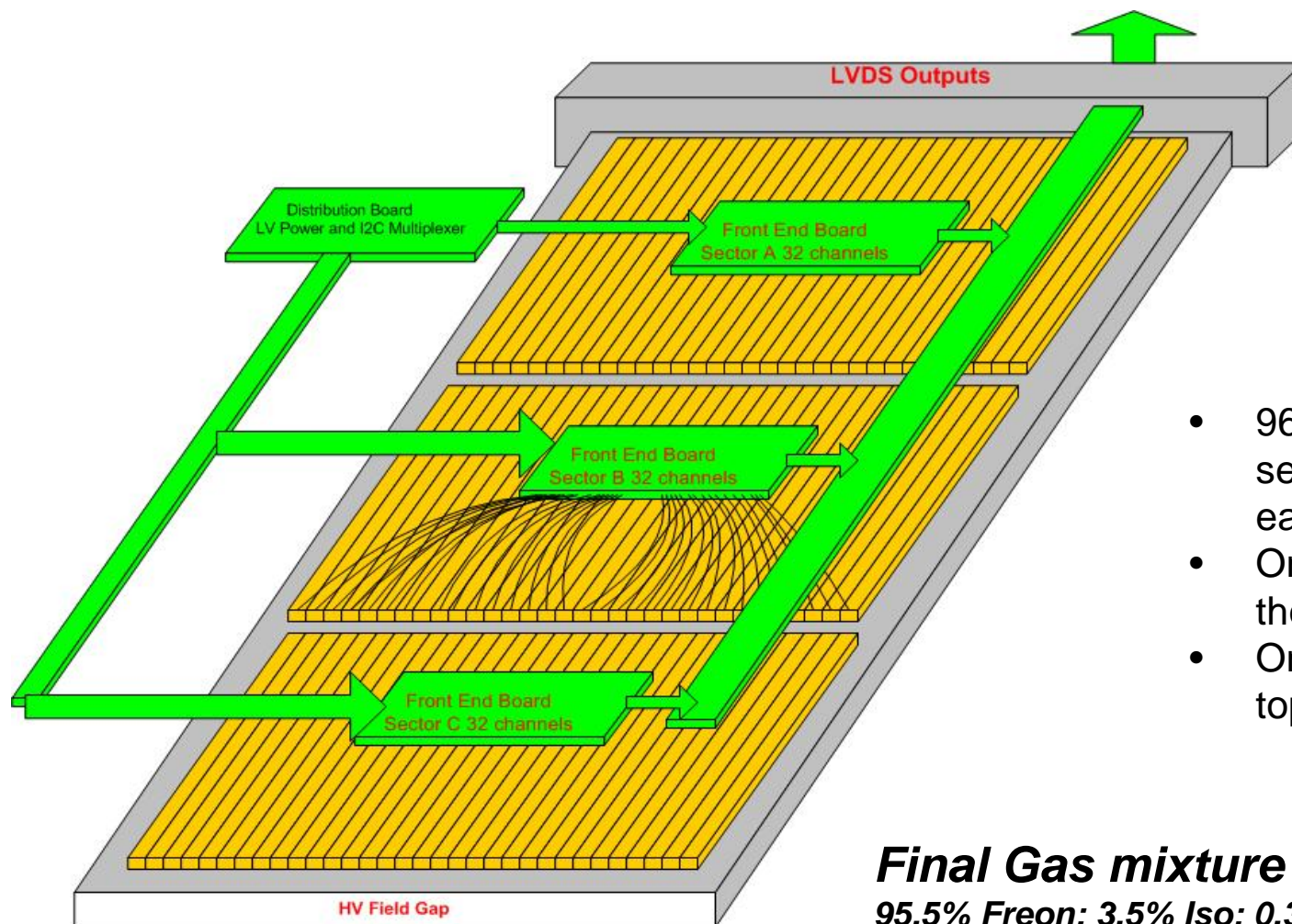


RE 1 Disk

RPCs are positioned in concentric circles



Three Trigger Sectors



- 96 Channels - 3 sectors of 32 strips each (A, B, C)
- One gas gap on the bottom
- One split gap on top

Final Gas mixture used in all tests
 95.5% Freon: 3.5% Iso: 0.3% SF6 + RH 50%

Sijian will describe construction next

W. Whitaker

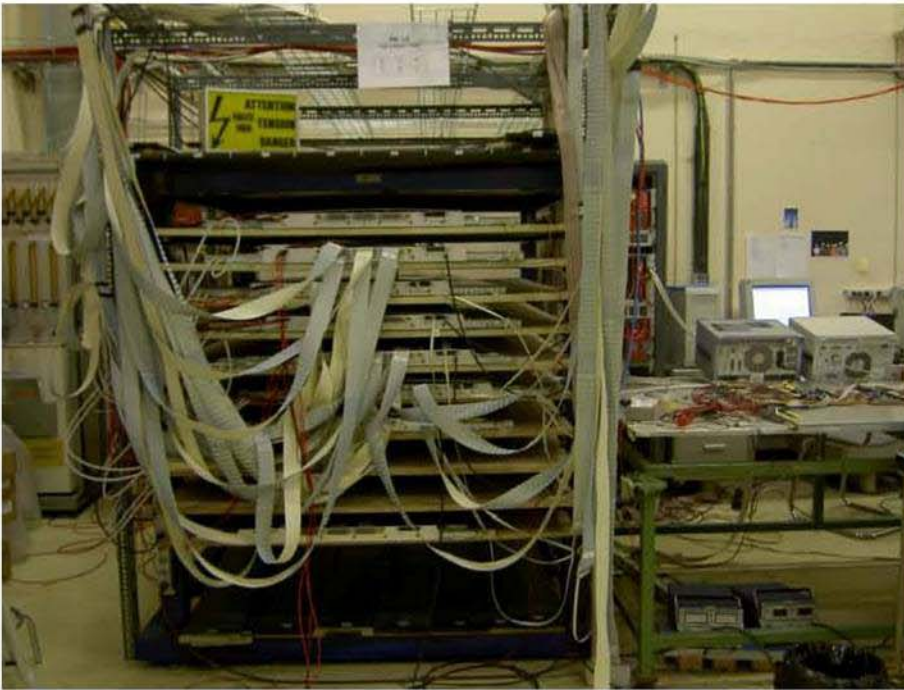
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Test Stands

Cosmic Stand

Efficiency/Cluster size



10 chambers
Round about time 3-4 days

High Voltage Monitor Stand

Long Term Stability



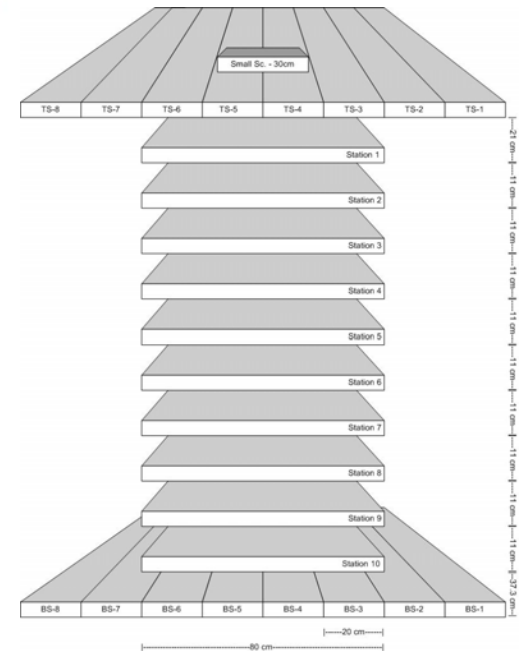
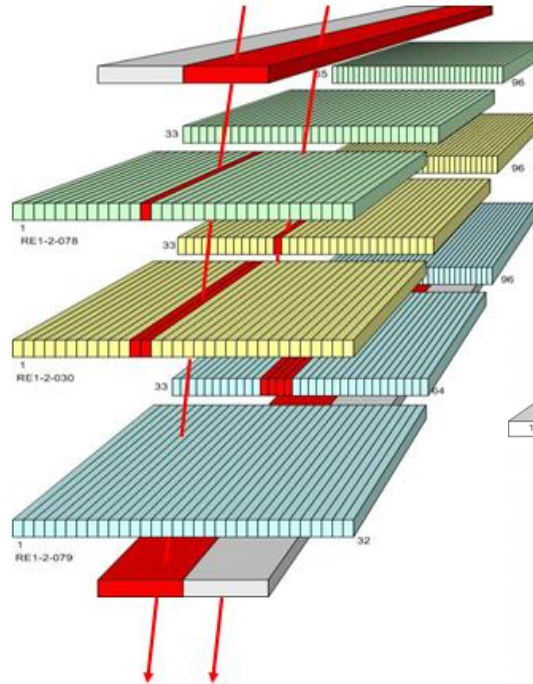
10 chambers
Round about time 7-15 days

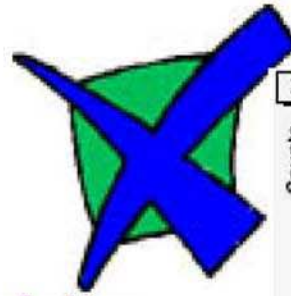
Testing with Cosmic Rays

- Cosmic stand.

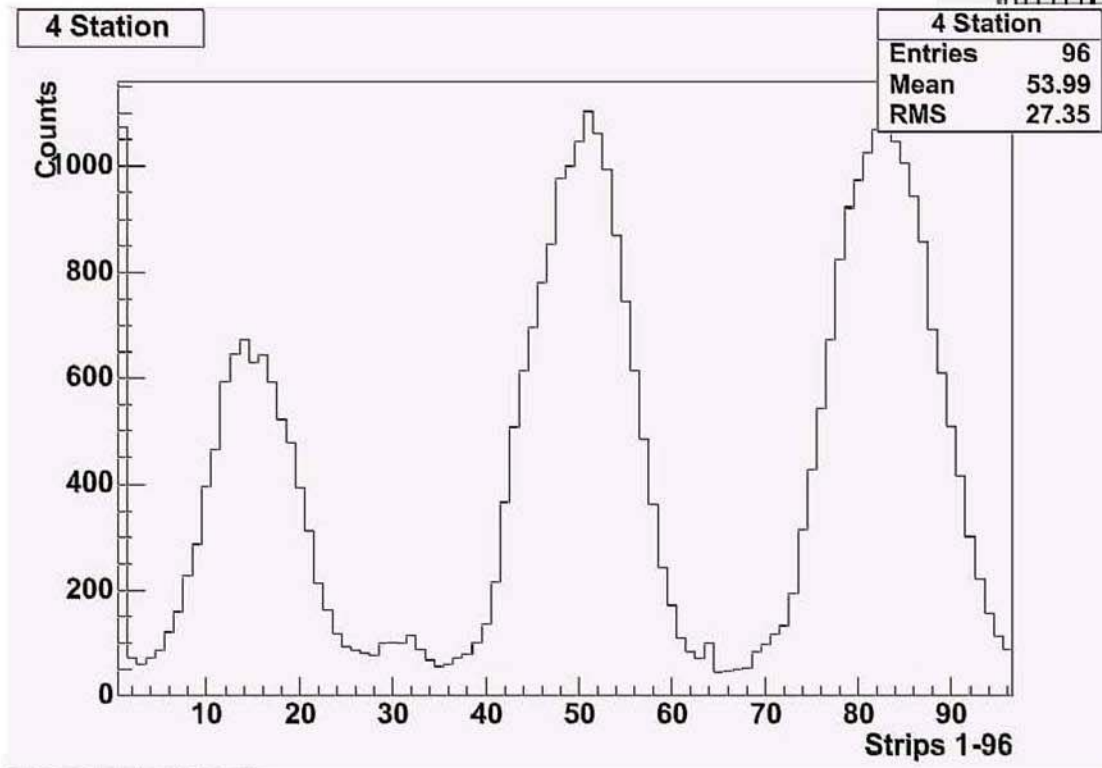
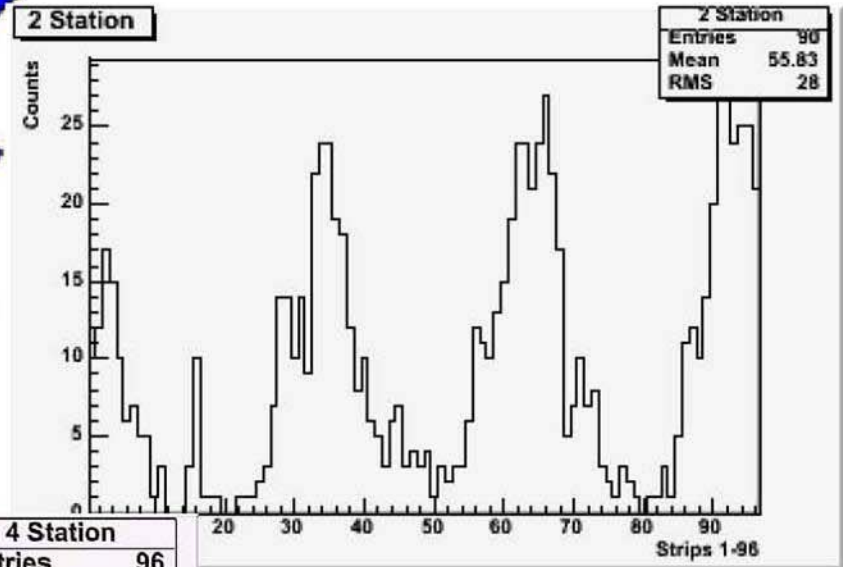
Top and Bottom layers scintillators.

Possibility to put 10 chambers inside to test them with cosmics

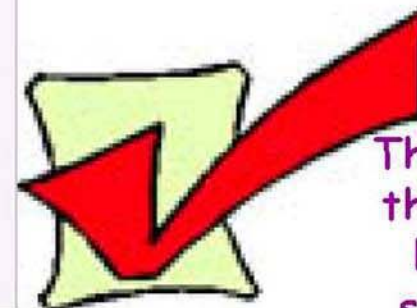




The chamber in the 2nd station has dead strips and flat signal cables connected incorrectly



Diagnostic Plots: Strip Response Profiles



The chamber in the 4th station has perfect strip response

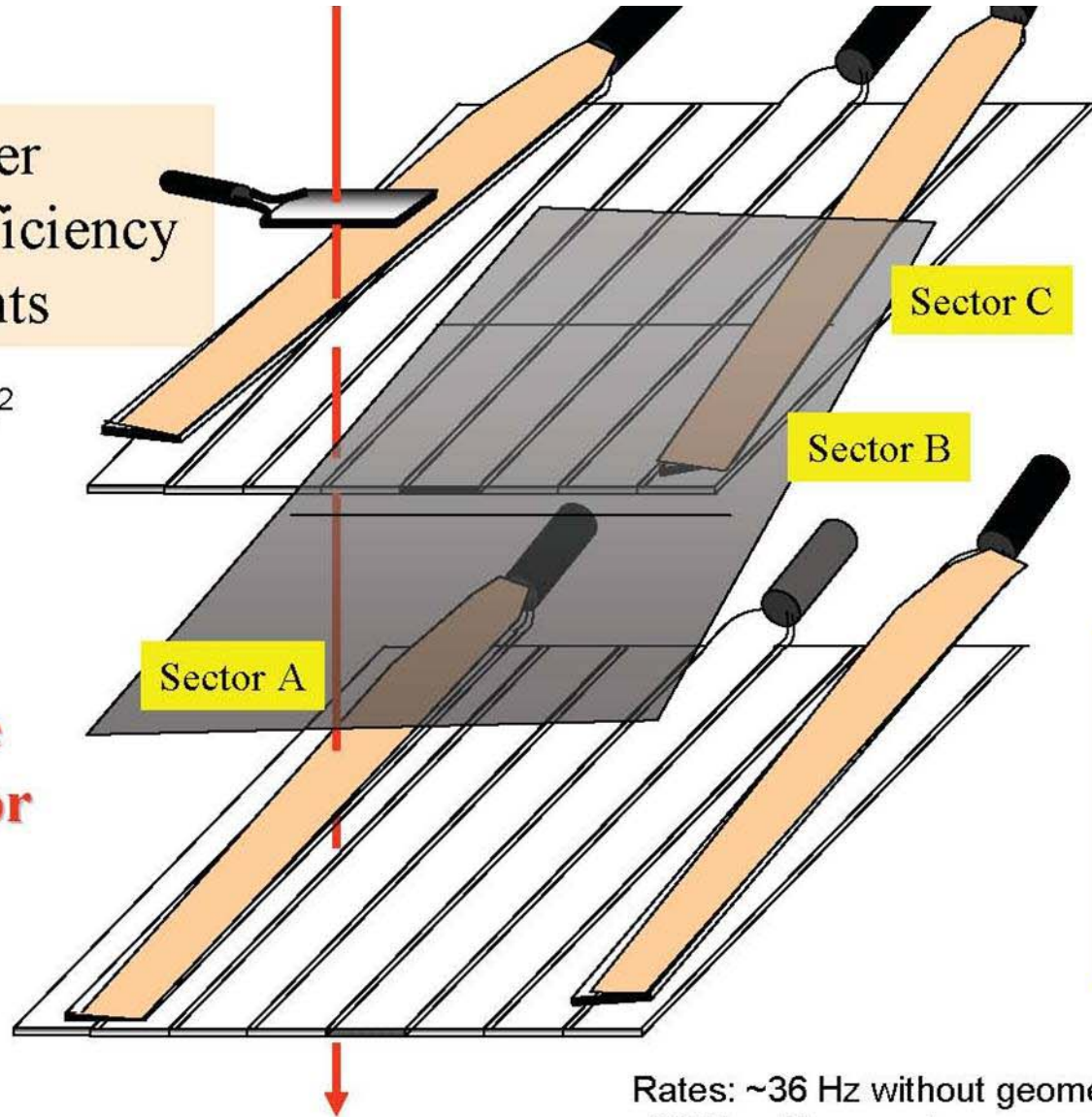


Cosmic Stand Trigger Acceptance

Small counter
For local efficiency
measurements

16 x 20 cm²

Efficiency
Cluster size
Noise profile
HV-I monitor



Sector C

Sector B

Sector A

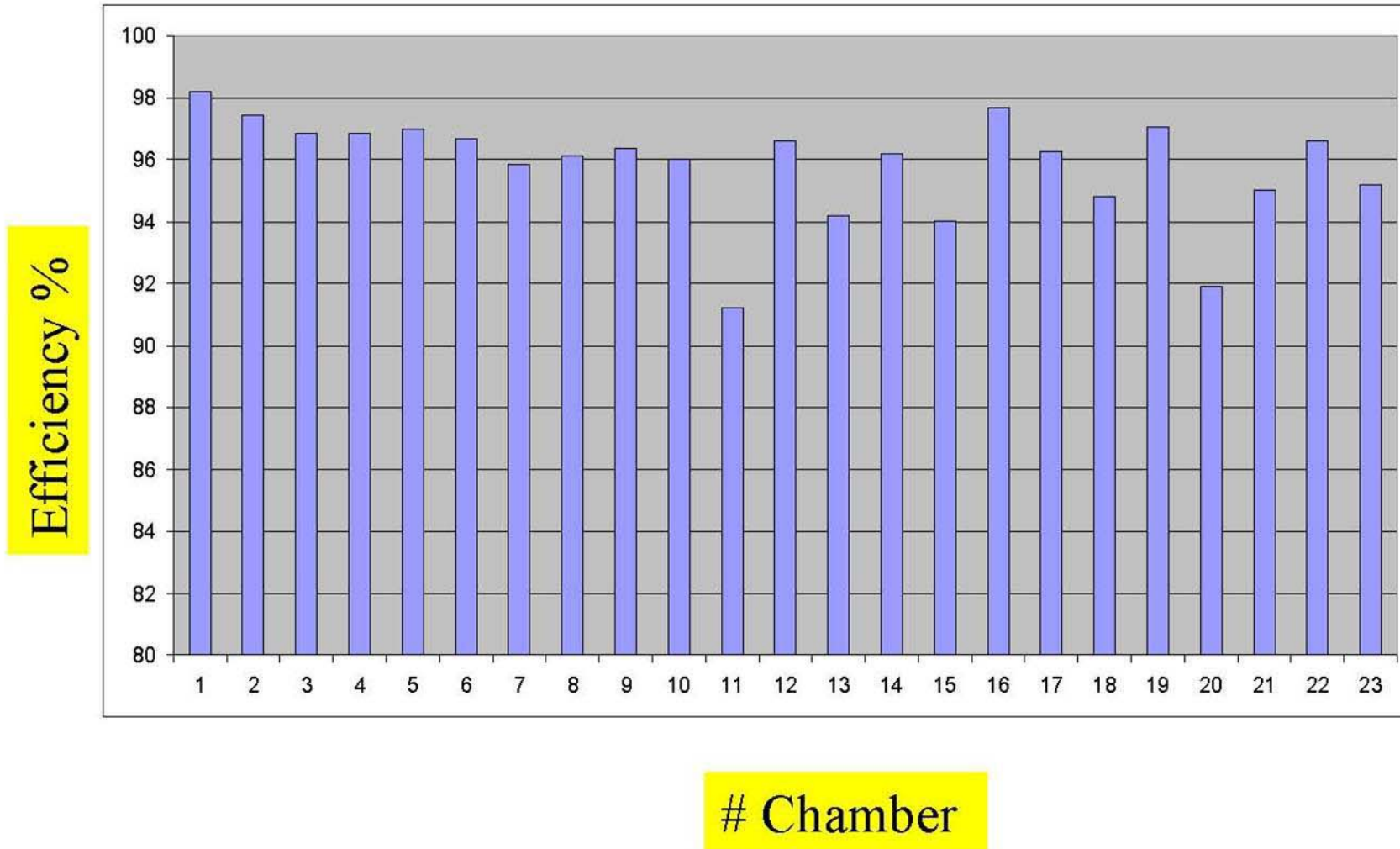
Geometry
Optimized
for
RE1/2
and
RE1/3

120cm x 180cm

Rates: ~36 Hz without geometry counters
~28 Hz with acceptance counters
0.8 – 1.2 with small local efficiency counters

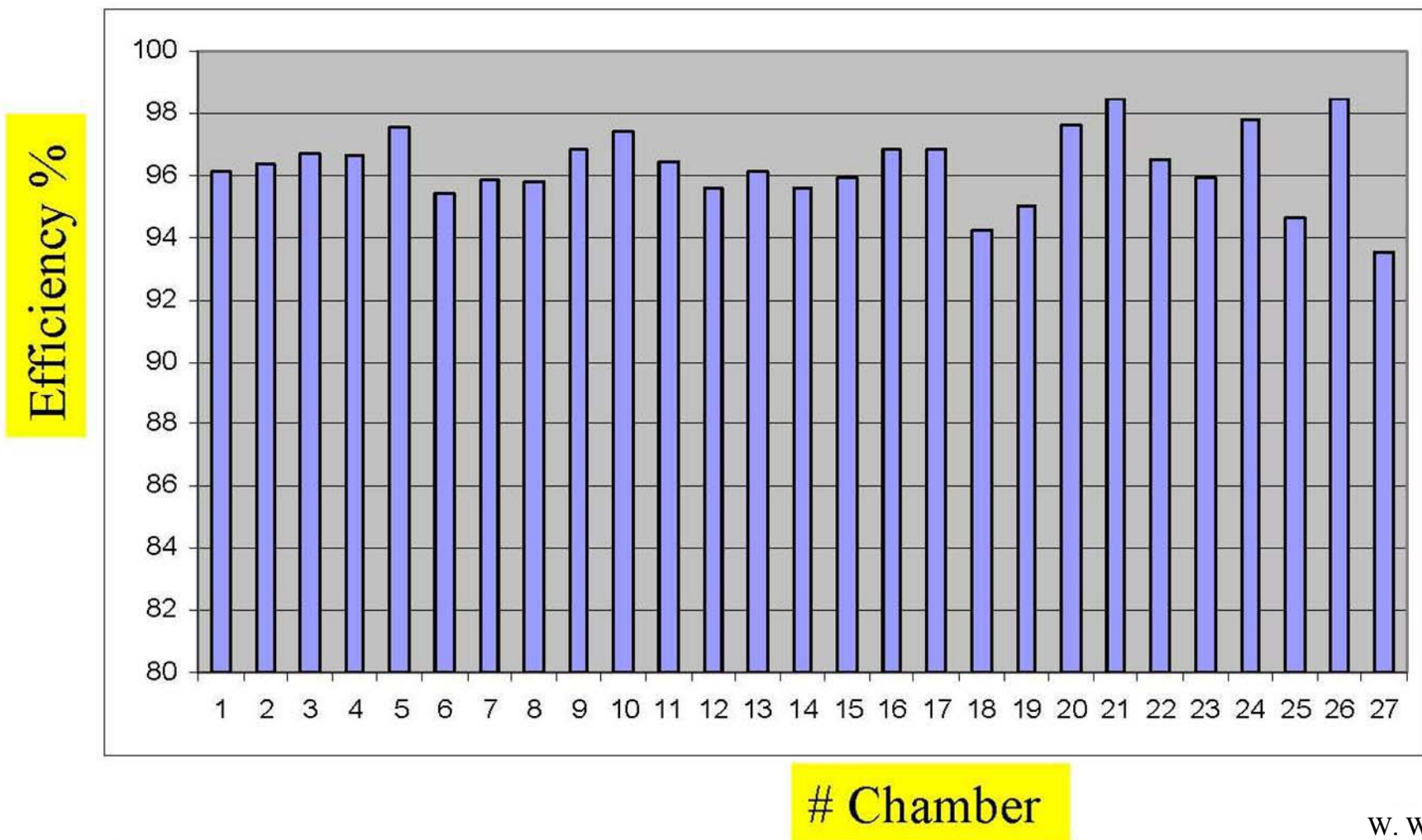


RE1/3 Efficiency at 9.3 kV





RE1/2 Efficiency at 9.3 kV



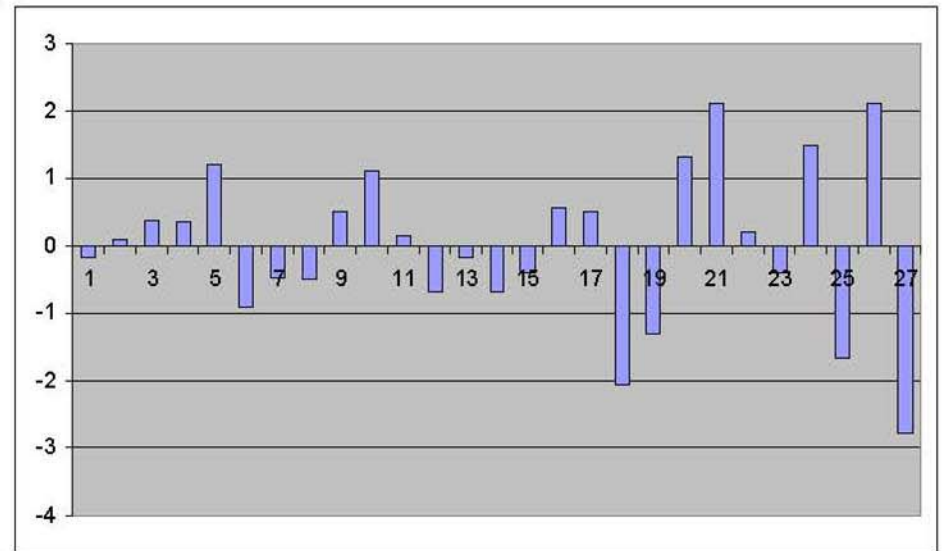
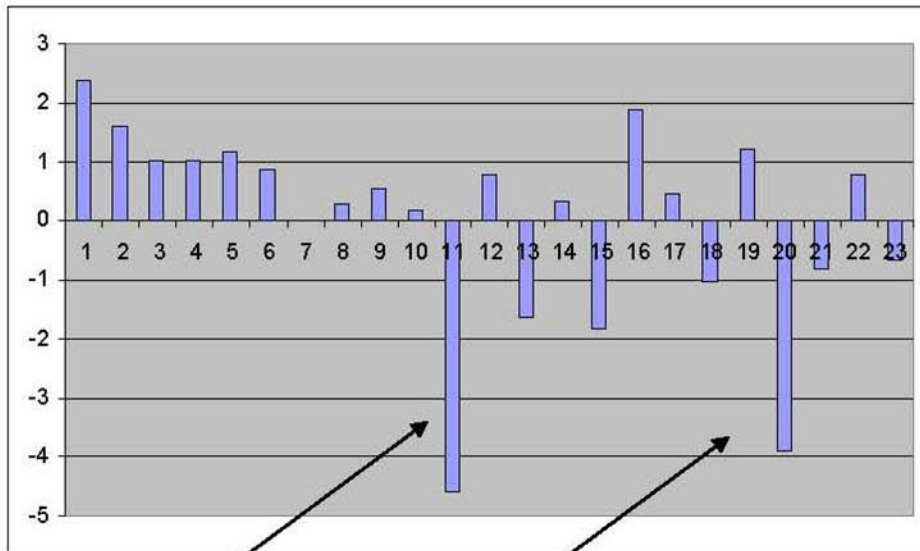


Acceptance Criteria:

Efficiency >95%

RE1/2 9.3kV

RE1/3 9.3 kV



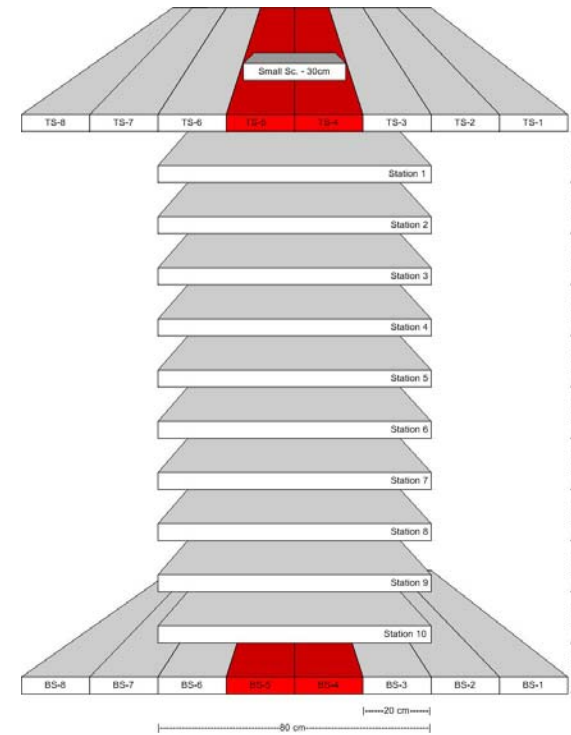
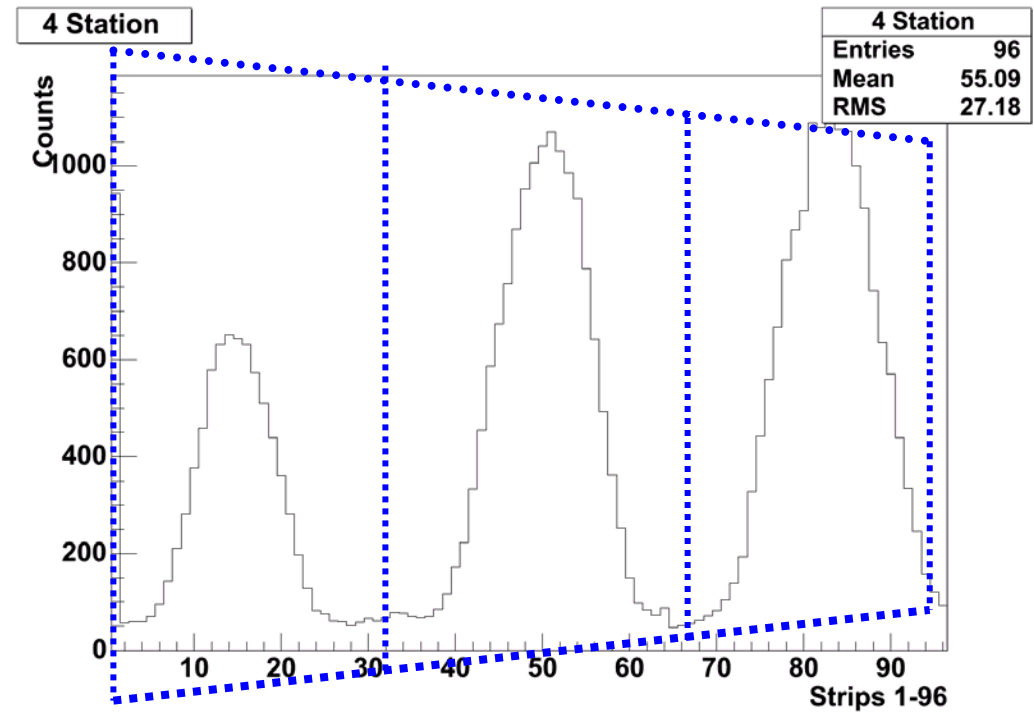
Geometry effect
On stand

No chamber rejected out of 50 tested



Data from Cosmic Test

Strips Profile

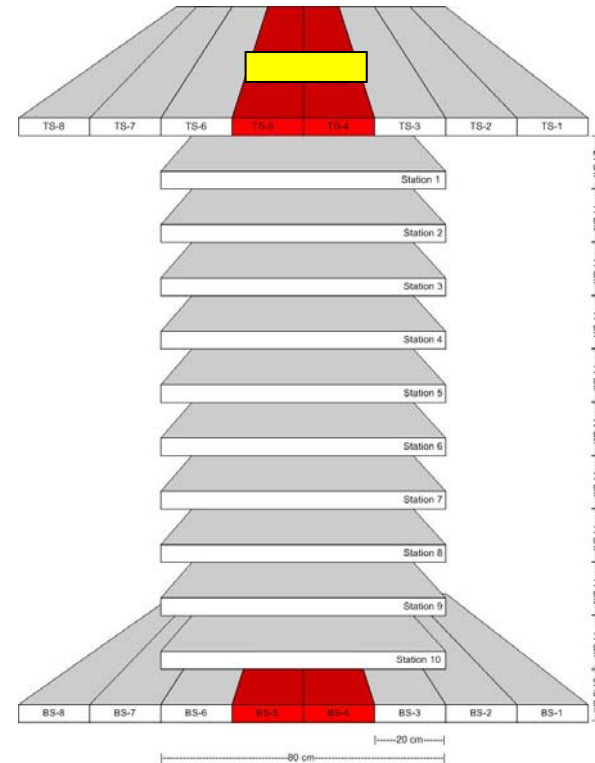
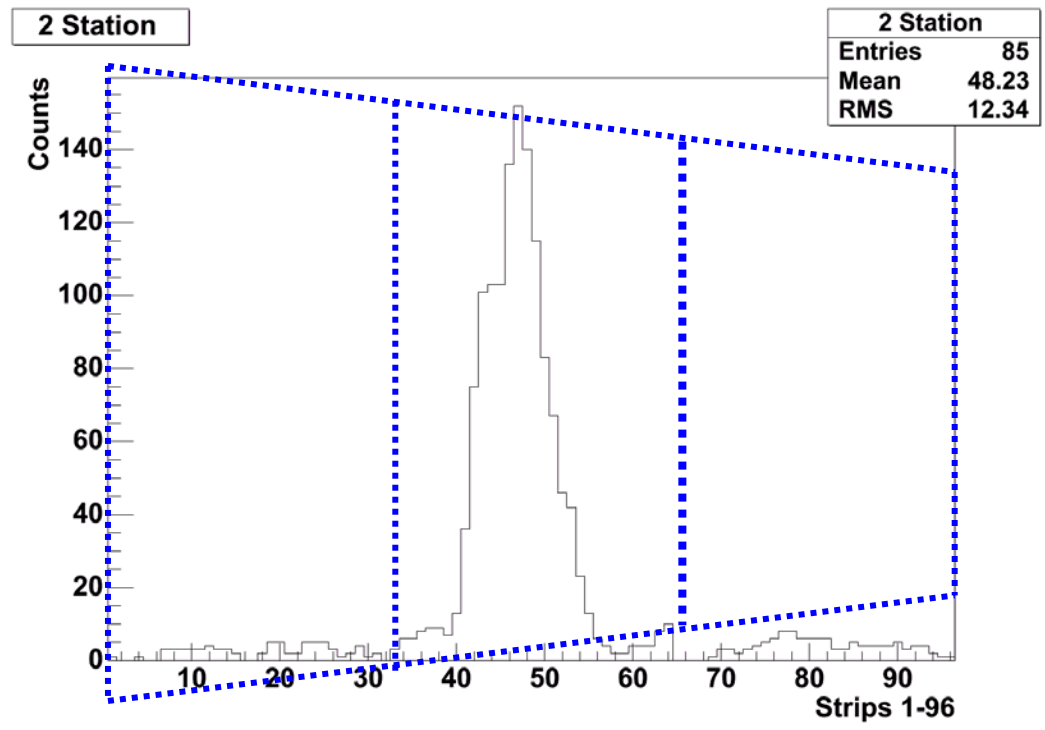


Using only 2 scintillators from the top and 2 from the bottom layer



Data from Cosmic Test

Strips Profile

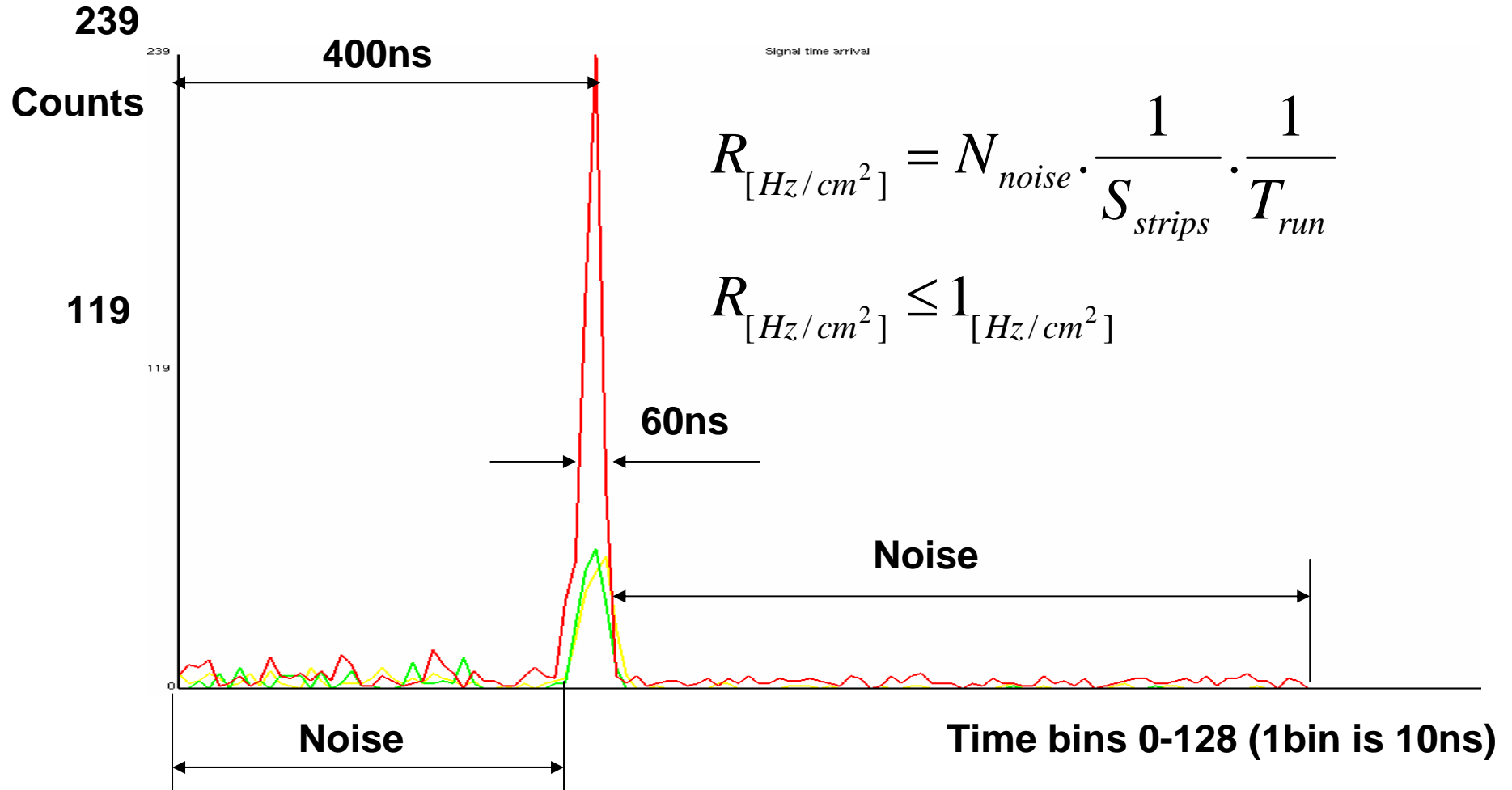


Coincidence with 2 scintilators from top, 2 from bottom and small counter placed on sector B.



Data from Cosmic Test

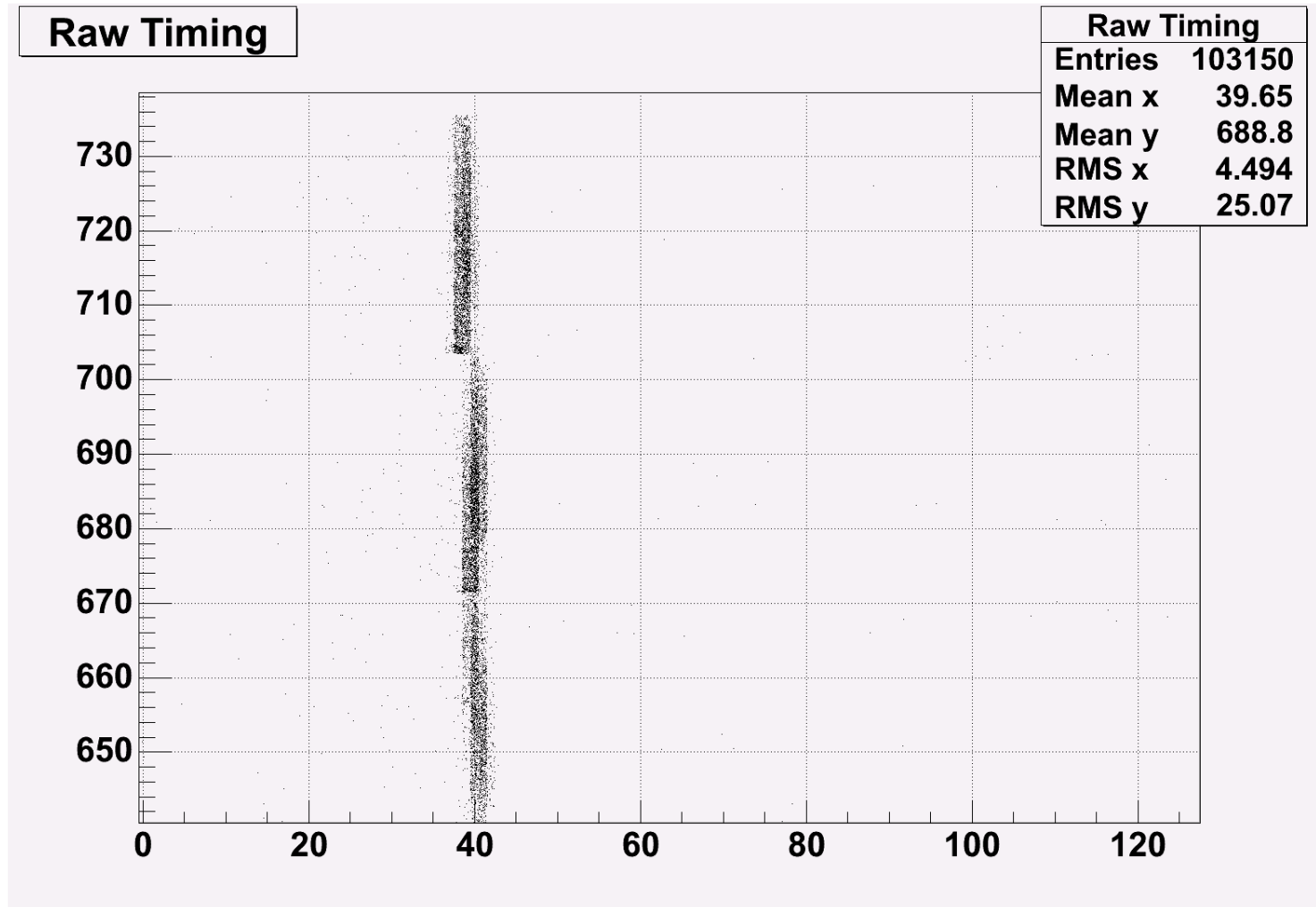
Noise Rate and Time distribution





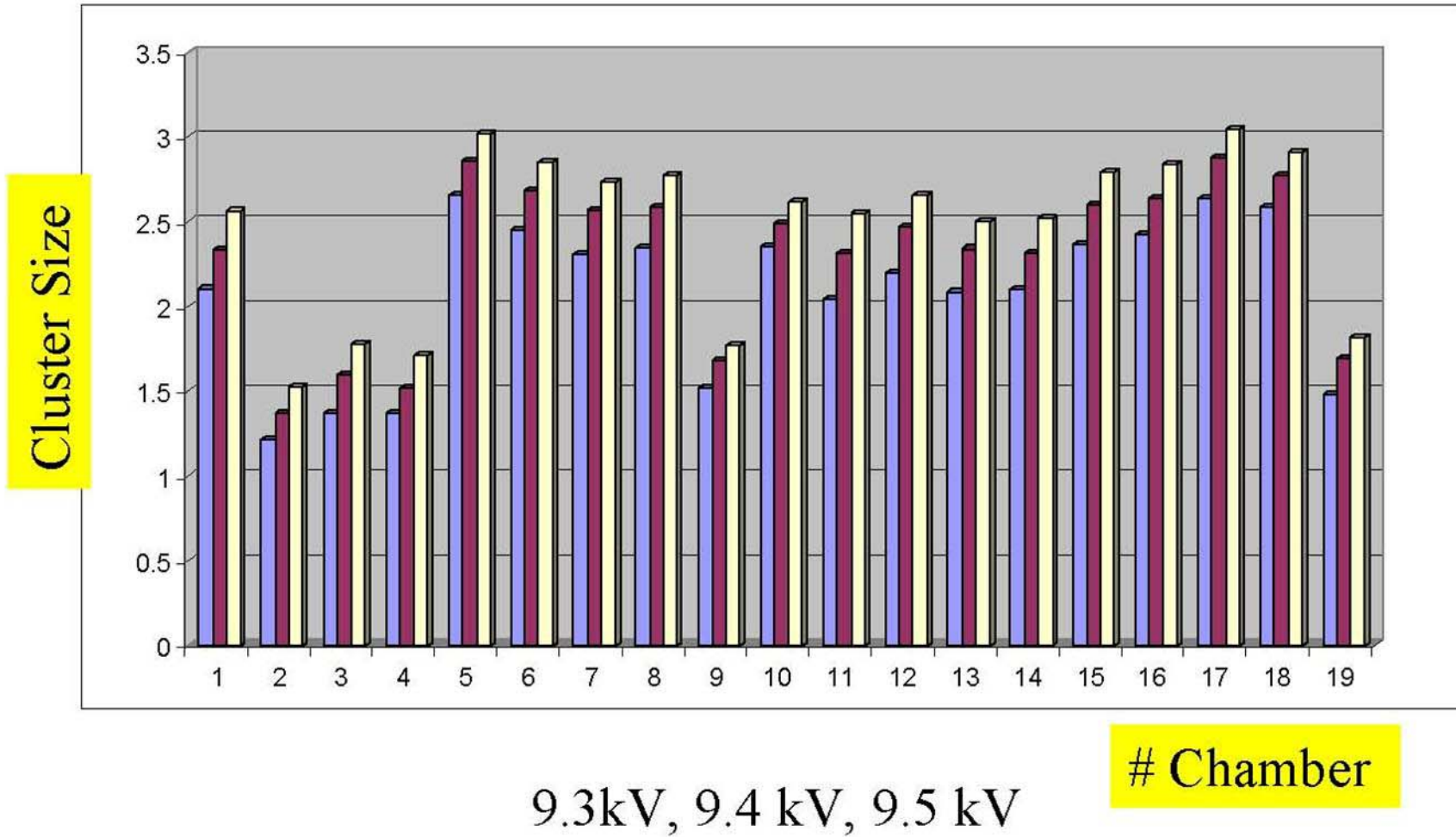
Data from Cosmic Test

Time Distribution





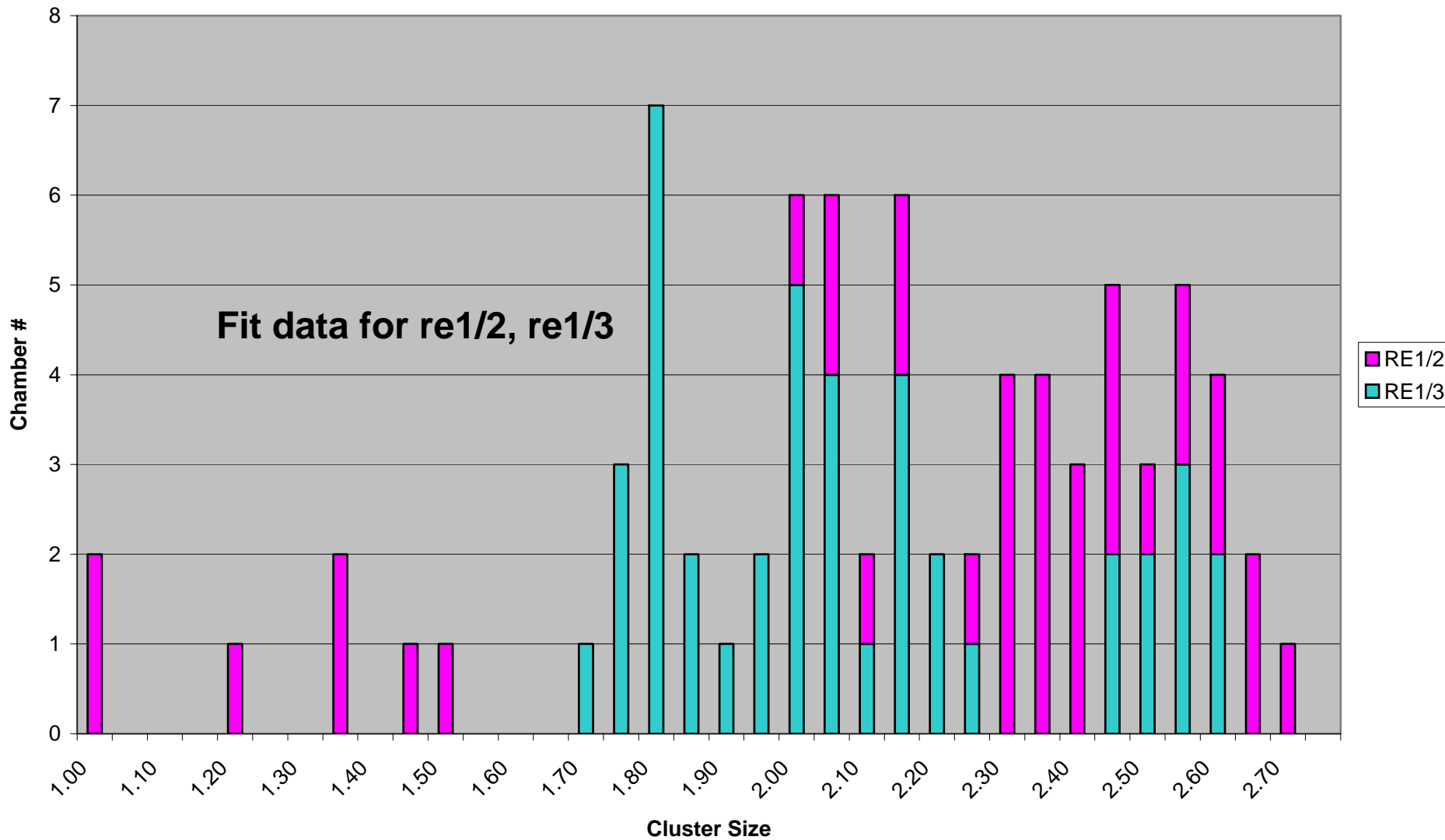
Cluster Size $RE1/2$





Mean Cluster Size Distribution for HV = 9400V (N = 79 chambers)

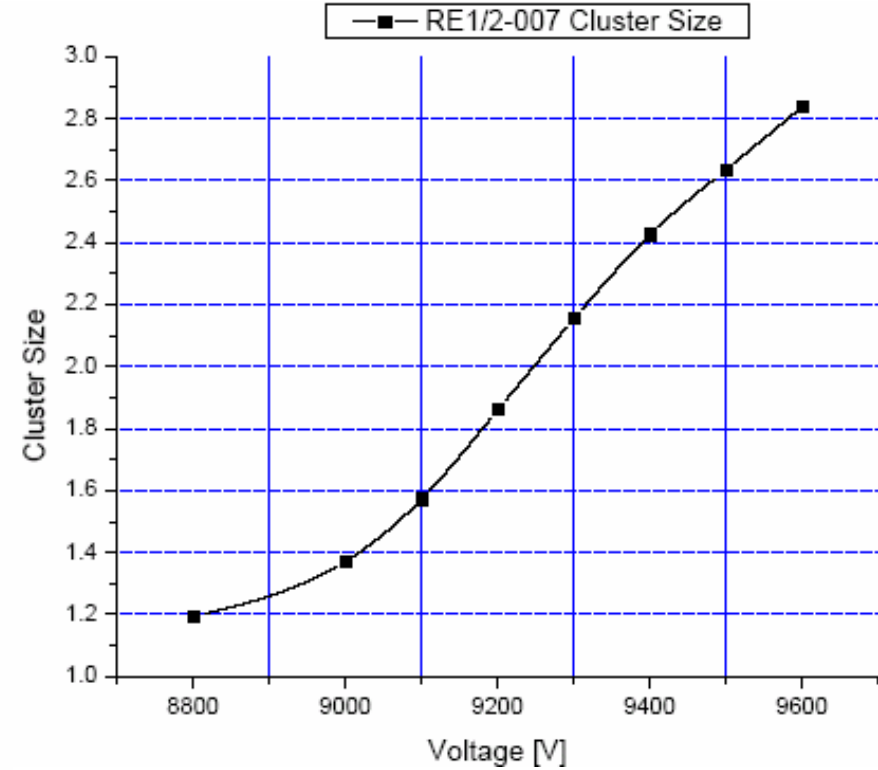
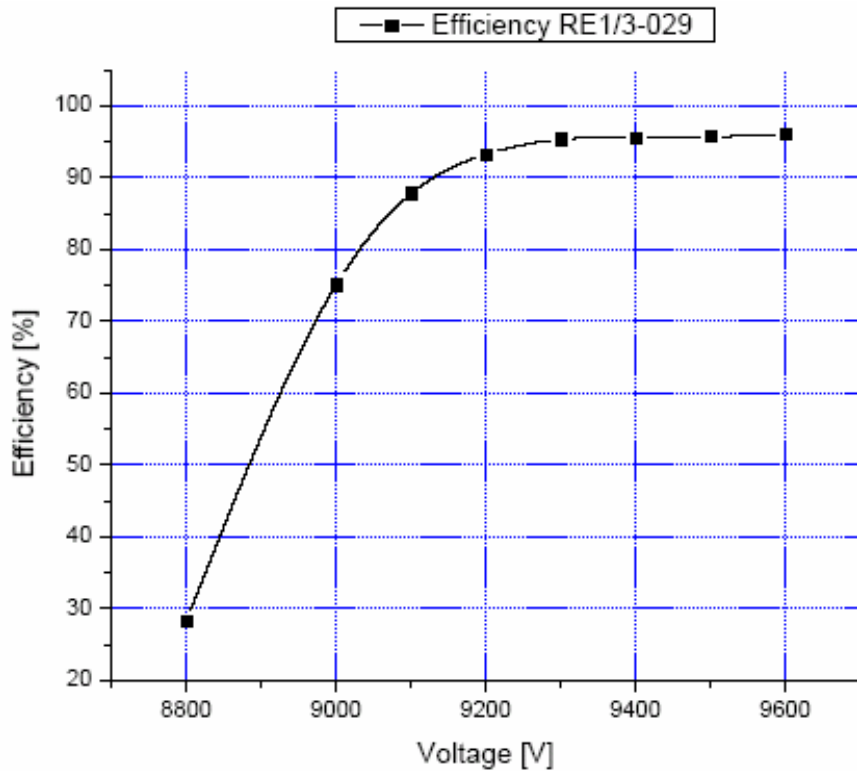
RP1/2: Mean Cl. S. = 2.245, RMS Cl. S. = 0.461; RP1/3: Mean Cl. S. = 1.981, RMS Cl. S. = 0.160





Data from Cosmic Test

Efficiency and Cluster Size



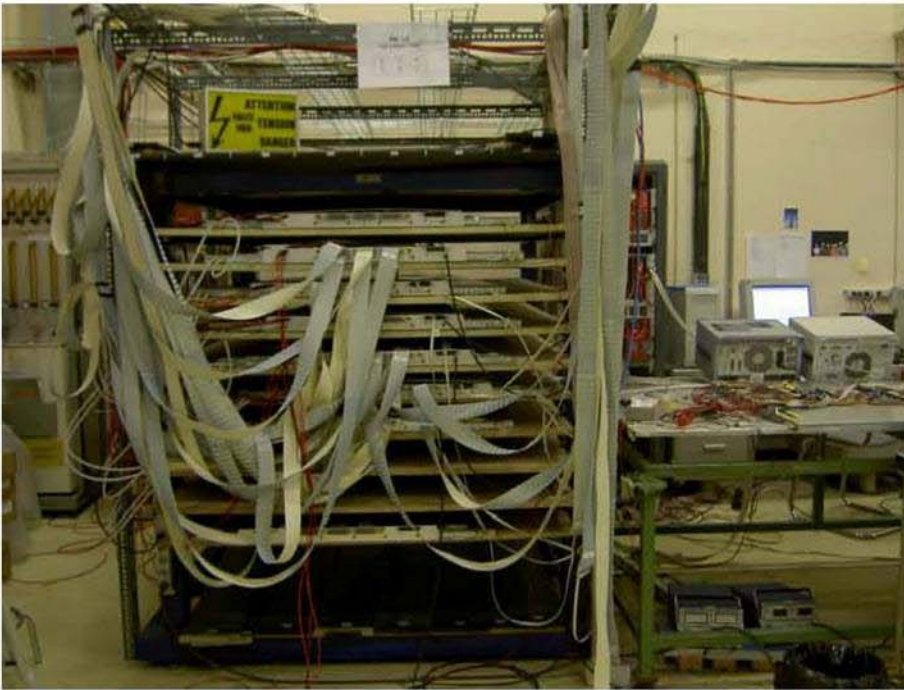
Scanning for efficiency and Cluster size values at different voltages.



Test Stands

Cosmic Stand

Efficiency/Cluster size



10 chambers
Round about time 3-4 days

High Voltage Monitor Stand

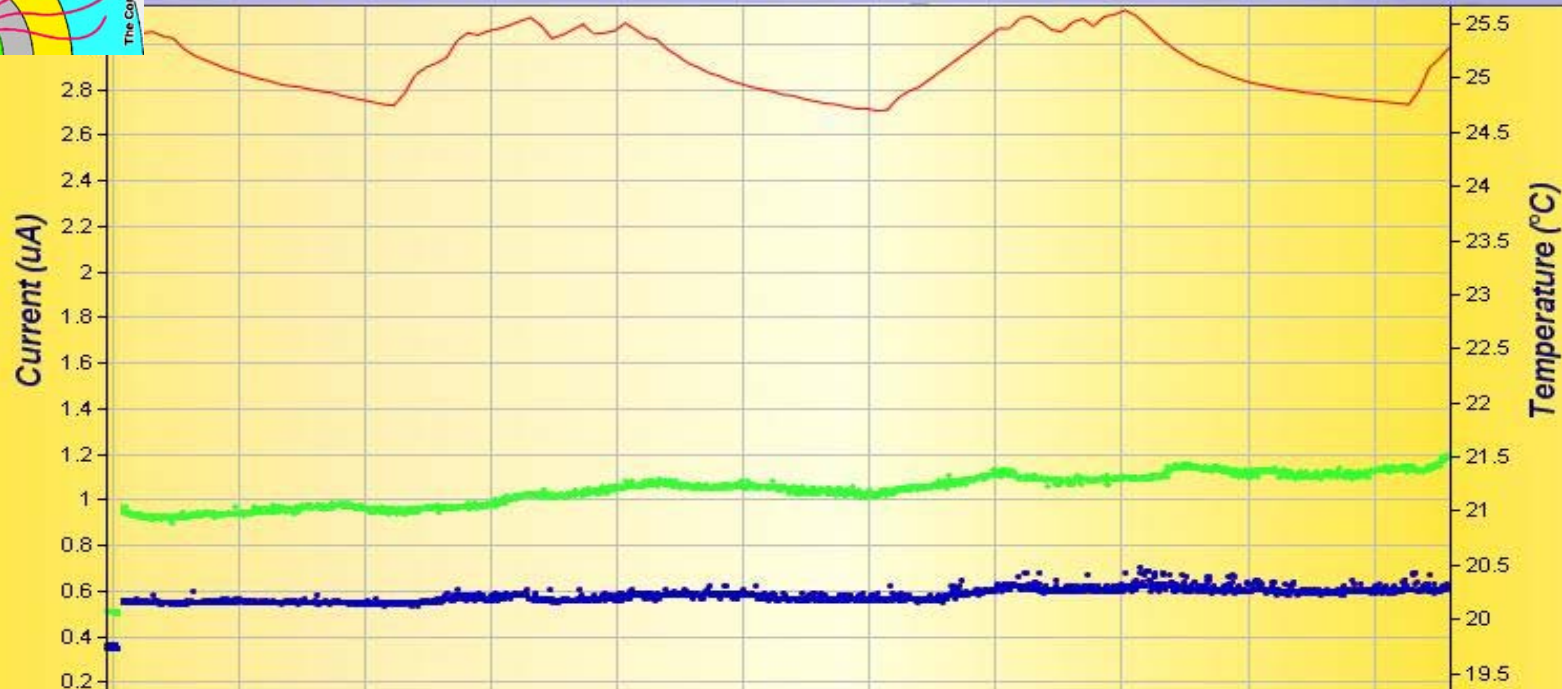
Long Term Stability



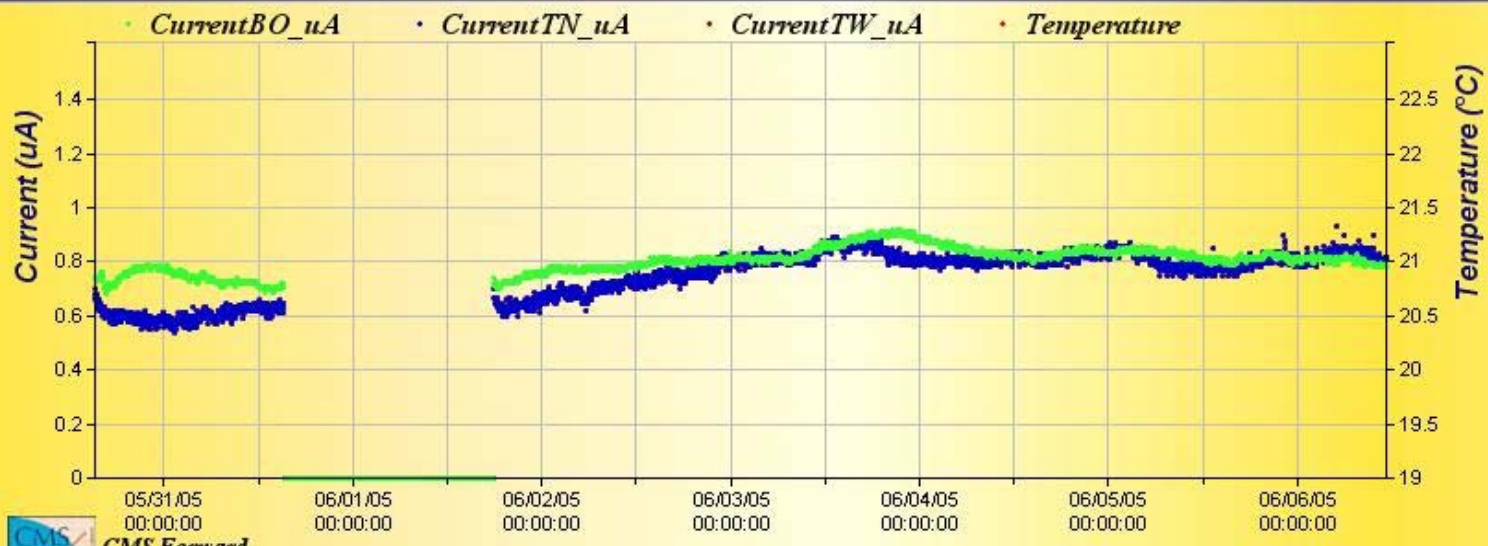
10 chambers
Round about time 7-15 days



Current for Chamber RE1/2-073 at 9400 V



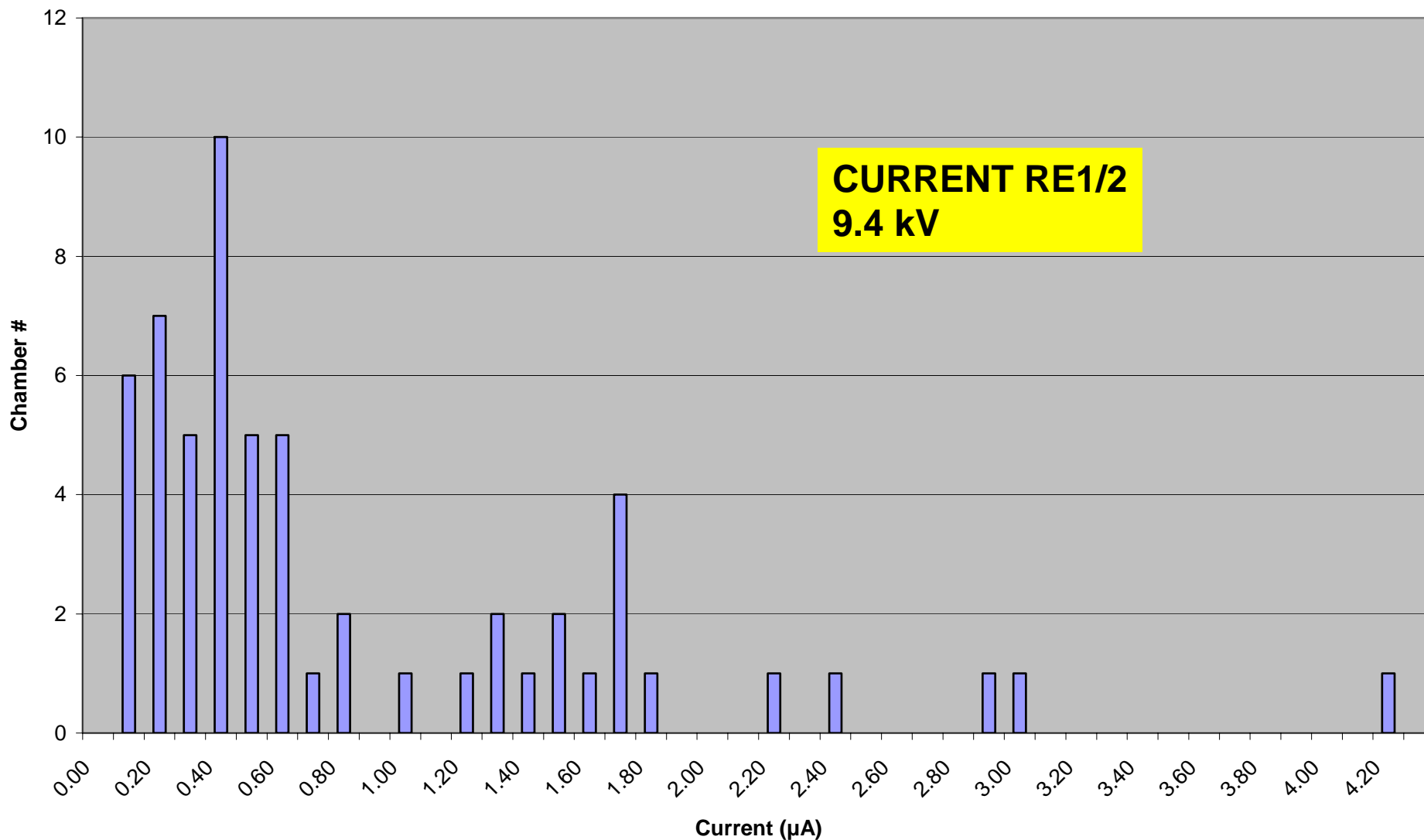
Current for Chamber RE1/3-032 at 9400 V





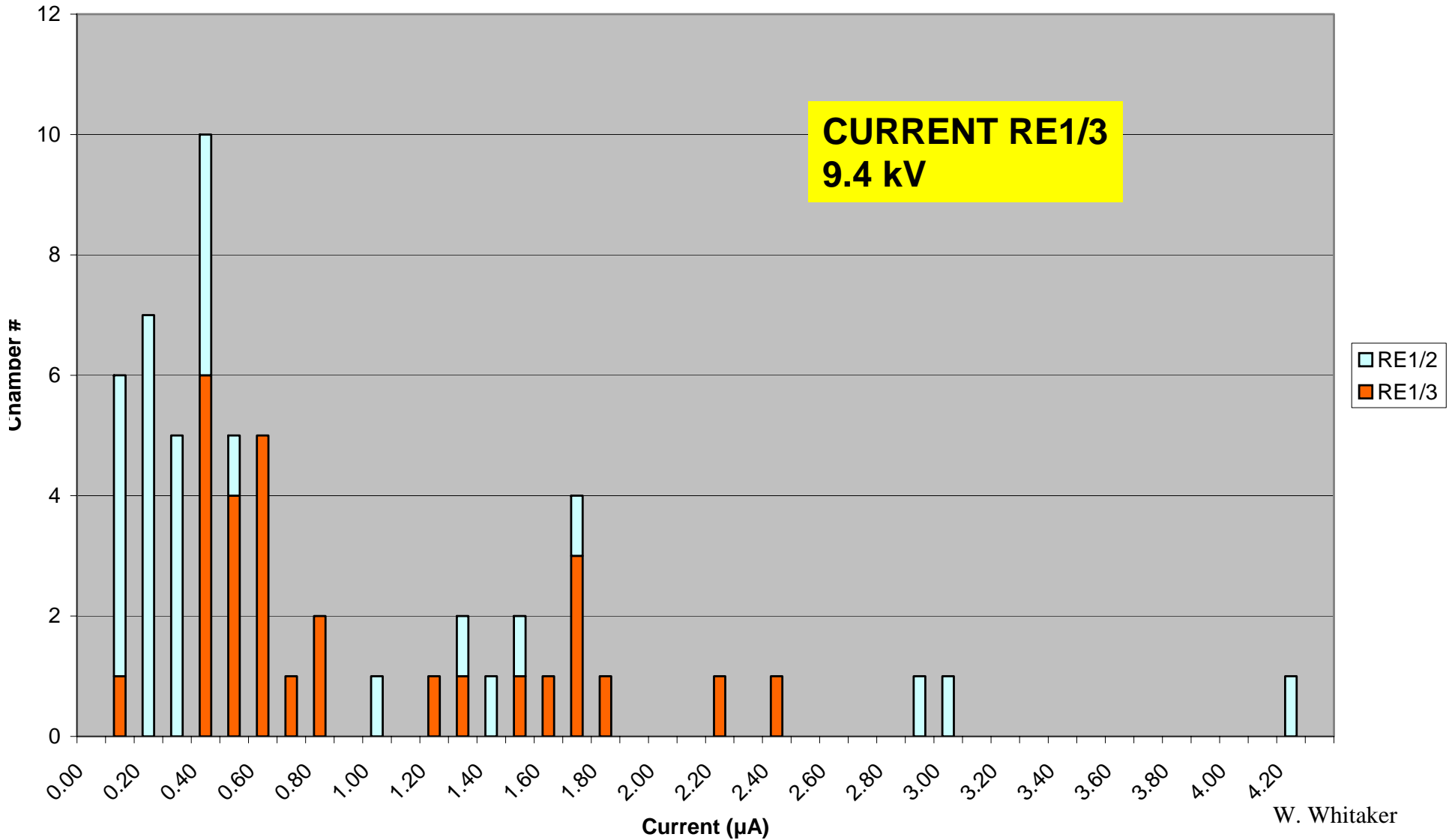
Current Distribution for HV = 9400V (Bottom Gaps of the Chambers)

Mean Current = 0.859 μ A, RMS Current = 0.836 μ A



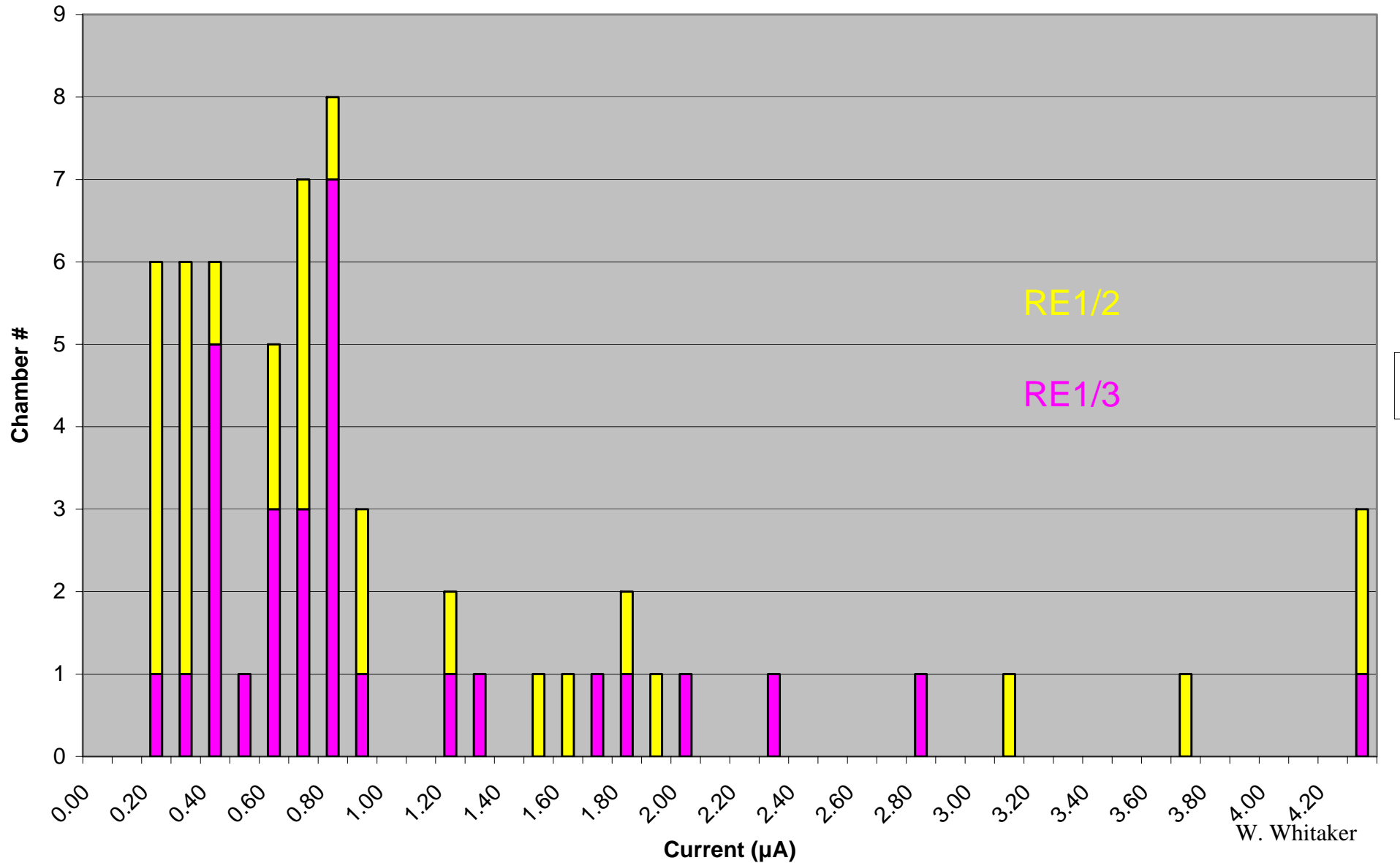


Current Distribution for HV = 9400V (Bottom Gaps of the Chambers)
RE1/2: Mean $I = 0.769\mu A$, RMS $I = 1.004\mu A$; RE1/3: Mean $I = 0.952\mu A$, RMS $I = 0.622\mu A$





Current Distribution for HV = 9400V (Top Gaps of the Chambers=67)
RE1/2: Mean $I = 1.171\mu\text{A}$, RMS $I = 1.281\mu\text{A}$; RE1/3: Mean $I = 1.126\mu\text{A}$, RMS $I = 1.127\mu\text{A}$



W. Whitaker

October 2005



Check-lists

- **Chamber traveller contains:**
- **Preparation list (15 items)**
- **Production checklist (50 items)**
- **Cosmic test checklist (15 items)**
- **Lab sign out checklist (10 items)**

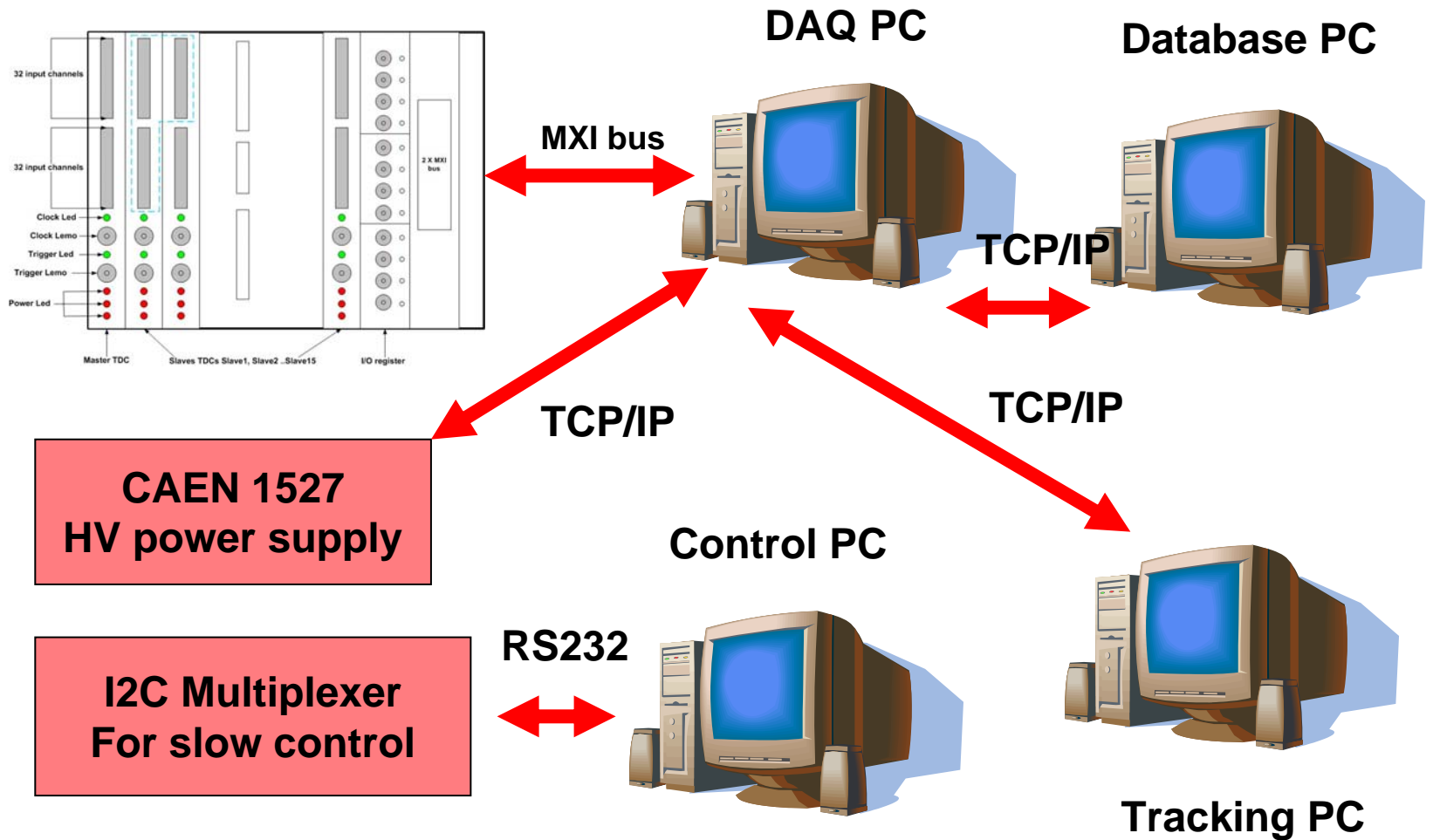
- **Some duplications**

Attention to detail
ensured by checklists

37 Make sure that the screen box and the HCP box have
the same number.

38 De burr the sharp edges of the slot and holes after
modification.

Taking Data





Database

http://forwardrpc.cern.ch/cms_forward_rpc/index.htm

Chamber QC data

Gas gaps QC data

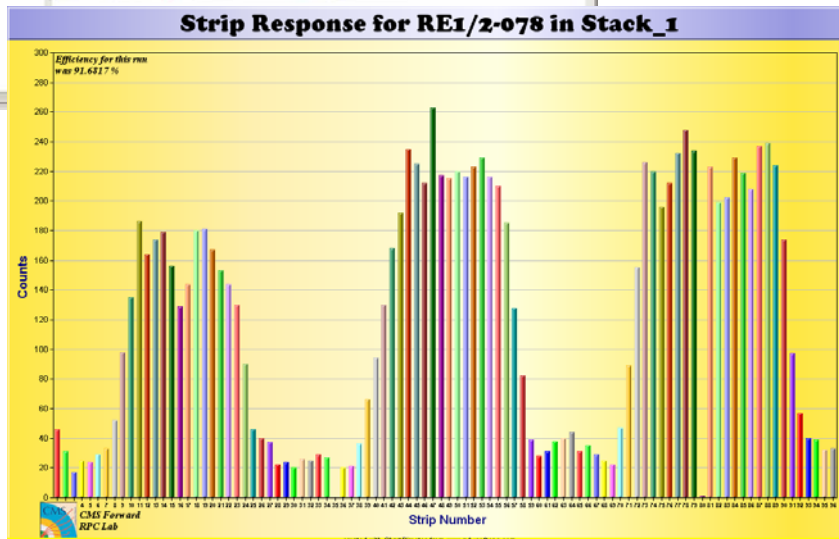
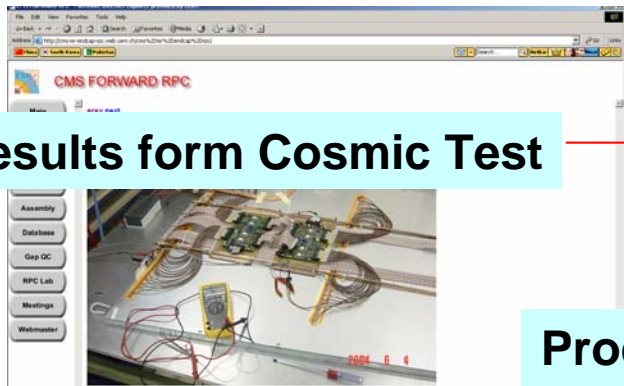
Results form Cosmic Test

DATABASE

**VISIBLE
SEARCHABLE
WORLDWIDE**

Production data

Environment conditions data



Online

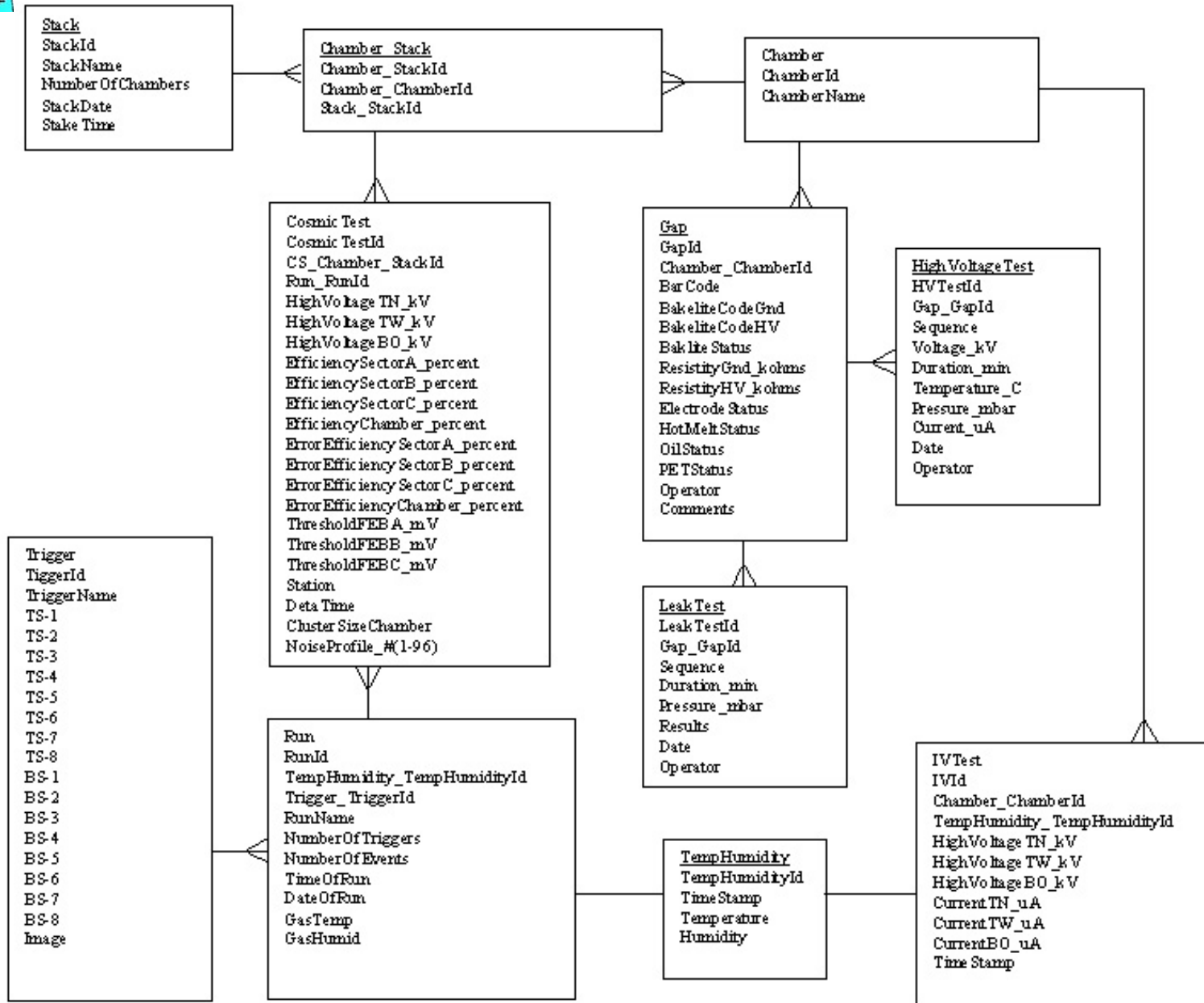
- HV monitoring and QC IV data storage
- Searchable tracking for individual Gaps / Chambers
- Production QC procedures
- Mechanics
- Cosmic Tests

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Construction Database





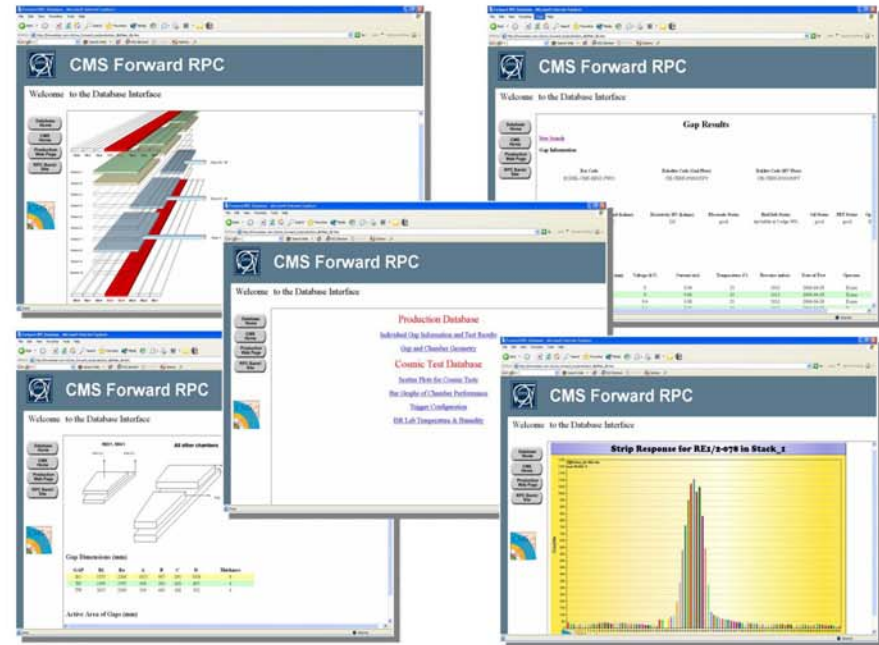
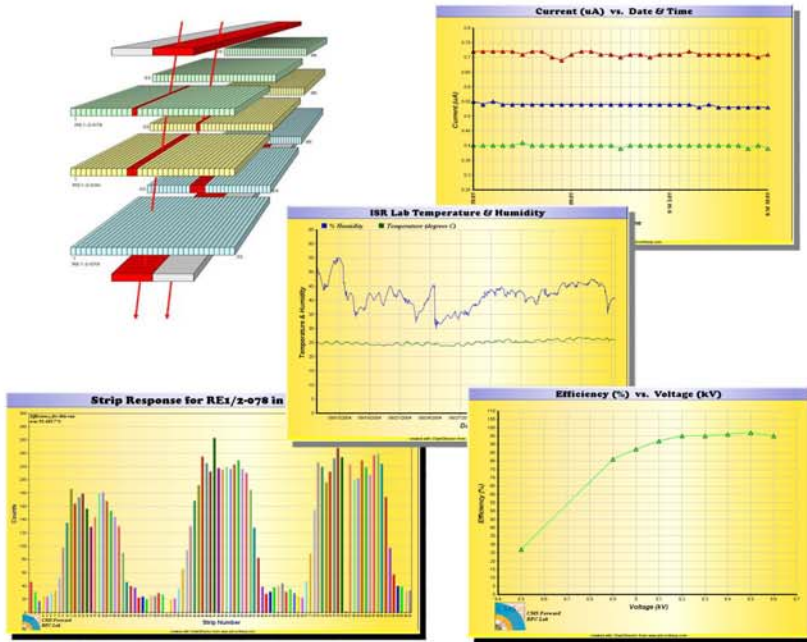
CMS Endcap RPC Graphical Interface

Cosmic tests & DAQ

- *Efficiency*
- *Chamber Certification*

Database

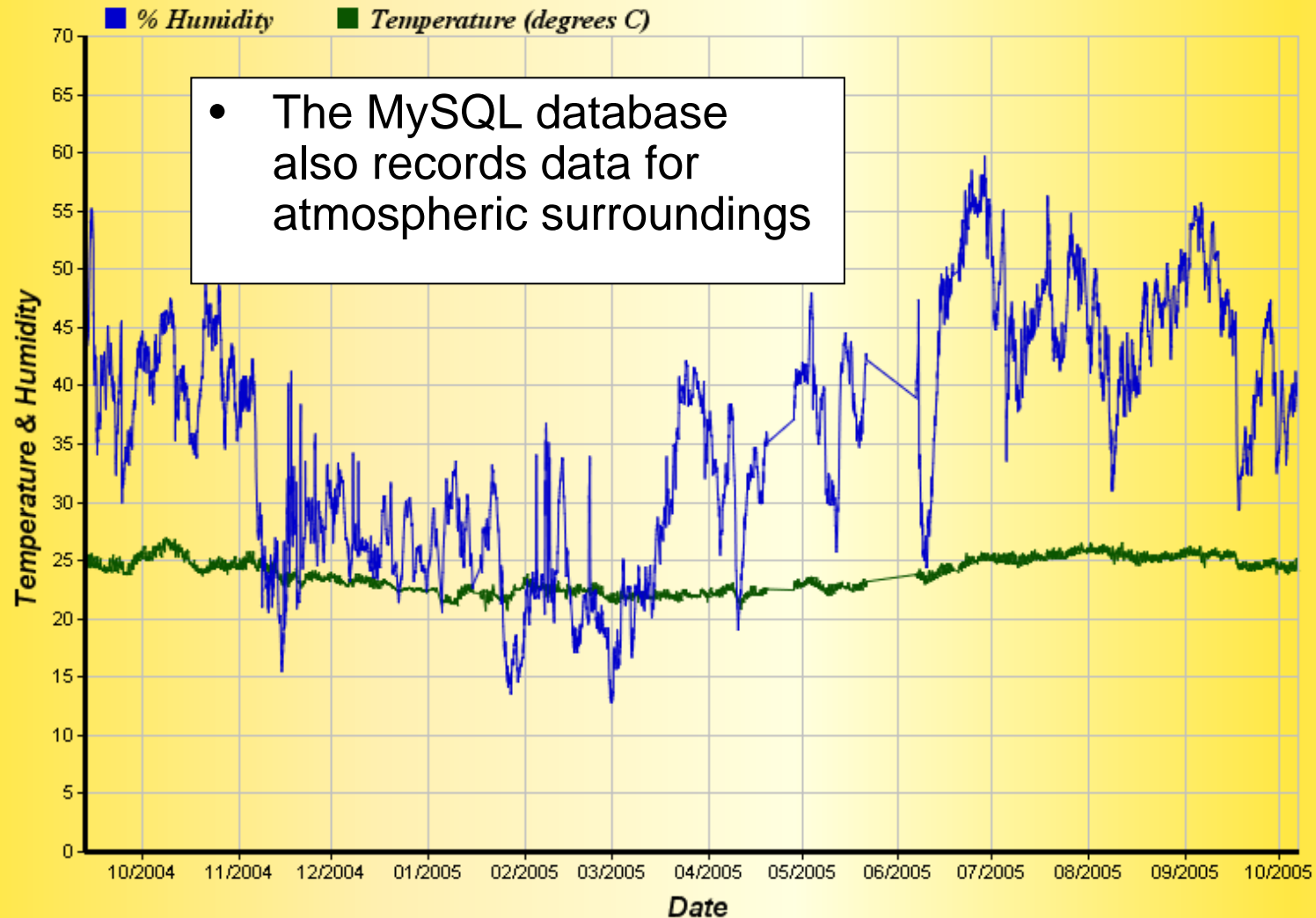
- *Dynamic Plots*
- *Searchable Worldwide*





Continuous Monitoring of Ambient Conditions

ISR Lab Temperature & Humidity

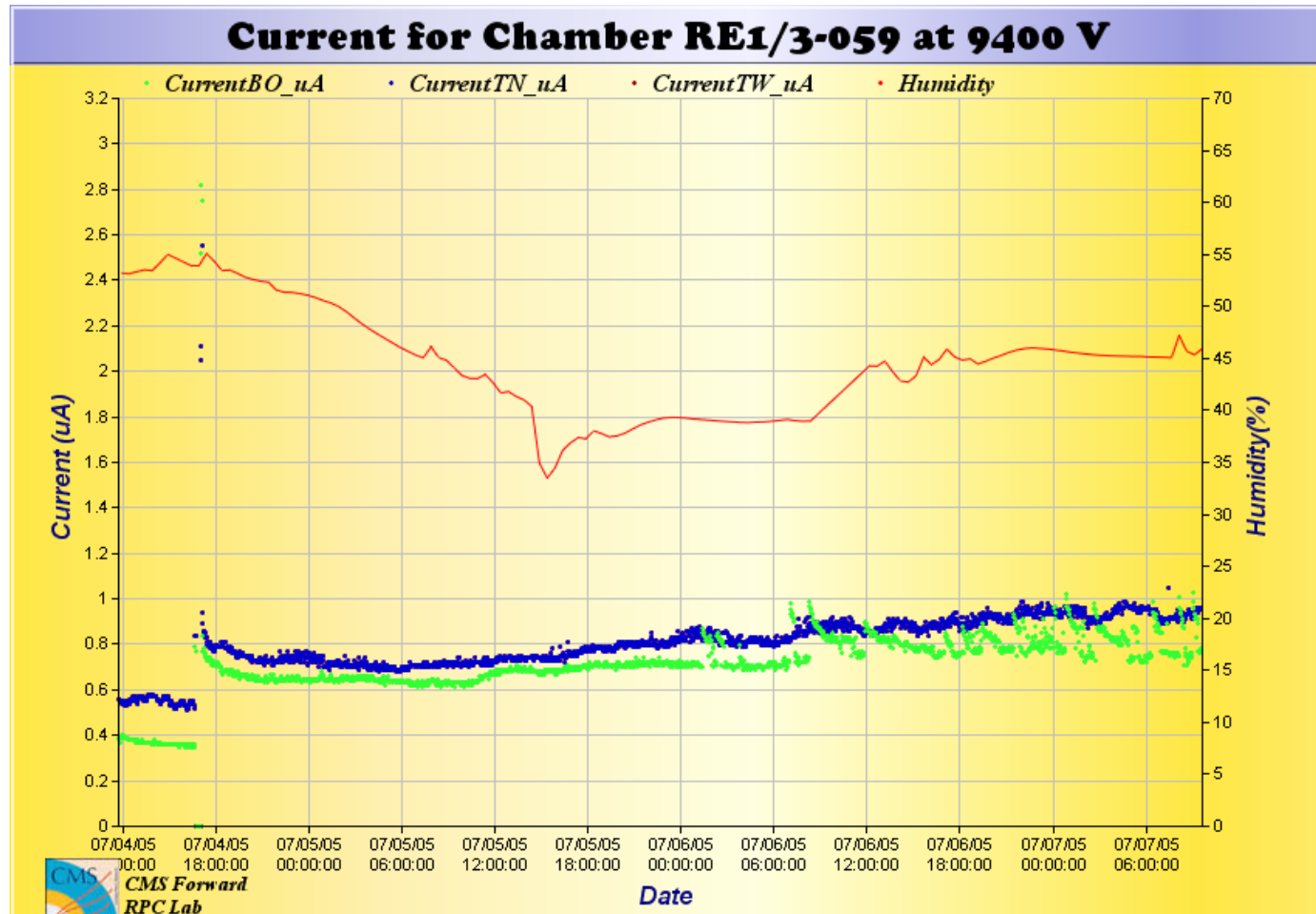




Continuous H.V. Monitoring

Recording the HV currents every 2 min, and store the data in to the Database.

Including the environment conditions. Temperature and Humidity





Plans for Database

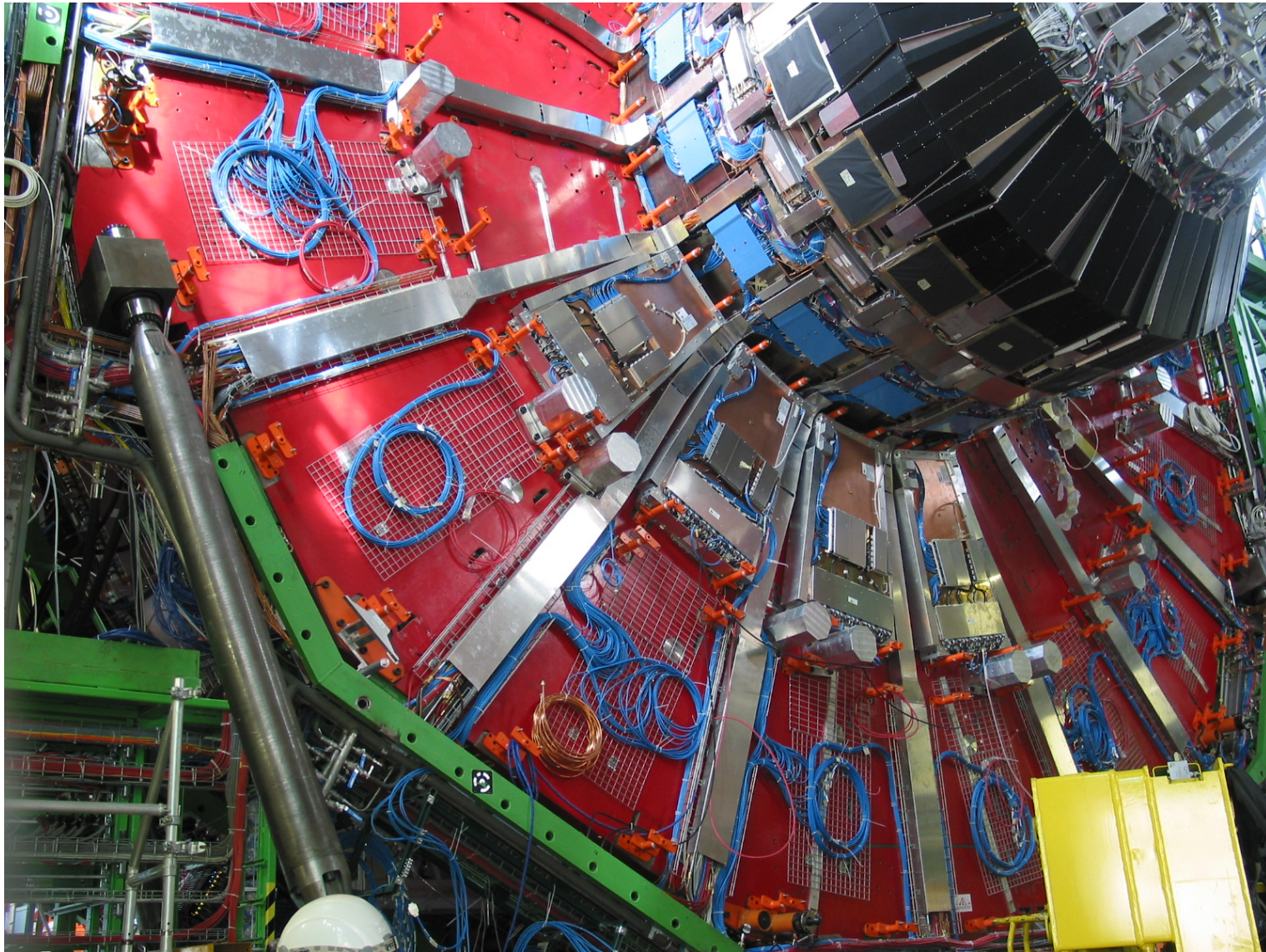
- Currently working on a fully implemented Oracle database
 - Already copying data to an Oracle database as mentioned before
 - Graphic interface is in the preliminary stages of development
 - Interface development will continue as time permits.



Plans for Construction Database

- 2005:
ALL chambers certified
- 2006:
Chamber tests completed and data are stored for the life of the experiment

Installation





The Collaboration

CHINA

Yanlin Ye
Sijin Qian
Jun Ying
Quanjin Wang
Yong Ban
Jianxin Cai
Hongtao Liu
Ge
Xue Zhiuwa

PAKISTAN

Hafeez Hoorani
M. Irfan Asghar
Ijaz Ahmed
Tariq Solaija
M. Shariq Khan
Zia Aftab
Javed Alam Jan
Muhammad Usman
Mian Iftikhar

KOREA

Sungkeun Park
Kwang-Souk Sim
Byungsik Hong
Seongjong Hong
Kyong Sei Lee

ITALY

Giuseppe Iaselli
Flavio Loddo
Marcello Maggi
Marcello Abbrescia
Anna Colaleo
Carlo Pinto
Michele Papagni

CERN

Austin Ball
Serguei Akimenko
J.P. Chatelain
Ian Crotty
Archana Sharma
Andrey Marinov
Walter Vandoninck
William Whitaker
+
15 temp
students/visitors