Slow Control System for RICH prototype

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Pusan National University
Heavy Ion Physics Experiment LAB.

Heavy Ion Meeting

2012.2.22

The Compressed Baryonic Matter experiment

CBM collaboration

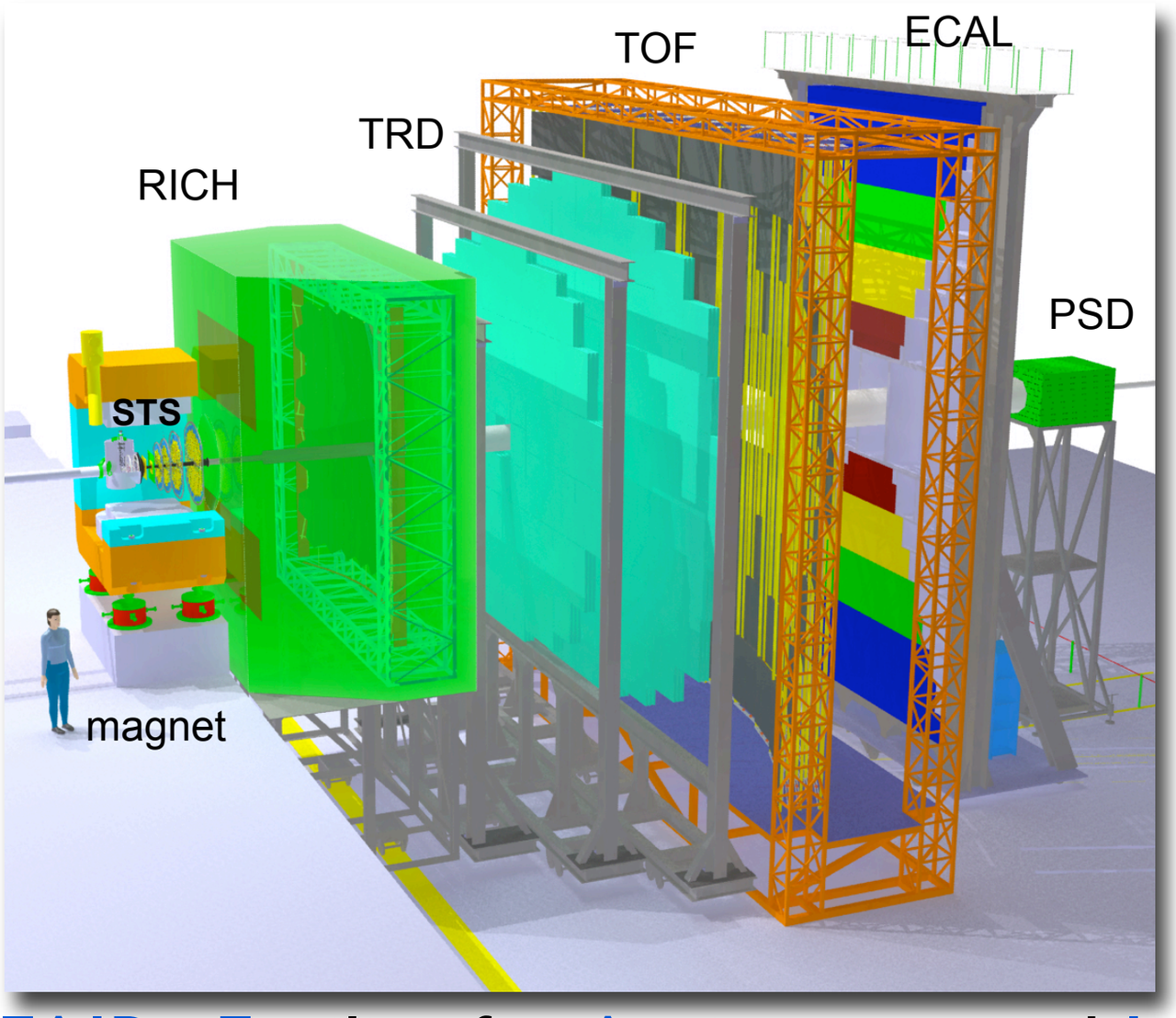
Outline

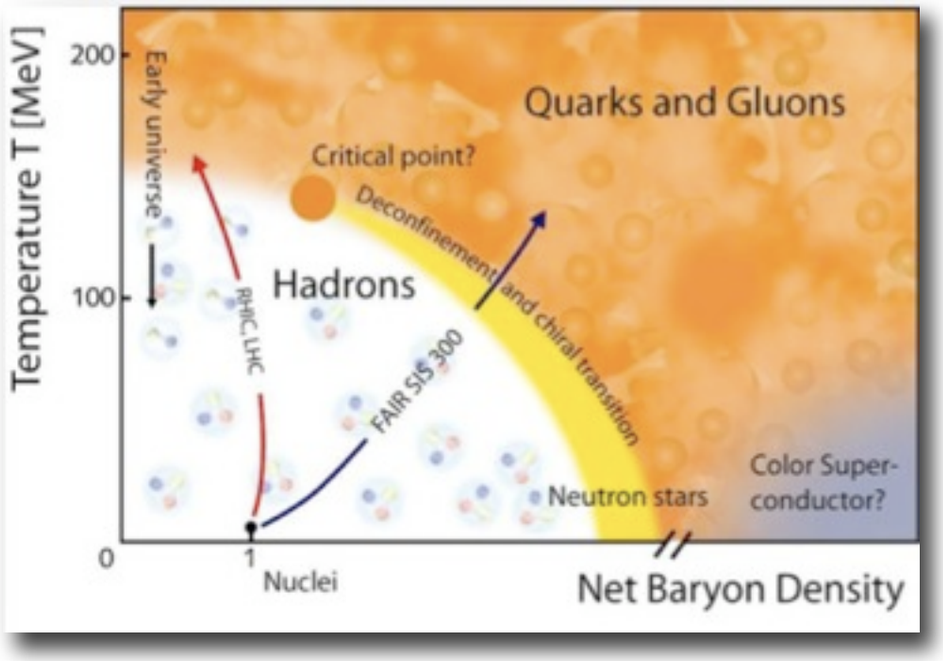
- Compressed Baryonic Matter
- Ring Imaging CHerenkov detector
- Slow Control System
  - Mirror positioning control system
  - High Voltage control system
- Experiment (Nov.2011.T9 @ cern)

  - Parameter scan & Results
- Conclusion

The CBM experiment

Compressed Baryonic Matter





Goal

✓ properties of Super-dense nuclear matter
✓ rare and penetrating probes(dileptons)

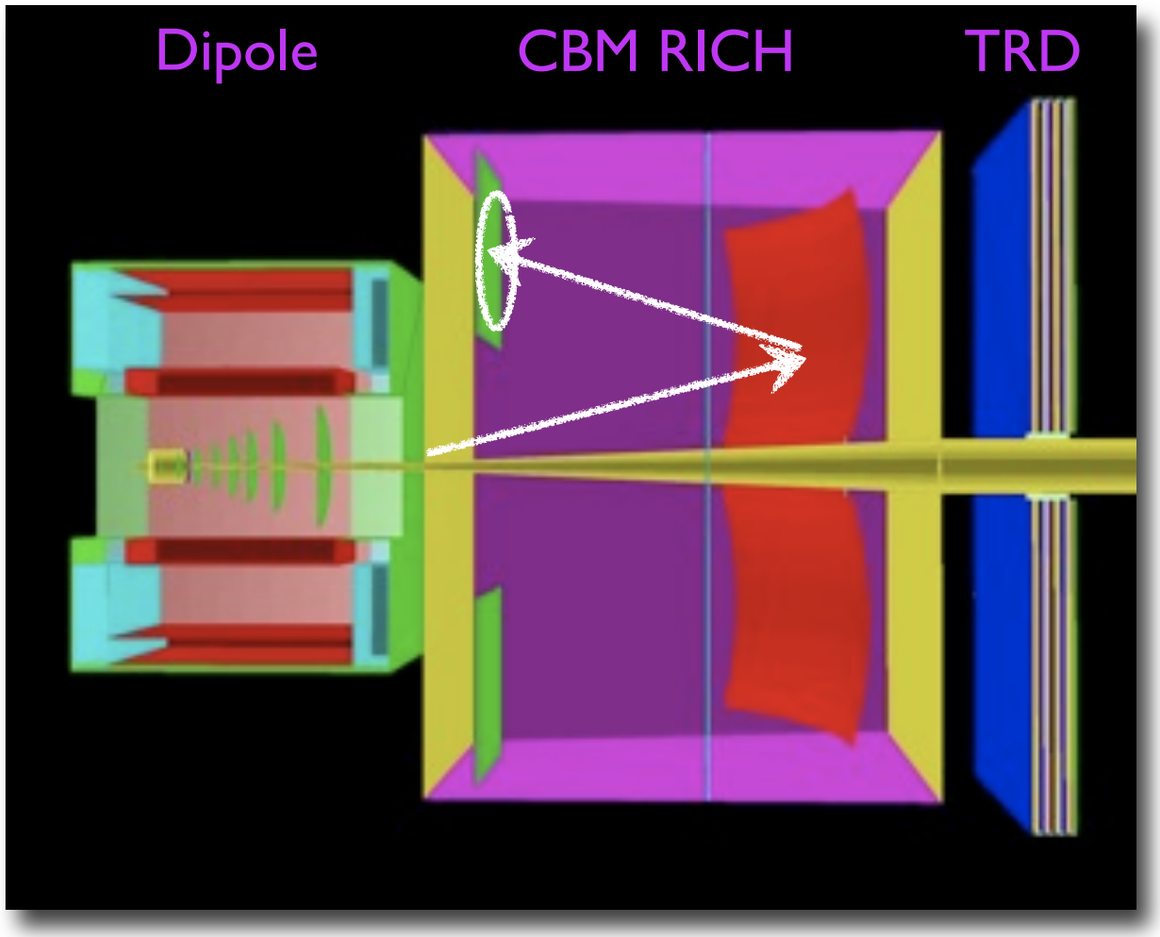
penetrating probes : ρ,ω,φ→e+e-
: J/Ψ, Ψ'→e+e-

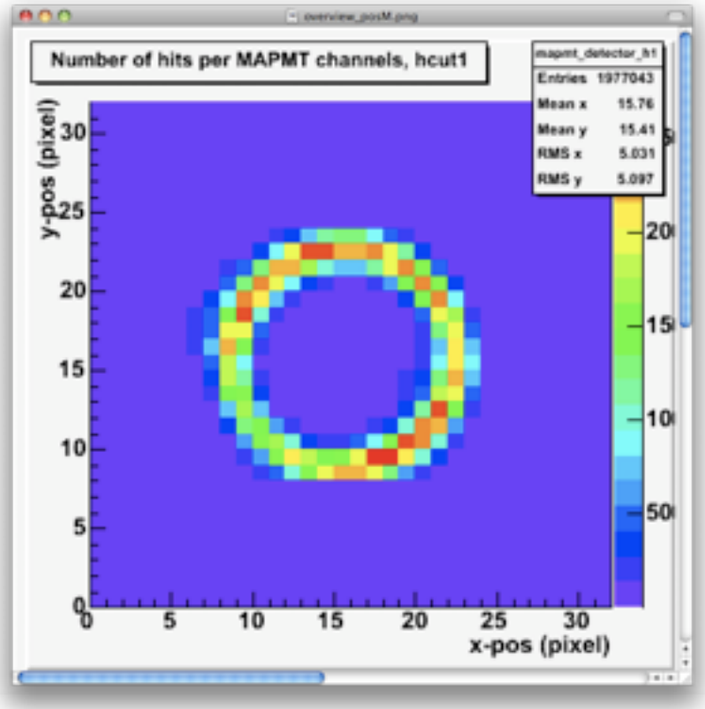
FAIR : Facility for Antiproton and Ion Research

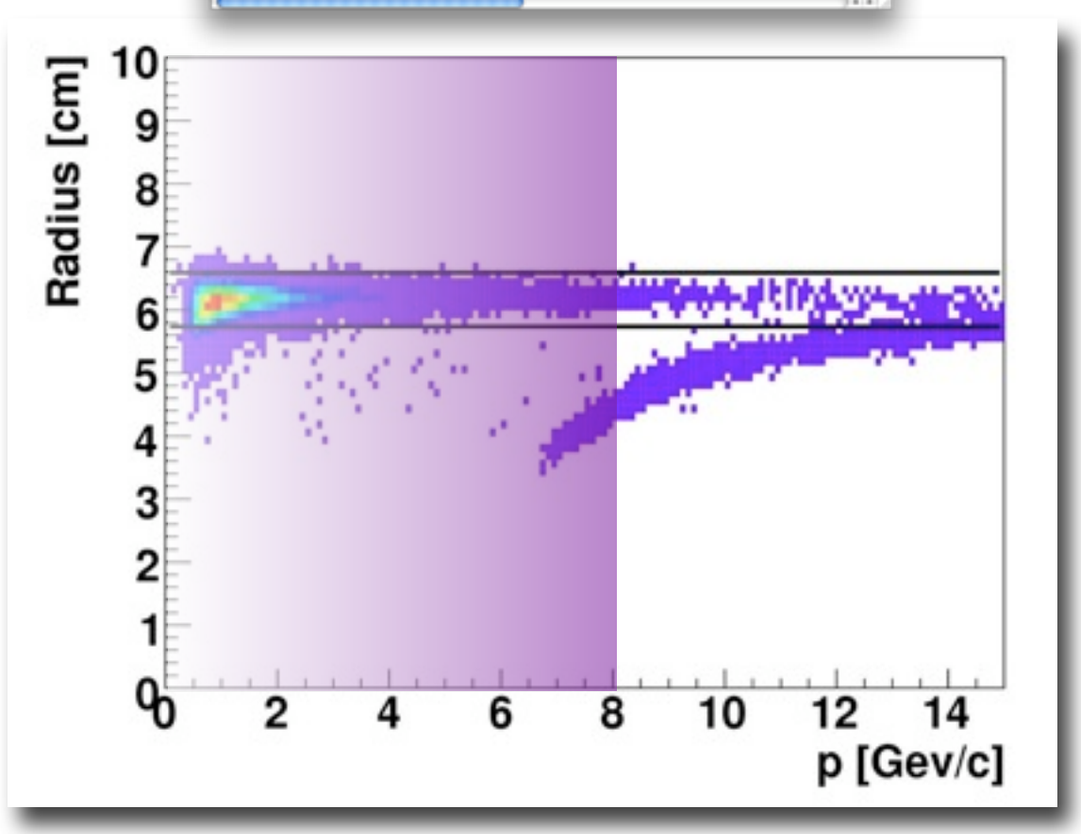
- 10 to 40 GeV/u energy scanned
- it will be installed ~ 2018

The CBM RICH detector

Ring Imaging CHerenkov detector



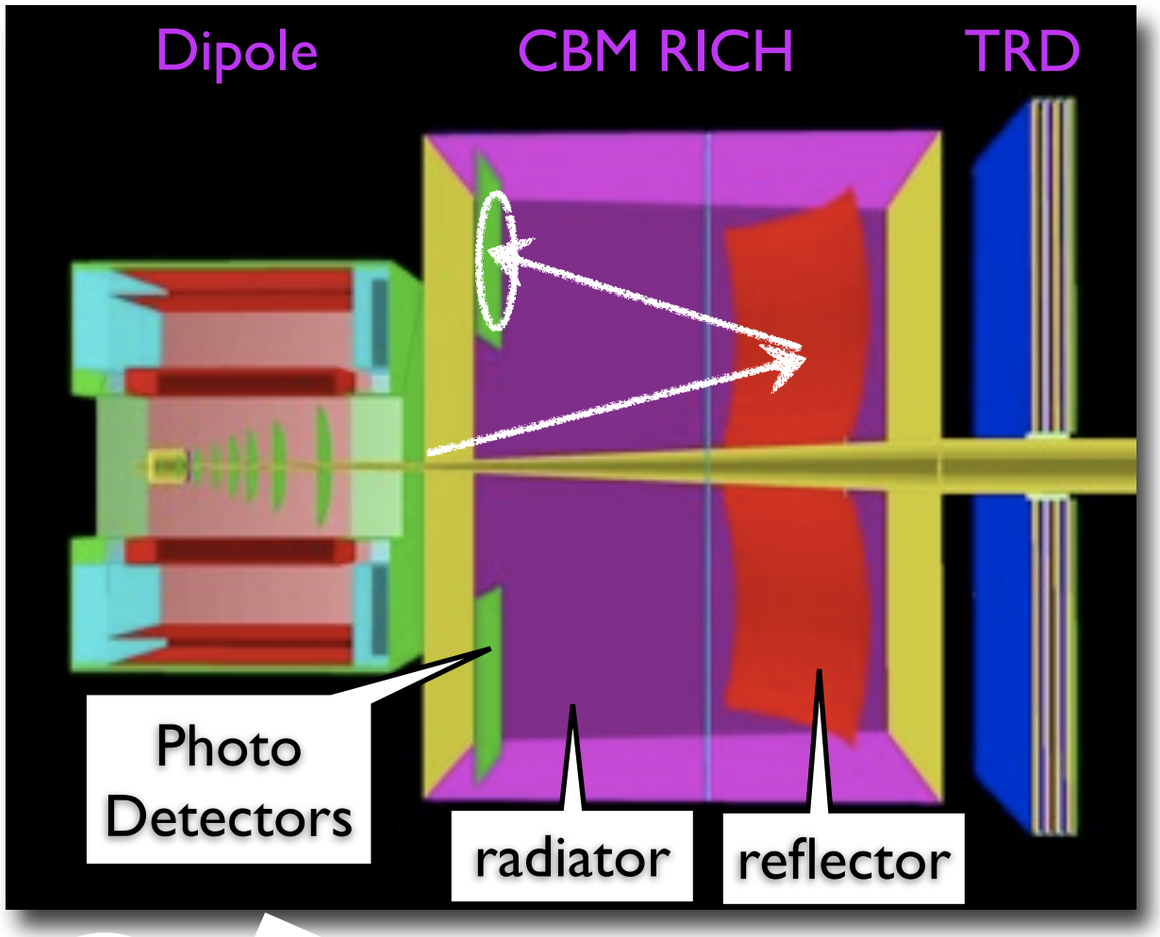


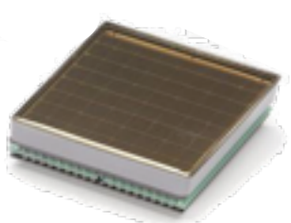


Aim : **Clean electron identification for momenta below 8GeV/c**

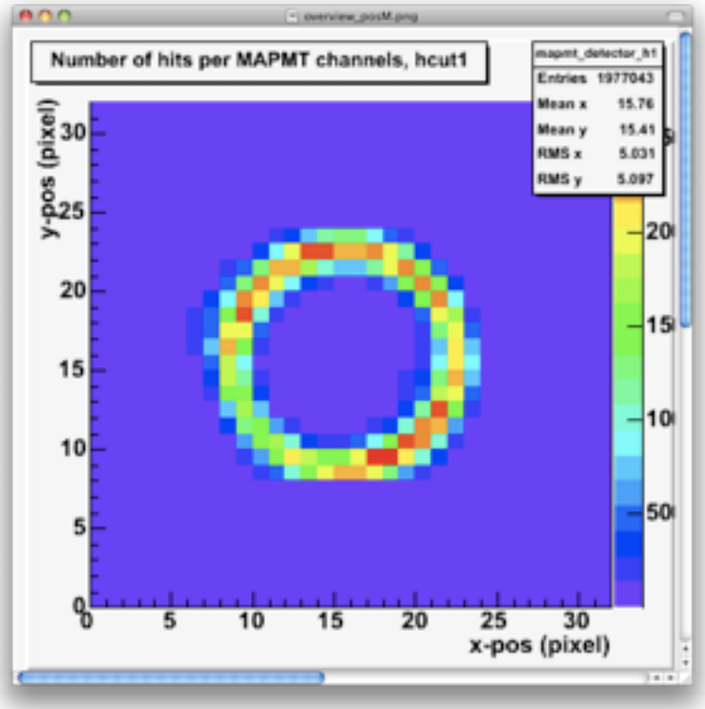
The CBM RICH detector

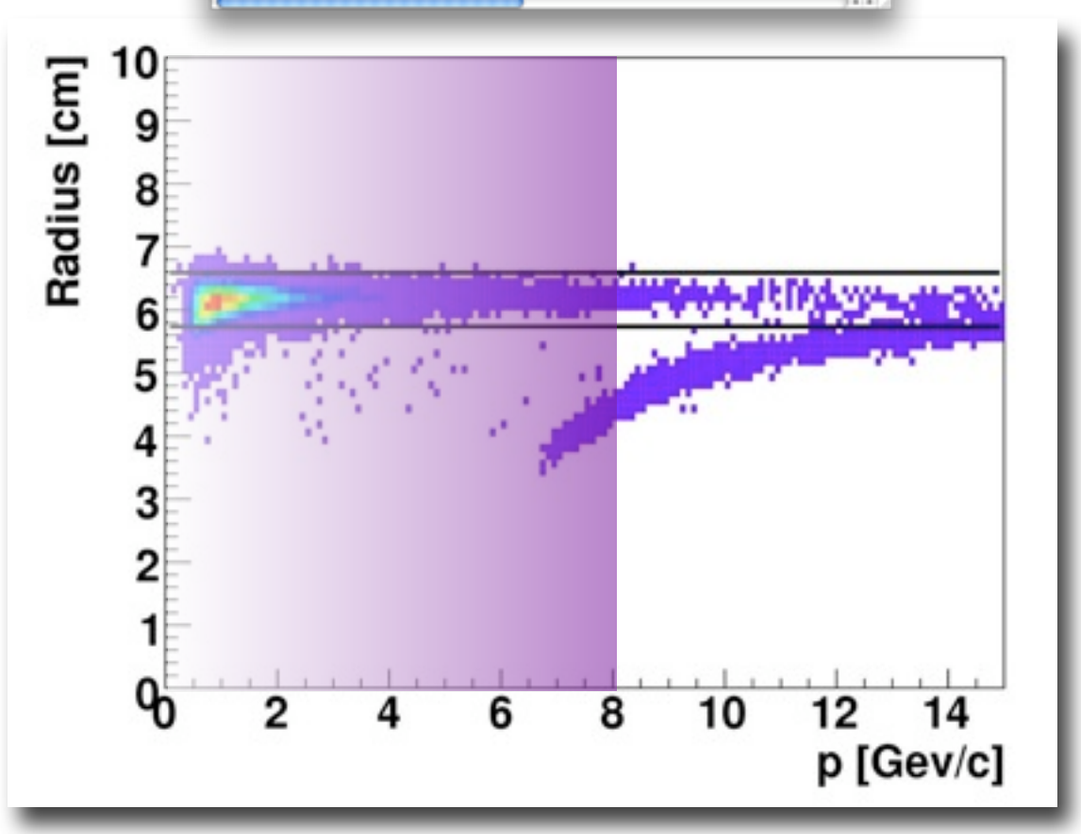
Ring Imaging CHerenkov detector





MAPMT : Multi-Anode Photo Multiplier Tube





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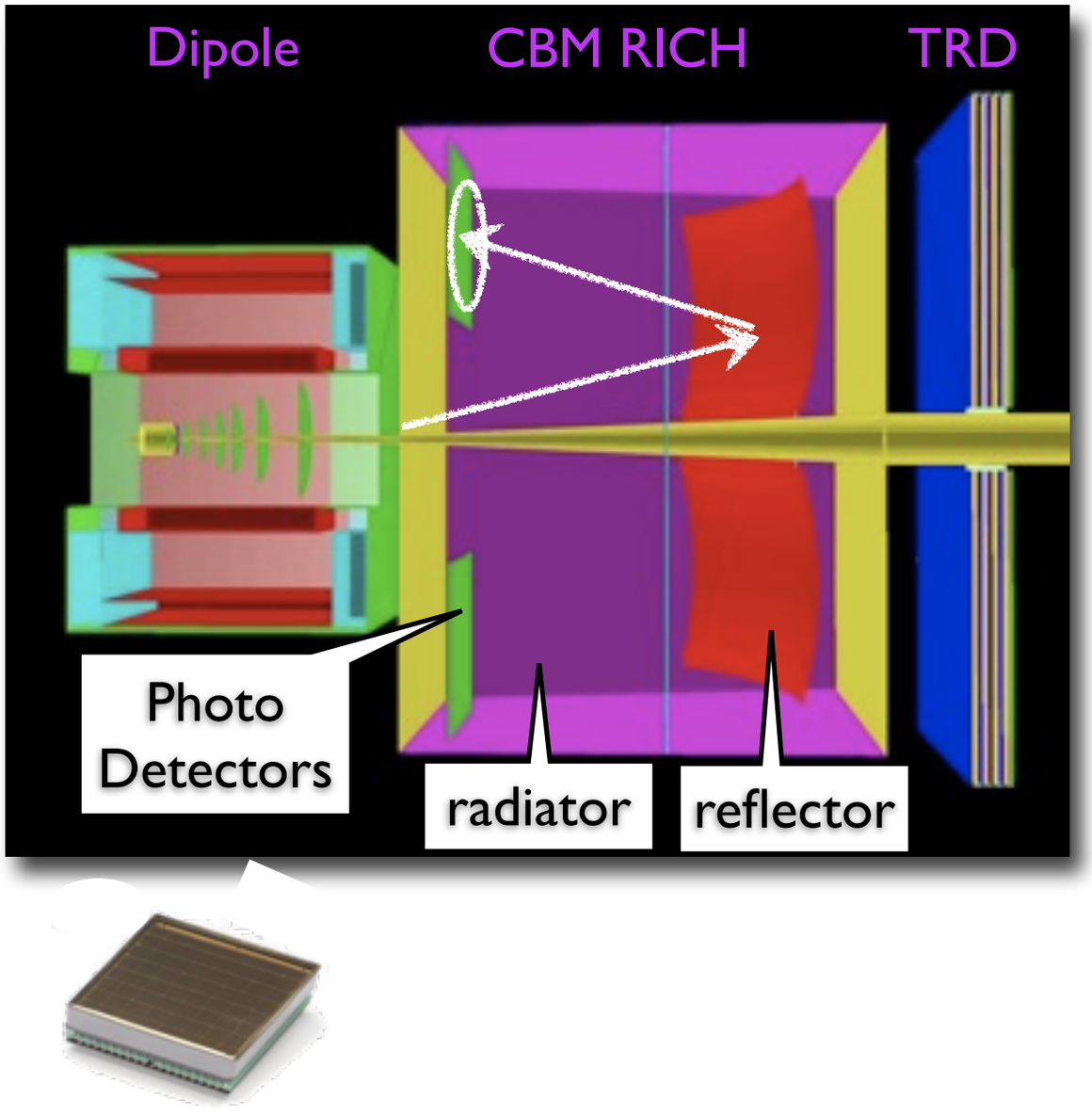

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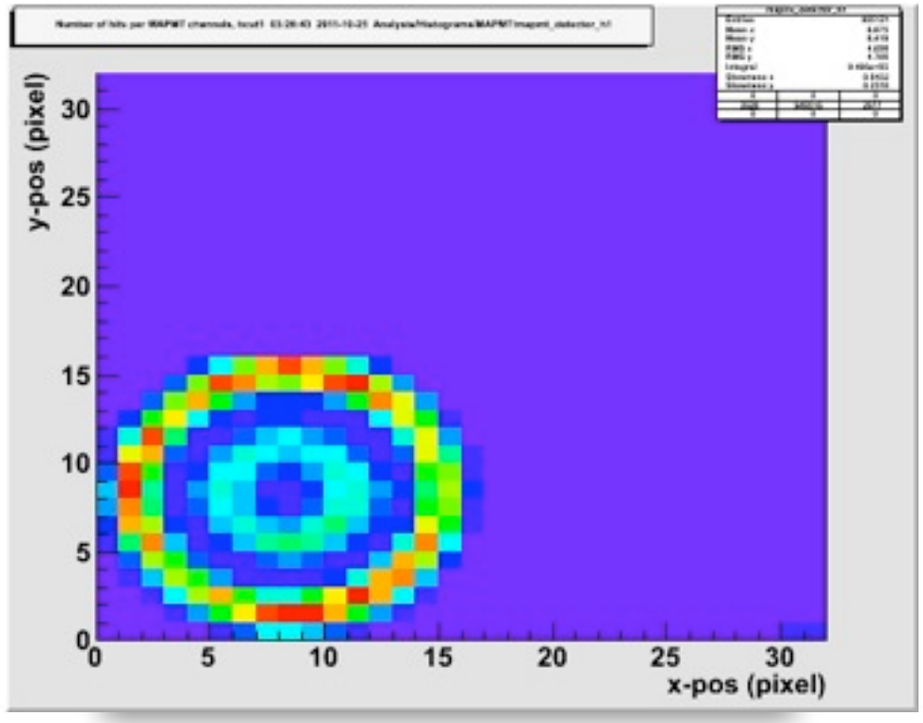
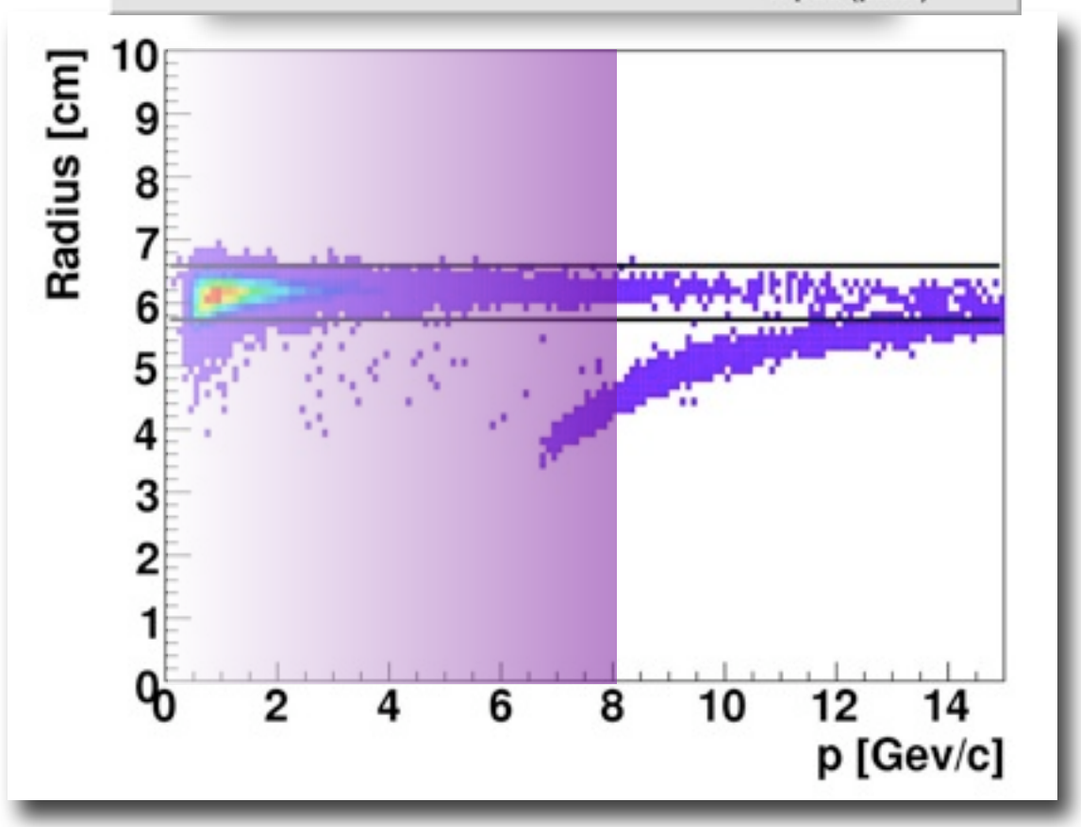


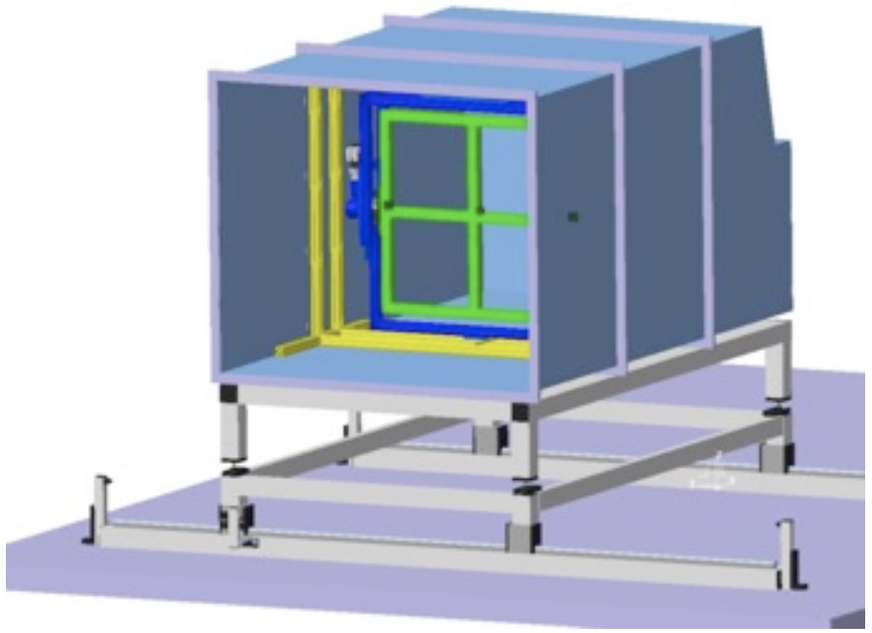


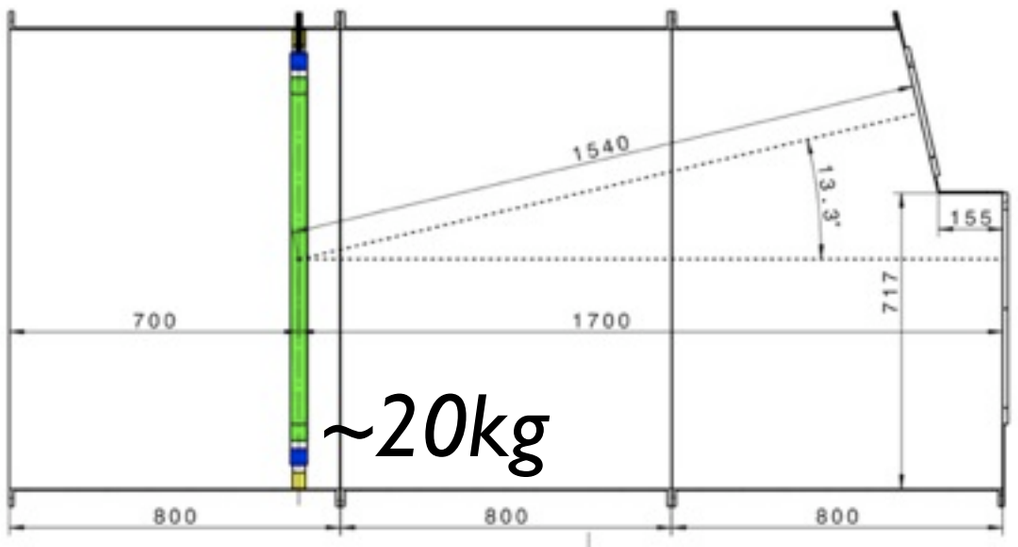
Aim : **Clean electron identification for momenta below 8GeV/c**

Slow Control System

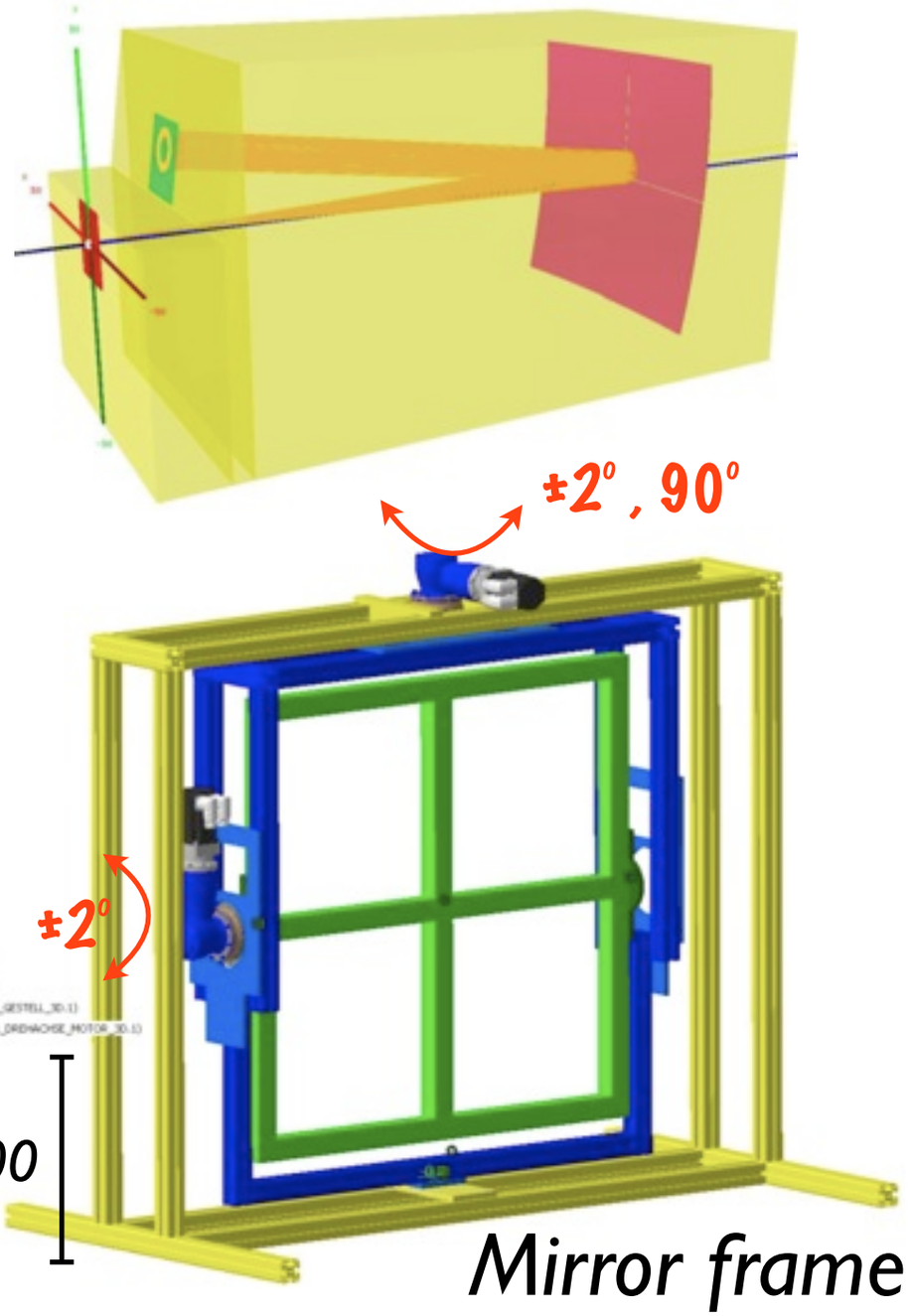
To make HV control system &
Mirror Positioning control system

CBM-RICH prototype
@Giessen University





~20kg



Mirror frame

Slow Control System

To make HV control system & Mirror Positioning control system

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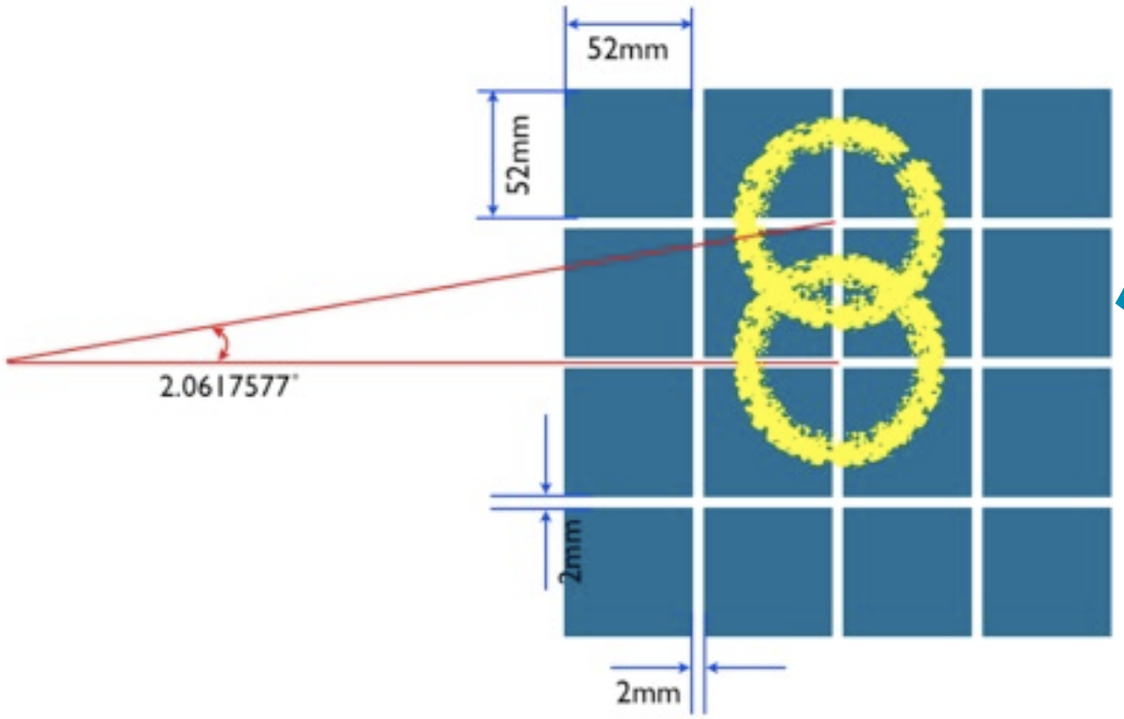
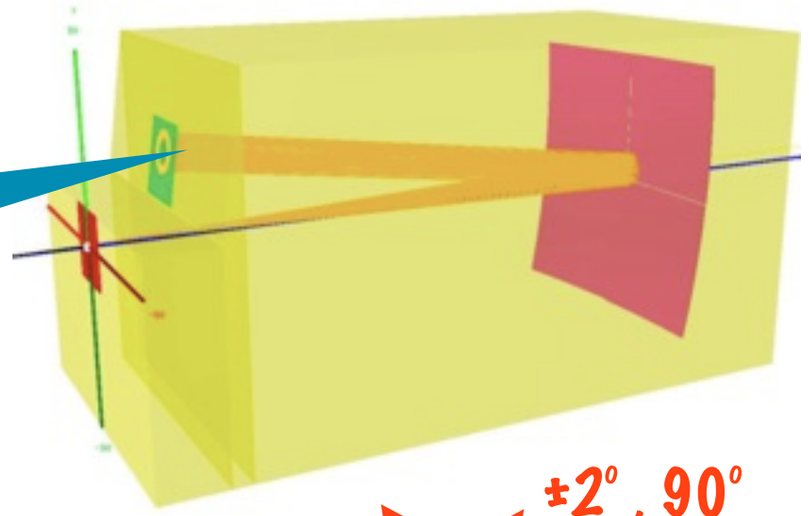
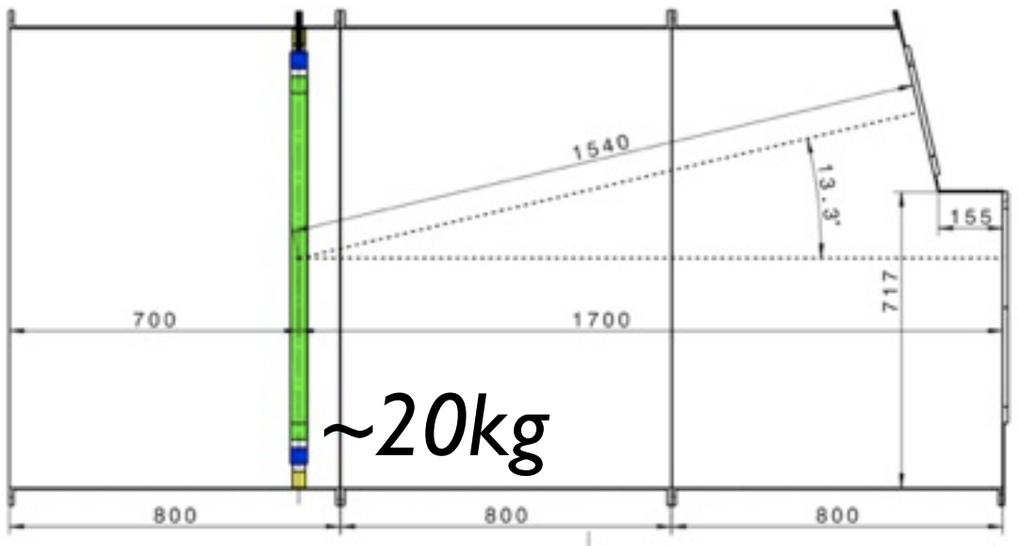
@Giessen University





MAPMTs



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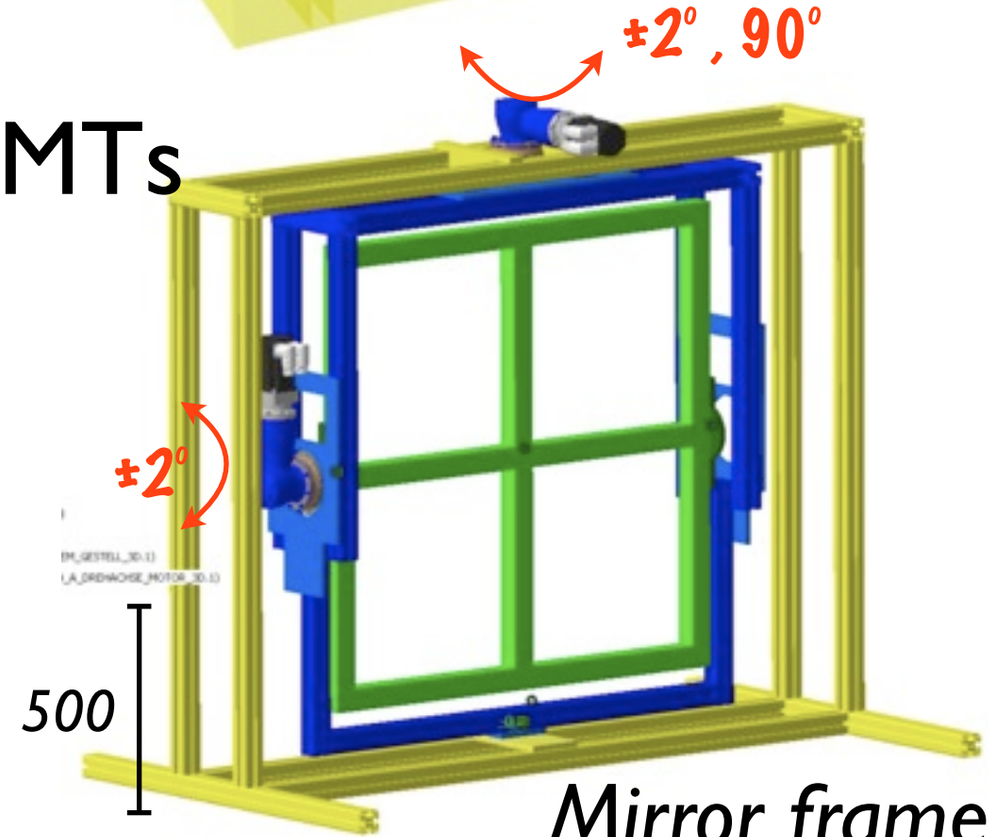
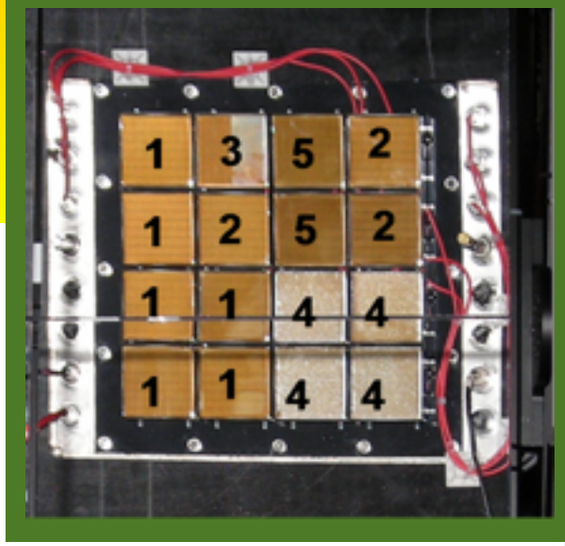


Mirror frame

trol System



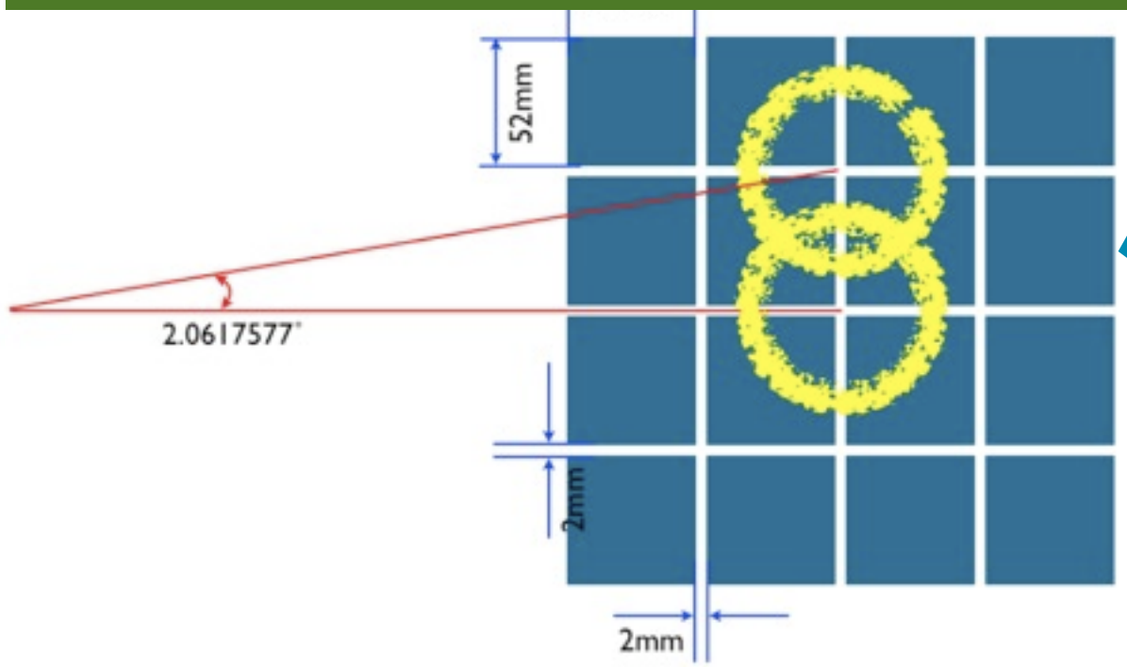
1. H8500-03 D no WLS
2. H8500-03 C no WLS
3. H8500-03 C 1/2 WLS
4. H8500-03 D with WLS
5. H10966, 8 stage, SBA

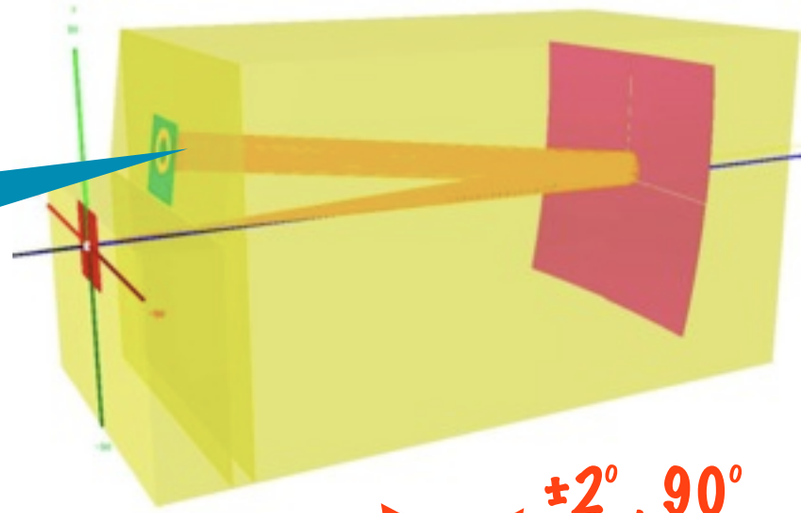
ntrol system &

control system

CBM-RICH prototype

@Giessen University





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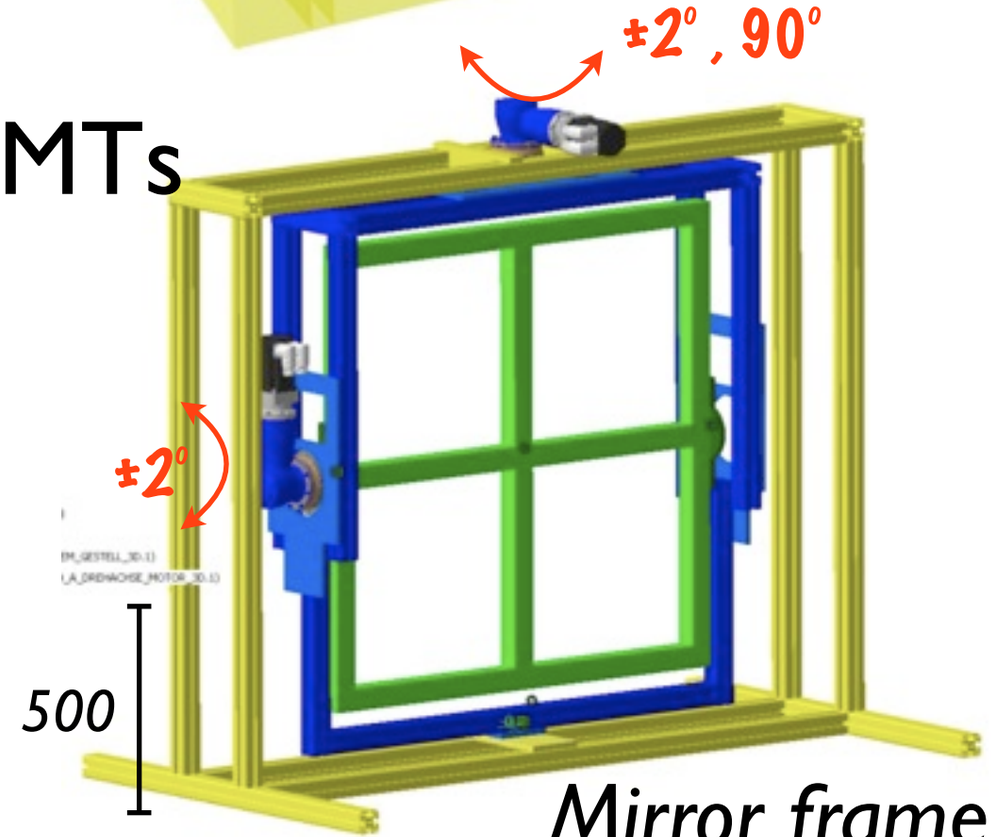
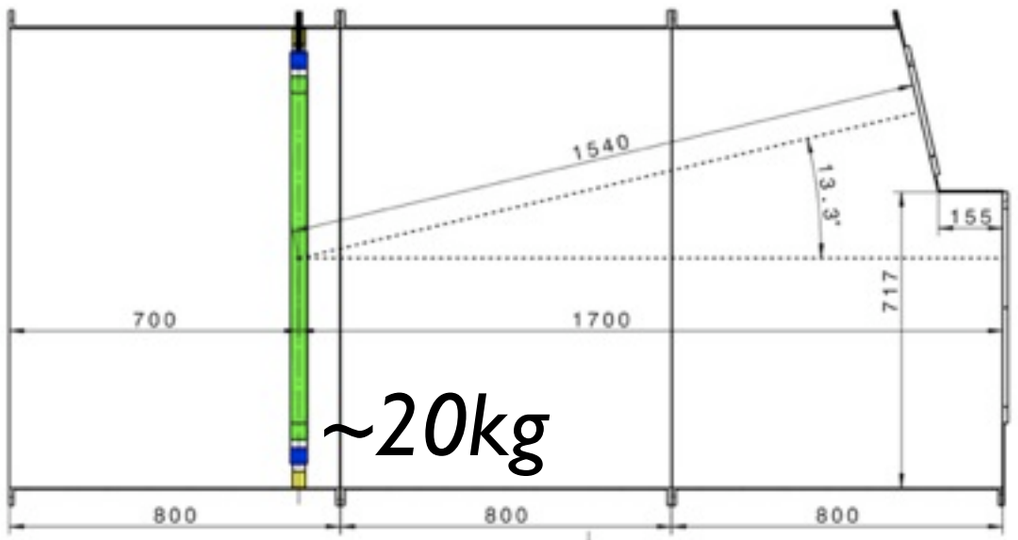
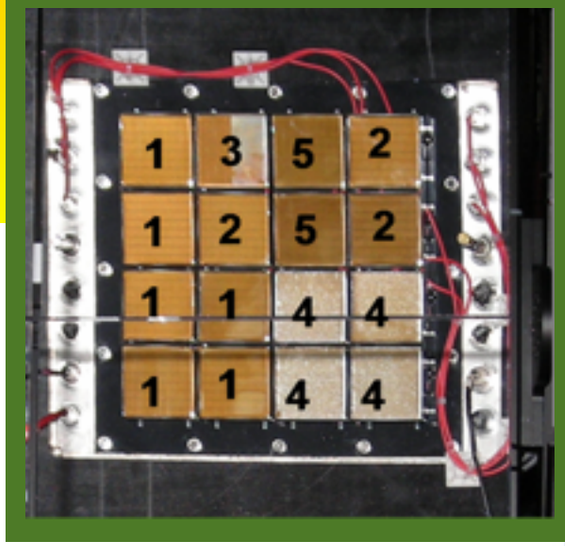


Mirror frame



~20kg

trol Syst



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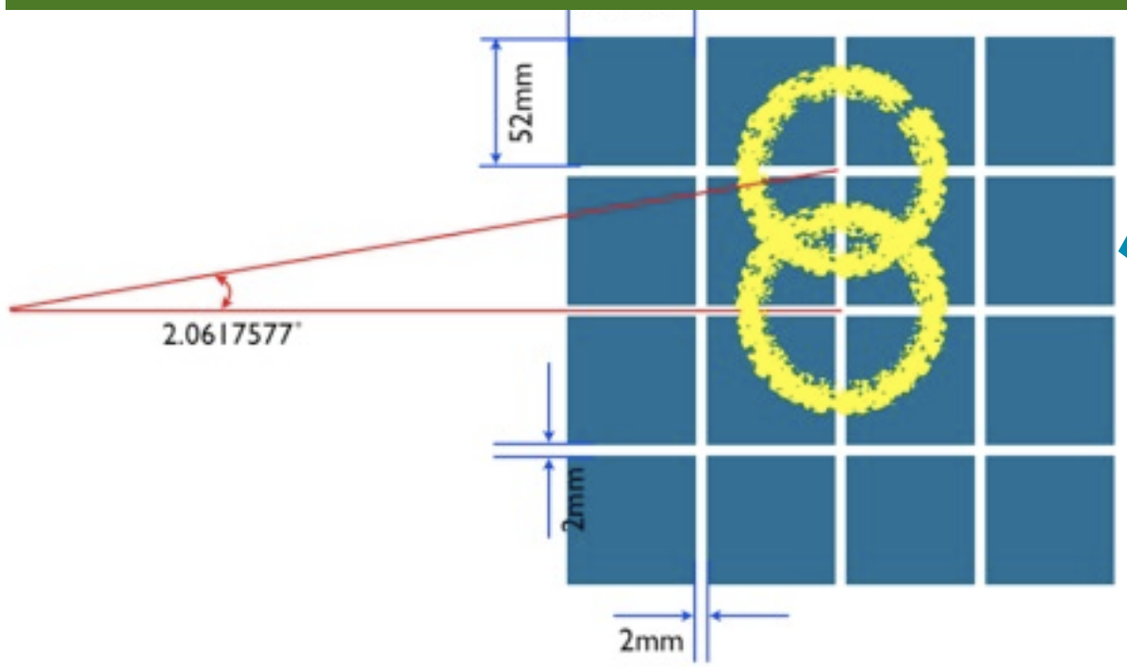
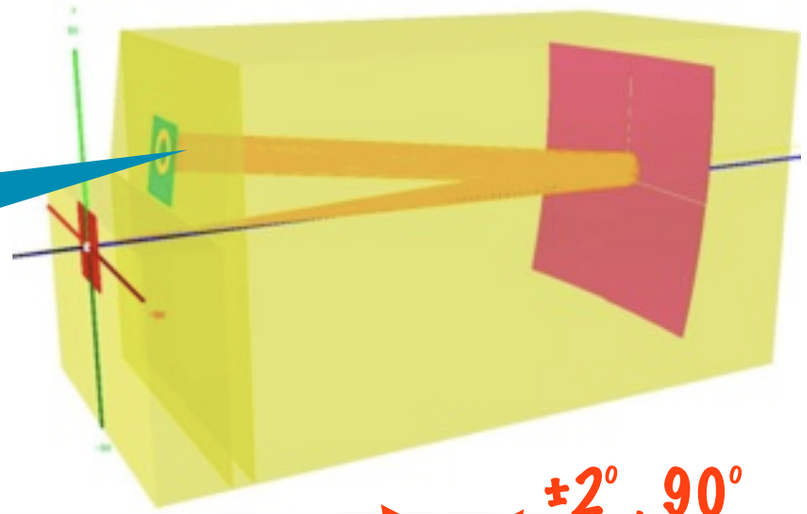
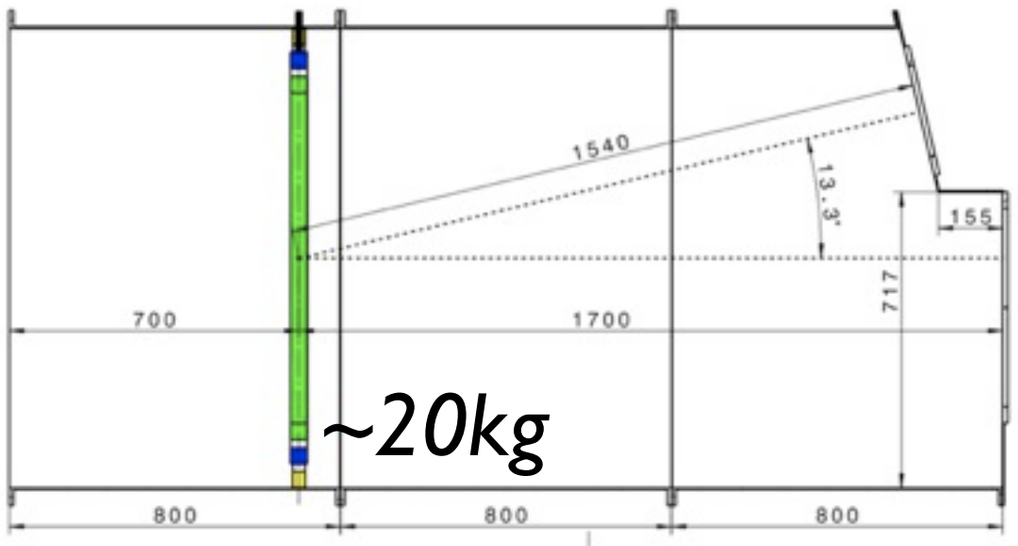
CB

@Giessen University





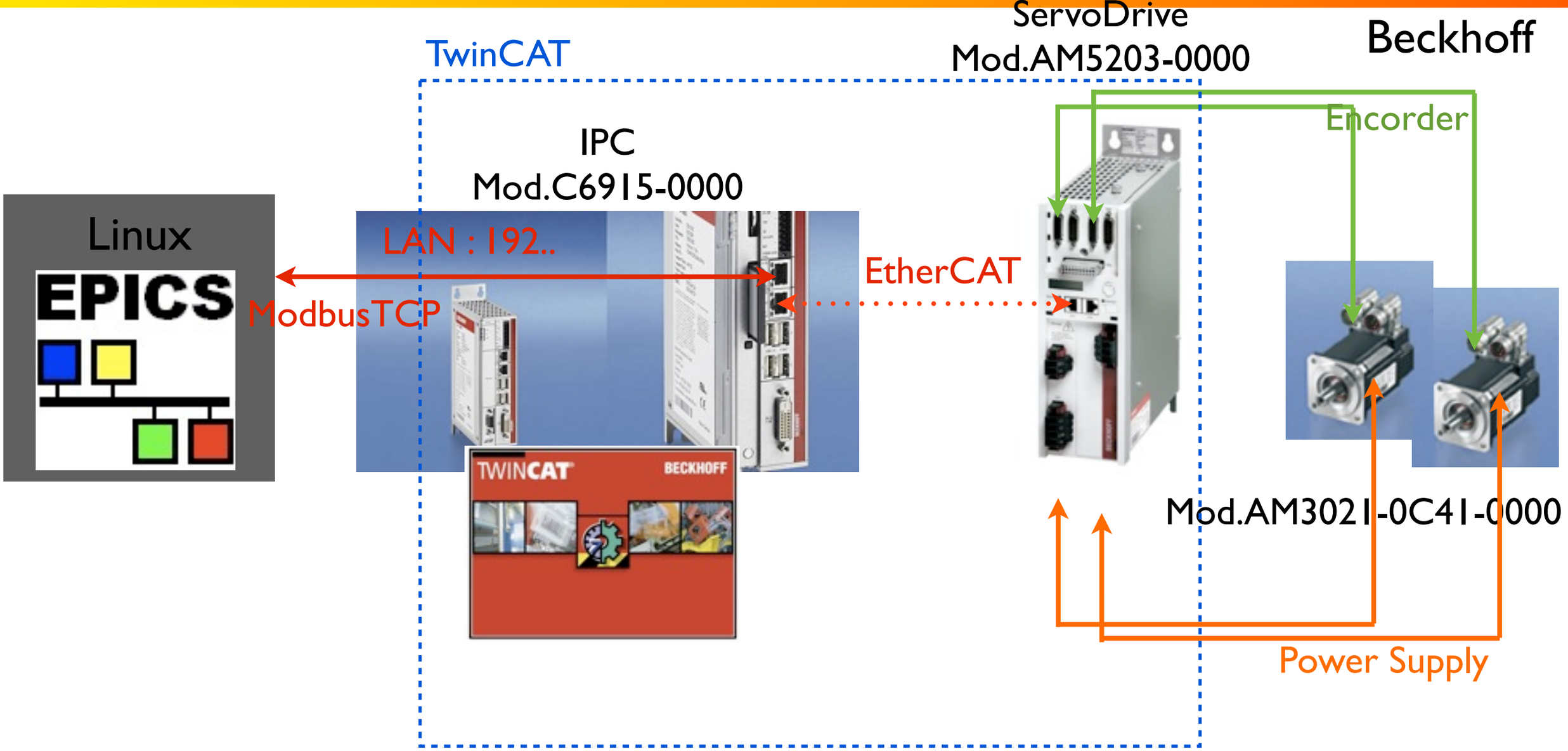


~20kg

MAPMTs

Scheme of Positioning control system

Hardware:
Beckhoff



EPICS : Experimental Physics and Industrial Control System.

TwinCAT : The Window Control Automation Technology.

Scheme of Positioning control system

Hardware:
Beckhoff

TwinCAT

ServoDrive
Mod.AM5203-0000

IPC
Mod.C6915-0000

Linux

EPICS

LAN : 192..

ModbusTCP

EtherCAT

Encorder

Mod.AM3021-0C41-0000

Power Supply

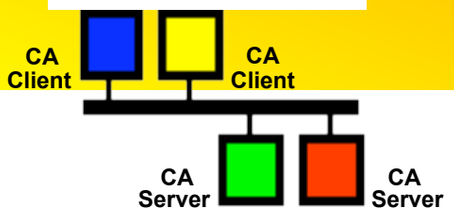
TwinCAT PLC control

TwinCAT system manager

EPICS : Experimental Physics and Industrial Control System.

TwinCAT : The Window Control Automation Technology.

EPICS architecture



For Mirror Positioning Control System

EPICS Client e.g. CSS

Channel Access

EPICS server

modbus TCP connection

Hardware

LAN

IOC (Input Output Controller)

e.g. PC

Server provides information and service
Client uses the service or asks for information

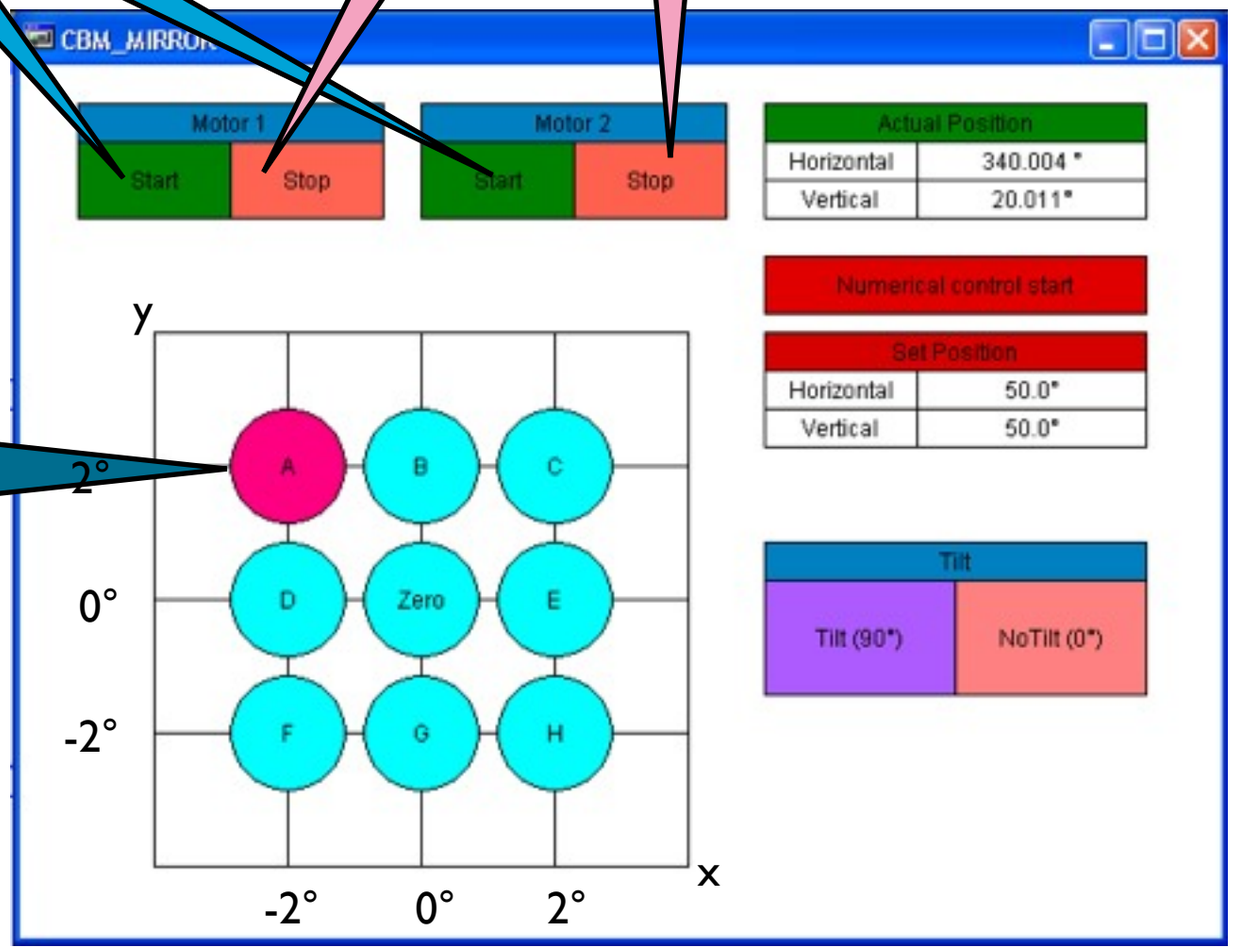
EPICS : Experimental Physics and Industrial Control System.

Control Panel(TwinCAT)

1.Start

2.Stop

3.If you click button A, mirror will be moved and you can see the ring image in this position.



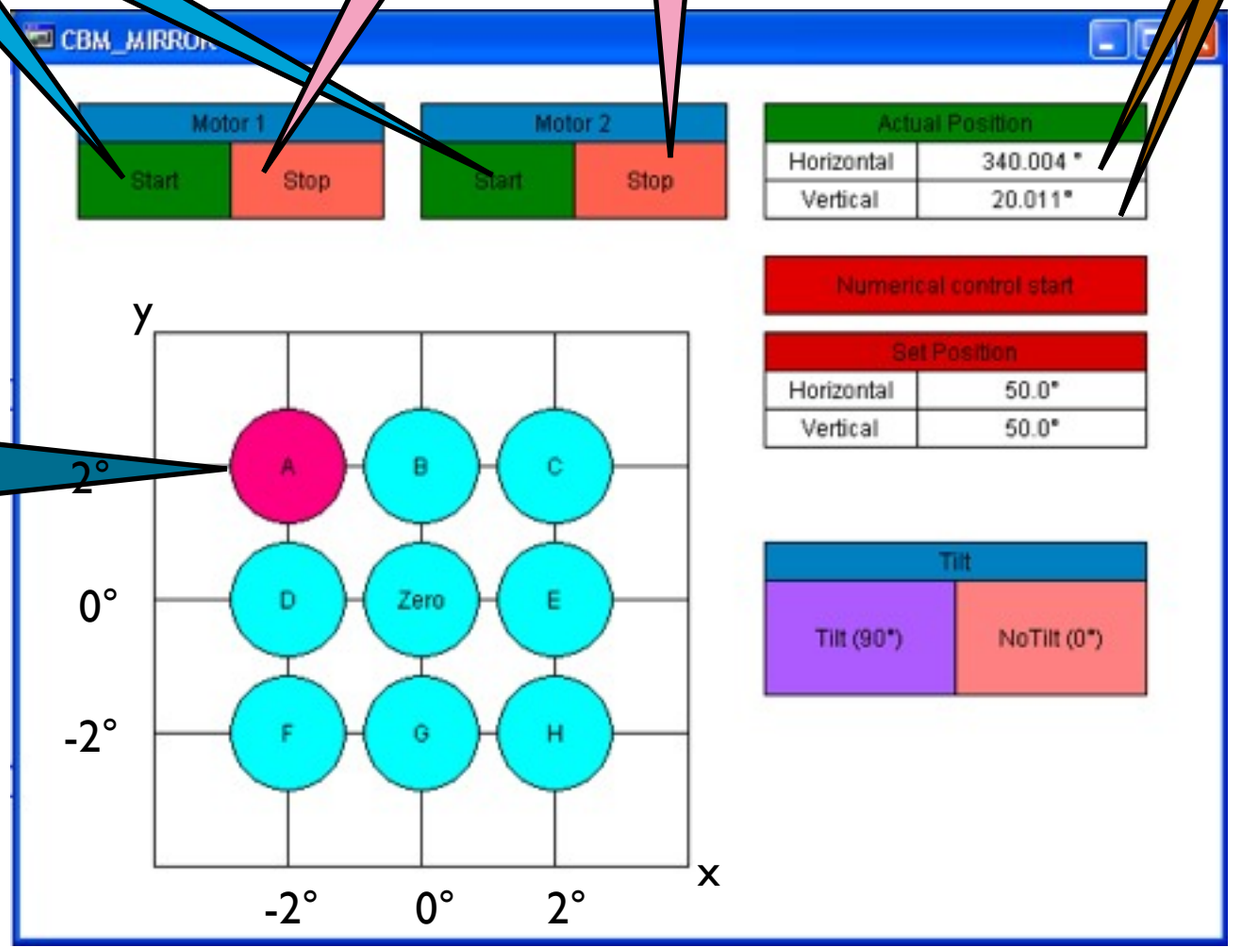
Control Panel(TwinC

1.Start

2.Stop

4.you can check the real position

3.If you click button A, mirror will be moved and you can see the ring image in this position.



Control Panel(TwinC

1.Start

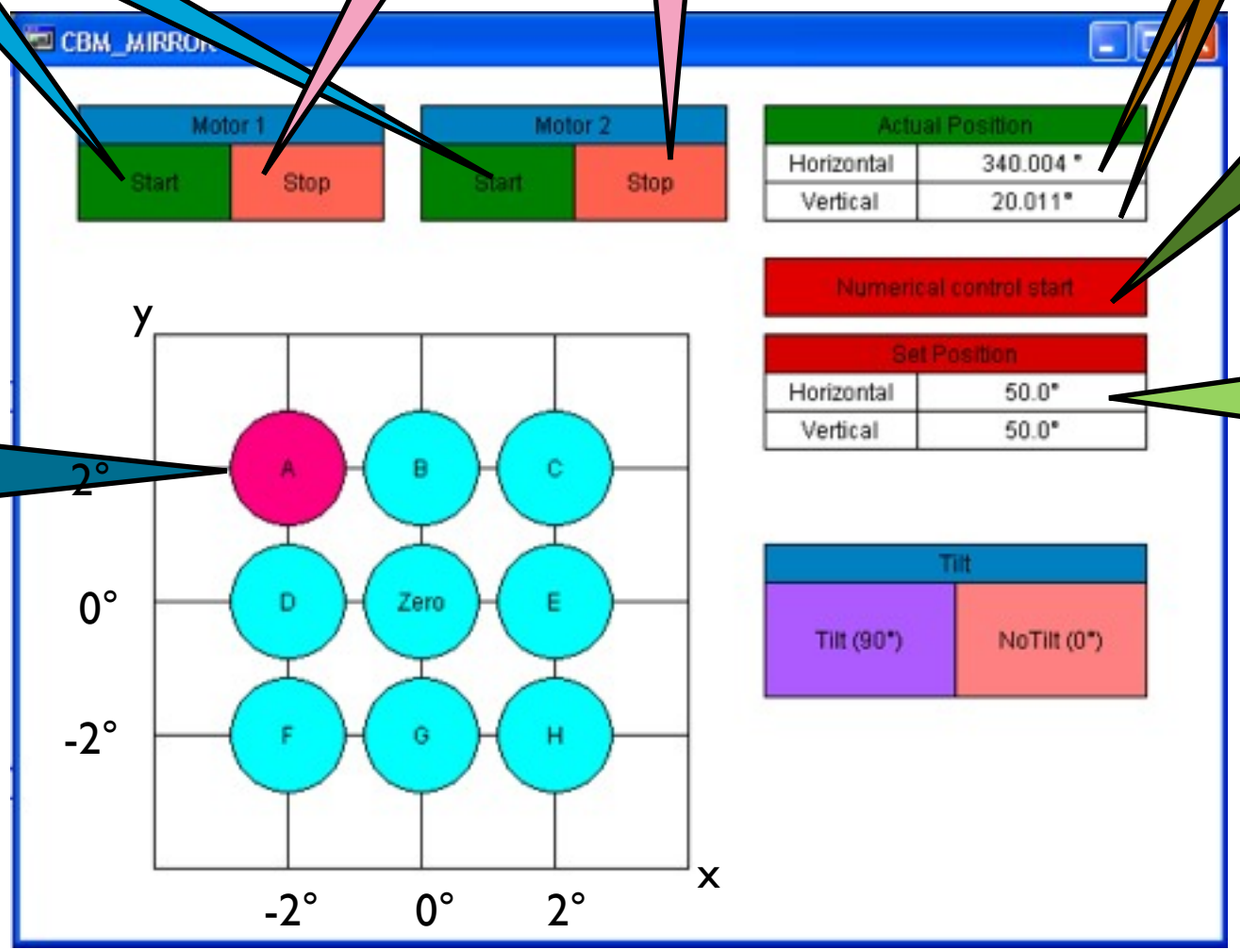
2.Stop

3.If you click button A, mirror will be moved and you can see the ring image in this position.

4.you can check the real position

5.If you want to numerical control, Click this

6.When you click this, Number pad appears.



Control Panel(TwinC

1.Start

2.Stop

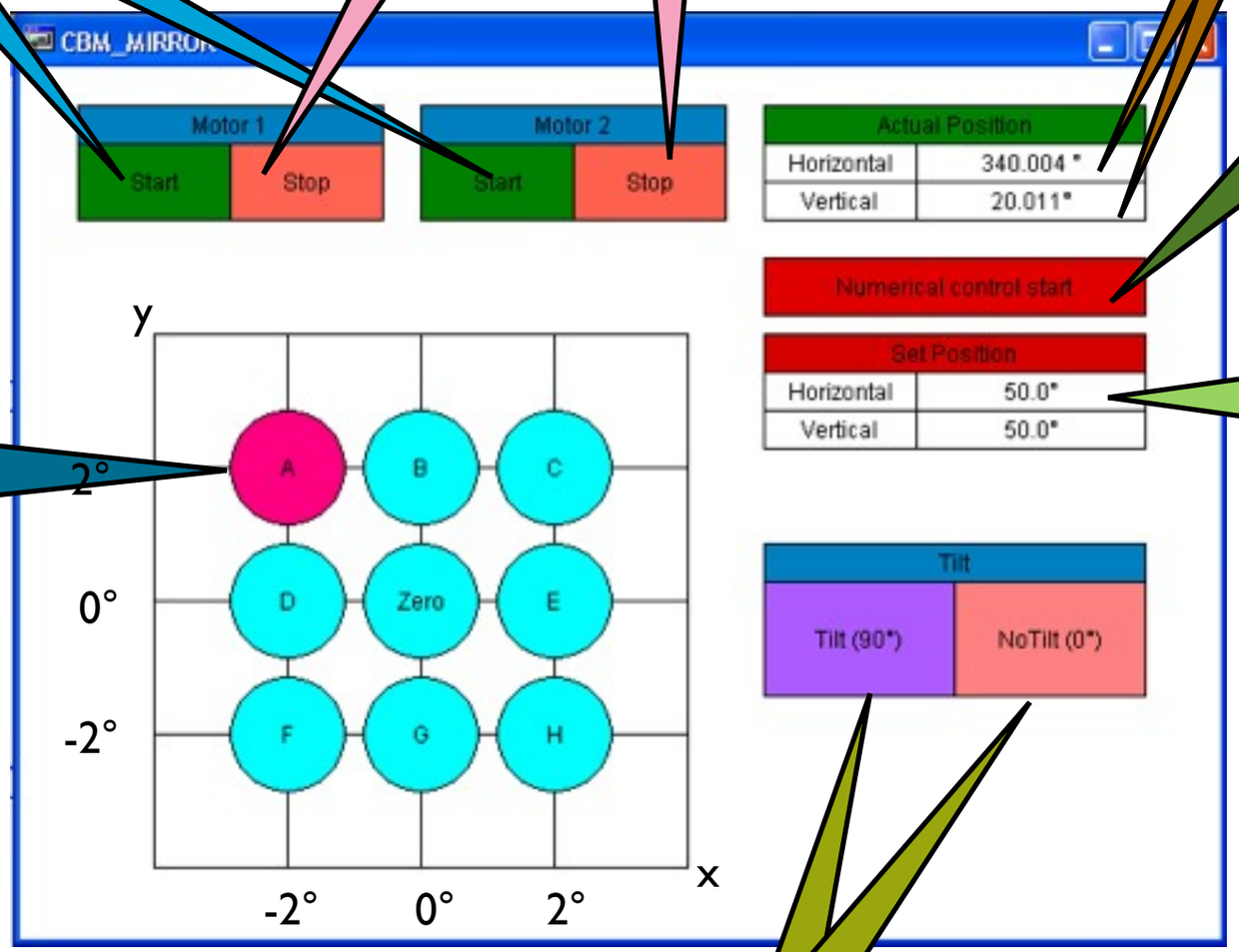
3.If you click button A, mirror will be moved and you can see the ring image in this position.

4.you can check the real position

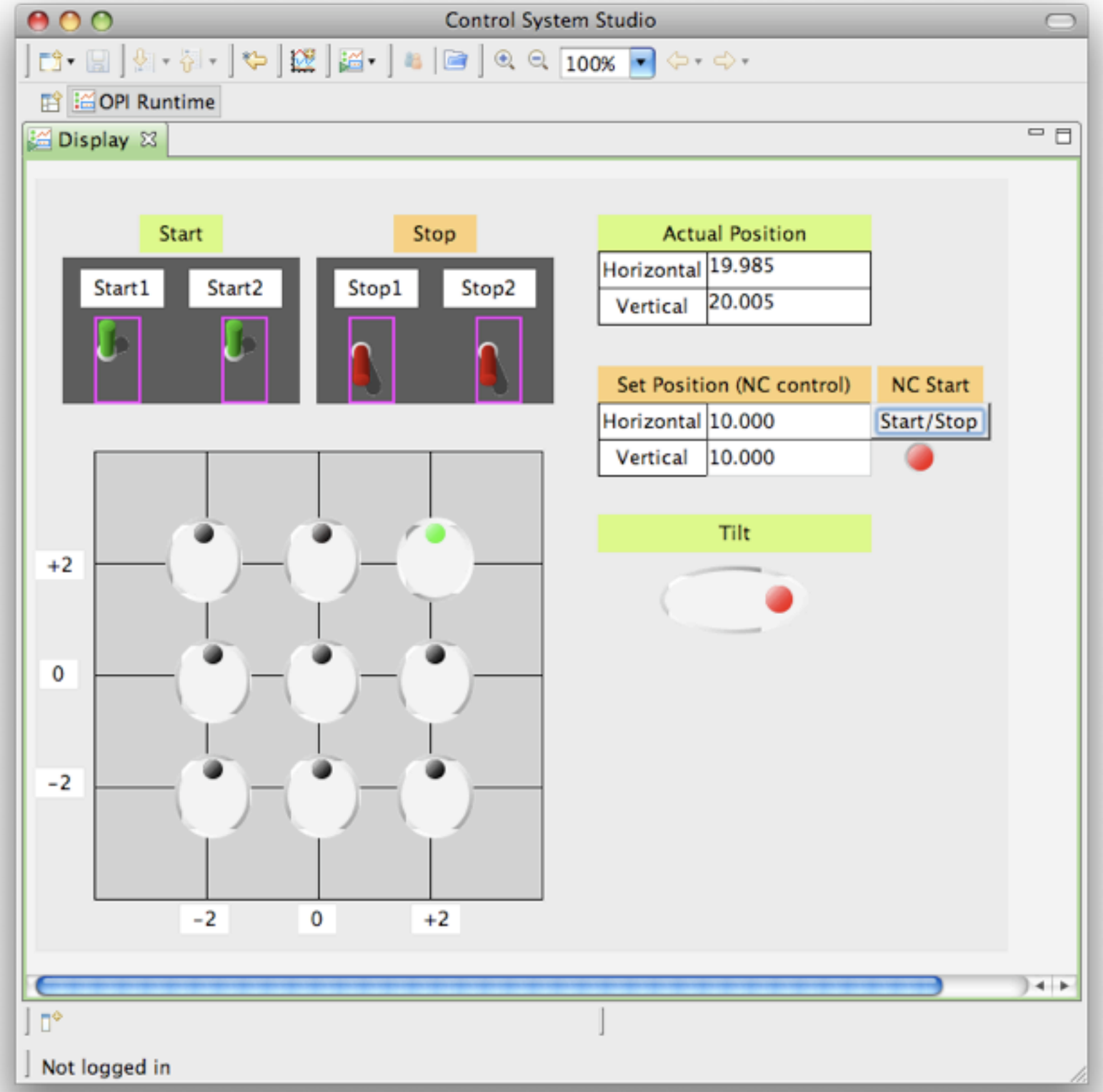
5.If you want to numerical control, Click this

6.When you click this, Number pad appears.

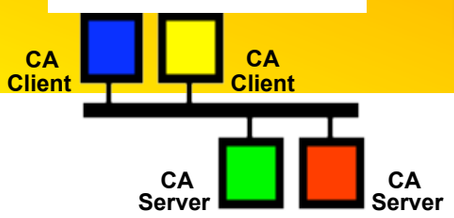
7. for Tilt(90°,0°) NoTilt(0°,0°)



Control Panel(EPICS)



EPICS architecture



For ISEG HV module and WIENER crate Control System

EPICS Client e.g. CSS

Channel Access

LAN

EPICS server

IOC (Input Output Controller)

e.g. PC

SNMP

MIB

create : WIENER
modules : ISEG

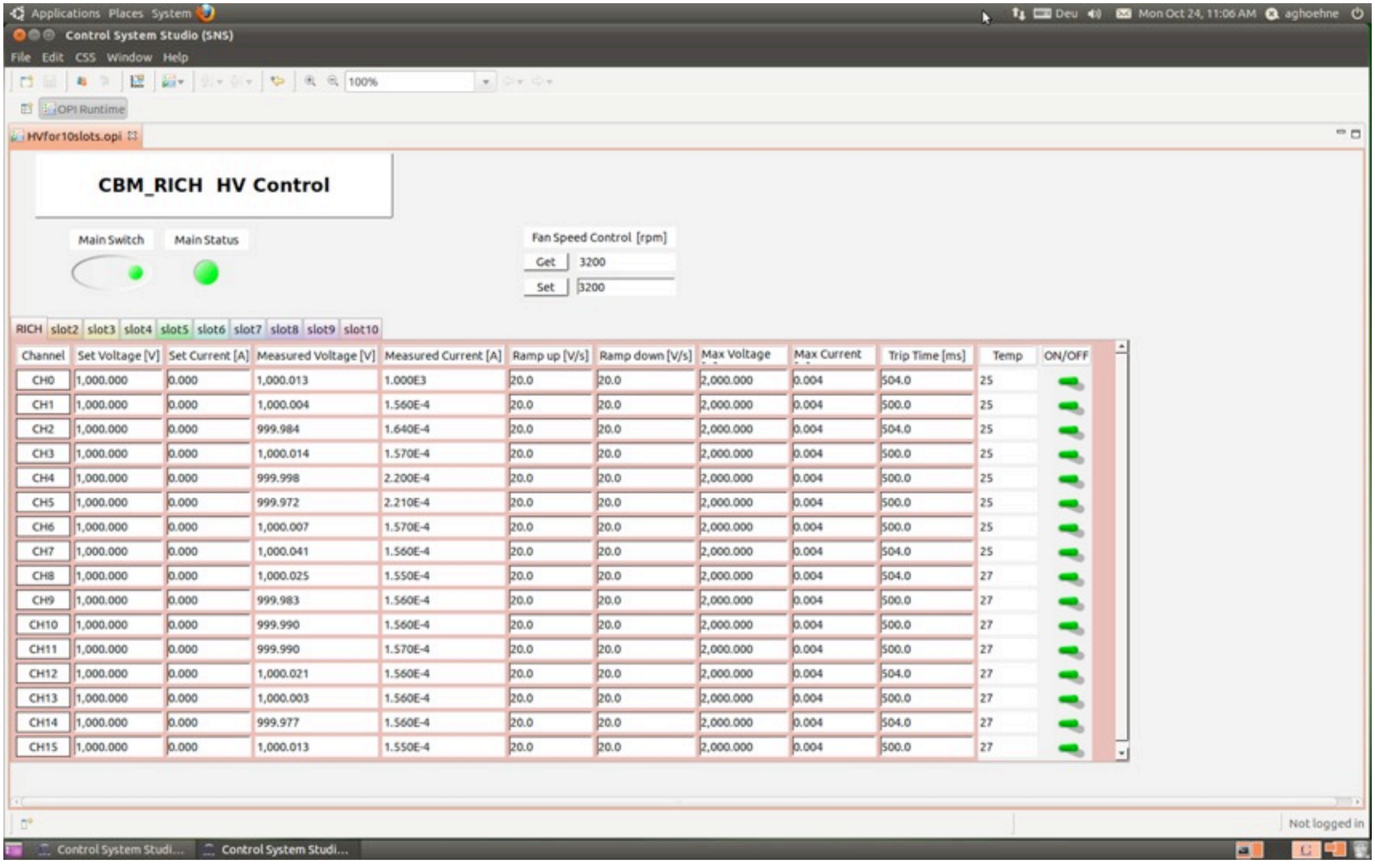
Hardware

SNMP : Simple Network Management Protocol

MIB : Management Information Base

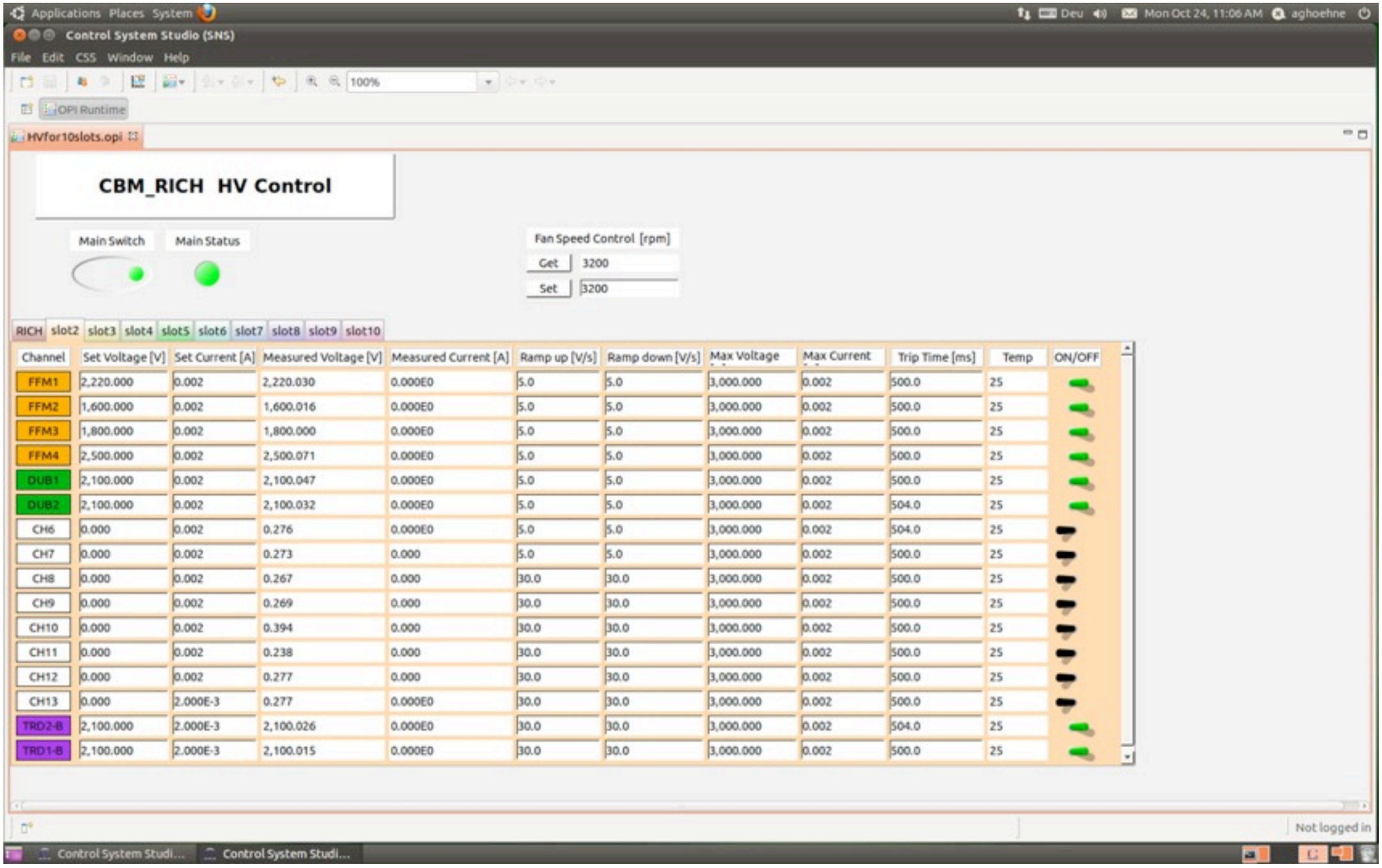
Control Panel

Slot 1 : for RICH



Control Panel

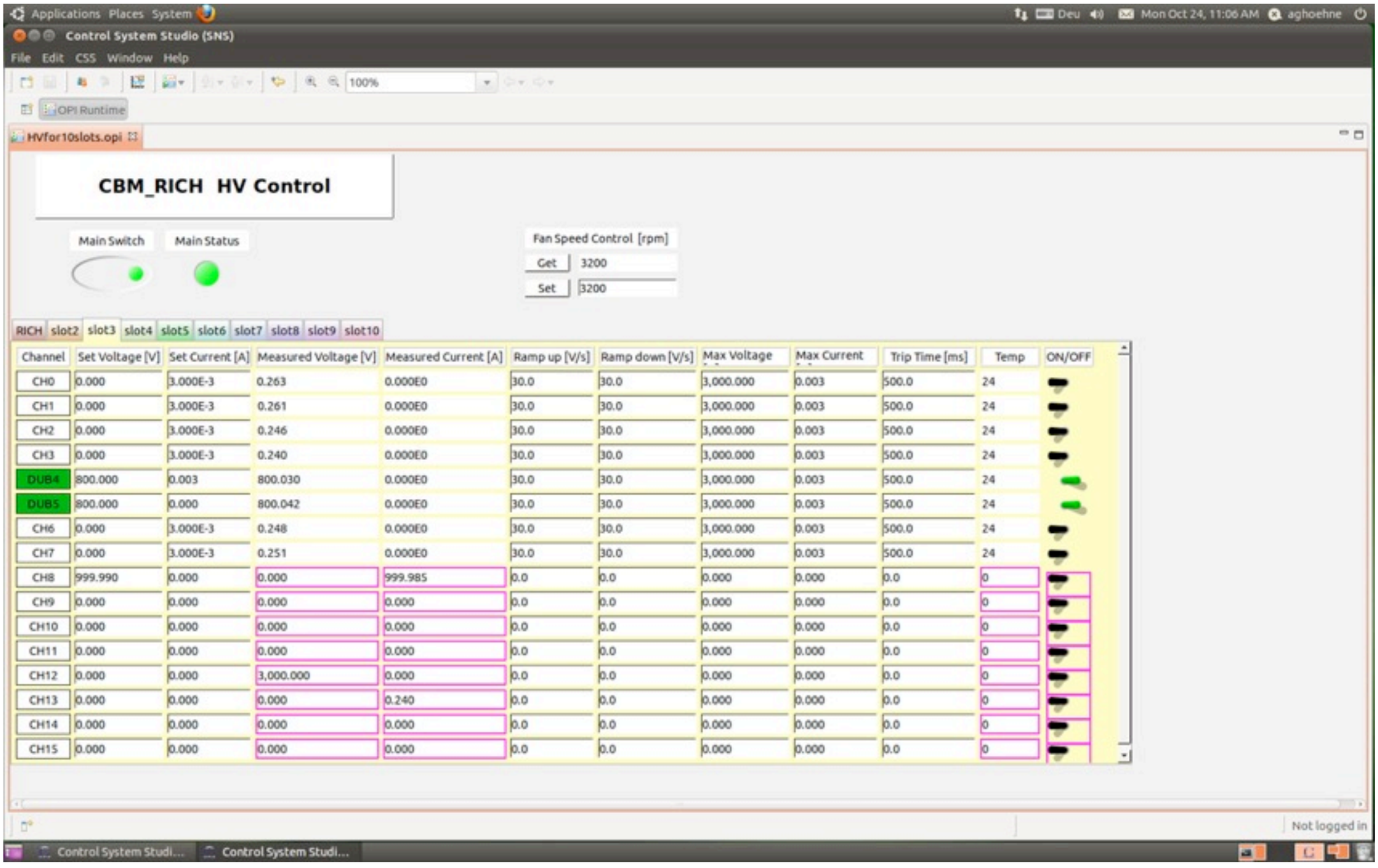
Slot 2: for FFM , DUB, TRD



Channel	Set Voltage [V]	Set Current [A]	Measured Voltage [V]	Measured Current [A]	Ramp up [V/s]	Ramp down [V/s]	Max Voltage	Max Current	Trip Time [ms]	Temp	ON/OFF
FFM1	2,220.000	0.002	2,220.030	0.000E0	5.0	5.0	3,000.000	0.002	500.0	25	
FFM2	1,600.000	0.002	1,600.016	0.000E0	5.0	5.0	3,000.000	0.002	500.0	25	
FFM3	1,800.000	0.002	1,800.000	0.000E0	5.0	5.0	3,000.000	0.002	500.0	25	
FFM4	2,500.000	0.002	2,500.071	0.000E0	5.0	5.0	3,000.000	0.002	500.0	25	
DUB1	2,100.000	0.002	2,100.047	0.000E0	5.0	5.0	3,000.000	0.002	500.0	25	
DUB2	2,100.000	0.002	2,100.032	0.000E0	5.0	5.0	3,000.000	0.002	504.0	25	
CH6	0.000	0.002	0.276	0.000E0	5.0	5.0	3,000.000	0.002	504.0	25	
CH7	0.000	0.002	0.273	0.000	5.0	5.0	3,000.000	0.002	500.0	25	
CH8	0.000	0.002	0.267	0.000	30.0	30.0	3,000.000	0.002	500.0	25	
CH9	0.000	0.002	0.269	0.000	30.0	30.0	3,000.000	0.002	500.0	25	
CH10	0.000	0.002	0.394	0.000	30.0	30.0	3,000.000	0.002	500.0	25	
CH11	0.000	0.002	0.238	0.000	30.0	30.0	3,000.000	0.002	500.0	25	
CH12	0.000	0.002	0.277	0.000	30.0	30.0	3,000.000	0.002	500.0	25	
CH13	0.000	2.000E-3	0.277	0.000E0	30.0	30.0	3,000.000	0.002	500.0	25	
TRD2-B	2,100.000	2.000E-3	2,100.026	0.000E0	30.0	30.0	3,000.000	0.002	504.0	25	
TRD1-B	2,100.000	2.000E-3	2,100.015	0.000E0	30.0	30.0	3,000.000	0.002	500.0	25	

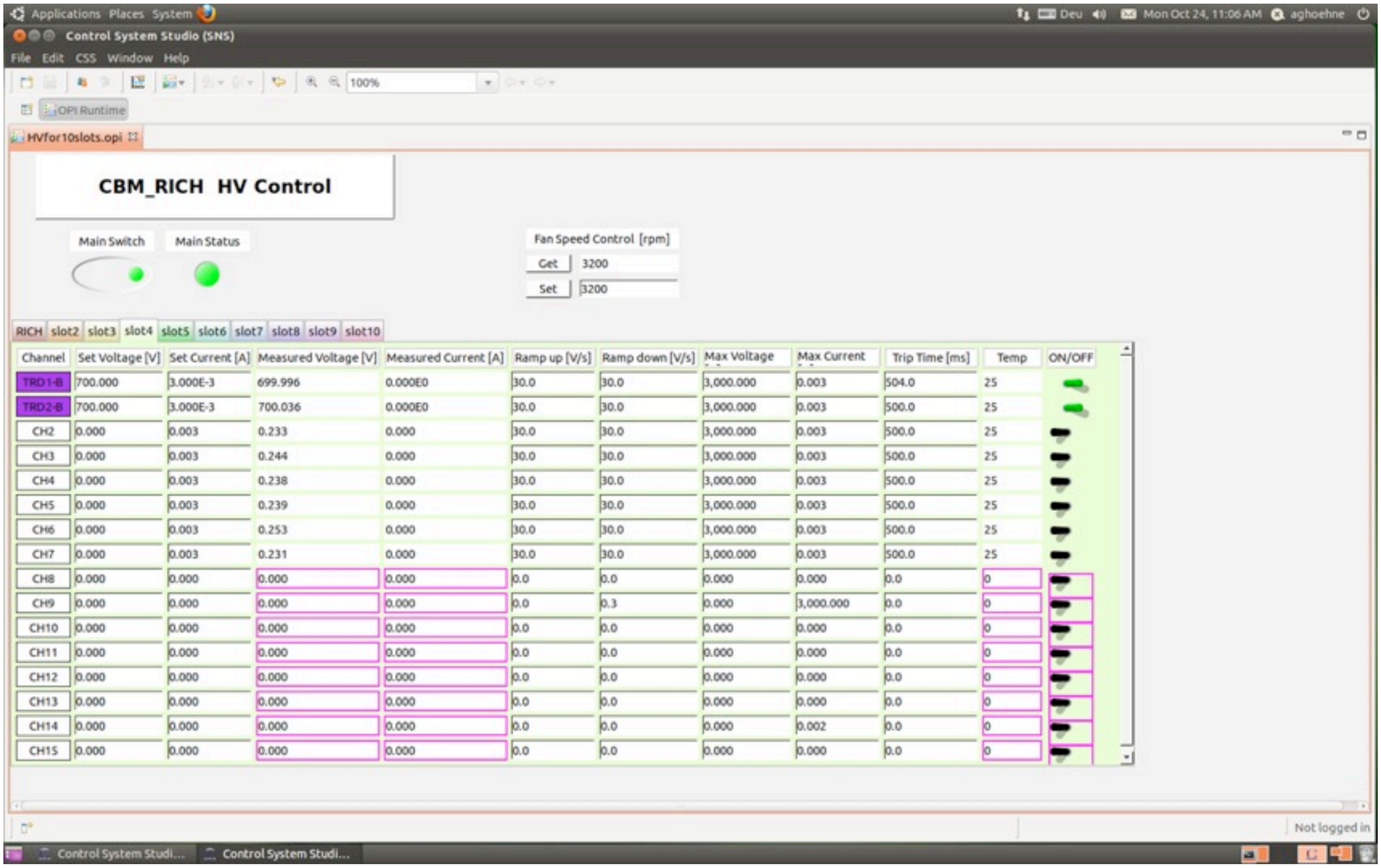
Control Panel

Slot 3 : for DUB



Control Panel

Slot 4 : for TRD



Parameter scan

- Camera scan
  - identify the number of Cherenkov photons per ring
  - measure the overall detection efficiency for the different PMTs.
- Gas parameter scan
  - number of photons per ring was studied as function of the gas purity in terms of O2 contamination
- High voltage and threshold scan
  - Threshold : 28, 35, 40, 50, 75, 100
  - High voltage : 1000V, 1100V
- Momentum scan (2GeV, 4GeV, 6GeV, 8GeV)
- Mirror scan

Parameter scan

- **Camera scan**
  - identify the number of Cherenkov photons per ring
  - measure the overall detection efficiency for the different PMTs.

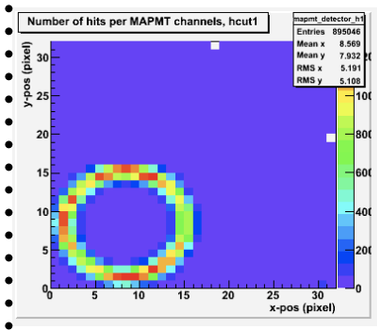
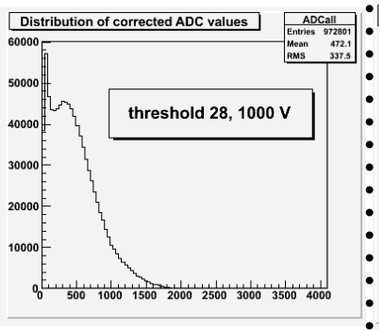
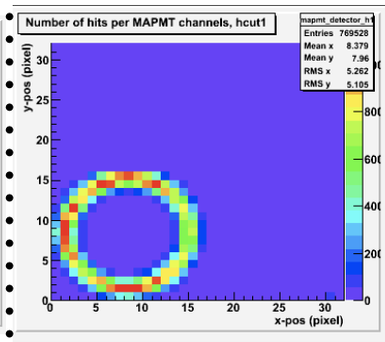
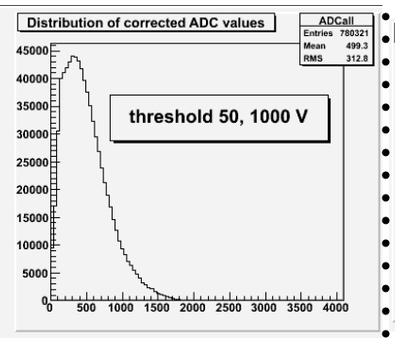
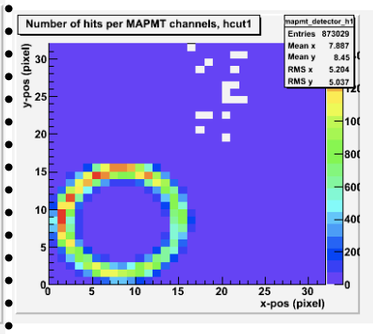
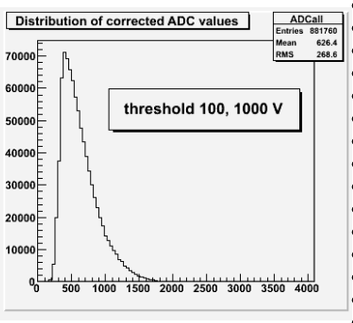
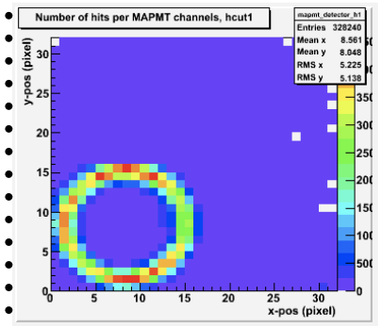
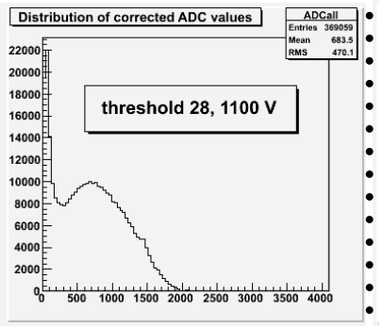
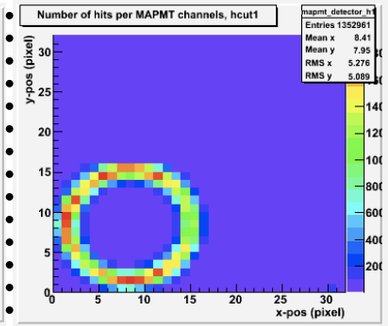
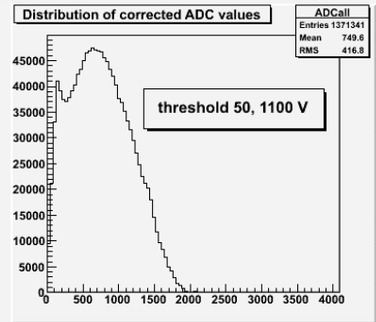
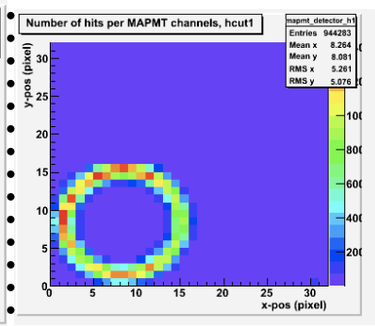
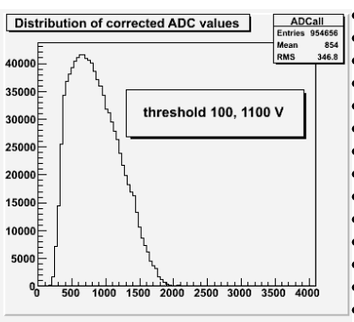
- **Gas parameter scan**
  - number of photons per ring was studied as function of the gas purity in terms of O2 contamination

- **High voltage and threshold scan**
  - Threshold : 28, 35, 40, 50, 75, 100
  - High voltage : 1000V, 1100V

- **Momentum scan** (2GeV, 4GeV, 6GeV, 8GeV)

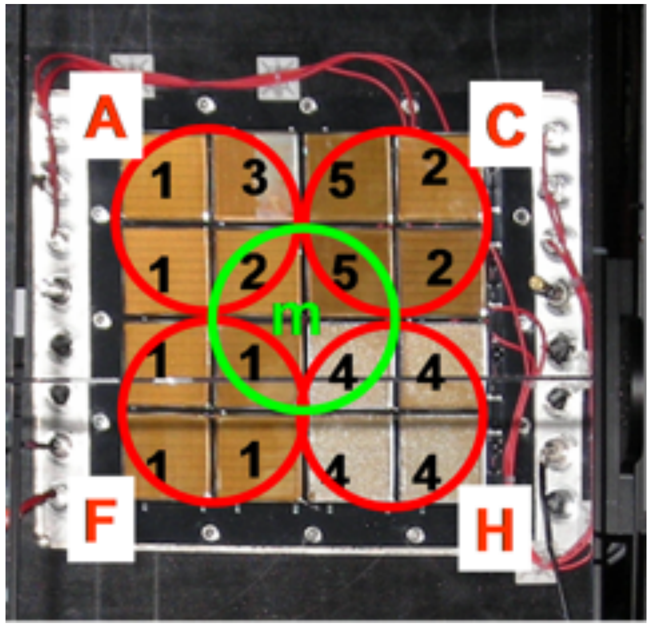
- **Mirror scan**

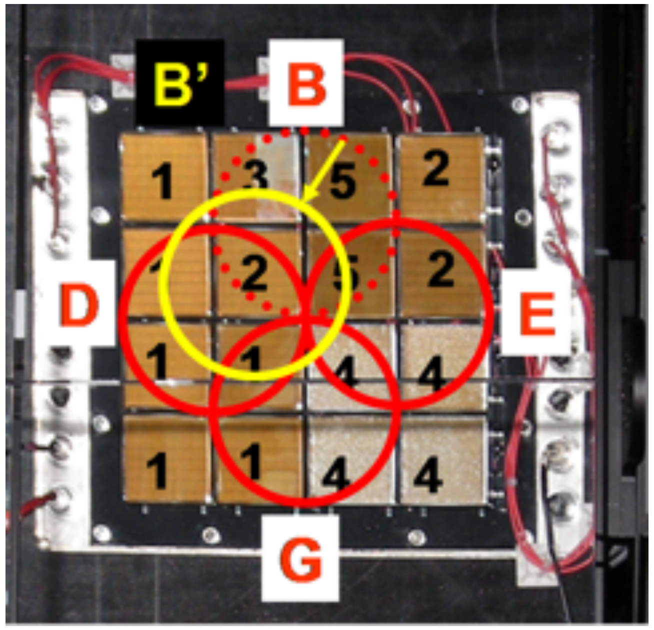
Results 1 : HV control

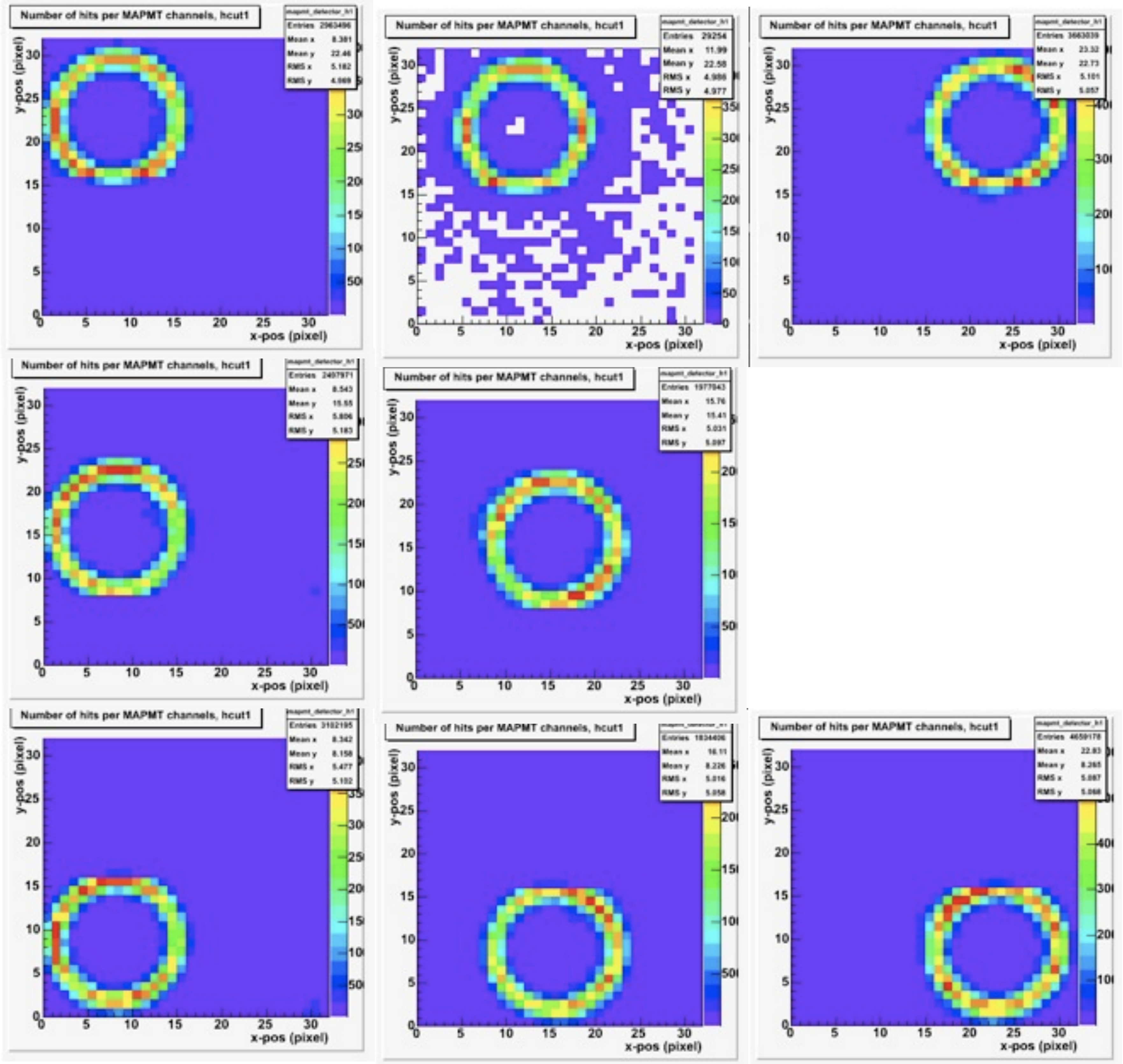
Threshold	28	50	100
HV			
1000 V	 	 	 
1100 V	 	 	 

Results II : mirror positioning control

Position



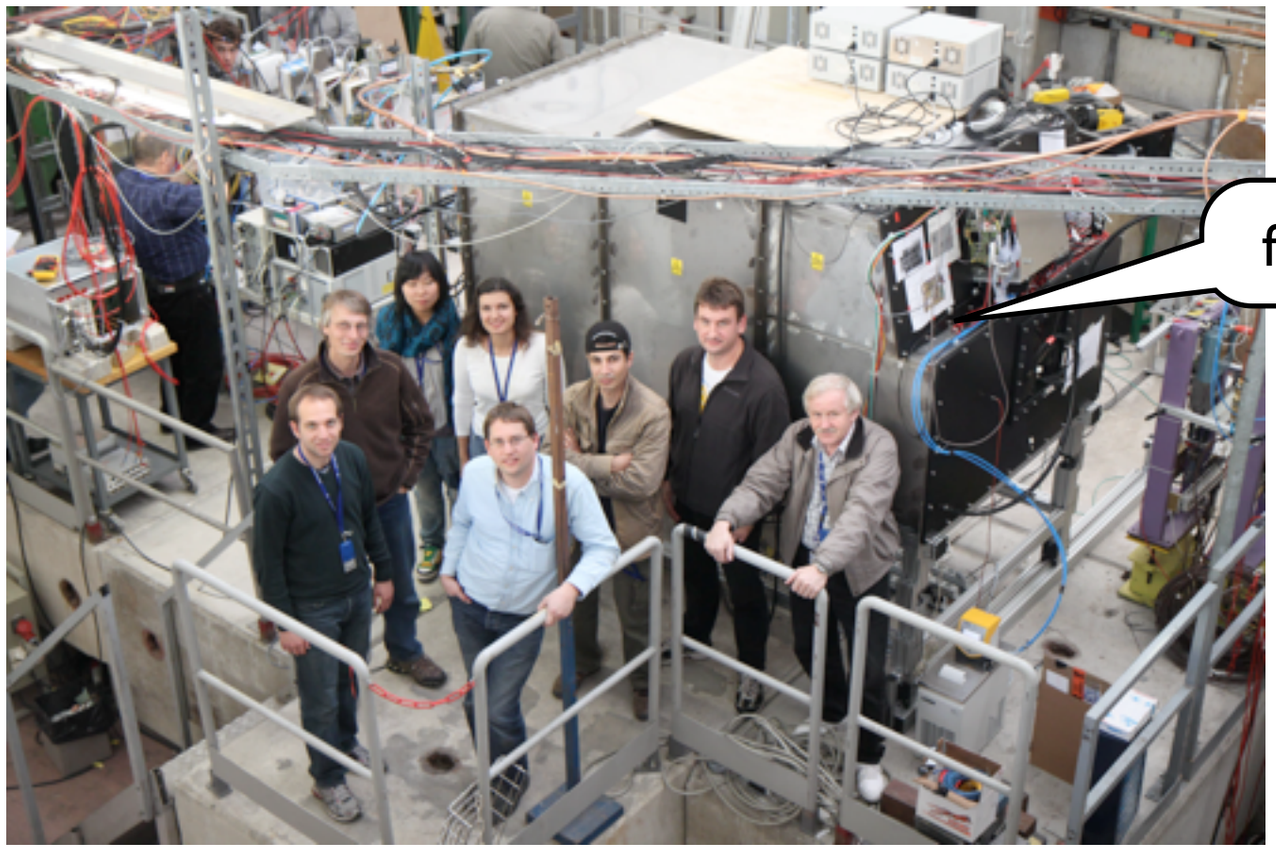




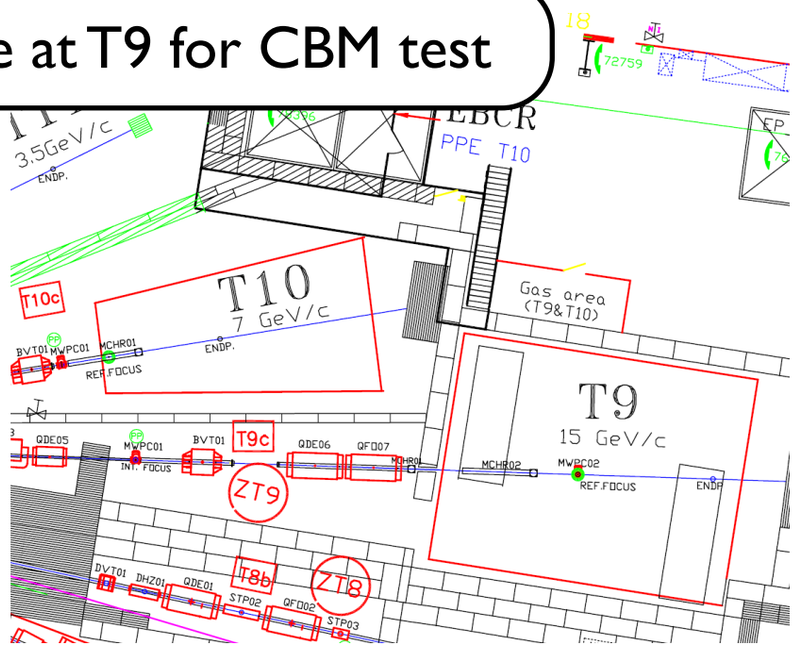
Conclusion

- EPICS is successfully implemented for
  - Mirror Positioning control system (BECKHOFF motors)
  - HV control system (WIENER crate + ISEG HV module)

- Tested experiment for prototype @CERN, T9 in Oct.2011

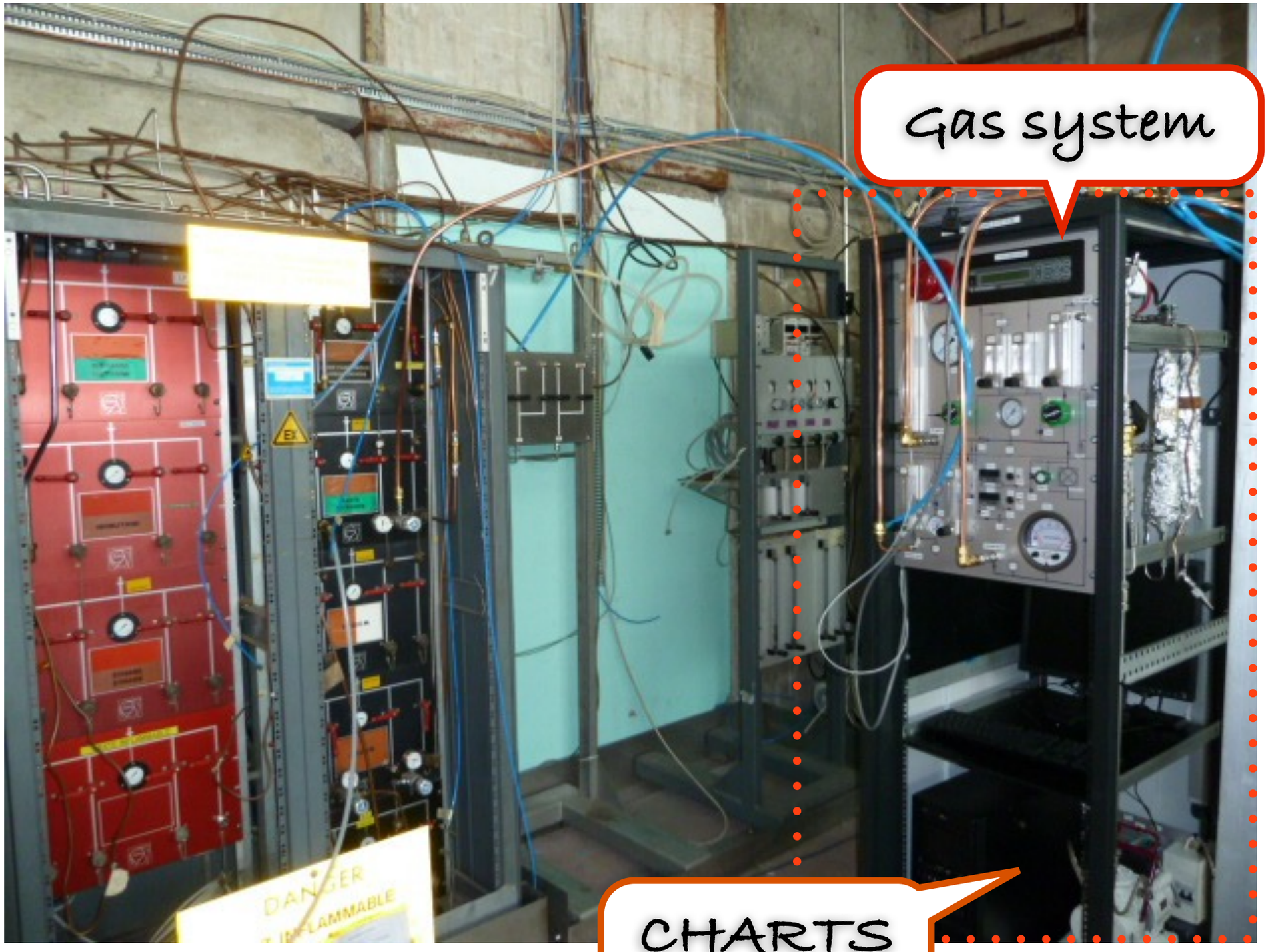


floor space at T9 for CBM test

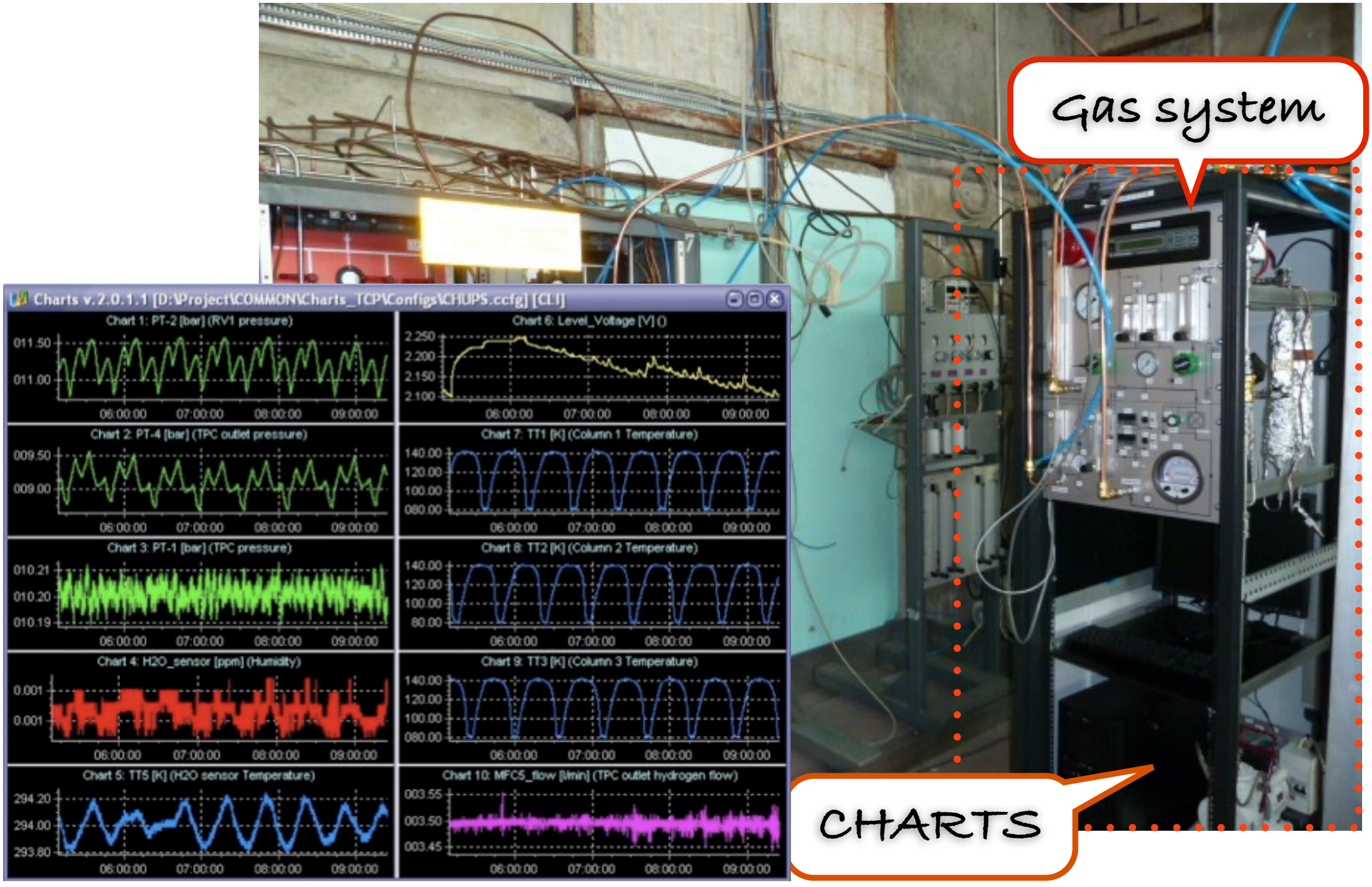


Thank you.

Gas monitoring system



Gas monitoring system



Gas monitoring system