



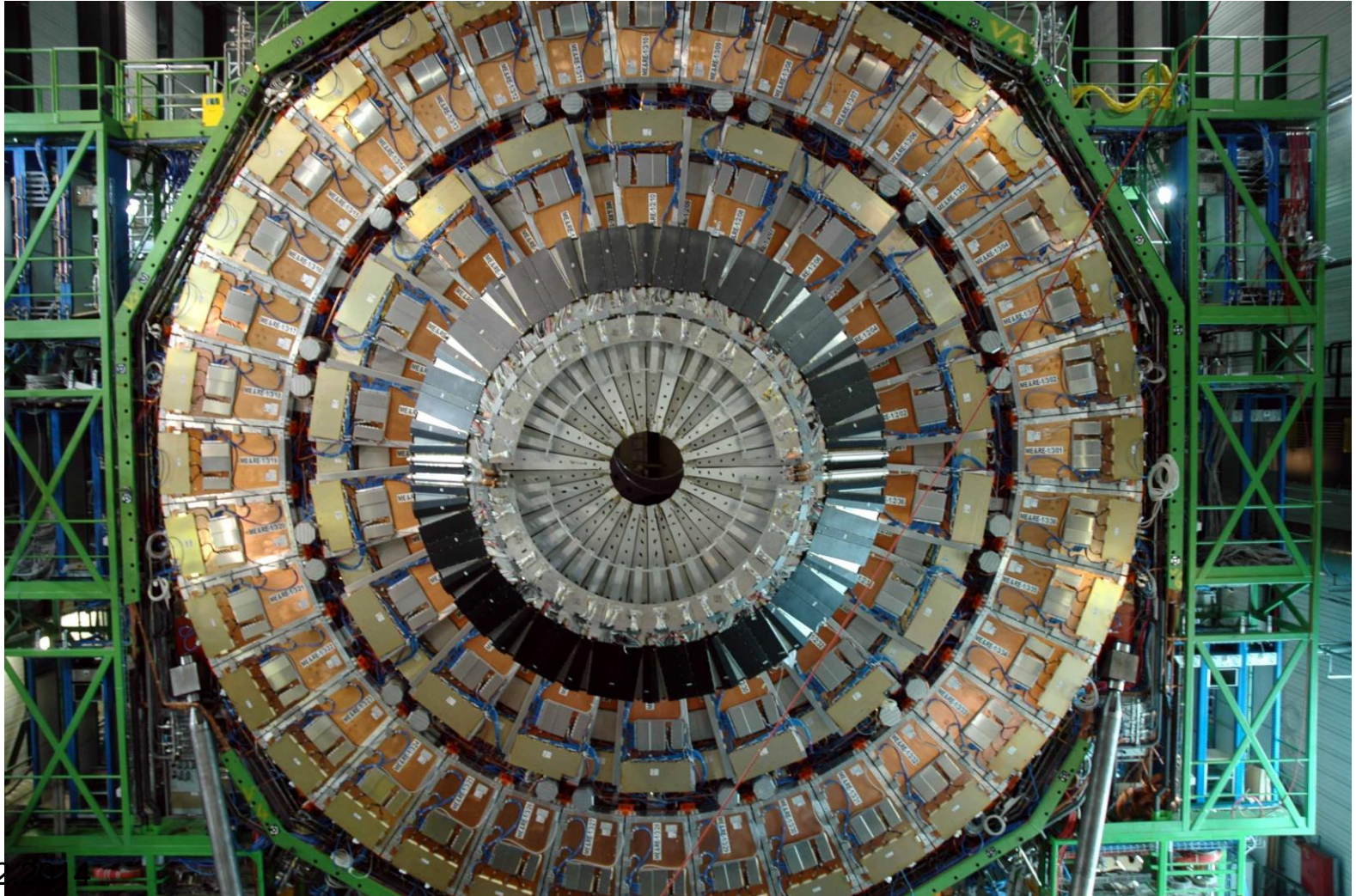
**НАУЧНОЙ СЕССИИ ОФВЭ**  
23-26 декабря 2014

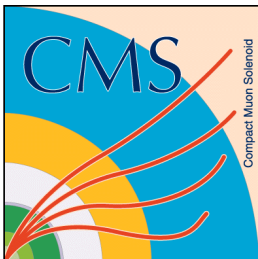


# Эксперимент CMS

В.Сулимов

# Muon Subsystem





# CSC Upgrade LS1



- Original design unfinished – ME4/2 not built, because of finance restrictions, it was decided to postpone the construction of the ME4/2 region (72 CSCs) until the first LHC shutdown
- 72 ME4/2 chambers to complete system
  - Identical to chambers already built and working well
  - Increase redundancy of system
  - Efficient triggering at high luminosities



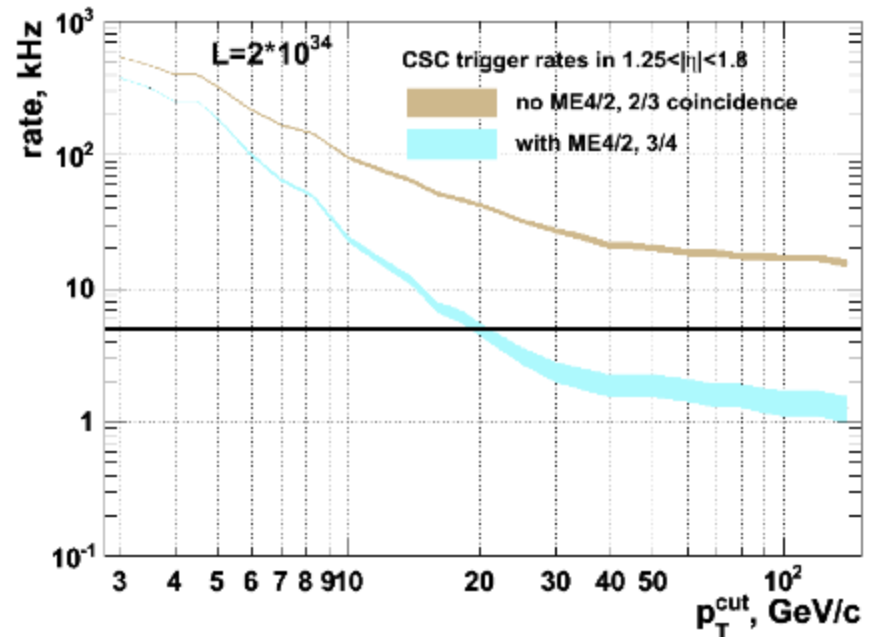
# Why ME4/2 upgrade?



With ME4/2, we can change the trigger Condition to be 3/4 Coincidence instead of 2/3

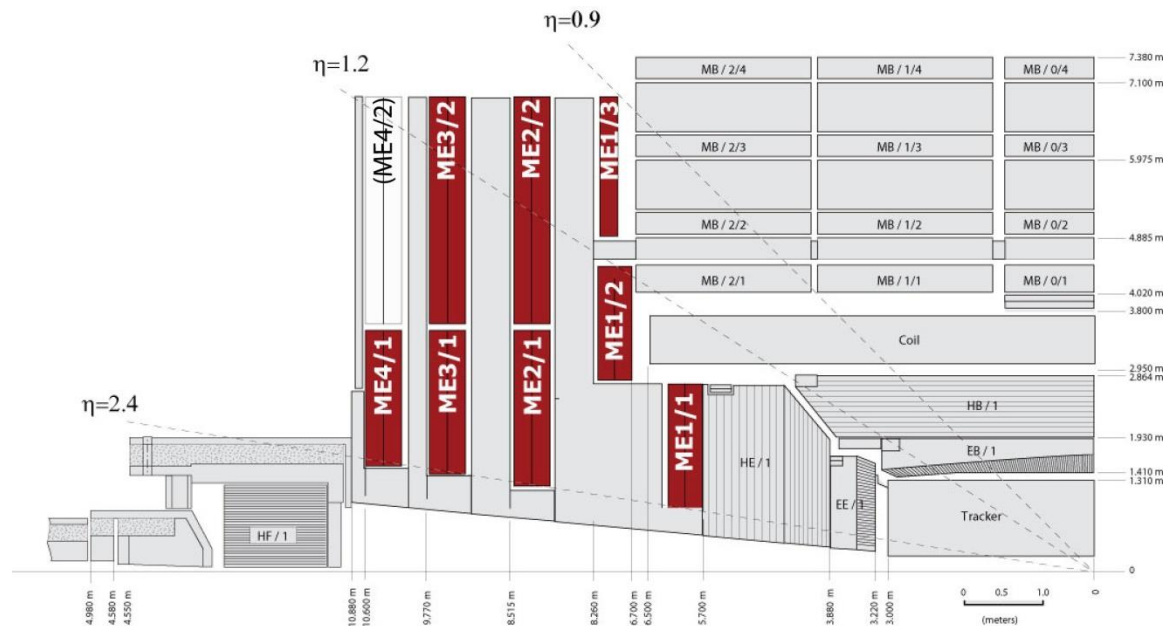
- Decrease in fake rate (predicted)

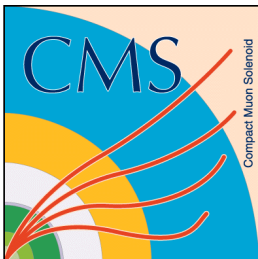
Prediction of adding ME4/2 from simulation





- ME1/1 72 1.5×0.5 m<sup>2</sup>**
- ME1/2 72 1.6×0.8 m<sup>2</sup>**
- ME1/3 72 1.7×0.9m<sup>2</sup>**
- ME 2/1 36 1.9×1.25 m<sup>2</sup>**
- ME3/1 36 1.7×1.25 m<sup>2</sup>**
- ME4/1 36 1.5×1.25m<sup>2</sup>**
- ME2/2 72 3.2×1.3m<sup>2</sup>**
- ME3/2 72 3.2×1.3m<sup>2</sup>**
- ME4/2 72 3.2×1.3m<sup>2</sup>**
- 540 CSCs (cover about 6000 m<sup>2</sup>)**
- 2.5 10\*\*6 anode wires**
- 210816 anode readout channels**
- 273024 cathode readout channels**



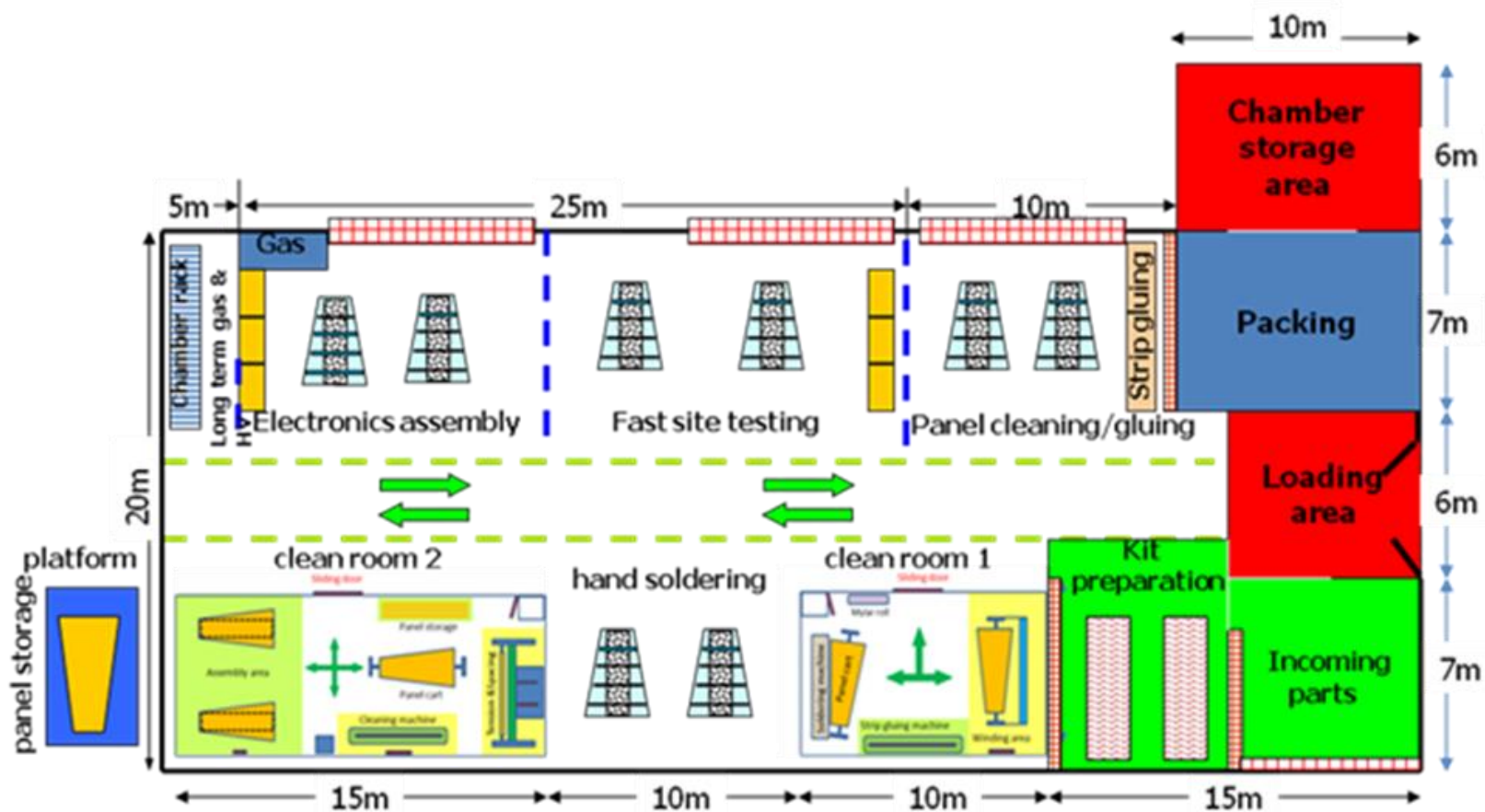


# CSC Production Milestones



- May 2010: Refurbishing B904
- Nov 2010: Equipment from FNAL arrived, set up, commissioned
- May 2011: Factory ready for CSC construction
- June 3, 2011: First CSC construction began using parts from old production
  - Completed July
- Beginning of 2012: Five chambers built
- Feb 2012: Delivery of new chamber parts
- May 2012: Delivery of new panels
- Jun 2012: Started “mass production” of chambers.
- 11 Feb 2013: Final chamber for first endcap (prod.number 230) completed
- 11 Oct 2013: Final Chamber For Second Endcap (prod. Number 266) completed
- 17 Oct 2013: Chambers For First Endcap Sent To P5
  
- 2014 Final testing mid--February, 1.5 Months Before April installation date

# CSC Production





# CSC Production



December 2010



June 2011



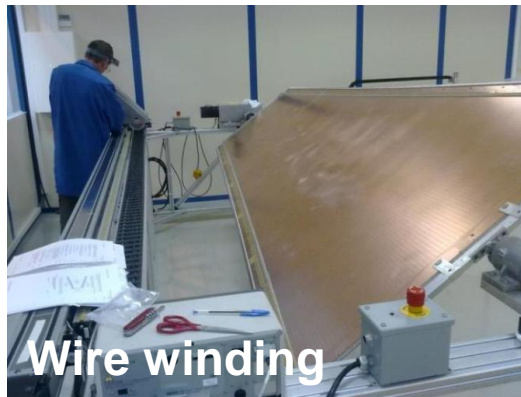
# CSC Production



Today



FR4 bar bonding



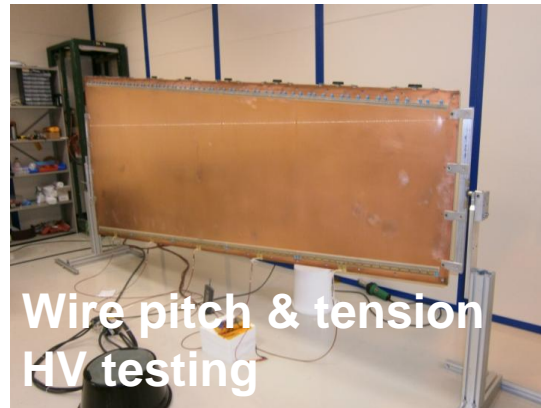
Wire winding



Wire soldering



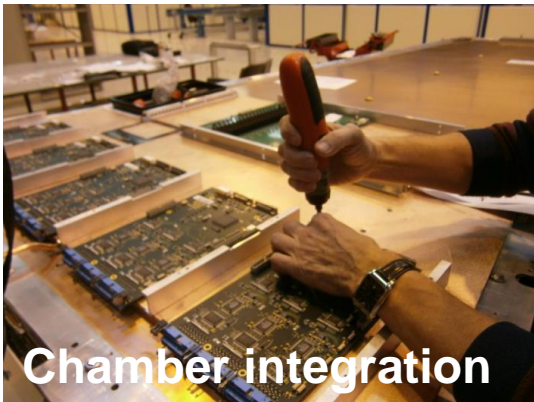
Chamber assembly



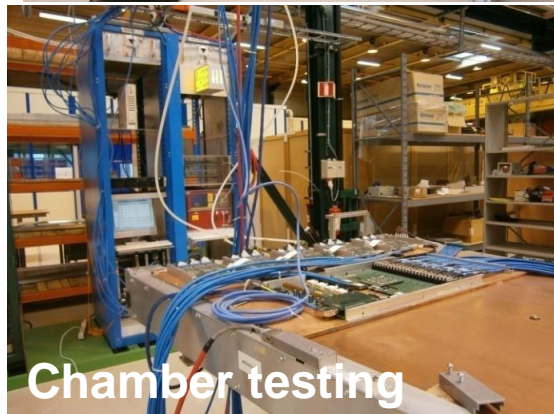
Wire pitch & tension  
HV testing



components  
soldering



Chamber integration



Chamber testing



Chamber installation

# ME4/2 CSC parameters



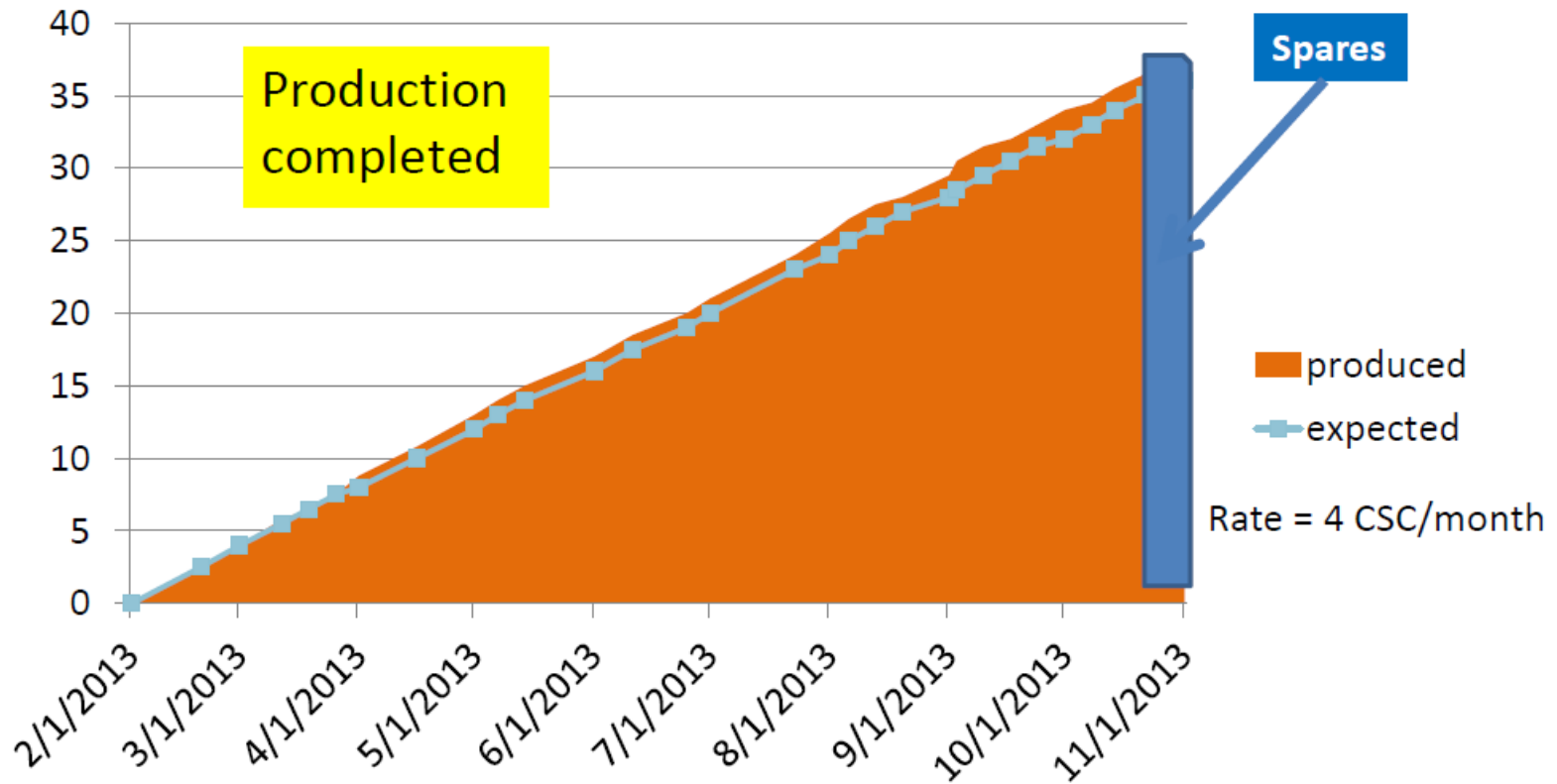
Width (top),	1530 mm
Width (bottom),	895 mm
Length, mm	3380 mm
Wire per plane	1028
Wire ch. per plane	64
Strip ch. per plane	80
HV segments per plane	5
Chamber weight, kg	276

# CSC Production





# ME-4/2 Production



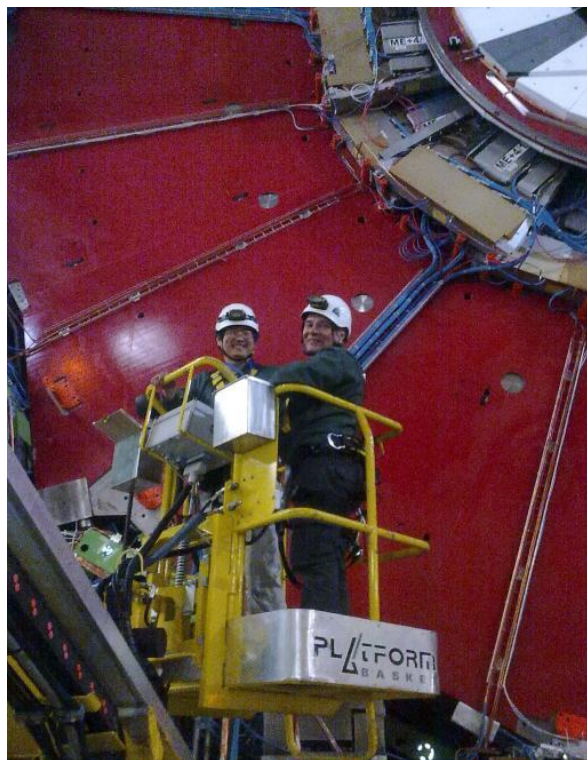
# ME4/2 Upgrade



# LS1 activities at P5



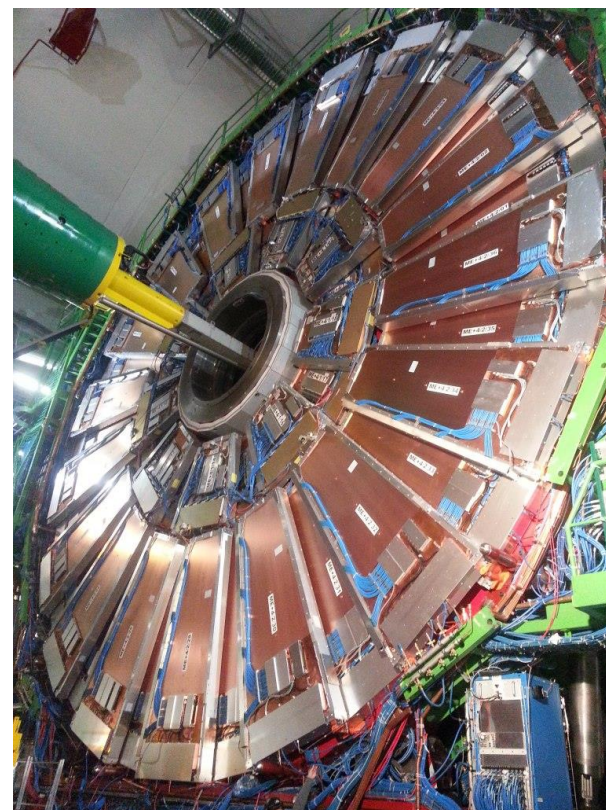
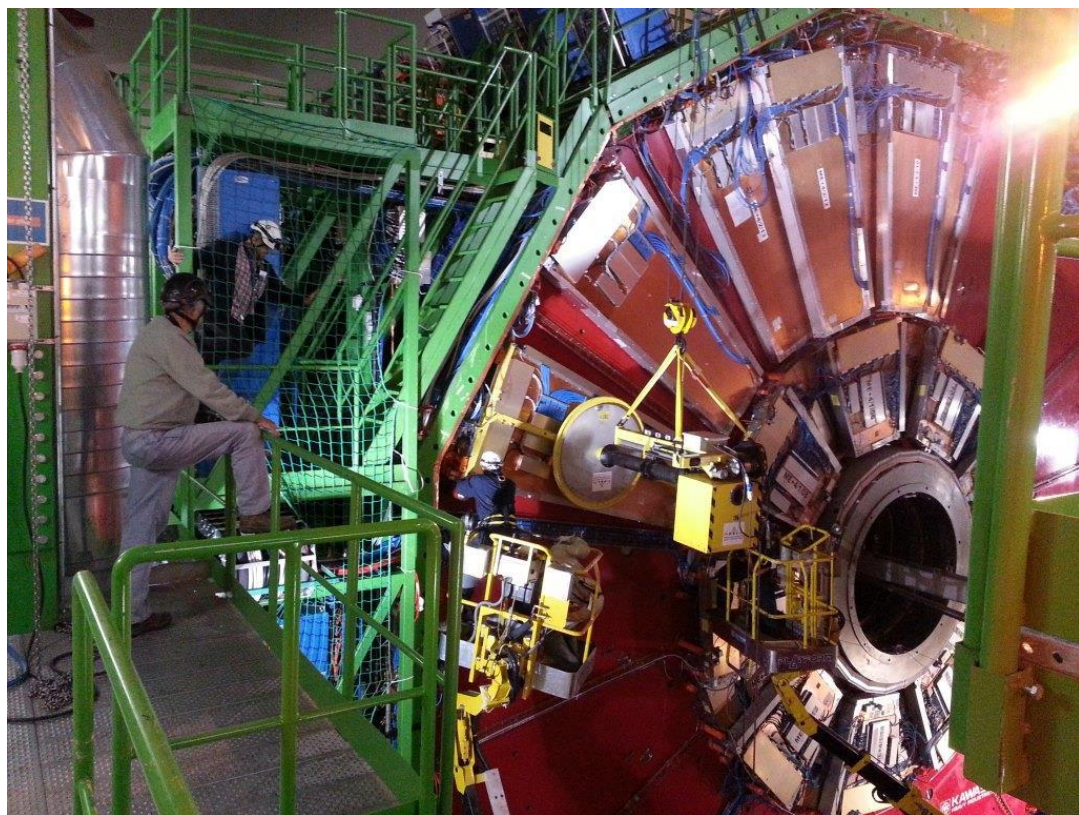
Installation ME4/2 LV cables on YE+/- 3  
Installation ME4/2 CSC+gas+cooling



25.12.2014

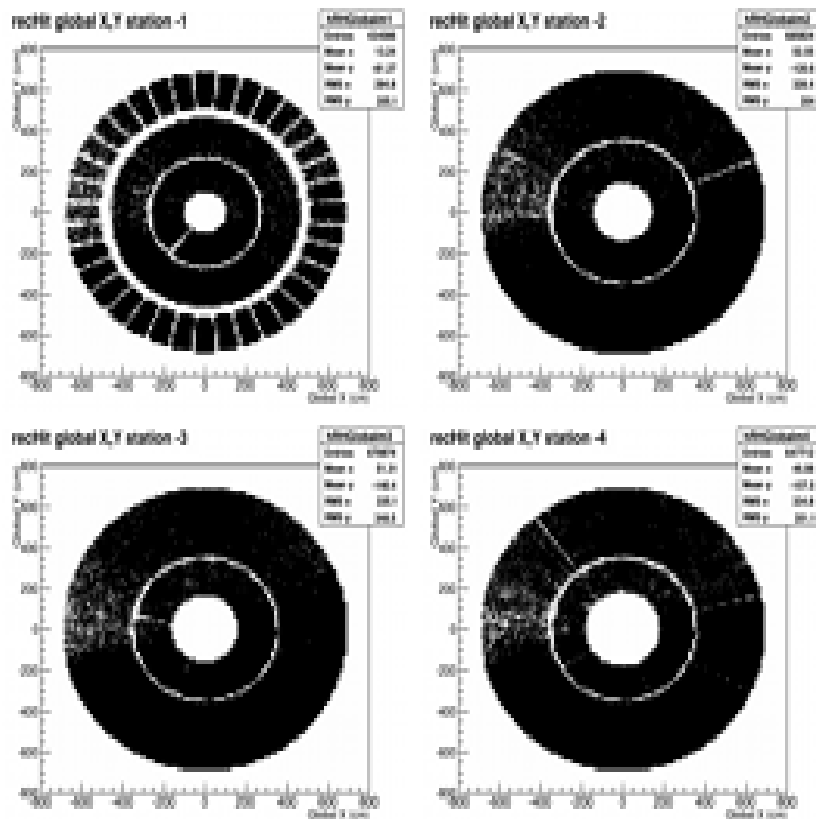
15

# LS1 activities at P5

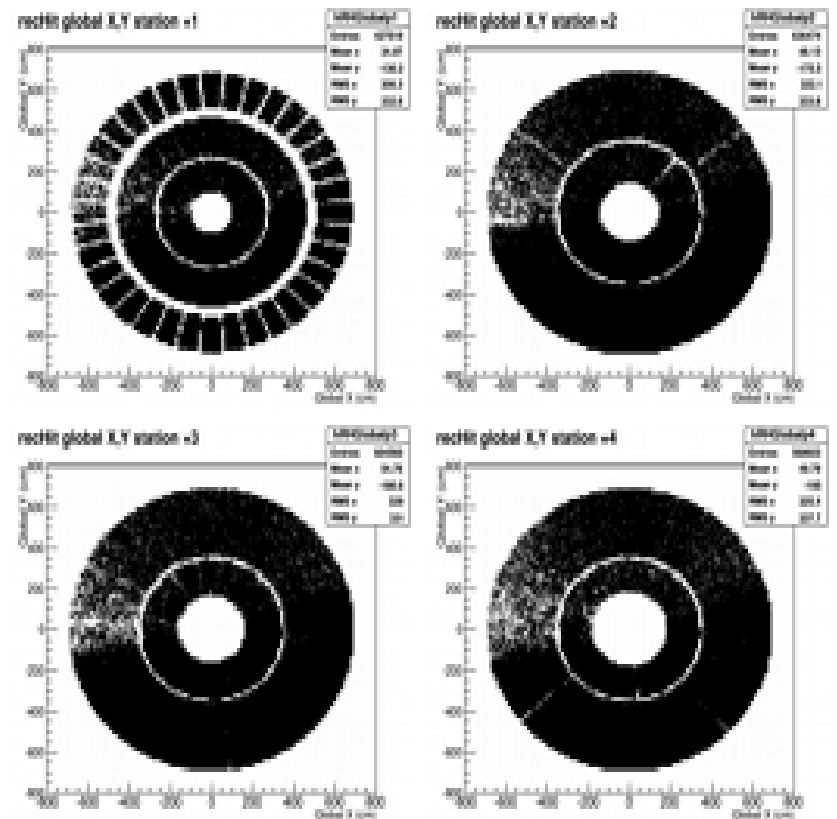




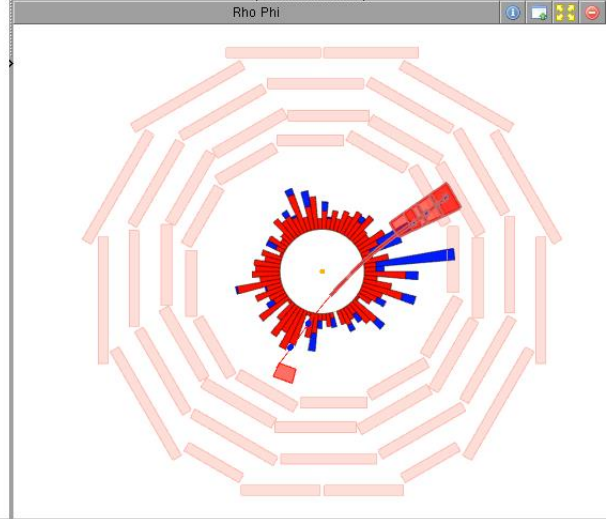
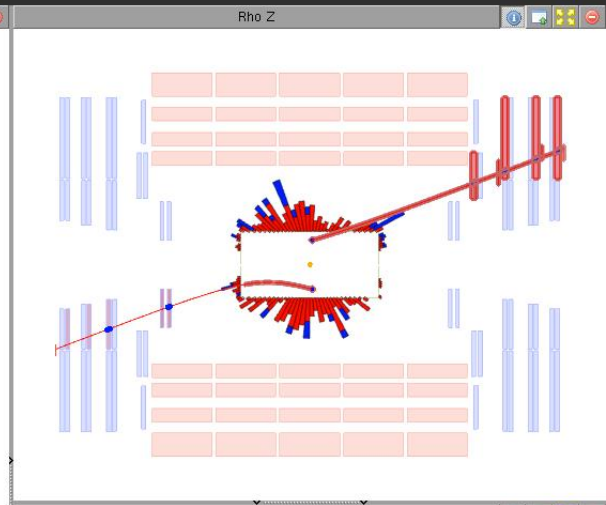
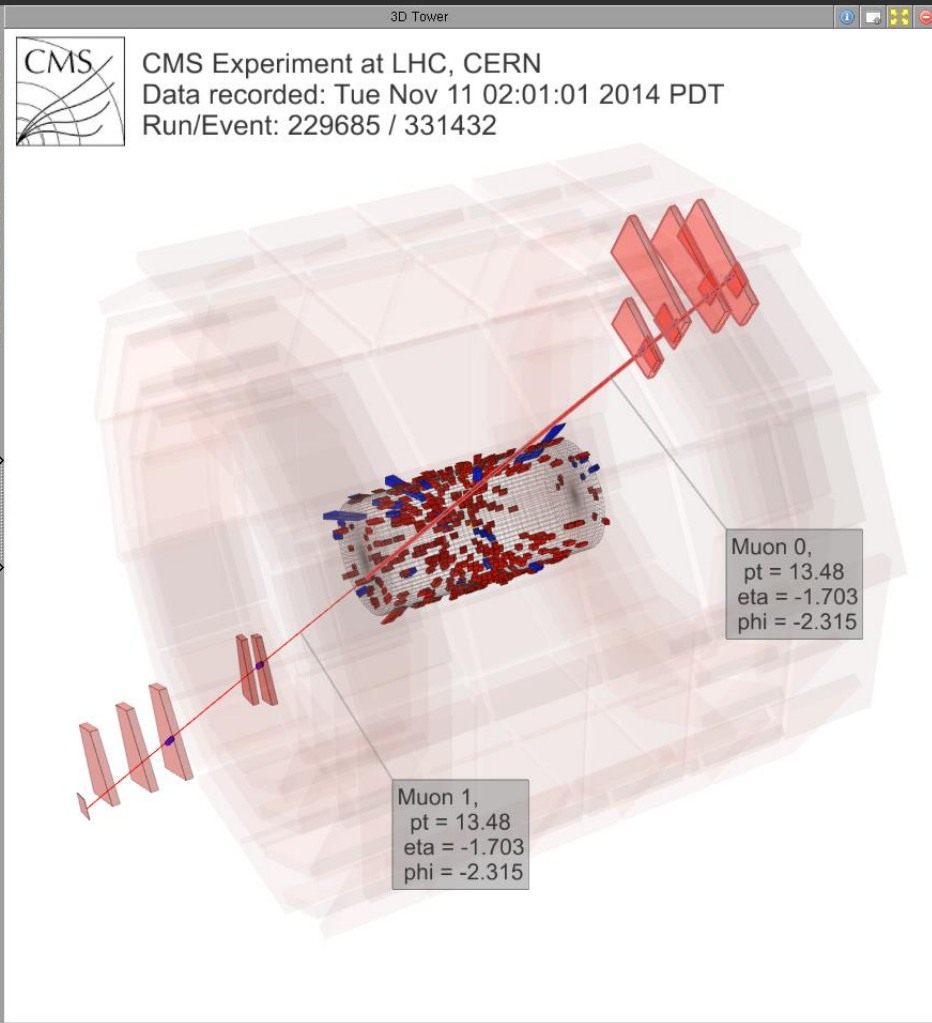
## 06 Physics Efficiency - RecHits Minus



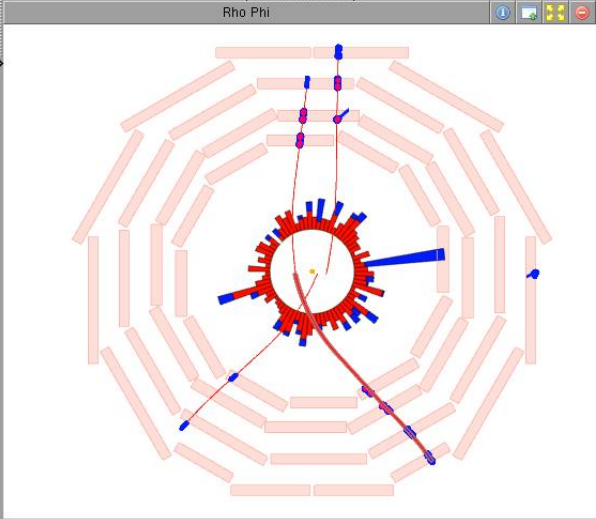
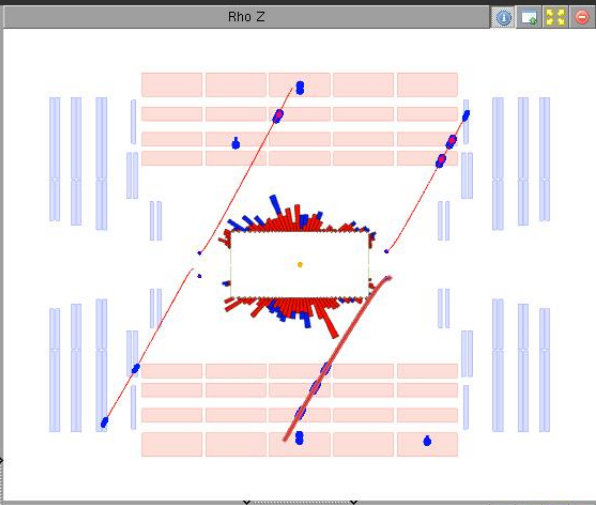
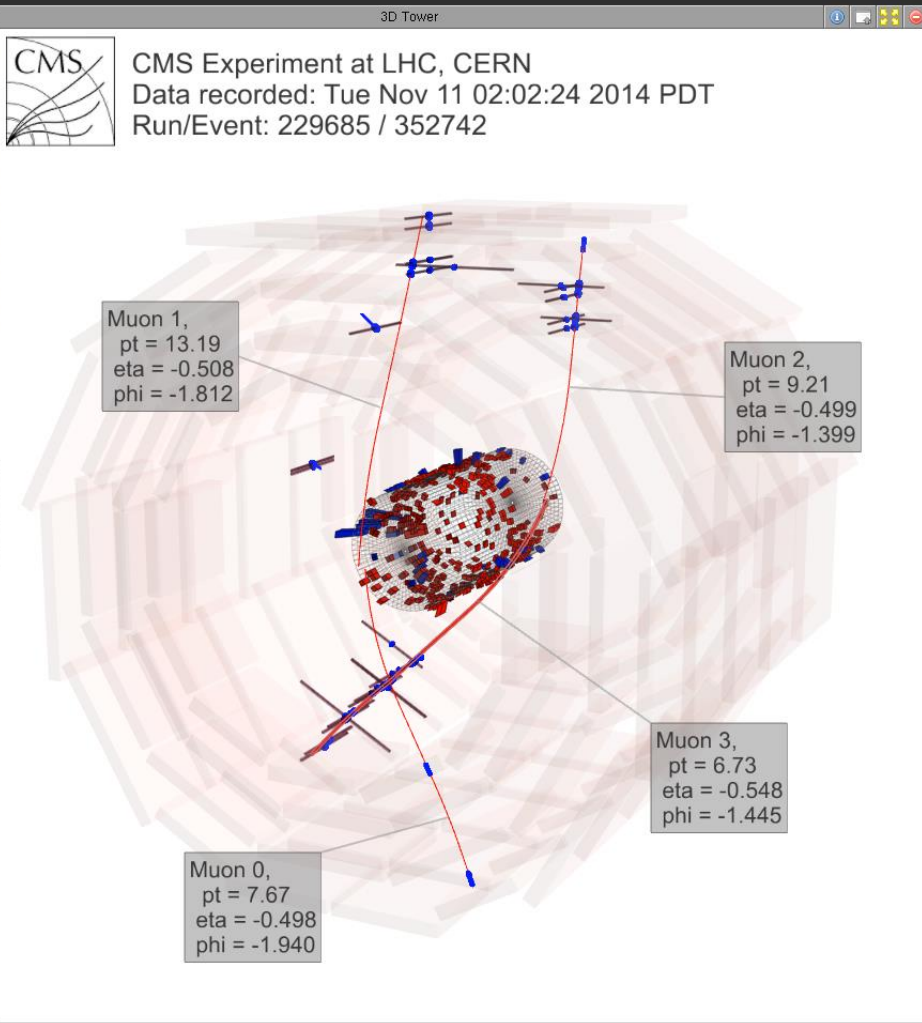
## 07 Physics Efficiency - RecHits Plus



- Summary View  
Add Collection
- ECal
  - HCal
  - Jets
  - Tracks
  - Muons
  - Electrons
  - Vertices
  - BeamSpot
  - DT-segments
  - CSC-segments
  - Photons
  - MET
  - Conversions
  - rpcRecHits
  - csc2DRecHits
  - dt1DRecHits
  - muonDTDigs



- Summary View  
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# UF/ PNPI HV system



## System development

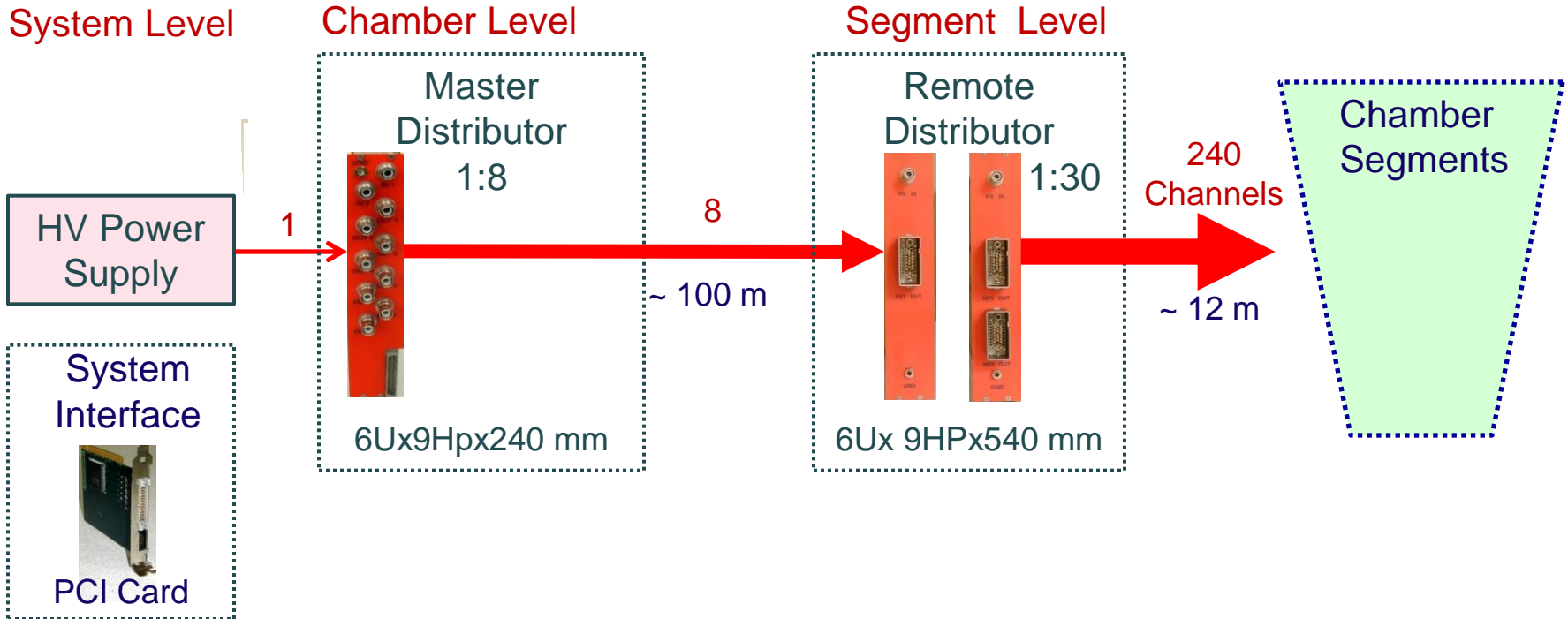
- **2003** - Tender win over CAEN on 10000-channel system
- **2005-2006** - Production and test of 11500-channel system at PNPI
- **2007** - System installation at CERN
- **2008 - 2013** - System run at CERN
  
- **2012-2013** - Production and test of 2500-channel system for ME4/2

# UF/ PNPI HV system

## • System development

- 2003 - Tender win over CAEN on 10000-channel system
- 2005-2006 - Production and test of 11500-channel system at PNPI
- 2007 - System installation at CERN
- 2008 - 2013 - System run at CERN
- 2012-2013 - Production and test of 2500-channel system for ME4/2

# UF/ PNPI HV system specification



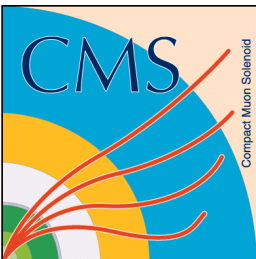
1	<b>Voltage regulation</b>	<b>0 – V max = 4000 V</b>
2	<b>Voltage regulation step</b>	<b>20 V</b>
3	<b>Voltage measurement resolution</b>	<b>10 V</b>
4	<b>Max current per channel</b>	<b>100 mA</b>
5	<b>Current measurement resolution</b>	<b>100 nA</b>

# 2500-channel HV system production plan

## Items to manufacture

<b>N</b>	<b>Item</b>	<b>Quantity (including spares)</b>
<b>1</b>	<b>Remote Distributor</b>	<b>86</b>
<b>2</b>	<b>Master Distributor</b>	<b>10</b>
<b>3</b>	<b>Regulator 1 kV</b>	<b>2840</b>
<b>4</b>	<b>Regulator 4 kV</b>	<b>90</b>
<b>5</b>	<b>Relay board</b>	<b>90</b>

Production of the whole system  
was completed by Feb 2014



# ME4/2 Upgrade



- The production of 72 ME42 chambers (67 needed and 5 spares) has successfully finished.
- All ME+/-4/2 chambers have been installed.
- The testing of ME+/-4/2 chambers is in progress and will continue in 2015.