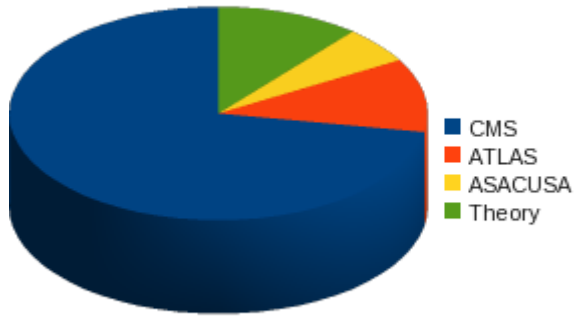
Standard Model and New Physics Group

Viktor Veszprémi for the group

Group projects:

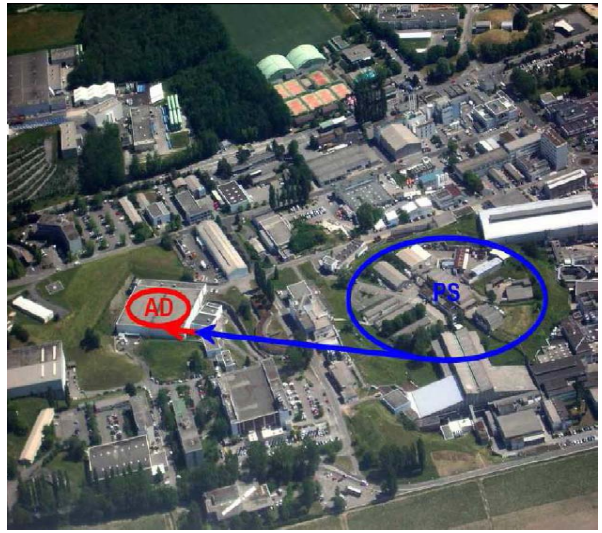
CMS: 7 staff + 2 students
ATLAS: 1 staff + 1 external
ASACUSA: 1 staff + 1 external
Theory: 1 staff

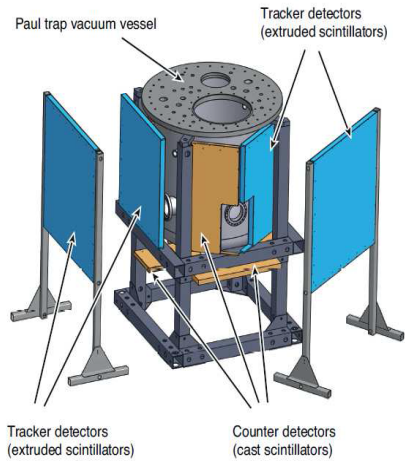


Antimatter Spectroscopy

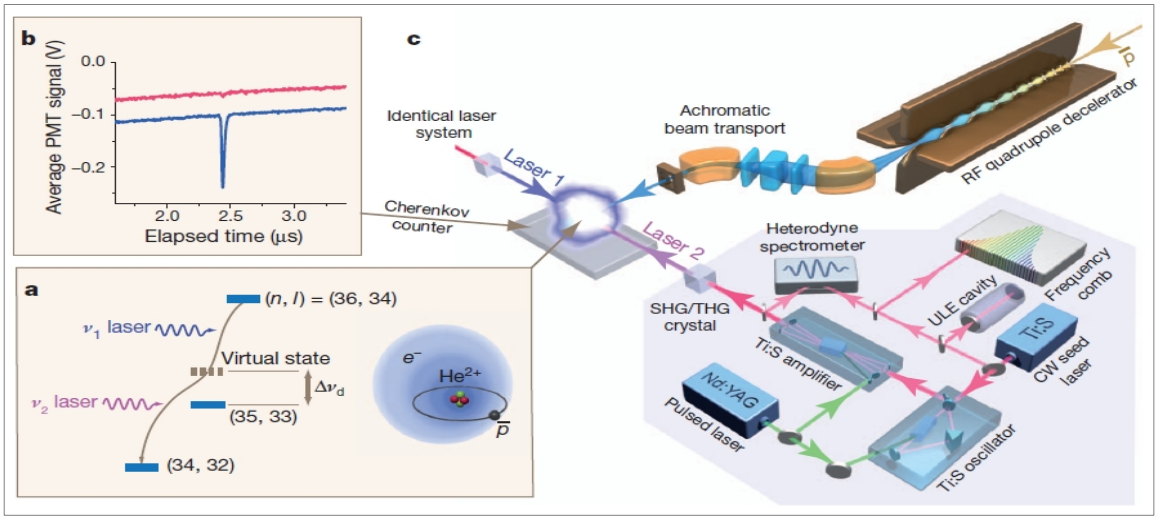
Dezső Horváth,
Dániel Barna

- Investigates the symmetry between matter and antimatter
- Representation in the ASACUSA experiment located in the Antiproton Decelerator (AD)
- Antiproton and proton masses were found consistent (Nature article in 2011 July)





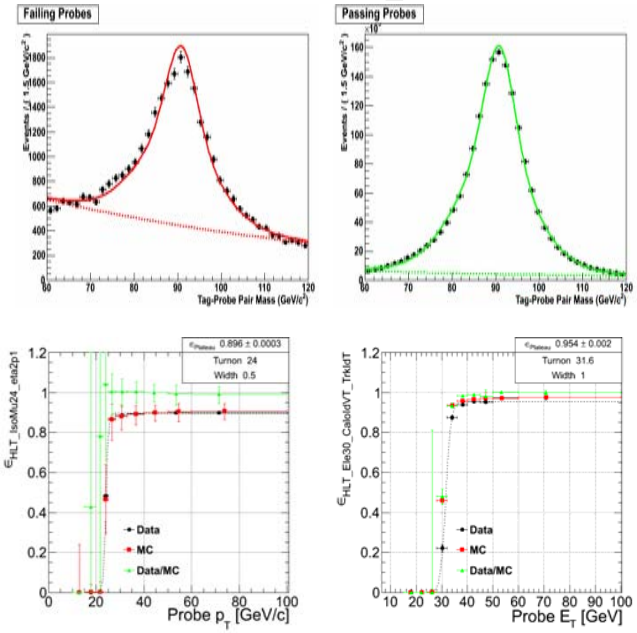
New trapping device (Paul-trap)



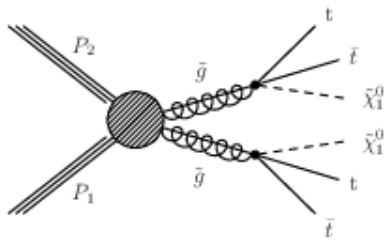
- Antiproton beam from AD captured by He gas in meta-stable states
- Antiprotons are excited to short-lived states by lasers
- When annihilating antiprotons are detected, the laser frequencies correspond to transition energy
- Ratio of antiproton and electron masses are computed

CMS: Lepton Reconstruction and SUSY Searches

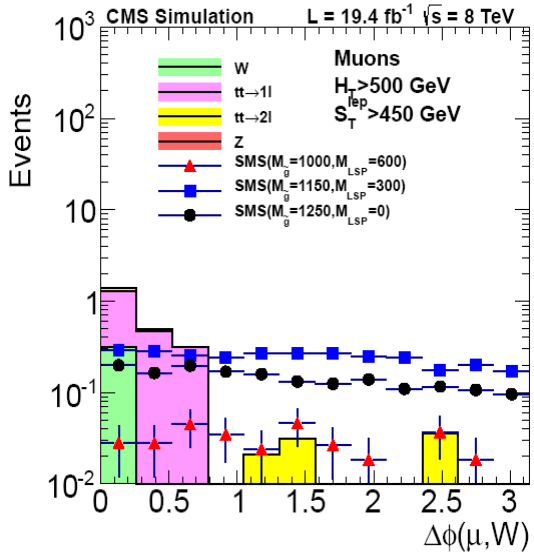
Dezső Horváth,
Viktor Veszprémi

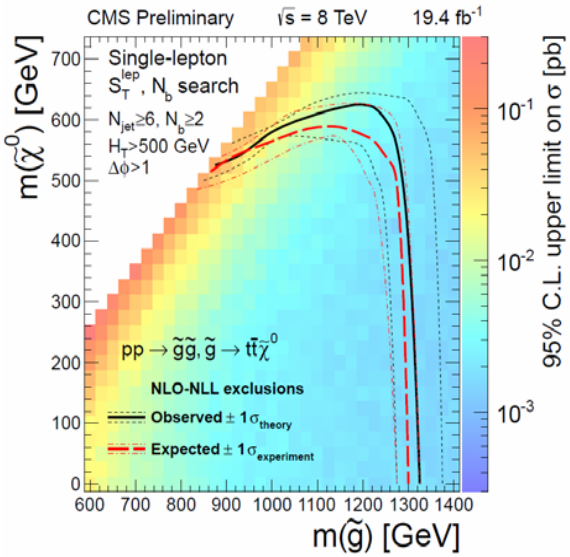


- Measured the invariant lepton-lepton (electron, muon) mass spectrum in a Z-centered window
- Studied and computed efficiency for online event selection, reconstruction, and identification in SUSY analysis
- Analyses performed in large cooperation of several institutes across Europe and the US



- Studied simplified MSSM topology: top + LSP final state via gluino pair-production
- Extended SUSY particle exclusion region in 2012 data

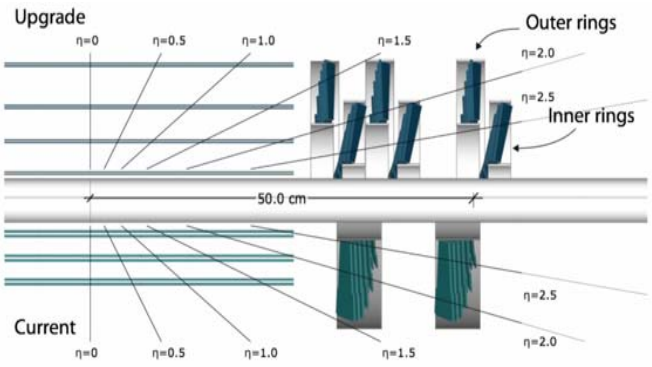


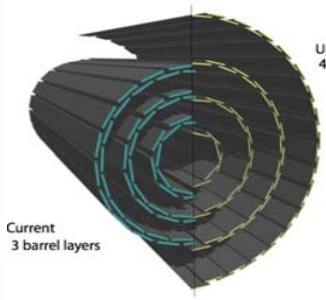


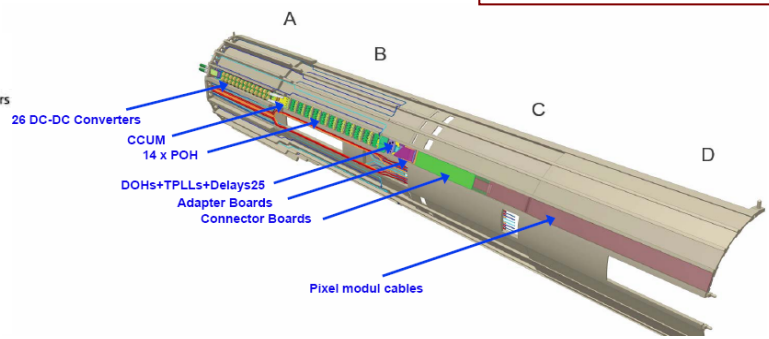
One of the various background estimations methods and its result

CMS: Pixel Detector Upgrade

Viktor Veszprémi

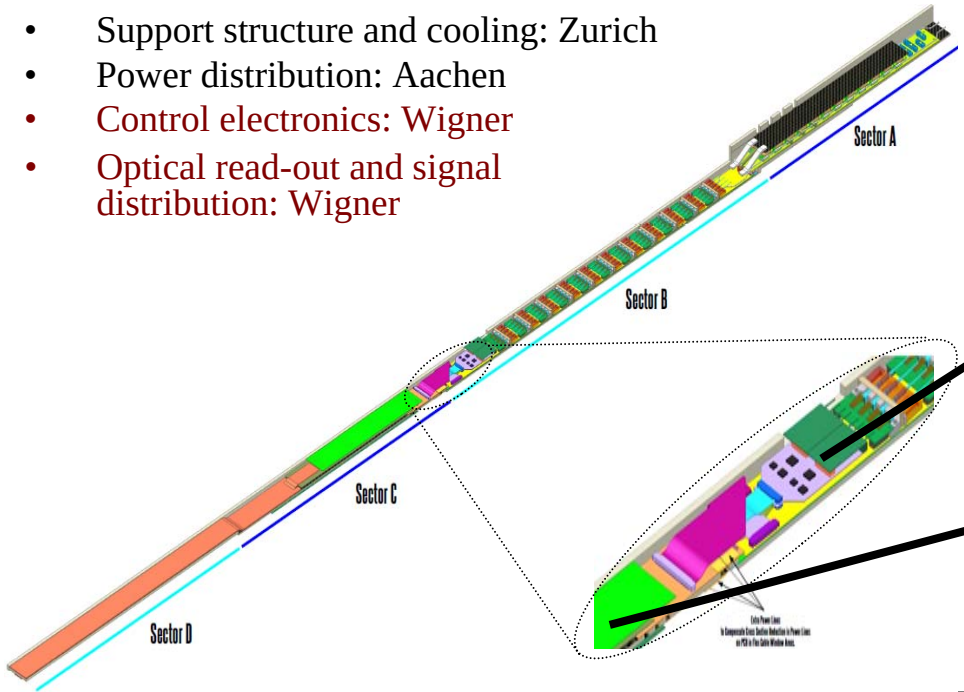


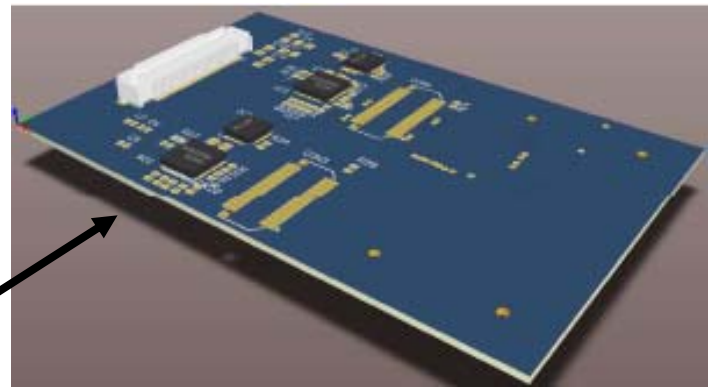




- Improvements in the upgraded pixel detector: measurement in one more layer, reduced material budget
- Supply tube at the two ends of the sensor barrel: controls, programs, and reads out the detector

- Support structure and cooling: Zurich
- Power distribution: Aachen
- Control electronics: Wigner
- Optical read-out and signal distribution: Wigner

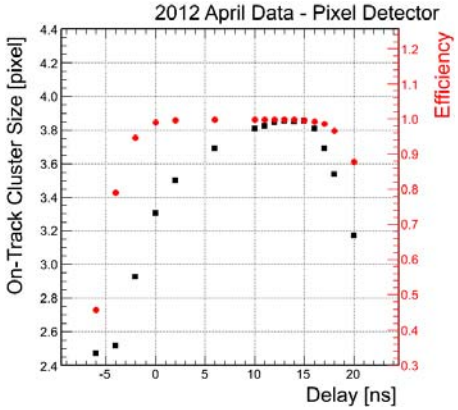




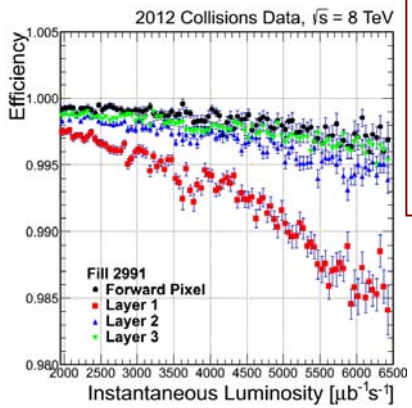
- Control electronics with fiber optic communication devices
- Connector board for pixel modules

CMS: Pixel Calibration, Simulation, and Alignment

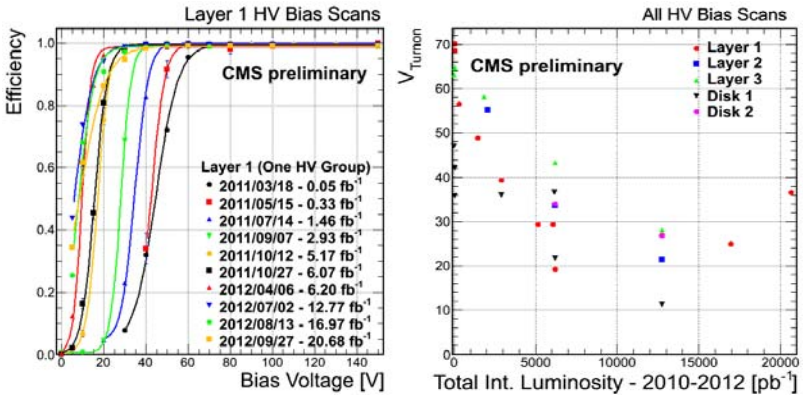
Márton Bartók,
Pál Hidas.,
Tamás Vámi,
Viktor Veszprémi,
György Vesztergombi



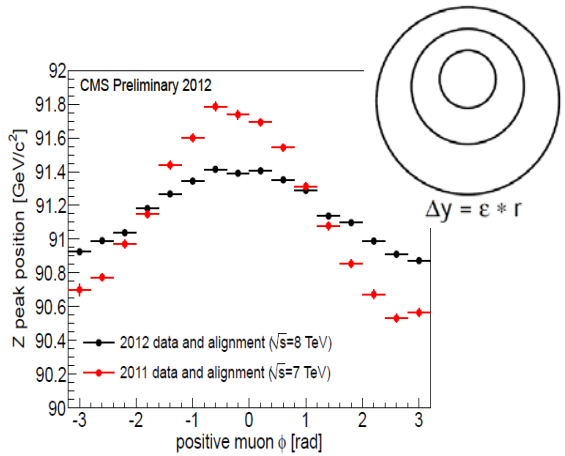
- Optimizing the alignment of the pixel exposition time to the LHC collisions



- Pixel hit efficiency vs collision rate. Adjusting simulation to reproduce the effect



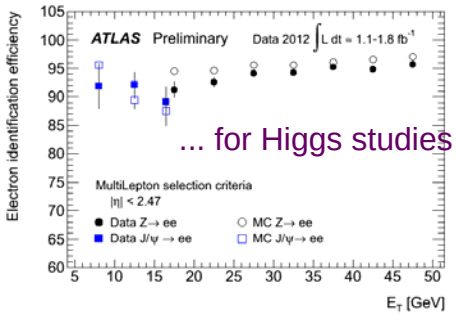
- Radiation causes effective doping of the pixels to change. Monitoring bias voltage required for fully efficient running



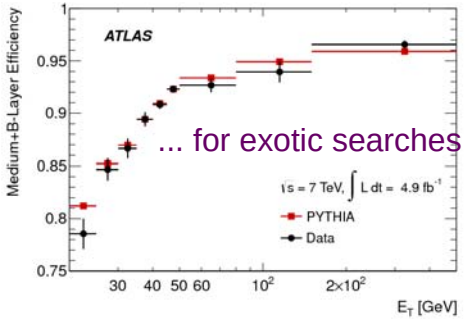
- Spatial alignment of the pixels directly affect reconstruction of Z boson mass. We are correcting for pixel movements

ATLAS: Electron Reconstruction and Higgs Searches

József Tóth,
Gabriella Pásztor



... for Higgs studies



... for exotic searches

- Improved material budget simulation in the EM Calorimeter
- Studied the electron identification efficiency in large momentum range

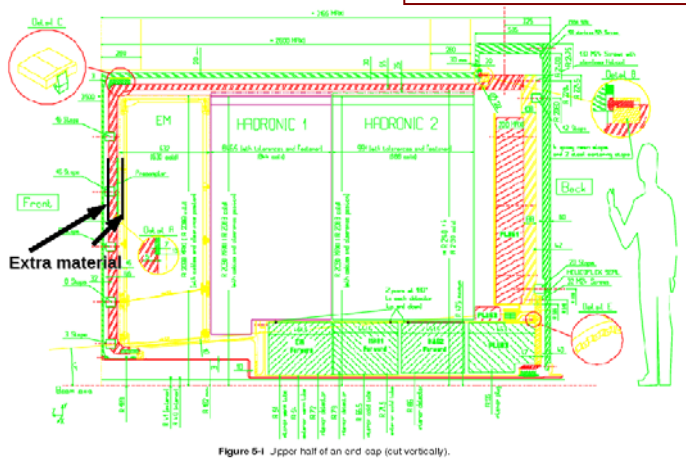
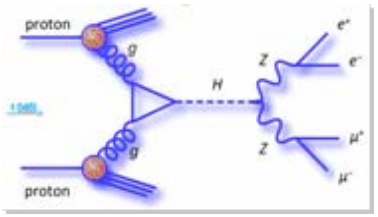
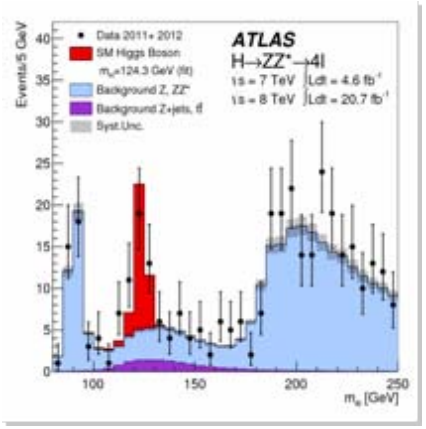


Figure 5-1 Upper half of an end cap (cut vertically).

Measurement of the new boson (**Higgs**) in the golden channel

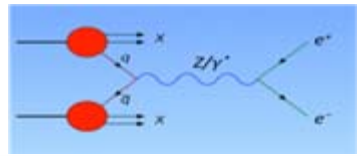


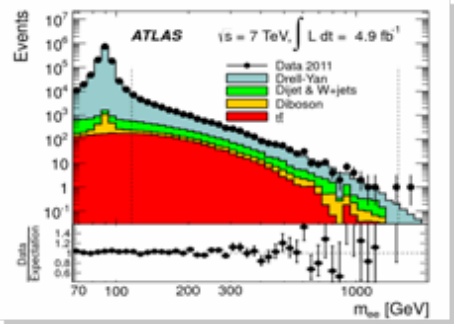


Submitted to Phys.Lett. B, arXiv:1307.1427 [hep-ex]

High-mass Drell-Yan cross-section measurement

- Test of perturbative QCD
- Sensitive to parton distribution functions (especially to anti-quarks at large x)
- New phenomena could modify the spectrum





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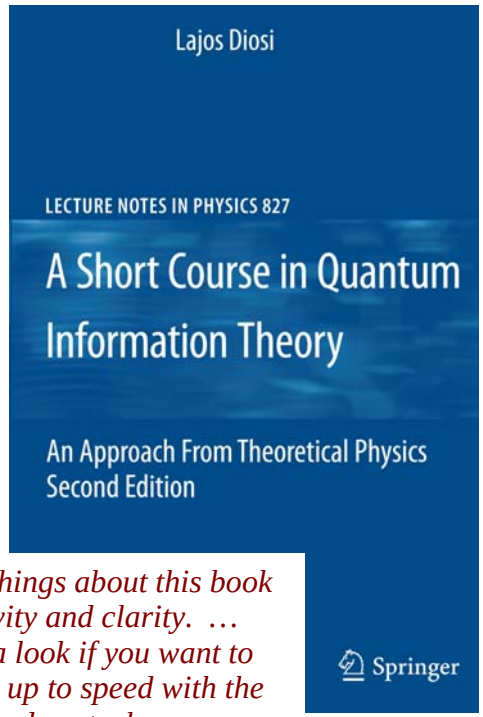
Q-Foundations, **Q-I**nformation, Open Q-Systems

Lajos Diósi

- **Q-F**: Diósi-Penrose theory – wave function of massive objects collapses spontaneously at rate Newton-self-energy/Planck-constant

- Test: isolate (cool down) and q-control nano-object in/on lab/satellite, observe DP wave function collapse!



"The best things about this book are its brevity and clarity. … it's worth a look if you want to quickly get up to speed with the language and central concepts..." (review on 1st edition, C.Savage, Austr.Phys,)

- Multiple experiments: Leiden, Vienna, Garching, Pasadena...
- E.g. collaboration with D. Bouwmeester's group at UCSB

Computing Infrastructure: CMS Centre and Tier-2 Site

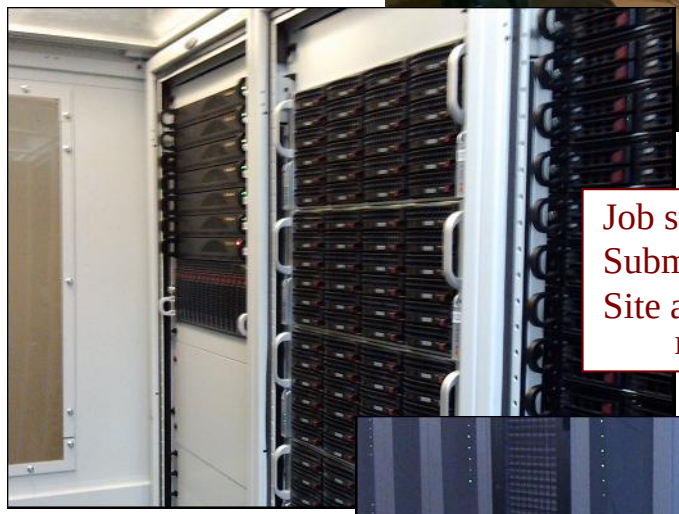
CMS Centre

- Data Quality Monitoring shifts for the CMS Tracker Collaboration (60 days)
- Adjustment of Pixel calibration parameters within the 48 hour reconstruction delay window

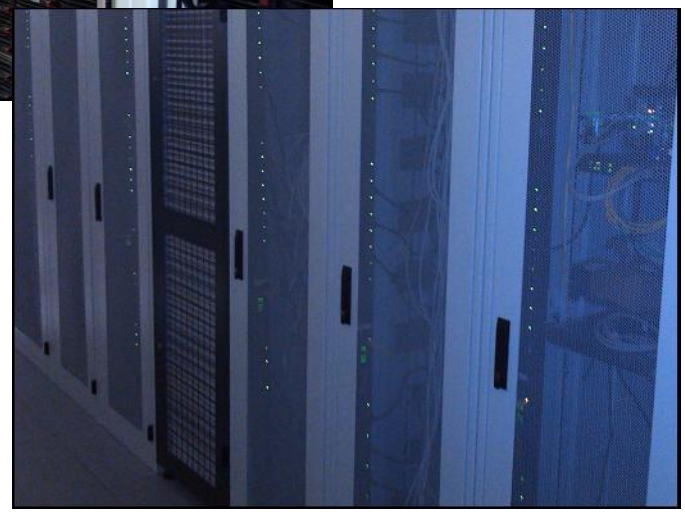
Grid Tier-2 Site:

- Hardware statistics:
  - CPU: ~500 cores
  - Storage: ~300 TB
- Infrastructure developments (this year):
  - Renewal of the grid server room
  - Cooling systems, safety systems etc.
  - New worker nodes, one new UI machine

Csaba Hajdú.
András Házi



Job statistics:
Submitted: ~1 million/year
Site availability: 99%,
reliability: 100%



Users:
CMS – 67%
ALICE – 23%
HunGrid – 8%
Virgo – 2%