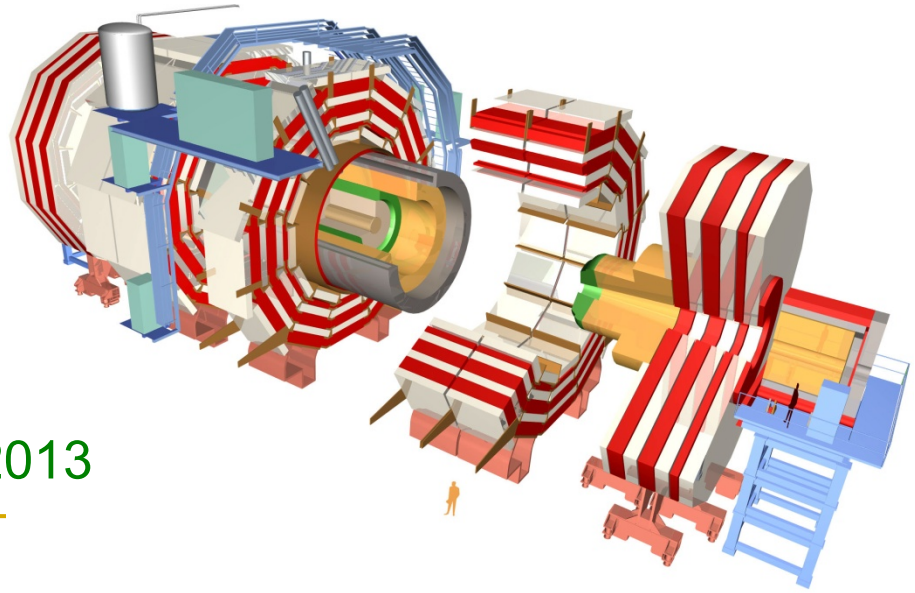
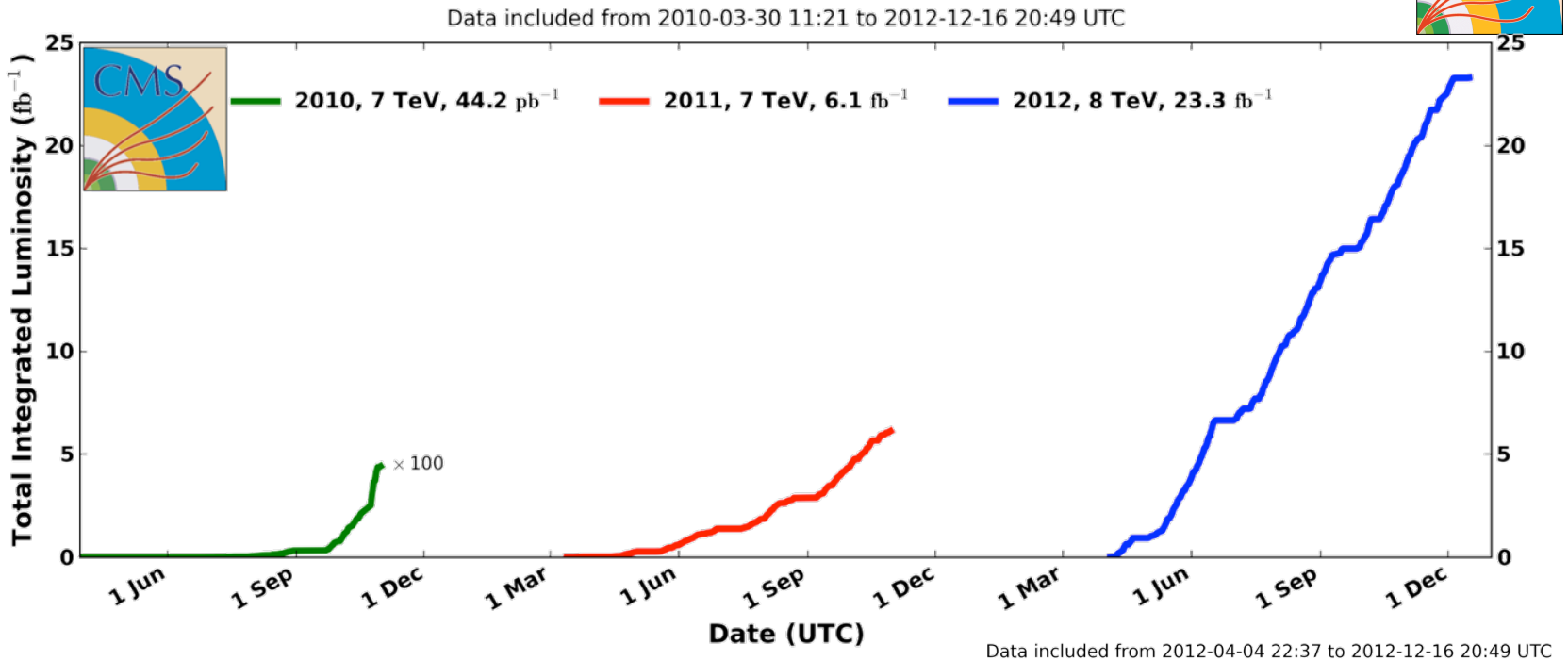
CMS Trieste



Giuseppe Della Ricca

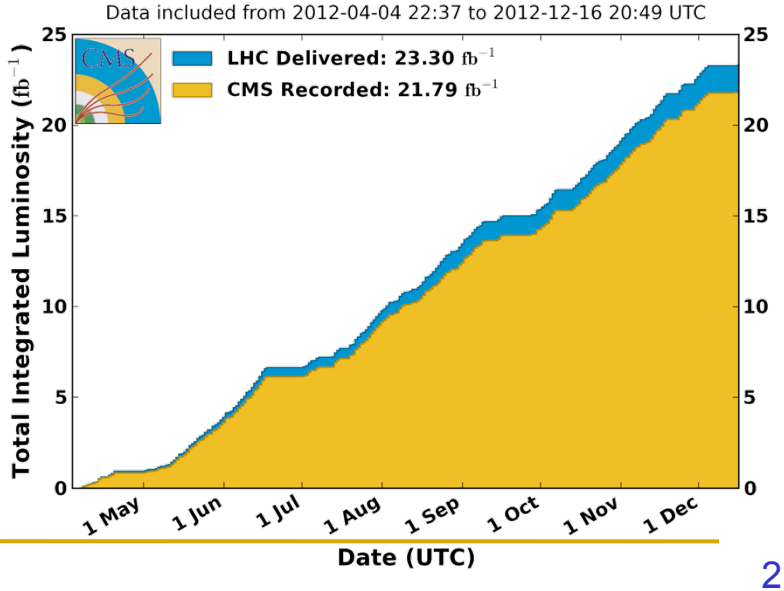
Consiglio di Sezione, Trieste, 11/07/2013

LHC & CMS Performance



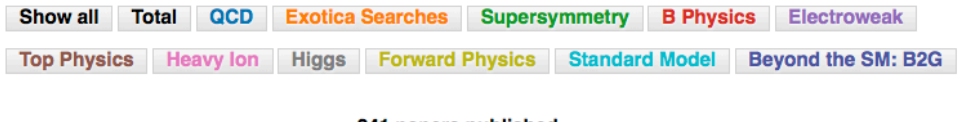
"The LHC's performance has exceeded all expectations over the last three years," said Steve Myers, "The accelerator delivered more than 6 million billion collisions and the luminosity has continuously increased. It's a fantastic achievement, and I'm incredibly proud of my team."

The luminosity, a crucial parameter measuring the rate of collisions of an accelerator, has reached a value of $7.7 \times 10^{33} cm^{-2} s^{-1}$, more than twice the maximum value obtained in 2011 (3.5×10^{33} cm^{-2} s^{-1}). The collision energy was increased from 7 TeV in 2011 to 8 TeV in 2012.

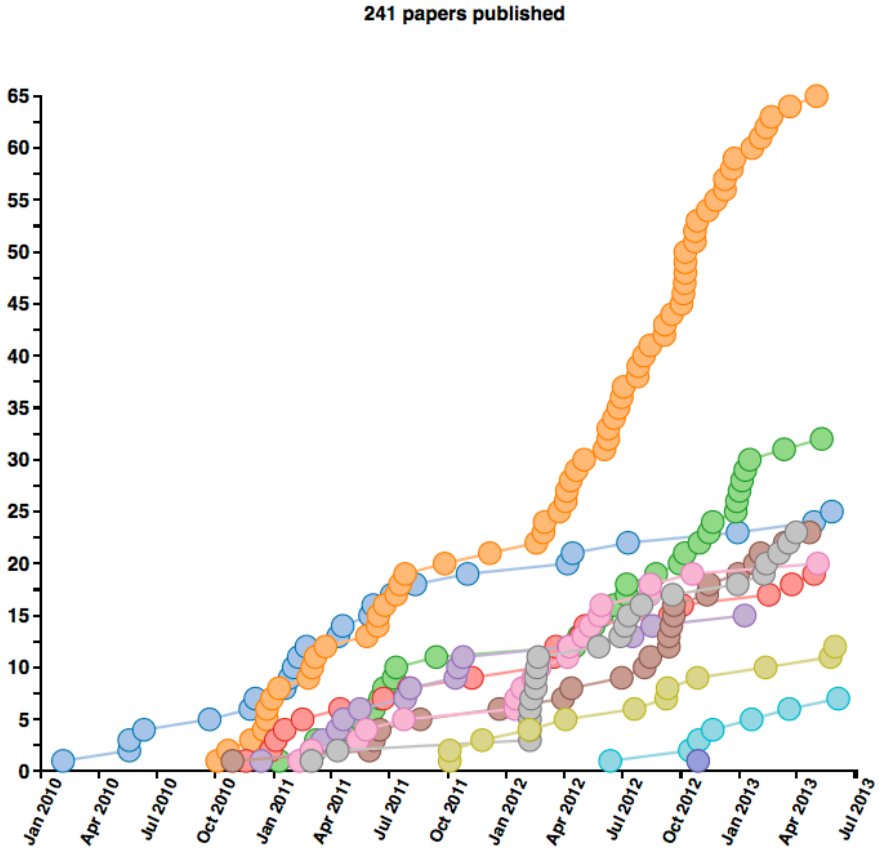


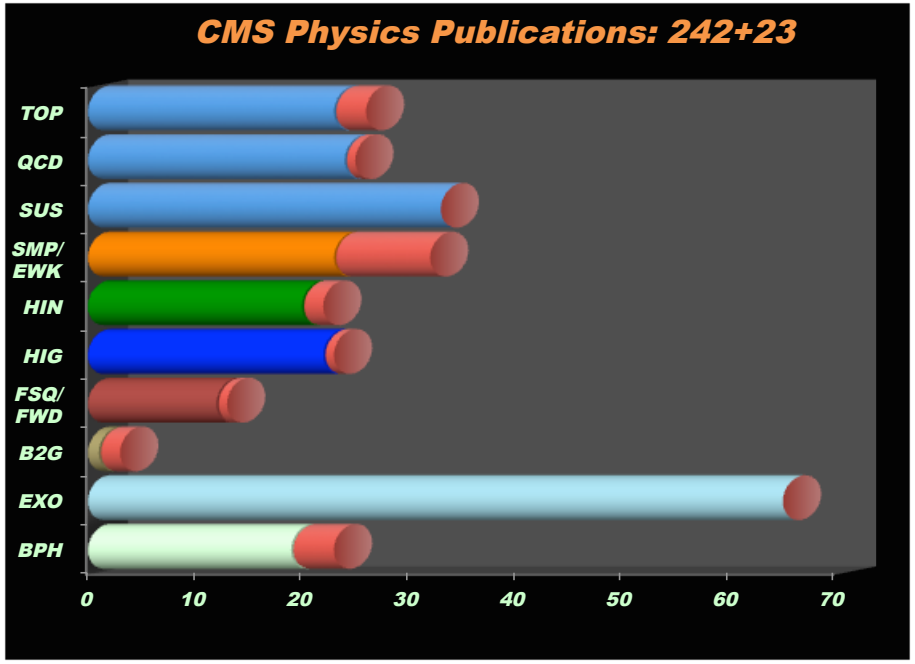
CMS is taking data & publishing

242 published papers, 23 on the way



(Higgs discovery paper: 1300 citations)





Responsabilità di CMS Trieste

- S. Belforte: CMS physics support co-coordinator
- M. Casarsa: CMS MC & Data production manager
- F. Cossutti: CMS deputy offline coordinator, XEB member
- G. Della Ricca: ECAL national representative, SC & FB member
- B. Gobbo: ECAL validation responsible, CMSSW code performance expert
- M. Marone: ECAL Prompt Feedback Group co-coordinator, ECAL DCU expert

Physics analysis:

Measurement of Z+jets associated production in pp collisions ☞

Measurement of Z+b production in pp collisions (new) ☞

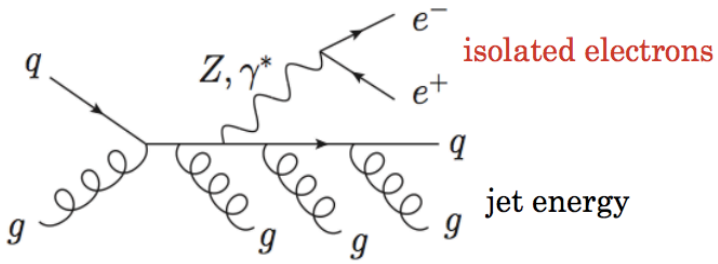
ECAL Upgrade:

Involvement in preliminary simulation studies on new ideas and projected performances ☞

PRIN 2010/11 (con ALICE-TS, e BA/BO/CA/CT/GE/INFN/MI/NA/PG/RM/TO):

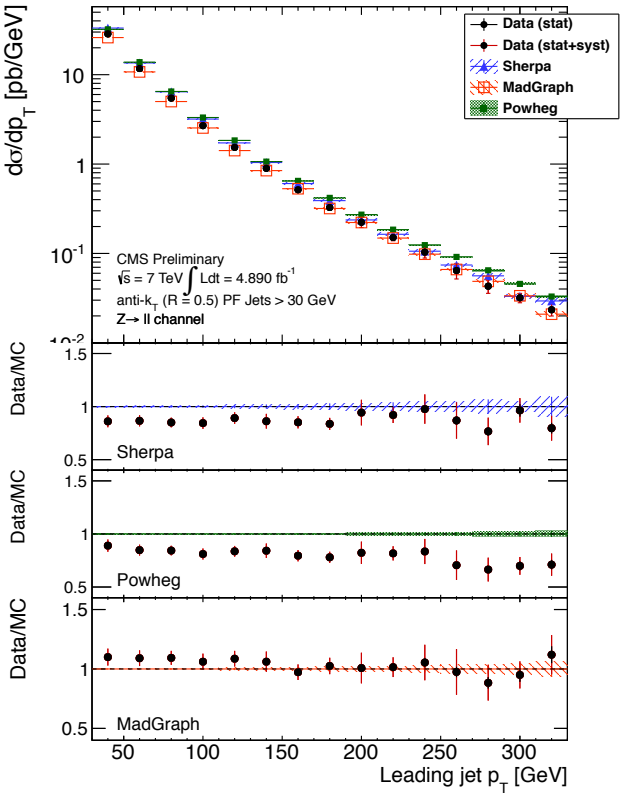
Sviluppo di tecnologie per l'ottimizzazione dell'accesso ai dati di LHC, trasferibili ad altri domini scientifici, mediante l'approccio del grid e del cloud computing

Z+jets Analysis at 7 TeV

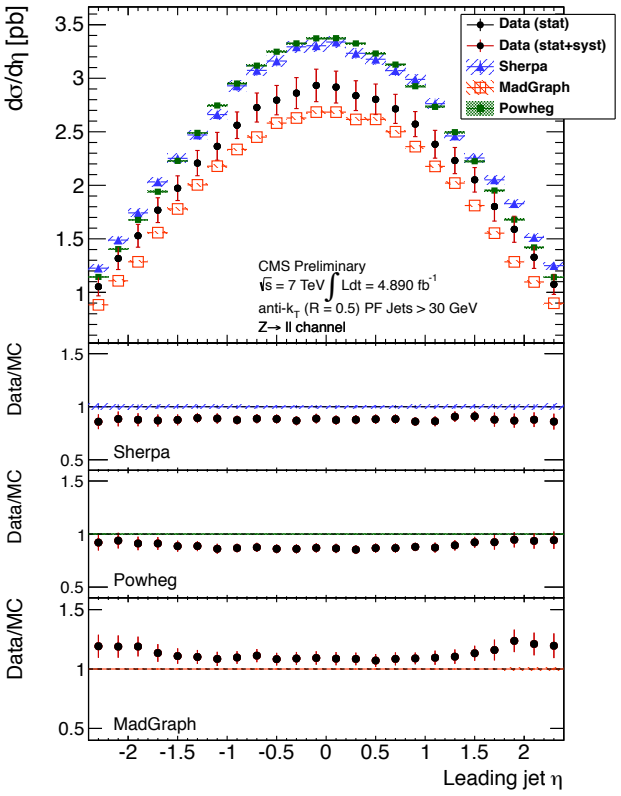


- Measuring differential cross sections up to 4 jets
- Stringent tests of pQCD, PDFs, MC tuning
- Relevant background for Higgs analysis
- Status: pre-approved, under review for publication

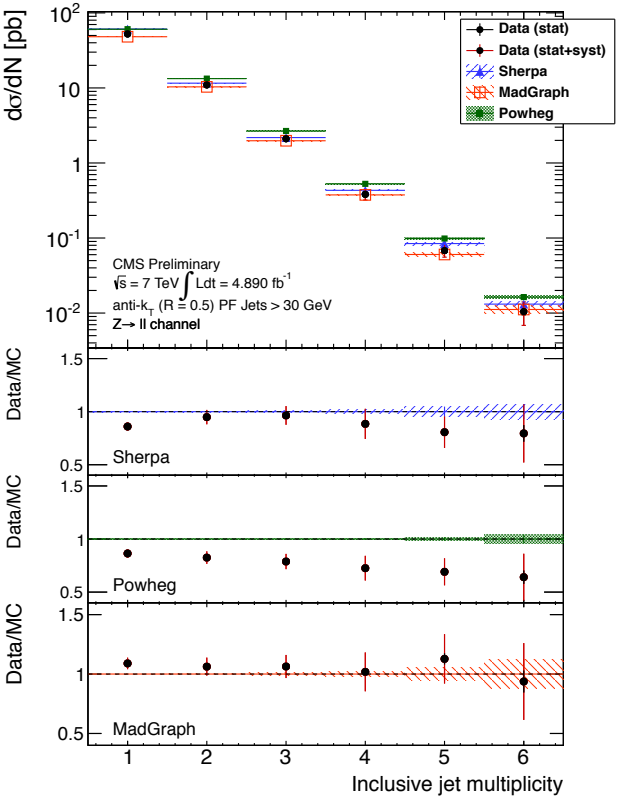
dσ/dp$_T$



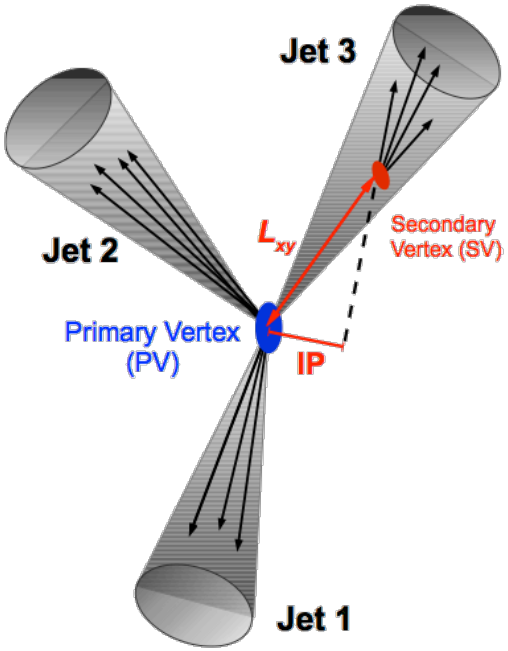
dσ/dη

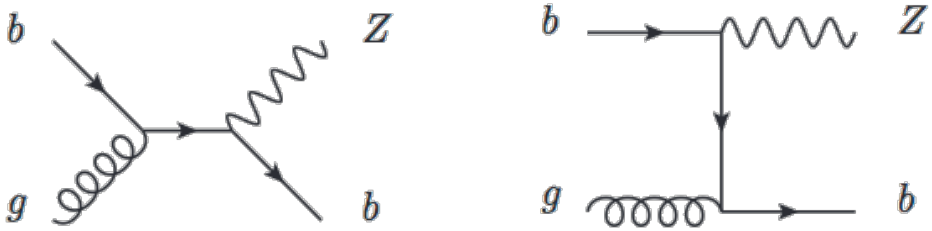


dσ/dNj



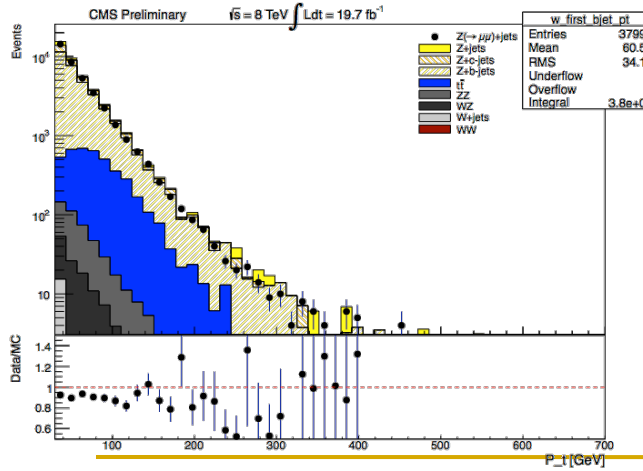
Z+b Analysis at 8 TeV



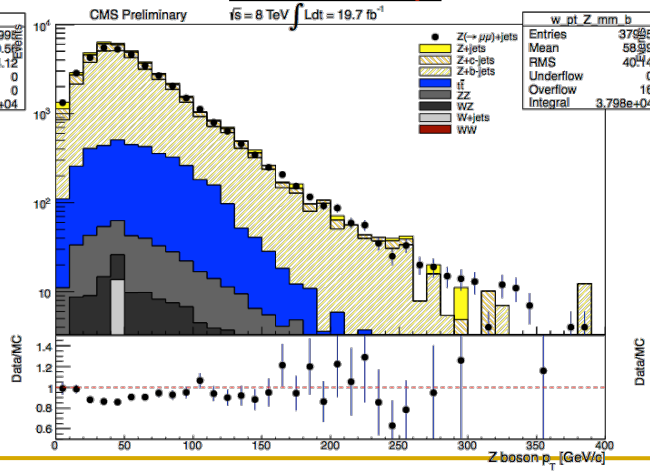


- Important SM background to new physics searches
  - b-associated Higgs production
  - b-enriched SUSY final states
- Sensitivity to heavy-flavour PDFs
- Status: quickly ramping-up

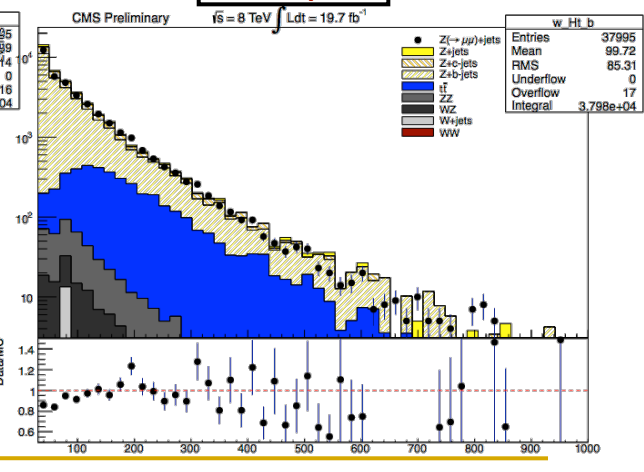
$d\sigma/dp_T$



$d\sigma/dp^Z_T$



H_T

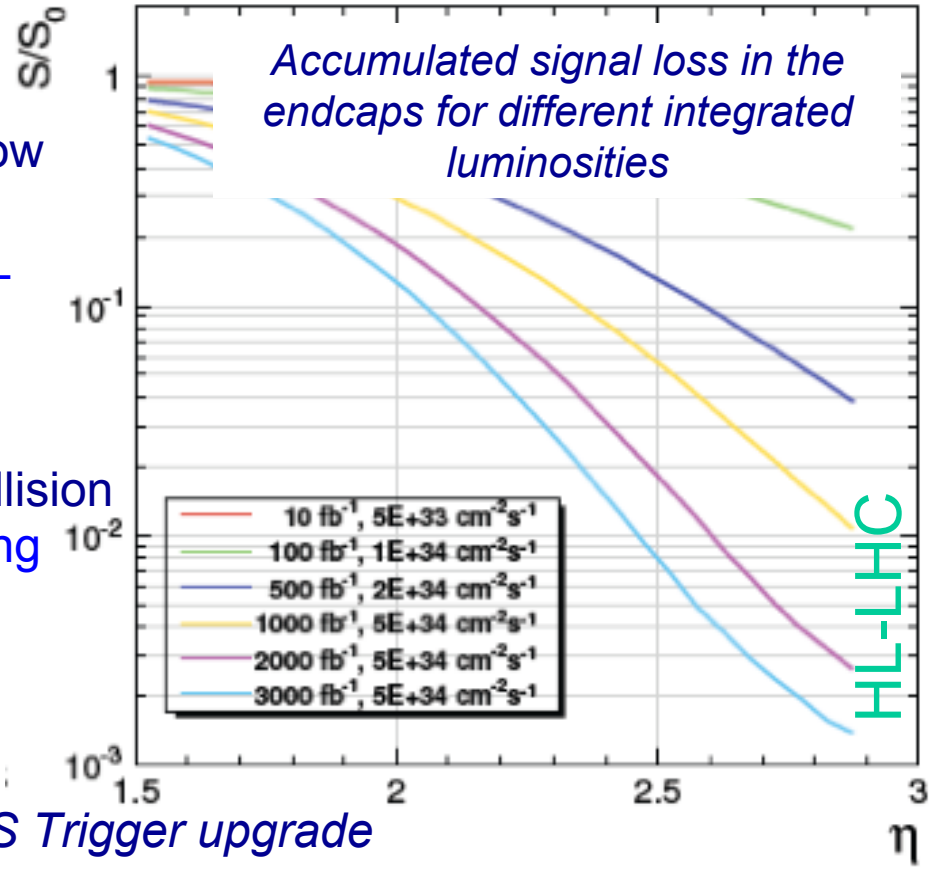


ECAL R&D towards HL-LHC

- General goals:
  - Performance on exclusive channels (e.g. H→γγ): Higgs stoichiometry
  - Resolution on MET: key signature of 'new physics'
  - Good jet reconstruction in the forward direction

- Endcap performance severely degraded at HL-LHC
  - Radiation levels much higher than now
  - Light Output << 10% |η|>2.5
  - → Need a high radiation-resistant ECAL

- Performance in reconstruction of e/γ/jet/MET degraded by *pile-up*
  - about 140 interaction vertices per collision
  - → Mitigation possible with *extreme* timing



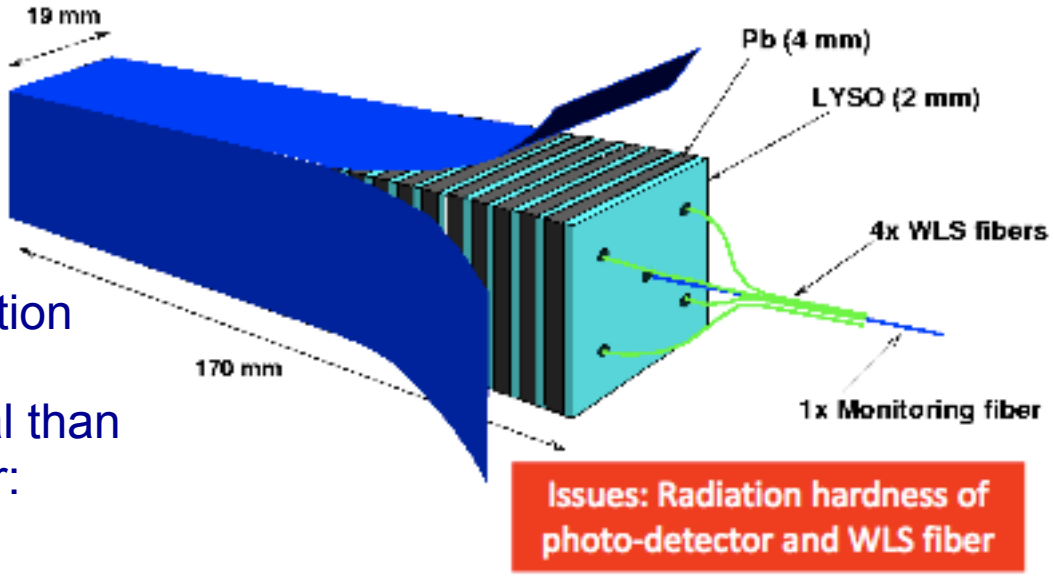
Note: ECAL Barrel performance OK; Refurbishment of the digital part of the on-detector and off-detector electronics may be necessary for compliance with CMS Trigger upgrade

A crystal shashlik

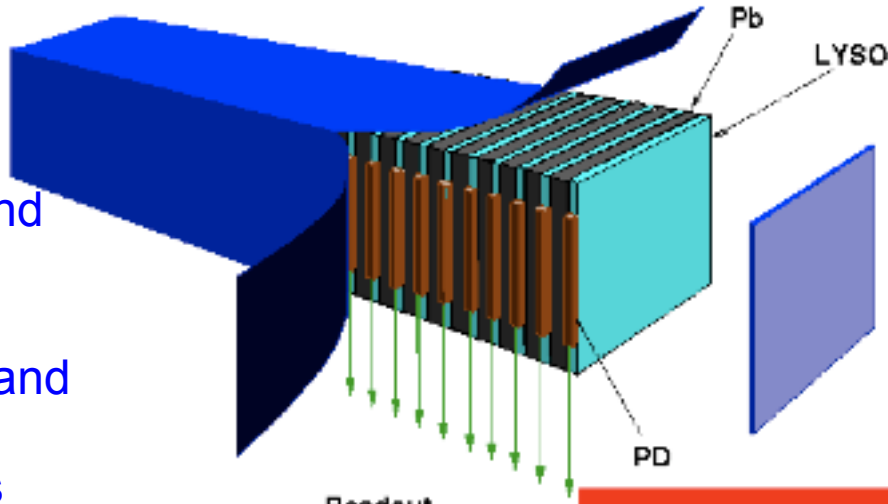
- Compact calorimeter fits into CMS endcap region

- Crystal properties
  - High density and short X_0
  - Large light yield (for light collection efficiency)
  - Radiation hardness (less critical than in an homogeneous calorimeter: optical path is shorter)
  - Fast response

- R&D towards tech. proposal
  - Crystals: LYSO, BaF_3, …
  - Light readout (rad-hard fibres, and photodetectors)
- Time resolution?
  - Time spread of light generation and collection O(100 ps)
  - Luminous region LHC σ_t~300 ps



Issues: Radiation hardness of photo-detector and WLS fiber

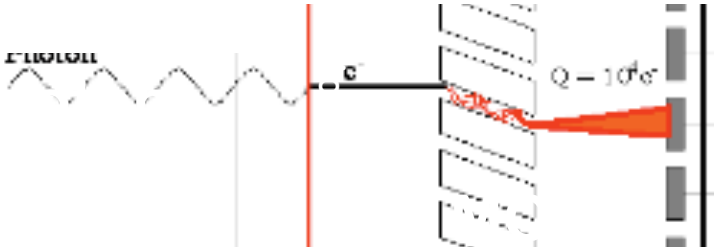


Issue: Radiation hardness of the photo-detector

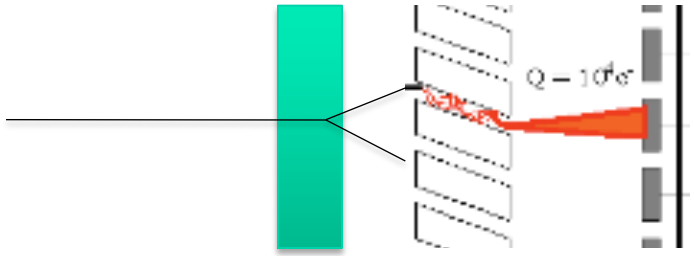
Ionisation micro-channel plates (iMCP)

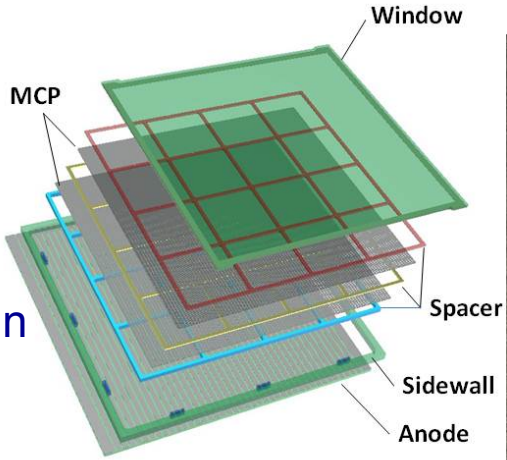
- One (or more) layer(s) embedded in the calorimeter for fast timing (<50 ps) of showers
- From literature: MCP efficiency to m.i.p.s >70% with at least σ_t=75 ps
  - NIM A 478 (2002) 220
- Technology *now* mature for mass production of large surface MCPs
  - LAPPD collaboration (see e.g. this talk)
- R&D towards technical proposal
  - Proof of principle
  - Optimization of MCP geometry
  - Study of the efficiency and timing vs the sampling depth
    - If preshower, timing decoupled from design of the CALO
  - Electronics for fast timing
- Cutting edge technology, with applications in other fields (TOF-PET)

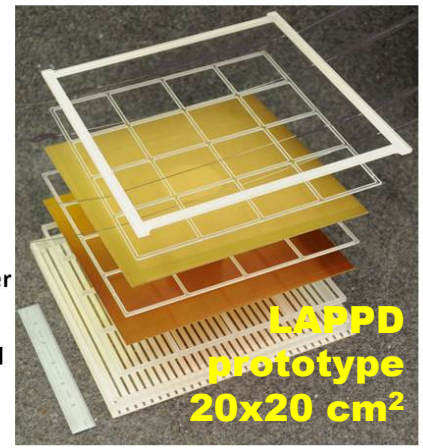
Classical PMT-MCP



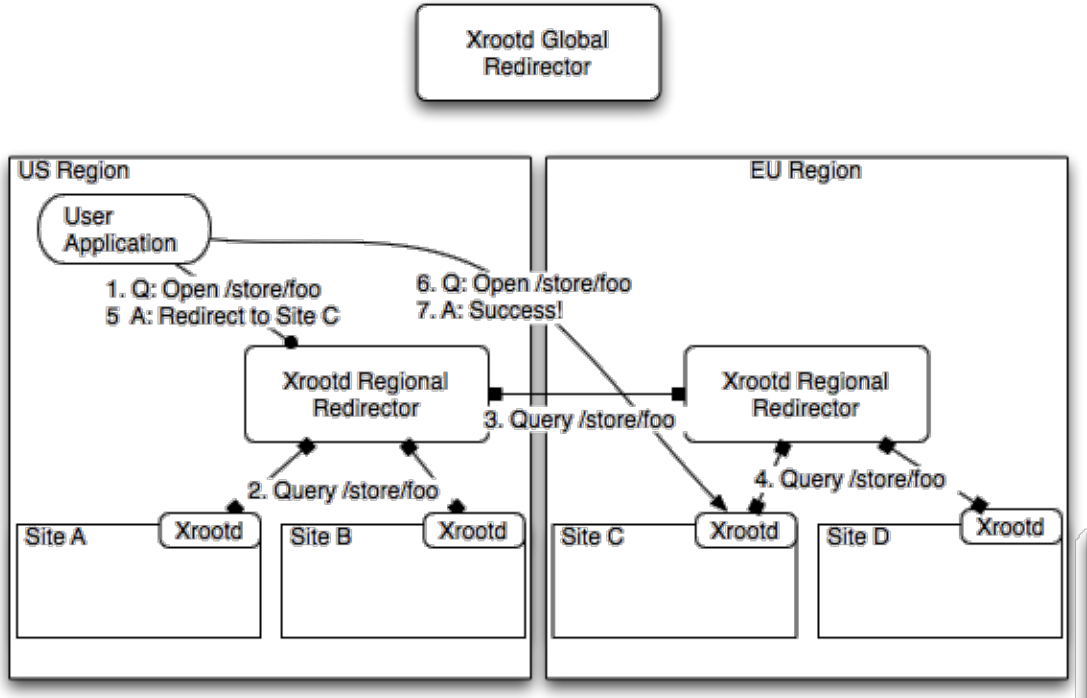
ionisation-MCP in CALO



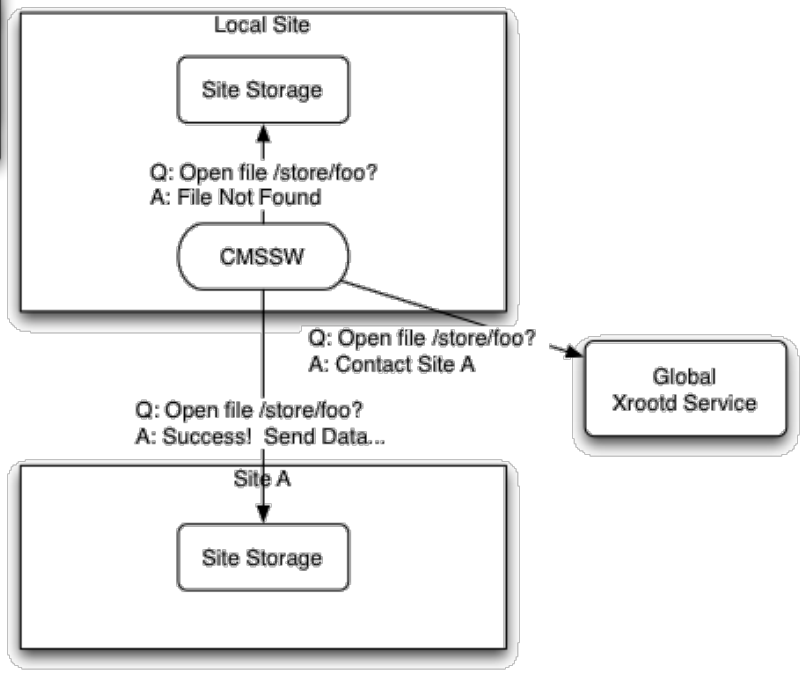




CMS Xrootd Federation



fallback access:
local CPU – remote data



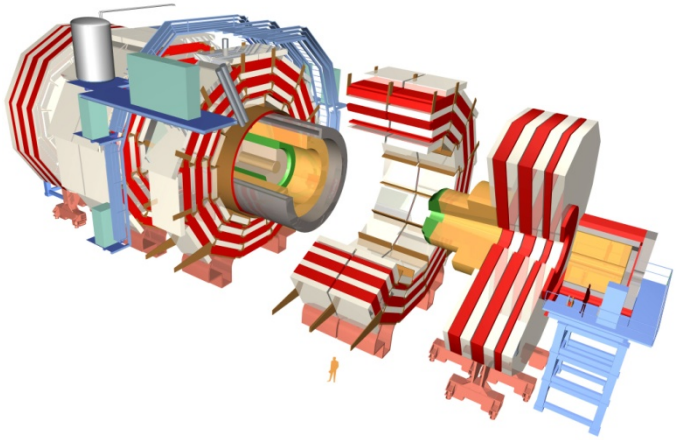
local-region / cross-region redirection

current local configuration:
TS → BA ↔ CERN ↔ world

CMS Trieste: preventivi 2014

persone:

Stefano Belforte	Dir. Ric.	100%*
Vieri Candelise	Dott.	100%
Massimo Casarsa	Ric.	100%*
Fabio Cossutti	Ric.	100%*
Giuseppe Della Ricca	R.U.	100%*
Benigno Gobbo	I Ric.	100%*
Chiara La Licata	Dott.	100%
Matteo Marone	Ass. Ric.	100%
Aldo Penzo	Dir. Ric.	0%
Andrea Schizzi	Dott.	100%
Tomo Umer	Dott.	100%
Anna Maria Zanetti	Ric.	70%*



richieste finanziarie:

MI	12 kE
ME	134 kE
CONS	20+102 kE
INV	1 kE
totale	269 kE

PRELIMINARY

totale:

10.7 FTE nel 2014 (11.1 FTE nel 2013, 8.1 FTE nel 2012)

*: anche PRIN 2010/11 (percentuali da finalizzare)

Higgs Miscellanea