

Status and recent developments of the ECAL transparency corrections

Federico Ferri on behalf of the Saclay laser monitoring team

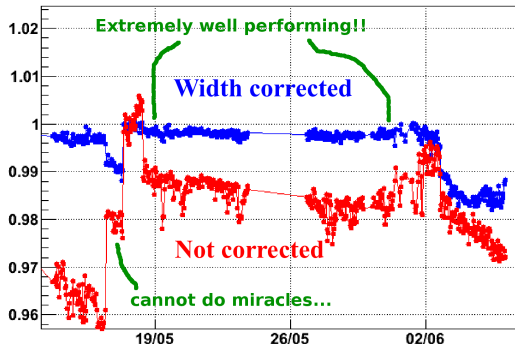
DSM/IRFU CEA/Saclay

ECAL General Meeting – June 28, 2011

One slide reminder

- Get to a precision of 0.3% in following the ECAL transparency changes. At this level, all the “second order effects” matters.
- The challenge starts from the raw data processing:
 - Single Pulse Response xtals-by-xtals to account for different shaping times of APD(VPT) and PN
 - most of the hardware imperfections, namely laser pulse width variations, are cleaned out, but not all of them (cf. later in the talk)

apd0026/pnAB vs t



- hardware must be kept as much stable as possible

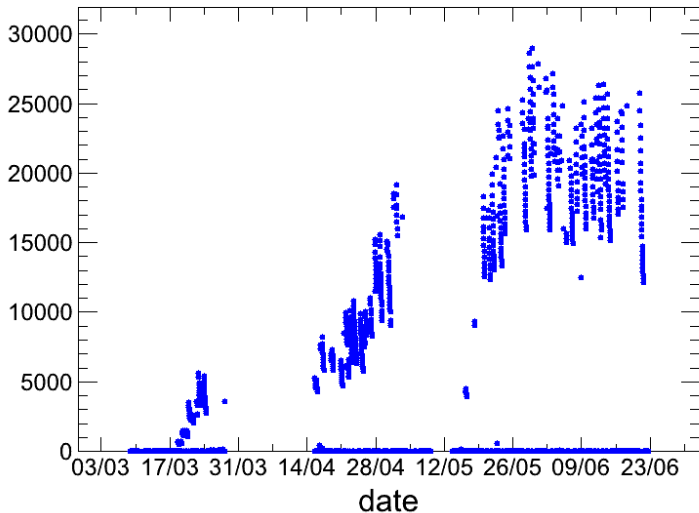
One slide technicalities (workflow)

- Sufficiently advanced to be able now to concentrate on performance (see Tommaso's plenary report [1] for more detail on the achievements)
 - first re-reco with corrections (winter 2010)
 - prompt calibration loop deployed in 2011 and running fine
- Recent efforts on tools for quick diagnosis of corrections (data, model, whatever) significantly improved (see rest of the talk)
- “Kick-off” meeting to DQMify the light checker on the 20th of June (Yutaro I. + Emanuele, Philippe, Marc, FF)

[1] <https://indico.cern.ch/getFile.py/access?contribId=12&sessionId=1&resId=1&materialId=slides&confId=121535>

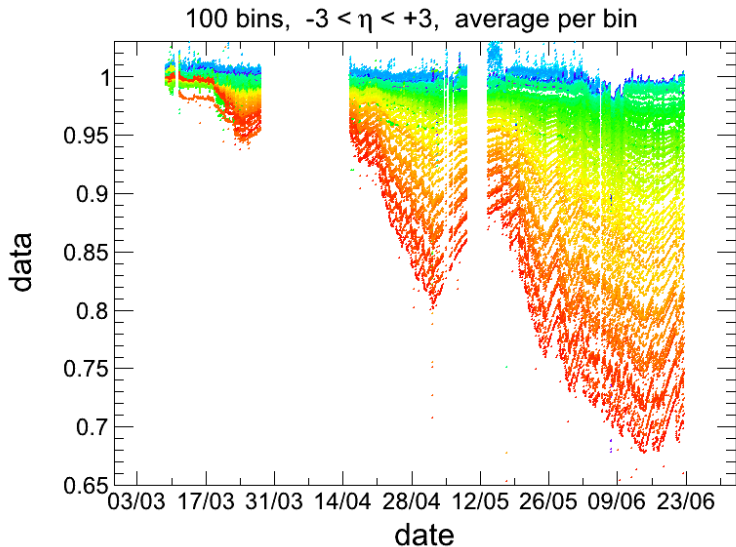
Luminosity in 2011

- As retrieved automatically on the laser farm using lumiCalc.py.



Status of ECAL: APD(VPT) / PN vs. η

- Blue laser only. η position in EE obtained from approximate geometry.



Status of ECAL: APD(VPT) / PN vs. η

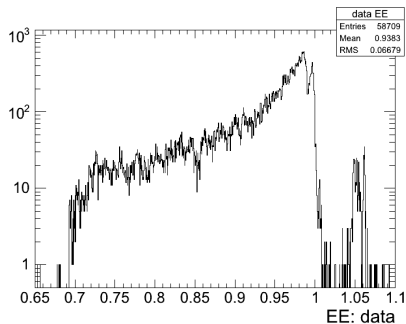
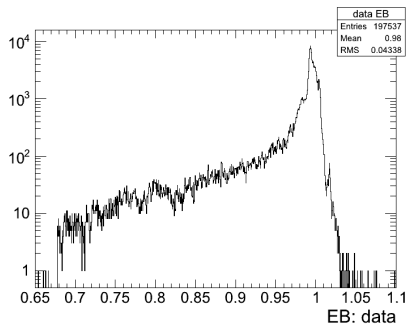
■ Blue laser only.

■ EB mean: 0.98

■ EB rms: 4

■ EE mean: 0.94

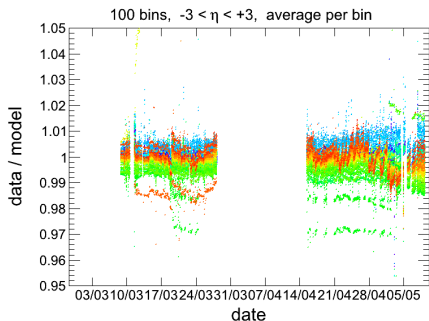
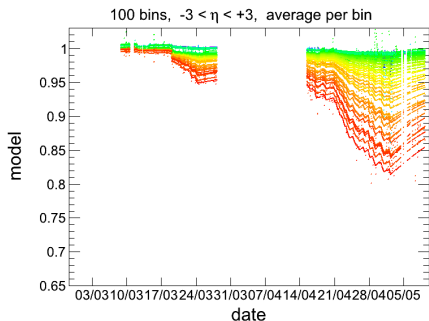
■ EE rms: 7



Transparency variation: model description

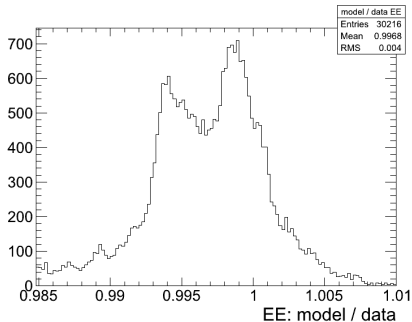
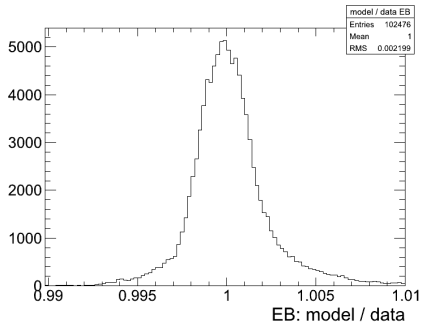
- Useful probe of our understanding of the crystal behaviour
 - Provides a valuable backup solution in case of hardware issues
 - Important if effects other than transparency loss need to be disentangled and corrected for
 - the case in 2010 with the VPT response
 - May not be the tool (in the current state) to reach the ultimate precision
 - Pure data are certainly a good option too, under study already. An interplay model-data can allow faster convergency on a long term stable solution.
- 3 parameters describing the dynamic of the colour centres (creation, saturation, annihilation)
 - steps to cope with CMS magnet, ECAL ON/OFF cycles, laser tuning/maintenance: fixed a priori in time, free to adjust on a crystal basis
 - additional effects that can be parametrised (e.g. VPT loss in response of 2010)
 - instantaneous luminosity needed as input

Status of the model up to May 10 (TS)



- EB: fit (blue laser/PN) / (IR laser/PN)
- EE: fit blue laser / PN
- few pathological channels affecting the average in η slice but generally OK - hints for some features in the last period
- quantitative estimate of the spread data/model in the next slide

Status of the model up to May 10 (TS)

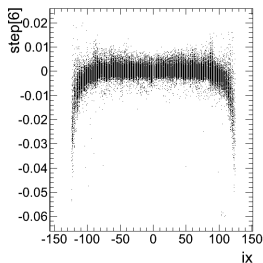
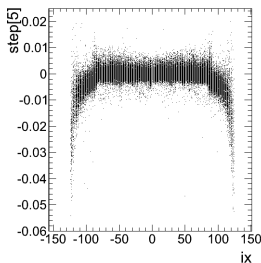
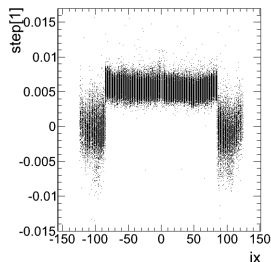
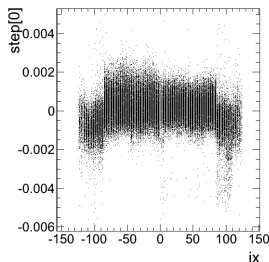


- EB agreement (rms) at the level of 0.2%
- EE agreement (rms): clear structure, nonetheless bulk at the level of 0.4%

A deeper look to the model: steps

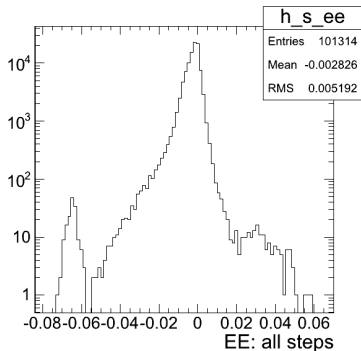
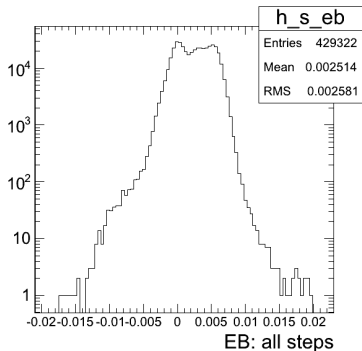
- 7 steps fitted on the model (CMS magnet, ECAL ON/OFF, laser maintenance) at fixed time. Amplitude free channel-by-channel.

- step projection vs η index (ix)
- first steps are OK: different for EB and EE, but flat
- latest steps in EE: dependence on η
→ depend on irradiation
→ bias on the fit parameters



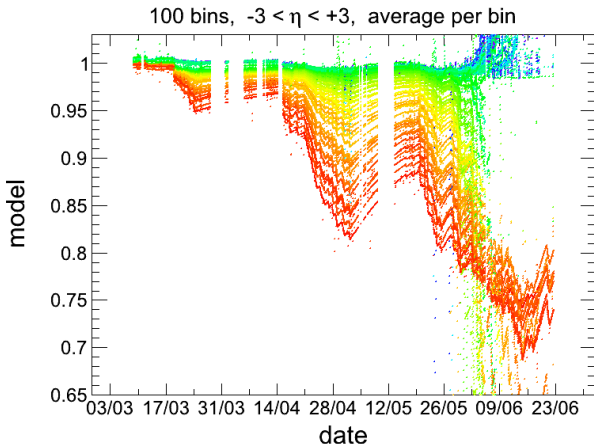
A deeper look to the model: steps

- 7 steps fitted on the model (CMS magnet, ECAL ON/OFF, laser maintenance). Amplitude free channel-by-channel.



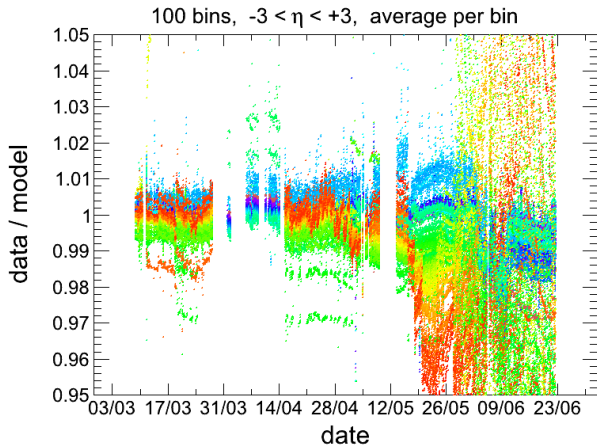
Extrapolation of the model after May 10 (TS)

- Fit degraded outside the fit right boundary (May 10, TS)
- Model fitted using blue laser/IR response
- Clearly visible also in the E/p analysis (a special thank to AndreaB. for the prompt and tireless checks)



Extrapolation of the model after May 10 (TS)

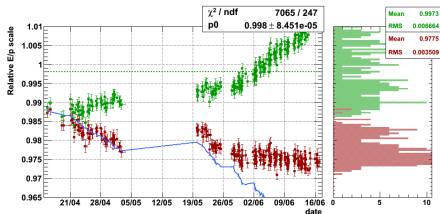
- Fit degraded outside the fit right boundary (May 10, TS)
- The model is fitted using blue/IR response
- Clearly visible also in the E/p analysis (a special thank to AndreaB. for the prompt and tireless checks, see next slide)
- fit not good at “extrapolating”



Fit over the whole 2011

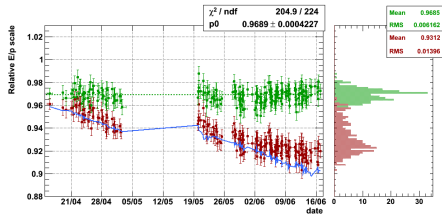
Validation plots with $W \rightarrow e\nu$ from AndreaB et al. over the week-end (DB tag produced last Friday)

- EB: fit using (blue laser/PN) / (IR laser/PN)



- clearly something wrong with EB!

- EE: fit using LED



- EE is OK

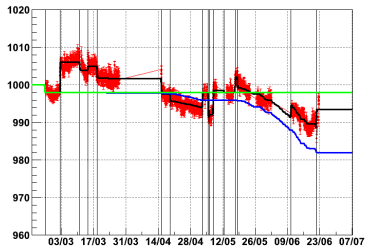
- complete analysis of the fit parameters not possible in time for today because of a power outage of a PC cluster at CEA... (&~!\$@&^@#\$&)

Fit over the whole 2011 - EB case

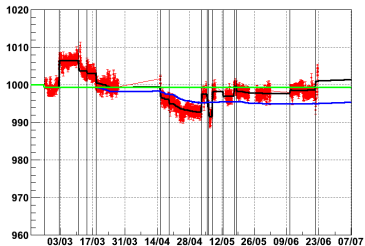
■ (blue laser/PN) / (IR laser/PN)

■ (blue laser/PN) only

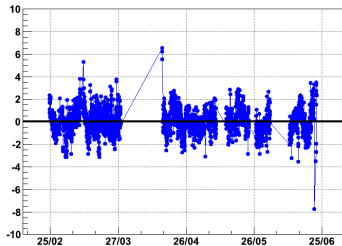
Fed 630 : Irradiation fit on channel 0026



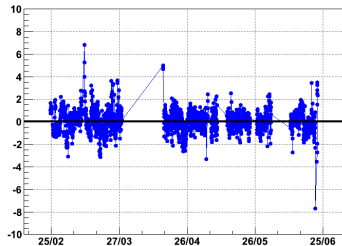
Fed 630 : Irradiation fit on channel 0026



Fed 630 : Fit residuals for channel 0026



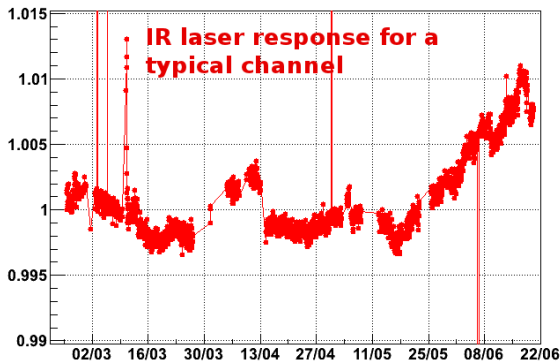
Fed 630 : Fit residuals for channel 0026



New effects in EB?

- Under deeper investigation as we speak
- Not as foolish as it seems, reminding that we observed the same pattern in EE at the beginning of the irradiation
 - however the amplitude of it seems somehow too large
 - and the IR laser in that period had quite some troubles
 - further investigation as well as detailed quantification of the effect is ongoing (it affects all the harnesses, not just a few channels)

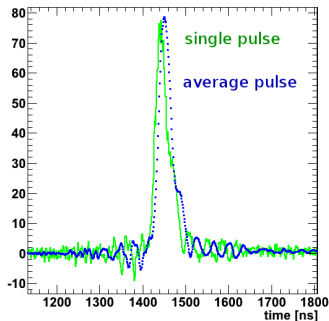
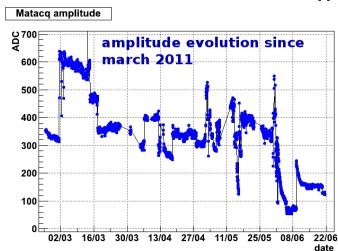
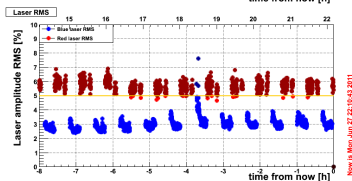
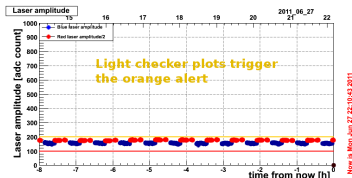
apd0026/pnAB vs t



To be followed up closely!

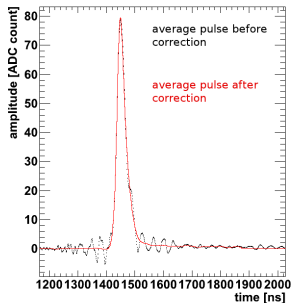
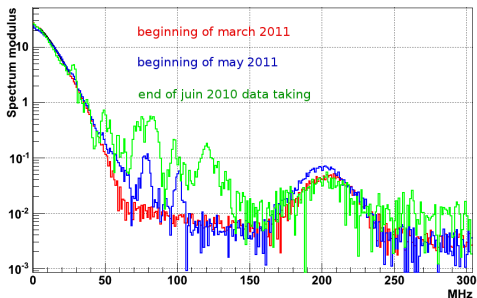
- if like in EE, the effect will saturate

Recent data reconstruction: MATAcq signal

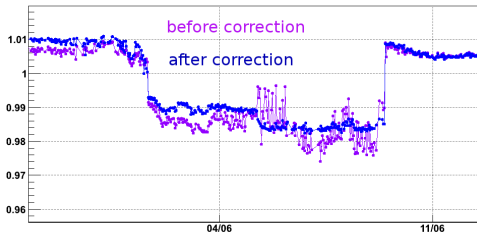


- the MATAcq is a key factor of the data reconstruction!!
 - coherent noise clearly visible and no longer negligible (pulse shape amplitude used to be > 500 ADC count)
- N.B laser hardware intervention foreseen within days (CalTech expert coming)

Remove noise in the frequency domain



apd0026/pnAB vs t



- method correctly cope with new features
- the steps still visible are due to a change of laser

Conclusions

- Never ending effort to develop new tools to cope offline with the somehow new (worsening) features of the system
- As already anticipated by and discussed with Tommaso, need to improve the current procedure to deploy prompt reco corrections:
 - need a stable method which does not prevent good physics even if not with the ultimate precision (e.g. use pure data)
 - more subtle methods developed and constantly deployed in parallel and checked with re-reco of Z , W , π^0 on a periodic basis (e.g. bi-weekly)
 - so to be ready in advance for central CMS re-reco calls
- improve hardware and try to keep it stable as much as possible
- on a more practical aspect, a new tag with a fit over the whole 2011 will be made available today
 - EB fitted with blue only laser
 - EE fitted with LED