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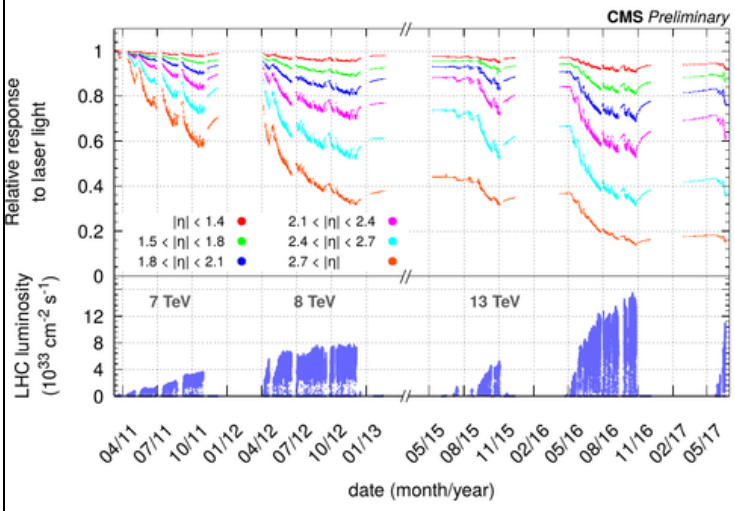
CMS-DP-2017/023

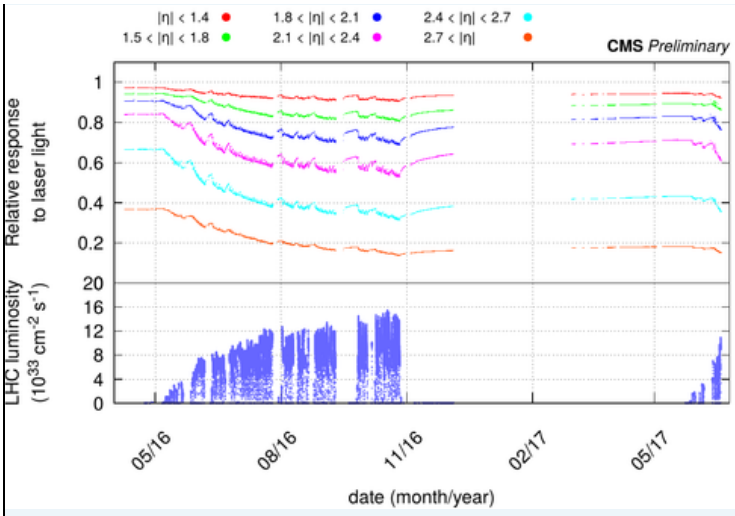
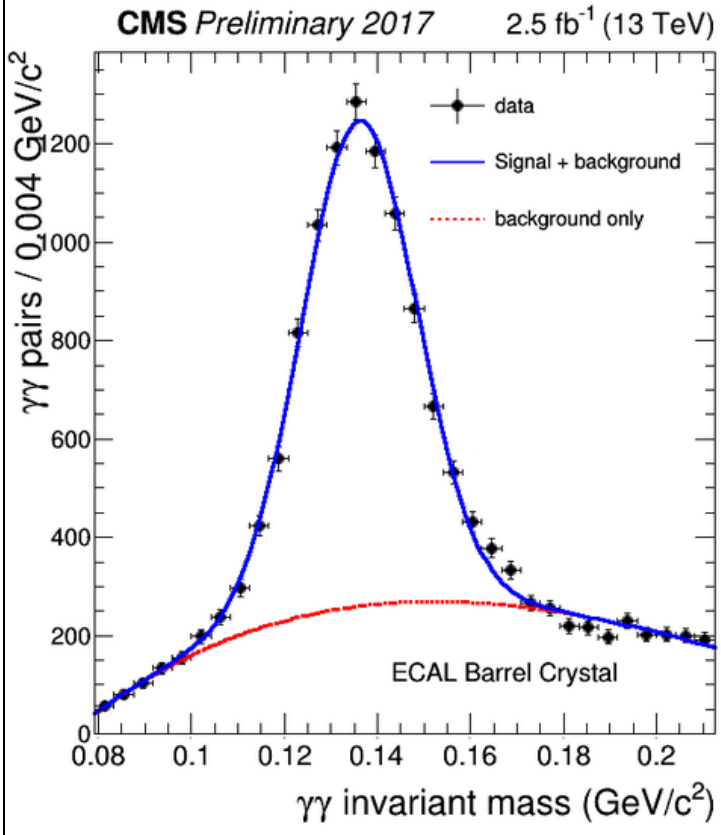
CMS ECAL Laser monitoring up to 2017, pi0/eta >gammagamma spectrum and monitoring, ES calibration

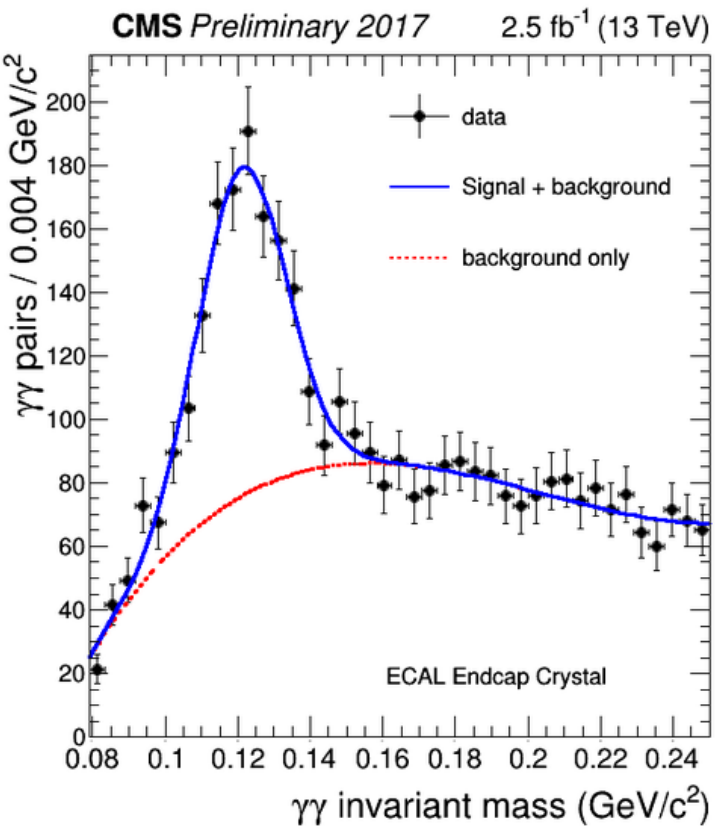
Abstract: CMS ECAL Laser monitoring up to 2017, pi0/eta >gammagamma spectrum and monitoring, ES calibration.

CDS entry

iCMS entry

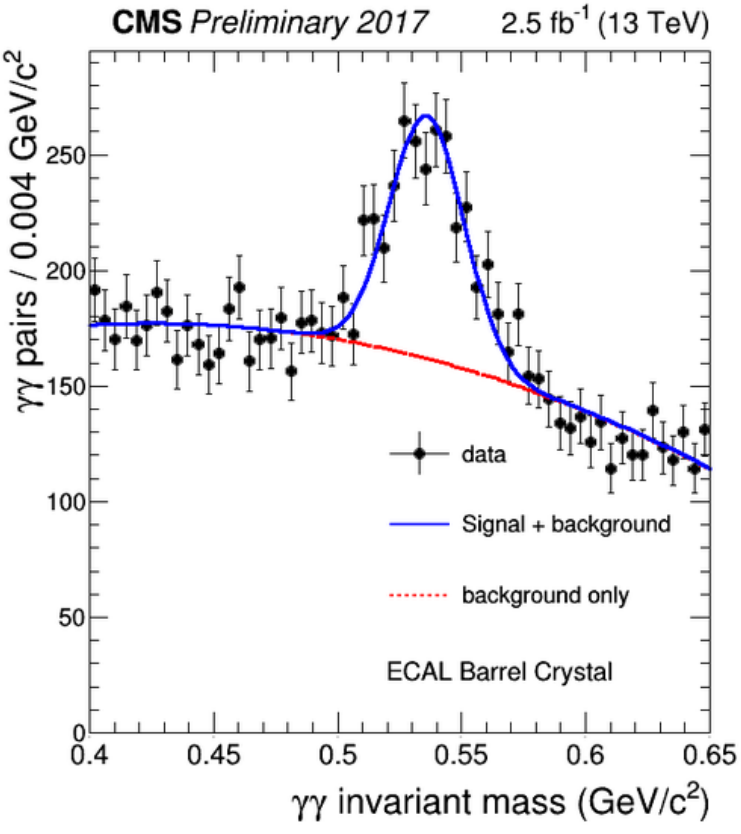
Figure	Caption
pdf version 	Relative response to laser light (440 nm in 2011 and 447 nm from 2012 onwards) injected in the ECAL crystals, measured by the ECAL laser monitoring system, averaged over all crystals in bins of pseudorapidity, for the 2011, 2012, 2015, 2016 and 2017 data taking periods, with magnetic field at 3.8 T. The response change observed in the ECAL channels is up to 10% in the barrel and it reaches up to 50% at ~ 2.5, the limit of the tracker acceptance. The response change is up to 90% in the region closest to the beam pipe. The recovery of the crystal response during the periods without collisions is visible. These measurements performed every 40 minutes are used to correct the physics data. This is an update of the plots appearing in CMS-DP-2012/007, CMS-DP-2012/015, CMS-DP-2015/016, CMS-DP-2015/063, CMS-DP-2016/031and CMS-DP-2017/003 and includes measurements taken up to June 2017. The bottom plot shows the instantaneous LHC luminosity delivered during this time period. A zoomed version highlighting the last months is reported as well.
pdf version	Relative response to laser light (440 nm in 2011 and 447 nm from 2012 onwards) injected in the ECAL crystals, measured by the ECAL laser monitoring system, averaged over all crystals in bins of pseudorapidity, for the 2011, 2012, 2015, 2016 and 2017 data taking periods, with magnetic field at 3.8 T. The response change observed in the ECAL

	channels is up to 10% in the barrel and it reaches up to 50% at ~ 2.5, the limit of the tracker acceptance. The response change is up to 90% in the region closest to the beam pipe. The recovery of the crystal response during the periods without collisions is visible. These measurements performed every 40 minutes are used to correct the physics data. This is an update of the plots appearing in CMS-DP-2012/007, CMS-DP-2012/015, CMS-DP-2015/016, CMS-DP-2015/063, CMS-DP-2016/031and CMS-DP-2017/003 and includes measurements taken up to June 2017. The bottom plot shows the instantaneous LHC luminosity delivered during this time period. A zoomed version highlighting the last months is reported as well.
pdf version 	Examples of the invariant mass of photon pairs with one photon in one fixed crystal of the ECAL Barrel, at =0.5, (left plot), and of the ECAL Endcap, at =1.7, (right plot), in the mass range of the 0 , taken in June 2017, corresponding to an integrated luminosity of approximately 2.5 fb-1 . These events are collected by CMS with a dedicated trigger at a rate of 8 (6) kHz in the Barrel (Endcap), allowing to save only the minimal information of the events, in particular energy deposits in the ECAL crystals surrounding a possible 0 candidate. For the candidates in the Endcaps in the region covered by the Preshower (ES, 1.7< <2.55), the position of the ES is used. These events are used as prompt feedback to monitor the effectiveness of the laser monitoring calibration and will be used to intercalibrate the energy of ECAL crystals. The 0 invariant mass plot is built with uncalibrated energy scale.
pdf version	Examples of the invariant mass of photon pairs with one photon in one fixed crystal of the ECAL Barrel, at =0.5, (left plot), and of the ECAL Endcap, at =1.7, (right plot), in the mass range of the 0 , taken in June 2017, corresponding to an integrated luminosity of approximately 2.5 fb-1 . These events are collected by CMS with a dedicated trigger at a rate of 8 (6) kHz in the Barrel (Endcap), allowing to save only the minimal information of the events, in particular

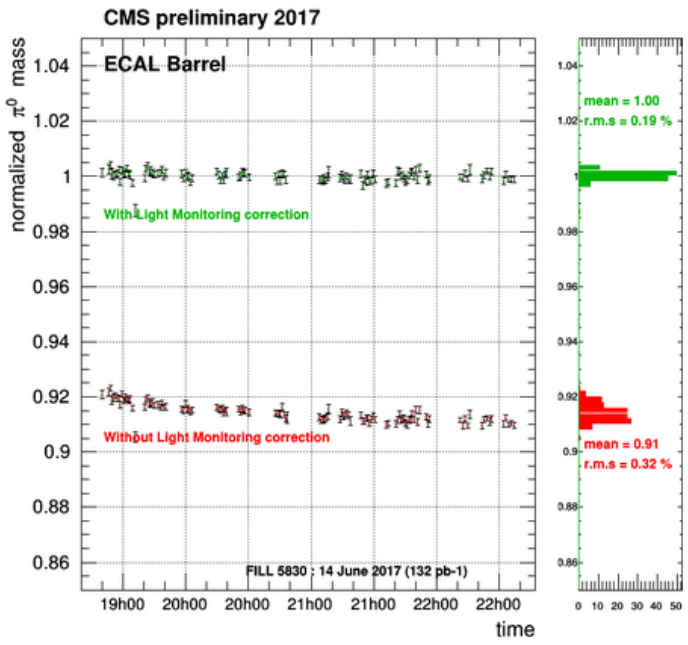
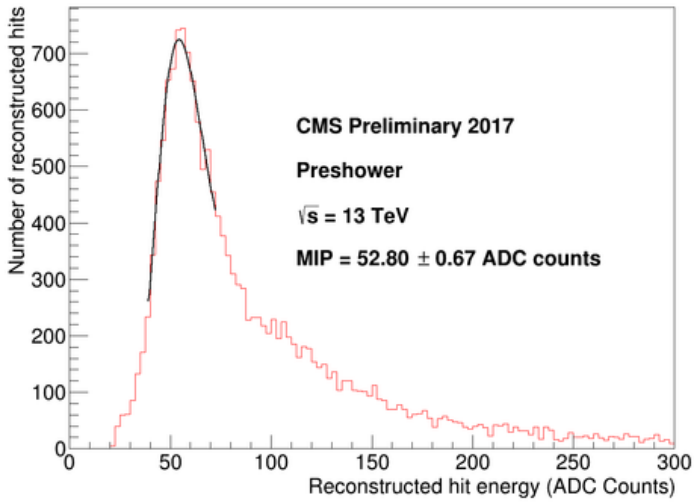


energy deposits in the ECAL crystals surrounding a possible 0 candidate. For the candidates in the Endcaps in the region covered by the Preshower (ES, 1.7< <2.55), the position of the ES is used. These events are used as prompt feedback to monitor the effectiveness of the laser monitoring calibration and will be used to inter-calibrate the energy of ECAL crystals. The 0 invariant mass plot is built with uncalibrated energy scale.

pdf version



Example of the invariant mass of photon pairs with one photon in one fixed crystal of the ECAL Barrel at =0.04 in the mass range of the , taken in June 2017, corresponding to an integrated luminosity of approximately 2.5 fb-1. These events are collected by CMS with a dedicated trigger at a rate of 8 kHz, allowing to save only the minimal information of the events, in particular energy deposits in the ECAL crystals surrounding a possible candidate. These events are used as prompt feedback to monitor the effectiveness of the laser monitoring calibration and will be used to inter-calibrate the energy of ECAL crystals. The h invariant mass plot is built with uncalibrated energy scale.

pdf version 	Stability of the relative energy scale measured from the invariant mass distribution of 0 > gg decays in the ECAL Barrel.The energy scale is measured by fitting the invariant mass distribution of approximately 200,000 photon pairs in the mass range of the 0 meson. Each point is obtained from a fit to approximately 8 minutes of data taking. The error bars represent the statistical errors on the fitted peak position. The energy scale is plotted as a function of time, over a period of 3 hours during an LHC fill, for data recorded on 14th June 2017 during LHC fill 5830. The plot shows the data with (green points) and without (red points) light monitoring corrections applied. The right-hand panel shows the projected relative energy scales.
pdf version 	The two planes of the Preshower (ES), coupled with the EE crystals, forms a sampling calorimeter. The ES essentially counts the number of charged particles passing through the layers of silicon, which is an estimate of the amount of energy deposited in the ES lead absorbers. We use charged particles with momentum nearly close to minimum ionizing to calibrate the ES, so for simplicity we refer to them as MIPs . The design-goal accuracy of the channel-by-channel calibration is set to 5%. This corresponds to a contribution of about 0.25% to the overall EE+ES energy resolution for high-energy electrons since only a few percent of electron/photon energy is deposited in ES. The sources of response variation (sensor-to-sensor and channel-to-channel) are the sensor thickness seen by the incident particles (depends on angle of incidence), gain of the front-end electronics chain, and charge collection efficiency which varies with the radiation damage. The plot shows the energy distribution for a silicon sensor. The red histogram represents the real data while the black line represents the fit. The data were obtained from the 2017A run period. The distribution is fitted by a Landau function (to model the signal) convoluted with a Gaussian function (to model the intrinsic noise). The equivalent MIP for this sensor is 52.8 ADC counts.

-- AndreaMassironi - 2017-07-04

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