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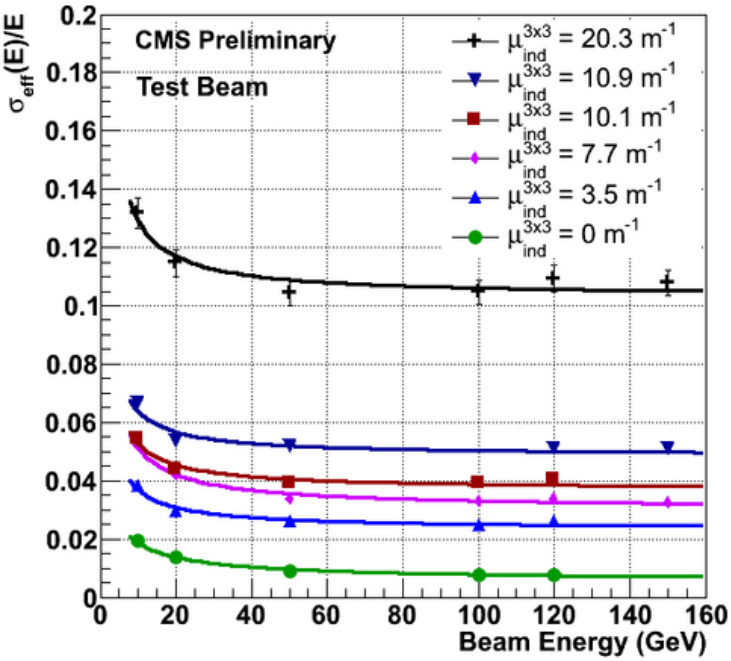
CMS-DP-2013/022
ECAL upgrade performance plots

Abstract: ECAL upgrade performance plots for 2013 EPS Conference

CDS entry

iCMS entry

Figure	Caption
pdf version 	***Energy resolution of proton-irradiated PBWO4 EE crystals*** The plot shows the energy resolution for PbWO4 crystal matrices constructed from proton irradiated crystals. The numbers in the legend indicate the average induced absorption µind, defined in the equation below, where LT is the crystal light transmission at wavelength measured longitudinally, LT0 is its original value before irradiation and L is the crystal length. The induced absorption is calculated as a weighted average of the values of the 3x3 crystals in the matrix. The weights are given by the relative energy deposit in each crystal assuming an EM shower centered on the 3x3 matrix. The resolution was measured using test beam data with high energy electrons (10-150 GeV). The crystals were read-out by PMTs. The noise term at the test-beam (different from the one at CMS due to the different photo-detectors and electronics) is correctly taken into account. The induced absorption coefficient indicated in the plot is affected by an error of about 20-30% due to the non-uniformity of the proton beam used for the irradiation. The energy resolution is measured for electrons impacting on a 1x1 cm2 window on the crystal front face. The resolution is calculated using the effective sigma, defined as the smallest width of the distribution containing 68% of the events.
$\frac{LT(\lambda)}{LT_0(\lambda)} = e^{-\mu_{IND}(\lambda)\times L}$	***Equation defining µind*** Average induced absorption µind is defined by this equation, where LT is the crystal light transmission at wavelength measured longitudinally, LT0 is its original value before irradiation and L is the crystal length.

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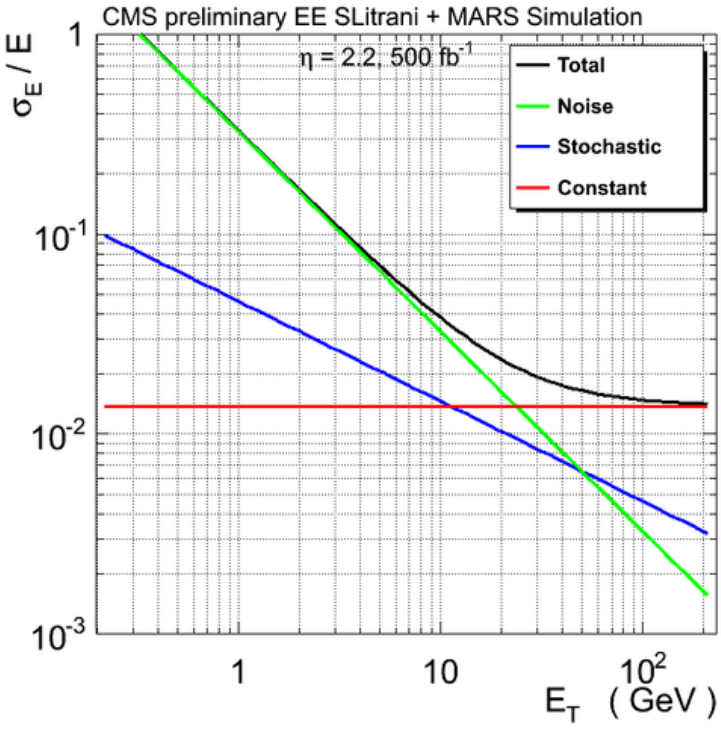

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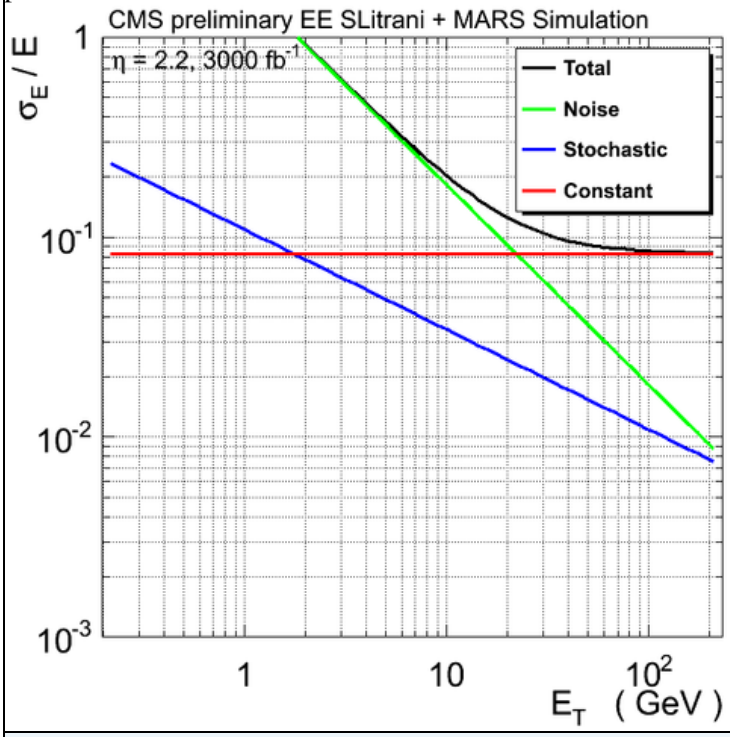

ECAL Endcap Longevity Predictions for the energy resolution in the endcaps at =2.2 after 500 (top) and 3000 (bottom) fb-1 of integrated luminosity, calculated using the ECAL model for crystal radiation damage. The model is made using crystal transparency measurements from hadron and gamma irradiated crystals, radiation doses calculated by the MARS program and the SLITRANI light transport simulation program. The model was validated using test-beam data from of hadron-irradiated crystal matrices. The energy resolution is given by three terms: the stochastic (a), noise (b) and constant term (c) as in the formula given below. The light output degradation contributes to the stochastic term, as well to the noise term, which is amplified by the noise equivalent of the energy. The constant term is also degraded due to the deterioration of the light collection uniformity.

$$\frac{\sigma(E)}{E} = \frac{a}{\sqrt{E}} \oplus \frac{b}{E} \oplus c$$

Energy Resolution

The energy resolution is given by three terms: the stochastic (a), noise (b) and constant term (c).

This topic: CMSPublic > EcalDPGResultsCMSDP2013022
Topic revision: r3 - 2013-09-24 - ToyokoOrimoto