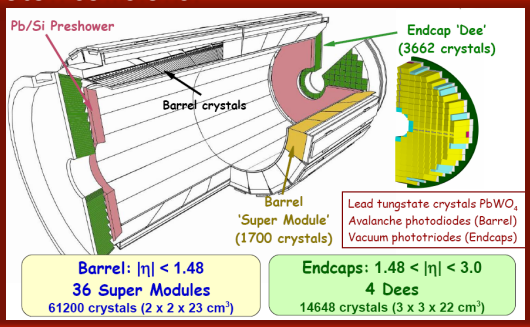
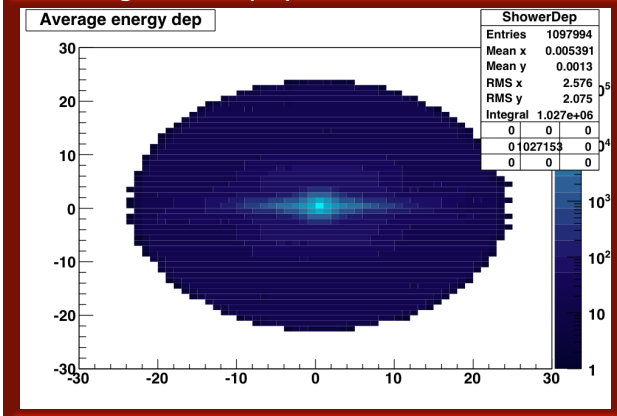
Search for New Phenomena with Photons using first data from the CMS detector at the LHC

Searches for new physics with photons are an integral part of the design of the CMS experiment.Imagine this device as a camera, taking pictures millions of times per second of electromagnetic energy originating from proton-proton collisions.



A "picture" of one photon would on average leave an energy deposition as below (each square is one crystal). Compared to false patterns, these are much more compact. Separating the two is a central problem in searching for new physics.

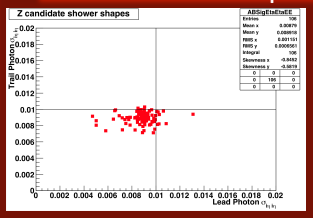


The actual distributions for these widths can be studied in collider data samples other than the one used for searching for new physics. Then the number of true diphoton events in data can be estimated.

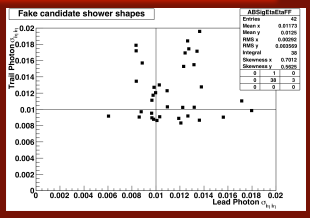
The purity in early data was estimated to be >50%, suitable for searching for new physics. The studies done during the project period formed the foundation for subsequent analysi and the publication.

The CMS detector is one of the experiments at the Large Hadron Collider (LHC). The LHC collides protons at the highest energies ever achieved.

Supersymmetric particles like the gluino ($\tilde{g}$), if produced in collisions, could cascade decay to give a photon and a gravitino (which escapes undetected). Since these particles would be pair produced, collisions which produce these new particles would have at least two photons.

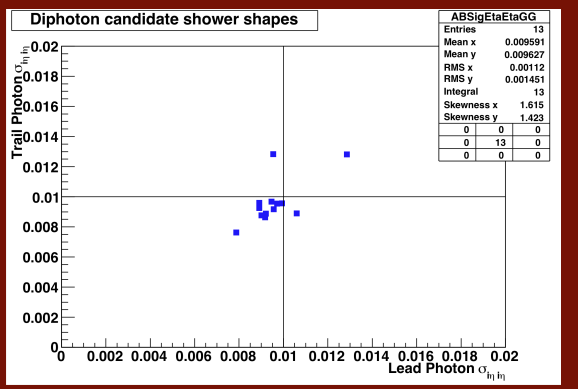


Electrons from collisions.



Fakes from collisions.

The information about the "width" (denoted $\sigma_{i\eta i\eta}$)of the energy deposition from each photon can be reduced to a single number for each photon candidate. We can characterize these in collider data.



Result is available at http://arxiv.org/abs/arXiv:1103.0953, and has been accepted by Physical Review Letters

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