Reconstruction of photon conversions at the CMS tracker

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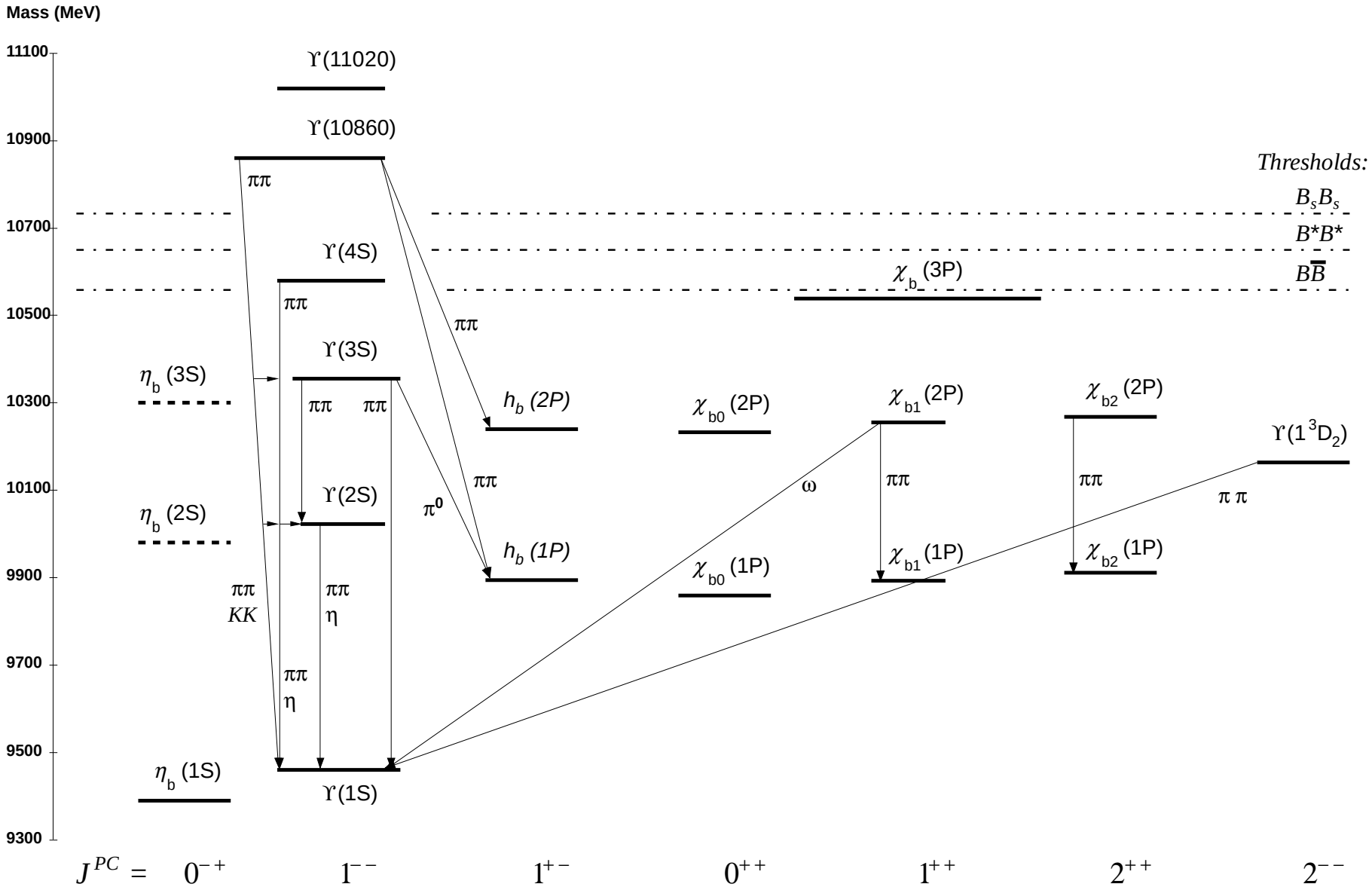
Motivation

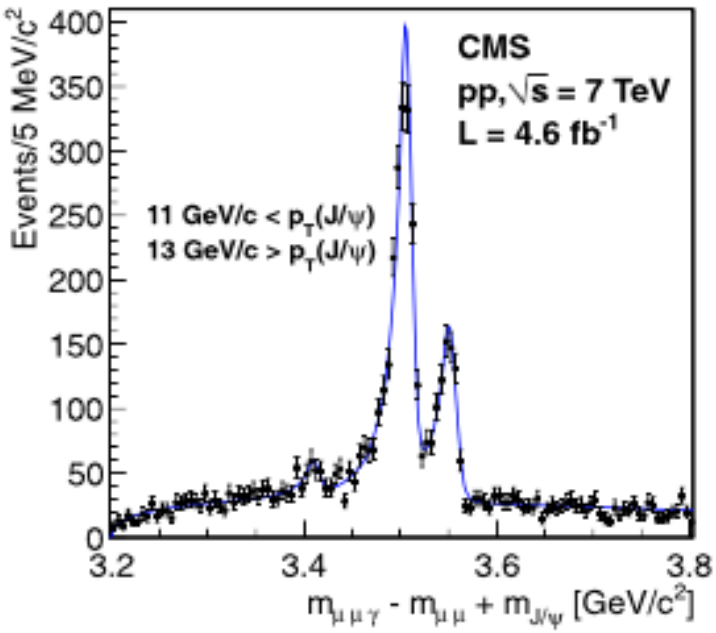
THE BOTTOMONIUM SYSTEM

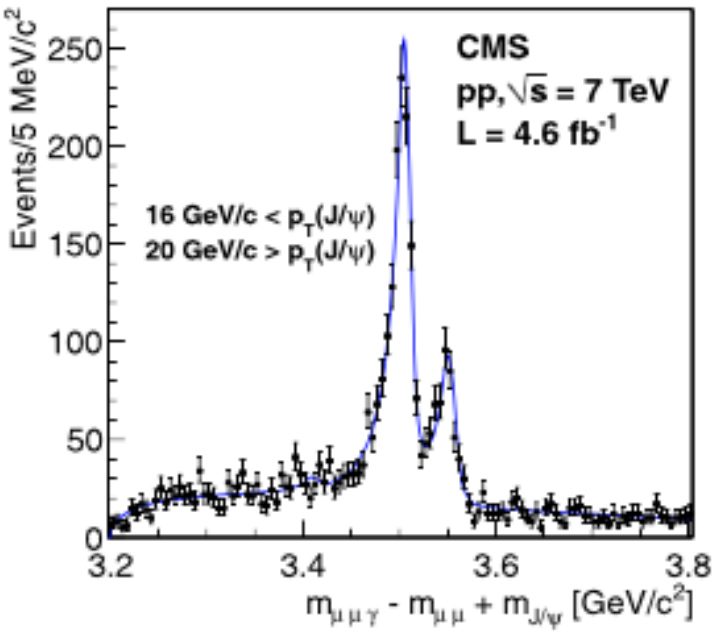
Meson particle listing from PDG: Bottonium



Motivation

Measurement of the relative prompt production rate of χ_{c2} and χ_{c1} in pp collisions at $\sqrt{s} = 7$ TeV



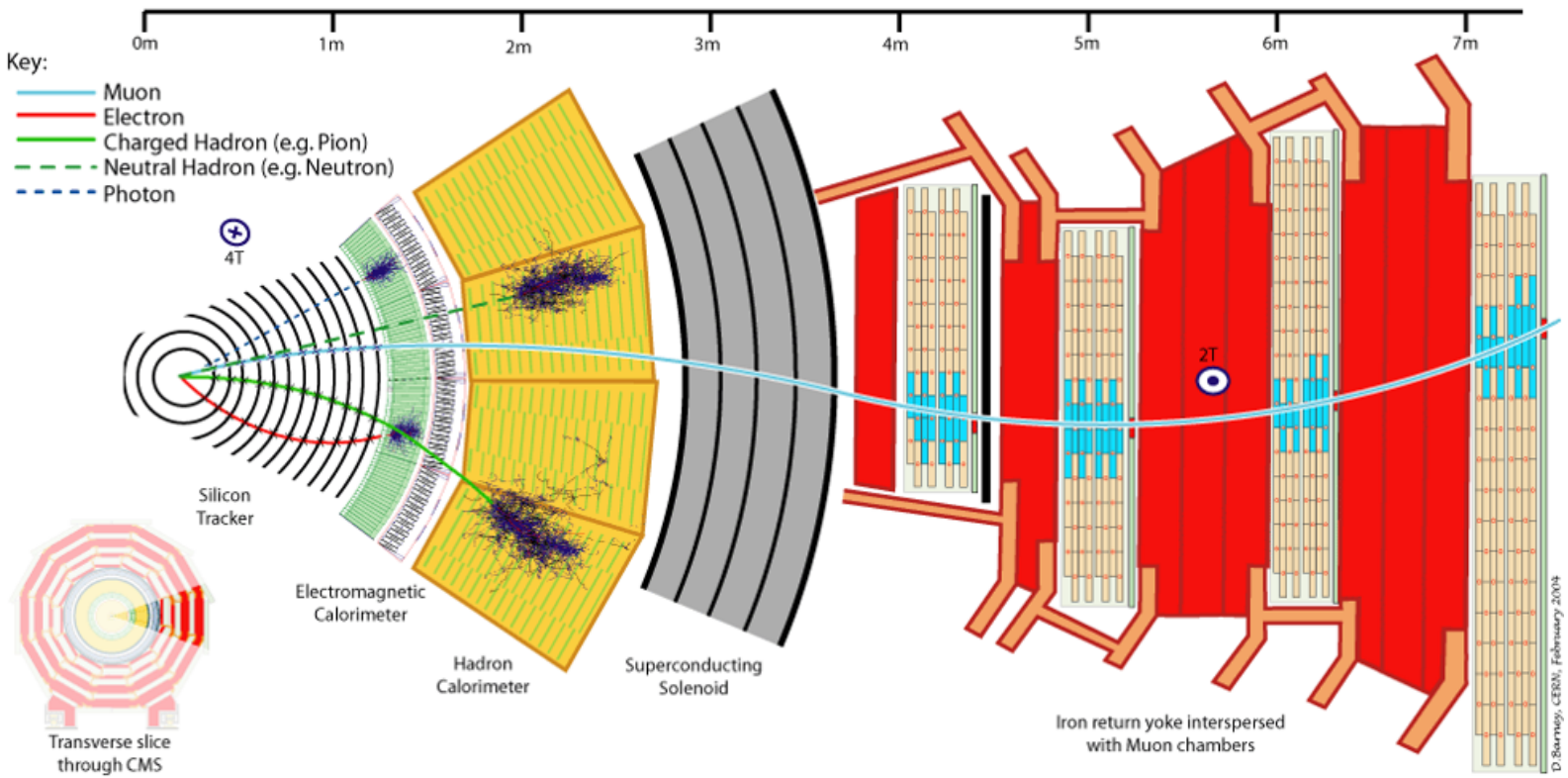


The CMS detector

The Compact Muon Solenoid (CMS) detector features an all-silicon tracker, a lead tungstate crystal electromagnetic calorimeter (ECAL), and a brass-scintillator hadronic calorimeter, all contained inside a 3.8T superconducting solenoid. The strong magnetic field enables the measurement of charged particle momenta over more than four orders of magnitude, from less than 100MeV/c to more than 1TeV/c, by reconstructing their trajectories as they traverse the CMS inner tracking system. The iron return yoke of the solenoid is interspersed with gas detectors that are used to identify muons.

The CMS detector

CMS in Layers



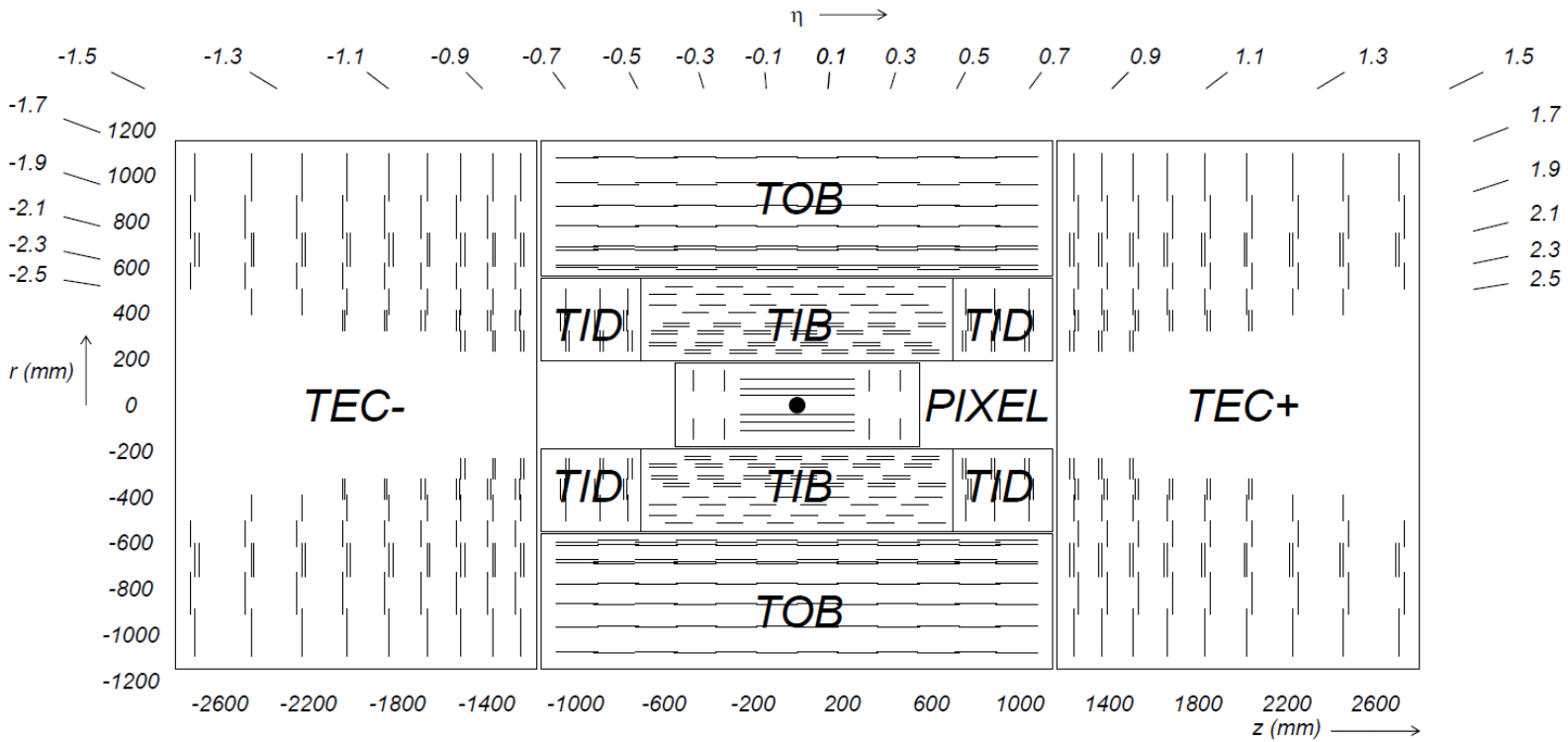
The CMS detector

The tracker before march 2017

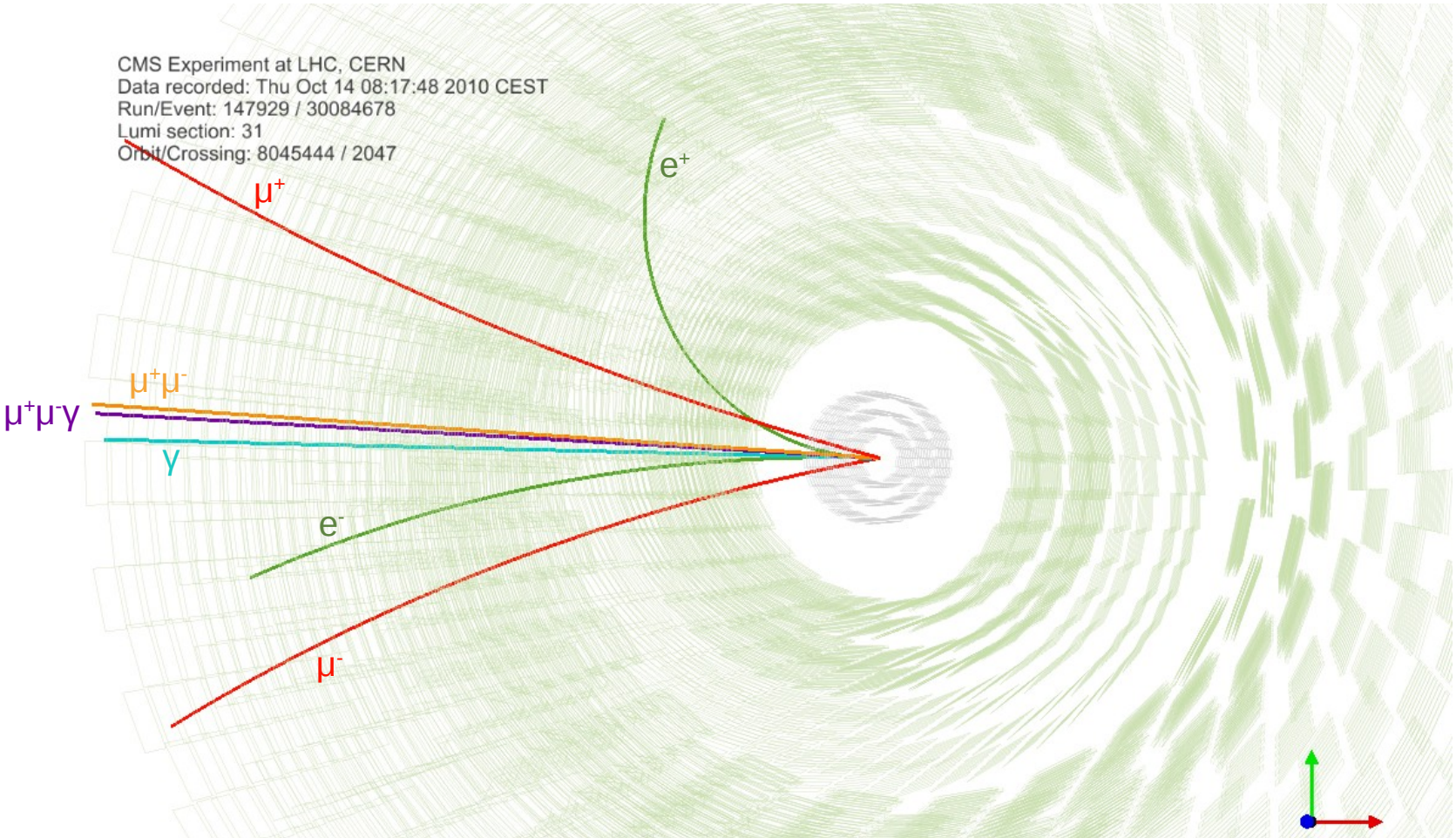
- 1 440 silicon pixel and 15 148 silicon strip detector modules, covering the region from 4 cm to 110 cm in radius, and within 280 cm on either side of the collision point along the LHC beam axis
- The tracker acceptance extends up to a pseudo-rapidity of $|\eta| < 2.5$. The pseudo-rapidity is defined as $\eta = -\ln[\tan(\theta/2)]$
- Impact parameter resolution of ≈ 15 μm and a transverse momentum (pT) resolution of about 1.5% for 100 GeV/c particles
- The ECAL towers are projective and finely segmented, with $\Delta\phi \approx \Delta\eta \approx 0.087$ in the central region, allowing precise reconstruction of the e/γ position and energy

The CMS detector

Schematic Cross Section



Event Display



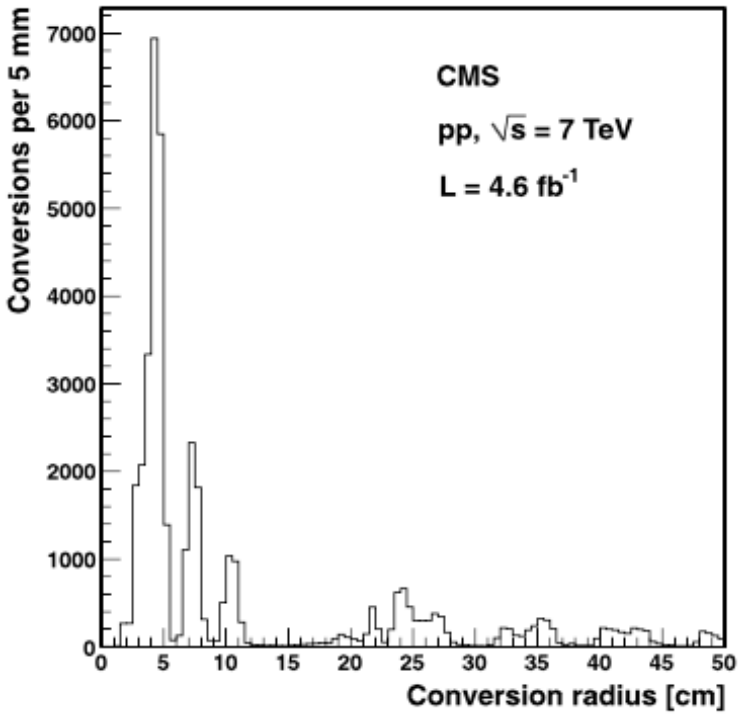
Conversion reconstruction

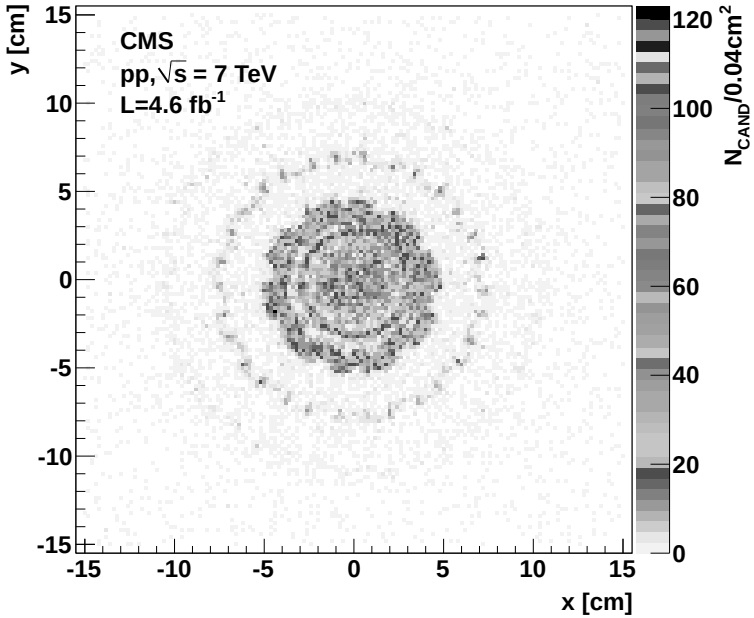
Old Selection Criteria

- Two tracks with opposite charge
- Both tracks have ≥ 6 hits and normalised $\chi^2 \leq 10$
- Charge-signed impact parameter $Q \cdot d_0 > 0$ cm
- Distance of minimum approach, $d_m > 0.25$ cm and $d_m < 1$ cm to reject looper
- Difference in the z coordinate of the innermost hits in the track pair $\Delta z < 5$ cm;
- Radial distance between the point of closest approach of the two tracks and the nominal vertex $d_r > 2$cm
- Track opening angle $\Delta\phi < 0.4$ radians
- $|\Delta \cot\theta| < 0.1$
- Valid vertex fit with χ^2 probability greater than 5×10^{-4}

Conversion Reconstruction

From the measurement of the relative prompt production rate of χ_{c2} and χ_{c1} in pp collisions at $\sqrt{s} = 7$ TeV





Summary

Converted photons in the CMS tracker have been proven to be a good tool for Radiative Decays reconstruction. We are performing a new study with the 2016 Data in order to find out if with the current conditions (colisions and detector) the reconstruction efficiency is similar to the previous runs and if it possible to improve it.