

PERFORMANCE OF THE DIAMOND TIMING DETECTORS FOR THE TOTEM UPGRADE

M. Berretti, F. Garcia, J. Heino, R. Lauhakangas, L. Martikainen, T. Naaranoja, F. Oljemark, K. Österberg, H. Saarikko and J. Welti on behalf of the TOTEM collaboration

Helsinki Institute of Physics and Department of Physics, University of Helsinki ,
P.O.Box 64, FIN-00014 University of Helsinki, Finland
email: tiina.naaranoja@helsinki.fi

The TOTEM experiments [1] timing upgrade [2] for the vertical Roman Pots (RP) adds the capability to measure the Time-Of-Flight (TOF) of protons in the very forward region. The timing detector [3] consists of four layers of single crystal Chemical Vapor Deposition (scCVD) diamonds. Detector grade scCVD diamond is an ideal option for the detector material for its fast and efficient charge collection properties and radiation hardness.

All of the diamond sensors quality was tested with dedicated current-voltage measurement systems in Helsinki and CERN. The quality of the metalization was tested by measuring the long term stability of the signal from a Sr-90 β -source. The time resolution of the sensors with dedicated electronics was determined with beam tests. It varied from 80 to 108 ps depending on the pixel size for individual sensor. This gives the full detector with four sensor layers a total time precision in the order 50 ps. The time resolution was confirmed from data taken after installation to the LHC (see fig. 1).

The first package of diamonds was installed in the LHC in November 2015. Further two packages were installed in June 2016 and are operated as a part of the CT-PPS project [4]. The detectors have taken 2 fb^{-1} of data as a tracking device in 2016.

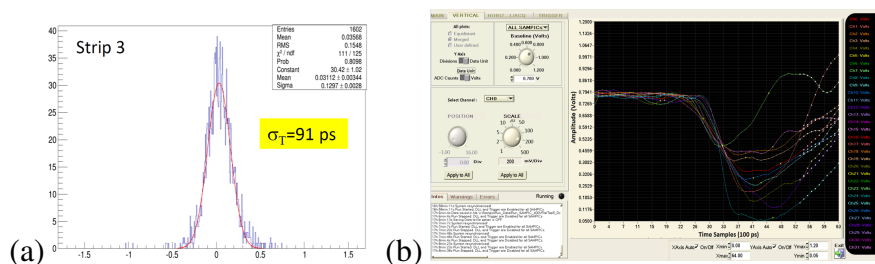


Figure 1: Detector performance in the LHC: (a) time resolution measurement (b) Event display showing shower of particles hitting the diamond detector .

- [1] G. Anelli et al., (TOTEM collaboration), JINST 3 (2008) S08007.
- [2] TOTEM collaboration, CERN-LHCC-2014-020 TOTEM-TDR-002 (2014).
- [3] G. Antchev et al., (TOTEM collaboration), CERN-PH-EP-2016-317 arXiv:1701.05227v1 (2017).
- [4] CMS and TOTEM collaborations, CERN-LHCC-2014-021 TOTEM-TDR-003 CMS-TDR-13 (2014).