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Perfomance of novel and upgraded instrumentation for luminosity and beam conditions measurements in CMS

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The beam monitoring and luminosity systems of the CMS experiment are enhanced by several new and upgraded sub-detectors to match the challenges of the LHC operation and physics program at increased energy and higher luminosity. A dedicated pixelated luminosity telescope is installed for a fast and precise luminosity measurement. This detector measures coincidences between several three-layer telescopes of silicon pixel detectors to arrive at luminosity for each colliding LHC bunch pair. An upgraded fast beam conditions monitor measures the particle flux using single crystalline diamond sensors. It is equipped with a dedicated front-end ASIC produced in 130 nm CMOS technology. The excellent time resolution is used to separate collision products from machine induced background, thus serving as online luminosity measurement. A new beam-halo monitor at larger radius exploits Cerenkov light from fused silica to provide direction sensitivity and excellent time resolution to separate incoming and outgoing particles. The back-end electronics of the beam monitoring systems include dedicated modules with high bandwidth digitizers developed in both VME and microTCA standards for per bunch beam measurements and gain monitoring. All new and upgraded sub-detectors have been taking data from the first day of LHC operation in April 2015 and results on their essential characteristics will be presented.

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