Lessons learned during CMS Tracker End Cap Construction

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With an active silicon area of about 200 squaremetres, 15148 silicon strip modules and roughly 10 millions of electronic readout channels, the silicon strip tracker of the CMS experiment at the LHC will be the by far largest silicon strip tracker in the world. To cope with the harsh irradiation environment at the LHC, the CMS tracker must be operated at a temperature below $-10\,^{\circ}$C. It will be located in a 4 T magnetic field. For high momentum muon tracks, a momentum resolution of about 2 % and a transverse and longitudinal impact parameter resolution of $10\,\mu m$ and 20-50 μm are expected, respectively.
The CMS tracker is constructed out of three main subdetectors: the inner detector, consisting itself of the inner barrel and inner disks, the outer barrel and the end caps. These subdetectors are currently under construction at CERN, Italy and Germany. Integration of the complete tracker into the CMS detector is scheduled for early 2007, still in time to record the first collisions.
The tracker end caps cover the pseudorapidity region between 1.0 and 2.5. Each end cap or TEC is built out of 9 carbon fiber disks. The disks have a diametre of 2.2 m and are located at distances between 1.3 m and 2.7 m from the interaction point. The end caps feature a modular design, with up to 28 silicon strip modules mounted onto wedge-shaped carbon fiber support plates, so-called petals. Eight petals are assembled onto each side of a TEC disk. With in total 6400 silicon strip modules of 14 different types, the end caps are the biggest and probably also the most complex subdetector in the CMS strip tracker.
In this presentation, the design of the CMS silicon strip tracker end caps will be outlined, and the experience from the construction, assembly and integration of this subdetector will be discussed. Quality assurance and control during mass production of the modules and petals will be reviewed, and results from operation of petals in system tests and test beams will be presented. Measurements during end cap integration, including a test of one eighth of a TEC at CMS operating temperature as well as alignment studies both with a dedicated laser system and with cosmic muon tracks, will be discussed.