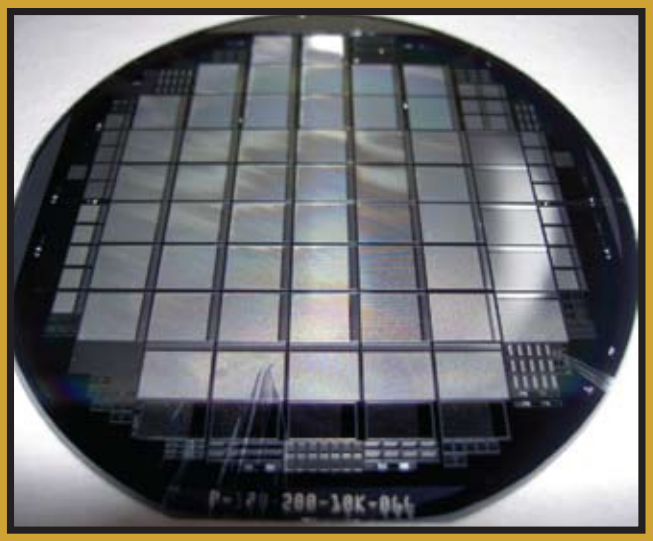
Advanced Instrumentation Seminars

January 21, 2009
1:30 pm, 1st Floor
KAVLI Auditorium

3D silicon Detectors
for LHC Upgrades

Guest Speaker –
Cinzia Da Via
University of Manchester



3D silicon sensors, where electrodes penetrate throughout the entire wafer thickness are among the technologies being considered for the replacement of the innermost layers (B-layer) of the ATLAS pixel detector. Such layers will suffer very high radiation damage during their life time and will therefore require radiation hard technologies to guarantee proper tracking reconstruction at high luminosity. Current silicon technology can operate up to 10^{15} 1 MeV equivalent neutrons cm^{-2}. This is possible because radiation induced space-charge build-up can be controlled by increasing the oxygen content of Float-Zone silicon substrates and high operating voltages are possible due to the development of sophisticated guard-rings. Such devices are currently installed in the CERN Large Hadron Collider (LHC) experiments. Much work is in progress to improve this limit to 10^{16} cm^{-2} so that silicon technology can be used in detectors at an upgraded LHC (SLHC). Beyond fluences of 10^{15} cm^{-2}, charge trapping is the major limit to performance. To date, the only means to improve matters is by the use of device engineering, in particular, by the development of 3D technology (originally fabricated at Stanford) or operating planar devices with thinner substrates. This talk will discuss the status of 3D silicon detectors and the system implications of using this technology for the B-layer in the ATLAS experiment.

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