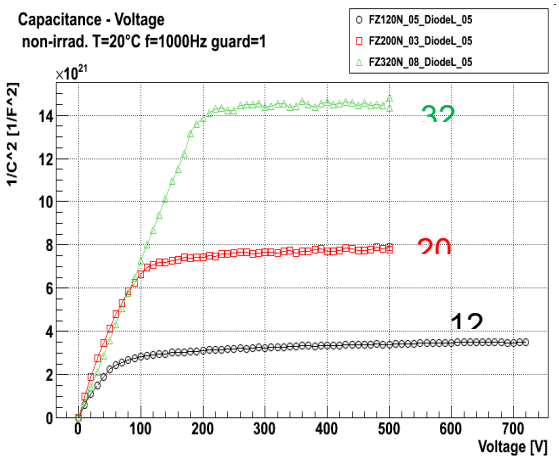
Master thesis

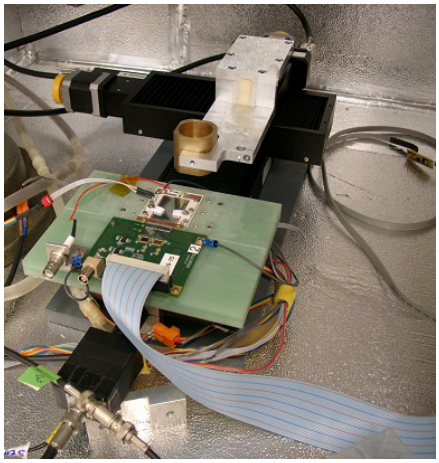
at the

Detector labororatory of the Institute for Experimental Physics

Measurement Program on Silicon Strip Sensors for the Phase 2 Upgrade of CMS

The topic of this thesis is linked to the Upgrade of the CMS Silicon Tracker for the High Luminosity Phase of the LHC[1]. The luminosity of the LHC will be increased in several steps. The high instantaneous and integrated luminosities foreseen necessitate completely new tracking detectors at CMS, which have to be finer segmented and more radiation hard than the current trackers, as well as provide triggering capabilities at the low level trigger. The group is currently involved in a CMS wide measurement and irradiation campaign to select the best-suited sensor material for the outer tracker for the phase 2 upgrade[2]. As part of the measurement program, mini strip sensors are implemented on a variety of silicon sensor materials, which will be systematically studied in this master thesis.





You will learn about key measurement techniques for silicon sensors such as current-voltage and capacitance-voltage measurements, the transient current technique (TCT) and measurements with radioactive sources (beta-emitters like ^{90}Sr), which are all used in our lab to characterize strip sensors.

The mini strip sensors are being irradiated with protons and neutrons to study radiation induced damage as present during the high luminosity phase of the LHC. A variety of measurements like current-voltage and capacitance-voltage measurements as well as the inter-pixel coupling are performed after each irradiation step and the data will be analyzed to gain a systematic understanding of the effects of radiation damage. This analysis on strips sensors is a crucial part of the overall program.

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[1] A. Affolder et al. , “Silicon detectors for the sLHC”, NIM A Vol. 658, Issue 1, 2011, Pages 11-16.

[2] G. Auzinger, “Silicon sensor development for the CMS tracker upgrade”, 2011 JINST 6 P10010

Discuss:

- what are IV, CV, TCT measurements on silicon sensors
- what parameters are extracted / how?
- what is the effect of radiation on these parameters?
- What is the energy deposited by a ^{90}Sr source in 200um thick silicon?
- How does the E distribution look like? Why?
- What is the expected electrical signal in the detector?

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