Project Proposal, PH/CMX:

Title:

Design of Bonner Spheres for Neutron Spectrometry measurement inside the CMS cavern.

Project Description:

The CMS experiment has some detector readout electronics installed on the balcony, inside the CMS cavern. During LHC collisions at CMS, a flux of particles is produced in the cavern volume, some of which are neutrons that can cause radiation damage to electronics. This project requires firstly, the analysis of the spatial and energy dependence of the neutron flux, from already produced FLUKA Monte Carlo simulations. Secondly, the student should design a detector, which is adapted to measure the energy distribution of the neutrons in the CMS cavern, in the places where sensitive electronics are present. It is suggested that an initial version of the detector design could be based on polyethylene spheres, surrounding embedded neutron sensitive thermo luminescent dosimeters. The student will need to run his own Fluka Monte Carlo simulation to estimate the most suitable Bonner Sphere radius, for the CMS application. The student can also follow up on the construction and installation of such a detector.

Following the successful design of the above detector, more sophisticated online neutron spectrometers can also be considered and the design adapted to the CMS environment.

Beneficial Computer training acquired:

- Plotting and analysis of data
- Monte Carlo simulation using FLUKA code
- Analytical calculations using mathematica, Matlab or root.

60% physics, 30% computing, 10% engineering

The student should be familiar with computing and have some linux computing and programming skills. This project is most suited to a mature student in their final year of under graduate studies, doing either physics, applied physics, computational physics or mechanical engineering.