



The CMS Outer Tracker modules: Prototyping, characterisation and quality assurance

Project code	60
Supervisor	Alessandro La Rosa
Department	EP (funding only for 2 EP projects)
Title	
The CMS Outer Tracker modules: prototyping, characterisation and quality assurance	
Description	
<p>CMS is one of the two experiments at CERN's Large Hadron Collider (LHC) that, in 2012, announced the discovery of the Higgs boson. It is one of the largest, most complex and highly performant experiments in history and has so far taken <5% of the total expected data. It will continue operation until around 2040. In order to operate efficiently for this length of time, in the harsh radiation environment of CMS, several subsystems must be upgraded in the coming years. One of the biggest upgrade projects is that of the CMS Tracker detector, based on around 200 square metres of high-resolution silicon strip and pixel detectors. The entire CMS Silicon tracking system will be replaced in 2024-2025 with a new system, which will feature increased radiation hardness, higher granularity and compatibility with higher data rates. The heart of the outer tracking system will consist of about 14,000 silicon detector “modules”, each consisting of silicon sensors with front-end electronics on a light-weight mechanical support structure. Unlike most commercial electronics, the systems in particle physics experiments must be maintenance-free for at least a decade, whilst operating in a high radiation environment and in the presence of a very strong magnetic field. Quality assurance and control is thus a critical activity at all stages of design, development, construction and commissioning.</p> <p>You will participate in the development, prototyping, and characterisation of the CMS Outer Tracker modules, in particular, by designing and then implementing a quality assurance and reliability testing program for key components of the future outer tracking system such as the front-end electronics. You will also help define the module assembly and qualification process (optical inspections, metrology survey, electrical/functional characterisation, etc ..). These activities will involve test-plan definition and operation of sophisticated reliability test equipment in the Quality Assurance and Reliability Testing (QART) lab within the CERN EP-DT group.</p>	
Functions and Training Value	
<p>You will gain insight and understanding in:</p> <ul style="list-style-type: none">- particle physics experiments- silicon detector systems, interconnect technologies and reliability testing- the complete lifecycle of a project from conception to production	
Qualifications/Skills	
<p>Applied physicist or electronic engineer, with basic knowledge of, or willingness to learn:</p> <ul style="list-style-type: none">- quality control and assurance techniques for electronics- programming in LabVIEW and/or C++	



Knowledge of solid-state particle detector technologies would be an advantage, as well as associated assembly and testing techniques.