EP 6: Combined detector session (joint session HK/T/ST/EP)

Time: Wednesday 16:30–18:30 Location: H-HS X

Invited Talk EP 6.1 Wed 16:30 H-HS X

Detectors for Measuring Space Radiation — •Robert F. Wimmer-Schweingruber and and the Kiel Extraterrrestrial Physics Team — Christian-Albrechts-Universität zu Kiel, Kiel, Germany

Radiation in the solar system comes from various sources, primarily galactic cosmic radiation (GCR) and solar (cosmic) radiation, as well as particles trapped and/or accelerated in and at planetary magnetospheres and traveling shock waves. While measurements of radiation on Earth and in its atmosphere have been performed for more than a century, measuring space radiation is more complicated, mainly because of the limited resources available on spacecraft. In this talk I will discuss examples of how to measure space radiation on Mars, the Moon, and in the inner solar system, i.e., between the Sun and Earth, thus covering measurements on a body with a (thin) atmosphere, with no atmosphere, and in free space. The examples include the Radiation Assessment Detector (RAD) on NASA*s Mars Science Laboratory (MSL), the Lunar Lander Neutrons and Dosimetry (LND) instrument on China*s Chang*E 4 lander on the far side of the Moon, and the four sensors STEP, EPT, SIS, and HET on ESA*s Solar Orbiter which is scheduled for launch on February 7, 2020, at the time of writing this abstract.

Invited Talk EP 6.2 Wed 17:00 H-HS X

Modern Timing Detectors in HEP — •Jörn Lange — II. Physikalisches Institut, Georg-August-Universität Göttingen, Germany

Particle detectors with precise time information are traditionally used in HEP as time-of-flight detectors. A new generation of high granularity and radiation-hard timing detectors with a precision of few tens of picoseconds is being developed for event time measurements at the High-Luminosity upgrades of the LHC experiments. By measuring the arrival time of each particle in the detector, its underlying collision vertex can be identified to suppress the background from event pileup in an environment with up to 200 collisions per proton-proton bunch crossing. This is made possible thanks to the rapid advance of new detector technologies like Silicon Low Gain Avalanche Detectors (LGADs). For the longer term future, 4D tracking detectors are being developed, which combine precise timing with the high granularity and spatial resolution of today's pixel detectors, enabling enhanced pattern recognition in high density track environments. This presentation will motivate and introduce the novel timing detectors and their technologies. New developments such as 4D-tracking and possible other applications will be discussed as well.

Invited Talk EP 6.3 Wed 17:30 H-HS X

Experimental time resolution limits of modern SiPMs and TOF-PET detectors — •Stefan Gundacker — CERN, Esplanade de Particules 1, 1211 Meyrin, Switzerland — UniMIB, Piazza dell'Ateneo Nuovo, 1-20126, Milano, Italy

Time Of Flight (TOF) information applied in Positron Emission Tomography (PET) has shown to improve the image quality, shorten scan times and reduces the patient radiation dose. A Coincidence Time Resolution (CTR) in the range of 20 ps FWHM would enable to access image voxels of 3x3x3mm^3 along the line of response and is likely to revolutionize clinical PET. Inorganic scintillator-based detectors are able to record the 511 keV annihilation gammas with high sensitivity and have strongly benefited from the appearance of solid-state photodetectors (e.g. the SiPM), new crystal types (e.g. LYSO:Ce codoped with divalent ions) and improved front-end electronic readout. Such developments enabled commercial PET systems to achieve CTRs around 210 ps FWHM (Siemens Biograph vision). Nevertheless, a complete assessment of state-of-the-art scintillators and SiPMs in terms of their currently achievable time resolution limits was still missing and will be given in this paper. That is important, as it helps to define future strategies and directions of research in order to improve the system CTR by at least an order of magnitude. Furthermore, general aspects of the theoretical CTR limits in TOF-PET will be discussed along with some considerations on how to bring promising laboratory results into real world medical applications.

Invited Talk EP 6.4 Wed 18:00 H-HS X

260 megavoxel camera with continuous readout - the upgraded ALICE TPC — •Laura Fabbietti for the ALICE-Collaboration — JamesFranckstr. 1

The ALICE Time Projection Chamber (TPC) is the world largest detector of this type. It is the main tracking and PID device of the ALICE detector. It is currently being upgraded with a new readout system, including new GEM-based Readout Chambers and new front-end electronics. The upgraded TPC will operate in continuous mode, recording the full minimum-bias interaction rate of 50 kHz in Pb-Pb offered by the LHC in Run 3 and beyond. This will result in a significant improvement on the sensitivity of rare probes*that are considered key observables to characterise the QCD matter created in such*collisions. In this presentation I will discuss the physics potential of the upgraded TPC and show the status of the TPC upgrade activities during the ongoing LHC Long Shutdown 2. First results of the commisioning tests will be presented.