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The NA60+ experiment: high precision measurements of hard and electromagnetic processes at CERN-SPS energies

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The energy range covered by the CERN SPS is unique for the investigation of the region of the QCD phase diagram corresponding to finite μ_B. In this talk we will describe the studies for a new fixed target experiment, NA60+, aimed at a precision study of heavy quark and thermal dimuons in Pb-Pb collisions via an energy scan in the interval of incident beam energy 20-160 GeV/nucleon. High statistics measurements of rare processes require interaction rates of $\sim$ 1 MHz. In addition, a large angular acceptance is required to provide a good coverage around mid-rapidity. The apparatus is designed to reach a mass resolution below 10 MeV in the low mass dimuon region and to collect a statistics $\sim$ 100 times larger than the original NA60 experiment.
These aspects pose challenging requirements to the apparatus, that will be discussed in the talk, highlighting the original solutions and concepts that will be adopted. Muons will be measured by a spectrometer, including a toroidal magnet based on a new light-weight and general-purpose concept. The system of tracking and triggering devices, covering almost 200 m^2, will be based on GEM and RPC detectors, respectively. The system will have to cope a 50-100 kHz dimuon trigger rate, but a triggerless scheme is also under investigation to record all interactions in order to measure simultaneously dimuons and open charm decays in an unbiased way. A silicon spectrometer placed in front of a hadron absorber provides an accurate measurement of the muon tracks, the primary interaction vertex and the secondary decay vertices. This detector will profit from the tremendous advance of monolithic active pixel sensors occurred in recent years. A new R&D will lead to a sensor suited for the operation in a high rate fixed target experiment with ideal features: spatial resolution at the micron level, data rate capability of $\sim$ 100 MHz/s and radiation tolerance exceeding $\sim 10^{14}$ n_{eq}/cm^2. The stitching technology, available in commercial CMOS imaging processes, will allow the new sensor to reach a wafer-scale area of 15x15 cm^2 or even more. This will lead to the possibility to design a practically massless tracker, with all services and connections to outer world confined to the edges of the silicon planes. The implication of the choice of MAPS will be discussed in relation to physics performance, in particular for what concerns the measurement of open cham at low energies.

Collaboration (if applicable)

OTHER (Please specify in comments field)

Track

New Experimental Developments

Contribution type

Contributed Talk

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