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The physics program of the NA60+ experiment at the CERN SPS

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The NA60+ experiment is designed to study the phase diagram of the strongly interacting matter at high baryochemical potential, μ_b 200-400 MeV at the CERN SPS. Its main goals will be focused on precision studies of thermal dimuons, heavy quark and strangeness production in Pb-Pb collisions at center-of-mass energies ranging from 5 to 17 GeV.

The proposed experimental apparatus will be composed of a vertex telescope located close to the target and a muon spectrometer located downstream of a hadron absorber. The vertex telescope will consist of several planes of ultra-thin, large area Monolithic Active Pixel Sensors (MAPS) embedded in a dipole magnetic field. The muon spectrometer will utilize large area gaseous detectors for muon tracking and a toroidal magnet based on a new light-weight and general-purpose concept.

Significant progress has been achieved in the R&D for the MAPS detectors of the vertex spectrometer, thanks to a common project with the ALICE ITS3, and towards the construction of prototypes (GEM, MWPC) for the muon tracker. Furthermore, a working prototype of the toroidal magnet of the muon spectrometer (scale 1:5) was built and tested. An experimental zone on the beam line H8 of the SPS was singled out for the experiment, after detailed integration and radioprotection studies. A Letter of Intent is in preparation and will be submitted in 2022, and the experiment aims at taking data after LHC Long Shutdown 3.

An ambitious physics program is foreseen, which includes the search for chiral symmetry restoration effects through the $\rho - a_1$ interference, the study of the order of the phase transition at large μ_B, the onset of the deconfinement through J/ψ suppression and the transport properties of the medium via the measurement of open charm states.

Strangeness production will be studied by measuring the production of several strange hadrons through their hadronic decays.

In this talk the status of the R&D activities, as well as the physics program of the NA60+ experiment will be described, together with its competitiveness and complementarity with respect to other experiments. The physics performances expected for hard and electromagnetic probes will be discussed. The capabilities for the measurement of ϕ, K^0_S, (anti-)Λ^0, $\Xi^{\pm}$, and $\Omega^{\pm}$ production in central Pb-Pb collisions, reconstructed using the vertex telescope as a stand-alone detector will be presented.

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