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Heavy ions at the Future Circular Collider

Wednesday 8 February 2017 16:50 (20 minutes)

This presentation will review the projected accelerator performance and the physics opportunities for a heavy-ion programme at FCC-hh [1]. In addition, the status of the FCC-hh detector design studies will be discussed.

The FCC-hh Design Study will assess the feasibility and potential of a hadron collider with a centre-of-mass of 100 TeV for pp collisions. The status of the project will be summarized.

Operating FCC-hh with heavy-ion beams would provide Pb-Pb and p-Pb collisions at $\sqrt{s_{NN}}$ of 39 and 63 TeV, respectively. Current estimates indicate that a luminosity of about 30/nb could be integrated during a one-month Pb-Pb run, that is more than one order of magnitude above the maximum projections for the LHC. The FCC-hh beams could also be used for fixed-target collisions, either with beam extraction or gaseous target techniques.

The Quark-Gluon Plasma state produced in Pb-Pb collisions at 39 TeV is expected to have initial temperature and energy density substantially larger than at LHC energy, a stronger flow field and freeze-out volume twice as large. The larger temperature could entail novel features, like e.g. abundant in-medium production of charm quarks. The latter could determine an increase in the number of degrees of freedom of the QGP and provide a new tool to study its temperature evolution. New, rarer, hard probes would be available, like boosted top quarks, which could give access to the time-evolution of the medium opacity.

The physics of high gluon densities at small Bjorken-x and the onset of saturation can be studied using pA, AA, and γA collisions. The FCC-hh will provide access to the region down to $x < 10^{-6}$ with perturbative probes like heavy quarks and quarkonia and to the region of high Q^2 down to $x \sim 10^{-4}$ with W, Z and top. High-energy photon-photon interactions in ultraperipheral AA collisions will also enable the study of very rare processes such as light-by-light scattering and $\gamma\gamma \to W^+W^-$.

Detector design studies, focused on multipurpose pp experiments, and a survey of the possible technological solutions are ongoing and will be summarised as well in the presentation.

[1] A. Dainese et al., Heavy ions at the Future Circular Collider, arXiv:1605.01389

Preferred Track

Future Experimental Facilities, Upgrades, and Instrumentation

Collaboration

Not applicable

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