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LHCspin: Unpolarized gas target SMOG2, and prospects for a polarized gas target

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The LHCspin project aims at unpolarized (SMOG2) and polarized fixed-target measurements by means of a gas target upstream of the LHCb detector, close to the vertex detector VELO. The forward geometry of the LHCb spectrometer ($2 < \eta < 5$) allows for the reconstruction of particles produced in fixed-target collisions, with center-of-mass energies ranging from $\sqrt{s_{NN}} = 72$ GeV with Pb beam and $\sqrt{s_{NN}} = 115$ GeV in pp collisions. The design and status of the study will be presented. An openable storage cell with wake field suppressor and unpolarized gas feed system (SMOG2) is installed and being commissioned (summer 2022). The 7 TeV/1 A beam traversing the target might cause instabilities, which must be suppressed. This is studied in close collaboration with the LHC machine group. The experimental SMOG2 program aims at precision measurements of cross sections. Therefore, methods to precisely determine the target areal density are under study.

A polarized target (H, D) with atomic beam source, transverse B-field and diagnostics is being designed. For using a target cell similar to SMOG2, a coating must be found in accordance with the LHC technical rules. In order to avoid problems with coatings, a free-beam target is under study which would result in about 1/40 times lower density compared to a 20 cm long storage cell and a luminosity of about $1031/\text{cm}^2 \text{ s}$. The use of H and D targets, polarized transversely to the beam will allow to study the quark TMDs in pp collisions at unique kinematics.

Category

Polarized Targets

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