Contribution ID: **817** Contribution code: **TUPB029** Type: **Poster Presentation**

Simulations of beam halo distributions at the LHC as input to a feasibility study of in-beam gravitational experiments

Tuesday 3 June 2025 16:00 (2 hours)

Within the realm of general relativity, the measurement of signals coming from relativistic celestial bodies have offered great insights. However, the relatively low frequency of these signals and the lack of control over their source may make the creation of well-controlled laboratory environments desirable. One possibility is to measure the relativistic beams in the Large Hadron Collider (LHC) at CERN using a milligram-scale monolithic pendulum. This would offer the possibility to test general relativity and alternative theories of gravity in an entirely new parameter regime, where the source of gravity is the almost pure kinetic energy of the ultra-relativistic particles. The low-bandwidth of the source, combined with the controllability of the setup, may offer new opportunities and insights in gravity-related research. To design the experiment, it is necessary to analyze the factors that contribute to the deterioration of the signal-to-noise ratio. One of the contributors is the impact on the pendulum of beam halo particles. This paper presents an initial assessment of the impact of beam halo on the detection of gravitational signal.

Footnotes

Paper preparation format

LaTeX

Region represented

Europe

Funding Agency

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Session Classification: Tuesday Poster Session

Track Classification: MC4: Hadron Accelerators: MC4.T19 Collimation