A prototype electromagnetic calorimeter for the MUonE experiment: status and first performance results

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The MUonE experiment proposes a novel approach to determine the leading hadronic contribution to the muon g-2, from a precise measurement of the differential cross section of the μe elastic scattering, achievable by using the CERN SPS muon beam onto atomic electrons of a light target. The detector layout is modular, consisting of an array of identical tracking stations, each one made of a light target and silicon strip planes, followed by an electromagnetic calorimeter made of $PbWO_4$ crystals with APD readout, placed after the last station, and a muon filter. The scattering particles are tracked without any magnetic field, and the event kinematics can be defined in a large phase space region from the expected correlation of the outgoing particle angles. The ambiguity affecting a specific region, with electron and muon outgoing with similar deflection angles, can be solved by identifying the electron track as the one with extrapolation matching the calorimeter cluster or the muon track by associating it to hits in the muon filter. The role of the calorimeter will be important for background estimate and reduction, and to assess systematic errors, providing some useful redundancy and allowing for alternative selections.

Beam tests are carried out at CERN with a prototype calorimeter to determine its calibration with both high energy (20-150 GeV) and low energy electrons (1-10 GeV). In late summer a pilot run is scheduled with up to three tracking stations and the calorimeter integrated within a common triggerless readout system. The main motivations for the MUonE calorimeter are discussed, and the status and first performance results will be presented.