

R&D on muon detectors for the IDEA experiment

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The IDEA experiment muon systems (pre-shower and external tracking) require a large number of u-RWELL detectors. To keep the cost of the entire system affordable, an optimization of the readout electronics channel is needed. For this purpose, resolution studies as a function of the readout segmentation pitch and of the DLC resistivity have been performed.

From the 2021 beam test results, more focused for the pre-shower studies, a spatial resolution of around 100 μm has been obtained with 400 μm strips pitch and about 80 MOhm/sq. DLC resistivity.

In the beam test campaign held in October 2022, mainly pointing to studies for the external trackers, the comparison among the response of the detectors, with a resistivity ranging between 40 and 80 MOhm/square, suggested the possibility to manufacture detector with millimetric strip pitch: indeed a spatial resolution of 500 μm has been achieved with a 1.6 mm strips pitch equipping the chambers with analog Front-End Electronics (APV25).

During the beam test in June 2023, two different 2D-readout concepts have been studied: the TOP READOUT and the Capacitive Sharing (CS). In the first case the second coordinate is provided by the segmentation of the amplification stage (0.8 mm pitch). In the second one, we have two planes with orthogonal strips (1.2 mm pitch) and the signal is induced by capacitive coupling. Preliminary results show spatial resolution around 300 μm for the TOP READOUT version and 150 μm for the CS.

The construction of all the prototypes, even with different geometries (from 10 x 10 cm² up to 40 x 40 cm²) has been shared between the CERN EP-DT-EF workshop and the ELTOS S.p.A company, both providers of the core of the detector: the u-RWELL_PCB. The main purpose to carry on this task sharing is to maintain the cost effectiveness of the micro-Resistive WELL also for the large production required for the IDEA experiment (about 500 detectors for the pre-shower and more than 7000 for the muon tracking system).

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