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Large-area scintillator detector of the Fast Interaction Trigger for the ALICE Experiment.

During the ongoing Long Shutdown 2 the accelerator complex at CERN will significantly improve the performance of the collider by boosting the heavy-ion collision parameters of Run 3 and 4 to well beyond the specifications of the current ALICE setup. For instance, the Pb-Pb instantaneous luminosity during Run 3 will increase by a factor of 5 to 6 and the minimum-bias (MB) Pb-Pb interaction rate will reach ˜50 kHz, which is ˜50 times more than the rate recorded by ALICE with heavy-ion collisions during Run 2. In order to remain operational during the Run 3 and Run 4 ALICE has to upgrade many of its subsystems or replace them with new solutions [1] including the new Fast Interaction Trigger (FIT) [2]. The main online functionalities of FIT will be luminosity monitoring with a direct link to the LHC and the generation of a fast trigger signal for ALICE subsystems. The trigger generated by FIT will allow for online vertex determination, minimum bias and centrality-based event selection, suppression of beam-gas events, and a veto for ultra-peripheral collisions. FIT is a hybrid detector composed of two Cherenkov detector arrays (T0+) and a large sectored scintillator ring (V0+). Due to the limited space, the V0+ scintillator disk will be located only on one side of the interaction point. Nevertheless, because of its large acceptance, V0+ will significantly improve determination of the centrality and the event plane.

The 1.5m diameter plastic scintillator disc of V0+ will be divided into 40 optically-separated cells, each grouped into eight 45o sectors and subdivided into 5 radial segments. The size of the radial segments follows equal steps in pseudo-rapidity coverage. The light from the scintillator will be collected by a matrix of clear, equal-length optical fibers coupled perpendicularly to the surface of the scintillator. At the other end the fibers will be grouped into bundles and read out by Hamamatsu H6614-70 fine-mesh PMTs. This light collecting scheme is characterized by high efficiency, uniform across the entire surface of the scintillator, single-MIP time resolution of around 150-300 ps, and the ability to cope with the required high dynamic range of 1-600 MIP. This presentation will focus on the design of the V0+ and on the outcome of the test results obtained with various prototypes including a full-size 45o section of the actual detector. These measurements were carried out using secondary beams from the CERN-PS accelerator.

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[1] Upgrade of the ALICE Experiment: Letter of Intent, J.Phys. G41 (2014), 087001
[2] W.H. Trzaska, New Fast Interaction Trigger for ALICE, Nucl. Instrum. Meth. A 845 (2017) 463

Primary authors: Dr GRABSKI, Varlen (Instituto de Fisica UNAM); ON BEHALF OF THE ALICE COLLABORATION.

Presenter: Dr GRABSKI, Varlen (Instituto de Fisica UNAM)

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