

Photo-sensors and Front-end Electronics for the Fast Interaction Trigger detector of the ALICE experiment at CERN

Tuesday, 23 October 2018 09:30 (15)

The new Fast Interaction Trigger (FIT) [1] was developed for the upgrade of the ALICE detector [2] at CERN LHC. FIT will consist of two arrays of Cherenkov radiators (T0+) and a large segmented scintillator ring (V0+). FIT will serve as the main luminometer, as well as the detector which will determine collision time, multiplicity, centrality, and reaction plane in ALICE during Runs 3 and 4. Among the many challenges of this project are: a high dynamic range (0.4 to 250 MIP (minimum interaction particle) amplitude for T0+, 0.5 to 600 MIP amplitude for V0+), operation with the sustained bunch crossing of 25 ns, time resolution below 50 ps, signal processing and trigger generation within 205 ns. Light generated in the scintillators of the V0 will be detected by 48 Hamamatsu fine mesh 2" PMTs. The Cherenkov radiators will be coupled to 52 modified Planacon light sensors. The photocathode size of XP85012/FIT-Q is 53x53 mm². The 64 anodes at the base of a chevron-shaped assembly of MCP plates are divided into 4 equal sectors matching the radiator quadrants. To reach the required lifetime and dynamic range, Planacons will operate at the output amplitude of 10 mV/MIP (charge 0.63 pC/MIP) requiring special cabling and low-noise fast electronics. The time information will be extracted from a CFD and digitized with the accuracy of better than 50 ps over the entire dynamic range. The input charge will be integrated and measured by an ADC. The first prototype of a Cherenkov module and the full chain of front-end electronics were installed inside of the ALICE magnet and are part of the Run 2 data collection since 2016. This work was supported by INR RAS and NRNU MEPhI within the Russian activities in the ALICE upgrade and by the Ministry of Education and Science of Russian Federation, contract No14.610.21.0003.

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

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Session Classification : Facilities and Advanced Detector Technologies

Track Classification : Facilities and advanced detector technologies