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Design, production and performances of the Encapsulated Resistive Anode Micromegas detectors for the readout of the High-Angle TPCs of the upgrade of the T2K Near Detector

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The long baseline neutrino experiment T2K will upgrade its near detector (ND280) next year to reduce the systematic uncertainty to less than 4% by adding an active highly segmented neutrino target (Super Fine Grained Detector) surrounded by two new gaseous Time Projection Chambers (High-Angle TPCs) and a 4p TOF veto. The required performances of these TPCs for momentum measurement and particle identification are a 3D track reconstruction with better than 600 µm space point resolution and an energy loss resolution better than 10%. These 2x1.8x0.8 m3 TPCs, operated with the 95%Ar/2%isobutane/3%CF4 T2K gas with 270 V/cm drift electric field will be readout on both sides of their central cathode by an anode endcap of 8 MPGD detectors called ERAM (Encapsulated Resistive Anode Micromegas). These 34x42 cm2 ERAM detectors are 128 µm gap bulk-micromegas with an anode of 1152 square centimeter copper pads readout by a new AFTER ASIC based electronic readout architecture. In order to reach the required space point resolution with such large pads, the anode is covered with a ˜400 kOhm/sq. Diamond Like Carbon (DLC) layer to spread the primary charge over multiple pads. This charge spreading is driven by the RC constant of the gap defined by the anode copper plane and the DLC layer. After an introduction on the ND280 upgrade and the HA-TPCs, we will present the result of the 3 years of development leading to the tuning of the track reconstruction software tools and the final design of the ERAM detector, the production and qualification of the 20 detectors produced so far with an automated 55Fe X-ray test bench (gain and 5.9 keV resolution), and the performances (spatial resolution and dE/dx) of some of them operated in the HA-TPC mode conditions with cosmic rays and particle beams.

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