Large scale production of the Multi-Chip Module of the ATLAS Level-1 Calorimeter Trigger

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Abstract:

The Pre-Processor Multi-Chip Module (PPrMCM) is the main processing block of the Pre-Processor System in the ATLAS Level-1 Calorimeter Trigger. The PPrMCM holds a dedicated signal-processing ASIC and a Phos4 timing-chip together with seven commercial dice mounted on the substrate. Those are four FADCs and three LVDS-serialisers.
The PPrMCM holds the main functionality of the Pre-Proccessor System, namely the digitization, calibration and Bunch-Crossing-Identification of calorimeter signals.
The production phases of the PPrMCMs (more than 3200) and test procedures for quality control at different stages of the production are presented.

Summary:

The Pre-Processor Multi-Chip Module (PPrMCM) is the most crucial part of the of the Pre-Processor System of the ATLAS Level-1 Calorimeter Trigger. The main tasks of the PPrMCM are the digitization, calibration and Bunch-Crossing-Identification of all ATLAS calorimeter signals.
The production of the PPrMCM is done in several steps. The main steps are substrate manufacturing, dice placing and bonding, “Glob-top” protection and hermetic brass-cover soldering.
Among the chips on the PPrMCM, the Pre-Processor ASIC (PPrASIC) is the major component as it performs the ATLAS-specific digital data processing. Thorough tests of the PPrASIC and of the complete PPrMCM were developed and combined later into a testing framework. The framework contains the software to perform automatic tests in order to verify the full functionality of the PPrMCM. It is applied after each PPrMCM production phase starting with the ASIC-dice production on wafers, up to final acceptance-tests for the complete MCM-assembly. This strategy allows to detect faulty components at early stages of production. Such components can be located and replaced in a repair cycle. This improves initial production yield from 87% to an even higher percentage.
More than 3200 fully functioning PPrMCMs are produced and ready to be installed in the ATLAS Level-1 Calorimeter Trigger. The experience gained from the large scale production of the PPrMCM is reported including the optimization of the test procedures, the production yields, observed problems and corresponding solutions.