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Development of large area pixel modules for the ATLAS HL-LHC tracker upgrade

ATLAS is proposing to replace the entire tracking system for operation at the HL-LHC. This will include a significantly larger pixel detector. This paper reports on the development of large area planar detectors for the outer pixel layers and the pixel endcaps. Large area sensors have been fabricated and mounted onto 4 FE-I4 readout ASICs, so called quad-modules, and their performance evaluated in the laboratory and testbeam. Results from characterisation of sensors prior to assembly and modules in the laboratory and testbeam studies will be presented. A particular challenge in producing thinned large area modules is the bump-bonding, where low yield can be observed due to bowing of the sensor and readout chip during the bonding process. A new bump-bonding process using backside compensation to address the issue of low yield will be presented.

Author: BUTTAR, Craig (University of Glasgow (GB))

Co-authors: Dr BLUE, Andrew (University of Glasgow); STEWART, Andrew (U); MILLS, Corrinne (University of Edinburgh (GB)); FORSHAW, Dean Charles (University of Liverpool (GB)); SIDIROPOULOS, Georgios (University of Edinburgh (GB)); CASSE, Gianluigi (University of Liverpool (GB)); TSURIN, Ilya (University of Liverpool (GB)); LIPP, John (Science and Technology Facilities Council); MATHESON, John (STFC - Rutherford Appleton Lab. (GB)); PATER, Joleen (University of Manchester (GB)); DOONAN, Kate (University of Glasgow (GB)); WRAIGHT, Kenneth Gibb (University of Glasgow (GB)); MILOVANOVIC, Marko (University of Liverpool (GB)); BATES, Richard (University of Glasgow (GB)); BURDIN, Sergey (University of Liverpool (GB)); EISENHARDT, Stephan (University of Edinburgh (GB)); MCMULLEN, Thomas (University of Glasgow (GB))

Presenter: DOONAN, Kate (University of Glasgow (GB))

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