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Intrinsic n-well MAPS for particle physics

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The Arachnid collaboration has been set up in the UK to develop CMOS Monolithic Active Pixel Sensors. The first device of this collaboration is named Cherwell. The Cherwell device consists of several arrays of pixels optimised either for vertexing or for calorimetry. For the former, two subarrays were designed. The first one has 96x48 pixels on a 25 um pitch. Each pixel consists of a low-noise 4T pixel, lifted from the previously tested sensor FORTIS. The readout is on a rolling shutter base with a fine resolution 12-bit, single-slope column parallel ADC. The second array has a similar structure but the column-parallel ADC was folded back into the array, to generate strixels. The use of the INMAPS process allows the PMOS transistors for the ADC to be isolated into deep P-wells islands, thus preserving the 100% fill factor of the pixel. The pixels for calorimetry are arranged into 2 arrays: one of 96x48 pixels on a 25um pitch and the one of 48x24 pixels on a 50 um pitch. Readout is done through column-parallel ADCs as the ones used for the tracking array. The pixel architecture is built around the same 4T pixel mentioned above, but has additional devices to provide snapshot and in-pixel correlated double sampling (CDS) capability. At the periphery of the 25um pixel array, additional circuitry is added to provide charge summing of 2x2 pixels during readout. The Cherwell sensor was manufactured on a standard resistivity as well as on high (>1kOhm cm) epitaxial wafers. This latter would allow the charge collection to be helped by an electric drift field. The sensor has been characterised with different sources of radiation, and studied in test-beam CERN. Experimental results will be presented at the conference. We have also designed a new device, Cherwell 2, as a prototype for a silicon tracker to be used in the upgrade of ALICE.

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