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# ATLAS Upgrade Strip Tracker Stavelets

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The engineering challenges related to the supply of electrical power to future large scale detector systems are well documented. Two options remain under active study in our community, namely serial powering and the use of DC-DC convertors. Whilst clearly different in detail, both have the potential to increase the efficiency of the powering system.

The ATLAS Upgrade Strip Tracker Community has constructed a serially powered demonstrator stavelet comprising four silicon strip detector modules using the ABCN-25 ASIC with integrated shunt transistors. At the time of writing, construction of a companion stavelet built using DC-DC converters (provided by the CERN group) is underway. The latest results from both stavelets shall be presented to the workshop.

## Summary 500 words

The present ATLAS SCT (semiconductor tracker) comprises 4088 silicon microstrip detector modules, each powered by its own independent low and high voltage power supply channels. Given the requirements of the upgraded inner tracker needed for ATLAS running at HL-LHC, with over 10,000 detector modules in the short strip region alone, it becomes increasingly difficult to justify the retention of independent powering both in terms of system efficiency and overall cost. Therefore two alternative powering schemes are under active consideration within our community, namely Serial Powering and on-detector DC-DC conversion.

For the upgraded detector, it is natural to integrate groups of modules into intermediate scale structures, referred to here as "staves". A stave functions both as a thermal-mechanical core, to precisely support and cool the modules, and as a "backplane" through which digital signals, power, and detector bias can be distributed to modules. A stave is also a convenient
unit for which to implement the serial or DC-DC powering infrastructure.

For the purpose of prototyping, we have chosen to study 1/3 length staves, referred to as "stavelets", using the ABCN-25 readout chip. This ASIC incorporates a number of features in support of the serial powering option, notably the integration of a pair of shunt transistors. A simple shunt control circuit was therefore integrated into the hybrid design such that a fully serially powered system may be easily realised.

A serially powered stavelet comprising four short strip modules was assembled last year, with initial results showing promising ENC noise values being presented at the previous TWEPP workshop. Since then a number of improvements have been made to the system hookup, grounding and shielding to reduce the susceptibility of the system to external noise sources. This has led to the observation of lower and more consistent ENC noise results. Improvements made to the data acquisition firmware and software have facilitated the first studies of correlated noise effects within the stavelet. This work shall be described in detail.

More recently, construction of a companion stavelet using DC-DC converters (provided by the CERN group) has begun. This follows the successful demonstration of the electromagnetic compatibility of these convertors, suitably shielded, with the short strip module design. Early results from this stavelet shall be reported to the conference, allowing a preliminary comparison of the performance of the two stavelets to be made.

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