Contribution ID: **18** Type: **Vortrag**

Development of a Scintillation Neutron Detector Prototype using Digital SiPMs

Wednesday 10 April 2019 09:20 (20 minutes)

Proceedings

Ich entscheide später

Summary

Silicon Photomultipliers (SiPM) offer several advantages over Photomultiplier Tubes (PMT), such as insensitivity to magnetic fields, low supply voltage and higher count rates. Therefore, SiPMs have become the photodetector of choice for many applications. However, due to the vulnerability of Silicon to neutron radiation, PMTs remain the prevalent photodetector in scintillation neutron detectors. Recent studies found that SiPM devices keep an acceptable performance in typical neutron detection environments for 10 years. This motivated us to develop a 13.6 x 13.6 mm² scintillation neutron detector prototype based on digital SiPMs. The target spatial resolution is 1 x 1 mm² and the detection efficiency should be better than 80% for cold neutrons. The detector will be able to handle count rates of 10 Mcps distributed across the surface area. First measurements at the TREFF instrument in Garching suggest, that the prototype will reach a better spatial resolution than targeted.

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Session Classification: Vorträge 4