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# NitroGEM, a beam monitor for high-intensity neutron beamlines

The NitroGEM is a neutron beam monitor optimised for high-intensity beamlines. It is under development at ISIS in the UK for use on the Loki instrument at the ESS neutron source in Sweden. The Loki instrument is built by ISIS as part of the UK's in-kind contribution to the ESS. The beam monitors play a crucial role during the commissioning and operations of a neutron instrument like Loki. Loki will use five NitroGEM monitors. Three monitors are positioned upstream of the sample to measure how many neutrons arrive at the sample position. Two monitors are installed downstream of the sample. They measure the neutrons transmitted through it. Here we discuss the two most upstream monitors which operate in the v a cuu m o f the neutron beam guide. These are the first two monitors to be installed on Loki. These monitors require a low efficiency in the range between 10-5 and 10-7. NitroGEM monitors achieve these efficiencies using Nitrogen as a neutron converter since it h as a low neutronabsorptioncross-section(1.9barnsfor1.8Åneutrons).We show how we control the efficiency of NitroGEM with great precision by setting the nitrogen content in the gas mixture and how we obtainedan extremelylow gamma sensitivity crucial for the operation at the ESS. Despite the low efficiency, the expected rate of neutron detection on these monitors is about 1MHz. This is the main reason for using GEMs for the electron multiplication.The monitor supstream of the sampler equire very high neutron transparency, higher than 95% for neutrons of wavelengths up to 12Å. NitroGEM can achieve this transparency by placing in the neutron beam only a single GEM inside a sealed aluminium vessel with a 0.5mm thick entrance and exit windows. NitroGEM does not use any additional electrode as a cathode or anode to maximise the monitor transparency. We discuss NitroGEM's engineering layout designed to achieve this transparency and the impact on its operations and the electronics readout.

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