Hanno Perrey - Abstract for the "Characterization of multi-anode photomultiplier"

The underlying design feature of the detector technology developed within the SoNDe (Solid State Neutron Detector) project is the combination of pixelated multi-anode photomultipliers (MAPMTs) with a well-chosen Li-6 glass neutron converter/scintillator material. This results in both the position resolution and areal neutron flux density being determined by the physical segmentation of the MAPMT.

MAPMTs employ a photosensitive cathode and several dynode stages at which electron acceleration by electrical fields is used to yield a multiplication of the initial photoelectron. Commercially available MAPMTs that fulfill the specifications of the SoNDe detector include the Hamamatsu H8500 shown in figure 1. Possible upgrades include the H12700 or the H9500 by the same manufacturer. Typically, there are sizable variations in gain between different pixels, making a careful calibration of the MAPMT necessary to be useful for imaging [Montgomery13].

Such calibrations can be performed using the Laser Testing Facility at University of Glasgow or one of its counterparts, for example at Jefferson Lab (USA), Forschungszentrum Jülich (Germany), or INFN-LNF (Italy). The Glasgow setup uses an automated stable ps laser pulse to scan the sensitive surface of the MAPMT in steps down to 0.1 mm with 5% accuracy. A photograph of the setup is shown in figure 2. The resulting analog signals are typically extracted to custom-made readout boards and then passed to VME-controlled Charge-to-Digital converter modules. The scanning of a photosensitive device is fully automated making the setup also suitable for quality assurance testing.

In this contribution, the Laser Testing Facility at University of Glasgow will be presented together with plans for a similar setup at Lund University to be employed within the SoNDe project. Selected results from studies of the H8500 and H12700 MAPMTs will also be presented.

[Montgomery13] R. Montgomery, A position sensitive photon detector for the CLAS12 ring imaging Čerenkov application, PhD thesis, University of Glasgow, 2013

Figure 1: The H8500 multi-anode photomultiplier Figure 2: The Laser Testing Facility at University of Glasgow with optical setup, light-tight box and data acquisition system (a), and a close-up of the setup inside the light-tight box showing laser fiber, lens and MAPMT (b)