pfRICH mirror test stand at BNL

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March 2024

Executive summary

As a first step towards building a full size pfRICH mirror 3D scanning setup, we propose to assemble a test stand in Room 2-201 in Physics 510D to evaluate first small (up to 70 mm x 70 mm) samples.

The setup will be fully automated, and will allow one to evaluate the absolute mirror reflectivity of these samples as a function of wavelength between ~300 nm and ~700 nm over a wide range of incident angles.

It will be built mostly from readily available components, and should be brought into operation within a month.

The developed testing procedure, software, and most of the equipment used on this test stand will be later adapted to a QE measurement on the HRPPD QA station.

Apparatus

A CAD model of the setup is shown in Figure 1 (in a configuration with a 1" reference mirror). Mirror samples (either stock 1" round mirrors for the reference measurements or 70 mm x 70 mm square test samples) will be mounted on a pair of Thorlabs PRMTZ8/M rotation stages in a custom dark box. An Oriel 77250 monochromator equipped with a 7340 Hg/Xe illuminator and a 20050 stepping motor will be used as a light source, coupled to a dark box via a UV graded fiber. Light will be focused into a narrow beam by an Ocean Optics 74-UV collimator, and then passed through a 1 mm thick sapphire plate installed at 45^0 and acting as a ~85:15 beam splitter over the entire wavelength range of interest. The reflected beam photon flux will be continuously monitored by a reference Hamamatsu photodiode S1227-1010BQ (#1) with a 10 mm x 10 mm active area. A second photodiode (#2) will measure the through beam photon flux, either after a reflection off a mirror oriented at a desired angle (configuration A, see Figure 1), or without any mirrors installed (configuration B with a direct beam, for absolute calibration). The former configuration will be implemented either with a mirror test sample installed (for the actual measurement), or with a stock Thorlabs mirror (for comparison purposes). Photodiode currents will be measured by a pair of Keithley 6487 picoammeters in all cases. A double ratio $(I_2^A/I_1^A)/(I_2^B/I_1^B)$ of the photodiode currents is a measure of the mirror reflectivity.

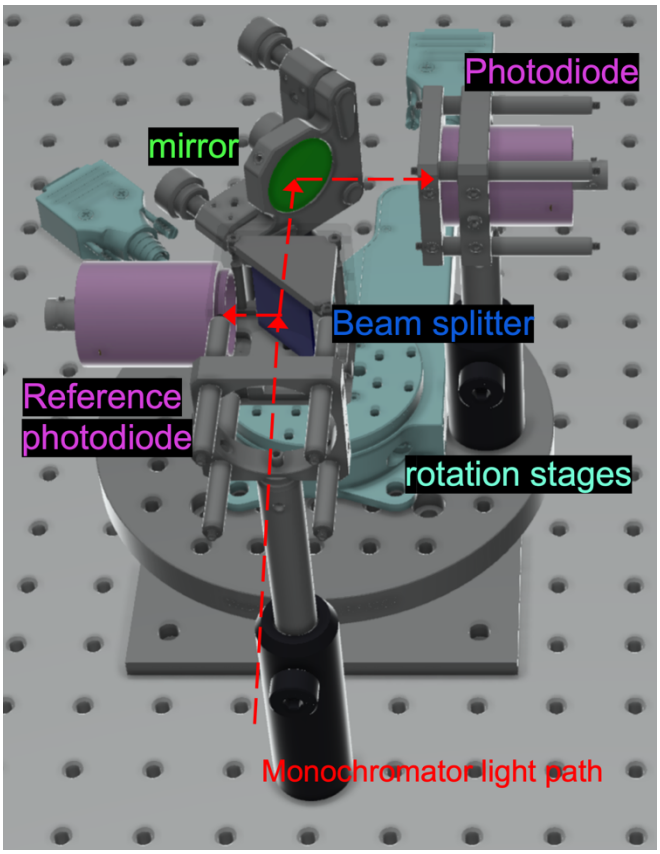

Figure 1 CAD model of the mirror test stand.

The setup will have a newly installed Linux Debian 12 PC attached to it, for automated data collection (steering of the rotation stages and the monochromator grating grid, as well as the picoammeter readout), and data analysis.

Deliverables and timelines

The fully functional test stand as described in the previous section and shown in Figure 1, will be built and ready for mirror sample evaluation on a time scale of one month after receiving additional funding as listed in the following section, provided minor modifications of the dark box can be negotiated with the mechanical workshop on this time scale.