RE: Review of minimum angle of incidence limit for the SST PGM M2 mirror

Chitra, Sunil

Sent: Tuesday, February 13, 2018 2:44 PM
To: Coburn, David Scott
Cc: Broadbent, Andrew; Fischer, Daniel; Lee, Robert J; Benmerrouche, Mohamed; Ackerman, Andrew

Dear David
Thank you very much for your detailed and prompt analysis. It is indeed helpful.
Andy, please attach this as support document for the RSC review.
Best regards
Sunil

-----Original Message-----
From: Coburn, David Scott
Sent: Tuesday, February 13, 2018 1:49 PM
To: Chitra, Sunil
Cc: Broadbent, Andrew; Fischer, Daniel
Subject: Review of minimum angle of incidence limit for the SST PGM M2 mirror

Sunil,

A formal request was made by you through Andy Broadbent and Dan Fischer (CCed here) to review the assumptions made in the setting of a minimum angle of incidence of the "M2" mirror in the PGM chamber of the SST beamline.

The angle of incidence is measured relative to the incoming beam, which is parallel to the floor as it enters the PGM chamber. Zero angle (0 degrees) is defined as the mirror active surface oriented parallel to the incoming beam. Positive angles are reached by raising the upstream end of the mirror. Negative angles are reached by lowering the upstream end of the mirror. The mirror angle is controlled by an external stepper-motor driven actuator. This actuator has dual redundant limit switches.

The working angle range of the PGM is approximately -1.5 degrees to -11 degrees. The zero angle is required only for survey at the time of installation. The approximately +2 degree angle is provided only to ensure that the mirror can actually pass the zero (horizontal) position.

The PGM vendor (FMB-Berlin) installation report provided calibrations of limit switch actuation at mirror angles of +2.096 and -11.883 degrees. The report also states that the mirror was positioned at "zero" incident angle when the installation was completed. The actual position was measured with an inclination meter and was recorded as -0.021 degrees.

In order to limit the incident angle range the SST beamline staff has installed a spacer block onto the mirror actuator which will actuate the limit switches before the mirror upstream end can be raised to a position which would give an incident angle more positive than -1 degrees.

The sizing of this spacer block was determined by driving the mirror actuator from its "zero" position (as left by the vendor) to the upper limit switch actuation point. A total of 7,921,252 motor steps were required to move the mirror through this angle range (2.096 + 0.021 = 2.117 degrees).

After the spacer block was installed the actuator was again driven to the upper limit switch actuation point. A motor step count of -4,715,471 was recorded at this point. (A negative value here indicates that the actuator was at a position

"below" the zero incident angle position of the mirror.)

Since the angles involved are small it is reasonable to use the ratio of the motor counts to determine the mirror incident angle at the new actuation point for the upper limit switch.

This new actuation point is determined to be at -1.26 degrees. (2.177 degrees * (4,715,471/7,921,252))

I concur that the assumptions made are reasonable and the scaling from the linear translation to angle over this small range, and the calculation, are reasonable.

I have reviewed the physical installation of the new spacer block and feel that it is a robust solution.

Please let me know if you have any questions or need any other information.

Scott

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