1. ABSTRACT

This note describes survey and alignment of the LAT during instrument integration and test.

2. DEFINITIONS

TRK: Tracker subsystem
ACD: Anti-Coincidence Detector
NRL: Naval Research Lab, Building A59 Payload Checkout Facility

3. SURVEY REQUIREMENTS

The purpose of surveying the LAT will be to ensure proper spacing and orientation of TRK flight towers on the flight grid during instrument integration and test. Also, proper seating of the ACD on the flight grid will be verified. In orbit, the location of TRK trays will be measured with straight track cosmic ray muons traversing the LAT. The SLAC Metrology Department will perform survey measurements using a laser tracker and 1-½” sphere mounted reflectors mounted at points on the LAT. SLAC Metrology will provide laser tracker and sphere-mounted reflectors. The laser tracker can achieve a positional accuracy of 6 microns using interferometry along the line of sight. Laser tracker survey can be used to verify workmanship of mechanical integration during instrument I&T. In addition, the laser survey results can crosscheck simultaneous cosmic muon surveys performed on the ground, which have a precision of 10 microns for a 12-hr muon data package taken in an upright configuration, or 24-hr in a sideways configuration. In order to maximize accuracy of the laser tracker survey (or muon survey) thermo-mechanical stability of LAT at the few micron level is required.

The tooling requirements for survey are as follows:
- Each TRK tower top tray surface will provide at least 3 mounting points for 1-½” sphere mounted reflectors.
- Each corner of the flight grid will provide at least 2 mounting points for 1-½” sphere mounted reflectors. At least 3 reflectors on the flight grid and 3 reflectors on a TRK tower must be visible simultaneously to the laser tracker.
- Each lower corner of the ACD will provide at least 2 mounting points for 1-½” sphere mounted reflectors. At least 3 reflectors on the flight grid and 3 reflectors on the ACD must be visible simultaneously to the laser tracker.

4. INSTRUMENT I&T SURVEY SEQUENCE
Survey of LAT during instrument I&T will be performed 6 times:

1. After 1st (inner) tower is integrated: survey of 1 TRK + Grid
2. After 4 inner towers are integrated: survey of 4 TRK + Grid
3. After all 16 towers are integrated and just before integration of Flight ACD: survey of 16 TRK + Grid
4. Just after integration of Flight ACD, before shipping to NRL: survey of ACD + Grid
5. After environmental tests and sensors are removed from TRK tower top tray surfaces, and just before re-integration of flight ACD: survey of 16 TRK + Grid
6. Just after integration of Flight ACD, before shipping to spacecraft I&T: survey of ACD + Grid.

The purpose of survey 1) will be to provide a starting point for multiple tower installation. Re-centering of the TRK tower may be required to achieve the necessary placement accuracy; thus multiple surveys of the tower may be required in an iterative process. The subsequent 3 inner towers will be spaced relative to the 1st tower using mechanical tooling. The purpose of survey 2) is to ensure good workmanship and proper spacing for remaining outer towers. Again, re-centering of TRK towers may be required to achieve the necessary placement accuracy. The subsequent 12 outer towers will be spaced relative to the inner towers using mechanical tooling. The purpose of survey 3) will be to provide baseline measurements for the Reference Comprehensive Performance Test. The purpose of survey 5) will be to provide follow-up measurements after environmental tests to compare with survey 3) and to crosscheck the results from cosmic muon survey of TRK towers. Surveys 4) and 6) are workmanship verification tests of ACD-Grid mechanical integration.

The first 4 surveys will be performed in Building 33, SLAC, in the LAT instrument assembly area. The last 2 surveys will be performed either at Naval Research Lab or at SLAC, depending upon instrument pre-ship schedule.