

Report on internal HFT review on survey and alignment software status on October 12, 2012

The committee members were H.Wieman, J.Webb, Y.Fisiak, X.Dong and F.Videbæk. There were presentations by S.Margetis, H. Qiu and J.Bouchet on overview, PXL survey efforts, and software for alignment efforts and geometry.

#### Comments & findings:

There has been significant progress on survey of PXL ladder on a test sector, and on understanding of reproducibility. This was presented in Hao's talk. The procedures for sector-to-sector survey have yet to be developed.

Reproducibility with touch probe and vision seems quite good, but changes depending on possible environment and method seem to be present. Systematic dependences on y-displacement may indicate bowing of ladder backing.

The framework for going from the survey data of ladders chips to parameterization and populating the STAR Databases (DB) is not fully developed. Some of the steps have been investigated. It is important to have this in place, when the engineering run sectors have been produced and ready for survey late this year or early January. It was presented as being part of planned activities

The overall scheme for performing alignment was presented. It is based on ideas developed for the SSD/SVT alignment in STAR, but will take advantage of the high precision track point from PXL. The scheme seems reasonable. Clearly more tests and iterations will be needed with both simulations and data from the engineering run to make sure it works for the full HFT. The increased reliance on PXL vs. TPC tracks seems a good strategy.

The current semi-blind alignment tests of the software previous used for SSD alignment some 5 years ago are promising and seems to be working. It may not be the optimal methods for the full HFT system. It is significant progress to have this working again within the STAR framework. There seems to be some misunderstanding in using the structures in the STAR framework for geometry, Survey.idl. The only information in these are the rotation and translation matrices. The unique ID for a subsystem, has to be worked out based on e.g. ladder number and sensors ID, e.g. in case of SSD and IST.

To speed up development existing structures from the old SSD in term of 4 sectors with several ladders per sector. This is not appropriate for the current system.

The numbering scheme for HFT was not presented. This is available within the project. Clear methods to convert sensor, ladder, sector number (or equivalent for IST and SSD) should be developed and used in code.

The mis-alignment tests are currently done in the hit-framework where offsets are generated at the hit level (after the simulation) rather than at the level of the geometry. With the current StarSIM it cannot be done at the geometry level. It is most desirable to have the STAR framework, as planned for a long time, to use the VMC for simulation, and STV for reconstruction using the same geometry for both. This will dramatically help in performing alignment simulations, as well as embedding on real data.

The geometry-model used for the inner detectors in STAR including HFT (IST, SSD, PXL) as well as FGT and TOF does not current allow for proper placement relative to the Magnet and TPC system. This should be fixed for future upgrade, but may have consequences for backward capabilities with STARSIM (Zebra, Geant3 based)

#### Recommendations:

Develop the software chain and DBs needed to handle the PXL survey data. This should take precedence over investigating the systematic dependences, which can be revisited later.

Implement method in software to convert sensor, ladder, sector number (or equivalent for IST and SSD) should be developed and used in code. Continue work on cleaning up code.

Request that a prototype VMC application be implemented by the S&C group for testing of alignment procedures in the HFT. Work with the S&C group to develop this prototype, and to modify the geometry hierarchy in order to allow for consistent misalignments of the geometry.

On a longer time-scale possible end-of-engineering run , start work to implement alternative alignment procedures like Millepede.