

Summary of the Triplet Alignment Experience in RHIC

- **Longitudinal and transverse warm to cold shrinkage. The triplet magnets were not measured cold and warm due to inability to built the cryostats outside of the tunnel. This is definitely not a recommendation for the LHC !**
- **Software development and data base connection**
 - Translation and rotation of the “local coordinate system” defined during the quadrupole survey measurements into the “global” system in the tunnel. Analysis and flagging differences between the designed and real measured dimensions.
- **Measurements of the quadrupole magnetic centers along the magnet length - “beam vector” determination (“antenna” and colloidal cell).**
- **Control of the:**
 - Quadrupole roll - field angle during the production along the length of the quads. [It was found that there was one to one correspondence between the mechanical (during the production) and rotating probe field angle measurements.
 - Straightness of the cold-mass during the production: before welding the corrector package and after, before closing the openings for the notches check out and after.
- **Control of the corrector’s coils positions and field angles inside of the corrector package during the production and during the connection to the quadrupoles. (Design of the “crosses”, which define the correctors positions, were improved - changed).**
- **Cross calibration of different methods in determination of the magnetic field centers.**

Additional Triplet Checks Performed in RHIC

- **Special Probe measurements for the Hall field measurements to confirm the right polarity of the magnets**
- **Beam Position Monitor center determination by the specially built “antenna”. These measurements were performed at the same time as the survey measurements within the same coordinate system.**
- **Corrector centers determination by the “antenna” (or colloidal cell measurements - not the dipoles).**
- **No human error during the survey measurements was possible due to multiple instruments (telescopes) shutting into each other, and automatic data recording into the local PC.**