Purpose: To track interfractional patient positioning consistency during a course of stereotactic radiotherapy using BrainLAB frameless immobilization and localization system, with ExacTRAC IGRT and Robotic couch.

Methods: One relationship between the BrainLAN iPLAN coordinates and the Varian couch parameters was developed so that three translational couch positions were incorporated into Aria R&V system as part of the plan parameters. Therapists use these positions to verify patient's initial set-up. After ExacTRAC calculates 3 shifts and 3 rotations of a patient's current position to the expected position based on the registration of a pair of x-ray images with DRR, the robotic couch can be driven to place the target at Linac isocenter. However, since the rotational axes for pitch and roll of the robotic couch are not coincident with the Linac isocenteral axes, the couch positions will be changed to allow for pitch and roll corrections. Current R&V system only records 3 translational and 1 couch angle (no pitch and roll), and the interfractional couch position difference can be > 8 cm vertically. A second relationship was developed between the recorded translational parameters and the actual target position, taking into account the pitch and roll from the ExacTRAC system, so that the interfractional patient position can be tracked.

Results: The differences between the estimated and actual translational couch positions are < 2 mm on average for 28 patients. The interfractional couch position variance is < 1.5 mm for 3 patients (10 fractions per patient).

Discussions: If the EaxcTRAC IGRT system is mis-calibrated to a wrong position other than Linac isocenter, the x-ray image registration system cannot in itself detect the error. Therefore, this patient position tracking methodology can be a very important safety tool for preventing errors, so that the treatment team can deliver stereotactic radiation at a higher confidence level.