Purpose: Spatial accuracy in a Gamma Knife SRS treatment plan is of utmost importance because of the single fraction high doses of ionizing radiation intended to be delivered to small volumes often times at close proximity to critical brain structures.

Methods: Leksell-Gamma Knife head frames and associated fiducial marker box attached to a phantom, as well as the MRI scanner were studied in this regard. Three phantoms with known geometrical accuracy were scanned. These included the ACR MRI accreditation phantom, GE MRI standard calibration phantom, and a specifically designed MRI phantom. The latter phantom consists of known size and positional coordinates of structures including a cone, cube, cylinder, and sphere. Observed measurements were made using a GE 1.5 tesla MRI scanner. Scanning was done following our standard protocol, i.e. T1 imaging, 512x512 pixels, 28x28 cm fov, and 1.5 mm slice thickness with no gap. All data was analyzed after being dicom transmitted to our Gamma Knife Treatment Planning computer.

Results: We will show that over many applications of the head frame to patients, warping of the head frame can and does occur. Fiducial marker boxes are unlikely to warp or change the parameters of the copper sulfite tracks. The MRI scanner remains spatially accurate as long as a gradient field test is done routinely and attention is closely paid to the head coil and its associated small field gradient. This is generally accomplished during routine PMI by the manufacturer.

Conclusions: Head frame alignment parameters dictate where the fiducial markers are actually found. If the fiducial marker parameters measured do not agree with the known position of the fiducial markers as stored in the treatment planning computer errors occur in the "Leksell" coordinate frame space. Clues will be provided indicating that the head frame has warped out of allowed tolerances.