

Due to the complexity of the stereotactic treatment, a control is performed before each Cyberknife® treatment. The SRS MapCheck® matrix in the StereoPhan® ensures all patients-QA. The study presents an optimization of the commissioning of the SRS MapCheck® based on the retrospective analysis of 3 months of clinical use.

Methods & Materials



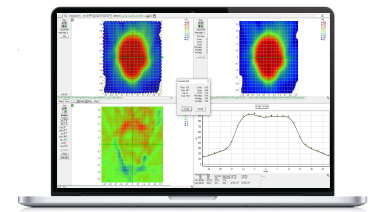
Accuray Cyberknife® M6
Stereotactic radiosurgery robot



**Accuray TPS Precision®
2.0.0.1**
Treatment planning



**SNC SRS MAPCHECK®
and STEREOPHAN®**
Patient-QA control, E2E



SNC Patient® 8.3
Gamma Index calculation

The retrospective analysis concerns 120 treatment plans with dual control (240 patient-QA) in absolute dose (PTW® PinPoint) and in Gamma Index (SNC Patient®). First, the advantages and limits of each modality were researched, depending on the size and type of collimator (MLC, fixed). Then, an optimization of the dose calibration of the SRS MapCheck® was obtained from the dose measured for each collimation. The results of the gamma index analysis (GI) from the database have been updated.

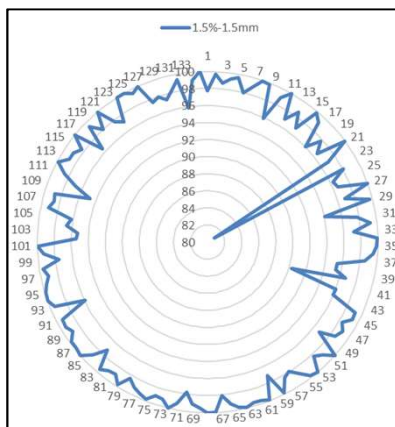
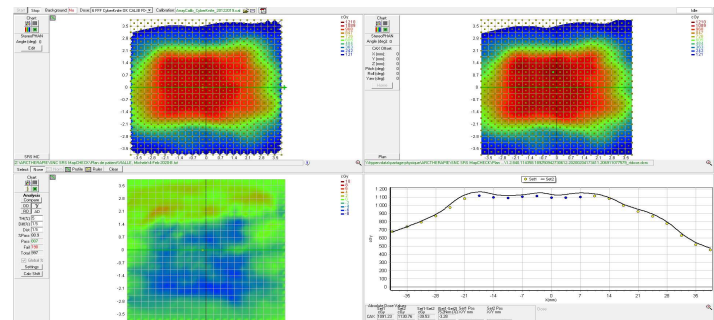
For absolute dose comparisons, cutoffs of ± 3 , 4 and 5% relative deviations were used. The parameters used for GI were 1.5%-1.5mm, 2%-2mm and 3%-1mm with threshold at 5.0% and absolute dose analysis.

Results & Discussion

For the SterePhan® patient-QA, there is no correlation of results according to the diameter of the cone. There appear to be more MLC plans distributed between [3.0; 4.0]% deviations. A relative deviation of $\pm 3.9\%$ validates 95.0% of the distribution. These results in absolute doses and the GIs of SRS MapCheck® do not show a significant correlation (table below).

The most discriminating analysis criterion is **1.5%-1.5mm**, with a threshold set at **GI > 93.2%** to validate 95% of the plans. The thresholds calculated for the other tests are GI > 96.5% in 2% - 2mm and GI > 96.0% in 3% - 1mm.

From these results a new calibration in measured absolute dose rather than TPS dose was performed, for fixed and MLC collimators. An important step of merging the scan images of the StereoPhan® with and without MapCheck® made it possible to perfectly identify the position of the center in the matrix in order to be able to move the Cyberknife®. TPS calculations in Ray-Tracing / FSPB (high resolution) and Monte-Carlo (uncertainty 0.1%) show relative differences between [+1.8; +3.9]% concerning PinPoint® versus Mapcheck®.



After applying the new calibrations to all GI analyzes, the number of KO plans shots dropped from 12 to 4 (GI > 95.0%). Only one plan remained KO with a GI = 80.9% in 1.5%-1.5mm, probably due to the large size of the irradiation field (above). From these new results, the acceptability thresholds for GI analysis have been adapted as well as the use of 2 thresholds: the **optimized GI** and the **critical GI**. The optimized GI represents the threshold obtained to validate 95.0% of our patient-QA distribution and the critical GI is the reference threshold of the literature.

	1.5%-1.5mm, TH5%	2%-2mm, TH5%	3%-1mm, TH5%
GI optimized	95.4%	97.8%	97.0%
GI critical	95.0%	95.0%	95.0%