

## AbstractID: 14018 Title: A distance to dose difference tool for estimating the required spatial accuracy of a displacement vector field

### **Purpose:**

To introduce a tool, termed distance to dose difference (DTD), which estimates the required spatial accuracy of displacement vector fields (DVF) used for mapping lung treatment 4D dose values.

### **Method and Materials:**

4D dose mapping pulls dose values from the irradiated geometry to the reference geometry. DVF errors result in dose being pulled from the wrong spatial location in the irradiated geometry, with a dose error equal to the dose difference between the error-free and sampled spatial locations. The DTD, defined as the distance to observe a given dose or percentage dose difference in the irradiated geometry, quantifies the permitted DVF error to ensure a pre-specified desired dose mapping accuracy is achieved. To demonstrate the DTD and its dependence on dose conformity, plans are generated with the CTV as the target and with a 1 cm CTV-PTV margin for an IMRT lung patient. DTD is evaluated for 330 cGy, 5 % of the 66 Gy prescription dose. DTDs are loaded into the treatment planning system to visualize positional dependencies of permissible DVF errors overlaid on the patient's anatomy. DTD-volume-histograms are generated.

### **Results:**

Tolerated DVF errors vary with plan conformity. Outside of irradiated geometric regions, DVF uncertainties up to 9 mm are tolerated before introducing 330 cGy dose mapping errors. Inside the irradiated volume, excluding the CTV, 1-4 mm errors are tolerated for the PTV plan and 1-2 mm for the CTV plan. Within the CTV, the CTV-based plan tolerated larger DVF errors than the PTV plan due to better target dose homogeneity in the CTV plan.

### **Conclusions:**

The DTD tool provides a first estimate of DVF required spatial accuracy. Accurate DVF's (~1 mm) are required in dose gradient regions, but large DVF errors are acceptable in homogenous dose regions.

**Conflict of Interest:** Supported by NIH-P01CA116602 and Philips Medical Systems