AbstractID: 14095 Title: In-field risk of radiation induced second cancer in proton therapy and IMRT for pediatric patients considering dose inhomogeneities.

Purpose: In radiation therapy organs outside of the treatment volume receive medium to low doses. These doses might lead to side effects, e.g. the induction of a second cancer. In general IMRT treatment plans require more fields than proton treatment plans to reach comparable dose conformality. In addition, photon beams do not stop in the patient. The dose distributions and organ dose levels therefore differ substantially. The purpose of this analysis was to assess the risk for developing a second cancer for organs directly in the beam path. When treating pediatric patients.

Method and Materials: Age and gender specific whole-body phantoms (4-year old female and 14-year old male) were implement in the treatment planning system in order to determine in-field doses. We have used two treatment sites for our study, namely, optic glioma and pelvic sarcoma. We have used a recently published second cancer risk model which takes into account the dose levels and dose inhomogeneities by using the concept of organ equivalent doses. Lifetime attributable risks (LAR) were determined.

Results: In IMRT parotids receive exit dose, therefore, the second cancer risks (LARs) for treating opticglioma from IMRT is around 0.5%, whereas, in proton therapy parotids do not receive any dose. Considering brain tissue, IMRT causes LARs between 1.2% and 2.0% considering repopulation rates between 0% and 50%. In proton therapy, the values vary from 0.4% to 1.2%, respectively. LARs in the 14-year old patient are found to be smaller compared to LARs in the 4-year old patient.

Conclusions: Integral doses to in-field organs are in general 2 to 3 times larger from IMRT as compared to proton therapy. We find LARs from IMRT are higher compared to those from proton therapy e.g. for brain tissue 1.2% in IMRT as opposed to 0.4% in proton therapy considering zero repopulation rate.