AbstractID: 13915 Title: Total body irradiation (TBI) : Looking from differrent angles

Purpose:
To explore the new degree of freedom of VMAT to design a novel technique for TBI, in which patient is positioned supine/prone on the floor and an arc field is delivered with variable dose rate and/or dynamic collimators.

Method and Materials:
A formalism of designing an arc field with variable dose rate and/or dynamic jaw/MLC to deliver an arbitrary one-dimensional dose profile is developed. The dose rate and/or jaw/MLC position are obtained by minimizing the difference between prescribed and calculated dose at each spatial point. The formalism is applied to design TBI treatment plan to achieve (1) a uniform dose over the entire body, and (2) a reduced dose in the lung region. MATLab codes were developed to solve the optimization problem using gradient decent method.

Three types of treatment plans were generated: (1) variable dose rate (VDR) only, (2) VDR with dynamic MLC (DMLC), and (3) DMLC only. The optimized treatment plans were converted into DICOM-RT format and delivered in a Varian 21-EX machine capable of Rapidarc in DICOM-RT mode. Measurements with farmer chamber in air with buildup cap were performed and compared with the optimization results.

Results:
For a patient with 200cm height placed at 100cm below the linac iso-center, the differences between measured profile from plans with VDR only for uniform/lung sparing case are (-1.4±1.9)% and (-0.2±2.4)%, respectively. They improved to (-0.4±1.0)% and (-0.5±2.2)% with VDR+DMLC. The latter also had 40% higher efficiency. The results for DMLC only were less desirable with reduced range of (-85cm, 85cm) and slightly higher discrepancies.

Conclusion:
It is feasible to deliver TBI using VMAT, thereby eliminating the need for large treatment room size or hand-made compensators. Regular linac operating in arc therapy with dynamic MLC alone can be also used, although with less efficiency.