# AbstractID: 2870 Title: The use of a Miniature Multileaf Collimator in Stereotactic Proton Therapy

**Purpose:** To evaluate - in terms of dose conformity, neutron dose, activation, and leakage - the use of a Miniature Multileaf Collimator (MMLC) in stereotactic proton therapy, both as an aperture and for segmented intensity modulated proton therapy (IMPT).

**Method and Materials:** Firstly, we compute the neutron production and activation of the MMLC with Geant4. In a simple geometry - a cylindrical target hit by a pencil proton beam – we determine the neutron distribution as function of position and energy, and compare tungsten, brass, nickel, and lead. Given the point-spread functions, we assess the secondary-neutron dose to the patient for the different materials and MMLC distance to patient. Secondly, we model the Radionics ConforMAX™ MMLC as integrated in our stereotactic proton beamline, and compare the dose distributions for the MMLC and an equivalent aperture. The results are validated with radiographic film measurements. Finally, we measure the proton leakage, activation, and neutron dose.

**Results:** The neutron production in tungsten, the leaf material in most MLC's, is more than twice that of nickel. For a 10 cm diameter field, with a range of 15 g/cm$^2$ and modulation of 5 g/cm$^2$, and with the MMLC positioned at 30.0 cm from the patient, the maximum neutron dose, i.e. for a closed MLC, is ~0.04% of the target dose. The MMLC leaf width at iso center is 3.2 mm; the lateral penumbra in air is 0.6 mm.

**Conclusion:** In beam-lines with a large SAD, such as our stereotactic beam-line, the use of the MMLC as aperture is feasible. The device can be positioned far away from the patient, which reduces the neutron dose to acceptable levels, while hardly compromising the lateral penumbra. Given a decrease in proton efficiency of a factor of 3, the MMLC could also be used for IMPT.