Purpose: To determine if a rotated collimator on an Elekta Synergy-S with Beam Modulator MLC (BMx) allows for dosimetrically acceptable treatment of targets exceeding the length of the maximum field size (21x16cm). The BMx is a high-resolution MLC with 4mm leaves but is of limited clinical use on patient target volumes exceeding 20cm in length. Rotation of the collimator utilizes the Pythagorean geometry to extend treatment length. This potentially increases the length of the PTV that be conformally treated.

Methods: Rods of 21-23cm length were contoured in water with the Pinnacle treatment planning system. The width of the rods varies from 1-5cm. Four isocentric treatment plans were generated for each target: four-field conformal, 7-field IMRT, single-arc VMAT, and a modified double-arc VMAT (MDAV), with the collimator angled at 55º. The MDAV method consists of two opposing 180º arcs with the collimator turned 55º in opposite directions. A successful plan is defined as 99% of the target volume being covered by a minimum of 95% of the prescribed dose. Conformality is determined as a ratio of the volume exposed to prescribed isodose and target volume.

Results: Targets of length 21cm, 22cm, and 23cm are able to be treated with widths of 4cm, 5cm, and 4cm respectively. The MDAV method achieves these results on all trials. The VMAT method achieves these results for the 21cm and 23cm long target. The IMRT Method achieves these results for the 21cm long target. With the exception of the 1cm wide targets, the average conformality is approximately 2.5.

Conclusions: Changing the collimator angle of the BMx Elekta-S machine allows for a 3cm length increase of targets up to 5cm. Further work will assess clinical suitability of these findings for treatment of head and neck tumors and spinal masses.