We have a Varian Novalis TX equipped with MV, OBI/CBCT imaging system and the BrainLAB ExacTrac patient positioning system. It was commissioned for regular radiotherapy and for stereotactic radiosurgery (SRS) in 2009. The BrainLAB iPlan Pencil Beam Convolution (PBC) model is used for SRS planning. After commissioning we performed intensive verification of the iPlan TPS before treating the first SRS patient. We upgraded the system with Monte Carlo (MC) model in 2011 and commissioned it for stereotactic body radiotherapy (SBRT) application.

In this work, we used two phantoms: one is a 30x30x12 cm$^3$ solid water phantom and the other a 30x30x18 cm$^3$ inhomogeneous phantom made of solid water and cork board representing low density media such as lung. Both phantoms were CT scanned and the images were transferred to the iPlan TPS for planning. An Exradin A-14 ionization chamber was inserted into the middle 2-cm thick solid water slab in both phantoms before CT scans.

First, we compared the doses calculated using the MC model against those calculated using the PBC model for field sizes ranging from 2x2 to 15x15 cm$^2$ on the homogeneous phantom. They agree within 2%. The difference between the planned doses and the measured doses are shown in Fig. 1. For all plans calculated in this work, the heterogeneity correction was applied.

Second, we compared the doses calculated using the MC model against those calculated using the PBC model for the various field sizes on the inhomogeneous phantom. The single field beam hit the phantom perpendicularly (gantry angle 0). With the same prescribed dose to the isocenter, the MU ratios of the MC model to the PBC model ranged from 1.016 to 1.048. The dose differences between the plan and the measurements are shown in Fig. 2, where the plans calculated using MC model agree with the measurements very well, from -0.5% to 1.1%, and those calculated using PBC model differ with the measurements up to -4%.

Third, we evaluated the effect of the BrainLAB robotic couch top to the dose at the isocenter where the chamber center of the A-14 ion chamber is located. In the iPlan TPS, the robotic couch top model named as BL Imaging Couch Top was inserted in the CT scanned phantom image before planning the posterior-anterior fields ranging from 2x2 to 15x15 cm$^2$. The dose difference between the measurements and the plans for the inhomogeneous phantom are shown in Fig 3. The results show that the couch model in the iPlan TPS works well for the PBC model, and not so well for the MC model. There is some discrepancy between the plans and measurements for 2x2 and 15x15 cm$^2$ fields. It seems that the BL Imaging Couch Top in the TPS over estimated the attenuation of the couch top, resulting in slightly overdosing the phantom. Considering the actual clinical scenarios, this discrepancy is acceptable.

Finally, a six-field IMRT plan (with two posterior oblique fields) and a six-dynamic-arc plan were calculated for both phantoms using the MC model with inserted BL Imaging Couch Top. The total dose to the isocenter measured by the A-14 ion chamber agree with that of the planned within 2%.