Purpose: To quantify the dose uncertainties in the out-of-target regions for both VMAT and IMRT.

Methods: 12 clinical IMRT (6) and VMAT (6) plans for six patients were created in Varian Eclipse 8.6 and delivered to solid water phantoms containing a 2D ion chamber array – MatriXX. The measured doses in the out-of-target regions were compared with TPS calculations. Two types of out-of-target regions were considered in this study: type I, with direct irradiations and type II, without direct irradiations.

Results: The TPS was found to generally underestimate the out-of-target doses for both IMRT and VMAT plans. The mean underestimate was 48.0% and 35.5% for IMRT and VMAT, respectively, in regions without direct irradiations (type II), where the dominant dose contributions are scatter. In regions where direct irradiations are present (type I), the underestimate was significantly smaller, which was 6.5% and 4.0% for IMRT and VMAT, respectively. The percentage dose discrepancy increases as the distance to the field edge increases for both IMRT and VMAT. The dose discrepancies between TPS and measurements also demonstrate a clear dependence on the equivalent square jaw size for both IMRT and VMAT plans. As the jaw size increases, the observed discrepancy increases. This phenomenon is attributed to both open beam and dynamic MLC modeling in the TPS.

Conclusions: The accuracy of the out-of-target dose by Varian Eclipse TPS for IMRT and VMAT was investigated through 2D phantom measurements. Eclipse was found to underestimate the doses in those regions. The underestimate shows dependence on the types of plans, equivalent field size, and the distance to the field edge. Such an underestimate can have impacts on the evaluation of the OAR and normal tissue sparing.