Comparative study of modulation for VMAT treatments planned on Eclipse and Raystation: complexity index and experimental correlation   
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**Introduction:** Volumetric modulated arc therapy technique allows to shape the isodose distribution around irregular or complex target and spare organ at risks. Those various dose distribution complexity will directly be translated in the level of modulation to be applied to the fluence and thus to the delivery system in terms of mechanical variations such as gantry speed, leaf movements, number of segments or dose rate variation. These last years, several studies have been carried out for the definition of fitted indexes that could be correlated to a plan complexity with regards to patient QA results [1,2].   
In this context, two points have motivated this study:

* Using existing indexes and defining new ones to compare VMAT plan issued from two different TPS;
* Correlate these indexes to the experimental patient specific QA results.

**Material and method:** In this study, two types of indexes have been used: the classical one described in the literature and simple derived indexes. The first derived index is based on the distance between two opposite leaves for each beam (not under a jaw) calculated for every control point of every arc of the plan. The first classical index is the MCSV [3] which the value is decreasing when the complexity is increasing.   
Among all VMAT plans for various indications, 450 VMAT plans have been analyzed (nearly 2/3 from Eclipse and 1/3 from Raystation) all of them treated on the same accelerator (Novalis TX).   
Patient specific QA have been performed with 2D diodes measurements using the ArcCheck phantom and a Pinpoint ionization chamber measurement located in the center of the ArcCheck. The analysis have been performed with local and global gamma indexes of 3%/3 mm with threshold set at 10% of the maximal dose.

**Results:** As a first step, we focused on the derived indexes and applied them to the Eclipse/Raystation plans. The median of the tip to tip distance of opposite leaves for all plans is about 10 mm and 18 mm, respectively, for Eclipse and Raystation. The mean proportion of opposite leaves having a tip to tip distance less than 10 mm is about 32% and 20%, respectively, for Eclipse and Raystation. As a second step we analyzed the exact same plans with the MCSv index. Results show a mean MCSV value of 0.25 and 0.39 and standard deviation of 0.08 (32%) and 0.13 (33%), respectively, for Eclipse and Raystation. These results show that the derived index we developed is in a good agreement with the standard index MCSV. Secondly, the results tend to show that plans, issued from Eclipse show or higher degree of modulation than those from Raystation. These tendency need to be correlated with the patient specific QA results.

**Conclusion:** The work already achieved in the framework of this study using plans performed according to our clinical standards, has showed clear differences in the complexity with regards to the TPS used. These results are confirmed by standard literature metric, such as the so called MCSv, but will be deeply investigated using other metrics. These results seems to corroborate a higher modulated solution on the Eclipse side that may lead to a more difficult plan to deliver, this has to be correlated with experimental QA.

**References:**[1] Crowe *et al*., Examination of the properties of IMRT and VMAT beams and evaluation against pre-treatment quality assurance results, Phy. Med. Biol. 60 (2015) 2587—2601.   
[2] Park *et al*., Modulation index of VMAT considering both mechanical and dose calculation uncertainties, Phys. Med. Biol. 60 (2015) 7101—7125.   
[3] Masi *et al*., Impact of plan parameters on the dosimetric accuracy of volumetric modulated arc therapy, Med. Phys. 40(7), 2013