JULY 12–16 2020 VIRTUAL JOINT AAPM | COMP MEETING
EASTERN TIME [GMT-4]

Linac Dynamic QA with an EPID

F. SAN MIGUEL[1], **F. CLEMENTE**[1], **P. CHAMORRO**[1]
1 Hospital Central de la Defensa 'Gómez Ulla', Madrid, Spain

INTRODUCTION

In order to ensure proper treatments in radiotherapy, there are several guidelines for the quality assurance (QA) of medical accelerators. While dynamic treatments (DMLC and VMAT) are becoming a regular practice, most of these guidelines are based on static fields. There is a need to implement a machine specific QA procedure in order to assess this kind of deliveries. Another important issue, is that is impossible to find an ideal device for measuring all the different tests suggested in the literature. It is required an accurate dose measurement and high spatial resolution.
There is an electronic portal imaging device (EPID) mounted on most of the linacs. In the case of Elekta, this detector has a pixel size of 0.25 mm at the isocenter and it could be calibrated in absolute dose.

AIM

The aim of the work is to develop a dynamic QA program, including DMLC and VMAT tests, using only the information provided by the electronic portal imaging device. Besides the advantage of being mounted on the linac, it also has a high spatial resolution and can perform an absolute dose measurement.

METHOD

For this study, it has been used the EPID (Perkin Elmer) mounted on an Elekta Synergy accelerator (6 MV, 40 leaf pairs with 1 cm at isocenter). Based on the work by Lee et al. [1], the panel was calibrated in water for absolute dosimetry and tested against a farmer type ion chamber. This procedure allowed to replace the ion chamber in dosimetric tests. The dynamic tests were designed following the paper by Kaurin et al. [2]. These include positioning of the MLC using different delivery techniques, leaf speed and backup jaw speed, flatness and symmetry as a function of dose rate, arc dosimetry, dose rate versus gantry speed and MLC speed, MLC reversals and dose rate changes. The files for controlling each component of the delivery were implemented using the iCom Customer Acceptance Test (iComCAT) v1.0.0.14. Using the raw images exported from IviewGT (version 3.4) as input data, the analysis was made with a self-developed software coded in Python. Some tests were performed with the assistance of the Pylinac software.

RESULTS

Physical analyzed data, like leaf and gantry speed, showed very small differences between the nominal values entered in the treatment planning system (TPS) and the values measured.

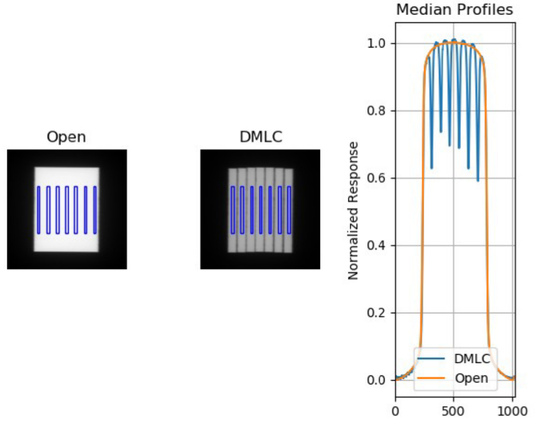
Dosimetric results also showed good agreement between the static and dynamic deliveries.

	MLC speed (cms/s)	Backup jaw speed (cms/s)	Gantry speed (°/s)
Nominal (TPS)	2.4	1.5	6
Measured 6 MV	2.03	1.5	6

Maximum values of MLC speed, backup jaw speed and gantry speed, compared to the values introduced in the treatment planning system.

	Static		360° Arc	
Monitor chamber reading	36 MU	1000 MU	36 MU	1000 MU
EPID Reading (PV)	323400	8322000	322000	8364000
Difference Arc-Static (%)			-0.421	0.5

Monitor chamber stability for static gantry and 360º arc fields. EPID reading is in Pixel Value (PV).



Dose Rate vs Gantry Speed test. Seven strips with the same dose but delivered with different DR and GS. The strips are normalized with the open filed measurement

Dose Rate Gantry Speed	max/16 max/16	max/8 max/8	max/4 max/4	max/2 max/2	max max	1.2 max max	max 1.2 max
Normalized dose	99.4	100.3	99.8	99.9	100	100.3	100.2

Seven strips with the same dose but delivered with different dose rate and gantry speed. Results are normalized to the open field measurement.

MLC speed Dose Rate	max/16 max/16	max/8 max/8	max/4 max/4	max/2 max/2	max max	1.2 max max	max 1.2 max
Normalized dose	99.5	100.1	99.4	99.8	100.3	100.4	99.6

Seven strips with the same dose but delivered with different dose rate and MLC speed. Results are normalized to the open field measurement.

CONCLUSIONS

Although slight differences were observed, it does not seem to be clinically relevant since the same device is used to measure IMRT planar dose maps, with good agreement with the TPS (previously tested against other devices). Nevertheless, the influence of the MLC speed in the treatments have yet to be investigated, since the value measured is quite different from the nominal value in the treatment planning system. The rest of the parameters studied gave good results, supporting the ability of the linac to deliver proper non static treatments. Dynamic QA can be performed with only one measuring device, already mounted on the linac, and one software. This allows the user for a fast method that can be included in the routine procedures.

REFERENCES

[1] A simple approach to using an amorphous Silicon EPID to verify IMRT planar dose maps. Lee et al. Medphys 36 p.984
[2] VMAT testing for an Elekta accelerator. Kaurin et al. Journal of Applied Clinical Medical Physics, Volume 13, numer 2, 2012

ACKNOWLEDGEMENTS

No acknowledgements.

CONTACT INFORMATION

franciscojavier.sma@gmail.com.