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# Quality Assurance of a new accelerator with an integrated MR system

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Introduction

The introduction of the MR-Linac technology poses new challenges on the definition of a suitable machine Quality Assurance (QA) program. In this work, we present our current QA program for the MRIdian MR-Linac (Viewray) and the preliminary results on machine performance.

#### Materials and Methods

The acceptance of the MRIdian was performed in December 2018. Since then, we acquired data using MRcompatible ion chambers, StarCheck MR (PTW) and Gafchromic® films. In order to check the correlation between MR and RT isocenter, we used the DailyQA phantom (Viewray). ACR, NEMA and distortion measurements were performed to check the MRI quality and stability. We adapted the SGSMP recommendations for Linac QA to the characteristics of this new machine and devised a QA program to check the Linac and MRI performances.

#### Results

The output stability is measured daily with an ion chamber. Over a period of six months, the stability was better than 1%. The symmetry is measured weekly using the Starcheck MR and it was stable over the same period of time; being 1.8% and 0.7%, in the LR and GT directions. MLC positional accuracy is evaluated daily at gantry zero and monthly at gantry 90° and 270°, using the picket fence test, and it showed a maximum deviation of  $0.5\pm0.1$  mm. The size of the treatment isocenter is evaluated weekly with star shots, and it has a diameter of around  $0.7\pm0.1$  mm in the axial plane. The deviation between MRI and radiation (RT) isocenter was evaluated using the Viewray daily phantom and it was  $0.7\pm0.3$  mm. ACR, NEMA and distortion measurements were performed weekly for the first four months. At present only the ACR is performed weekly and the other checks monthly. Additionally, a quick MRI distortion check is performed daily.

### Conclusions

The SGSMP recommendations covered satisfactorly the QA requirements for the MR-Linac technology with the exception of the MRI QA. Viewray MRIdian proved to be stable over a six-month period. The size of the treatment isocenter, the MLC positional accuracy and the agreement between MR and RT isocenters are on the submillimeter range.

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