Technical Note myQA SRS TN006 260715 01 / SR01-100

Subject: myQA SRS Cyberknife SAD Dependence

Products affected: myQA SRS for Cyberknife

Function affected: myQA SRS Cyberknife SAD Dependence

1. Introduction

It is known that the response of the myQA SRS device depends on the applied dose rate. For classical C-arm LINACs this effect is compensated by a dose rate calibration.

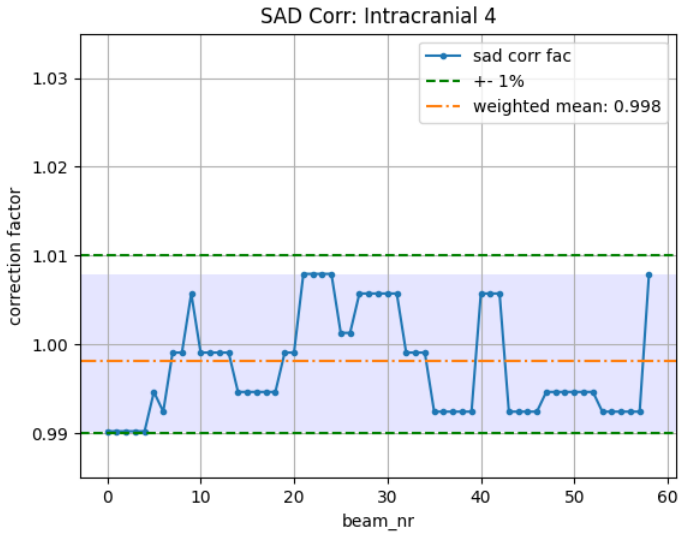
The Cyberknife operates at a fixed dose rate, but the dose per pulse can change due to different distances of the LINAC head to the myQA SRS device during the measurement of a treatment plan. In the literature[1] it was reported that the response of the myQA SRS device changes by 6% when the SAD value changes from 650 mm to 1350 mm.

In the workflow for the Cyberknife using the gantry angle sensor (GS+), the SAD dependent response is currently not compensated. The next section estimates the resulting effect on real clinical cases.

2. Impact on Clinical Cases

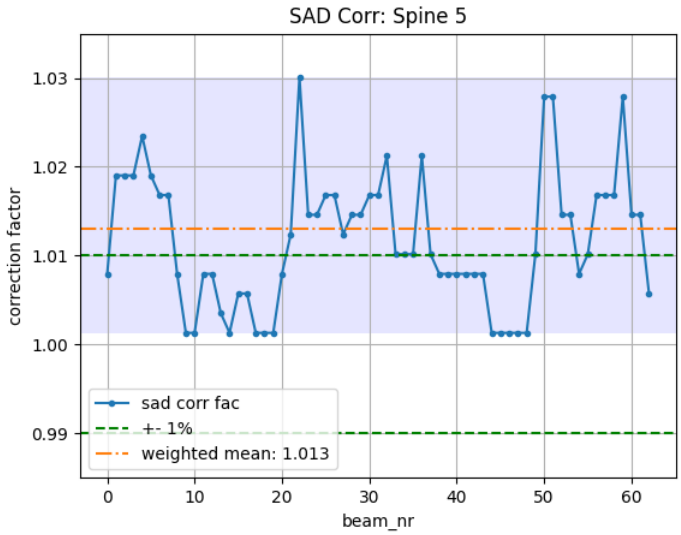
The effect on the indicated dose by not taking into account the SAD dependent response of the myQA SRS depends on the actual clinical case. Multiple plans of different target regions were analyzed. It is assumed that the output calibration is performed at a SAD value of 800 mm. The figure below shows the SAD correction factors for the individual beams for two different target regions.

The graph below comes from an intracranial treatment. The SAD values for these beams are centered around 800 mm, and the corresponding SAD correction values fluctuate between 0.99 and 1.01. The weighted mean of the SAD correction factors for this treatment is very close to 1.0 so that neglection of this correction factor will not lead to a major alteration in the indicated dose.



[1] F. Padelli et al. Appl. Sci. 2022, 12, 7791. https://doi.org/10.3390/app12157791

The graph below shows the correction factors for a spine case. Here, a systematic offset of the used SAD values and the corresponding correction factors is revealed. A weighted means of all correction factors results in a factor of 1.013.



To conclude, the impact of not including the SAD correction depends on the actual clinical treatment plan and the used SAD values. The effect can hardly be detectable, as for intracranial cases, or the effect can be on the order of 1-1.5 % (indicated dose too low) for spine cases.

3. Mitigation

The SAD correction for the Cyberknife can be handled in a similar way to the effect of different dose rates at C-arm LINACs. A calibration step will involve measurements at different SAD values with the myQA SRS device and ionizing chambers as references. This part is under implementation in the myQA software.

An alternative approach for clinical cases where the SAD correction may become significant, is to apply the workflow using path.xml files for compensating the angular and SAD influence.

TTP: 30396

Please feel free to contact us as follows if you have any further questions:

USA, Canada, Latin America
Phone: +1 786 288 0369
service-usa@iba-group.com

Europe, Middle East, Africa
Phone: +49 9128 607 38
service-emea@iba-group.com

Asia Pacific
Phone: +65 3129 2472
service-apac@iba-group.com