

# Sensitivity of RadCalc EPID Dosimetry for In Vivo Composite Dose Evaluation

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## PURPOSE

This study is designed to test the sensitivity of the RadCalc EPID Dosimetry Suite using a heterogeneous Easy Cube phantom in a full body configuration, from LAP.

## MATERIALS AND METHODS

The RadCalc EPID Dosimetry system was commissioned for pre-treatment and in-vivo measurements.

The in-air measurements required approximately 20 minutes per energy. The in-vivo measurements were approximately 1 hour per energy. Six field sizes were used from 2 cm by 2 cm to 24 cm by 24cm. As well as 8 thicknesses incrementing by 5 centimeters from 5 centimeters to 35 centimeters taking the couch into account and including one delivery with nothing in the beam.

A treatment plan was created and delivered on the Elekta machine three times. 2 errors were introduced. First the plan was delivered with the wrong monitor units, and then it was delivered with the corrected Monitor Units. Both of these were delivered with the phantom flipped 180 degrees on the couch. The third time the phantom was aligned as intended. Images were captured with the EPID during delivery and imported into RadCalc to compute the respective dose volumes.

We evaluate the dose volumes histograms for two structures using the heterogeneous Easy Cube phantom, the isodose lines and gamma analysis. A gamma threshold of 3% 2mm is used while ignoring values lower than 10% of the prescription dose.

## RESULTS

In the first calculation, illustrated in **Figure 1**, the lateral monitor units were incorrect, here the DVH clearly indicates an issue from the incorrect monitor units. This difference is also seen in the dose colorwash. The corresponding Gamma analysis results show only 25.2% of voxels passing, as seen in **Figure 2**.

The second calculation, illustrated in **Figure 3**, has the correct monitor units delivered, the plan is recalculated, and the DVH comparison improves significantly. However, the sensitivity of the flipped phantom shows up as demonstrated by the DVH discrepancies and the unique areas of gamma failures around the introduced heterogeneities, demonstrating the sensitivity in expected anatomical densities. Additionally, the pass rate is still below 90%.

In the third calculation as seen in **Figure 4**, the treatment was performed as intended and we see the DVH match very well and a gamma passing rate of 99.4%.

## CONCLUSIONS

This leads to a great result of the sensitivity of RadCalc's EPID Dosimetry System.

It helps illustrate that even if you have verified the plan was delivered as intended and the machine has done its job perfectly by using the log files, there is still a need to verify changes from the intended plan and patient setup and changes through treatment.

## REFERENCES

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# RADCALC

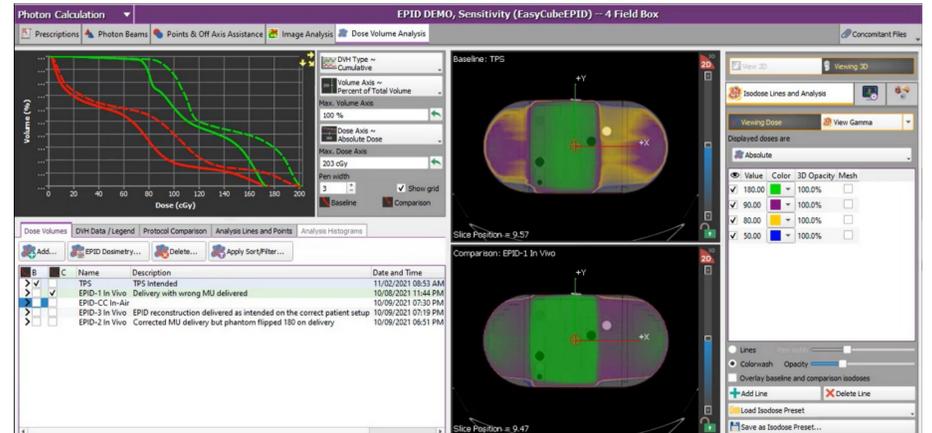


Figure 1: The calculation of the delivery with erroneous Monitor Unit, showing DVH and dose in colorwash.

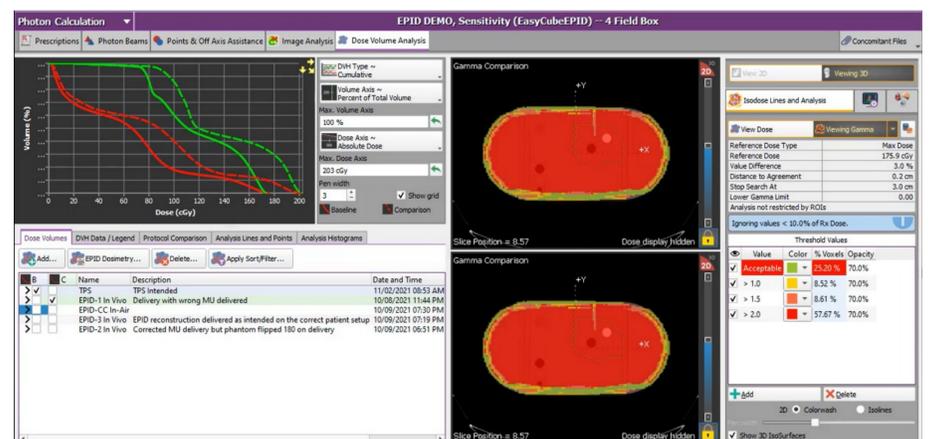


Figure 2: The Gamma analysis of the delivery with erroneous Monitor Units.

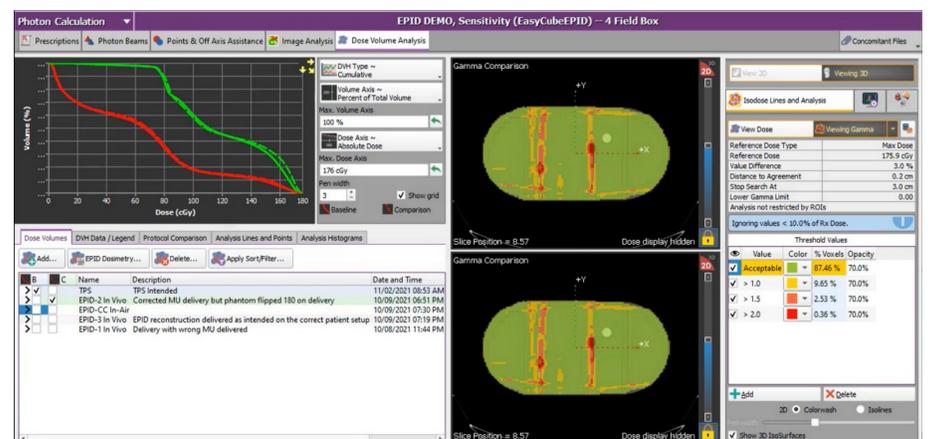


Figure 3: The delivery with correct Monitor Units and flipped 180 degrees.

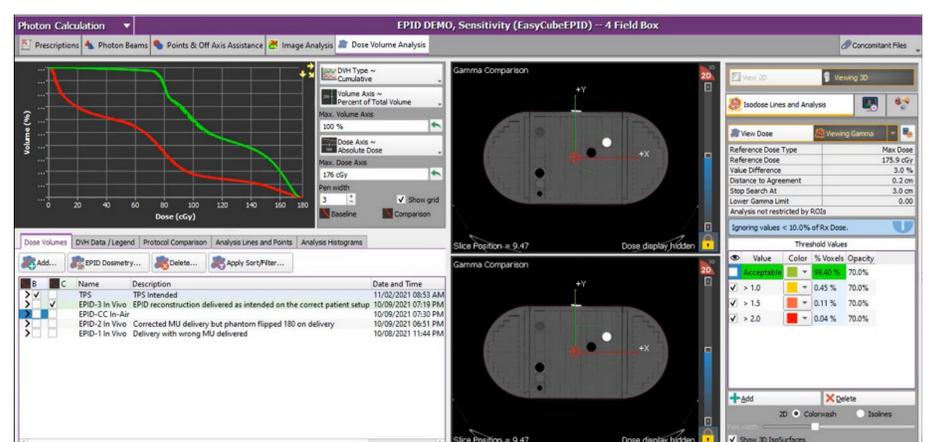


Figure 4: The delivery was performed as intended.

## CONTACT INFORMATION

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