# Simple method for evaluating flatness and symmetry based on EPID and MATLAB

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## Background and Objective

The use of Electronic Portal Imaging Devices (EPID) for the evaluation of dosimetric parameters such as flatness, symmetry and radiant field size of the linear accelerator (LINAC) photon beam, requires a calibration method adapted to the requirements and equipment of the clinic.

Currently, in our institution, this controls are carried out using detector arrays, but the limited spatial resolution and the time it takes to mount them, generates the need to implement a more practical method. Faced with this situation, it is proposed to implement the use of EPID for the execution of these controls.

## Methods

To achieve the conversion of pixel values to dose values, **we propose to acquire two calibration curves**.

**First**, a calibration curve that relates optical density (OD) values from a film to delivered dose from the treatment planning system (TPS). In this point, EBT3 radiochromic films were irradiated, under the following conditions: isocentric technique, 5 centimeters deep in solid water and a field size of 10x10cm$^2$. Films with different MUs were irradiated from 0 to 500 UM, which were related to a dose value calculated in the MONACO® TPS from ELEKTA.

**Second**, 10x10cm$^2$ fields with the same UM values were irradiated on the EPID model iView GT AL, from ELEKTA®, with no material interposed between the source and the detectors. The pixel values obtained in each image were related to a DO value of the irradiated radiochromic films.

**Finally**, it's necessary to perform a gain correction for the off-axis points; this is due to the non-homogeneous response present in the EPID detectors and the depth difference at which it is measured, compared to the 5 cm depth of the plane of reference dose. To solve this, the plane obtained from the EPID is calibrated with a reference plane obtained with an array of Octavius 1500 detectors from PTW® at a depth of 5 centimeters.

The processing algorithm was developed in numerical computation system MATLAB®.

For this study, only the data obtained using an ELEKTA® SYNERGY linear accelerator for 6MV energy will be analyzed with an ELEKTA® EPID iView GT AL.

## Results and Discussion

The graphic interface allows the user to see a quick result and generate a PDF document for register the quality control.

The following tables show the results of EPID measurements and Octavius 1500 PTW® measurements.

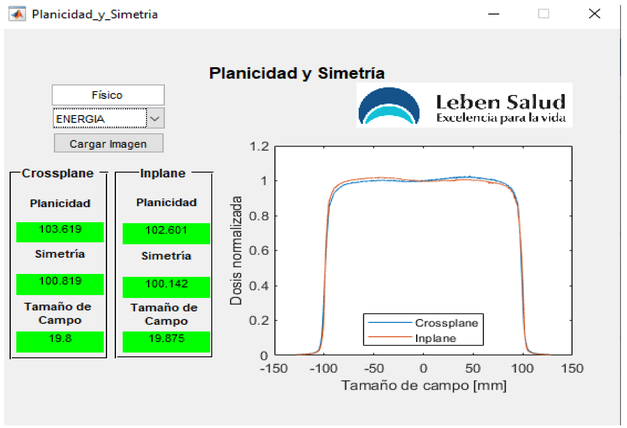


Figure 1. User interface

| | Date | Flatness | | Symmetry | | Field Size | |
|---|---|---|---|---|---|---|---|
| | | Crossplane | Inplane | Crossplane | Inplane | Crossplane | Inplane |
| EPID Measurements | May-20 | 103.2 | 102.4 | 100.5 | 100.4 | 19.7 | 19.8 |
| | June-20 | 103.1 | 102.4 | 100.6 | 100.2 | 19.7 | 19.8 |
| | Aug-20 | 103.3 | 102.6 | 100.5 | 100.2 | 19.8 | 19.9 |
| | Sep-20 | 103.4 | 102.4 | 100.7 | 100.2 | 19.7 | 19.8 |
| | Oct-20 | 103.4 | 102.4 | 100.5 | 100.3 | 19.7 | 19.8 |
| | **Standard deviation** | **0.13** | **0.09** | **0.09** | **0.09** | **0.04** | **0.04** |

Table 1. EPID measurements.

| | Date | Flatness | | Symmetry | | Field Size | |
|---|---|---|---|---|---|---|---|
| | | Crossplane | Inplane | Crossplane | Inplane | Crossplane | Inplane |
| Octavius 1500 PTW® measurements | May-20 | 102.8 | 101.9 | 101.4 | 100.8 | 20.2 | 20.1 |
| | June-20 | 102.5 | 102 | 101.5 | 100.6 | 20.2 | 20.2 |
| | Aug-20 | 102.8 | 102.1 | 101.2 | 100.6 | 20.2 | 20.2 |
| | Sep-20 | 102.4 | 101.9 | 101.6 | 100.7 | 20.3 | 20.1 |
| | Oct-20 | 102.2 | 101.9 | 101.2 | 100.7 | 20.3 | 20.3 |
| | **Standart deviation** | **0.26** | **0.09** | **0.18** | **0.08** | **0.05** | **0.08** |

Table 2. Octavius 1500 PTW® measurements.

## Conclusions

The results indicate a lower standard deviation in the measurements obtained with the EPID and this validates the constancy of the data obtained. Therefore, the tool can be used for flatness and symmetry routinely checks.

Although, it's important to take into account that the EPID response becomes more inhomogeneous over time, therefore must be recalibrated it every certain period of time.

## References

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[2] *Mohammadi M, Bezak E. Two-dimensional transmitted dose measurements using a scanning liquid ionization chamber EPID. doi: 10.1088/0031-9155/51/11/019. Epub 2006 May 24. PMID: 16723778.*