

Flatness, Deviation and Symmetry Analysis Tree for IQWorks

Notes for User

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December 2010

This IQWorks analysis tree calculates flatness, symmetry and deviation for an image of a 20 x 20 cm radiation field. It was written for IQWorks version 0.6 and may not function correctly with earlier releases. **It is provided for educational purposes only; it has not been tested for clinical use.** Please feel free to edit and re-distribute.

The radiation field does not need to be in the centre of the image, although the edge finder will require a boundary of 5% of the total image size around the field. The field must be aligned with the image (i.e. field edges must be parallel to the edges of the image). If not then it will be necessary to rotate the image prior to performing the analysis. If different field sizes are needed then it is unfortunately necessary to manually edit the sizes and positions of the profiles and ROIs. In principle, it's possible to 'trick' IQWorks into analysing other field sizes by using the pixel re-scaler in the general fixer, but I wouldn't recommend this.

The tree uses an edge finder to determine the centre of the field. Profiles are drawn horizontally (labelled AB) and vertically (labelled GT) through this central axis (CAX) point. The CAX pixel value is taken to be the mean of a 2 mm x 2 mm ROI centred on CAX. All three parameters are calculated along the GT and AB profiles using:

$$\text{Symmetry} = \max \left\{ \frac{P_i}{P_{-i}}, \frac{P_{-i}}{P_i} \right\},$$

$$\text{Flatness} = \frac{\max\{P_i\}}{\min\{P_i\}},$$

$$\text{Deviation} = \frac{\max\{P_i\}}{P_0},$$

where P_i is the fluence at pixel i along the profile. The profile length ($-i$ to i) is set equal to 80% of the field width, i.e. 16 cm. P_0 is the CAX pixel value. The points P_i and P_{-i} represent points an equal distance either side of CAX (i.e. the points which should be symmetrical).

For the symmetry calculation, the tree compares the mean pixel values in sixteen 2 x 2 mm ROIs arranged along the profile rather than individual pixels in the profile. This is necessary as IQWorks does not currently have a built-in method of

comparing pixel values from two profiles. The symmetry value calculated will therefore be an *under-estimate* of the true value.

The tree generates a PDF report, listing the symmetry, flatness and deviation in the vertical (GT) and horizontal (AB) direction. The values are tested against nominal tolerances of 3%. This can be edited in the report section of the tree. Vertical and horizontal profile plots are also printed, together with the estimated field size (in mm) calculated using the FWHMs of the AB and GT profiles. Note that if IQWorks is run in batch mode (i.e. processing multiple images) then these profiles are not shown.