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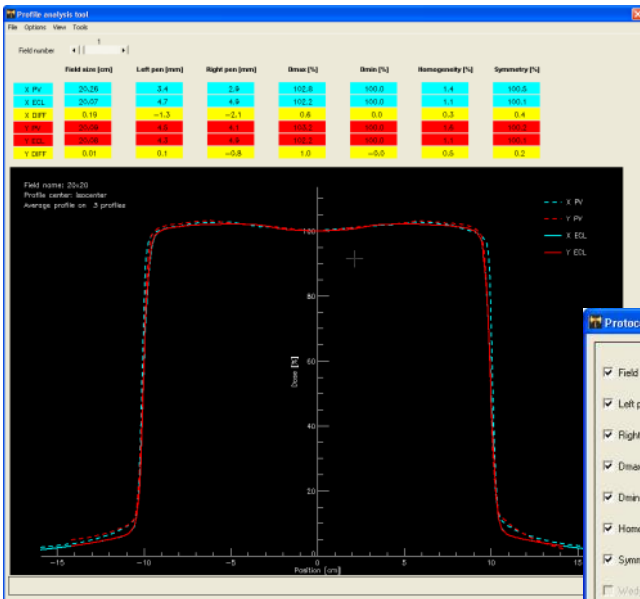


**ATHENA**  
**Machine QA**



# Symmetry & Homogeneity Verification

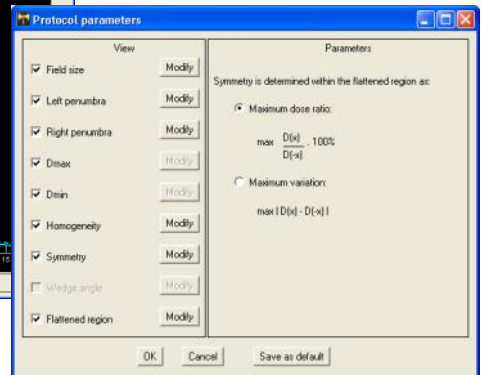
**Beam symmetry and homogeneity evaluation** - determination of the core beam parameters and its long term stability. 2D map comparison of the reference and measured dose map provides instant results for your morning check out protocol.



## Profile Analysis Window

Example of open field analysis

- ◆ Solid line - Eclipse
- ◆ Dashed line - Measurement



**Flexibility** - The detector installation at the gantry provides possibility to verify beam quality at any gantry angle without need of tedious installation of the array holder.

**Speed** - Create plan with the field sizes required for beam parameters testing and acquire portal dosimetry images in no more than 50 MU per field, i.e. 5 seconds per field with 600 MU/min.

**Simplicity** - Export acquired images and load them in Epiqa software. All fields and results are calculated by one mouse click. Print protocol and sign - done.

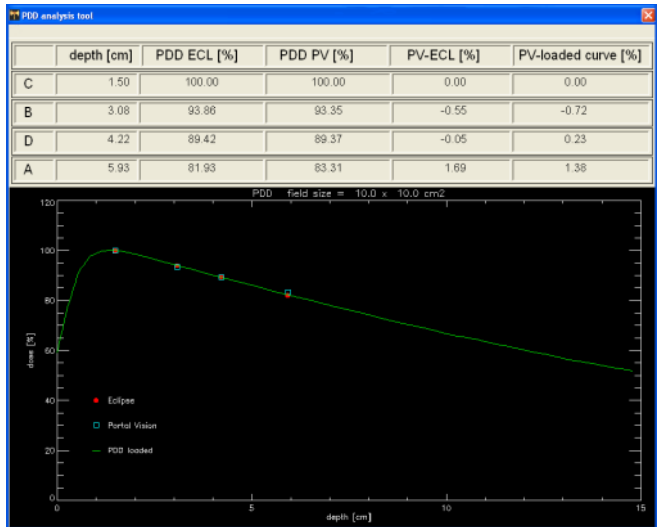
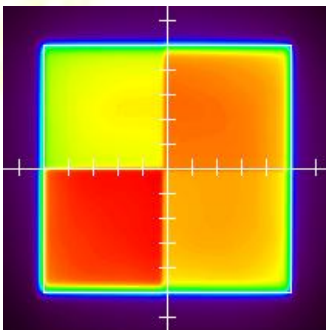
# Beam Energy Verification



**Beam energy stability verification** - using small build up phantom placed on the surface of the imager. Analysis of single phantom image provides dose information of 4 different depths and along the depth dose curve measured in water.

## Build up phantom image

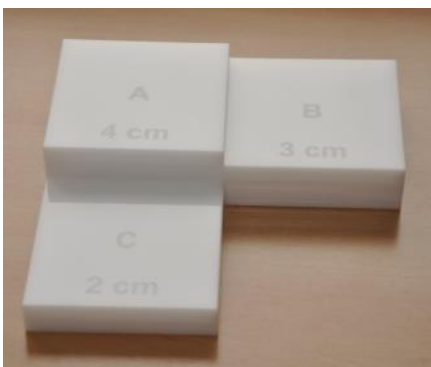
Each sector is covered by different material thickness resembling different detector depth.



## Depth Dose Curve Analysis Window

Example of energy stability analysis:

- ◆ Green line - Water phantom measurement
- ◆ Red dots - Eclipse
- ◆ Blue squares - Measurement using EPID



## Plastic phantom delivered with Athena module

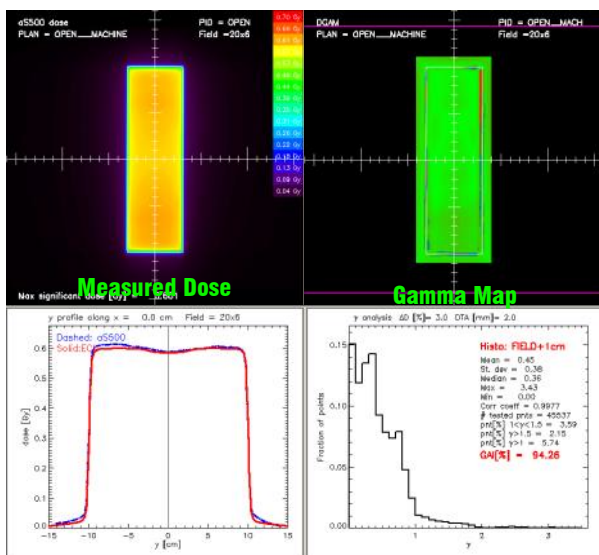
The phantom size is carefully designed not to trigger collision switch of the imager cover.



# Machine Commissioning

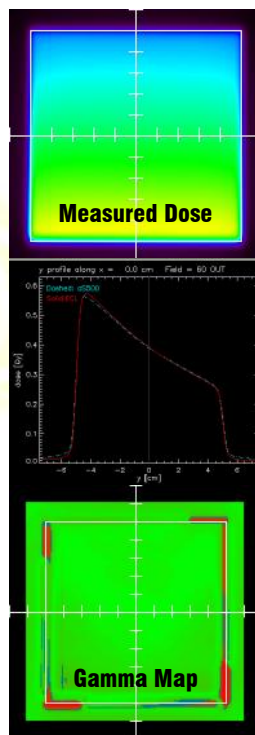
**Qualitative analysis of the TPS performance after initial beam data collection** - by comparing calculated open fields and wedged fields module Athena provides great help to quickly assess TPS output with the real beam without need to use film or water phantom.

## 1. Open field evaluation - TPS vs. measurement comparison at 2D level.



## 2. Wedge field evaluation

Mechanical and dynamic wedge calculation vs. measurement analysis using profiles and gamma method based on dose maps.



## 3. Output and wedge factors evaluation - comparison of the field factors calculated by TPS vs. measured.

| Field name | Wedge type | Wedge angle | Wedge orient | OF ECL  | DF PV  | Diff % |
|------------|------------|-------------|--------------|---------|--------|--------|
| 10 IN      | DYNAMIC    | 10.00       | IN           | 0.950   | 0.953  | -0.3   |
| 15 IN      | DYNAMIC    | 15.00       | IN           | 0.920   | 0.931  | -0.6   |
| 25 IN      | DYNAMIC    | 25.00       | IN           | 0.878   | 0.881  | -0.4   |
| 30 OUT     | DYNAMIC    | 30.00       | OUT          | 0.852   | 0.853  | -0.1   |
| 45 OUT     | DYNAMIC    | 45.00       | OUT          | 0.768   | 0.773  | -0.5   |
| 60 OUT     | DYNAMIC    | 60.00       | OUT          | 0.657   | 0.662  | -0.7   |
| 10X10 OPEN | NONE       |             |              | REF ECL | REF PV |        |