RELATIVE DOSIMETRY IN SMALL FIELDS: WHICH DETECTOR TO CHOOSE ?

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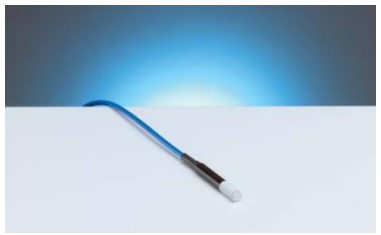
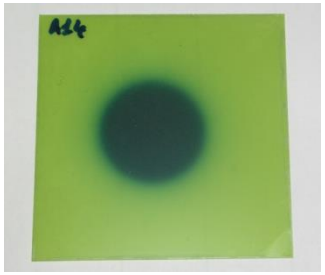
1- Introduction

- Small field dosimetry is a challenging area
- No ideal detector exists. Recommendation: use at least three different suitable types (IPEM, 2010[1])
- Only one set of measurement is used by the TPS





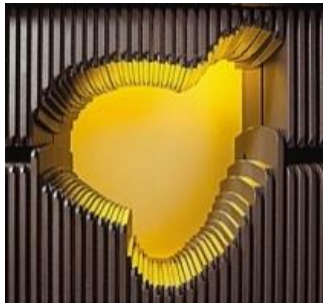
- **<u>Purpose</u>**: compare several dosimeters and select the adequate one

[1] *Institute of Physics and Engineering in Medicine, 2010. Small field MV photon dosimetry. Report 103*

2- Materials

2.1. MLC shaped beams:

- MLC field sizes: 30, 20, 10 and 5 mm
- Energies: 6 MV, 6-FFF MV, 16 MV
- Novalis TrueBeam STx (Varian, Brainlab)
- Measurement of depth dose, radial profiles and output factors



Dosimeter	Diameter of the sensitive volume
Diode IBA Razor	0.6 mm
Diamond PTW60017	2.2 mm
Ionization chamber IBA CC01	2 mm

2- Materials

2.2. Circular cones:

- Cone diameters: 15, 12.5, 10, 7.5, 6, 5, 4 mm
- Energies: 6 MV, 6-FFF MV
- Novalis TrueBeam STx (Varian, Brainlab)
- Measurement of depth dose, radial profiles and output factors

Dosimeter	Dimensions of the sensitive volume
Diode IBA Razor	Diameter: 0.6 mm
Diamond PTW60017	Diameter: 2.2 mm
Diode IBA SFD	Diameter: 0.6 mm
EBT3 films	Resolution: 0.1 mm

3- Results

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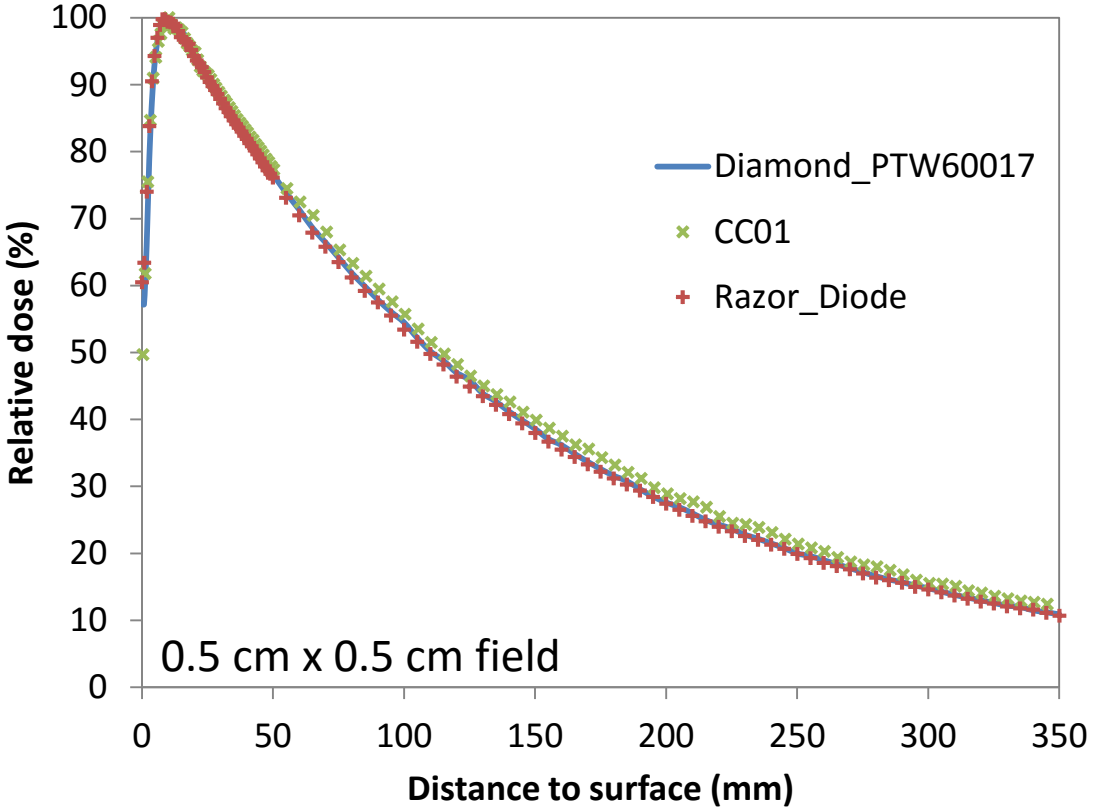
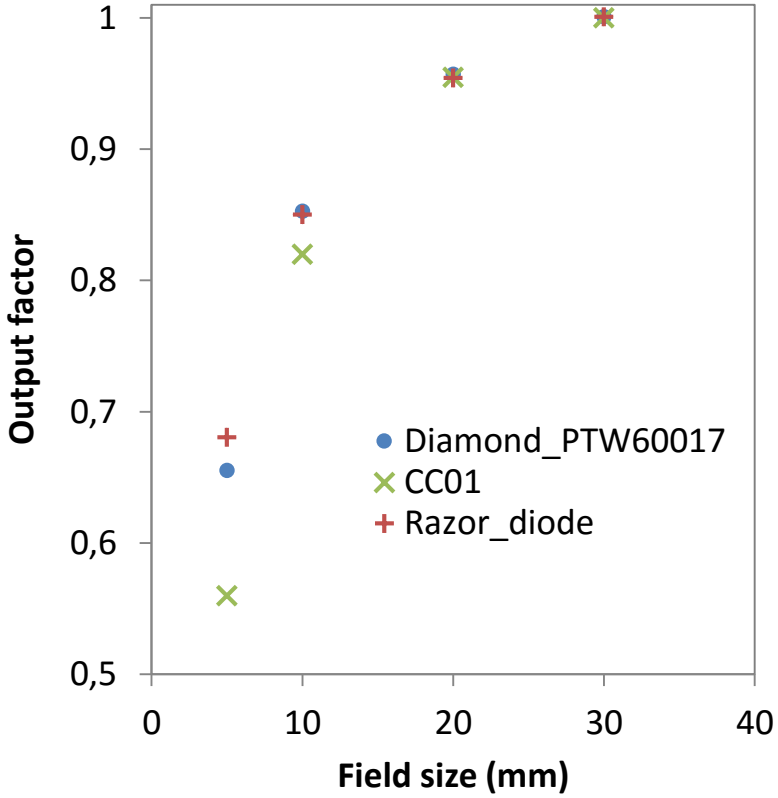
3.1. MLC shaped beams (similar results for all energies)





- Good agreement between Razor diode and PTW diamond
- CC01: noisy measurements and high Z electrode

3- Results

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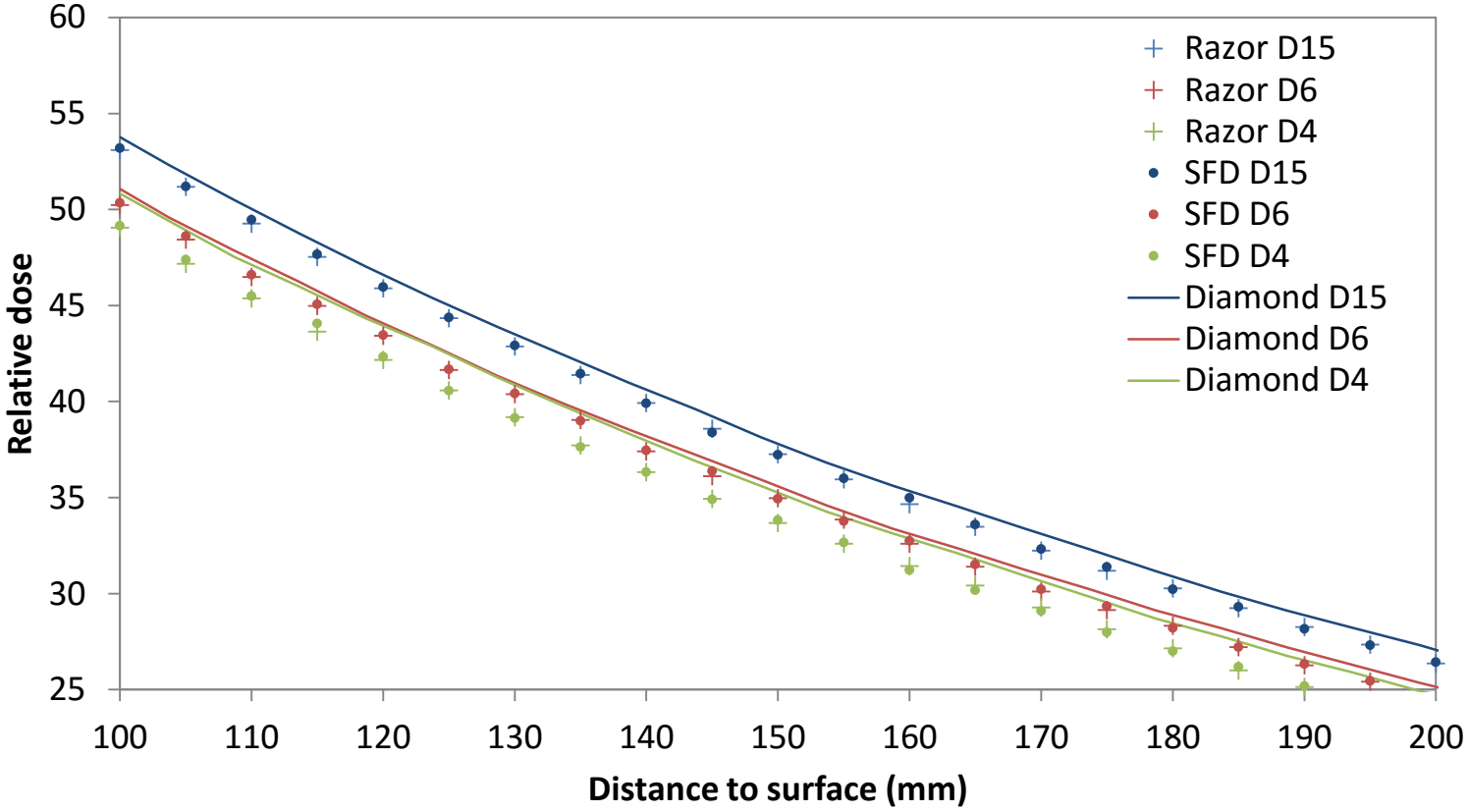
3.2. Circular cones (similar results for all energies)



- Good agreement between the Razor and the SRS diodes
- Overestimation by the diamond due to its large sensitive volume

3- Results

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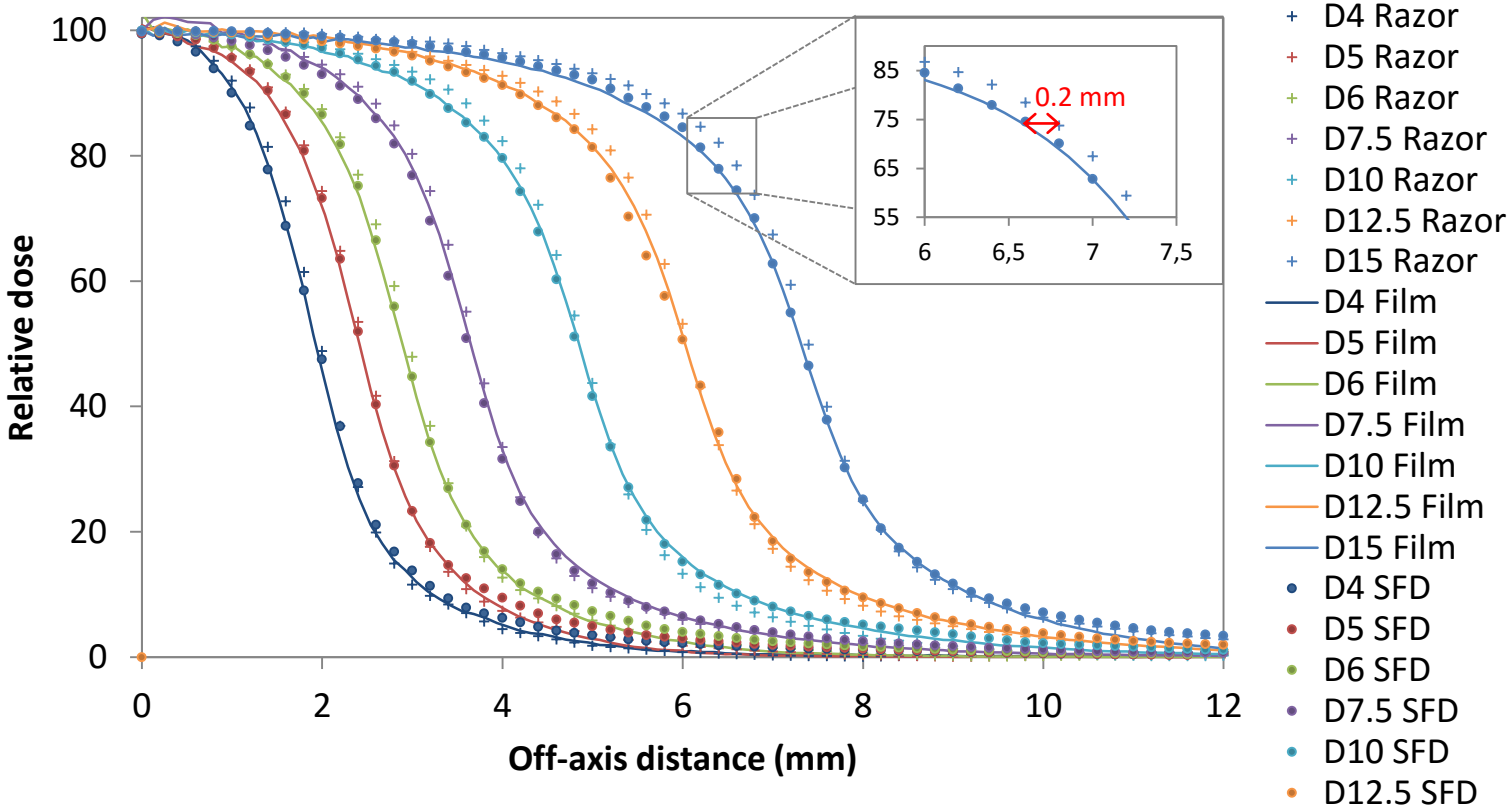
3.2. Circular cones (similar results for all energies)



- Good agreement between SRS diode and EBT3 films
- Differences smaller than 0.2 mm with the Razor diode

3- Results

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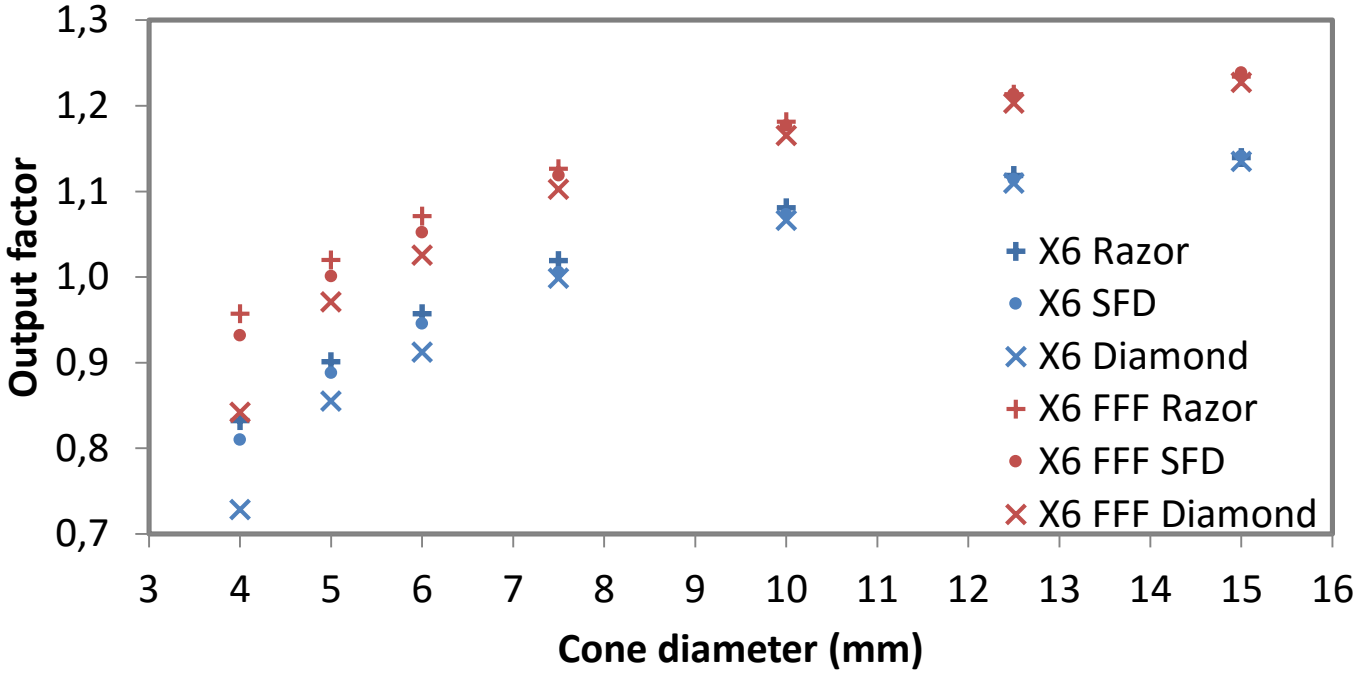
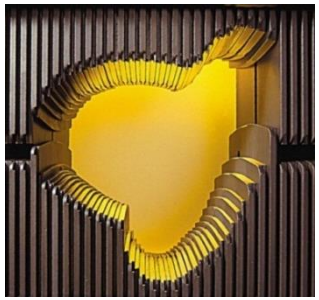
3.2. Circular cones



- Reproducibility of measurements < 1 %
- No $k_{Q_{msr},Q}^{f_{msr},f_{ref}}$ applied
- Good agreement between the Razor and the SRS diodes
- Large sensitive volume of the diamond => underestimation

4- Conclusion

- MLC shaped beams:
  - CC01: high Z electrode, not suitable for small field dosimetry
  - Razor diode selected for depth dose and profile measurements
  - Mean of Razor diode and PTW diamond selected for output factors:
    - 1 cm x 1 cm: 0.3 % difference between diode and diamond
    - 0.5 cm x 0.5 cm : 3.5 % (not used in clinical practice)



- Circular cones:
  - PTW diamond: large sensitive volume, not suitable for very small field dosimetry
    - Difference between diode and diamond > 2 % for cones smaller than 1 cm diameter
  - Razor diode selected for all measurements