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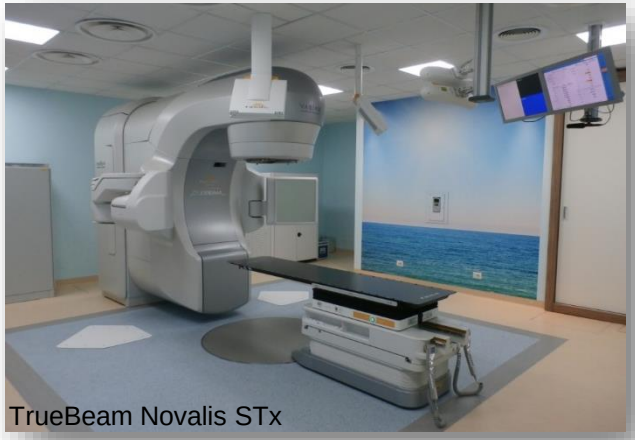
Preliminary comparison between two different stereotactic machines, robot based and linac based, by means of a 3D phantom

A. K. Reyes Ramos(a,b)*, L. Strigari(a), M. D'Andrea(a), G. Iaccarino(a), G. R. Borzì(c), G. Candiano(d), N. Franza(e)

(a) IFO, Roma, Italy
(b) ICTP, Trieste, Italy
(c) REM Radioterapia, Viagrande (CT), Italy
(d) Fondazione IOM, Viagrande (CT), Italy
(e) DosimETrICA, Nocera Inferiore (SA), Italy
*Email: antonyreyesr@yahoo.es


TrueBeam Novalis STx

Different stereotactic machines


Cyberknife

Purpose: to evaluate differences in dose distributions

Cylindrical phantom with diodes distributed on two orthogonal planes

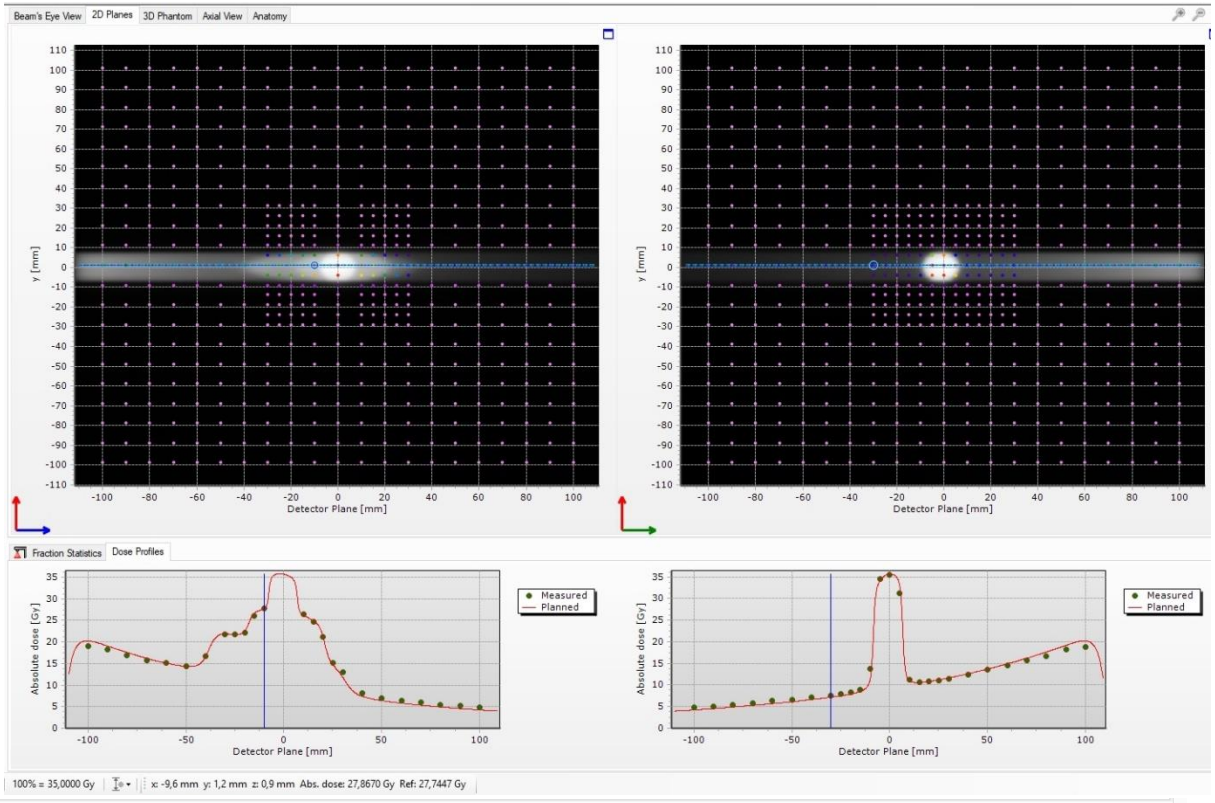
Cyberknife plan setup was converted into linac coordinates (gantry and couch angles) with the same stereo cone size.

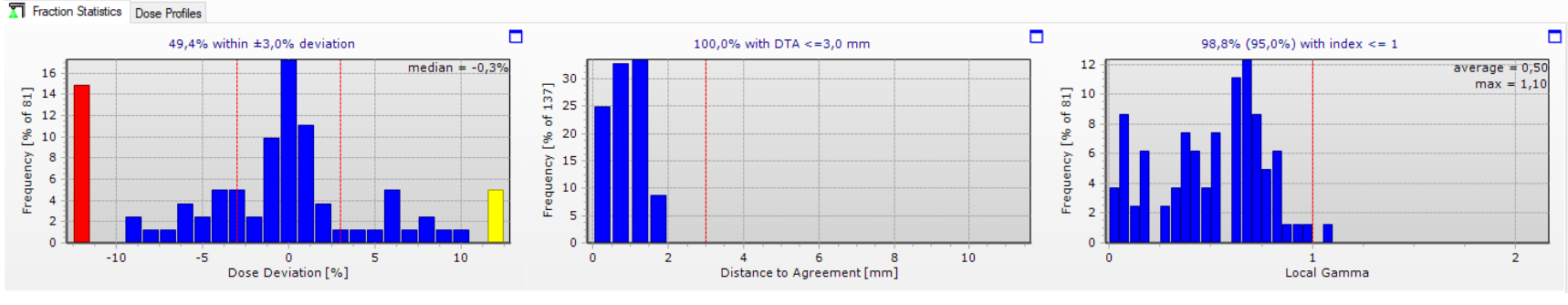
Plan comparison on TrueBeam Novalis STx

- ✓ 6MV flattened filter
- ✓ 15 mm cone

Plot of cross profiles of the 3D phantom:

- ✓ Measured data: green points
- ✓ Calculated data on TPS: continuous red line



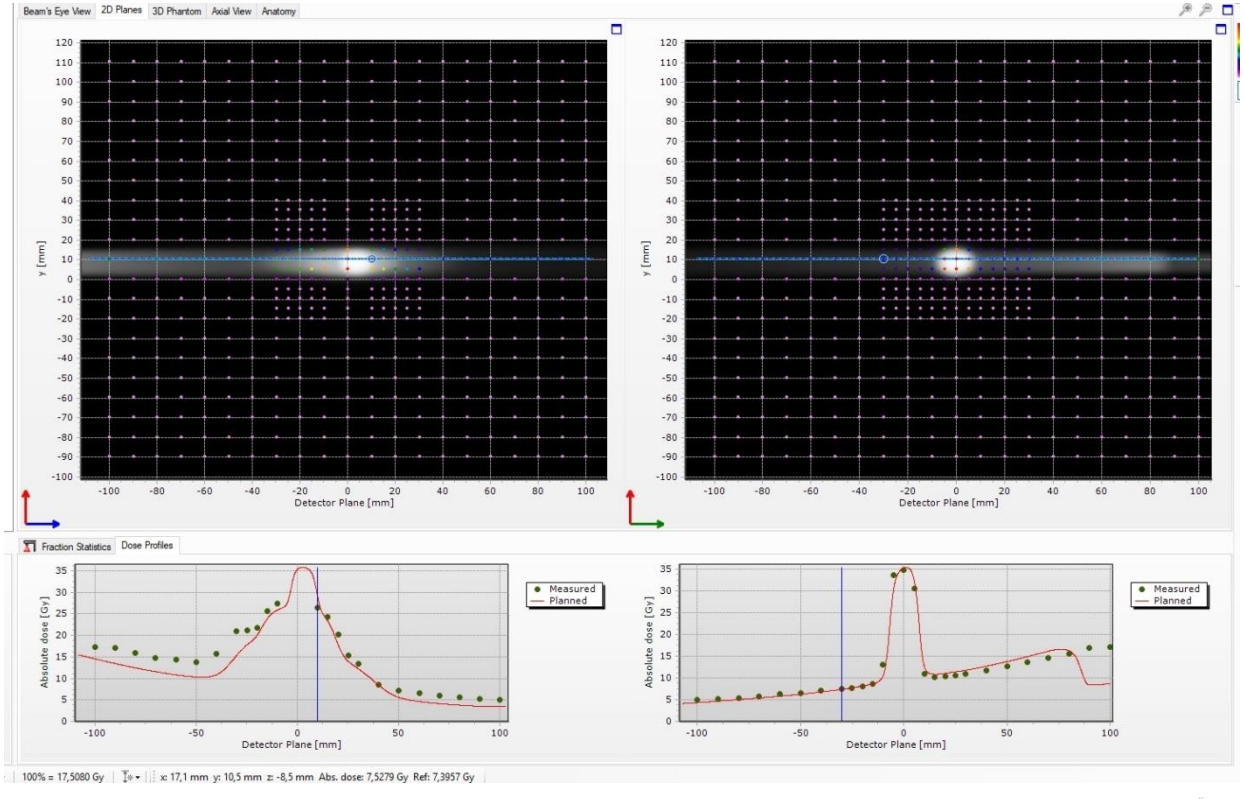


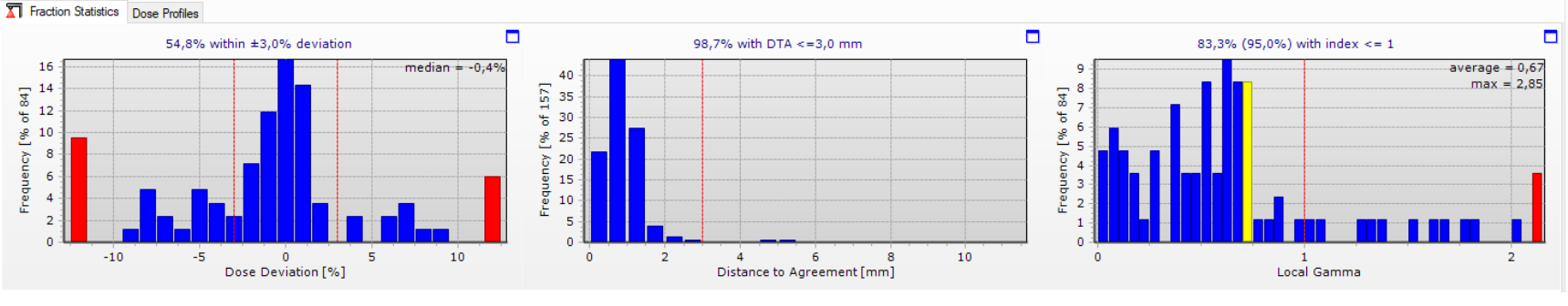
Plan comparison between the two machines

- ✓ 6MV FF and 6MV FFF
- ✓ 15 mm cone

Plot of cross profiles of the 3D phantom:

- ✓ TrueBeam measured data: green points
- ✓ CyberKnife measured data: continuous red line





Results: The 3D phantom was used on both machines with same correction factors derived from linac. Linac measurements compared with linac calculated data showed a good gamma agreement for both energies (98.8% 6MV FFF, 99.0% 6MV FF, 2%-2mm threshold 20%). Measured dose deliveries for linac and robotic were compared obtaining gamma values of 84.1% for 6MVFFF and 82.1% for 6MV FF (2%-2mm, 20% threshold local gamma).

Conclusions: The deliveries of two machines were similar in terms of dose fall, dose coverage over target, and in general clinical acceptance of the plans. Further considerations involving differences due to Pencil Beam approach of the two TPS used, correction factors to apply for the geometry of robotic knots entrance beams and anisotropic response of the 3D phantom, impact on general accuracy of the QA system and should be considered carefully and applied.