Verification of Lung and Kidney Shielding in Total Body Irradiation Using an EPID with Extended Image Detection Unit

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- 2 Varian Clinac 2300C/D + 1 Clinac 600C
  - 2 static + 1 dynamic MLC
  - Enhanced Dynamic Wedge
  - Varis R&V
  - Portal Vision (Mark 2)
- Picker CT PQ5000
  - 2 VoxelQ & AcQSim
- 2 CadPlan TPS Servers

Total Body Irradiation Machine and Treatment Room Layout

- ap beam: prone position
- pa beam: supine position
- SSD = 5.10 m

Portal Vision XL: An EPID with Extended Image Detection Unit

- 2 x 2 standard PortalVision IDUs
  - sensitive area of 65 x 65 cm²
  - 512 x 512 Electrodes = 262144 pixels
  - spatial resolution of 1.27 x 1.27 mm²
  - Source-detector distance of 600 cm
- Build up plates optimized for 6 MV
- Lead shielding for electronic parts
- Fully closed cover mounted on rails
PortalVision XL System Overview

TBI treatment planning: Multiplanar Reconstruction

TBI treatment planning Virtual Simulation

TBI treatment setup

PortalVisionXL User Interface

TBI treatment planning Lung tissue density

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Pelvic CT

Axial CT

3D Reconstruction

Digitally Reconstructed Radiograph

Patient prepared for treatment in supine position, radiopaque markers on anterior skin

PortalVision XL in operating position

TBI treatment planning Lung tissue density

\[ \rho_{\text{Lung}} \left[ \text{g/cm}^3 \right] = 1 + \frac{\text{HU}}{1000} \, \text{(for HU < 0)} \]
Online Matching
Digitally Reconstructed Radiograph
Electronic Portal Image

Online Matching (cont’d)
Digitally Reconstructed Radiograph
Electronic Portal Image

Results and Discussion
• Easy to handle
• Fast and precise positioning
• Image acquisition time of about 2 seconds
• Patient dose varies between 0.8 and 5 mGy/image
• Image quality suitable for verification of lung and kidney shielding blocks in TBI
• Monitoring of patient movement during the treatment
• Fast and precise quantitative evaluation of setup errors
• In vivo transmission dosimetry (???)

The city of Ulm and the river Danube