

LDR-Brachytherapy of Prostate Cancer: Impact of Post-Implant Dosimetry on the Intraoperative Procedure

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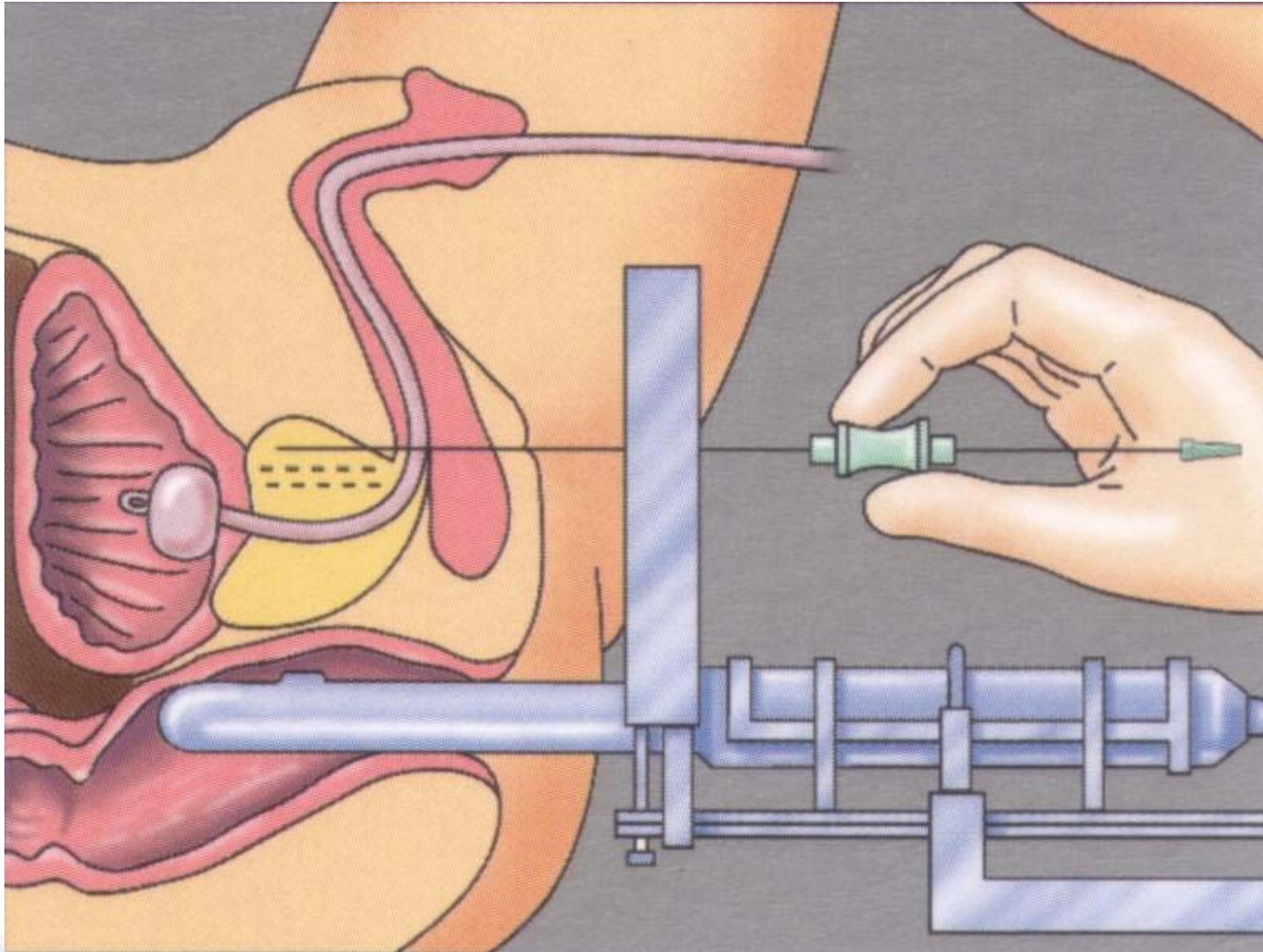
Radio-Onkologie, Lindenhofspital



**LINDENHOF
SPITAL**

 ROTKREUZSTIFTUNG FÜR KRANKENPFLEGE

Permanent Prostate Brachytherapy (PPB) - Principle



LDR Brachytherapy – permanent implantation of I-125 Seeds

Single seeds (0.8 x 4.5 mm)



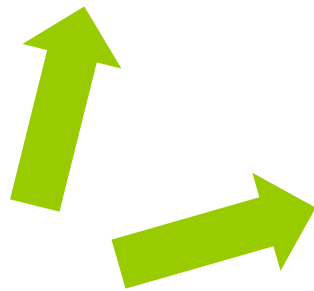
Iodine-125

- Low activity: 0.5 mCi (20 MBq)
- Low energy: 27-35 keV
- Half-life 60 days



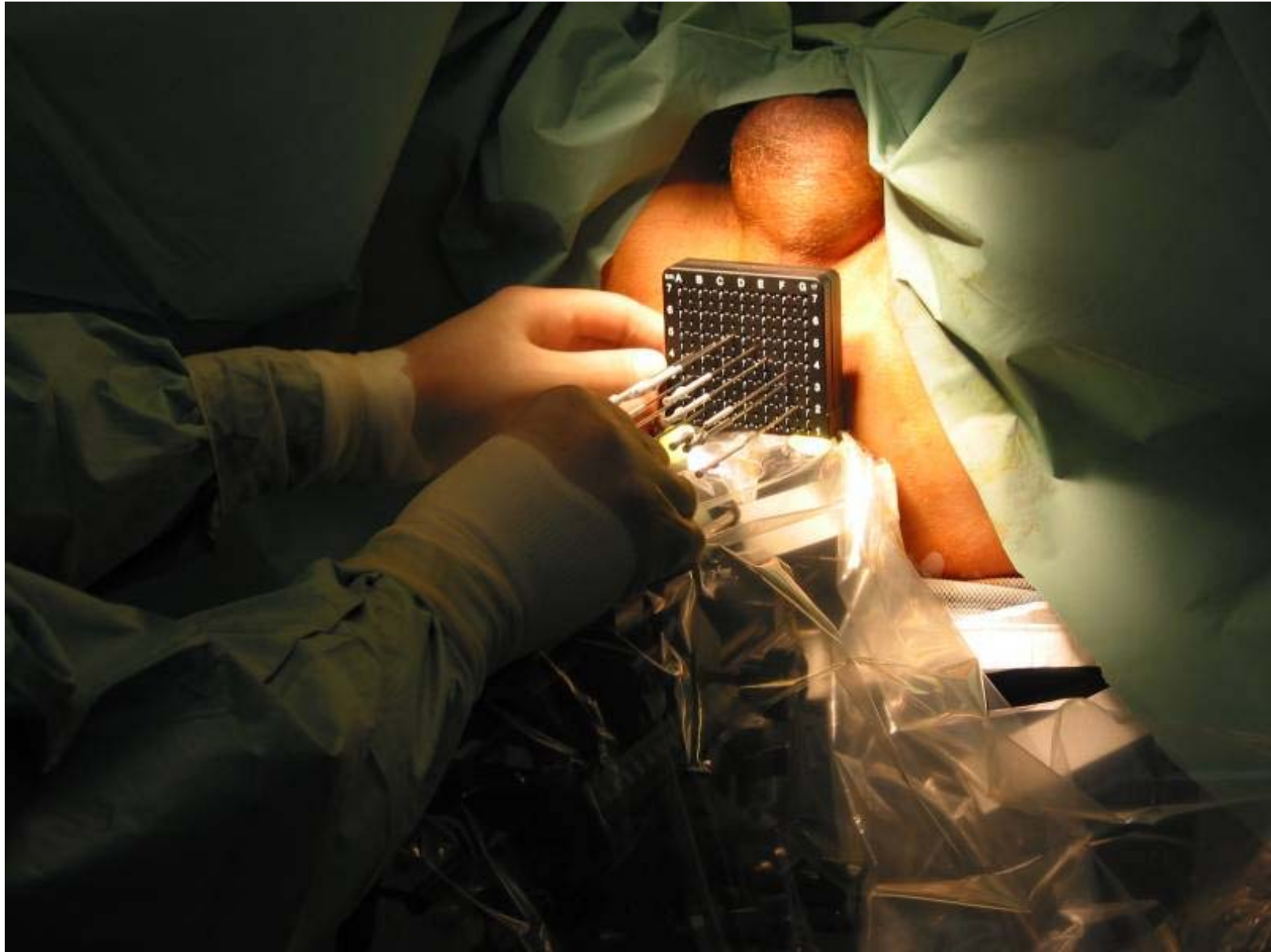
Several different **implantation techniques** in PPB

- Preplanning with CT and implantation with TRUS-guidance
- Preplanning on ultrasound
- Intra-operative (real-time) planning and implantation on US
- Interactive, dynamic, intra-operative planning and implantation with TRUS

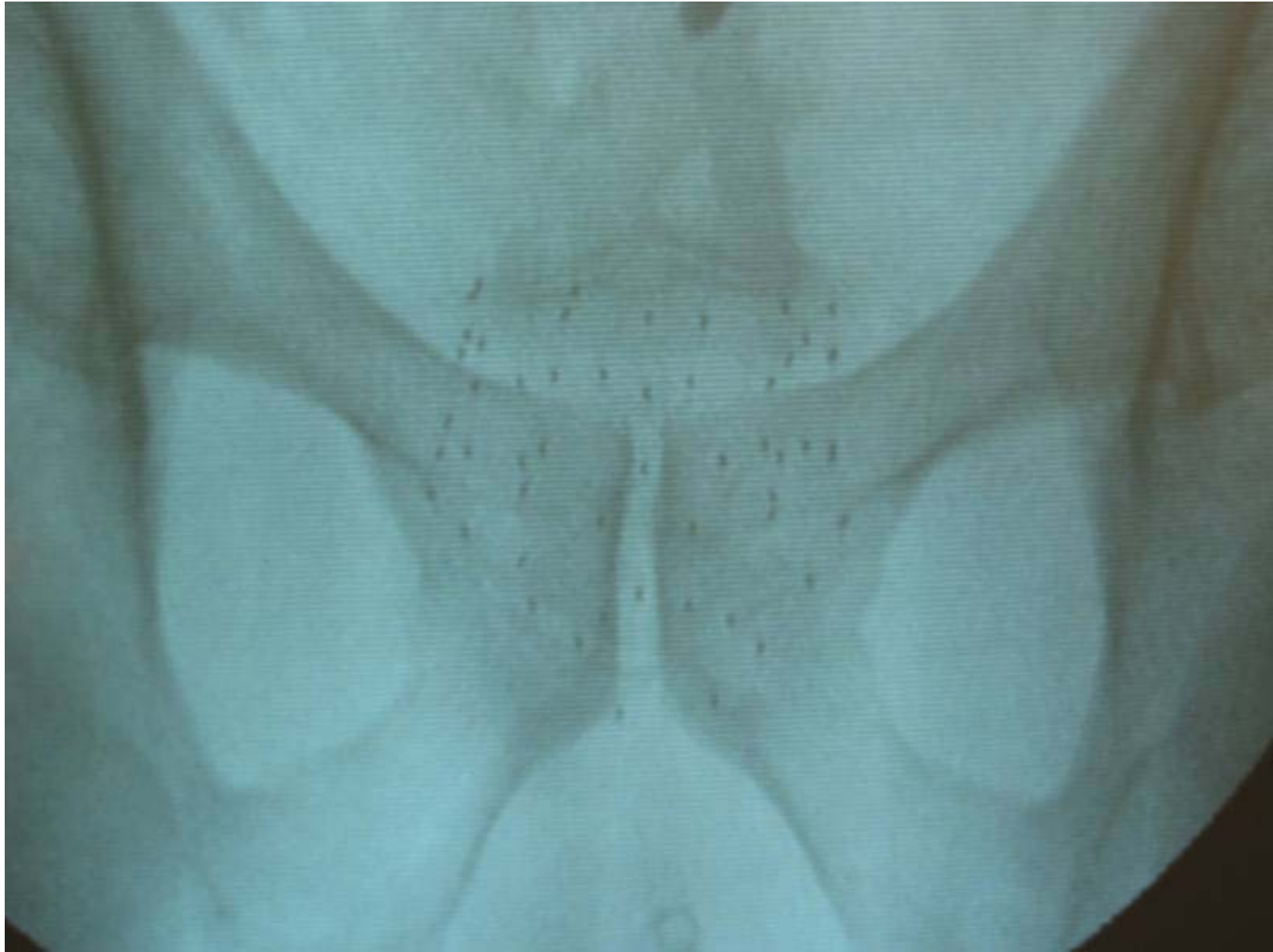


Peripheral loading vs homogenous loading

The last needle of the outer ring



Seeds on the fluoroscopy screen



Post-planning

Goals:

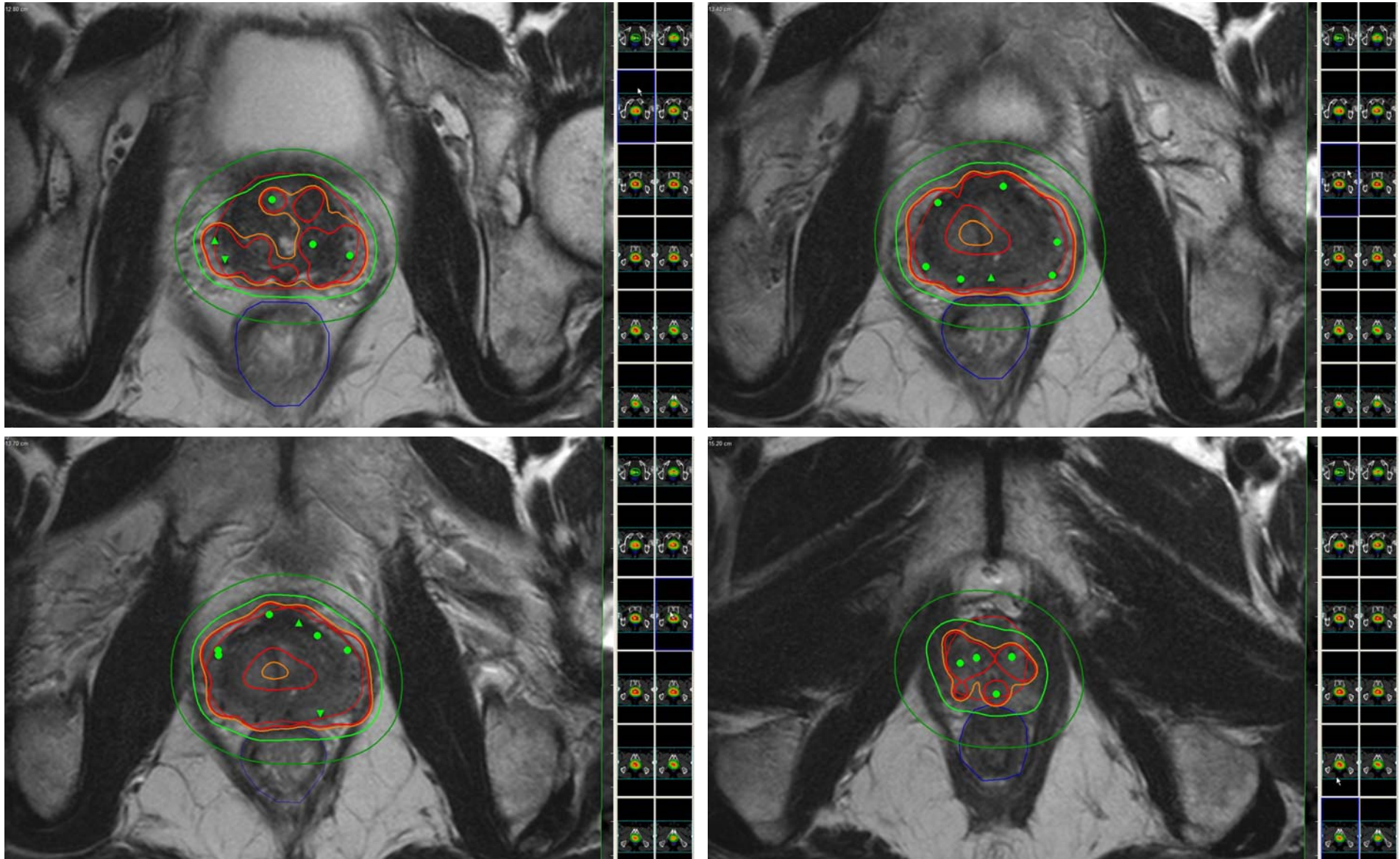
- Evaluation of the quality of the implant
- Detection of unfavourable dose distribution due to edema, seed loss or seed dislocation

6 weeks after implantation:

- **Fluoroscopy**: Seed-count
- **CT**: Identification of the seeds
- **MR**: Identification of prostate and rectum

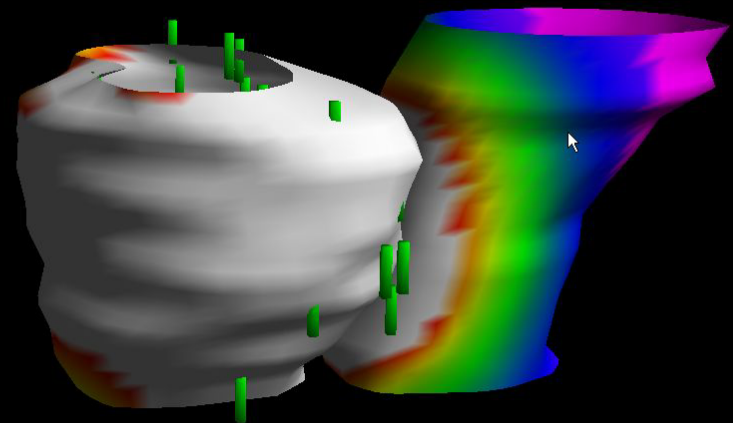
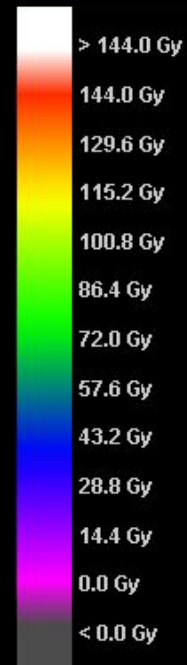
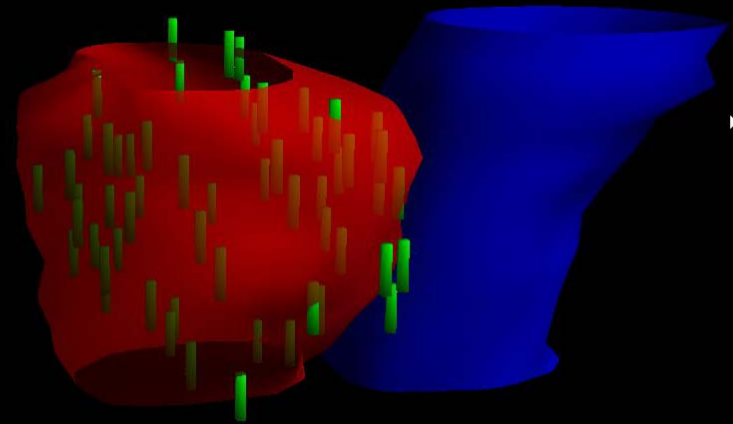
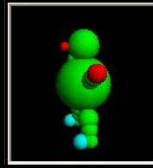


Postplanning: dose distribution on MR



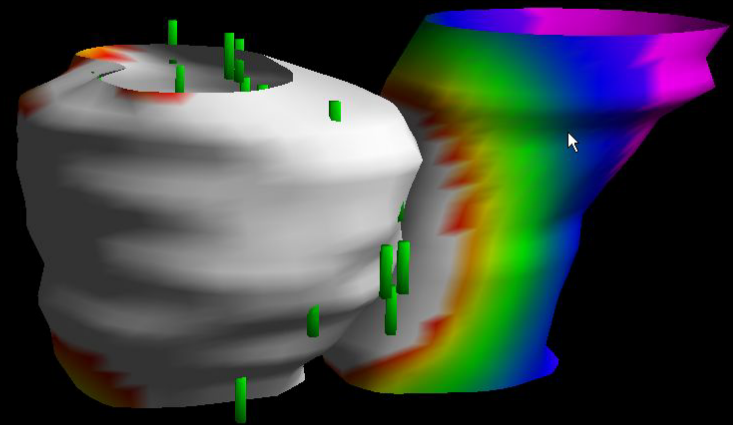
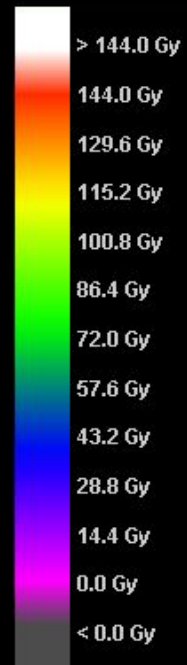
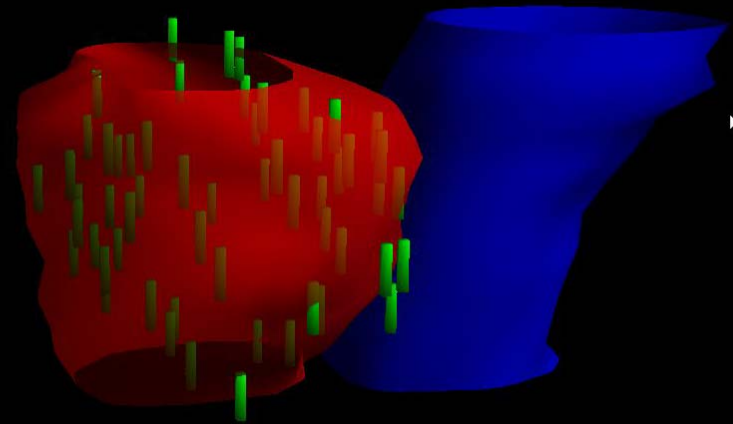
Post-planning:

3D-
reconstruction



Post-planning:

3D-
reconstruction



The role of the **radio-oncology core team** in PPB in our setting

Pre-evaluation of the patient	Referring urologist
Information of the patient	Urologist and Radiooncologist
TRUS for planimetric volumetry	Radiooncologist
Filling out the evaluation forms	Radiooncologist and Physicist
Decision on indication	Radiooncologist
Scheduling, seed-ordering	Radiooncologist and Physicist
<u>During intervention:</u>	
Positioning of the US-Probe	Radiooncologist
Outlining of organs	Radiooncologist
Plan-calculation, supervision	Physicist
Placing of needles	Urologist
Seed-implantation	Urologist or Radiooncologist
Postplanning	Radiooncologist and Physicist
Measurements of seed-activity	Physicist
Seed accounting/database	Physicist



Patients

- 127 pts. treated in 2005 – 2007
 - 2004 (since 4.6.): 10 Pts
 - 2005: 18 Pts
 - 2006: 36 Pts
 - 2007: 73 Pts
- 115 low risk, 12 intermediate risk
- all treated with single seeds I-125 in one single session
- Prescription dose 145 Gy
- no combinations with EBRT
- only occasional antiandrogens (n = 7)



Post-planning-results (general)

- Seed loss / seed migration 0.6% (30/127 pts, mostly SV):
no appreciable consequence on dosimetry
- no significant difference in prostate volume (based on MRI)
compared to the volume at implant time
 $V(\text{post}) / V(\text{intra}) = 1.01 \pm 0.1$



Dosimetric goals for CTV

- $D_{90} > 145 \text{ Gy}$
(Dose covering 90% of CTV)
- $V_{100} > 95\%$
(% of CTV receiving prescription dose)
- $V_{150} < 65\%$
(% of CTV receiving 150% of prescription dose)



Post-planning-results (CTV)

- D90 > 145 Gy (Dose covering 90% of CTV)
- V100 > 95% (% of CTV receiving prescription dose)
- V150 < 65% (% of CTV receiving 150% of prescription dose)

	mean	range
D90	163.9 Gy	131.8 - 202.9 Gy
V100	94.7 %	75.6 - 99.4 %
V150	62.3 %	34.6 - 83.7 %

- Problems in partially „cool“ implants:
ventrally at base of prostate:
normally not site of a tumour;
- no salvation procedures deemed necessary.



Post-Planning-Results (dosimetry)

- Relationship $D_{90}(\text{post}) / D_{90}(\text{intra})$
 - = quality marker for the precision of the implant:
Goal as close as possible to 1
 - 2005 & 2006: 0.86 ± 0.08
 - 2007: 0.91 ± 0.07
 - this difference is significant ($p=0.0003$)
- that allowed us to gradually decrease $D_{90}(\text{intra})$ at implant time without compromising the quality of the implants



Other results

- Rectal dose: Goal V100 < 1.3 cc: not fulfilled in 15 / 127 pts
(But: only 1 pt with rectal bleeding)
- Urethral dose: not evaluated in post-planning
(3/127 pts with temporary suprapubic catheter)
- No obvious correlation between D90 (or other parameters)
and postoperative urinary symptoms
- until now no biochemical failure



But still too early to presents results on
outcome (recurrence, toxicity)

Conclusions

- The quality of the PPB procedure and the resulting implants have been improved over time
- Post-implant dosimetry:
 - indispensable for the proper evaluation of an implant
 - feedback on the quality of the intra-operative procedure
 - hints on adjustments for future implants



Conclusions

- Our local organizational procedure (radio-oncological core-team, multiple urologists) seems to be effective and could be recommended also for other centers
- There is no difference in implant quality between a trained and an untrained urologist if guided by an experienced core team (physicist and radio-oncologist)



Outlook

- To overcome the problem of seed moving a few mm backwards during implantation:
 - Bard SourceLink[®] connector system
 - offers various selectable distances between sources

