



8th International
ISIORT Conference

September 25-27, 2014

Cologne/Germany

Cologne Marriott Hotel





HIRO

Heidelberger Institut
für Radioonkologie

Nationales Zentrum für
Strahlenforschung in der
Onkologie Heidelberg

getragen von:
Deutsches Krebsforschungszentrum
Universitätsklinikum Heidelberg
Heidelberger Ionenstrahl-Therapiezentrum



8th International ISIORT Conference
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UniversitätsKlinikum Heidelberg

New developments in IORT The Physics View

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Overview

- **Changes in IORT :**
the transformation from extending surgical margins to treating an extended PTV
- **Dose coverage of an extended PTV**
- **What can IORT technology do?**



A change in paradigm:

Extending surgical margins:

Macroscopic tumor removed,

but unresectable rest or infiltrated tumor bed remain

Clinical decision on tissues which require radiation to improve surgical result

→ Typically a few mm of tissue in the tumor bed

Further treatment decided later on base of clinical development

Treating an extended PTV:

Evidence from studies that infiltrated areas must be treated

Not completely surgically resectable

Can be treated later with EBRT (and chemo)

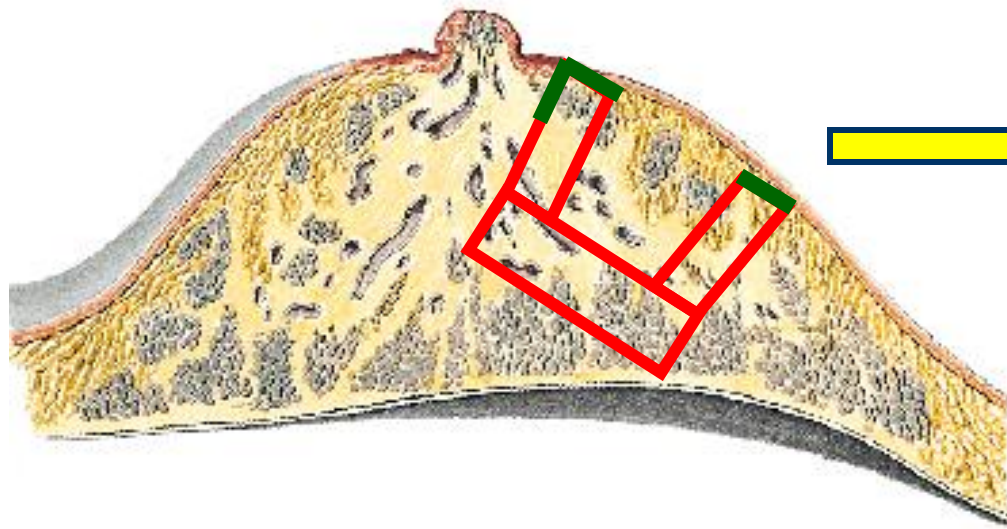
or

Can be treated immediatly during IORT

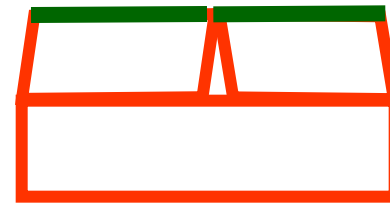
→ Preparation and treatment of an extended PTV

→ Requirements on dose coverage comparable to EBRT

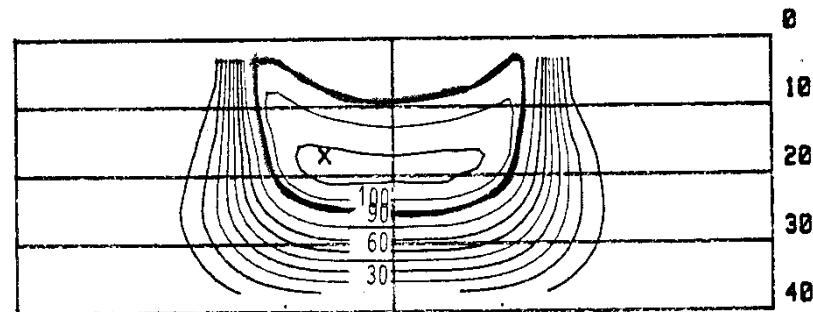
Treating an extended PTV : Target preparation



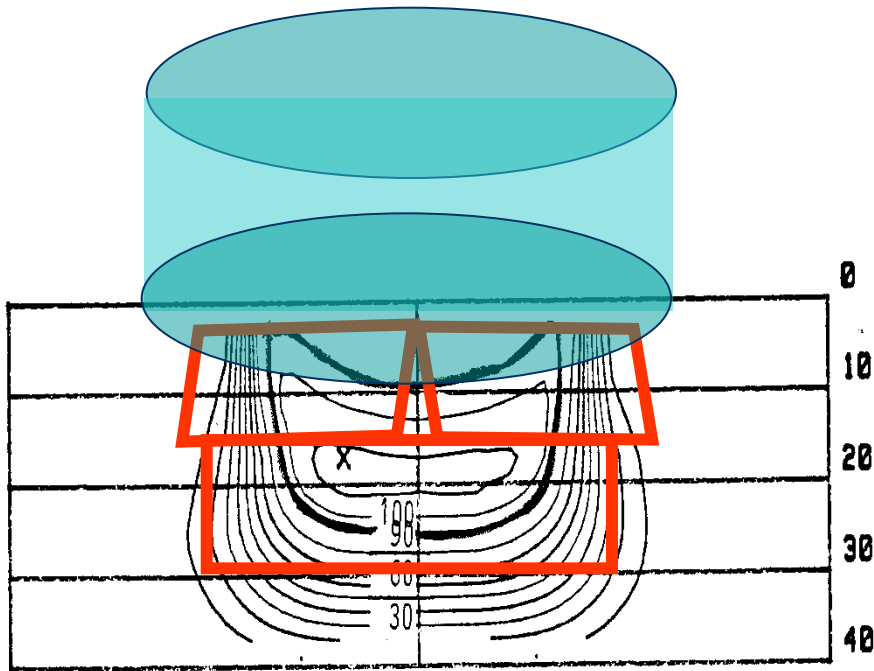
Target



- coverage of complete target with prescribed dose at 90% isodose
 - selection of applicator
 - selection of beam energy
- + documentation of all steps

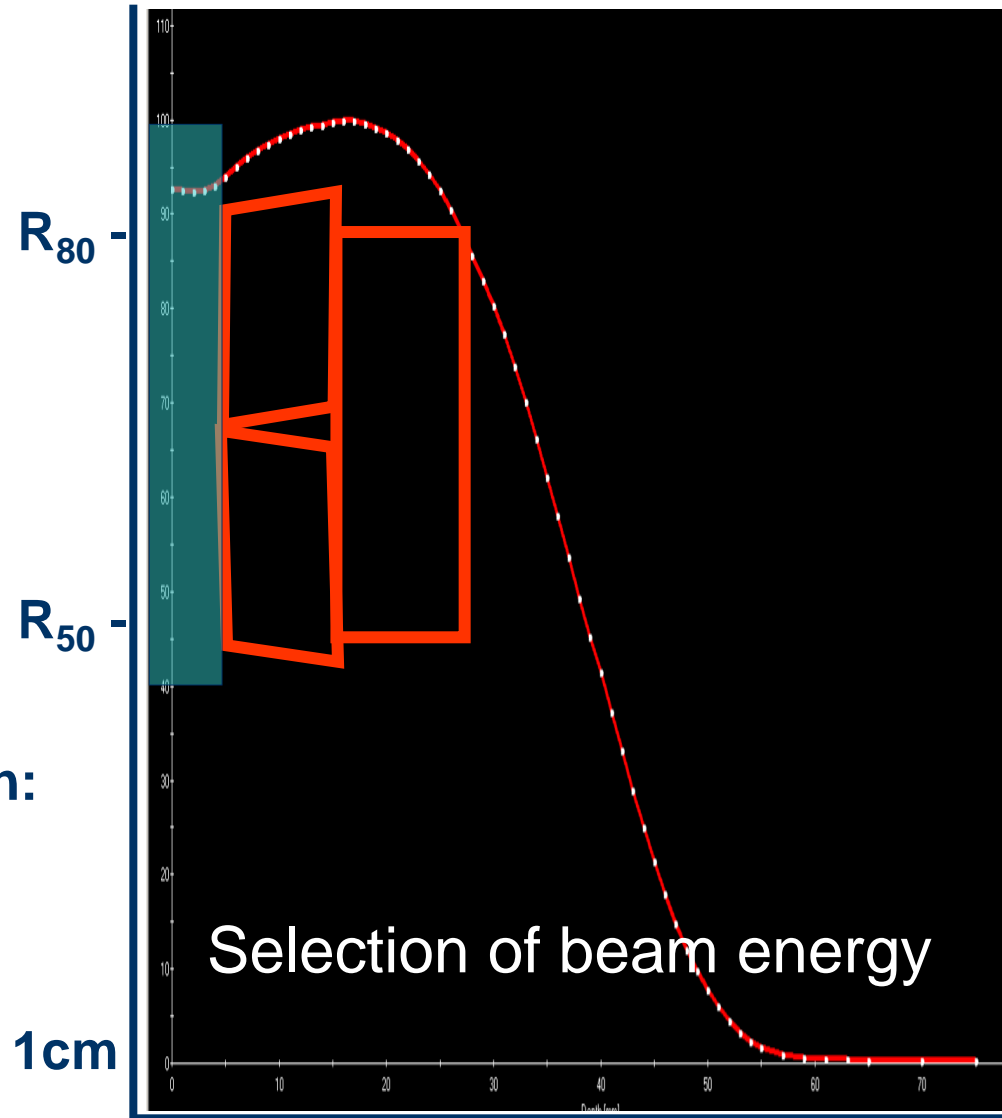


Dose coverage of an extended PTV



Typical electron dose distribution:
80-90% region
 ~ 1cm smaller
 than diam. of applicator

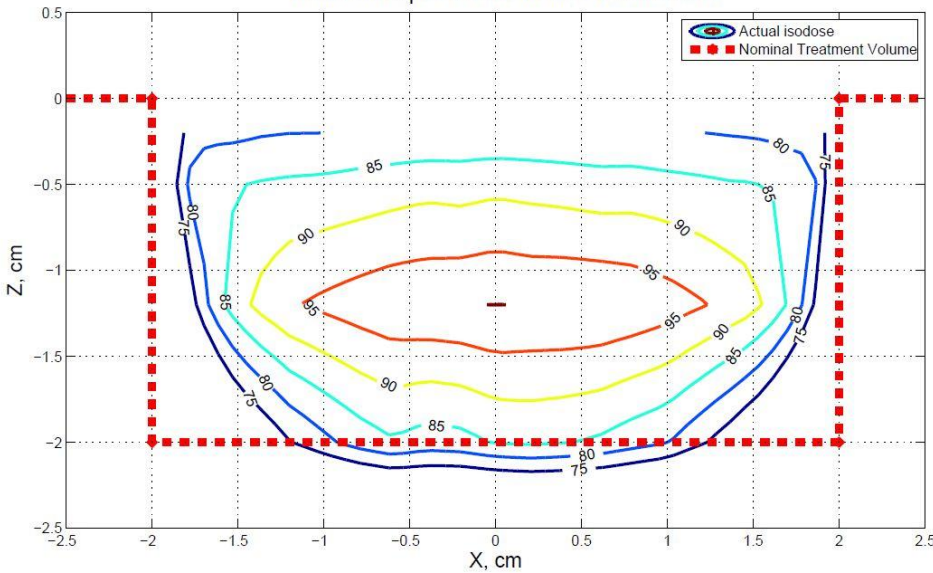
→ Applicator diameter must be min. 1cm larger than target





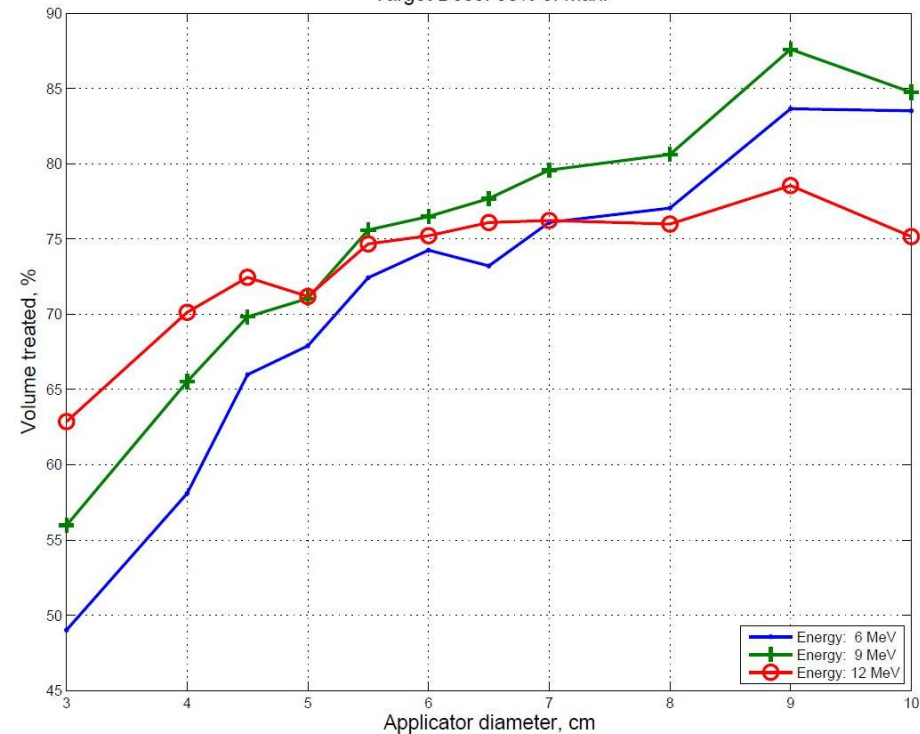
Dose coverage of an extended PTV

Isodose along Central Axis. Energy: 6 MeV. Appl: C4.0cm. Treat. Dose: 80%
Treatment depth: 2.0 cm Treated Volume: 59%

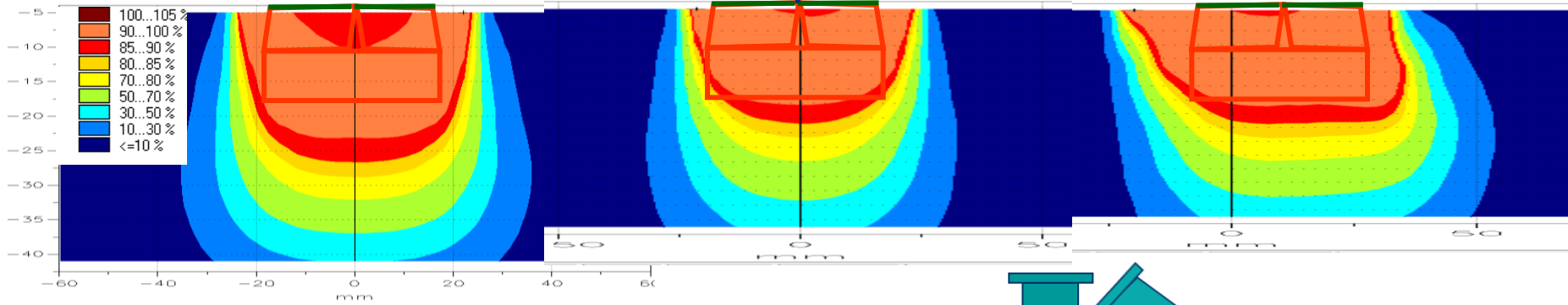
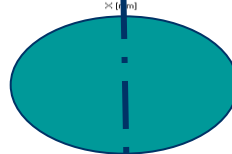
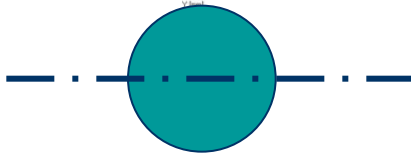
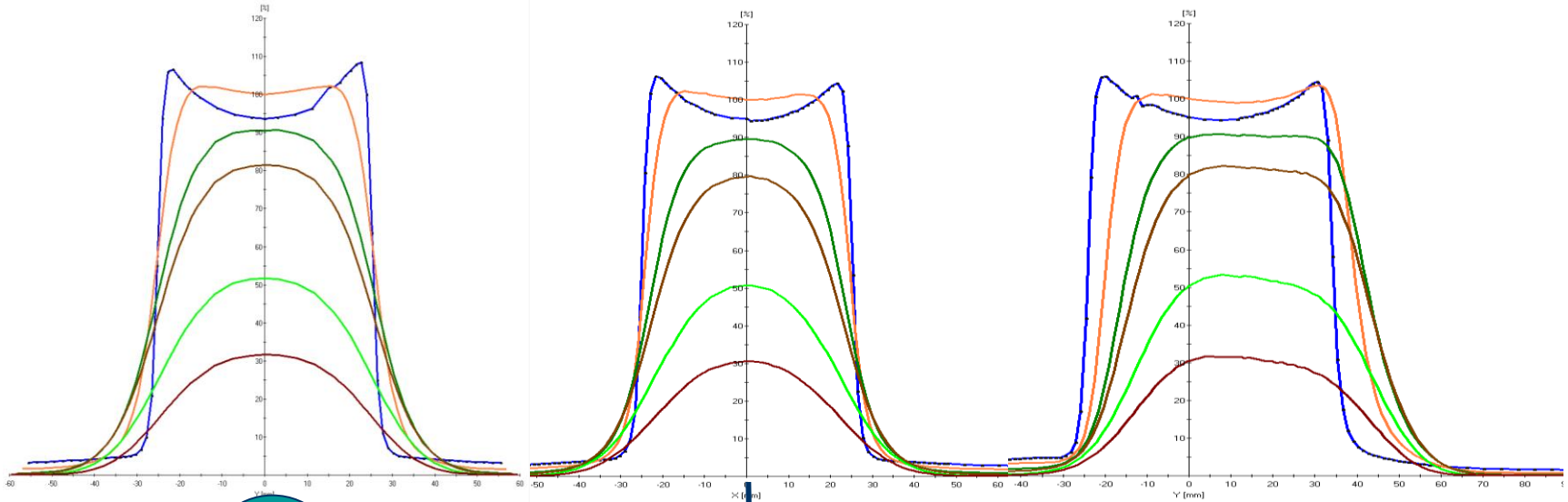


Krechetov 2014

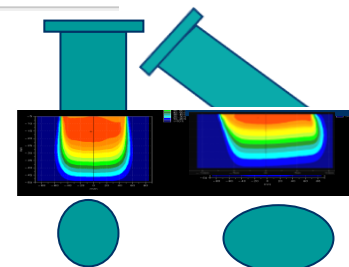
Treated Volume ratio for various applicators.
Target Dose: 80% of max.

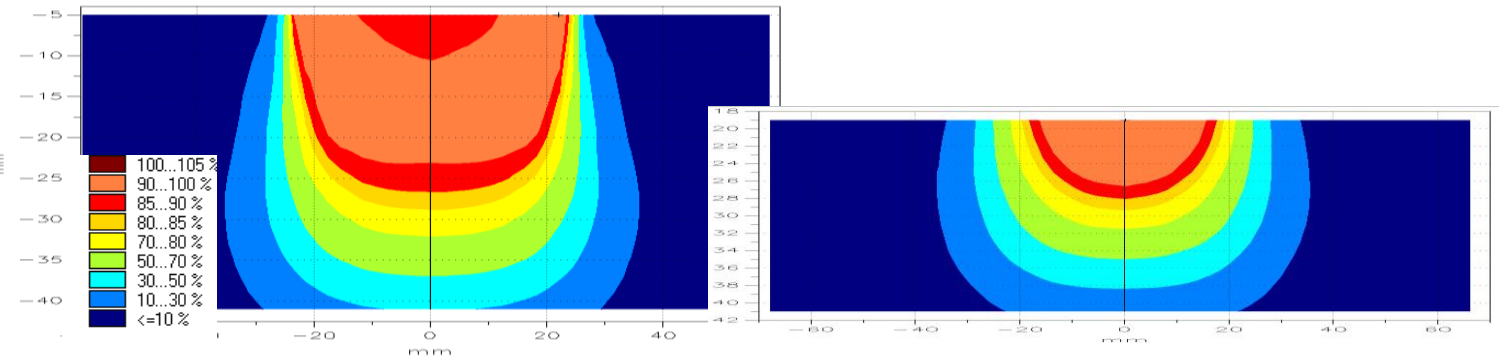
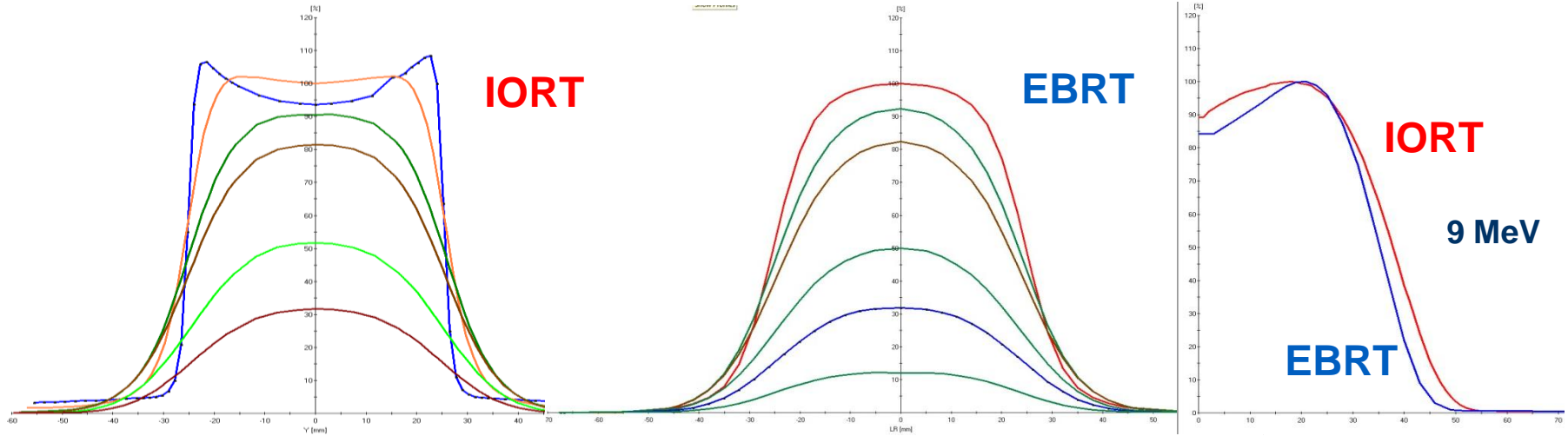


80% Volume decreases with applicator size
& with energy



5cm applicator with - w/o 30° bevel (10 MeV)
Beveled applicators are different!

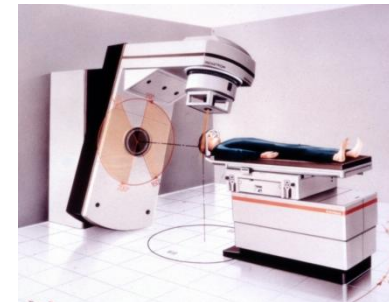




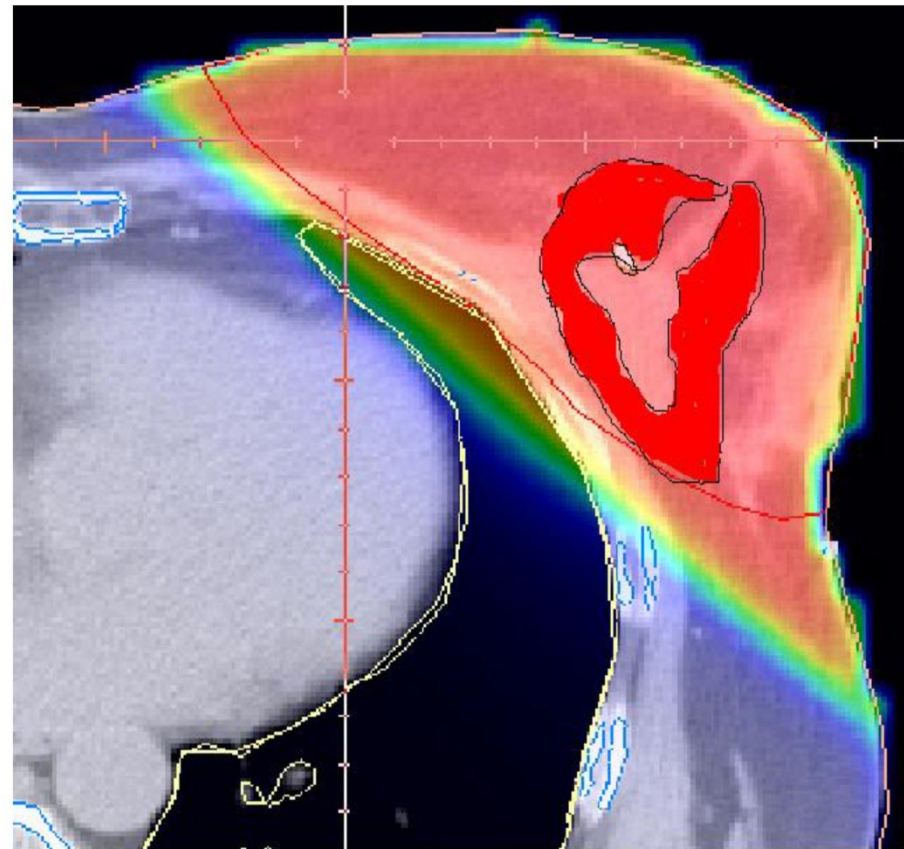
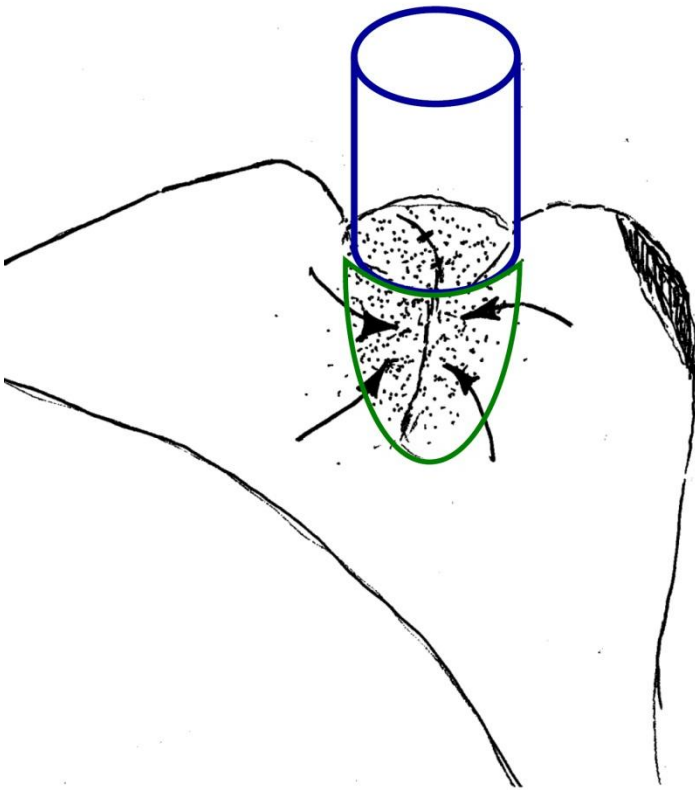
9 MeV / 5cm fields
IORT (Mobetron)



EBRT (Siemens KD2)



Treating an extended PTV : Target preparation



IORT planning system

gmV CaseID: RIO101 ANCU
Configuration File: PB_LaLuz_320G_90B_b15_d80_E6_INTRA.xml

radiance

Dosimetry Planning

PencilBeam_LALL2

SSD 1350 (mm)

Ref Point

Dose (cGy) Dose % Rate MU

0 : 90 100 0.0

Angulation (Degrees)

0 15 30 45

Diameter (mm)

40 70 90

60 80

Energy (MeV)

6 12 20

9 16

Isodose Curves (2D-3D)

Dosimetry Planning

Segmentation

Viewing Tools

Adobe Updater
Adobe Updater necesita la participación del usuario

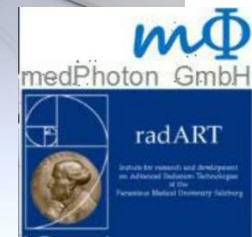
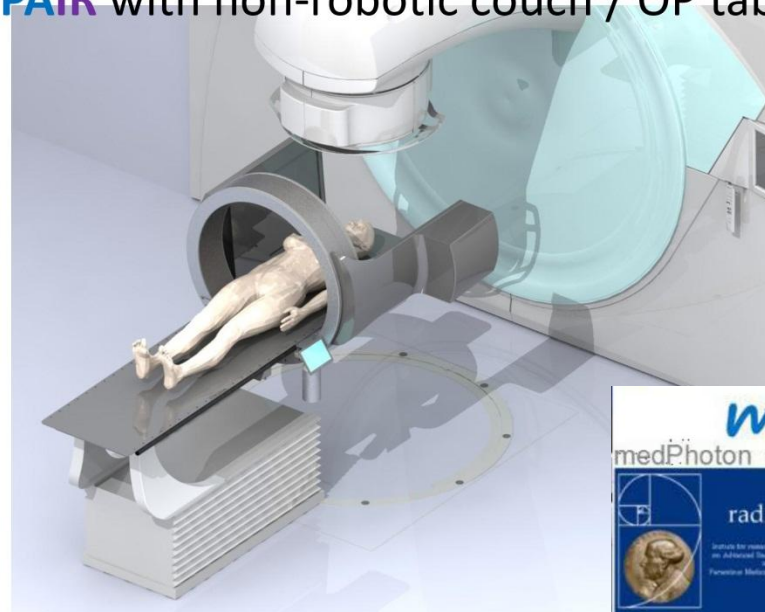
Hospital Gregorio Marañón
Primera Simulación de RIO con Imagen
Intraoperatoria
24 de febrero de 2011
Dra. González San Segundo y Dr. Santos (Oncólogos)
Dres. Cuervo y Calvo (Cirujanos Traumatólogos)
Dr. de Diego (Anestesiología)
Dr. Pascau (UMCE)
Dr. López Bote y Dra. Jiménez (Radiofísica)
Emilio Andrés Santamaría y Srta. Cruz (Enfermería)
Rafael (Sanitario)
Elena, Maribel y Beatriz (Técnicos)



IORT Imaging



PAIR with non-robotic couch / OP table





Problems:

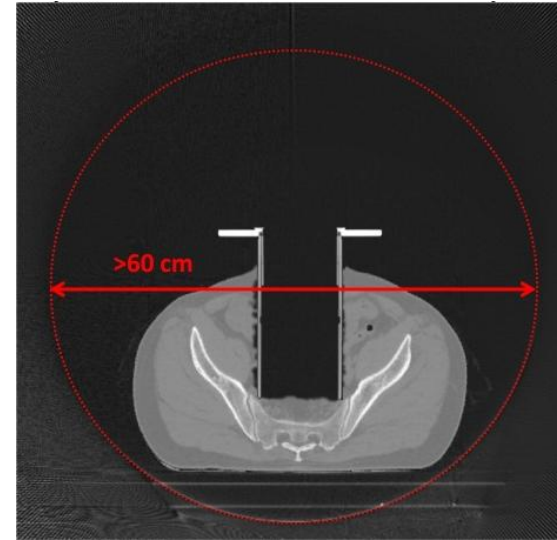
FOV :



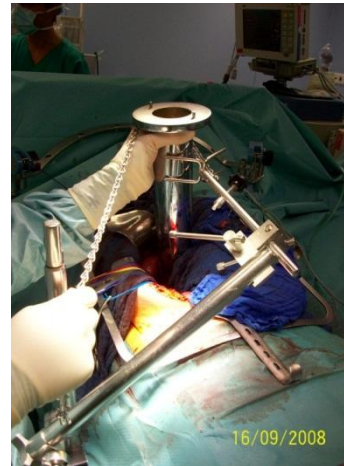
C-arm CBCT



needed :

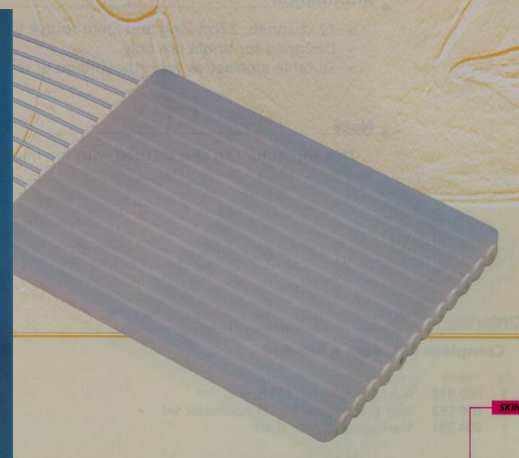
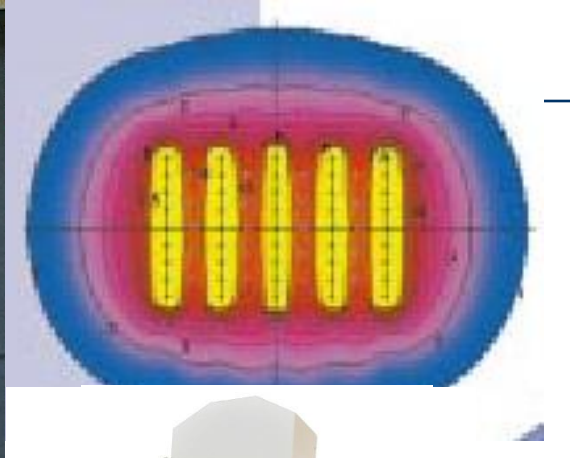


drapes / sterility



metal, & other artifacts
image distortions

- Correct calculation of Hounsfield units / density
- **Time** for: imaging - reconstruction - segmentation – planning
- **? Segmentation of IORT target ?**



Dose coverage and IORT technology

Different machines have different advantages and disadvantages:

- Penetration
- Shielding requirements
- Mobility
- Set-up procedures
- Beam stop & table placement
- Monitor stability
- Energy stability
- Radiation Workload
→ Dose consumption for QA !



- No single IORT machine is ideal für all purposes
- possibly several technologies should be available for an extended IORT program

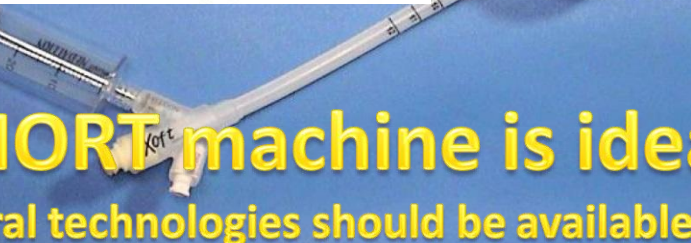
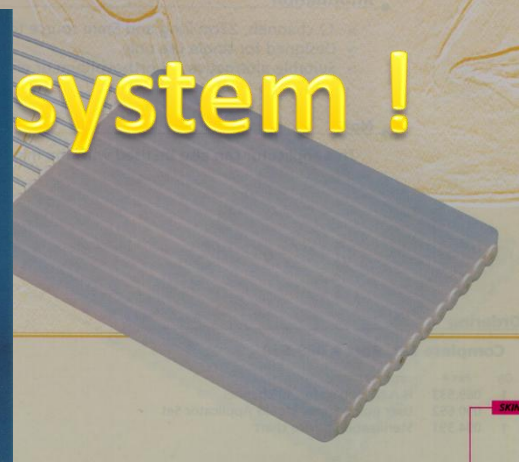


It is time to develop IORT towards treating

- individually adapted**
- conformal**
- extended**

target volumes

We need an IORT planning system !



➔ No single IORT machine is ideal für all purposes
➔ possibly several technologies should be available for an extended IORT program