



IMRT in Austria- An Overview

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Contents

- Where in Austria is IMRT performed ?
 - University Vienna (AKH)
 - University Graz
 - Donauspital Vienna (SMZO)
 - Kaiser Franz-Josef-Spital Vienna (KFJ)
- Common experiences
- Future of IMRT in Austria



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*IMRT at the department of
radiotherapy and
radiobiology, Univ. of
Medicine, Vienna*

WFO SCHMIDT (OeGMP); IMRT in Austria – An Overview; Würzburg, Feb. 19/20, 2004

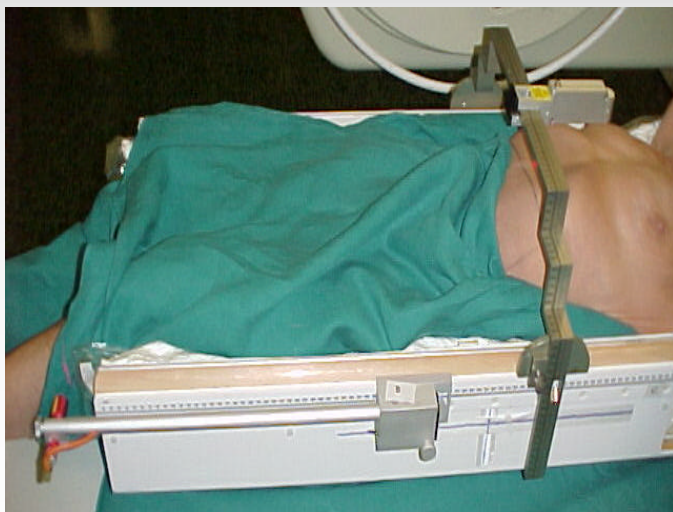


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Infrastructure

- † *Linac: Elekta Precise*
 - † *segmental MLC technique*

- † *Immobilization:*



*Head and Neck-System
(Brainlab)*

Bodyframe (ELEKTA)

ExacTrac (BrainLAB)

- † *Planning Systems:*

- † *Helax-TMS 6.1A.1 (Nucletron)
[clinical]*

- † *Brainscan 5.2 (Brainlab) [R&D]*

- † *XIO (CMS) [R&D]*



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(Limited) Resources for IMRT

† *One (out of 4) linac is
dedicated to precision RT*

† *cranial SRT*

† *Image Guided RT*

† *Extra-cranial SRT*

† *IMRT*

† *Number of IMRT patients
needs to be limited for the sake
of R & D and routine SRT*

† *20 Patients*

† *5 Prostate**

† *12 H&N*

† *2 spinal tumors*

† *1 Thoracic wall*

**...Participation in a 3D-CRT
clinical trial 70 vs. 74 Gy*

† *do not want to change
protocol !!!*



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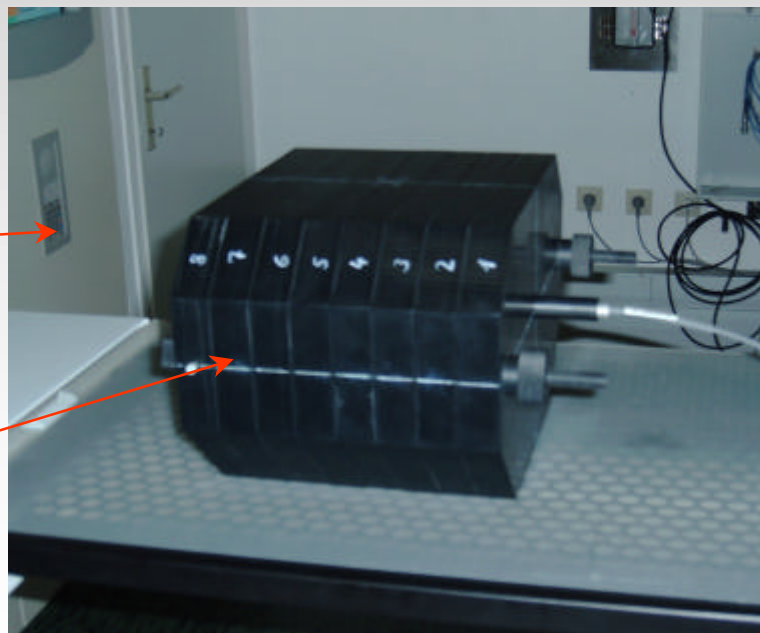
IMRT Verification & Dosimetry

- † Verification of a composite ‘hybrid’ plan
 - † Absolute Dose verified with IC
 - † Relative Dose verified with films in 3 axial planes (EDR2-Films, RIT 113)

- † in-house developed IMRT phantoms

- † small phantom (H&N)
- † large phantom (pelvis and thorax)

slabs to sandwich films

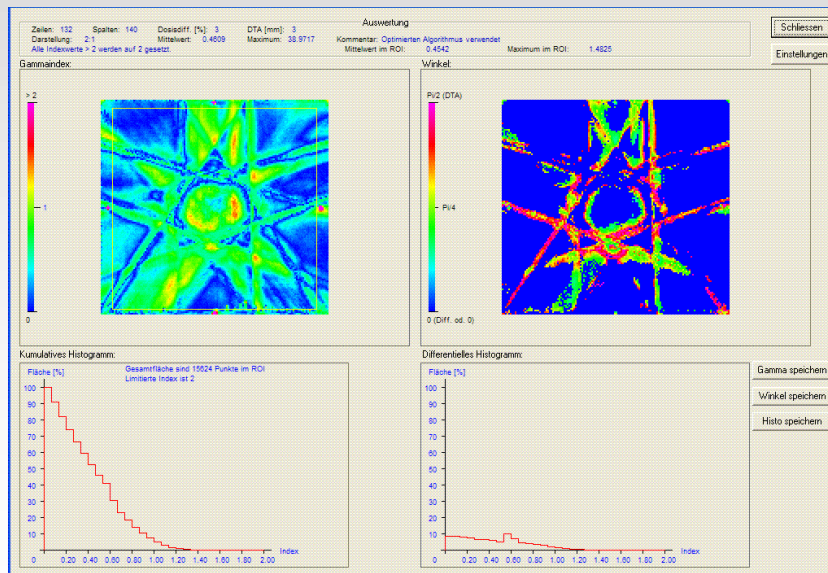




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IMRT Verification & Dosimetry

- † Film dosimetry method is based on normalized sensitometric curves
- † in-house developed software for comparing dose matrices



For more details see:

- † Georg D, Kroupa B. Pre-clinical evaluation of an inverse planning module for segmental MLC based IMRT delivery. Phys Med. Biol. 2002 Dec 21;47(24):N303-14.
- † Georg D, Kroupa B, Winkler P, Pötter R. Normalized sensitometric curves for the verification of hybrid IMRT treatment plans with multiple energies. Med. Phys. 2003 Jun;30(6):1142-50.

Hard-/Software

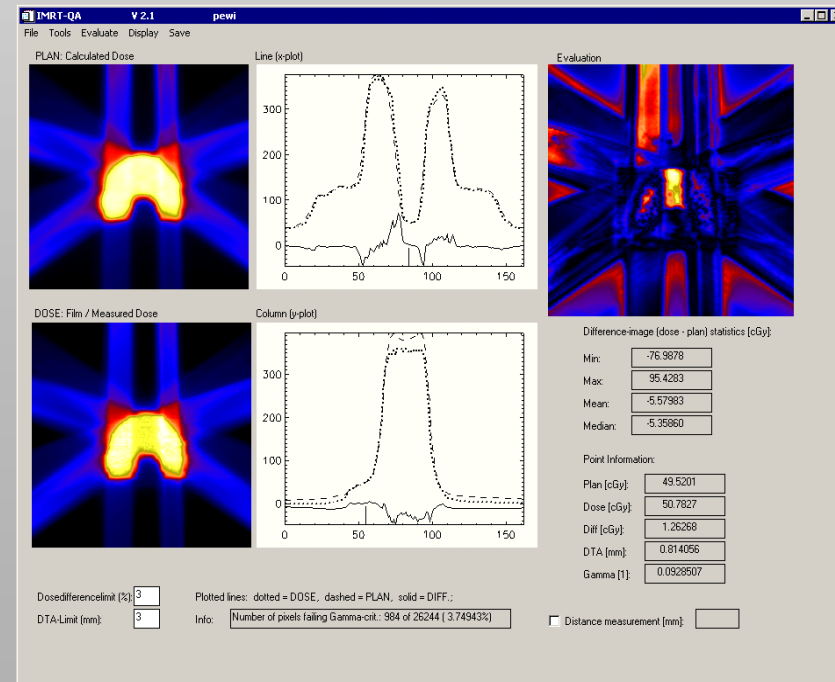
- **Varian Clinac 2300C/D**
 - Varian 80 MLC (step and shoot)
 - Brainlab m3 micro-MLC (sliding window)
- **TPS: Pinnacle /Brainscan**
- **Patients treated: 6**
(starting July 2003)
 - Skull/ H&N regions



Verification, Dosimetry

- Verification of compound plan using calibrated film and diamond detector measurements

comparison of film measurement (radiated in a phantom) with computed dose in the corresponding plane



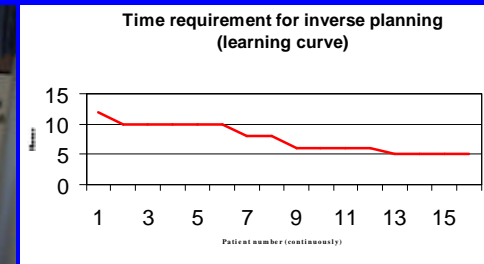
Hard-/Software:

- Mevatron KD2
(SIEMENS) with MLC;
„step-and-shoot“
- „Paperless department“
- CORVUS 5.x (NOMOS)
- 36 Pat. (Kan 31th, 2004)
 - 25 H&N
 - 5 Thorax
 - 2 Abdomen
 - 4 Pelvis



System setup, planning and routine

- First patient 09/09/1999
 - System setup mid-Aug '99
 - Physicist from NOMOS present for appr 3 weeks !
- PTV and critical organs defined by CT and mostly MR for each patient
- Only 1 linac available !
 - IMRT runs parallel to up to 80 pat/day. Max 3 IMRT-patients at the same time !



Total Accumulated Dose

Deliver 60.00 Gy at % of maximum
(minimum dose to Target1 - target PTV, 12.79 Gy, is 19.0% of maximum)

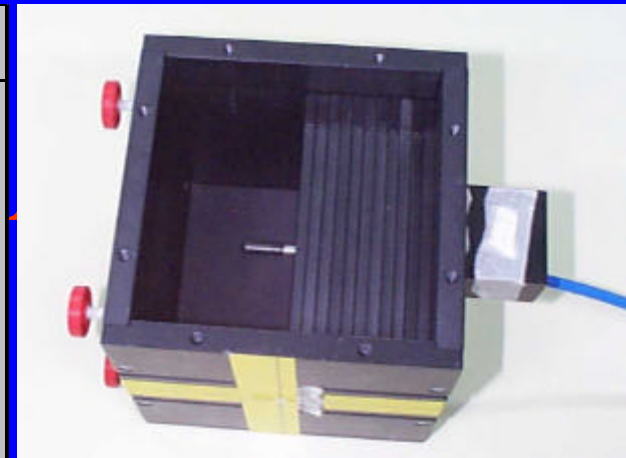
Target Name	Goal (Gy)	Vol Below Goal (%)	Vol Below Goal (cc)	Min (Gy)	Max (Gy)	Mean (Gy)	S.D. (Gy)	Vol. (cc)
Target1 - target	60.00	33.74	288.29	13.80	66.82	60.20	3.70	854.43

Structure Name	Limit (Gy)	Vol Above Limit (%)	Vol Above Limit (cc)	Min (Gy)	Max (Gy)	Mean (Gy)	S.D. (Gy)	Vol. (cc)
Non-target Tissue	25.00	19.52	1177.66	0.00	67.00	12.85	17.47	6033.06
Tissue	25.00	29.50	2032.01	0.00	67.00	18.72	22.64	6887.49
Brain Stem	53.00	19.00	14.88	6.40	62.62	35.34	15.52	78.32
Optic Nerve (L)	50.00			46.46	48.48	47.27	0.71	0.01
Optic Nerve (R)	50.00			46.12	49.83	47.57	0.87	0.02
Orbit (L)	40.00	28.62	1.91	9.43	51.17	34.33	8.06	6.67
Orbit (R)	40.00	27.77	2.09	10.10	52.52	33.88	8.30	7.52
Temporal Lobe (R)	50.00	57.28	17.85	24.91	63.97	50.14	8.46	31.16
Temporal Lobe (L)	50.00	38.47	12.71	11.45	65.31	44.36	13.05	33.03

Dosimetry, verification, patient fixation

- Basic dosimetry with chamber, TLDs (individ. calibrated)
 - Films not successful !
- Before each treatment (at the moment):
 - Data transfer to calculate dose in the „NOMOS-phantom“
 - 1 run with chamber at reference point
 - 1 run with 20 – 40 individually calibrated TLDs at points of interest
- Mask system (for H&N)

Patient Nr	chamber meas/plan
1	1,03
2	0,96
3	0,96
4	xxx
5	0,95
6	0,98
7	xxx
8	0,97
9	1,00
10	0,98
11	0,99
12	0,97
13	0,99
14	1,01
15	0,97
16	1,02
17	1,01
18	1,03
19	1,02
20	1,04
21	0,99
Mean:	0,993



Development of new QA-procedures with chamber and films; weekly; appr 2h



KFJ Vienna

Institute of Radiooncology



- 100% Digital Radiotherapy
- Start in Dec 1996
- IMRT clinical since Dec 2000
- 10 Doctors, 13 Technologists, 3 Physicists, ...
- Planning done by physicians





Hard-/Software

- Varian Clinac 2300CD
(Two Identical Machines)
 - DMLC (Sliding Window)
 - amorphous Si-Detectors
(since Feb. 2004)
- Varian Eclipse/Helios,
(4 workstations)
- 22 IMRT patients (Feb 04)
 - Mainly Head/Neck
 - 2 – 7 Fields



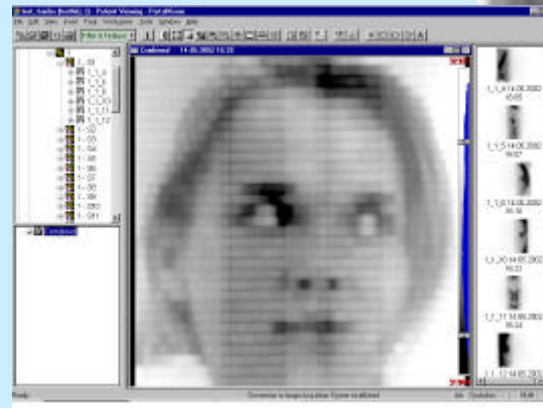
Verification, Dosimetry

- „Conventional“ Pre-Treatment Verification: Various Chambers/Diodes + Film Dosimetry
- DMLC Treatments: Dynamic PortalVision During 1st Fraction
- Setup Fields + PI for each Fraction

Film (EDR2):



PortalVision:



Chambers/Diodes





Common Experiences I:

- No payment ! In Austria even RT-treatment is not fully paid by insurances, so no private RT-departments exist:
 - IMRT is mostly of scientific interest !
- (Almost) no prostate IMRT in Austria !
 - Physicians do not feel a strong need for it, 3D-techniques seem to bring the same results
 - May change when introducing the BAT/I-Beam-system (tests in Innsbruck/Tyrol)



Common Experiences II:

- IMRT is a lot of work for physics:
 - Setting up of IMRT systems (hard-/software) in many cases is not sufficiently supported by the companies.
 - No regulations for acceptance testing and QA of hard-/software
- Up to now hard-/software are not stable sometimes or deliver unreliable results



Common Experiences III:

- On the long run IMRT is a lot more work for physicians and planners:
 - Defining new criteria for critical doses and volumes
 - esp to define critical doses for partial volumes
 - Evaluation of plans with DVHs
 - Necessity for new evaluation criteria; ICRU50/62 are not enough
- The „values“ of IMRT are still under discussion
 - Italian experiences
 - discussion in the AAPM-newsletters (Schultheiss vs Schulz) in 2003



Common Experiences IV:

- Influence of „Scatter Dose“ on the patient when using „step-and-shoot“
 - Paliwal, MP 1/2004, point/counterpoint, 1: „IMRT results in a significant increase in total body dose from increased treatment times and leakage radiation.“
- Comparison of results of different planning systems is not really possible; missing evaluation criteria
- ...



Common Experiences V:

- European IMRT-meetings (2 up to now):
 - Main work (and responsibility) lies on the physicians to prescribe doses, to define critical doses and to evaluate DVHs
- Finding the „right patients“ !
 - IMRT has no standards !
 - IMRT is not standard !
- Development of class solutions to compare results
 - Benefits and limits unknown
 - Biology...





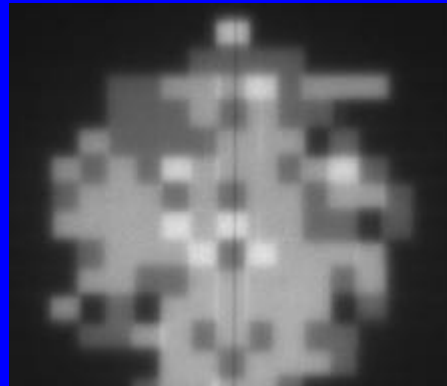
uture of IMRT in Austria - I

KH: IMRT - R & D projects

- † *Dose calculation accuracy of TPS*
 - † *Gel-Dosimetry (Univ. Prague / Univ. Vienna)*
 - † *Film dosimetry*
- † *Image-guided radiotherapy*
 - † *uveal melanoma (see presentation J. Bogner)*
 - † *thoracic lesions (work in progress)*
- † *Development of a semi-analytical model for 'independent' dose calculation in IMRT (Univ. Umea)*
- † *EPID-Dosimetry*

Future of IMRT in Austria - II

Donauspital : Storage Foils

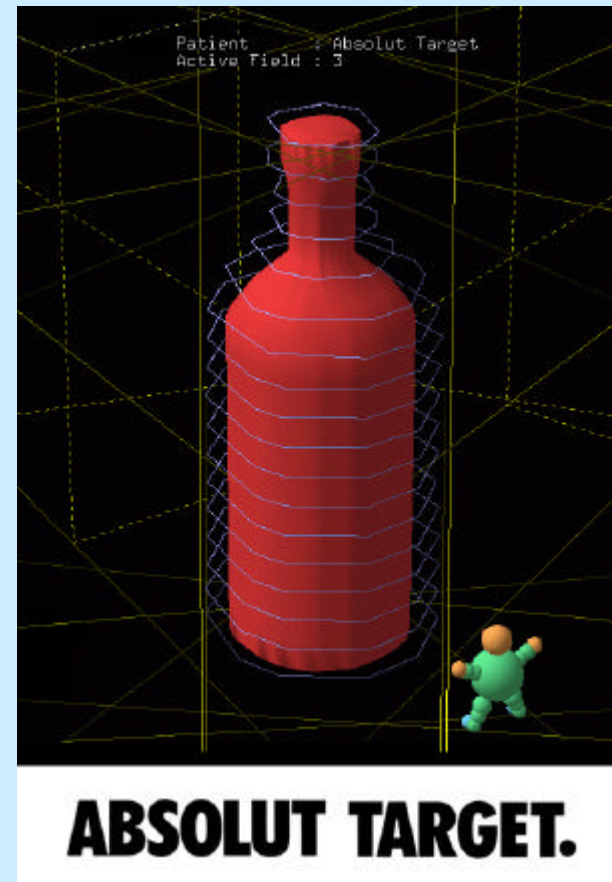


- 2D-dosimetry with storage foils
 - IMRT-verification, diagnostics (brachy), QA, verification & dosimetry
- New imaging techniques (eg PET)
- Making IMRT faster with new software
- Treatment of more than one target volume per fraction (with different doses)

Future of IMRT in Austria - III

KFJ: Projects

- Ab Juni 2004 keine Filmentwicklung mehr möglich
- Suche nach Ersatz dafür (z.B. Licht-/Strahlenfeld)
- Digitale Lösungen angestrebt (PortalImaging? 2D-Array? Speicherfolien?)



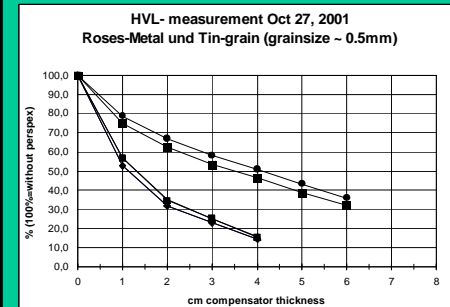
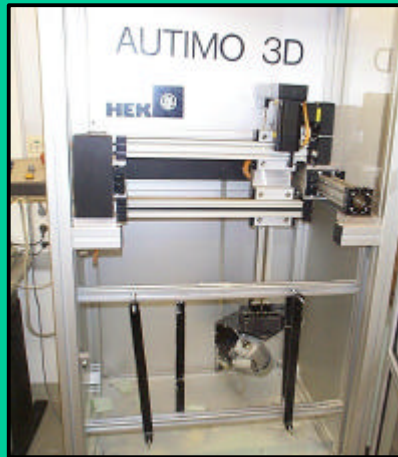


Future - IV:

IMRT with compensators at the WSP Vienna

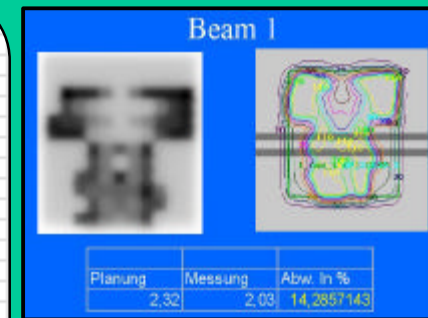
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Future Work:

Installation of CMS-planning system for IMRT-compensators
Comp. planning/measurement with films and storage foils
checks of production accuracy



First patients expected in 2004 at a Mevatron (6MV) without MLC

WFO SCHMIDT (OeGMP); IMRT in Austria – An Overview; Würzburg, Feb. 19/20, 2004



Aktivitäten in Österreich – Zusammenfassung

- Begeisterung für IMRT eher zurückgegangen
- Wenig Interesse zur Teilnahme an größeren IMRT-Studien
- „Herumspielen“ mit Planungssystemen – insbesondere bedingt durch bessere Bildüberlagerung und neue Modalitäten
- Derzeit Entwicklung und Erprobung verschiedener Positionierungssysteme:
 - Aktive (BAT, I-Beam, bildgestützte Systeme)
 - Fixationssysteme (z.B. Körperfixation)
- Programmentwicklung für Secondary MU-checks