Francis H. Burr Proton Therapy Center

Integration of Particle Therapy into the Daily Clinical Routine in the Hospital: Just Another Tool or a Universal Solution?

Medical Director: Thomas F. DeLaney, MD
Associate Medical Director: Helen Shih, MD
Associate Director: Hanne Kooy, PhD
Technical Director: Jay Flanz, PhD
Physics Research: Harold Paganetti, PhD
Chief, Physics: Thomas Bortfeld, PhD
Chief, Radiation Oncology: Jay Loeffler, MD

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To the job right,
you need the right tool !

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Some jobs require hammers !

Some jobs require screw drivers !!!!

Pre-Rx

1 year after 70 Gy/35 fx
9 MeV electrons plus bolus

Some jobs require kV photons or MV electrons !

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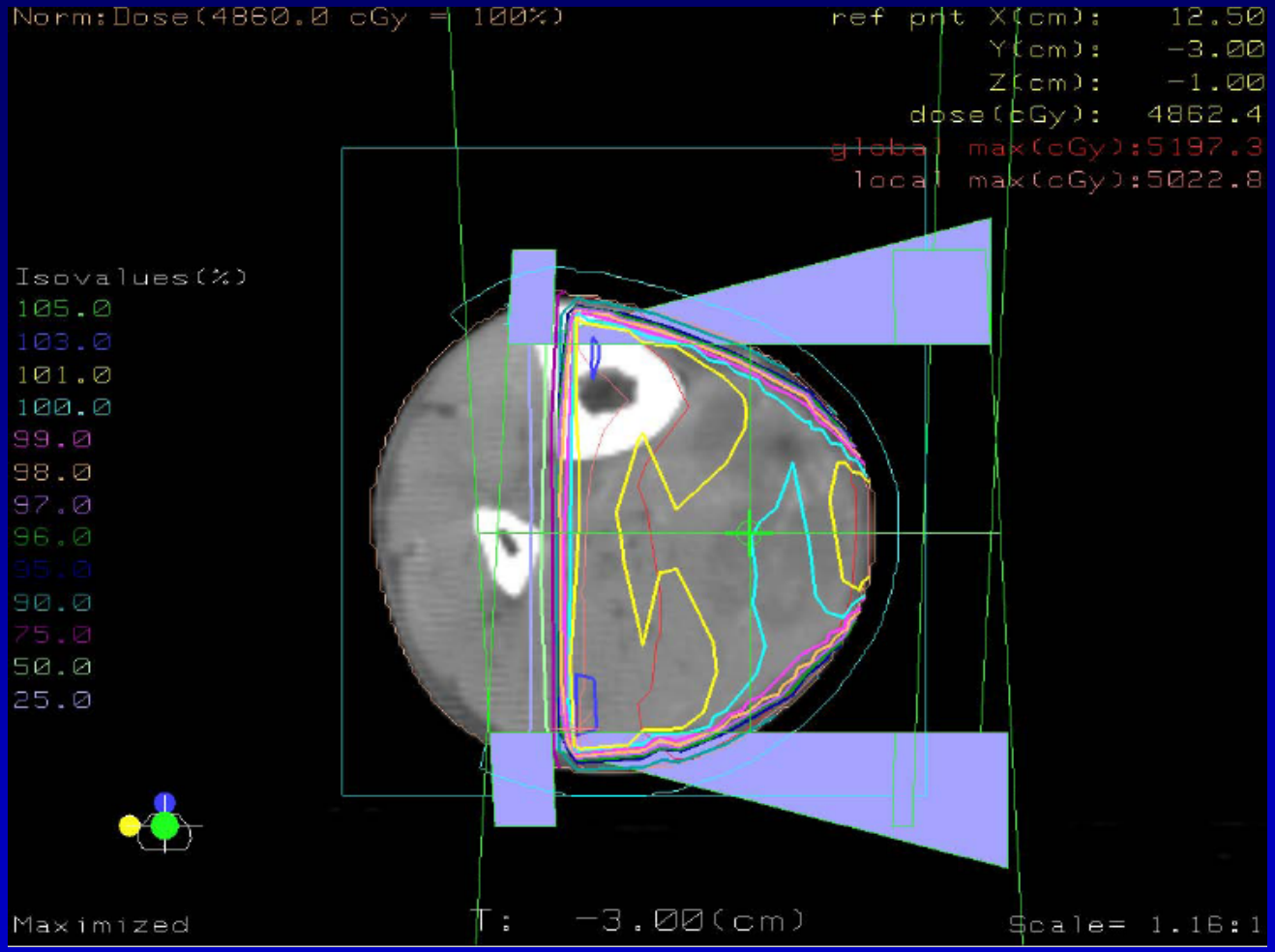

Some jobs managed very well with 3D conformal XRT !

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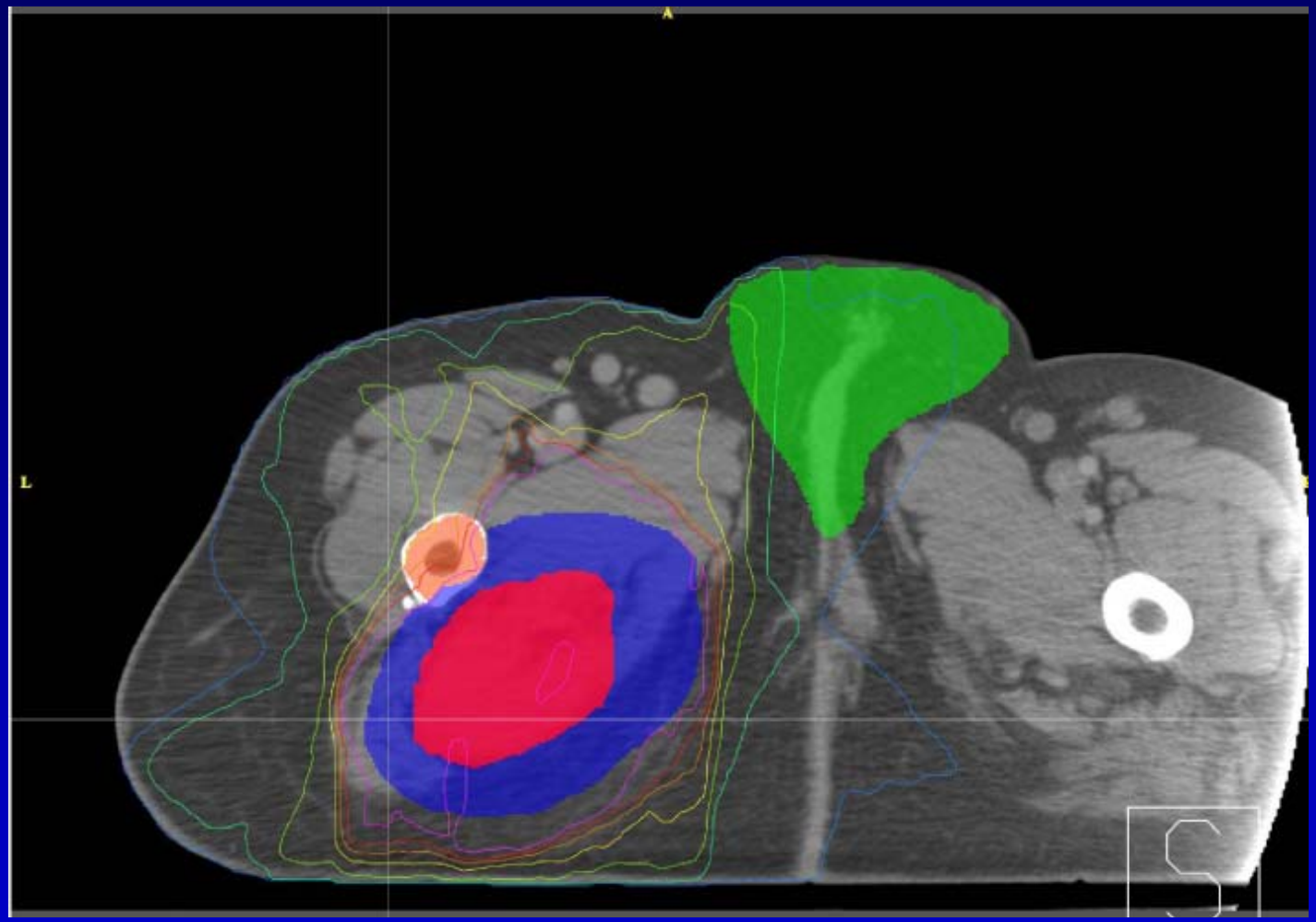
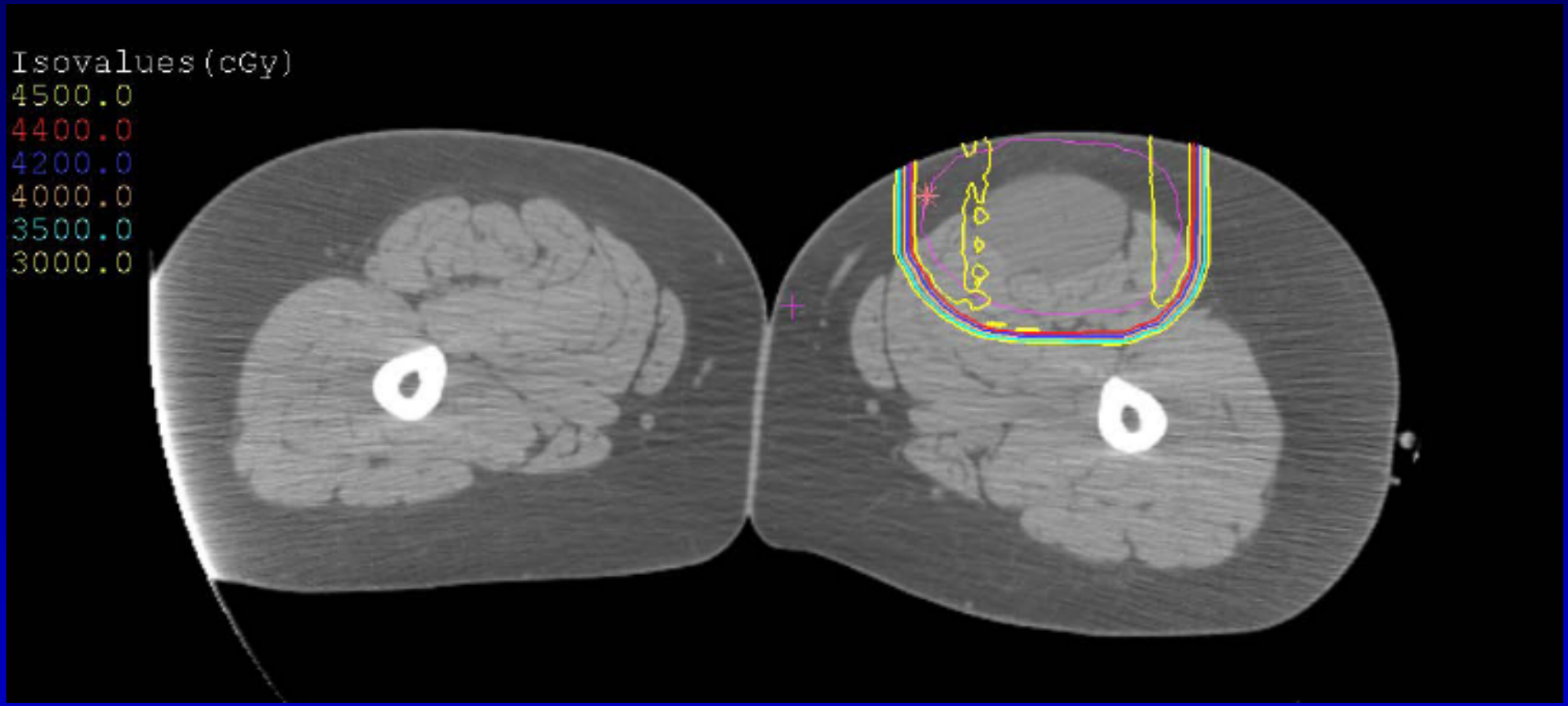
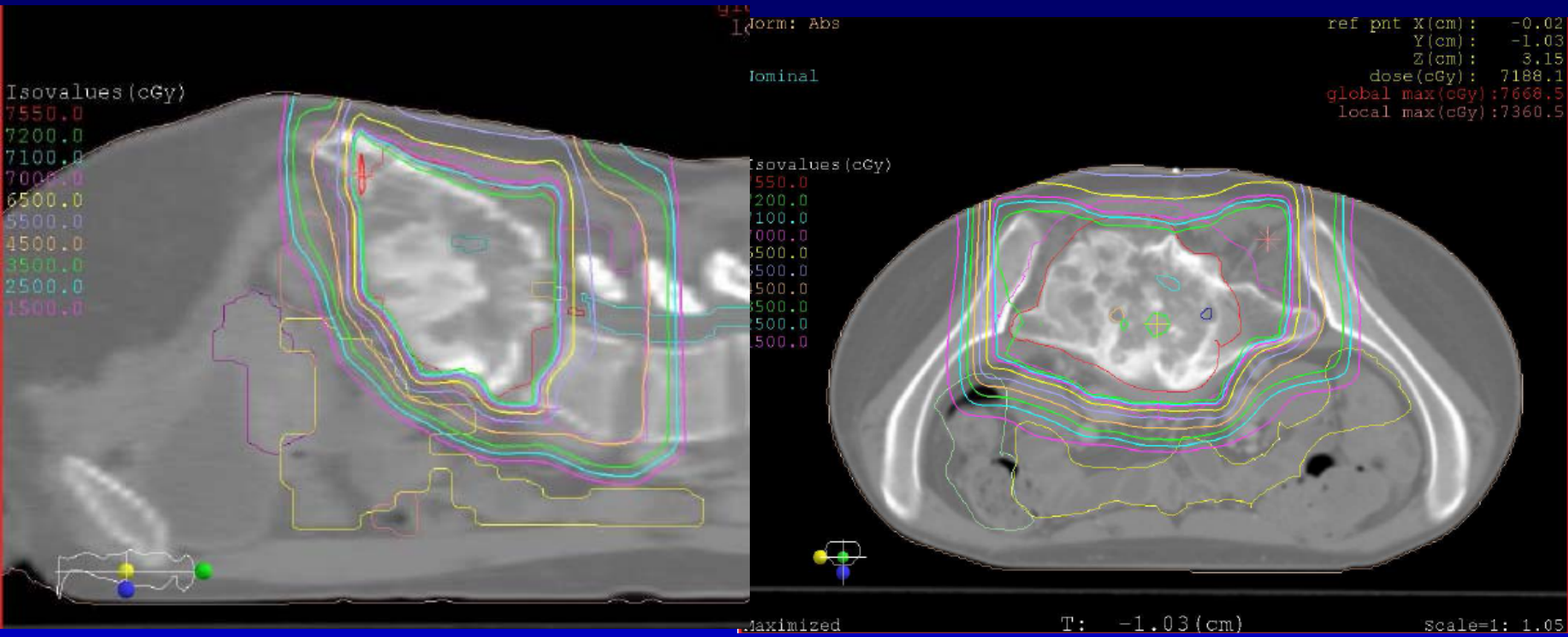


Some jobs managed better with IMRT !



Protons reduce integral dose, although for some patients this may not be critical.



For 18 year old girl with unresectable osteosarcoma, protons were CRITICAL for normal tissue sparing

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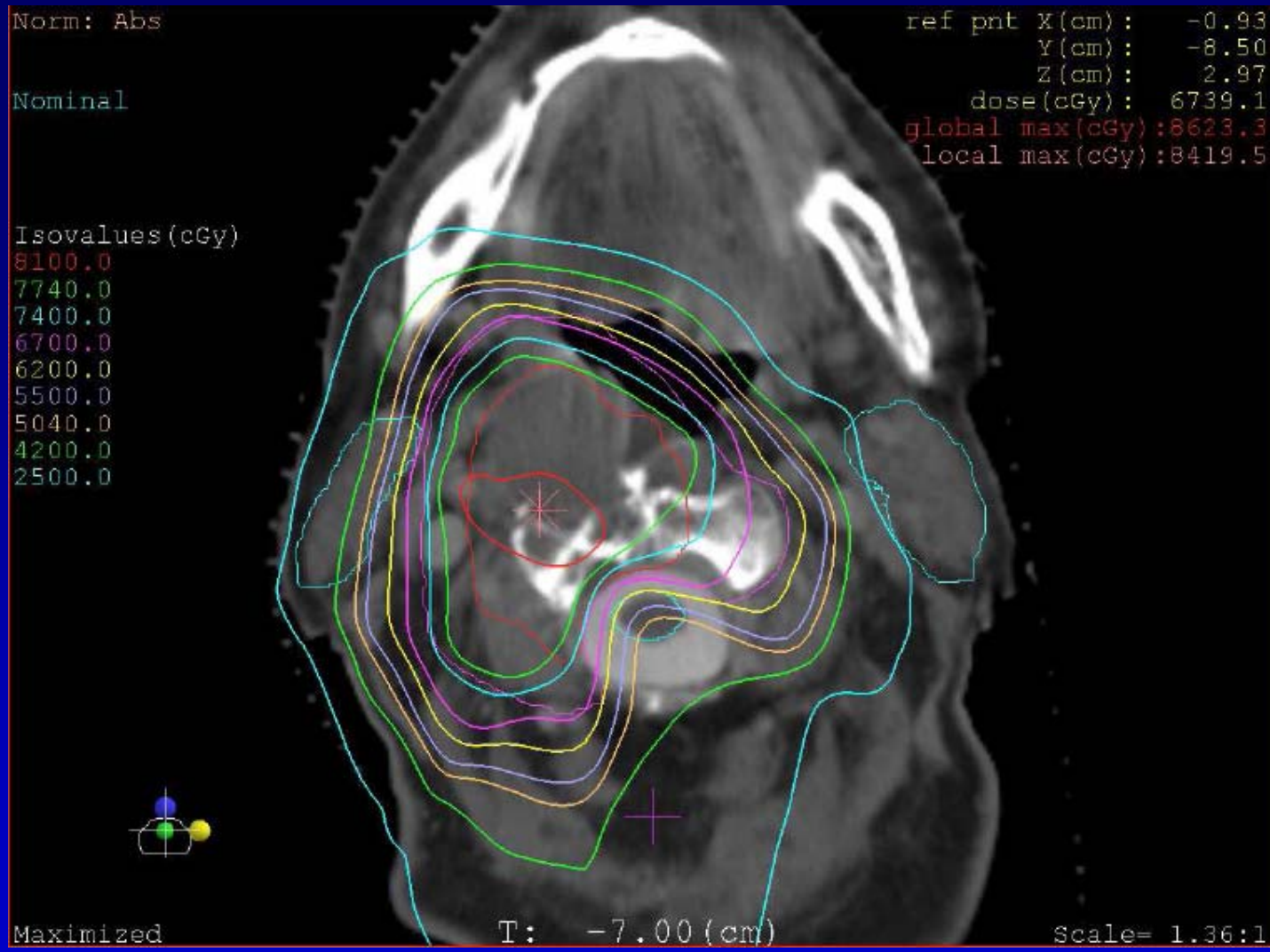
C2 Chordoma

77.4 Gy RBE

19.8 Gy IMRT +
57.6 Gy RBE 3-D
protons



For others, the best plan employs photons and protons !

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CLINICAL INVESTIGATION

OPTIMAL TREATMENT PLANNING FOR SKULL BASE CHORDOMA: PHOTONS, PROTONS, OR A COMBINATION OF BOTH?

MYLIN A. TORRES, M.D.,*‡ ERIC L. CHANG, M.D.,* ANITA MAHAJAN, M.D.,* DAVID G. LEGE, C.M.D.,* BEVERLY A. RILEY, C.M.D.,* XIAODONG ZHAI, M.D.,† MINGFWU LII, M.S.,† DAVID G. KORNGUTH, M.D.,* CHRISTOPHER E. PELLOSKI, M.D.,* AND SHIAO Y. WOO, M.D.*

Departments of *Radiation Oncology and †Radiation Physics, The University of Texas M.D. Anderson Cancer Center, Houston, TX; and ‡Department of Radiation Oncology, Emory University School of Medicine, Atlanta, GA

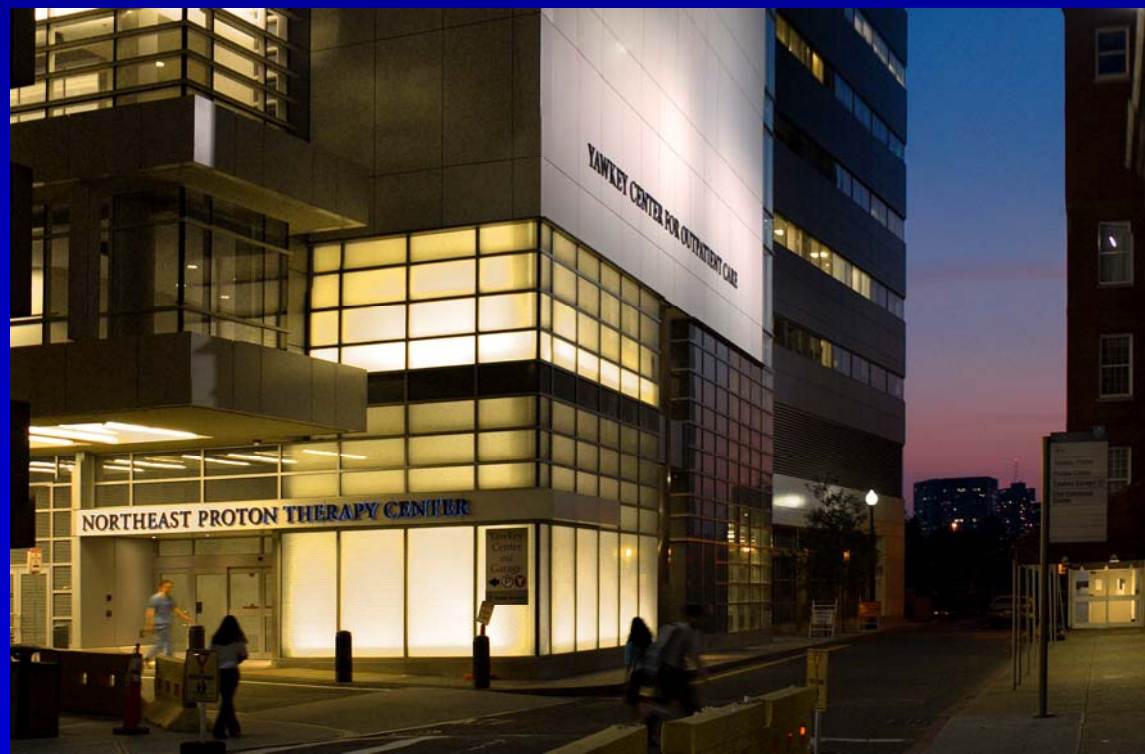
- Compared pure proton, pure IMRT photon (PTV 1 or 3 mm), and mixed modality plans with protons and photons in 5 patients with skull base chordoma
- Conclusions: There are dosimetric advantages to using either IMRT 1 mm or proton plans, with the combined photon/proton plans yielding the best target coverage and conformality.

Particles: Another Tool

- Hence, particles perhaps best viewed as another tool that we can use to optimally manage patients
- How can we best integrate its use into the operation of a radiation oncology department?
  - Physical location of the facility
  - Process for selection and intake of patients
  - Treatment planning
  - Treatment delivery

Location, Location, Location

- Ideally sited in the medical center
  - Access to Radiation Oncology department
    - MDs, CT simulators, Linacs
    - QA: establish parallel processes
  - Anesthesia, diagnostic radiology (i.e. lumbar instillations)



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Patient Selection/Intake

- Establish list of patients/protocols to guide intake coordinators
- System to gather and screen patient intake materials
  - MD review→Proton Rounds→Patient accepted
  - Intake sheet to intake coordinator/scheduler
    - Treatment plan outline with # of photon/proton fractions
    - Immobilization parameters
    - CT simulation parameters (i.e. oral, iv contrast)
    - Start date (i.e. if specific date mandated by research protocol, such as within 30 days of surgery)

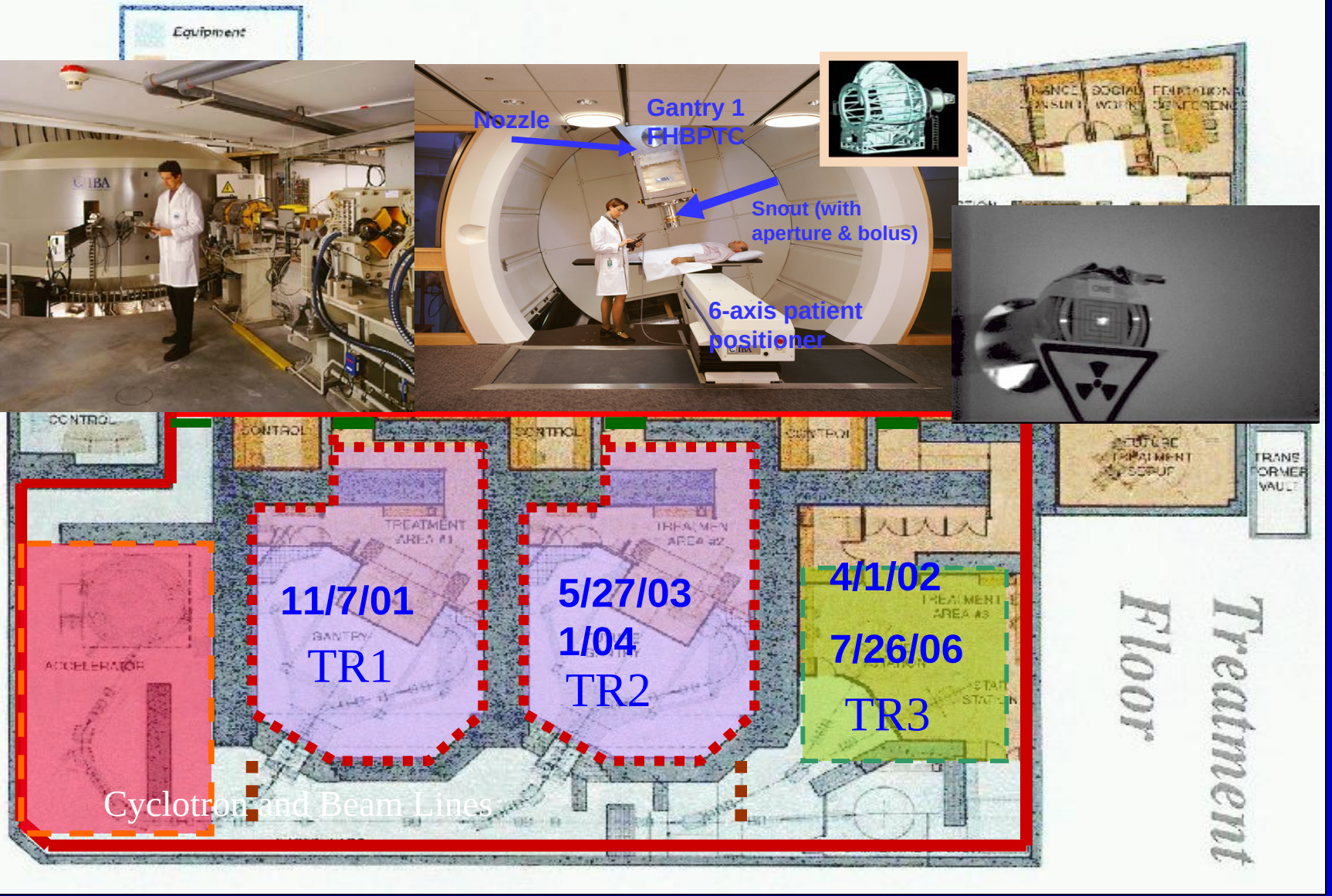
Treatment Planning

- Immobilization devices compatible with both photons and protons
- Standardized acquisition of CT planning data
- PACS to push diagnostic scans to planning stations
- Treatment planning system that can integrate photon and proton treatment plans

Treatment Delivery

- Coordination/scheduling of photon/proton fractions
  - Photon fractions in reserve
- Comparable degrees of image guidance for photon/protons

FHBPTC Equipment Areas



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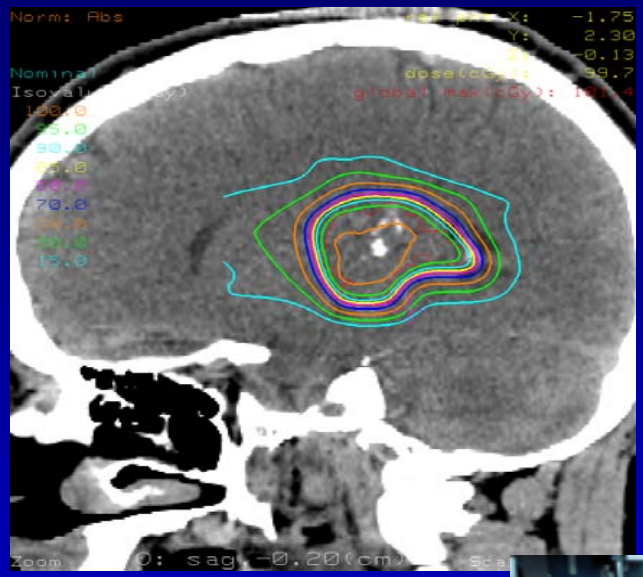
- Equipment
  - Cyclotron 230 MeV (IBA)
  - 3 Treatment rooms
    - Two 360° rotational gantries (Double scattered)
    - Fixed horizontal beams room
      - Eye station- Degraded 70 MeV beam
      - STAR (single scattered)
  - Experimental room
    - Horizontal beam

STAR: Stereotactic Assisted Radiosurgery/Therapy

- STAR
  - Radiosurgery
  - Fx radiotherapy
- Unique facility optimized for cranial fields treatments



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Burr Proton Therapy Center

- First patient treatment: November 8, 2001

TREATMENT STATISTICS

First year	11/01-10/02:	208 patients
Second year	11/02-10/03:	366 patients
Third year	11/03-10/04:	404 patients
Fourth year	11/04-10/05:	509 patients
Fifth year	11/05-10/06	602 patients
Sixth year	11/06-10/07	621 patients
Seventh year	11/07-10/08	818 patients
TOTAL		**3528 patients**

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Department of Radiation Oncology MGH

- Average daily patient treatments
  - Photon: 190
  - Proton : 60

- **F. H. Burr Proton Therapy Center**
  - **818 patients 11/107-10/31/08**
    - Adult patients 732 89%
    - Pediatric patients 86 11%

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• CNS	294	36%
• Eye	157	19%
• Bone/Soft Tissue	97	12%
• Prostate	80	10%
• Head/Neck	56	7%
• Skull Base	55	7%
• Lung	8	1%
• Liver	4	0.5%
• Other	67	8%

Proton Clinical Research

- **Prostate:** Drs. Shipley, Zietman, Coen, Efstathiou
- **Pediatrics:** N. Tarbell MD, T.Yock MD, S. Macdonald MD
- **Brain/CNS**: J. Loeffler MD, H. Shih MD , K. Oh MD
- **Head/Neck/Sinus**: P. Busse MD/ N. Liebsch MD/A. Chan MD
- **Gastrointestinal**: Ted Hong, MD
- **Gynecologic:** Anthony Russell, MD
- **Sarcoma**: T. DeLaney MD/ Y-L Chen MD,PhD
- **Thoracic**: N. Choi, MD, H. Willers
- **Eye:** Y-L Chen MD, H Shih MD
- **Breast:** A. Taghian, MD, S. Macdonald MD
- **Statistics**: B. Yeap PhD

Proton Clinical Research

- "Optimizing Proton Radiation Therapy"
  - NCI program project grant with MD Anderson
  - Funded through 8/31/2013
- Project 1: Non-Small Cell Lung Cancer
  - Central Early Stage: 87.5 GyRBE/35 fx of 2.5 GyRBE
  - Locally Advanced: 74 Gy IMRT vs. 3D Proton ChemoRT
- Project 2:
  - Pediatric: Medulloblastoma, Rhabdomyosarcoma, QOL
  - Adult: Liver, Paranasal sinus, Spine/Skull base

Proton Therapy Program Project
MGH/MD Anderson

- Project 3: Reducing Range Uncertainties in Proton Radiation Therapy

- Project 4: Achieving What-You-See-Is-What-You Get in Proton Radiation Therapy