

Progress at Midwest Proton Radiotherapy Institute

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 - Administration: Jim Buher, Ed Dickey, Karin Campbell
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- Clarian Health Partners

Distribution of Scarce Resources – Randomized Studies?

- Orthovoltage to Supervoltage equipment (1925 – 1940)
- Supervoltage to Cesium/Cobalt (1940-1960)
- Isocentric Cobalt/Betatron (1955-1965)
- Linac-based Megavoltage (1962 →)
- Particle Therapy (1957 →)

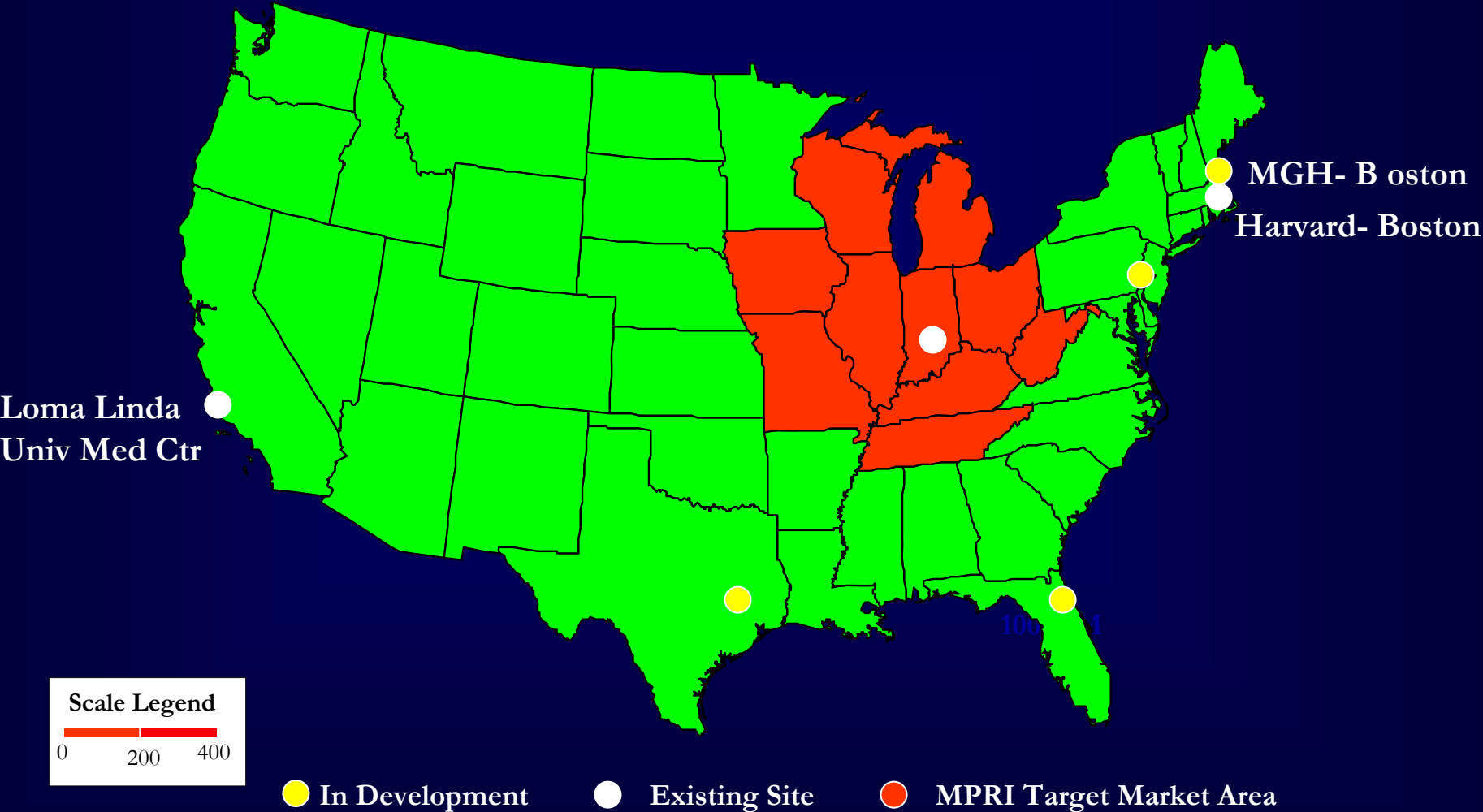








Current and Future Treatment Sites for Proton Delivery





Unique Ramp-up of MPRI

- Started with experienced medical staff (>10yrs avg in particle therapy), Boston and S. Africa
- Commenced with complex cases – little chance for slow build-up of experience
- Supported by IUCF – decades of physics beam-line/control experience
- Robotics integration with passive horizontal beam and now robotics with UBS gantry

MPRI Limitations

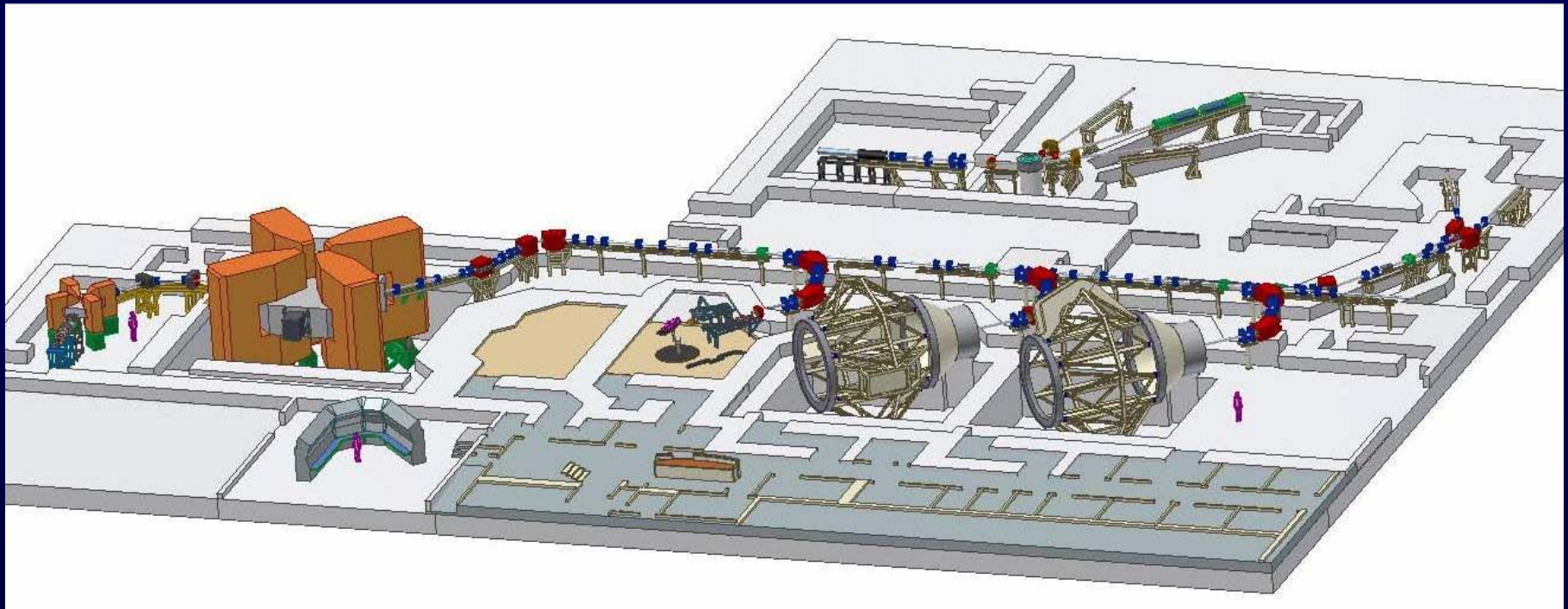
- FDA IDE treatment provisions – significant documentation, quality control
- Concomitant 510K preparation and submission with IDE – huge IUCF and MPRI demands
- One radiation oncologist – technique homogeneity, yet self-limited

Beam Resources

- Split sector cyclotron 208 MeV
- One fixed horizontal beam line (FHBL) treatment room operating
- Two gantries
 - First gantry room currently under commissioning. Expected treatment 2006
 - Second gantry under construction. Expected treatment 2007

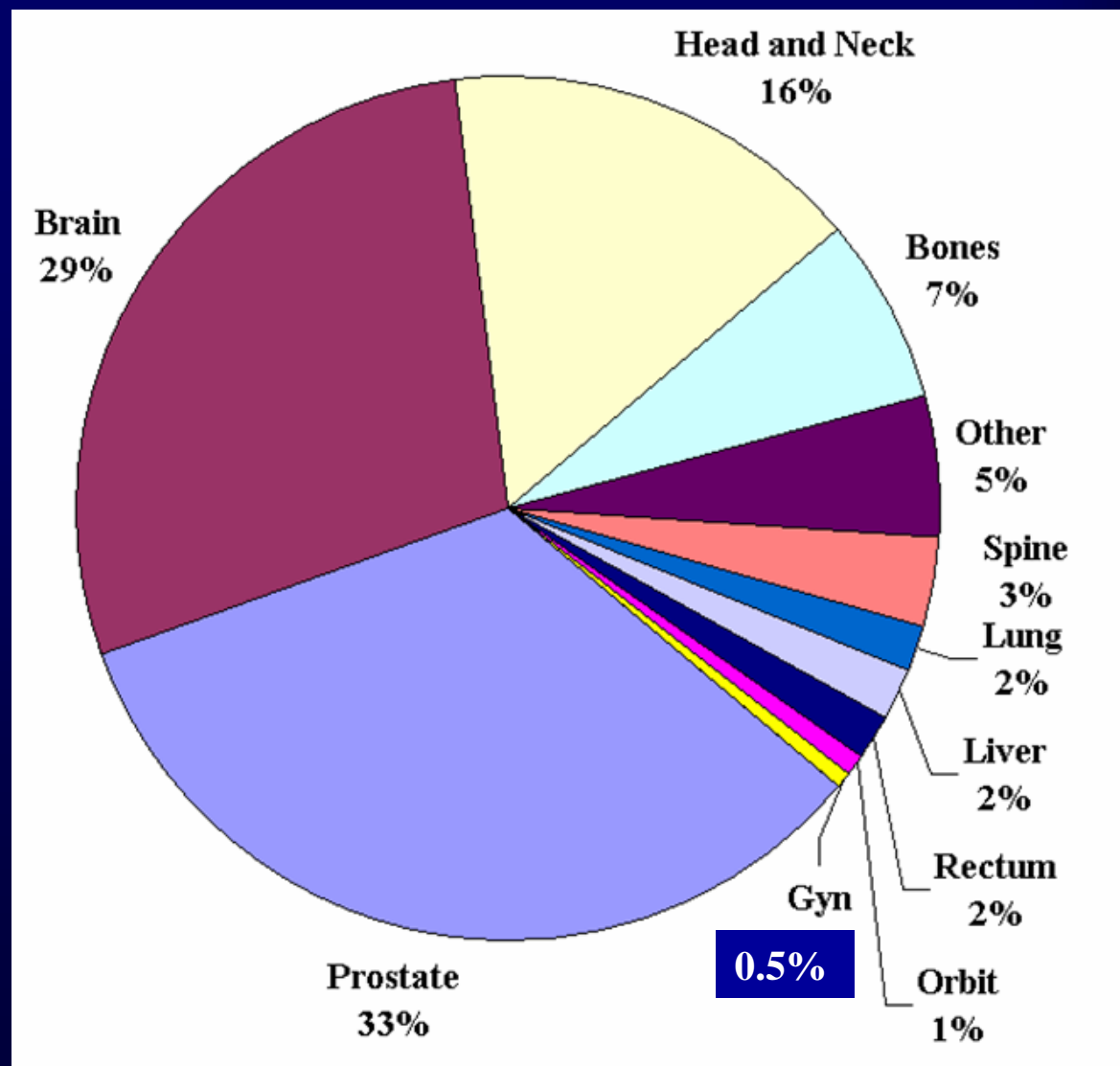
Introduction

- FHBL operating under IDE
- IDE and 510(k) filed for gantries
- After both gantries operational FHBL shutdown for retrofit and eye line



Patient Treatments

- 220 patients treated
- 600 separate fields delivered



Facility Uptime

- 92% over the entire operating period
- Longest period of downtime - one week
- 33% of total downtime - new radio frequency quadrupole: fixed tuning slug
- Secondary RF problems 11%
- Power failures 11%

RFQ



Facility Expansion and Improvements

IBA GANTRY SPECIFICATIONS

Manufacturer:	Ion Beam Associates (IBA)
Weight:	~ 90 Tons
Diameter:	58 ft
SAD:	2.5 m
Rotation Angle:	+/- 185°
Isocenter Var:	+/- 1 mm
Pos. Accuracy:	0.25°
Rotation Speed:	1 rev/minute max

Gantry Beam Transport
Line

FAST KICKER

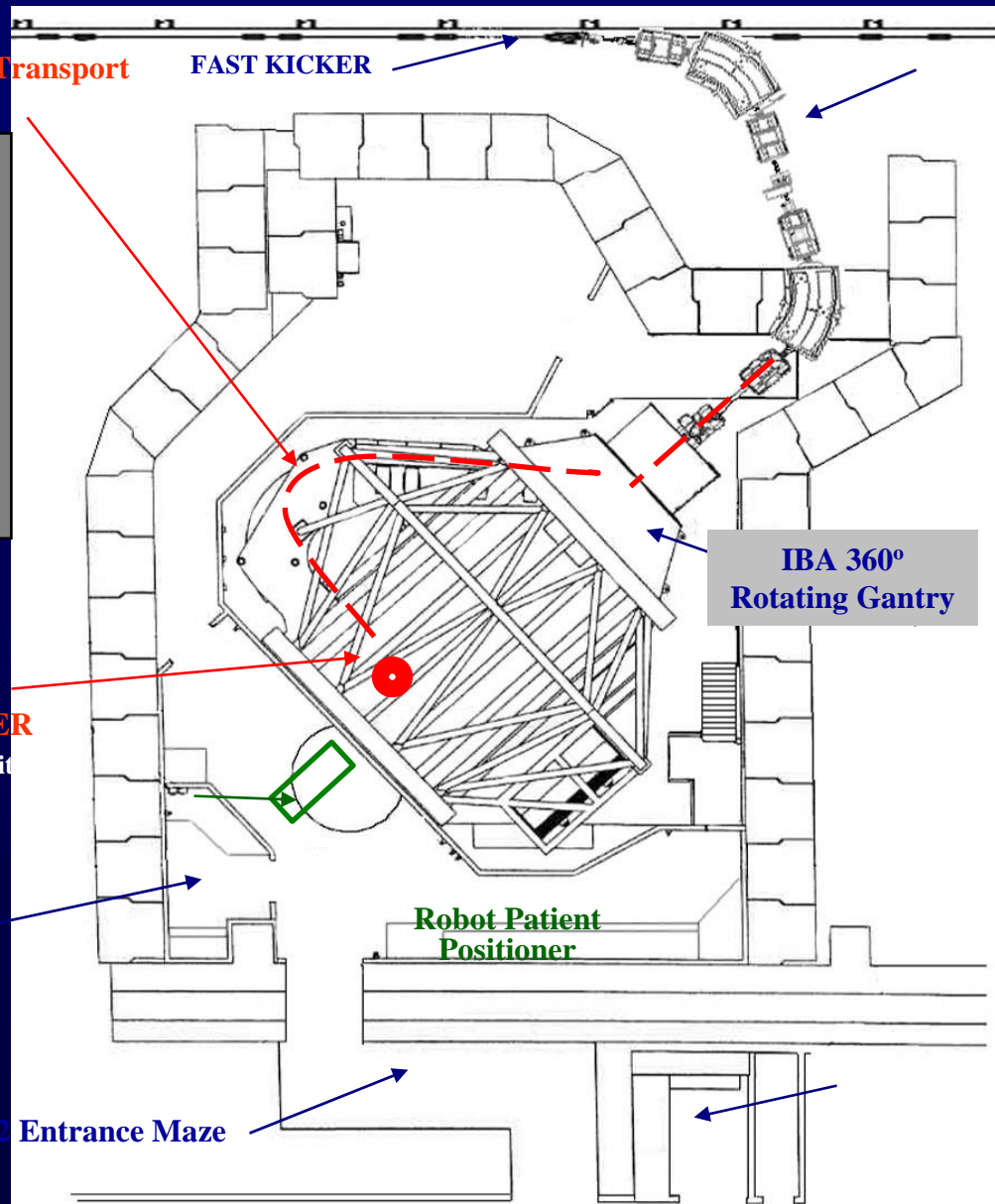
Gantry
ISOCENTER
(Treatment Site)

IBA 360°
Rotating Gantry

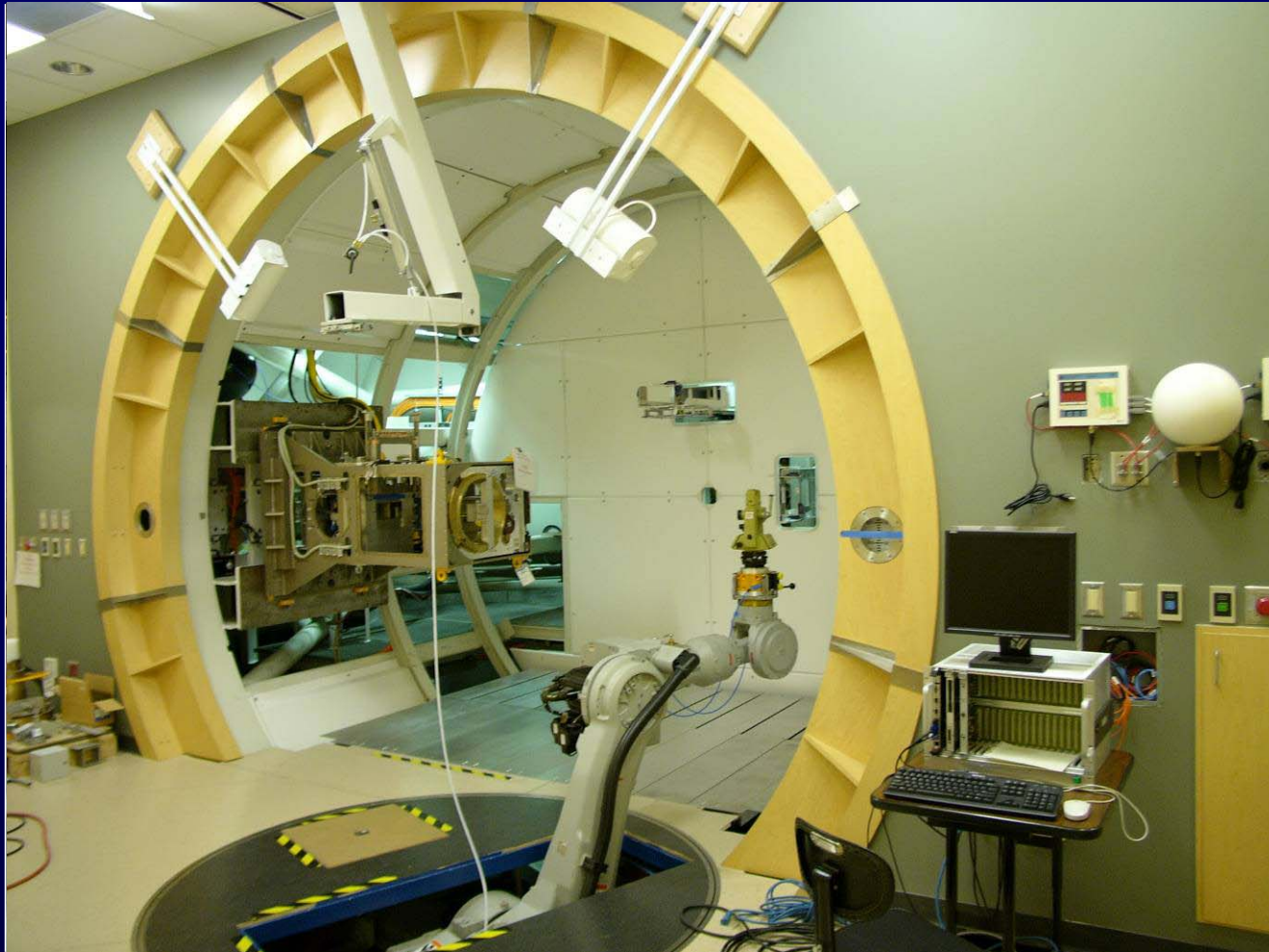
Robot Patient
Positioner

Internal Control Room
(Patient Setup Control)

TR2 Entrance Maze



Facility Expansion and Improvements



Facility Expansion and Improvements

- The FHBL room uses a double passive beam spreading system
 - Lose 1-2 cm of range from foils
 - Contributes to secondary scattered dose, primarily neutrons
- The gantries have a uniform scanning active delivery system
 - Get back 1-2 cm range
 - Lower integral dose?

Scattered Dose from a Passive Beam Spreading System

- Anthropomorphic phantom
- Bubble detectors
- Characterize scattered dose to the fetus from a pregnant patient
- Supplements facility commissioning
- Continued work to determine spectrum, also MPRI uniform scanning system

Fetal Dose Measurements

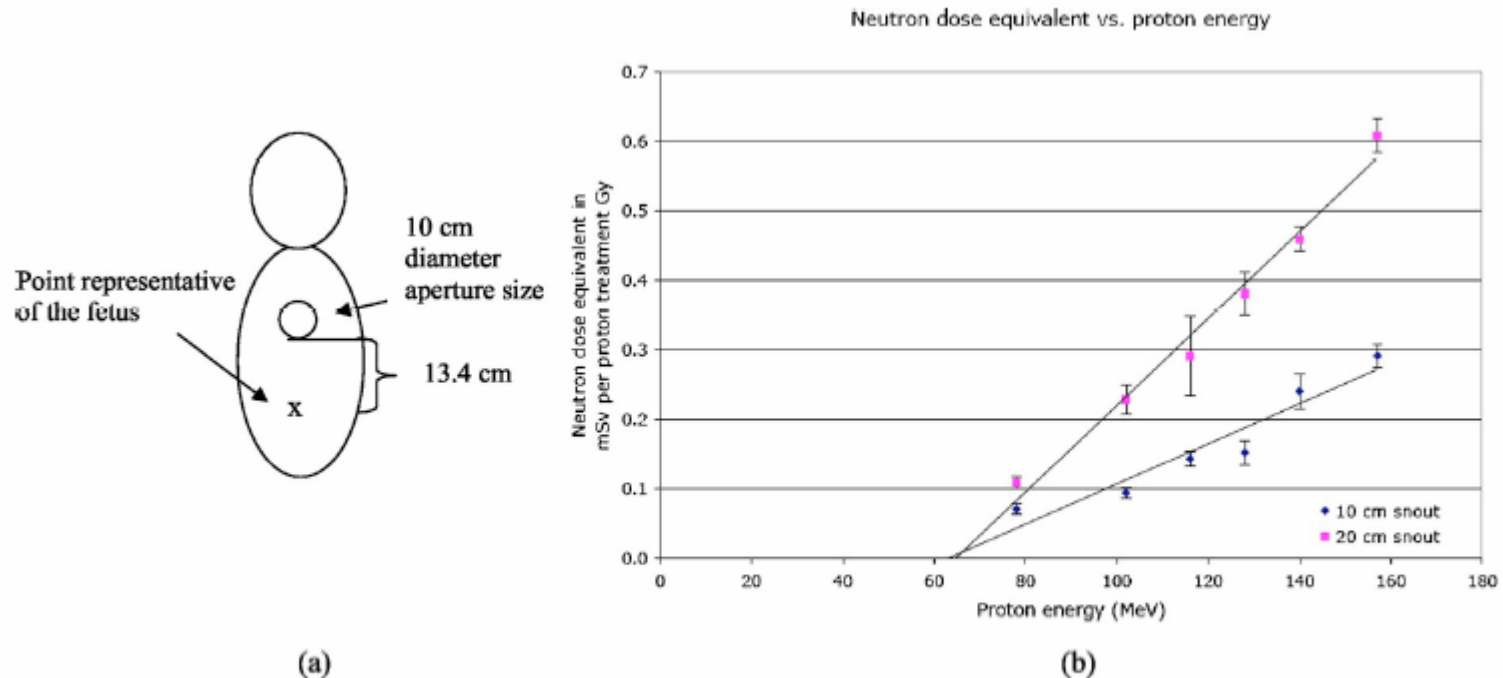


FIG. 4. (a) Experimental setup for the effect of proton beam energy measured using a 10-cm-diam aperture size, an 8 cm SOBP, a 15 cm air gap, and a 13.4 cm distance to the field edge, and (b) neutron dose equivalent variation with proton energy in water in each snout.

Neutron scattered dose equivalent to a fetus from proton radiotherapy
of the mother

Geraldine Mesoloras, George A. Sandison, and Robert D. Stewart

School of Health Sciences, Purdue University, West Lafayette, Indiana 47906

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Fetal Dose Measurements

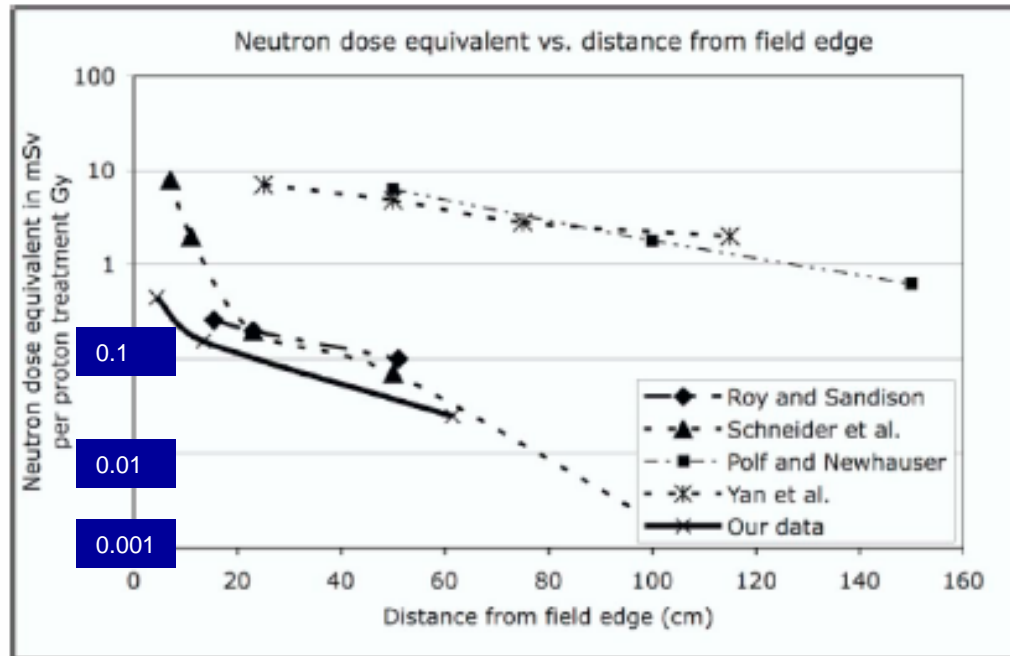


FIG. 7. Comparison of our measured data on neutron dose equivalent with distance to the treatment field edge compared to previously published data.

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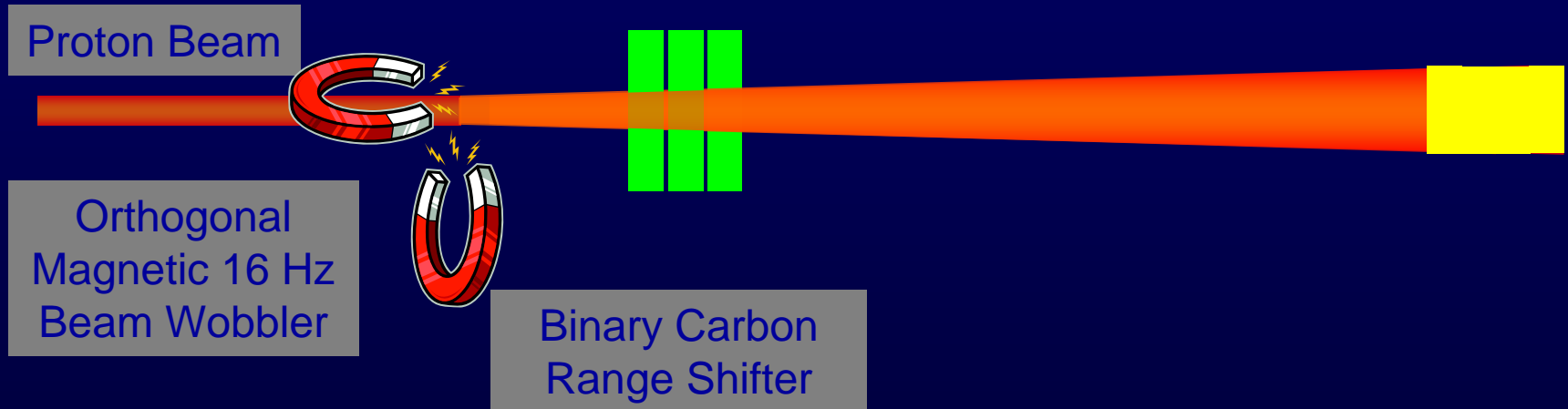
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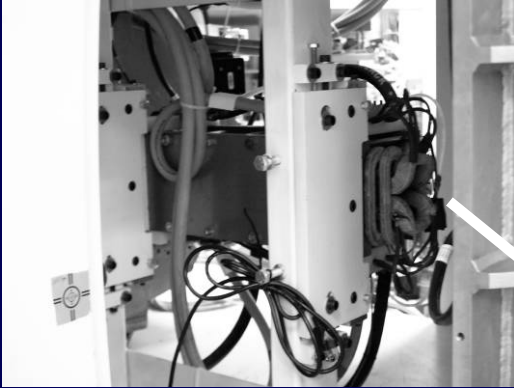
Uniform Scanning System

- Large spot size wobbling
- Binary range shifter
- Requires final beam collimation due to spot size
- Relatively “efficient” compared to IMPT with regard to treatment time

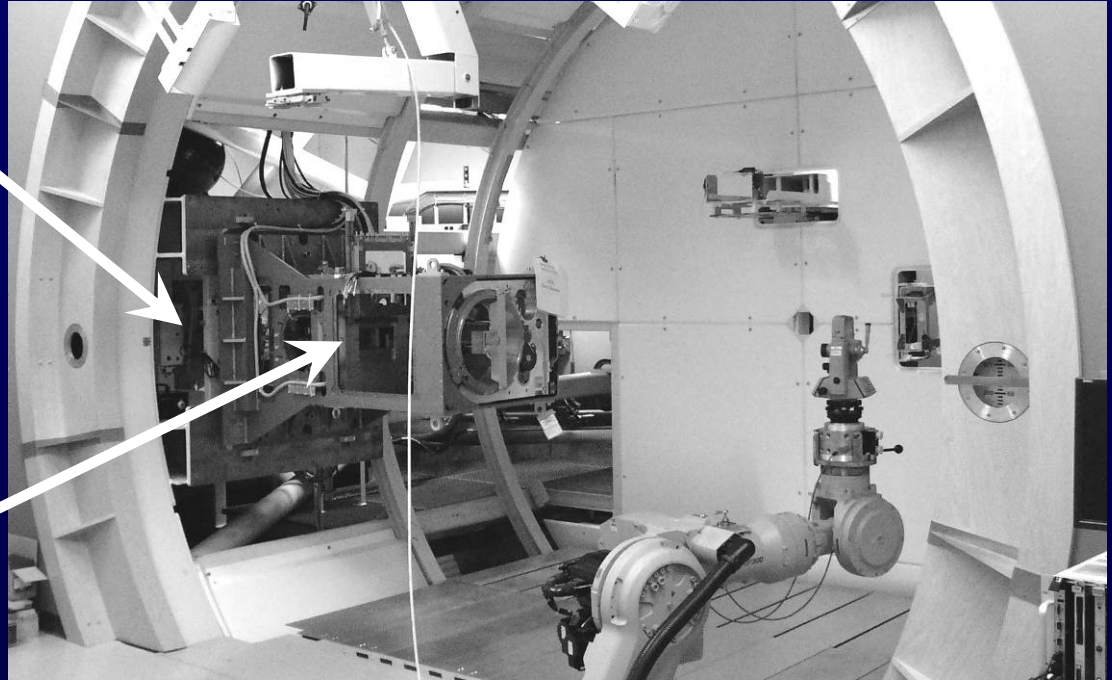
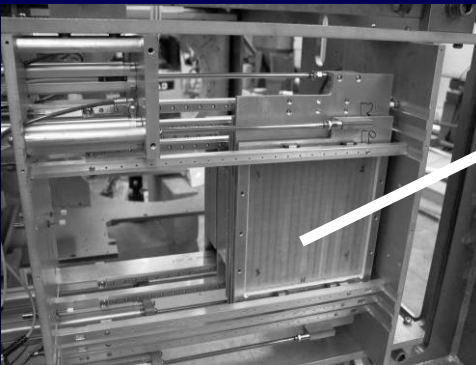


Uniform Scanning System

Beam Wobbler



Range Shifter

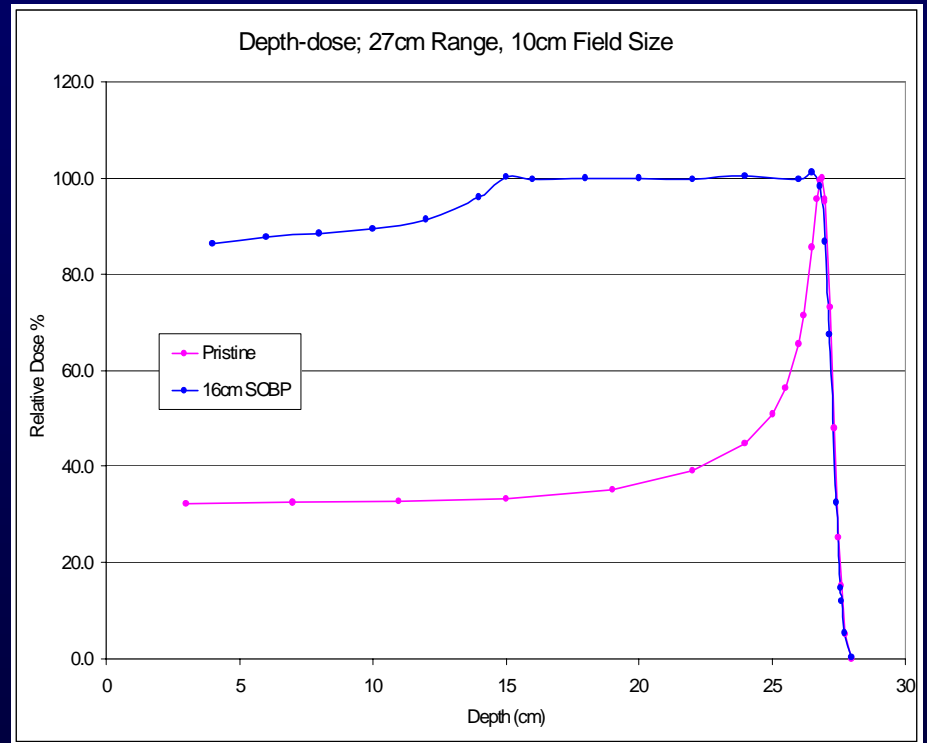
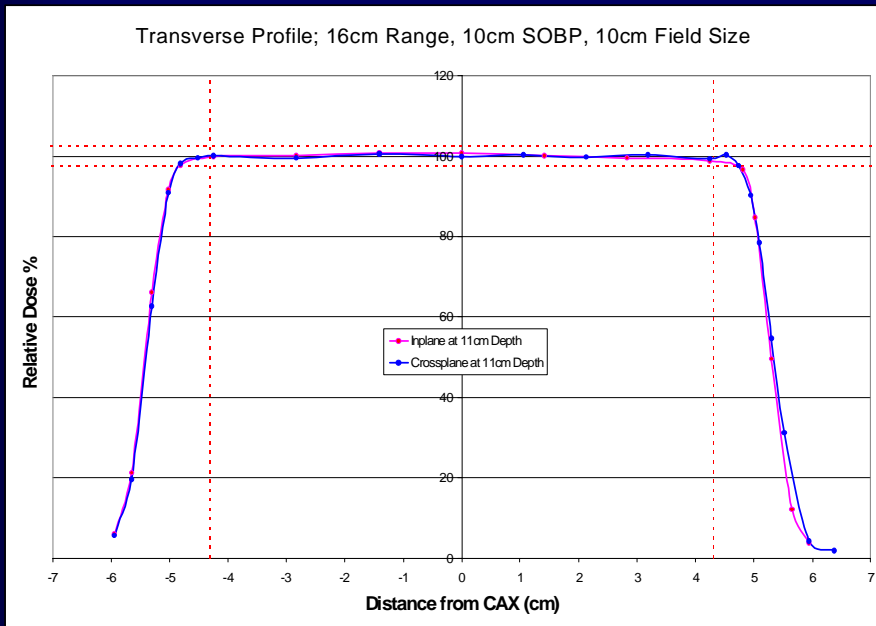


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Uniform Scanning System

Acceptance testing results



Uniform Scanning System

- Commissioning 90% complete
- Expected Treatment November 2006



Conclusions

- MPRI has treated over 200 patients since February 2004
- Expansion and improvements include two gantries with uniform beam scanning
- IDE and 510(k) applications for the expansion filed
- First gantry opening late 2006
- Second gantry 2007