McLaren Proton Therapy Center

Sung Yong Park, Ph.D., Bijan Arjomandy, Ph.D.,
Wen Chien Hsi, Ph.D., Tae Kyu Lee, Ph.D.,
Travis Shultz, M.S., Alfred Smith, Ph.D.

McLaren Proton Therapy Center

McLaren Cancer Institute

McLaren - Flint

2013 Particle Beam Therapy Symposium, 2013.08.03

McLaren

McLaren Cancer Institute

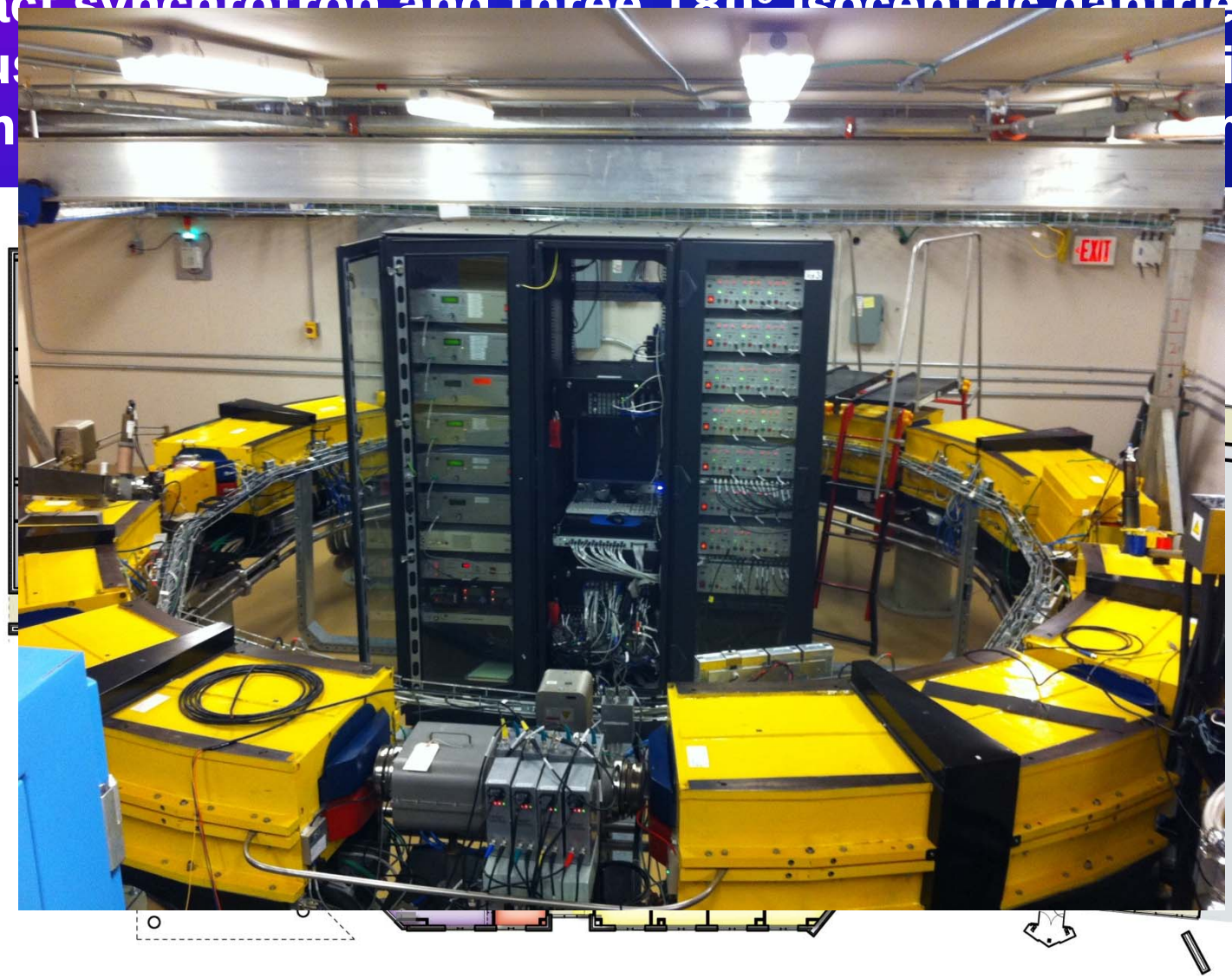
- Describe machine configuration and layout
  - 3 Gantry rooms
  - Delivery systems (PBS only)
  - TrueBeam, Tomotherapy, 21EX in same building, and 2 21IX off site

McLaren Proton Therapy Center Flint, MI

McLaren

Space Layout for the MPTC

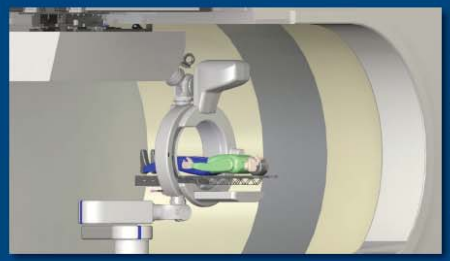
- Compact synchrotron and three 180° isocentric gantries
- IGRT us ies
- Treatm ns



McLaren

PROTON THERAPY CENTER

The Proton Therapy Center represents a new era for lower-cost, breakthrough technology treatment centers. It has 52,000 sq. ft. of space, with a synchrotron, three treatment rooms, an additional CT simulator and a PET/CT.



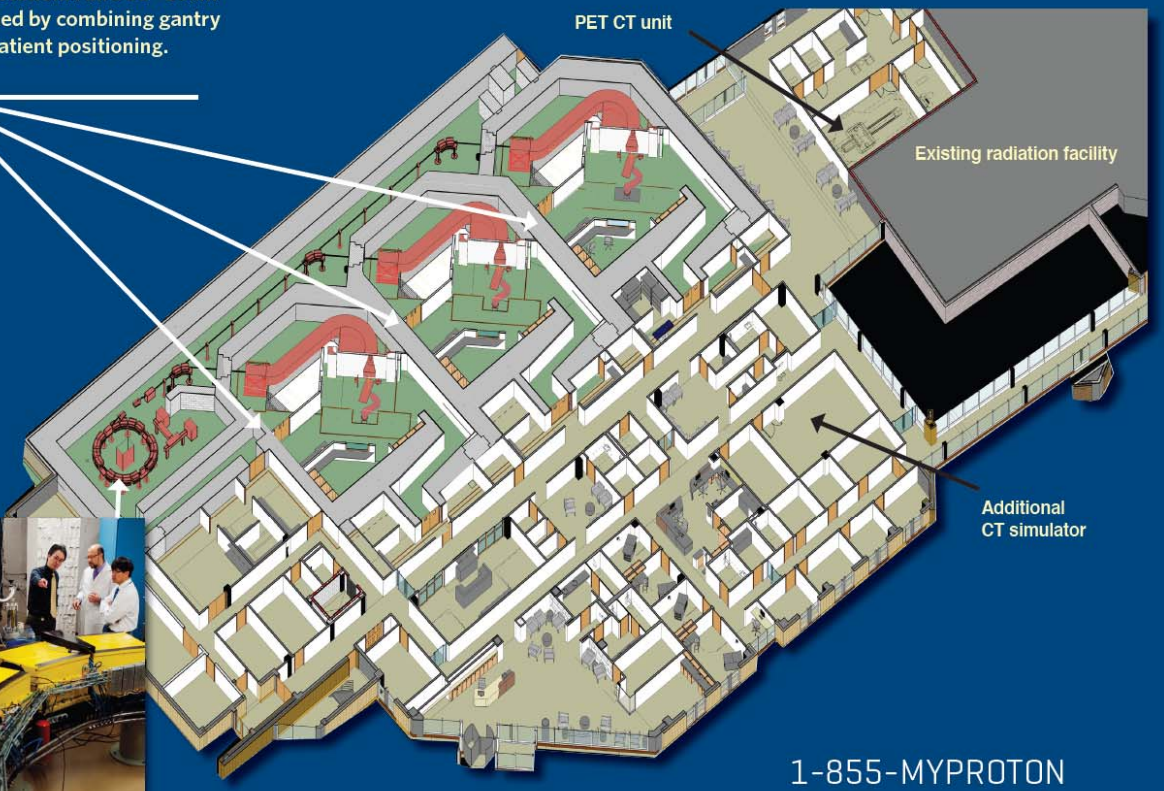
The McLaren Proton Therapy Center takes proton therapy into its next generation with several major advances including pencil-beam scanning, an isocentric gantry and cone beam CT.

The gantry has 180° rotation. Full 360° beam delivery is accomplished by combining gantry rotation and robotic patient positioning.

Construction space and costs are reduced via integration with an existing radiation facility.

The Hospitality House at McLaren will provide an affordable, supportive home-away-from-home environment to patients and their caregivers which will assist in the overall healing process.

The Radiance 330 synchrotron is a compact design that accelerates protons up to 250 MeV for therapy and 330 MeV for proton tomography.



1-855-MYPROTON
(697-7686)

mclaren.org/protonbeamtherapy

McLaren

McLaren Cancer Institute

- Estimated number of patients per day
  - 30 patients per room (2 adult gantries)
  - 8 patients per day (pediatric gantry)
- Disease Sites:
  - Prostate (initial)
  - Other pelvic
  - Cranial / CNS
  - H&N
  - Breast
  - Lung (pending resolution of interplay effect for modulated scanning delivery)

McLaren

McLaren Cancer Institute

- Staffing
  - Physicists
    - Current: 5 ; Planned: 5
  - Physicist Assistants
    - Current: 0; Planned: 2
  - Therapists
    - Current: 3; Planned: 10
  - Dosimetrists
    - Current: 2; Planned: 5
  - Radiation oncologists (Covering both proton and x-ray)
    - Current: 3; Planned: 6

McLaren

Anticipated Daily Machine QA

- Daily QA testing includes
  - Safety: door interlock, A/V, beam on indicators
  - Mechanical: couch motion and laser accuracy
  - Dosimetric: output, range/energy, spot positioning
  - Imaging: alignment and positioning
- Will initially be performed by physicists and eventually will be run by physics assistants
- Goal is to reduce daily QA time to under 30 minutes per room

McLaren

Overview of Daily Tests

- Dosimetric tests: output accuracy, range, spot position, spot pattern
- Mechanical tests: couch motion, laser positioning system
- Imaging system tests: image alignment test, PPS correction accuracy
- Safety tests: door interlock, audio and video, proton beam on indicators, X-ray imaging beam on indicators

Weekly QA

- Do you have a weekly schedule? Yes
- Describe tasks performed by physicists during weekly(if applicable) or monthly QA processes: to be followed
- Describe main equipment used: MatriXX, CCD camera based detector

Overview of Weekly Tests

- Procedures
  - Dosimetric tests: Dose/MU constancy check, uniform field
  - Mechanical tests: couch isocentricity
  - Imaging system tests: Imaging isocenter accuracy
  - Review of daily QA
- Equipment
  - 2D ionization chamber array
  - In house 2D optical dosimeter

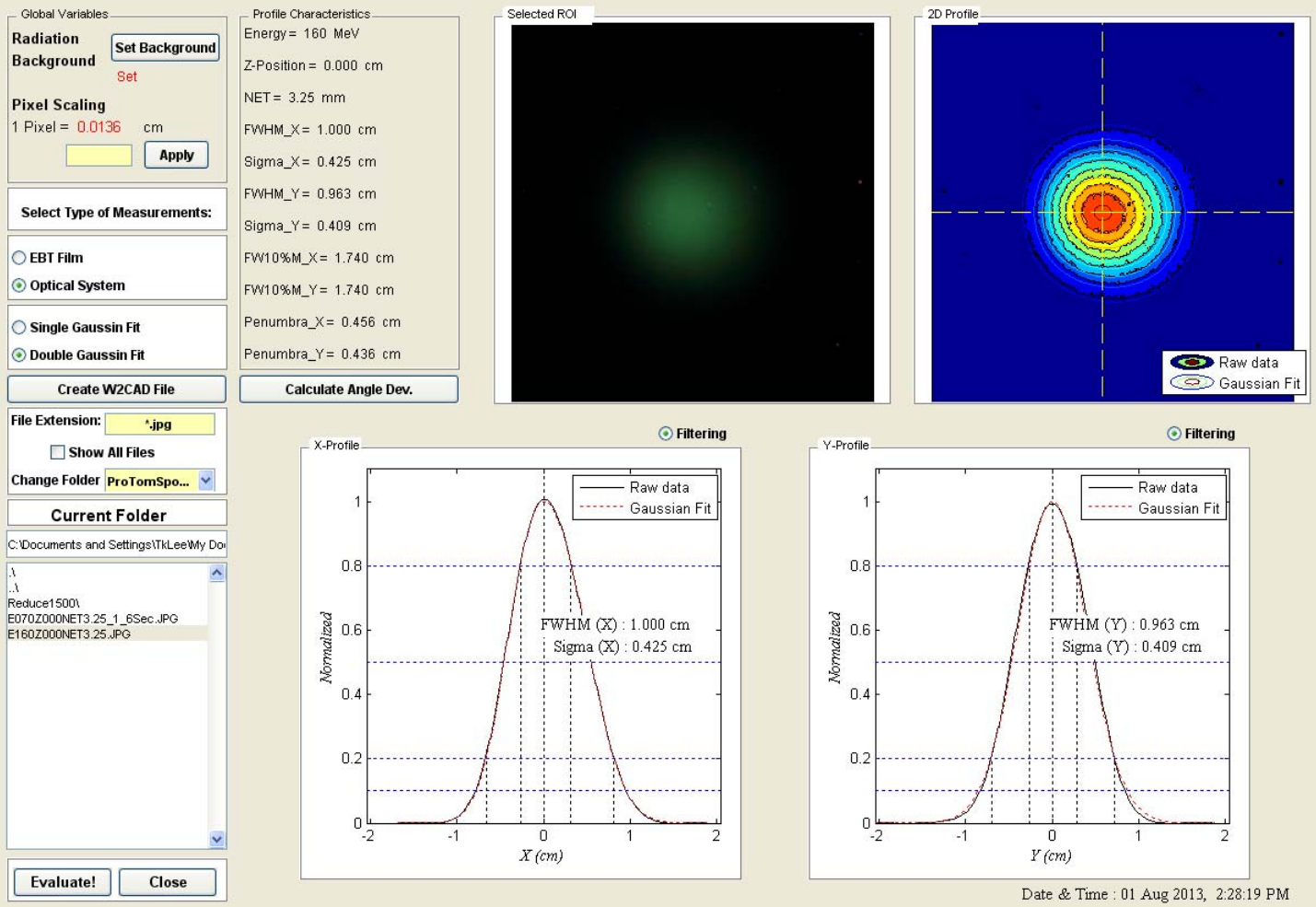
Overview of Monthly Tests

- Dosimetric tests
  - Output accuracy of 3 reference fields
  - Range accuracy of 3 reference fields
  - Spot alignment tests
- Mechanical tests
  - Gantry Isocentricity Test
  - Gantry Angle Accuracy
  - Imaging system isocentricity
- Imaging system
  - Imaging and radiation coincidence
- Safety tests: Gantry collision, couch collision
- Review of daily and weekly QA

Monthly QA

- Performed by Physicists
- Estimated time 8 hours
- QA Equipment includes
  - Water tank
  - MLIC
  - 2D optical dosimeter
  - 2D Ion chamber array

2D optical dosimeter



Annual QA

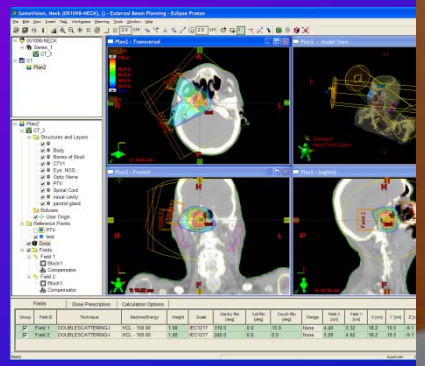
- Dosimetric
  - Dose calibration using TRS-398 protocol
  - Verification of subset of TPS Data
    - Spot profile verification
    - DD checks
  - Dose linearity
  - Spot positioning accuracy
  - Dosimetric verification at multiple gantry angles
- Safety Interlocks (radiation and mechanical)
- Imaging and Mechanical per established guidelines

Anticipated Patient Specific QA

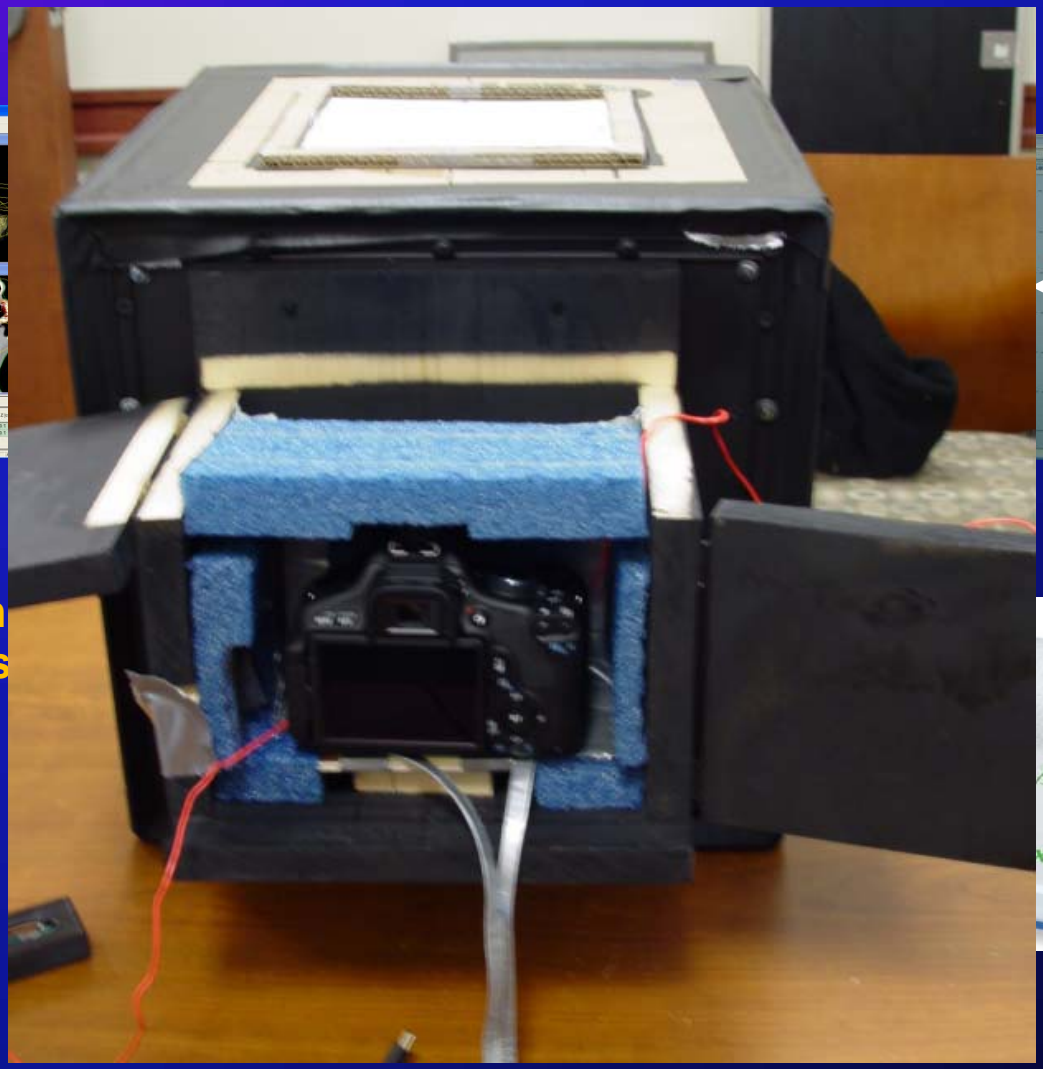
- Modulated scanning is able to deliver patient treatments with no patient specific hardware (e.g. aperture and compensator)
  - Patient specific QA will focus on dosimetric measurements
- 2 hours per patient
- Tolerance: γ index with 2% dose and 2 mm DTA with 90% passing

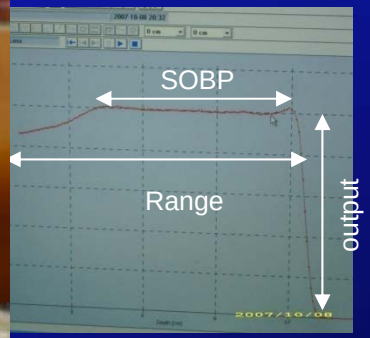
Patient QA Procedure

TPS



Treatment Planning
→ 2D dose profiles measured with ion chamber array at s depths





Time consuming job : ~ 2hrs/patient

McLaren

Other Unique Implementations in your center

- **Compact synchrotron and gantries reduce the required building footprint.**
- **System is exclusively pencil beam scanning capable of delivering both IMPT and SFUD fields.**
- **Synchrotron reduces the thickness of shielding as compared to cyclotron-based systems, resulting in reduced construction costs and reduced radioactivity contamination.**
- **Unique high energy proton acceleration to 330 MeV that can be used for Proton Tomography, which will improve TP accuracy.**
- **Modular, rather than monolithic, control system.**

McLaren

Hospitality House

- Designed for Patients and Caregivers
- Many patients will travel an hour or more to Flint for Proton Therapy
- Long-term stays, typically 6 – 8 weeks
- The Hospitality House will be a non-profit
  - Room fees would be in the form of suggested donation ($35 per night)
- 20 – 30 guest rooms
- About 38,000 square feet

Hospitality House

Open July 18, 2013

Your top 3 items in your wish list (if you could have them in the future)

- Tumor tracking and respiratory gating system for PBS
- Optical surface imaging system that is able to account for 180° table rotation
- Multi-layer ionization chamber (> 15 cm diameter)

McLaren