History of Proton Therapy at UPENN

- 1996- Dr. Gillies McKenna started a campaign to build a combined conventional and proton therapy facility.

- Several failed attempts to secure finance until 2005

- Proton therapy group works continuously- 4-6 MDs, PhDs and administrator.
History of Proton Therapy at UPENN

- 2005- Partnership- University of Pennsylvania, Children’s Hospital of Philadelphia and Walter Reed Army Medical Center

- Budget of ~ 140 million dollars to add Proton Therapy to the new department of Radiation Oncology that UPENN is building.

- Total cost of new department including construction and equipment is ~ 200 million dollars
Perelman Center for Advanced Medicine
Floor Plan of the New Department of Radiation Oncology- UPHS---140,000SqFt Combined Conventional and Proton Therapy
Proton Therapy Facility- UPHS
Proton Therapy at Upenn- Timeline

- Contract with IBA and Varian - 06/2006
- Cyclotron and Gantries at site – beginning of installation- 10-12/2007
- Acceptance of first Gantry- July 2009
- First patient treatment- Summer 2009
- Open last treatment room- Summer 2010
UPENN approach

- minimize number of vendors in the facility to minimize problems of integration

- Combine advanced technology of conventional radiotherapy with proton technology = MLC, CBCT

- Throughput close or identical to conventional system - switching time, set up room, beam scheduling system, automatic bolus exchange, PBS
IBA- main contractor

- IBA- Main contractor; responsible for the entire system integration
  - Cyclotron-Proteus 235-230MeV
  - Beam lines
  - 4 Gantries
  - 1 fixed beam room
  - 1 research room
  - Control system
  - Treatment control system
Varian- main equipment for UPENN

- 4 linear accelerators- Clinac iX
- Treatment planning system- Eclipse
- Oncology information system- Aria
- 2 conventional simulators- Acuity
- Respiratory gating
- Stereotactic equipment
- Zmed
- Multileaf collimator- 3 way agreement
- Cone Beam CT- 3 way agreement
UPENN –new developments-Proton

- MLC
- Automatic compensator exchange
- Cone Beam CT
- Fast switching time
- Beam scheduling system
- Set up room (before first treatment)
### Equipment of Proton Treatment Rooms - UPHS

<table>
<thead>
<tr>
<th></th>
<th>Room 1</th>
<th>Room 2</th>
<th>Room 3</th>
<th>Room 4</th>
<th>Room 5</th>
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<tbody>
<tr>
<td><strong>Type</strong></td>
<td>Gantry</td>
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<td><strong>PPS</strong></td>
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<tr>
<td><strong>Rolling Floor</strong></td>
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<td>✗</td>
<td>✓</td>
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<tr>
<td><strong>Nozzle</strong></td>
<td>Full Universal</td>
<td>PBS Dedicated</td>
<td>Full Universal</td>
<td>Universal (SIS-DS-US)</td>
<td>Universal (SIS-DS-US)</td>
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<tr>
<td><strong>MLC</strong></td>
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<td>✗</td>
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<tr>
<td><strong>Light Field</strong></td>
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<td>✓</td>
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<tr>
<td><strong>Lasers</strong></td>
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<tr>
<td><strong>X-Rays</strong></td>
<td>2 (BEV incl.)</td>
<td>3</td>
<td>2 (BEV incl.)</td>
<td>2 (BEV incl.)</td>
<td>2 (BEV incl.)</td>
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<tr>
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<tr>
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<td>✓</td>
<td>✓</td>
<td>✗</td>
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</table>
Upenn –Proton Facility-Throughput Projection

- Patients will be treated 16 hours per day.
- 11 shifts per week
- Approximately 200 patients per day
  (average of 23-24 minutes per patient)