Dosimetry Technology For Radiation Oncology
Tech Transfer Workshop 2018

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Personal Introduction

- Product Specialist – IBA Dosimetry
- ARRT Board Certified
  - Radiography
  - Therapy
- Experience
  - Clinical
    - Facility Director
    - Therapist
  - Vendor
    - Applications Specialist
      - Hardware
      - Software
    - Project Management
    - EMR Implementation Consultant
Introduction to IBA

- Proton Therapy
- Dosimetry
  - 220 International Employees
  - 4 Offices
    - USA, Germany, China, France
Radiation Oncology

- Radiation Oncology
  - ‘Mysterious’ Portion of Healthcare
- Radiation has been an effective tool for treating cancer for more than 100 years.
- About two-thirds of all cancer patients will receive radiation therapy as part of their treatment.
- Radiation therapy works by damaging the DNA within cancer cells resulting in cell death.
- The goal is to destroy as many of the cancer cells as possible while committing as little damage to the healthy cells as possible.
Radiation therapy is used different ways.

- **Destroy Tumors**
- **Shrink Tumors**
  - Pre / Post Surgery or Chemotherapy
    - Pre – reduce size for resection
    - Post – residual / microscopic
- **To reduce symptoms - Palliation**
  - Shrink tumors affecting quality of life, like a lung tumor that is causing shortness of breath or tumor causing compression.
Traditional Radiation Oncology

- **Photon Beam (X-Ray):**
  Energy: 6 MV and 15 MV

- **Electron Beam:**
  Energy: 6, 9, 12, 15 and 18 MeV
Radiation Oncology QA - Dosimetry

- Treatment is the point of no return.....

- Similar to a pharmacist checking a Rx

- QA is extremely important.....
  - Short Term: Disease Management
  - Long Term: Side Effects
IBA Dosimetry Product Line

- Medical Imaging
- Radiation Therapy
  - Photon
  - Electron
  - Proton
- Software
  - MyQA Product Suite
    - Machine QA
    - Patient QA
    - Real Time Analysis
    - Trending / Analytics
Detectors

- StarTrack
  - Machine QA
  - 452 Chambers
  - 5mm Resolution

- MatriXX
  - Machine QA
  - Patient QA
  - 1020 Chambers
  - 7.6mm Resolution
All QA applications **integrated**

**Instant QA overview**

**Intuitive and unique interface**

**Simple and clear reporting**

All data
- managed by **one Platform**
- saved into **one database** (SQL)
IBA Proton Dosimetry Product Line

- Beam Models
  - PBS
  - DS
- QA Equipment
  - Commissioning
- Patient QA
FROM COMMISSIONING TO PATIENT QA

Blue Phantom²

Commissioning

Machine QA

Patient QA

Stingray
Lynx

How it works

- **Scintillator**
  - Active surface: 30 x 30 cm
  - Gadolinium based

- **Mirror**

- **CCD Camera**
  - Resolution= 0.5 mm
  - 1024x1024, 12-bit
  - Controllable Iris
    - For beam current saturation control
  - Different modes
MyQA – Lynx Plugin
FROM COMMISSIONING TO PATIENT QA

Commissioning

Machine QA

Patient QA

Blue Phantom²

Lynx

Giraffe

Stingray

Zebra

Sphinx
Sphinx - MyQA
FROM COMMISSIONING TO PATIENT QA

Blue Phantom²

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Stingray

Zebra

Sphinx

DigiPhant
Customer Needs / Challenges

- **More Efficiency**
  - Less QA Time = More Patient Care Time

- **Peace of Mind**
  - SBRT
    - High Dose
    - Small Fractions
    - One incorrect treatment = 20% Error
Absolute and Relative Dosimetry

- AAPM TG 142 Protocol
- Overwhelming amount of QA for Physics teams
  - Daily, Weekly, etc.
  - kV, mV, CBCT, SRS, SBRT, etc.

- Water Phantoms
  - Cumbersome
  - Time consuming: Long setup and measurement time
  - Gold Standard
LINAC QA

- Needs
  - Equipment
    - Dosimetric
    - Imaging
    - Mechanics

- Challenges
  - Different Vendors
  - File Formats

- Solution?
  - ‘Standard’ Detectors
  - Single File Protocol
Patient Treatment QA - Pretreatment

- **Most Time Intensive QA**
  - Trend = Adopt Most Effective Method
    - Quick Verifications
      - EPID
      - Calibration Concerns by customers
    - Additional Measurements only when necessary (Europe)
      - Not currently strong in US
        - Mandatory
        - Reimbursed

- **Normal Fractionated IMRT**
  - Solutions are abundant
  - Rotational QA

- **Stereotactic Treatment**
  - Small Fields need small resolution
  - Measurement at Isocenter
  - Currently there are no good solutions
Patient Treatment QA – ‘Online’

- **EPIID**
  - Same concerns with calibration
  - 2D Analysis
    - Good for Patient positioning and Anatomy
    - Not good for dose distribution
  - Transmission Detectors
    - Measures’ ‘clean’ data without patient anatomy
    - Beam Attenuation
      - Multiple Vendors
        - Nominal Resolution
        - Pre-treatment measurement with phantom
        - No fluence map = No Dose
  - Log Files
    - Not real measurement?
    - Not independent of machine manufacturer under test
Patient QA – Data

How is it utilized?
- TPS
- QA Dose Engines
- Adaptive Radiation Therapy (Real Time)
  - Registration of Components
    - CBCT
    - Dose Distribution
    - Planning CT
- Leads to Automated Re-planning
- Requires more patient time
- Requires more CMD resources
Additional Challenges

- **Many Vendors**
  - Different File formats
  - Competition – leads to inability to work together for a solution
    - Proprietary Hardware / Software

- **MR Linacs**
  - Elekta
  - ViewRay

- **IT**
  - Network Concerns
    - Data Breaches
    - Wireless Connectivity
    - HIPAA

- **Cardiac Treatments**
Future?

- AI
- New Technologies
- More Automation
Thank you for your time!