



# ProNova

**Redefining the Future of Cancer Treatment**

## **Student Research Day Tennessee Technological University**

**Joe Matteo**  
**Co-Founder and President**  
**ProNova Solutions, LLC**  
**Research, Development, and Operations**  
[Joe.matteo@pronovasolutions.com](mailto:Joe.matteo@pronovasolutions.com)

# What is Research? - The Scientific Method

- **Research** and experimental development is formal work undertaken systematically to increase the stock of knowledge, including knowledge of humanity, culture and society, and the use of this stock of knowledge to devise new applications
- **Scientific Method**
  - [Observations and Formation of the topic](#): Consists of the subject area of ones interest and following that subject area to conduct subject related research.
  - [Hypothesis](#): A testable prediction which designates the relationship between two or more variables.
  - [Conceptual definition](#): Description of a concept by relating it to other concepts.
  - [Operational definition](#): Details in regards to defining the variables and how they will be measured/assessed in the study.
  - [Gathering of data](#): Consists of identifying a population and selecting samples, gathering information from and/or about these samples by using specific research instruments.
  - [Analysis of data](#): Involves breaking down the individual pieces of data in order to draw conclusions about it.
  - [Data Interpretation](#): This can be represented through tables, figures and pictures, and then described in words.
  - [Test, revising of hypothesis](#)
  - [Conclusion, reiteration if necessary](#)

# Discovery - Passion, Persistence

Research + Development + Commercialization + 5(P) = SUCCESS

## 5 P's of success

- **Purpose**

- *The secret of success is constancy of purpose.* - Benjamin Disraeli

- **Planning**

- *In all things, success depends upon previous preparation, and without such preparation there is sure to be failure.* - Confucius

- **Positive Thinking**

- *The difficult can be done immediately, the impossible takes a little longer.* - Army Corp. of Engineers

- **Passion**

- *Do what you love.*— Marsha Sinetar

- **Persistence**

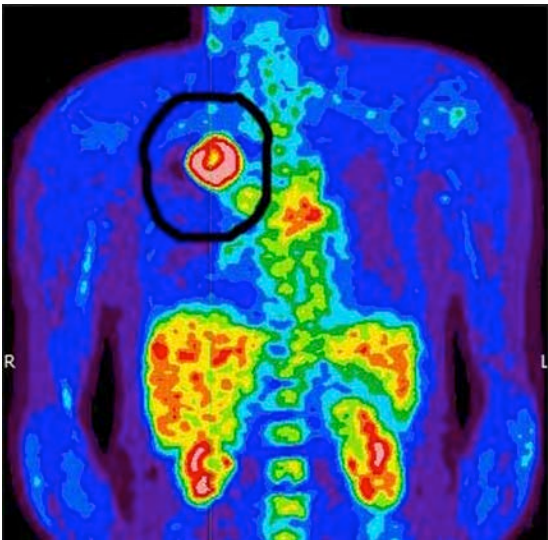
- *Success is going from failure to failure without losing your enthusiasm.* - Abraham Lincoln

# Research Making a Difference – Cancer Care



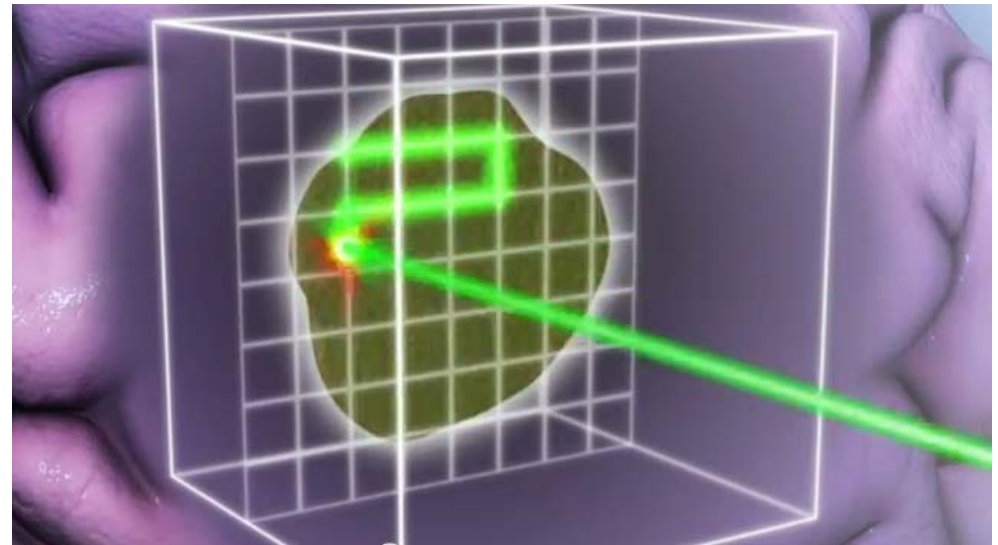
## PET - Diagnosing Cancer (Positron Emission Tomography)

- *Functional Imaging*
- *Early detection*



## PT- Treating Cancer (Proton Therapy)

- *Precision treatment*
- *Faster, safer*





# A Pioneering Community

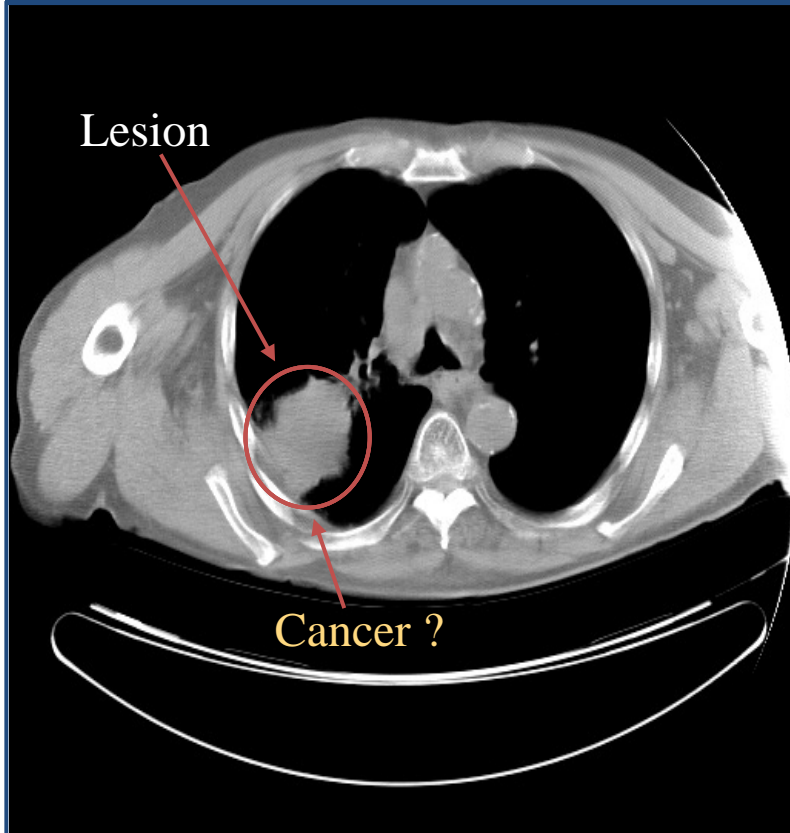
**Knoxville-Oak Ridge Innovation Valley** is the hub for Radiological Science

- Oak Ridge National Laboratory
- Spallation Neutron Source
- Radiation Detection and Instrumentation
- PET & PET/CT Imaging, PET Cyclotrons
- Bio-Tracer Technology
- University of Tennessee
- Proton Therapy
- Cryo-magnetics
- Radioisotopes
- Scintillation

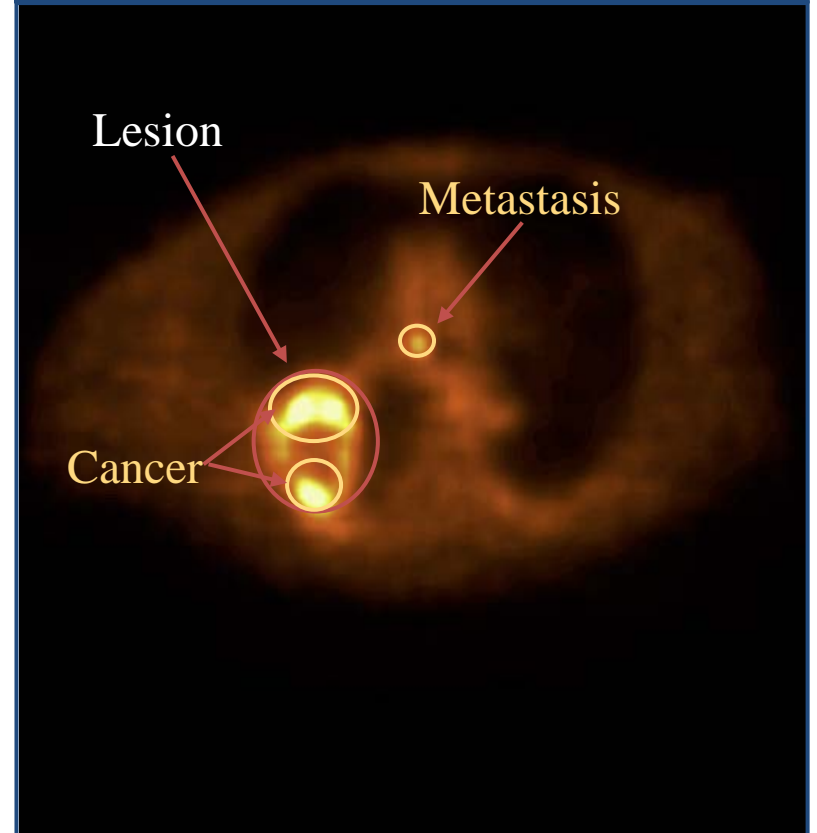


# The Power of PET/CT

CT = Lesion Localization

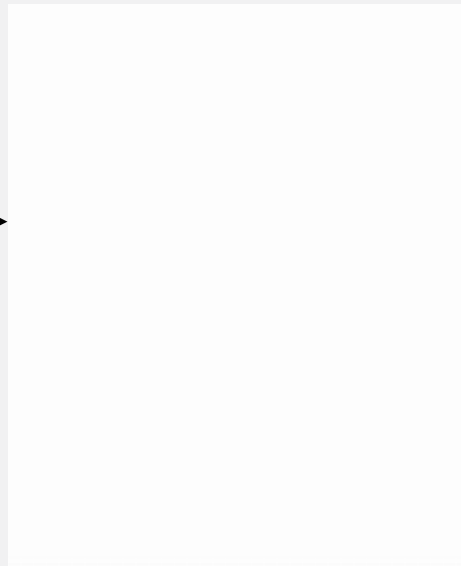
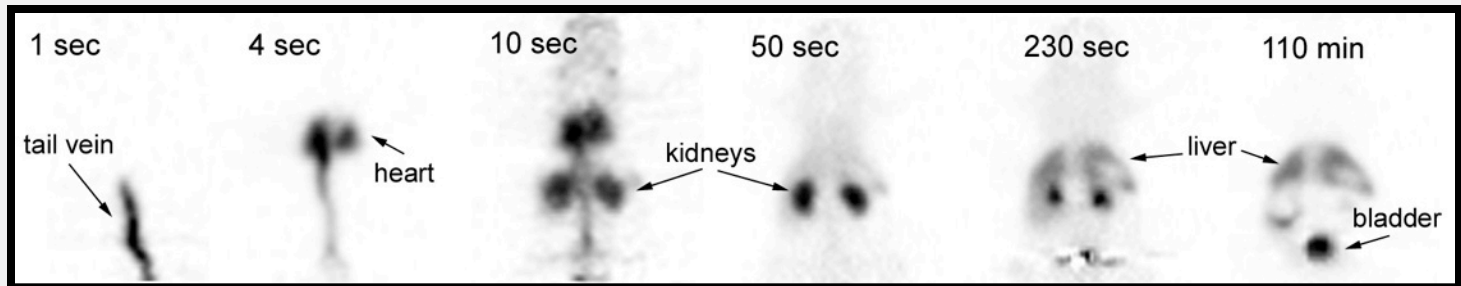


PET = Cancer Identification



**PET/CT impacts patient management 36% of the time compared to CT or PET alone.**

# microPET<sup>®</sup> Image Acquisition



**34g mouse**

**1 bed position**

**Variable time frames**

**1msec -static**

Michael Kreissl MD, Hsiao-Ming Wu PhD, David Stout PhD, Patrick L Chow MS, Arion Chatziioannou PhD, Sung-Cheng Huang DSc, Heinrich R. Schelbert MD PhD, Crump Institute for Molecular Imaging



ProNovaSolutions.com

# Combined Experience



## ProNova has a strong History of Innovation



Developed and commercialized  
**PET & PET/CT**  
technology



One of the largest suppliers of  
**Cyclotrons**  
In the world





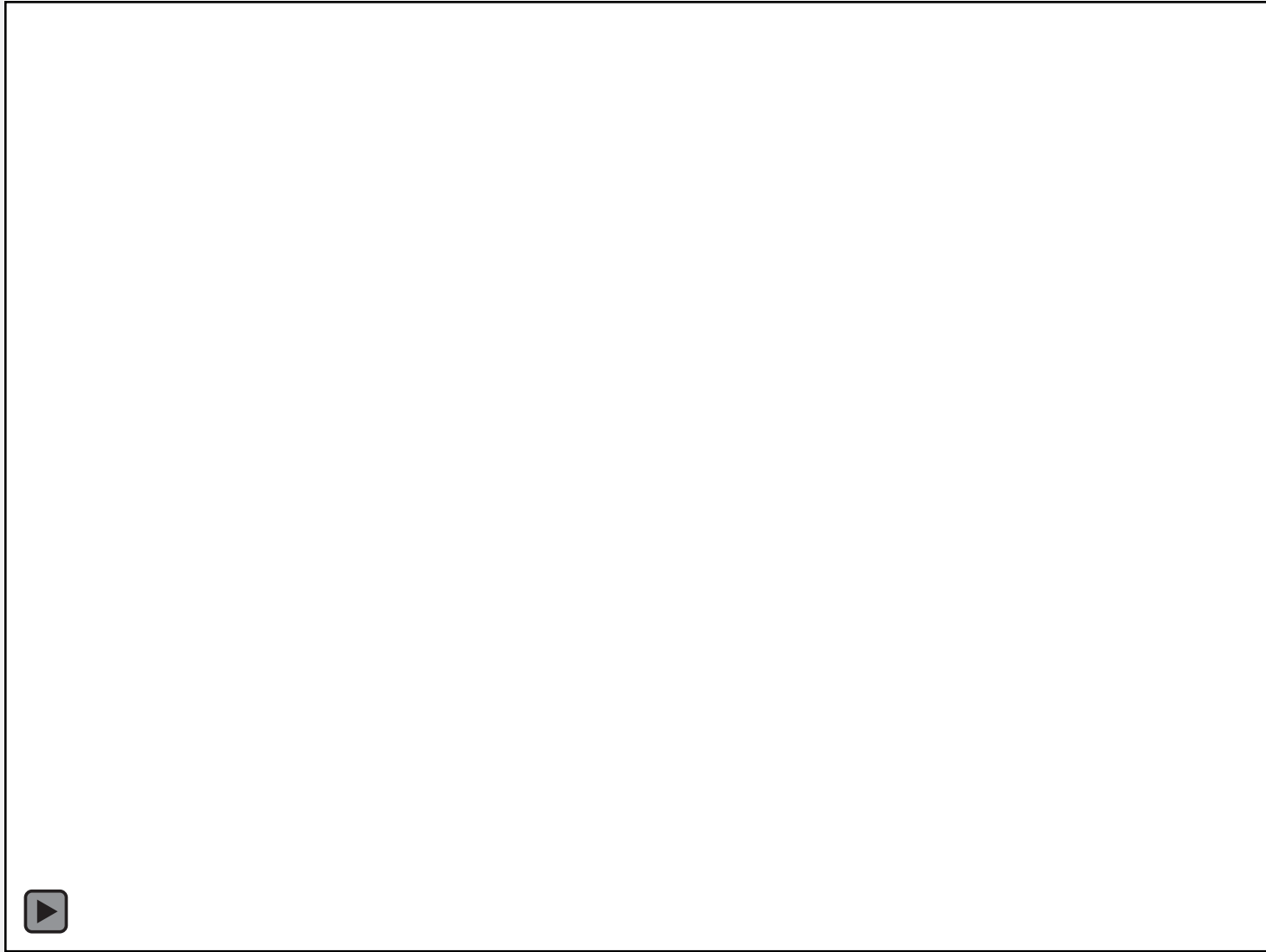
# ProNova

**Redefining the Future of Cancer Treatment**

## **Proton Beam Radiation Therapy**

- **Research**
- **Development**
- **Commercialization**

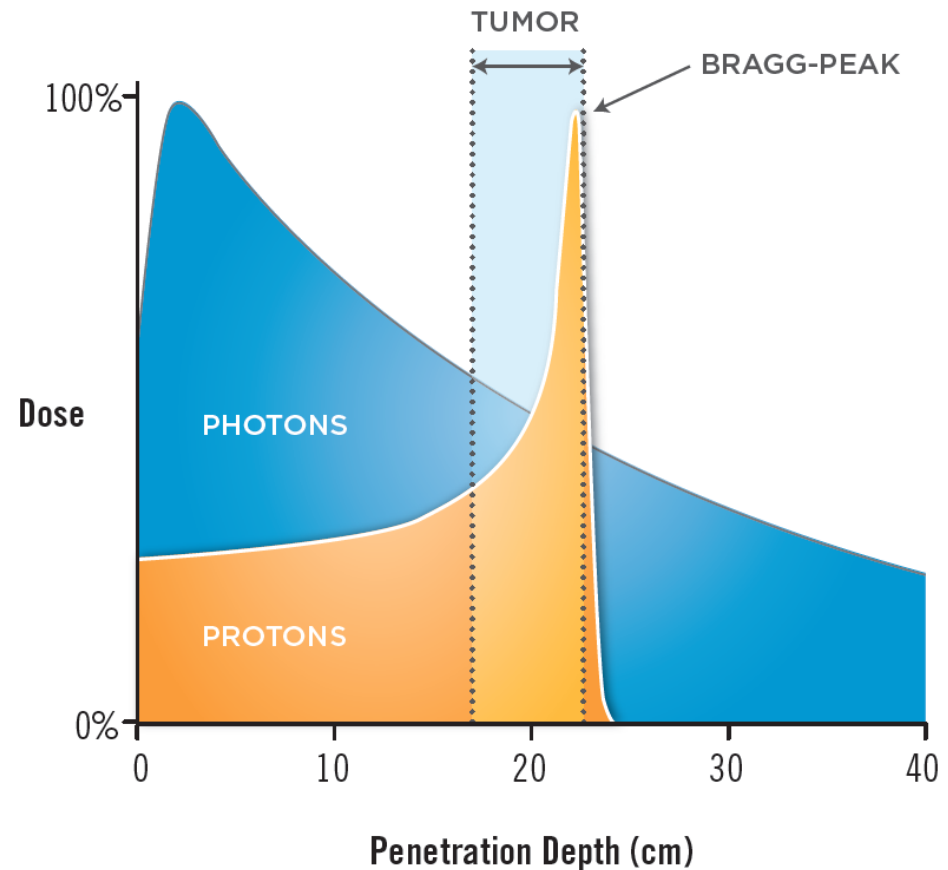
# Proton Beam Radiation Therapy





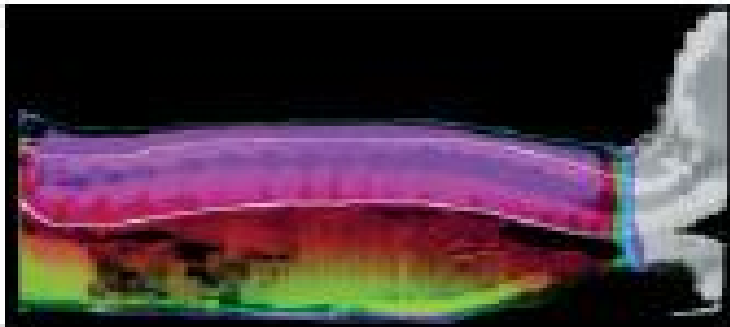
# What is Proton Therapy?

- Protons deposit their maximum energy in the tumor and then stop.
- Conventional radiation therapy (photons or x-rays) deposits energy entering the tumor and exiting the tumor potentially damaging healthy tissue.
- Collateral tissue damage, side effects, secondary tumors, and total treatment costs are all reduced with proton therapy.

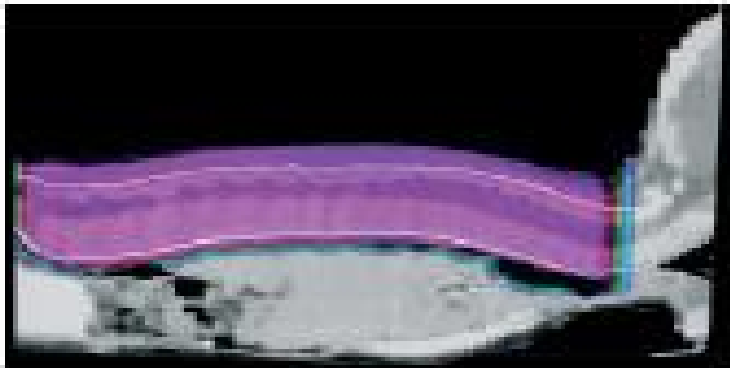
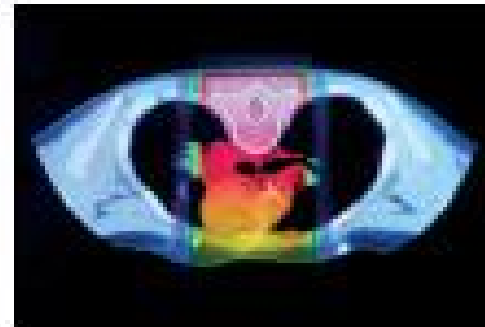


# What Makes PT Different?

Protons deposit their maximum energy in the tumor and then stop



Photons



Protons: Vital healthy organs are spared with Particle Therapy





# Proton Therapy Improved Outcomes

MODALITY	DOSE	RECURRENCE	COMPLICATIONS
Conventional Radiation	<60GY	38%	22%
Conventional Radiation	60-65GY	36%	35%
Conventional Radiation	70GY	28%	45%
Conventional Radiation	>75GY	20%	60%
<b>PROTONS</b>	<b>75GY</b>	<b>5%</b>	<b>12%</b>

ACUTE SIDE EFFECTS	PROTONS	PHOTONS
Nausea/Vomiting	0%	30%
Shortness of Breath	0%	16%
Esophagitis	<5%	31%
Fatigue	<5%	23%
>5lb Weight Loss	0%	34%

SIDE EFFECTS	PROTONS	PHOTONS
Restrictive Lung Disease	0%	60%
Reduced Exercise Capacity	0%	75%
Abnormal EKGs	0%	31%
Growth Abnormality	20%	100%
IQ Drop 10 pts by 6yrs old	1.6%	28.5%
Risk of IQ score <90	15%	25%

## Improvements in Prostate Cancer

N. Mendenhall M.D.

*Presentation*

University of Florida, IBA

## Improvements in Lung Cancer

J. Metz M.D.

*Reduced Normal Tissue Toxicity with Proton Therapy Comparative Effects for Lung Cancer Treatment. Oncolink 4.29.02*

## Improvements in Pediatric Cancer

Head, Neck, & Chest. J. Metz M.D.

*Reduced Normal Tissue Toxicity with Proton Therapy Comparative Effects for Lung Cancer Treatment. Oncolink 4.29.02*

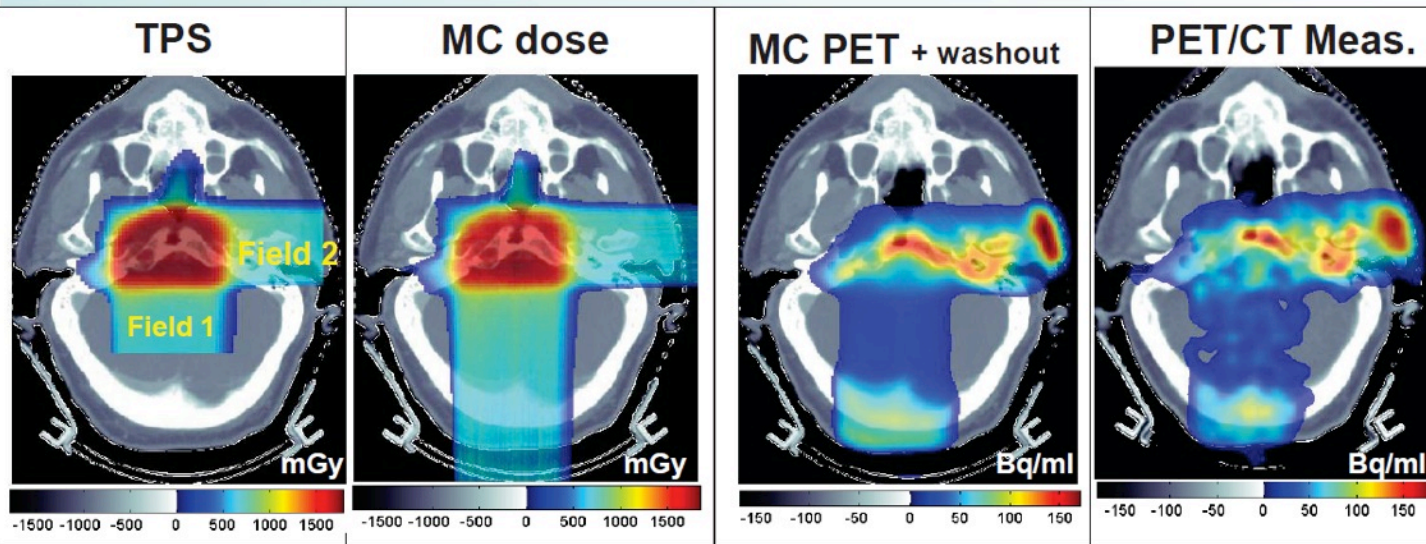
# PT and PET Come Together

## Offline PET/CT for scattered $p$ therapy at MGH

*Clinical case of clival chordoma*

*Field 1: 0.87 Gy,  $\Delta T_1 \sim 26$  min*

*Field 2: 0.87 Gy,  $\Delta T_2 \sim 16$  min*



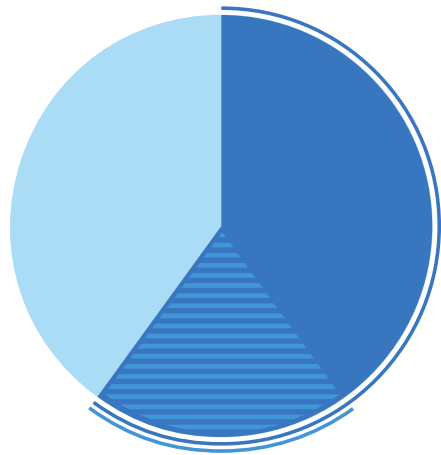
Range monitoring: possible in well co-registered low perfused tissues  
Challenges: washout, S/N, and (extra-cranial sites) motion, registration

*Parodi et al Int J Rad Oncol Biol Phys 2007*

# U.S. Need for Proton Therapy

## 1.6 million people

will be diagnosed with cancer in 2012



**960,000**

will receive radiation

**320,000**

are candidates for  
proton therapy

**11** existing centers have  
limited capacity & long waits



can treat only  
**12,900** patients a year.

**1,000 more**  
treatment rooms are needed

Source: Technology Insights research, analysis, and treatment volume projections. Advisory Board Outpatient Market Estimator  
<http://www.cancer.gov/aboutnci/ncicancerbulletin/archive/2009/090809/page8>

# What we are doing in Knoxville...



## Proton Therapy Equipment Manufacturer

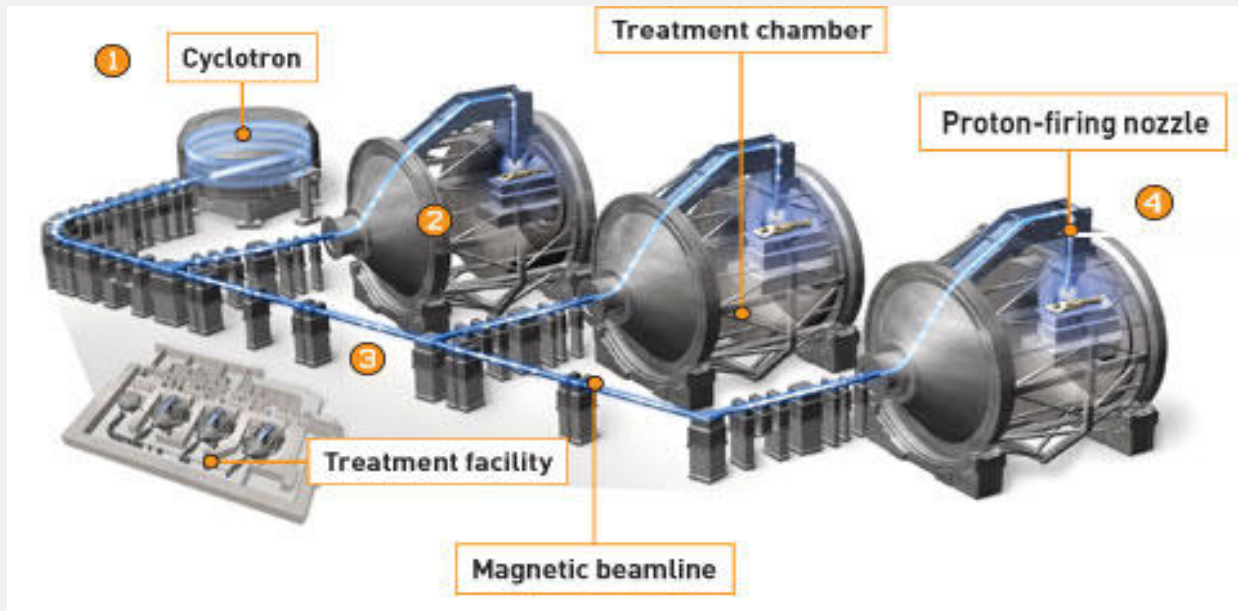
- PT 2-room compact system
- PT Research & Development
- PT Manufacturing
- High resolution imaging
- Superconducting magnets



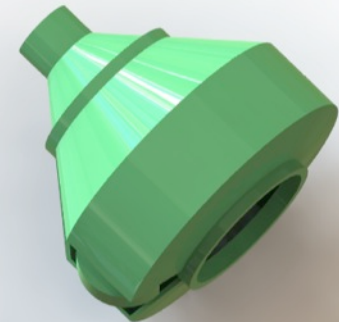
## Proton Therapy Clinical Provider

- Provision Center for Proton Therapy (PCPT)
- Provision RT Facility
- 1<sup>st</sup> ProNova customer
- Administrative services

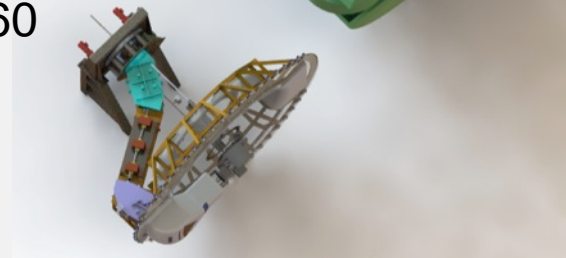
# Compact ProNova SC360 System



Conventional 360  
Gantry



PRONOVA  
SC 360



- **One-half the size**
- **One-half the power**
- **One-tenth the weight**



# Trending Smaller – Making Compromises

- **Competitive compact systems**

- IBA - Proteus One
- Mevion - Monarch 250
- Protom - Radiance 330

- **Compromises to get compact**

- Reduced treatment angle
- Reduced patient access
- Limited treatment options
- Limited imaging capability
- Limited upgradeability
- Limited access for maintenance
- Limited treatment capacity

**Conventional 360 Gantry**



**Mevion  
Monarch 250**

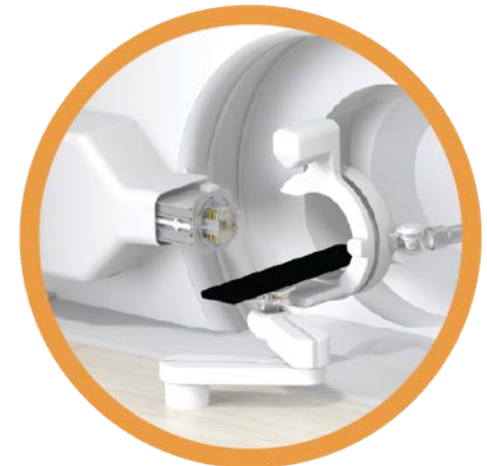
# ProNova's No Compromise Solution

## Full featured and future-proofed

- ✓ Maintain 360° treatment angle
- ✓ Direct Pencil Beam Scanning and Uniform Beam Scanning
- ✓ Intensity Modulated (IMPT), Image Guided (IGPT), and Hypo-Fractionation capable
- ✓ Workflow that mimics radiation therapy
- ✓ Cone Beam CT with Optional PET and multi-slice CT at isocenter
- ✓ Cantilever head allowing full access to patient
- ✓ 30% more room in treatment area



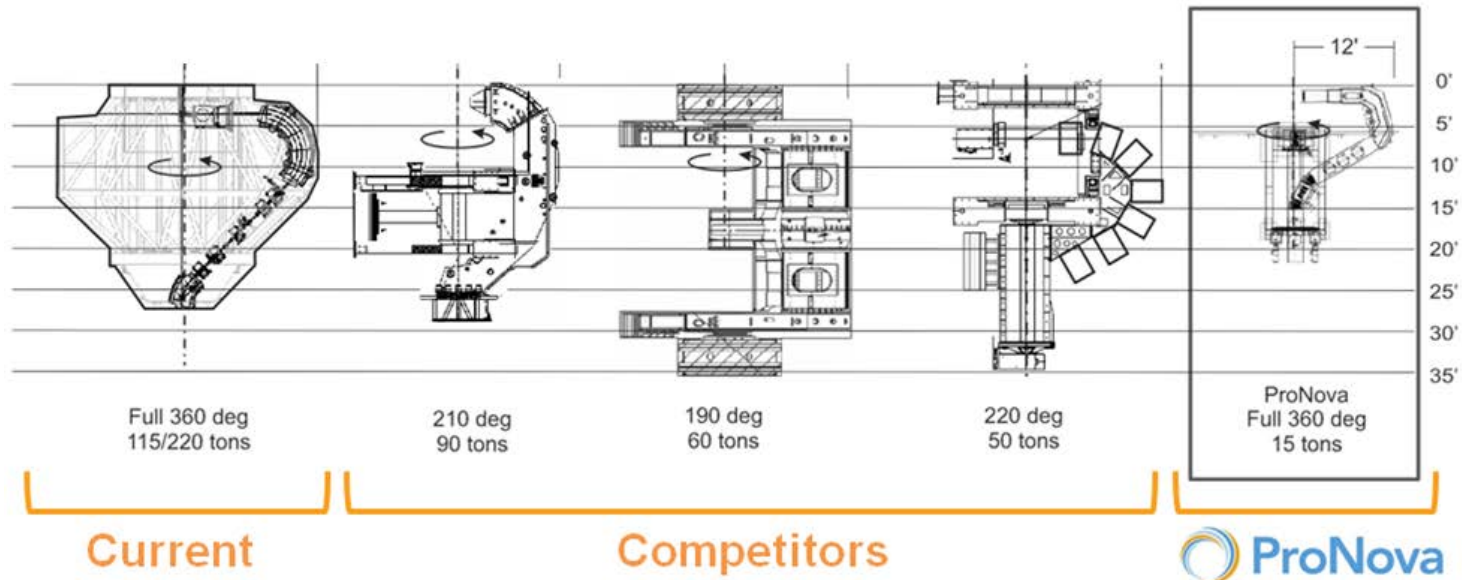
RT treatment room



ProNova PT treatment room

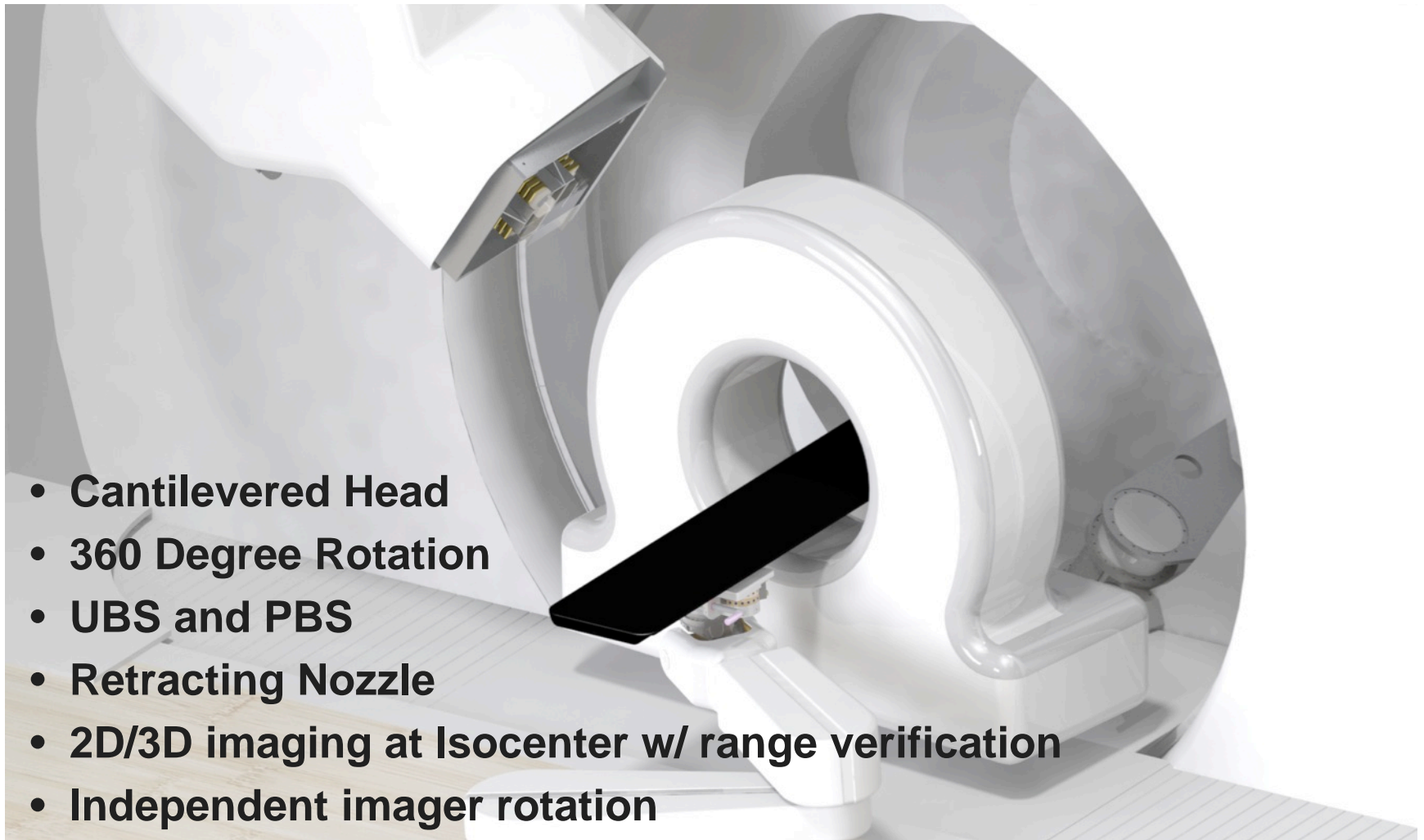
# Leveraging Technology

- **Superconducting magnets have multiple benefits**
  - Dramatically smaller size, weight, and power
  - 2X higher magnetic field, 0.5X bend radius
- **ProNova leverages superconducting magnet technology**
  - Maintains 360° rotation similar to radiation therapy
  - Ample room for full ring imaging at isocenter
  - Simplified shipping and installation reducing cost and time to market





# Multi-Slice CT and PET at Iso-center

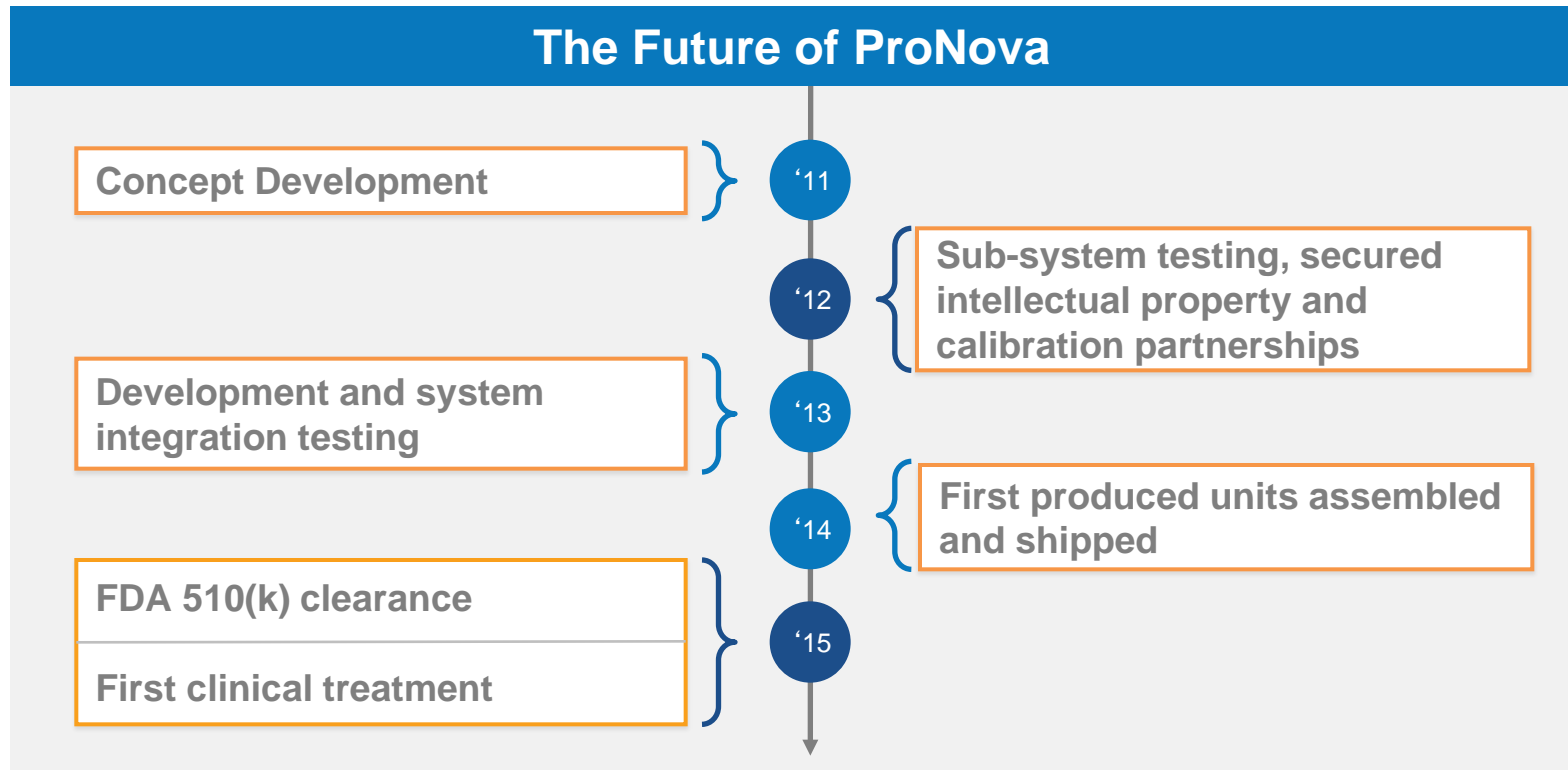


- **Cantilevered Head**
- **360 Degree Rotation**
- **UBS and PBS**
- **Retracting Nozzle**
- **2D/3D imaging at Isocenter w/ range verification**
- **Independent imager rotation**

# Gantry Assembly has started...



# ProNova Timeline



# Provision Center for Proton Therapy Knoxville, TN 2014



# ProNova R&D and Manufacturing Alcoa, TN 2014



# Ongoing PT Research & Development

- **Imaging**

- Use of imaging
- High resolution
- PET panels,
- Workflow

- **Control and**

- User Interface
- Planning software
- Re-planning

- **Patient Positioning**

- PT specific protocols
- Workflow with imaging
- Workflow with treatment

- **Dose Delivery**

- PBS techniques
- PBS with collimation
- Dosimetry

- **Advanced Manufacturing**

Careers in

- Engineering
- Physics
- Medical Physics
- Software
- Finance
- Operations
- Logistics
- Marketing
- Sales

- Sales

- Marketing

- Logistics

- Operations

Developments

Energy selection

Target technology

Simultaneous delivery

Studies

Response to therapy

## Position

Use of dual treatment plans

Utilize advanced imaging

Physicist, Dosimetrist

Management

## Management & Finance



# Thank You!

## Passion & Persistence make a difference

