Capital Market Day

Olivier Legrain (CEO)

25 September 2017

Agenda

Introduction

Olivier Legrain, Chief Executive Officer, IBA

The role on proton therapy in oncology

Andrew K. Lee, MD, MPH, Medical Director, Texas Center for Proton Therapy

Testimony on the development of a state-of-the-art proton therapy center

Craig W. Stevens, MD, PhD, Chair of Radiation Oncology, Beaumont Health System

North America PT market dynamics

Beth Klein, Beth Klein - Executive Vice President, IBA North America

Question and answer

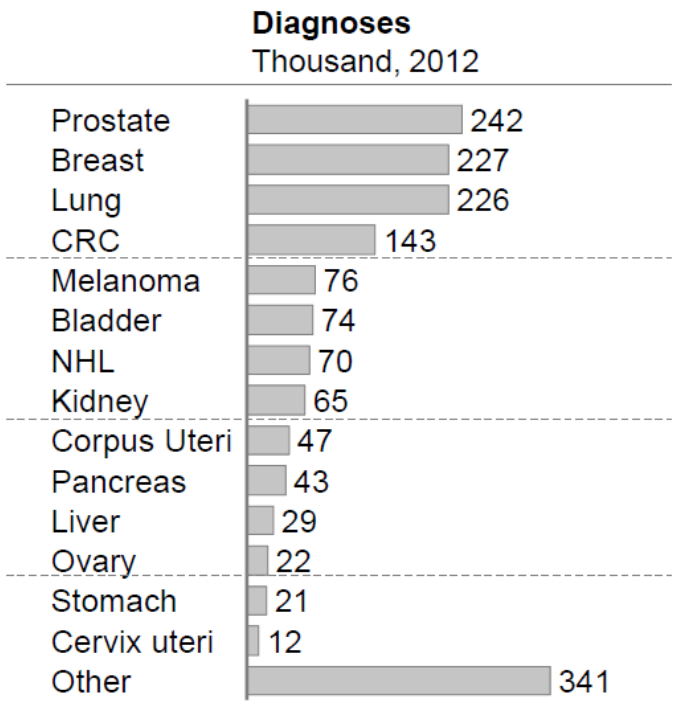
Optional tour of IBA's booth, # 2135

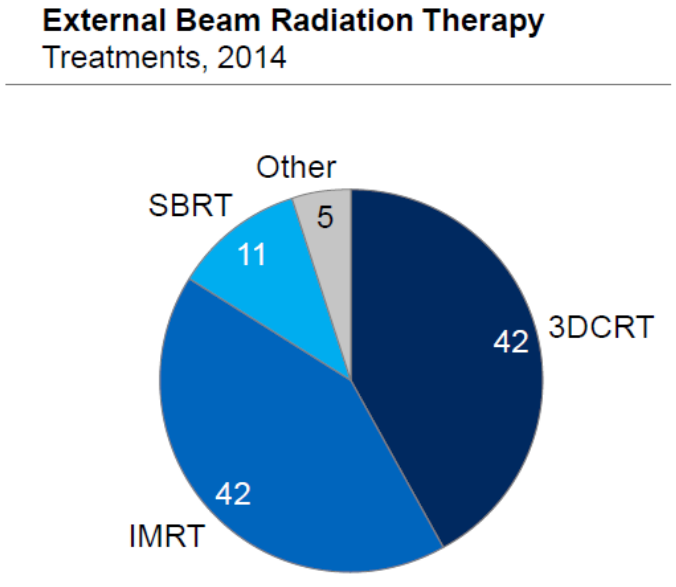
Disclaimer

This presentation may contain forward-looking statements concerning industry outlook, including growth drivers; the company's future orders, revenues, backlog, or earnings growth; future financial results; market acceptance of or transition to new products or technology and any statements using the terms "could," "believe," "outlook," or similar statements are forward-looking statements that involve risks and uncertainties that could cause the company's actual results to differ materially from those anticipated. The company assumes no obligation to update or revise the forward-looking statements in this release because of new information, future events, or otherwise.

In the US, 1.1M patients receive radiation therapy

- There are about 1.7M new cancer diagnoses per year in the US, and about 1.1M of patients receive radiation, often with curative intent





Total	**1.7 M**	**1.1 M**

SOURCE: SEER, IMV

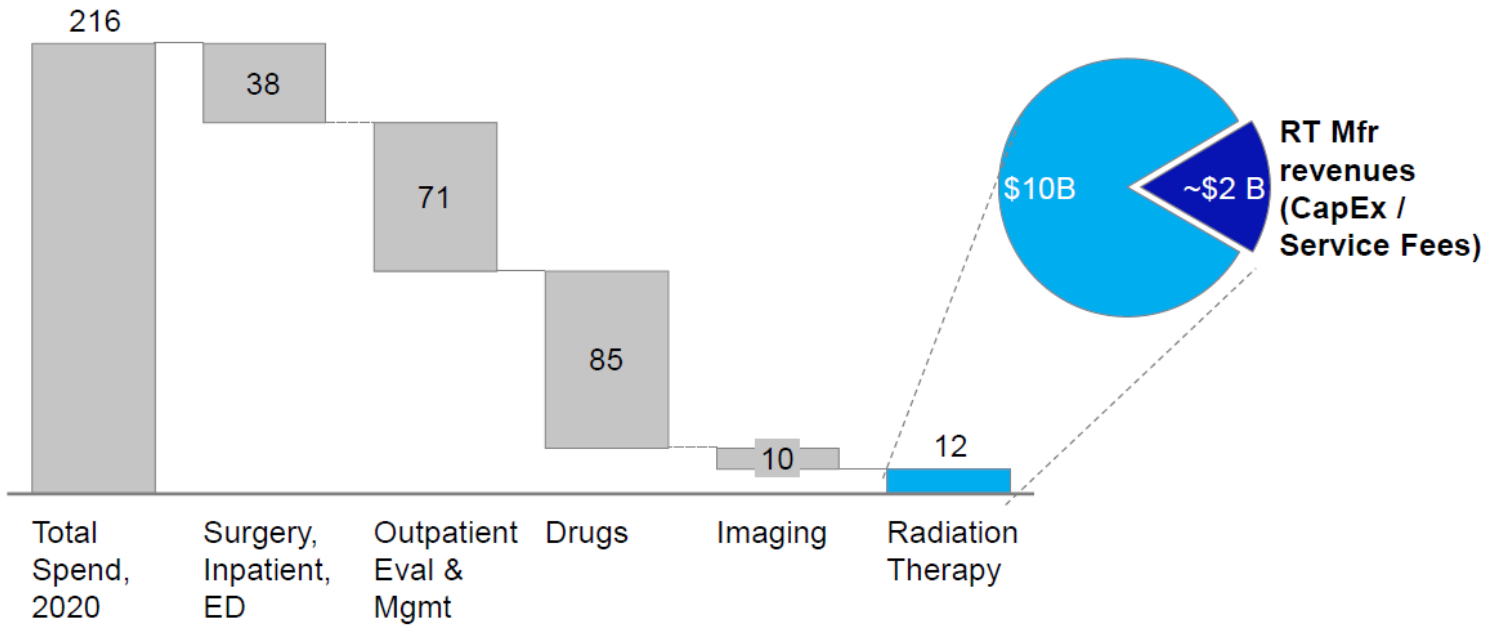
RT manufacturers capture a tiny slice of US Oncology market

- Despite nearly 1M patients treated per year, often with curative intent, RT manufacturers capture a tiny slice of the US Oncology market

PRELIMINARY ESTIMATES

US Annual Spend on Cancer Treatment, 2020

USD $B

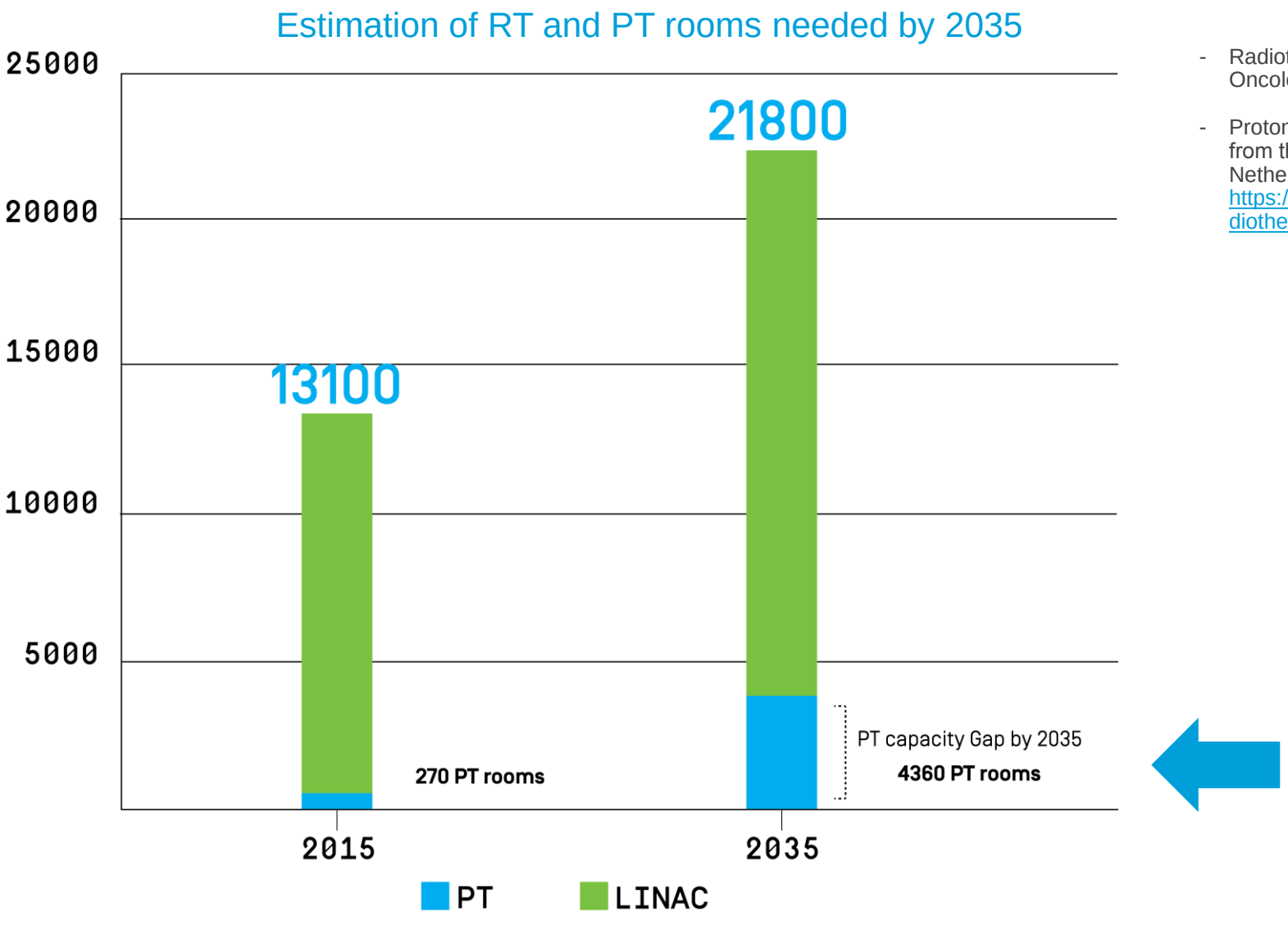


CAGR, 2015-2010

7-9	4-5	4-5	12-15	1-3	1-3

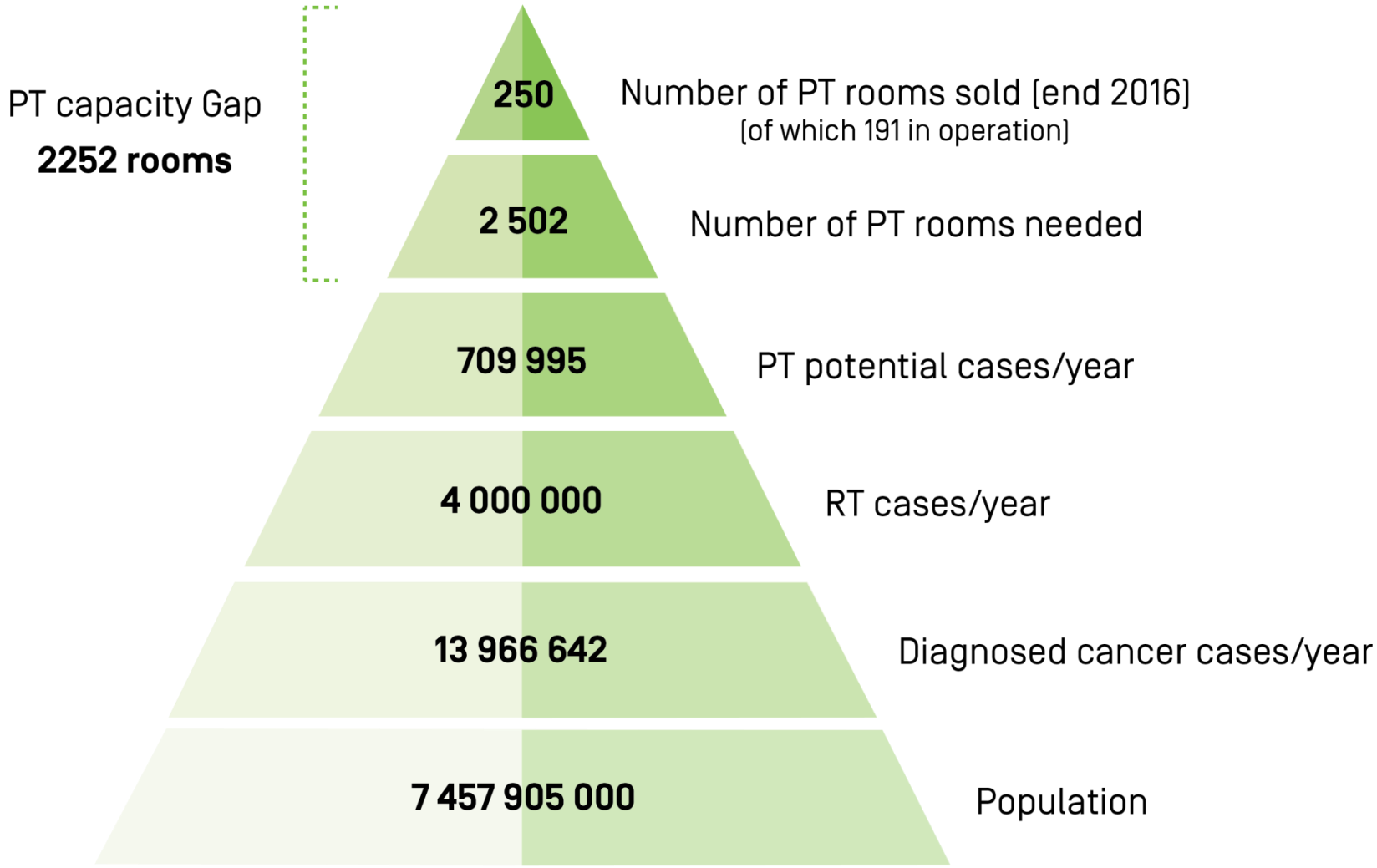
SOURCE: Team Analysis

Proton therapy capacity gap - 2035



- Radiotherapy rooms needed by 2035 estimated by Lancet Oncology - www.thelancet.com/oncology
- ProtonTherapy rooms needed by 2035 extrapolated worldwide from the “Horizon Scanning : Proton Therapy “in the Netherlands https://www.gezondheidsraad.nl/sites/default/files/proton%20radiotherapy200917E_0.pdf

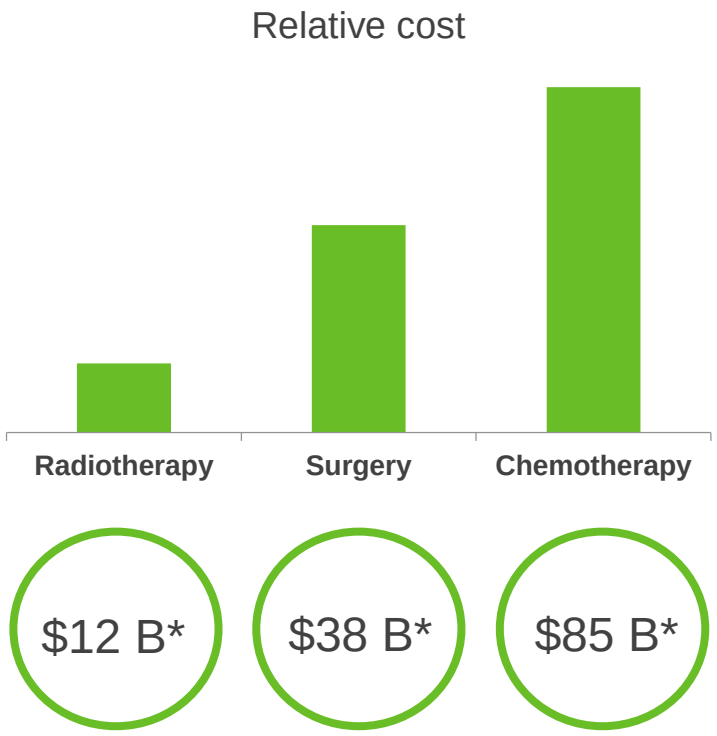
Proton therapy capacity gap - today



Source : IBA internal modeling based on Model Based Approach developed in The Netherlands (https://www.gezondheidsraad.nl/sites/default/files/proton%20radiotherapy200917E_0.pdf)

Proton therapy catalysts

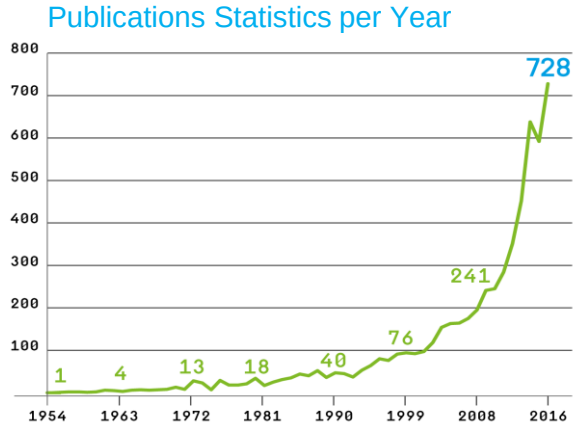
1 Cost efficient



*US spending per year in cancer care

2 Increasing publications and support

Guidelines ASTRO / NCCN



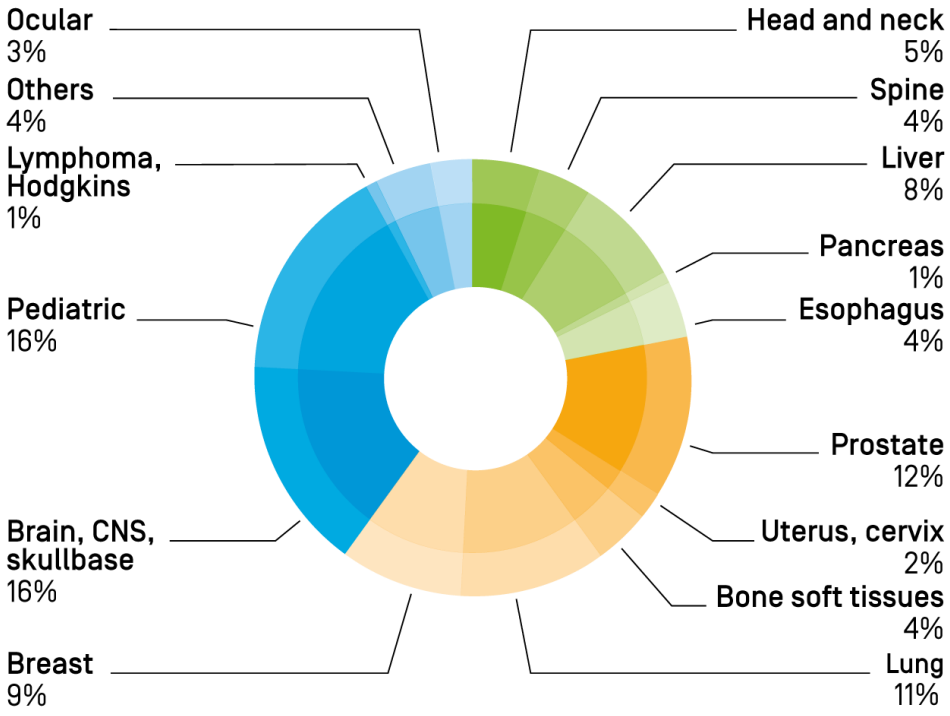
Number of publications up to end of 2016

3 Innovations and new technologies

- Compact PT
- Adaptive PT
- Software
- Imaging
- Organ motion management
- Turnkey solutions
- Laser-based PT system

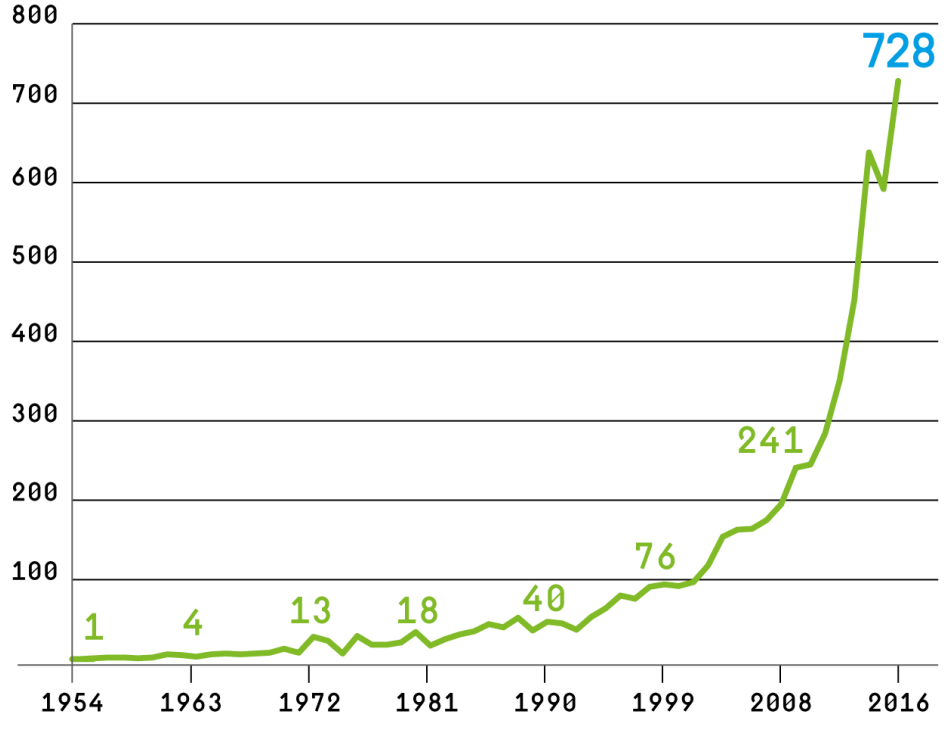
Growing acceptance of proton therapy

108 Trials Open and Recruiting



End December 2016

Publications Statistics per Year



Number of publications up to end of 2016

Data from https://clinicaltrials.gov/

Growing acceptance of proton therapy

- New guidelines further endorse proton therapy as an important treatment option in the fight against cancer

- **American Society for Radiation Oncology (ASTRO)**
  - **5 new indications in Group 1**
    (frequently supported treatment with proton therapy)
    - Paranasal sinuses and other accessory sinuses
    - Non-metastatic retroperitoneal sarcomas
    - Malignant and benign primary Central Nervous System tumors
    - Advanced and/or unresectable head and neck cancers
    - Re-irradiation cases (where cumulative critical structure dose would exceed tolerance dose)

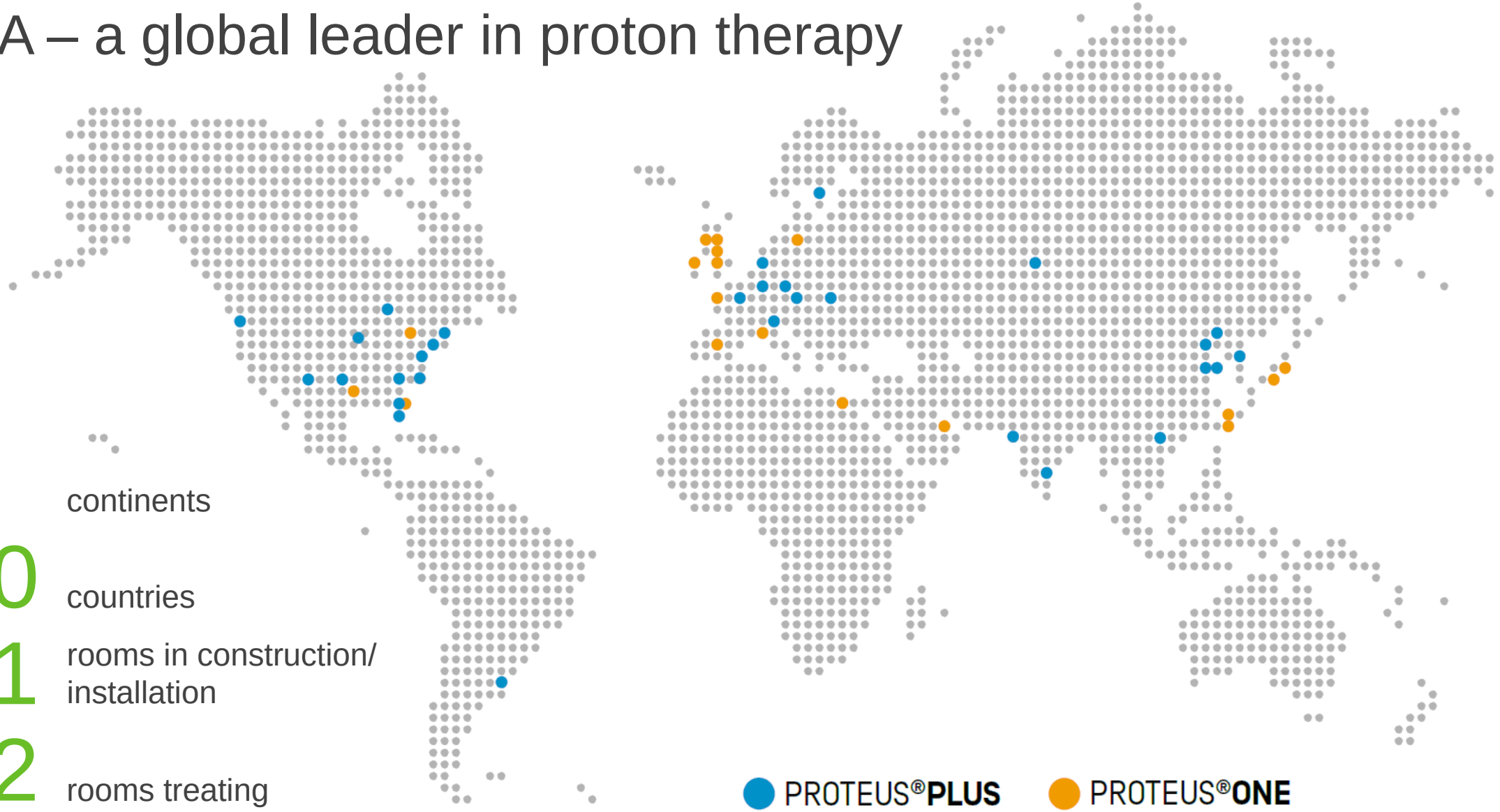
    Source: www.astro.org

- **National Comprehensive Cancer Network (NCCN)**
  - **5 new indications**
    (where proton therapy is appropriate or may be appropriate in specific situations)
    - Central Nervous System Cancers
    - Head and Neck Cancers
    - Non-Small Cell Lung Cancer
    - Hepatocellular Carcinoma (Liver)
    - Eosophagial and Esophagogastric Junction Cancers

    Source: www.nccn.org

IBA - a global leader in proton therapy

IBA – a global leader in proton therapy



5 continents

20 countries

51 rooms in construction/ installation

62 rooms treating

Massachusetts General Hospital

淄博万杰肿瘤医院 Zibo Wanjie Cancer Hospital

UFHealth Proton Therapy Institute

Proton Therapy Center

institut Curie

ProCure Oklahoma

Penn University of Pennsylvania

Hampton University Proton Therapy Institute

ProCure New Jersey

WPE

Seattle Cancer Care Alliance
Fred Hutch · Seattle Children's · UW Medicine
Proton Therapy Center

Northwestern Medicine Chicago Proton Center

Proton Therapy Center

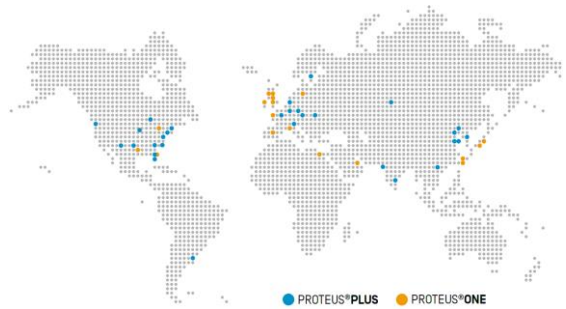
OncoRay
National Center for Radiation Research in Oncology Dresden

Provision Healthcare
Innovation that CARES

FMBA of Russia
Federal Medical and Biological Agency

Azienda Provinciale per i Servizi Sanitari
Provincia Autonoma di Trento

Skandionkliniken



Willis-Knighton Health System

Texas Center for Proton Therapy

Antoine Lacassagne
Centre de lutte contre le cancer de Nice

Apollo Cancer Hospitals
Proton Treatment Centre

Beaumont

Miami Cancer Institute
Baptist Health South Florida

umcg

广东恒健投资控股有限公司
Guangdong Hengjian Investment Holding Co., Ltd

Centre de Lutte contre le Cancer François Baclesse

Roffo
Instituto de Oncología Ángel H. Roffo
Universidad de Buenos Aires

PLAGH

The Rutherford Cancer Centres
South Wales

The Rutherford Cancer Centres
North East

The Rutherford Cancer Centres
Thames Valley

Changhua Christian Medical Foundation

承業生醫 CHC Healthcare Group

Narita Memorial Protoncenter

社会医療法人 孝仁会
北海道大野記念病院

UZ Leuven
KU Leuven Université catholique de Louvain UCL
Cliniques universitaires Saint-Luc UCL Bruxelles

Tata Memorial Centre
Service Research Education

CCM 泰和诚
Concord Medical

مركز الخليج الدولي للأورام
Gulf International Cancer Center

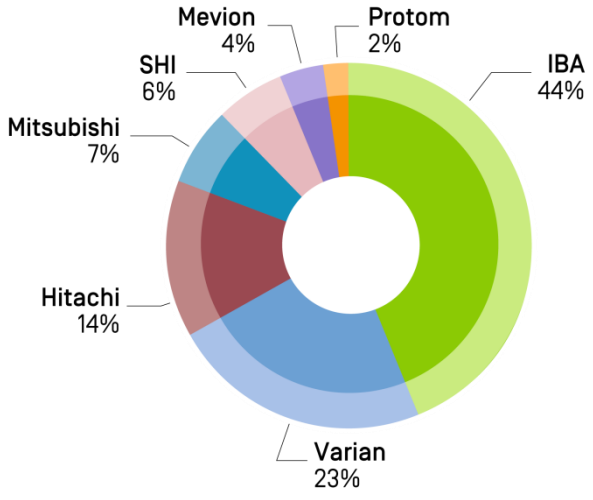
quirónsalud

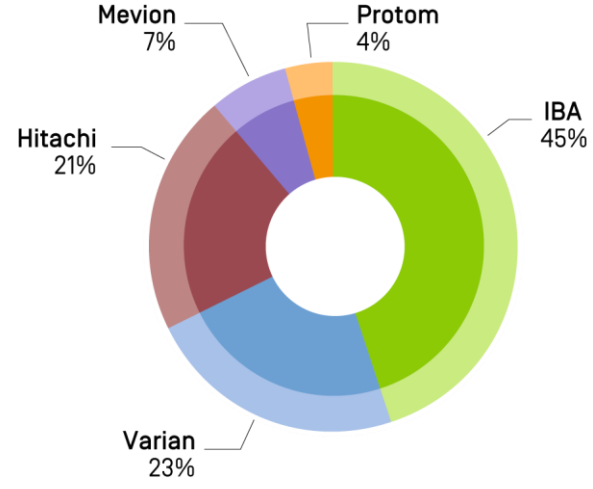
57357 مؤسسة مستشفى سرطان الأطفال
Children's Cancer Hospital Foundation

INOVA

IBA – a global leader in proton therapy

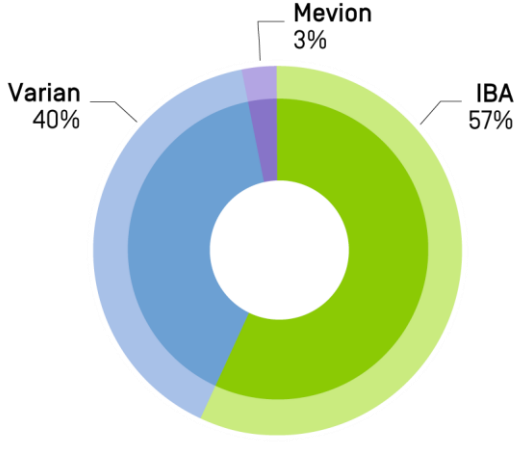
Global share of installed base in rooms

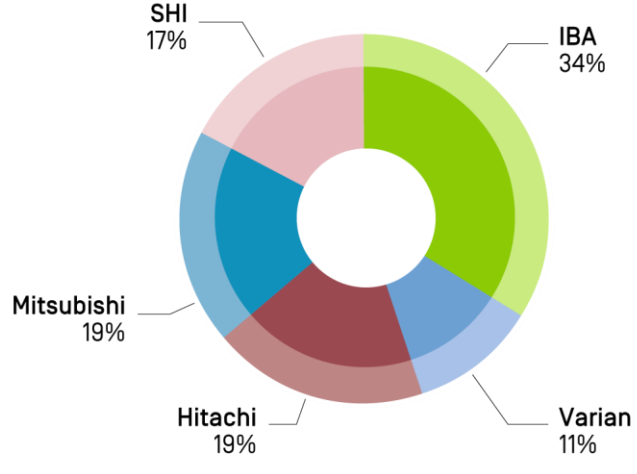




Share of installed base in rooms

Share of installed base in Europe and ROW in rooms

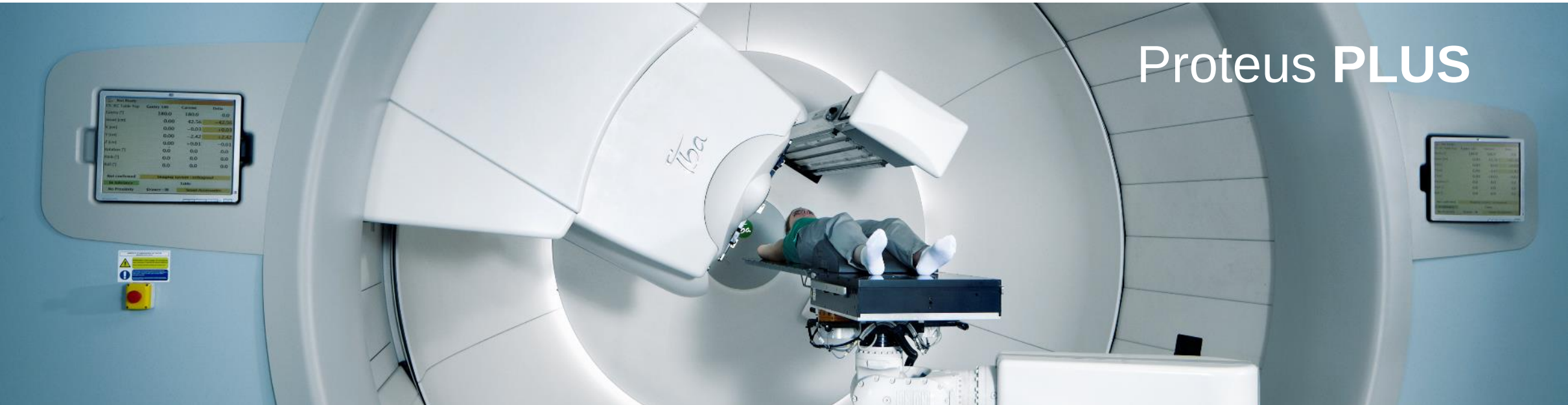




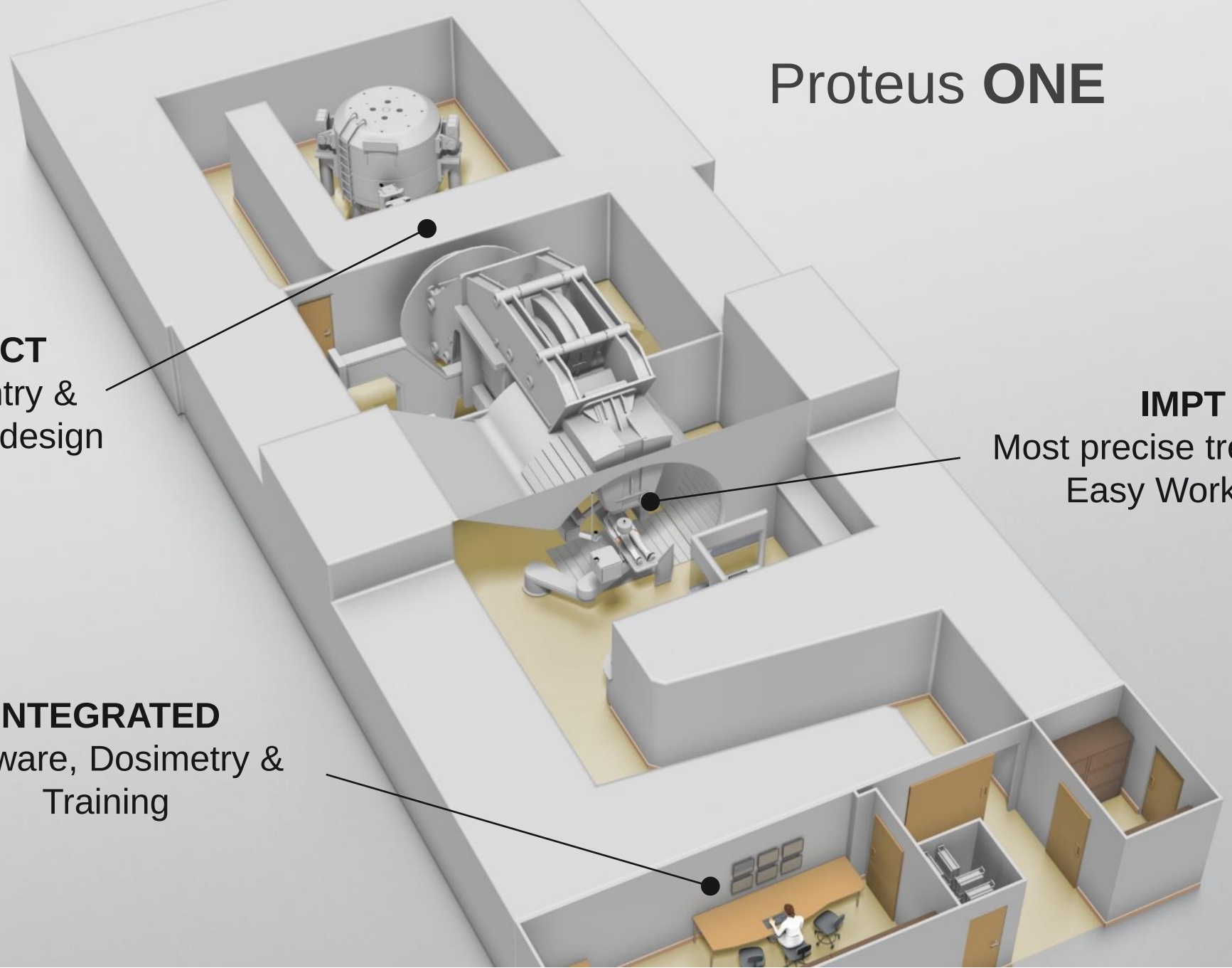
Share of installed base in APAC in rooms

IBA lead over competition

IBA world-class innovative proton therapy solutions



Proteus **ONE**



COMPACT
Open Gantry &
accelerator design

IMPT
Most precise treatments
Easy Workflow

INTEGRATED
Software, Dosimetry &
Training

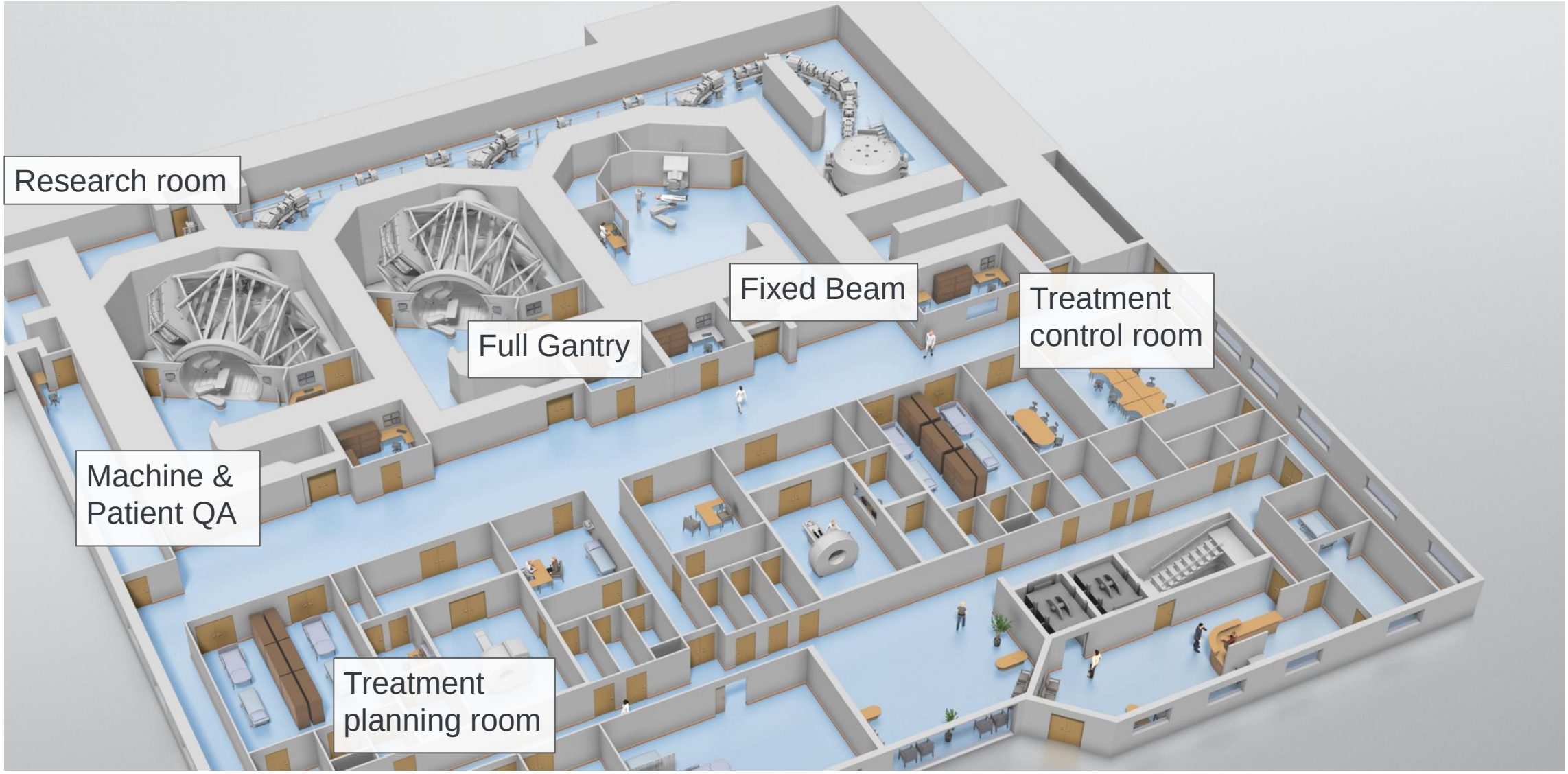
Proteus **ONE**

INSTANT 2D & CONE-BEAM CT
For Image-Guided PT

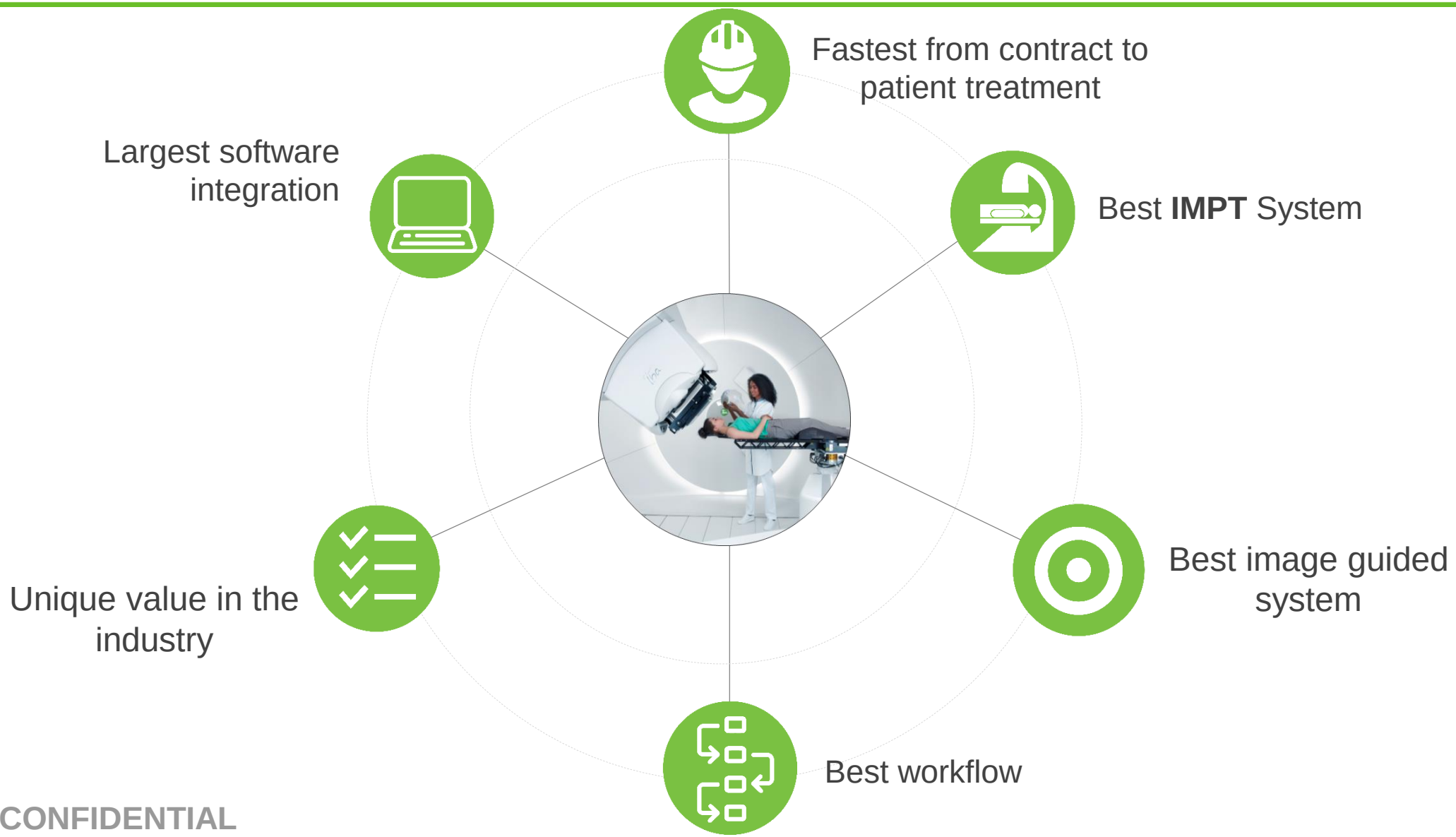
PROVEN PENCIL BEAM SCANNING
For highly conformal IMPT

PATIENT AND STAFF FRIENDLY
Open environment

Proteus PLUS

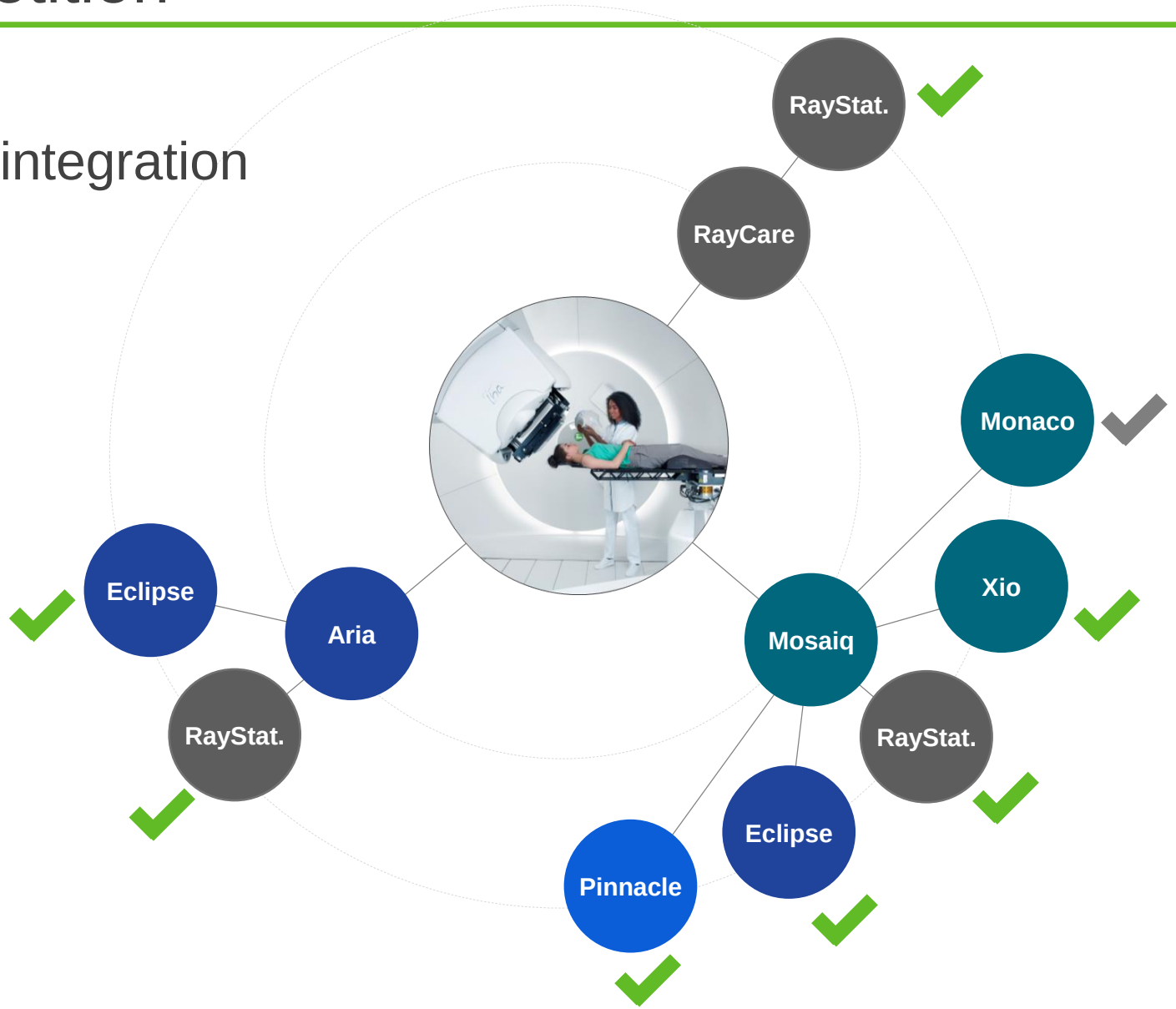


IBA lead over competition



IBA lead over competition

Largest Software integration



Elekta and IBA agree on a comprehensive partnership

- Co-funding for all PT related software development
  - MOSAIQ and Monaco
- Competitive bundling of PT/Linac/SW vs competition
- Commercial collaboration
  - finder's fee globally for PT deals Elekta initiate
  - finder's fee globally for Elekta linac deals IBA initiate
- Co-marketing of each others products (but non-exclusive)

Jointly work towards an integrated offering to elevate user experience in improve patient care

IBA lead over competition

Fastest from Contract to Patient treatment

IBA **building 14 months** | **equipment 12 months**

Competitor 1 building 23 months | equipment 19 months

Competition 2 building 22 months | equipment 22 months

IBA lead over competition

Best IMPT System

Features	Customer gain	IBA	Competitor 1	Competitor 2
Beam availability	Best treatment quality	**< 1s**	3s	5s
Room matching	Best treatment quality	**< 1%**	< 3%	< 5%
Room switching time	Best throughput Patient confort	**< 10s**	**< 30s**	**< 45s**
Minimum range	Best conformity	**3,1g/cm²**	4,1g/cm²	4,1g/cm²
Accessory management **a) H&N snout supported** **b) Dual motion**	Best conformity for shallow tumors Best throughput	**Yes** **Yes**	No No	No No
Beam gatting **a) Universal** **b) Inputs**	Motion management Right solution for each patient (no compromise)	**Yes** **4**	**Mono** **1**	**Unknown** **1**

IBA lead over competition

Best Image Guided System

Features	Customer gain	IBA	Competitor 1	Competitor 2
X-Ray direction VS beam direction	Best treatment quality Best workflow	**BEV**	45°	45°
Orthogonal kV-kV	In combination with BEV, faster and better setup	**Yes**	Yes	Yes
CBCT LFOV	Best imaging quality	**50cm**	38cm	38cm
CBCT longitudinal FOV	Best imaging quality	**34cm**	24cm	24cm
Virtual topogram	Guarantees proper imaging acquisition	**Yes**	Unknown	No
Sticky settings / window level prop.	Best workflow	**Yes**	No	No
Beam gating for X-Ray	Best organ motion	**Yes**	No	Unknown

IBA lead over competition

Best Workflow

Features	Customer gain	IBA	Competitor 1	Competitor 2
Ambient experience solution	Reduced anesthesia for pediatrics, best throughput	**Yes**	No	No
Wireless hand pendant	More seamless operation, more freedom of movement, best throughput	**Yes**	No	No
Beam eye view imaging	Most intuitive way for human to interpret patient images	**Yes**	No	No
Dual motion of accessory	Best throughput	**Yes**	No	No
Fast irradiation delivery	Patient confort Best throughput	**45s** (high range) **60s** (low range)	60s	90s
Fast room switching	Patient confort Best throughput	**< 10s**	< 30s	< 45s

IBA lead over competition

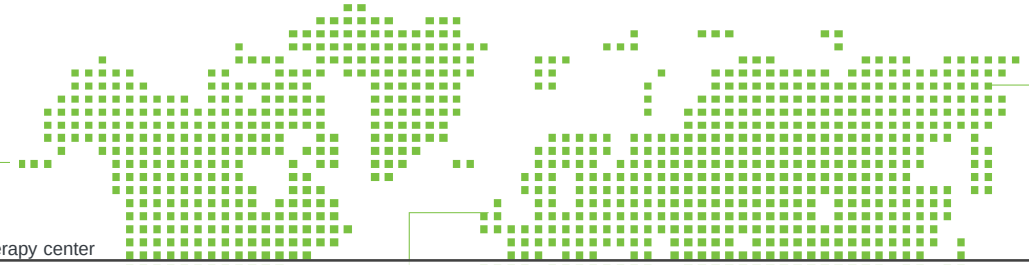
Unique Value in the Industry

Features	IBA	Competitor 1	Competitor 2
Upgradeability	Proven at 10+ centers	No proven track record	No proven track record
Open architecture	Proven at 48 centers	Optimized for own SW only	Yes, limited experience
Experience	> 30 years in Proton Therapy	Recently acquired technology	No worldwide experience
Size and depth of the service organization	> 250 trained and certified service engineers in USA	Limited PT service organization	No worldwide experience
Motion management solutions	Multiple solutions in clinical use	Mono gating solution	Unknown
Imaging software	Designed to move in the future of Adaptive PT	Limited to image guidance	3rd party, limited to image guidance
Training program	First to offer comprehensive & formal training; faster ramp up	Basic and limited	Limited
R&D	Experience allows IBA to be first to offer advanced technology (prompt gamma, eye treatment, range verification, etc)	Limited focus on PT	Limited focus on PT
Gantry ocular solution	Innovative patent pending solution	Traditional solution under development	Unknown
Dosimetry	In-house & integrated to improve workflow efficiency	3rd party	3rd party

The future of proton therapy

Largest and most experienced community in proton therapy

IBA's worldwide research collaboration



+90
Clinical & research collaborations

+300
Patents

North America

Clinical partners

- Massachussets General Hospital Burr Proton Therapy center [US]
- University of Florida Health Proton Therapy Institute [US]
- University of Pennsylvania Roberts Proton Therapy Center [US]
- Hampton University Proton Therapy Institute [US]
- Oklahoma Procure Treatment Center [US]
- Northwestern Medecine Chicago Proton Therapy Center [US]
- New Jersey Procure Treatment Center [US]
- Seattle Cancer Care Alliance Proton Therapy Center [US]
- Provision Center for Proton Therapy [US]
- Willis-Knighton Cancer Center [US]
- Texas Center for Proton Therapy [US]
- Beaumont Health System [US]
- Miami Cancer Institute – Baptist Health South Florida [US]

Research partners

- Massachussets General Hospital Burr Proton Therapy center [US]
- University of Florida Health Proton Therapy Institute [US]
- University of Pennsylvania Roberts Proton Therapy Center [US]
- Massachussets Institute of Technology [US]
- Northwestern Medecine Chicago Proton Therapy Center [US]
- Seattle Cancer Care Alliance Proton Therapy Center [US]
- Willis-Knighton Cancer Center [US]
- Texas Center for Proton Therapy [US]
- Beaumont Health System [US]
- Miami Cancer Institute – Baptist Health South Florida [US]
- MD Anderson Cancer Center [US]
- Memorial Sloan Kettering Cancer Center [US]
- Fermilab [US]

Latin America

Clinical partners

- Centro de Protonterapia y Tecnicas Avanzadas de Tratamiento - Insituto de Oncologica Angel Roffo Hospital [ARG]

Russia

Clinical partners

- Federal High-Technology Center for Medical Radiology FMBA [RUS]

Asia Pacific

Clinical partners

- Wanjie Proton Therapy Center [CN]
- Korea National Cancer Center [KR]
- Apollo Proton Therapy Center [IN]
- Changhua Christian Hospital [TW]
- Narita Memorial Hospital [JPN]
- Kojinkai Hokkaido Ohno Memorial Hospital [JPN]
- Guangdong Hen Ju Medical Technologies [CN]
- Zhuozhou Proton Therapy Center [CN]
- Taipei Medical Hospital [TW]
- Tata Memorial Centre [IN]
- Qingdao Zhong Jia Lian He Healthcare [CN]
- Beijing Proton Medical center [CN]

Europe, Middle East, Africa

Clinical partners

- Institut Curie [FR]
- Proton Therapy Center Czech [CZ]
- Westdeutsches Protontherapiezentrum Essen [DE]
- APSS Azienda Provinciale per I Servizi Sanitari [IT]
- Universitatklinikum Carl Gustav Carus [DE]
- Skandionkliniken [SW]
- Bronowice Cyclotron Center – IFJPAN [PL]
- Centre Antoine Lacassagne [FR]
- Cyclhad – Cyclotron for Hadron Therapy [FR]
- Universitair Medisch Centrum Groningen – UMCG [NL]
- Universitair Ziekenhuis Leuven [BE]
- Proton Partners International – Newport [UK]
- Proton Partners International – Newcastle [UK]
- Proton Partners International – London [UK]
- Proton Partners International – Reading [UK]
- Proton Partners International – Undisclosed [UK]
- Proton Partners International – Abu Dhabi [UK]

Research partners

- Institut Curie [FR]
- Proton Therapy Center Czech [CZ]
- Westdeutsches Protontherapiezentrum Essen [DE]
- APSS Azienda Provinciale per I Servizi Sanitari [IT]
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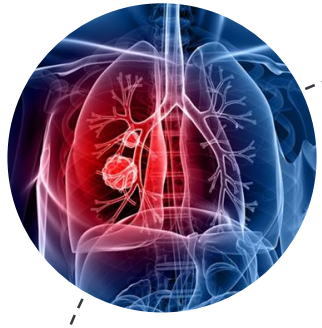
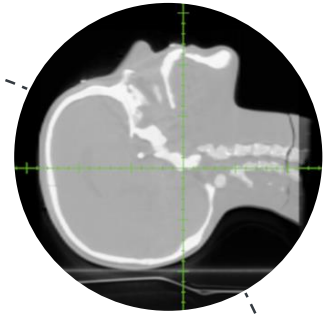
- Universitair Ziekenhuis Leuven [BE]
- Centre Oscar Lambret [FR]
- Universite Paris-Sud [FR]
- Université Lyon 1 [FR]
- University College London Hospital [UK]
- Université Catholique de Louvain [BE]
- Université Libre de Bruxelles [BE]
- Université de Liège [BE]
- Erasmus Medisch Centrum [NL]
- Heidelberg Ion Therapy [DE]
- LMU [DE]
- MedAustron [AT]
- Paul Scherrer Institute [CH]
- CNAO [IT]
- INFN [IT]
- ...

The future of proton therapy

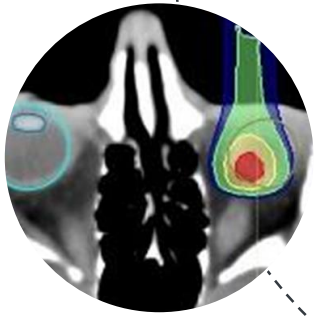
Irradiation in one breath hold

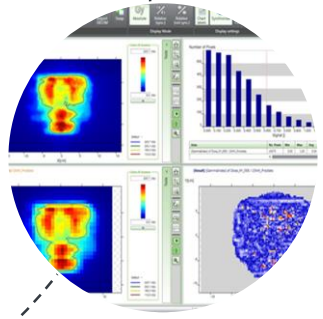




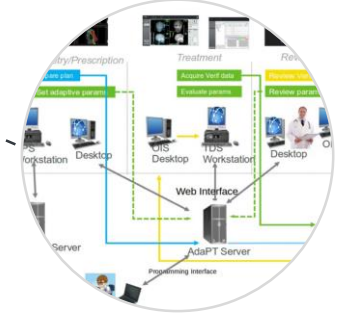
Volumetric imaging for replanning

Eye treatment in a Gantry





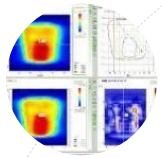
On-Line QA



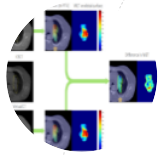
On-Line adaptive

The future of personalized precision

Log-based patient QA

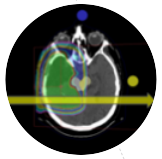


Virtual CT

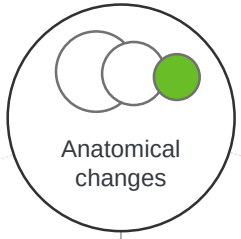


Prompt Gamma

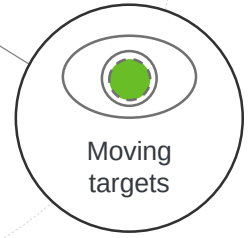
Proton Radiography

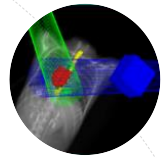


MR Guided Proton Therapy



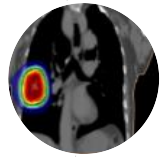
Lung
H&N
Breast
Pediatrics



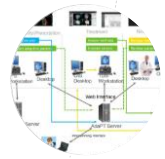


Automated re-planning

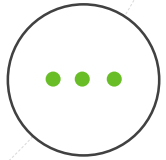
Fast Irradiation



Motion Reduction

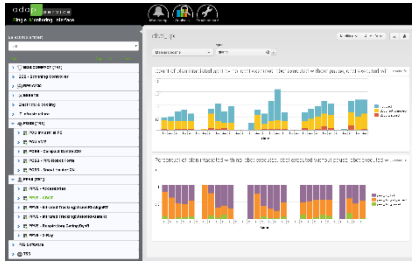


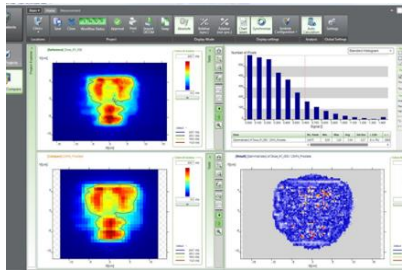
Online adaptive workflow



Others

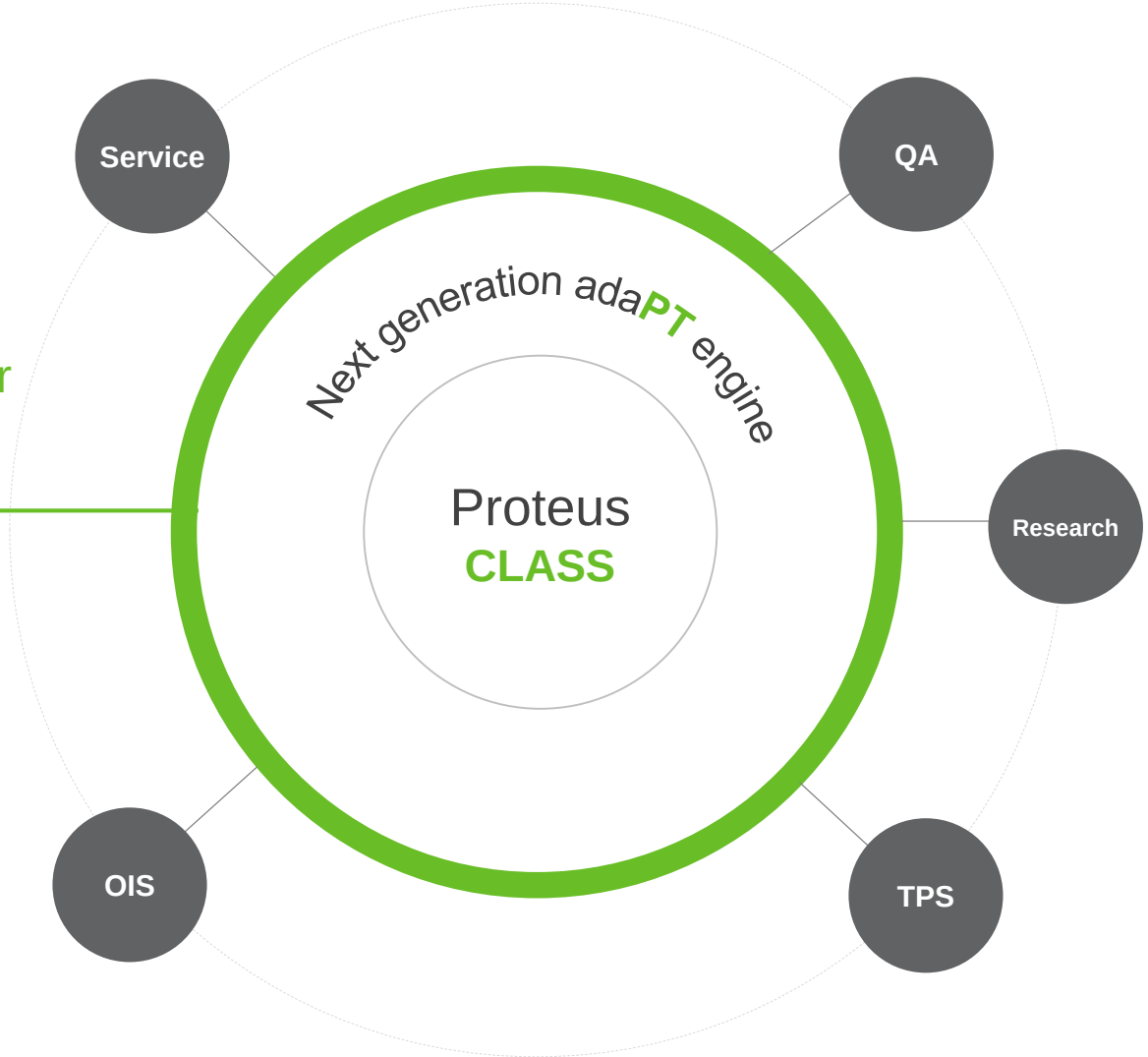
API based architecture to be fast and flexible

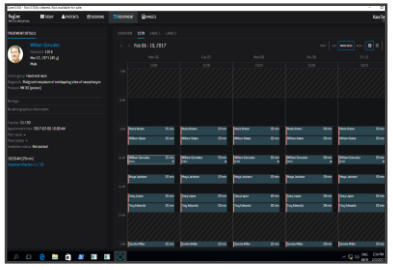


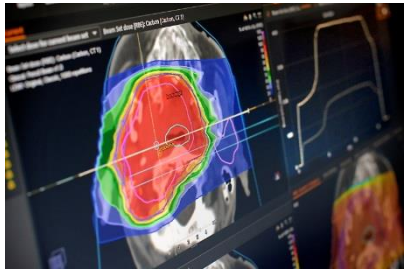


Treatment Session Manager

manages adaptive workflows in the PT treatment room







Strong worldwide pipeline

IBA global leads

PERSPECTIVE ON RADIATION THERAPY PATIENTS RECEIVING PROTON THERAPY AS PART OF THEIR TREATMENT

1% Today

20% Following reports & policies

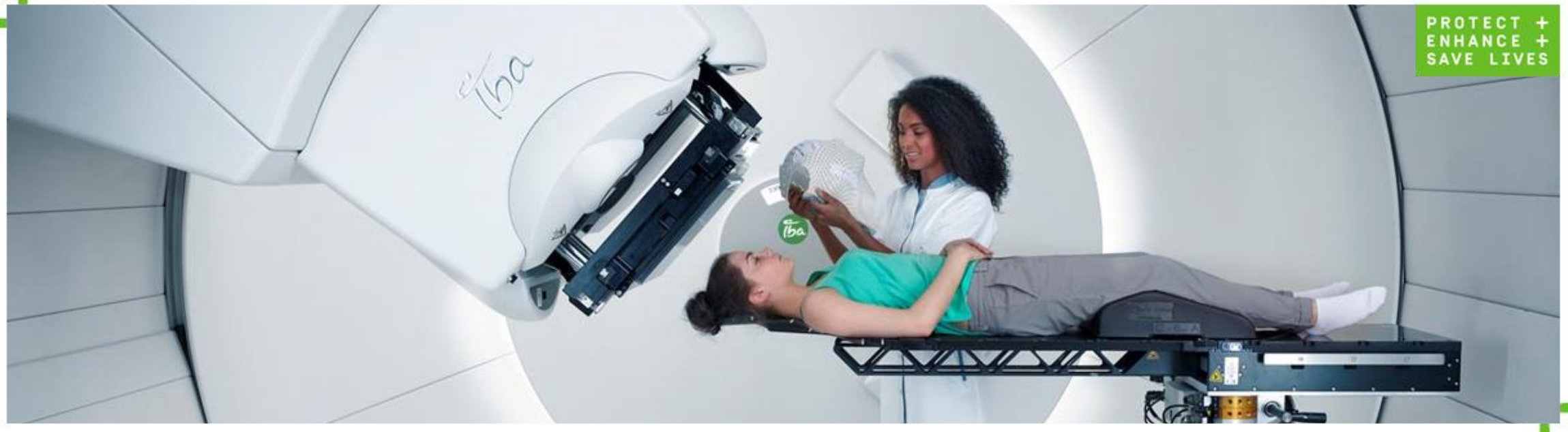
45% Following clients' experiences

Our strategy is to create a virtuous circle in PT

- Enhance market penetration
- Develop regionalization
- Leverage partnership

- Increase clinical relevance
- Reduce cost of modality

- Invest in clinical affairs initiatives
- Focus on product roadmap



The role on proton therapy in oncology

Andrew K. Lee, MD, MPH, Medical Director, Texas Center for Proton Therapy

TEXAS CENTER *for* PROTON THERAPY

The role of proton therapy in oncology and future evolution

Andrew K. Lee, M.D., MPH
Medical Director
Texas Center for Proton Therapy

Clinical benefits of proton therapy

- **Higher radiation doses to tumor**
- **Minimizes dose to normal tissues**

- **Better tumor control**
- **Decreased side effects: early and late**

- **Preserve organ function**

- **Better tolerance of multi-modality therapy**
  e.g. Chemotherapy and/or surgery

"One cannot have a radiation-induced side effect in tissue that receives no radiation."

What cases to consider for protons therapy?

Pediatric
Adults w/ projected longevity >20 years

Primary CNS
Skull base
Para-nasal sinus
Nasopharynx
Oropharynx (especially younger HPV+)

Left-sided breast + lymphatics
Anterior/Posterior mediastinum
Lymphoma
NSCLC (stage II-III, non-operative)
Distal esophagus (definitive, preop)
Liver

Prostate
Recurrent rectal
Sarcomas

Proton Rx: Advances and future directions

Pencil beam scanning

Intensity modulated proton therapy

Better treatment planning software

PBS with apertures for sharper edges

Smaller (and less expensive) proton units

On-board volumetric imaging (CBCT)

Advances in technology have expanded clinical indications

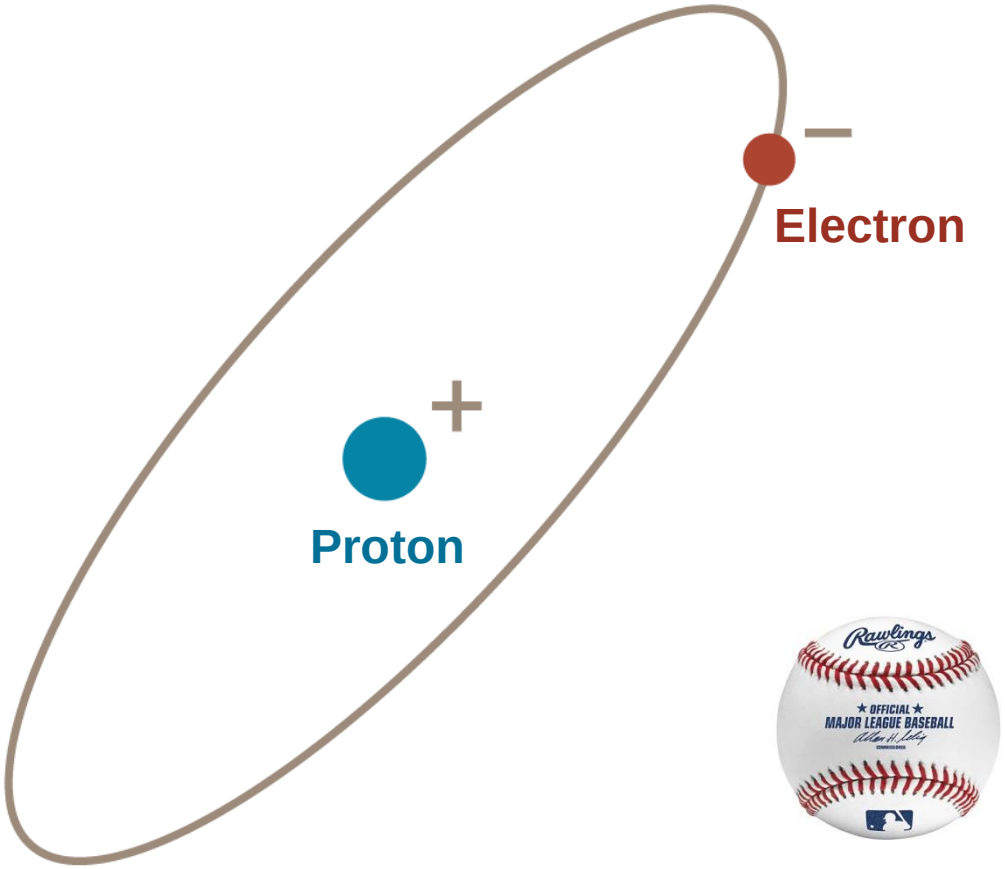
Increased utilization of SBRT/Hypofxn regimens with x-rays will benefit particle therapy

More protons users have resulted in increased advocacy

**** Better CT imaging would be cost-effective method to improve proton therapy**

How are protons different from X-rays?

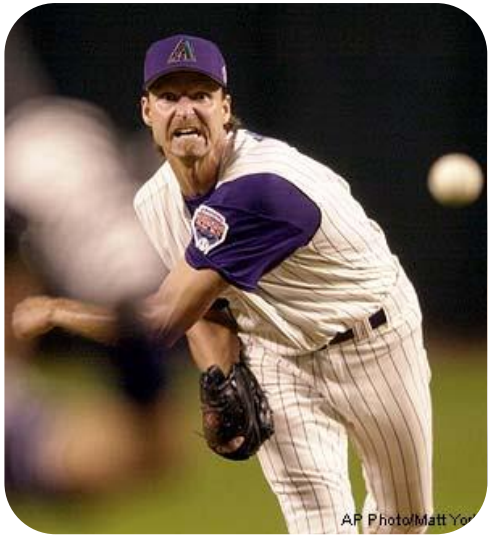
Proton is hydrogen atom without electron *(Heavy particle)*



TEXAS CENTER *for* PROTON THERAPY

Protons are **accelerated** to almost light speed for treatment

+



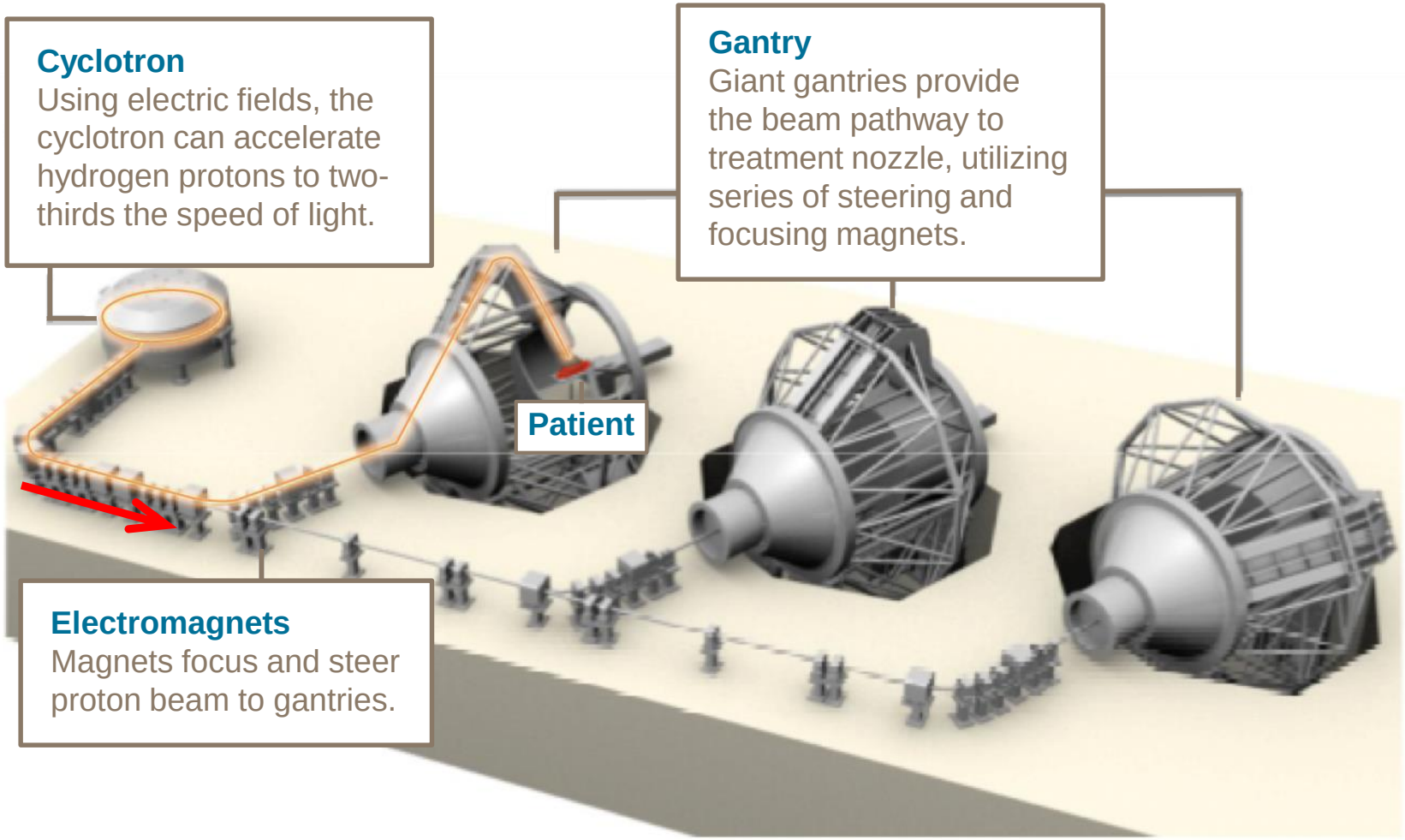
=

Hyper-speed protons are used like "smart bullets" to kill cancer cells.

Key components

Cyclotron
Using electric fields, the cyclotron can accelerate hydrogen protons to two-thirds the speed of light.

Gantry
Giant gantries provide the beam pathway to treatment nozzle, utilizing series of steering and focusing magnets.



Electromagnets
Magnets focus and steer proton beam to gantries.

X 7

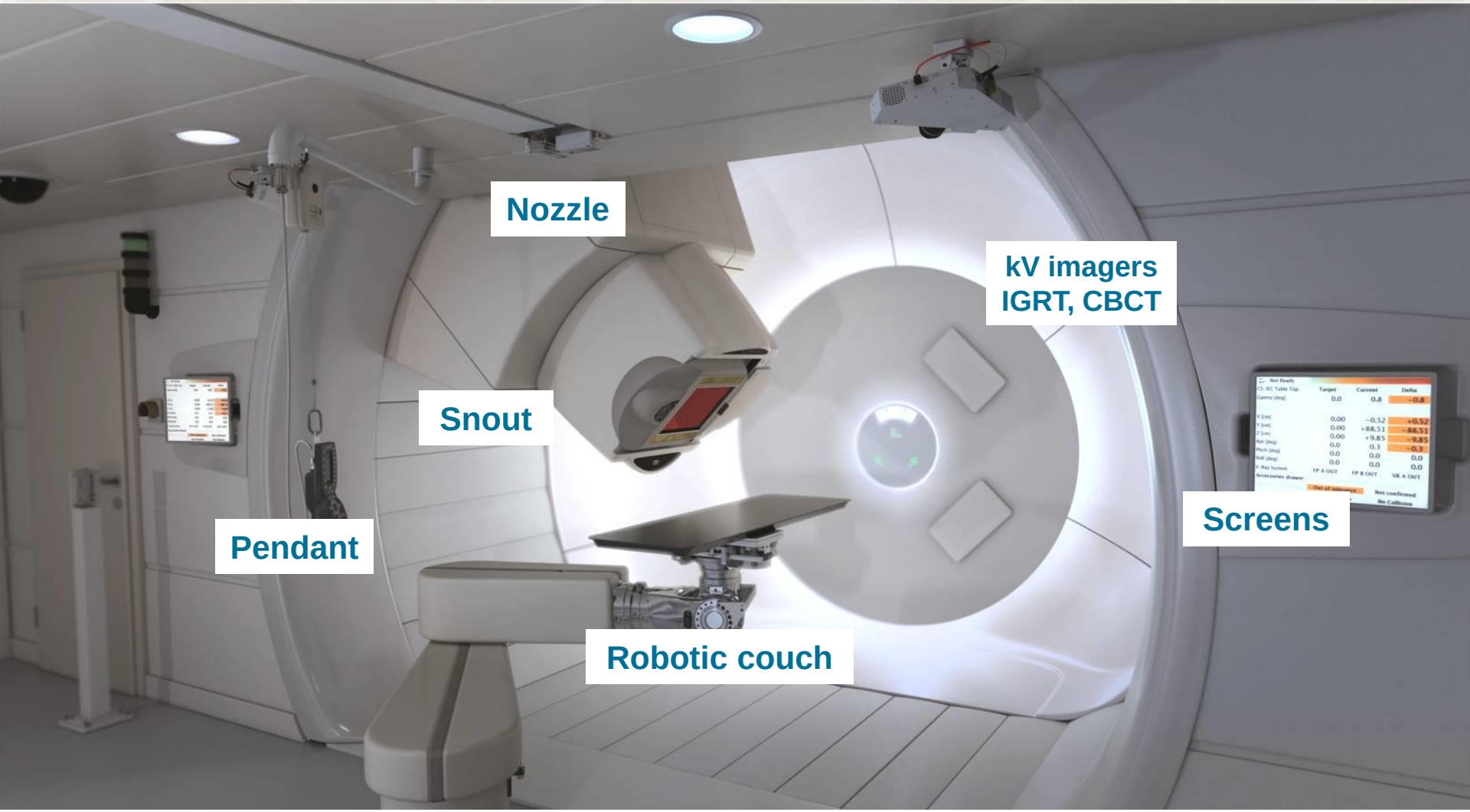
TEXAS CENTER *for* PROTON THERAPY

Diameter ~ 33 feet
Weight >100 tons

(equivalent to Boeing 757 with passengers and cargo)

TEXAS CENTER *for* PROTON THERAPY

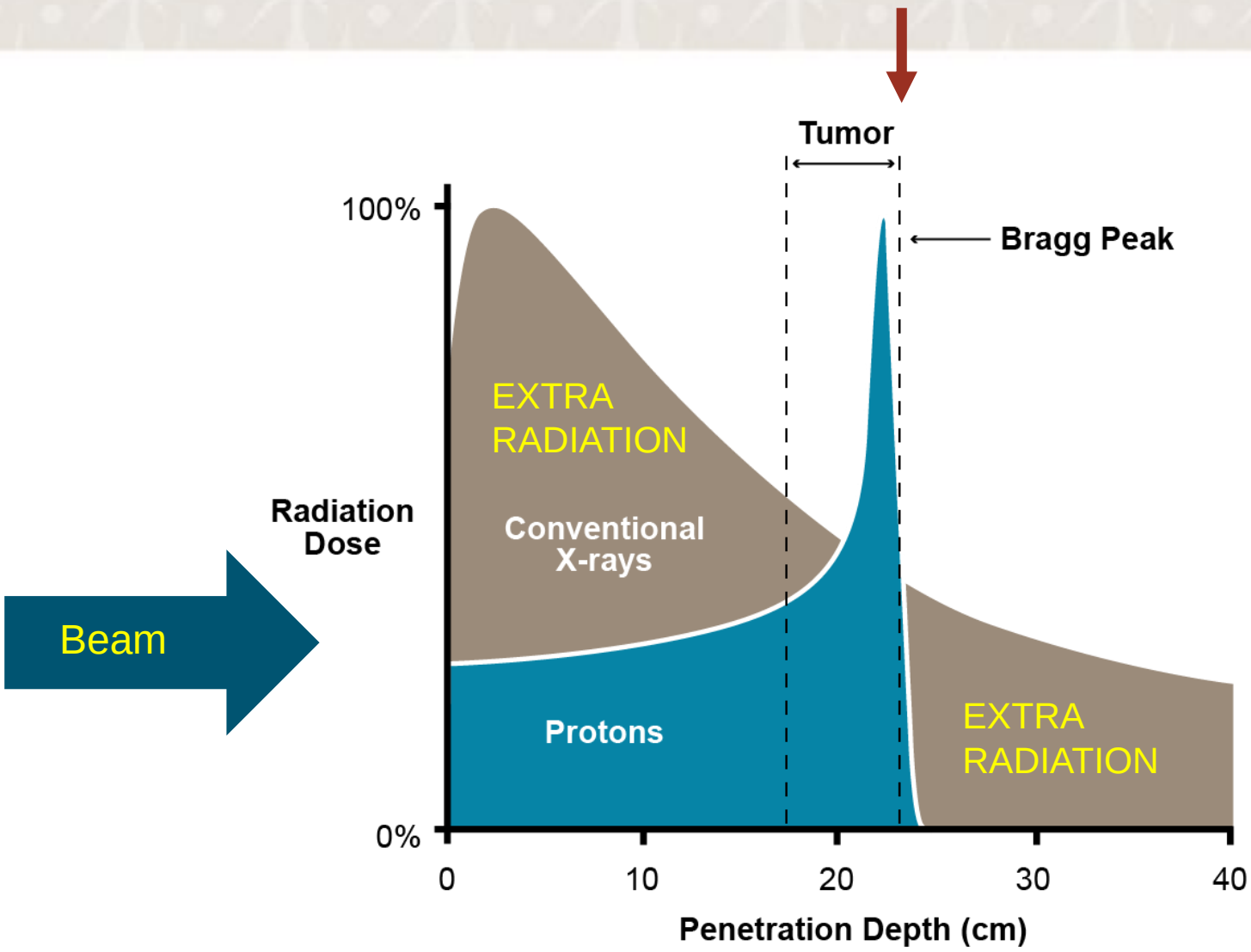
What patient sees



TEXAS CENTER for PROTON THERAPY

Single room units are a fraction of cost of multi-room centers but…
Typically partial gantries & not as cost-effective if > 2 rooms

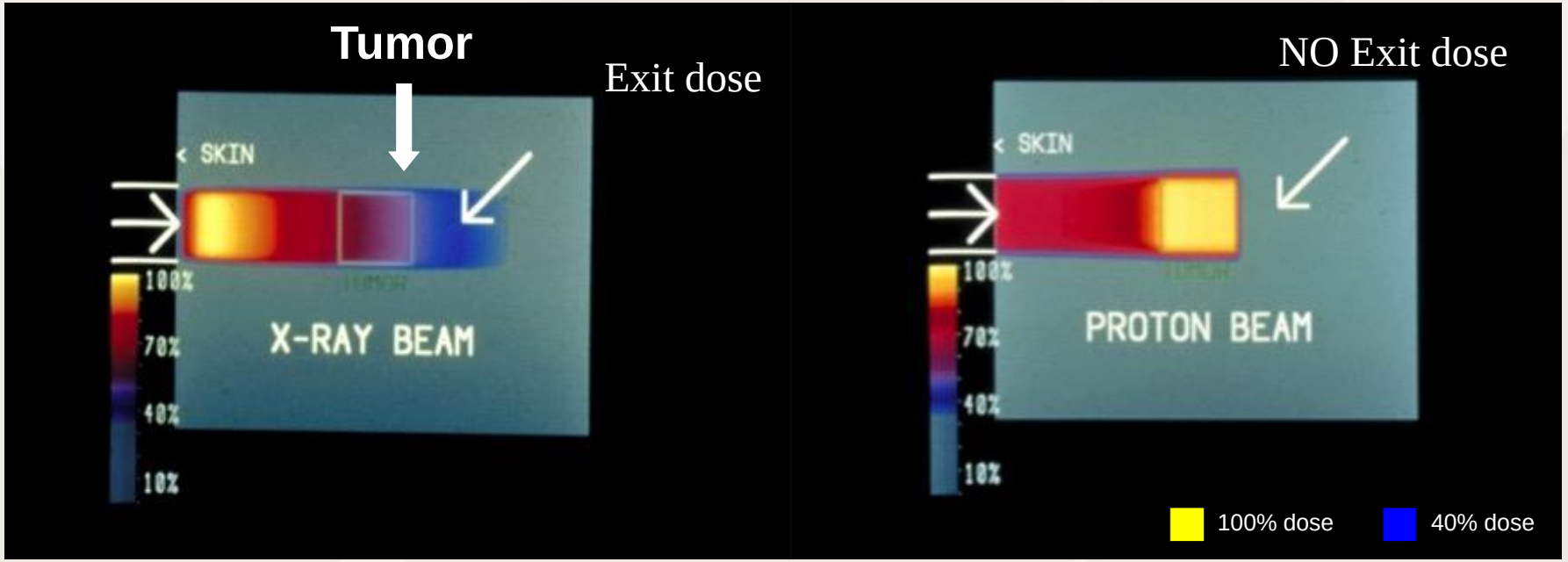
X-rays pass through tissue. **Protons STOP**



TEXAS CENTER *for* PROTON THERAPY

X-RAYS

PROTONS



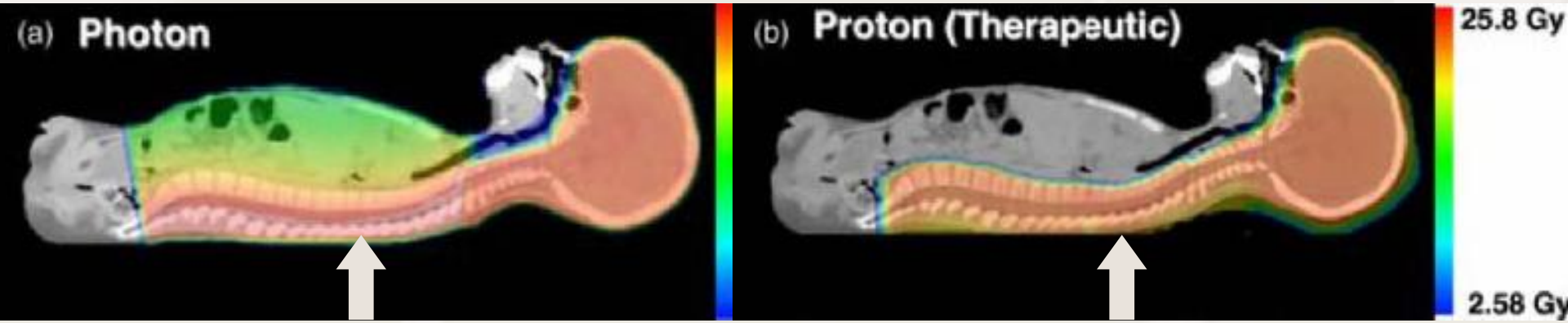
Exit dose

NO exit dose

Medulloblastoma

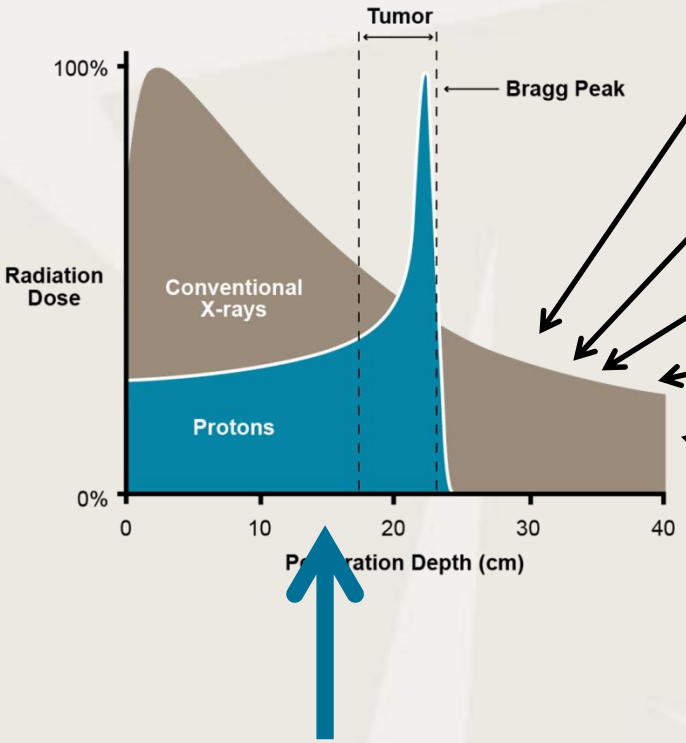
Exit dose ~ 50%

No exit dose



X-rays

Protons



IMRT or Protons?

Or Gamma Knife

Or Cyber Knife

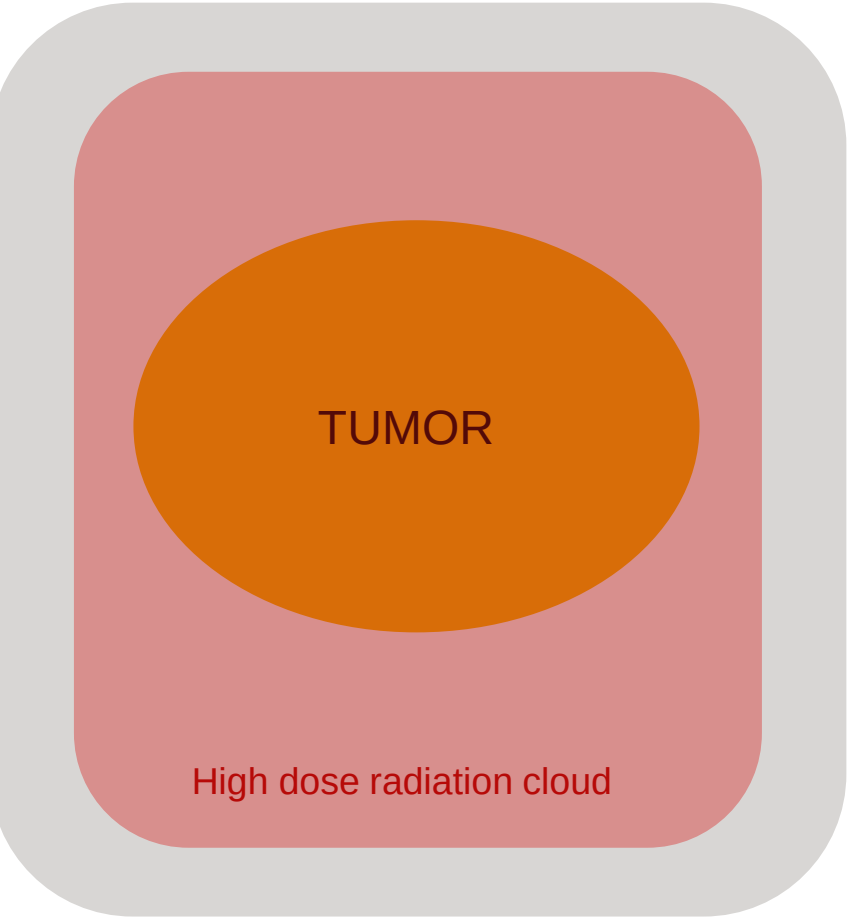
Or Tomo Therapy

Or True Beam

All X-rays

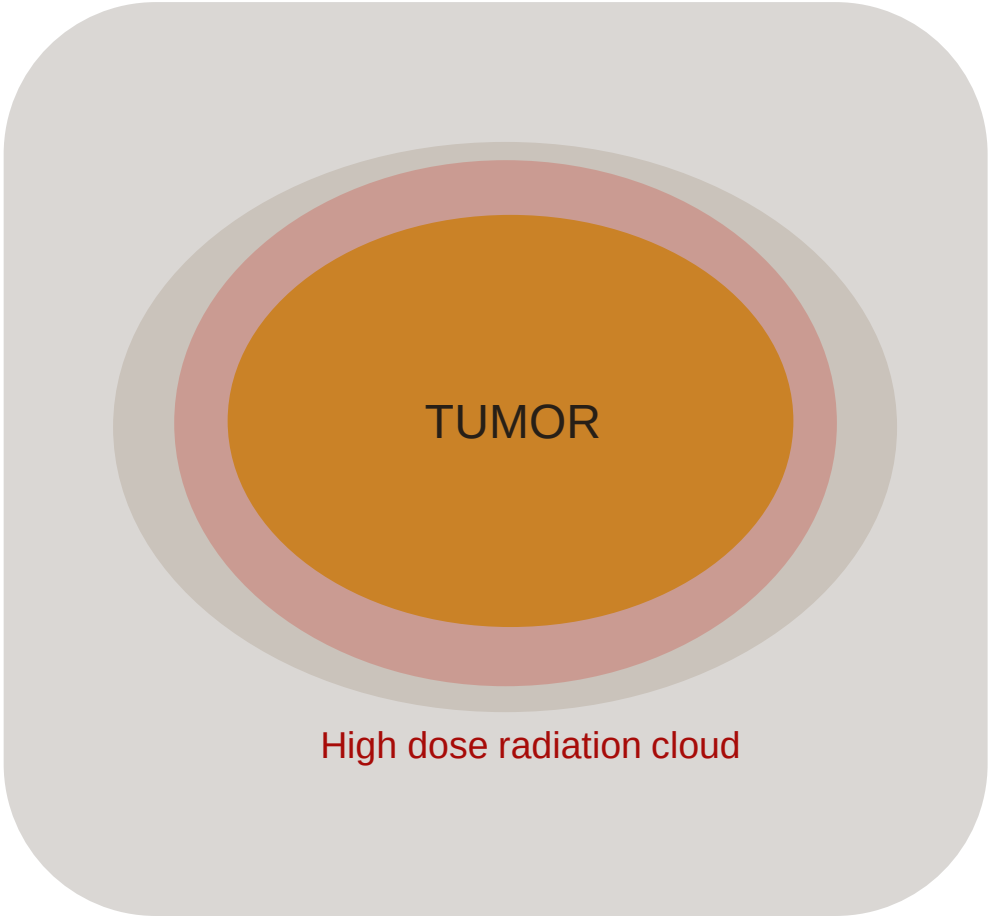
IMRT vs. Protons :

Maximize tumor dose conformity and minimize normal tissue exposure



Low Dose Radiation Cloud

Traditional 2D/3D RT



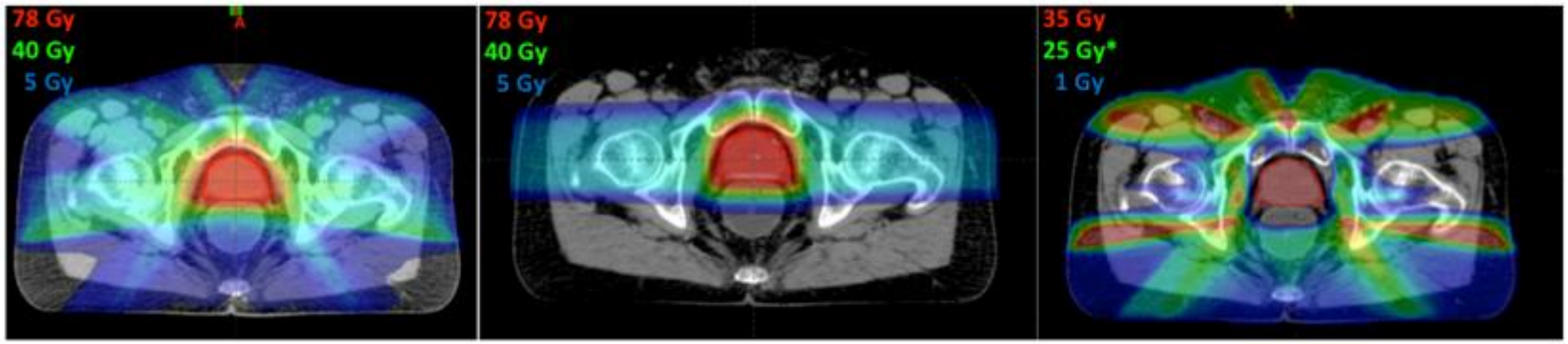
Low Dose Radiation Cloud

IMRT → **Protons**

TEXAS CENTER *for* PROTON THERAPY

Prostate cancer

IMRT | *Protons* | *Unnecessary radiation with IMRT*



*** 25 Gy (25 Sv) of Unnecessary Radiation =**

2,500
Pelvic CTs
(10 mSv)

20,833
Pelvic X-Rays
(1.2 mSv)

25,000x
General Public
Annual Limit
(1.0 mSv)

1.83x
Additional
Cancer Risk*
(CTs, 65 yo)

Source: Matt Palmer
** http://www.xrayrisk.com/calculator/calculator-normal-studies.php*

TEXAS CENTER *for* PROTON THERAPY

Longer waits result in more second cancers

	Latency **5-9 years**	Latency **10-14 years**	Latency **≥15 years**	p-trend
Oral/pharynx	1.12 (0.99 to 1.27)	1.14 (0.95 to 1.38)	0.95 (0.74 to 1.22)	0.34
Rectum*	1.13 (0.94 to 1.35)	1.33 (1.03 to 1.70)	0.91 (0.64 to 1.27)	0.54
Larynx	1.57 (1.08 to 2.36)	1.04 (0.66 to 1.70)	1.29 (0.75 to 2.30)	0.45
Lung (non-small cell)	1.12 (0.98 to 1.27)	1.37 (1.12 to 1.65)	1.62 (1.23 to 2.09)	0.0079
Female breast	1.17 (1.05 to 1.30)	1.42 (1.24 to 1.62)	1.56 (1.34 to 1.81)	0.0013
Cervix (external beam)*	1.18 (0.79 to 1.75)	1.55 (1.00 to 2.40)	2.59 (1.84 to 3.68)	0.0032
Endometrium (external beam)*	1.30 (1.08 to 1.56)	1.99 (1.60 to 2.47)	2.18 (1.78 to 2.65)	<0.0001
Prostate (external beam)*	**1.39 (1.29 to 1.50)**	**1.59 (1.41 to 1.80)**	**1.91 (1.53 to 2.38)**	**0.0031**
Thyroid*	0.89 (0.49 to 1.55)	1.03 (0.47 to 2.14)	1.21 (0.64 to 2.17)	0.47

Relative risk of second cancer at 10-14 years = 1.6, at **15 years RR = 1.9**

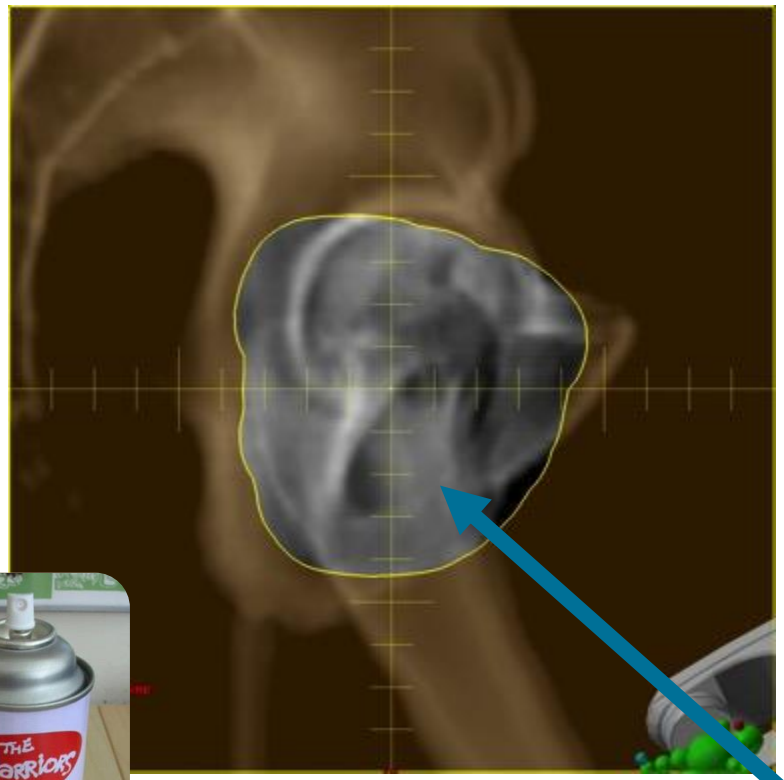
Source: de Gonzalez et al., Lancet Oncol, Mar 2011

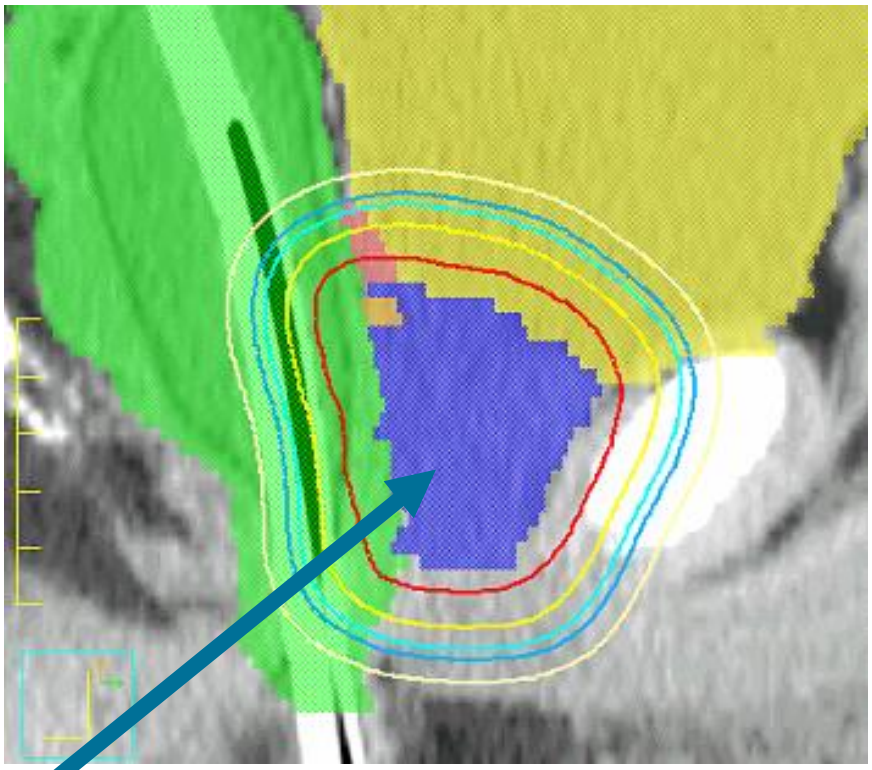
Types of proton therapy delivery

- **Passive scattered (most common)**
- **Spot-scanning (pencil-beam scanning)**
- **Intensity modulated proton therapy (IMPT)**

Spot scanning (pencil-beam scanning)

“Conventional” proton therapy (Right lateral beam’s eye view)

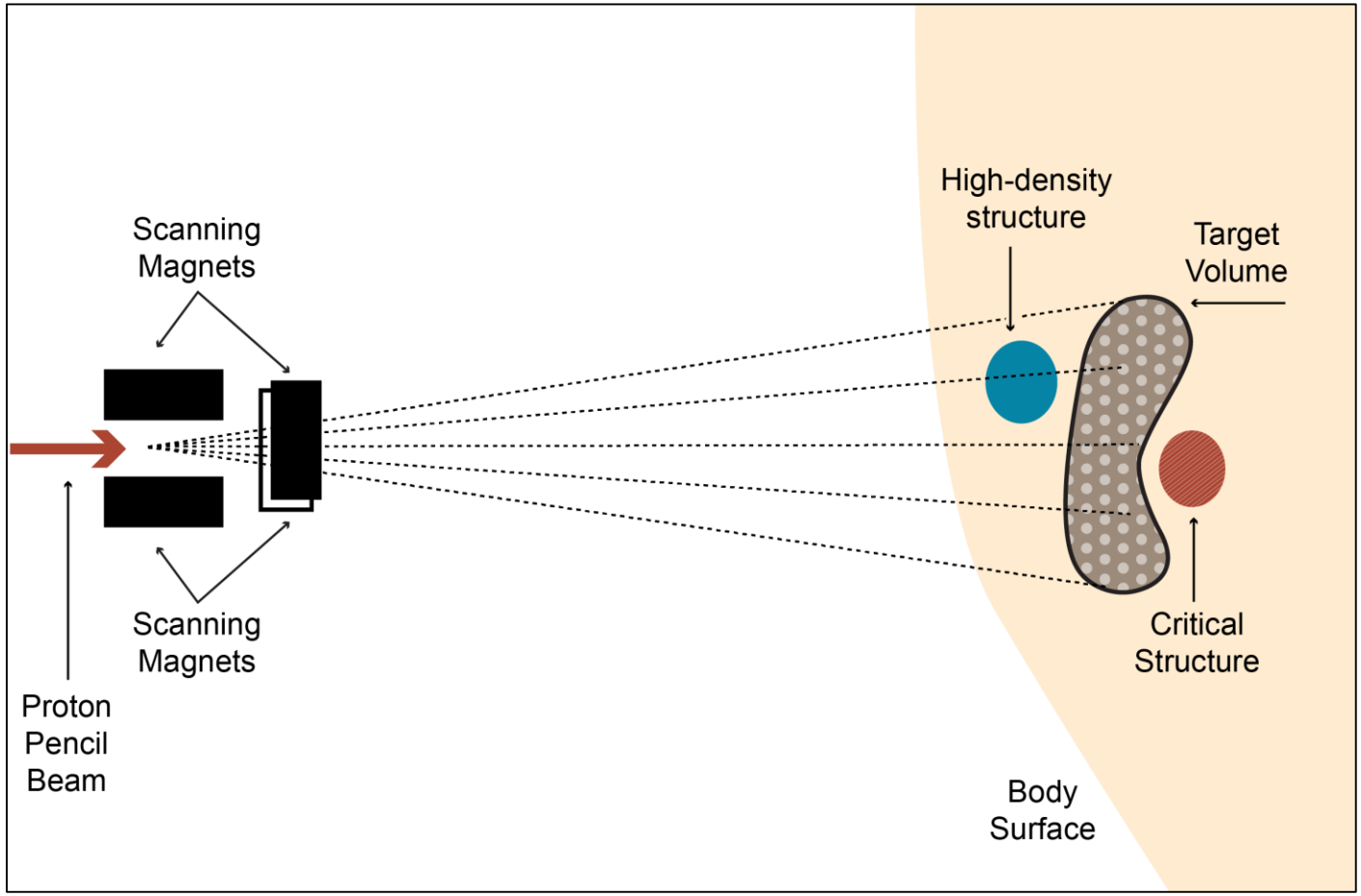




Target

TEXAS CENTER *for* PROTON THERAPY

The pencil-beam scanning mode of proton beam delivery



Source: A Smith. Med. Phys. 2009

Proton therapy in 1980's vs. Modern era

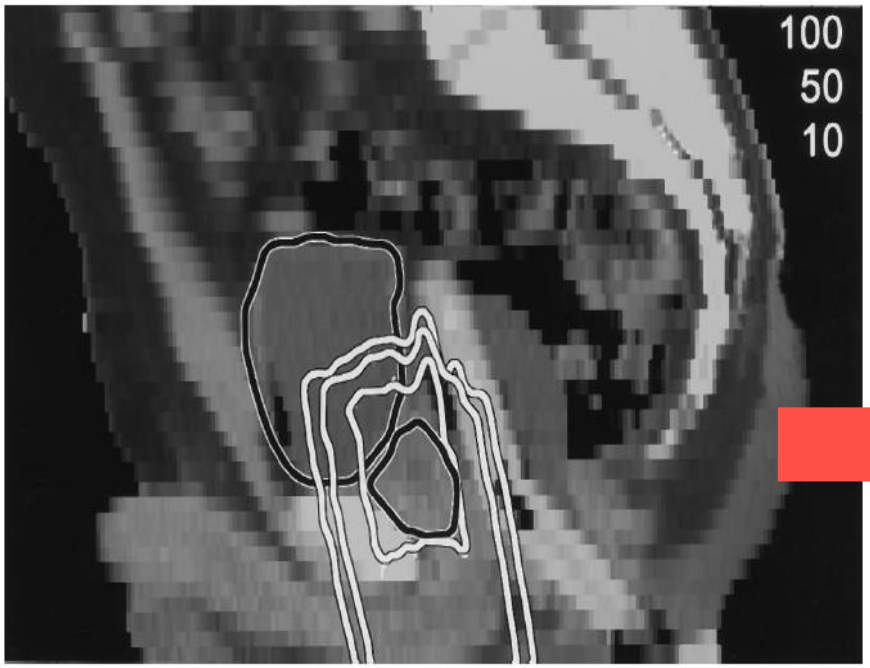
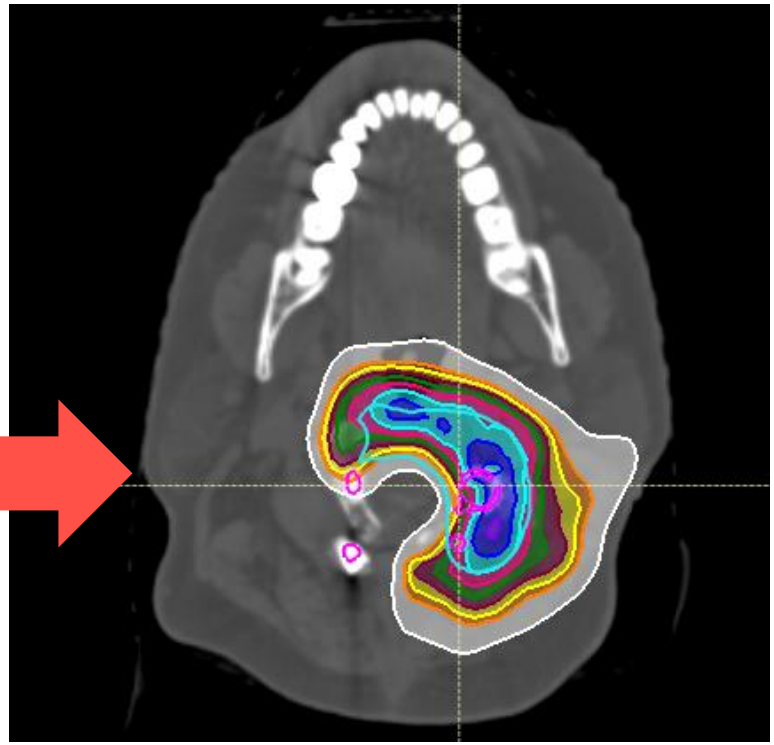


FIG. 1. Sagittal CT reconstruction shows perineal proton boost technique and how beam high dose region incorporates prostate, prostatic urethra and bladder neck.



Journal of Urology 167:123, 2002

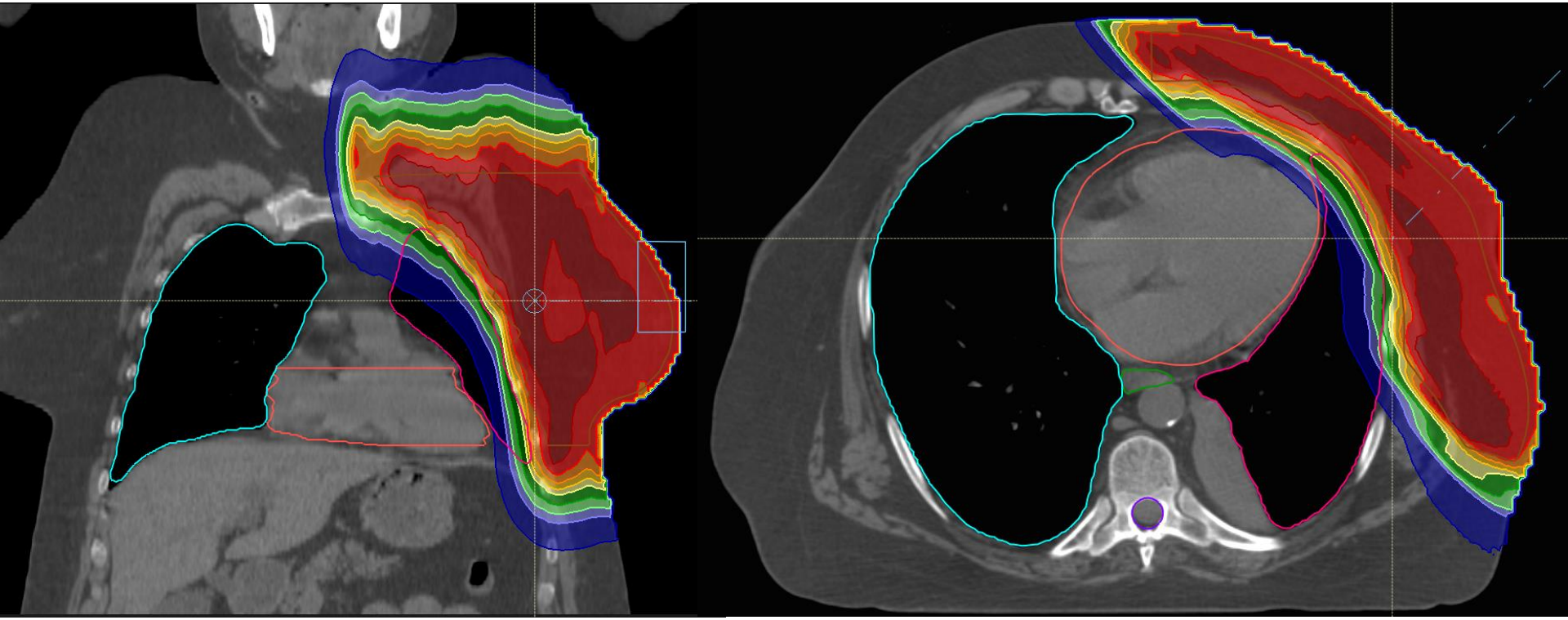
Any randomized trials between IMRT vs. Protons should be done with PBS (IMPT)

	2 D X-rays	3 D X-rays	IMRT	CONVENTIONAL PROTONS (Passive-scattered)	IMPT Intensity modulated proton therapy
Conformity	+	++	++++	+++1/2	++++
Normal tissue exposure	+++	+++	++++	++	++

Highly conformal but less tissue exposure

Beyond tumor sites like CNS & HN, how can pencil beam scanning proton therapy (IMPT) expand the clinical utility of proton therapy?

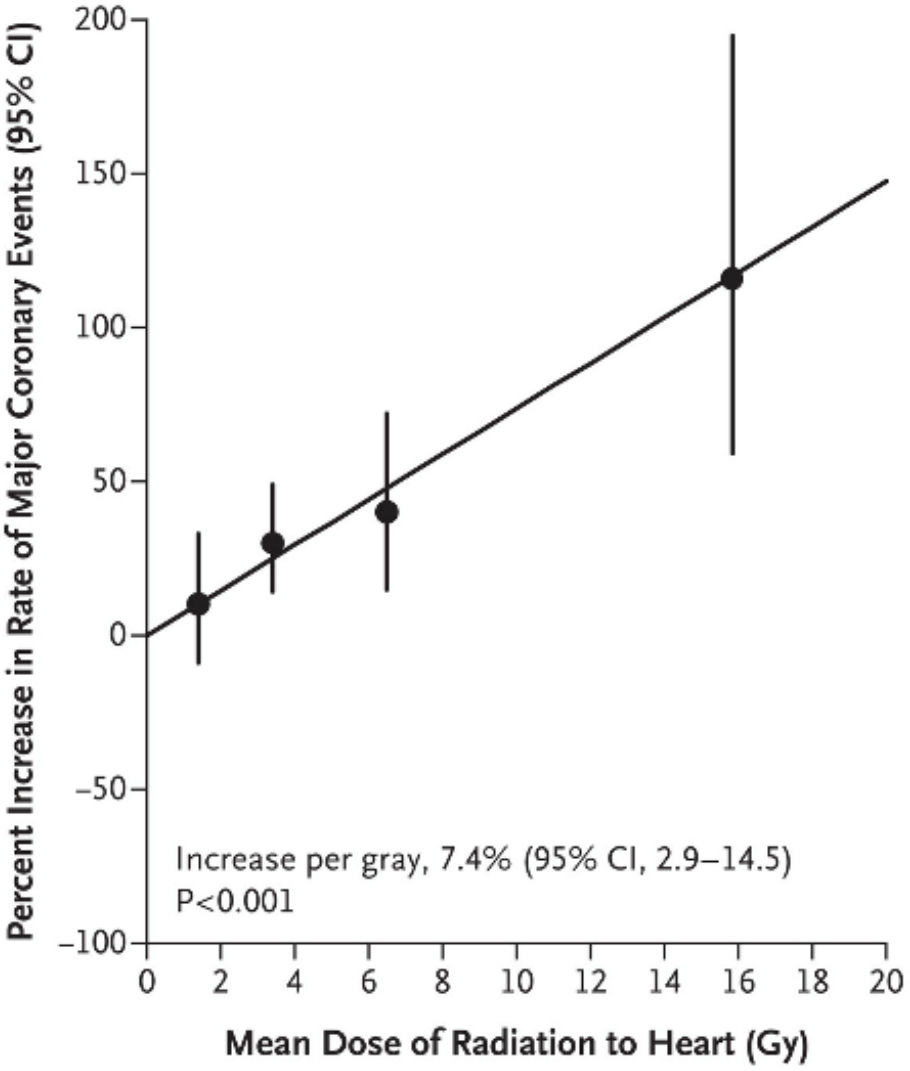
Breast + lymph nodes w/ pencil-beam proton therapy



Coronal

Axial

For breast cancer, linear risk of coronary events… 7.4% increase per mean Gy to heart



Darby et al. NEJM 2013;368.

Proton therapy for lung cancer represents particular challenge (e.g. moving target, density changes, etc)

PROTON ADVANCES IN LUNG CANCER

Better target delineation

Management of respiratory motion

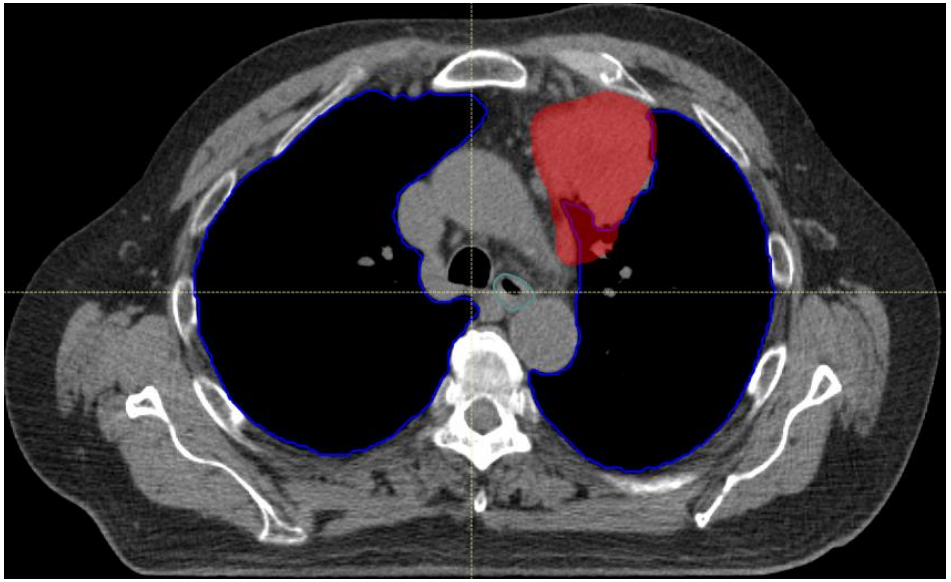
On-board image guidance (CBCT)

Better treatment planning techniques

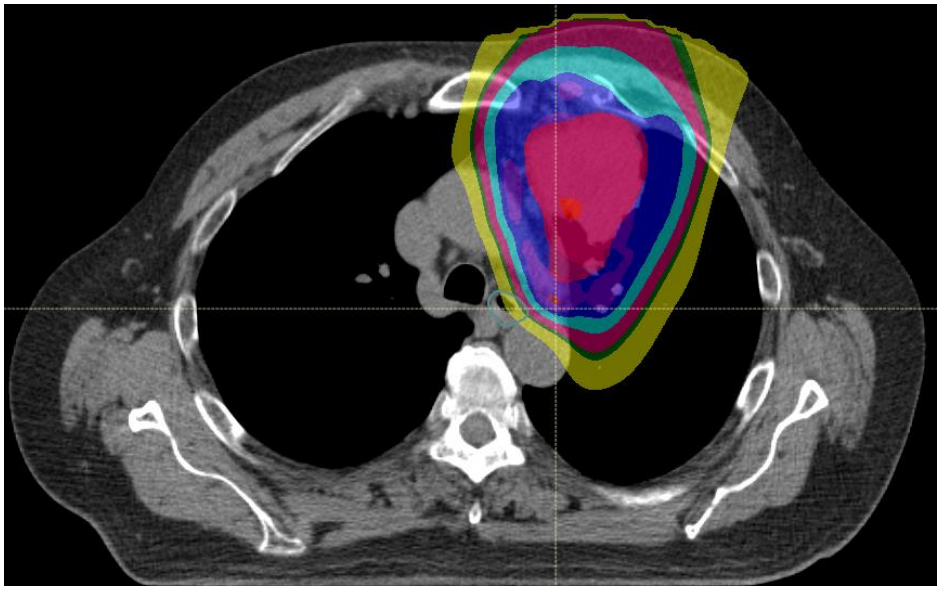
Better delivery techniques

Understanding importance of heart dose

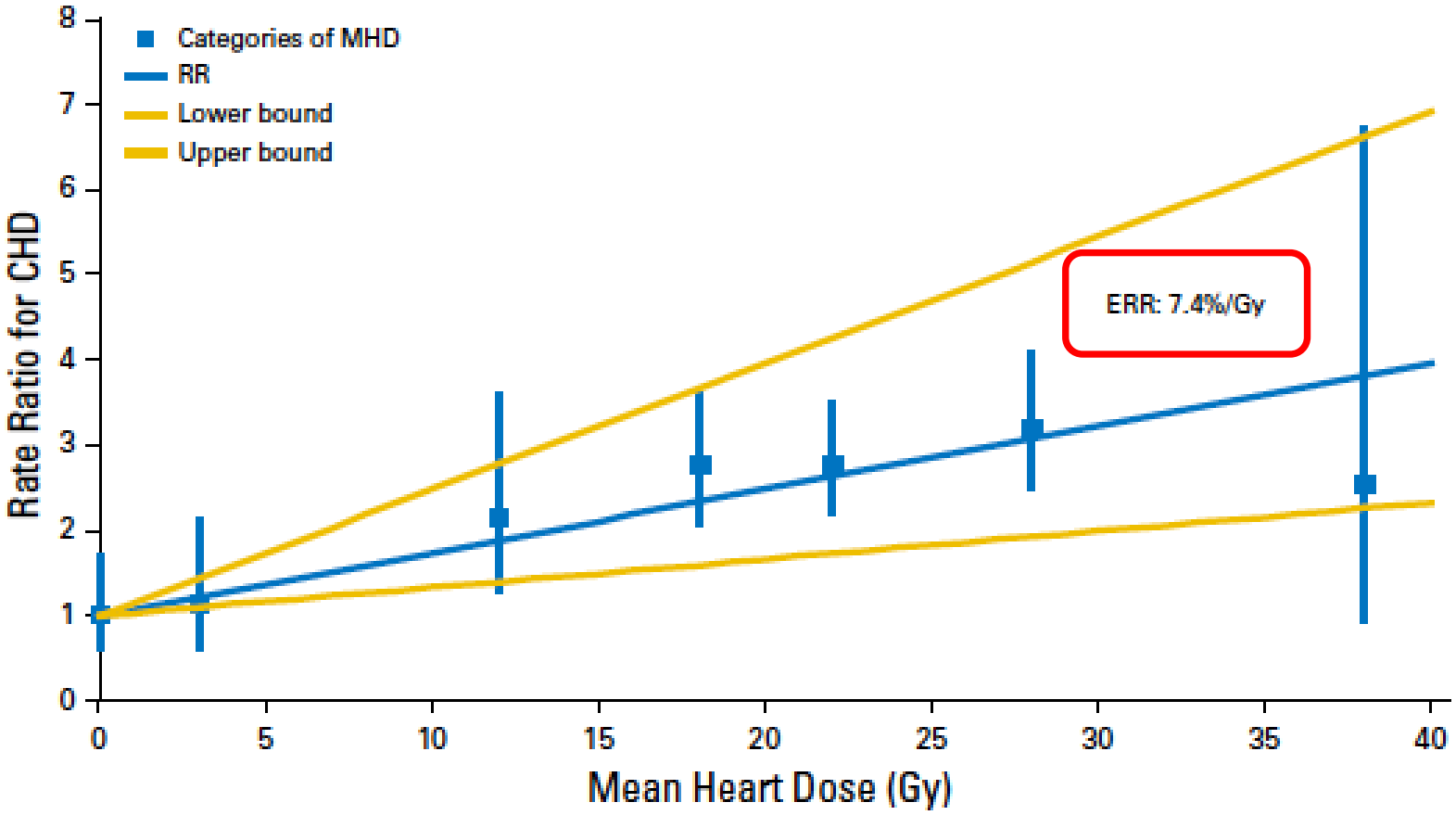
Anterior tumors (e.g. lung, thymoma, lymphoma)



Protons can keep dose anteriorly



Same risk for Hodgkin lymphoma survivors



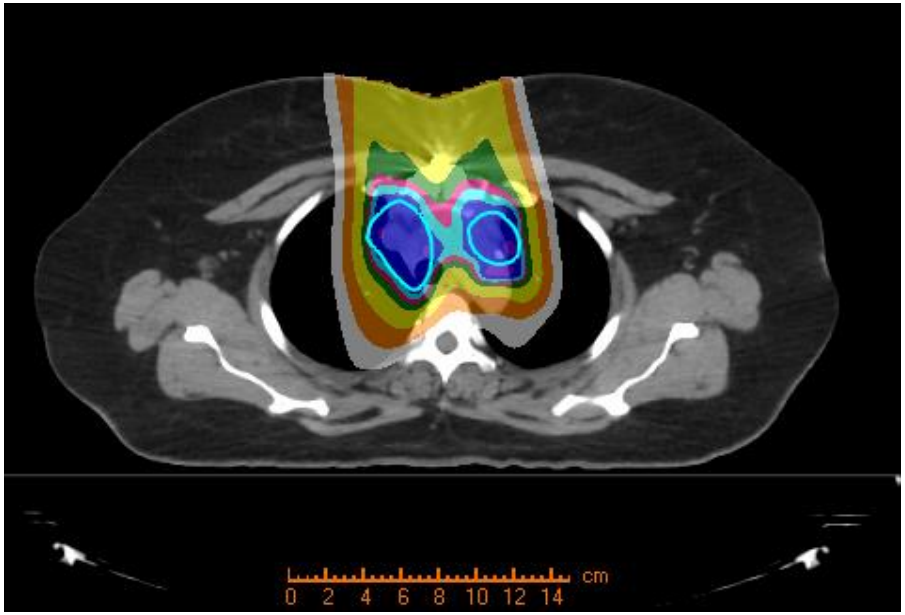
F. Van Nimwegen et al. J Clin Oncol 2015;34

As systemic therapy improves, so must local-regional Rx…Case example: Advanced NSCLC

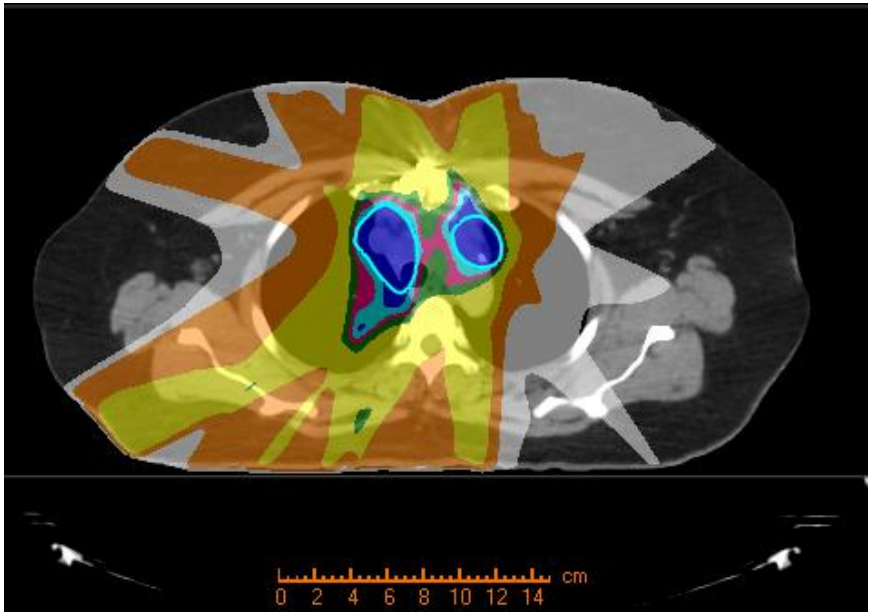
- **59 yo woman w/ stage IIIB NSCLC (T1N3, ALK +)**
- **RLL primary with extensive bilateral mediastinal, hilar, S/C disease**
- **Neaoadjuvant chemoRx and crizotinib**
- **Good metabolic response but gross residual disease**
- **Plan for consolidative chemo-XRT**

Axial Comparison

Protons



Photons (IMRT)

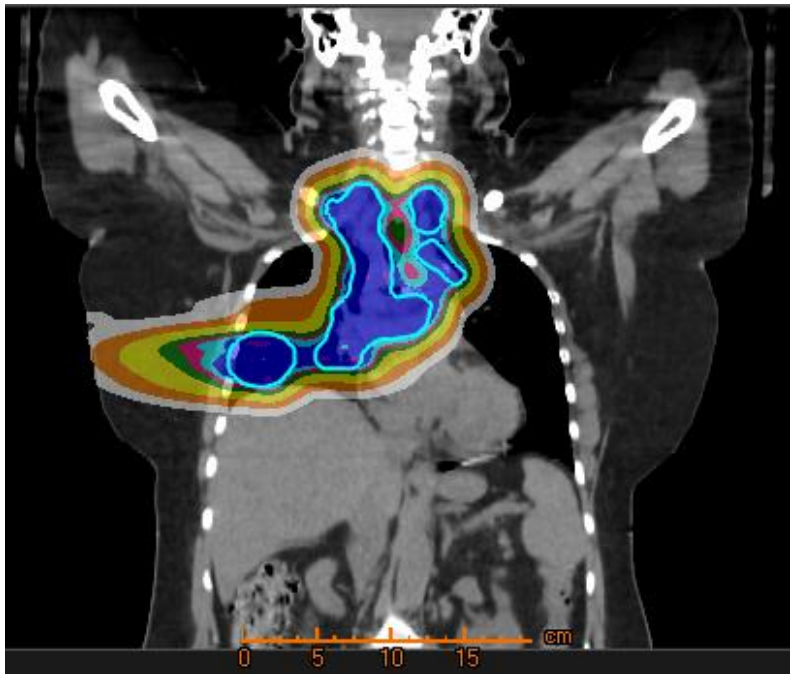


Dark Blue	60 GyE
Yellow	30 GyE
Gold	15 GyE

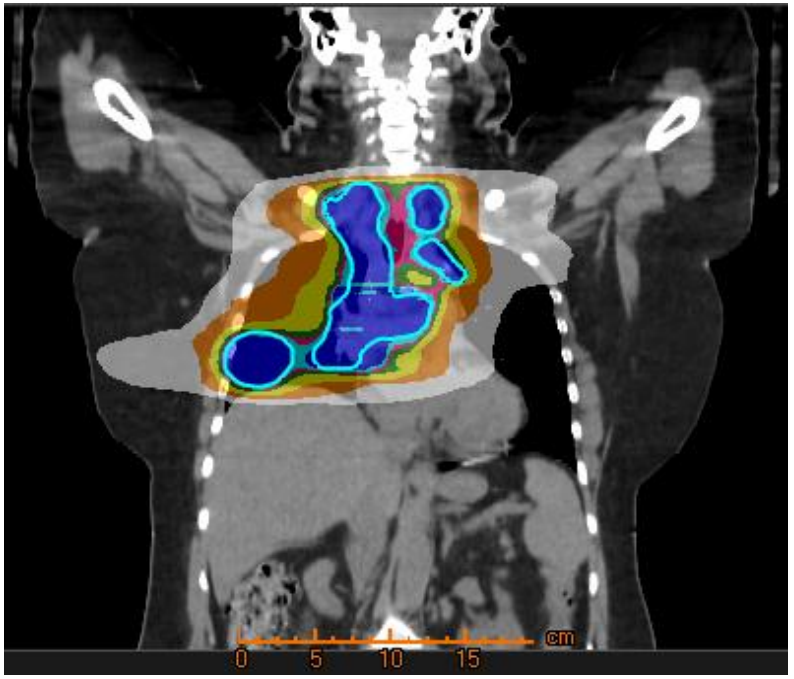
The Proton plan spares more normal LUNG than the IMRT plan

Coronal Comparison

Protons



Photons (IMRT)



Dark Blue	60 GyE
Yellow	30 GyE
Gold	15 GyE

RTOG 0617
Overall survival multivariable analysis
Heart dose was independent factor

Supplemental Table 2. Multivariable Cox model for overall survival*

Co-variate	Comparison	HR (95% CI)	p-value
RT technique	3D-CRT (RL) vs. IMRT	1.05 (0.83, 1.34)	0.682
Age	Continuous	1.012 (0.999, 1.026)	0.08
% of PTV covered by 100% of Rx dose	Continuous	0.996 (0.992, 1.001)	0.107
Heart V40	Continuous	1.012 (1.005, 1.02)	0.0017
Site accrual volume	Low volume (RL) vs. high volume	0.75 (0.59, 0.96)	0.021
PET-staging	No (RL) vs. yes	0.78 (0.54, 1.15)	0.207

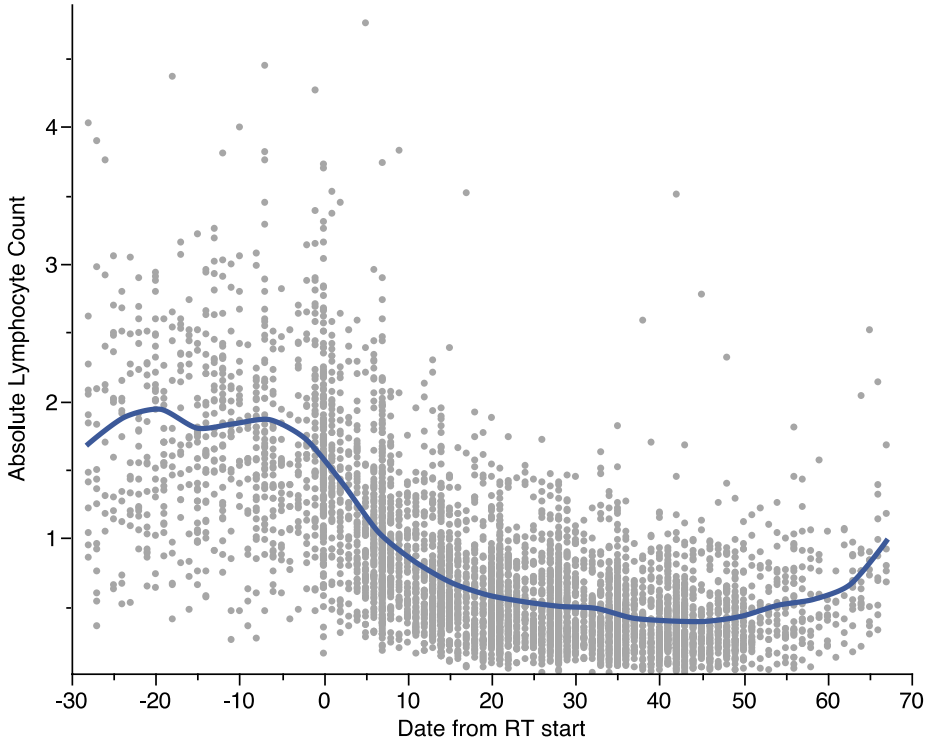
Potential to improve survival with particle therapy by reducing cardiac doses

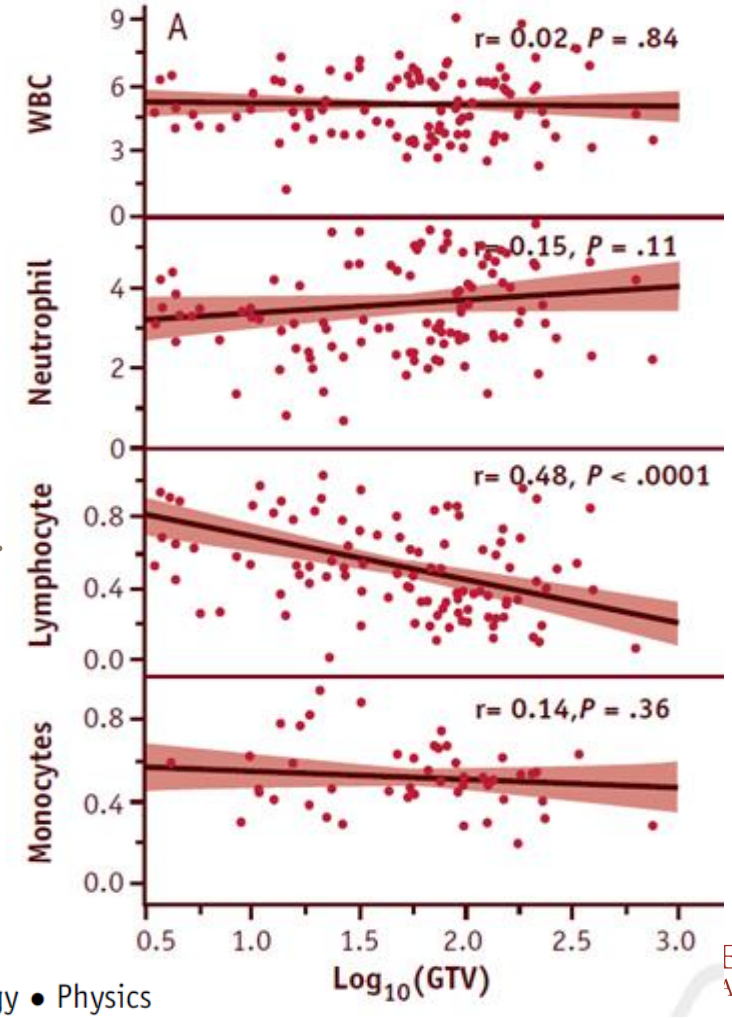
Courtesy of Dr. Stephen Chun. J Clin Oncol 34, 2016

International Journal of Radiation Oncology biology • physics

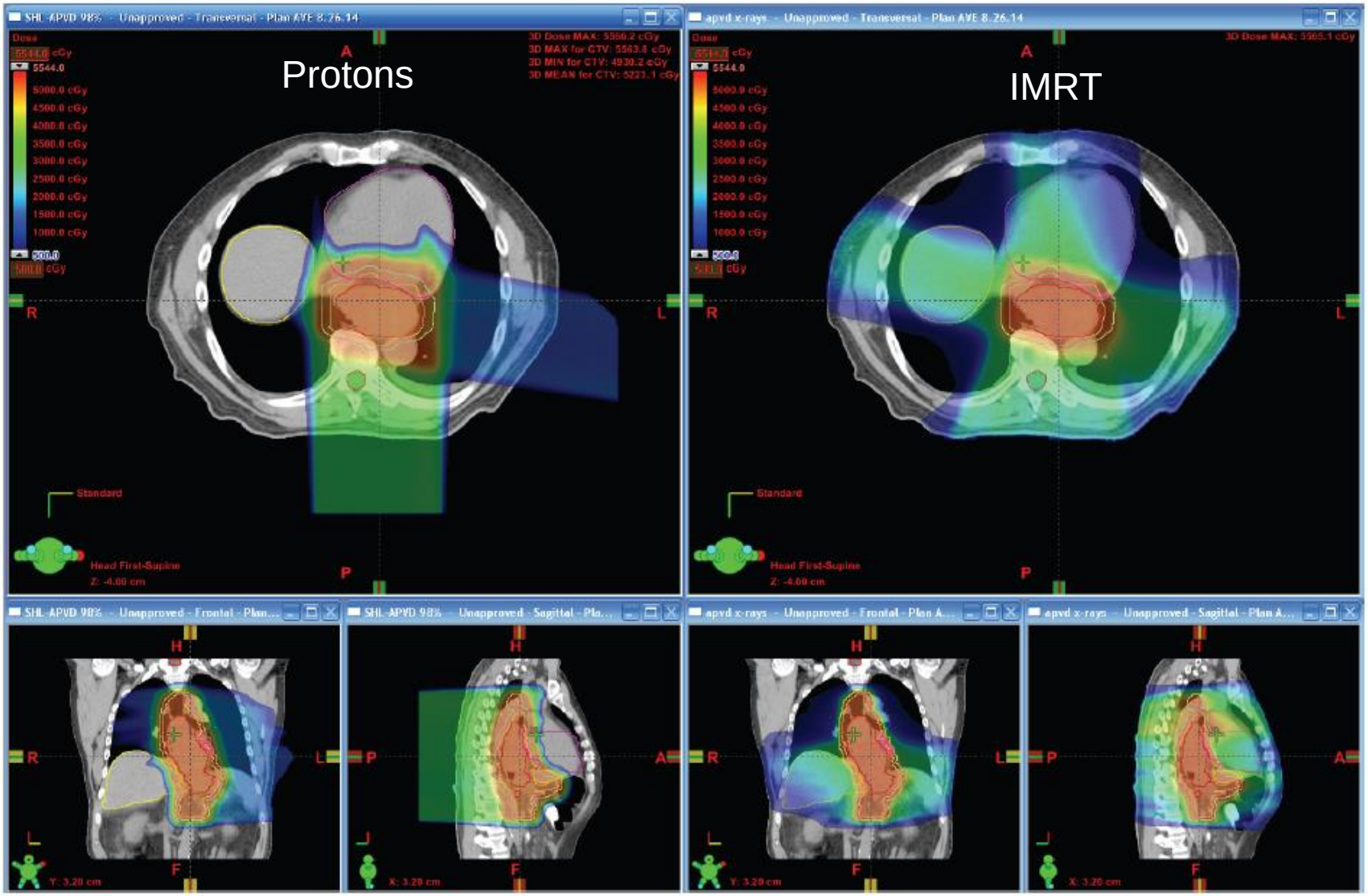
Lymphopenia Association With Gross Tumor Volume and Lung V5 and Its Effects on Non-Small Cell Lung Cancer Patient Outcomes

Chad Tang, MD, MS,* Zhongxing Liao, MD,* Daniel Gomez, MD,* Lawrence Levy, MS,* Yan Zhuang, MD,* Rediet A. Gebremichael, BS,* David S. Hong, MD,† Ritsuko Komaki, MD,* and James W. Welsh, MD*





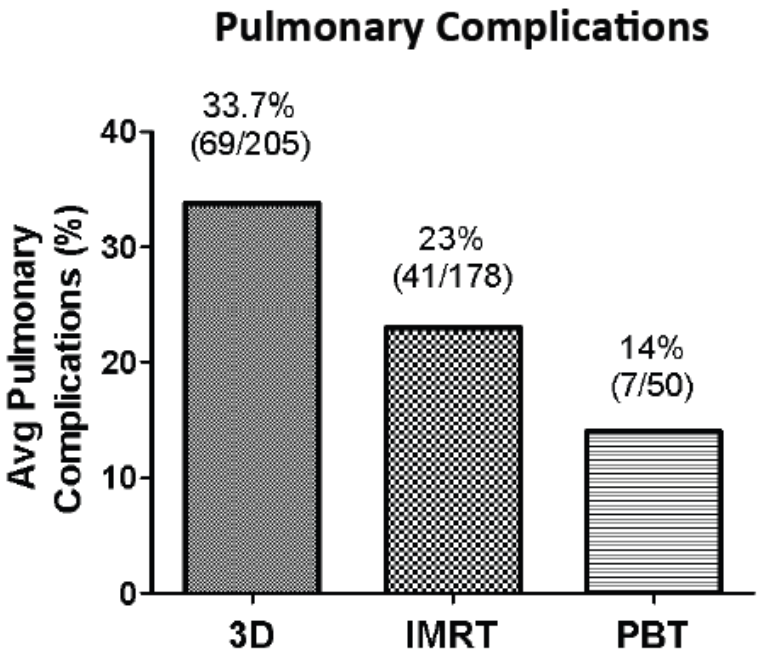
Esophageal Cancer



Improved perioperative pulmonary complications with proton therapy

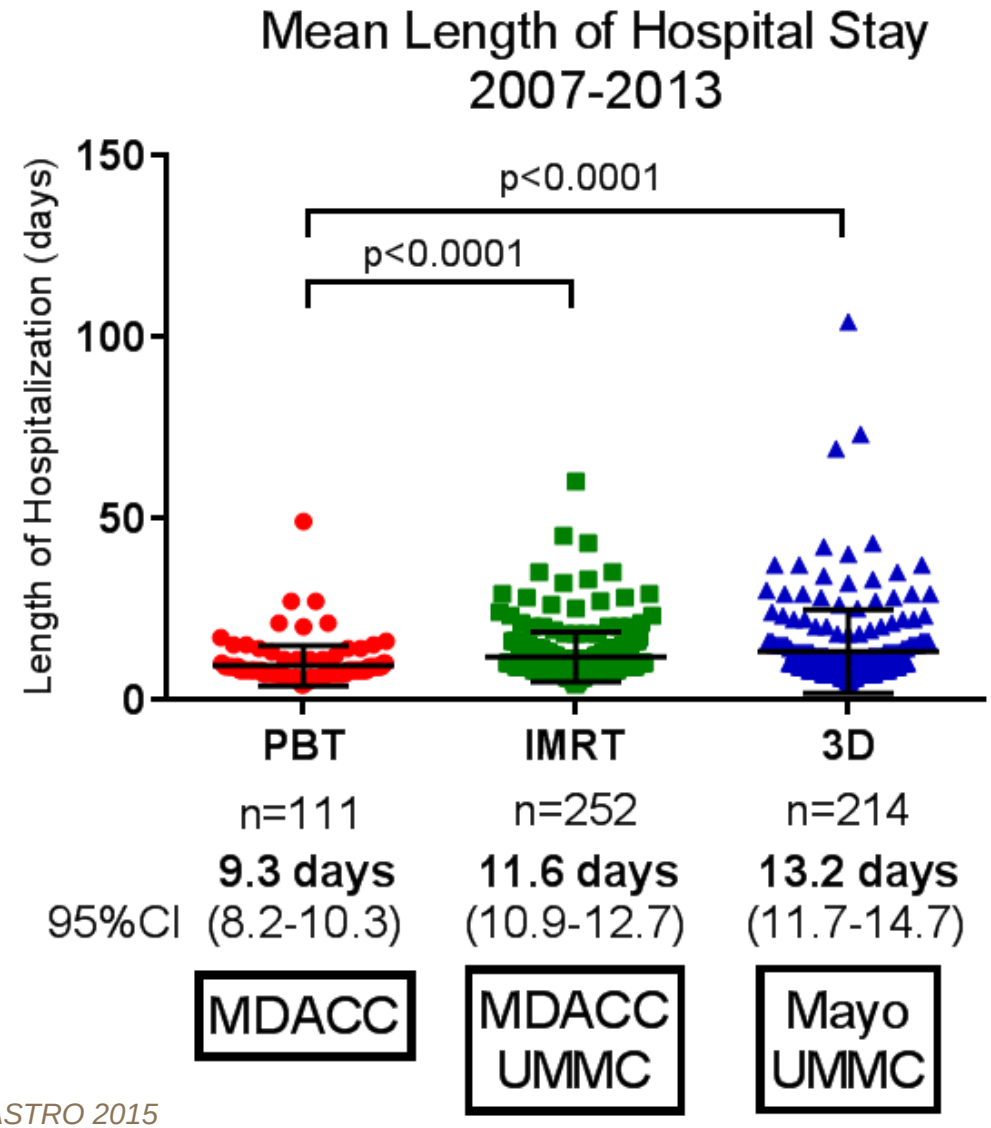
- **444 patients who had surgery after CRT**
- **3D** (n=208, 1998-2008); **IMRT** (N=164, 2004-2011), and **PBT** (n=72, 2006-2011)
- Evaluated Pulmonary, GI, cardiac, wound healing within 30 days of surgery

- **Pulmonary complications** (ARDS, pleural effusion, RI, PNA) most predictive based on radiation type
  - **IMRT vs 3D** (OR 0.50, 95% CI 0.27-0.91)
  - **PBT vs 3D** (OR 0.32, 95%CI 0.14-0.73)
  - **IMRT vs PBT** (OR 1.56, 95%CI 0.68-3.60)



Source: Wang J, Lin SH, et al. Int J Radiat Oncol Biol Phys 2013

Value of proton therapy in esophageal cancer



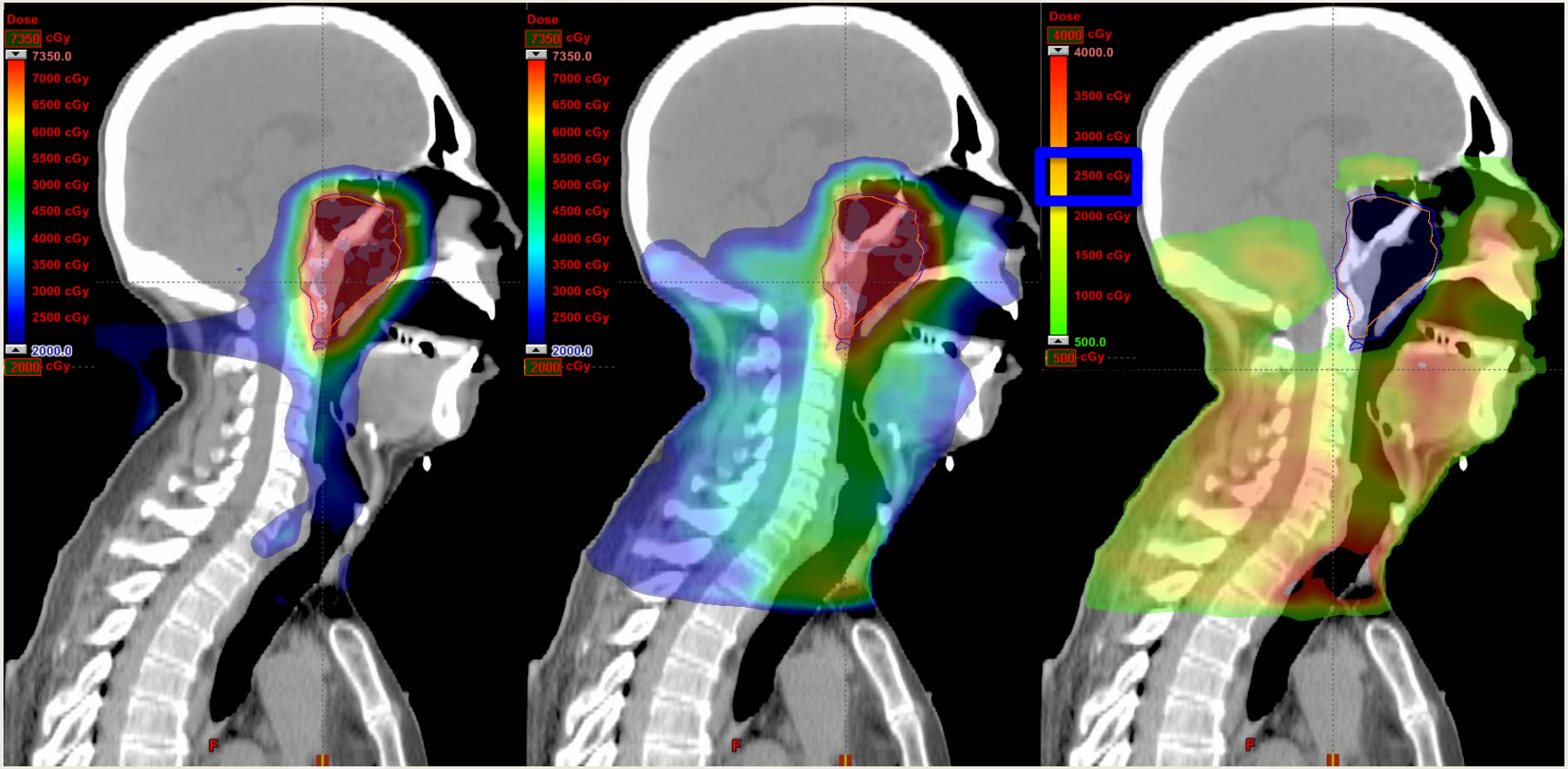
Protons reduces ***average*** hospital stay by > 2 days and ***max*** hospital days

Source: Lin SH et al., ASTRO 2015

Proton
Therapy (IMPT)

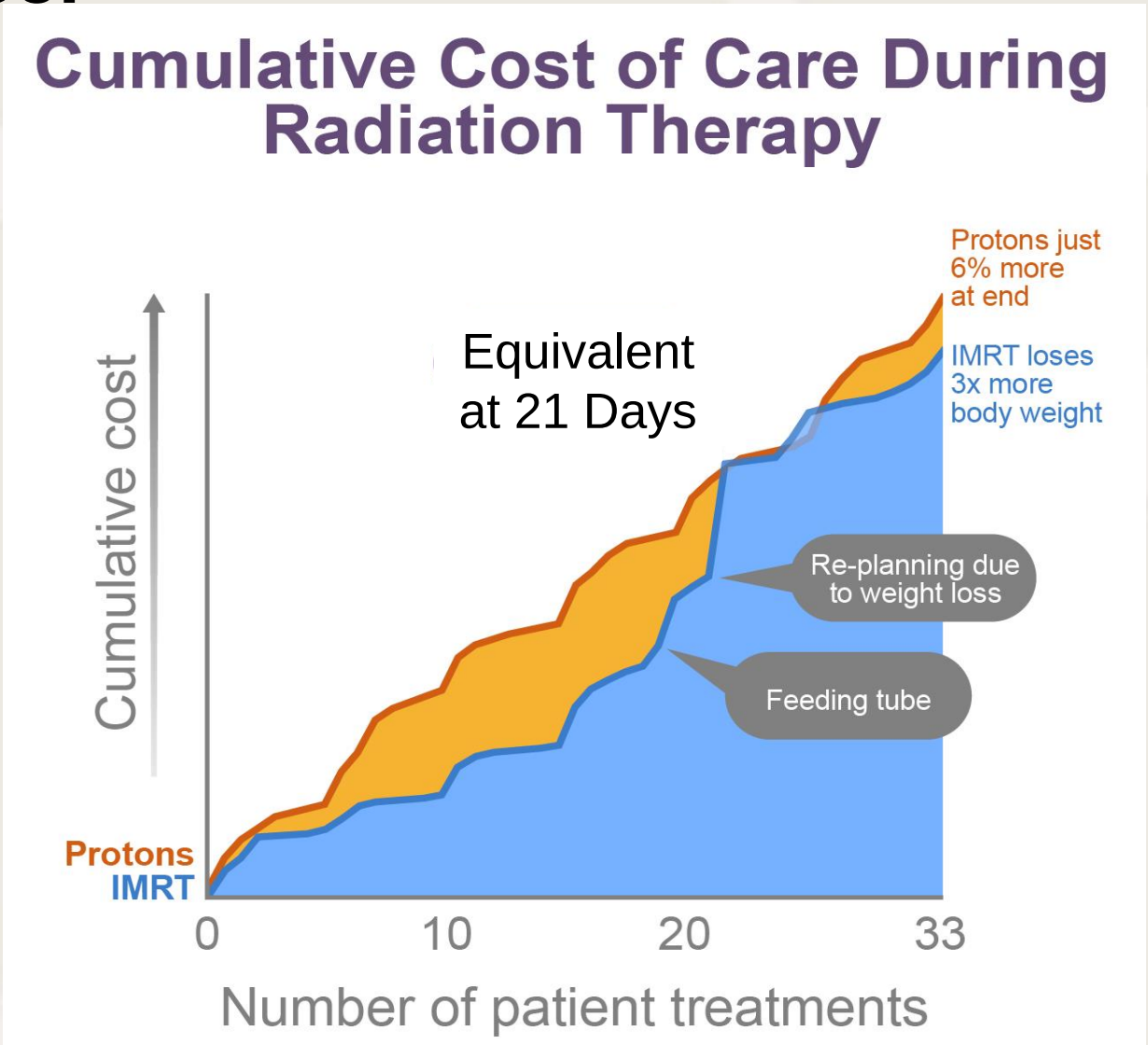
X-Ray
Therapy (IMRT)

Added Radiation with X-Rays



TEXAS CENTER *for* PROTON THERAPY

Value Proposition- Head and Neck Cancer



Thaker N et al. *Oncology Payers* 2014

What is “new” in proton therapy?

- **Proton therapy has improved as technology has advanced (just like X-ray therapy)**
- **Imaging (OBI and CBCT)**
- **Treatment planning (software)**
- **Treatment delivery systems**
- **Intensity modulation**
- **Immobilization**

TEXAS CENTER *for* PROTON THERAPY

THANK YOU

Andrew.Lee@USOncology.com

TexasCenterForProtonTherapy.com

Development of a state-of-the-art proton therapy center

Craig W. Stevens, MD, PhD, Chair of Radiation Oncology, Beaumont Health System

Beaumont

Beaumont Proton Therapy Center

Craig W. Stevens, M.D., Ph.D.
Professor and Chair
Department of Radiation Oncology

Thanks!

- IBA
- Team at Beaumont
  - Too many people to count but
  - Xuanfeng Ding, PhD
  - Peyman Kabolizadeh, MD PhD
  - Tom Lanni
  - Patti Cardoze

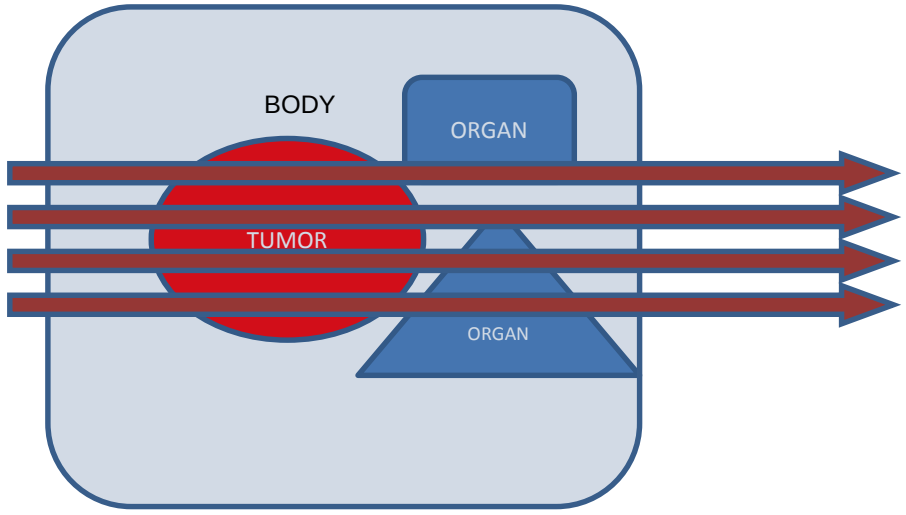
Summary

- We successfully installed and commissioned the first proton center in MI
- We met critical C.O.N. timeline requirements
- This allowed us to
  - Treat the first proton patient in MI
  - Increase our overall consults by almost 10%
  - Treat the first pediatric patient with protons in MI
- Impossible without STRONG commitment from IBA

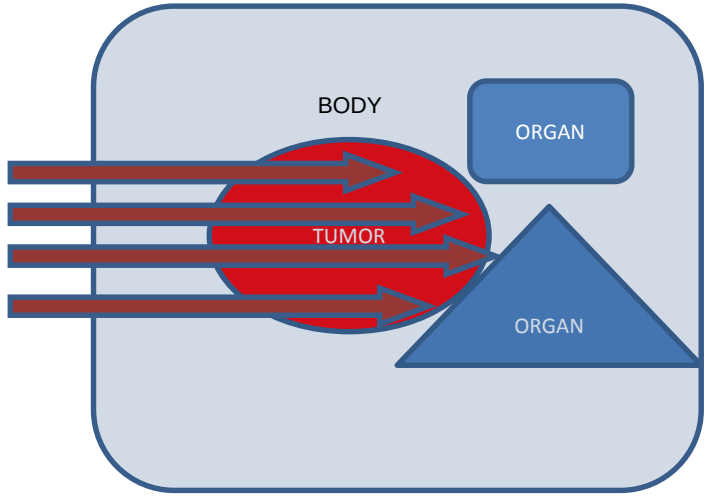
Beaumont Proton Therapy Center

Physics of Proton Therapy

- Photons



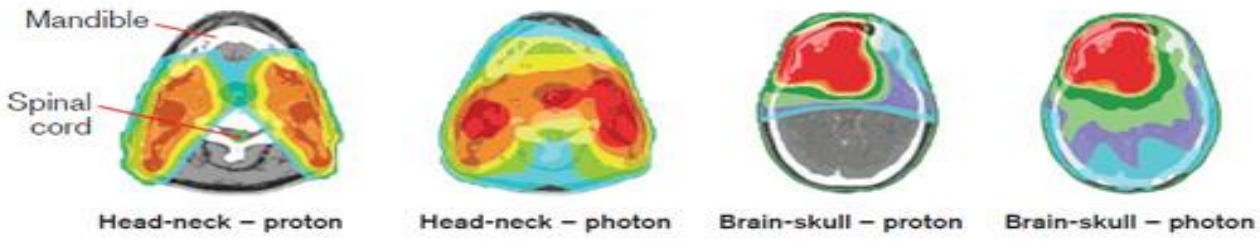
- Protons



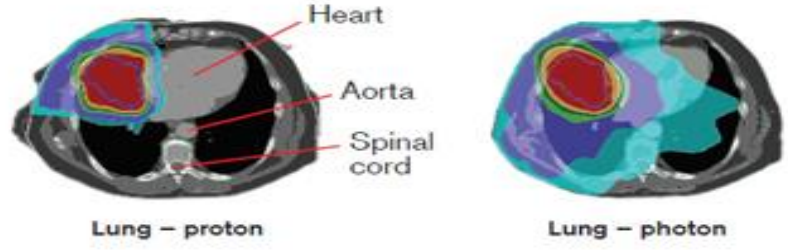
Disease sites

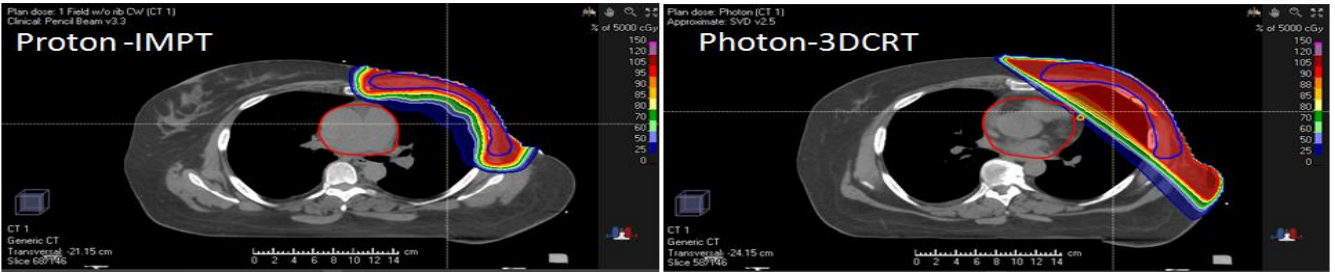
Less integral dose

Head, Neck and Brain

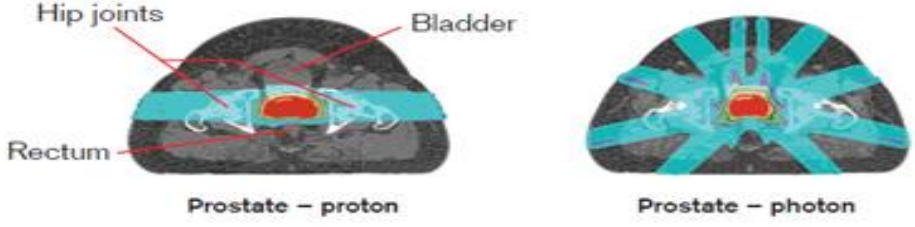


Lung

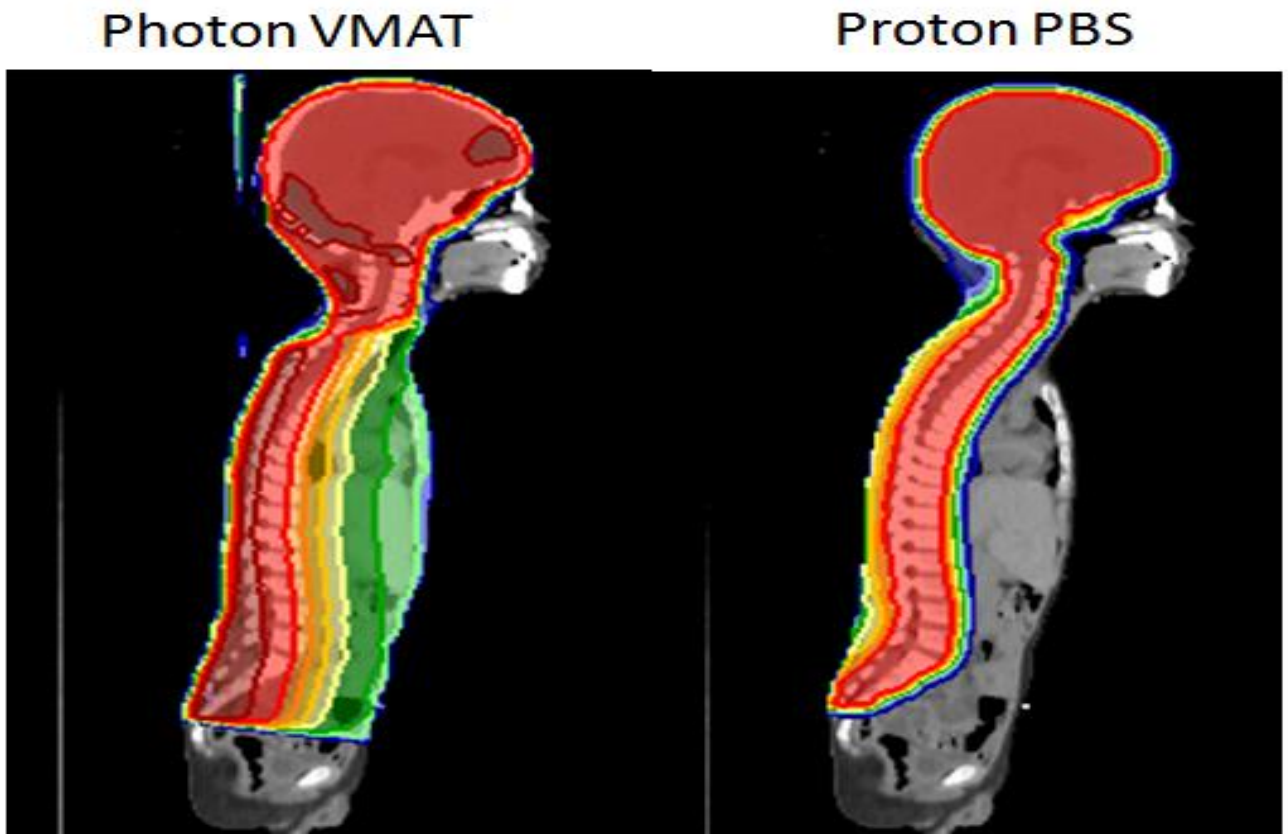




Prostate



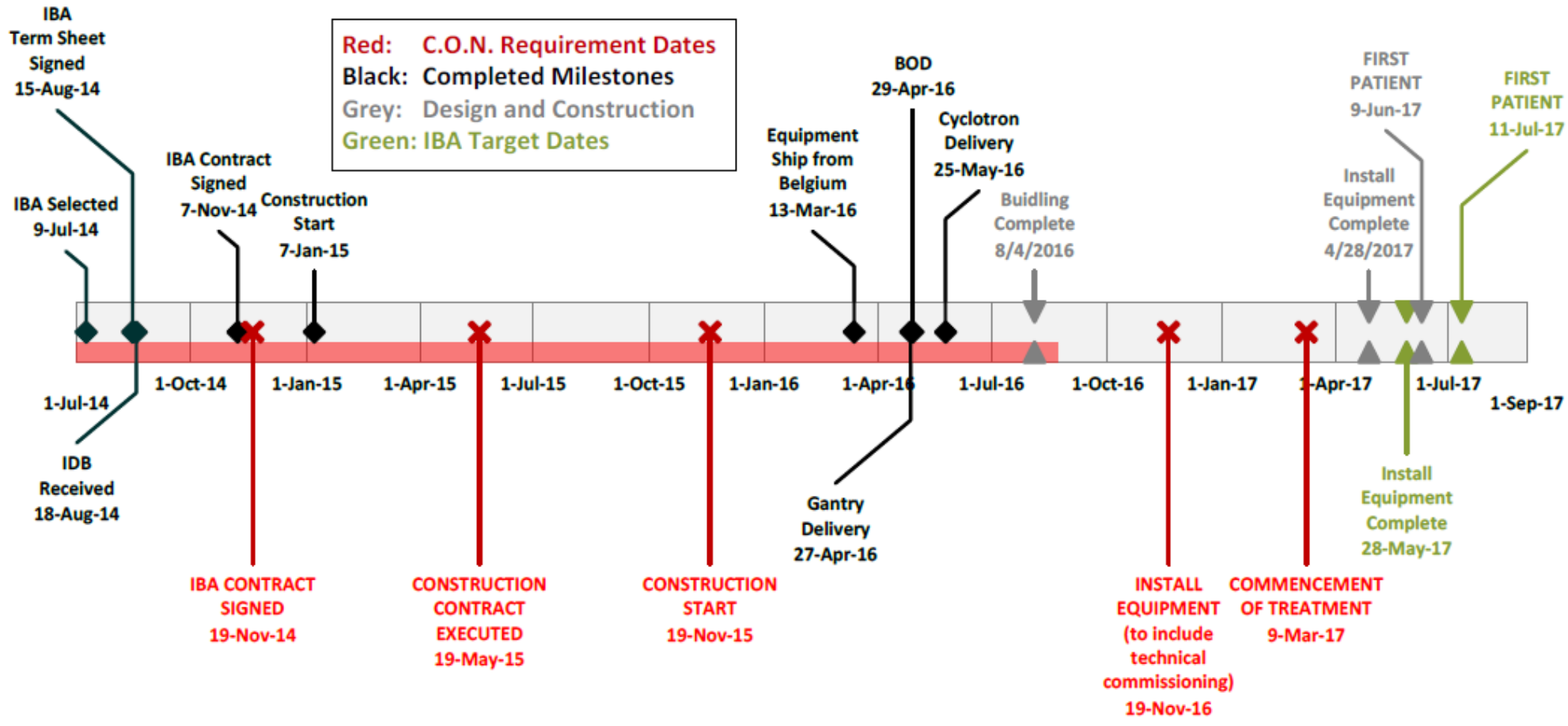
For Pediatric patient



Beaumont Journey

- Initial plan for Proton Center dates from ~2007
  - The 5 room plan was tabled due to the financial crisis
- When I was being recruited to Beaumont in 2013, PTC was reintroduced.
- Board approval in January of 2014
- CON requirements were daunting
  - CON commission had NEVER overseen the construction of a successful center
  - Penalties could be severe if we failed

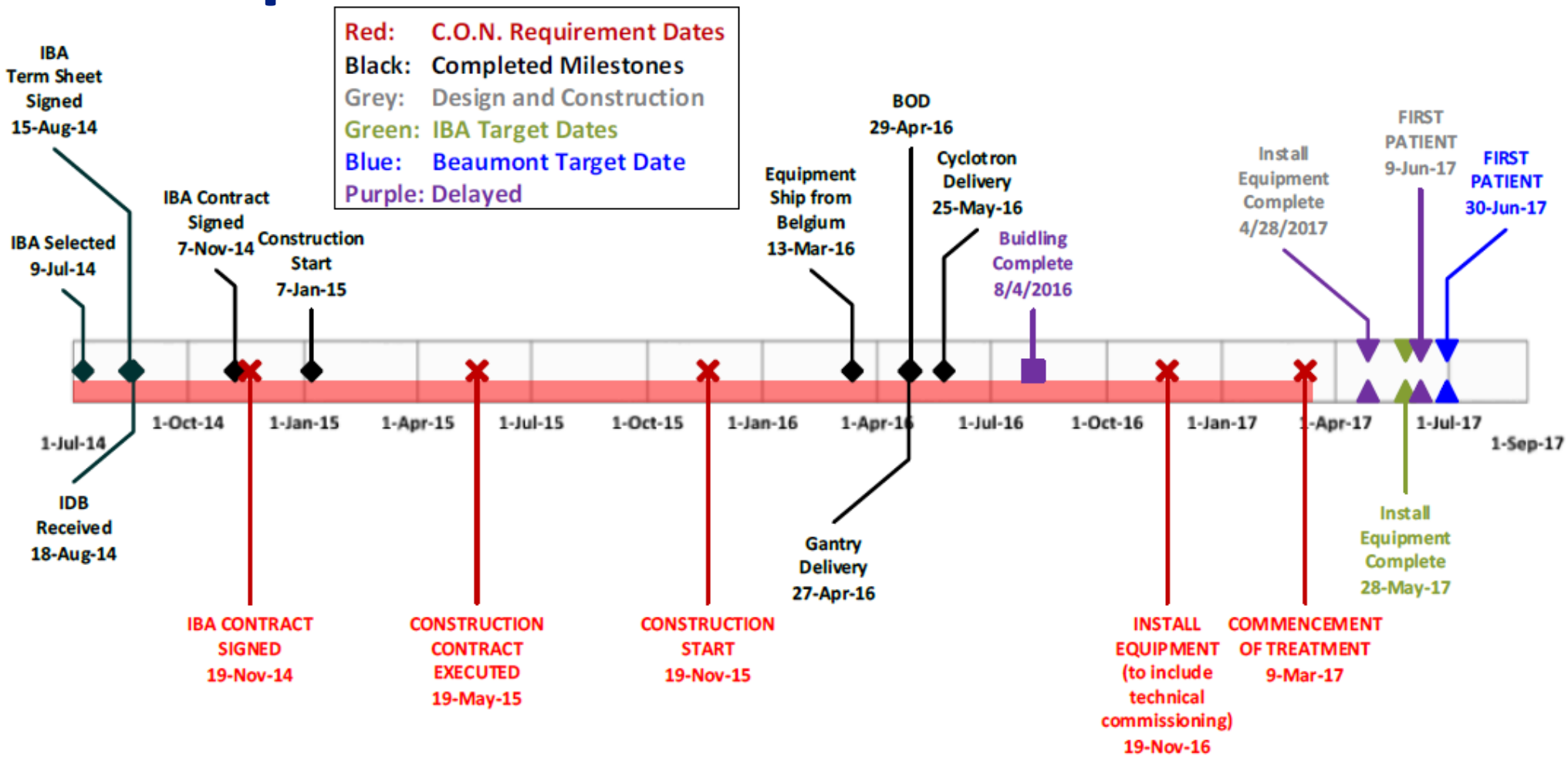
CON Requirements



Beaumont Journey

- Request for Proposals Drafted
  - With help from Proton International
  - IMPT, CBCT, FDA approved, install by March 2017
- Sent to 7 vendors
  - 6 responded
- Three vendors were chosen for site visit
  - One couldn’t deliver IMPT
  - One had a compact cyclotron that would reduce the cost of construction and operations so…….
- IBA was selected July 2014

CON Requirements



Beaumont Journey

- In November 2016, clear we would miss the last two milestones
  - One because it was never reasonable
  - One because of weather and other construction delays
- We restated the time line with a plan to treat the first patient by June 30, 2017

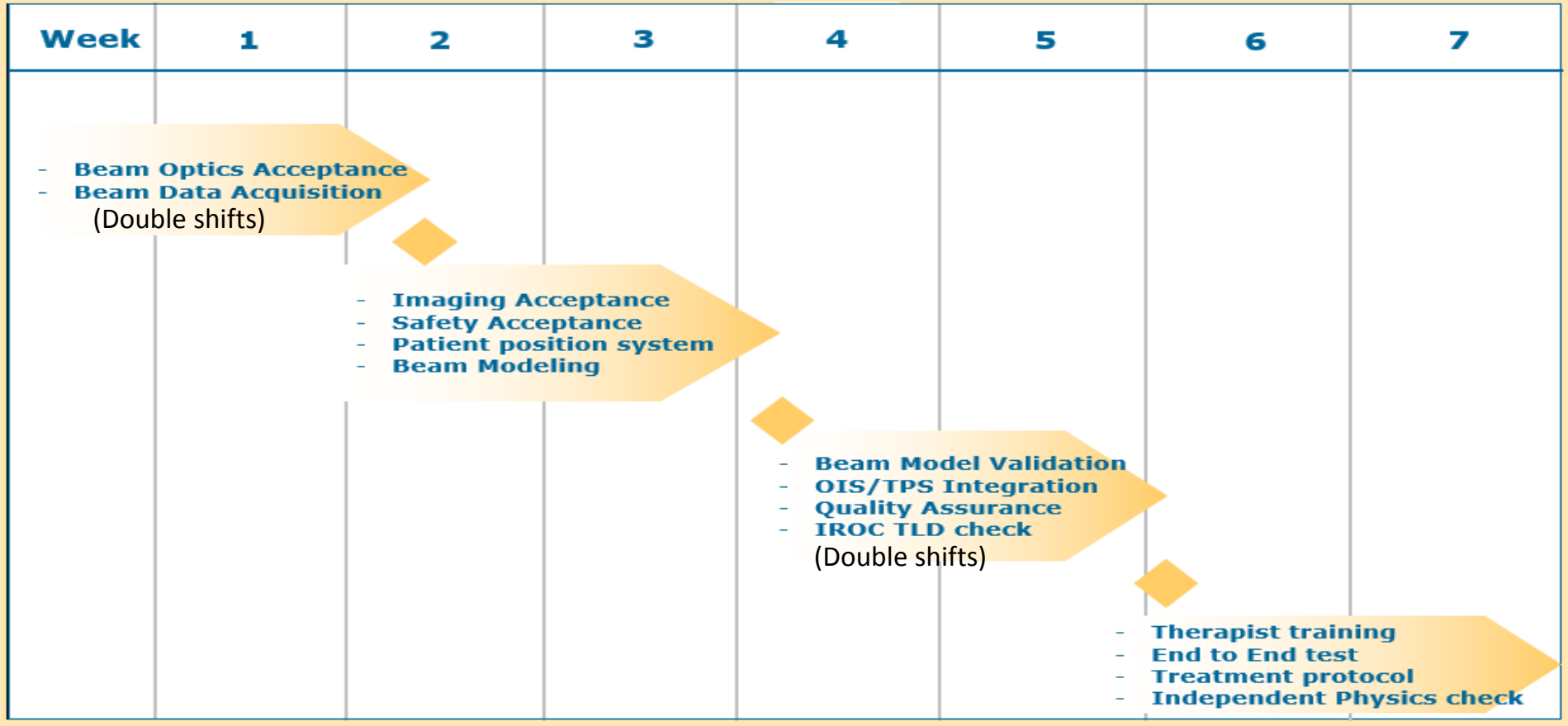
Beaumont Journey

- In February 2017, the schedule slipped again
- We reached out to IBA and other partners to develop an aggressive new schedule
- Plan for first patient to be a patient with a brain tumor

Collaborate and synchronize the team schedule

- Combine the beam data acquisition procedure with acceptance test (IBA & Beaumont)
    - Lock beam optics settings
- Beam modeling and validations (Beaumont & RaySearch America & Sweden)
    - Dry run with current data format
    - Communicate with the RaySearch team
- Mosiaq integration and on-site therapist training
    - Address the bugs and workflow issues
- Independent Physics Check/IROC TLD check
    - Dr. Gao from Chicago Proton Center
    - IROC team (Beaumont commission and treatment schedule)
- Took 16 week process and condensed it to 7

Beaumont Commissioning Timeline



Ding et al. NA-PTCOG 2017

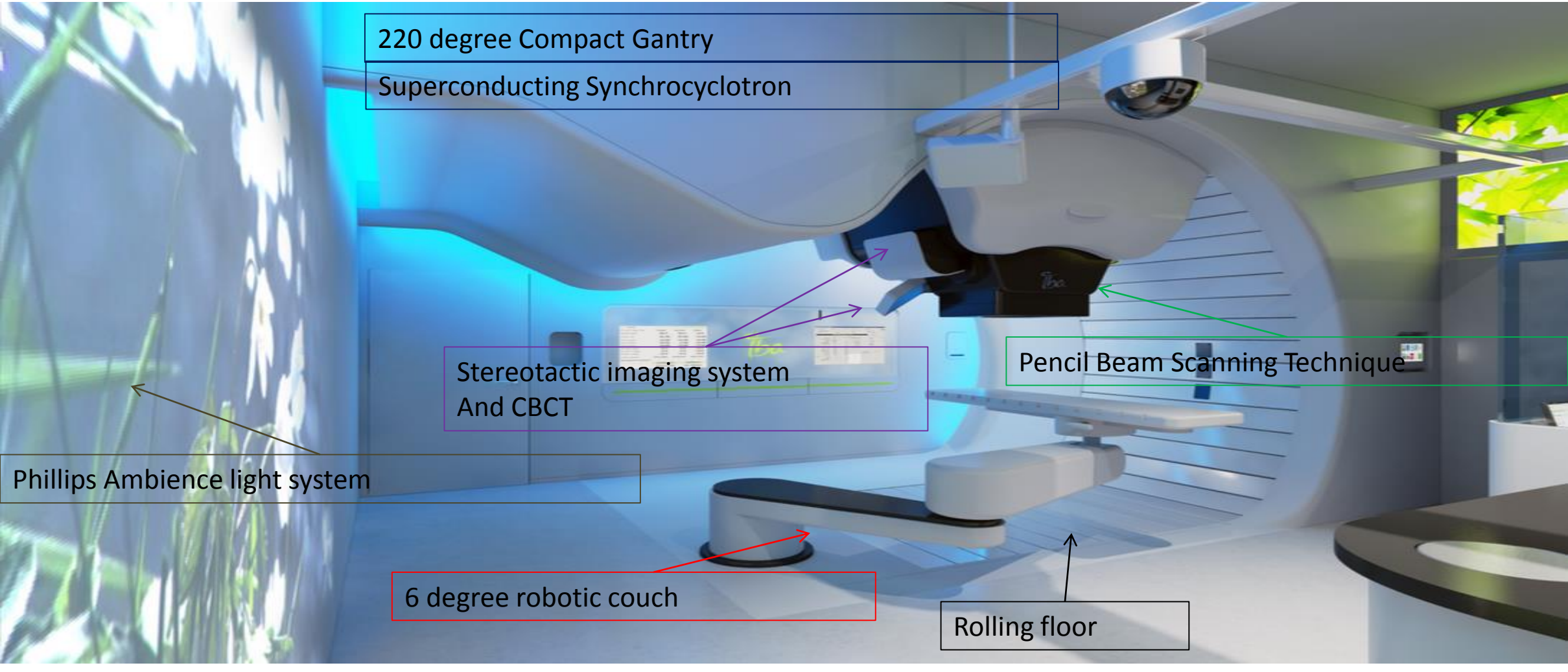
Ahead of Schedule


ERICKSONS
Proton Therapy
Center
Beaumont

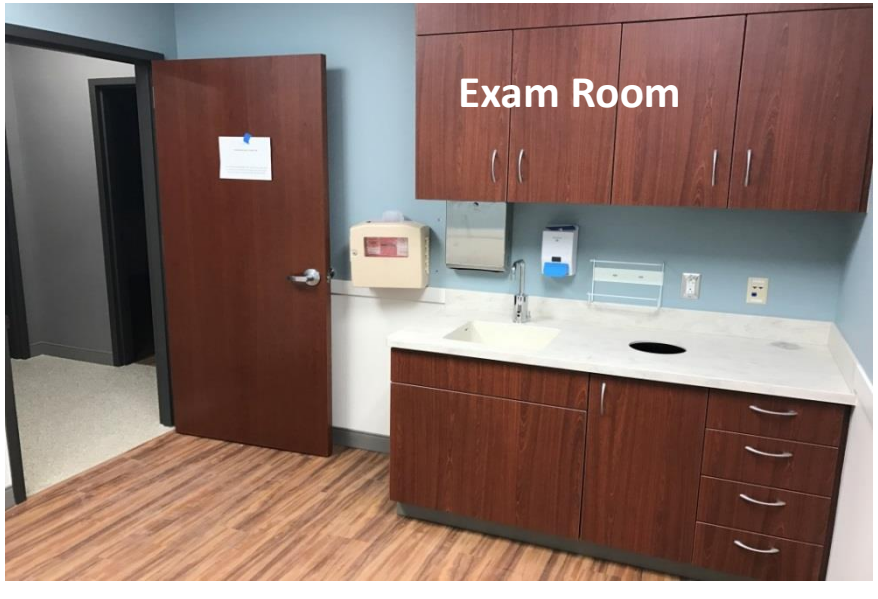
Protons

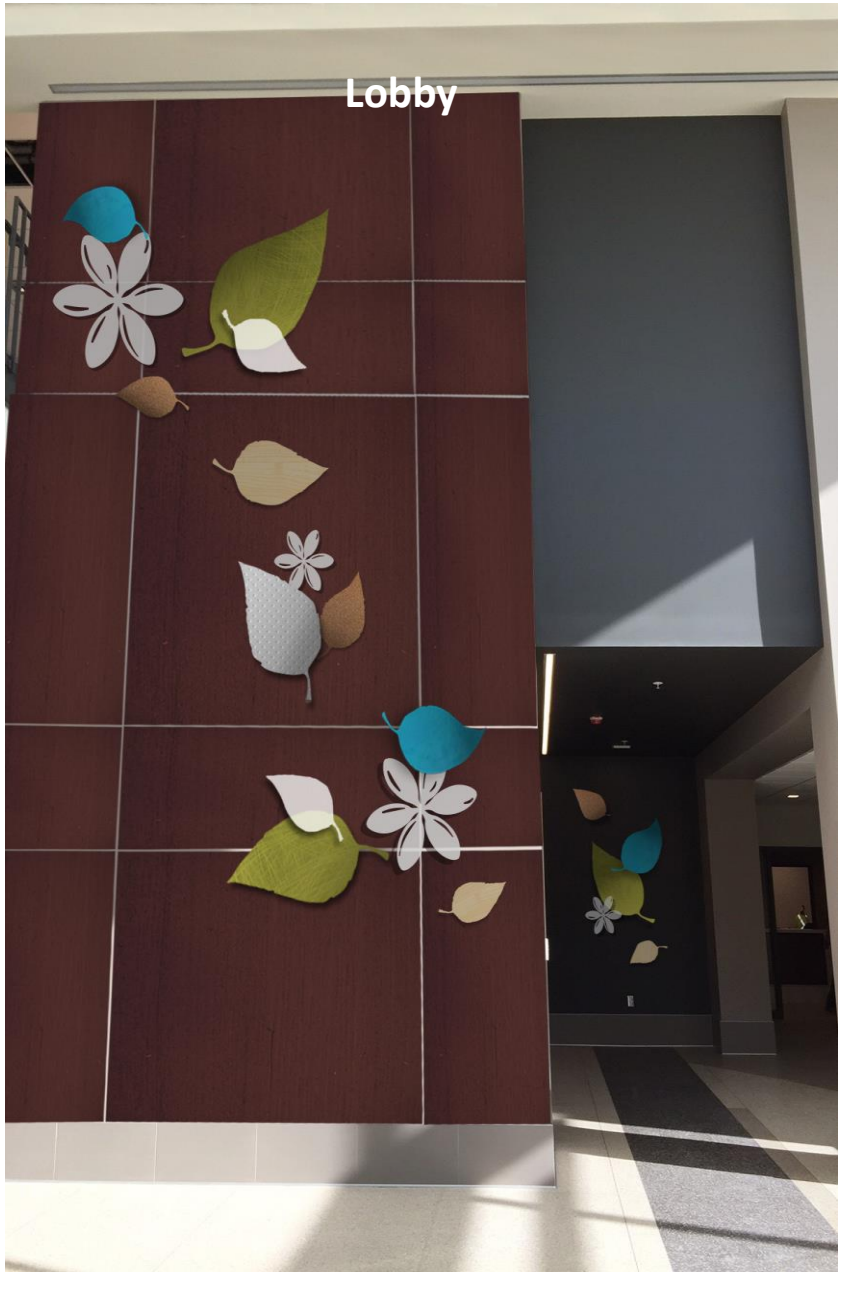
Beaumont Proton Therapy Center

ProteusONE treatment room




Treatment Room


Exam Room


Lobby

Protons

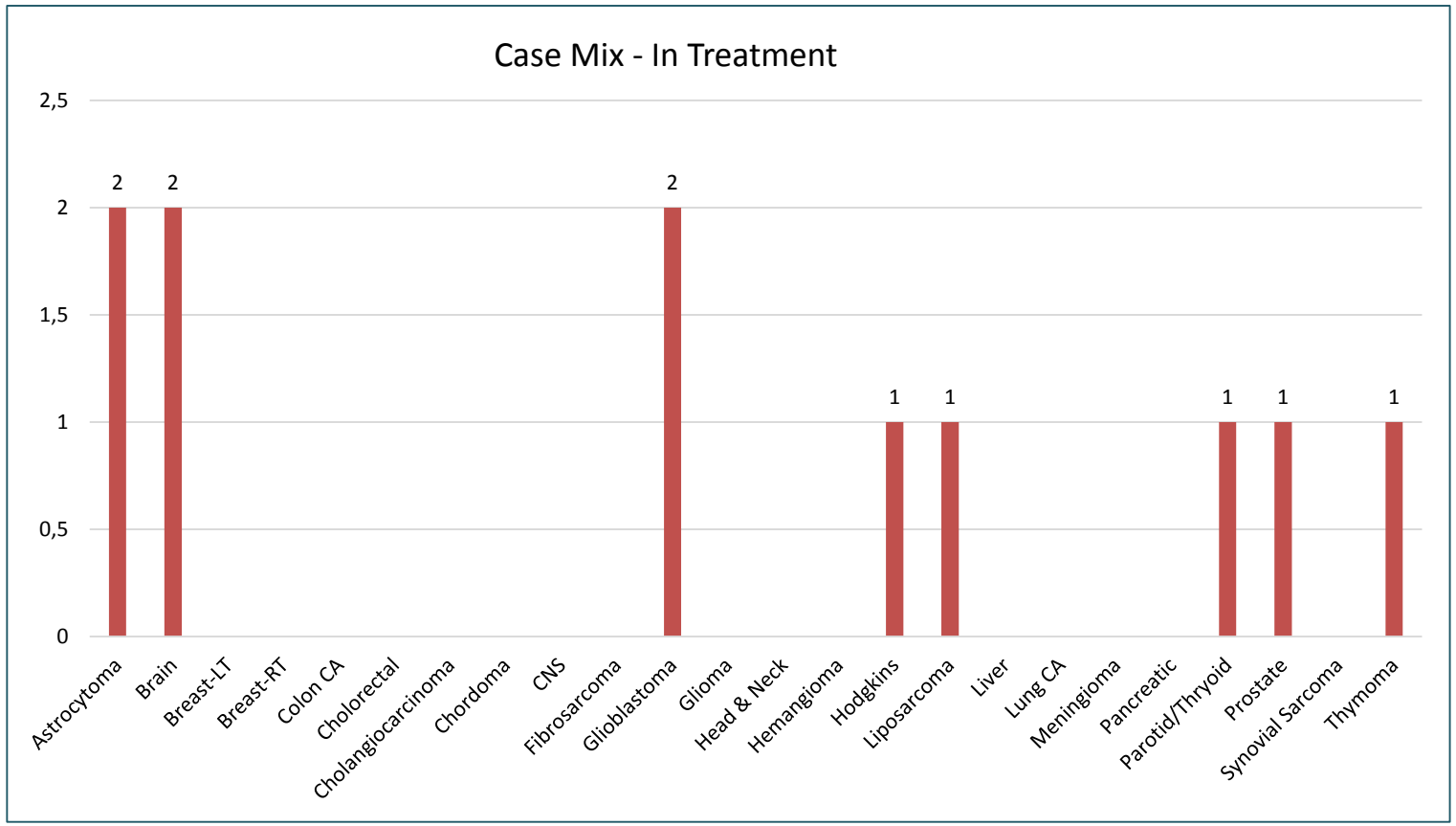
- Our center has IMPT and 3 options for daily imaging
  - Very precise delivery of dose to tumor
  - Reduce uncertainties, and so reduce the target volume
  - This further reduces normal tissue doses

  - Better dose to tumor with less side effects!!!
- Pediatric Oncology relocated to second floor of PTC
  - More than doubles space for pediatrics

Beaumont

Proton Center 1st Patient Treatment
June 28, 2017

Treatment mix



Beaumont Proton Therapy Center

Commissioning continues…….

- CNS – done
- Tumors with stable soft tissue component - done
  - Sarcomas
  - Prostate
- Tumors without stable soft tissue component – mostly done
  - Immobile lung cancers- done
  - Chest wall – almost done
  - H&N – almost done
- Anesthesia – November
- Mobile tumors - ~November
- Eyes - 2020

During this time we also

- Dr. Ding has developed a process for rotational IMPT with PBS
  - SParc
- Developed a sponsored research program with IBA
- Submitted R03 for technology development
- Published extensively
- Developed and opened a Patient Access Center to facilitate referrals and coordinate care
- Enhanced authorization and billing process
  - Only one patient ultimately failed authorization

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Questions?

North American Market Dynamics

Beth Klein - Executive Vice President, IBA North America

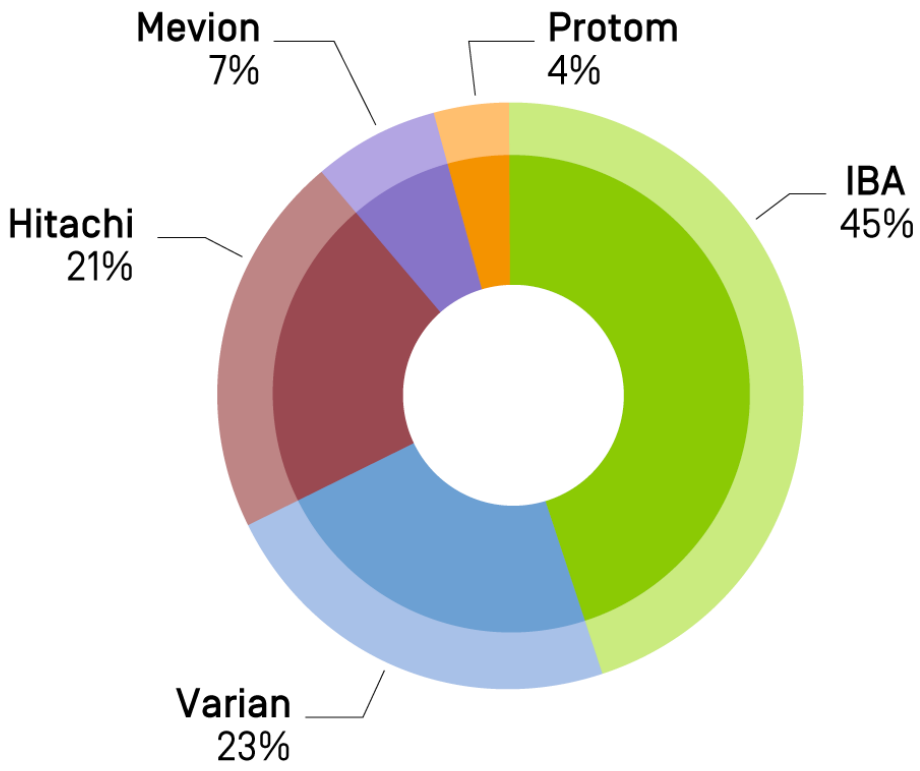
PT market dynamics in North America

Softer near term market
Chapter 11 concerns
Reimbursement/Payor uncertainties still exist
Competitive dynamics resulting in more aggressive pricing

NA predicted to grow to 46 centers by 2020
More centers opening, strong pipeline
Wider acceptance of PT, NCCN / ASTRO guidelines
The Alliance for Proton Therapy Access good efforts educating patients/payer's
Canada looking to establish PT presence
Lower entry barriers due to compact proton therapy
Mature technology, expanding clinical indications (PBS, CBCT,…)

Strong IBA North America market leadership position

Share of installed base in NA in rooms



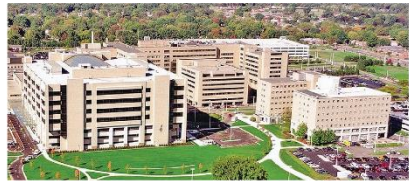
Newest additions to IBA's league of PT experts

INOVA™

Miami Cancer Institute
BAPTIST HEALTH SOUTH FLORIDA

UFHealth
PROTON THERAPY INSTITUTE

Beaumont HEALTH



TEXAS CENTER for PROTON THERAPY

North American headquarters – Reston VA

Proton Therapy functions co-located in Reston:

- Sales & Marketing
- Sales support
- Product specialists
- Project management
- Install seams
- Service delivery
- Operations
- Finance
- EHS, Legal, Information Technology

>250 PT Experts focused on serving our Customers better and faster!

Value of IBA's experience

IBA's unique value in the industry

Features	IBA
Upgradeability	Proven at 10+ centers
Open architecture	Proven at 48 centers
Experience	> 30 years in Proton Therapy
Size and depth of the service organization	> 250 trained and certified service engineers in USA
Motion management solutions	Multiple solutions in clinical use
Imaging software	Designed to move in the future of Adaptive PT
Training program	First to offer comprehensive & formal training; faster ramp up
R&D	Experience allows IBA to be first to offer advanced technology (prompt gamma, eye treatment, range verification, etc)
Dosimetry	In-house & integrated to improve workflow efficiency

Conclusion

Olivier Legrain, Chief Executive Officer, IBA

Conclusion

- Strong perspectives for the proton therapy market
  - Growing acceptance of proton therapy
    - Increasing amount of scientific data
    - Recent update of ASTRO and NCCN guidelines
  - Strong pipeline
- IBA technological lead over competition
  - IBA world-class innovative proton therapy solutions
  - Strong partnerships
  - IBA experience in installing equipment clearly established

Question and Answer