

Overview Proton Therapy

Marco van Vulpen

7th NCS Iustrum, 27-10-2017

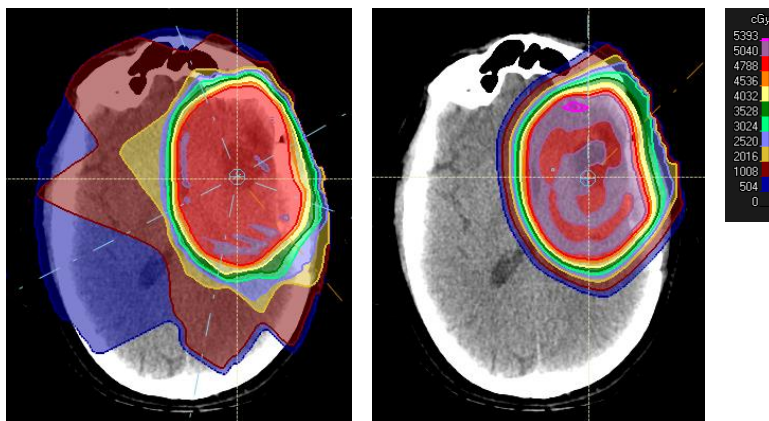


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Photon plan - Proton plan



Photon plan (IMRT, 6 bundles)
CTV-PTV margin 2 mm

Proton plan (MFO, 2 bundles)
Robustness 2 mm, 3.5%

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Proton therapy in HollandPTC

Proton therapy:

- Strong rationale

Value proposition:

- No value proven up to now
- Highest level of evidence: 4
- Proton centers are expensive

Goal of HollandPTC:

- Proton therapy value proposition

Method:

- Open work space, for RTH community both for care and R&D
- Open knowledge center
- All patients in studies



Life magazine, May 5th, 1958

Proton therapy is the
"fresh hope on cancer"

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Contents

- Status of Proton Therapy in the Netherlands
- Core technical uncertainties in proton delivery
- The proton value proposition

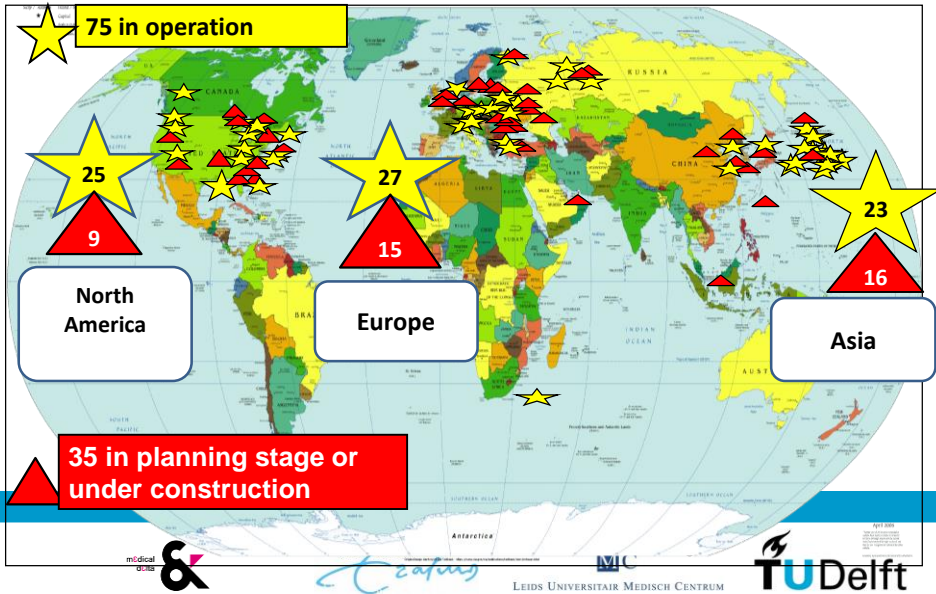
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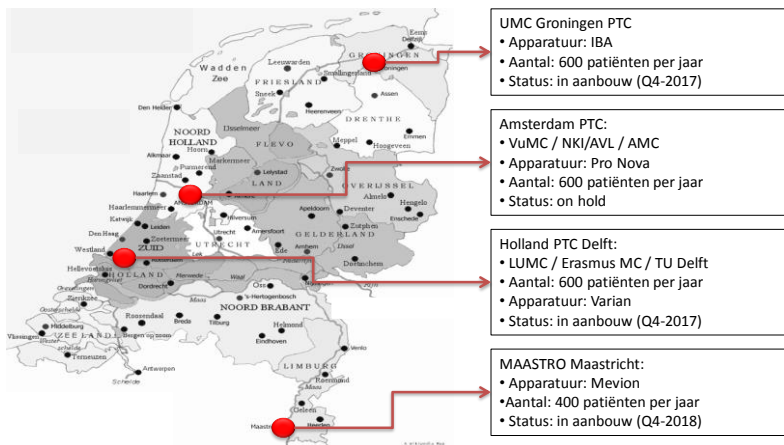
Particle Therapy Facilities Worldwide

Particle Therapy Co-operative Group (PTCOG), <http://ptcog.web.psi.ch>, September 2017.



Stand van zaken PTC's

Nederlandse initiatieven



Courtesy J Langendijk

HollandPTC

Planningsbesluit Protonen

Ministerie van VWS (WBMV)

- Kernpunten:
 - Vergunningsplicht
 - Maximaal 2.200 patiënten/jaar
 - Maximaal 4 centra (400-600 patiënten/jaar)
 - Looptijd tot 2020
- Onderbouwing:
 - Realistische capaciteit per centrum
 - Optimale geografische spreiding (bereikbaarheid)
 - Optimale regionale samenwerking
 - Betere mogelijkheden voor klinische validatie

Courtesy J Langendijk

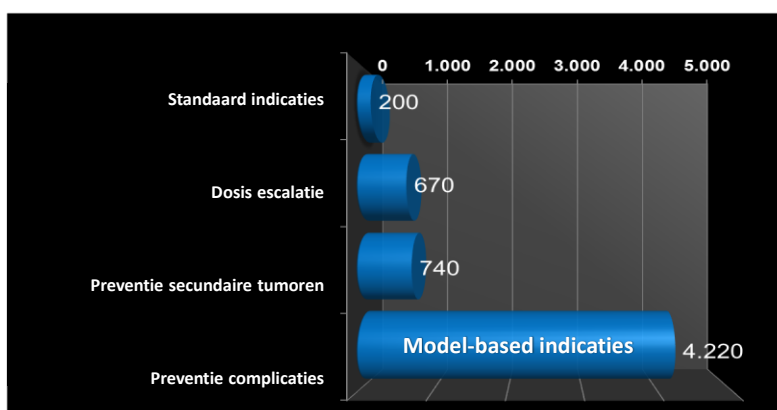
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Protonentherapie

Indicaties en aantallen



Signalering Protonentherapie (Gezondheidsraad 2009) / Actualisatie NVRO 2016

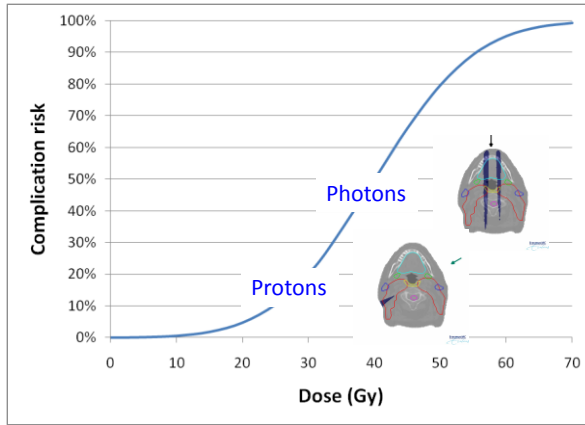
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Δ NTCP Based Patient Selection



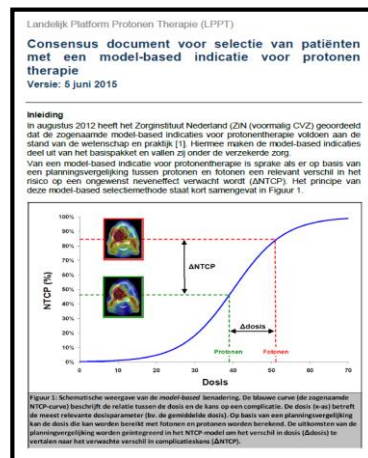
NVRO consensus

Drempels voor ΔNTCP

Drempels bij 1 complicatie

Graad	NTCP-drempel
I	Geen indicatie
II	≥ 10%
III	≥ 5%
IV-V	≥ 2%

Aparte rekenregels in geval van meer dan 1 complicaties worden meegenomen



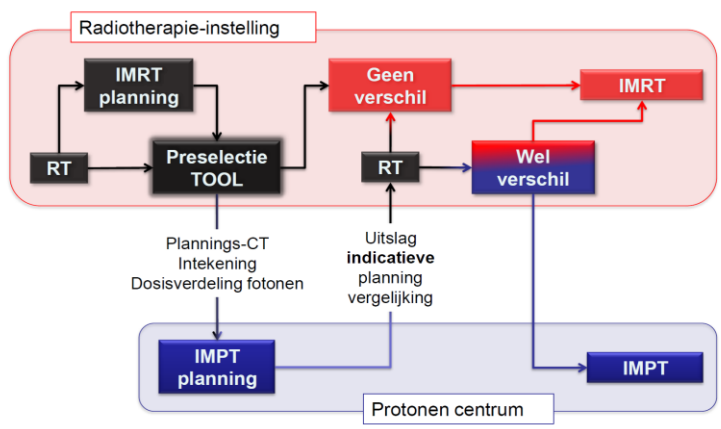
Step 3: NTCP-profiles

Protonen versus fotonen

RT	Side effects	Acute toxicity							Late toxicity																																																																																																																																																																																																																																																																																																																																																																																																																								
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	Sicky saliva (grade2)	-2%	-7%	-12%	-12%	-15%	-15%	-20%	-20%	-10%	-10%	-10%	-10%	-10%																																																																																																																																																																																																																																																																																																																																																																																																																			
	Loss of taste (grade2)	0%	-2%	-5%	-5%	-10%	-10%	-15%	-15%	-10%	-10%	-10%	-10%	-10%																																																																																																																																																																																																																																																																																																																																																																																																																			
	Oral mucositis (grade3)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%																																																																																																																																																																																																																																																																																																																																																																																																																			
	Aspiration (grade3)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%																																																																																																																																																																																																																																																																																																																																																																																																																			
	Osteoradionecrosis (grade3)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%																																																																																																																																																																																																																																																																																																																																																																																																																			
	Hypothyroidism (grade3)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%																																																																																																																																																																																																																																																																																																																																																																																																																			

ANTCP-profile

Verwijslogistiek Workflow



Landelijke spelers

Implementatie

- DUPROTON
 - Samenwerkingsverband tussen 4 initiatieven / 7 betrokken centra
 - Taken:
 - Richtlijnen
 - Uniforme behandelprotocollen en workflows
 - Landelijke database voor prospectieve dataregistratie
 - Gezamenlijk wetenschappelijk onderzoek

- LPPT: Landelijk Platform Protonen Therapie
 - Vertegenwoordiging vanuit alle radiotherapie afdelingen in Nederland
 - Taken:
 - Indicatieprotocollen
 - Verwijslogistiek

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Implementatie

- Expert Groep Protonen ZiN
 - Leden: ZiN, DUPROTON, NVRO, ZN, NZA, ZonMw, VWS, LPPT, NFK
 - Toezicht op klinische implementatie van protonentherapie

Landelijke database

- ProTRAIT (Proton Therapy IT ReseArch InfrastRucture)
 - WP2 registratie bepaald door:
 - Nationale Indicatie Protocollen (LPPT)
 - Uniforme richtlijnen uitvoering (DUPROTON)
 - Commissie Toxiciteit (NVRO)
 - Kanker Registratie (IKNL) (Sustainability)
 - Rol IKNL:
 - Datamanagement registraties
 - Epidemiologie / statistiek (THINC)
 - Quality assurance

Courtesy J Langendijk

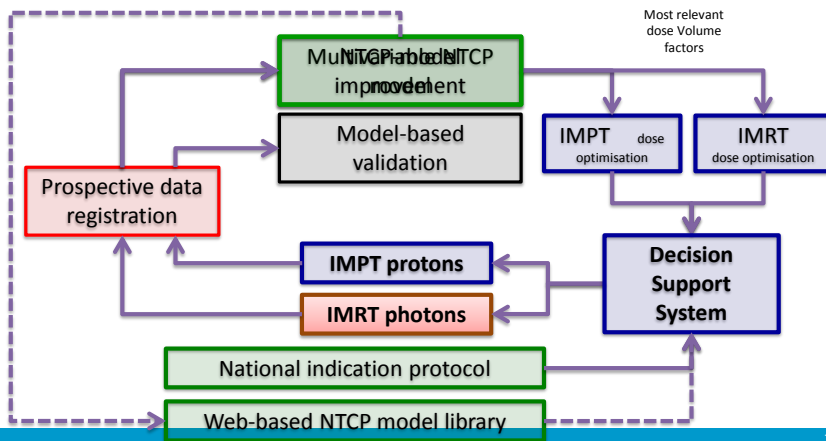
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Clinical implementation

Rapid learning health care system



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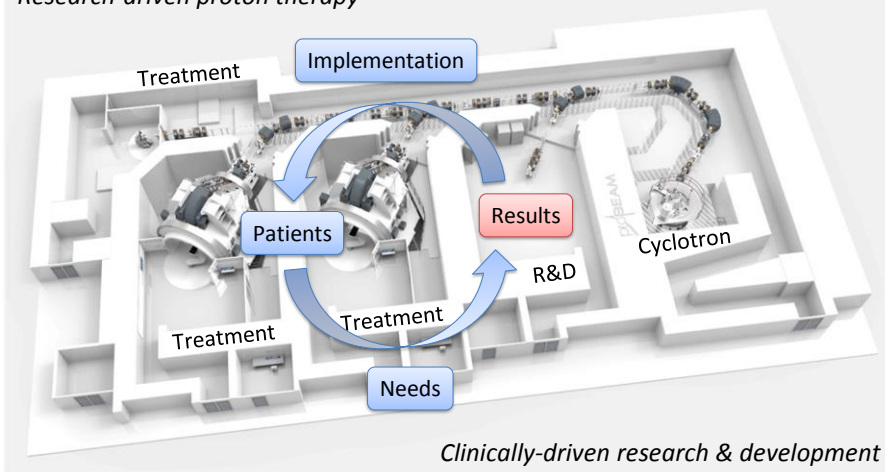
Courtesy J Langendijk

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Holland Particle Therapy Centre

Research-driven proton therapy



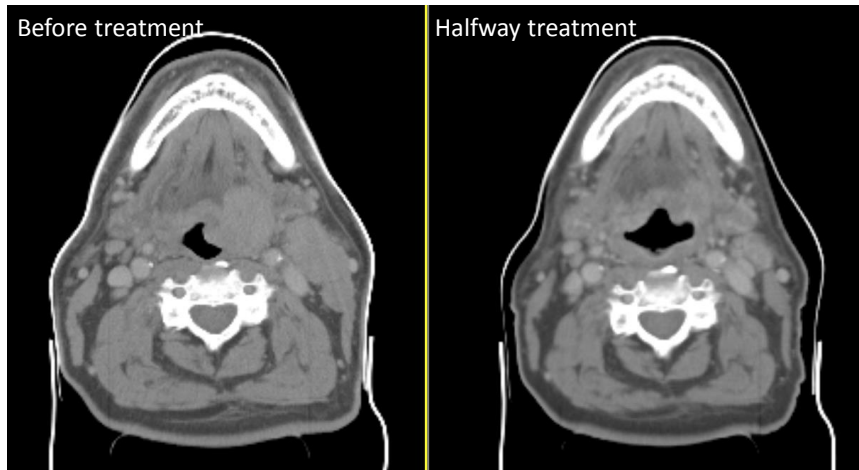
Clinically-driven research & development

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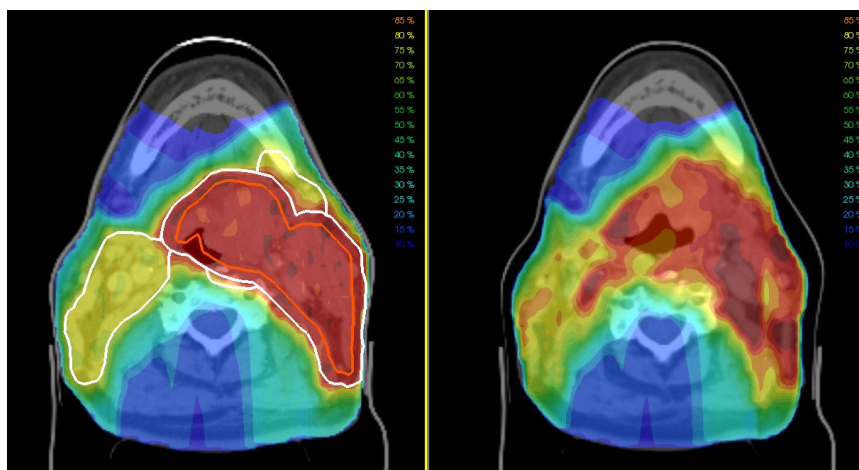
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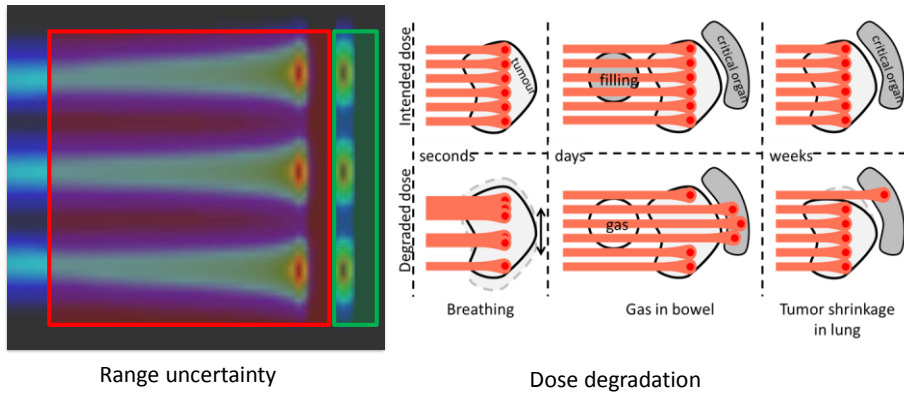
Anatomy Changes



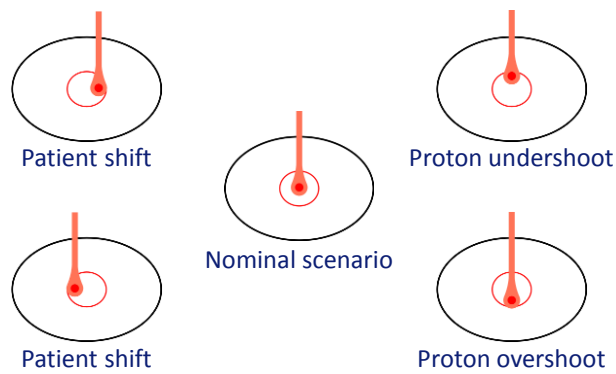
Dosimetric Changes



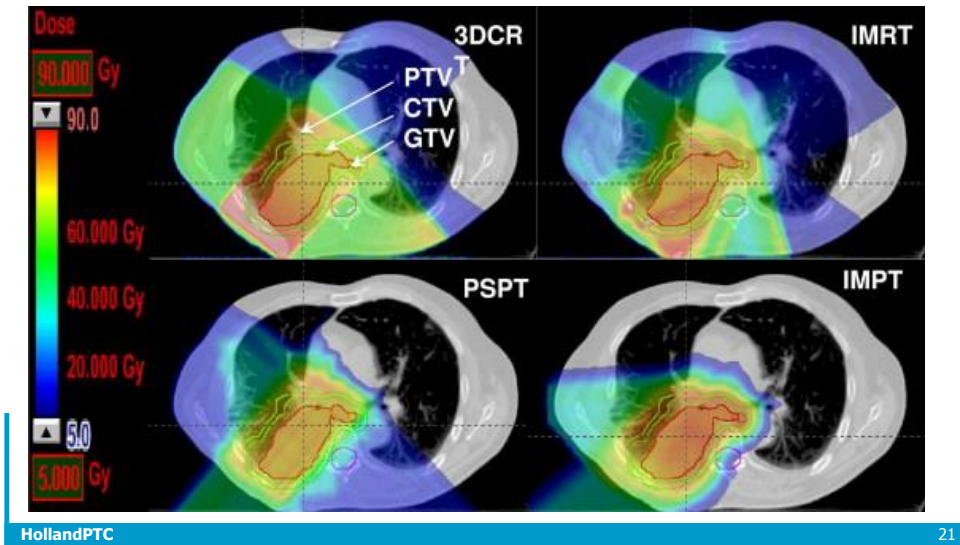
Core uncertainties



Robust Against Errors



Scanning Beam Potential

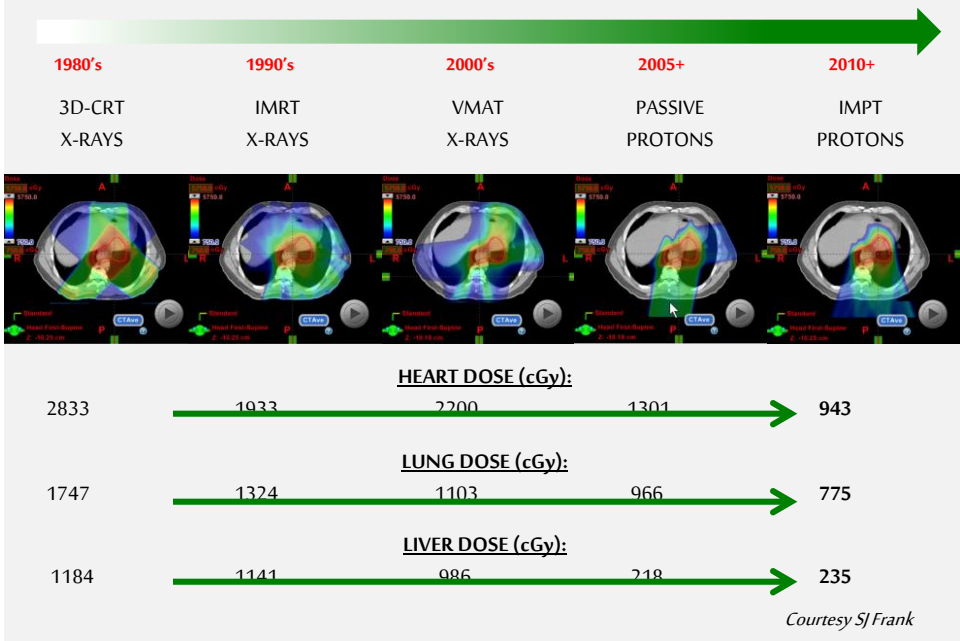


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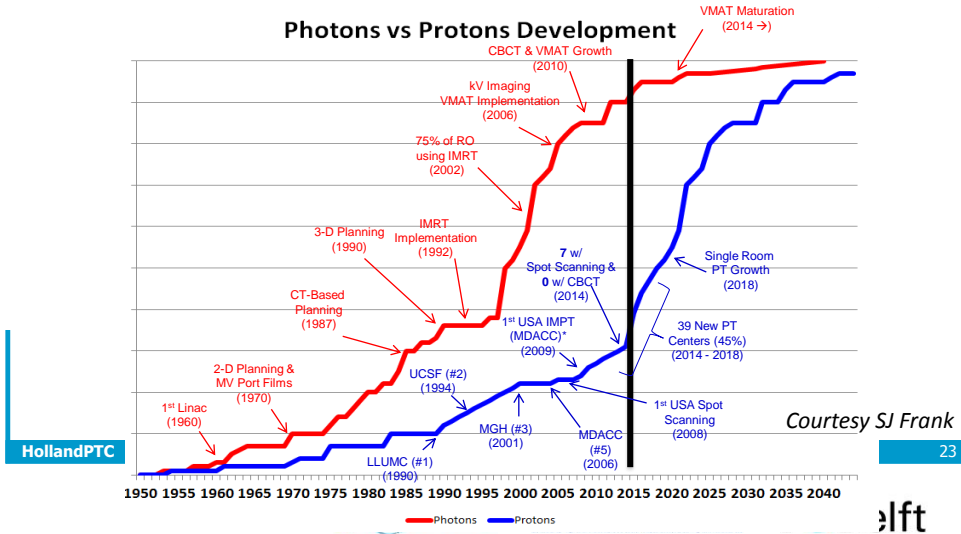


Technology Advances



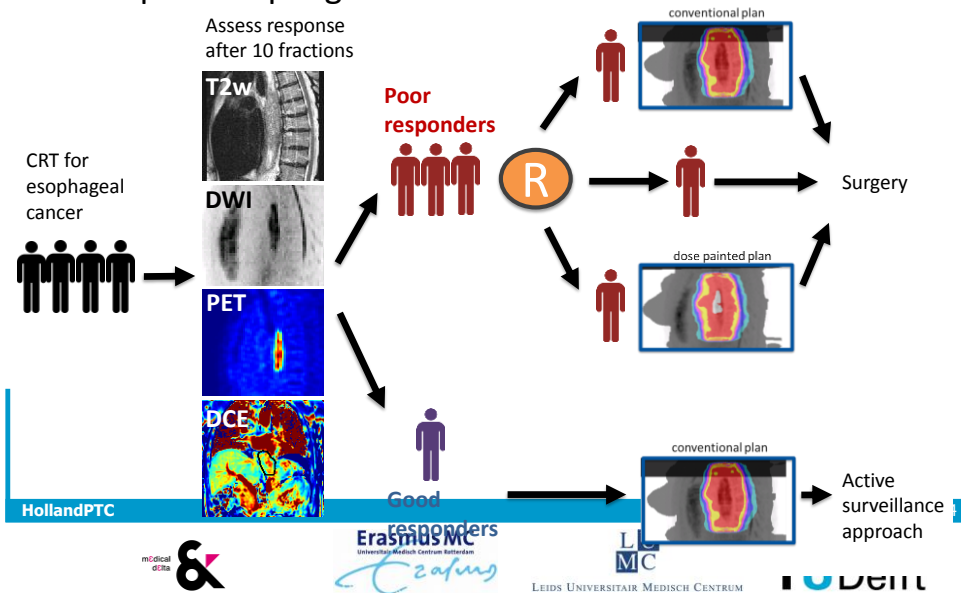
Future Potential of Proton Therapy

Proton Therapy Development Lag = ~17 Yrs.

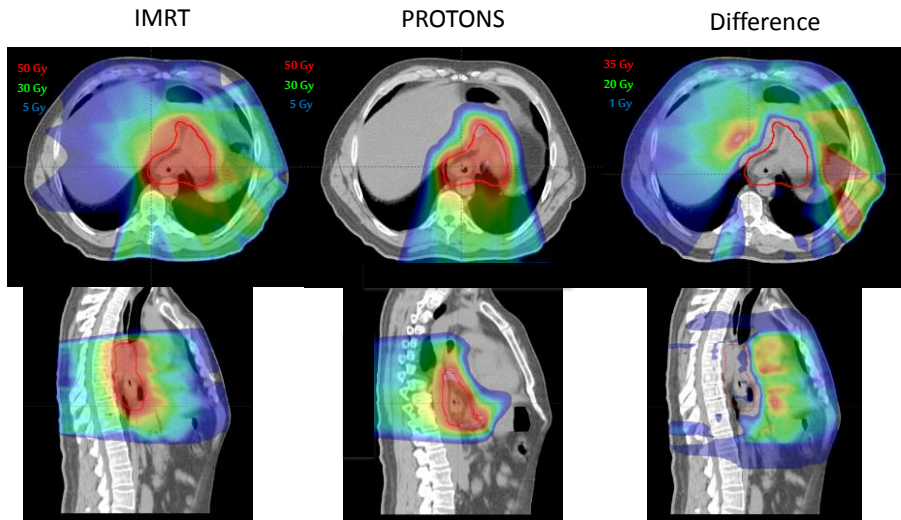


Value of Proton therapy in Care Chain?

Example oesophagus



Oesophagus Cancer

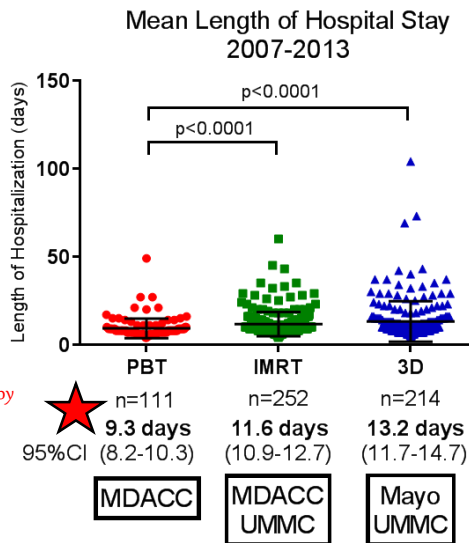


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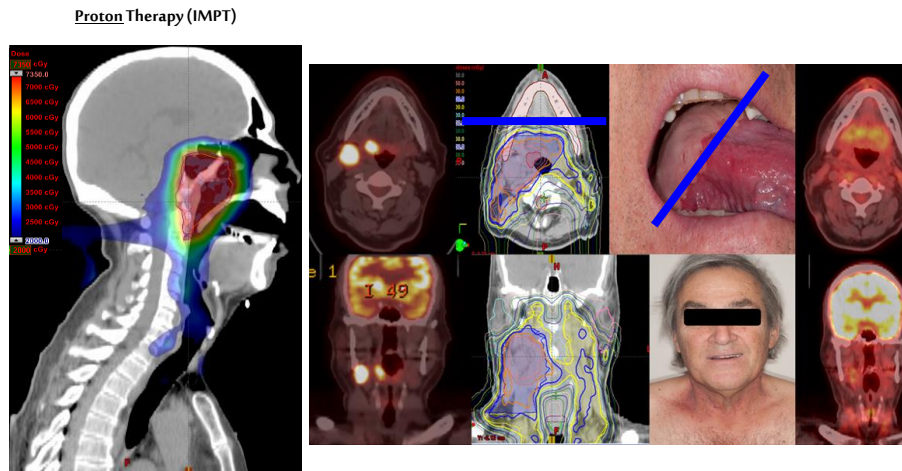
Value Proposition- Esophagus



Lin SH et al. 2015

Courtesy SJ Frank

PT for Nasopharynx/Oropharynx Ca 50%+ reduction in feeding tubes



Frank SJ et al. IJROBP 2014

NCI Supported Randomized Trials

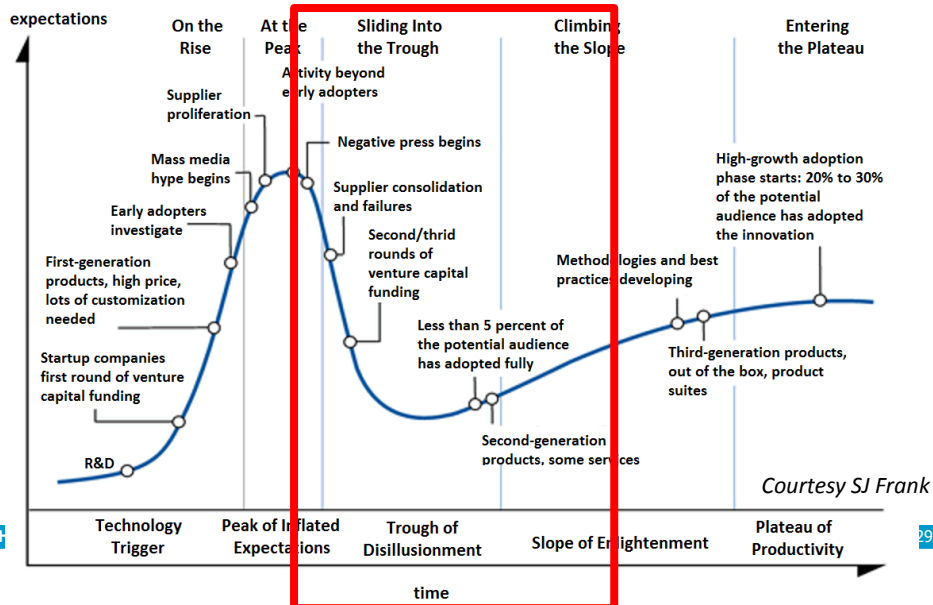
1. Oropharyngeal Cancer
2. Esophageal Cancer
3. Stage II-III B Non-Small-Cell Lung Cancer
4. Stage I, selected stage II & recurrent NSCLC
5. Glioblastoma
6. Prostate Cancer

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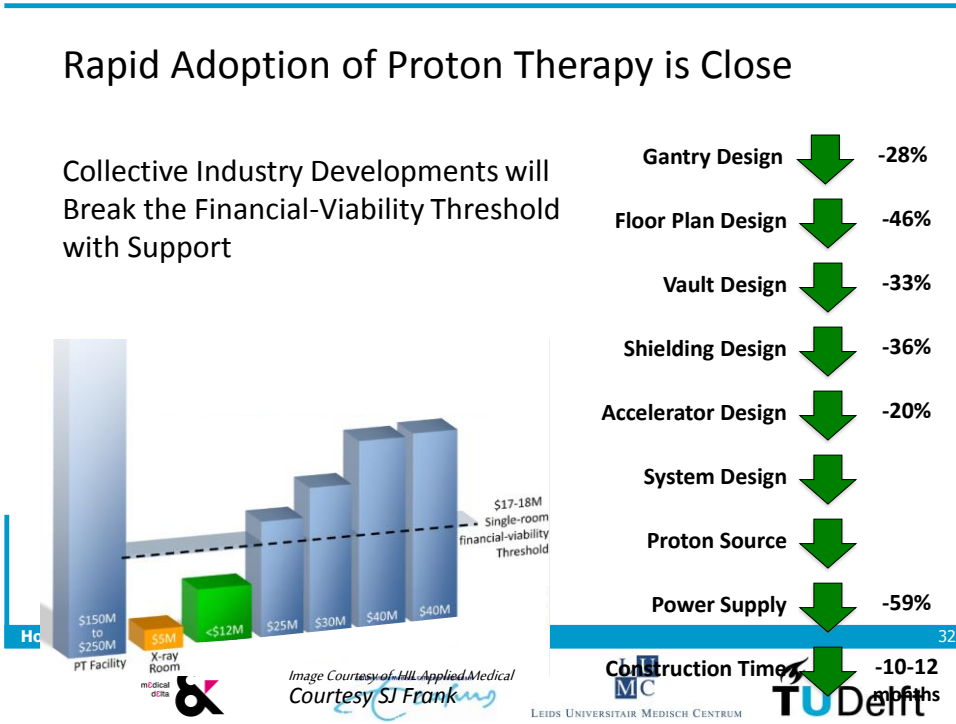
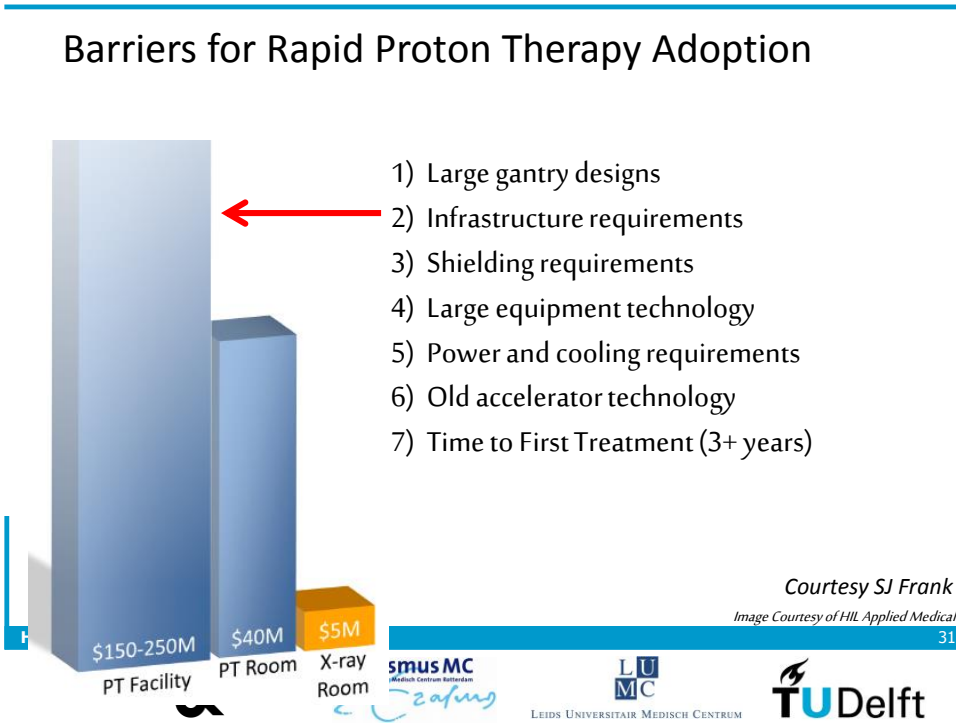
Technology Development Lifecycle



Roadblocks for Proton Therapy

1. A limited number (14) of proton therapy centers to publish data and average time to publication
2. Varying Definitions of Medical Necessity
3. Lack of Validity and Accuracy in Insurance Companies Medical Policies
4. Only a few randomized studies
5. Required resources and cost of treatment

Courtesy SJ Frank



Thank you for your attention

- Status of Proton Therapy in the Netherlands
- Technical uncertainties in proton delivery
- The proton value proposition



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