An Introduction to:
GYROSCOPIC RADIOSURGERY PLATFORM

ITAPA HEALTH & CARE March 2023

Hotel IMPOZANT, Valčianska dolina

David Miles,

EIMEA

ZAP MOTIVATION

- **Dr. Adler's Vision**
  - Treat more patients in more places
    - 2 million a year!
  - Redefine the future of radiosurgery: a less challenging prospect, every day use intuitive and patient friendly
  - State-of-the-art machine
  - Aesthetically pleasing
  - Streamlined workflows

➢ https://firstinmanfilm.com

SURGICAL and RADIOSURGICAL

- Clinical outcomes are equitable in numerous disease type categories, suitable for RS.
- Reduction of negative side effects of treatment often favor RS.
- Social effect on patients' wellbeing immediately after procedure considerably favors RS
- Cost of clinical procedure’s significantly lower for RS.
- Selection of RS reduces surgical waiting times for treatments not suitable for RS.
- Social economic impact to patient and state vastly superior for RS.

RADIOSURGICAL Procedures

- Selected malignant cancers
- Selected benign cancers
- Selected metastatic cancers
- Vascular disorders
- Functional disorders
    - Trigeminal Neuralgia
    - Essential Tremor

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Clinical Conditions for which Functional Radiosurgery Has Been Used (mainly GK)

Essentially any indication for which precision lesioning of the brain can produce the desired physiological effect

- Trigeminal neuralgia (70-90Gy TGN)
- Parkinsonian tremor (130Gy Gpi)
- Essential tremor (130Gy VIM)
- Dystonia (120Gy STN)
- Cancer pain (130Gy CMN or 160Gy Pituitary)
- Thalamic pain (130Gy VPN)
- Obsessive compulsive disorder (180Gy anterior capsule)
- Epilepsy
- hypothalamic hamartomas (~15Gy to hamartoma)
- mesial temporal sclerosis (40-48Gy amygdala)
- Sphenopalatine neuralgia (80Gy to SPG)
- Chronic cluster headaches (80Gy to SPG or TGN)

Incidence of brain metastasis is increasing

Incidence of brain metastasis is increasing[1]:

- Improvements in imaging (e.g. MRI)
- Clinical trial screening
- Improvements in systemic cancer control (brain is a sanctuary site)
- Rates of brain metastasis may be influenced by changing treatments
  - 25% of lung cancer patients have brain metastasis at initial presentation
  - 80% of lung cancer patients surviving >2 years will develop brain metastases

Brain metastases may be underdiagnosed

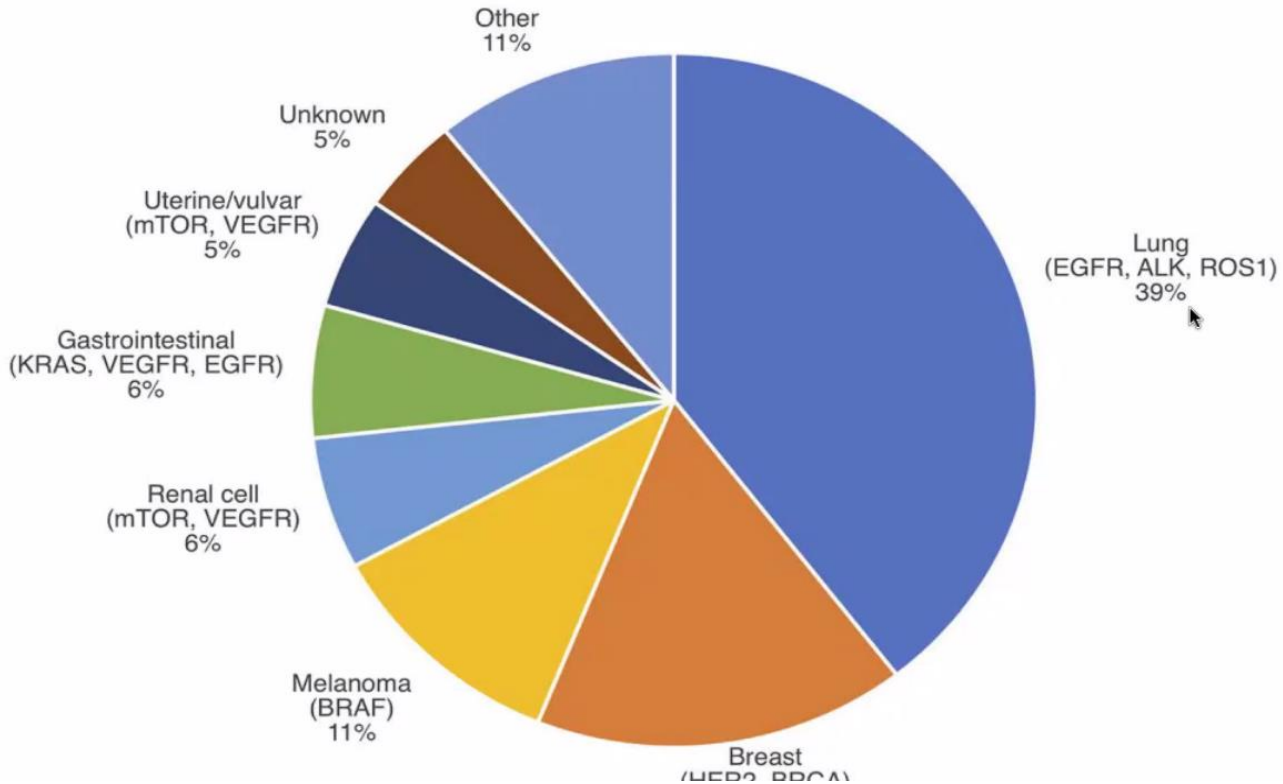
- Autopsy results reveal brain metastases that were not diagnosed clinically[2]
- Clinical trial screening reveals patients with asymptomatic brain metastases[1]

Image source: https://www.medicalexpo.com/prod/elekta/product-70692-424266.html

The Impact of Targeted Therapy on Intracranial Metastatic Disease Incidence and Survival

Anders W. Erickson [1] ***and Sunit Das*** [2,3]*

[1] *Institute of Medical Science, Faculty of Medicine, University of Toronto, Toronto, ON, Canada,* [2] *Division of Neurosurgery, University of Toronto, Toronto, ON, Canada,* [3] *Li Ka Shing Knowledge Institute, St. Michael's Hospital, Toronto, ON, Canada*



Frontiers in Oncology

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Image source: https://www.medicalexpo.com/prod/elekta/product-70692-424266.html

Disease group	N (% of all cancers)	N (%) with IMD	Median (IQR) time until brain met (months)	1-yr all cause mortality	Median (IQR) time until death since brain met
Lung and bronchus	77,613 (12.9%)	15,193 (19.6%)	2.1 (0.2, 7.5)	55%	1.7 (0.5, 3.9)
Breast	87,233 (14.5%)	2,686 (3.1%)*	22.8 (10.9, 40.5)	4.3%	4.6 (1.6, 12.5)
Colorectal	66048 (11.0%)	919 (1.4%)	16.6 (3.9, 34.8)	20.2@	2.5 (1.2, 6.2)
Melanoma	24,650 (4.1%)	1,581 (6.4%)*	11.7 (2.1, 26.6)	8.2%	3.4 (1.3, 8.7)
Kidney	18,237 (3%)	765 (4.2%)*	7.2 (1.0, 22.0)	16.5%	4.1 (1.6, 11.8)

Image source: https://www.medicalexpo.com/prod/elekta/product-70692-424266.html

Postoperative stereotactic radiosurgery compared with whole brain radiotherapy for resected metastatic brain disease (NCCTG N107C/CEC·3): a multicentre, randomised, controlled, phase 3 trial

Paul D Brown, Karla V Ballman, Jane H Cerhan, S Keith Anderson, Xiomara W Carrero, Anthony C Whitton, Jeffrey Greenspoon, Ian F Parney, Nadia N I Laack, Jonathan B Ashman, Jean-Paul Bahary, Costas G Hadjipanayis, James J Urbanic, Fred G Barker II, Elana Farace, Deepak Khuntia, Caterina Giannini, Jan C Buckner, Evanthia Galanis, David Roberge

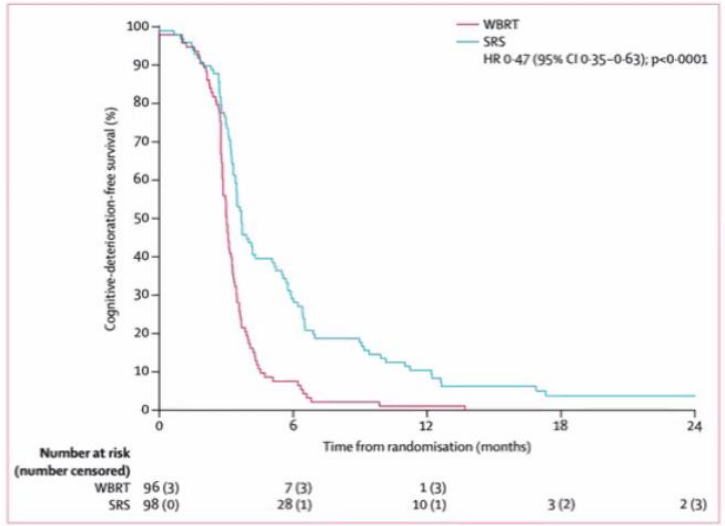


Figure 2: **Cognitive-deterioration-free survival**
WBRT=whole brain radiotherapy. SRS=stereotactic radiosurgery.

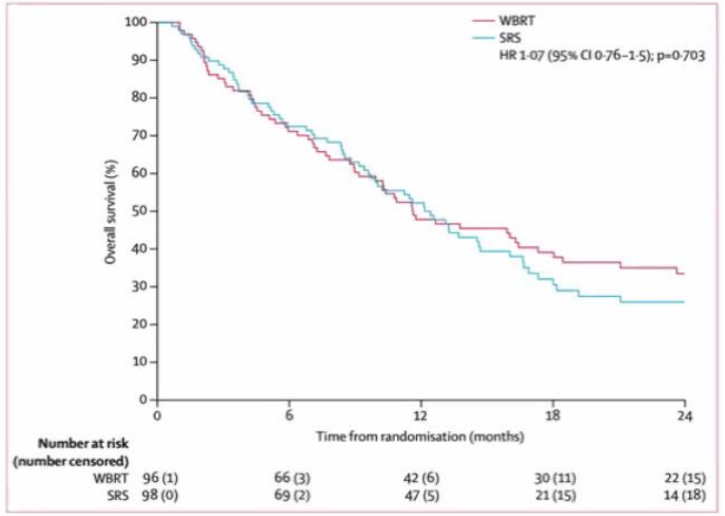


Figure 3: **Overall survival**
WBRT=whole brain radiotherapy. SRS=stereotactic radiosurgery.

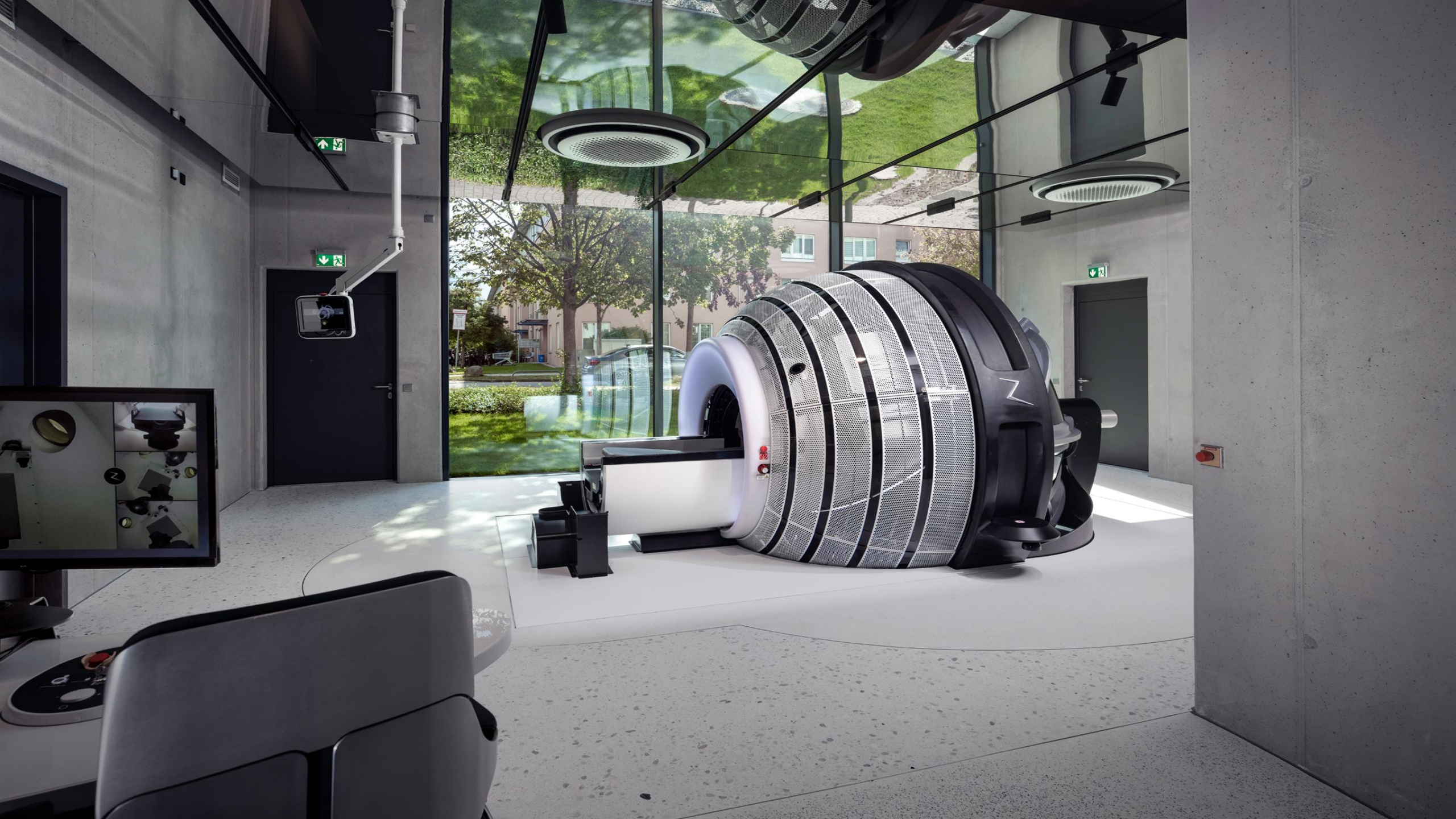
	SRS (n=54)	WBRT (n=48)	Mean difference (95% CI)	p value
HVLT-R Immediate Recall				
Deterioration	9 (17%)	23 (49%)	..	..
Non-deterioration	45 (83%)	24 (51%)	32·3 (20 to 44·5)	0·00062
Test not attempted	0	1	..	..
HVLT-R Delayed Recall				
Deterioration	14 (26%)	29 (62%)	..	..
Non-deterioration	39 (74%)	18 (38%)	35·3 (22·5 to 48·1)	0·00054
Test not attempted	1	1	..	..
HVLT-R Recognition				
Deterioration	10 (19%)	16 (36%)	..	..
Non-deterioration	43 (81%)	29 (64%)	16·7 (4·6 to 28·8)	0·0707
Test not attempted	1	3	..	..
TMT-A time to complete				
Deterioration	9 (17%)	18 (38%)	..	..
Non-deterioration	45 (83%)	29 (62%)	21·6 (9·6 to 33·6)	0·0233
Test not attempted	0	1	..	..
TMT-B time to complete				
Deterioration	10 (19%)	19 (42%)	..	..
Non-deterioration	43 (81%)	26 (58%)	23·4 (11 to 35·7)	0·0149
Test not attempted	1	3	..	..
COWAT total				
Deterioration	4 (7%)	7 (15%)	..	..
Non-deterioration	50 (93%)	39 (85%)	7·8 (–0·9 to 16·5)	0·3368
Test not attempted	0	2	..	..
Overall outcome for cognitive deterioration				
Deterioration	28 (52%)	41 (85%)	–33·6 (–45·3 to –21·8)	..
Non-deterioration	26 (48%)	7 (15%)	..	0·00031

We defined cognitive deterioration as a drop of 1 SD in score from baseline. There are missing values for some cognitive tests, as reflected by total number of a particular test being less than the total number of patients. p values were calculated with Fisher's exact test. WBRT=whole brain radiotherapy. SRS=stereotactic radiosurgery. HVLT-R=Hopkins Verbal Learning Test—Revised. TMT-A=Trail Making Test part A. TMT-B=Trail Making Test part B. COWAT=Controlled Oral Word Association Test.

Table 2: **Cognitive deterioration at 6 months**

Lancet Oncol 2017; 18: 1049–60

Image source: https://www.medicalexpo.com/prod/elekta/product-70692-424266.html



– Radiation Shielding

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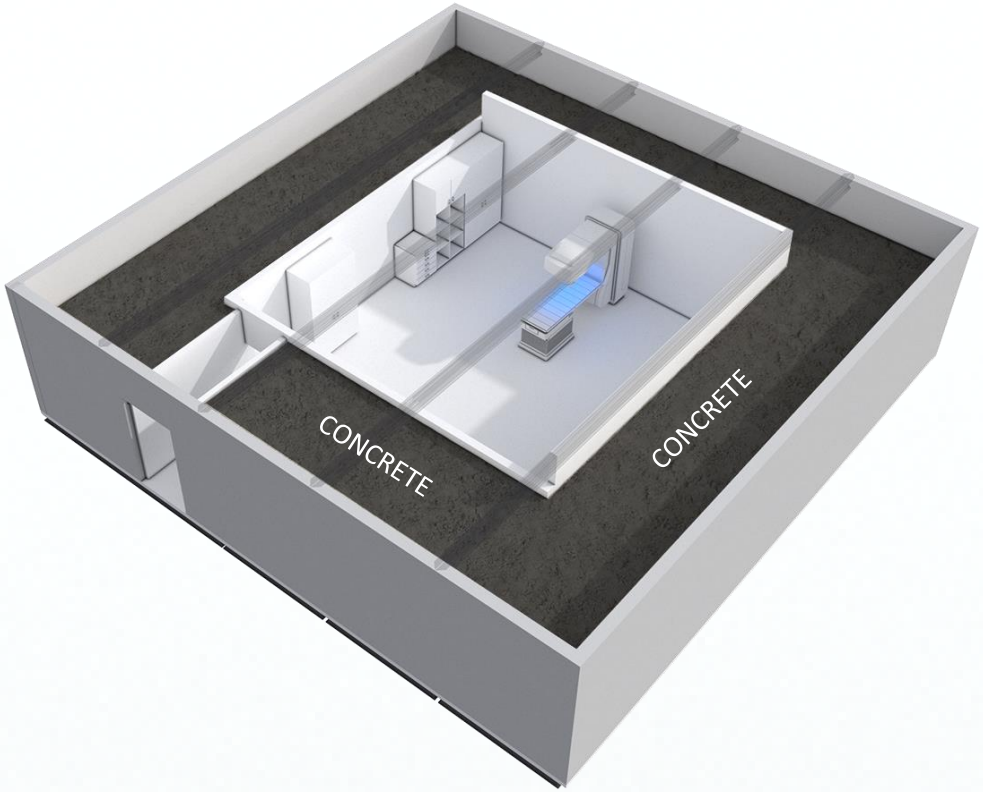
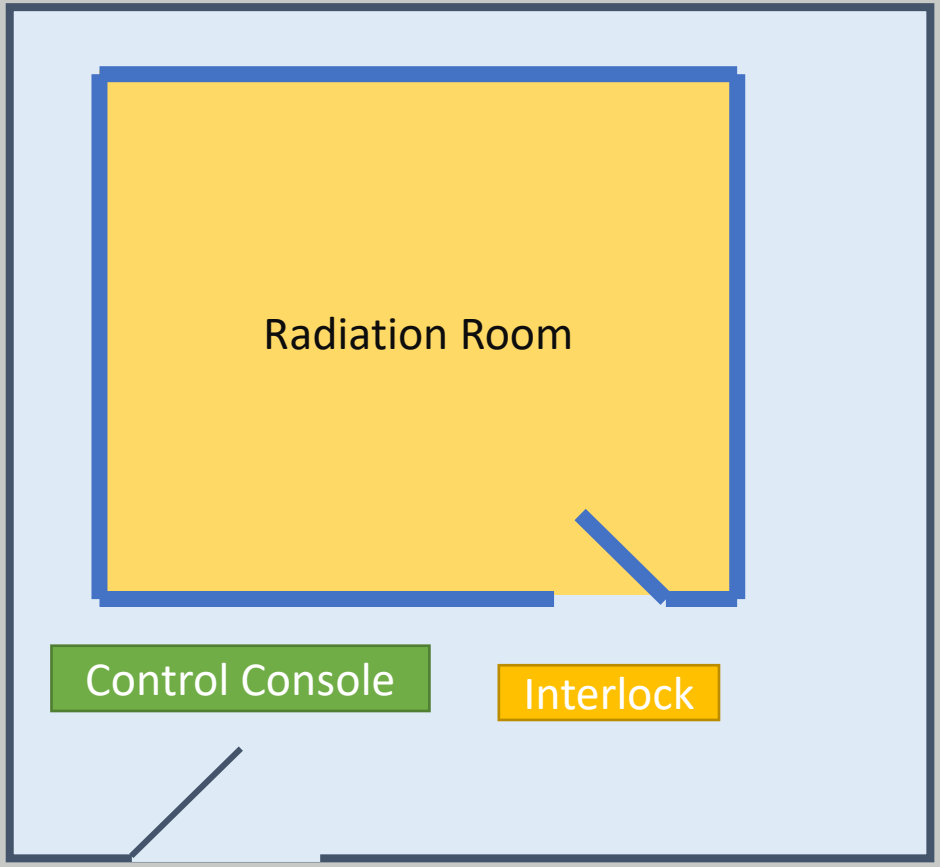
The first and only vault-free SRS delivery system, eliminating £££+ in infrastructure. In addition to allowing for simple department expansions, makes access to new satellite and outpatient settings feasible, while reaching new and underserved patient populations.



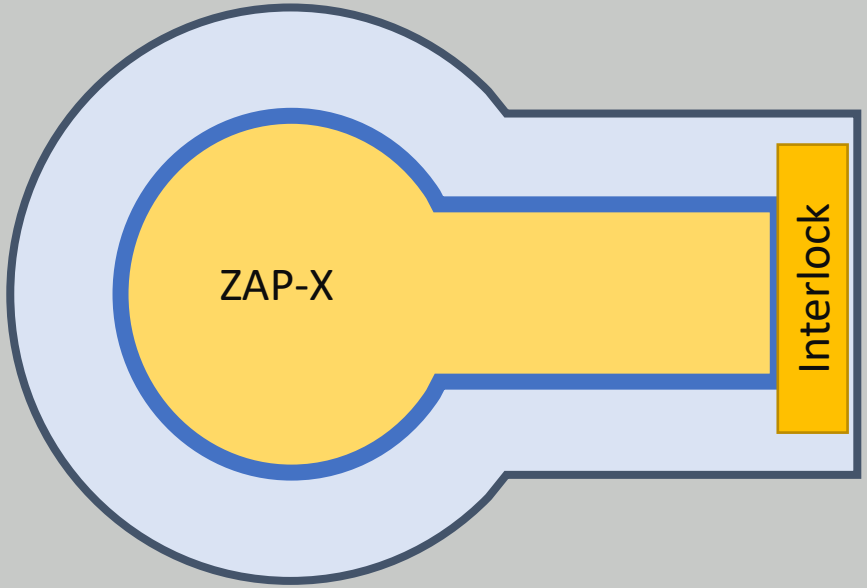
Multi-Purpose Gantry LINAC

Requires costly shielded radiation vaults in all instances. Comprised of >3M lbs. of high-density concrete and steel with a carbon footprint equivalent to the lifetime of ~300 automobiles.

Typical Treatment Vault



Integrated System Shielding



Control Console

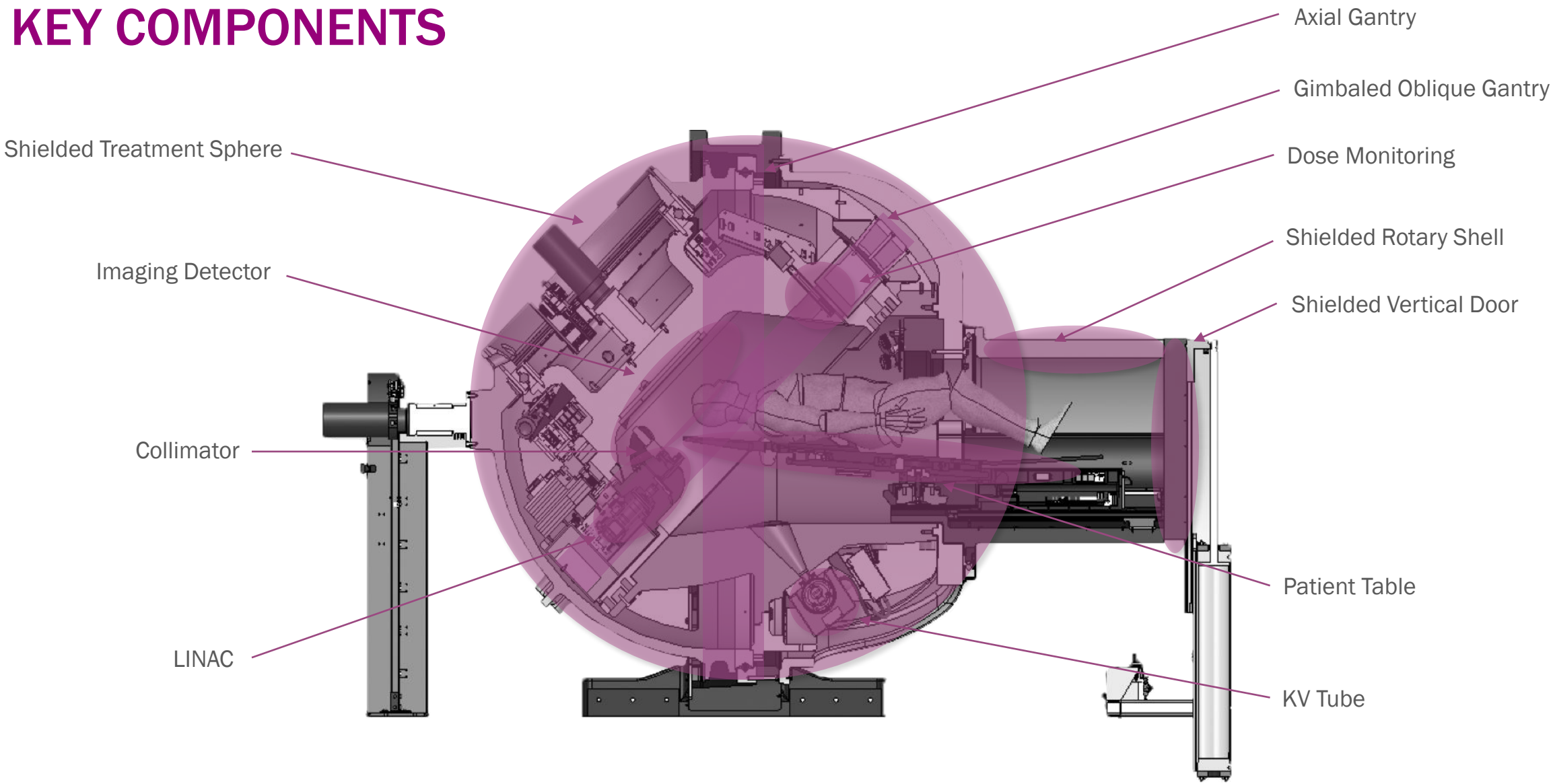
High Radiation

Controlled Area

Public Area

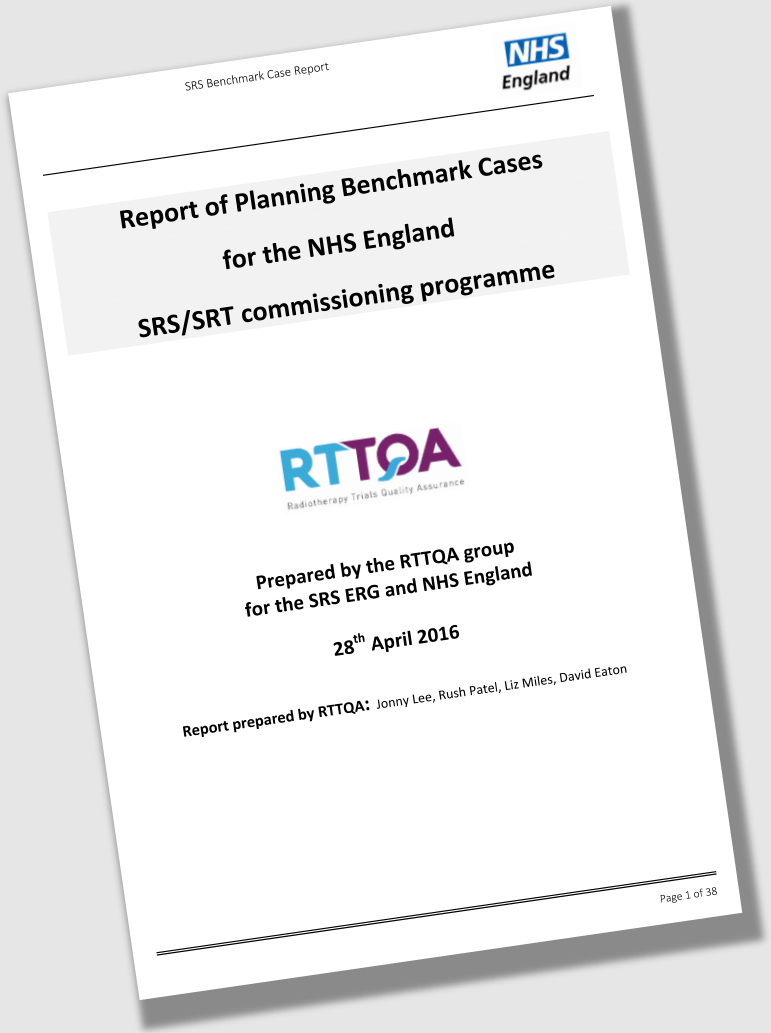
Courtesy: Cesare Jenkins

KEY COMPONENTS



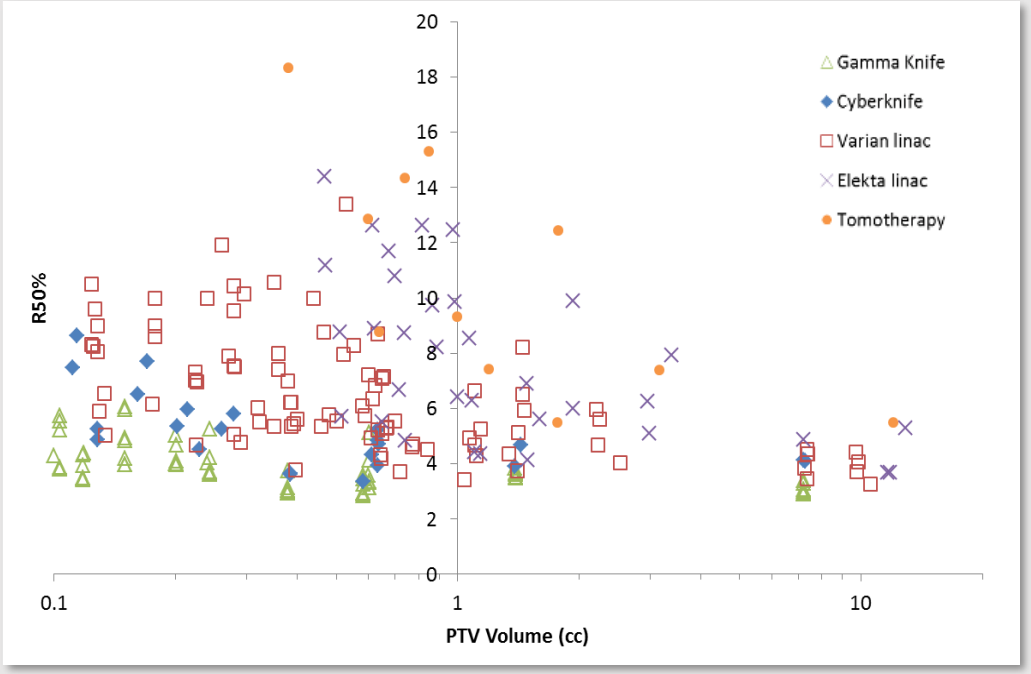
NHS RTTQA PROGRAM

- **Report commissioned by the UK's NHS**
- **Objective:**
  - Understand significant variations in outcomes across 21 hospitals
- **Methodology:**
  - Based on 6 benchmark cases, each site evaluated for contouring, planning and treatment delivery quality
- **The largest device comparison study ever**



CASE #2

- The $R_{50\%}$
  - Combines selectivity (absence of dose spillage) with gradient
  - $\frac{\text{Volume of 50\% of prescription dose}}{\text{Volume of target}}$



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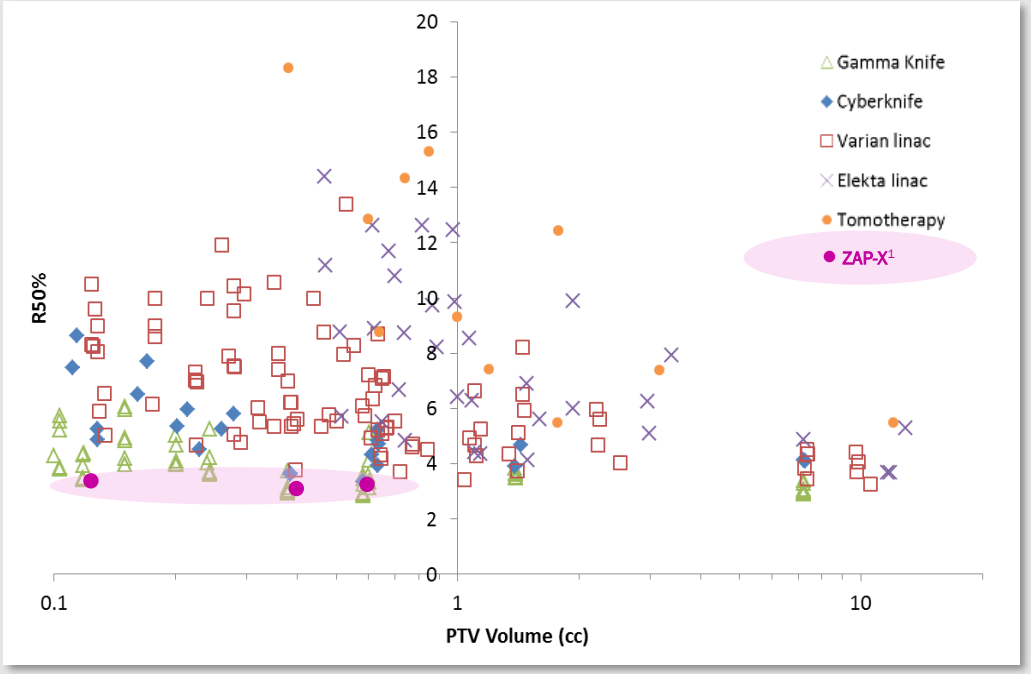

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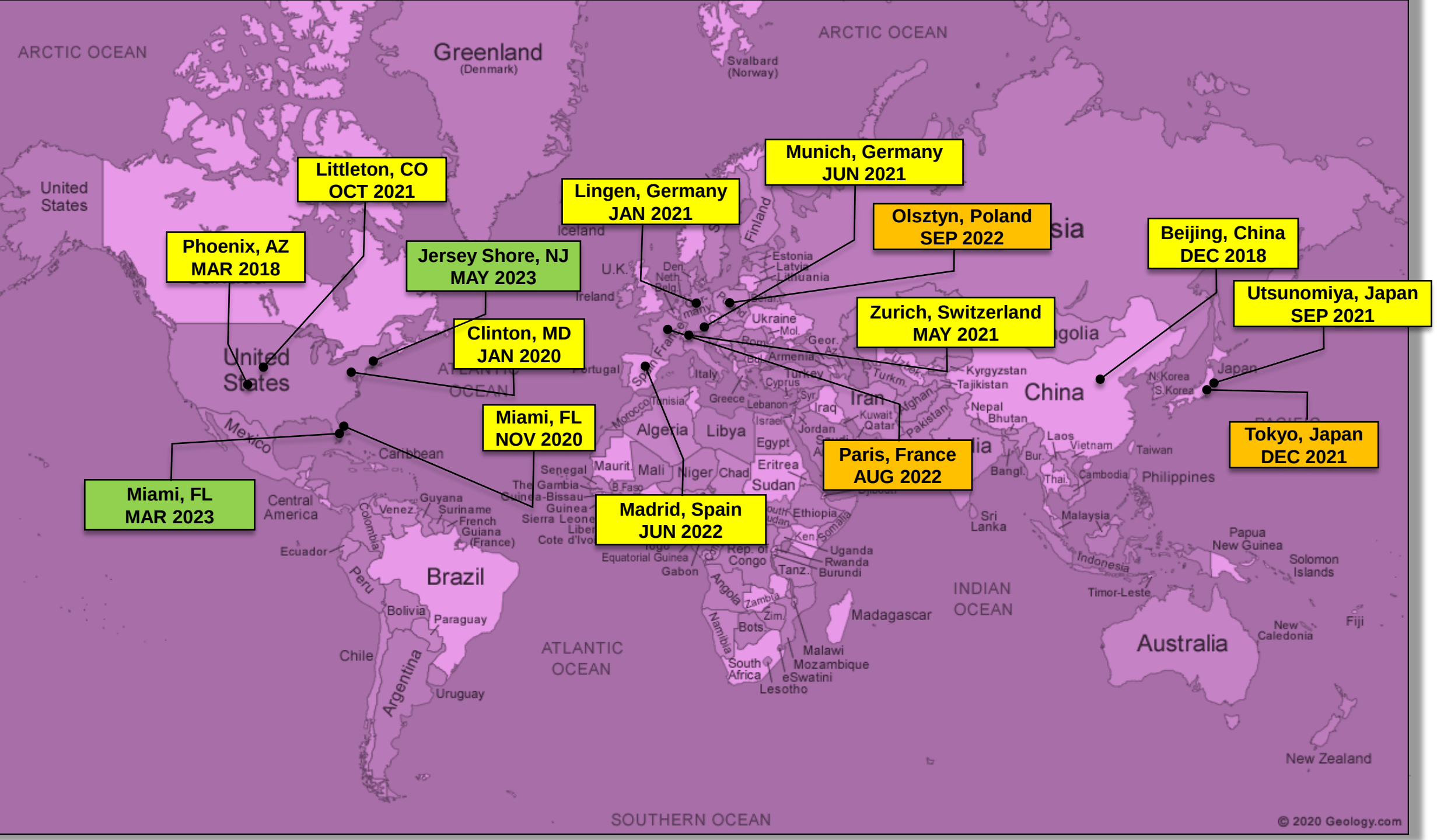
1. Planned retrospectively; not included in the original RTTQA report. Data presented by Ian Paddick, MSc, September 10, 2020; https://www.youtube.com/watch?v=6MupRYxzMpg

ZAP-X Gyroscopic Radiosurgery

Who are we and where are first users around the world.

ZAP SURGICAL SYSTEMS, INC.

- **Founded in 2014 by John Adler, MD**
  - Professor of Neurosurgery, Stanford University
  - Inventor of the CyberKnife®
  - Former CMO of Varian
- **Funded by Varian, Foxconn, and others**
- **Headquartered in Silicon Valley, CA**


Littleton, CO
OCT 2021
Phoenix, AZ
MAR 2018
Jersey Shore, NJ
MAY 2023
Clinton, MD
JAN 2020
Miami, FL
NOV 2020
Miami, FL
MAR 2023
Lingen, Germany
JAN 2021
Munich, Germany
JUN 2021
Olsztyn, Poland
SEP 2022
Zurich, Switzerland
MAY 2021
Paris, France
AUG 2022
Madrid, Spain
JUN 2022
Beijing, China
DEC 2018
Utsunomiya, Japan
SEP 2021
Tokyo, Japan
DEC 2021
ARCTIC OCEAN
Greenland
(Denmark)
Svalbard
(Norway)
United States
Canada
Mexico
Caribbean
Central America
Brazil
Peru
Chile
Argentina
Bolivia
Paraguay
Uruguay
Ecuador
Colombia
Venez.
Guyana
Suriname
French Guiana
(France)
ATLANTIC OCEAN
Iceland
Ireland
U.K.
Den.
Neth.
Belg.
Germany
Poland
Finland
Estonia
Latvia
Lithuania
Ukraine
Mol.
Rom.
Bul.
Georgia
Armenia
Turkey
Cyprus
Greece
Italy
Spain
Portugal
France
Morocco
Tunisia
Algeria
Libya
Egypt
Syr.
Iraq
Iran
Israel
Lebanon
Jordan
Kuwait
Qatar
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Pakistan
Afghan.
Turkm.
Uzbek.
Kyrgyzstan
Tajikistan
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Vietnam
Taiwan
Bur.
Bangl.
Thai.
Cambodia
Philippines
Malaysia
Sri Lanka
Indonesia
Papua New Guinea
Solomon Islands
Timor-Leste
Fiji
New Caledonia
Australia
New Zealand
INDIAN OCEAN
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Maurit.
Mali
Niger
Chad
Sudan
Eritrea
Ethiopia
Somalia
Ken.
Uganda
Rwanda
Burundi
Tanz.
Rep. of Congo
Gabon
Equatorial Guinea
Angola
Zambia
Zim.
Bots.
Namibia
South Africa
Lesotho
eSwatini
Malawi
Mozambique
SOUTHERN OCEAN
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12 sites treating
(15 soon)

+1420 fractions
treated

ZAP-X designed from concept to bridge the gap between to day’s shortfall of patients and tomorrow increasing need.

THANK YOU and Questions