DEUTSCHER ZUKUNFTSPREIS

(Un)sichtbare Tumore in Bewegung Neue Perspektiven für die Strahlentherapie durch präzises Tumortracking

Stefan Vilsmeier (Sprecher)
Prof. Dr. med. Cordula Petersen*
Dipl.-Inf. Claus Promberger

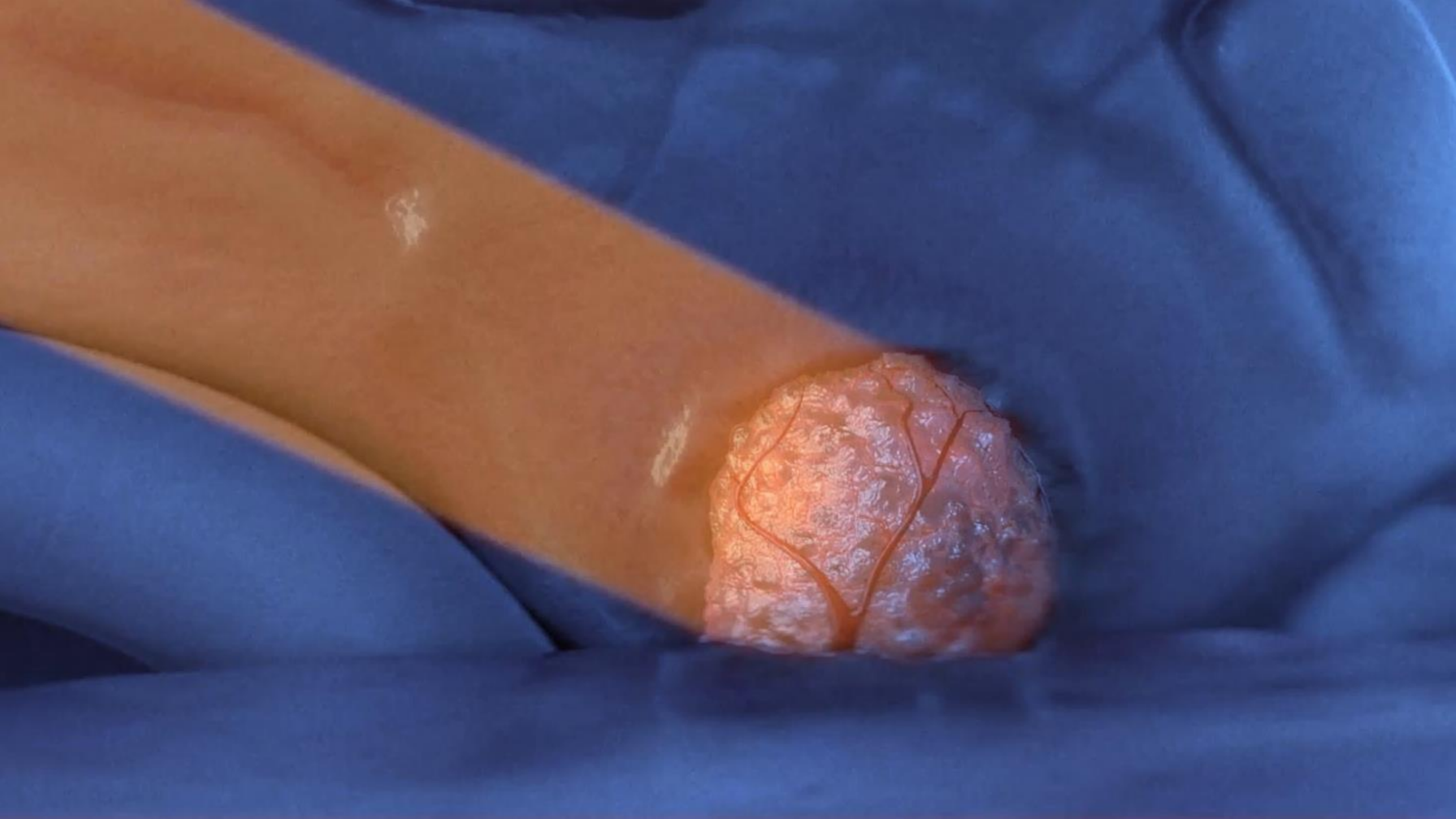
Brainlab AG, München
*Universitätsklinikum Hamburg-Eppendorf (UKE), Hamburg

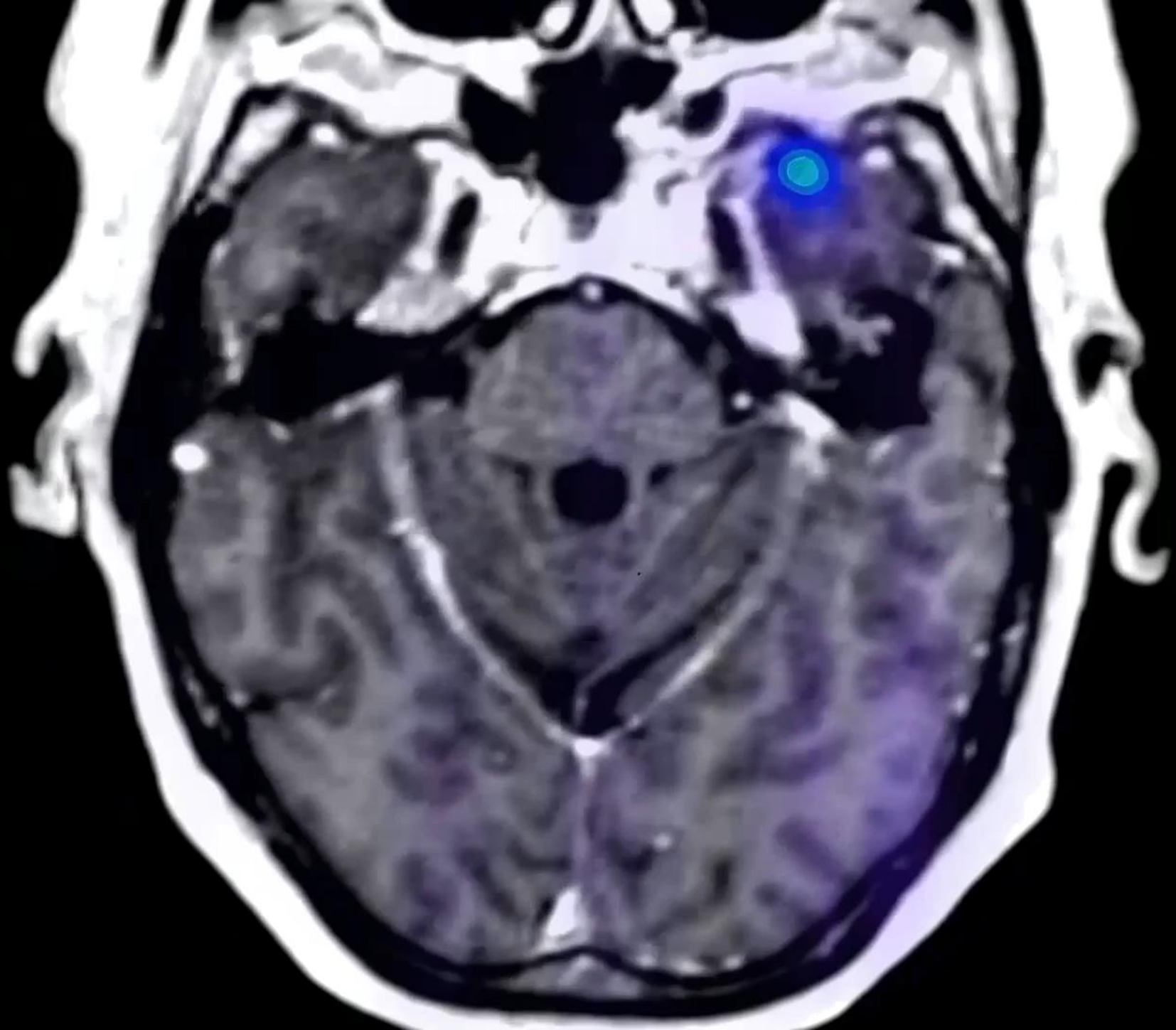
NOMINIERT FÜR DEN DEUTSCHEN ZUKUNFTSPREIS 2022

Chemotherapie/ Immuntherapie

Strahlentherapie

Chirurgie



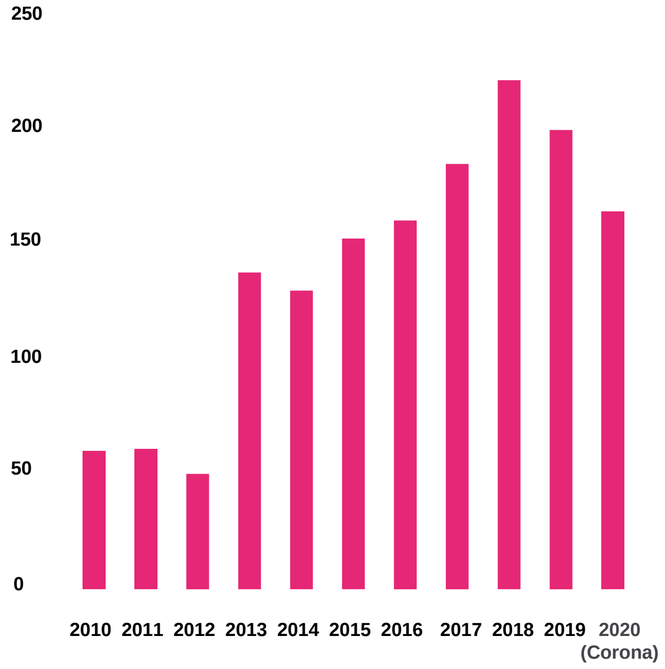


DEUTSCHER ZUKUNFTSPREIS

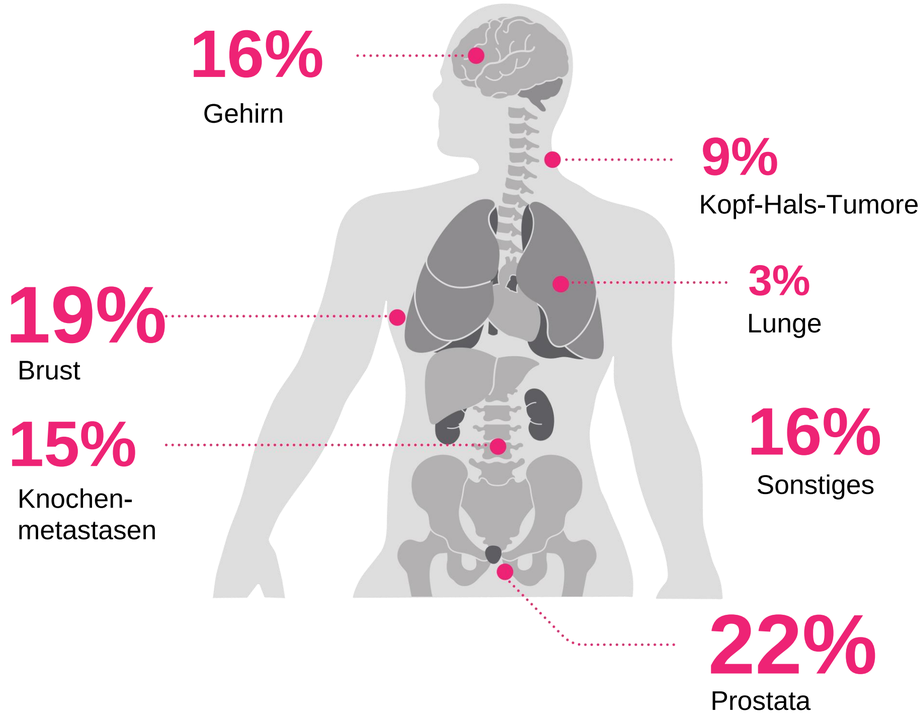
Einblick in klinische Praxis

Patientenzahlen am Universitätsklinikum Hamburg-Eppendorf (UKE)

Patientenzahlen für Hochpräzisionsstrahlentherapie am UKE



Tumorindikationen für Hochpräzisionsstrahlentherapie am UKE



UKE: Universitätsklinikum Hamburg-Eppendorf

DEUTSCHER ZUKUNFTSPREIS

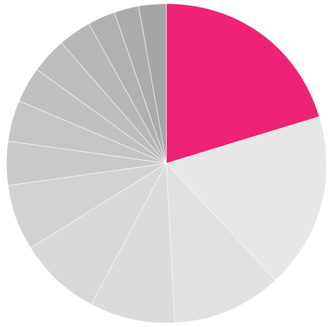
Lungenkrebs

Neuerkrankungen/Jahr

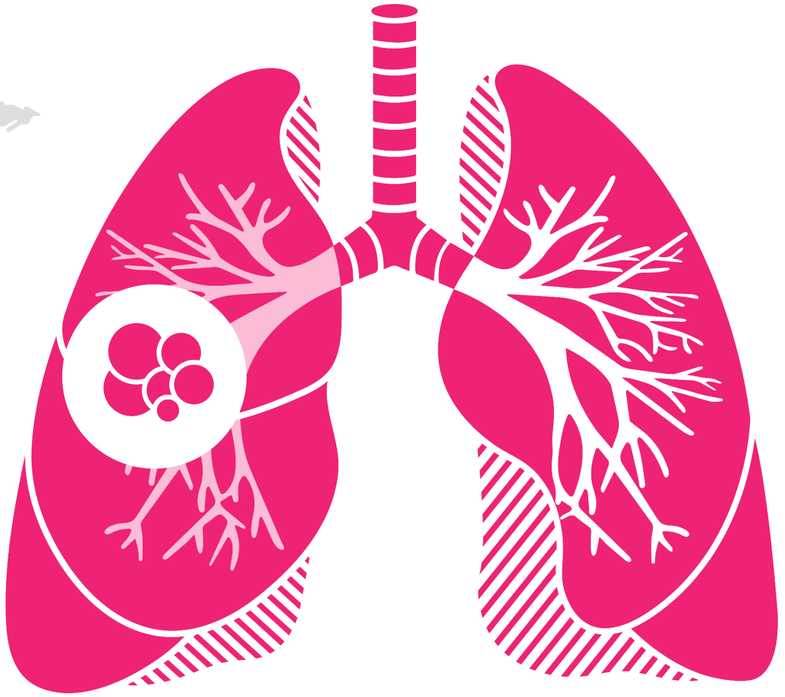
Deutschland
57.000

Weltweit
2,1 Mio.

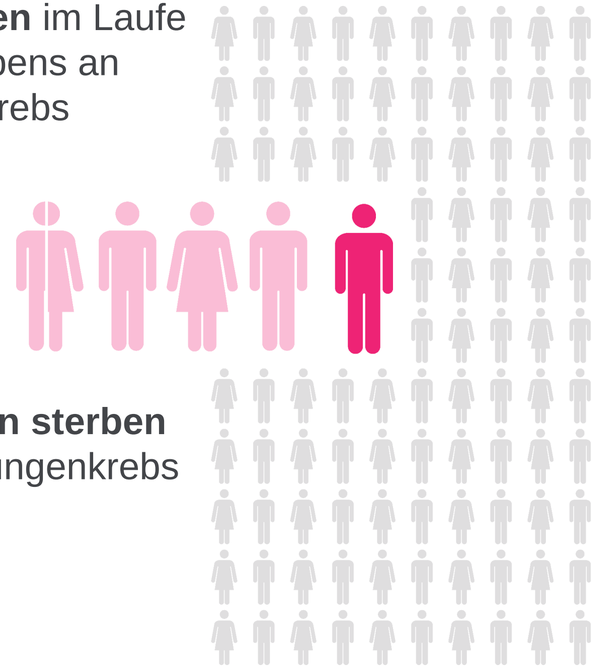
Krebstodesfälle/Jahr Deutschland



Lunge
45.000



5 von 100
erkranken im Laufe ihres Lebens an Lungenkrebs

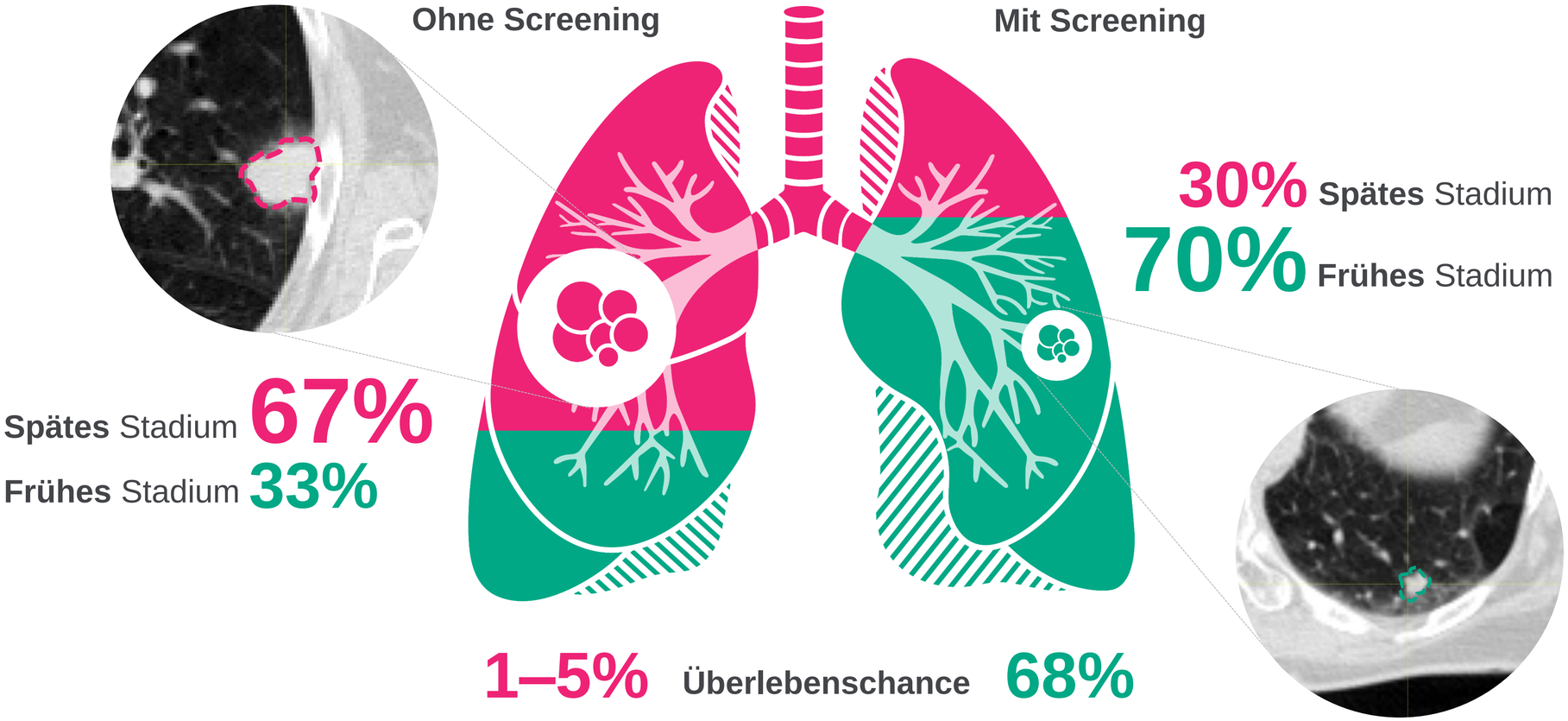


4 **davon sterben** an Lungenkrebs

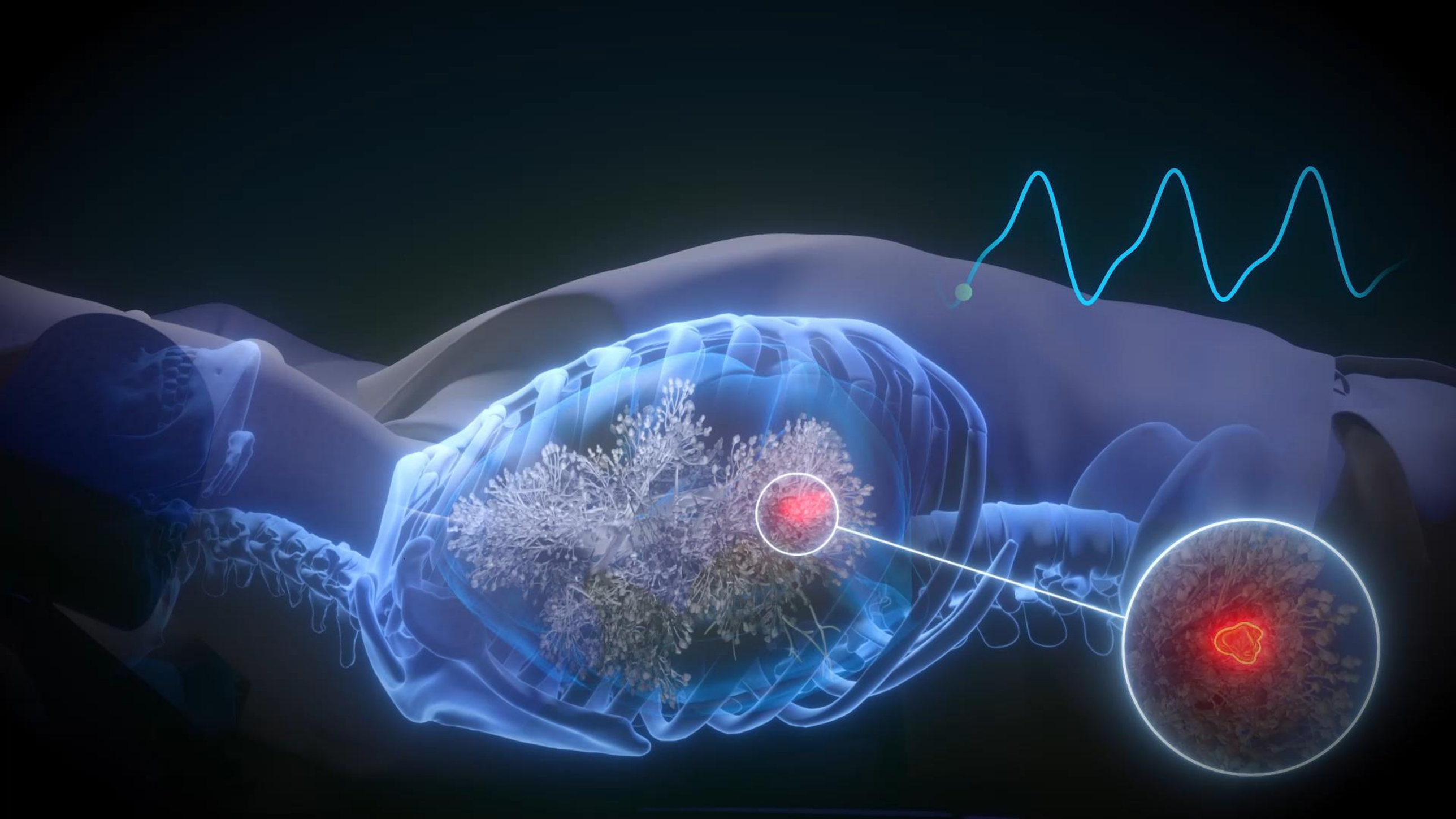
Erdmann et al. (2021) Krebs in Deutschland für 2017/2018. DOI: 10.25646/8353; LCFA (2022): Raising Awareness of Lung Cancer‘s Deadly Impact & Disproportionate Research Funding. https://lcfamerica.org/; Wild et al. (2020): World cancer report: cancer research for cancer prevention. http://publications.iarc.fr/586

DEUTSCHER ZUKUNFTSPREIS

Diagnose von Lungenkrebs



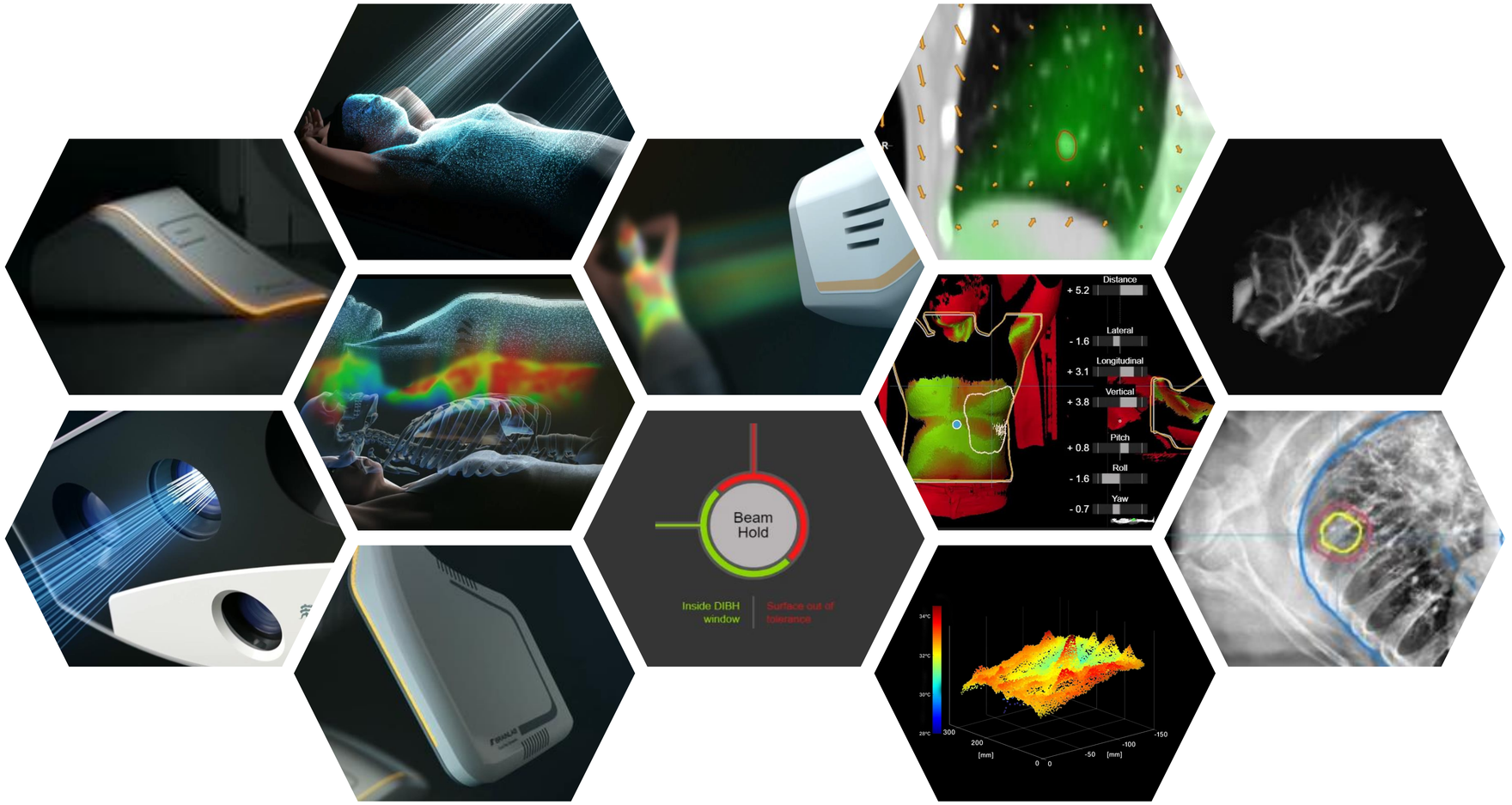
Erdmann et al. (2021) Krebs in Deutschland für 2017/2018. DOI: 10.25646/835; Saghir et al. (2012): CT screening for lung cancer brings forward early disease. The randomised Danish Lung Cancer Screening Trial: status after five annual screening rounds with low-dose CT. DOI: 10.1136/thoraxjnl-2011-200736



DEUTSCHER ZUKUNFTSPREIS

Zusammenwirken zahlreicher Innovationen

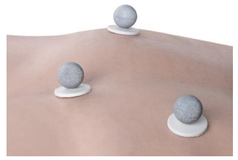
Hardware & Software



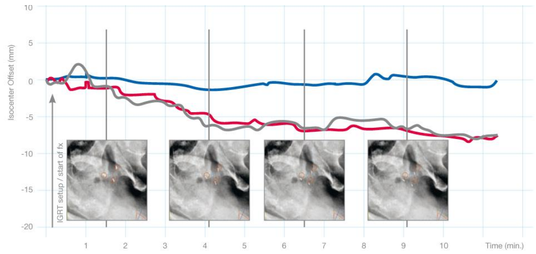
DEUTSCHER ZUKUNFTSPREIS

Entwicklung von ExacTrac Dynamic

Historische Behandlungsinnovationen



Infrarot Positionierung
ExacTrac 1.0



Intrafraktionelle Verifikation
ExacTrac 5.0

Robotische Positionskorrektur
ExacTrac 6.0

Oberflächentracking
ExacTrac Dynamic

1998

2003

2006

2008

2011

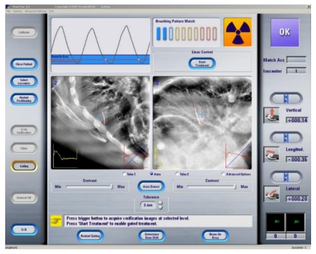
2012

2020

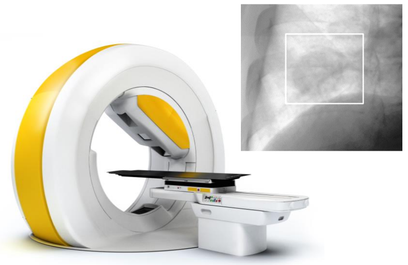
2022

Röntgenpositionierung
Novalis

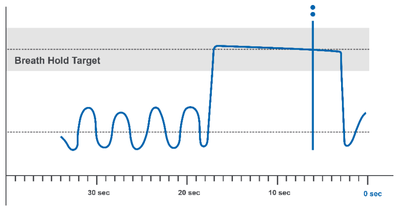
Implantierte Marker
ExacTrac 5.5



Dynamisches Tumortracking
Vero

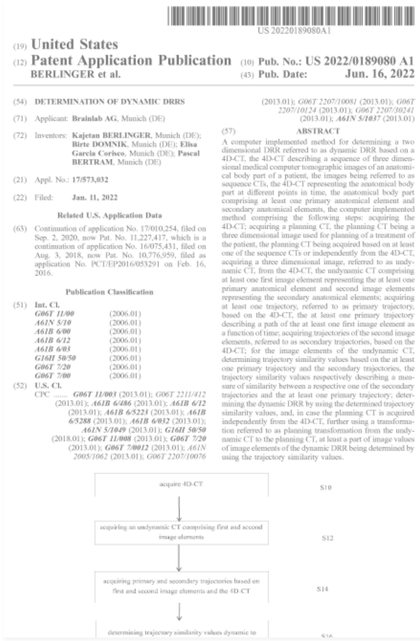


Atmungskorrelation
ExacTrac Dynamic



DEUTSCHER ZUKUNFTSPREIS

Patente & Publikationen


US 20220189080A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2022/0189080 A1

BERLINGER et al. (43) Pub. Date: Jun. 16, 2022

(54) DETERMINATION OF DYNAMIC DRRS

(71) Applicant: Brainlab AG, Munich (DE)

(72) Inventors: Kajetan BERLINGER, Munich (DE); Birte DOMNIK, Munich (DE); Elisa Barrelet Gerwen, Munich (DE); Pascal BERTRAM, Munich (DE)

(21) Appl. No.: 17/573,032

(22) Filed: Jan. 11, 2022

Related U.S. Application Data

(63) Continuation of application No. 17/010,254, filed on Sep. 2, 2020, now Pat. No. 11,227,417, which is a continuation of application No. 16/075,431, filed on Aug. 3, 2018, now Pat. No. 10,776,959, filed as application No. PCT/EP2016/053291 on Feb. 16, 2016.

Publication Classification

(51) Int. Cl.
G06T 11/00 (2006.01)
A61N 5/10 (2006.01)
A61B 6/00 (2006.01)
A61B 6/12 (2006.01)
A61B 6/03 (2006.01)
G16H 50/50 (2006.01)
G06T 7/20 (2006.01)
G06T 7/00 (2006.01)

(52) U.S. Cl.
CPC G06T 11/003 (2013.01); G06T 2211/412 (2013.01); A61B 6/486 (2013.01); A61B 6/12 (2013.01); A61B 6/5223 (2013.01); A61B 6/5288 (2013.01); A61B 6/032 (2013.01); A61N 5/1049 (2013.01); G16H 50/50 (2018.01); G06T 11/008 (2013.01); G06T 7/20 (2013.01); G06T 7/0012 (2013.01); A61N 2005/1062 (2013.01); G06T 2207/10076

(57) ABSTRACT

A computer implemented method for determining a two dimensional DRR referred to as dynamic DRR based on a 4D-CT, the 4D-CT describing a sequence of three dimensional medical computer tomographic images of an anatomical body part of a patient, the images being referred to as sequence CTs, the 4D-CT representing the anatomical body part at different points in time, the anatomical body part comprising at least one primary anatomical element and secondary anatomical elements, the computer implemented method comprising the following steps: acquiring the 4D-CT; acquiring a planning CT, the planning CT being a three dimensional image used for planning of a treatment of the patient, the planning CT being acquired based on at least one of the sequence CTs or independently from the 4D-CT, acquiring a three dimensional image, referred to as undynamic CT, from the 4D-CT, the undynamic CT comprising at least one first image element representing the at least one primary anatomical element and second image elements representing the secondary anatomical elements; acquiring at least one trajectory, referred to as primary trajectory, based on the 4D-CT, the at least one primary trajectory describing a path of the at least one first image element as a function of time; acquiring trajectories of the second image elements, referred to as secondary trajectories, based on the 4D-CT; for the image elements of the undynamic CT, determining trajectory similarity values based on the at least one primary trajectory and the secondary trajectories, the trajectory similarity values respectively describing a measure of similarity between a respective one of the secondary trajectories and the at least one primary trajectory; determining the dynamic DRR by using the determined trajectory similarity values, and, in case the planning CT is acquired independently from the 4D-CT, further using a transformation referred to as planning transformation from the undynamic CT to the planning CT, at least a part of image values of image elements of the dynamic DRR being determined by using the trajectory similarity values.

2. Family 75787093 (US2020069972 AA) View in PatBase

Title
[EN] IRRADIATION TREATMENT PLANNING BASED ON TARGET COVERAGE REDUCTION

Abstract
[EN] A computer-implemented medical method of irradiation treatment planning is provided. Therein, an initial coverage volume (118) for a planning target volume (116), which is to be irradiated in an irradiation treatment with a prescribed dose, is provided. Further, at least one constraint (106, 110) indicative of an allowed dose for an organ at risk (120) is provided. Applying an initial irradiation treatment plan, an organ dose deposited in at least a partial volume of the organ at risk (120) is calculated. Based on comparing the organ dose to the at least one constraint (106, 110), an amount of violation is determined. Taking into account the determined amount of violation, a reduction coverage volume is calculated for the planning target volume (116) and a virtual planning object (122) is generated based on changing a volume of the organ at risk (120), such that an overlap region (124) of the virtual planning object (122) and the planning target volume (116) corresponds to the reduction coverage volume. By removing at least a part of the overlap region (124) from the planning target volume (116), an optimized planning target volume (132) is generated.

International Class: A61N5/10

Cooperative Patent Class: A61N5/1031; A61N5/1069

Family Information


(19) EP 3 110 331 B1

EUROPEAN PATENT SPECIFICATION

(51) Int Cl.: A61B 6/00 (2006.01) A61N 5/10 (2006.01)

(86) International application number: PCT/EP2014/053790

(87) International publication number: WO 2015/127970 (03.09.2015 Gazette 2015/35)

(54) TRACKING SOFT TISSUE IN MEDICAL IMAGES
VERFOLGUNG VON WEICHGEWEBE BEI MEDIZINISCHEN BILDERN
SUIVI DE TISSU MOU DANS DES IMAGES MÉDICALES

(84) Designated Contracting States: AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(73) Proprietor: Brainlab AG 81829 München (DE)

(72) Inventors:
• BERLINGER, Kajetan 80797 Munich (DE)
• FRIDMAN, Stephen 81925 Munich (DE)

(74) Representative: Schwabe - Sandmair - Marx Patentanwälte Rechtsanwalt Partnerschaft mbB Joseph-Wild-Straße 20 81829 München (DE)

(56) References cited: US-A1- 2004 002 615 US-A1- 2006 074 292 US-A1- 2013 266 202


An evaluation of gating window size, delivery method, and composite field dosimetry of respiratory-gated IMRT

Geoffrey D. Hugo, Nichde Agazaryan, and Timothy D. Solberg

Department of Radiation Oncology, UCLA School of Medicine, Los Angeles, California 90095

(Received 30 April 2002; accepted for publication 14 August 2002; published 22 October 2002)

3. Family 31308755 (US2004242991 AA) View in PatBase

Title
[EN] METHOD FOR DETERMINING DOSAGE WHEN PLANNING RADIOTHERAPY AND/OR RADIOSURGERY PROCEDURES

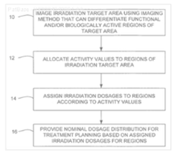
Abstract
[EN] A method for determining dosage when planning radiotherapy and/or radiosurgery procedures can include imaging an irradiation target area using an imaging method, which can differentiate functional and/or biologically active regions of the irradiation target area. Ascertained activity values can be allocated to individual regions of the imaged irradiation target and irradiation doses can be assigned to the regions in accordance with the activity values. A nominal dosage distribution, which can be ascertained from the irradiation dosages for the regions, can be used as an input value for treatment planning.

International Class: A61N5/10; A61B5/05

Cooperative Patent Class: A61N5/103

US Class: 600/407

Family Information




SUPPLEMENTAL MATERIAL

Practical Radiation Oncology (2011)

pro

Quality and Safety Considerations in Stereotactic Radiosurgery and Stereotactic Body Radiation Therapy

Timothy D. Solberg, Ph.D.[a], James M. Balter, Ph.D.[b], Stanley H. Benedict, Ph.D.[c], Benedick A. Fraass, Ph.D.[d], Brian Kavanagh, M.D.[e], Carlos Miyamoto, M.D.[f], Todd Pawlicki, Ph.D.[g], Louis Potters, M.D.[h], Yoshiya Yamada, M.D.[i]

[a]Department of Radiation Oncology, University of Texas Southwestern Medical Center, Dallas, Texas; [b]Department of Radiation Oncology, University of Michigan Health System, Ann Arbor, Michigan; [c]Department of Radiation Oncology, University of Virginia Health System, Charlottesville, Virginia; [d]Department of Radiation Oncology, University of Colorado, Denver, Aurora, Colorado; [e]Department of Radiation Oncology, Sample University, Philadelphia, Pennsylvania; [f]Department of Radiation Oncology, University of Maryland, Baltimore, Maryland; [g]Department of Radiation Medicine, Long Island Jewish Medical Center, New Hyde Park, New York; [h]Department of Radiation Oncology, Memorial Sloan Kettering Cancer Center, New York, New York

Reprint requests to:
Timothy D. Solberg, Ph.D.


Revised 2011 (CACTRO)*

ACR–ASTRO PRACTICE GUIDELINE FOR THE PERFORMANCE OF STEREOTACTIC RADIOSURGERY

PREAMBLE

I. INTRODUCTION

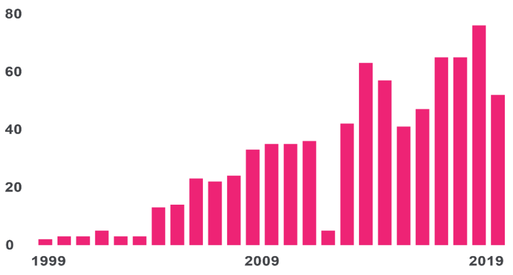
PRACTICE GUIDELINE

Stereotactic Radiosurgery 1 / 1

30 Patentfamilien mit 60 Patenten

„ExactTrac Dynamic“

175 Publikationen „ExactTrac“



734 Publikationen zu „Lung Stereotactic Radiotherapy“

1. Family 85486969 (WO2111563 A1) View in PatBase

Title
[EN] METHOD AND APPARATUS FOR DETERMINING INTERNAL ORGAN SHIFT

Abstract
[EN] A method and apparatus (10) for determining a displacement of an internal object (104) disposed in a body (102) of a patient (100) are provided. The method comprises positioning an arrangement (14) of electrodes (16) of a capacitive sensor (12) adjacent to a body part (103) of a patient (100), such that each electrode (16) is spaced apart from the body part (103), wherein the body part at least partly encloses the internal object (104) of the patient; providing, with the capacitive sensor (12), a plurality of sensor signals, wherein each sensor signal is indicative of a capacitance in a vicinity of at least one electrode (16) of the arrangement (14) of electrodes (16); determining a set of capacitance values for at least a subset of the electrodes (16) of the arrangement (14) of electrodes based on processing the plurality of sensor signals; and determining a displacement of the internal object (104) with respect to the body part (103) based on comparing the determined set of capacitance values with a set of reference capacitance values

International Class: A61B5/00; A61B5/053; A61B5/06

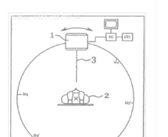
Cooperative Patent Class: A61B2562/0214; A61B5/0064; A61B5/053; A61B5/063

Family Information

5. Family 52443815 (US2013324785 AA) View in PatBase

Title
[EN] METHOD AND APPARATUS FOR PLANNING OR CONTROLLING A RADIATION TREATMENT

Abstract
[EN] The present invention relates to method for generating planning data or control data for a radiation treatment, comprising the following steps: acquiring segmented data of an object which contains a treatment volume and a non-treatment volume; modelling at least some or all of the volume or surface of the treatment volume as a source of light or rays exhibiting a predefined or constant initial intensity, modelling the non- treatment volume as comprising volumetric elements or voxels which each exhibit an individually assigned feature or attenuation or transparency value (tmin≥t≥tmax) for the light or rays which feature is assigned to the light or ray or which attenuation or transparency maintains or reduces the intensity of the light or ray as it passes through the respective volumetric element or voxel, wherein the feature or attenuation or transparency value is individually assigned to each volumetric element or voxel of the non-treatment volume; defining a map




An evaluation of gating window size, delivery method, and composite field dosimetry of respiratory-gated IMRT

Geoffrey D. Hugo,[a] Nichde Agazaryan, and Timothy D. Solberg

Department of Radiation Oncology, UCLA School of Medicine, Los Angeles, California 90095

(Received 30 April 2002; accepted for publication 14 August 2002; published 22 October 2002)

I. INTRODUCTION

II. METHODS

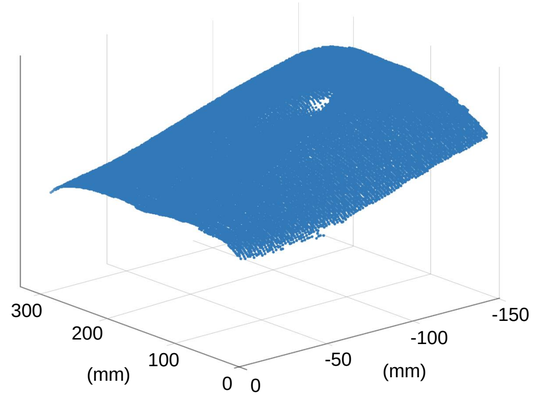
A. Gating system

DEUTSCHER ZUKUNFTSPREIS

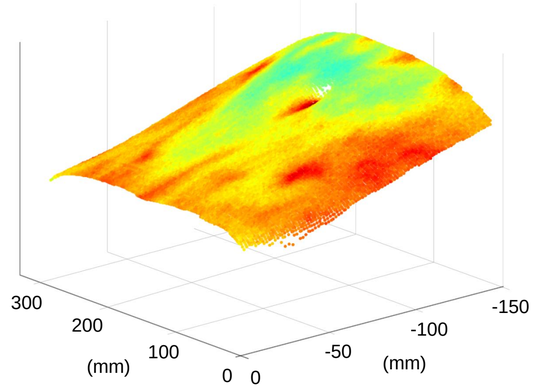
Zusammenwirken zahlreicher Innovationen

4D Thermal Tracking

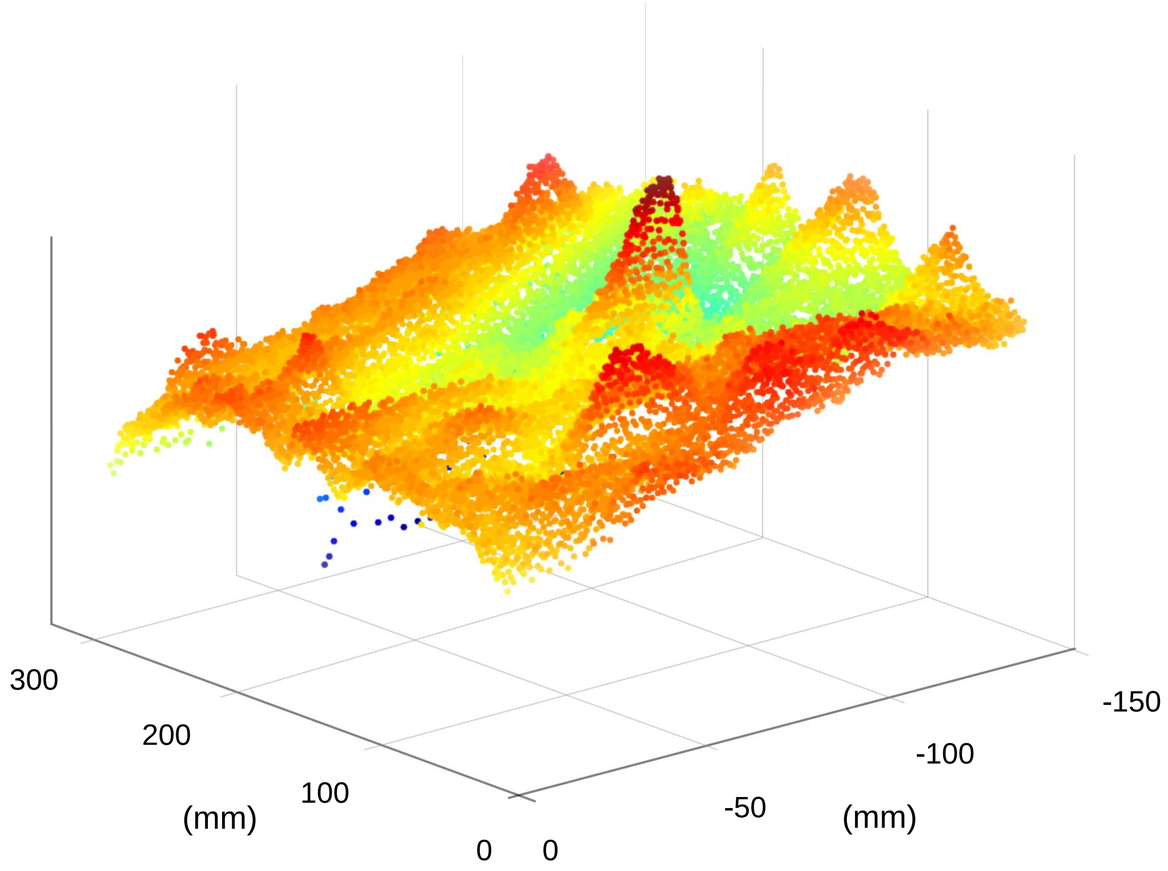
Oberflächen-Tracking

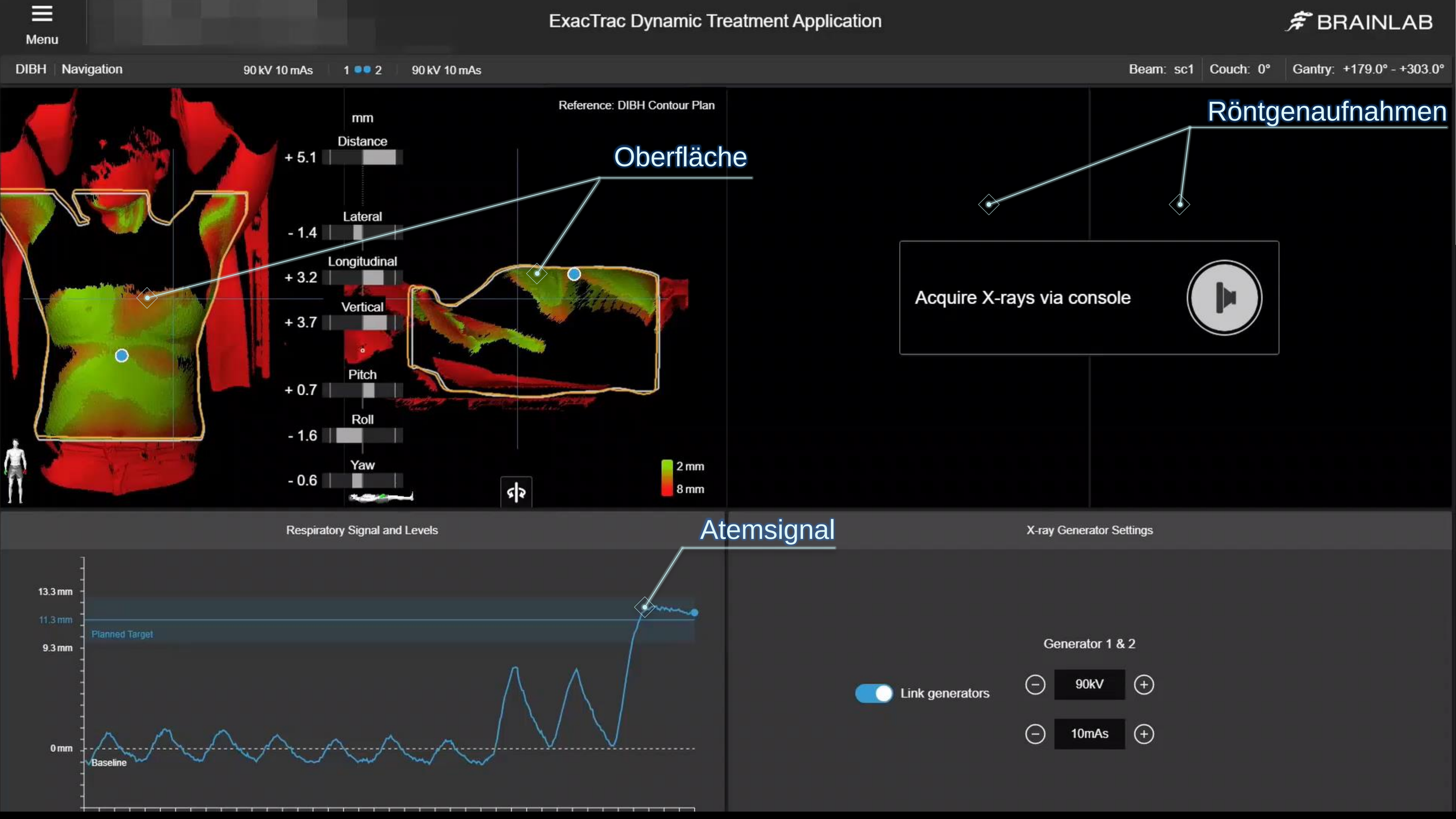


Thermo-Tracking



Kombiniertes 4D Tracking




Menu
ExacTrac Dynamic Treatment Application
BRAINLAB
DIBH | Navigation
90 kV 10 mAs
1 2
90 kV 10 mAs
Beam: sc1
Couch: 0°
Gantry: +179.0° - +303.0°
Reference: DIBH Contour Plan
mm
Distance
+ 5.1
Lateral
- 1.4
Longitudinal
+ 3.2
Vertical
+ 3.7
Pitch
+ 0.7
Roll
- 1.6
Yaw
- 0.6
2 mm
8 mm
Oberfläche
Röntgenaufnahmen
Acquire X-rays via console
Respiratory Signal and Levels
Atemsignal
13.3 mm
11.3 mm
Planned Target
9.3 mm
0 mm
Baseline
X-ray Generator Settings
Generator 1 & 2
Link generators
90kV
10mAs

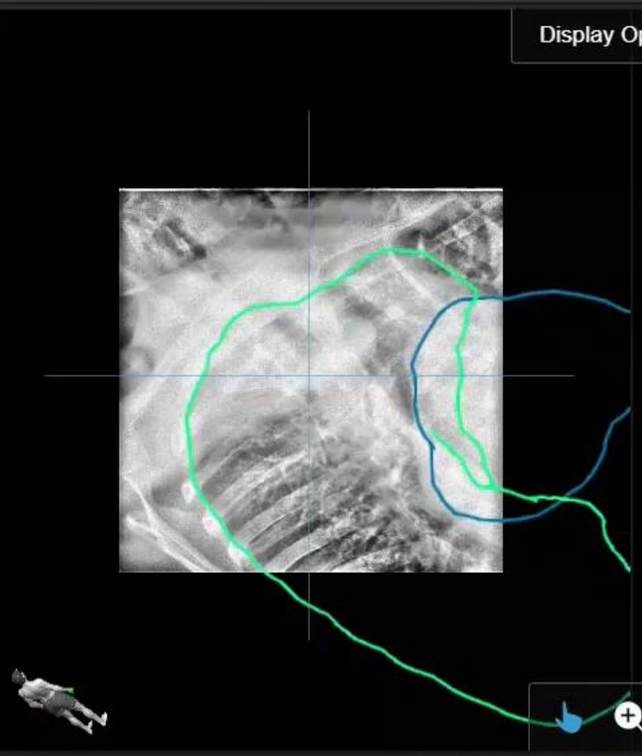
Menu

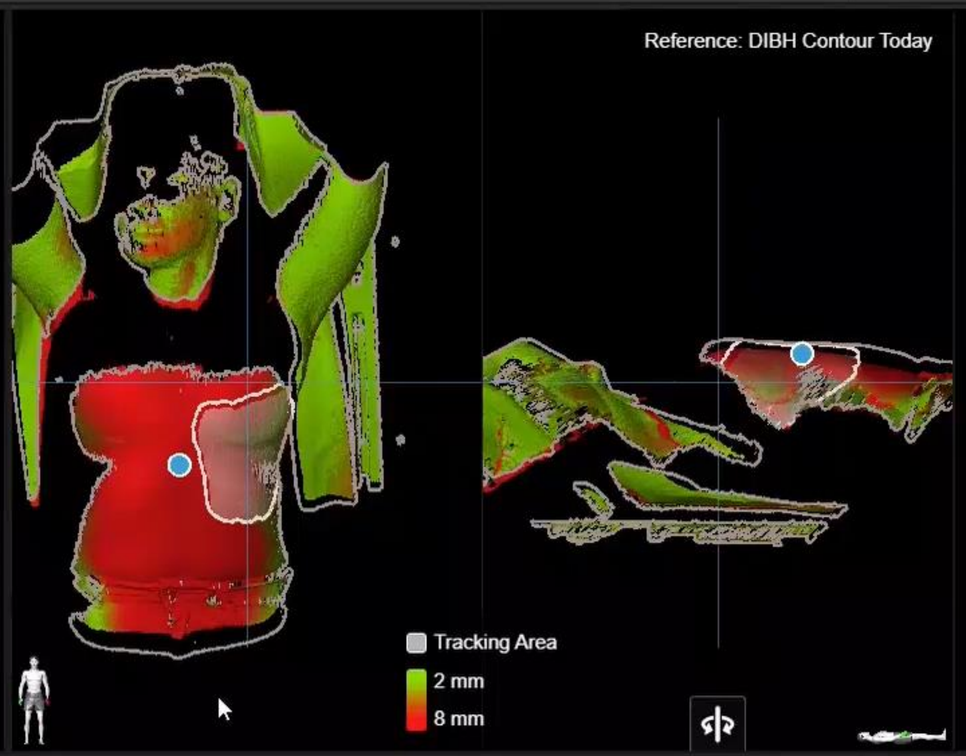
ExacTrac Dynamic Treatment Application

BRAINLAB

DIBH | Patient Monitoring | 90 kV 10 mAs | 1 ● ○ 2 | 90 kV 10 mAs | Beam: sc1 | Couch: 0° | Gantry: +179.0° - +303.0°

Display Options





mm

Distance + 12.2

Lateral + 4.5

Longitudinal - 6.0

Vertical - 9.6

°

Pitch + 0.2

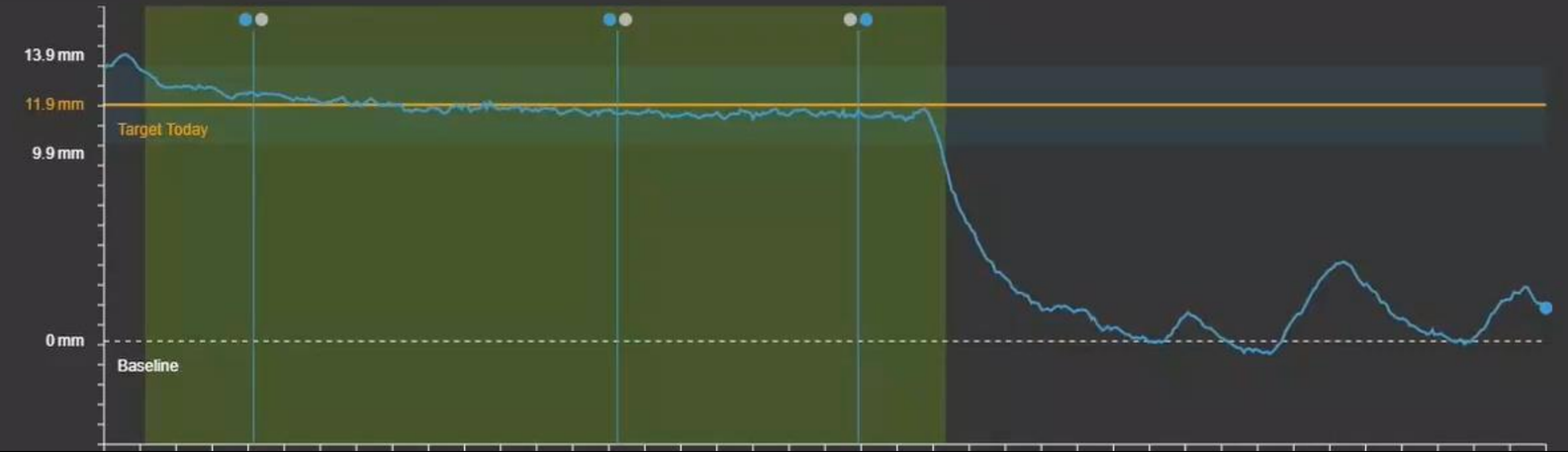
Roll + 0.4

Yaw - 0.6

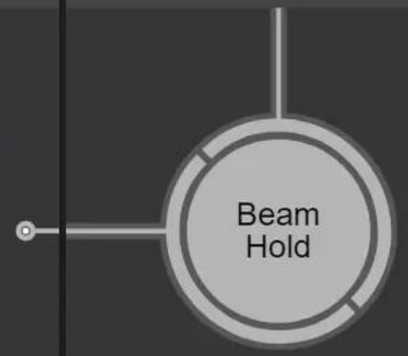
Gantry Position

Angle: 330°

Respiratory Signal and Levels



DIBH Gating Status

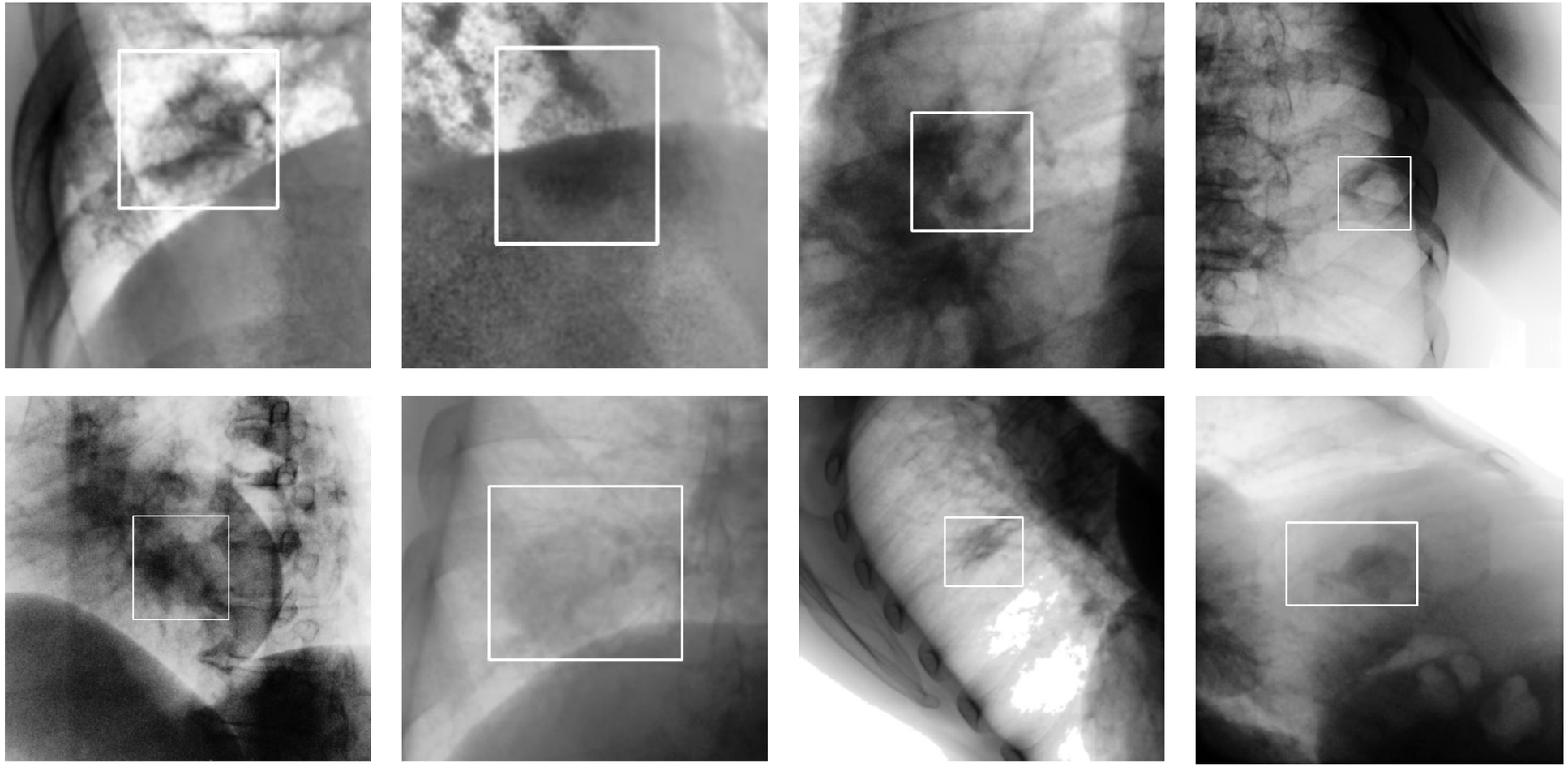


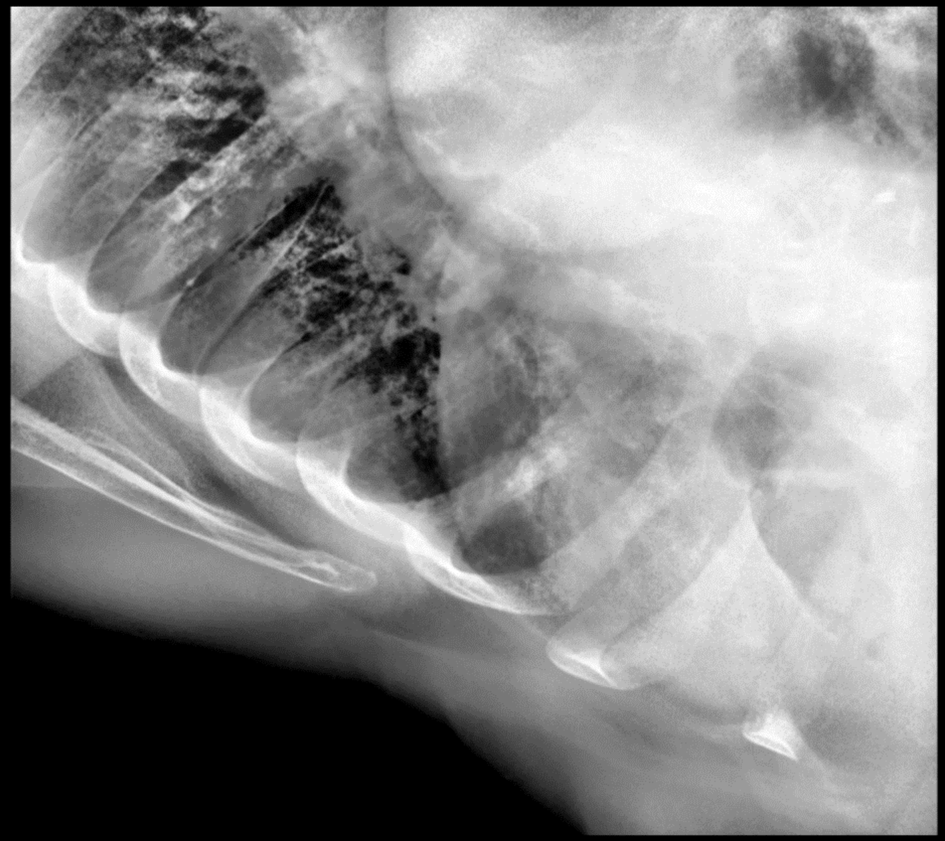
Outside DIBH Gating Window

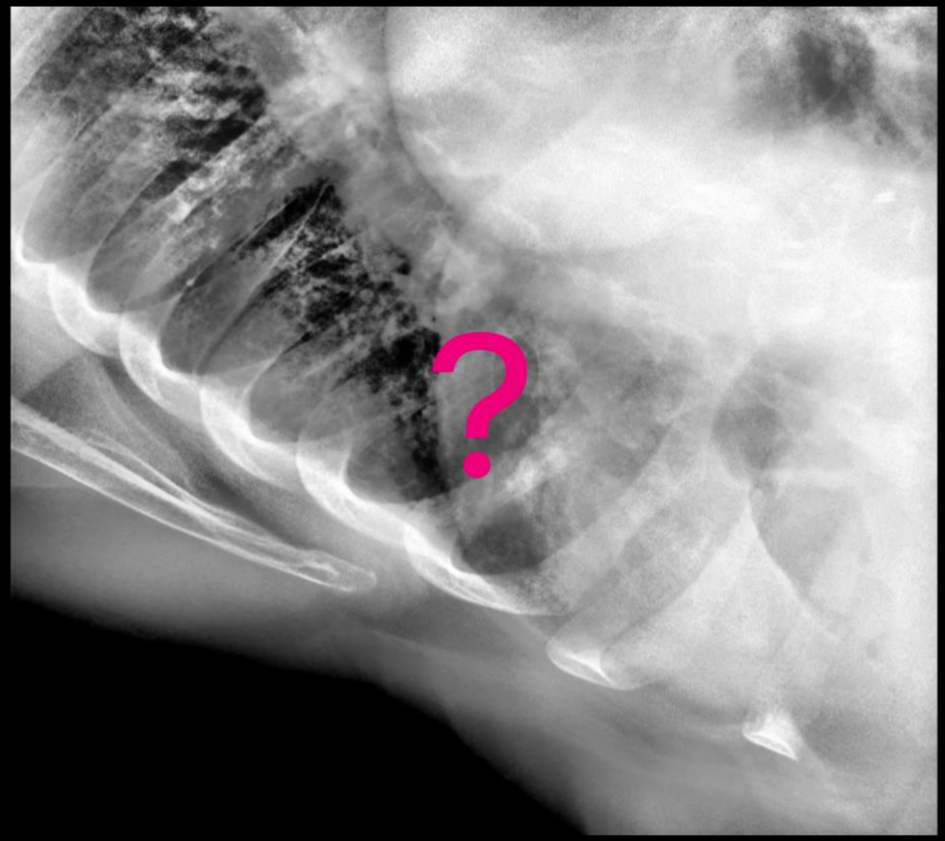
Surface out of tolerance

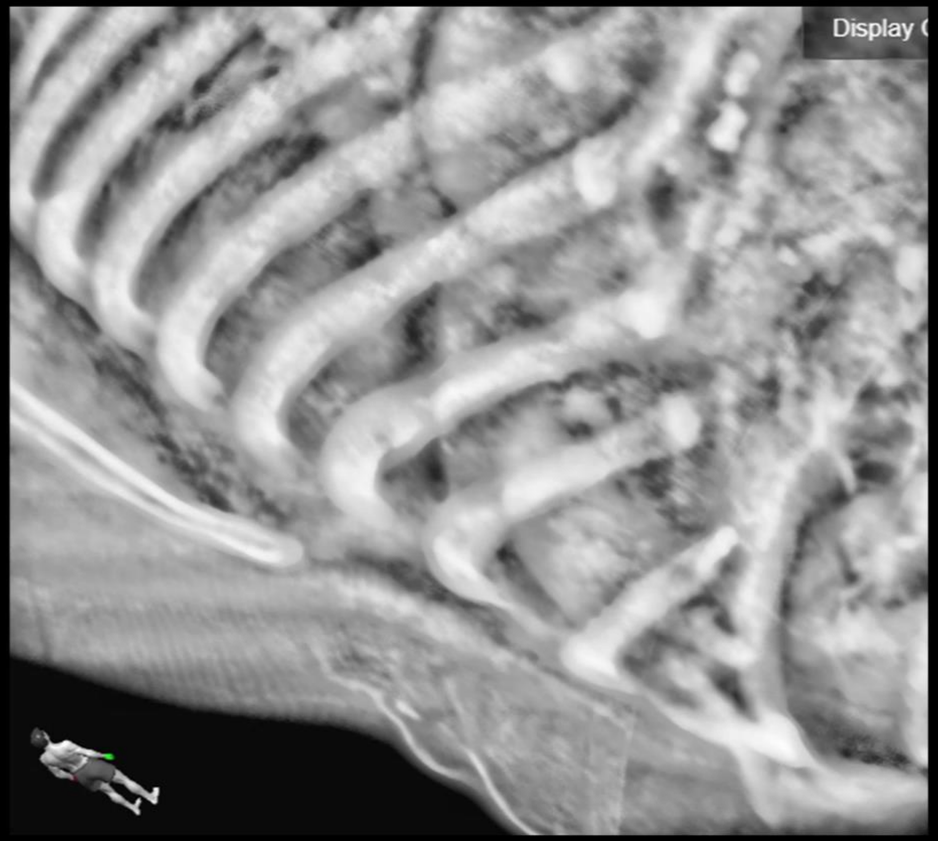
DEUTSCHER ZUKUNFTSPREIS

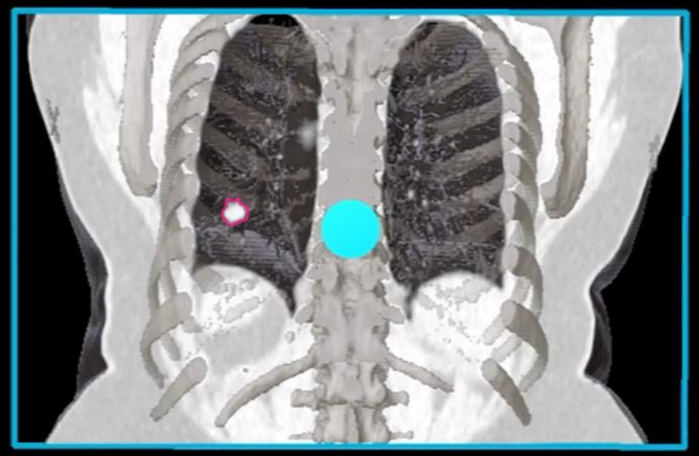
Erfassung der Tumorbewegung



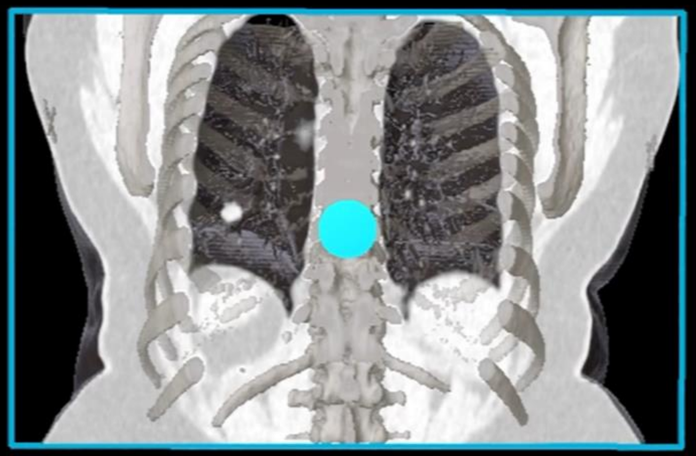


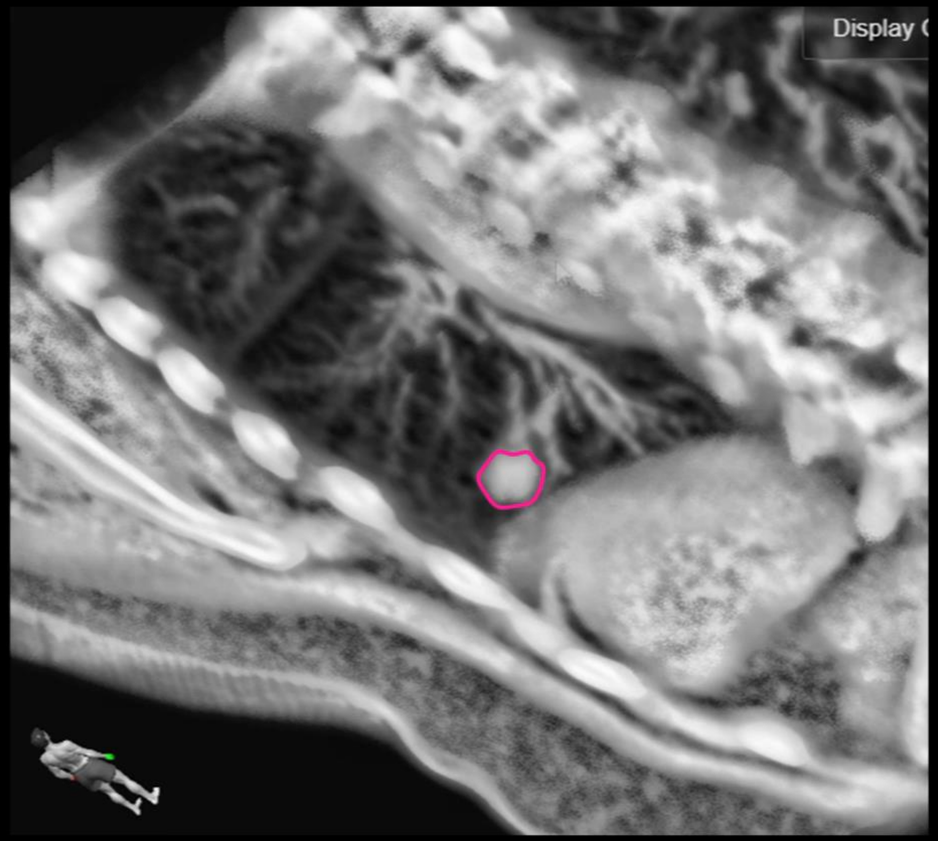


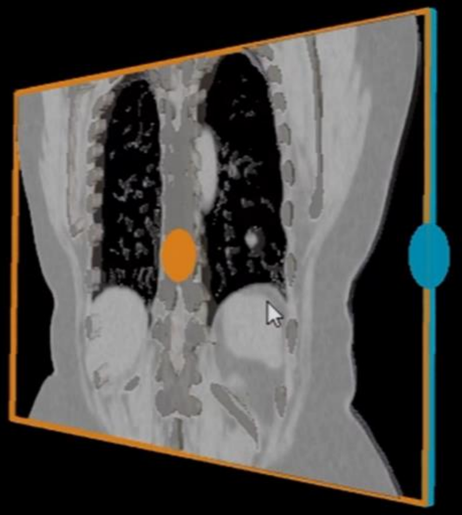

Display

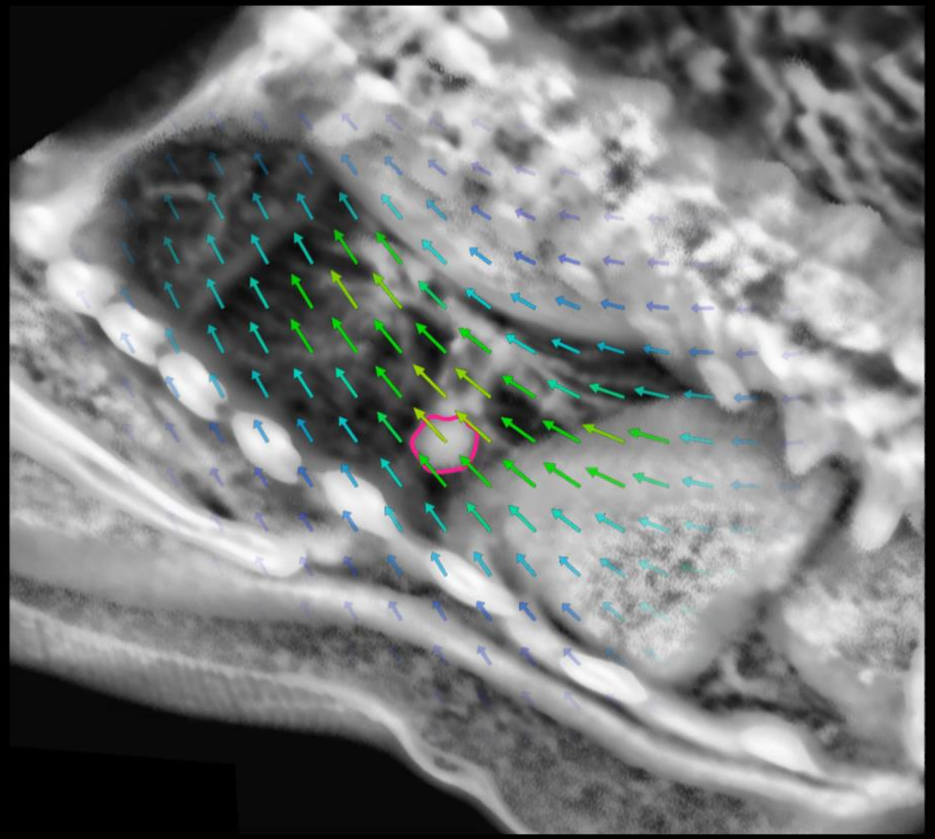


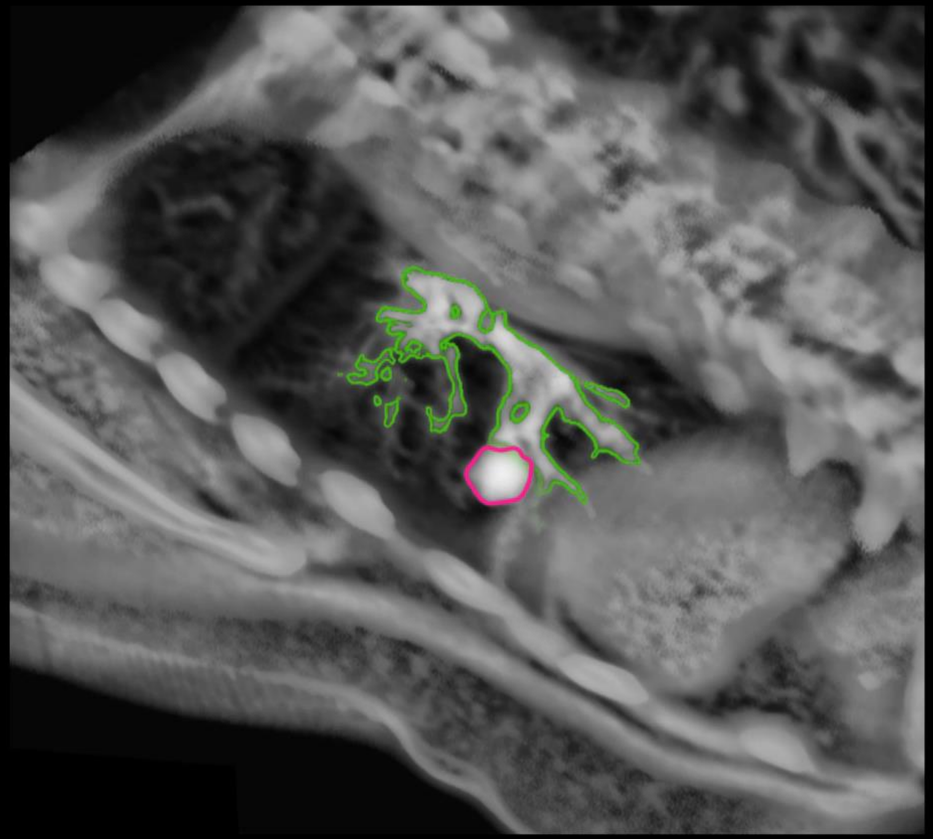

Display




Display





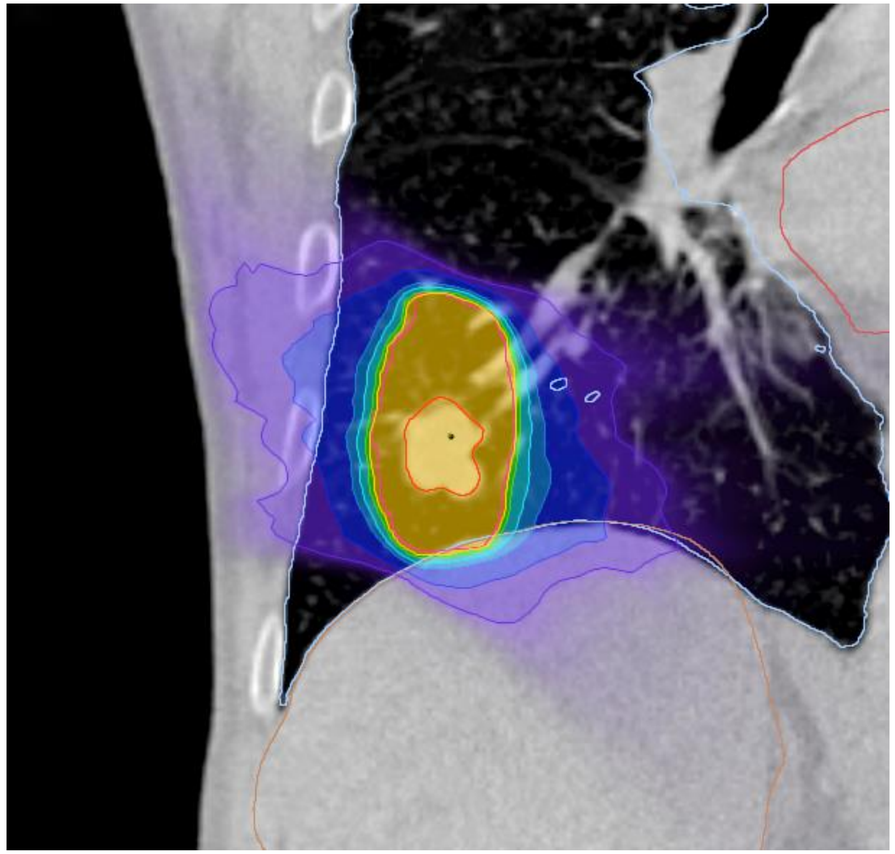


DEUTSCHER ZUKUNFTSPREIS

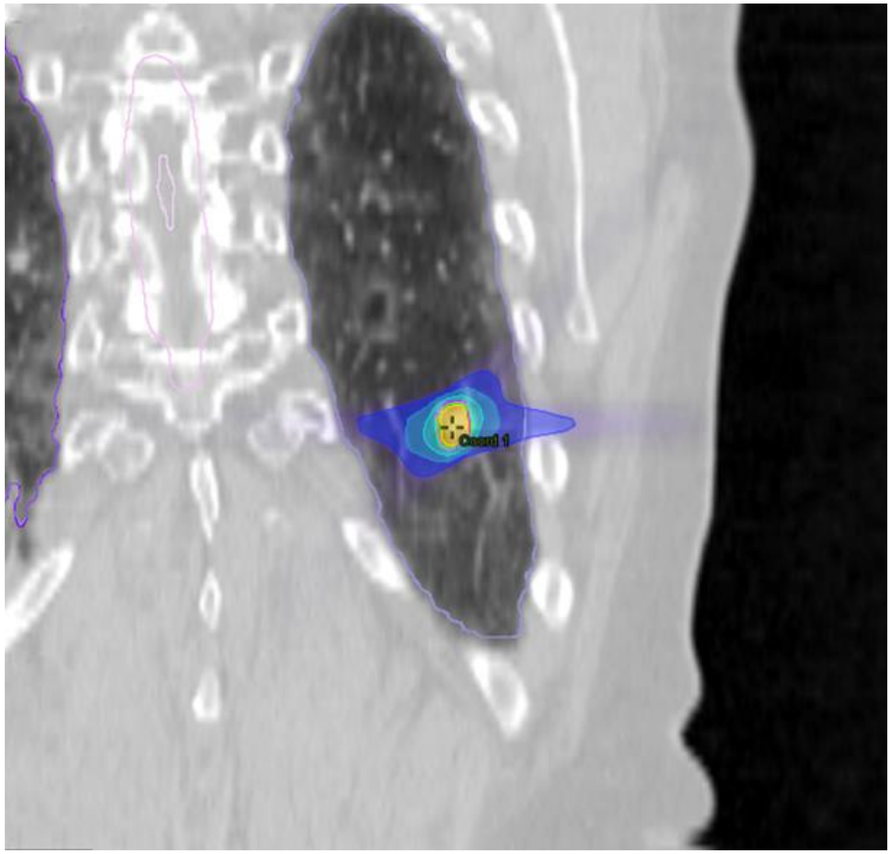
Dosisverteilung

Hohe Dosisbelastung limitiert Einsatzmöglichkeiten

Status Quo



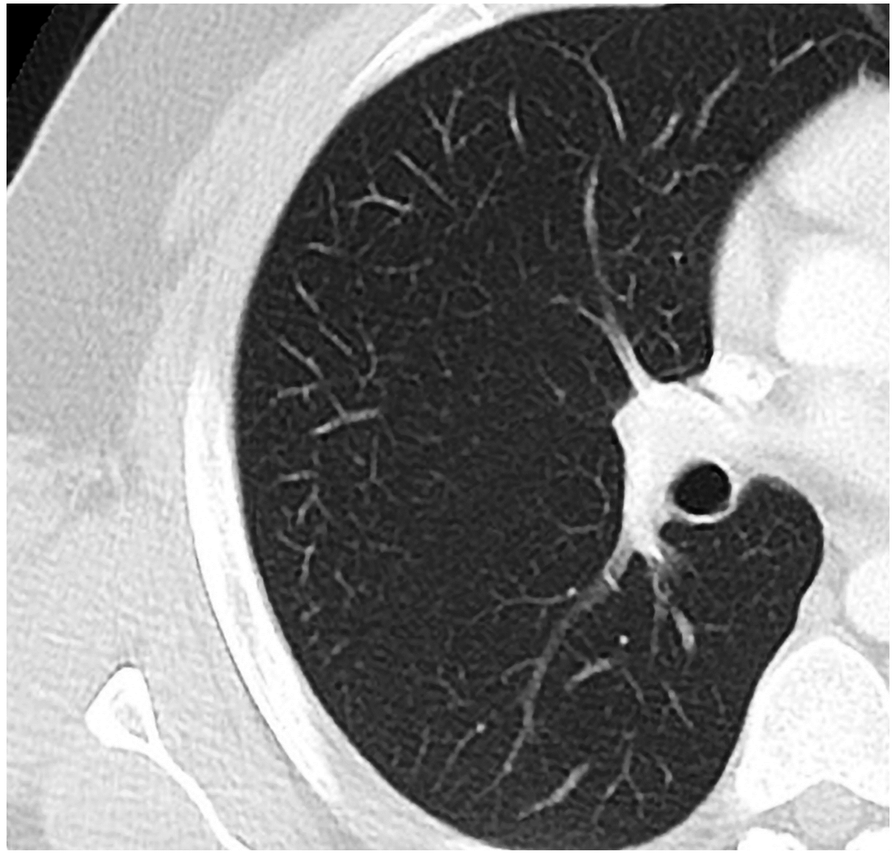
Ziel



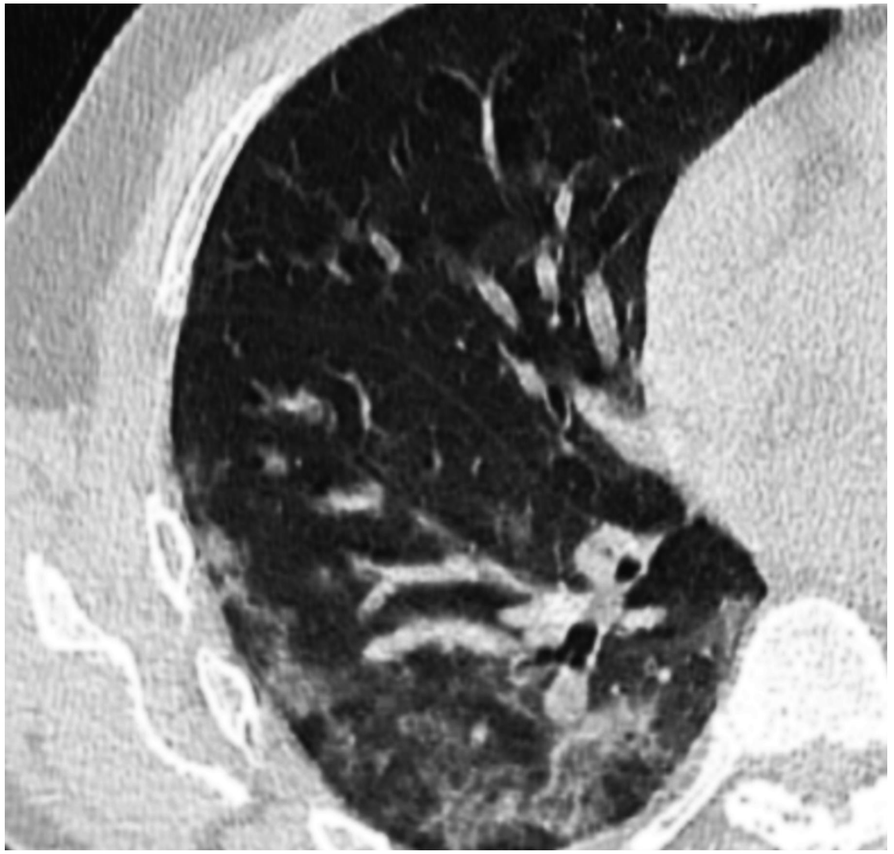
DEUTSCHER ZUKUNFTSPREIS

Bewahrung von Lungengewebe post-COVID

Gesund



COVID-19



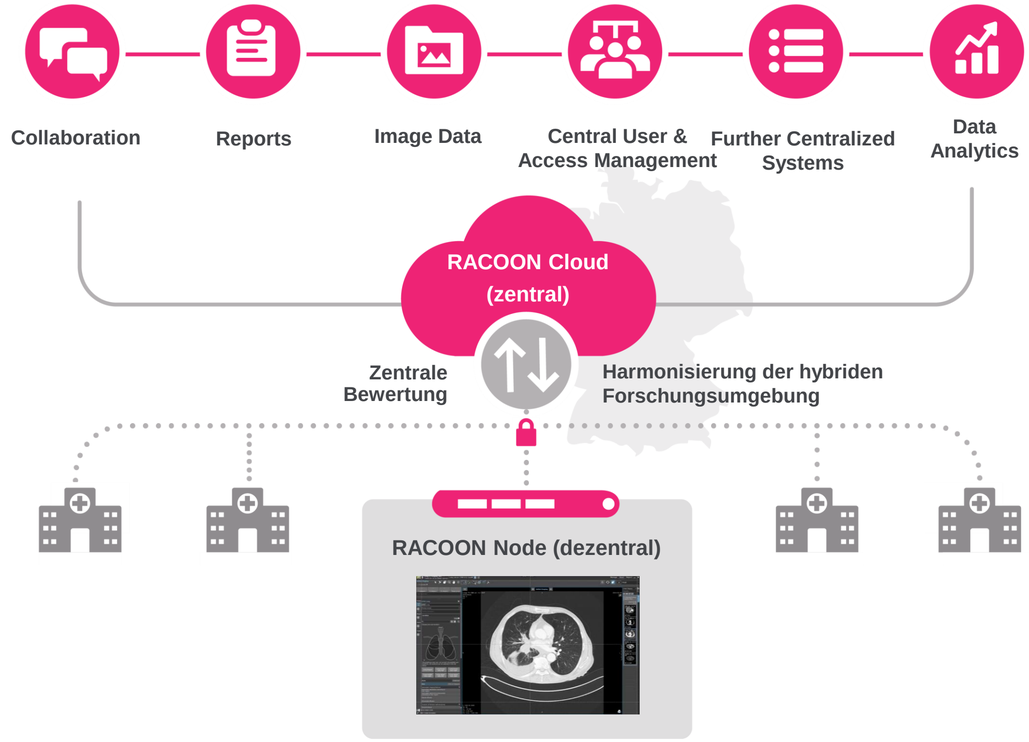
Dixon et al. (2022): Normal CT chest. Case study, DOI: 10.53347/rID-36676; Liu et al. (2021) Atlas of Chest Imaging in COVID-19 Patients. Springer Singapore, DOI: 10.1007/978-981-16-1082-0

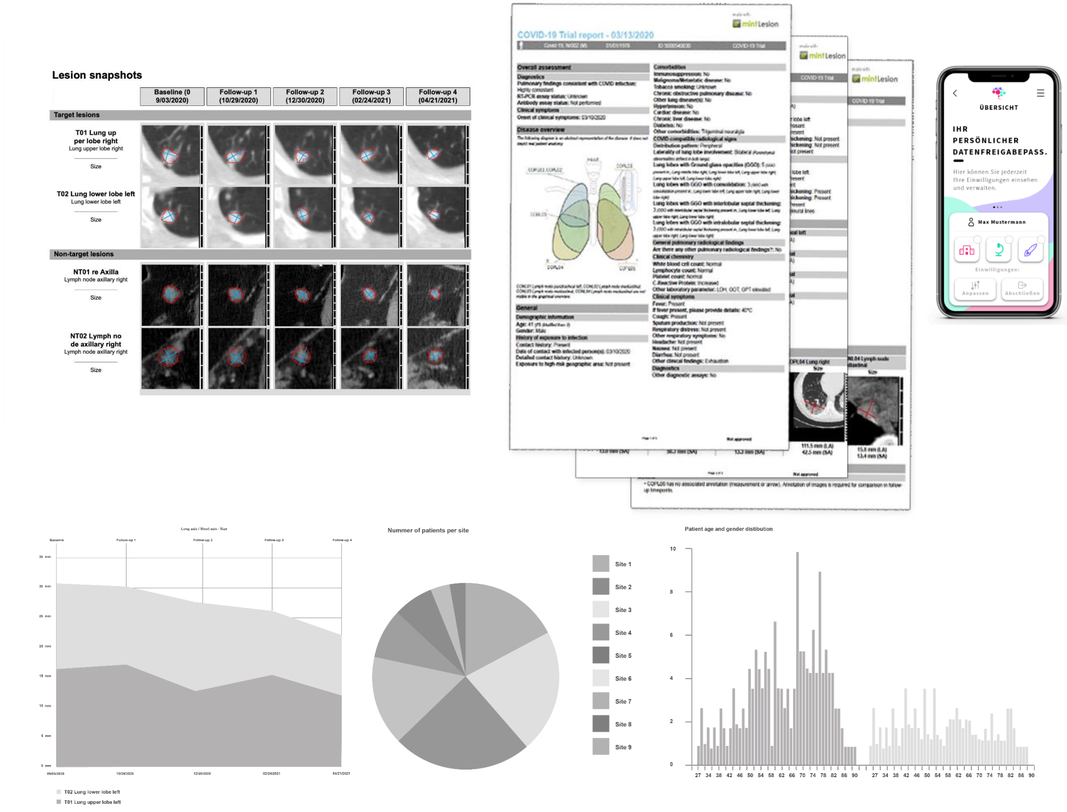

Plan Analysis
Configuration
Lungs Th-OBB-art 4.0 B60f
Axial
Alerts
Data
Home
Scroll
Zoom
Pan
Windowing
Revert
Continue
Monte Carlo
Dose
Dose Off
Dose Distribution
Dose Analysis
Highlight
7.90
Gy
Edit
Back
Next
BRAINLAB
DELL

DEUTSCHER ZUKUNFTSPREIS

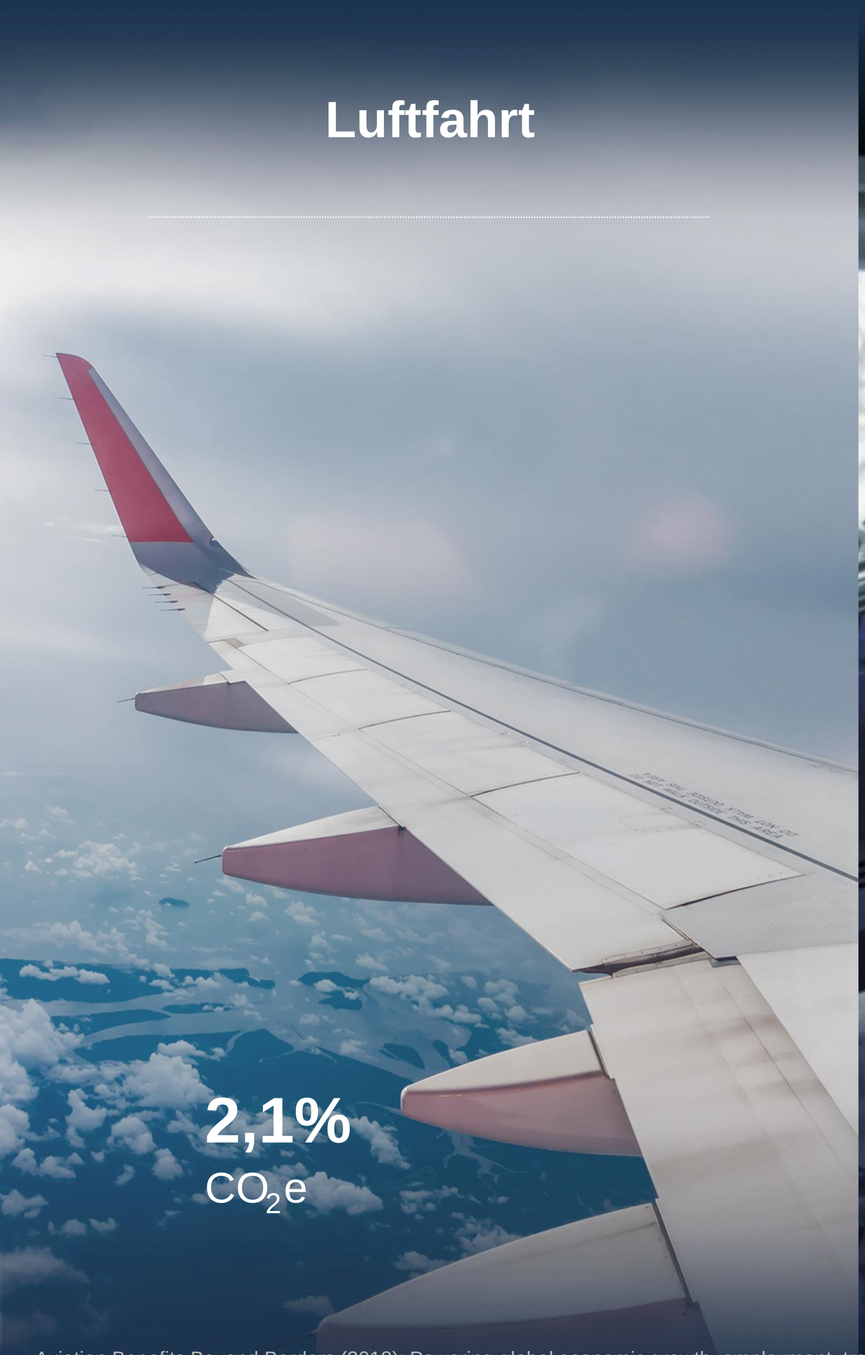
Quantifizierung des Therapieerfolgs

Einzigartig, granulares Register strukturierter Daten





Luftfahrt



2,1%
CO_2e

Gesundheitsbranche

4,4%
CO_2e

Schifffahrt

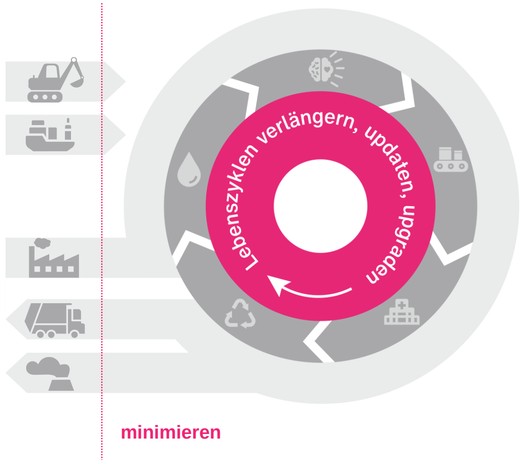
2,9%
CO_2e

Aviation Benefits Beyond Borders (2018): Powering global economic growth, employment, trade links, tourism and support for sustainable development through air transport. https://aviationbenefits.org/media/167517/aw-oct-final-atag_abbb-2020-publication-digital.pdf; International Maritime Organization (2020): Fourth IMO GHG Study 2020. Full Report. Fourth IMO GHG Study 2020 - Full report and annexes; Karliner, Josh et al. (2019): Health Care‘s Climate Footprint: How the Health Sector Contributes to the Global Climate Crisis and Opportunities for Action: Healthcare without Harm. https://noharm-global.org/sites/default/files/documents-files/5961/HealthCaresClimateFootprint_092319.pdf; Bilder von jannoon028 und tawatchai07 auf Freepikz

DEUTSCHER ZUKUNFTSPREIS

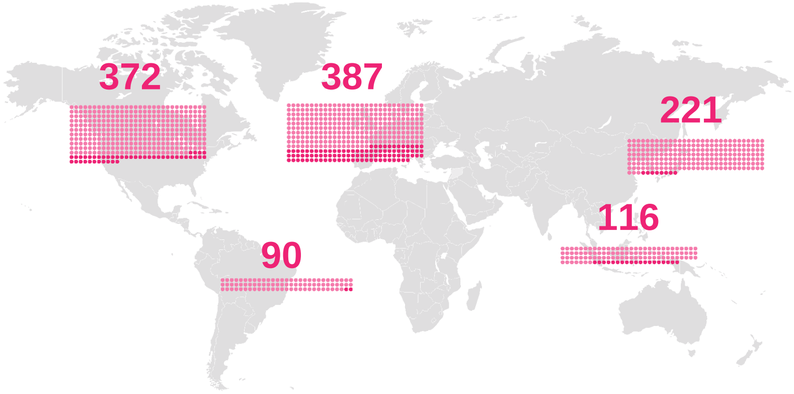
Nachhaltigkeit

Ökologisch
ExacTrac als Retrofit



Ökonomisch
Weniger Fraktionen & Energie

Sozial
ExacTrac für alle



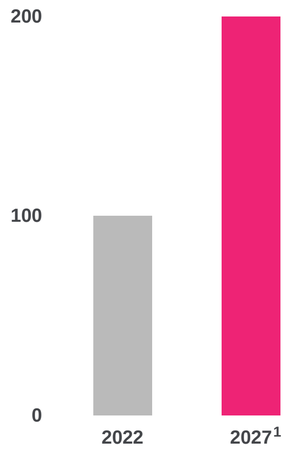
DEUTSCHER ZUKUNFTSPREIS

Wirtschaftlichkeit

Zukunftsstandort Deutschland

Umsatz

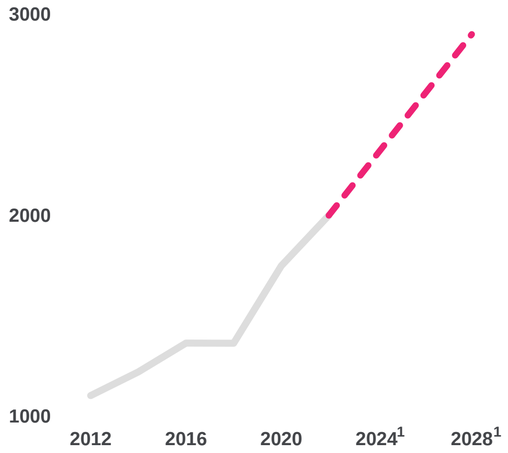
>1.000 installierte ExacTracs



100% Wachstum in 5 Jahren[1]

Mitarbeiter

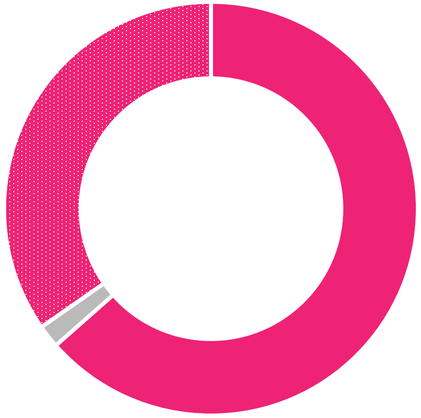
>700 Ingenieur:innen



+150 Neue Arbeitsplätze pro Jahr[1]

Eigentumsverhältnisse

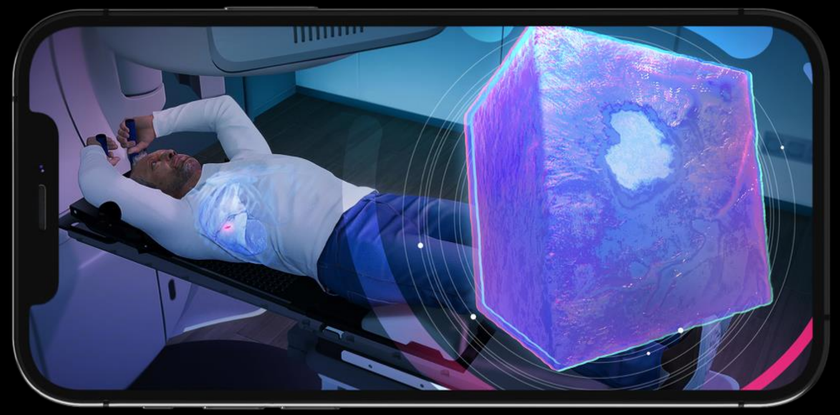
Inhabergeführt

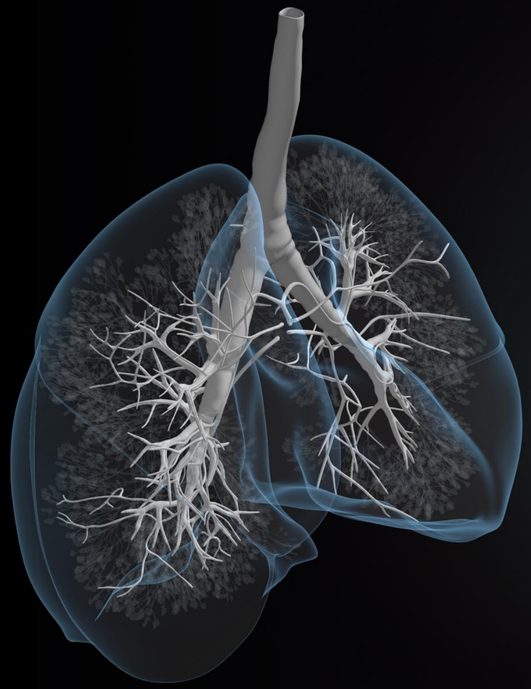


>90% Deutsche Aktionäre

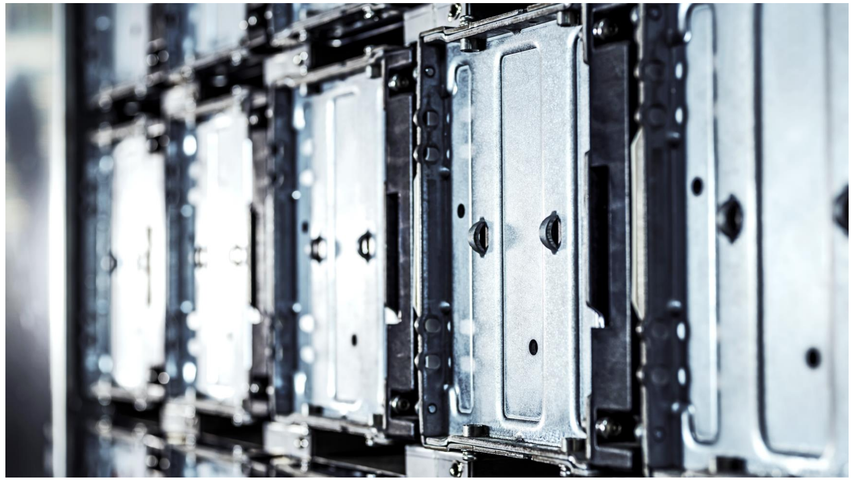
[1]Prognose: Installation weiterer 2.000 Systeme und Update von 70% der >1.000 Bestandsysteme; Eigentumsverhältnisse: 63,5% Management und assoziierte Parteien, 34,6% Finanzinvestoren und assoziierte Parteien, 1,9% aktuelle und ehemalige Mitarbeiter und assoziierte Parteien

DEUTSCHER
ZUKUNFTSPREIS





DEUTSCHER
ZUKUNFTSPREIS



NOMINIERT FÜR DEN DEUTSCHEN ZUKUNFTSPREIS 2022