

# EXACTRAC<sup>®</sup>

IMAGE-GUIDED RADIOTHERAPY

 BRAINLAB  
ExacTrac

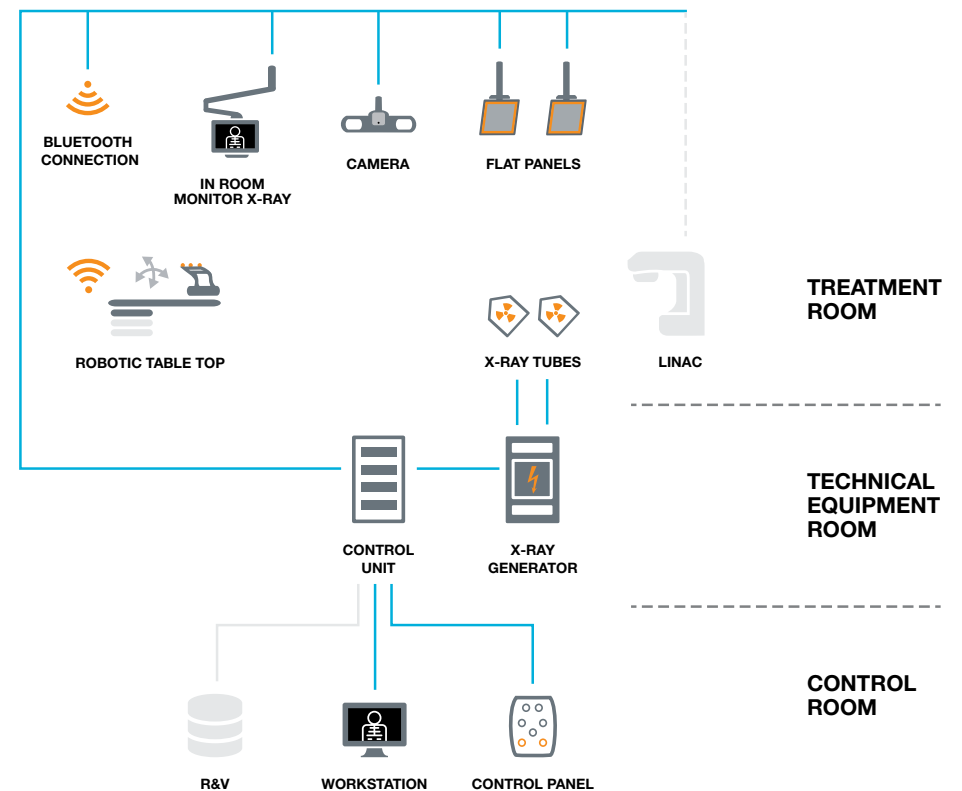
 BRAINLAB

# EXACTRAC IS

## ... A COMPLETE IGRT SYSTEM

ExacTrac® is a clinically proven platform for highly accurate patient positioning and tumor targeting. This highly automated image-guided radiotherapy (IGRT) system enables precise patient setup in a quick two-minute process. The room-based design offers continuous tracking of patient movement, including X-Ray verification, throughout the whole treatment, even at rotated table angles.

With ExacTrac, patients can be easily positioned and monitored with the system's integrated optical tracking system. In addition, the system uses high-resolution stereoscopic X-Ray images acquired before or during treatment delivery, or between fields, to instantly detect and visualize internal structures and their displacement. ExacTrac provides a proprietary 6D (x/y/z along with angular) fusion and robotic alignment in a quick, automated two-minute process. A selective, intelligent algorithm allows for the elimination of artifacts and ambiguities caused by objects not rigidly correlated to the target structure.



# EXACTRAC MONITORS

## ... WITH ITS ROOM-BASED IMAGING SYSTEMS

The ExacTrac imaging system consists of two kV X-Ray units recessed into the treatment room floor and two ceiling-mounted amorphous silicon flat panel detectors. The dual generators allow for true stereoscopic imaging of the target structure. With the possibility to acquire stereoscopic fluoroscopy sequences, ExacTrac provides the perfect setup for the visualization of respiratory motion. The integrated optical infrared tracking system continuously monitors patient positioning throughout treatment.



# EXACTRAC FACILITATES

## ... NON CO-PLANAR POSITIONING VERIFICATION

The challenge associated with gantry-based IGRT systems is to maintain the precision of the initial setup throughout the treatment session: mechanical inaccuracies from table rotation, random patient movement (even within the immobilization system), or organ movement may cause unpredictable and unnoticeable deviations. The fundamental architecture of ExacTrac allows for instantaneous imaging of internal structures (without moving any detectors or imaging units into position) anytime during beam-on, even at various table and gantry angles, unlike any other linac-based system.



# EXACTRAC POSITIONS

## ... IN ALL 6 DEGREES OF FREEDOM

A standard linac couch can correct patient position in four degrees of freedom. However, improved setup accuracy is necessary to avoid irradiation of critical structures, especially for head and neck, spine, prostate and other stereotactic radiosurgery (SRS) / stereotactic body radiotherapy (SBRT) cases. ExacTrac provides a fully integrated robotic module that allows for optimal patient positioning in all six degrees of freedom enabling an improved setup accuracy compared to translational corrections alone.<sup>1</sup> The carbon-fiber-imaging couch top ensures optimal quality of X-Ray images. With ExacTrac 6.0, both the couch and robotics motion can be enabled directly from the treatment console with no need to enter the treatment room.<sup>2</sup>



<sup>1</sup> Gevaert, T., et al. (2011). Clinical Evaluation of a Robotic 6-Degree of Freedom Treatment Couch for Frameless Radiosurgery. International journal of radiation oncology, biology, physics, 83(1), 467-474

# EXACTRAC INTEGRATES

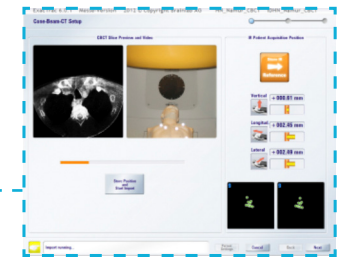
## ... CONE-BEAM CT POSITIONING

ExacTrac 6.0 provides, for the first time, the possibility to perform 6D patient positioning based on Cone-Beam CT (CBCT) images taken on a Varian OBI®. It automatically imports volumetric kV CBCT data sets into the ExacTrac software and performs an automatic 6D fusion to the pre-treatment CT images. The remote controlled treatment couch and robotic module allow for any shifts to be detected and compensated for from outside the treatment room. Afterwards any patient motion is monitored in real-time based on infrared markers attached to the patient's body.

ExacTrac CBCT integration provides an intuitive and streamlined workflow to perform a 6D patient alignment based on either X-Ray or CBCT images.

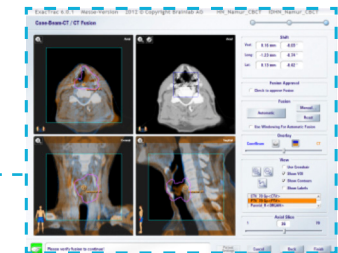
1 Start CBCT acquisition on Varian console

2 Store IR marker position



3 Automatic data import into ExacTrac

4 Automatic 6D image fusion



5 Remote 6D correction



# EXACTRAC ENABLES

## ... FRAMELESS RADIOSURGERY

The ExacTrac frameless radiosurgery system, in combination with ExacTrac robotics, offers highly accurate delivery of single fraction treatment without a conventional, invasive headring. A patient-friendly head-to-shoulder mask facilitates a streamlined workflow, overcoming the restrictions of frame-based radiosurgery and improving scheduling flexibility for imaging, planning and treatment.

Stereotactic sub-millimetric precision can be achieved with the patient's skull serving as localization geometry, allowing for single fraction radiosurgery.<sup>3</sup> The ExacTrac frameless system with its three-piece, non-invasive mask is compatible with couch tops from multiple vendors.

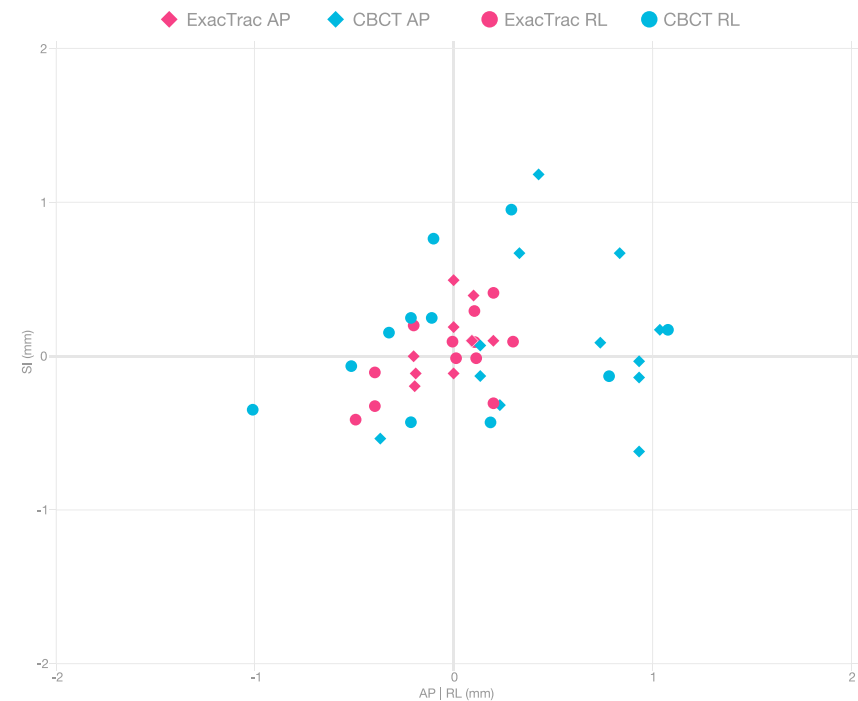


<sup>3</sup> Ramakrishna N. et al. A clinical comparison of patient setup and intra-fraction motion using frame-based radiosurgery versus a frameless image-guided radiosurgery system for intracranial lesions. *Radiotherapy and Oncology* 95, 109, 2010

# EXACTRAC PROVIDES

## ... CLINICAL CONFIDENCE

Brainlab has refined and revolutionized precise patient setup for stereotactic treatments for more than two decades. More than 1,000 centers have relied on Brainlab technology for cranial treatments, including more than 500 ExacTrac customers. ExacTrac precision is deeply embedded in all of its many facets: from refined installation procedures to ever-developing customer training to a vital network of experienced users. Today over one million frameless treatments have been performed with ExacTrac because leading institutions worldwide have confidence and trust in the benefits of the system. With ExacTrac 6.0, the intrinsic accuracy of the system has been pushed ever further with the ability to conduct a direct calibration to the radiation isocenter.



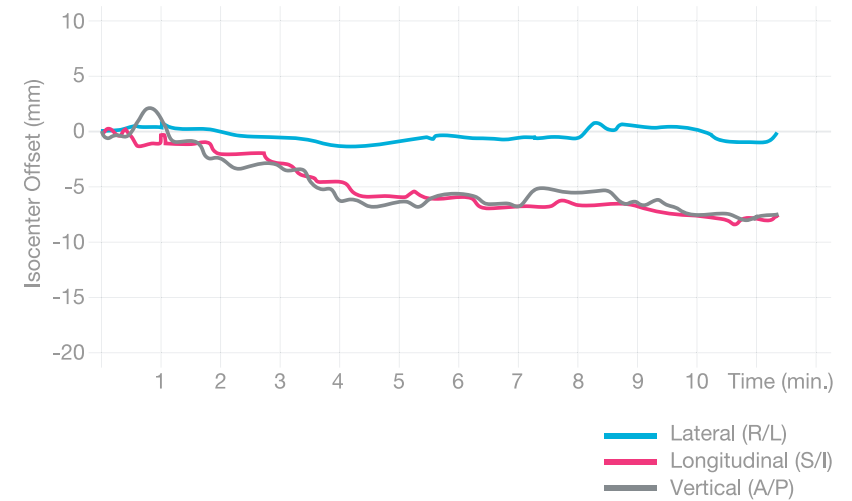
Source: Kim, J. et al. Image-guided localization accuracy of stereoscopic planar and volumetric imaging methods for stereotactic radiation surgery and stereotactic body radiation therapy: a phantom study. International journal of radiation oncology, biology, physics 79, 1588-96 (2011)



# EXACTRAC VERIFIES

## ... TUMOR POSITION

ExacTrac snap verification uses X-Ray images acquired during treatment delivery or between treatment fields to instantly detect and visualize internal tumor displacement. A threshold-based margin analysis algorithm indicates whether patient setup correction is recommended or not. ExacTrac automatic couch control can then be used to realign the patient remotely.

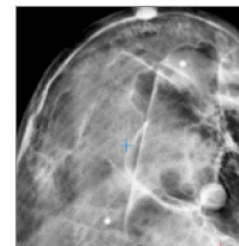


Possible drift of prostate from isocenter in 3D over a 10 min. treatment fraction

# EXACTRAC MEANS

## ... VERSATILITY

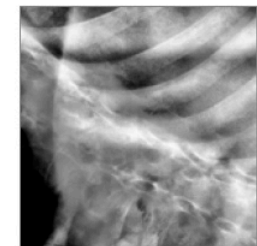
ExacTrac is a versatile IGRT system which enables users to easily and effectively setup patients with not only cranial and head and neck tumors, but also lesions in the lung, liver, prostate and other organs. The setup for cranial indications is performed based on bony anatomy, whereas extra cranial positioning can be based either on bony anatomy or internal markers that have been implanted prior to radiotherapy treatment. ExacTrac supports a wide range of implanted fiducials, such as short and long grains, stents and surgical clips. As an alternative, the system allows the positioning of the patient based on a virtual isocenter, which would generally be placed at a location with explicit bony landmarks.



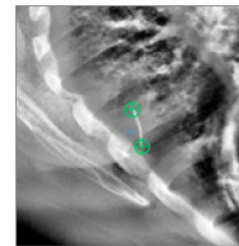
Cranium 19%



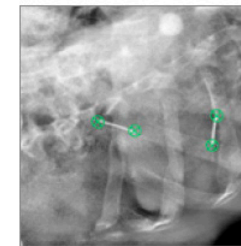
Head & Neck 14%



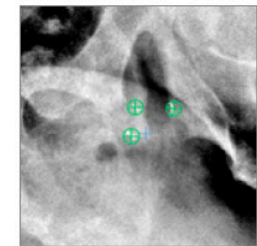
Spine 3%



Lung 13%



Liver 1%



Prostate 26%

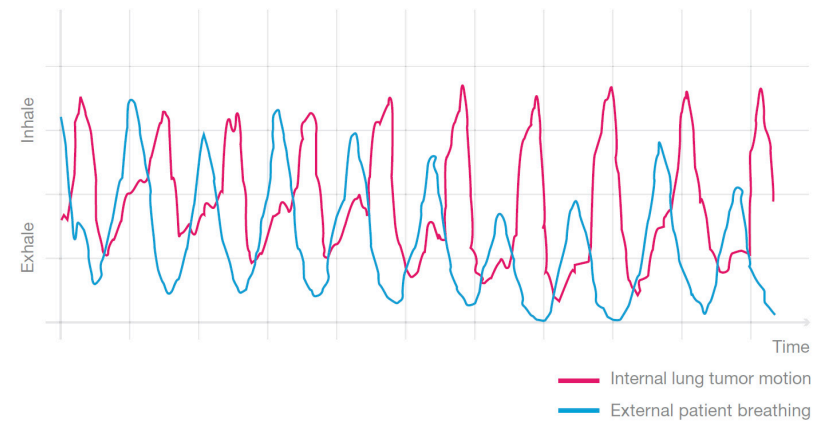
Numbers based on ExacTrac software usage statistics

# EXACTRAC GATES

## ... RESPIRATORY MOTION\*

A key principle in the evolution of radiotherapy has always been the reduction of normal tissue toxicity. Margins can only be reduced if respiratory baseline shifts and variations in a patient's external breathing patterns and internal tumor motion are correlated and accounted for using image guidance. For consistent, precise and safe gated treatment delivery, monitoring internal tumor position is essential before and during every gated treatment.

ExacTrac addresses respiration-induced tumor motion by uniquely combining continuous optical infrared patient tracking with X-Ray verification of the internal position via surrogates throughout the gated treatment. This lends confidence that daily respiration pattern changes and intra-fraction variation (e.g. breathing baseline shifts) are addressed.



Possible drift of breathing pattern of a lung patient during gated treatment

\* Gating module is currently not available in the EU

