



# Gamma Knife<sup>®</sup> surgery - preferred for a reason



ELEKTA

# Gamma Knife® surgery

## Preferred for a reason

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- Dedicated tool for intracranial radiosurgery
- Over 500,000 patients have undergone Gamma Knife surgery
- 50,000 treatments annually
- Documented clinical outcome (>2,500 published papers)



# Gamma Knife® surgery

## Preferred for a reason

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- Optimal tool for treating brain metastases (high tumor control rate)
- High efficiency - enable physicians to provide the best proven care in a single session
- Patient satisfaction  
- improving quality of life



# Gamma Knife<sup>®</sup> surgery

## Preferred for a reason

- Reliability - system accuracy 0.15 mm
- Guaranteed system up-time and lifetime accuracy\*
- Efficient workflow (requires low staffing)
- Cost effective treatment alternative
- High patient through-put
- Offering a complete product range for Gamma Knife surgery

\* *Service agreement*



# Saves cost and enhances quality of life



# Quality of life



- A non-invasive, single treatment session
  - ➔ Less trauma
  - ➔ Faster recovery
  - ➔ Minimal hospitalization
  - ➔ Fewer complications
- Documented efficacy

# Gamma Knife® surgery

## A documented treatment method

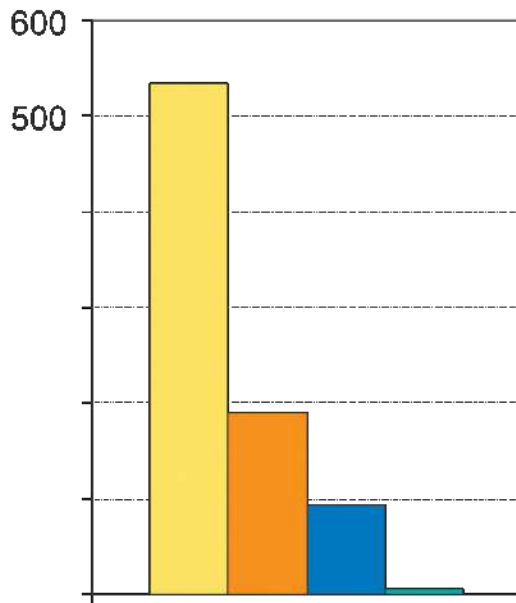
- In support of
  - Clinical excellence
  - Quality of care
  - Evidence based medicine

Clinically documented in over  
2,500 peer reviewed papers

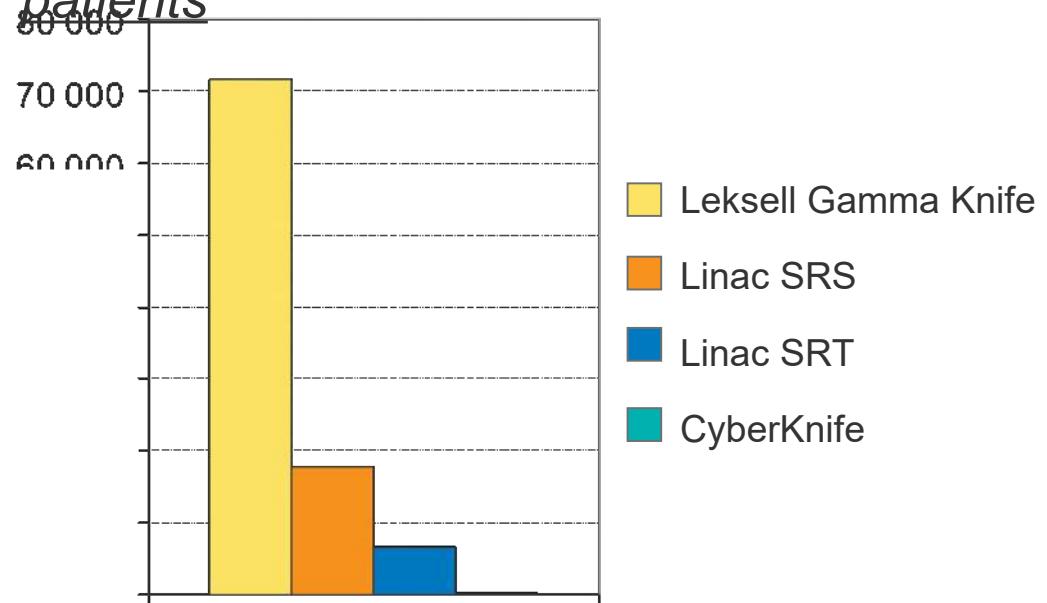
# Gamma Knife<sup>®</sup> surgery

## Clinical evidence

No. of studies



No. of patients

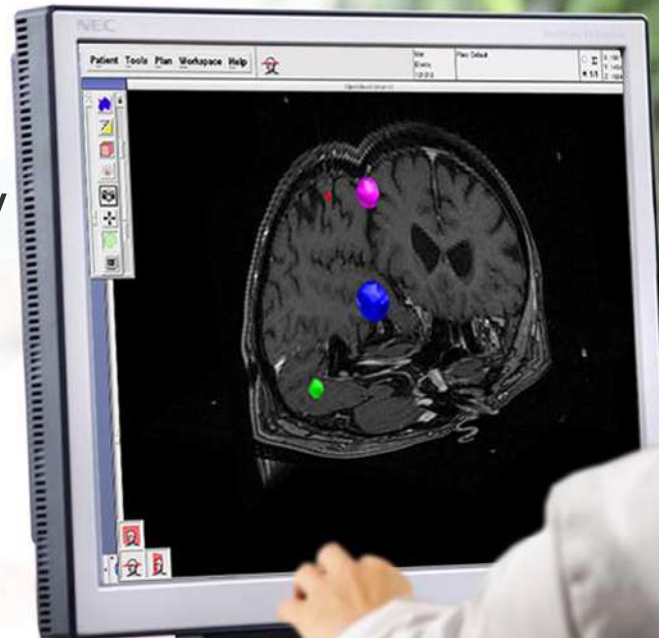


Medical publications with patient data (documenting >29 patients), covering the most important pathologies for intracranial radiosurgery. Accumulated data, Jan 2007



## Brain metastases – published papers

- The first report dates back to 1989
- Today some 300 papers discussing Gamma Knife surgery for brain metastases
- 99 papers reporting over 13,900 patients in various studies 2001-2006
- The largest single pathology being published for Gamma Knife surgery



# Leksell Gamma Knife®

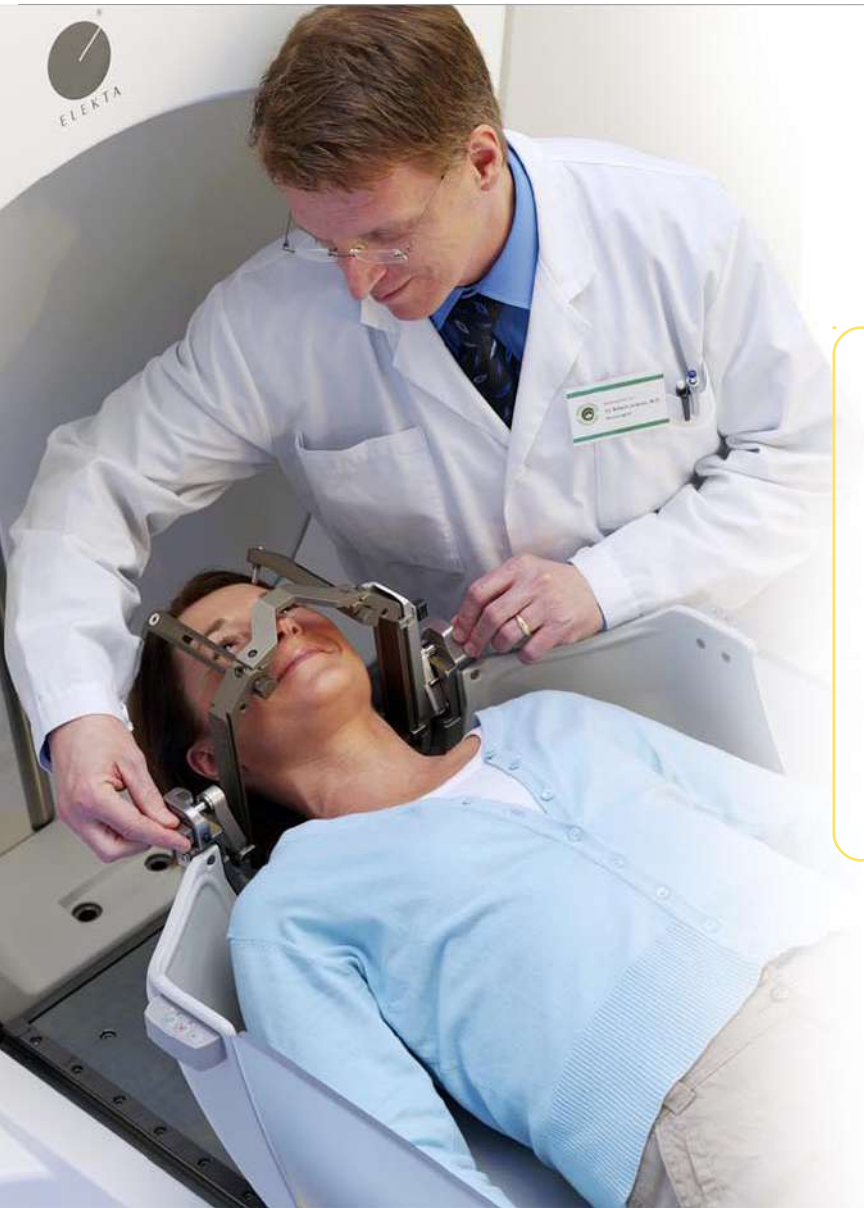
## Accuracy in every step



- Leksell Gamma Knife® – the only true stereotactic system
- Leksell® Coordinate Frame securely fixates the patient's head throughout the procedure
- Accuracy of 0.15 mm
  - proved by a study based on 332 commissioning protocols
- Elekta only provider of certified accuracy



# Gamma Knife<sup>®</sup> surgery



The delivery of a single, high dose of irradiation to a small and critically located intracranial volume through the intact skull

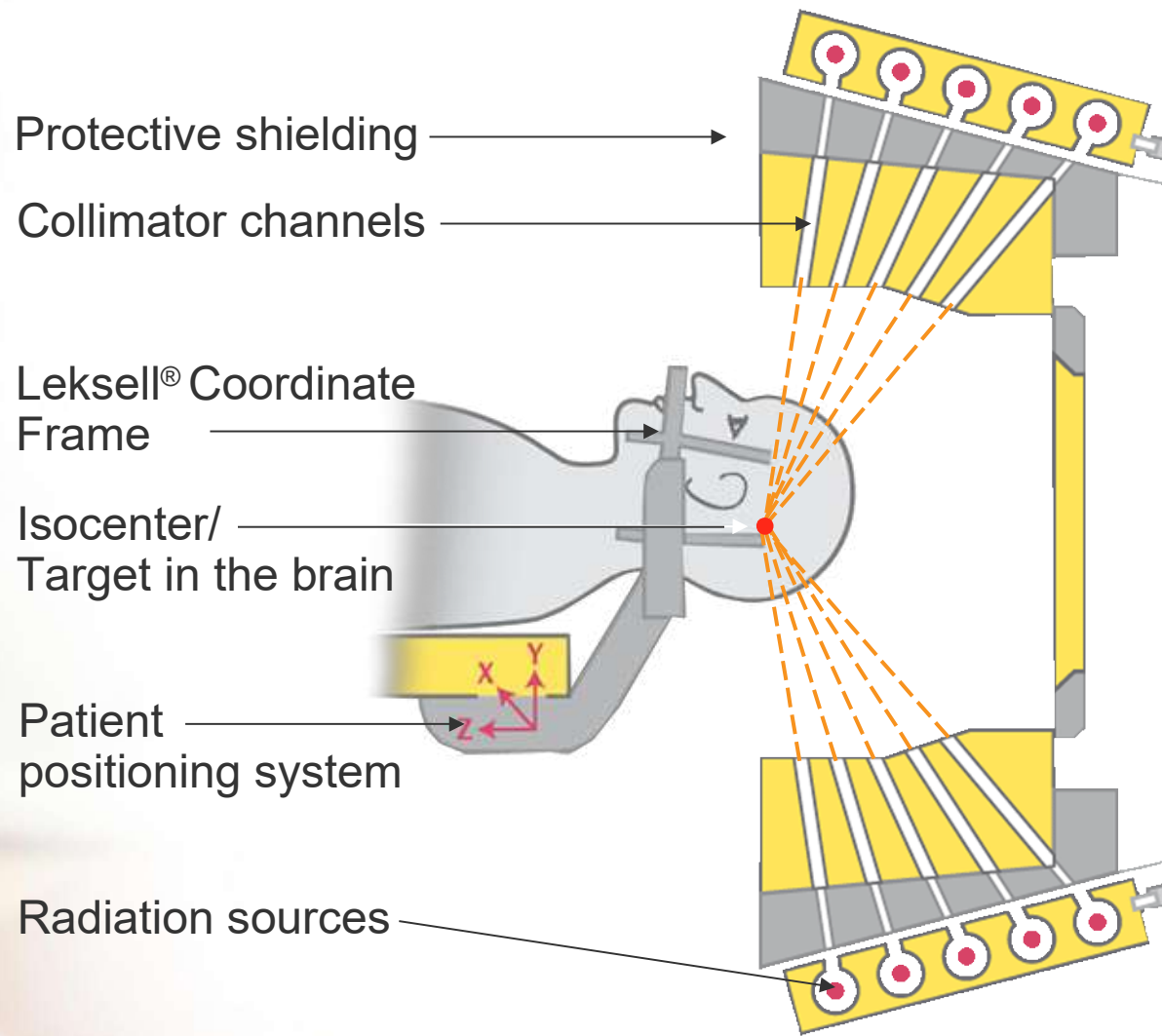
# Fundamental of Gamma Knife<sup>®</sup> surgery



- Non-invasive brain surgery
- Single-session treatment
- Locate and irradiate targets with extremely high precision and accuracy
- Multiple beams of radiation converging in three dimensions to focus on a target
- Intense dose of radiation delivered to the target volume
- Minimal exposure to healthy tissue from each individual beam

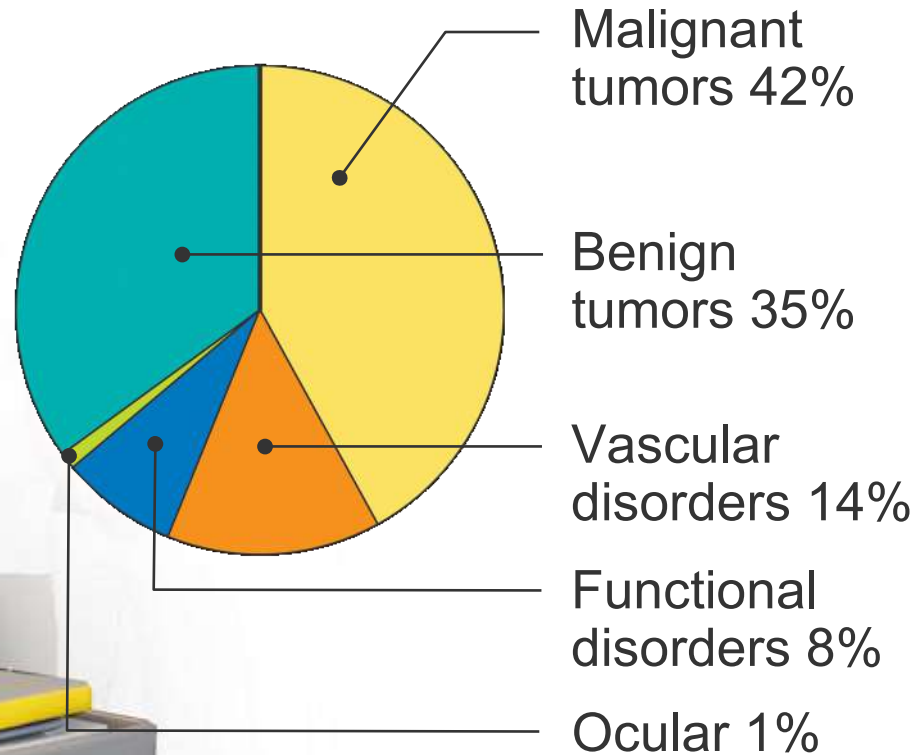


# Gamma Knife<sup>®</sup> surgery - principles



# Treated with Leksell Gamma Knife®

Neurological disorders\*

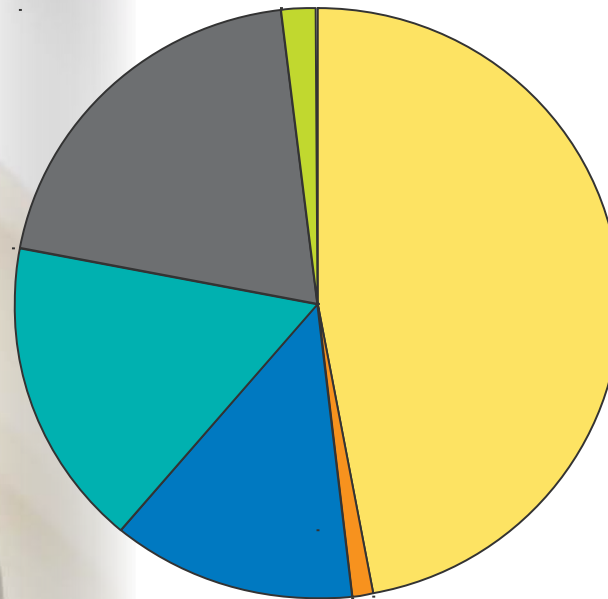
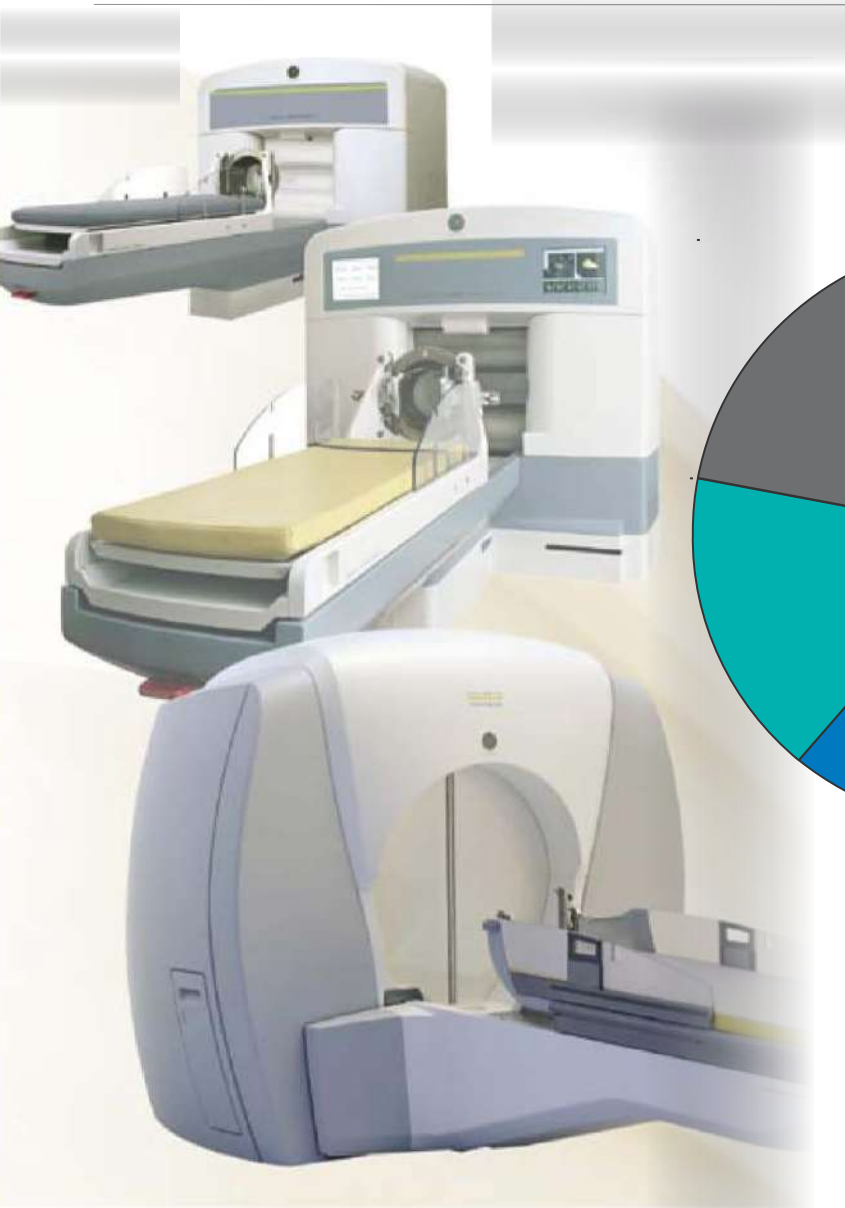


Over 500,000 patients treated  
- expanding by 50,000 annually

\* Approval of indications may vary between different countries

# Leksell Gamma Knife®

252 systems installed worldwide, August 2007



- Europe
- North America
- Latin America
- Middle East
- Asia
- Japan

# Leksell Gamma Knife®

## Offering a complete product range

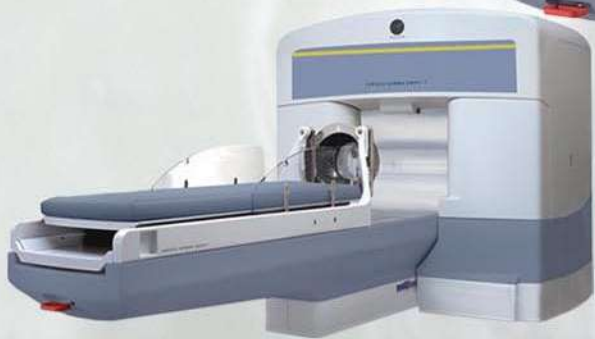
Leksell Gamma Knife® Perfexion™



Leksell Gamma Knife® 4C



Leksell Gamma Knife® 4





# Leksell Gamma Knife® - 4, 4C and Perfexion™

## Overview of product benefits

	4	4C	Perfexion
<b>All clinical evidence of Gamma Knife surgery</b>	✓	✓	✓
<b>Patient comfort</b>	Manual patient positioning.	Semi-automatic system.	Fully automated system.
<b>Ease-of-use</b>	Manual adjustments for each shot.	Automatic shot placement.	Fully automated system - single button approach.
<b>Time in treatment room*</b>	84 min. / patient**	62 min. / patient	35 min. / patient
<b>Treatable volume</b>	Cranial	Cranial	Extended cranial reach. Ready for neck and cervical spine.
<b>Patient case load</b>	Low patient volume clinics	Medium	High

\* Typical time in the treatment room for similar plans. Including setup, handling and beam-on.

\*\* Data based on treatments with Leksell Gamma Knife B

Neurosurgery, volume 61, Sept 07. Christer Lindquist, MD and Ian Paddick. MSc, Cromwell Hospital, London, UK.

# Leksell Gamma Knife<sup>®</sup> - 4, 4C and Perfexion<sup>™</sup>

## Overview of technical aspects

	<b>4</b>	<b>4C</b>	<b>Perfexion</b>
<b>Patient positioning system</b>	Manual adjustments.	APS (Automatic Positioning System <sup>™</sup> )	Fully automated system - single button approach.
<b>Collimator configuration</b>	Manual adjustments.	Manual adjustments.	Fully automated system - single button approach.
<b>Collimator sizes</b>	4, 8, 14 and 18 mm	4, 8, 14 and 18 mm	4, 8 and 16 mm
<b>Accuracy</b>	0.15 mm	0.15 mm	0.15 mm
<b>Check and verify system</b>	Basic functions	Most parameters	All functions
<b>QA procedure</b>	Manual	Semi-automatic	Automatic

# Leksell Gamma Knife® Perfexion™

*The ultimate tool  
for cranial surgery*



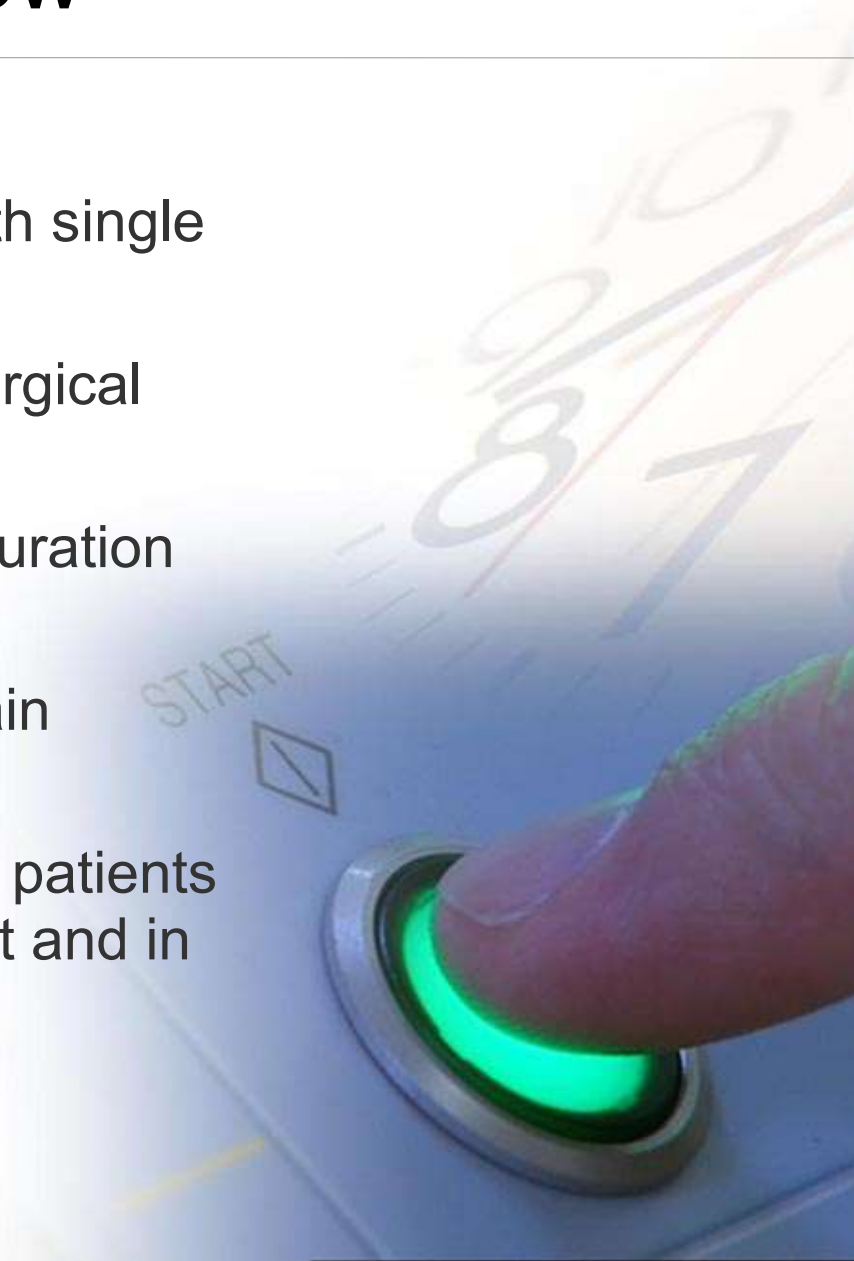
# Leksell Gamma Knife® Perfexion™



# Leksell Gamma Knife® Perfexion™

## Optimized workflow

- Fully automated system with single button approach
- Faster and more flexible surgical procedures
- Automatic collimator configuration occurs in seconds
- Optimal tool for treating brain metastases
- Enables substantially more patients to be treated with less effort and in shorter time



# Leksell Gamma Knife® Perfexion™

Perfecting the art and science of radiosurgery

- Represents the future of stereotactic radiosurgery
- Expanded treatment volume enables more cases in the cranial region
- Designed for neck and cervical spine treatments



# Leksell Gamma Knife® Perfexion™

Perfecting the art and science of radiosurgery

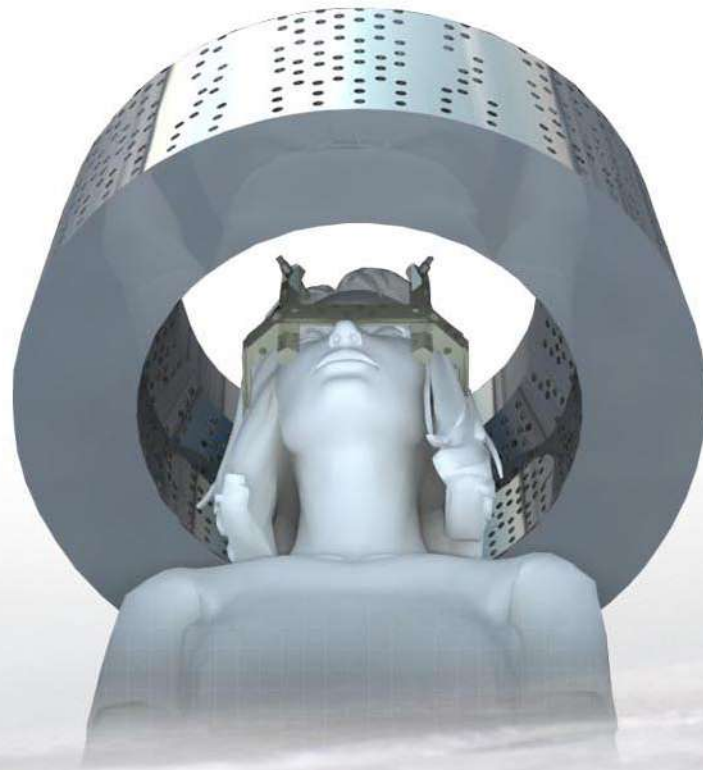
- Powerful and intuitive treatment planning with Leksell GammaPlan® PFX
- Unlimited dose sculpting using composite shots and dynamic shaping
- Radiation protection up to 100 times better than other technologies



# Leksell Gamma Knife® Perfexion™

## Expanding the clinical use

- Increased treatable volume by more than 300% (compared to other Leksell Gamma Knife systems)
- Cerebral cases
  - increase in available number of patients for existing indications due to extended reachability
- Designed for head & neck
  - additional patients from lesions in paranasal sinuses, orbits and some upper cervical lesions
- Cervical lesions
  - additional patients with upcoming fixation technique





Leksell Gamma Knife® Perfexion™

# Heart of system - Collimator body



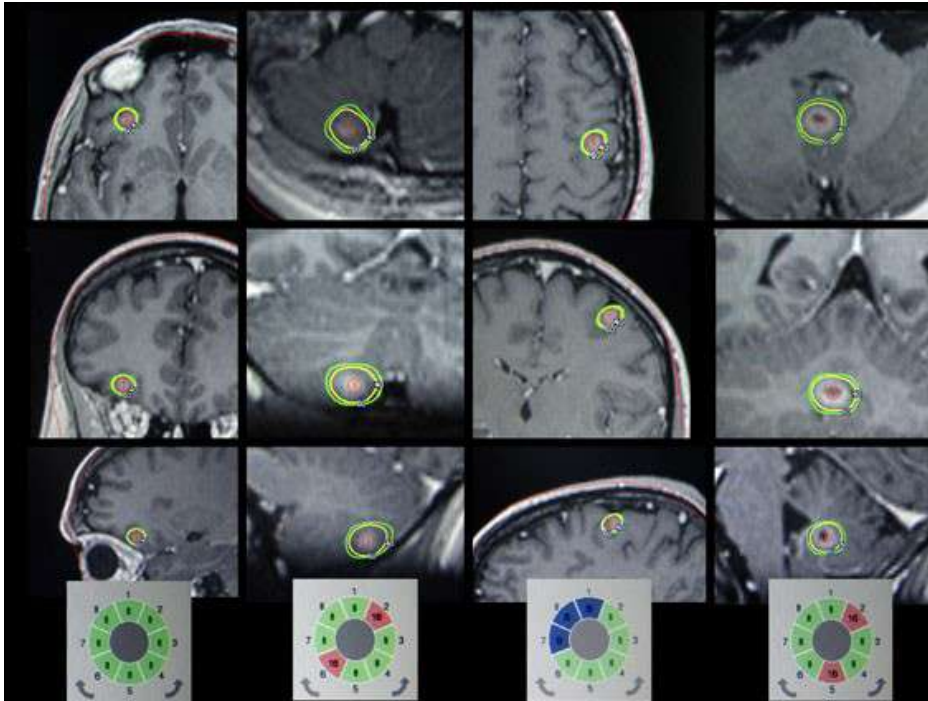
Leksell Gamma Knife® Perfexion™

# Initiating the perfect workflow



# Leksell Gamma Knife® Perfexion™

## Four brain mets in less than 2 hours



Four brain metastases  
eccentrically located  
(frontal anterior, far lateral  
and posterior fossa).

*Courtesy of University Hospital La Timone,  
Marseille, France*



**1** Frame attachment  
(10 min)



**2** Imaging - MR  
(20 min)



**3** Treatment planning  
(20 min)

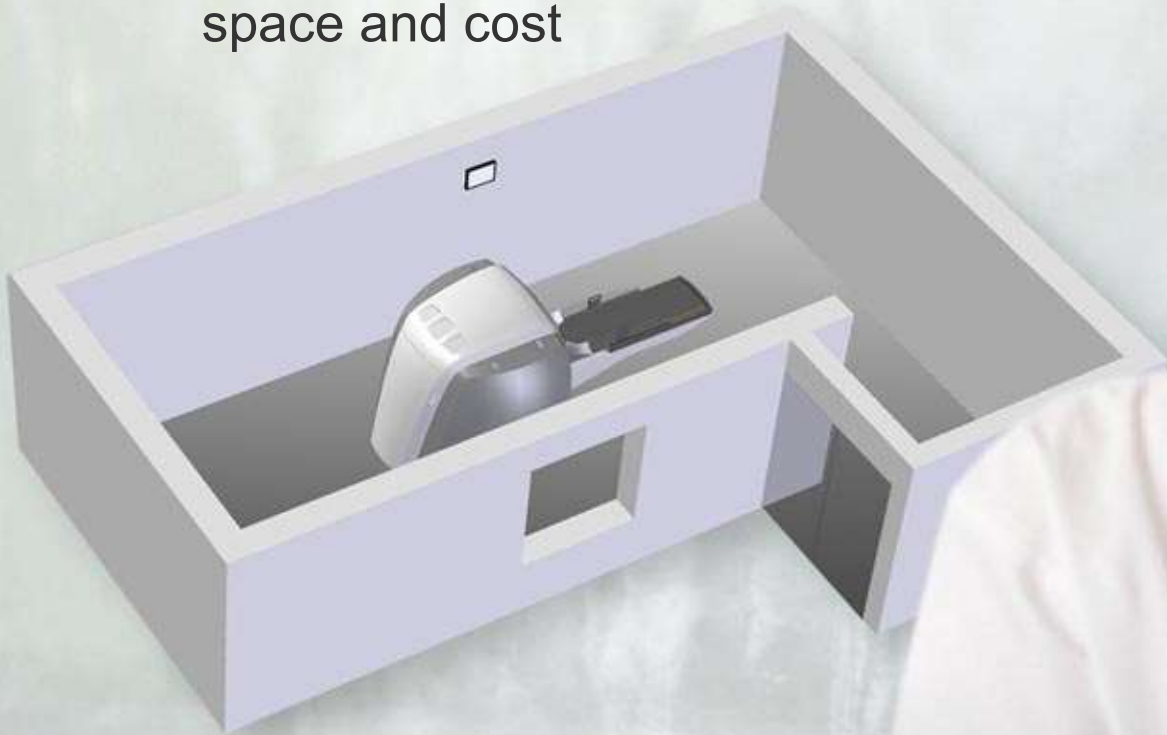


**4** Single treatment  
session (60 min)

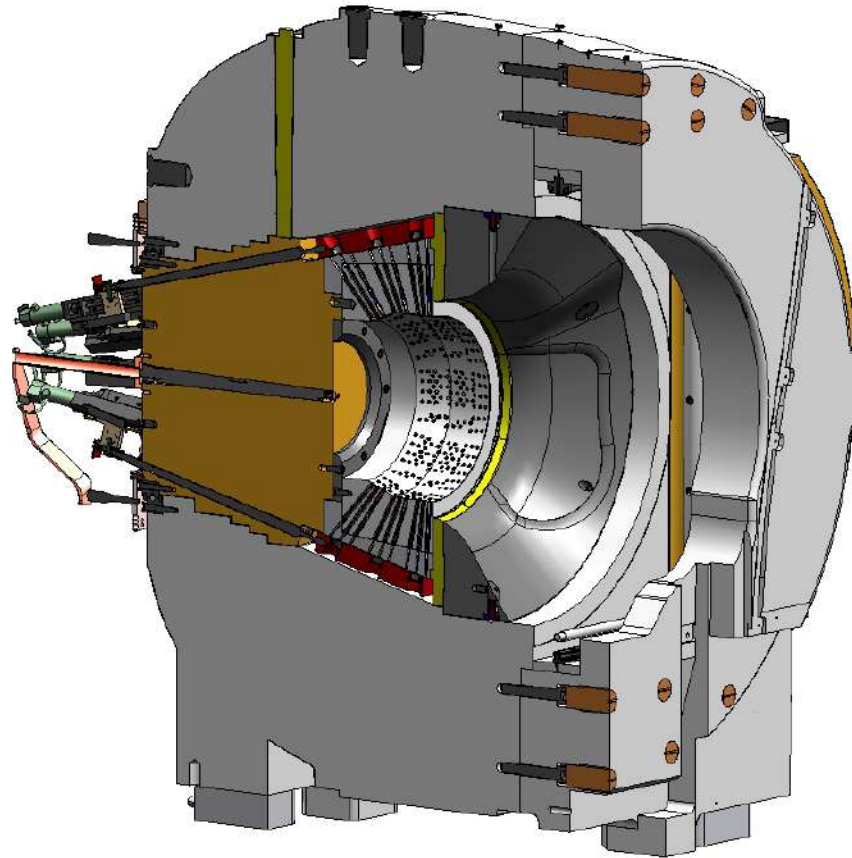
# Leksell Gamma Knife® Perfexion™

## Best radiation protection

- Body doses up to 100 times lower, compared to alternative technologies
- Leakage levels low enough to allow for a window in the operating room
- Room design can be optimized to space and cost



# Leksell Gamma Knife® Perfexion™ Radiation unit



# Leksell Gamma Knife<sup>®</sup> 4C

*Meets the highest  
demands of performance  
and efficiency*



# Leksell Gamma Knife<sup>®</sup> 4C

- Offers all the benefits of Gamma Knife<sup>®</sup> surgery
- Designed for clinics with a strong patient caseload
- APS (Automatic Positioning System<sup>™</sup>) - for optimized clinical outcome
- Provides fast and smooth workflow
  - Shorter treatment time
  - Enhanced patient comfort



# Leksell Gamma Knife<sup>®</sup> 4C

- Meets the highest demands of performance and efficiency
- High accuracy (0.15 mm)
- Powerful and intuitive treatment planning with Leksell GammaPlan<sup>®</sup>
  - Including remote planning, multi users and patient database access
- Dual built-in monitors with system user interface





# Leksell Gamma Knife<sup>®</sup> 4

*All the benefits of  
Gamma Knife<sup>®</sup> surgery  
for the basic needs*



# Leksell Gamma Knife<sup>®</sup> 4

Making Gamma Knife<sup>®</sup> surgery available

- All the clinical benefits of Gamma Knife surgery
- Delivers the highest levels of treatment efficacy
  - for all intracranial radiosurgery indications, including those limited on other technologies - by lack of precision
- Developed to meet the exacting demands of clinics with a small patient caseload
  - low break even volumes
  - ensure excellent profitability even with lower volumes



# Leksell Gamma Knife<sup>®</sup> 4

High level of clinical outcome

- True Gamma Knife<sup>®</sup> surgery with Leksell<sup>®</sup> Stereotactic Coordinate Frame fixation
- Provides high accuracy (0.15 mm)
- Powerful and intuitive treatment planning with Leksell GammaPlan<sup>®</sup>
  - Including remote planning, multi users and patient database access



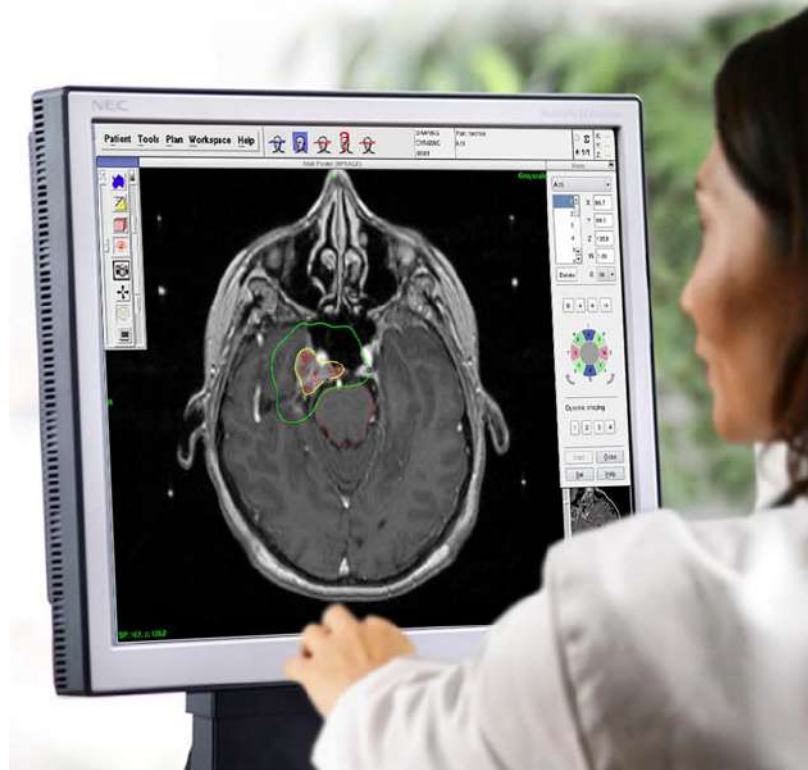
# Leksell GammaPlan®

- a dedicated treatment planning tool



# Leksell GammaPlan®

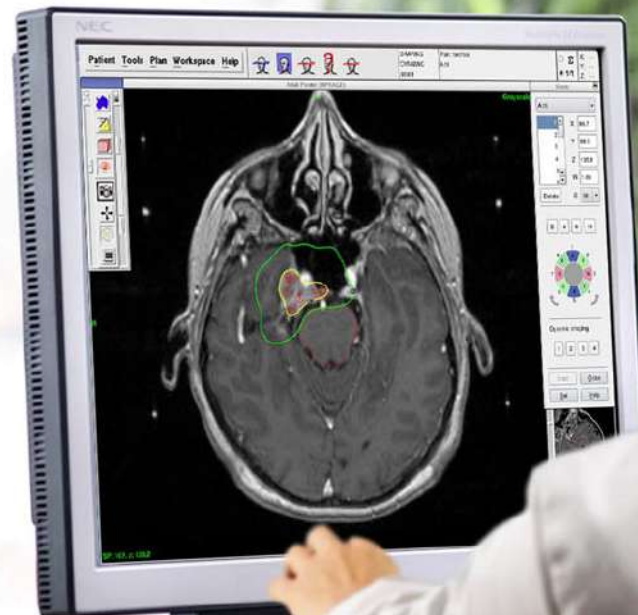
- Intuitive treatment planning tool for Leksell Gamma Knife®
- Available for:
  - Leksell Gamma Knife® Perfexion™
  - Leksell Gamma Knife® 4C
  - Leksell Gamma Knife® 4
  - Leksell Gamma Knife® C
  - Leksell Gamma Knife® B



## Scaling up treatment planning

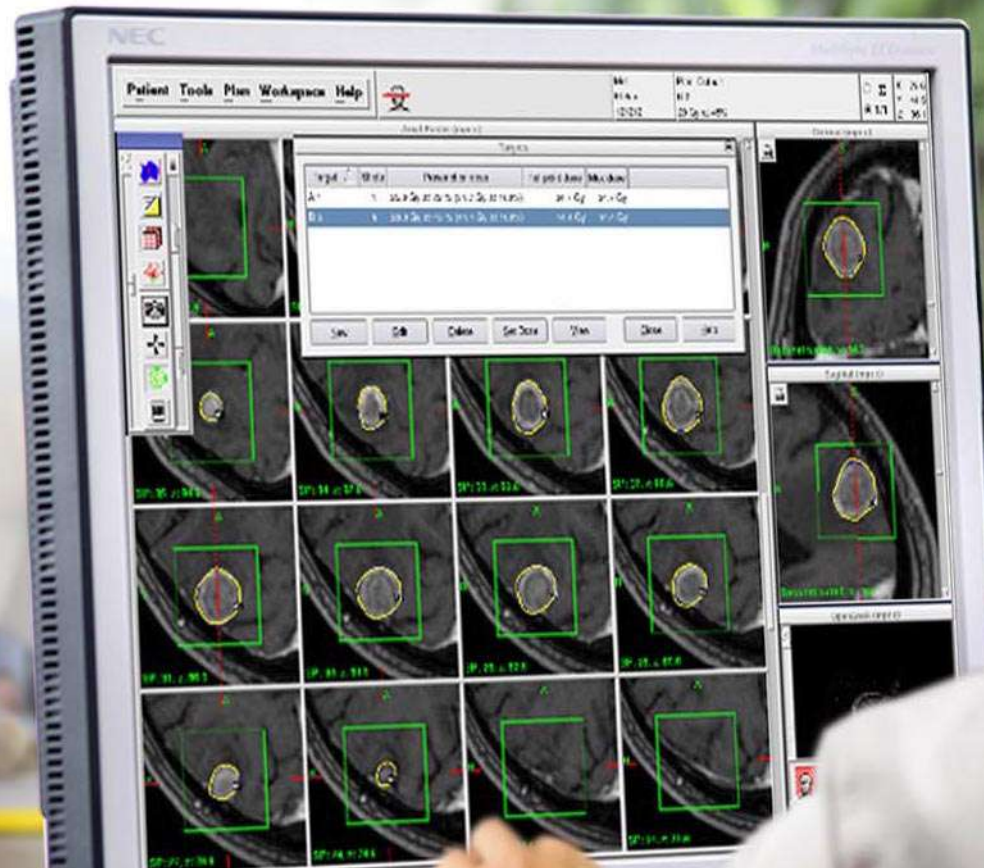
- Dedicated for neurosurgical applications
- Easy to plan multiple lesions
- Remote planning, multi-user access
- Instant access to database
- Online collaboration with affiliated clinics
- Remote imaging\*
- Flexibility to plan days before surgery\*
- Easy to follow-up and retreat patients\*
- Functional planning using AC-PC line\*

\* Optional features depending on Leksell Gamma Knife® model



Leksell GammaPlan®

# Efficient planning of multiple targets



Based on a new patented algorithm, using automatic balancing of radiation dose

# Treatment of more than 20 brain metastases in a few hours



Courtesy of Cromwell Hospital, London, UK





Target	Shots	Prescription dose	Ref point dose	Max dose
A:1Rf1	1	25.0 Gy at 75 % (33.3 Gy at 100%)	33.3 Gy	33.3 Gy
B:2Lf1	1	25.0 Gy at 70 % (35.7 Gy at 100%)	35.7 Gy	36.0 Gy
C:3Lf2	1	25.0 Gy at 90 % (27.8 Gy at 100%)	27.8 Gy	30.8 Gy
D:4Rf2	2	25.0 Gy at 55 % (45.5 Gy at 100%)	45.5 Gy	45.6 Gy
E:6Rf4	1	25.0 Gy at 80 % (31.2 Gy at 100%)	31.3 Gy	31.5 Gy
F:7Lf3	1	18.0 Gy at 85 % (21.2 Gy at 100%)	21.2 Gy	39.6 Gy
G:8Rf5	1	25.0 Gy at 90 % (27.8 Gy at 100%)	27.8 Gy	28.0 Gy
H:9Rf6	1	25.0 Gy at 85 % (29.4 Gy at 100%)	29.4 Gy	29.4 Gy
I:10Lf4	1	20.0 Gy at 50 % (40.0 Gy at 100%)	40.0 Gy	40.1 Gy
J:11Lf5	1	25.0 Gy at 85 % (29.4 Gy at 100%)	29.4 Gy	29.4 Gy
K:12Lf6	1	25.0 Gy at 90 % (27.8 Gy at 100%)	27.8 Gy	27.9 Gy
L:13Rf7	1	25.0 Gy at 90 % (27.8 Gy at 100%)	27.8 Gy	27.9 Gy
M:14Rf8	1	25.0 Gy at 90 % (27.8 Gy at 100%)	27.8 Gy	27.8 Gy
N:15Rp1	2	25.0 Gy at 80 % (31.2 Gy at 100%)	31.3 Gy	31.3 Gy
O:17Rp3	1	25.0 Gy at 90 % (27.8 Gy at 100%)	27.8 Gy	27.8 Gy
P:18Rf9	1	25.0 Gy at 82 % (30.5 Gy at 100%)	30.5 Gy	30.5 Gy
Q:19Lp1	1	25.0 Gy at 90 % (27.8 Gy at 100%)	27.8 Gy	27.8 Gy
R:20Lbg1	1	25.0 Gy at 90 % (27.8 Gy at 100%)	27.8 Gy	27.8 Gy
S:21Lt1	1	25.0 Gy at 90 % (27.8 Gy at 100%)	27.8 Gy	27.8 Gy
T:22Lt2	1	25.0 Gy at 90 % (27.8 Gy at 100%)	27.8 Gy	27.8 Gy
U:23Rt1	1	25.0 Gy at 90 % (27.8 Gy at 100%)	27.8 Gy	28.3 Gy
V:24Lt3	1	25.0 Gy at 75 % (33.3 Gy at 100%)	33.3 Gy	33.3 Gy
W:25Rt2	1	25.0 Gy at 85 % (29.4 Gy at 100%)	29.4 Gy	29.4 Gy
X:26Rt3	1	25.0 Gy at 70 % (35.7 Gy at 100%)	35.7 Gy	35.9 Gy

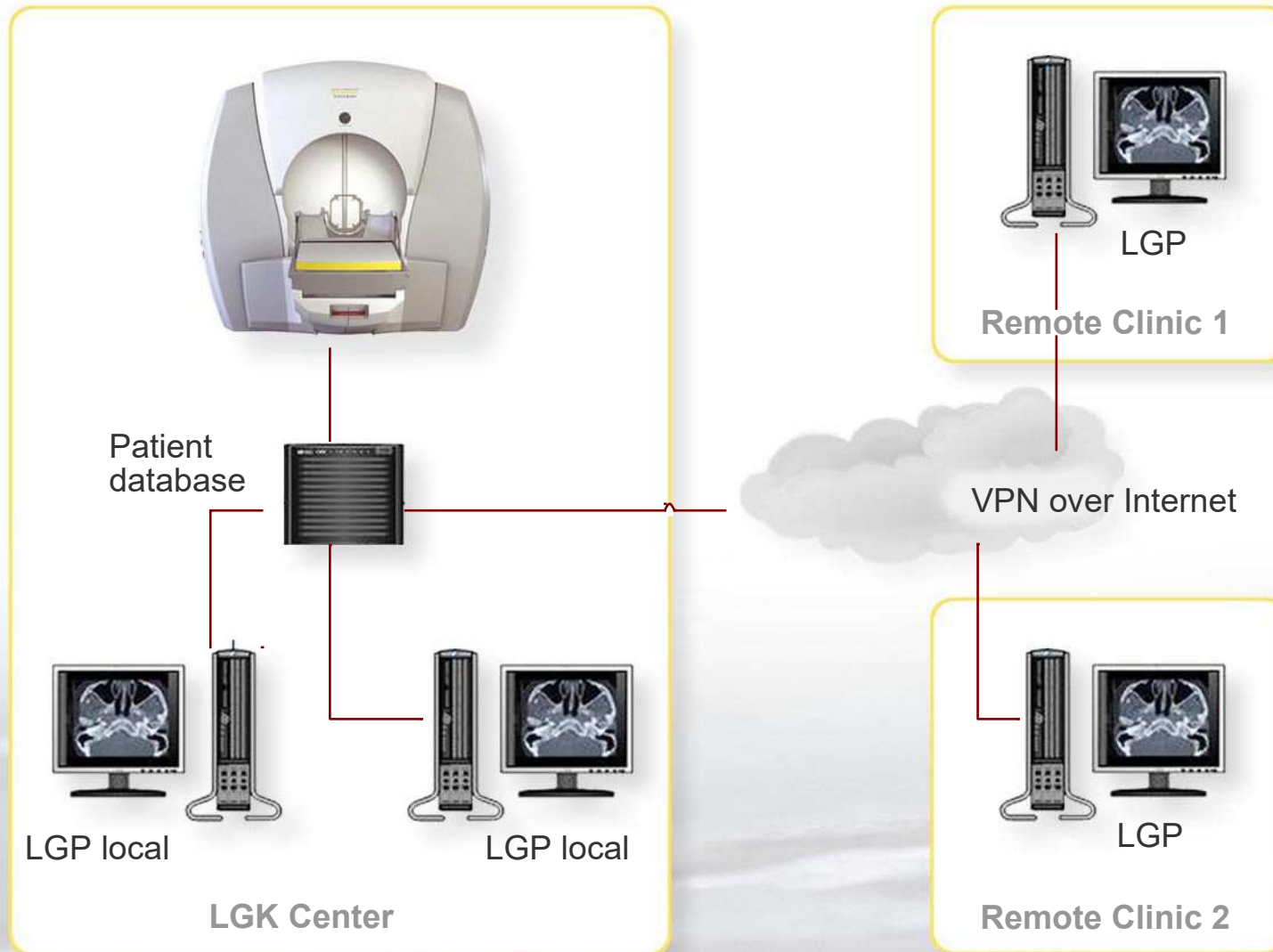
Buttons: New, Edit, Delete, Set Dose, View, Close, Help

Prescription of optimal dose for each individual multiple target.

*Patented technology*

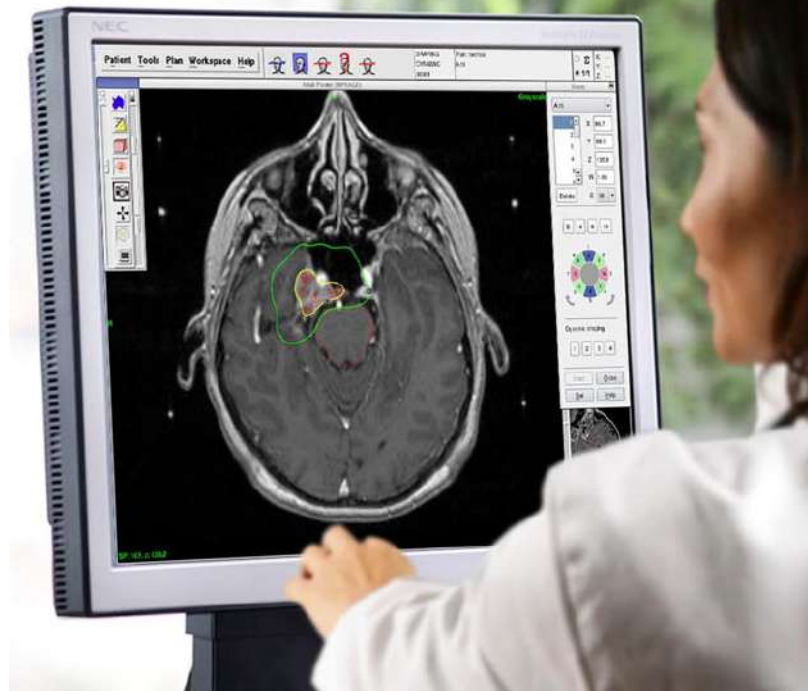


# Leksell GammaPlan® Remote capability



# Leksell GammaPlan®

- Supports all imaging modalities (CT, MR, angio, PET and MEG)
  - including images without fiducials
- PC platform with Linux OS
- Flexibility and cost efficiency in planning - allows image studies from remote centers
- Instant access to online patient database
  - 250 GB, scalable up to 1.5 TB
  - approx. 30,000 patients
- Real time dose calculation



# Leksell GammaPlan® Image co-registration



## Image fusion and alignment

Co-registered non-fiducial study

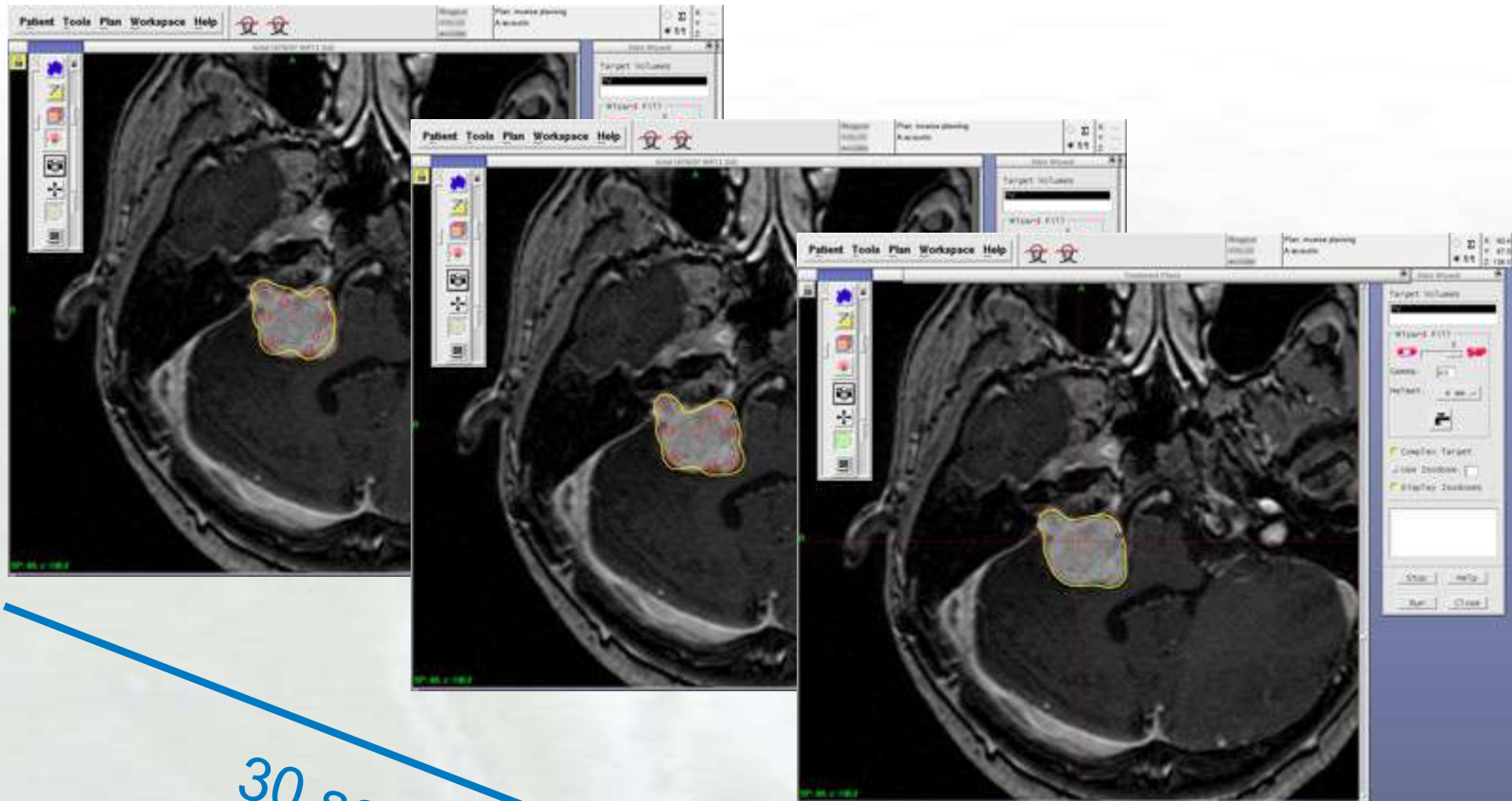
Stereotactic  
reference  
study



Fused  
(aligned co-reg. study)

# Leksell GammaPlan® Wizard™

## Inverse planning

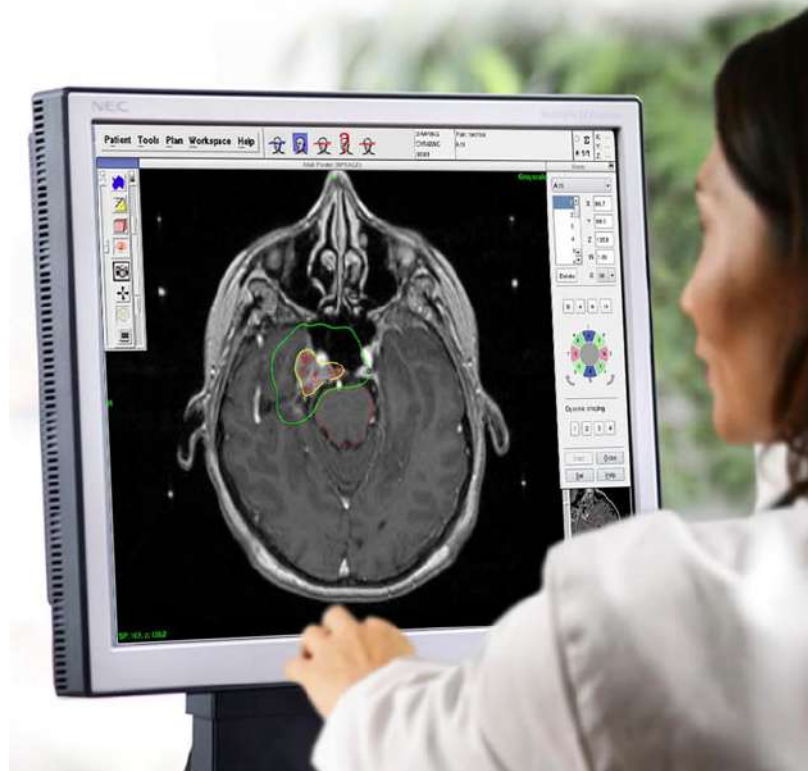


30 seconds

Interactive, real-time treatment plan optimization

## Providing exclusive features

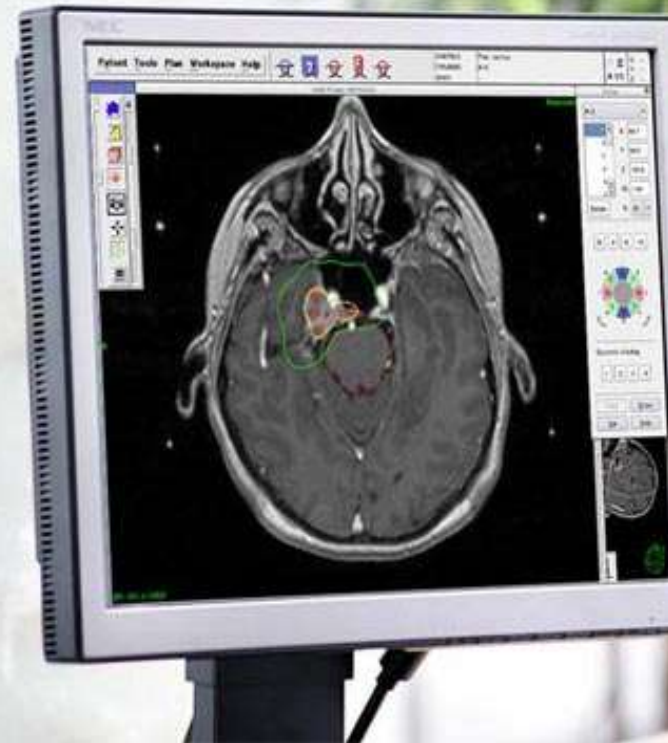
- The most sophisticated treatment planning systems on the market - based on decades of experience and successful clinical outcome
- Dedicated for Leksell Gamma Knife® Perfexion™
- Optimized for planning multiple metastases
- Unlimited dose sculpting - using composite shots and dynamic shaping



# Leksell GammaPlan® for Leksell Gamma Knife Perfexion

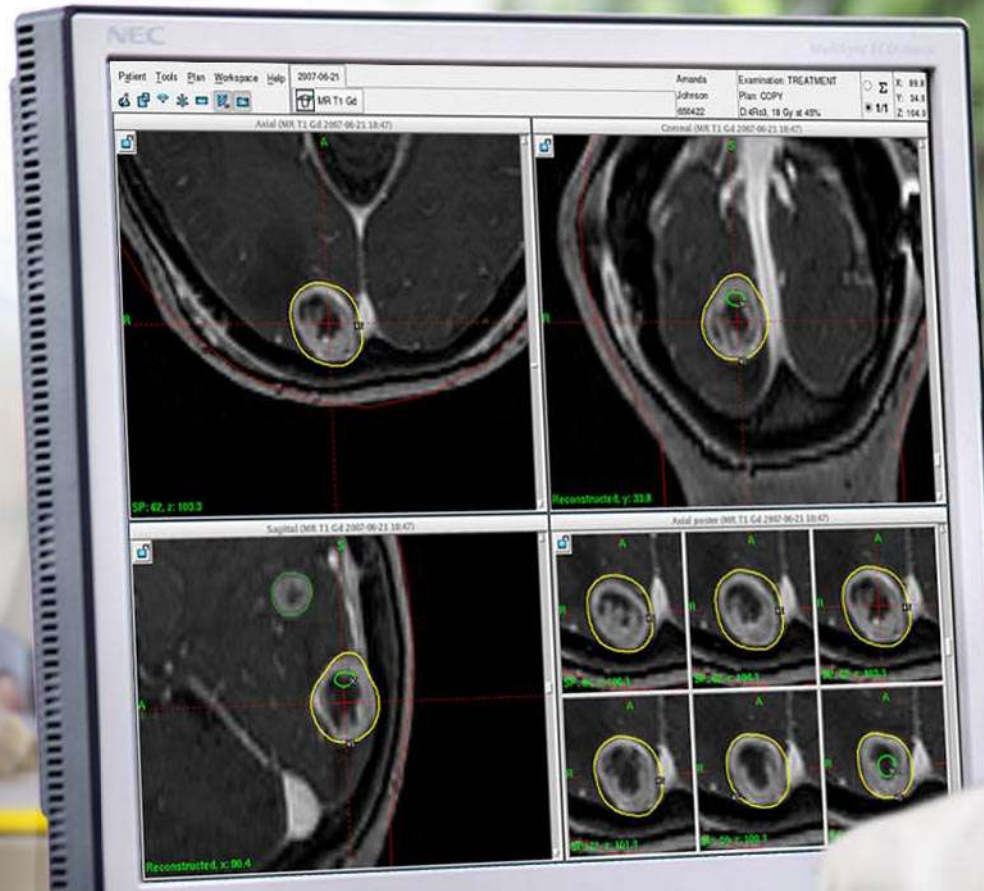
## Outstanding dosimetry

- Dose performance
  - Patented collimator design provides almost unlimited ability for sculpting the dose distribution
  - Optimized design guarantees full backwards compatibility to existing Gamma Knife surgery protocols and methods
- Shot features enabled
  - Classic
  - Composite
  - Dynamic shaping





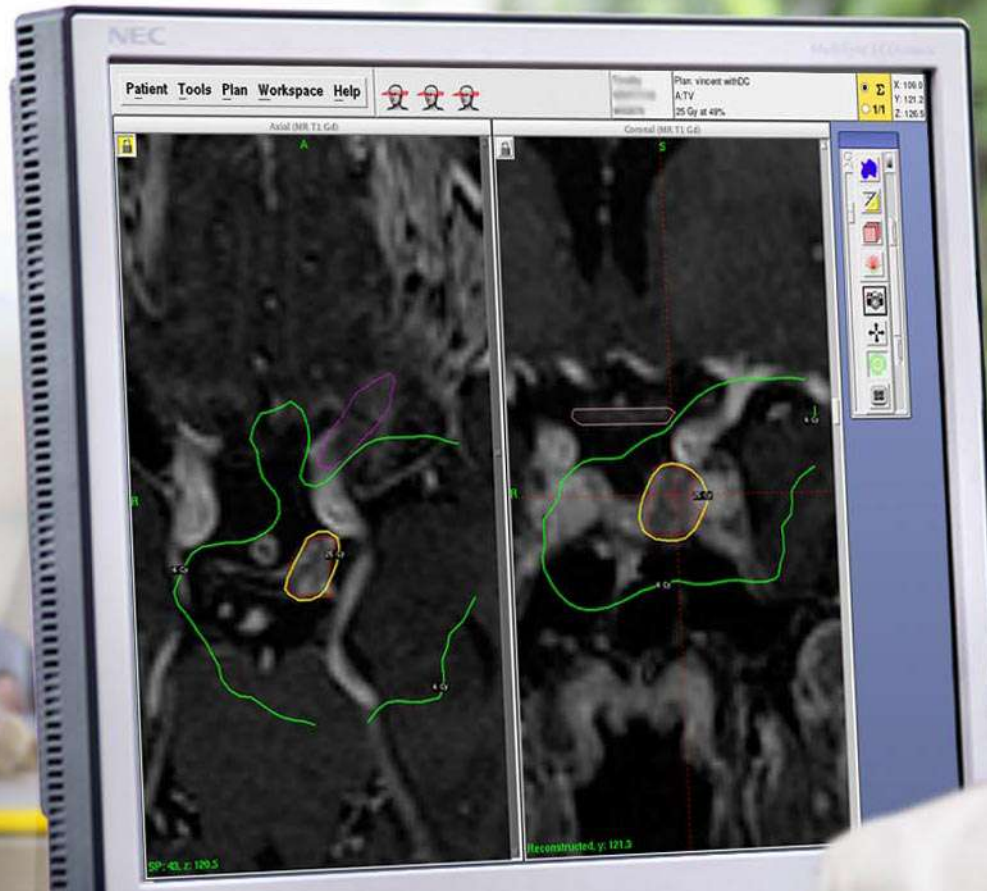
# Leksell GammaPlan® for Leksell Gamma Knife Perfexion Composite shots



- enables dose sculpting of complex structures

# Leksell GammaPlan® for Leksell Gamma Knife Perfexion

## Dynamic shaping

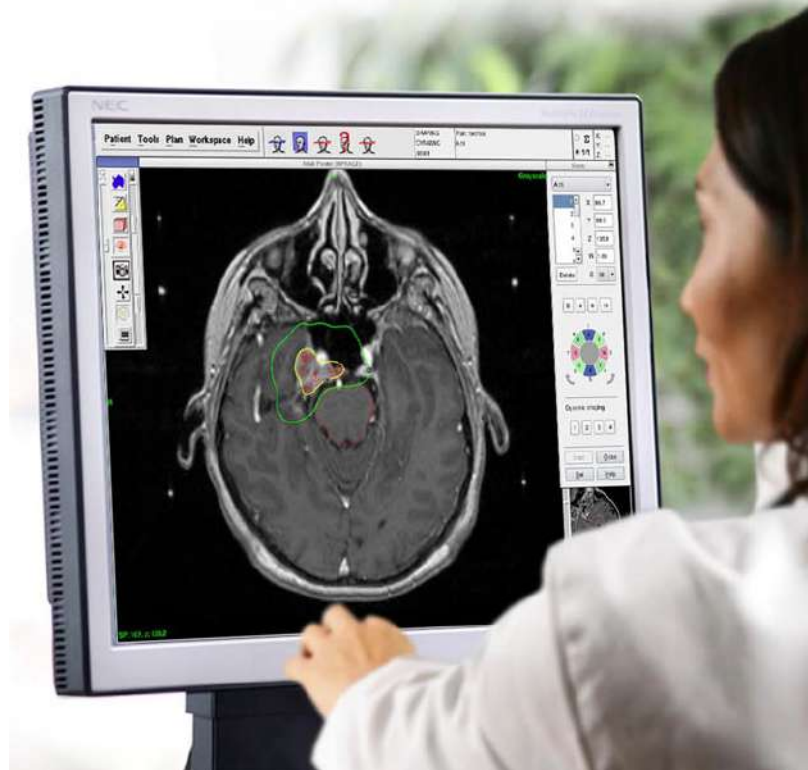


- protects critical anatomical structures

# Planning days before surgery

## Flexibility

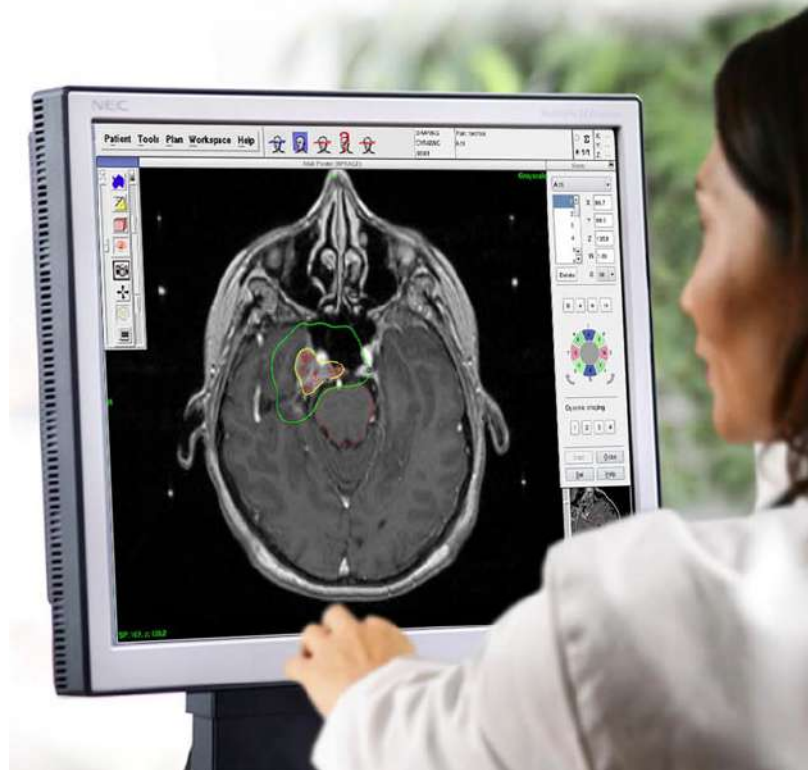
- Pre-operative planning allows users to plan days before surgery using frameless images
- Doctors can plan complex cases without time pressure and patients waiting
- Shorter treatment procedure for the patient



# Leksell GammaPlan® for Leksell Gamma Knife Perfexion

## Easy to follow-up

- Extensive information  
All treatment data (isodoses, region and volumes) are available and can be overlaid on the follow-up images
- Review  
Possible to display follow-up images over several years

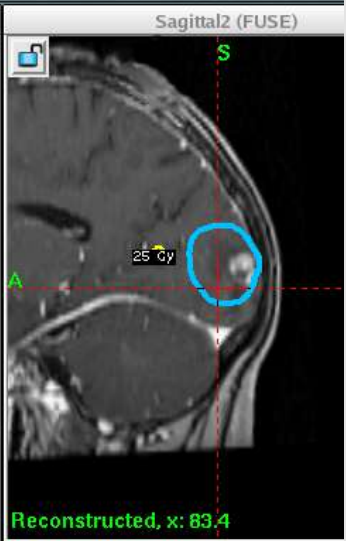
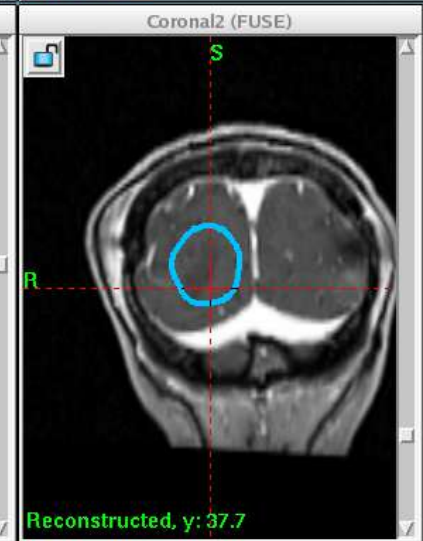
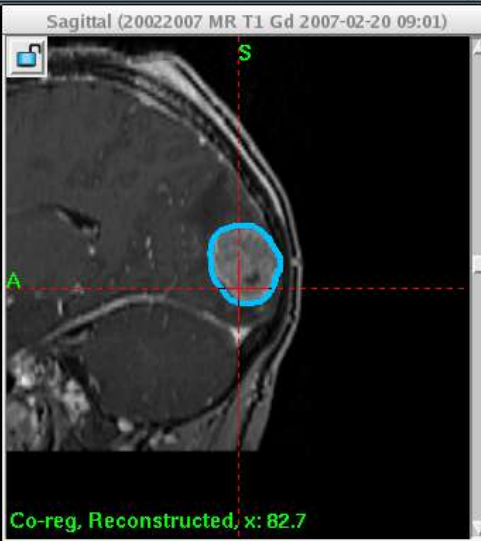
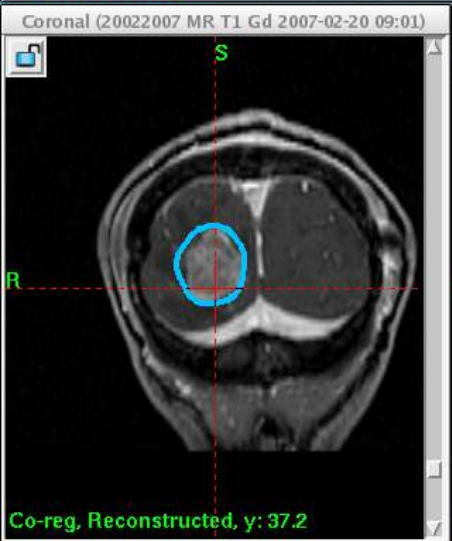
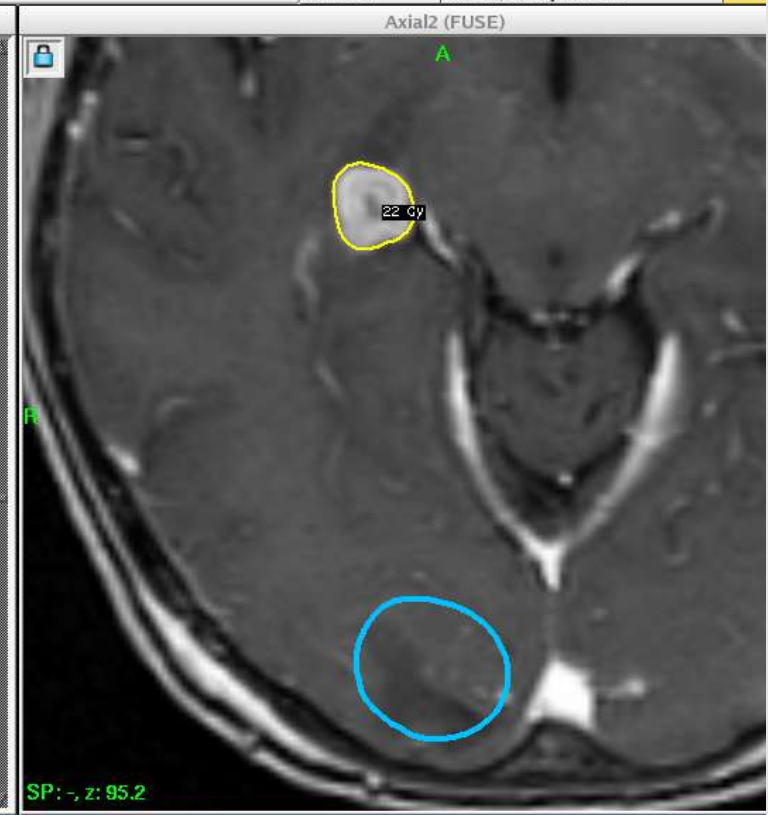
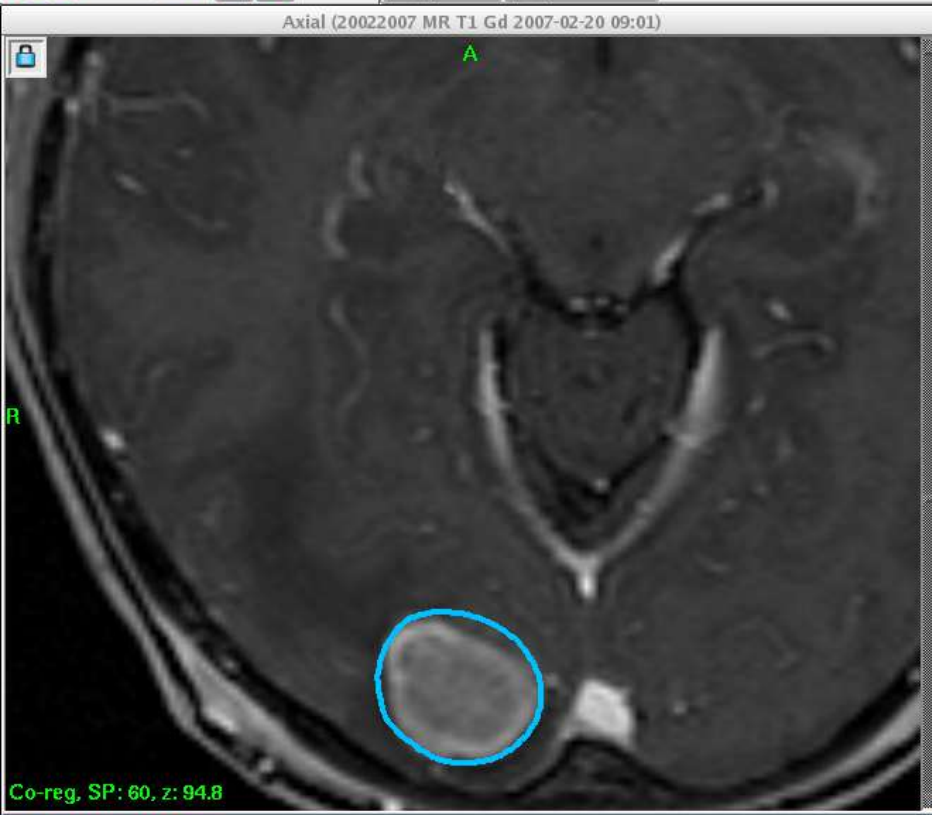


# Leksell GammaPlan® for Leksell Gamma Knife Perfexion

## Easy to retreat

- Displays previous key treatment data (e.g. prescribed isodose, regions and volumes) - facilitates the clinician to retreat or give additional treatment

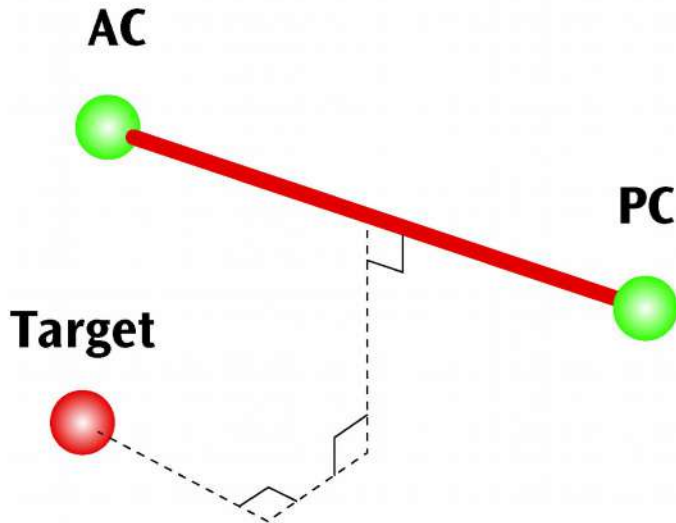




# Leksell GammaPlan® for Leksell Gamma Knife Perfexion

## Functional targeting

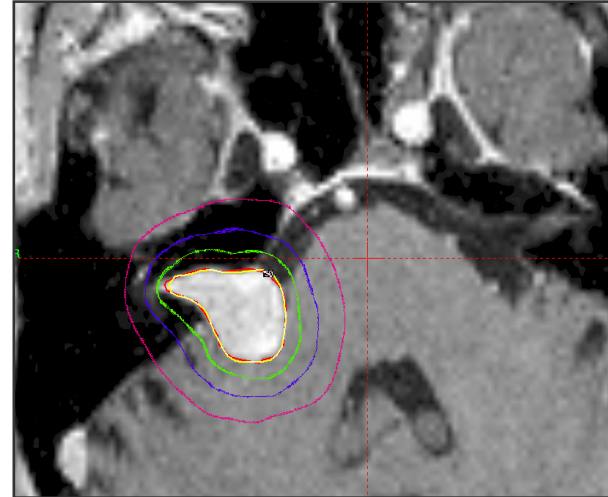
- Functional targets can be localized using formulas based on the AC-PC line and the corresponding stereotactic coordinates are automatically calculated
- AC-PC and functional targets markers are displayed in all views



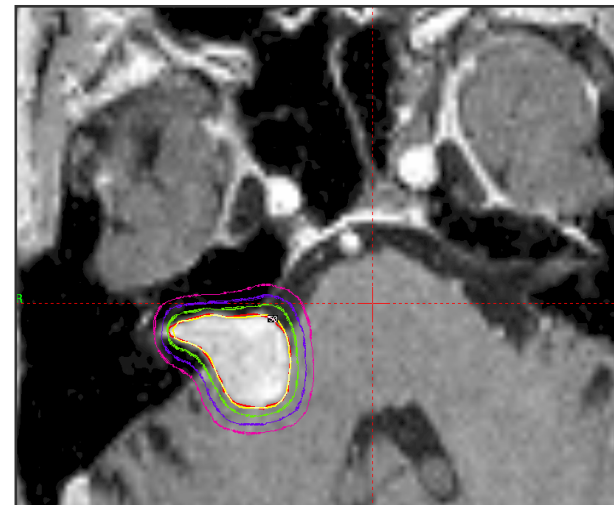
# Conformity and Selectivity

**Conformity** describes how well radiation dose is fitted to the target volume.

**Selectivity** describes how well surrounding tissue is spared, i.e. how steep radiation dose falls off outside target volume.



High conformity and low selectivity



High conformity and high selectivity



# Gamma Knife<sup>®</sup> surgery - an efficient workflow

# Gamma Knife<sup>®</sup> surgery

## Smooth and seamless workflow



**1**

Frame  
fixation

**2**

Imaging

**3**

Treatment  
planning

**4**

Treatment

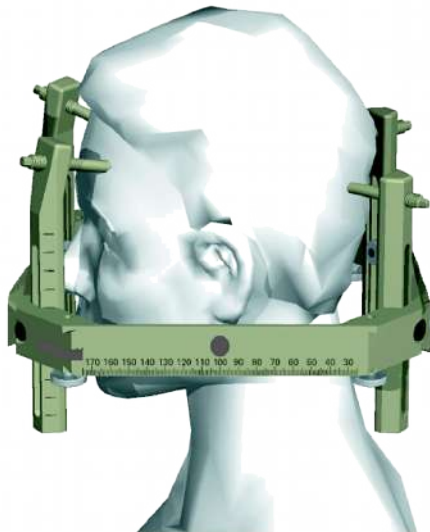
**5**

Follow-up

# 1. Frame fixation

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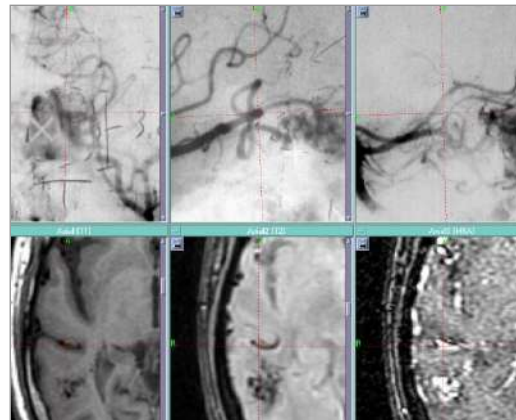
- Patient fixation - using Leksell® Coordinate Frame
- Establish spatial references



## 2. Diagnostic imaging



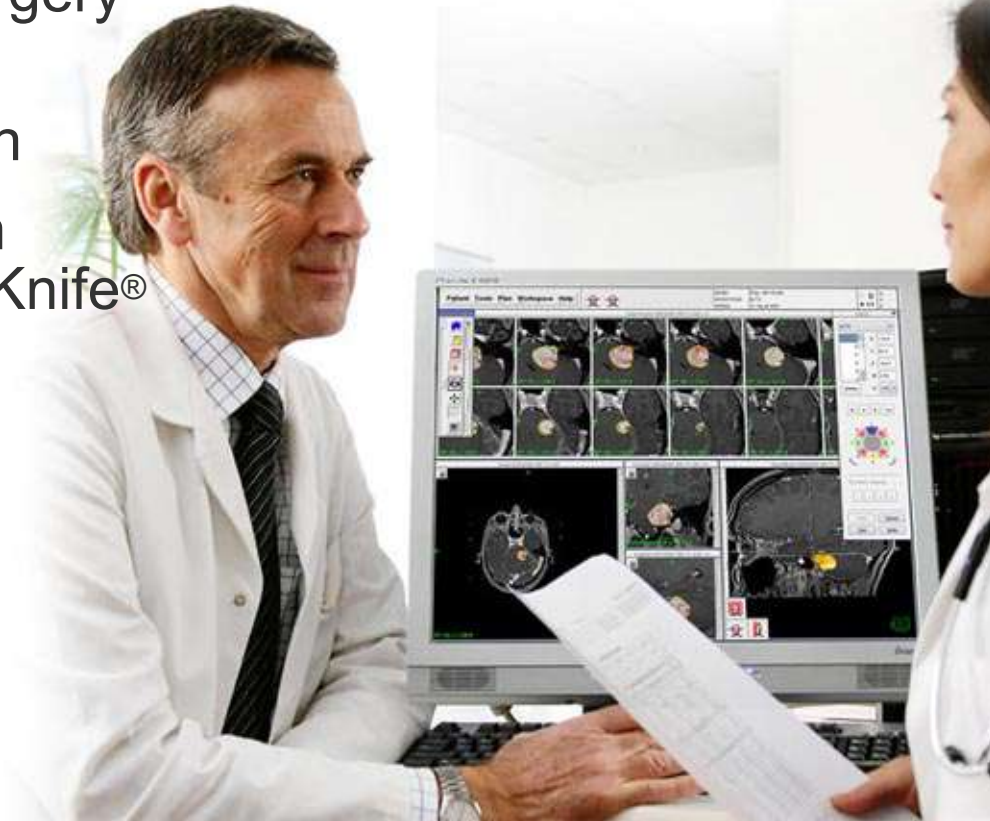
- Leksell® Coordinate Frame provides optimal stereotactic localization
- Supports all imaging modalities (CT, MRI, PET, Angio and MEG)
  - stereotactic and non-stereotactic image studies
- Digital image transfer to Leksell GammaPlan®



# 3. Treatment planning

Leksell GammaPlan® provides:

- Surgical precision in your hands
- Intuitive software dedicated for Gamma Knife® surgery
- Fast creation of optimal treatment plan
- Direct communication with Leksell Gamma Knife®



# 4. Treatment

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- During treatment the targets are automatically irradiated according to the treatment plan
- Through-out the procedure the patient and doctor communicate via the intercom system



# Gamma Knife<sup>®</sup> surgery - meets future needs



# Gamma Knife<sup>®</sup> surgery

## Expanding role



- Increasing demands from patients and greater awareness from medical community
- Need to reduce the overall burden on the healthcare system
- New possibilities by improved diagnostic imaging (3T MRI, PET, MEG)
- Development by refined technology - expanded clinical reach
- Increased need for efficient treatment of brain metastases
- Expanding new applications

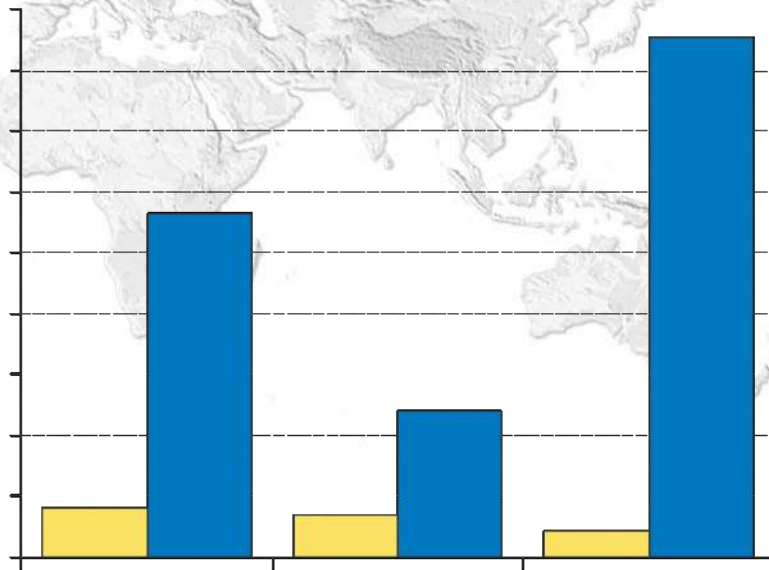




# Gamma Knife<sup>®</sup> surgery

## Unfulfilled clinical need

Approx. 375 patients/million inhabitants and year have diseases that are suitable for Gamma Knife surgery\*\*.



\*) Leksell Gamma Knife Society treatment statistics

\*\*\*) Epidemiological review, adjusted per population

# Brain Disorders

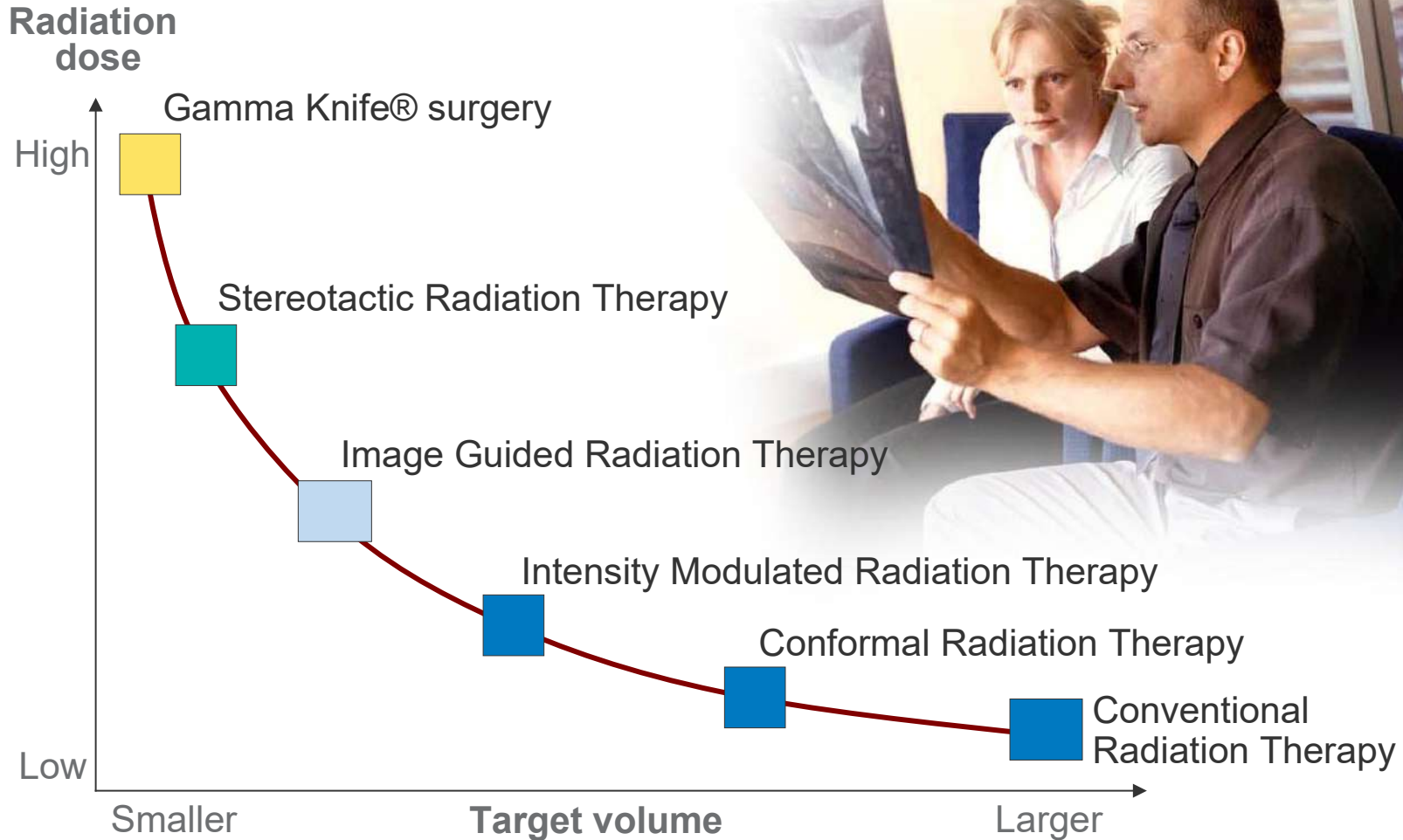
Tumors, vascular and functional disorders



- Incidence of primary brain disorders - approx. 1,000/million
- Malignant brain disorders
  - Primary tumors
  - Secondary metastases
- 20-40% of all patients with malignant cancer develop brain metastases
- Other brain disorders
  - Benign tumors
  - Cerebrovascular disorders
  - Functional disorders

*Source: American Cancer Society*

# Radiation therapy and Radiosurgery

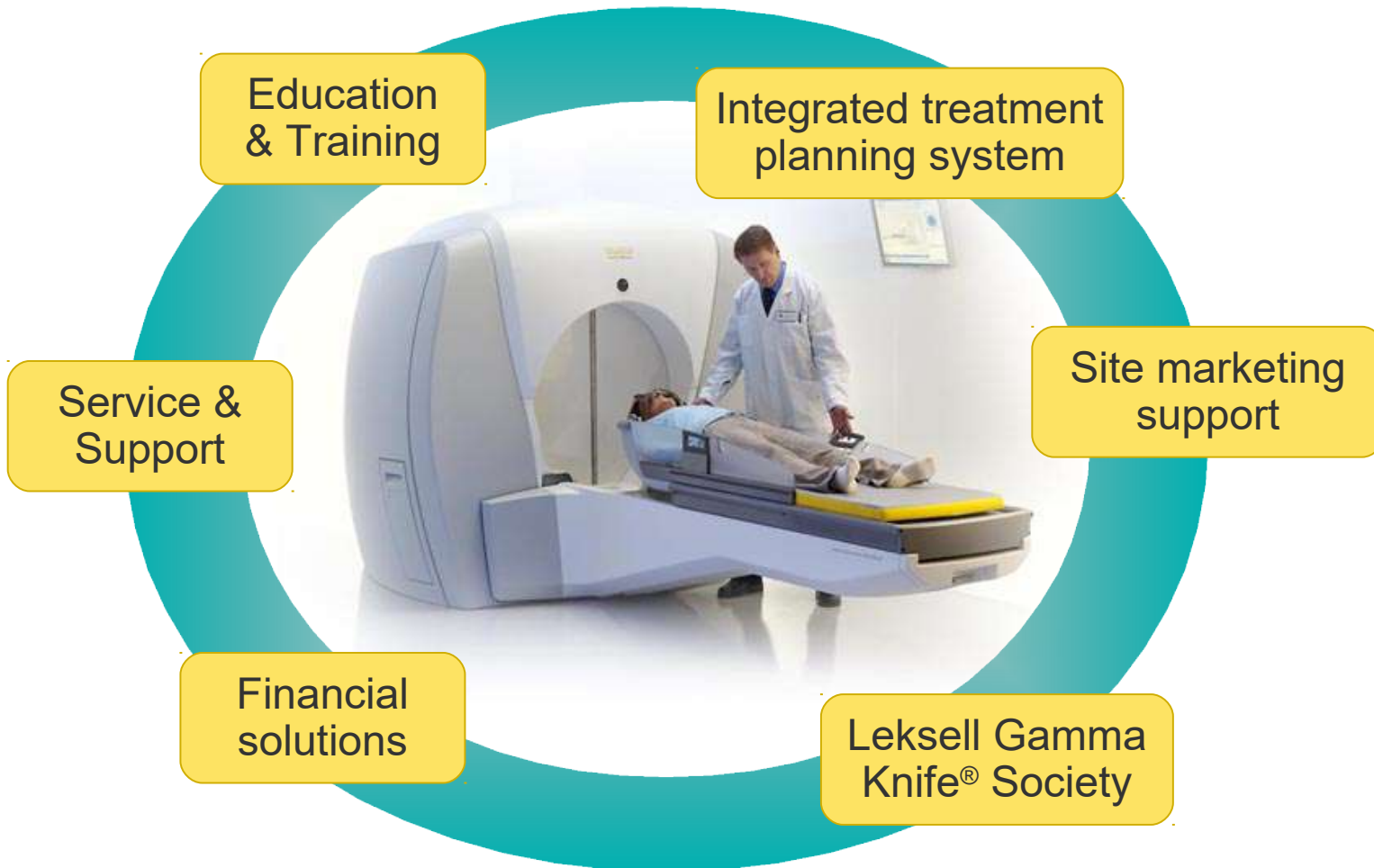


# Gamma Knife<sup>®</sup> surgery - a complete clinical solution



# Gamma Knife<sup>®</sup> surgery

## A complete solution



Clinical collaboration

# Leksell Gamma Knife<sup>®</sup> Society



To further define and expand the role of Gamma Knife<sup>®</sup> surgery

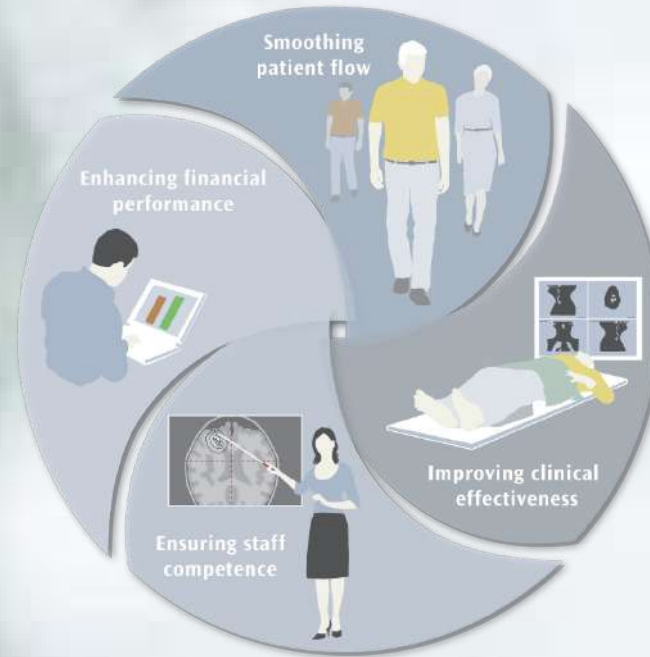
- Bi-annual meetings
- More than 2,000 members
- 200 scientific abstracts/ meeting
- Proceedings presented in Journal of Neurosurgery



# Elekta Lifecycle Services

## A lifetime commitment

*Elekta provides the industry's most comprehensive customer support programs and services through Elekta Lifecycle Services.*



- Smoothing patient flow
- Improving clinical effectiveness
- Ensuring staff competence
- Enhancing financial performance

# Gamma Knife® surgery

## Worldclass Education & Training



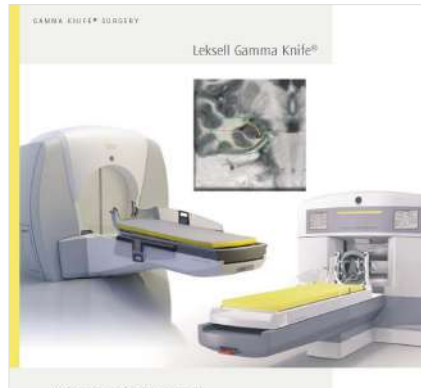
Leksell Gamma Knife® 4 and 4C

Introductory T  
5-day course in Stock  
Course Director: Bodo

EDUCATION & TRAINING

Leksell Gamma Knife®

Successful system start



Leksell Gamma Knife®

Advanced Program  
for Functional Disorders

University Hospital La Timone, Marseille, France  
Course Director: Jean Rigou, M.D.

The objective of this training is to present and discuss results of treatment in Functional Disorders with Leksell Gamma Knife®.

The course will feature lectures and clinical procedures for Trigeminal Neuralgia and Epilepsy. During the course delegates

will observe Gamma Knife® and patients' clinical history and treatment.

Leksell Gamma Knife®

Advanced Training Course  
Elekta Head Office, Stockholm, Sweden  
November 8-10, 2006

This training will give you an insight of Leksell Gamma Knife® technology of how this system can be applied in daily practice. This course provides comprehensive didactic and practical training for those who plan to start with Leksell Gamma Knife®.

Delegates will demonstrate proficiency in 3D volumetric cone beam Leksell Gamma Knife® and related software. There will also be an opportunity to interact with other centers to discuss and learn of ongoing treatment planning techniques.



Leksell Gamma Knife® Perflexion™

Technical and Applications  
Introductory Course

4-day course at Elekta Head Office,  
Stockholm, Sweden



Short track to become a center of excellence





# Gamma Knife<sup>®</sup> surgery - the history

# Elekta develops dedicated solutions

*“The tools used by the surgeon must be adapted to the task - and where the human brain is concerned they cannot be too refined.”*

Professor Lars Leksell (1907-1986)



# It all started in the operating room more than 50 years ago...

- Lars Leksell was professor at the department of neuroscience at Karolinska University Hospital
- He developed unique methods for stereotactic surgery and radiosurgery in the brain
- Elekta was founded as a R&D company 1972 based on Lars Leksell's innovations

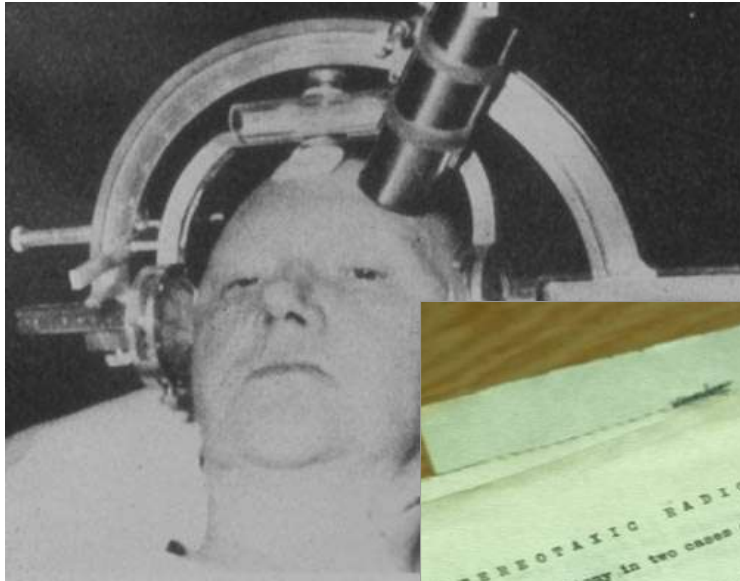


# Leksell Gamma Knife®

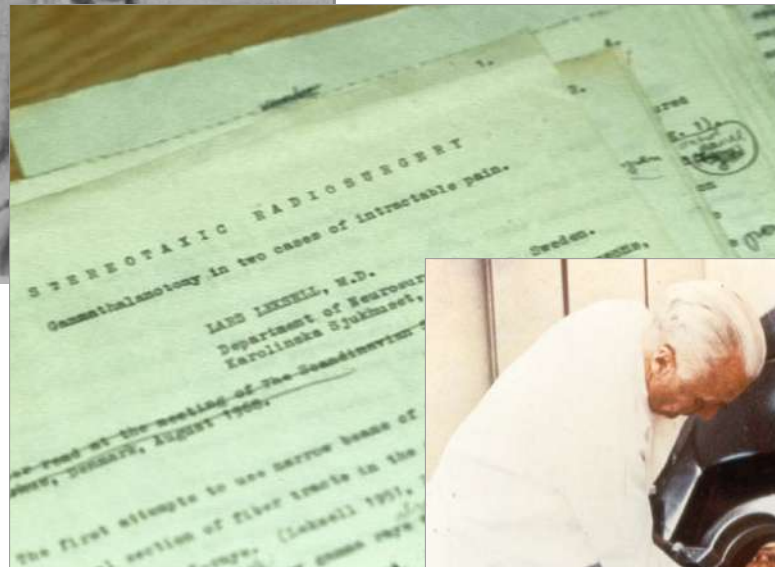
- Professor Leksell invented and established stereotactic radiosurgery
- With Elekta he developed Leksell Gamma Knife - a dedicated tool for neurosurgical indications
- A tool designed by a surgeon - for the surgeon
- Gamma Knife® surgery is today the proven gold standard for radiosurgery and an established treatment method used worldwide



# The steps towards Gamma Knife<sup>®</sup> surgery



Stereotactic irradiation was introduced in 1952 – forming the base for Leksell Gamma Knife<sup>®</sup>



# Non-invasive Gamma Knife<sup>®</sup> surgery

2006

Launch of  
Leksell Gamma Knife<sup>®</sup>  
Perfexion<sup>™</sup>



# Leksell Gamma Knife®

## Years of clinical development



**1968** – The prototype of Leksell Gamma Knife was installed in Stockholm, Sweden.



**1999** – Elekta refines the Art of radiosurgery by introducing Leksell Gamma Knife C, with the robotic APS (Automatic Positioning System™).



**2006** – Launch of the fifth generation, Leksell Gamma Knife Perfexion, including enhanced treatment volume, clinical reach and efficiency.

# The evolution

**1968**  
1<sup>st</sup> Gamma  
Knife<sup>®</sup> prototype



**1996**  
Leksell Gamma  
Knife<sup>®</sup> B



**2004**  
Leksell Gamma  
Knife<sup>®</sup> 4C



**1986**  
Leksell Gamma  
Knife<sup>®</sup> model U



**1999**  
Leksell Gamma  
Knife<sup>®</sup> C



**2006**  
Leksell Gamma  
Knife<sup>®</sup> Perfexion<sup>™</sup>

