



FACHHOCHSCHULE TRIER

Hochschule für Technik, Wirtschaft und Gestaltung
University of Applied Sciences



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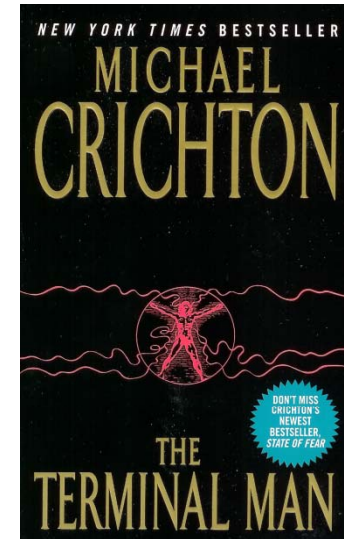
RECONSTRUCTION OF CT-ARTIFACTS FOR DEEP BRAIN STIMULATION

PETER GEMMAR

Neuro-Modulation ⇒ Utopia?



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Source: Spektrum der Wissenschaft, 9/2007

Deep Brain Stimulation for Morbus Parkinson Symptoms and Therapy Success



Therapy for treatment resistant cases of Parkinson's disease

Improvement of patient's situation / return to normal life activities

Cost reduction compared to conventional treatment



Deep Brain Stimulation

Treatment of various neural diseases



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Common practice

- Parkinson (> 40.0000)
- Dystonia
- Cluster headache
- Various pain syndromes

Future applications?!

- Mental disorders
depression, obsessive
compulsive disorder

Increasing demand

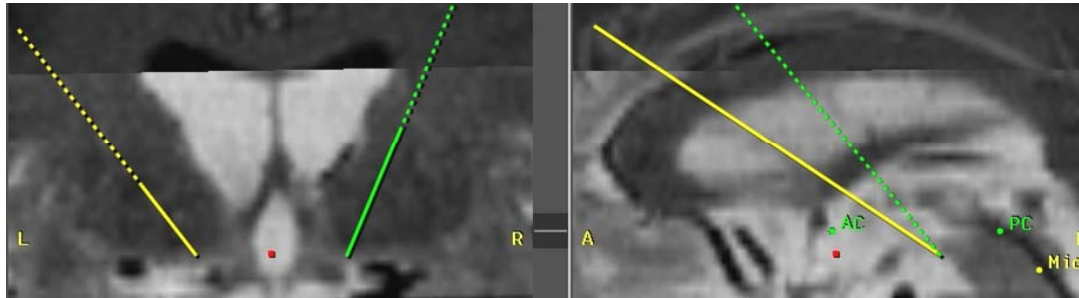
- Aging of society



Stereotactic Deep Brain Stimulation



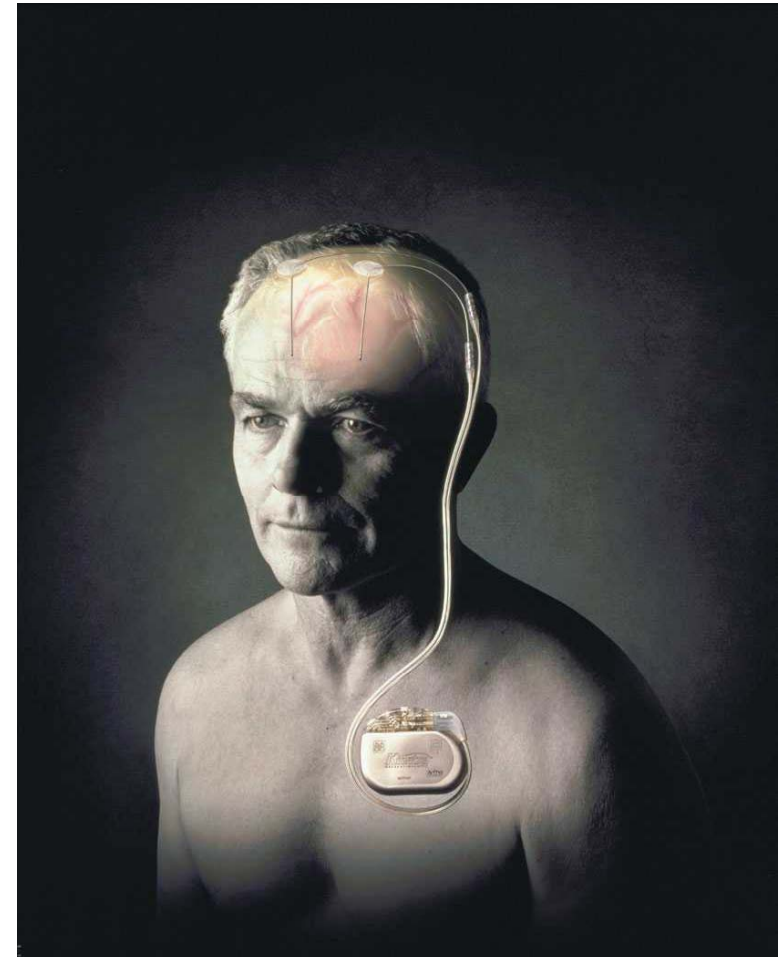
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Stimulating electrodes in deep brain areas



Stereotactic implantation method



Pacemaker for the brain

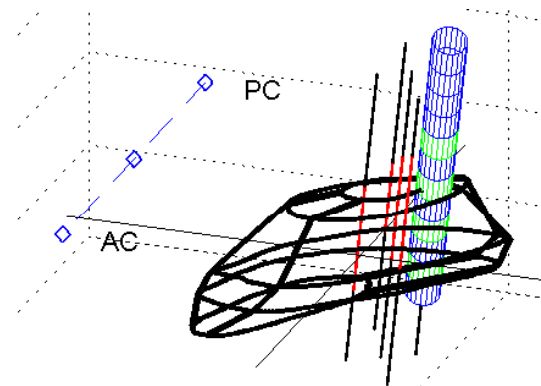
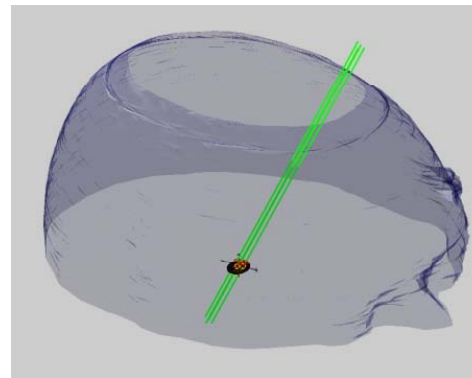
Stereotactic Deep Brain Stimulation Requirements



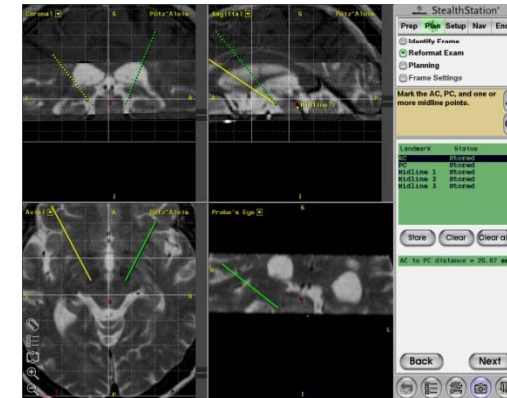
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DBS surgery by specialist



Optimal position !?

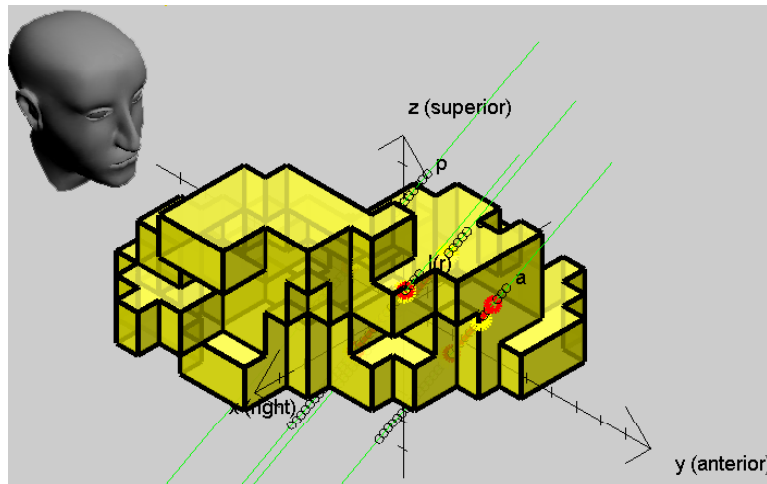


Process partly assisted by computer

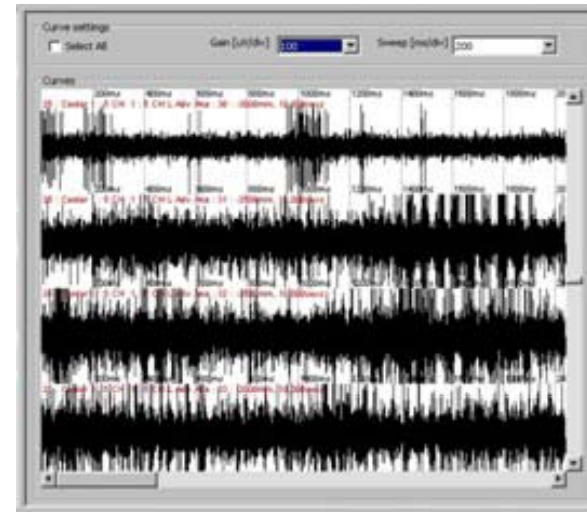
Verification of Electrode Position Difficulties



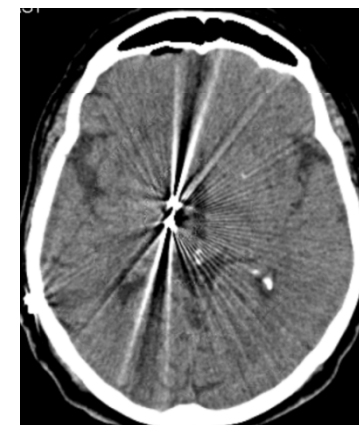
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Real position of electrodes?



Activity of neural areas

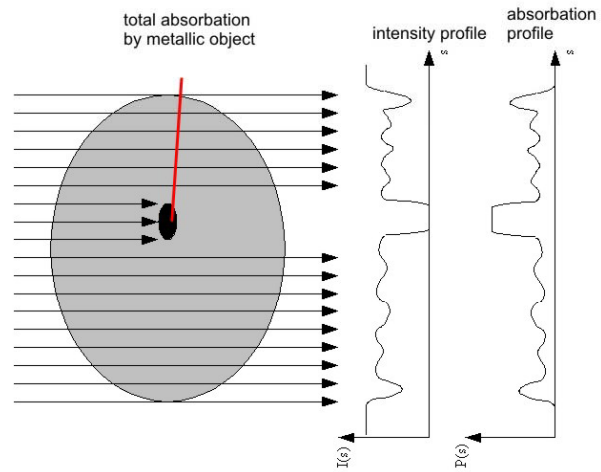


CT imagery with electrode artifacts

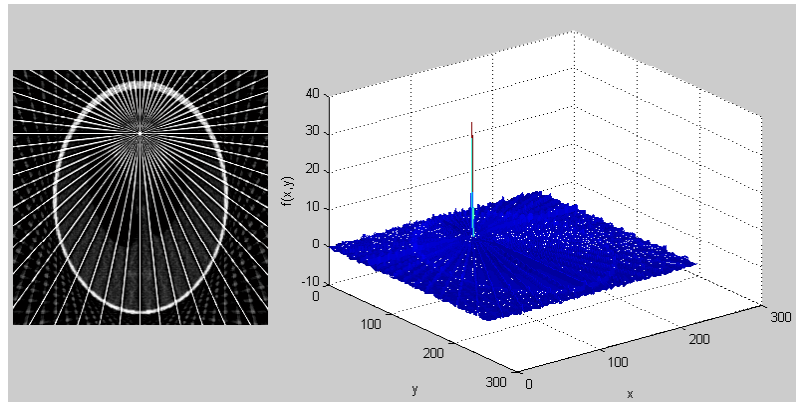


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Electrode Artifacts



Absorption of X-rays



Metal artifacts in CT



CT-artifacts

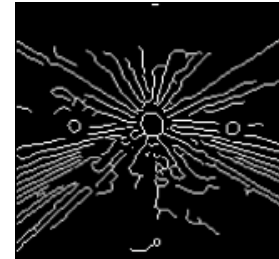
Image Processing Methods for Reconstruction of CT-Artifacts



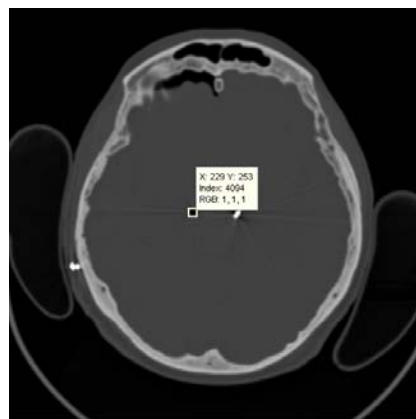
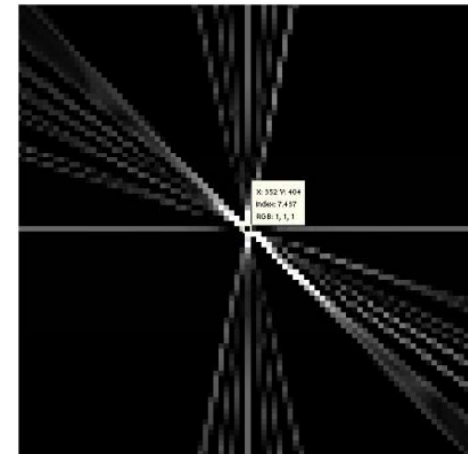
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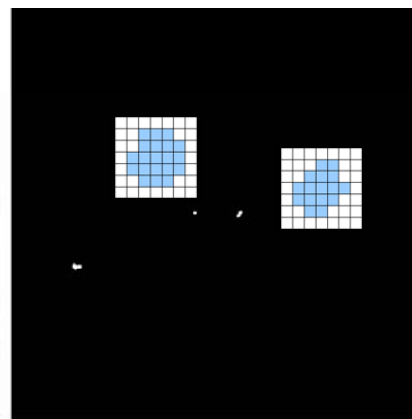
CT-artifacts



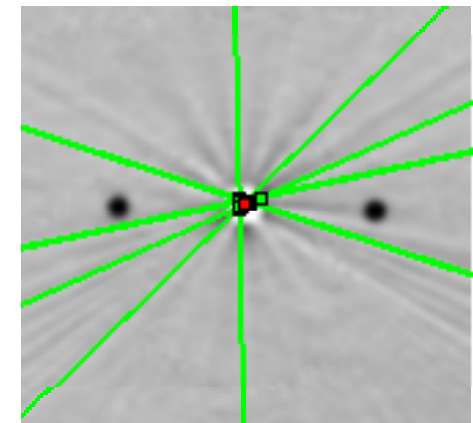
Analysis of line artifacts



a) Patientenaufnahme im DICOM-Format



b) Binarisiertes Bild

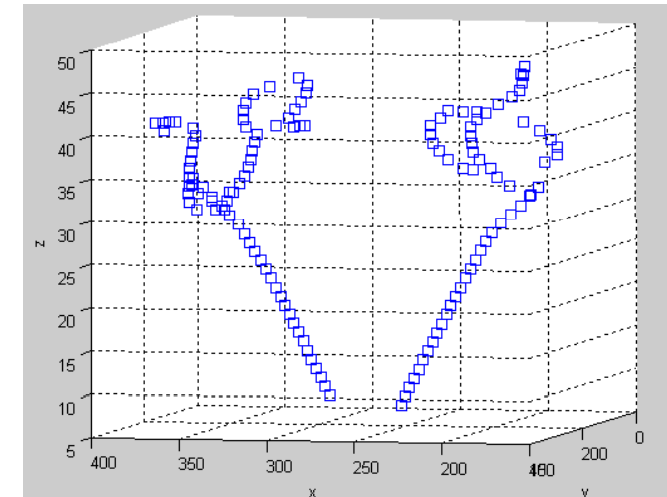
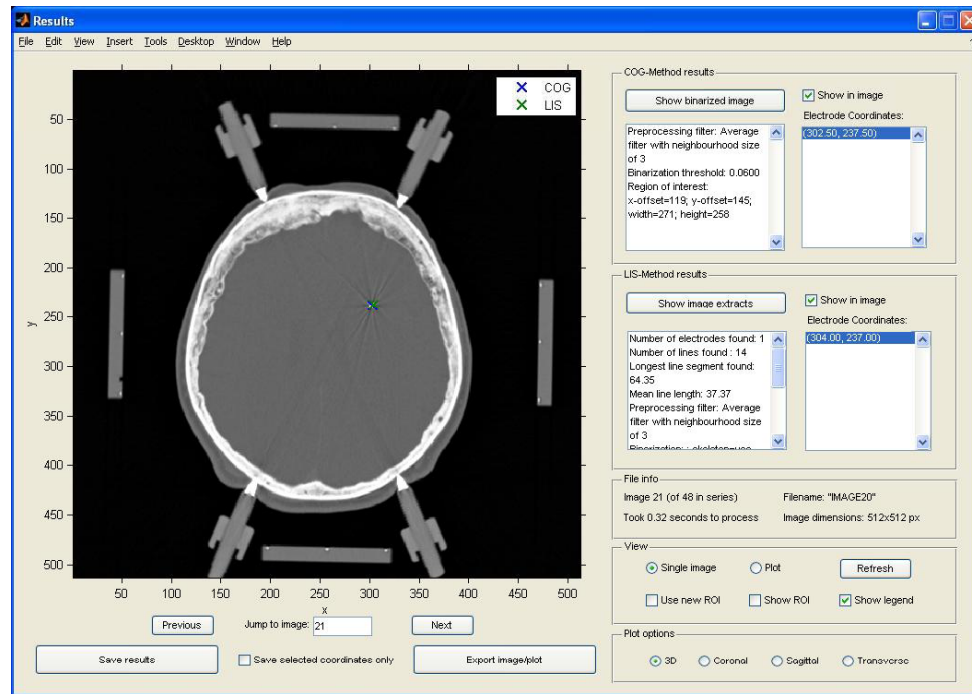


Analysis of electrode artifacts



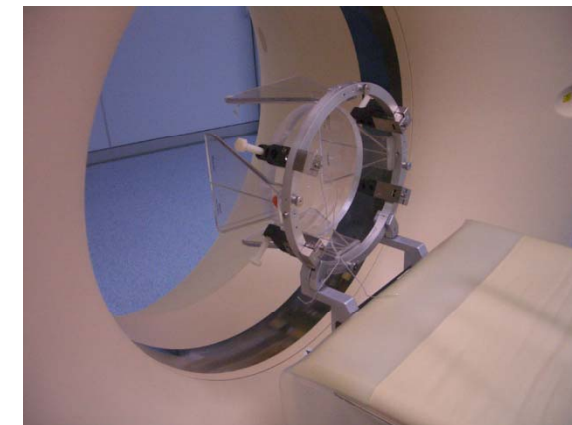
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Automatic Localization of Electrode Position



3D – positions of electrode

SW - Prototype for CT-Artifact reconstruction



Phantom for geometric verification



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Conclusion

- **DBS proven and promising therapy**
- **Increasing demand for treatment of neural diseases**
- **CT-Artifact reconstruction / Computer assistance supports:**
 - Quality control / management**
 - Optimization of therapy effects**
 - Medical and scientific analysis**
 - Development of new therapies**

Software Developments Neuro Modulation – Deep Brain Stimulation



Cooperation Partner:
Dr. med. F. Hertel, Klinikum Idar Oberstein

Method and prototype development:
2004/2005

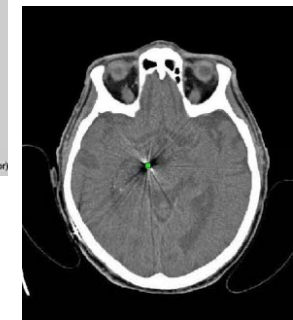
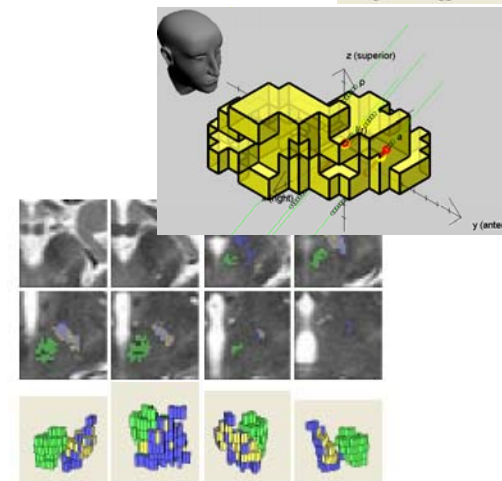
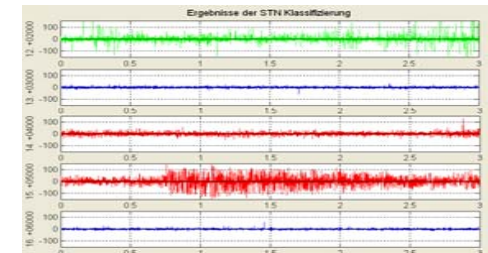
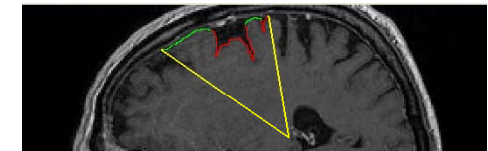
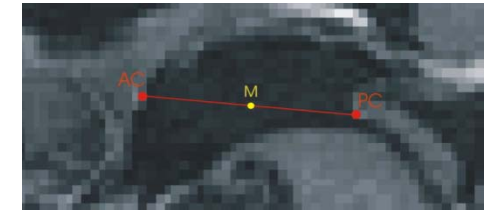
- Target Point Localization (AC-PC Detection)
 - Trajectory Planning
- (License transfer, Patent filing USA, 2006)

2006/2007

- MER Classification
- Registration of STN – Electrode Intersections
- CT-Artifact Reconstruction

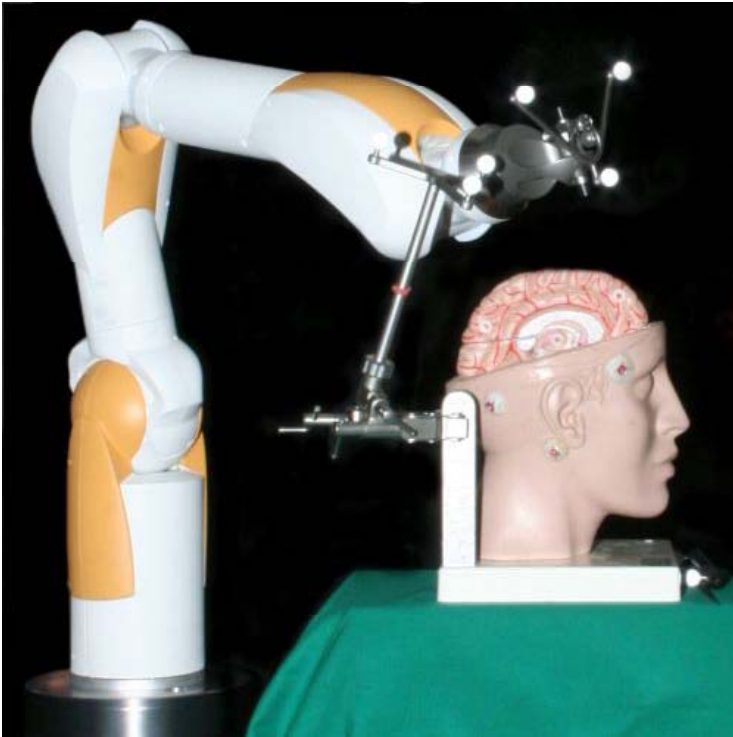
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- Segmentation of functional Areas in MRI /
Volume based Morphometrics



Requirements concerning the transfer business

- **We are looking for: Industry Partners**
- **We want to achieve:**
 - R&D Cooperation**
 - Development of the prototype ready for market**
 - Licensing or selling the prototype**



Vision?
(Curac 2007)



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INTERDISZIPLINÄRES
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