

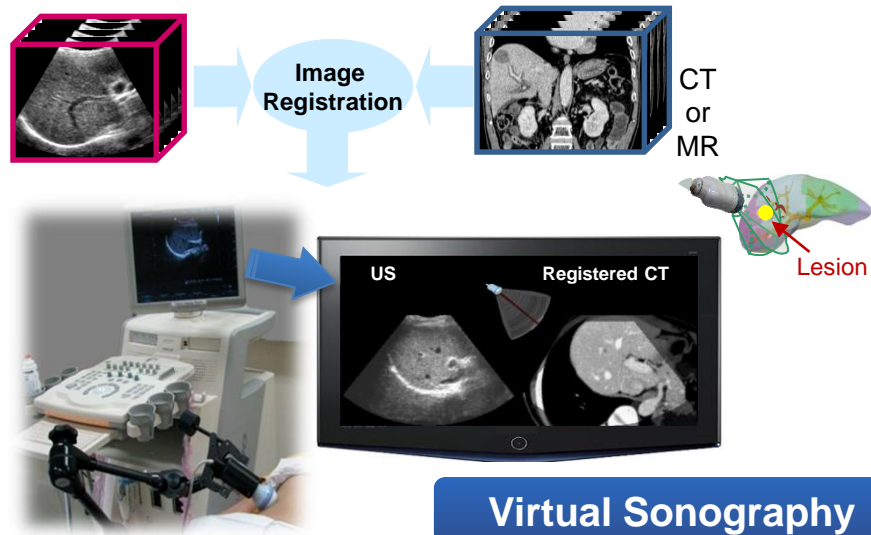


Mobile C-arm CT reconstruction based on prior knowledge on intra-operation

KAIST ISL & MIRLAB



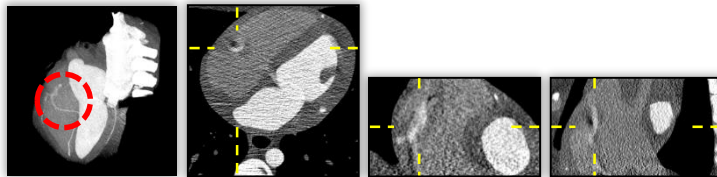
ISL (Image System Laboratory)



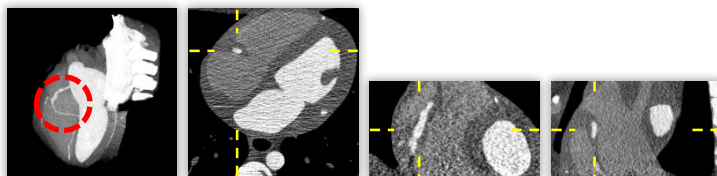
Virtual Sonography

Motion Compensated Reconstruction for Cardiac CT Image

Uncompensated CT images



Motion compensated CT images



Maximum intensity projection

Transaxial

Coronal

Sagittal

Positron Emission Tomography (PET) Image Reconstruction

Respiratory motion compensation

Uncompensated PET images



Motion-compensated PET images

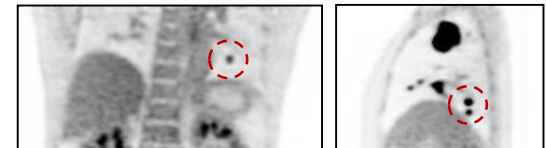
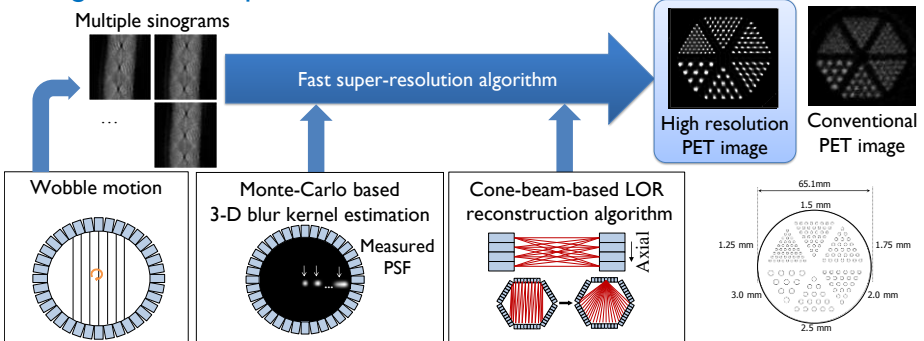
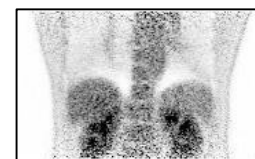


Image-based super-resolution



System and object adaptive denoising



Noisy image



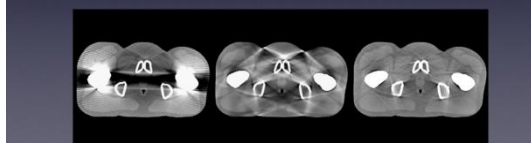
Gaussian filtered image



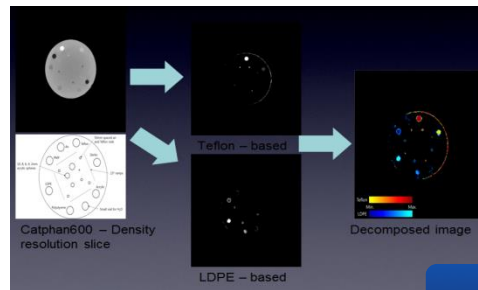
Adaptive denoised image

MIRLAB(Medical Imaging & Radiotherapeutics)

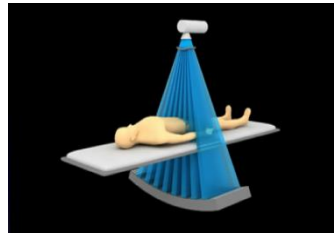
Metal artifact reduction (MAR)



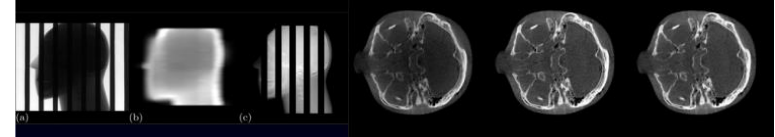
Low dose dual-energy imaging



Sparse-sampled CT



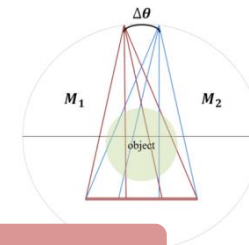
Scatter correction



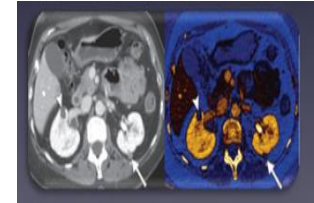
Cargo inspection



Multi Gamma Source CT



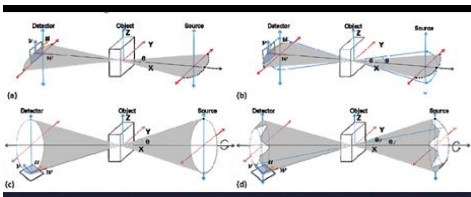
Photon Counting Detector



Safe&Optimized CT

Functional&Task-specific CT

Laminography



DBT-DOT breast

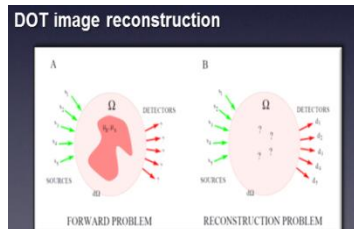
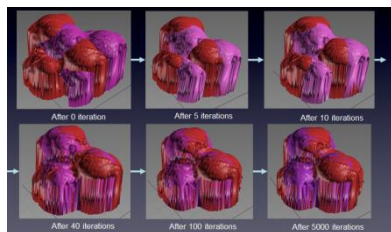
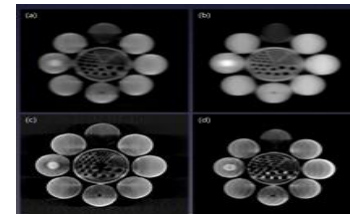


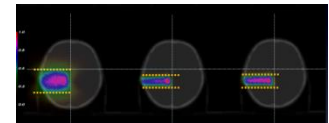
Image registration



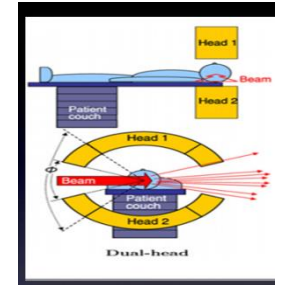
Proton CT



In-beam PET imaging for Hadron Therapy



Motion composition & prediction

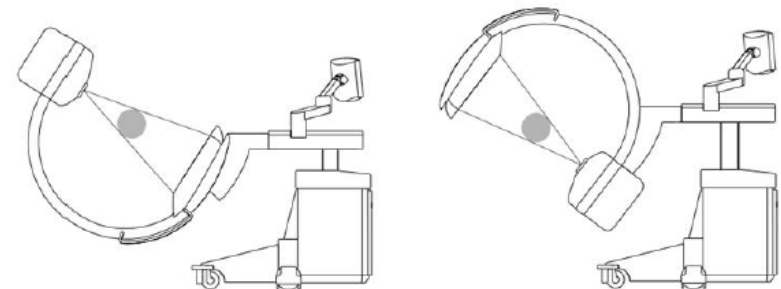


Mobile C-arm CT

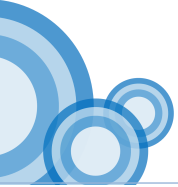
- C-arm system for image-guided radiotherapy and surgery
 - 2D fluoroscopic imaging
 - 3D CT imaging
 - Depiction of complex anatomic structure
- Mobile C-arm CT
 - Head and neck surgery, thoracic surgery
 - Advantages
 - Compactness and convenient use
 - Affordability
 - Limitations
 - Limited angular scan range
 - Small scan field of view
 - Long scan time



Mobile C-arm



Rotation scan for 3D CT



The trend of mobile C-arm CT

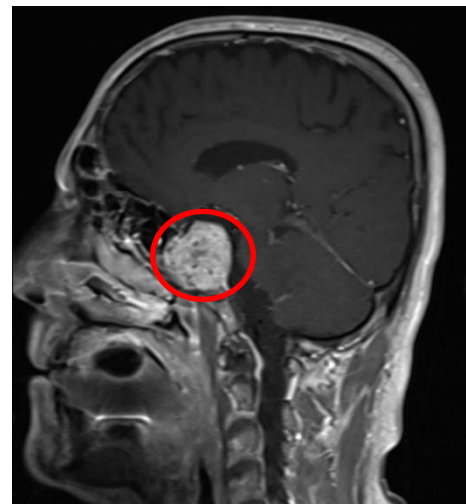
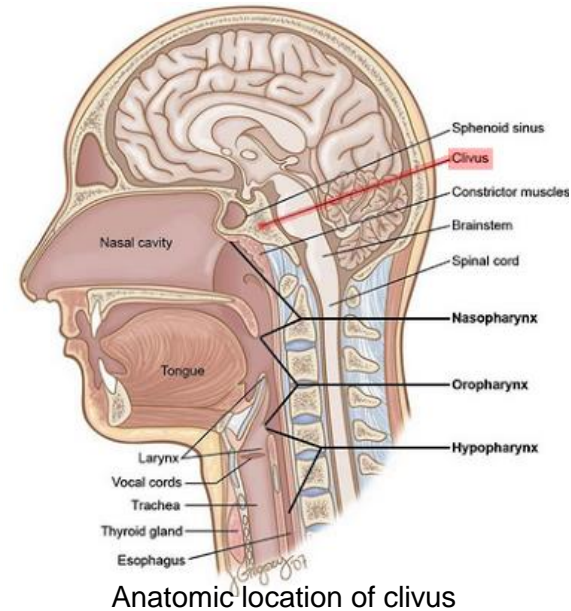
Manufactures	SIEMENS	SIEMENS	Ziehm imaging	PHILIPS Medical
Models	SIREMOBIL Iso-C(I.I) POWERMOBIL(FP)	ARCADIS ORBIC 3D(I.I)	Vario 3D I.I/FP	BV Pulsera 3D-RX(I.I)
Orbital movement	190°(±95°)	190°(±95°)	135°(-90°/+45°)	135°(-90°/+25°)
Vertical movement	40cm	40cm	43cm	50cm
Lateral movement	±190°	±190°	±225°	±205°
Free space	80cm	80cm	80-90cm	80cm
kV ranges	40-110kV	40-110kV	40-110kV	40-110kV
mA ranges	10mA	20mA	20mA	60mA
Scan time	100sec/60sec	30/60sec	30sec	30sec
Projection #	100/200	50/100	100	90-450
3D reconstruction	256x256x256 (0.46mm voxel)	256x256x256 (0.47mm voxel)	256x256x256 /512x512x512	256x256x256 (0.4-0.7mm voxel)

- Trade-off between “scan time + # of projection” and scan angle
- Truncation artifact caused by small FOV (11cm~17cm)

Applications of mobile C-arm CT



Image guidance using mobile C-arm CT



Chordoma in clivus



Chondrosarcoma located inside head

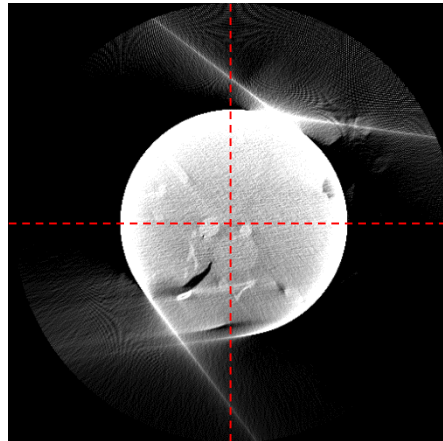
Research direction

- Mobile C-arm CT recon. for surgeon updated image
 - Head & neck surgery on intra-operation
- Problems of mobile C-arm CT
 - Super short scan
 - Truncation artifact

Ziehm imaging mobile C-arm CT system simulation

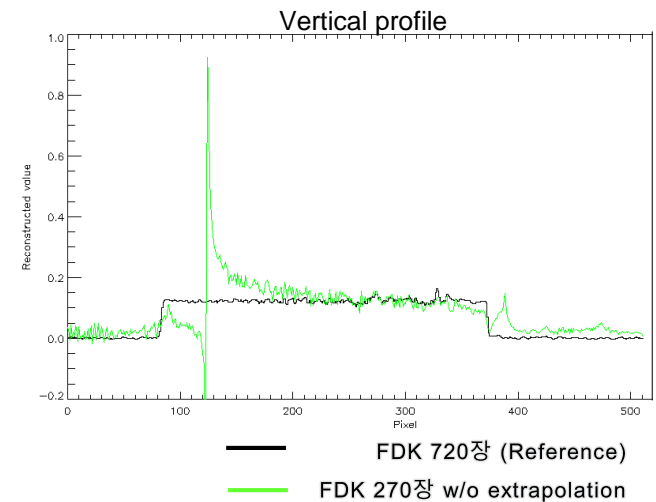
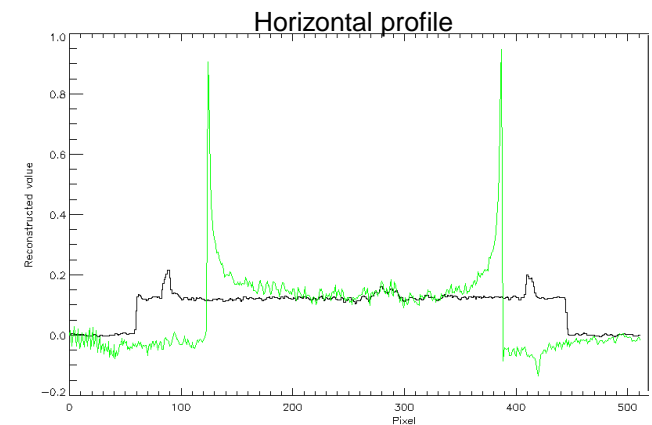


XCAT phantom



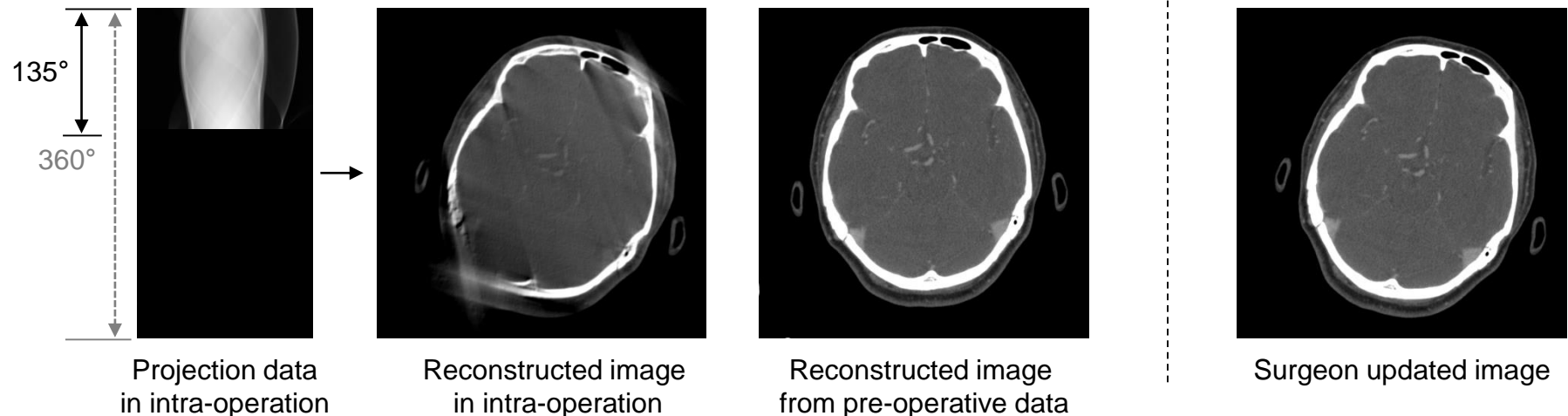
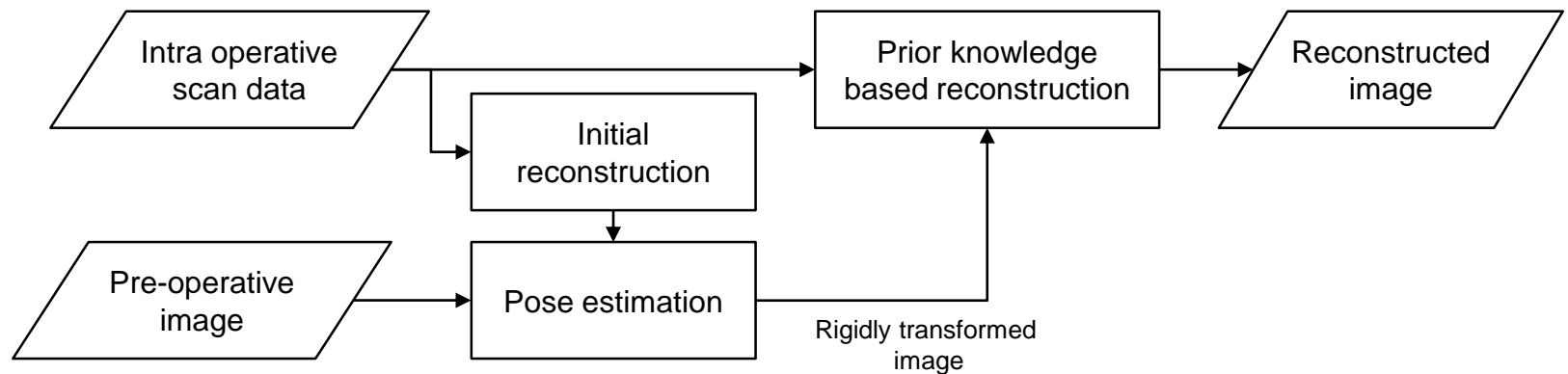
FDK reconstruction

FOV: 13.25 cm
Scan angle: 135°



Research direction

- Approach for reconstruction of head and neck surgery
 - Pose estimation of pre-operative image for head
 - Prior knowledge based reconstruction





THANK YOU