HERMES and Image Fusion

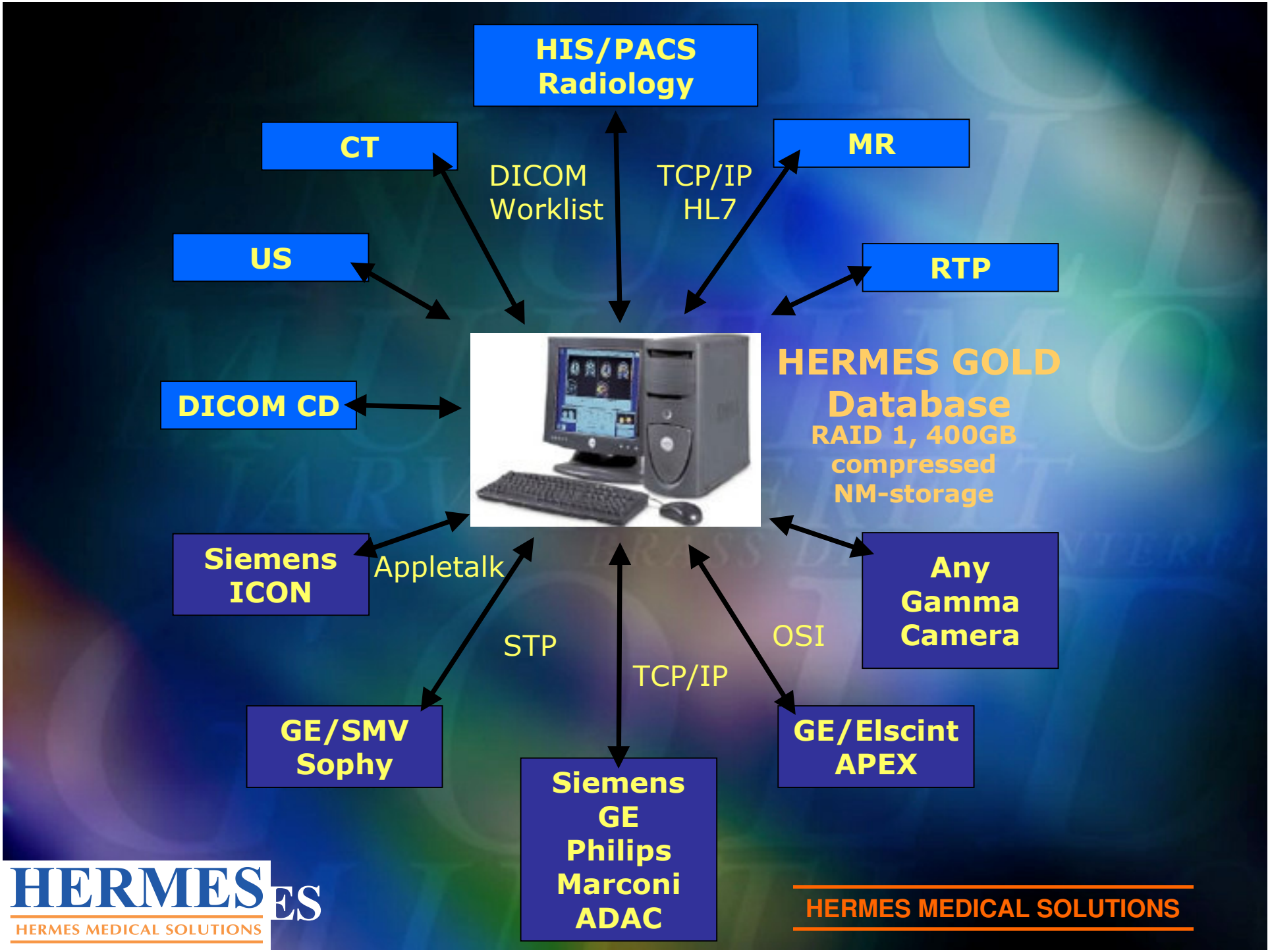
How do we get the images which we want to fuse?

How do we do image fusion?

What do we do with the images once they have been fused?

Connectivity
Sending to HERMES GOLD Archive

- Nuclear Medicine, PET – DICOM, Interfile, Native
- PACS, CT, MR, Ultrasound, CR - DICOM
- HIS/RIS – HL7, DICOM Worklists
- CDROM – Dicom Part 10, Dicom Dirs



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Network between two hospitals in Muenchen, Germany

Innenstadt

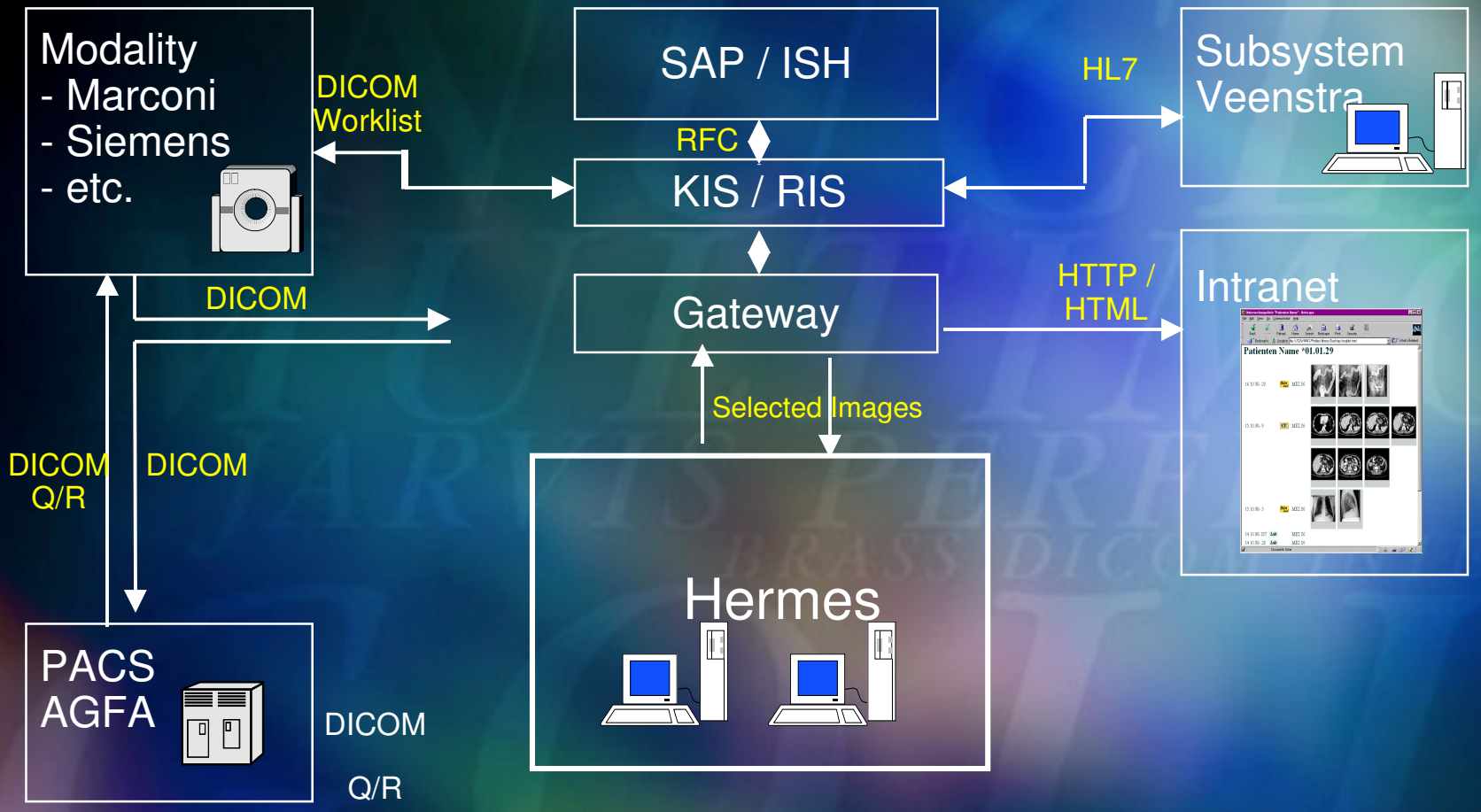
HERMES 1
HERMES 2
HERMES 3
HERMES 4
HERMES 5

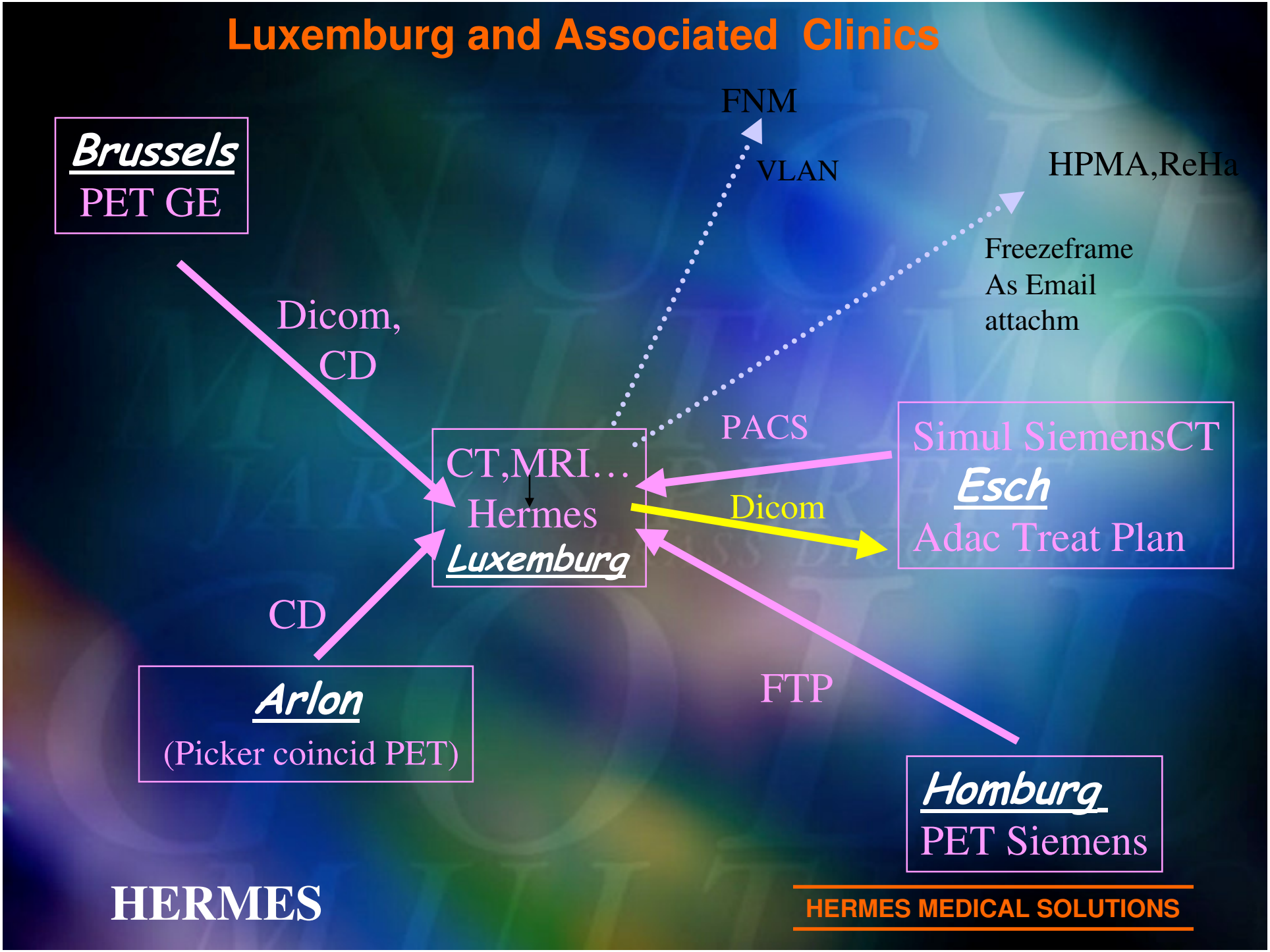
Distance 10km

Großhadern

HERMES 6
HERMES 7
HERMES 8
HERMES 9
HERMES 10

Integration of Hermes in Muenchen




Luxemburg and Associated Clinics
Brussels
PET GE
Dicom,
CD
FNM
VLAN
HPMA,ReHa
Freezeframe
As Email
attachm
PACS
CT,MRI…
Hermes
Luxemburg
Dicom
Simul SiemensCT
Esch
Adac Treat Plan
CD
Arlon
(Picker coincid PET)
FTP
Homburg
PET Siemens
HERMES
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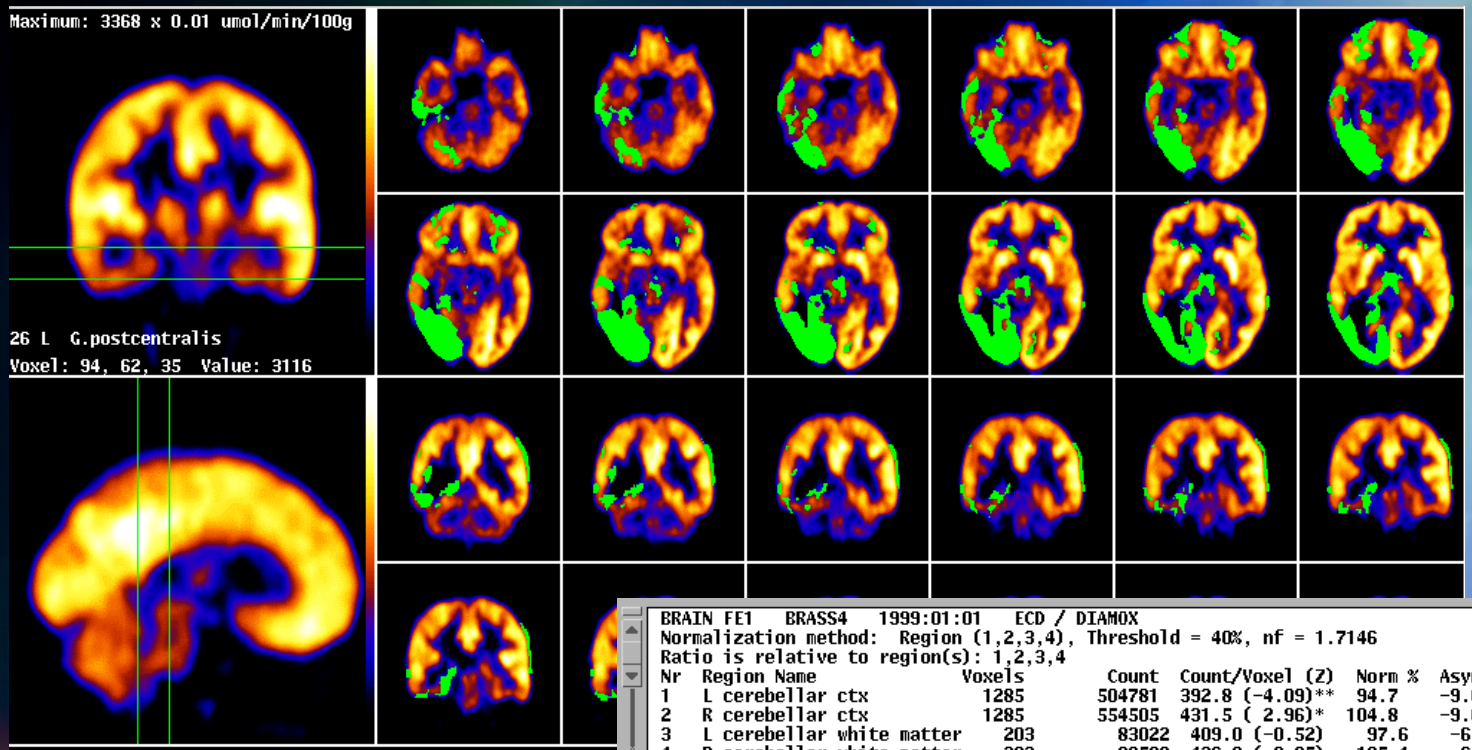
How do we do image fusion?

CT and PET
MRI and PET
PET and PET
CT and CT

CT and SPECT
MRI and SPECT
SPECT and SPECT
Plain Film and Nuclear Statics

BRASS – fit to template



STUDY1: BRAIN,MA/1 BRASS/MM 1996:(

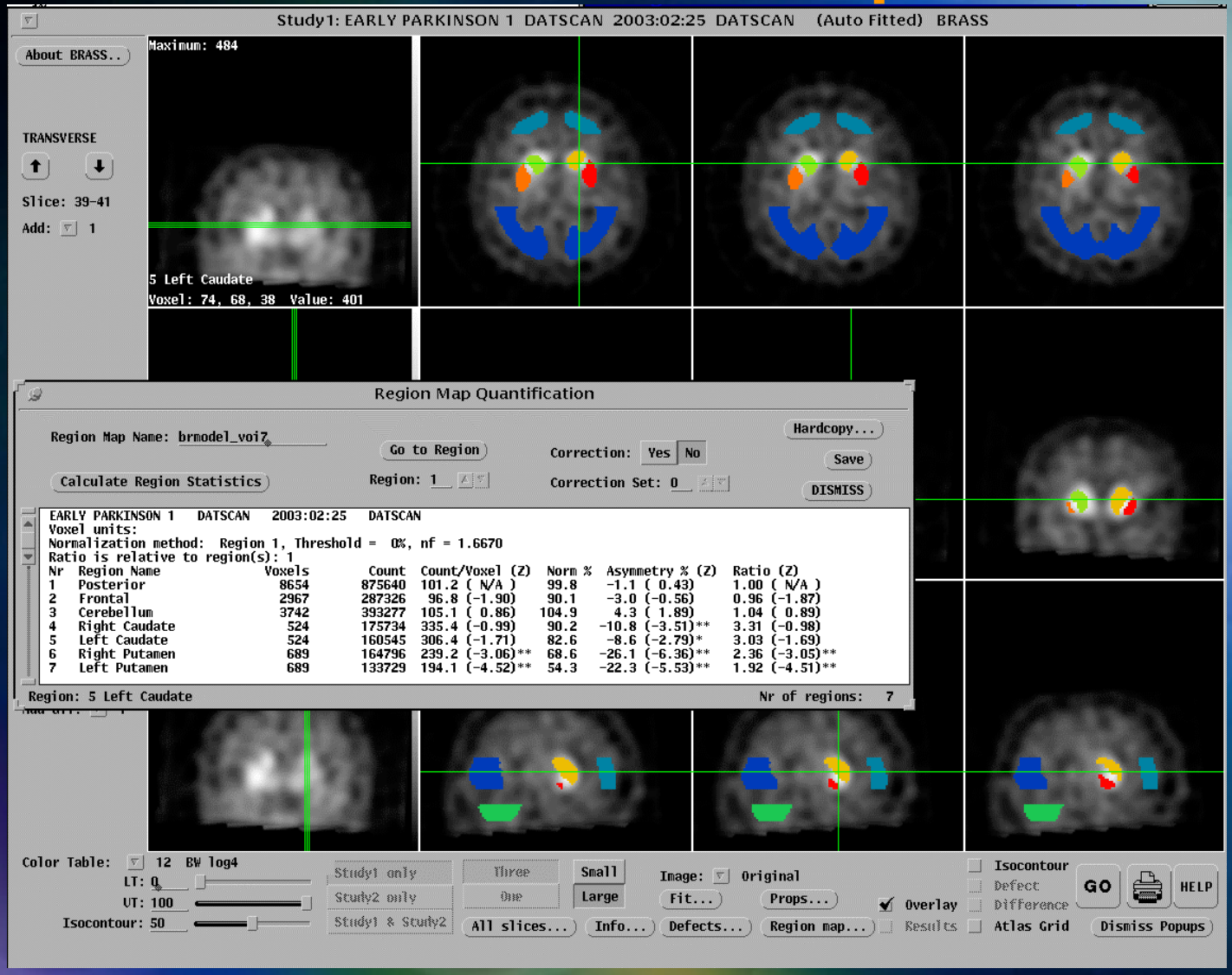
	Size (%)	Voxels	Size
STUDY1	9.87	19767	106.

DIFFERENCE was not significant.

BRAIN FE1 BRASS4 1999:01:01 ECD / DIAMOX
Normalization method: Region (1,2,3,4), Threshold = 40%, nf = 1.7146
Ratio is relative to region(s): 1,2,3,4

Nr	Region Name	Voxels	Count	Count/Voxel (Z)	Norm %	Asymmetry % (Z)	Ratio (Z)
1	L cerebellar ctx	1285	504781	392.8 (-4.09)**	94.7	-9.0 (-4.06)**	0.95 (-4.09)**
2	R cerebellar ctx	1285	554505	431.5 (2.96)*	104.8	-9.0 (-4.06)**	1.04 (2.96)*
3	L cerebellar white matter	203	83022	409.0 (-0.52)	97.6	-6.2 (-4.89)**	0.99 (-0.52)
4	R cerebellar white matter	203	88500	436.0 (0.95)	105.4	-6.2 (-4.89)**	1.05 (0.95)
5	L nucleus lentiformis	192	100158	521.7 (2.76)*	120.6	37.9 (10.76)**	1.26 (2.76)*
6	R nucleus lentiformis	192	62214	324.0 (-3.61)**	73.6	37.9 (10.76)**	0.78 (-3.61)**
7	L nucleus caudatus	126	39813	316.0 (-0.84)	91.8	26.8 (4.56)**	0.76 (-0.84)
8	R nucleus caudatus	126	29135	231.2 (-4.26)**	65.0	26.8 (4.56)**	0.56 (-4.26)**
9	L thalamus	200	84504	422.5 (1.25)	110.2	30.8 (6.80)**	1.02 (1.25)
10	R thalamus	200	58514	292.6 (-2.94)*	77.3	30.8 (6.80)**	0.71 (-2.94)*
11	L sensorimotor ctx	1823	800490	439.1 (1.61)	115.0	44.0 (29.47)**	1.06 (1.61)
12	R sensorimotor ctx	1823	448176	245.8 (-3.79)**	63.5	44.0 (29.47)**	0.59 (-3.79)**
13	L occipital ctx	1709	811603	474.9 (3.07)**	119.0	14.8 (3.69)**	1.15 (3.07)**
14	R occipital ctx	1709	691555	404.7 (0.60)	102.8	14.8 (3.69)**	0.98 (0.60)
15	L sup parietal lobule	581	262479	451.8 (1.43)	117.3	29.2 (11.64)**	1.09 (1.43)
16	R sup parietal lobule	581	185932	320.0 (-1.48)	83.2	29.2 (11.64)**	0.77 (-1.48)
17	L ant dorsal frontal ctx	579	226959	392.0 (0.90)	108.0	4.3 (2.34)*	0.95 (0.90)
18	R ant dorsal frontal ctx	579	217255	375.2 (-0.03)	99.7	4.3 (2.34)*	0.91 (-0.03)
19	L post dorsal frontal ctx	818	329553	402.9 (0.85)	107.3	28.6 (12.19)**	0.97 (0.85)
20	R post dorsal frontal ctx	818	235455	287.8 (-2.73)*	75.0	28.6 (12.19)**	0.70 (-2.73)*
21	L ant orbital frontal ctx	496	194406	391.9 (2.25)*	112.4	18.9 (5.44)**	0.95 (2.25)*
22	R ant orbital frontal ctx	496	157665	317.9 (-1.46)	88.4	18.9 (5.44)**	0.77 (-1.46)
23	L post orbital ctx	357	148456	415.8 (2.20)*	111.8	42.1 (22.32)**	1.01 (2.20)*

BRASS – fit to template



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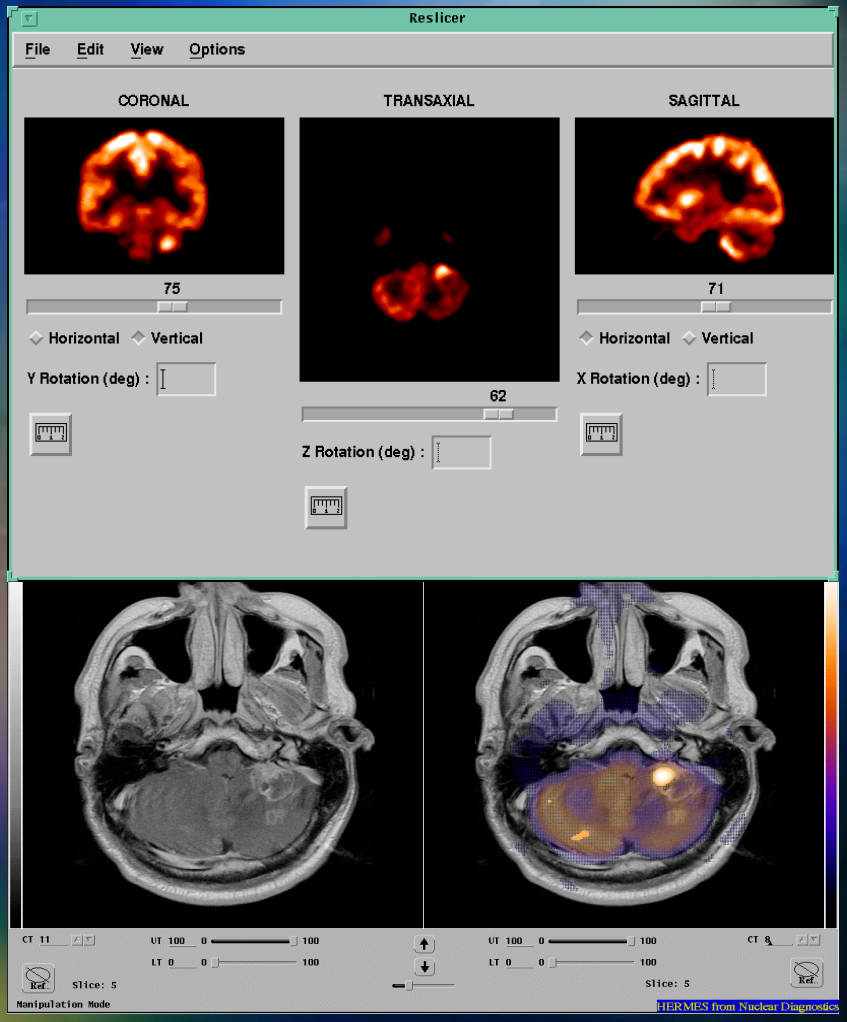
PET/MRI FUSION CASE STUDY:

- Patient History:
- Patient has history of lung carcinoma with suspicion of metastatic disease to the brain. MRI scan was performed first followed by a Pet scan. The MRI revealed a focus within the cerebellum suspicious for metastases. The Pet scan also revealed abnormal radiotracer uptake within the cerebellum. When both scans were fused, the focal area of suspicion was compatible. Patient was followed by his oncologist.



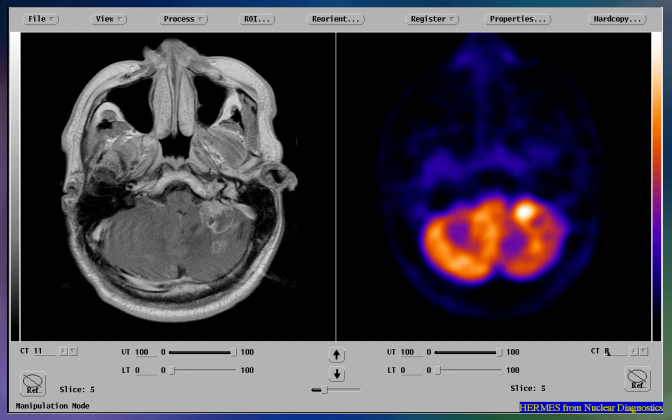


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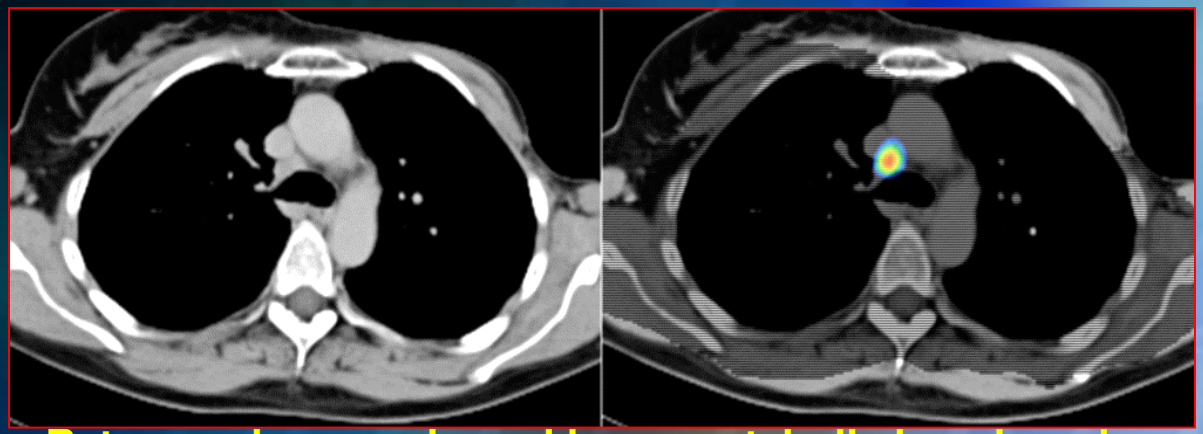
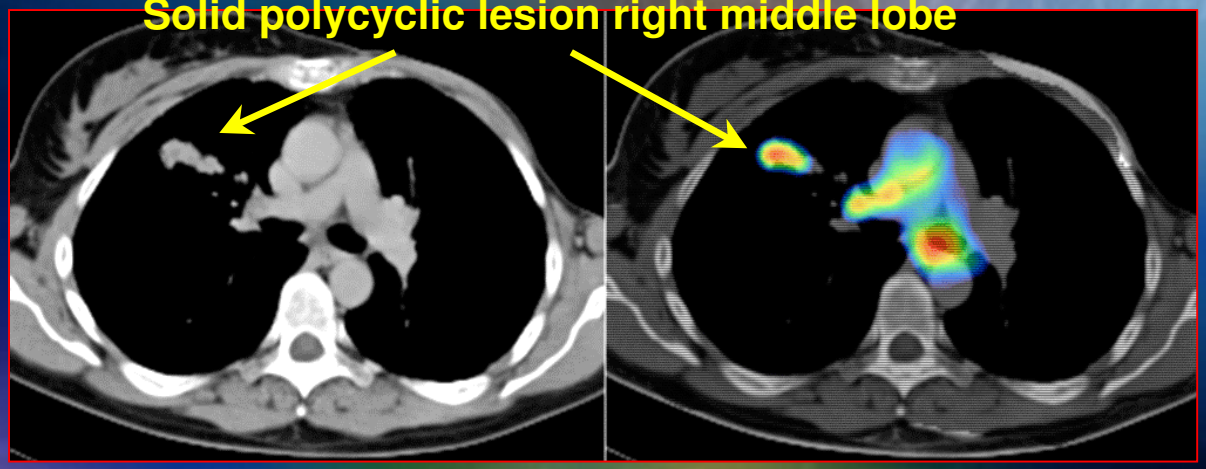
Image Registration Examples – PET/CT

B. H. , female, 27.09.1957 ID-No. 3075009
Image Fusion: FDG-PET / Multislice-CT (28.07.2000)
Diagnosis: Breast Cancer (1/1986) Since 1989 questionable metastases of the lung 6 cycles CMF, Tamoxifen



Retrocaval, non enlarged hypermetabolic lymph node

Solid polycyclic lesion right middle lobe



Causes of PET – CT mismatch

Position of arms (up/down)
Type of breathing (tidal/forced inspiration)
Shape of palet (flat/curved)
Position of trunk on palet (skew/straight,flat /rotated)
Position of neck on palet (extended/flexed)
Contention of soft tissues (breasts)
Abdominal content (colon)
Condition of patient (effusion…)

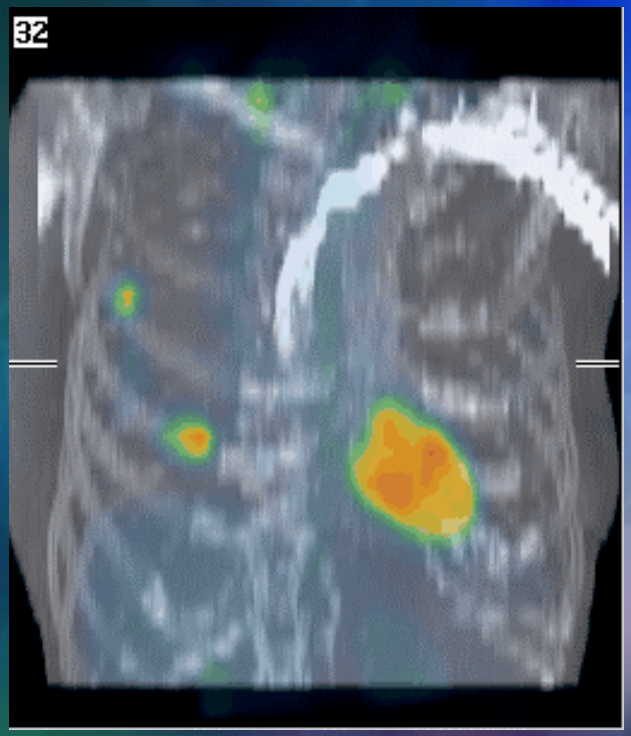
conventional CT

Volume investigated [whole trunk(PET) vs chest/abdomen(CT)]
Pixel/voxel size (Dicom/IF header)
Position of centre of rotation in the body (position of the image)
Dynamic organs (heart)
Erroneous co-registration (manual/automatic-linear/morphing)
Artefacts (metal,absorbing material,air..)
……..

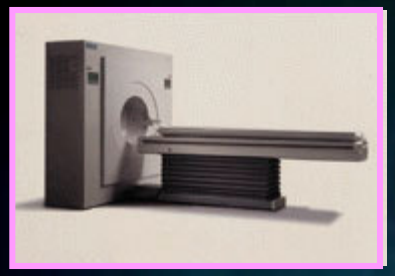
What do we do with the images once they have been fused?

- Present the fused images well
- Send to Radiotherapy Planning systems
- Burn Hreviewer CD with GIF, PNG or JPEG images
- Use JADE – web-based radiology application for PC viewing
- Burn RAPID CD (Read Anywhere Image Display) CD with application and data
- Use JaRViS (Java Remote Viewing Software) web-based PC viewing

Fused MIP Movie



Radiotherapy planning - Hermes connection



PET

CHL server

HEALTHNET

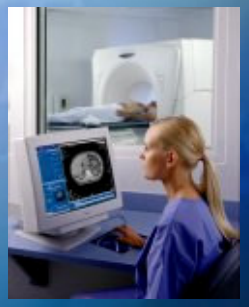
Dicom

LAN

Co-registration
PET - CT

PACS

PACS



Rx Ther Planning
(Adac)

Simulation CT
(Siemens)

Hermes

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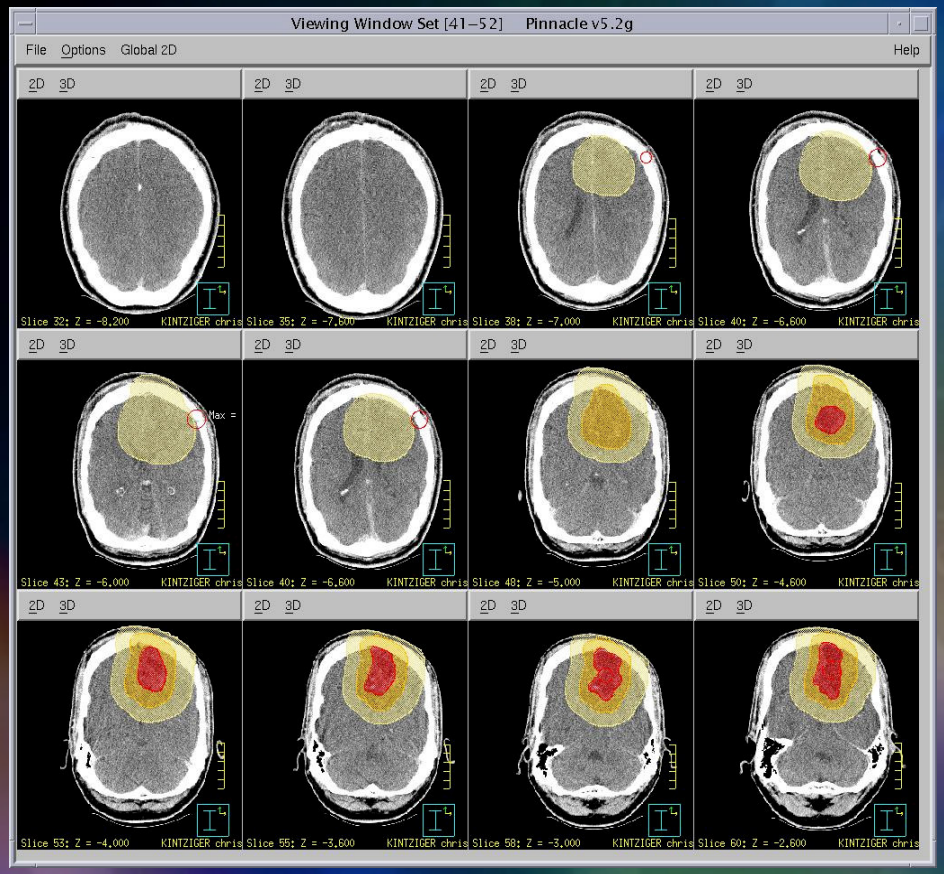
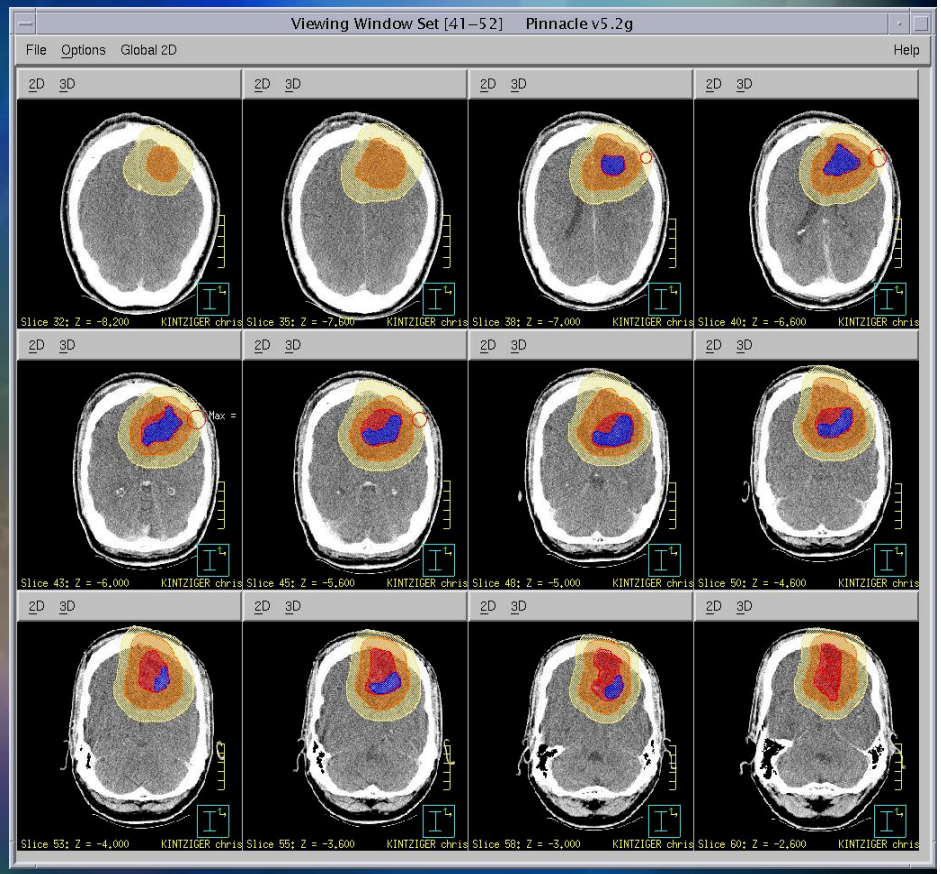
Without PET



With PET



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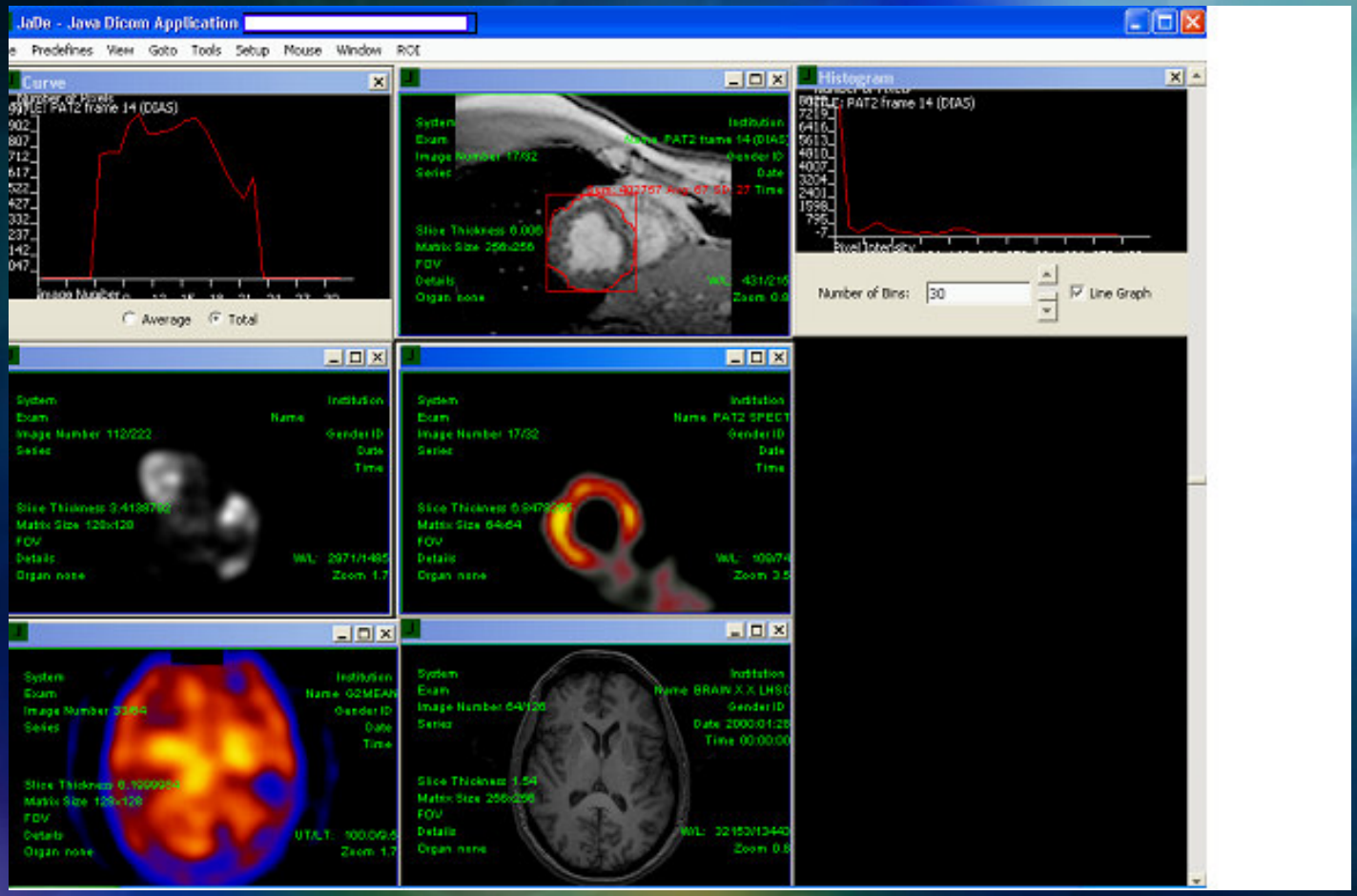
JADE Viewing/Reporting



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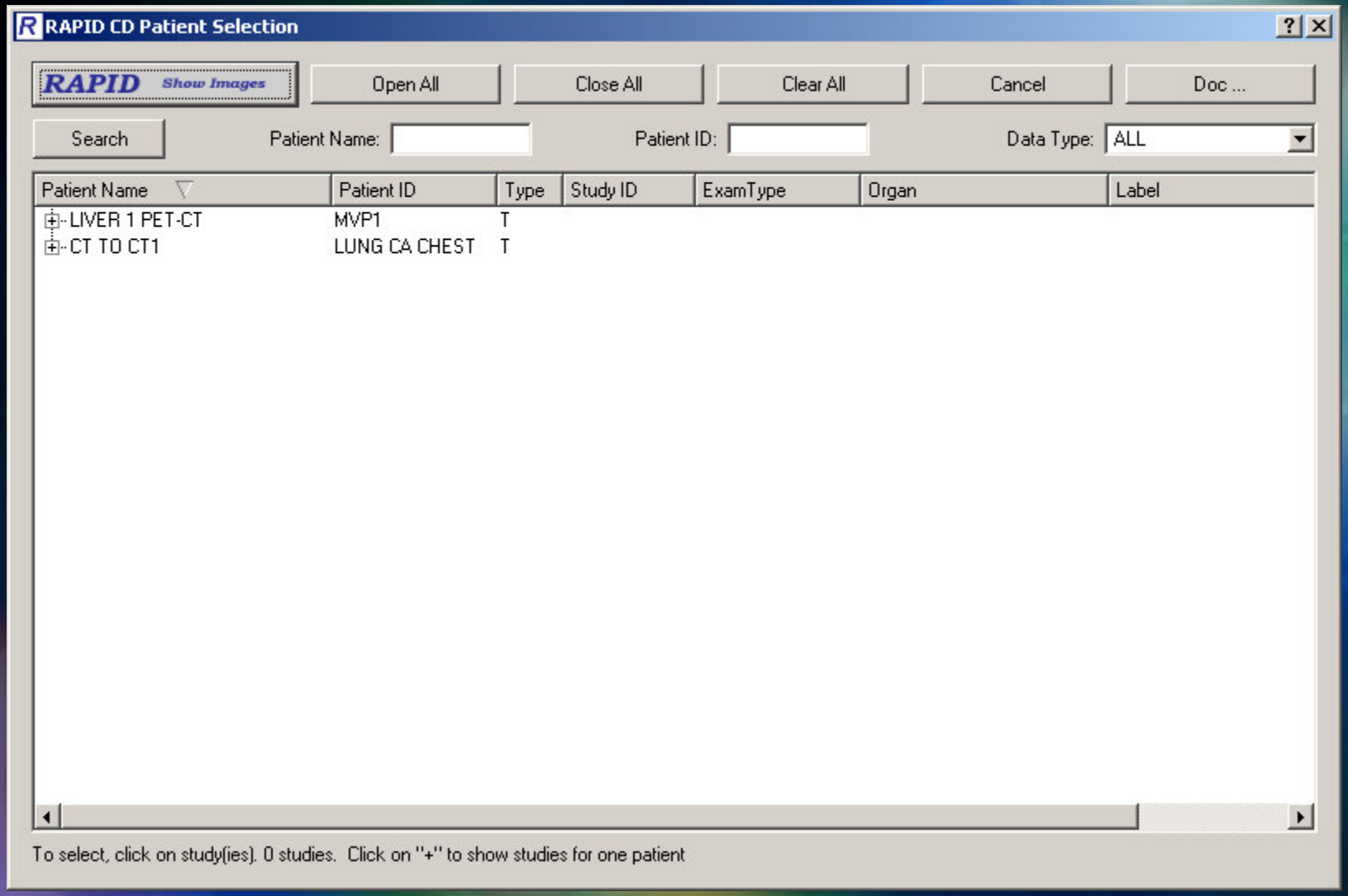

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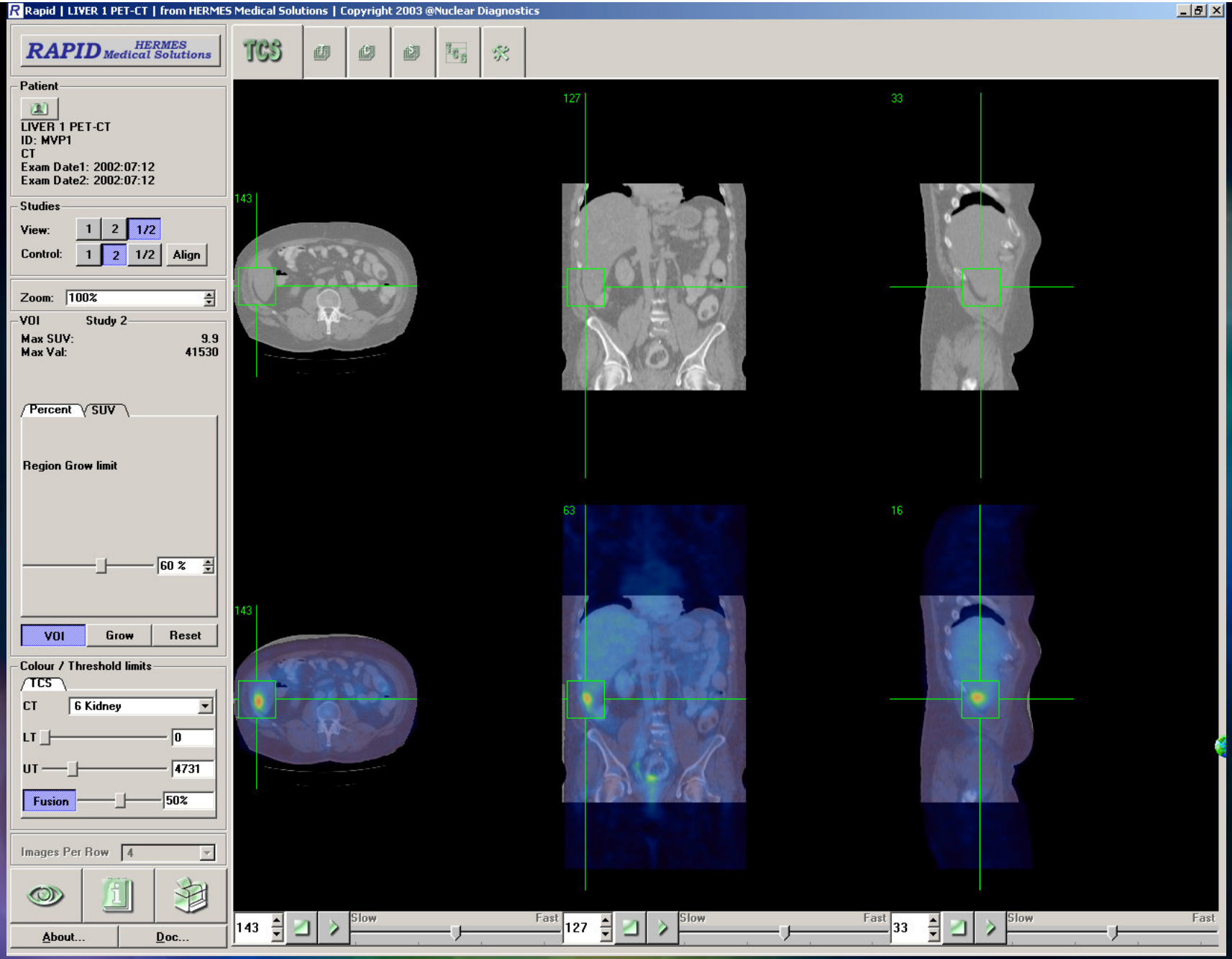

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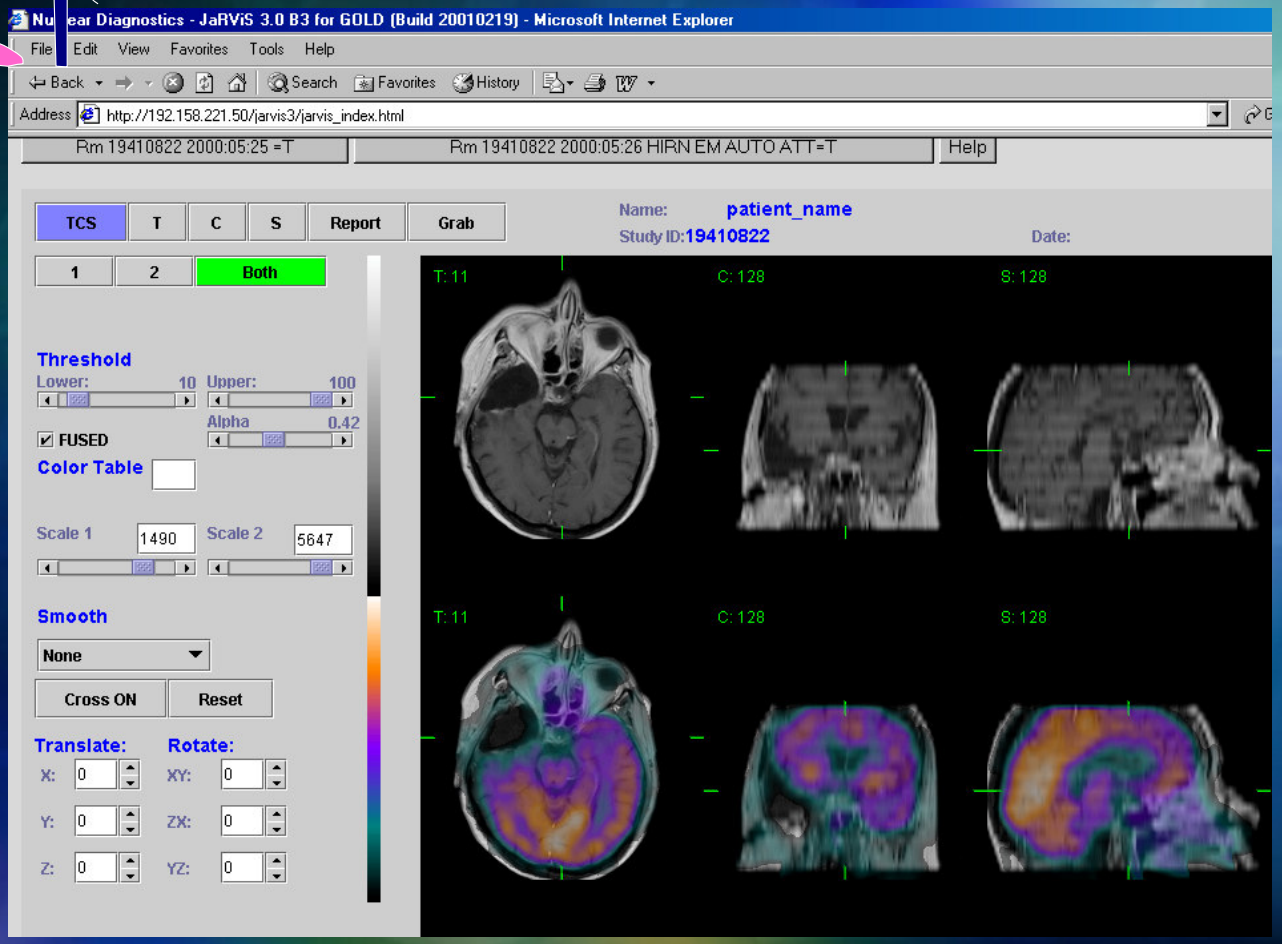
JaRViS remote viewing stating

Referring physician using Netscape/Iexplorer on Windows-PC/Mac

Hermes workstation = Web-Server

name, passwort, query

Java applet, patient index, color tables, compressed images



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