

HERMES and Image Fusion

HERMES

HERMES MEDICAL SOLUTIONS

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

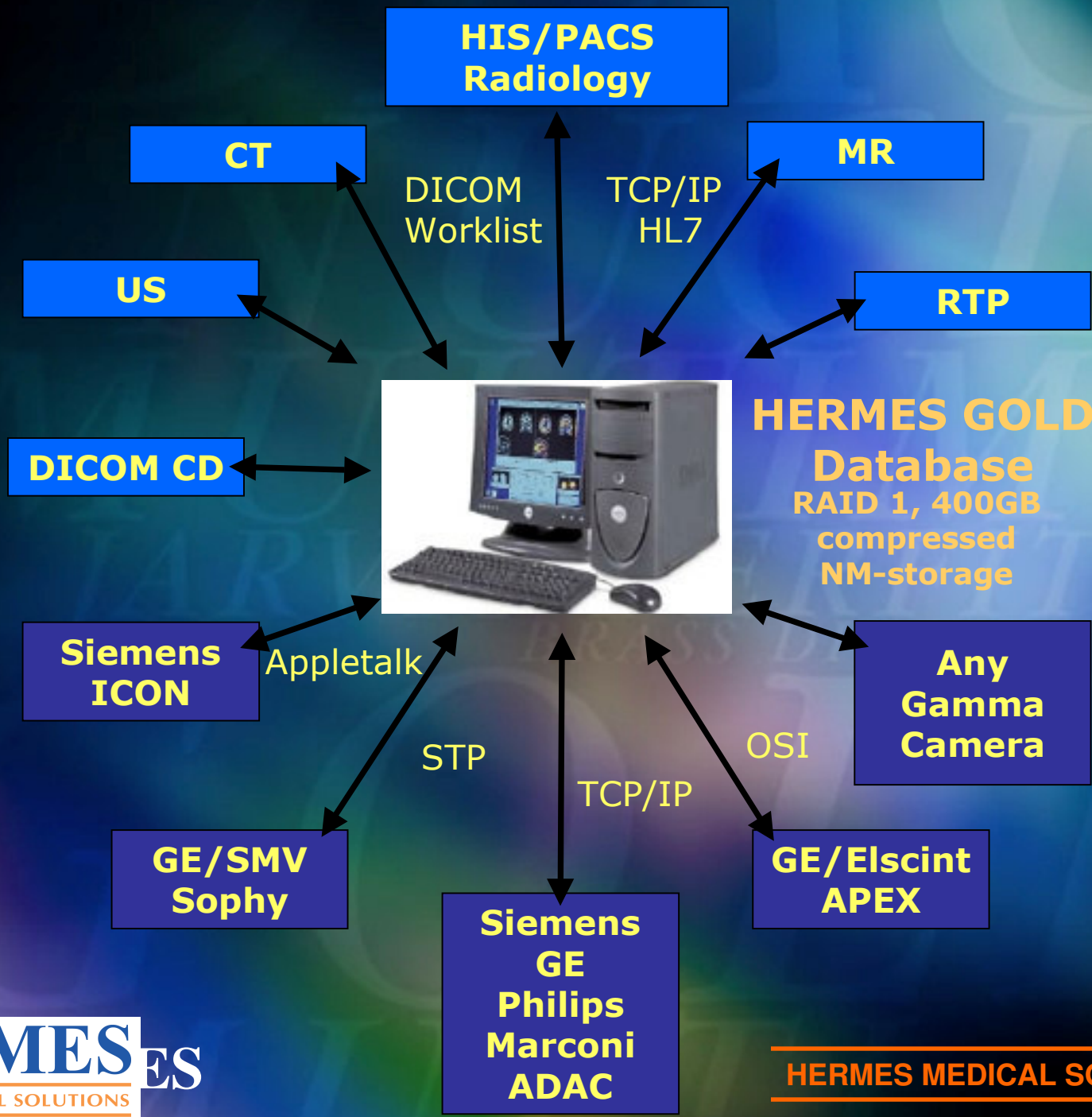
How do we do image fusion?

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



Network between two hospitals in Muenchen, Germany

Innenstadt

HERMES 1

HERMES 2

HERMES 3

HERMES 4

HERMES 5

Großhadern

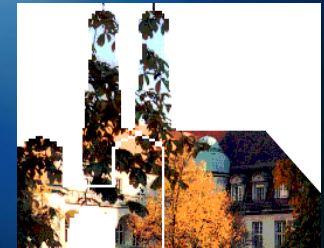
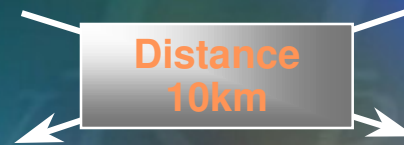
HERMES 6

HERMES 7

HERMES 8

HERMES 9

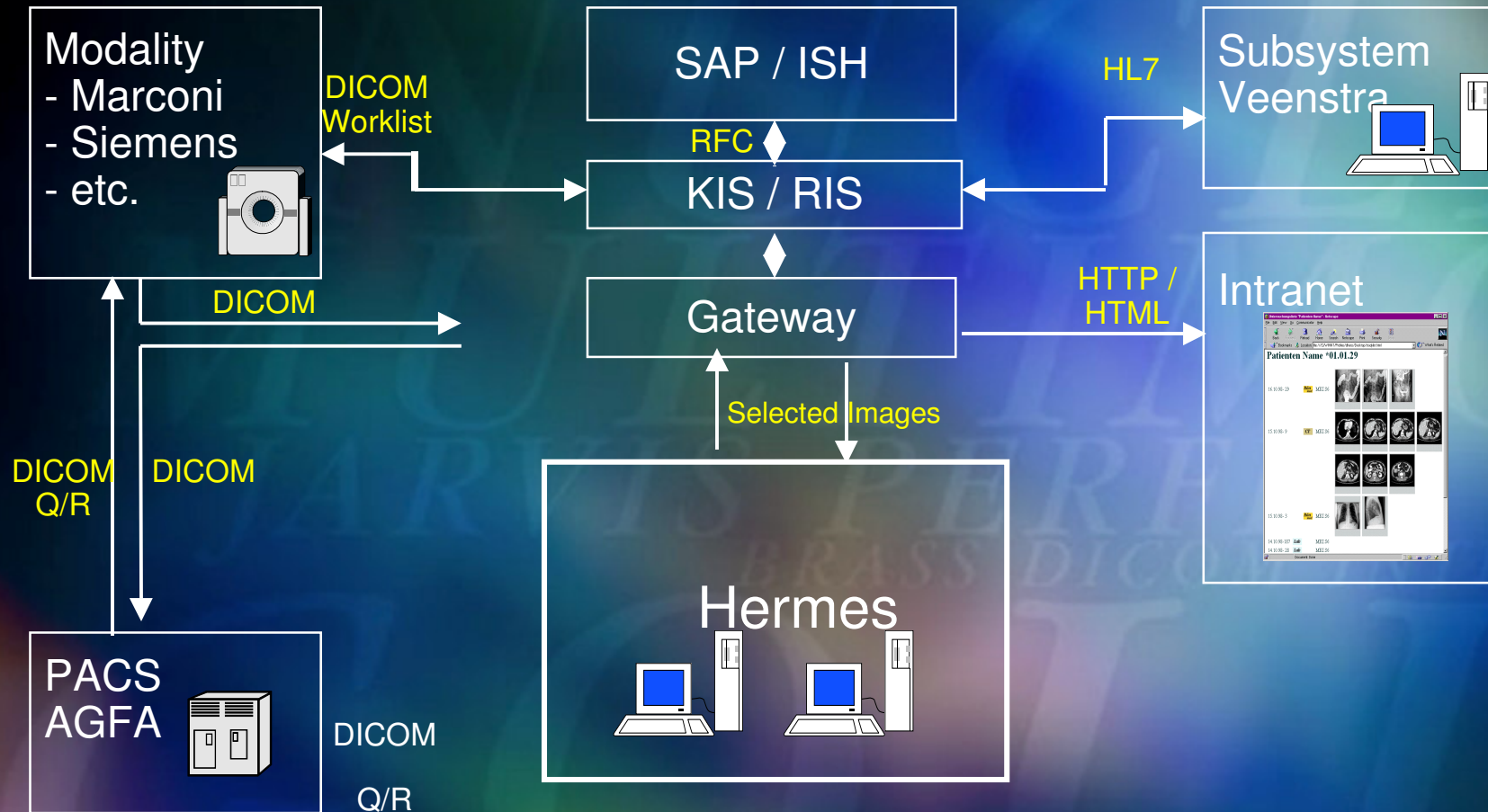
HERMES 10



HERMES

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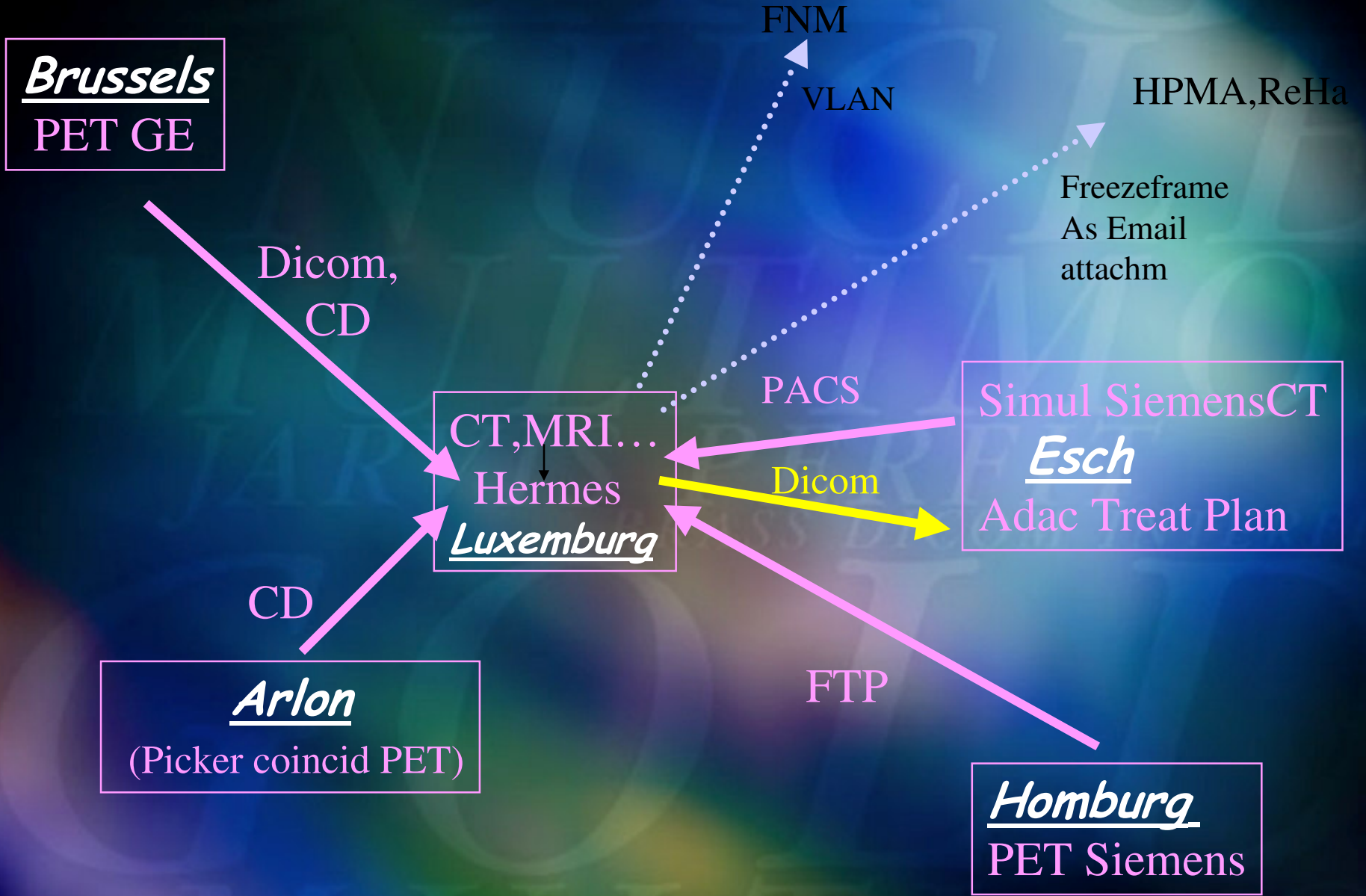
Integration of Hermes in Muenchen



HERMES

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Luxemburg and Associated Clinics



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

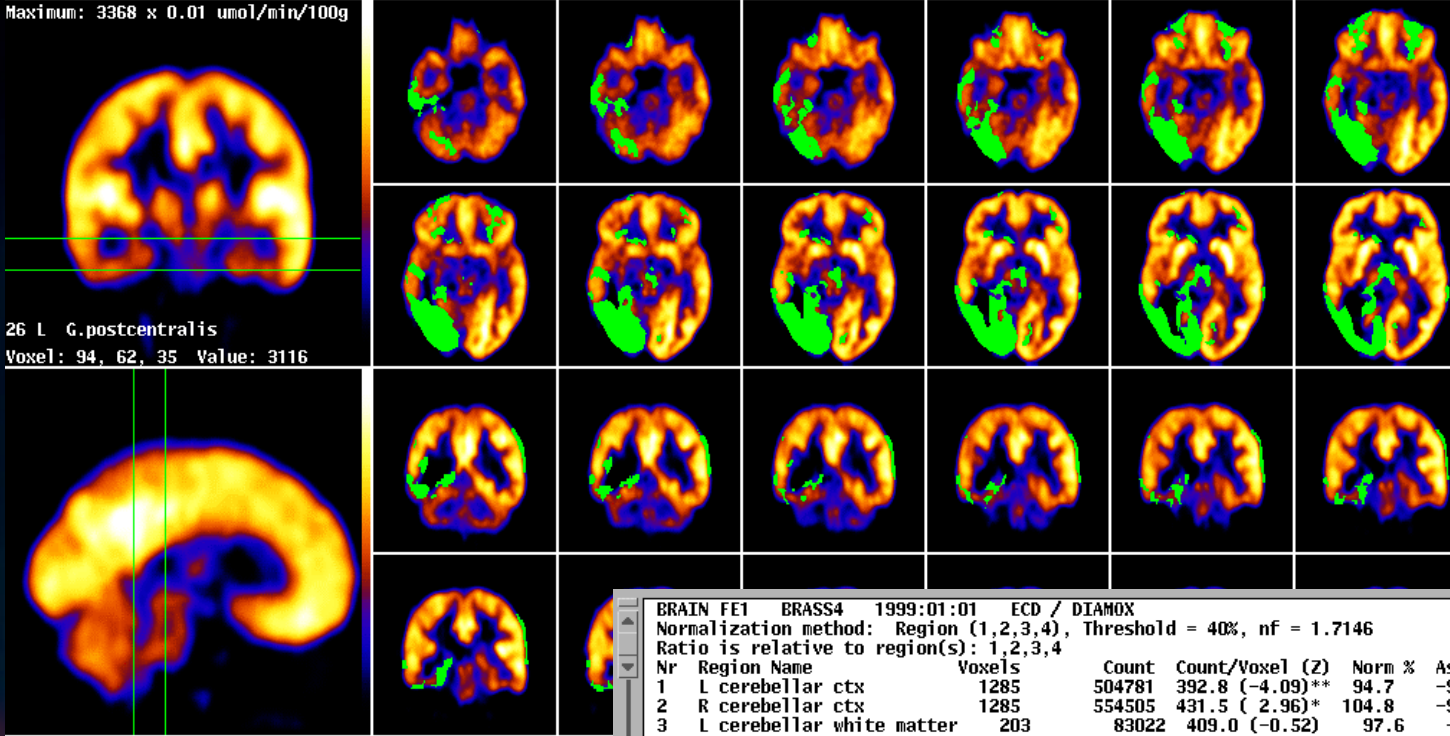
SPECT and SPECT

Plain Film and Nuclear
Statics

BRASS – fit to template

Maximum: 3368 x 0.01 umol/min/100g

26 L G.postcentralis
Voxel: 94, 62, 35 Value: 3116



STUDY1: BRAIN,MA/1 BRASS/MM 1996:0

STUDY1	Size (%)	Voxels	Size
	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

Study1: EARLY PARKINSON 1 DATSCAN 2003:02:25 DATSCAN (Auto Fitted) BRASS

Maximum: 484

About BRASS..

TRANSVERSE

↑ ↓

Slice: 39-41

Add: 1

5 Left Caudate
Voxel: 74, 68, 38 Value: 401

Region Map Quantification

Region Map Name: brmodel_voiz

Go to Region

Correction: Yes No

Hardcopy...

Calculate Region Statistics

Region: 1

Correction Set: 0

Save

DISMISS

EARLY PARKINSON 1 DATSCAN 2003:02:25 DATSCAN

Voxel units:

Normalization method: Region 1, Threshold = 0%, nf = 1.6670

Ratio is relative to region(s): 1

Nr	Region Name	Voxels	Count	Count/Voxel (Z)	Norm %	Asymmetry % (Z)	Ratio (Z)
1	Posterior	8654	875640	101.2 (N/A)	99.8	-1.1 (0.43)	1.00 (N/A)
2	Frontal	2967	287326	96.8 (-1.90)	90.1	-3.0 (-0.56)	0.96 (-1.87)
3	Cerebellum	3742	393277	105.1 (0.86)	104.9	4.3 (1.89)	1.04 (0.89)
4	Right Caudate	524	175734	335.4 (-0.99)	90.2	-10.8 (-3.51)**	3.31 (-0.98)
5	Left Caudate	524	160545	306.4 (-1.71)	82.6	-8.6 (-2.79)**	3.03 (-1.69)
6	Right Putamen	689	164796	239.2 (-3.06)**	68.6	-26.1 (-6.36)**	2.36 (-3.05)**
7	Left Putamen	689	133729	194.1 (-4.52)**	54.3	-22.3 (-5.53)**	1.92 (-4.51)**

Region: 5 Left Caudate

Nr of regions: 7

Color Table: 12 BW log4

LT: 0

UT: 100

Isocontour: 50

Study1 only

Study2 only

Study1 & Study2

Three

One

All slices...

Small

Large

Info...

Image: Original

Fit...

Defects...

Region map...

Results

ISOcontour

Defect

Difference

Atlas Grid

Overlay

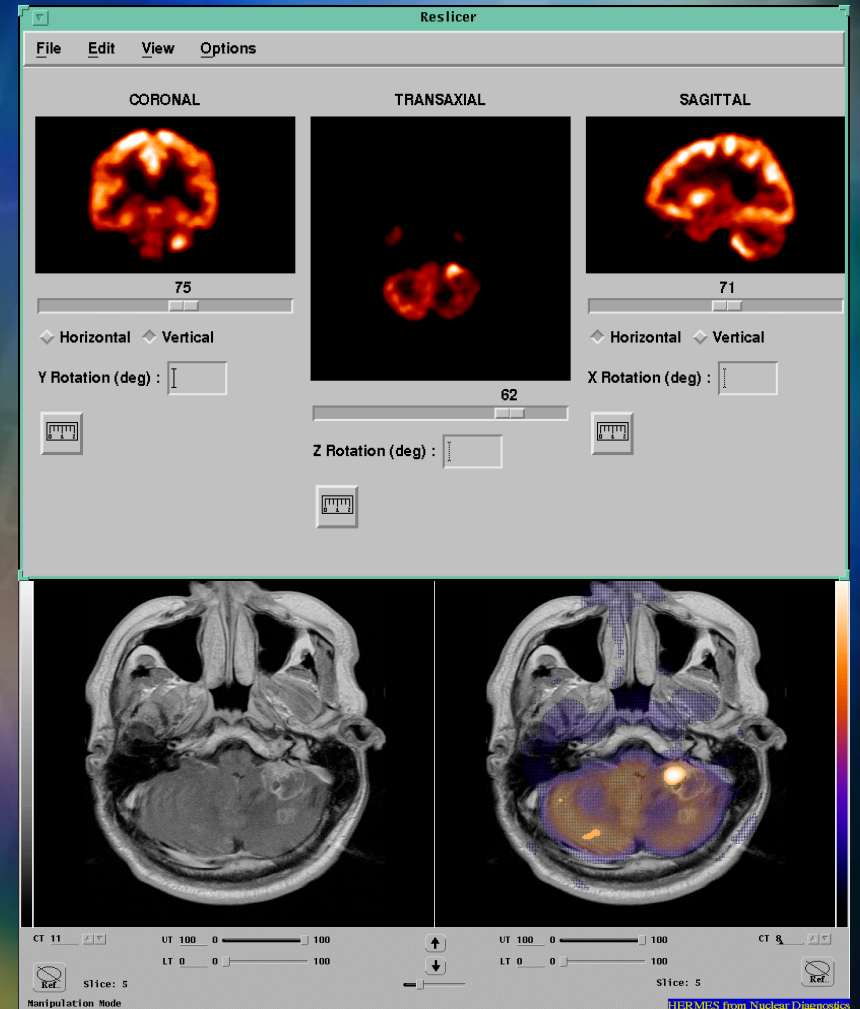
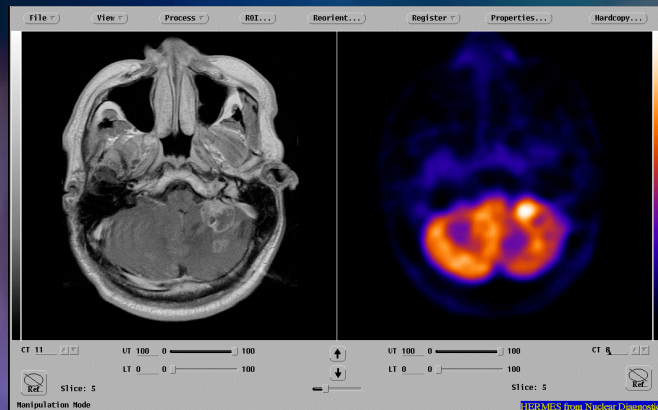
GO

HELP

Dismiss Popups

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.



HERMES

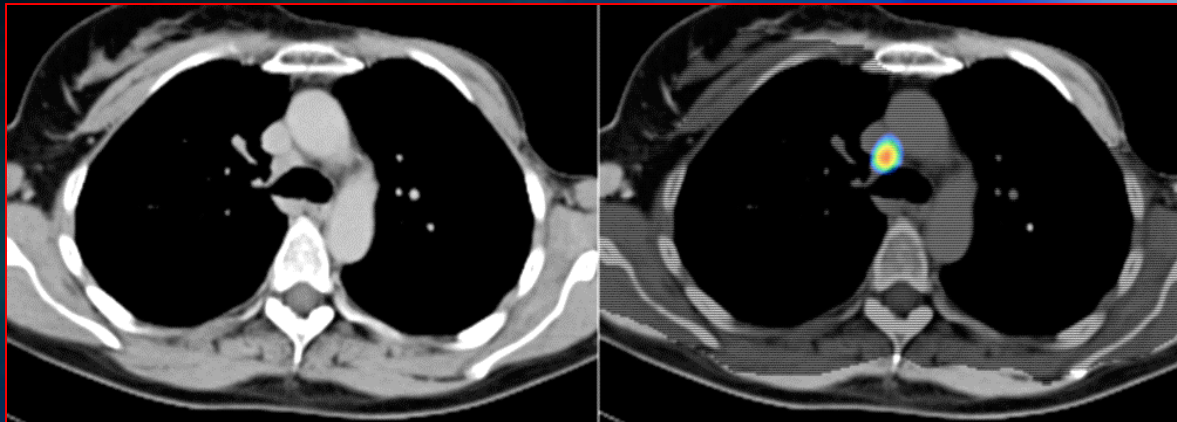
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Image Registration Examples – PET/CT

B. H. , female, 27.09.1957 ID-No. 3075009

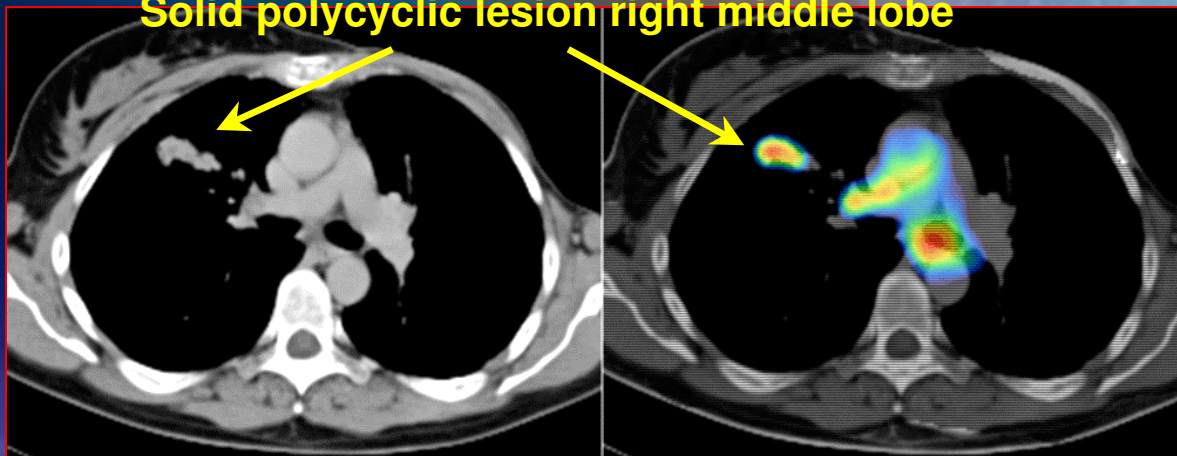
Image Fusion: FDG-PET / Multislice-CT (28.07.2000)

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

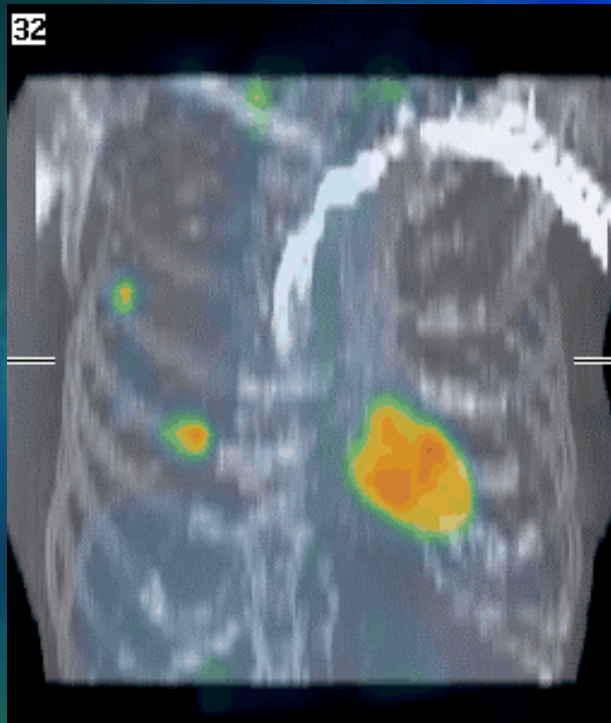
- Position of arms (up/down) ← conventional CT
- Type of breathing (tidal/forced inspiration) ←
- Shape of palet (flat/curved)
- Position of trunk on palet (skew/straight, flat /rotated)
- Position of neck on palet (extended/flexed)
- Contention of soft tissues (breasts)
- Abdominal content (colon)
-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

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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

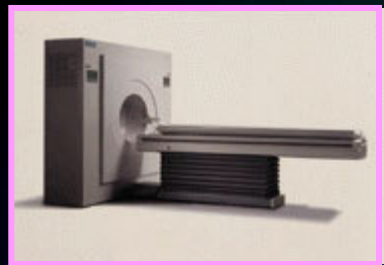
Fused MIP Movie



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Radiotherapy planning - Hermes connection

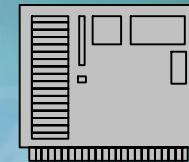


PET

CHL server

HEALTHNET

Dicom



LAN

Co-registration
PET - CT



Hermes

HERMES

PACS

PACS

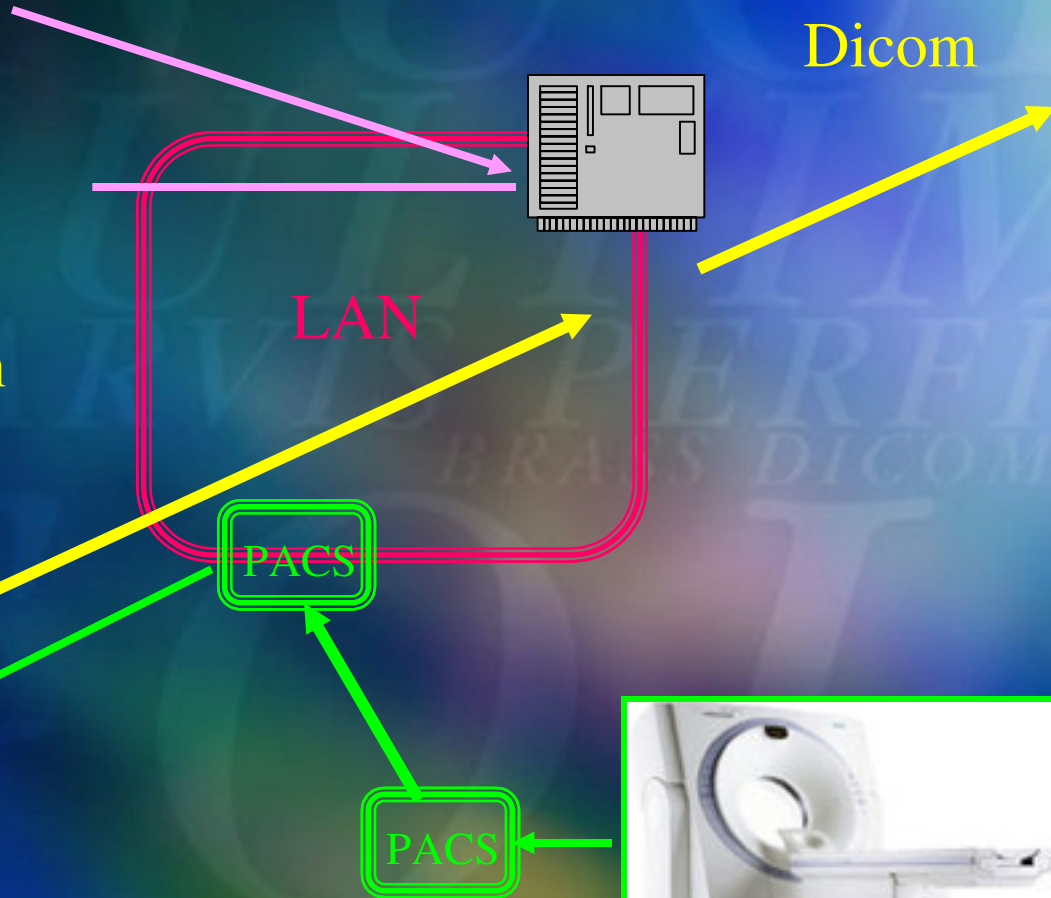


Rx Ther Planning
(Adac)

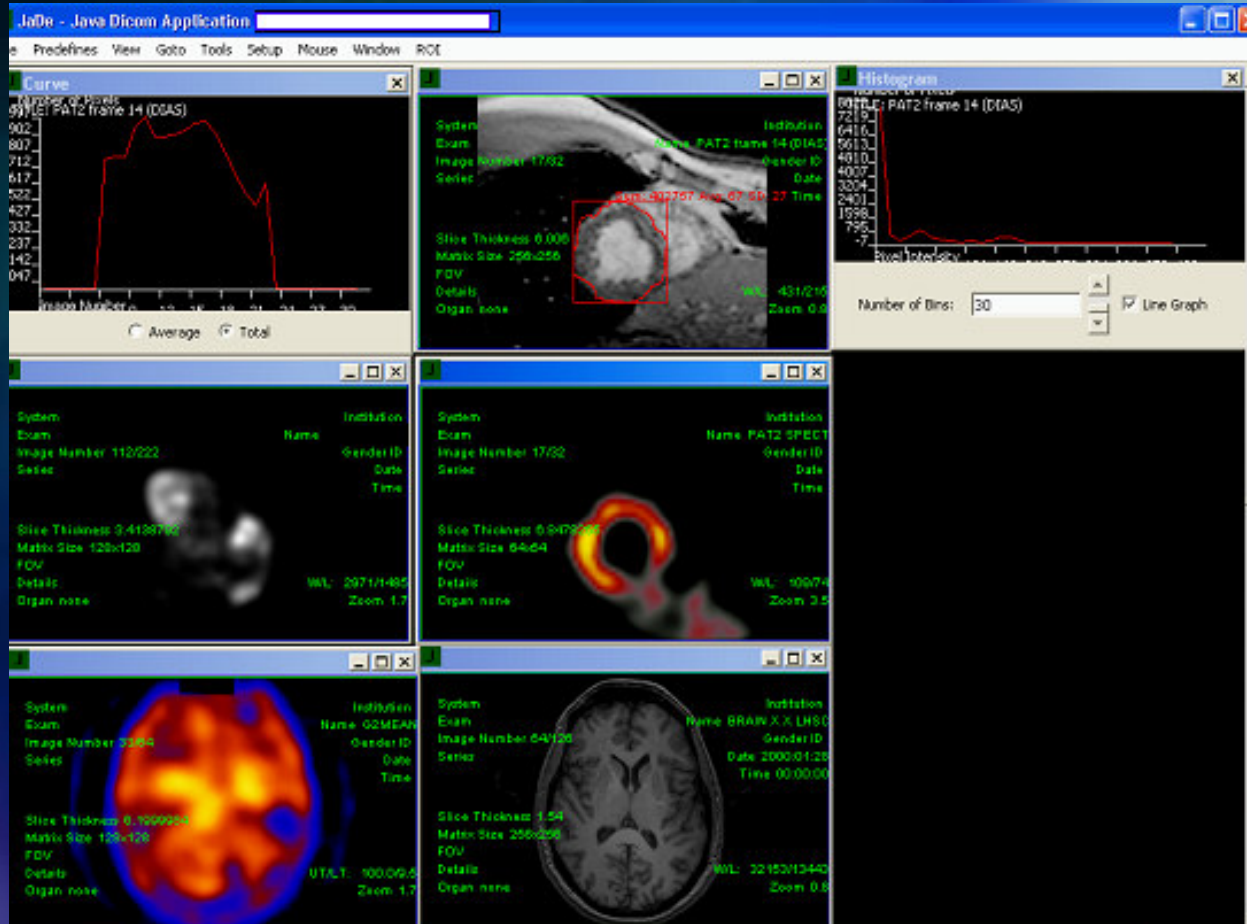


Simulation CT
(Siemens)

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JADE Viewing/Reporting



RAPID CD Patient Selection [?] [X]

RAPID Show Images

Open All Close All Clear All Cancel Doc ...

Search Patient Name: Patient ID: Data Type: ALL

Patient Name	Patient ID	Type	Study ID	ExamType	Organ	Label
+ LIVER 1 PET-CT	MVP1	T				
+ CT TO CT1	LUNG CA CHEST	T				

To select, click on study(ies). 0 studies. Click on "+" to show studies for one patient

RAPID HERMES Medical Solutions

TCS

Patient

LIVER 1 PET-CT
ID: MVP1
CT
Exam Date1: 2002:07:12
Exam Date2: 2002:07:12

Studies

View: 1 2 1/2
Control: 1 2 1/2 Align

Zoom: 100%

VOI Study 2
Max SUV: 9.9
Max Val: 41530

Percent SUV

Region Grow limit

60 %

VOI Grow Reset

Colour / Threshold limits

TCS

CT 6 Kidney

LT 0

UT 4731

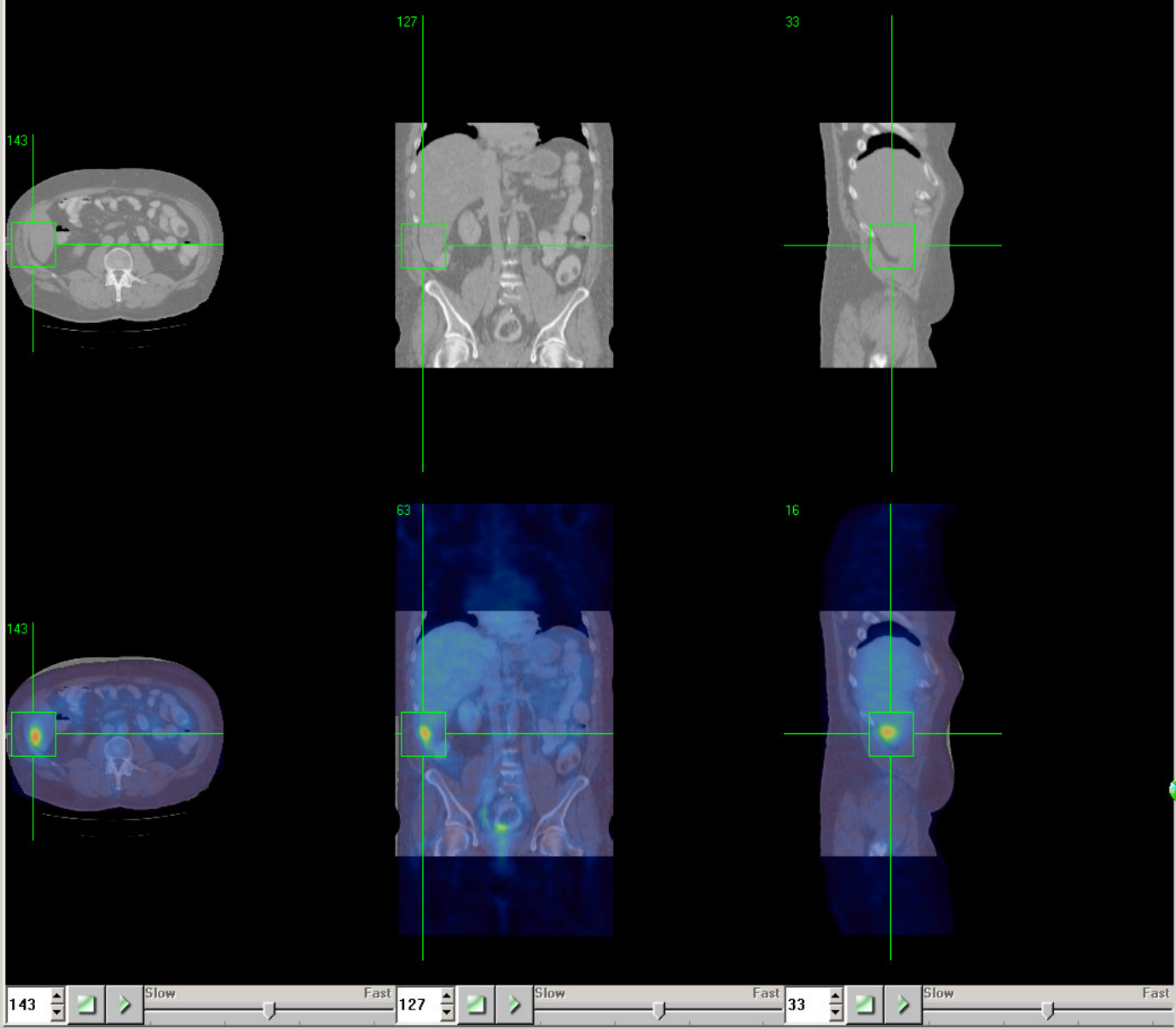
Fusion 50%

Images Per Row 4



About...

Doc...



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JaRViS remote viewing stating

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

Hermes workstation =
Web-Server



name, password, query



Java applet, patient index, color
tables, compressed images



Nuclear Diagnostics - JarViS 3.0 B3 for GOLD (Build 20010219) - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address http://192.158.221.50/jarvis3/jarvis_index.html

Rm 19410822 2000:05:25 =T Rm 19410822 2000:05:26 HIRN EM.AUTO ATT=T Help

TCS T C S Report Grab Name: **patient_name** Date: Study ID: **19410822**

1 2 **Both**

Threshold
Lower: 10 Upper: 100
 FUSED Alpha: 0.42
Color Table

Scale 1: 1490 Scale 2: 5647

Smooth
None

Cross ON Reset

Translate: **Rotate:**
X: 0 XY: 0
Y: 0 ZY: 0
Z: 0 YZ: 0

T: 11 C: 128 S: 128

T: 11 C: 128 S: 128

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