How to measure ΔSUV with the highest reproducibility

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Issues raised by IVS analysis

- Inter-observer agreement: Kappa 0.755 to 0.879

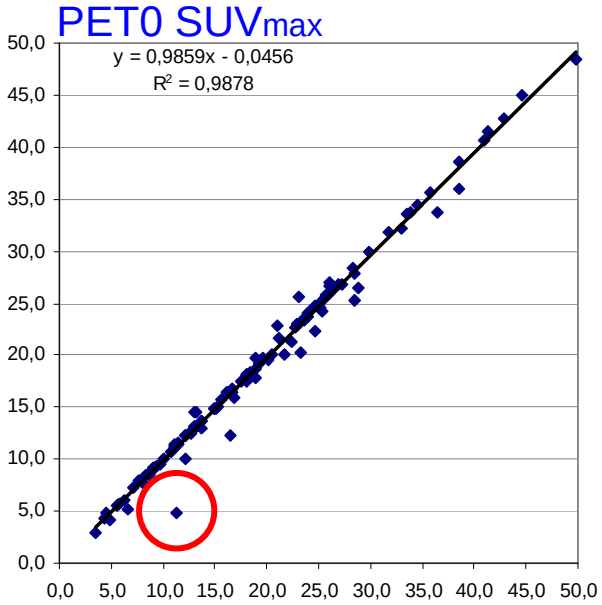
1) identification of the target lesion on baseline PET

2) identification of the target lesion on interim PET

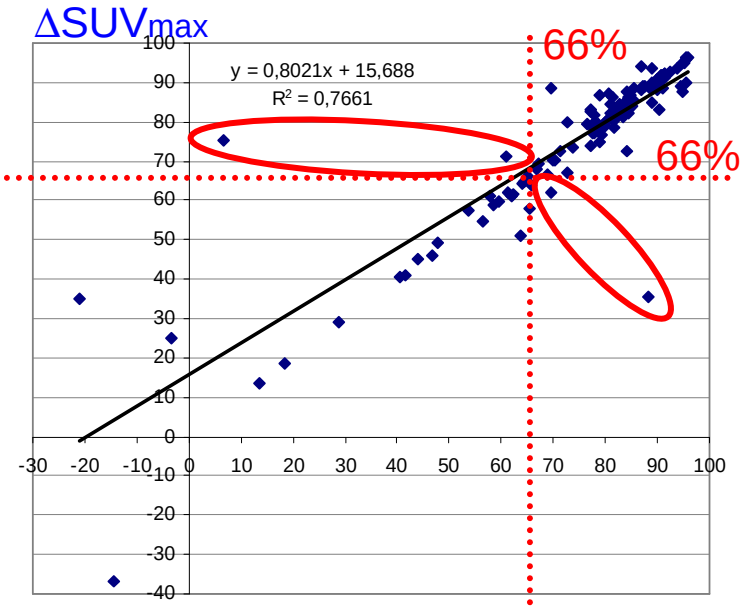
3) method of ROI drawing (2D vs. 3D)

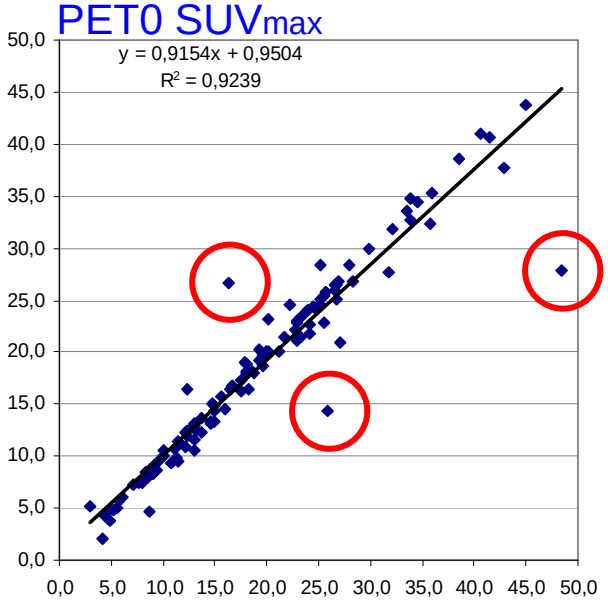
Landis and Koch scale	
0.81 – 1.00	almost perfect
0.61 – 0.80	substantial
0.41 – 0.60	moderate
0.21 – 0.40	fair
0.00 – 0.20	slight
< 0	no agreement

Inter-observer agreement

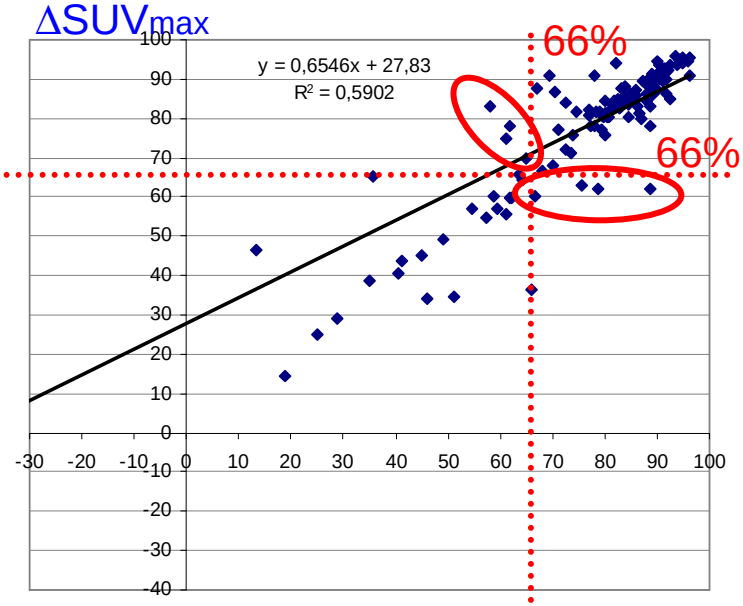


Obs1-Obs2
κ = 0.879



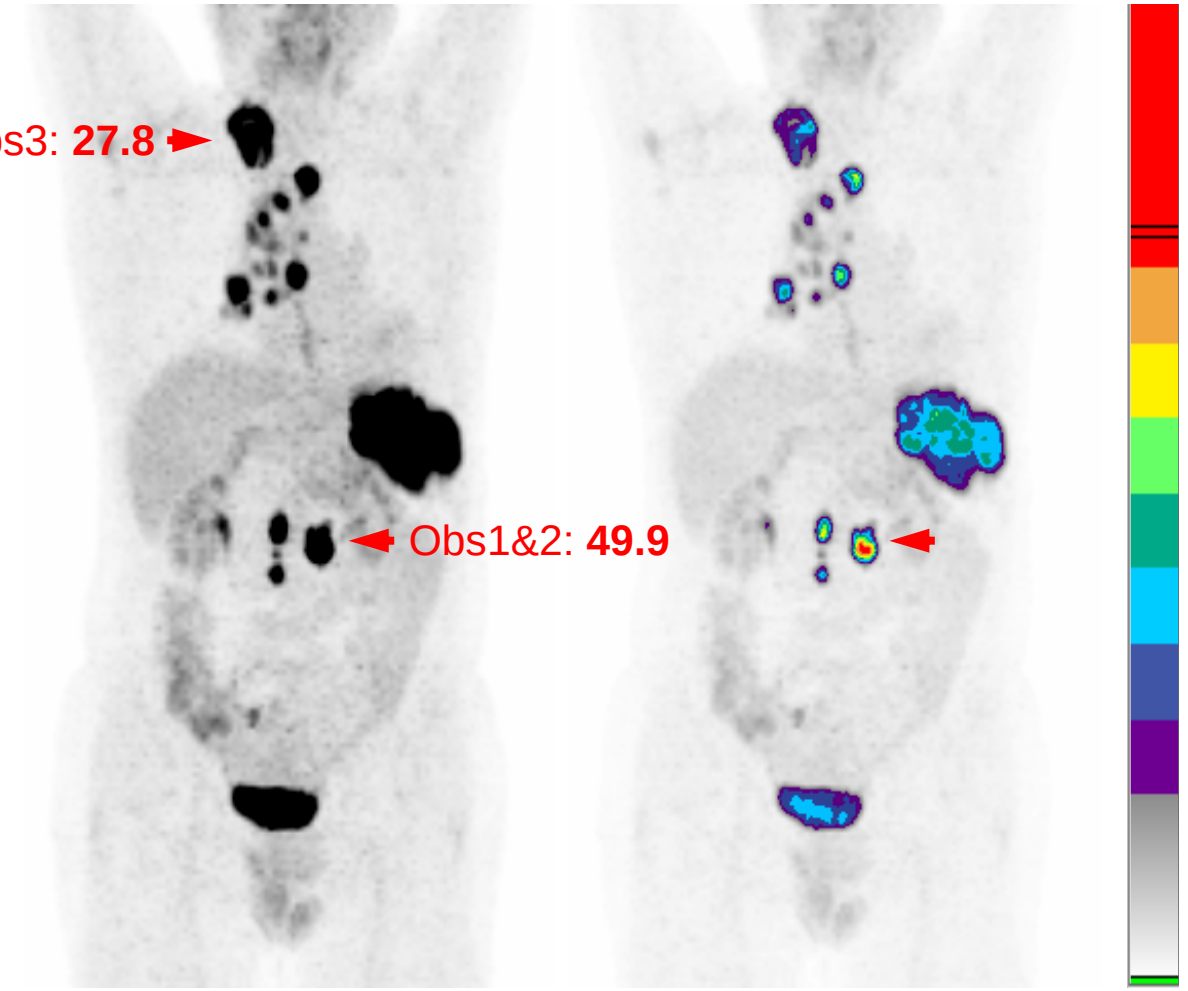


Obs2-Obs3
κ = 0.755



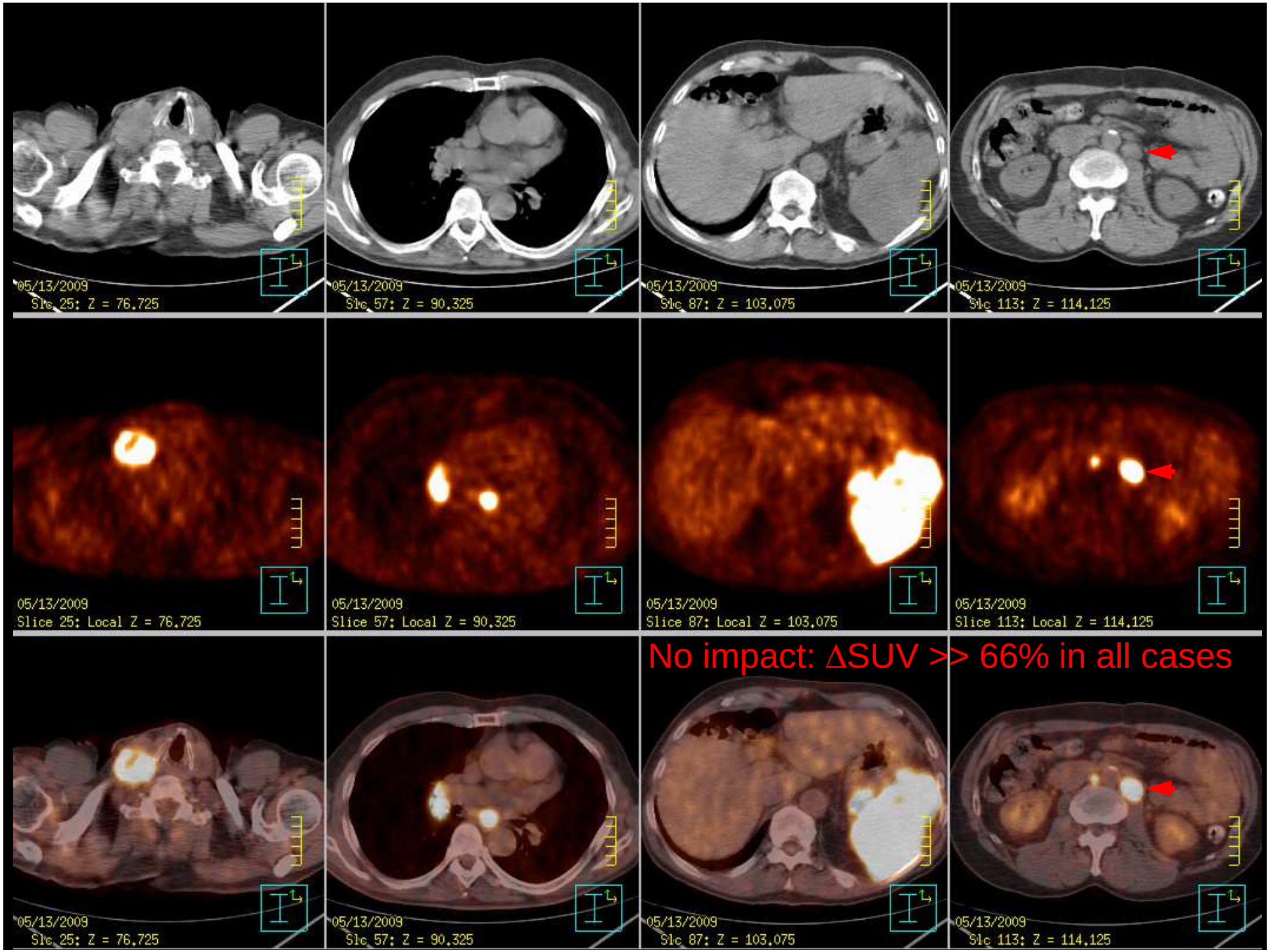
1) identification of the target lesion on baseline PET

- MIP
- color scale



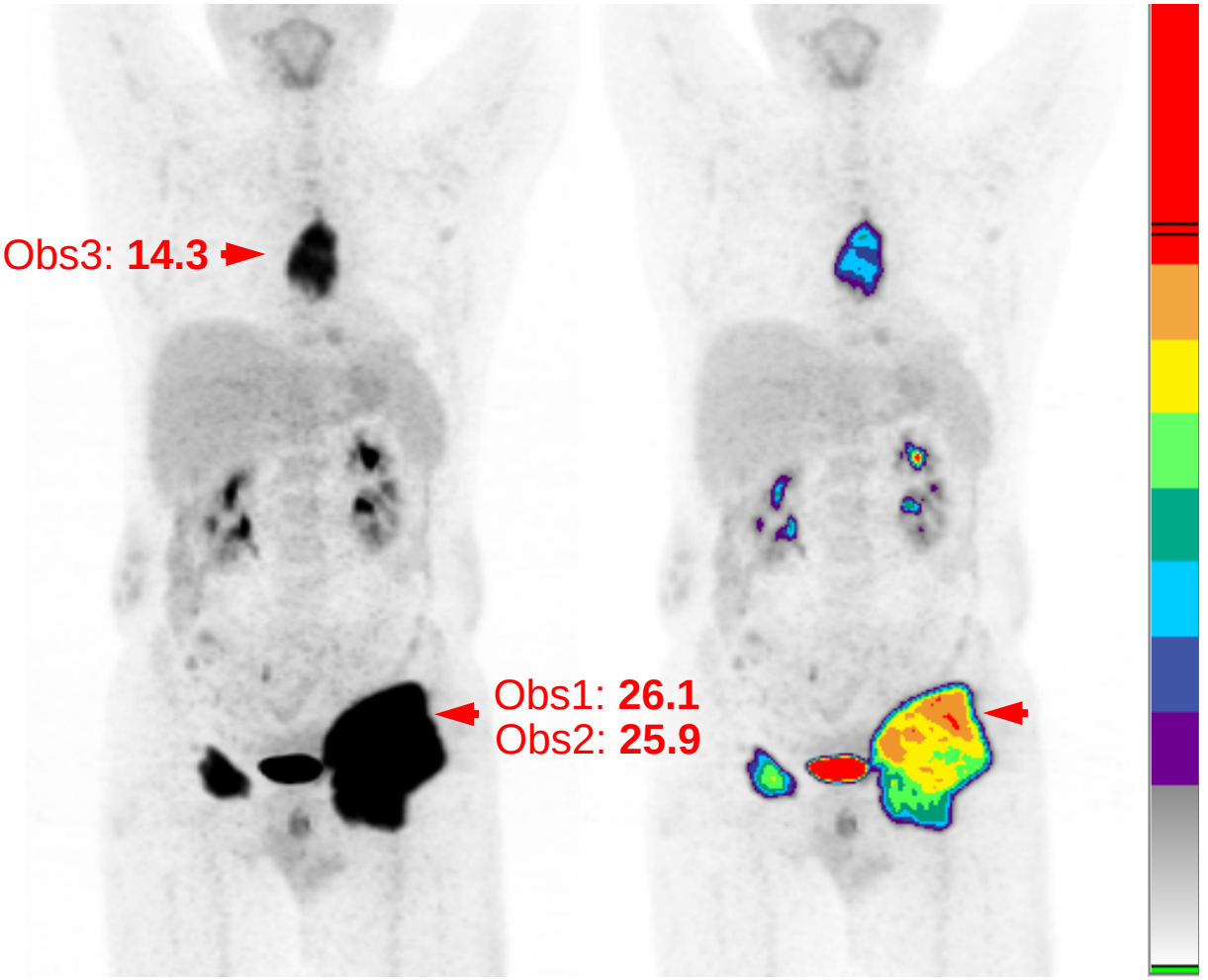
→ uretera?

Lin et al. *J Nucl Med* 2007;48:1626-32

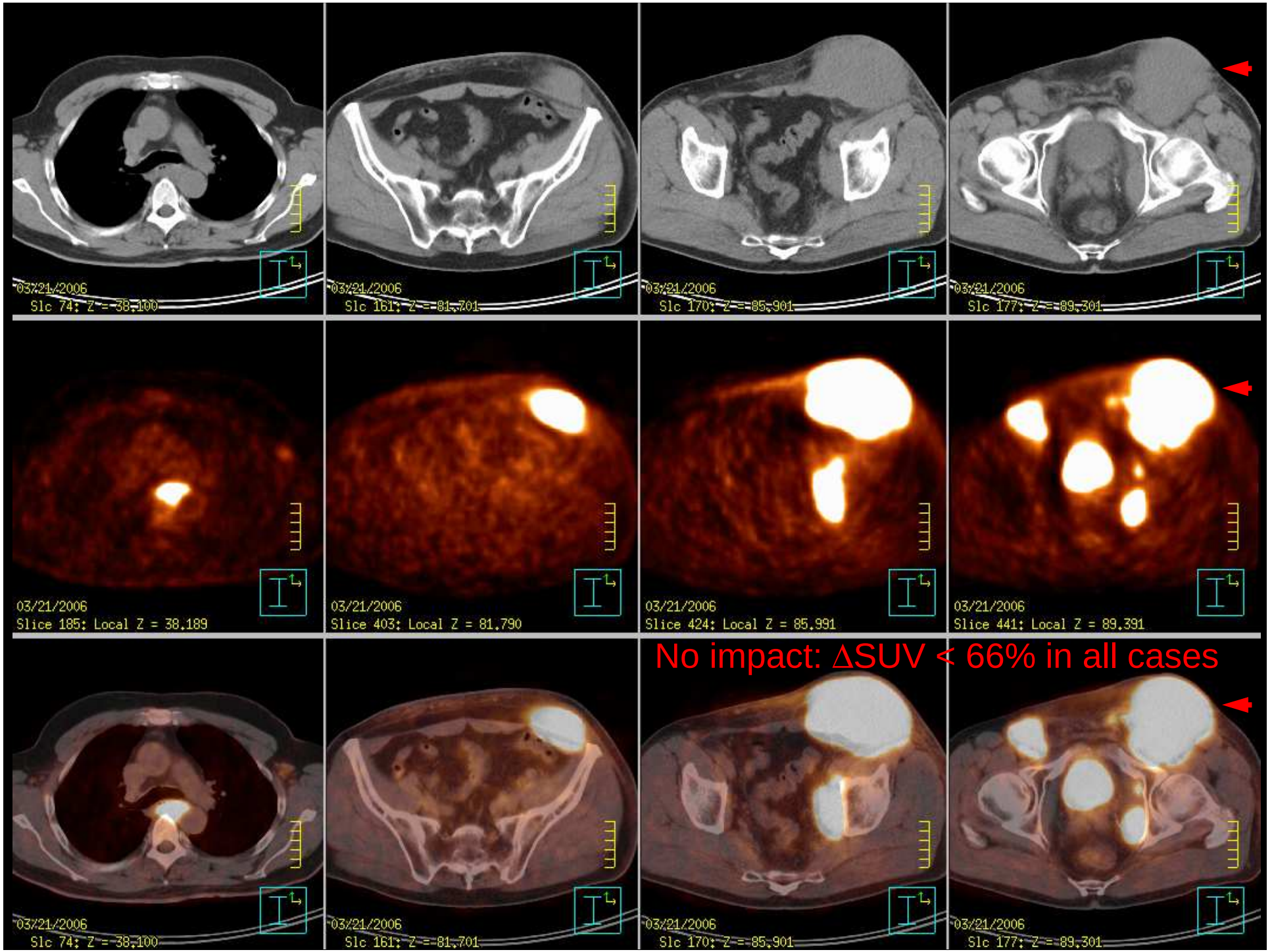

05/13/2009
Slc 25: Z = 76.725
05/13/2009
Slc 57: Z = 90.325
05/13/2009
Slc 87: Z = 103.075
05/13/2009
Slc 113: Z = 114.125
05/13/2009
Slice 25: Local Z = 76.725
05/13/2009
Slice 57: Local Z = 90.325
05/13/2009
Slice 87: Local Z = 103.075
05/13/2009
Slice 113: Local Z = 114.125
No impact: ΔSUV >> 66% in all cases
05/13/2009
Slc 25: Z = 76.725
05/13/2009
Slc 57: Z = 90.325
05/13/2009
Slc 87: Z = 103.075
05/13/2009
Slc 113: Z = 114.125

1) identification of the target lesion on baseline PET

- MIP
- color scale



→ contamination?


03/21/2006
Slc 74; Z = 38.100
03/21/2006
Slc 161; Z = 81.701
03/21/2006
Slc 170; Z = 85.901
03/21/2006
Slc 177; Z = 89.301
03/21/2006
Slice 185; Local Z = 38.189
03/21/2006
Slice 403; Local Z = 81.790
03/21/2006
Slice 424; Local Z = 85.991
03/21/2006
Slice 441; Local Z = 89.391
No impact: ΔSUV < 66% in all cases
03/21/2006
Slc 74; Z = 38.100
03/21/2006
Slc 161; Z = 81.701
03/21/2006
Slc 170; Z = 85.901
03/21/2006
Slc 177; Z = 89.301

2) identification of the target lesion on interim PET

- Case 1: interim PET (+)
  - SUV_{max} whichever the location

Lin et al. *J Nucl Med* 2007;48:1626-32
Itti et al. *J Nucl Med* 2009;50:527-33
Casasnovas et al. *Blood* 2011;118:37-43

→ Diffuse disease/lymphocyte clones/PVE?

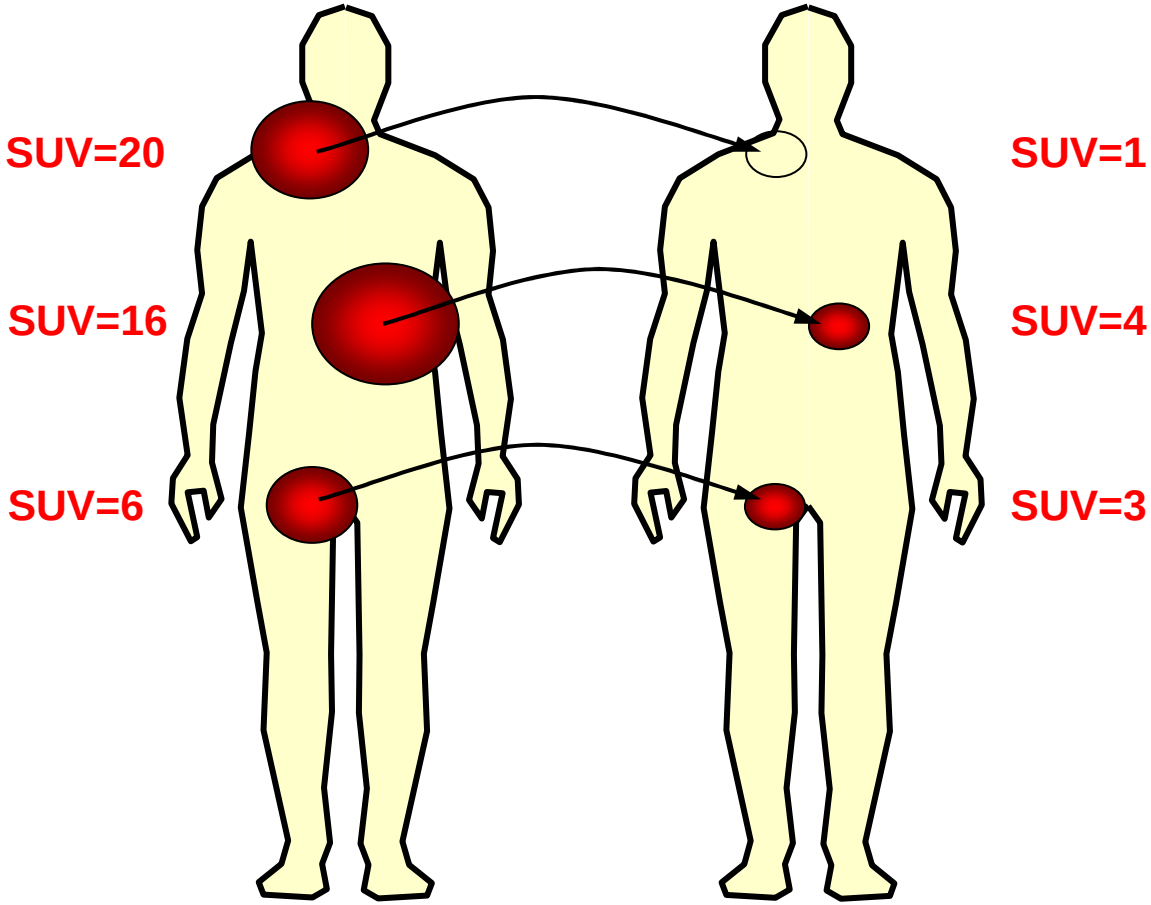
  - or same site as on PET0 (*follow-up of a target*)

→ What if 2 or more interim PET (+) lesions?

  - or define target on PET2, then go back to PET0

→ What if no lesion?

2) identification of the target lesion on interim PET

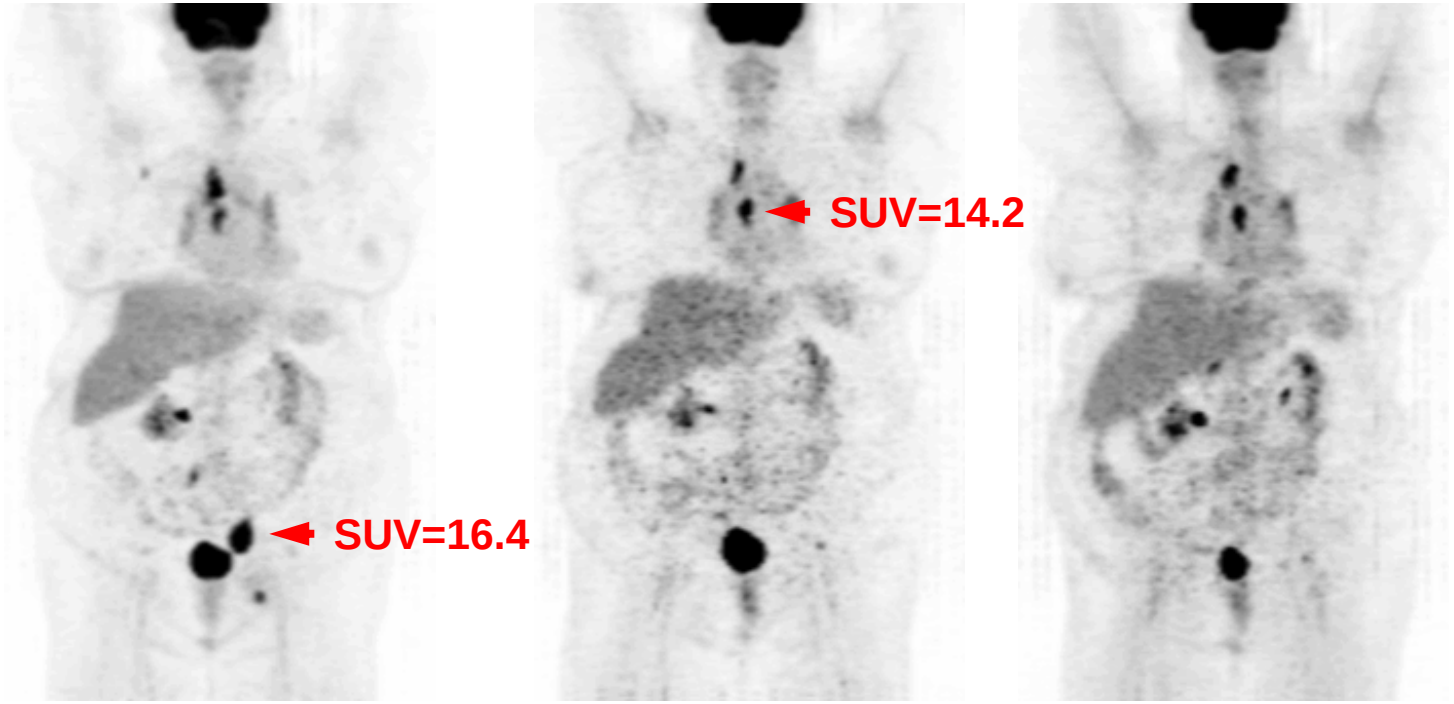


Whichever the location:
$SUV_0=20$, $SUV_2=4$
$\Delta SUV=80\% \rightarrow CR$

Follow-up of a target:
$\Delta SUV_{t1}=95\% \rightarrow CR$
$\Delta SUV_{t2}=75\% \rightarrow CR$
$\Delta SUV_{t3}=50\% \rightarrow PR$

Retrospective target:
$\Delta SUV_{t2}=75\% \rightarrow CR$
$\Delta SUV_{t3}=50\% \rightarrow PR$

Limits of this approach



Baseline PET PET2 End of treatment

→ ΔSUV=13%, no event after 43 mo f-u

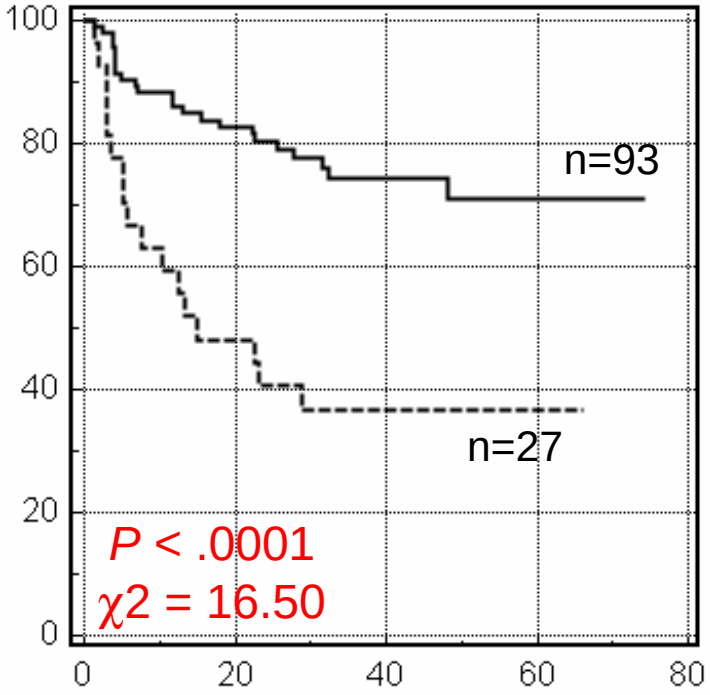
→ Sarcoidosis activation?

2) identification of the target lesion on interim PET

- Case 2: interim PET (–)
  - initial site on PET0?
  - or generic SUV of 1.0?

→ IVS data: PET(-) if 5PS ≤ 2 → average SUV=1.9±0.9

SUV in PET0 site

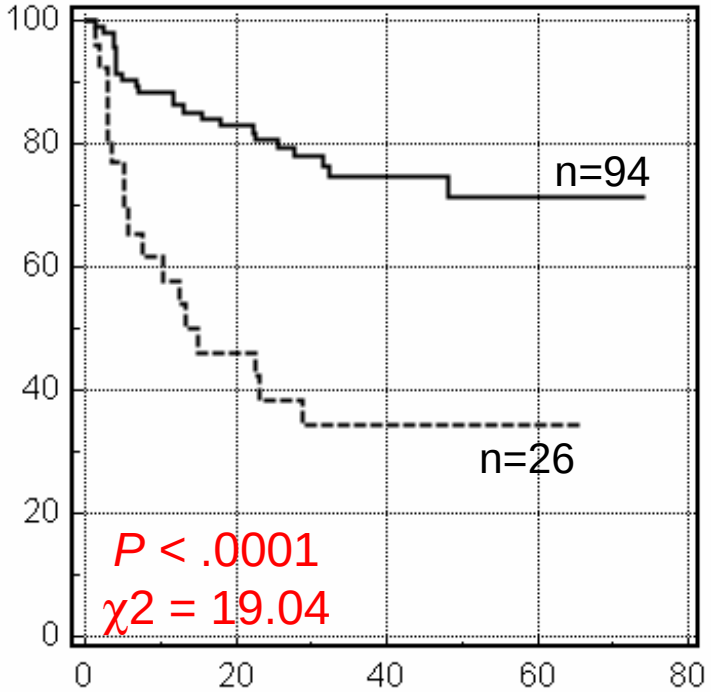


Obs1 :

2-y EFS : 80.4% vs. 40.7%

HR : 0.296 (CI 0.083-0.419)

Generic SUV of 1.0



Obs1:

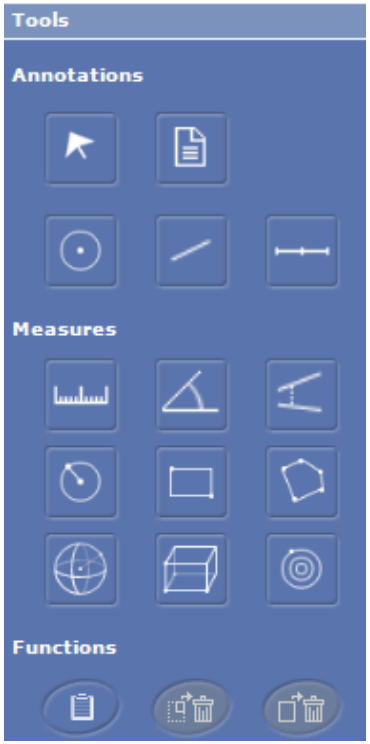
2-y EFS : 80.6% vs. 38.5%

HR : 0.273 (CI 0.068-0.360)

Method of ROI drawing (2D vs. 3D)

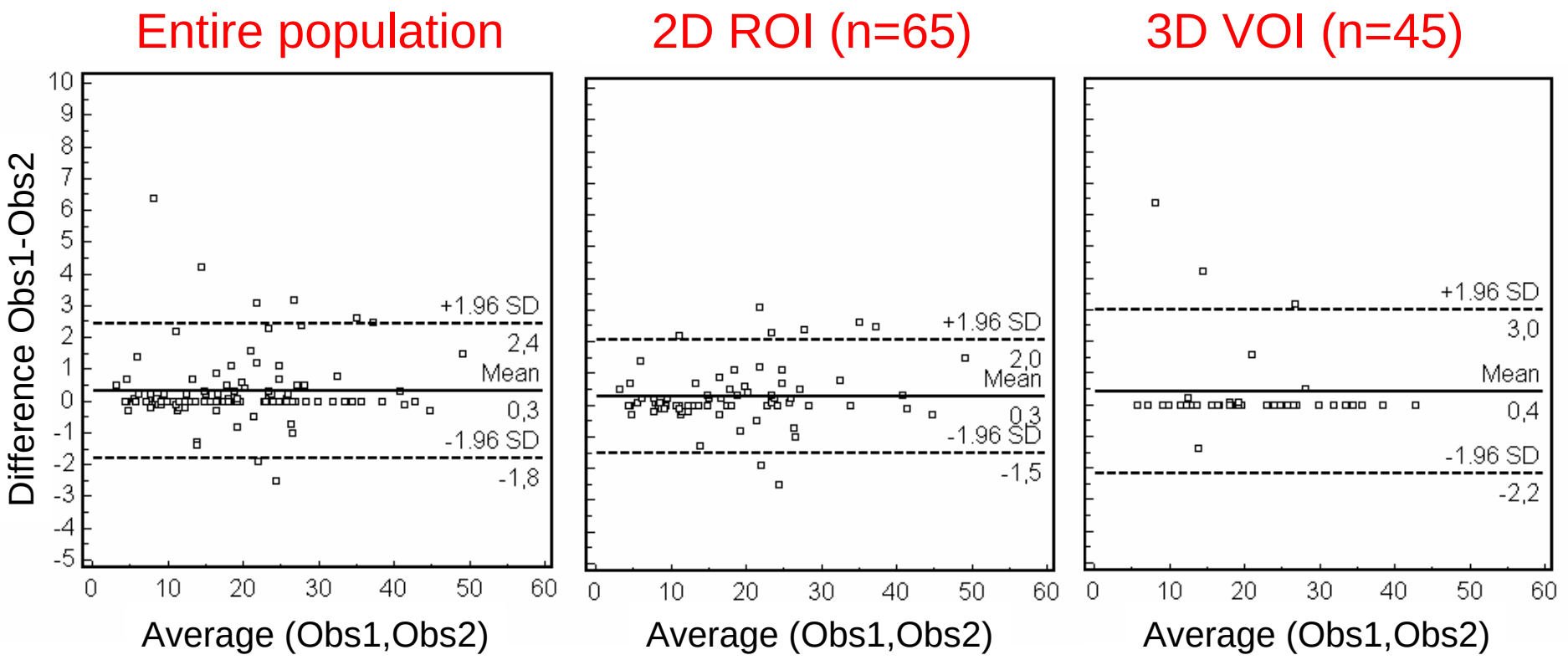
- circular ROI on axial slice with SUV_{max}
  - recommendation: 3-5 slices around the max
  - in practice: 1 slice

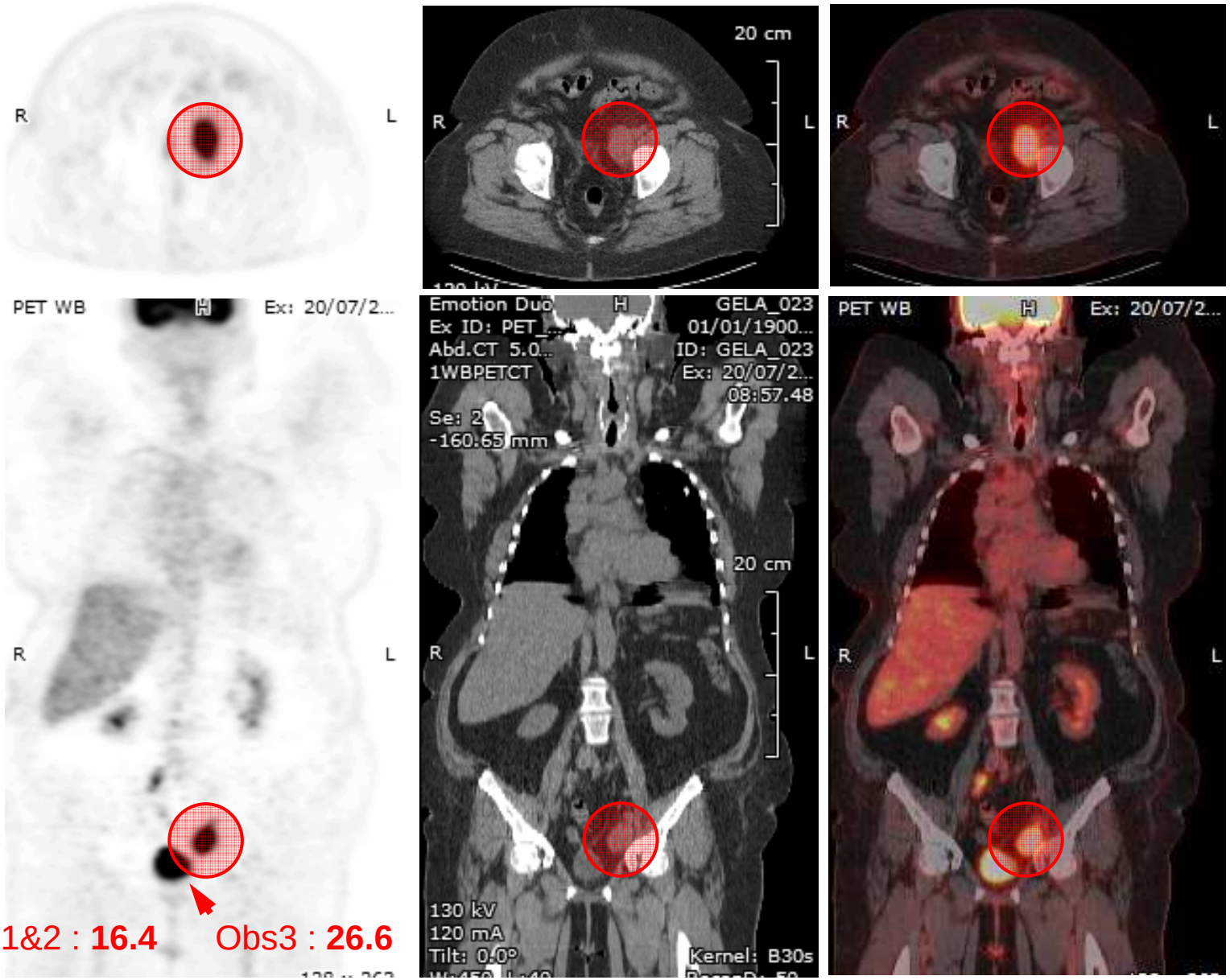
- volumetric VOI (spherical)
  - need special software
  - avoid areas of high physiol. uptake!



→ IVS data: upgade of the Imagys software with 3D VOI

Method of ROI drawing (2D vs. 3D)




R
L
20 cm
PET WB
H
Ex: 20/07/2...
Emotion Duo
Ex ID: PET_...
Abd.CT 5.0...
1WBPETCT
Se: 2
-160.65 mm
GELA_023
01/01/1900...
ID: GELA_023
Ex: 20/07/2...
08:57.48
130 kV
120 mA
Tilt: 0.0°
Kernel: B30s
Obs1&2 : 16.4
Obs3 : 26.6

Conclusion – Vote

recommendations of the Experts to be presented in plenary session on Thuesday

- 1) identification of the target lesion on baseline PET
  - MIP + color scale YES (n=25)
- 2) identification of the target lesion on interim PET
  - PET(+): whichever location YES (n=16) NO (n=9)
    same as PET0 NO
  - PET(-): initial site YES
    generic SUV of 1.0 NO
- 3) method of ROI drawing (2D vs. 3D)
  - 3-5 contiguous/volumetric YES