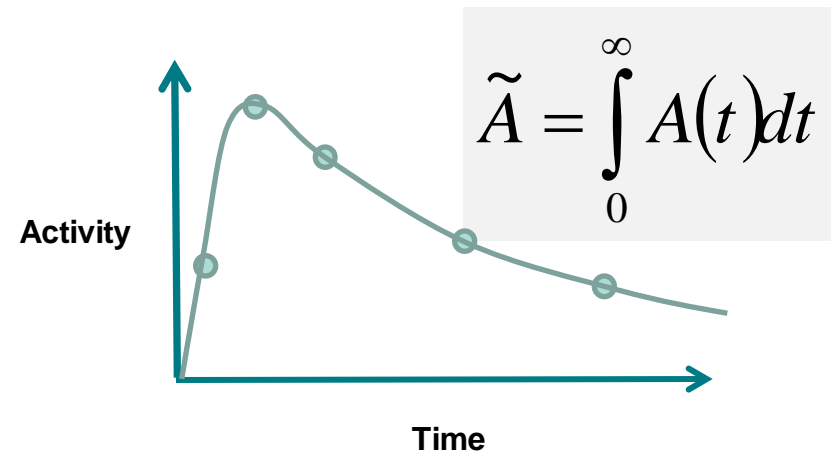
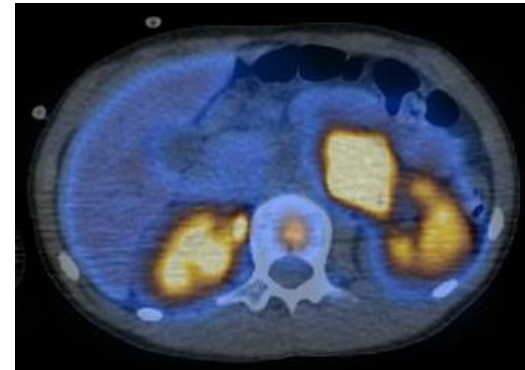


Data processing for dosimetry

Matt Aldridge, Clinical Scientist, UCLH

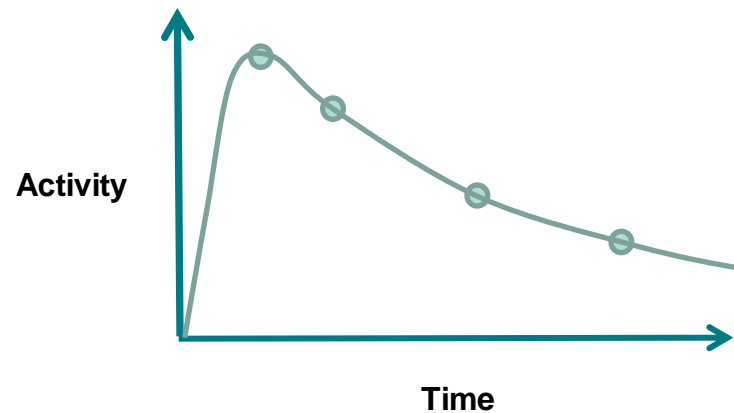


Imaging-based dose estimation



Dead-time

- If injected dose very large, number of γ – rays arriving on scintillator can exceed system recording capabilities due to electronics finite recovery and reset times → events get lost during the time the system cannot respond = cannot record the events → dead-time

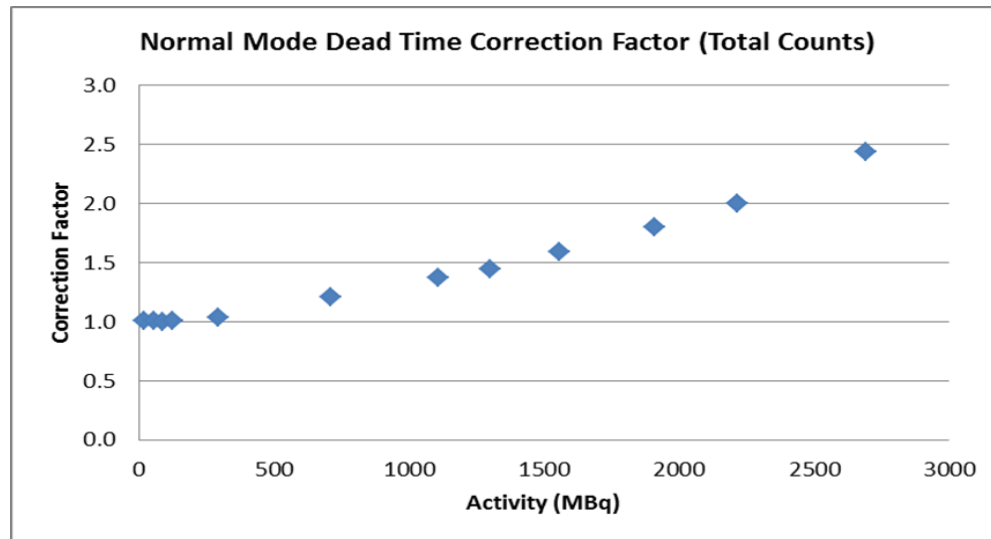
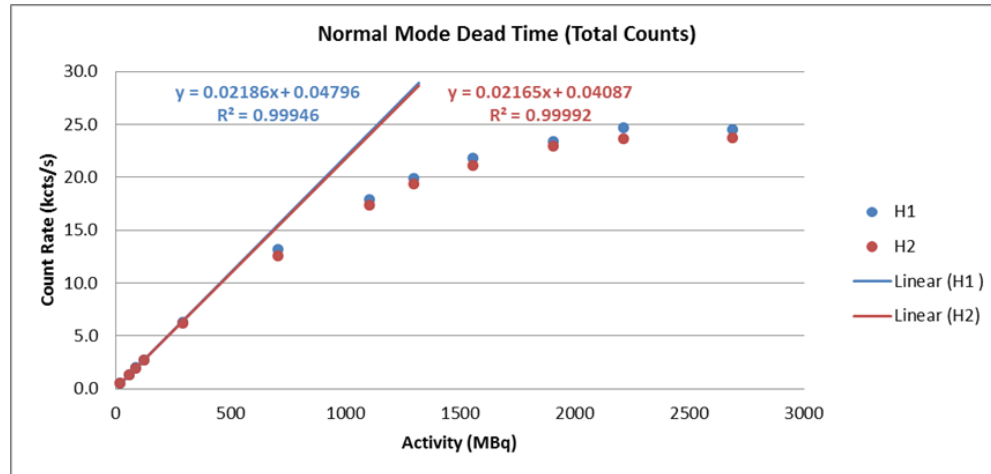


Dead-time correction

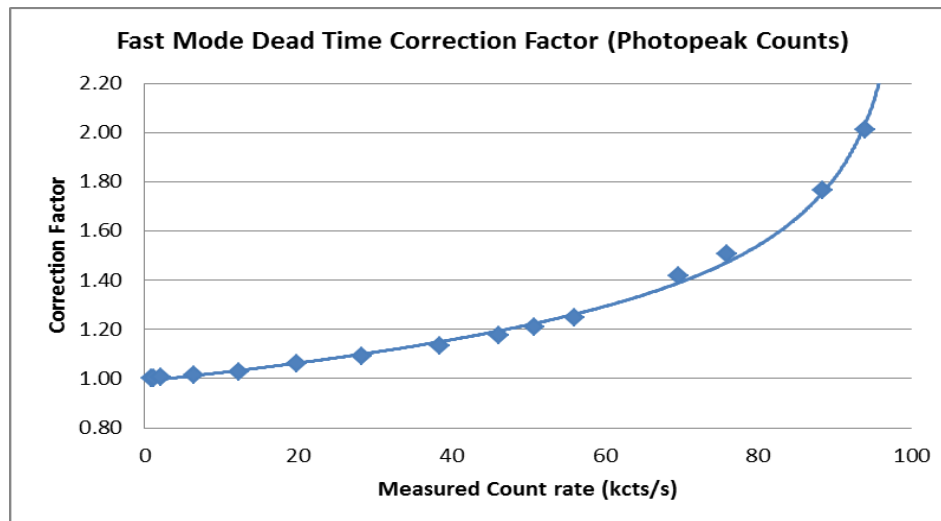
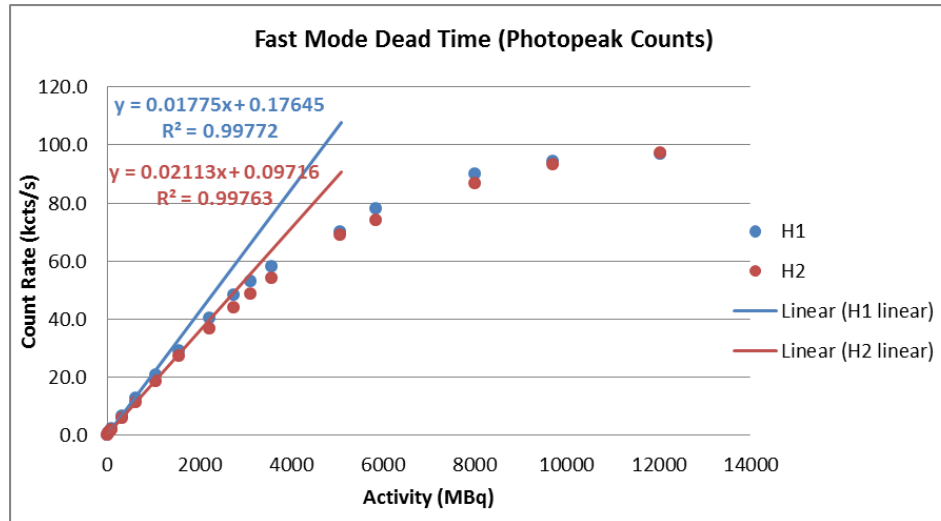
Dead-time correction at high counting rates (131I imaging) – significant number of events with energies outside the energy of the photopeak window – contribute to camera dead-time

System-specific dead-time model and dead-time constant determined by phantom experiments using same window setting as used for patient studies, as well as similar scattering conditions.

Dead-time correction

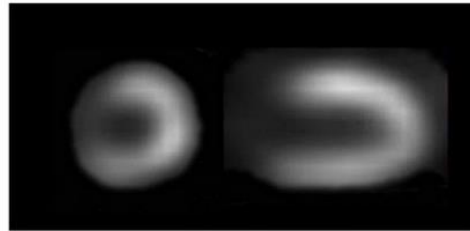


Dead-time correction (fast mode)

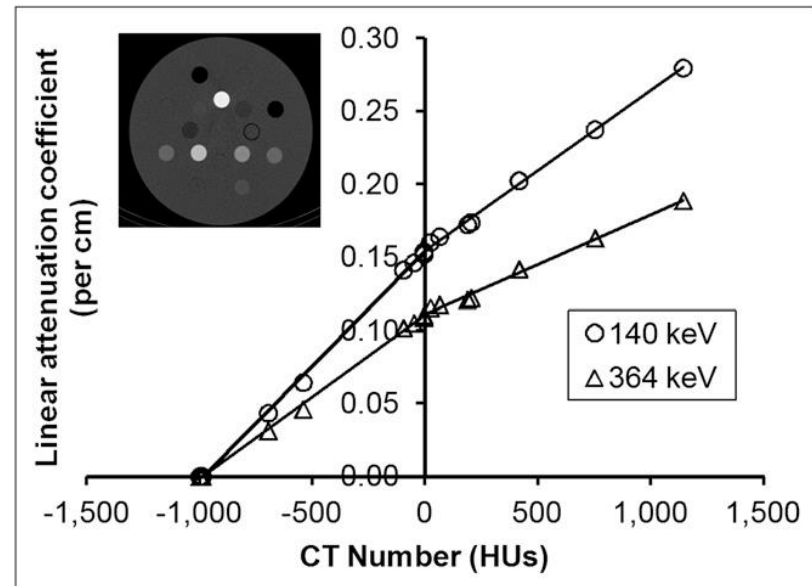
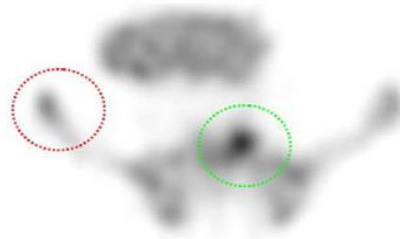
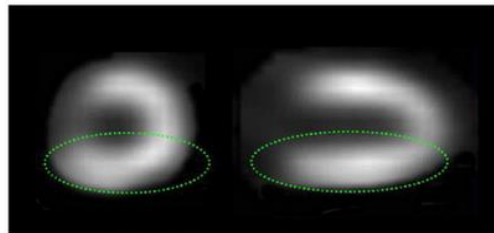


SPECT processing – Attenuation correction

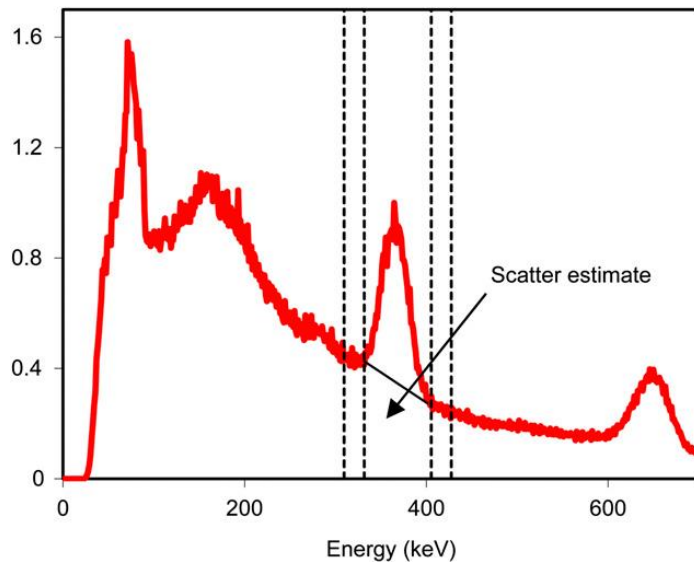
without CT
attenuation correction



with CT
attenuation correction



SPECT processing – scatter correction



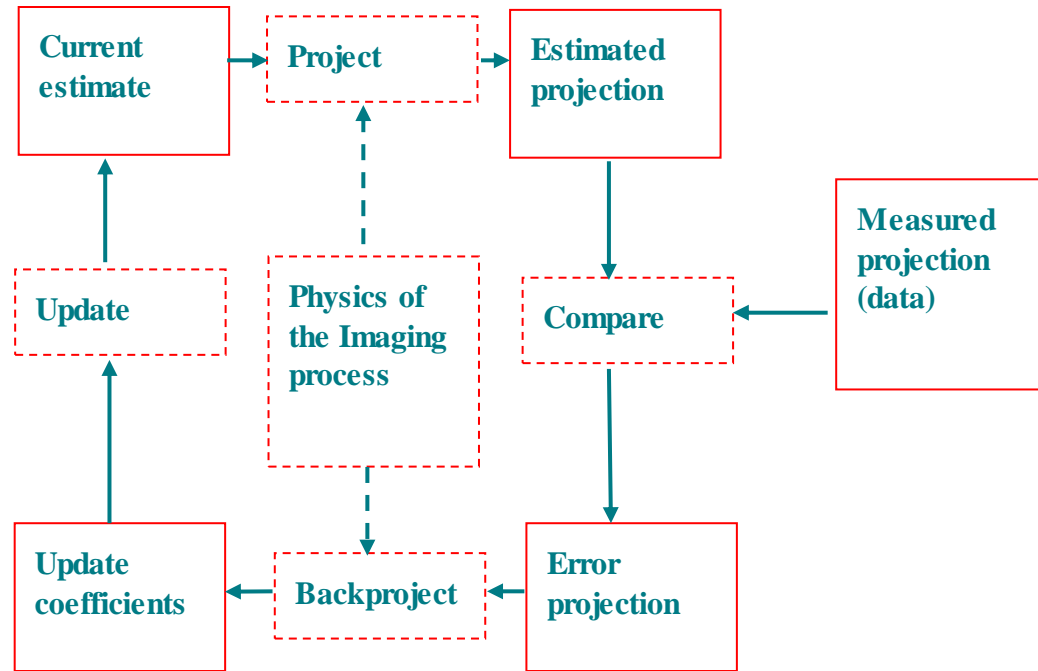
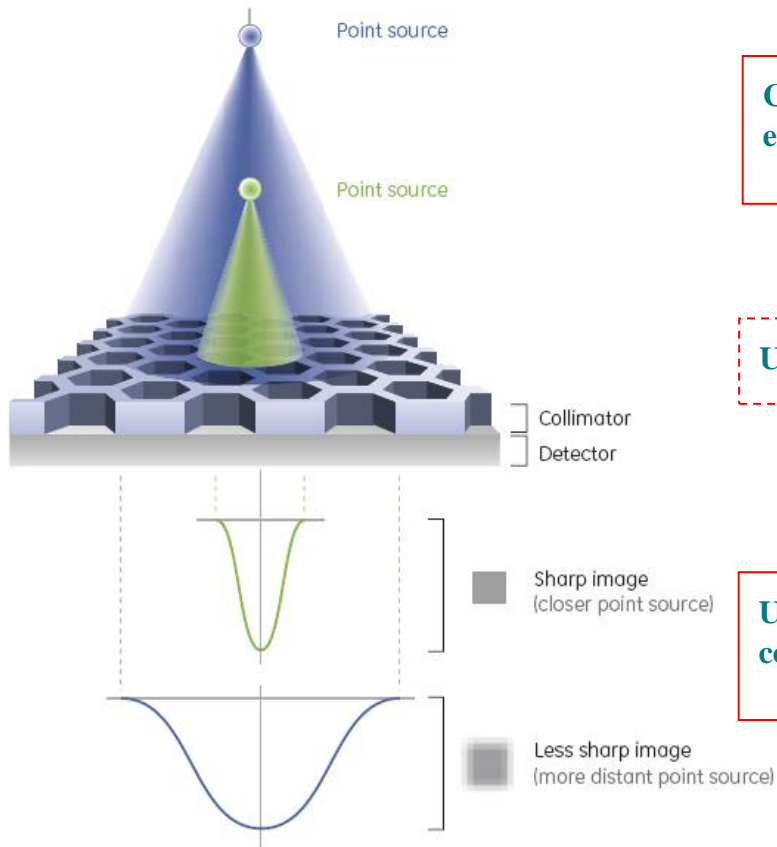
Scatter in 131I – high-energy photons (637 and 723 keV)

Use TEW scatter correction (accounts for downscatter of high energy emissions)#

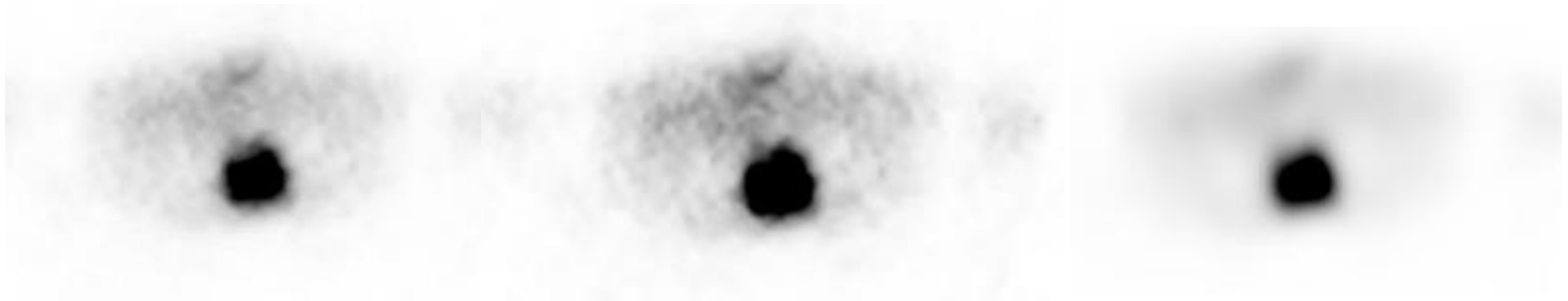
Patient imaging studies – scatter events in the photopeak window estimated by TEW are 40% - 50% of the total events

$$C_{i,scat} = (C_{i,lower}/W_{lower} + C_{i,upper}/W_{upper}) \times W_{main}/2$$

SPECT processing – resolution modelling



Applying reconstructions

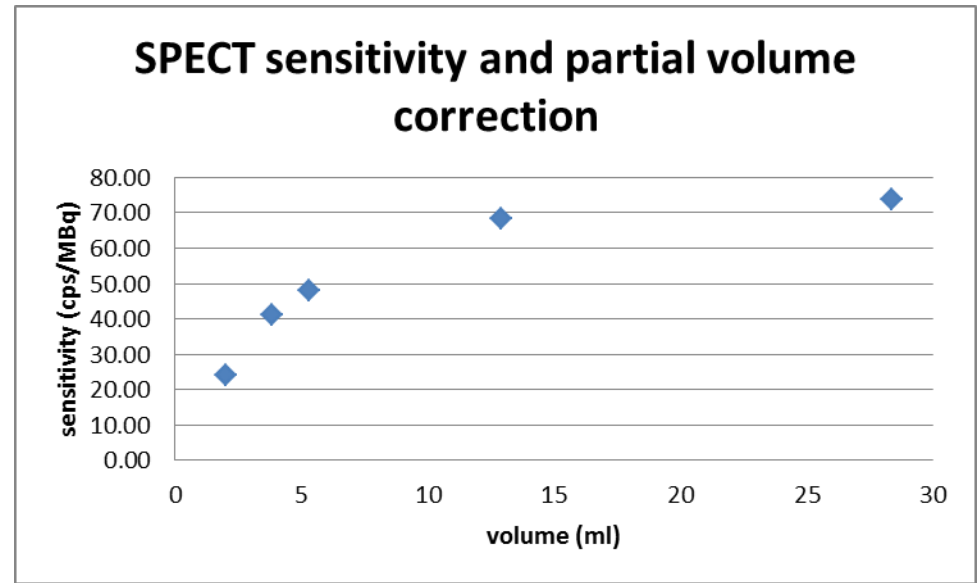
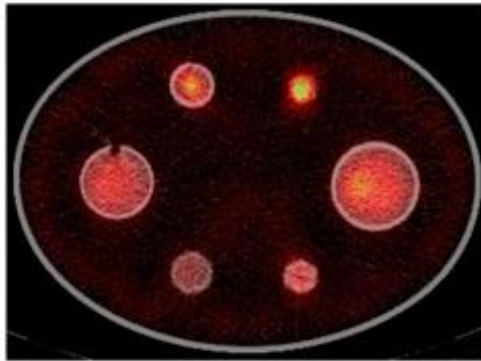


AC only

ACSC

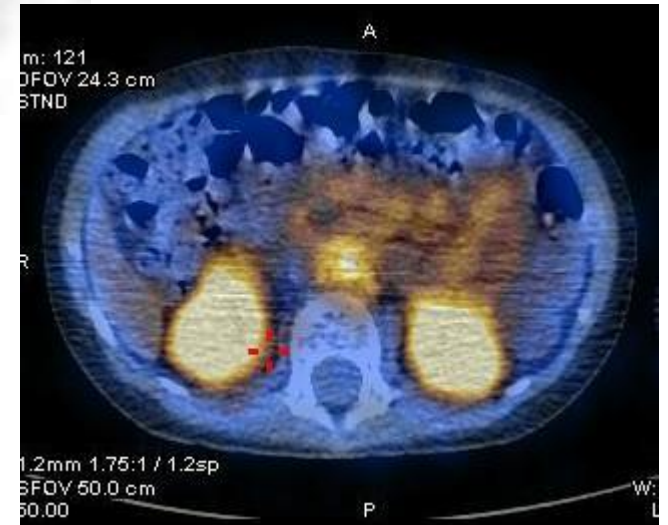
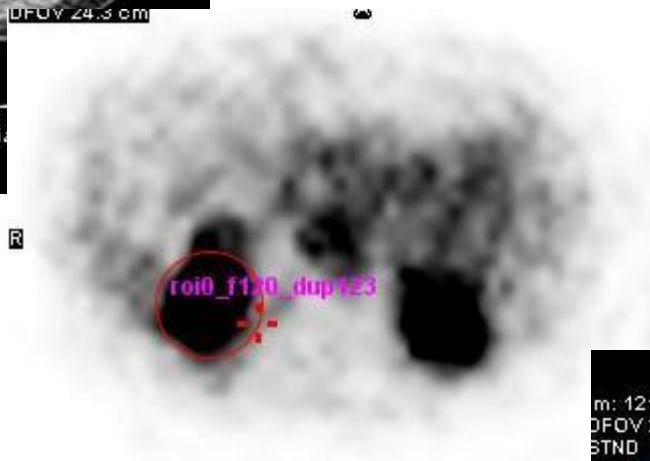
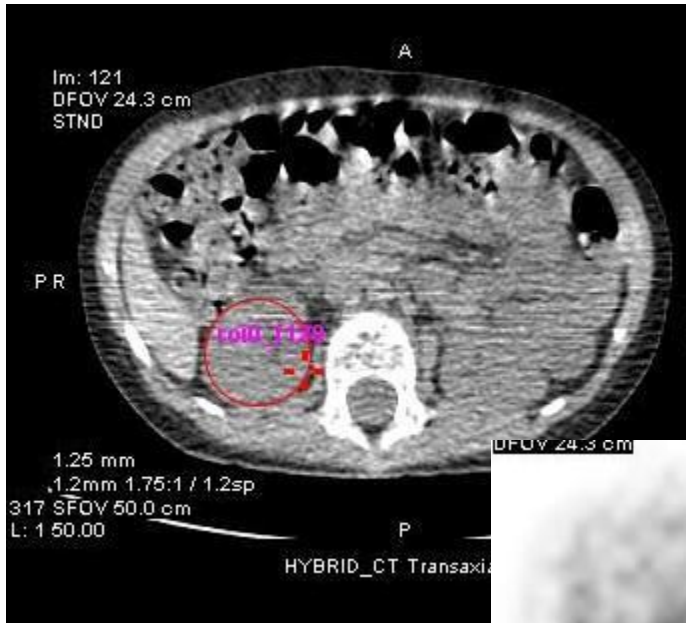
ACSCRR

Partial volume correction



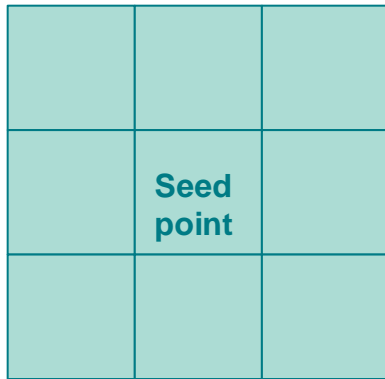
Target definition



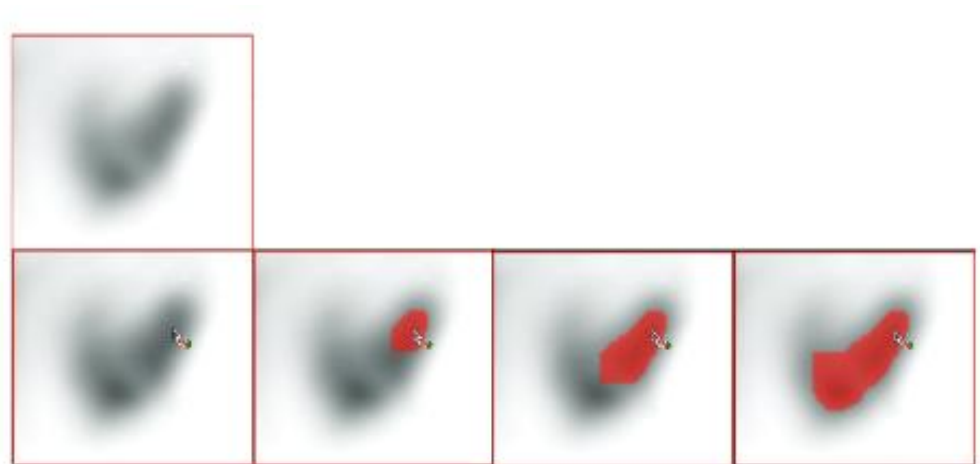


Segmentation

Segmentation process starts at the seed point. All neighbours within a specified square/cube are checked.

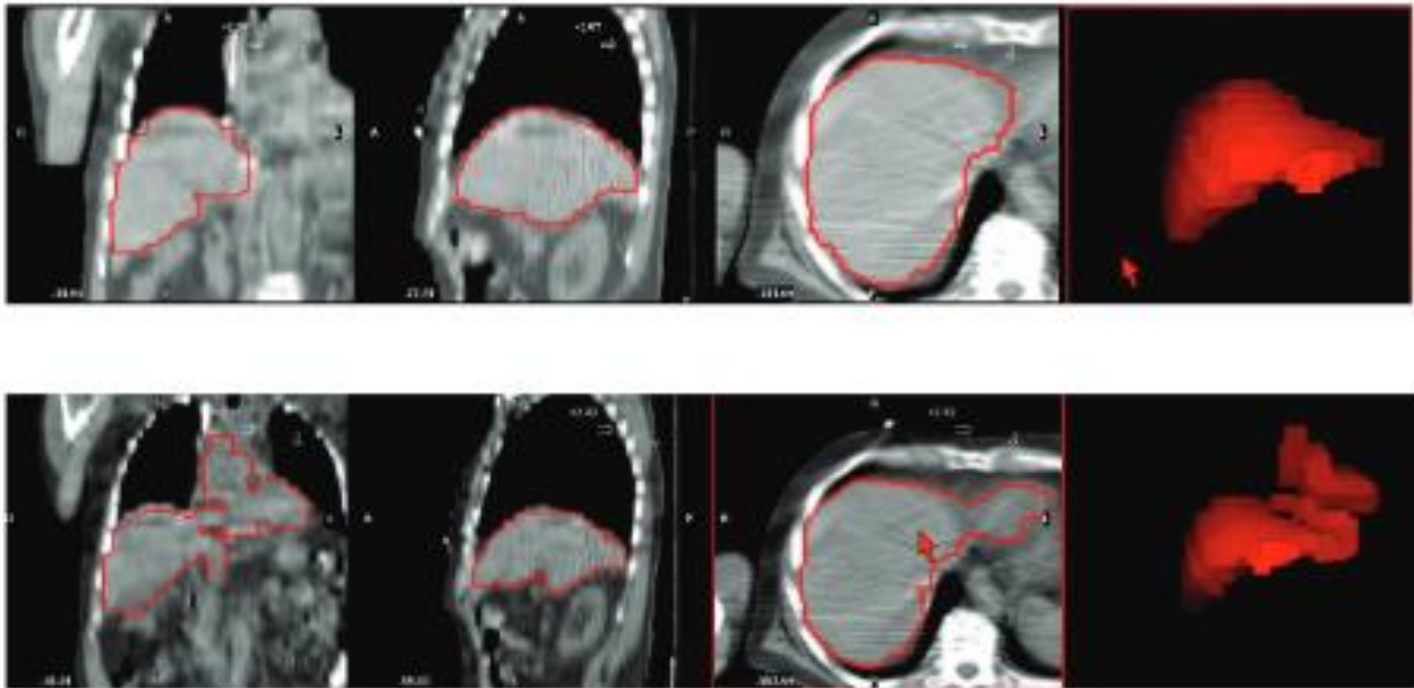


Voxels that comply with threshold criterion are included in the organ/lesion VOI.



Segmentation

Apply care with delineation !!!
 Particularly with lower quality CT.



Segmentation

Automatic organ segmentation for:

Lungs

Liver

All bone cavities (bone marrow + spinal cord)

e.g. lung segmentation – click on point inside the lung in a CT slice – will look for all points below -400HU (default lung threshold)



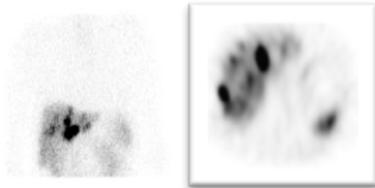
Multi SPECT-CT Processing

Universit

	Multi SPECT-CT	Multi WB Planars Single SPECT-CT (Hybrid)	Multi WB Planars	Single SPECT-CT
Reconstruction	Multi SPECT-CT	SPECT-CT		SPECT-CT
Registration	SPECT-CT SPECT-CT	SPECT-CT / Planar WB Planar WBs	Planar WBs	
Segmentation	SPECT-CT (3D)	SPECT-CT (3D)	WBs (2D)	SPECT-CT (3D)
Quantitation	Syringe / sys. sens.	Syringe / sys. sens.	Syringe / sys. sens.	Syringe / sys. sens.

Reconstruction

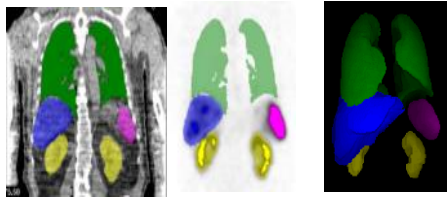
SPECT/CT (1)



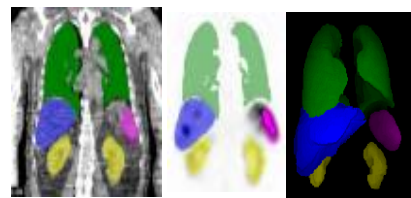
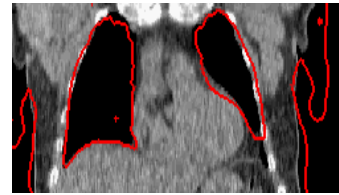
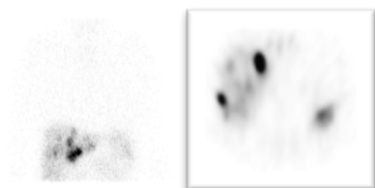
Registration



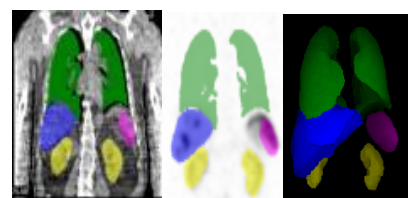
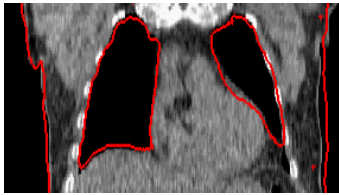
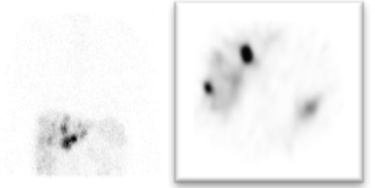
Segmentation



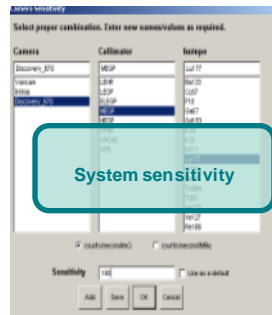
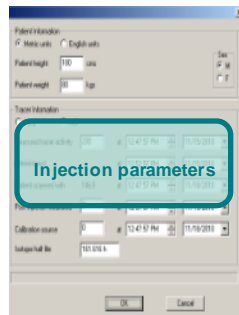
SPECT/CT (2)



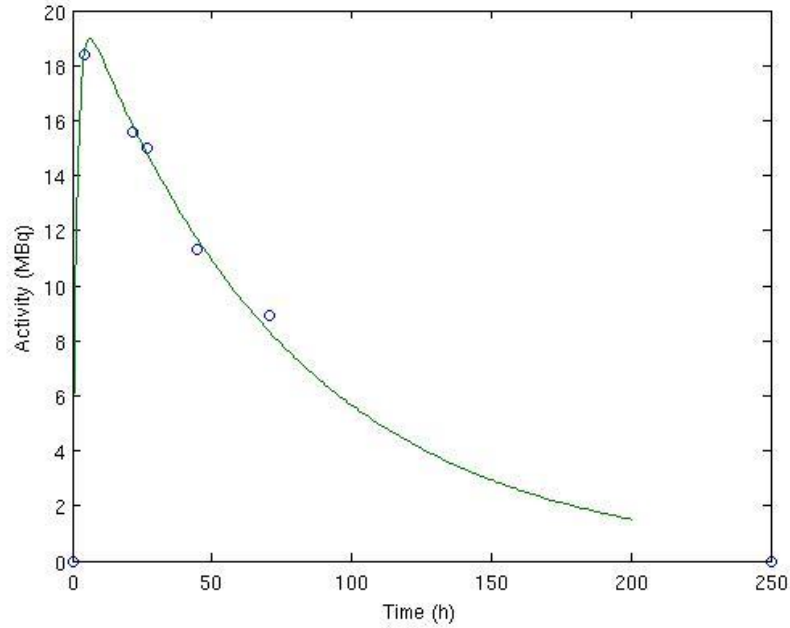
SPECT/CT (t)



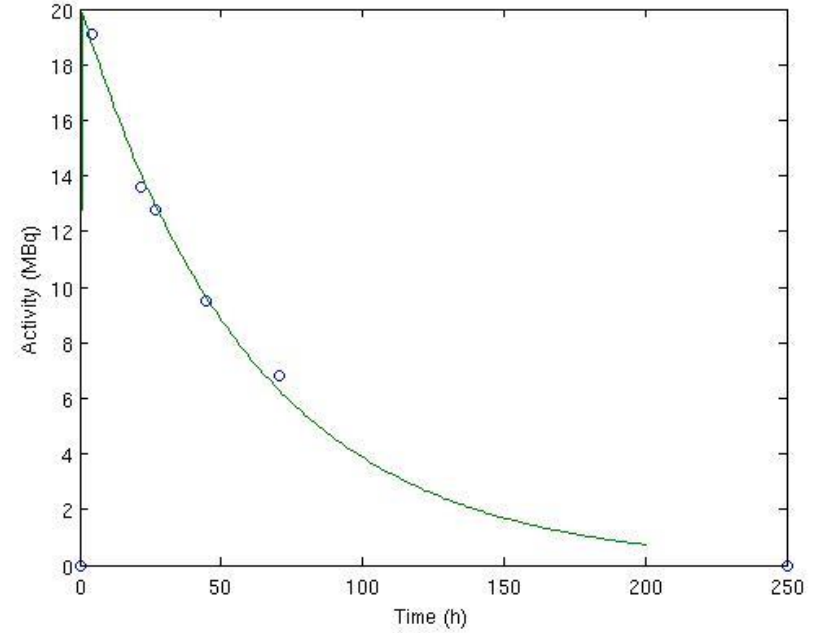
Quantitation

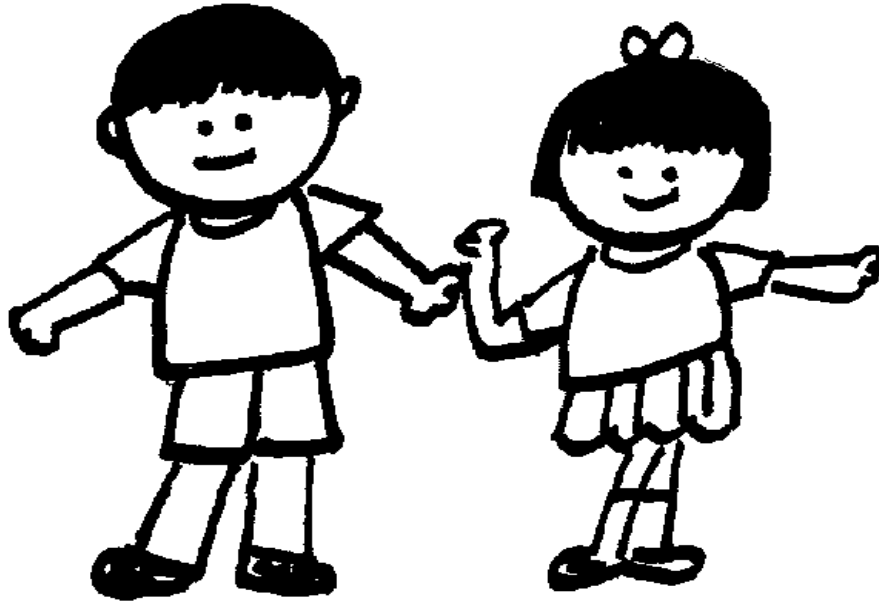


L KID spect TAC



R KID spect TAC





any questions?