TOF PET Imaging: Clinical and Research applications

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State-of-the-art Clinical PET Instrument

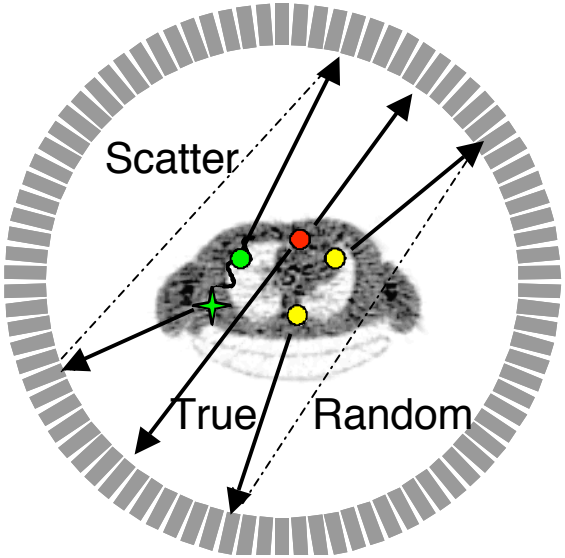
- Multi-modality — PET and CT
- Cost: — $2M
- Reliability: — uptime > 98%
- Throughput: — < 30 minutes/patient
- Software: — user friendly

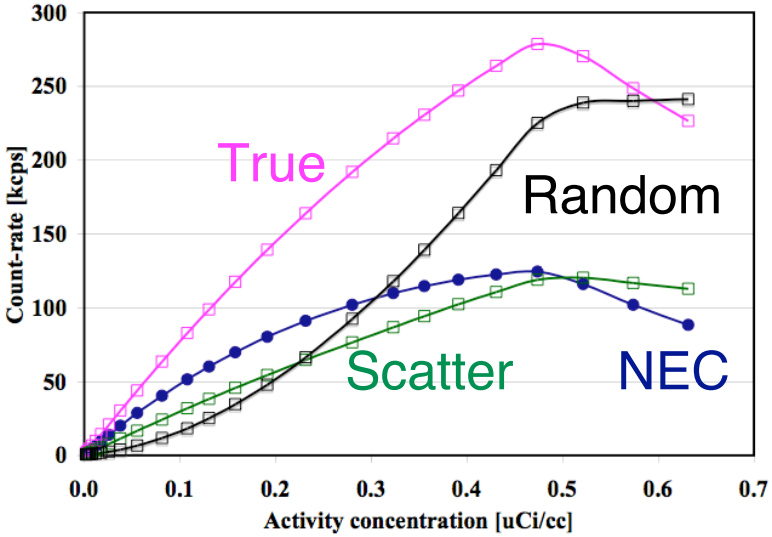
  QC(daily), acquisition, reconstruction, display, archive (PACS)
- Performance: — high spatial resolution, sensitivity

State-of-the-art Clinical PET Performance

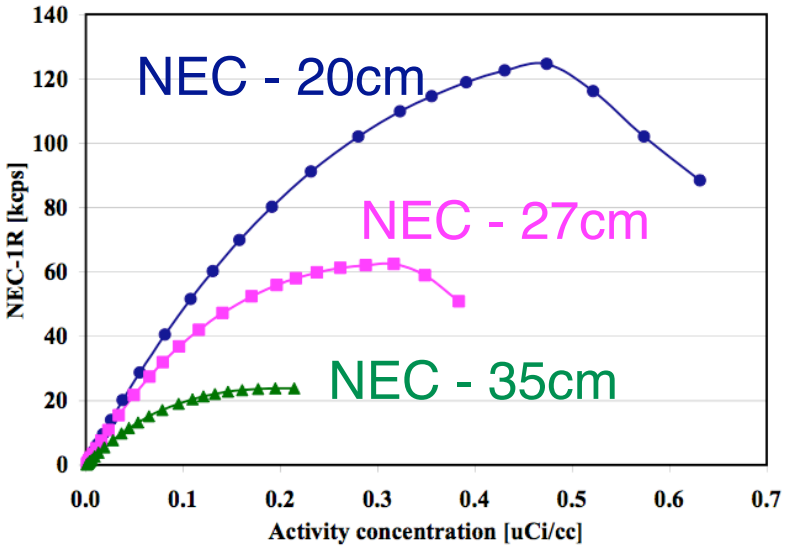
Spatial resolution: 4-5 mm *fwhm*
isotropic, center FOV

Sensitivity: 5-10% absolute





NEC = T (1+S/T+R/T)



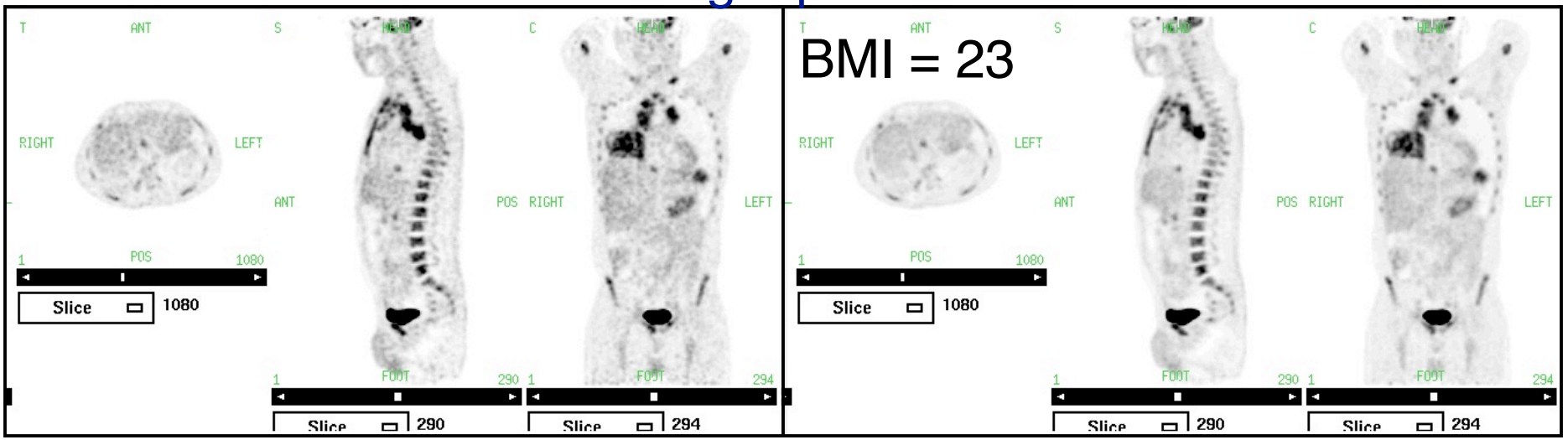
NEC ~ SNR^2

Image quality depends on patient size

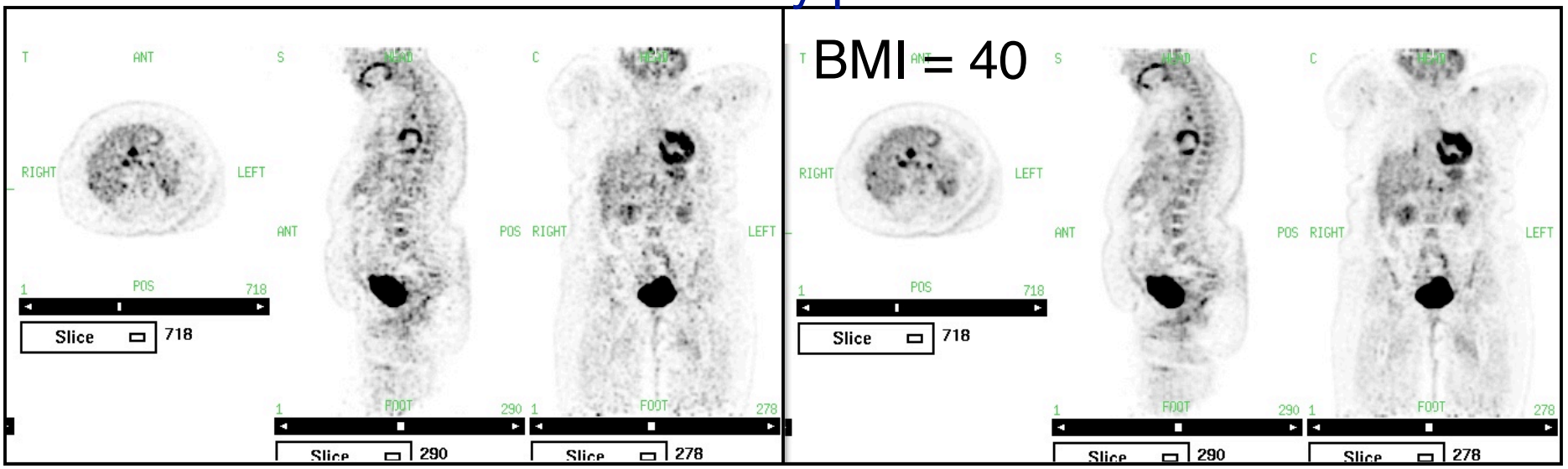
1 min/bed

Light patient

3 min/bed

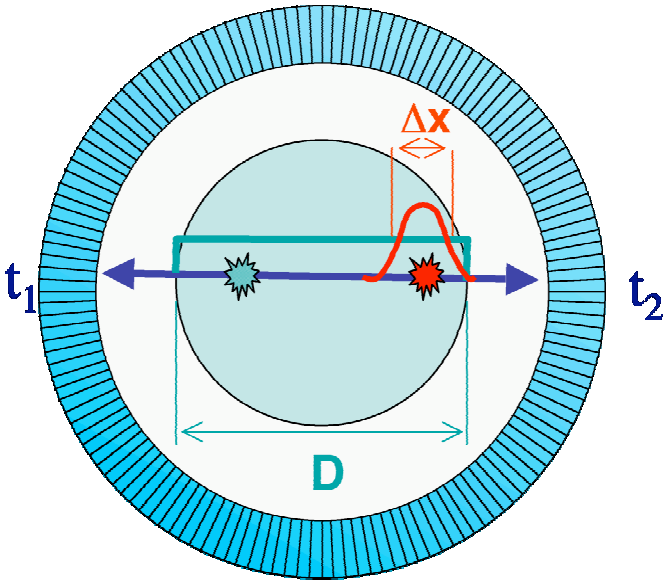


Heavy patient

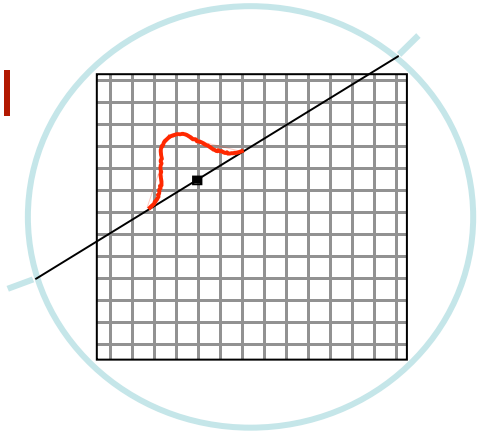


How does TOF work?

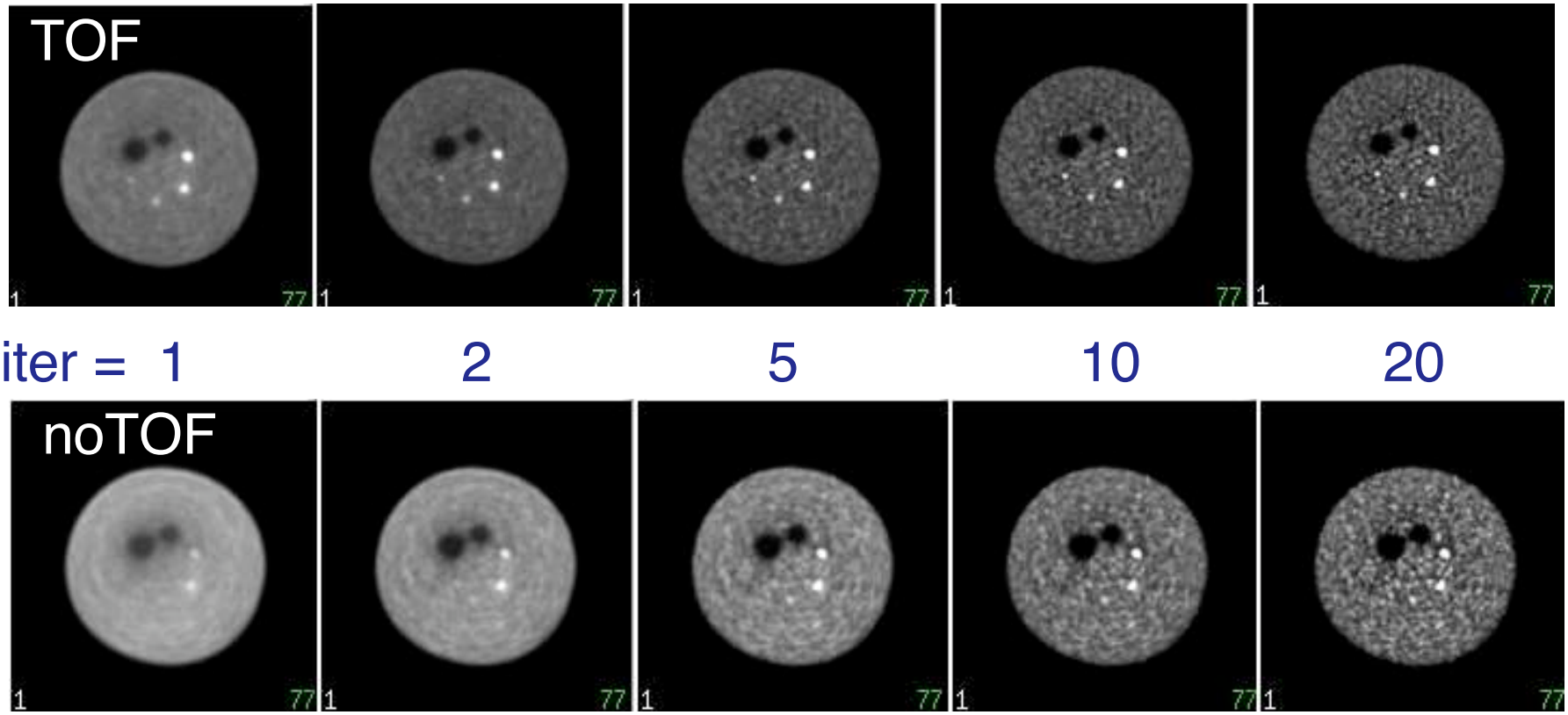
..and does it help?



TOF kernel



TOF converges faster, and achieves better contrast for given noise



35-cm diameter phantom

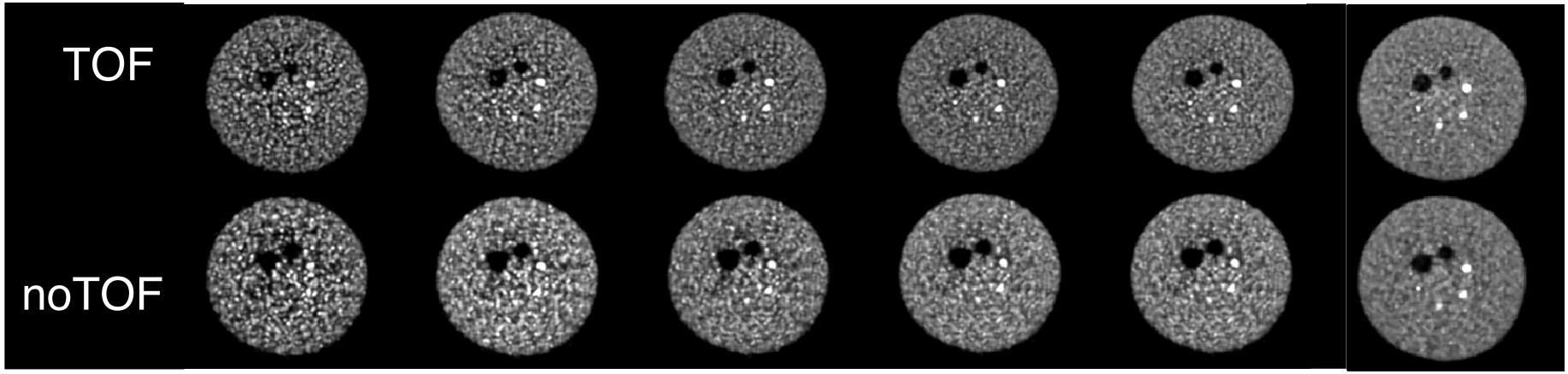
5 minute scan time

10, 13, 17, 22-mm hot spheres (6:1 contrast); 28, 37-mm cold spheres

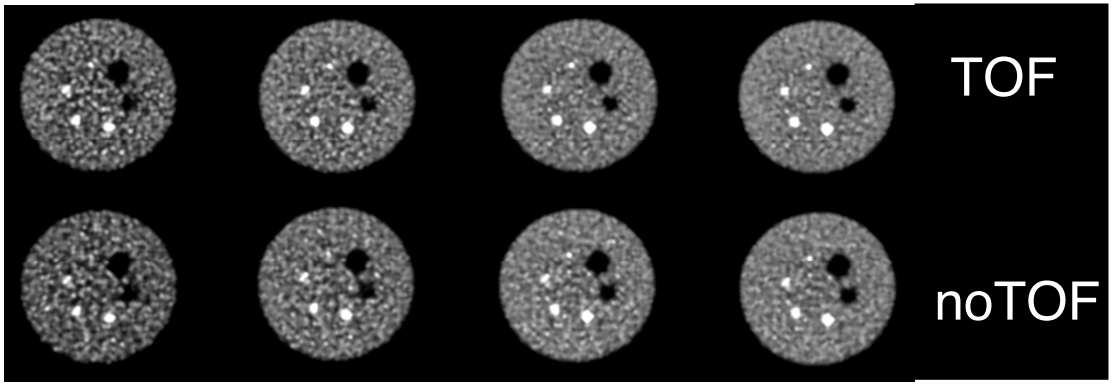
Philips Gemini TF

TOF benefit is more significant for larger size phantom (patient)

35-cm diameter phantom



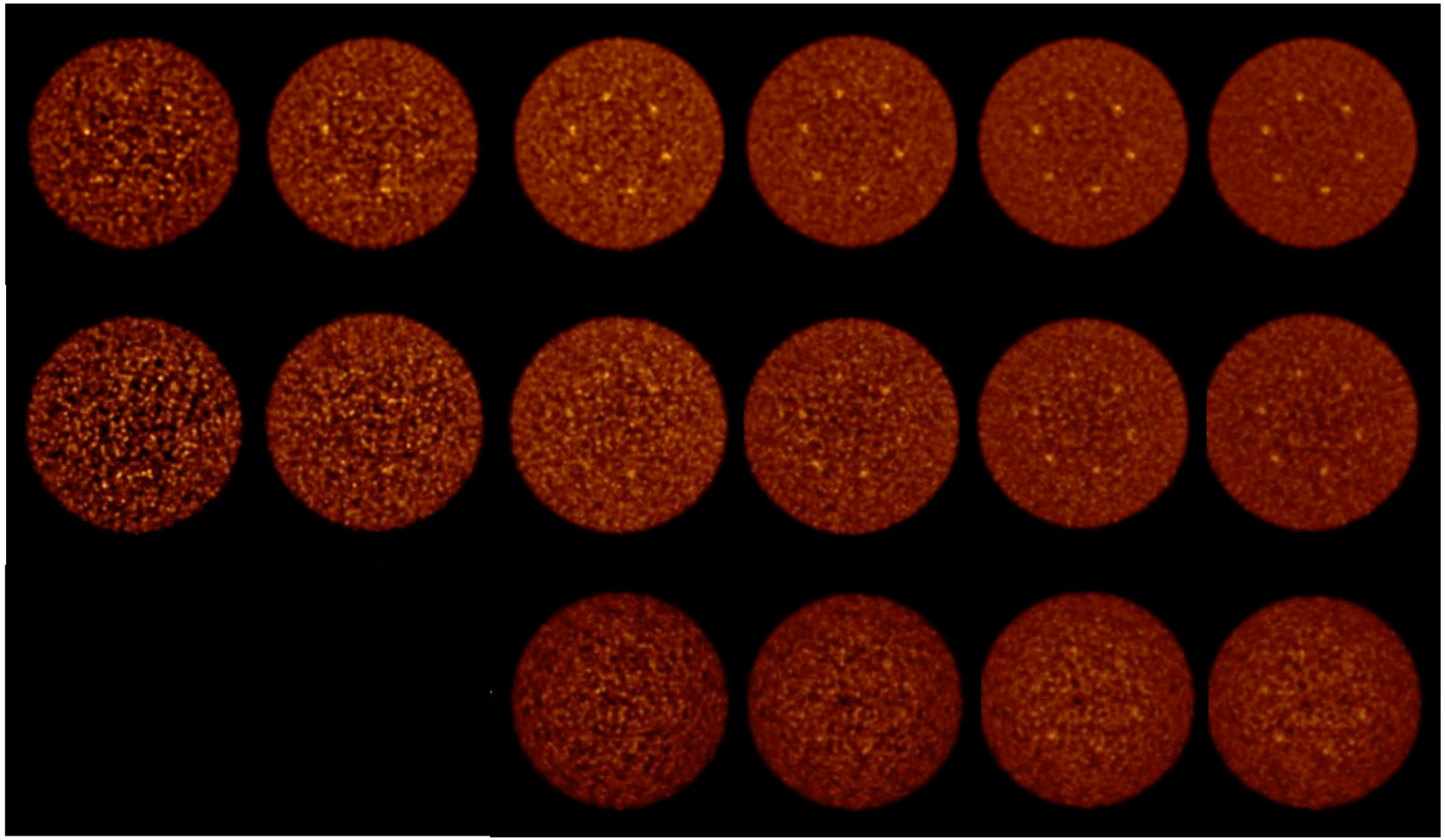
0.5 1 2 3 4 5 10 min



27-cm diameter phantom

Philips Gemini TF

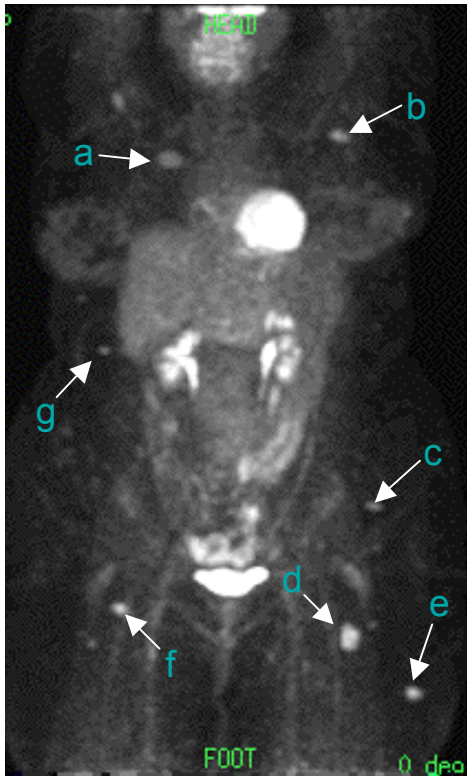
TOF benefit is more significant as timing resolution improves



35-cm diameter phantom

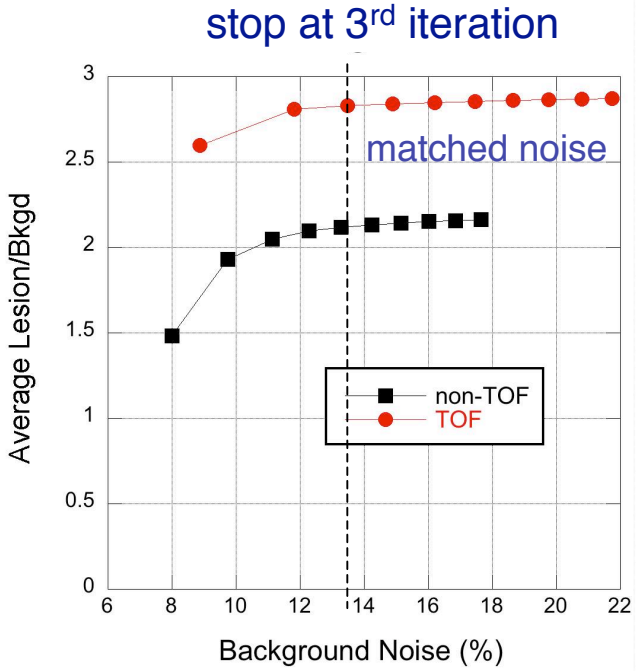
La-PET proto-type

TOF achieves higher contrast in patients for matched noise



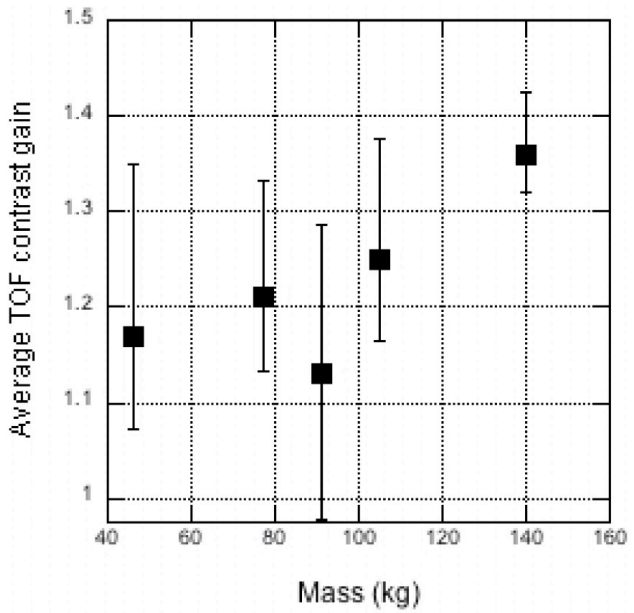
p542s0 (NHL)

140 kg, BMI=45.6



TOF contrast gain for 1 lesion in patient 542

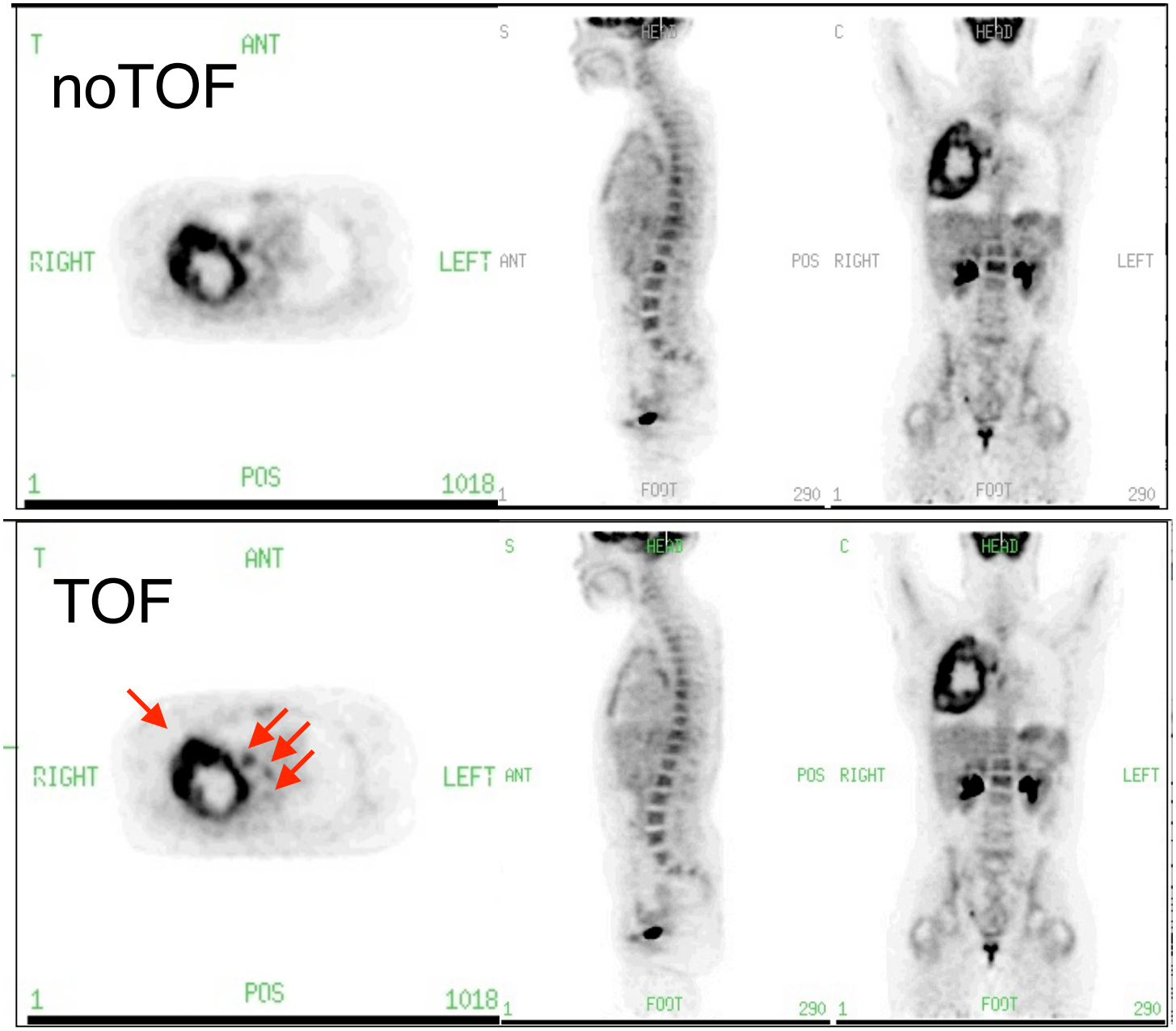
Relative contrast gain increases with BMI



Average TOF contrast gain for each of 5 patients

Philips Gemini TF

34 year old female with a metastatic sarcoma in the right lung



Philips Gemini TF