Objective: Our aim is to quantify the accuracy of PET image recovery with decreasing number of detectors using compressive sensing.

Methods: A $32 \times 32$ image of a uniform phantom was forward projected using a system matrix of $28336 \times 1024$ to generate a corresponding $184 \times 158$ sinogram. No noise was added to the sinogram. The sinogram was then repeatedly masked in an increasing but equidistant manner to simulate an increasing number of detector removals. The undersampled sinograms were then recovered using standard OSEM as well as Poisson CS techniques. No attenuation correction was applied. The same experiment with image size of $128 \times 128$ and sinogram of $367 \times 315$ (system matrix of $115605 \times 16384$) was also performed. The RMSE on a pixel by pixel basis between the baseline image (fully sampled) and the reconstructed images using OSEM or Poisson CS for different undersampled sinogram was used as a metric to measure the quality of recovery. A plot showing the RMSE of recovery versus number of observations (lines of response) was plotted.

Results: The RMSE between the recovered and baseline images increases when the number of observation decreases due to system matrix instability which results in poor image recovery. Further analysis of the plot for RMSE to be less or equal than 10%, number of PET detectors in the scanner should be 75%, 52% using OSEM and CS respectively when imaging a uniform phantom.

Conclusion: Imaging of a uniform phantom in a PET scanner can be achieved with good accuracy with 50% of detectors. Complex phantoms/patients might require higher percentage for similar results using CS recovery techniques.