

CRYSTAL LAB

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PET

- Detects gamma rays
 - Interact with the crystals and release photons
- Smaller the crystal, the less uncertainty

THE PROJECT

- TOFPET
 - Time of flight (TOF)
 - Positron emission tomography (PET)
- ClearPEM
 - The Crystal Clear Collaboration's positron emission tomograph for mammography (PEM)

TOFPET

- PET uses medical photon detectors
- New crystals coupled to photodetectors can reach coincidence time resolutions below 500 ps
 - Improvement of imaging signal to noise ratio is achieved with time resolution on the order of 500 ps
 - Exact localization of positron emission point

CLEARPEM

- Breast Cancer
- X-ray, mammography, MRI lack specificity
 - whole-body PET lacks resolution
- Improves diagnosis
 - Metabolic information from PEM
 - Exact position of cancerous lesions
 - Localizes the lesion in the surrounding tissue

CLEARPEM

- 3D images
- First Clinical Trail
 - Detects more cancerous lesions than whole-body PET
 - Contributes to an increase of the specificity in the diagnostic process

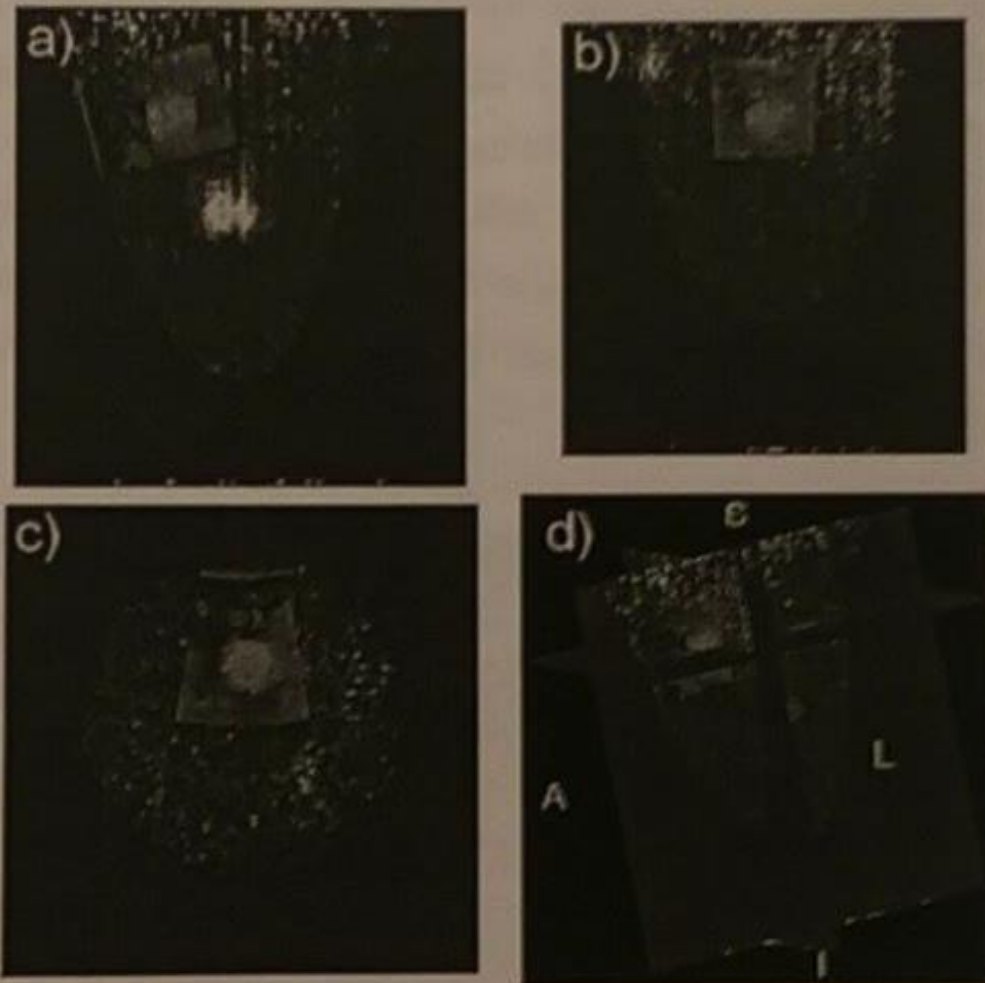


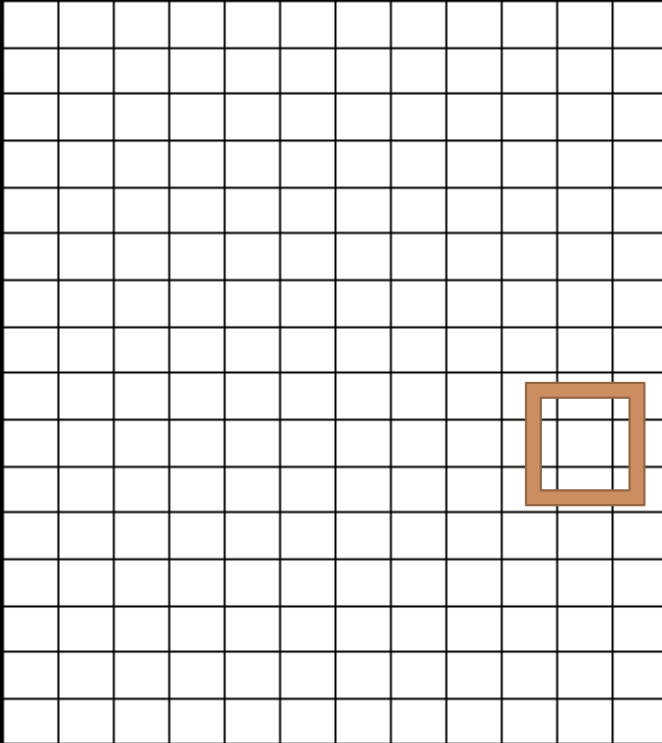
Figure 92 : a) Coronal, b) sagittal, c) transverse and d) 3D images of the co-registered US and ClearPEM acquisition

CLEARPEM DESIGN

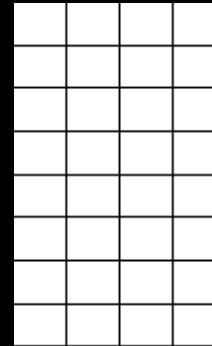
- Horizontal patient bed
 - Hole for the breast
 - Two parallel detector plates that revolve around the breast to register a 3D PET image

2 PLATES

192 matrices



4X8



$$192 \times 4 \times 8 = 6144 \text{ crystals}$$

MY PROJECT

- ClearPEM boards (2)
 - Arriving this week
- Measuring matrices at their breakdown voltage
 - 256 matrices → 1 detector for 4 crystals
 - Took about 1 month to glue photodetectors on each matrix (10 per day)
 - Test with gamma source to make sure glue didn't damage
 - Usually fine 😊

TESTING MATRICES

- Used Cs-137
- Spent some time accurately lining up the placement of the matrix, the source, ect.
- Set breakdown voltage (information given when glued)
 - Current between 15 and 25 microamps
- Run program, record data, plot values

LAST WEEK AND THIS WEEK

- Data comes in for each photodetector
 - Histograms of how many photons interact with each crystal
 - What percentage of one is in the other?

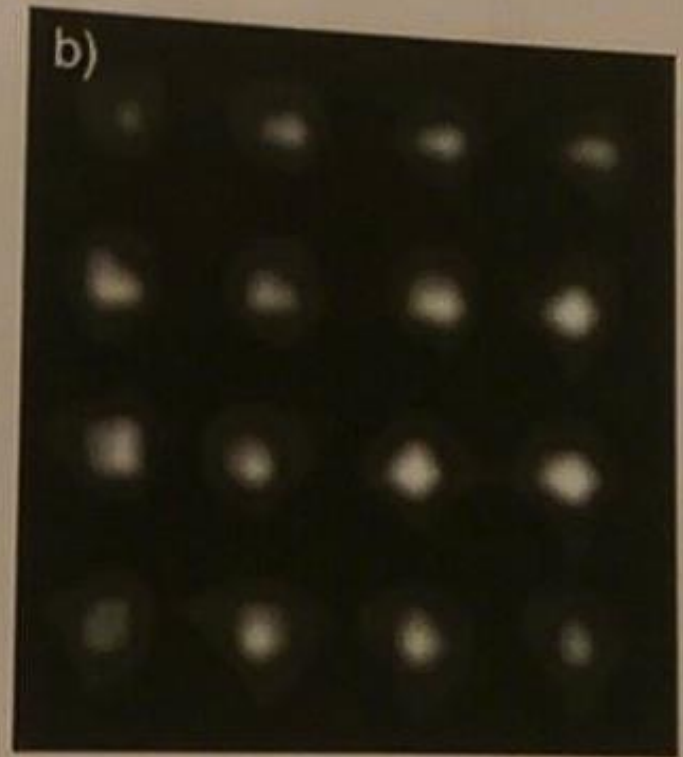
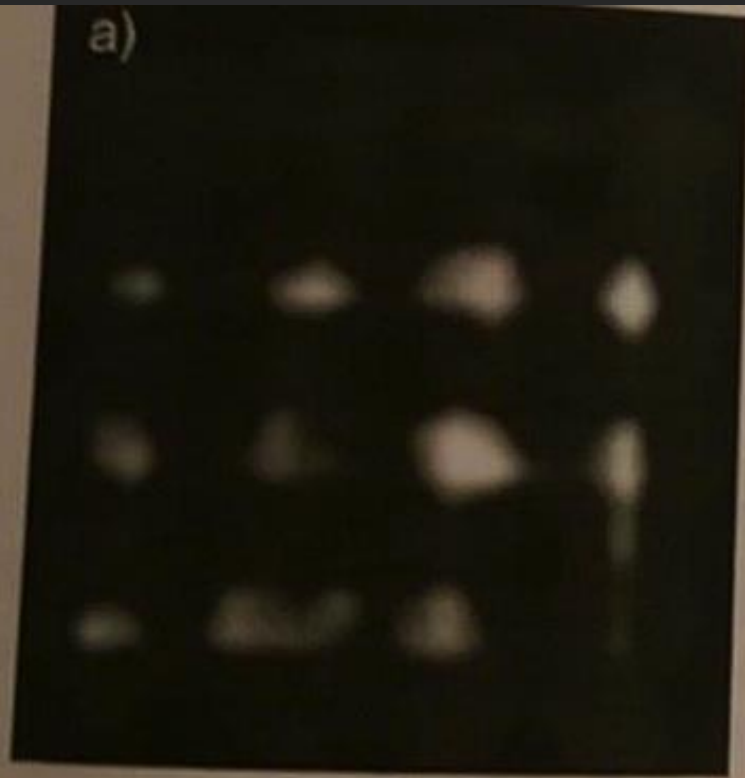
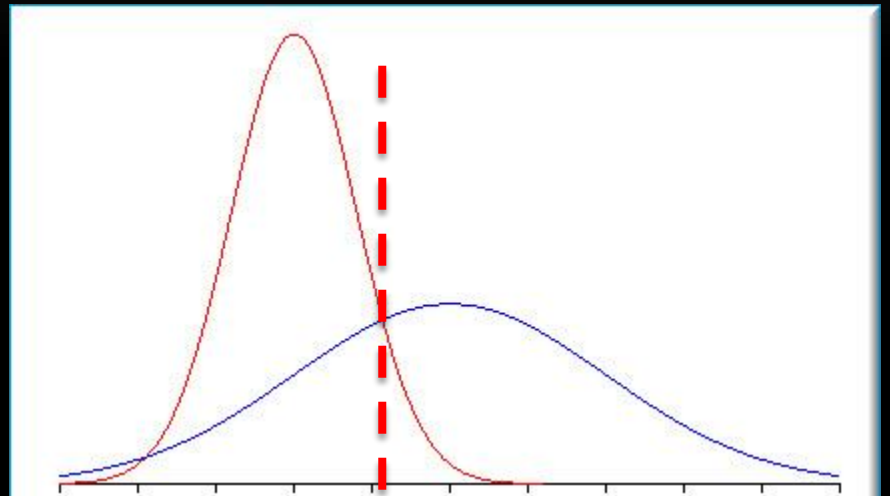
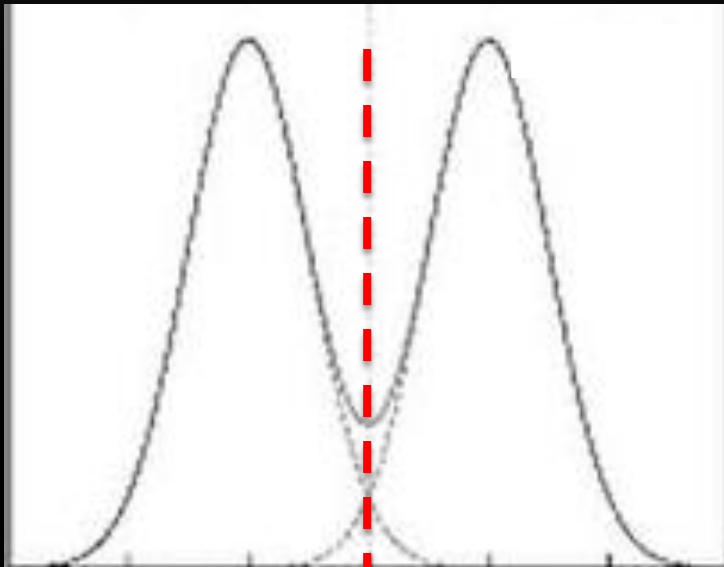


Figure 21 : Influence of the DOI measurement on image quality: a) reconstruction without DOI information, b) reconstruction with DOI information [119]



CONCLUSION

- Process of building the external plate
 - Characterization of crystals
 - Test photodetectors
 - Glue the two
 - Test crystals after gluing
 - Create external plate
- See medical images by the end of June