OSL Imaging

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Objectives

- OSL Image Theory
- Real World Application for Imaging
- Ongoing Imaging Studies
Imaging Filter – Luxel+
Image Filter - InLight
Al₂O₃:C detector under a grid.
- InLight and Luxel use copper grid.
- Energy response limited to the filter material.
- Radiation penetrates through holes.
- Radiation absorbed by copper.

Limited application.
- Photons below 150 keV
- More dense material could extend the range.
Image Filter Relative to Detector

Detector

$\text{Al}_2\text{O}_3$:$C$
Low Energy Static

Radiation
Low Energy Dynamic

Radiation
Copper Attenuation and Ability to Distinguish Static/Dynamic Exposures as a Function of Energy

![Graph showing copper attenuation and energy distribution](image-url)
Processing Method

- Defocus the laser beam during POSL read out.
- Cooled CCD Camera captures the luminescence in the grid area.
Optically Stimulated Luminescence

Energy Diagram

Luminescence Center

Dosimetric Traps

e- e- e- e-
Analysis of Data

- 2D Fourier Transform on Image
  - Applied to 2 dimensional signals
    - Frequency ($\xi$) - distribution of the image
    - Modulation ($\mu$) - defined filter pattern and shape
  - Mathematically determines probability of static and dynamic exposure.
  - Not subjective like film “sharp” or “blurred”
Low Energy Static
Low Energy Dynamic
Contamination
Angular Exposure
CT Scan
Shielded
Ongoing Studies

- Imaging performance in mixed static and dynamic radiation fields.
  - Tested mixtures from 1:4 to 4:1
  - Static:Dynamic (y) as a function of discriminator/modulation (Φ)
    \[ y = 0.46 + 1.05 e^{(-Φ/0.33)} \]
  - Equation may be used to determine which part of an exposure was dynamic and which was static
Static:Dynamic Exposure as Function of $\Phi$

\[ y = 0.46 + 1.05 e^{-\Phi/0.33} \]
Conclusion

- Imaging provides additional information regarding abnormal exposures.
- Not subjective base on mathematical interpretation.
- Current configuration limited to photons below 150 keV.