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Sandia National Laboratories

Streamlining the TA-V Effort: Applying Nuclear Technologies in Radiation Environments

David Saucier

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U.S. DEPARTMENT OF ENERGY

NNSA

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

Introduction

- **Studying at University of New Mexico (UNM)**
  - BS in Nuclear Engineering and Chemistry
- **Loves: Computers, Competitive Shooting, Martial Arts and Swimming.**
- **UNM American Nuclear Society President**
- **Mentors: Russell DePriest and Dave Vehar**

Outline of Discussion

- **RML**
  - Automated Gamma Field mapping
  - Sulfur Processing Report Setup
- **Computer Simulations**
  - X-Ray to PET scan Transitional Analysis
  - Working on Criticality Safety Benchmark Conversions
  - NuGET Regression Suite Additions
  - Writing New NuGET User's Manual

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Radiation Metrology Laboratory: Creating a 3-D Radiation Map for the GIF Facility Using Motorized Detectors

David Saucier- TA-V Student Intern / UNM Nuclear Engineering Student

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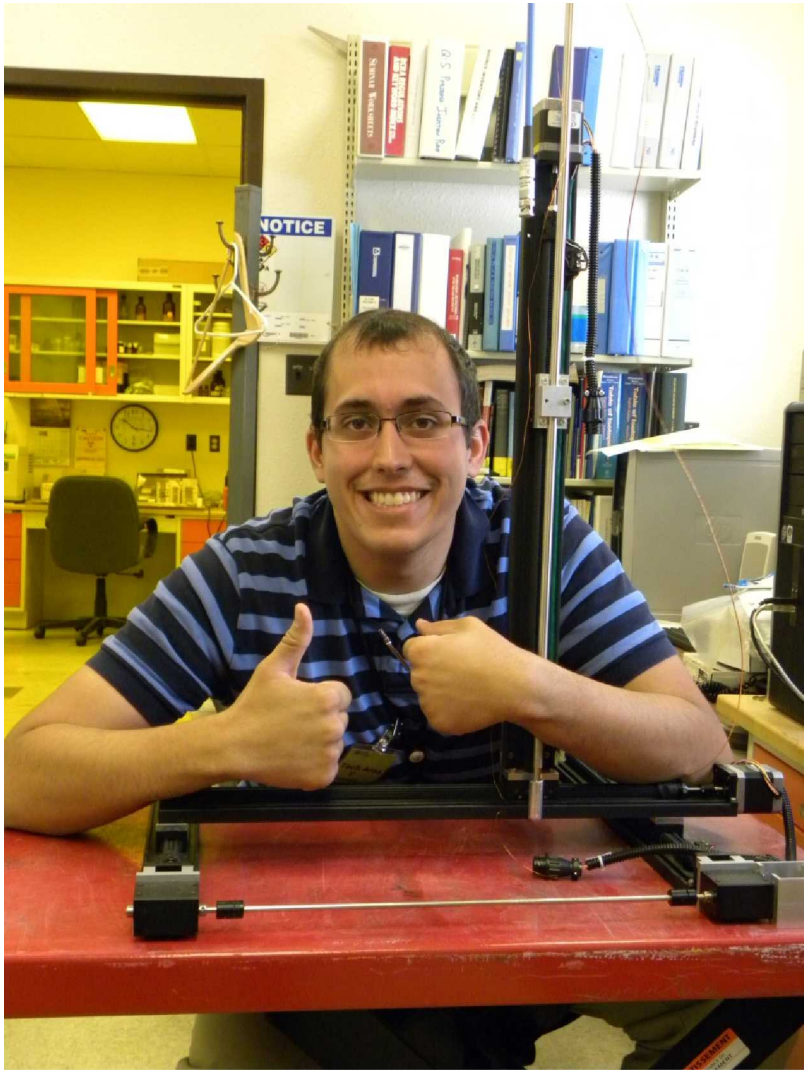
Automated Detection Tool



Radiation Sweeping Process

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Users Starts the MC Program

Origin Program Begins Finding The Coordinates of the Basket

User Enters Wanted Parameters

Sweeping Program Begins

Progress and Data Stream Updated

Program Completes and Data is Finalized

Background Processes
-Data Acquisition
-Safety Programs
-Positioning Formulas

What I Discovered

- **This Setup Offers huge benefits**
  - More Data
  - More Time (10 minutes vs. 10 seconds)
  - Overall Better Results
- **3D Radiation Mapping is Possible!**
  - Graphically See Co-60 Radiation Fields
  - Preliminary data is being taken!

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Medical Radiation Transport: Determination of Lead Shielding Requirements in PET Suites Using MCNP

David Saucier- TA-V Student Intern / UNM Nuclear Engineering Student

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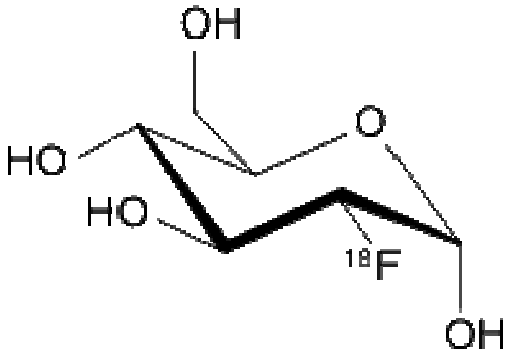
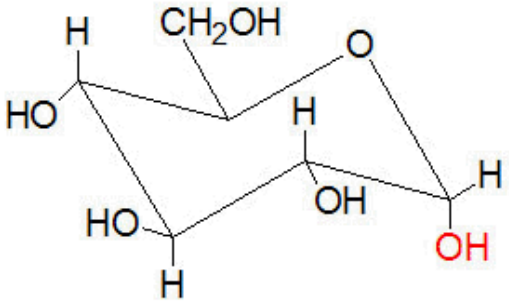
PET Introduction

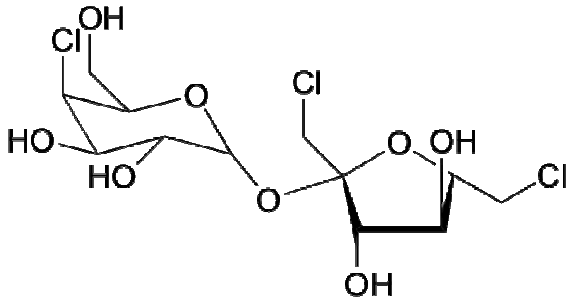
- **PET Stands for Positron Emission Tomography**
  - PET is commonly used for Cancer Imaging
    - Using Radioactive sugar (using Fluorine-18)



Fluorodeoxyglucose



α-Glucose



Sucralose
(Splenda)

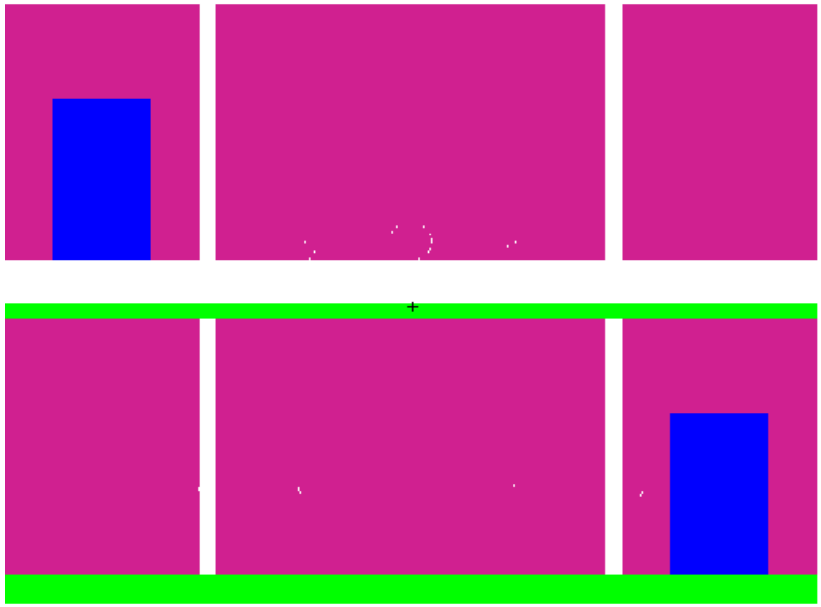
The Problem

- **Many places are converting X-ray suites to PET suites**
  - So how do we:
    - Minimize dose to Medical Personnel?
    - Create a Realistic Environment/Situation?
    - Maximize Cost and Benefit?

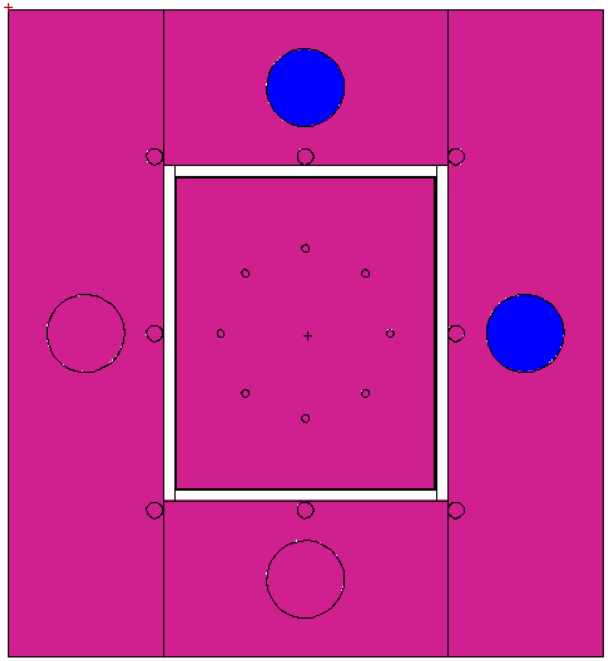
The Solution

- **Radiation Transport Code (MCNP5) will:**
  - Models a gamma radiation source
  - Create a environment that is accurate to the dimensions of a PET suite from a hospital.

Geometric Setup

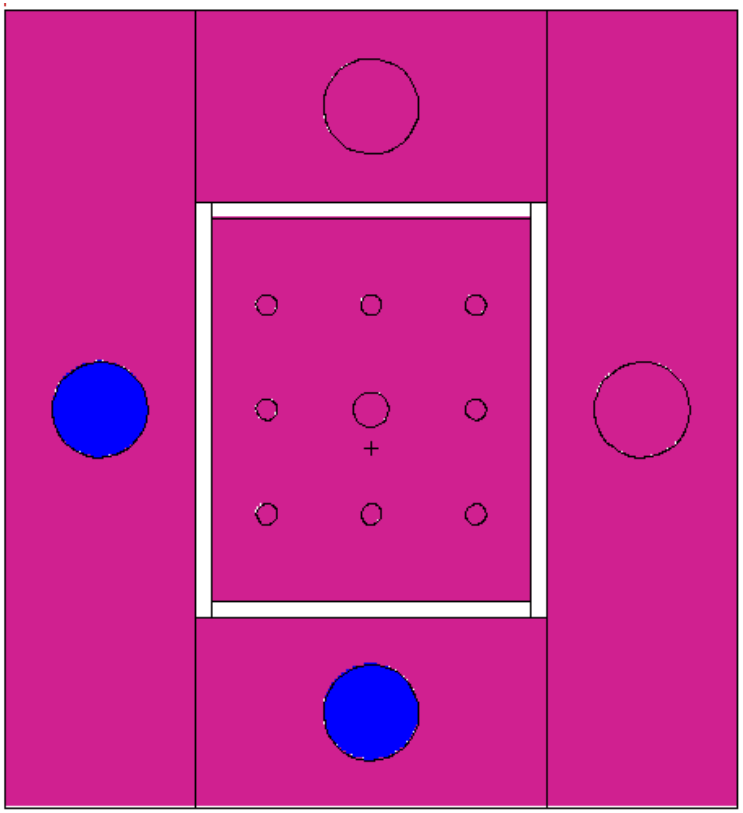


YZ Plane-Upper & Lower Rooms



XY Plane- PET Suite Bottom

Geometric Setup (cont'd)



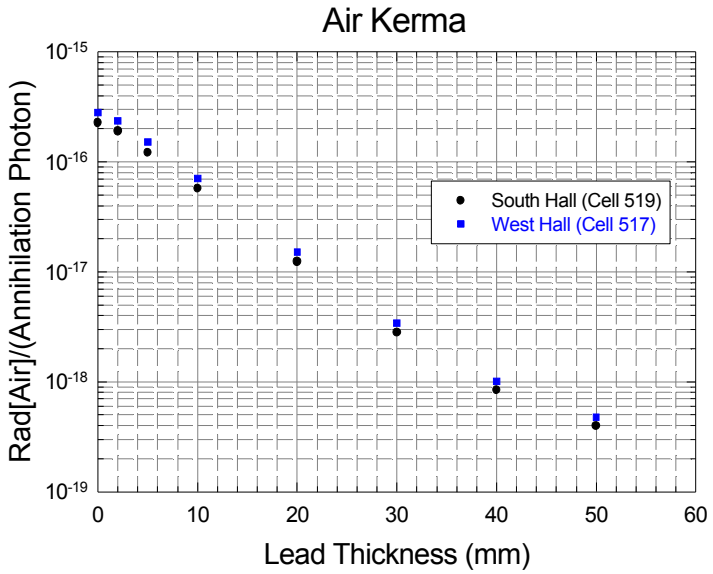
XY Plane- Upper Room

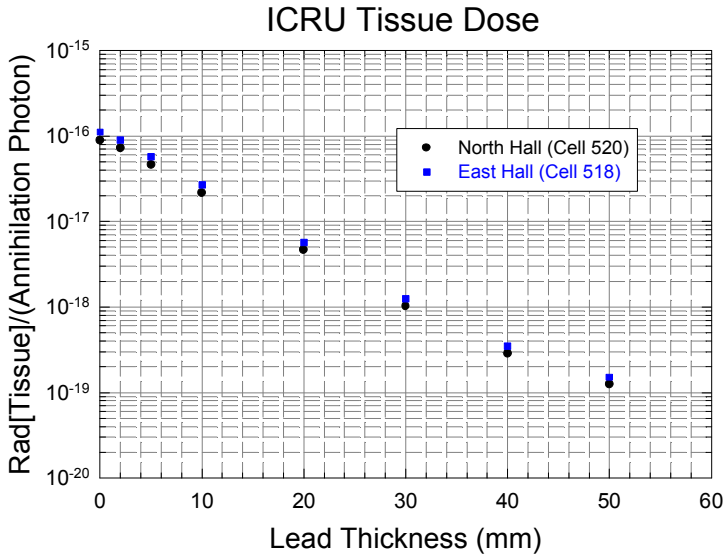
Results

- **Baseline Model Was Successful**
  - Less than 1% difference from published data
- **Gamma In-Scatter Effects**
  - Detectors saw more gammas with addition of walls, floor and ceiling

Results

- **Lead Shielding Trends are consistent with expectations**





- Received values deviated from NIST data for mass attenuation factors by 12-15%
  - Because of radiation buildup factors on the lead surface

Conclusion & Final Comments

- **Projects have been received very well!**
  - Increased Visibility for TA-V and SEERI
    - MIT
    - UNM
    - Sandia
  - Working towards publishing the PET Suite Study
  - Taught an intern a lot of things
- **If you have more questions, come and talk to me.**
  - I don’t bite… much

Thank you!

- **Embarrassing thank you time!**
  - My mentors Russell DePriest and Dave Vehar
  - Organization 1384
    - My Manager- Ken Reil
  - The People of TA-V and SEERI
    - You all are amazing!
- **SEERI and TA-V offers an amazing experience to students**
  - I couldn’t have been where I am now without y’all!

David and Drew's Epic Closing Picture