



# The Role of Modern Positioning Systems in In-situ Survey Techniques

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# Philosophical Tidbit #1

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**If you're not taking data,  
then you're just making  
conversation!**



# Philosophical Tidbit #2

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If you're not analyzing your data, you're wasting your money!



# Current Situation

- **MARSSIM (NUREG-1575)**
- **Current practices “de facto” requirements?**
- **MARSSIM alludes to “alternative methods”**
- **MARSAME (new)**
- **Opportunities for improvement?**



# Future Options

- GPS-coupled detectors outdoors
- Fan-laser surveyor-coupled detectors indoors
- Automated data acquisition and analyses
- Vastly increased data volume
- Improved Analysis & Presentation Software
- Graphical (Visual) Data Presentation



# Considerations

- Fully MARSSIM Compatible
- Fewer fixed-point measurements
- More frequency distribution and statistical analyses
- Continued DCGL assurance
- Easier, yet more powerful



# Automated Data Collection Systems

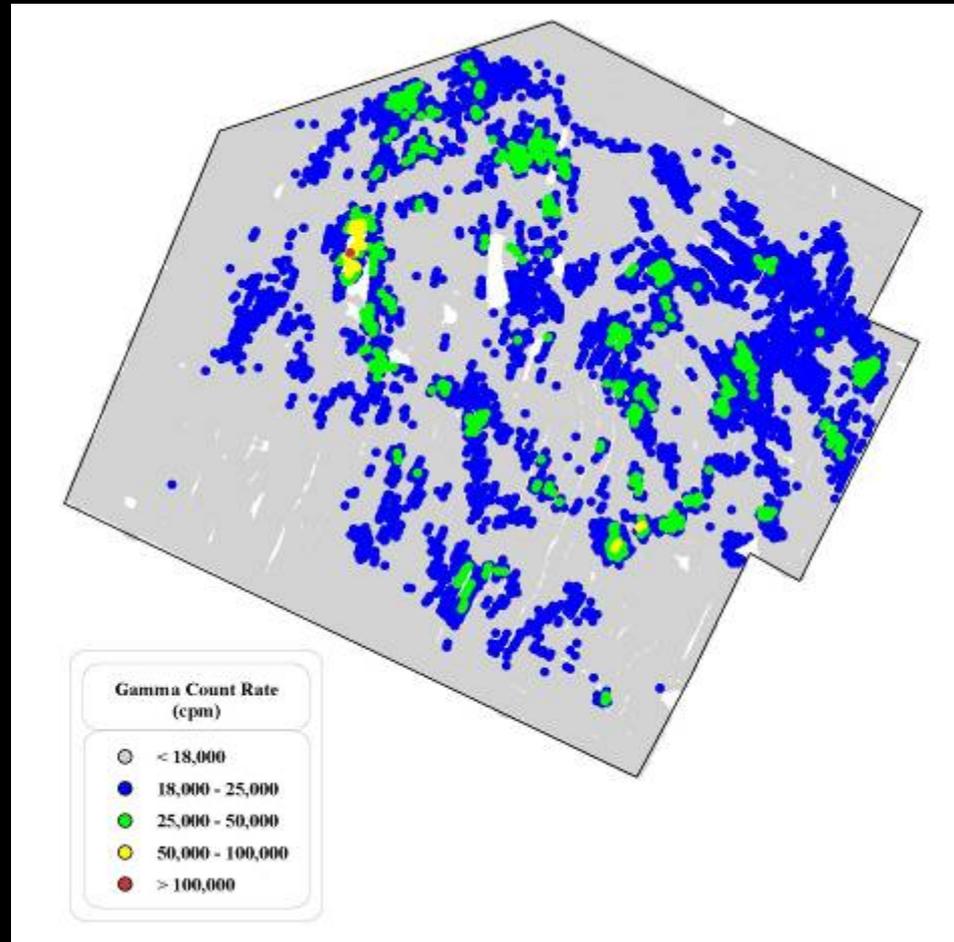
- **USRADS**
- **GPS-Coupled (sub-meter accuracy)**
- **Infrared Fan Laser-Coupled (sub-centimeter accuracy)**
- **Ultra-sonic Locator-Coupled**
- **X, Y, Z data logging**



# Automated Capabilities

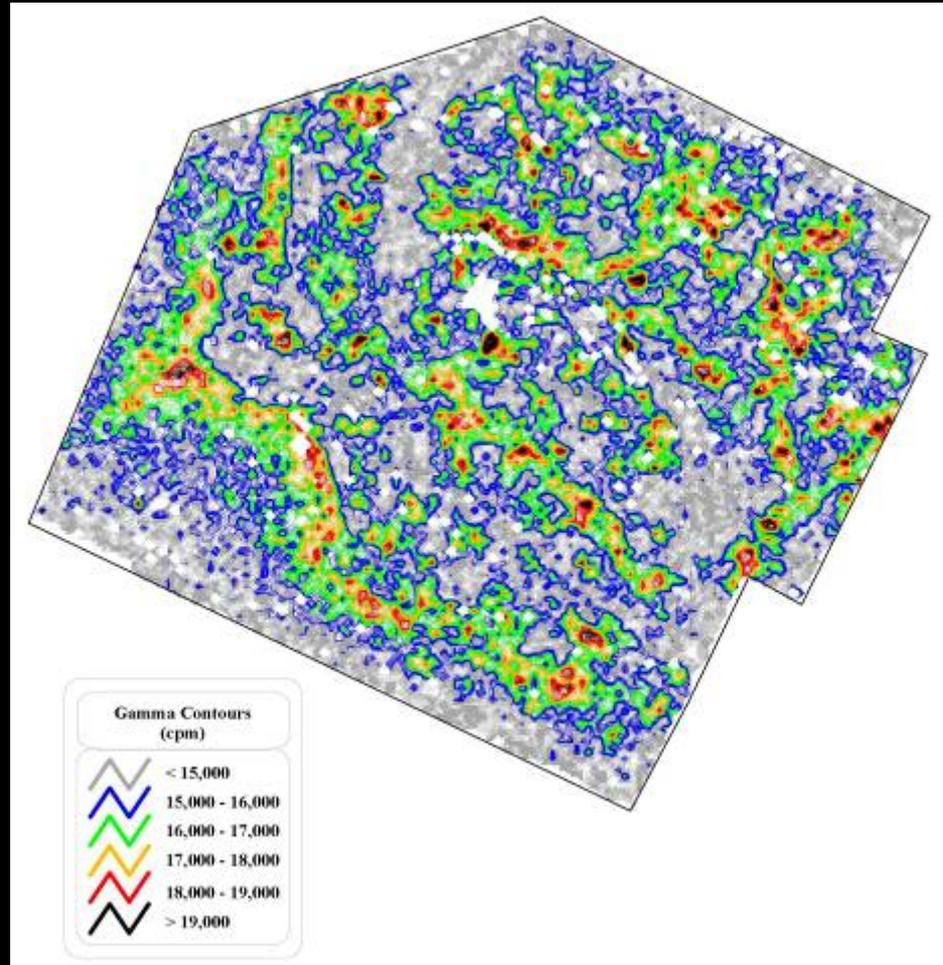
- Determine scanning MDA
- Scan 100% of surfaces with constant scanning speed
- Measure variability for use in the final status survey design
- Make integrated measurements on a defined grid
- Return to a predetermined position (x, y, z) for “surgical remediation” or follow-up surveys
- Download data into ArcView GIS, AutoCAD, or other application

# Example Data Output



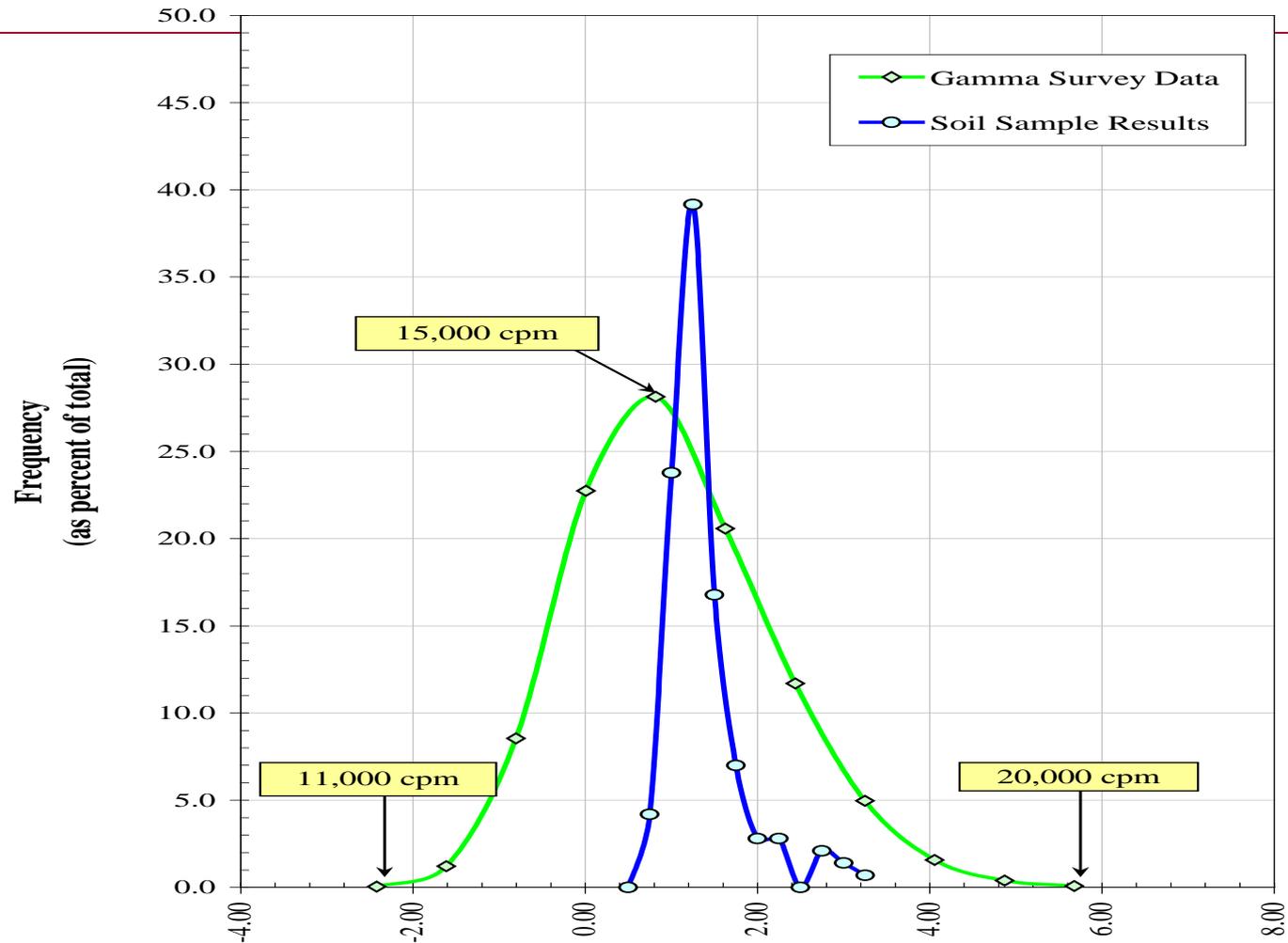
## Remedial Action Support Survey

# Example Data Output



Final Status Survey

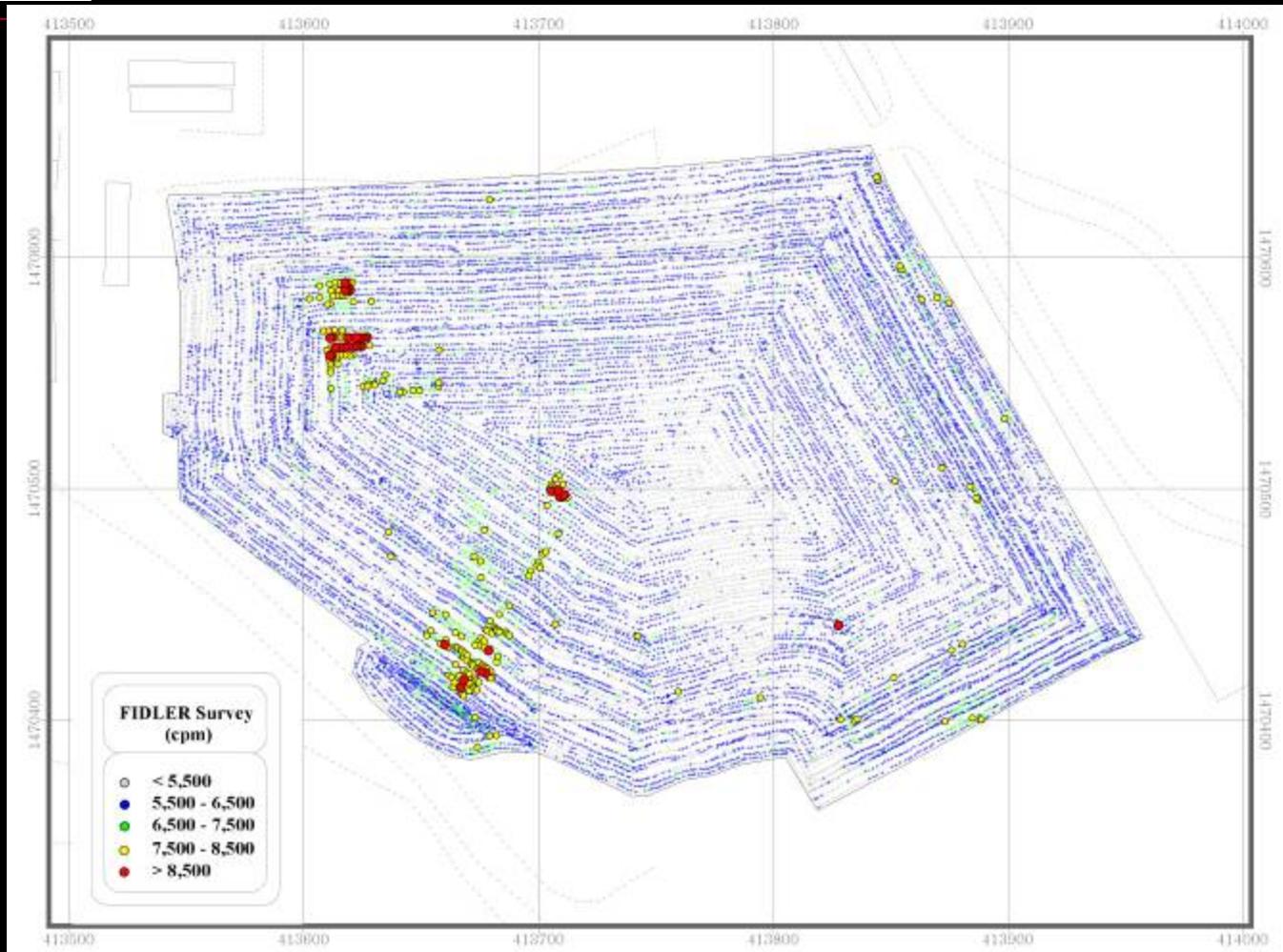
# Example Data Output



**Thioium-232 Concentration (pCi/g)**  
**Comparison of Final Status Frequency Distributions**

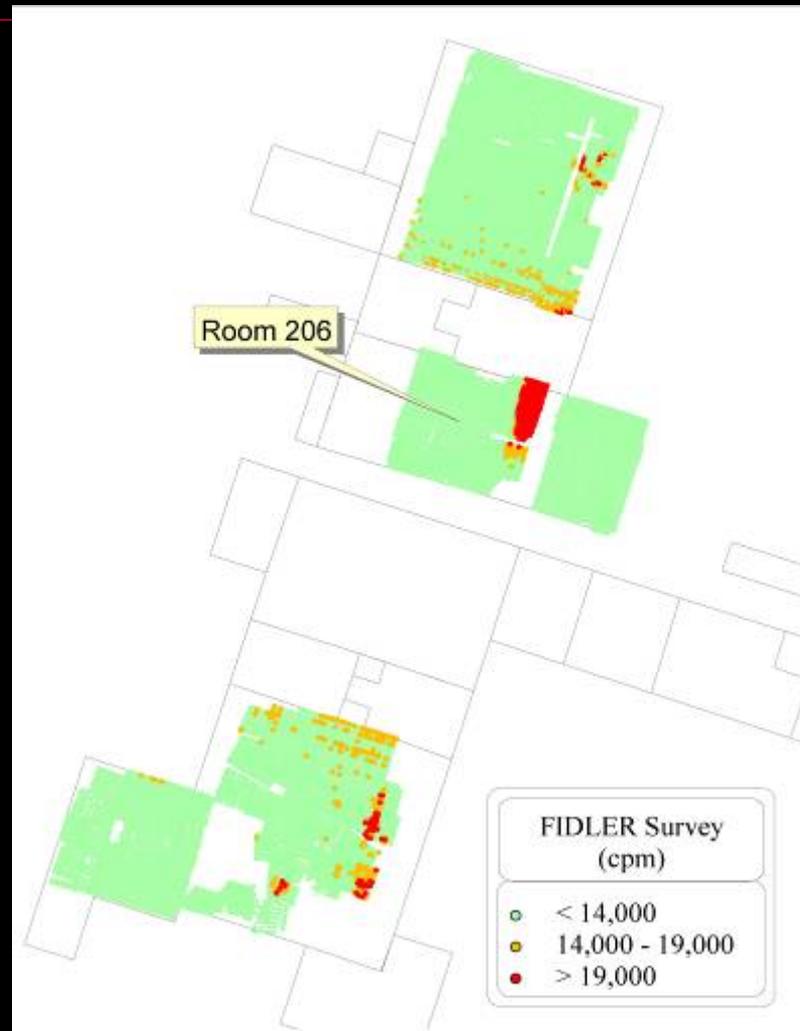
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# Example Data Output



## Characterization Survey Raw Data

# Example Data Output



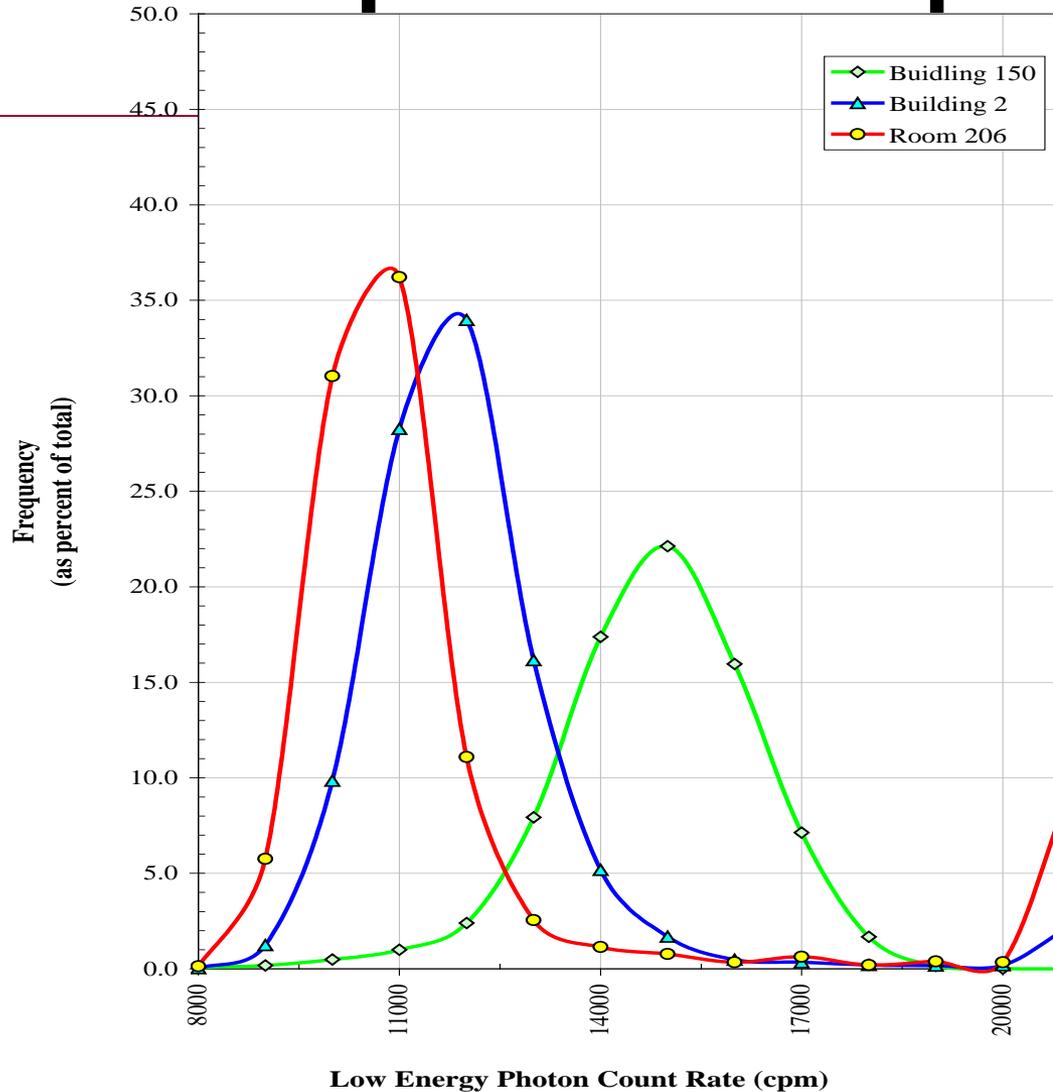
**Floor Survey in Building**

# Example Data Output



**Floor Survey in Building**

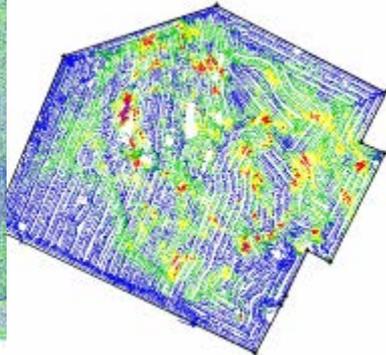
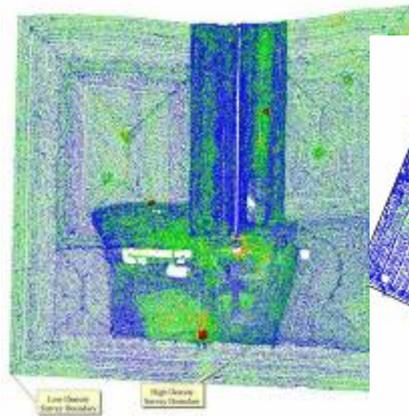
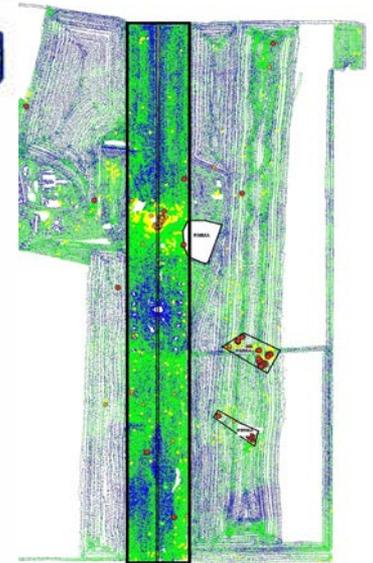
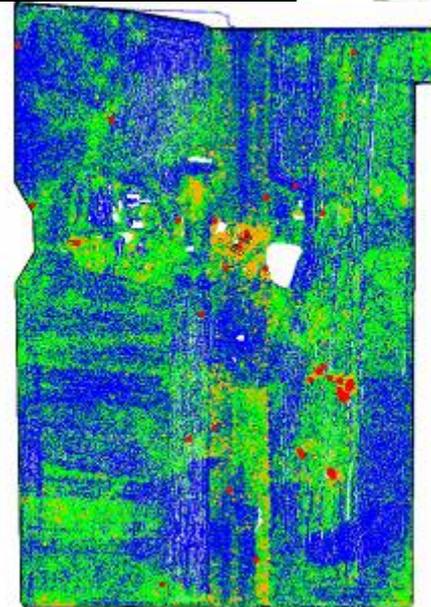
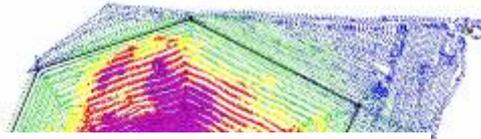
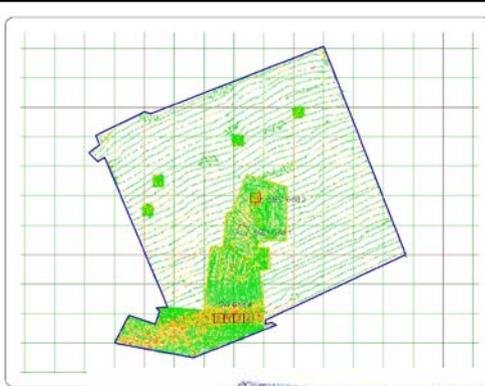
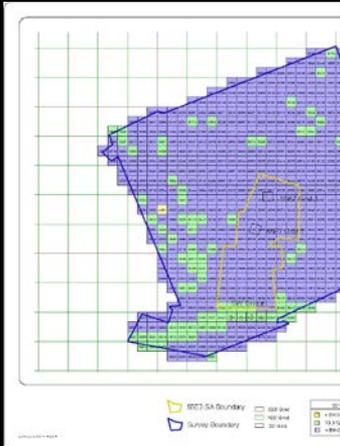
# Example Data Output



## Frequency Distributions of Low Energy Photon Count Rates



# Miscellaneous Outputs



TS-5  
GPS Radiological Survey  
March, 2009  
ERG

Gamma Count Rate (cpm)

< 15,000
15,000 - 20,000
20,000 - 25,000
25,000 - 30,000
> 30,000

GW observations  
06/06

Gamma/Total (cpm)

10.00 - 20.00
14.00 - 18.00
11.00 - 14.00
6.00 - 11.00
< 6.00

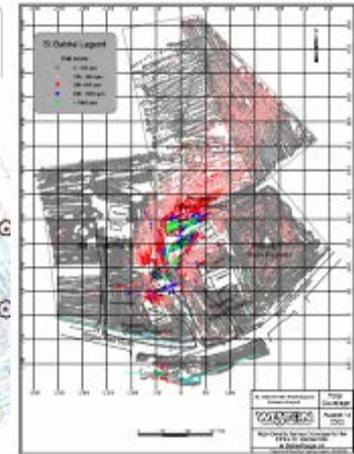
TS-5  
FS Radiological  
October, 2009  
ERG

Gamma Count

< 15,000
15,000 - 20,000
20,000 - 25,000
25,000 - 30,000
> 30,000

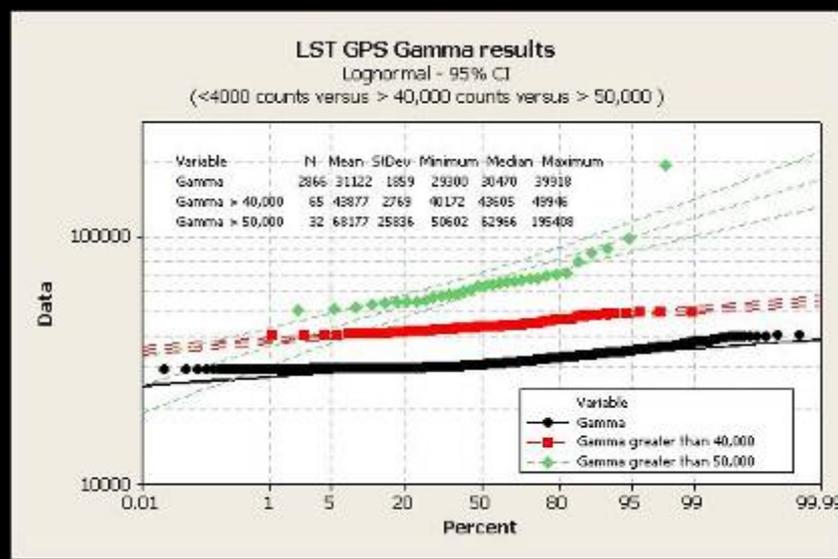
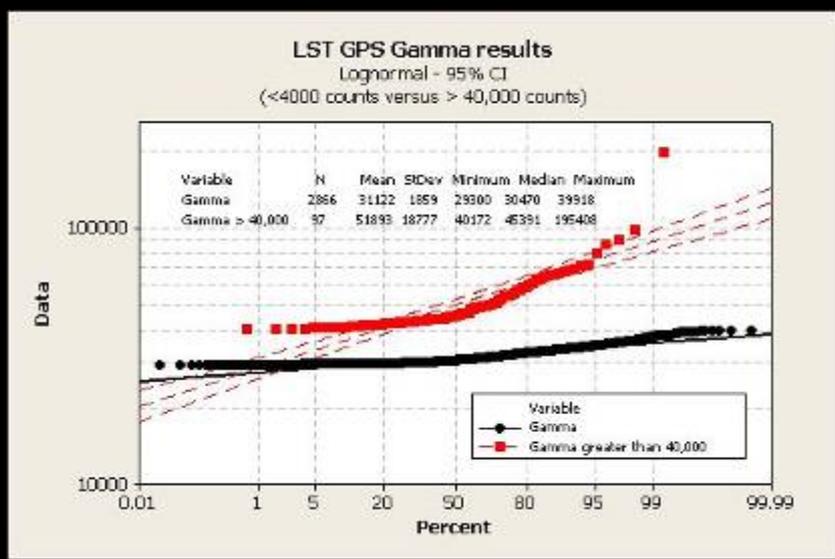
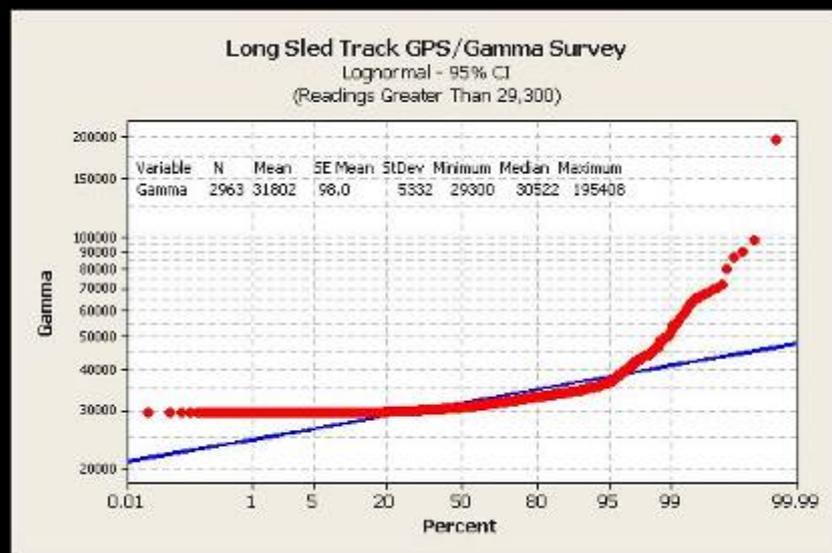
ERG  
Legend

15.000 - 20.000
20.000 - 25.000
25.000 - 30.000
30.000 - 35.000
35.000 - 40.000



# Using Statistical/Graphical Tools

Starting with a “mere” 420,000 readings:





# Summary

- **Automation may soon become the “industry standard”**
- **Indoor and outdoor applications “off-the-shelf”**
- **Computerized data analysis and presentation extremely powerful**
- **Iterative, on-the-fly surveys, “surgical” remediation**