



Evaluation of One Month of Temporal Data from Multiple Consumer-Grade Radon Detectors

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Introduction and Motivation

- * Background radiation knowledge is essential for precise radionuclide monitoring
- * Affordable temporal Rn monitors would enable crowdsourcing
- * Stable and reliable monitors are best
- * Devices need testing under different conditions

Mission Relevance

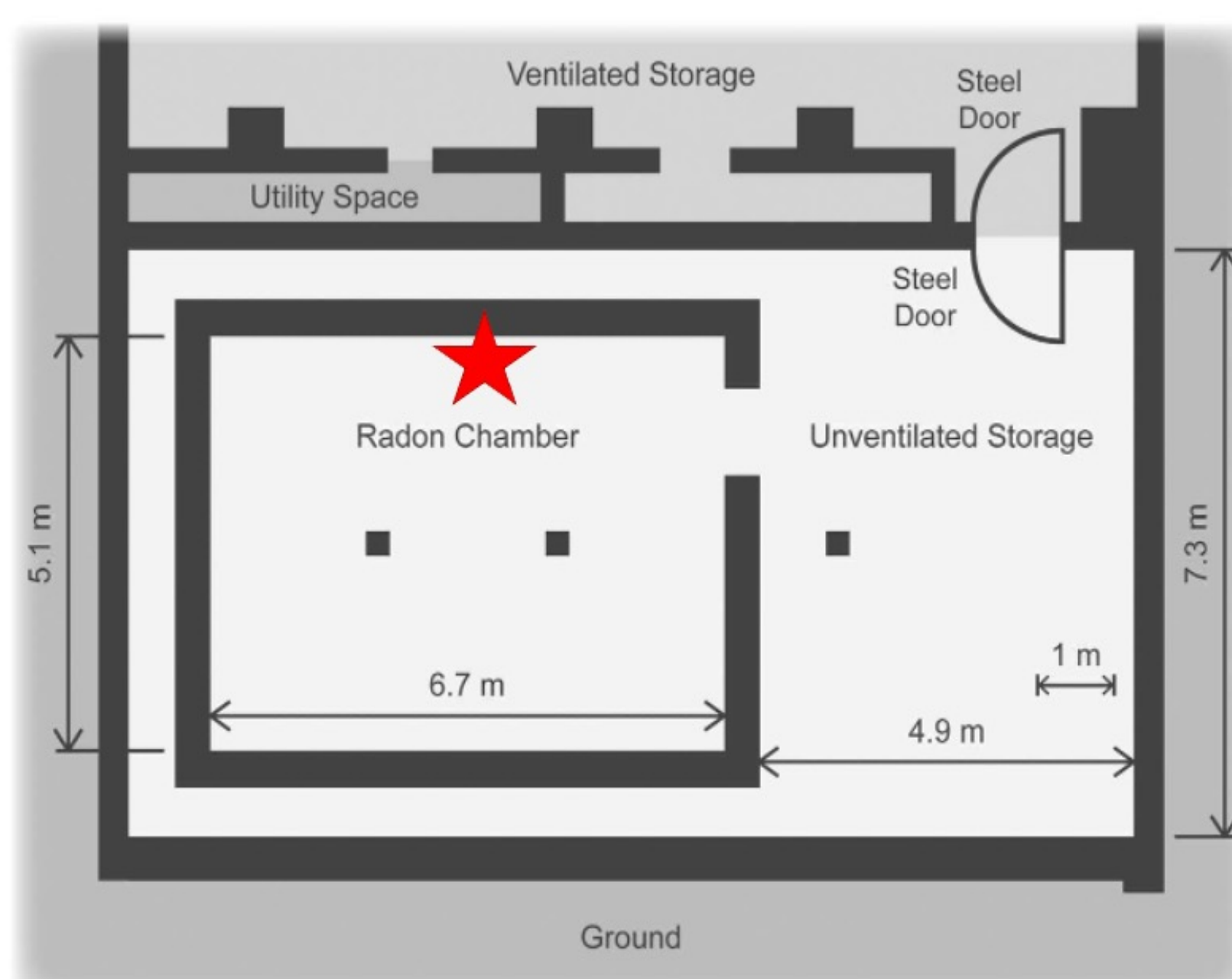
- * Improved radionuclide detection over background
- * Discriminate seismic activity vs weapons tests

Expected Impact

- * Increased knowledge of background Rn
- * Affordability expands research capabilities

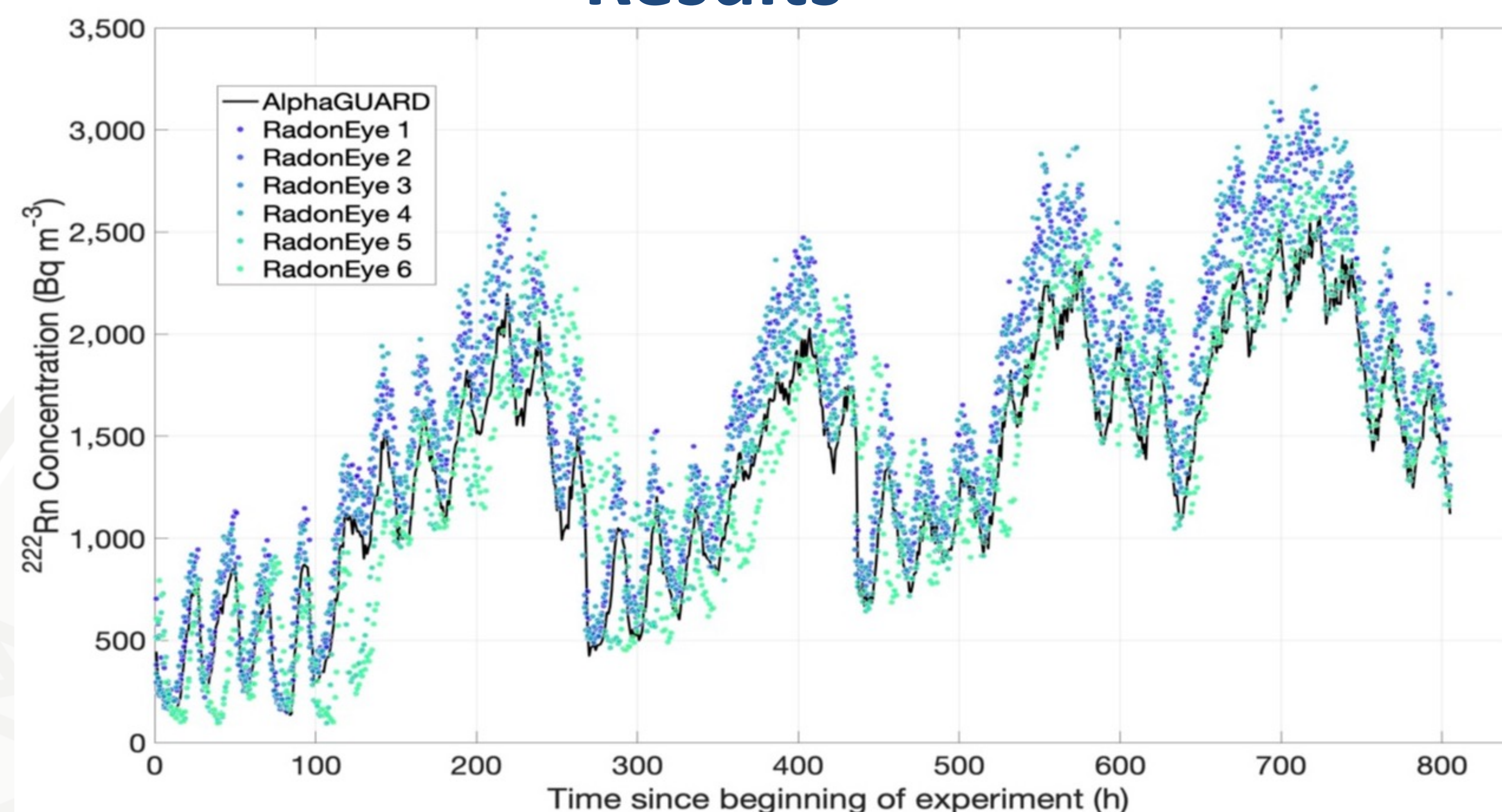
Technical Approach

- * Six consumer-grade FTLab RadonEye
- * Professional Saphymo AlphaGUARD
- * Natural radon chamber
 - 63±1% humidity; 18.3±0.3°C,
- * MathWorks MATLAB and Microsoft Excel
- * 30 d data collection (Nov-Dec 2021)

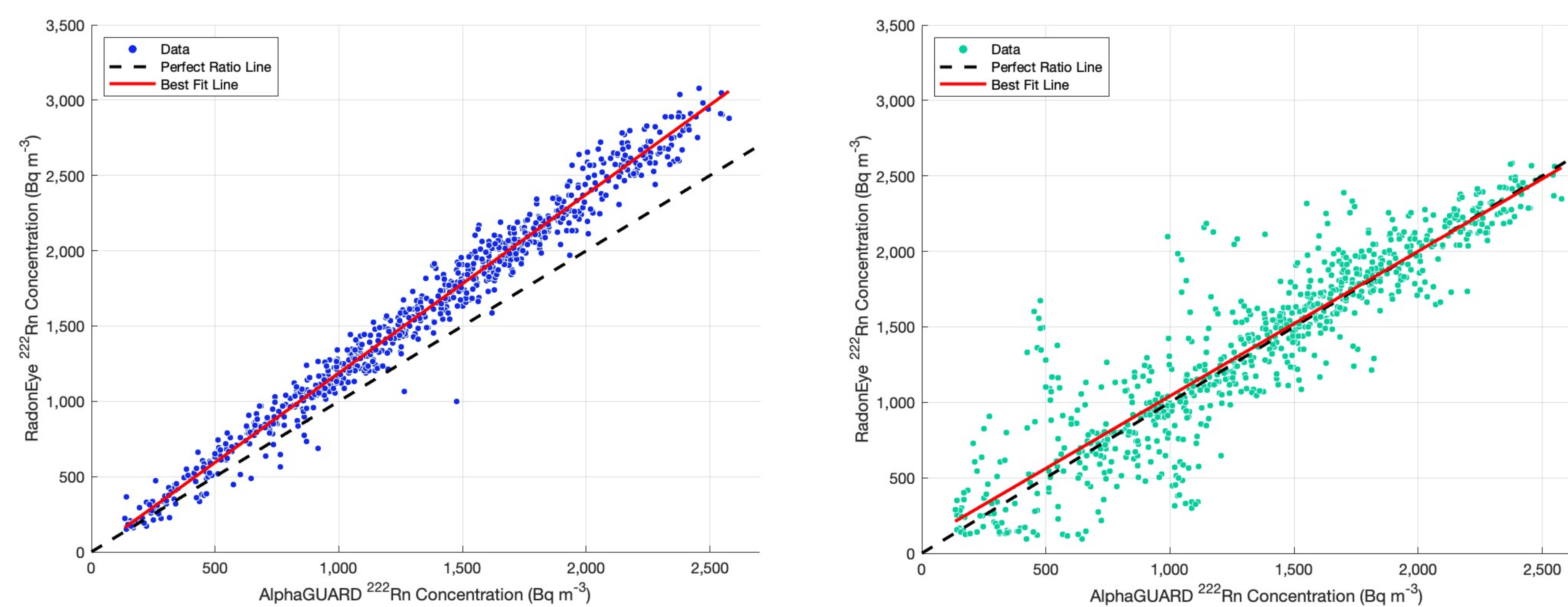


▲ Fig 1. Natural radon chamber floorplan, with experiment location denoted by a red star

Results



▲ Fig. 2: ^{222}Rn concentration measurements using AlphaGUARD and six RadonEyes in a natural radon chamber as a function of time for 30 d experiment

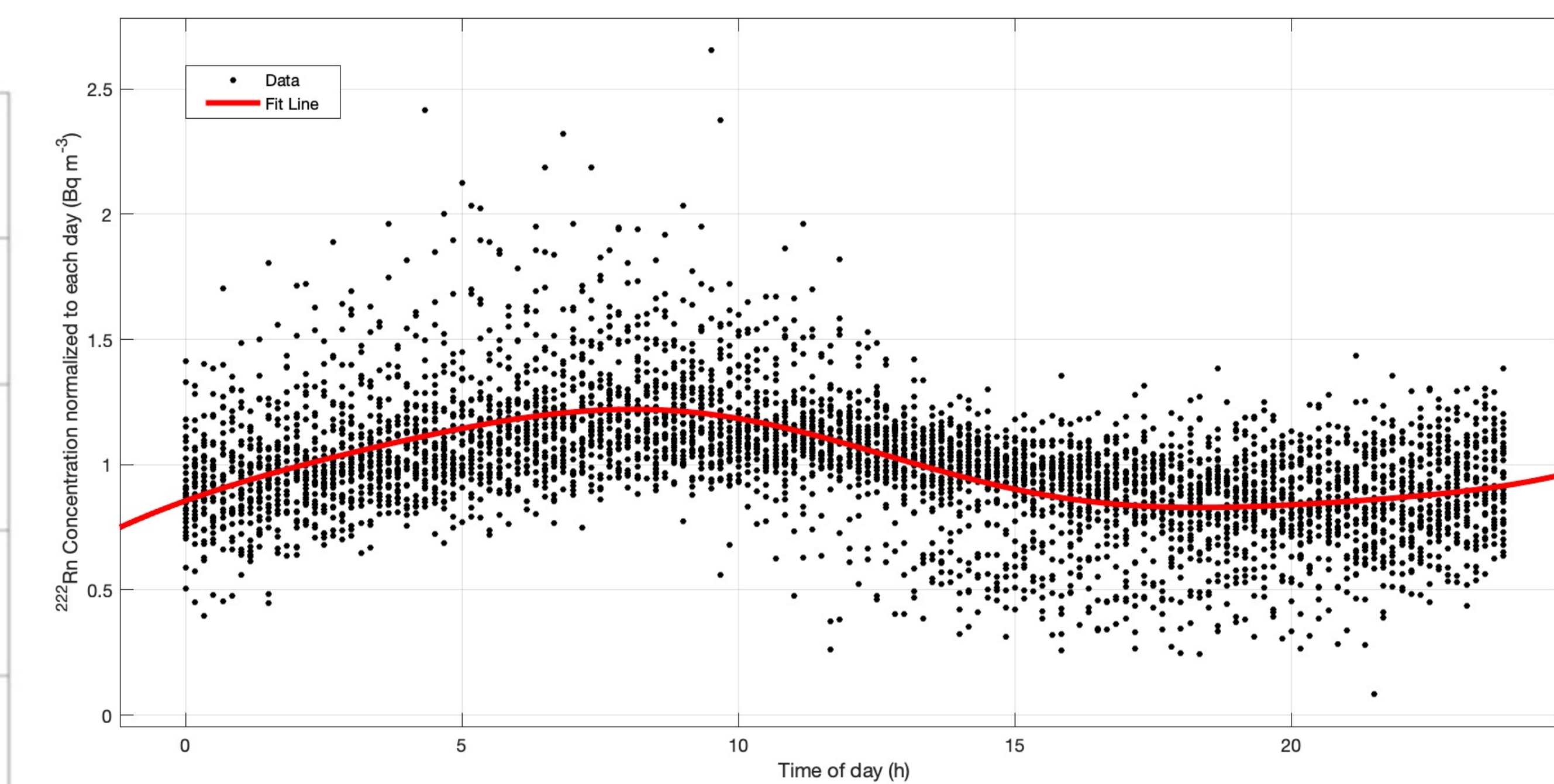


▲ Fig. 3: RadonEye ^{222}Rn concentration as a function of AlphaGUARD ^{222}Rn concentration. Perfect agreement shown as dashed line and best fit as solid red line. Representative RadonEyes with (LEFT) higher sensitivity and lower noise, and (RIGHT) Matching sensitivity but high noise are presented.

▼ Table: Linear least squares best fits of RadonEye as a function of AlphaGUARD ^{222}Rn concentrations

RadonEye	Slope	Y-intercept	R-squared
1	1.17	68	0.98
2	1.19	1.0	0.98
3	1.06	62	0.96
4	1.22	25	0.95
5	0.96	83	0.82
6	0.99	71	0.74

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▲ Fig 4: Normalized AlphaGUARD ^{222}Rn data as function of time of day. Red line is sinusoidal best fit. The diurnal variation is clearly evident.

MTV Impact

- * *Personal development:* Undergraduate research (first year!), academic credit, tools for coursework (MATLAB, statistics, exploratory data analysis)
- * *Ultimate applications:* Rn professionals (test, mitigate), Rn researchers, public health officials; Radiation Weather Station (Pro and Lite),

Conclusion

- * Great RadonEye and AlphaGUARD agreement
- * Very clear diurnal variation
- * Notable effects of ventilation changes

Next Steps

- * Extend experiment duration
- * Test in controlled environmental chamber
- * Explore ^{222}Rn vs. environmental conditions
- * Analyze variations (daily, weekly, monthly)
- * Present at local Health Physics Society meeting
- * Present at Health Physics Society conference
- * Prepare note for Health Physics Journal

