

2024/08/19

SNO+ and Radon

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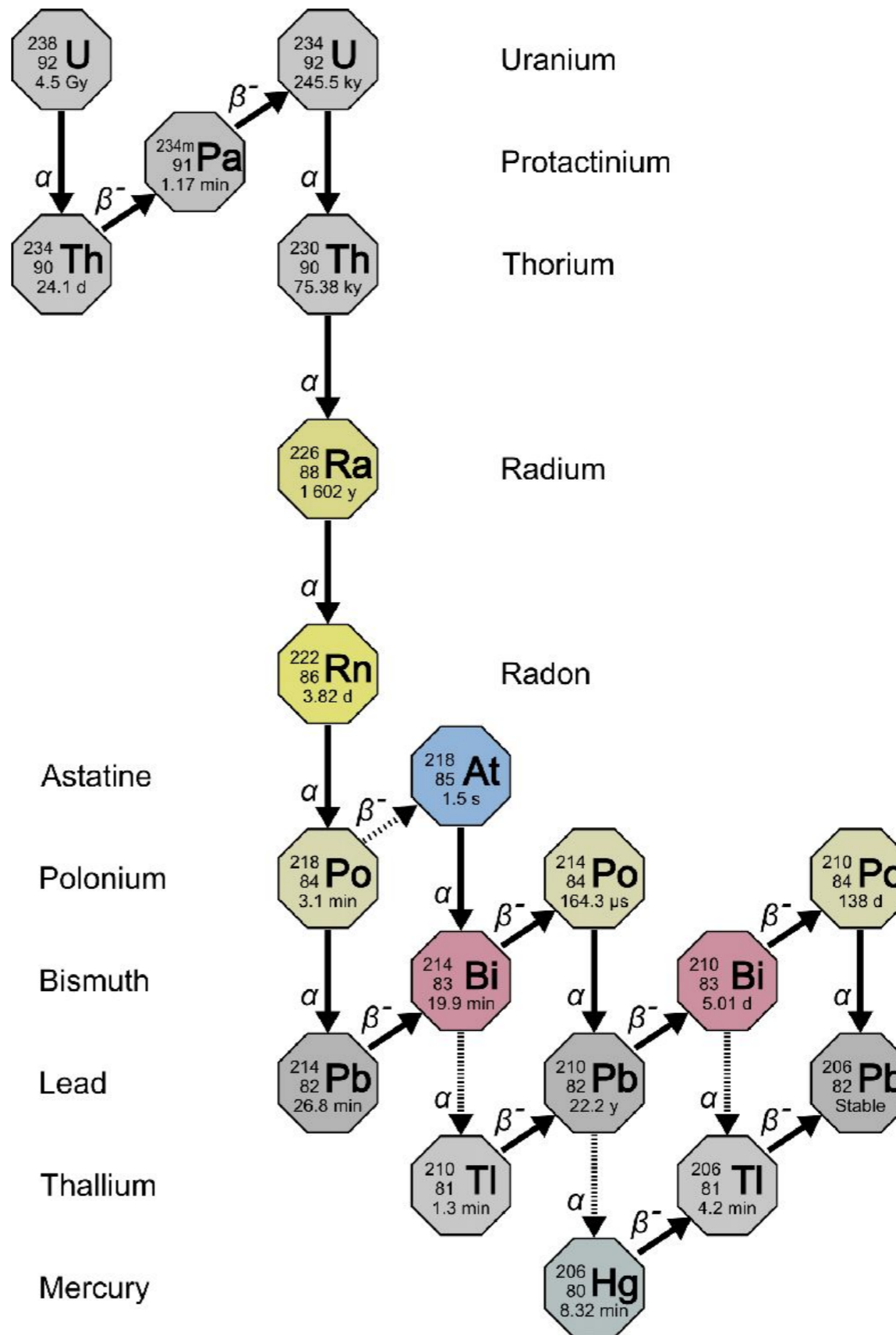
Disentangling the U-238 Decay Chain



Dirt, rock, and dust

Radon vs Parents

Pb-210 long lived



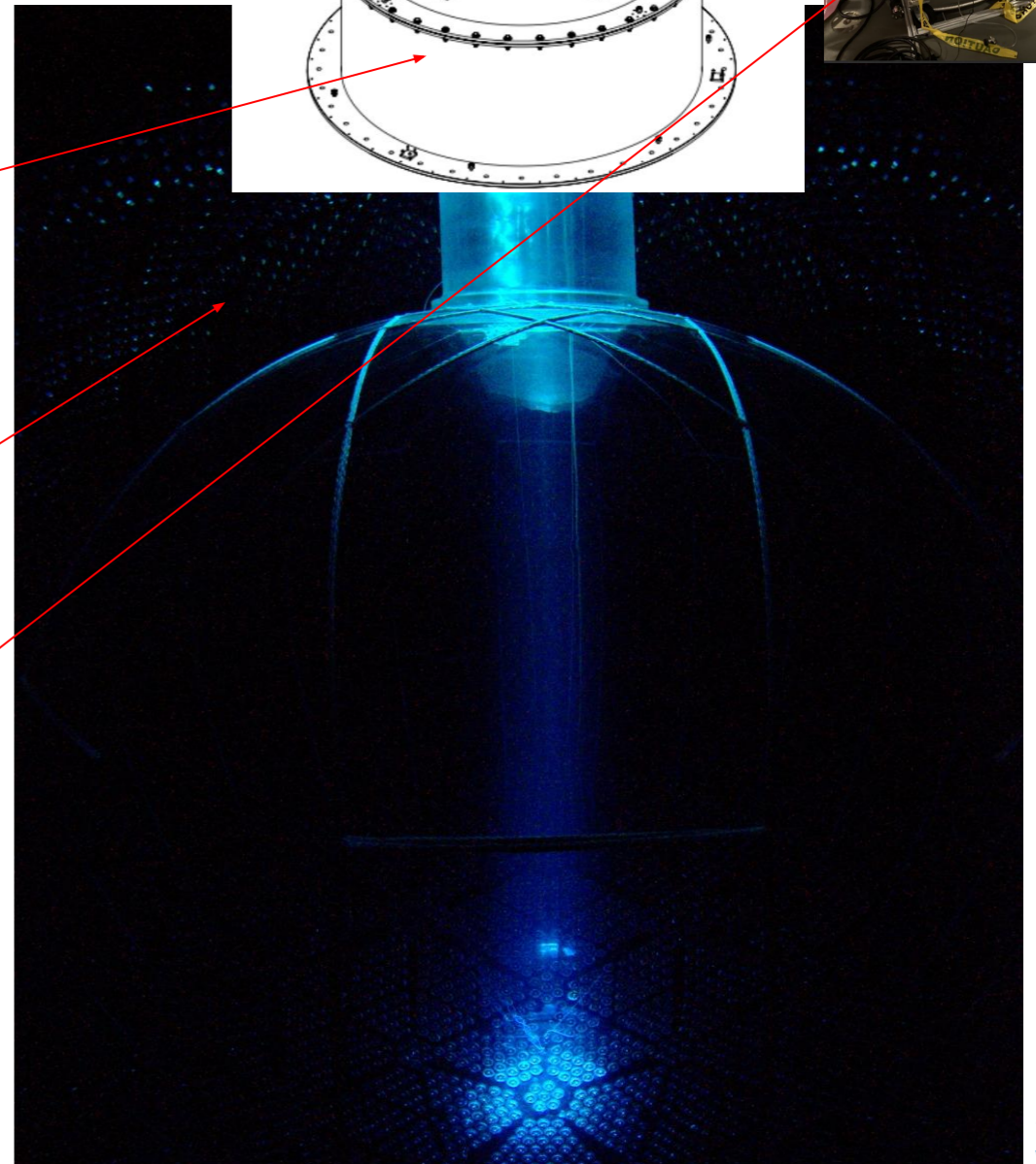
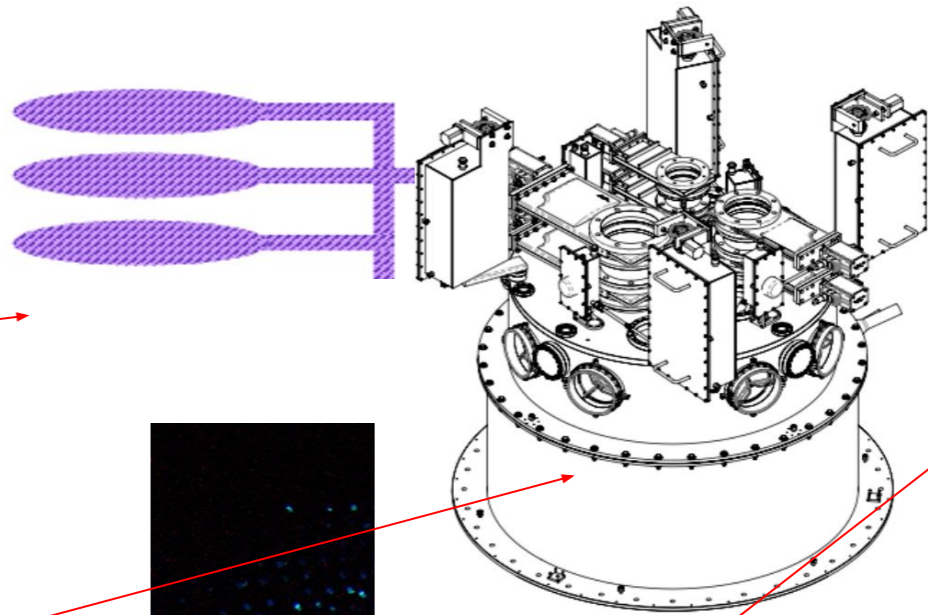
SNO+ Radon Mitigation

N2 Cover Gas system

Universal Interface (UI)

Ultra pure water (UPW) shielding

Electrostatic Radon Monitor



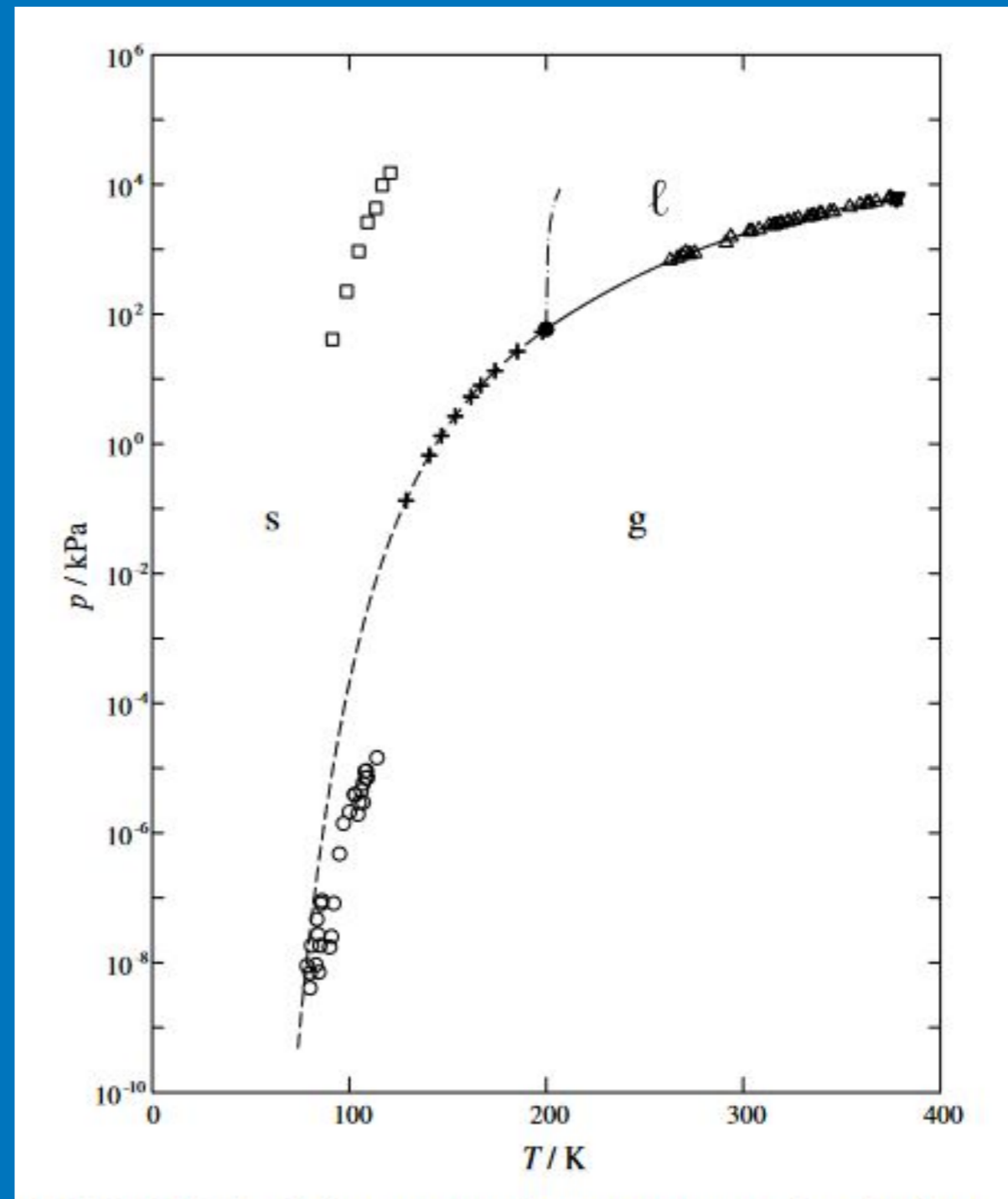
Cryogenically Trapping Radon Gas

Radon Phase Diagram

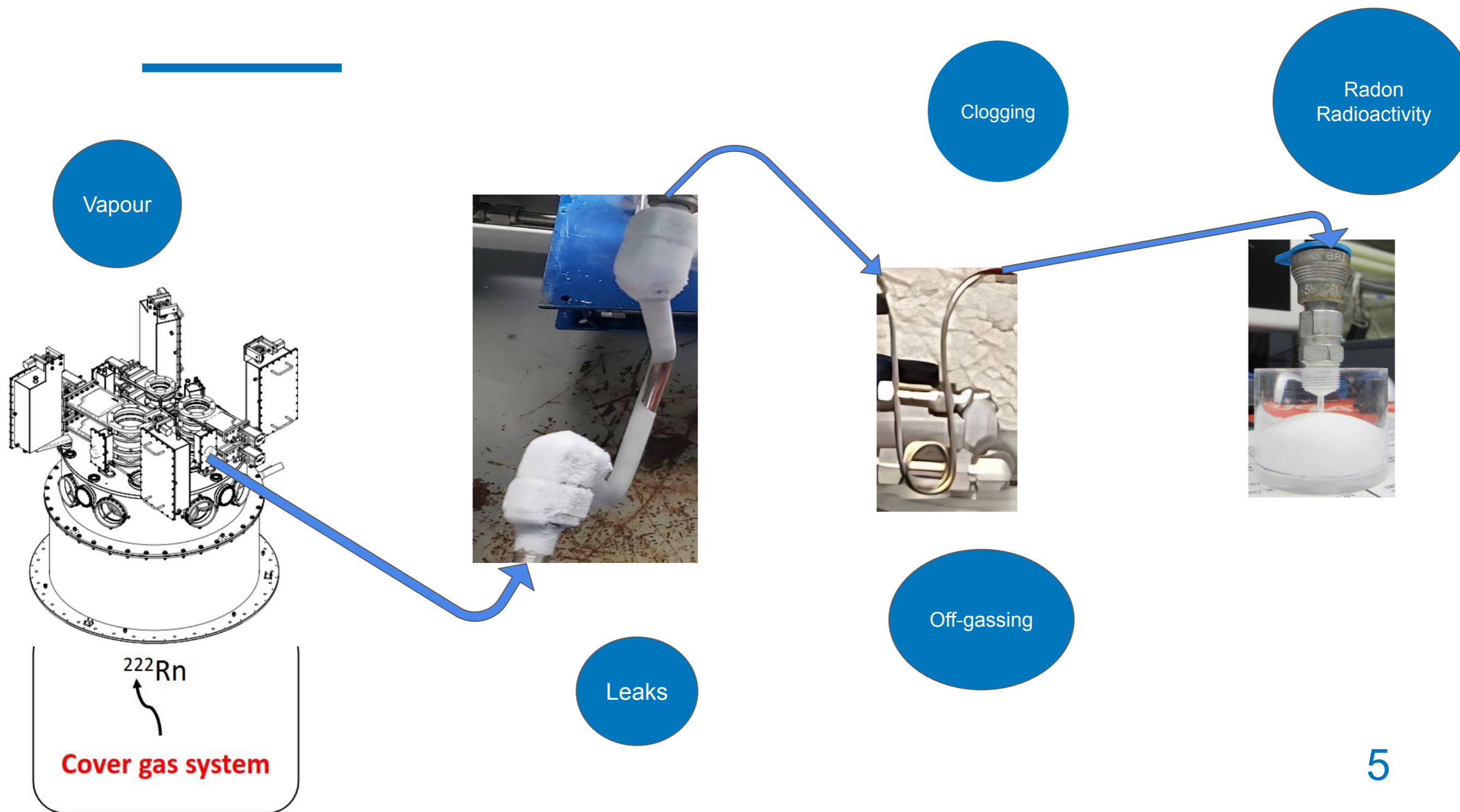
Noble Gas

Can be frozen by LN2 - 77K

Control sublimation and deposition



What is a Radon Assay

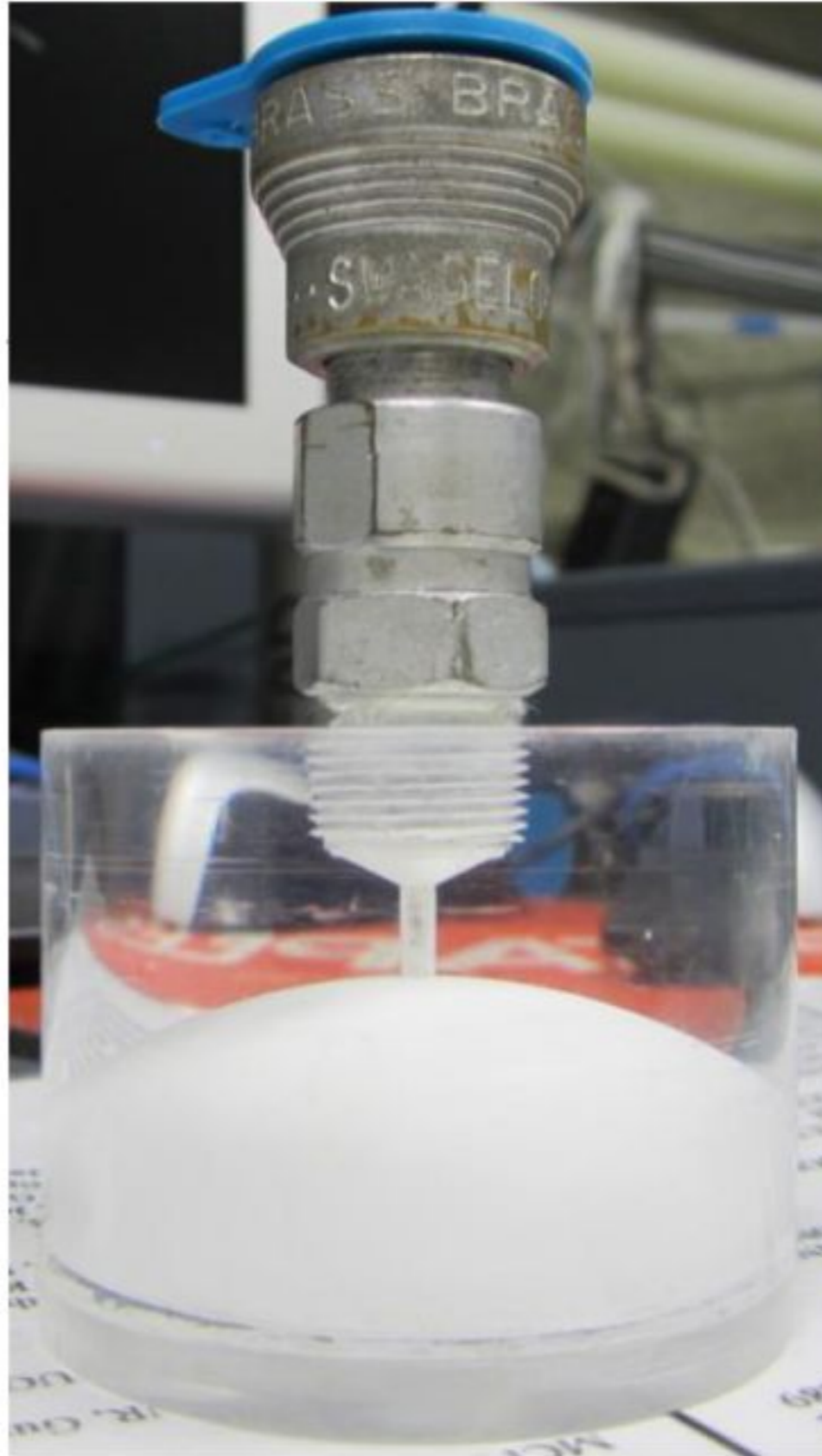


Lucas Cells

Quantifying an analyte -
Rn222 atoms

ZnS (Ag) scintillator

Counting flashes

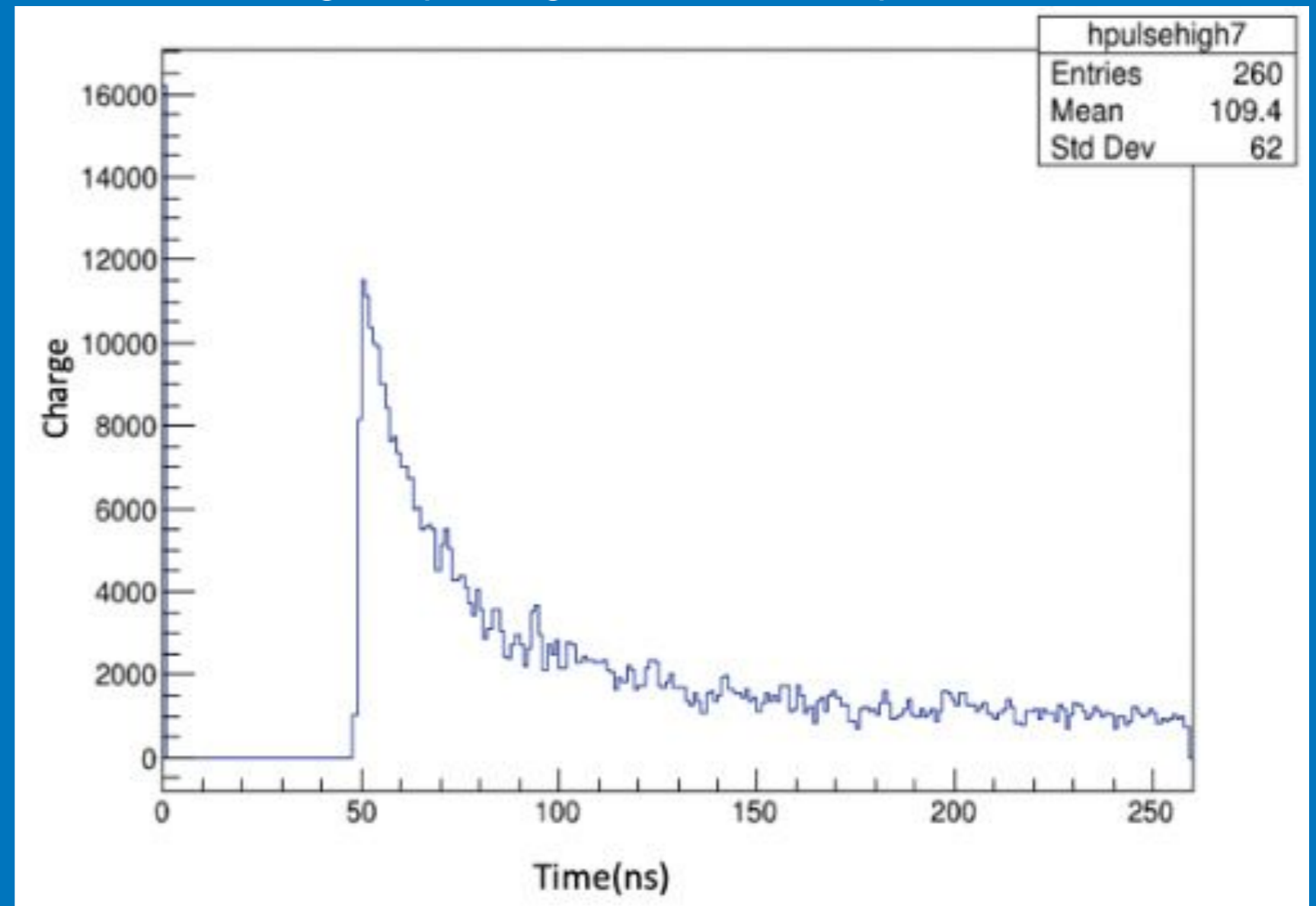


Counting Alphas

Single alpha signal - Photomultiplier Tube

Three alphas per Rn

Read out by
Photomultiplier Tube



Credit Adil Hussain

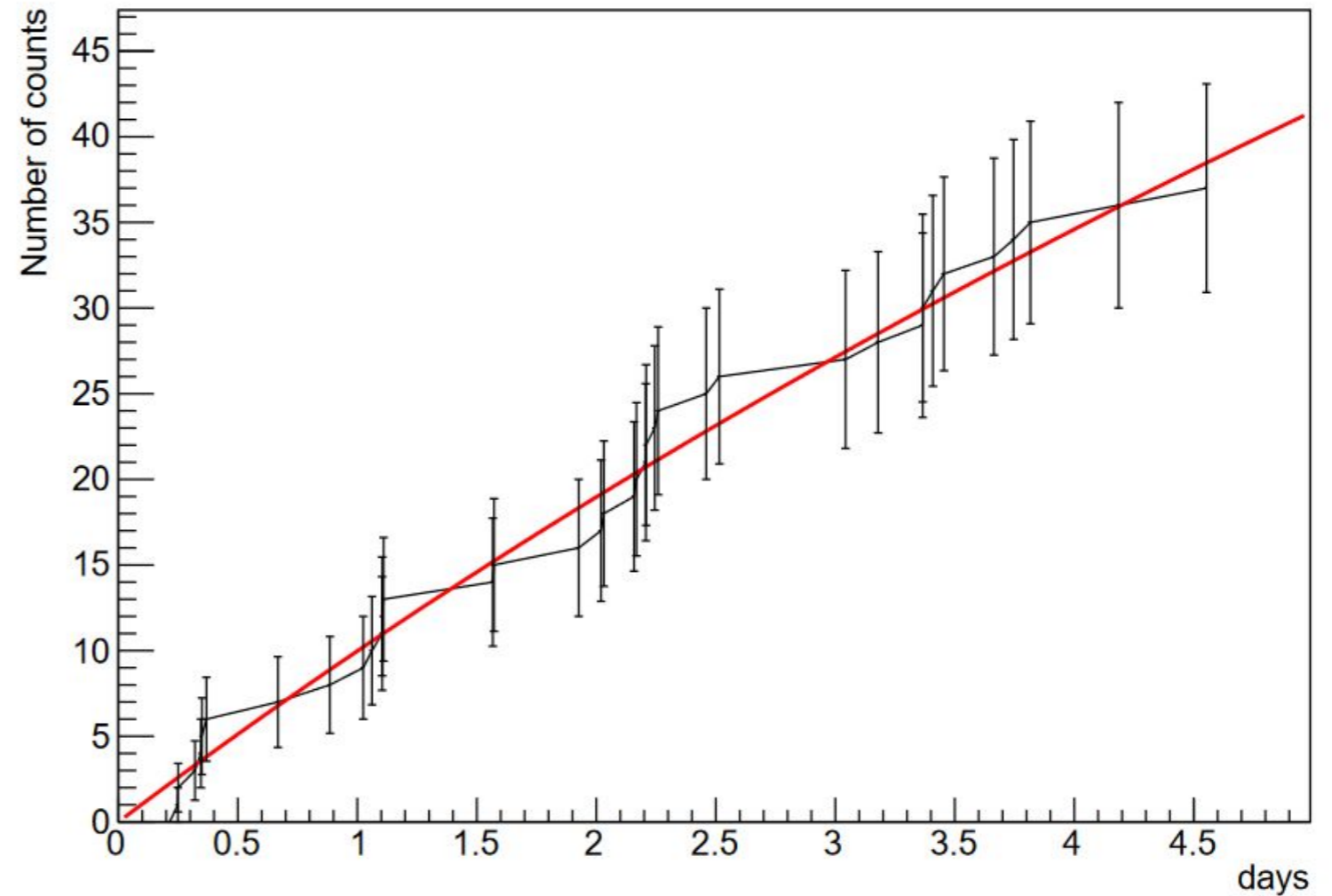
Background Results

System Background Radon Counts vs Time

Multiple fixes

Leak checked hot + cold

38 +/- 6 counts



Improving Assays with Titan Trapping

Cools down to -90C

Freezes H₂O, CO₂, and
Scintillator Vapour

Leak checked



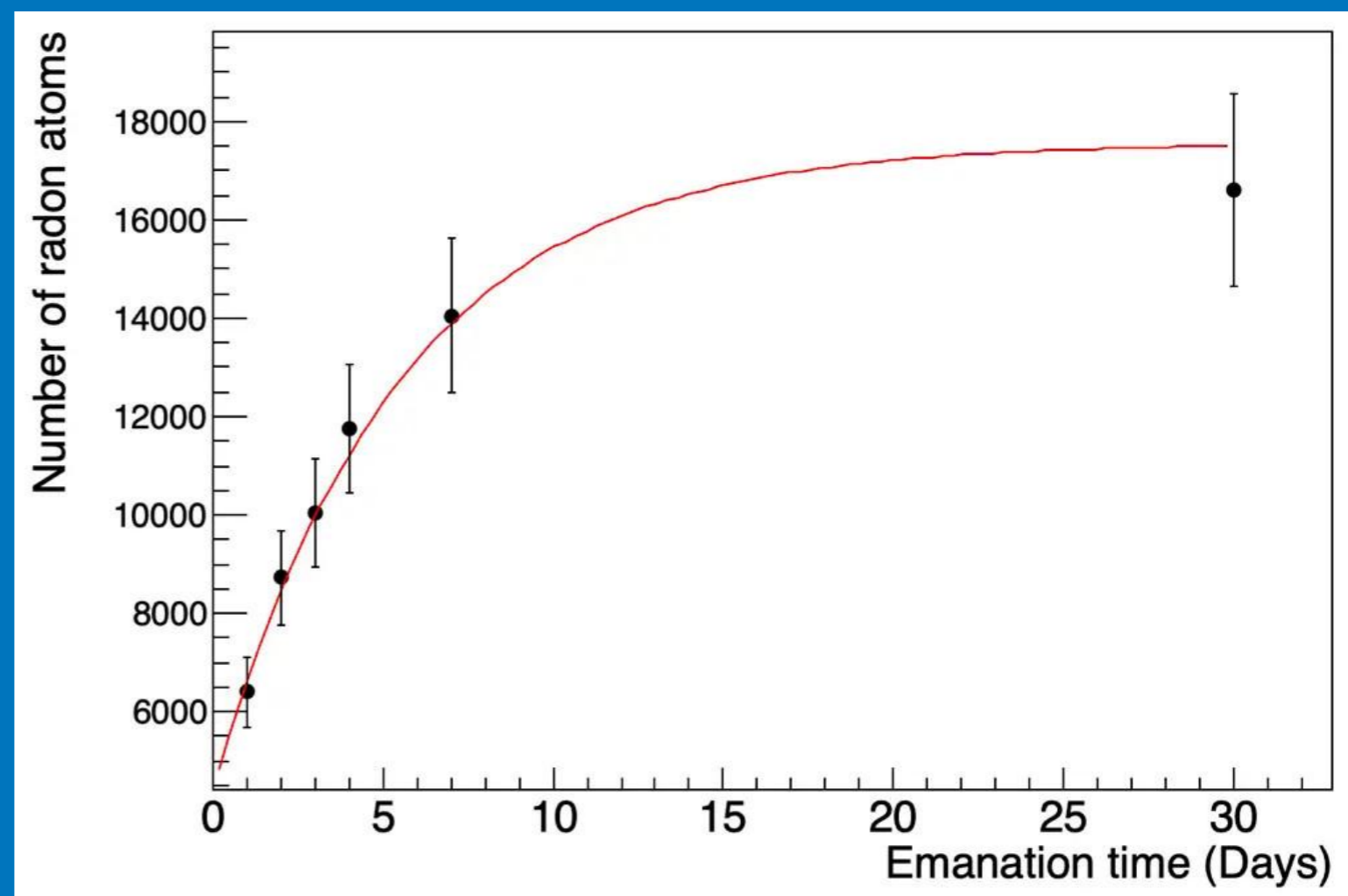
Gas Assay Calibration

Calibration Can Radon Emanation Curve

Available emanation source

Background of carrier gas understood

Emanation curve characterized



Credit to Yusuf Ahmed and Nasim Fatemighomi

Gas Assay Calibration Campaign

Background needed after modifications

Flow through calibration possible

Compare cold vs warm calibration



Next Steps

Lots of Data from
Electrostatic Radon
Monitor available

Radon Monitor
Calibration Campaign
Planned

Characterization of
consistent high activity
source ongoing



Special Thanks!

Christine Kraus

Justin Suys

Nasim Fatemighomi

Nelson Zhou

Adil Hussain

Danica Levesque

Yusuf Ahmed

Mark Ward

Juliette Deloye

Aleksandra Bialek

Preliminary Calibration Results



1st run, 3 day emanation

1625 +/- 40 cpd

59% efficiency

15 Minute Calibration Assay with Titan Trap Cold

