

BHUC: Ultra-low Background Counting Now at the Davis!

Brianna Mount

SURF General User Meeting

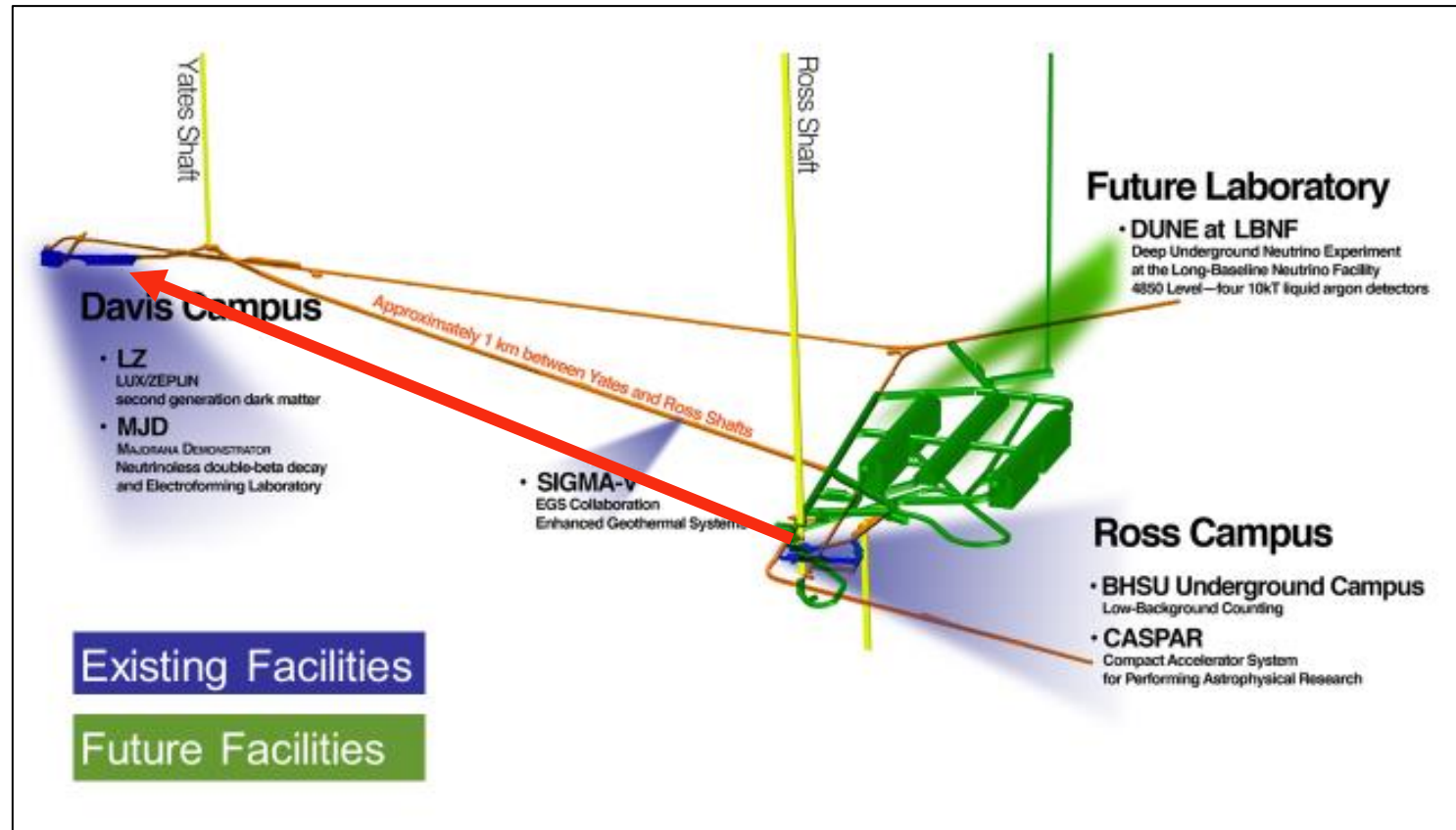
September 29, 2021



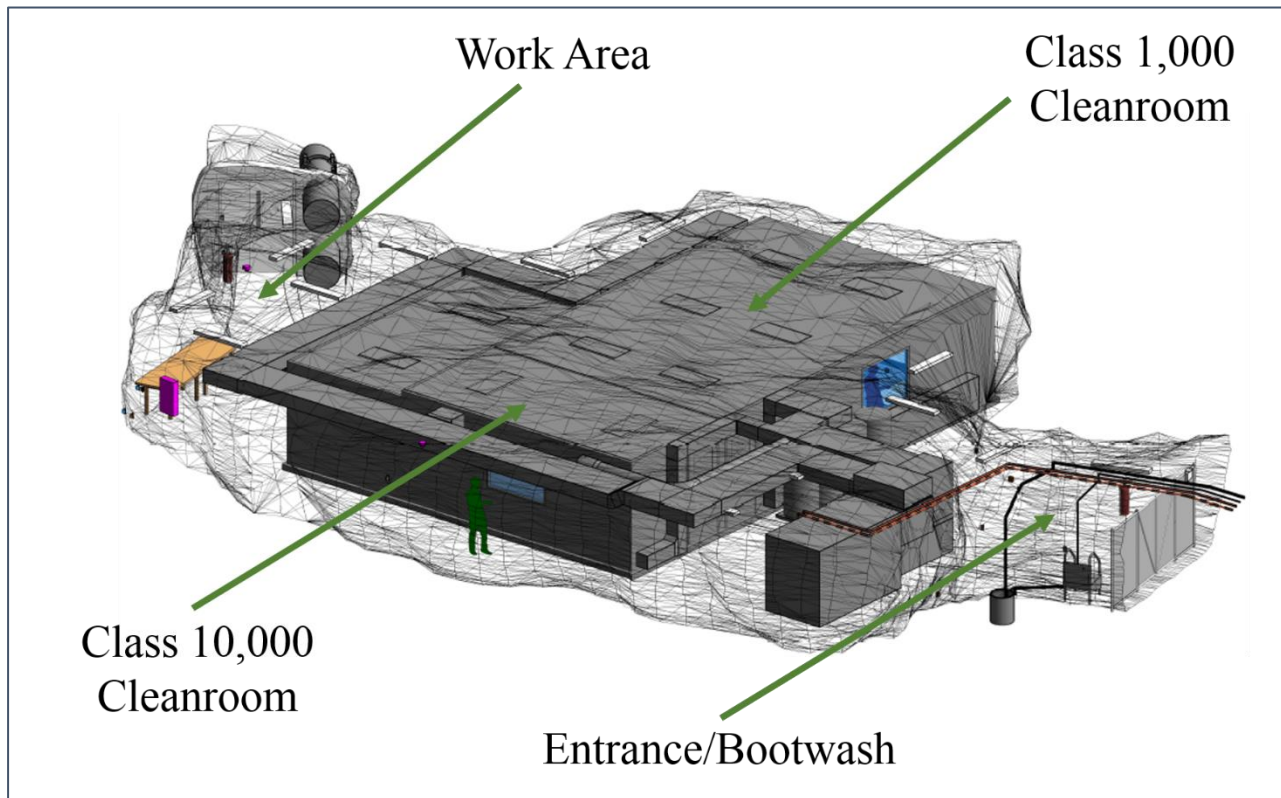
Low Background Counting

- BHSU Underground Campus (BHUC) is a user facility that currently hosts low background counting systems
- These High-purity Germanium (HPGe) detectors measure U, Th, K (and others) very sensitively
- Here, we're going to focus on the facility itself, see K. Lesko's following talk

Move from the Ross to the Davis



oldBHUC at Ross: Sleeping Beauty for ~5 yrs



Stations with Electrical and Network Connections



Automated LN₂ Distribution



oldBHUC Counting Room



oldBHUC Program

- From 2015-2020, counted ~500 samples
 - Counters were fully subscribed almost the entire lifetime
- Black Hills State University Underground Campus, B.J. Mount et al., Appl Radiat Isot., 126, 130 (2017).
- [The LUX-ZEPLIN \(LZ\) radioactivity and cleanliness control programs, June 3, 2020. Published in Eur.Phys.J. C 80 \(2020\) 1044.](#)

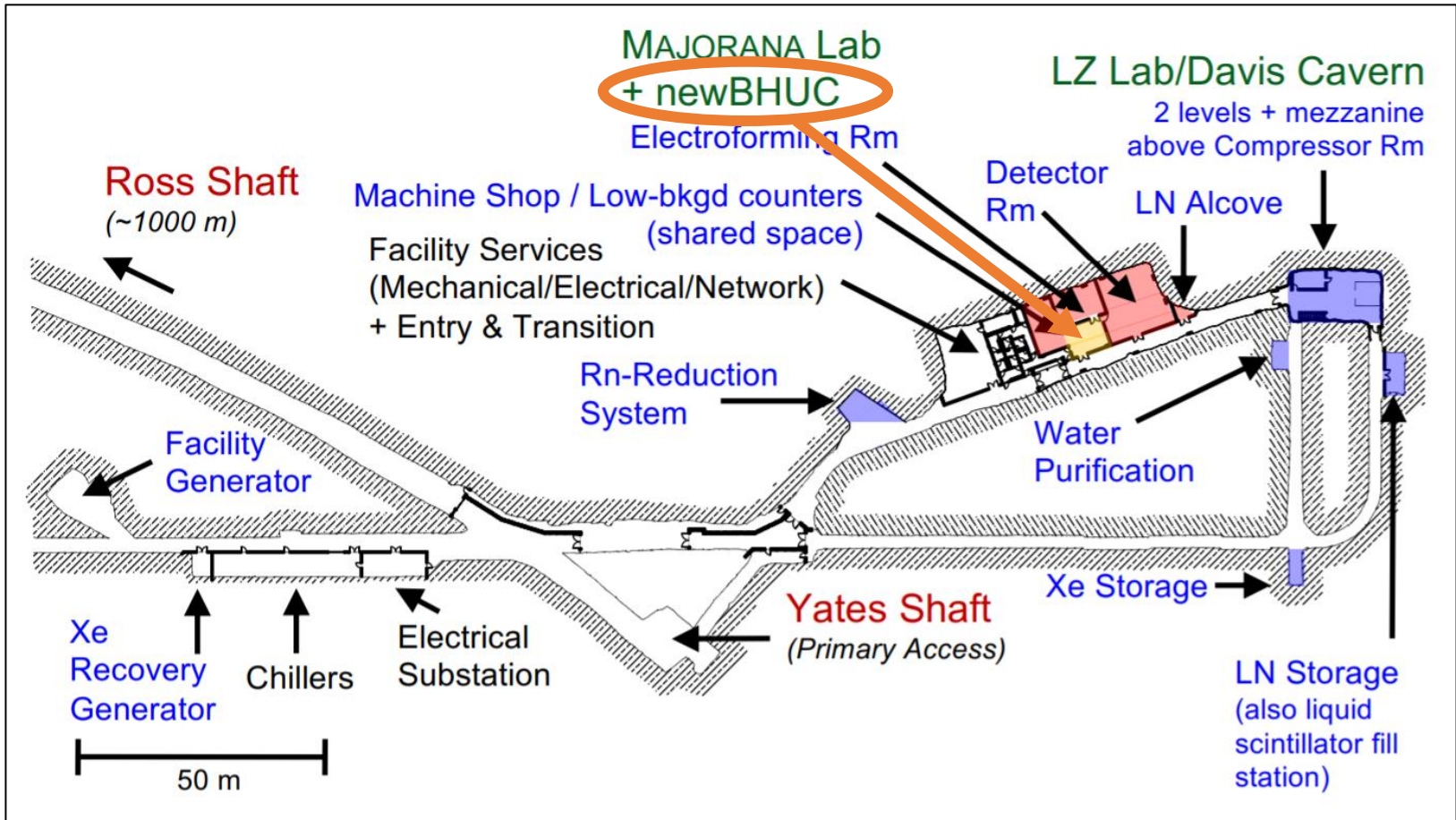
Future uses of oldBHUC

- Exciting new life in 5 years for small-scale experiments?
 - Pre-set up for “stations”
 - Electrical, network, LN2, N2 purge
 - 600 sq ft. class 1,000 space
 - 200 sq ft class 10,000 space
 - With workbench, laminar flow hood
 - Soft-walled gowning area
 - Outside work area

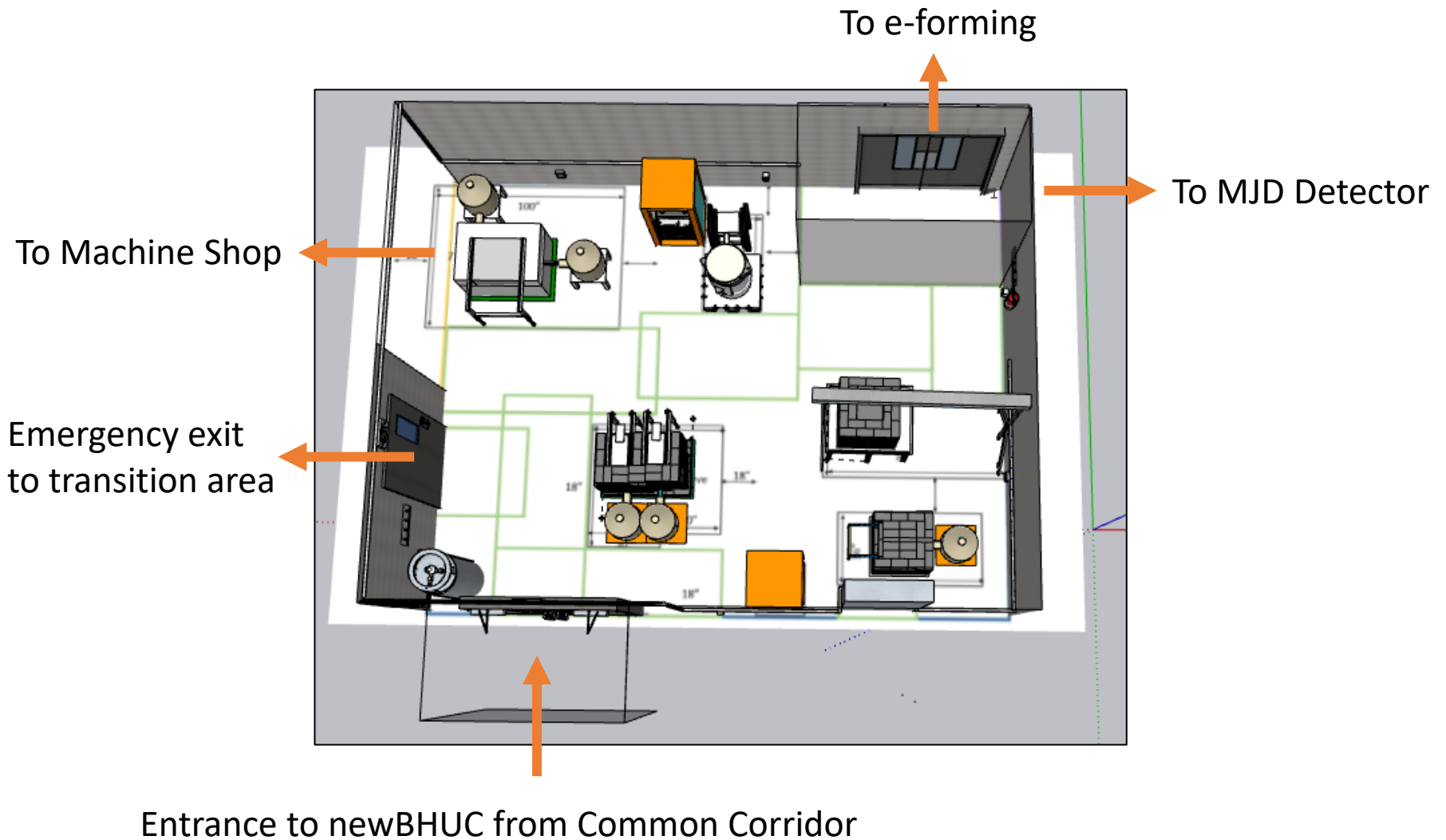
7 HPGe and 2,750 Pb bricks later...



New space at the Davis



newBHUC: Davis Campus



newBHUC: construction



Detectors and Collaborators

- Maeve, Morgan, Mordred, Twins
 - Kevin Lesko (LBNL), Doug Tiedt (SDSTA)
- RHYM/RESN
 - Keenan Thomas (LLNL)
- GeIV
 - Andreas Piepke (Univ. Alabama), Ryan MacLellan (Uky)

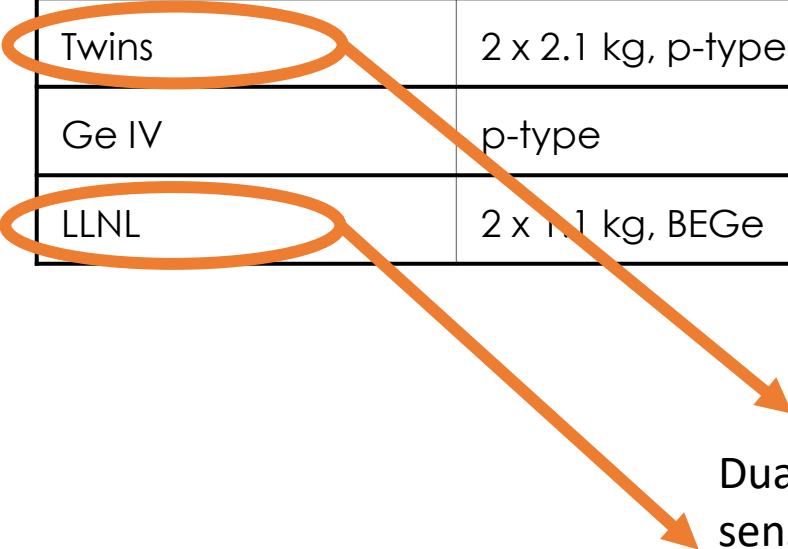
Current, planned and nearby low background capabilities

Detector	Detector Type	[U] mBq/kg	[Th] mBq/kg	Owner
Morgan	2.1 kg p-type	0.2	0.2	BLBF
Maeve	1.7 kg p-type	0.1	0.1	BLBF
Mordred	1.4 kg n-type	0.7	0.7	USD/BLBF
Twins	2 x 2.1 kg, p-type			BHSU/BLBF
Ge IV	p-type			nEXO
LLNL	2 x 1.1 kg, BEGe			LLNL

Limits listed above are average sensitivities for ~1-2 kg sample for
2 weeks sample time

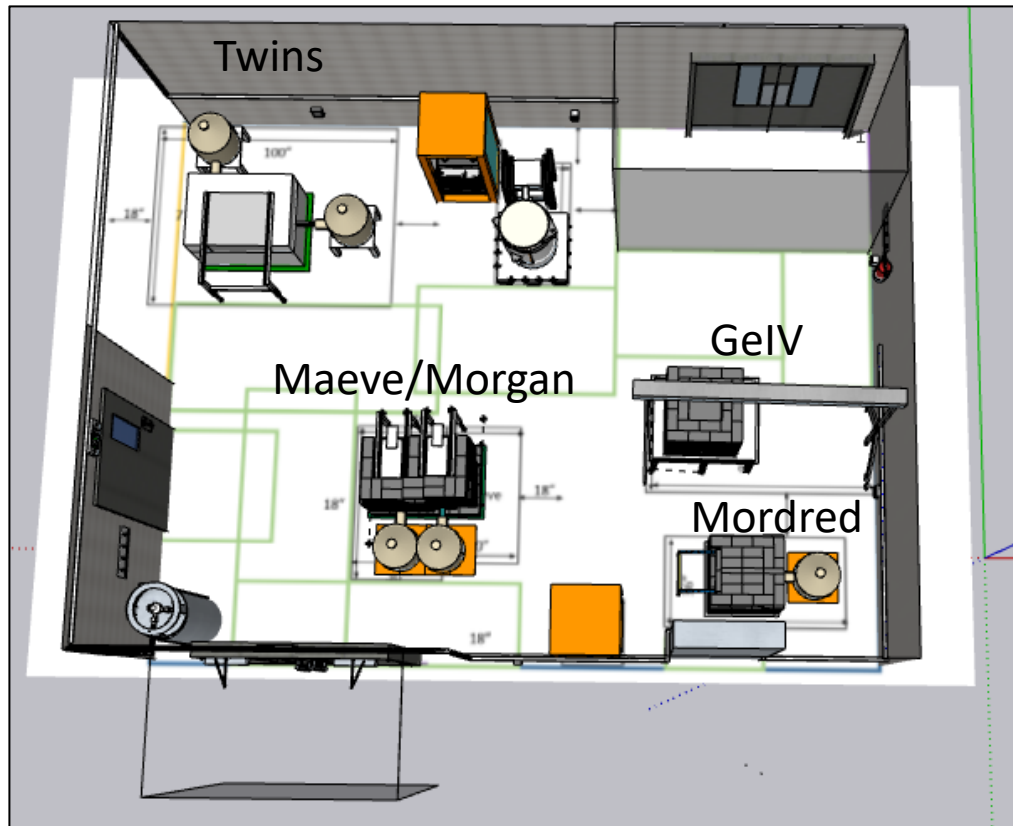
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Dual detectors will have increased sensitivity, results to follow shortly

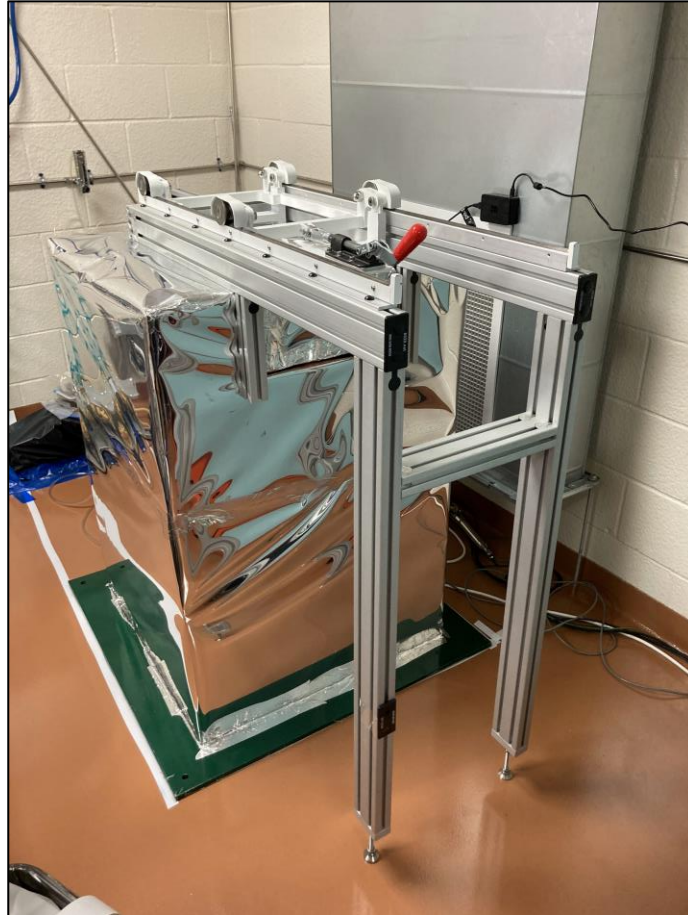
newBHUC: Davis Campus



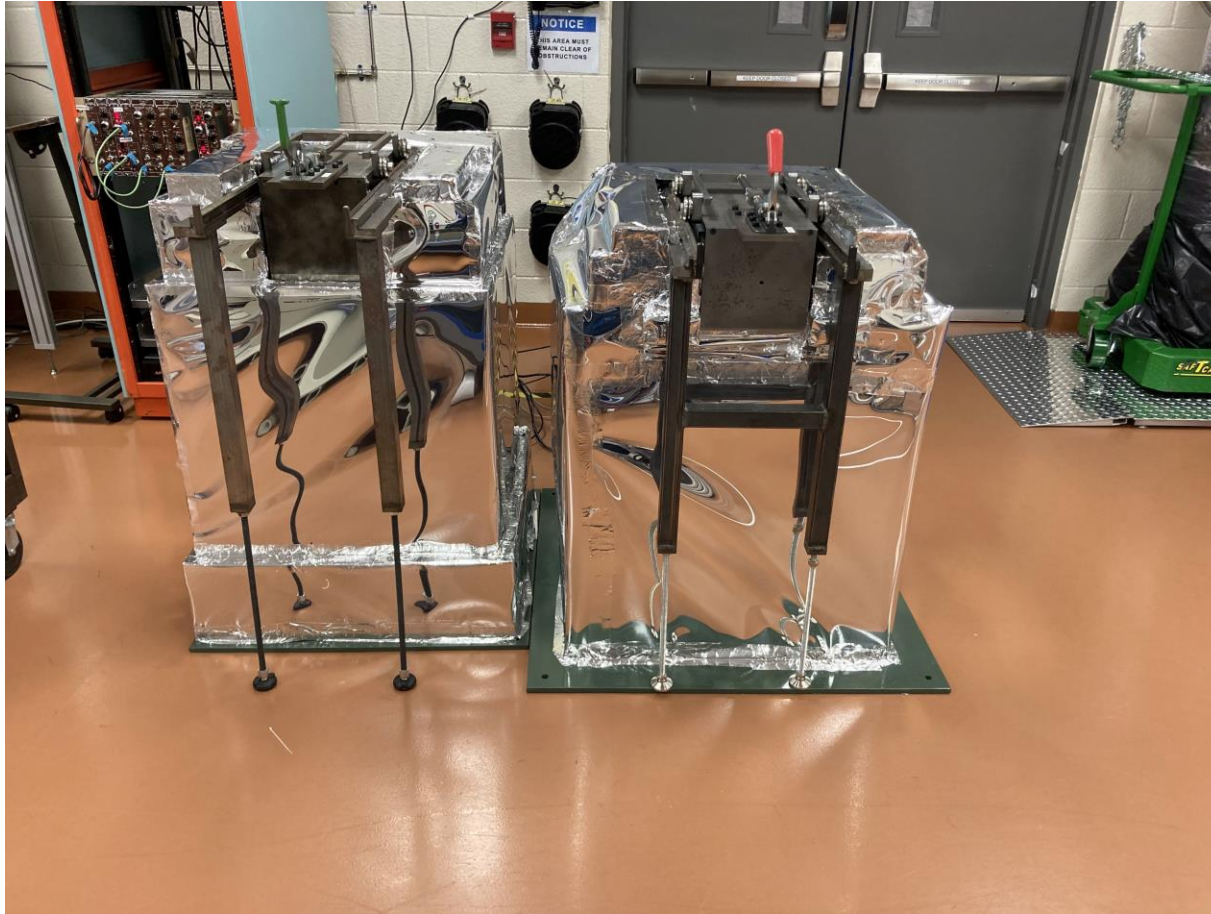
newBHUC wrap-around view



Mordred



Maeve and Morgan



Twins



RHYM and RESN

- Second crystal arriving at SURF soon
- Operational by December



In Construction: GeIV



Pictured here at the oldBHUC at Ross Campus

Counting Consortium

- All current and planned counters in the BHUC have agreed to join the counting consortium
- Each counter retains autonomy, but free time on the counter is made available
- Single point of contact for anyone needing analysis
- World-wide consortium being formed...See K. Lesko's talk next

How to get something counted at the BHUC

- Contact: Brianna Mount: brianna.mount@bhsu.edu
- Normal sampling time is two weeks
 - Throughput for BHUC expected to be 6 samples/2 weeks
- Right now, the cost is cheap
- Website request form coming soon!

Future uses for LBCs at SURF

- SNOWMASS process for supporting facilities
 - Working to capture current capabilities and future uses of LBCs
 - Richard Schnee (richard.schnee@sdsmt.edu)
 - Alvine Kamaha (akamaha@albany.edu)
 - Brianna Mount (brianna.mount@bhsu.edu)

Aside: Undergraduate Research

- Low background counting lends itself well to undergraduate student projects
- Multi-disciplinary Science REU at SURF
 - 7 students per summer
- Undergraduate students at Black Hills State University
 - 2-3 students per semester



Aside: Undergraduate Outreach

- American Physical Society Conferences for Undergraduate Women in Physics (APS CUWiP)
 - SURF/BHSU hosted in 2016 and 2020

We're back in business!

- Maeve, Morgan, Mordred currently counting
- Twins, RHYM/RESN, GeIV to follow soon!