

June 18th, 2026

RISQ 2026 G4CMP Workshop Summary

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U.S. DEPARTMENT
of **ENERGY**

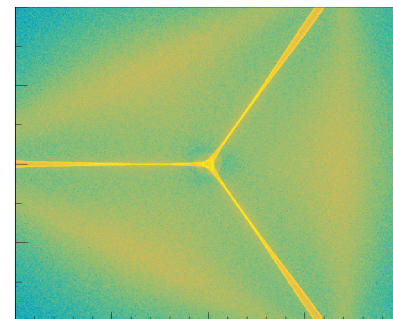
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Two Years of Progress in a Nutshell

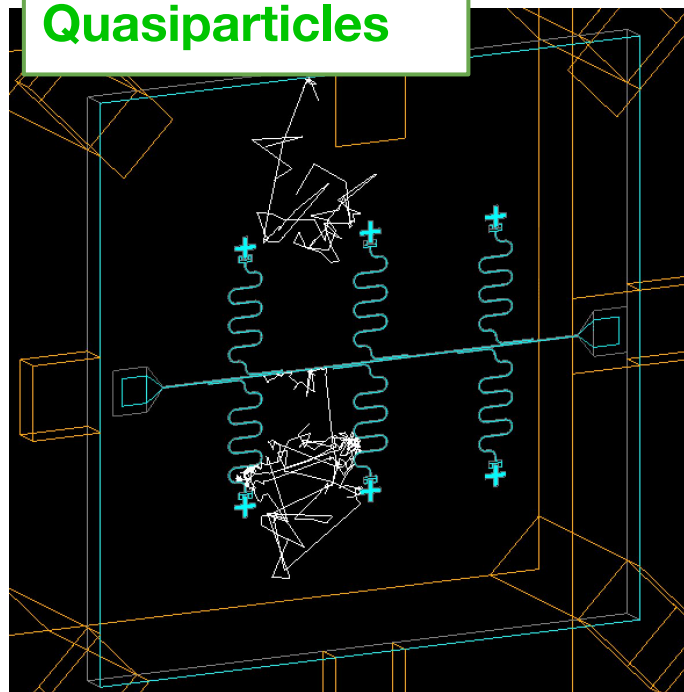
Goal of last two years: help microphysics response modeling keep pace with rapidly-advancing experimental studies, and improve accessibility of codebase.

- Refining existing physics of charges and phonons
- Adding **new materials** for modeling phonons/charges
- New, **trackable quasiparticles** and associated physics processes
- New Consortium organization to make the **codebase more user-friendly**

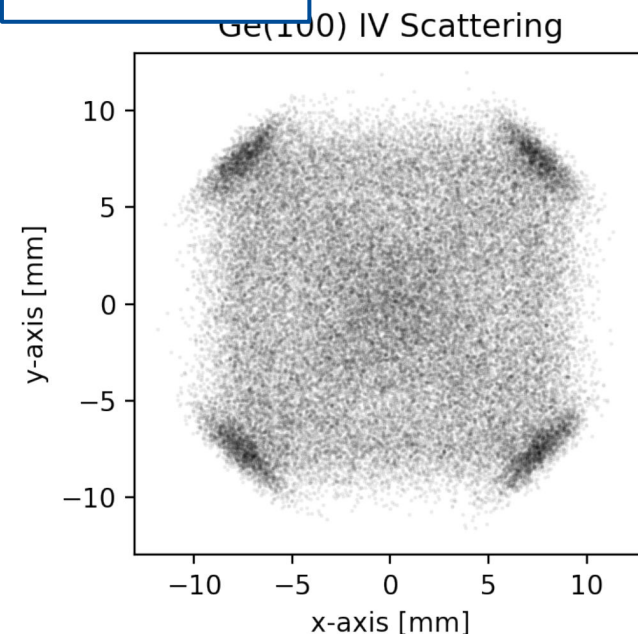
Phonons



Quasiparticles



Charges



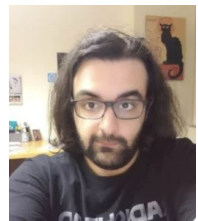
The driving force behind G4CMP development

We'll take a bit more of a detailed look at the work being driven, but I want to call out some of the people actively involved in codebase development (Most PIs not shown, but eternal gratitude still there!)

Toback Group, TAMU



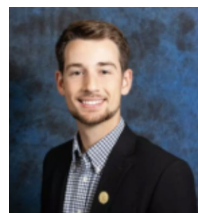
**Mike
Kelsey**



**Iman
Ataee**



**Wade
Lamberson**



**Nolan
Tenpas**

SNOLAB/ Laurentian Group



**Birgit
Zatschler**



**Stefan
Zatschler**

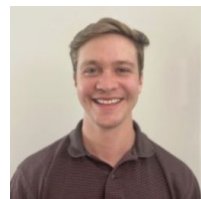


**Émile
Michaud**

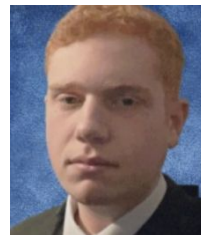


**Mingyu Li
(MIT)**

Plourde Group, UW-M



Eric Yelton



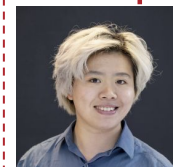
**John
Batarek**

Saab Group, UF



**David
Sadek**

SLAC DM/QIS Group



Selby Dang



**Caitlyn
Stone-
Whitehead**



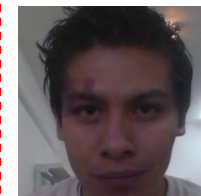
**Osmond
Wen**

Fermilab Group

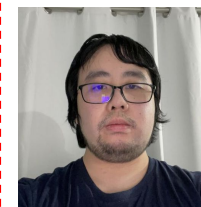


**Ryan
Linehan**

Khatiwada Group, IIT

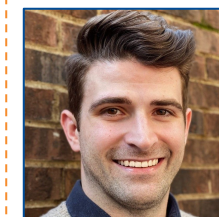


**Israel
Hernandez**



Ziyu Cai

PNNL Group

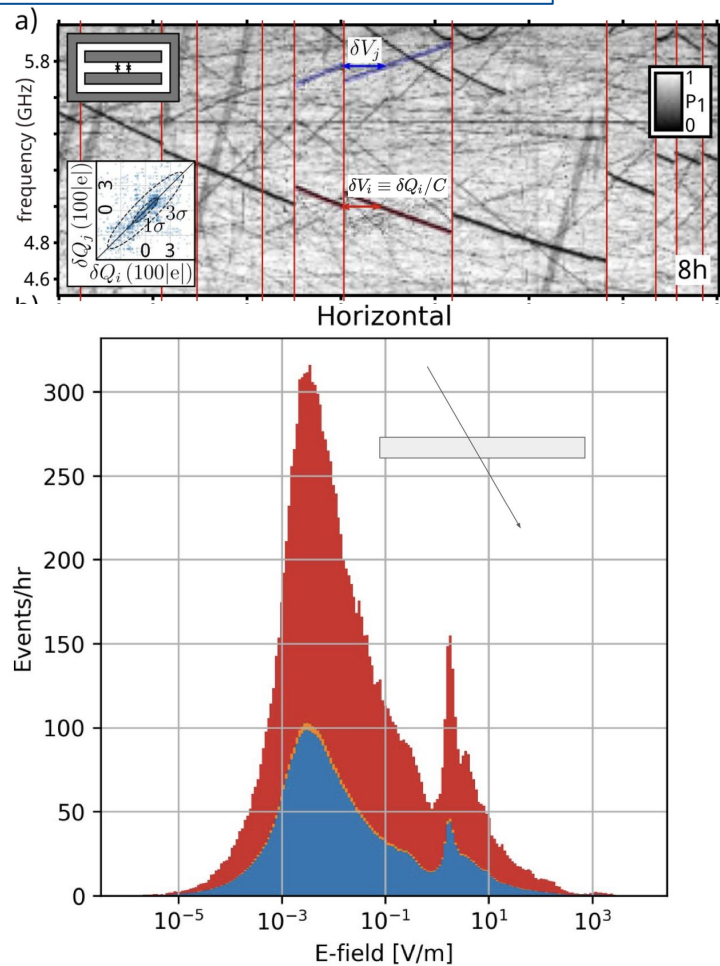


**Jake
Inman**

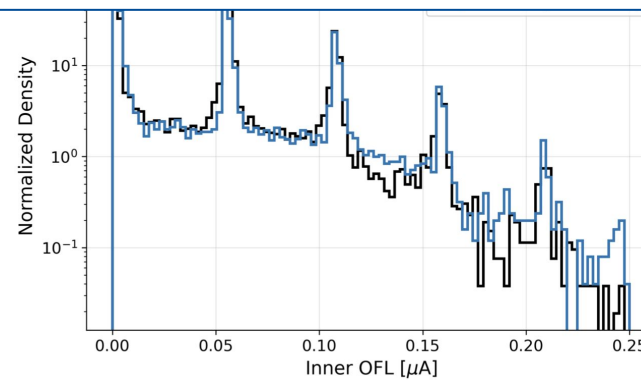
✚ This Week's Workshop: Applications

We've also seen successful of physics insights from efforts to match G4CMP to experimental data!

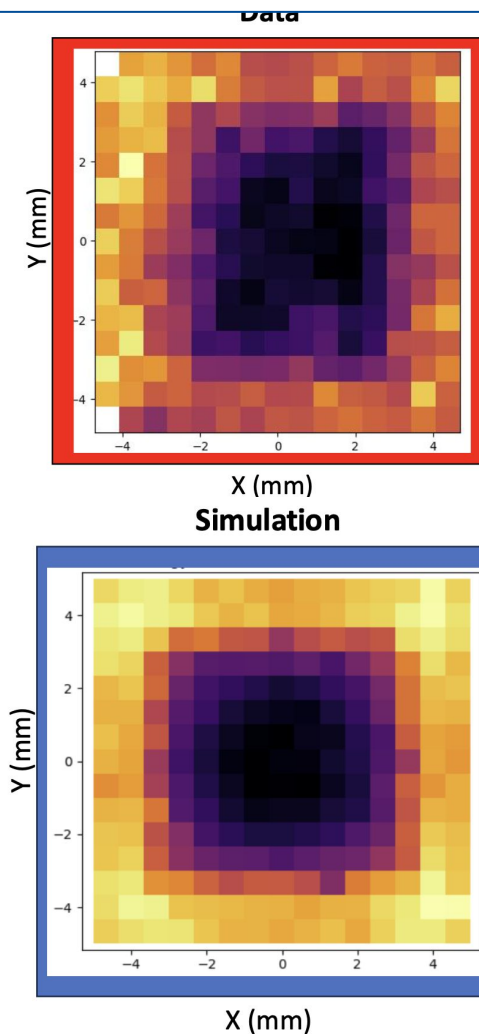
TLS Scrambling (E. Mascot)



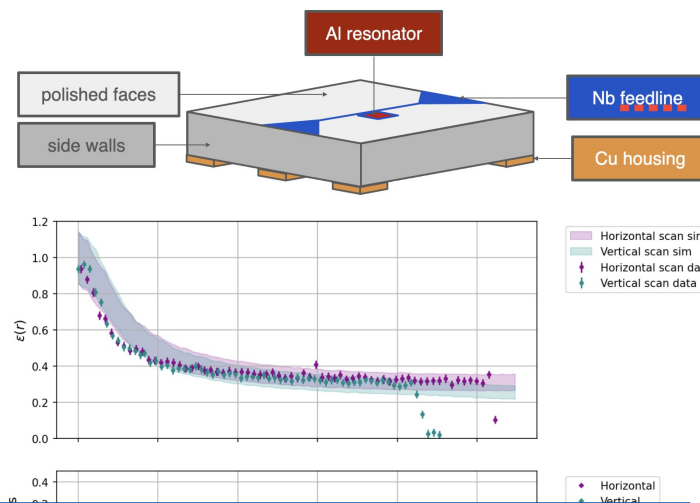
G4CMP models SCDMS Calibration (D. Sadek)



HVeV MEMS response (C. Stone-Whitehead)



Phonon Collection Efficiency on MKID (S. Q. Dang)



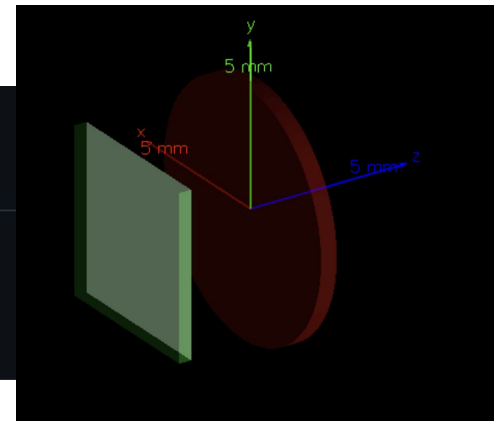
This Week's Workshop: Tutorials

There are two brand-new G4CMP tutorials and an S3DF demonstration for people who would like compute resources for G4CMP sims!

RISQ2 G4CMP Introductory Tutorial

Assembled by Jesse Lutz (jjlutz@sandia.gov)

This tutorial is meant to guide the user through their first steps with G4CMP. Our example geometry is based on the experimental setup used by Vepsäläinen et al. in their 2020 Nature paper, "[Impact of ionizing radiation on superconducting qubit coherence](#)". The original

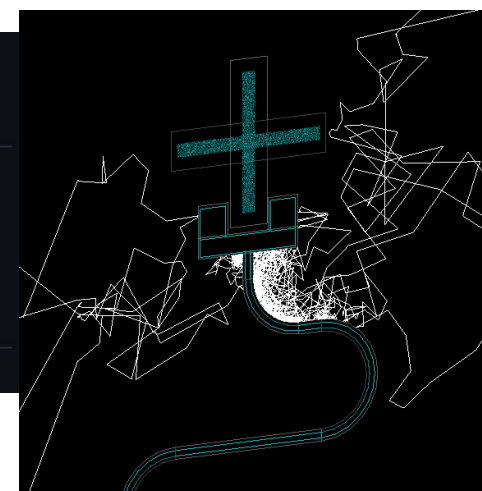


Tutorial: Quasiparticle Propagation in G4CMP

This example is a demonstration of several features and physics processes that are new to G4CMP as of November 2025. Ryan Linehan, linehan3@fnal.gov made this, so please email him with questions/compliments/complaints.

Preliminaries

To run this example, you need to install ROOT, Geant4 (Geant4 v11.4.1), and G4CMP (a version at least as large as G4CMP V10, but we



SLAC S3DF overview

*The **S3DF cluster** is a compute, storage, and network architecture designed to support SLAC's experimental facilities and programs, including LCLS, the Vera C. Rubin Observatory, SuperCDMS, and many more.*

This Week's Workshop: Discussion

Some interesting discussion points, at the workshop and throughout the week

1. **Can we do particle-particle interactions?**

- a. Quasiparticle n^2 recombination
- b. Space charge in spin/SC qubits
- c. Answer: not soon – G4 code not meant for this!

2. **G4CMP-compatible detector readout response code**

- a. Seems like there is still some demand for this, so may want to spin this back up

3. **Problem: “people hesitant to use it until validated, but people hesitant to spend time validating it”**

- a. Charge for simulation-familiar folks:
 - i. Initial “seed” validations where we can
 - ii. Concrete wishlist of parameters that experimentalists can measure to validate physics
 - iii. Work to make code accessible
- b. Charge for experimentalists:
 - i. “Jump in the pool” and just get started trying to use G4CMP
 - ii. Can you tell us: what modeling “language” is missing?

4. **Other current obstacles to adoption:**

- a. Documentation! How can we streamline new users to the kind of sim they should be doing?
- b. Rather large learning curve for G4
- c. Sociological “developer” and “other” divide

5. **Need faster experimental/modeler feedback loop than once every two years**

- a. Need to encourage more frequent dialogue, so we don't get siloed
- b. Need a bit of “give” both from people who primarily take data and from sims-familiar folks.
- c. Idea: mini-workshop in near future for MKID modeling under G4-v10

