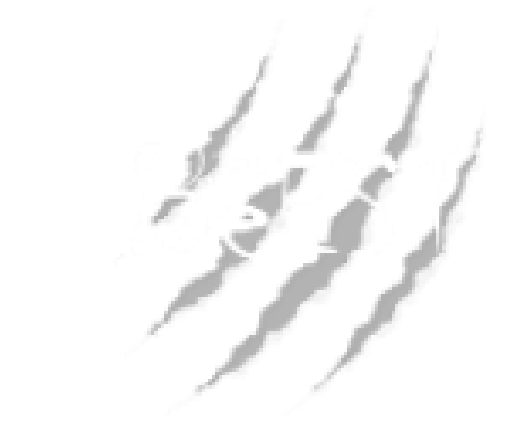


# **BeEST collaboration meeting 2025**



## **Report of Contributions**

Contribution ID: 98

Type: **Oral contributed talk**

## Superconducting Tunnel Junction Radiation Detectors

*Tuesday, 13 May 2025 09:35 (20 minutes)*

The BeEST Experiment is an international collaboration between experts in many different fields of science. Few of them are low-temperature solid-state physicists. But we all work on some aspect of nuclear decays in superconducting tunnel junctions at temperatures around  $\sim 0.1$  K. This talk will give a very basic overview of superconductivity and tunnel junctions that I think every collaborator should know. I will also discuss the current performance and future directions in STJ development in the context of the BeEST experiment and beyond. I will also draft a summary of what I consider the essential things to know about STJs as an introductory text for future students and collaborators. I would like to get some feedback on that draft, and there will be test at the end of the meeting ;-)

**Primary author:** FRIEDRICH, Stephan (Lawrence Livermore National Laboratory)

**Presenter:** FRIEDRICH, Stephan (Lawrence Livermore National Laboratory)

**Session Classification:** BeEST Concept & Status

Contribution ID: **99**

Type: **Oral invited talk**

## The BeEST Experiment

*Tuesday, 13 May 2025 09:15 (20 minutes)*

I will discuss a brief history of the experiment, the progress we have made, and our achievements over the past 2 years.

**Primary author:** LEACH, Kyle (Colorado School of Mines)

**Presenter:** LEACH, Kyle (Colorado School of Mines)

**Session Classification:** BeEST Concept & Status

Contribution ID: **100**Type: **Oral invited talk**

## Phase-III analysis details and current status

*Tuesday, 13 May 2025 11:05 (25 minutes)*

We discuss the analysis procedure of the BeEST Phase III and its current status. The discussion will include the application of likelihood profiling for the multiple spectra and various systematic uncertainties that may affect the final limits for the heavy neutrino search.

**Primary author:** KIM, Inwook (Lawrence Livermore National Laboratory)

**Presenter:** KIM, Inwook (Lawrence Livermore National Laboratory)

**Session Classification:** Theory & Analysis

Contribution ID: **101**Type: **Oral invited talk**

## STJs in Colorado - Fridges at CURIE and Mines

*Wednesday, 14 May 2025 12:15 (20 minutes)*

Together with Maybell Quantum, we are designing a low-vibration dilution refrigerator with a large and modular sample area. This fridge will be installed on the Mines campus and is a first step towards the Colorado Underground Research Institute (CURIE). At CURIE, the muon flux is 500x suppressed, and we will have low – and in-situ characterized – vibration, EMI disturbances, and high temperature stability. We aim to deploy STJs on campus during Fall 2025 and underground by 2027. This presentation will discuss current fridge designs, magnetic shielding, and plans for the upcoming years.

**Primary author:** VAN DE PONTSEELE, Wouter (Colorado School of Mines)

**Presenter:** VAN DE PONTSEELE, Wouter (Colorado School of Mines)

**Session Classification:** BeEST setups at collaborating facilities

Contribution ID: **102**Type: **Oral invited talk**

## **A laser-abaltion ion source for off-line radioisotope loading**

*Wednesday, 14 May 2025 14:10 (20 minutes)*

A challenge in preparing radioactive samples is the dependence on beam time at radioactive isotope facilities. One can imagine implanting large amounts of long-lived isotopes into a target at an isotope facility. The target is then brought to an offline laboratory where specific quantifies of the isotope are extracted from the target via laser ablation. The ablated ions can then be mass-selected to suppress ions from the target material and loaded into sensors.

We developed a spatially-selective laser ablation ion source to calibrate our mass spectrometry setup. The laser beam spot is positioned via movable mirrors on a target's surface. This allows the ablation of material only in specific, selectable regions. We proposed to investigate how efficient our setup can be to ablated and extracted implanted ions from the ion source for subsequent use in sensors.

**Primary author:** BRUNNER, Thomas (McGill/TRIUMF)

**Presenter:** BRUNNER, Thomas (McGill/TRIUMF)

**Session Classification:** Simulations/Systematics/New Avenues

Contribution ID: **103**Type: **Oral invited talk**

## **Adaptable implantation holder design for future work**

*Wednesday, 14 May 2025 15:30 (20 minutes)*

We will discuss the design of a more adaptable device holder for future implantations in the TRIUMF-ISAC facility. This holder will be able to accommodate much larger devices, such as the SLAC Transition Edge Sensors, as well as more objects at the same time so that fewer vacuum breaks are necessary. We are currently building a swap in replacement of the chamber that should be available by June.

**Primary author:** MONG, Brian (SLAC)**Presenter:** MONG, Brian (SLAC)**Session Classification:** Simulations/Systematics/New Avenues

Contribution ID: **104**

Type: **Oral invited talk**

## Beyond the BeEST: SALER

*Thursday, 15 May 2025 13:30 (20 minutes)*

The SALER experiment aims to expand the precision nuclear recoil measurements in STJs pioneered by the BeEST to much shorter-lived isotopes on-line at FRIB. In this talk we present on the initial commissioning of SALER with a 262 nm UV laser as well as development towards coupling STJs in an ADR cryostat to the FRIB beamline.

**Primary author:** MARINO, Andrew (Colorado School of Mines)

**Presenter:** MARINO, Andrew (Colorado School of Mines)

**Session Classification:** Beyond the BeEST



Contribution ID: **105**

Type: **not specified**

# Welcome

*Tuesday, 13 May 2025 09:00 (5 minutes)*

**Session Classification:** Welcome session

Contribution ID: **106**

Type: **not specified**

## Welcome & Logistics

*Tuesday, 13 May 2025 09:05 (5 minutes)*

**Presenter:** LENNARZ, Annika (TRIUMF)

**Session Classification:** Welcome session

Contribution ID: **107**

Type: **not specified**

## Introduction of new members

*Tuesday, 13 May 2025 09:10 (5 minutes)*

**Presenter:** LEACH, Kyle (Colorado School of Mines)

**Session Classification:** Welcome session

Contribution ID: **108**

Type: **Oral invited talk**

## **Rare isotope beam implantations at TRIUMF**

*Tuesday, 13 May 2025 09:55 (20 minutes)*

I'll present the experimental concept and status for  $^7\text{Be}$  and  $^{37}\text{Ar}$  beam implantations and prospects at TRIUMF.

**Primary author:** LENNARZ, Annika (TRIUMF)

**Presenter:** LENNARZ, Annika (TRIUMF)

**Session Classification:** BeEST Concept & Status

Contribution ID: **109**Type: **Oral invited talk**

## Gamma-Tagging and Future Prospects

*Wednesday, 14 May 2025 14:50 (20 minutes)*

Gamma-coincidence tagging has proven to be a valuable tool for performing high-selectivity measurements of specific excited state nuclear recoils for the BeEST experiment. In this talk I present experimental concepts for further utilizing coincidence tagging in the BeEST and SALER experimental programs.

**Primary author:** BRAY, Connor (Colorado School of Mines)**Presenter:** BRAY, Connor (Colorado School of Mines)**Session Classification:** Simulations/Systematics/New Avenues

Contribution ID: **110**

Type: **Oral invited talk**

## **Physics with the BeEST beyond sterile neutrinos**

*Wednesday, 14 May 2025 17:20 (20 minutes)*

I will describe some ideas for analyzing the  ${}^7\text{Be}$  recoil energy spectrum to search for physics other than sterile neutrinos with this data.

**Primary author:** MOORE, David (Yale)

**Presenter:** MOORE, David (Yale)

**Session Classification:** New Physics Searches with BeEST

Contribution ID: 111

Type: **Oral invited talk**

## Beyond the BeEST: Optomechanical Sensing

*Thursday, 15 May 2025 14:10 (20 minutes)*

I will describe ideas to use optically trapped nanoparticles to search for sterile neutrinos or other new physics by directly measuring the momentum of nuclear recoils from the decay of radioisotopes within the particles. These techniques can provide complementarity to the energy resolving measurements performed by the BeEST, and can allow a number of isotopes to be studied.

**Primary author:** MOORE, David (Yale)**Presenter:** MOORE, David (Yale)**Session Classification:** Beyond the BeEST

Contribution ID: **119**

Type: **not specified**

## **Systematics (placeholder Brian L)**

**Session Classification:** Simulations/Systematics/New Avenues



Contribution ID: 121

Type: **Oral contributed talk**

## Experimental Evaluation of Possible Material Effects

*Wednesday, 14 May 2025 09:25 (20 minutes)*

Recent BeEST experimental results displayed that the breadth of the measured peaks associated with electron capture (EC) decay were wider than the inherent resolution of the superconducting tunnel junction detector (STJ). One possible source of the measured peak resolution being appreciably worse than the resolution inherent in the STJ detector is from local imperfections in the materials that comprise the STJ. These could include clustering of the implanted species, crystal defects introduced during ion implantation, grain boundaries, or the presence of other impurities. In this work six different samples were explored by atom probe tomography (APT): three implanted aluminum thin film samples and three implanted tantalum thin film samples. While clustering and grain boundary segregation were observed at higher doses, in the STJ devices these were not at concentrations that would affect the performance. The lack of detected Li clustering in the STJs and minimal amorphization at all doses suggest that the effect of the material environment on the spectral broadening from Li core-hole relaxation in these devices is minimal. The measured clustering data as a function of dose provides guidelines for implantation limits. These characterization techniques are broadly applicable beyond the BeEST experiment to other detector materials and implanted ions.

**Primary authors:** Dr HARRIS, Cameron (Colorado School of Mines); DIERCKS, David (Colorado School of Mines)

**Co-authors:** Dr SAMANTA, Amit (Lawrence Livermore National Laboratory); LEACH, Kyle (Colorado School of Mines); CANTOR, Robin (STAR Cryoelectronics LLC); FRIEDRICH, Stephan (Lawrence Livermore National Laboratory); Dr LORDI, Vincenzo (Lawrence Livermore National Laboratory)

**Presenter:** DIERCKS, David (Colorado School of Mines)

**Session Classification:** Material Effects

Contribution ID: 122

Type: **Oral invited talk**

## GEANT4 Condensed Matter Physics (G4CMP)

*Wednesday, 14 May 2025 10:05 (20 minutes)*

G4CMP has been developed as an extension to GEANT4 to excite phonons and charges in cryogenic semiconductor crystals in response to energy deposited by radiation. G4CMP is currently being developed towards superconducting processes in the developer's consortium, allowing for modelling the implanted BeEST signal. This talk will demonstrate the applications and value of G4CMP for simulating the BeEST experiment.

**Primary author:** STONE-WHITEHEAD, Caitlyn (Colorado School of Mines)

**Presenter:** STONE-WHITEHEAD, Caitlyn (Colorado School of Mines)

**Session Classification:** Material Effects

Contribution ID: 123

Type: **Oral invited talk**

## 7Be Decay in Al STJs

*Wednesday, 14 May 2025 15:10 (20 minutes)*

The nuclear broadening of the BeEST spectrum as a result of materials effects is poorly constrained. While a precise model of the recoil of dopant radioisotopes in a superconductor such as tantalum and the resulting quasiparticle dynamics in an STJ are challenging, measuring this effect in analogous aluminum-based STJs provides an experimental comparison of this effect. This talk will discuss the ongoing effort to analyze data collected from aluminum STJs which may offer insight into the differences within the spectral response of recoiling 7Be in tantalum and aluminum STJs.

**Primary author:** FRETWELL, Spencer (Colorado School of Mines)

**Presenter:** FRETWELL, Spencer (Colorado School of Mines)

**Session Classification:** Simulations/Systematics/New Avenues

Contribution ID: 124

Type: Oral invited talk

## $\beta$ NMR Spectroscopy of Ta films for the BeEST Sterile Neutrino Search

*Wednesday, 14 May 2025 09:45 (20 minutes)*

One puzzling observation in the  $^7\text{Li}$  recoil spectra of the BeEST data is the fact that the peaks widths were significantly larger than the  $\sim 2\text{eV}$  width of the laser peaks set by the energy resolution of the STJ's. This isn't currently understood, thus is a limitation to the progression of the BeEST experimentation through the sensitivity, which is crucial for the observation of small SN masses which are especially interesting for WDM candidates. A possible investigation to provide clarity in where this broadening could have come from, involves looking deeper into the material properties of STJ's themselves, especially in the low temperature range. While Ta has been used for a long time in the fabrication of STJ's, its material behaviours in this environment remain unresearched. With this in consideration,  $\beta$ NMR was utilised to analyse the material effects of a sputtered thin foil of Ta. This experiment consisted of the film being implanted with a  $^8\text{Li}$  probe, used for its similar properties to the recoil daughter nucleus from the BeEST experiment. This technique allows the ability to infer the probes landing site in the Ta lattice after implantation at 25keV. The preliminary results showed a single resonance curve at all temperatures, with no observable quadrupolar splitting, unlike what is seen in similar materials. This indicates that the probe must land in a highly symmetrical location in the lattice indicating only a few options. An interesting observable in the data which also emerged was the change in features from analysis like the 'Knight' shift at low temperatures. The reasoning behind this is theorised but is currently under further investigation. In my presentation, I will present the experimental method and discuss preliminary results of the ongoing data analysis.

**Primary authors:** MCKENZIE, Iain (TRIUMF); WILLETT, Maisy (TRIUMF)

**Presenter:** MCKENZIE, Iain (TRIUMF)

**Session Classification:** Material Effects

Contribution ID: 125

Type: **Oral contributed talk**

## An Experimental Design for Testing STJs in Dilution Refrigerators for BeEST

*Wednesday, 14 May 2025 12:35 (20 minutes)*

Dilution refrigerators, in contrast to the single-shot adiabatic demagnetization refrigerators previously utilized in the BeEST experiment, provide continuous cooling power, resulting in a nearly indefinite experimental runtime and a colder, more thermally stable base temperature—properties beneficial for STJ operation. Here, I discuss a bespoke experimental design for testing STJs in dilution refrigerators at both PNNL and Mines, and outline the steps taken toward validating this design and its associated components, including detailed calculations of the thermal load at each cooling stage and the derivation of a generalized equation for thick Helmholtz-like configurations.

**Primary author:** TEMPLET, Joseph (Colorado School of Mines)**Presenter:** TEMPLET, Joseph (Colorado School of Mines)**Session Classification:** BeEST setups at collaborating facilities

Contribution ID: 126

Type: **Oral invited talk**

## BeEST@PNNL: Current Status and Plans

*Wednesday, 14 May 2025 11:35 (20 minutes)*

Phase IV of the BeEST experiment requires continuous stable operation of the STJ sensor arrays for 100+ days. This requires transitioning into a dilution refrigerator which will bring new systematics and additional opportunities to deploy recent capabilities demonstrated at LLNL. In this presentation, we will cover the status of STJ sensor operations at PNNL and outline potential areas of improvement.

**Primary author:** PONCE, Francisco (Pacific Northwest National Laboratory)

**Presenter:** PONCE, Francisco (Pacific Northwest National Laboratory)

**Session Classification:** BeEST setups at collaborating facilities

Contribution ID: **127**

Type: **Oral contributed talk**

## **Feasibility studies for low-mass dark matter searches**

*Thursday, 15 May 2025 14:30 (20 minutes)*

In this talk, we will review why low-mass (KeV-MeV) dark matter is an interesting field of study and how cryogenic superconducting techniques could assist in the search for this elusive component of the universe.

**Primary author:** GIAMPA, Pietro (TRIUMF)

**Presenter:** GIAMPA, Pietro (TRIUMF)

**Session Classification:** Beyond the BeEST

Contribution ID: 128

Type: Oral invited talk

## Current and future plans for LLNL

*Wednesday, 14 May 2025 11:15 (20 minutes)*

At LLNL, we can currently operate up to 32 STJs in two “wet” adiabatic demagnetization refrigerators (ADRs) with liquid N<sub>2</sub> and He pre-cooling and a base temperature of ~0.1 K. One of them holds the STJs at the end of a cold finger so that it can be surrounded by large scintillators for coincidence measurements. We also own a “dry” ADR with pulse-tube pre-cooling and a wet dilution refrigerator with a base temperature of ~10 mK, but they are not (yet?) set up for STJ operation. Our current plans are to focus on 1) testing new detector designs, 2) measuring decays of isotopes other than Be-7, and 3) performing gamma coincidence measurements, with the scaling to 128 pixels to be done at PNNL. But there are other options. I will discuss the facilities at LLNL and options for future technology development and scientific experiments.

**Primary author:** FRIEDRICH, Stephan (Lawrence Livermore National Laboratory)

**Presenter:** FRIEDRICH, Stephan (Lawrence Livermore National Laboratory)

**Session Classification:** BeEST setups at collaborating facilities



Contribution ID: 130

Type: Oral invited talk

## Atomistic Materials Science Effects for the BeEST

*Wednesday, 14 May 2025 09:05 (20 minutes)*

I will summarize various atomistic computational efforts to understand materials science effects on the sensitivity of BeEST experiments. Quantum mechanical simulations based on density functional theory (DFT) were applied to understand possible uncertainties (broadening) of capture peak energies due to defects (impurities, clustering, interstitial vs substitutional doping, crystal damage, grain boundaries) in the host matrix (Ta vs Al) were evaluated. Molecular dynamics simulations based on an empirical potential, as well as a custom-crafted machine-learned interatomic potential trained to closely reproduce DFT, were applied to understand clustering of Li in Ta. Comparisons to experimental characterization with atom probe tomography and electron microscopy will be presented. The molecular dynamics simulations were also applied to help understand Doppler broadening of nuclear recoil spectroscopy performed during coincidence measurements with BeEST STJ array; the MD was used to model details of the nuclear stopping, as well as assess validity of analytical stopping power (ion slowing) models, used in the analysis.

**Primary author:** LORDI, Vincenzo (Lawrence Livermore National Laboratory)

**Co-author:** SAMANTA, Amit (Lawrence Livermore National Laboratory)

**Presenter:** LORDI, Vincenzo (Lawrence Livermore National Laboratory)

**Session Classification:** Material Effects

Contribution ID: 131

Type: **Oral invited talk**

## **BSM Physics Targets Beyond Heavy Neutral Leptons at BeEST**

*Wednesday, 14 May 2025 16:20 (20 minutes)*

New physics coupled to neutrinos are well-motivated extensions of the SM, and could play a role in neutrino mass generation or mediating interactions between the SM and dark sectors. In this talk, we will explore the phenomenology of light neutrinophilic particles, and their signatures in electron capture experiments like BeEST.

**Primary author:** TUCKLER, Douglas (TRIUMF and Simon Fraser University)

**Presenter:** TUCKLER, Douglas (TRIUMF and Simon Fraser University)

**Session Classification:** New Physics Searches with BeEST

Contribution ID: 132

Type: **Oral invited talk**

## Neutrino Mass Generation and BSM Neutrino Physics

*Tuesday, 13 May 2025 10:45 (20 minutes)*

Neutrinos masses are clear evidence of physics beyond-the-SM. In this talk, we will review mechanisms of neutrino mass generation, focusing on the seesaw mechanism. This mechanism predicts the existence of heavy neutral leptons (or right-handed neutrinos) with rich phenomenology that can be probed with current and future experiments.

**Primary author:** TUCKLER, Douglas (TRIUMF and Simon Fraser University)

**Presenter:** TUCKLER, Douglas (TRIUMF and Simon Fraser University)

**Session Classification:** Theory & Analysis

Contribution ID: 134

Type: **Oral contributed talk**

## Using BeEST data for limits on neutrino wavepacket sizes and other ideas

*Wednesday, 14 May 2025 17:00 (20 minutes)*

The precision of the BeEST measurement can be used to study wavepacket sizes in 7-Be electron capture decays. Predictions for wavepacket sizes vary widely based on the scale of localizing interactions and are largely unconstrained by data. By using Heisenberg's uncertainty principle and conservation laws, the BeEST measurement places the first experimental limit on the size of decay products in electron capture decays and the first direct measurement of wavepacket sizes in a radioactive decay neutrino source. It may be possible to improve on this novel technique to determine the scale of localizing interactions in weak nuclear decays. BeEST data may also be used for other interesting secondary analyses such as half-life measurements.

**Primary author:** SMOLSKY, Joseph (STAR Cryoelectronics)**Presenter:** SMOLSKY, Joseph (STAR Cryoelectronics)**Session Classification:** New Physics Searches with BeEST

Contribution ID: 135

Type: **Oral invited talk**

## **ASGARD: Precision spectroscopy of short-lived isotopes**

*Thursday, 15 May 2025 13:50 (20 minutes)*

We will introduce the proposed ASGARD experiment, which utilises a combination of novel technological steps to perform high precision spectroscopy on short-lived isotopes. The latter is used for TeV-scale searches for new physics and can open up new directions in nuclear physics studies.

**Primary author:** HAYEN, Leendert (LPC Caen)**Presenter:** HAYEN, Leendert (LPC Caen)**Session Classification:** Beyond the BeEST

Contribution ID: **136**

Type: **Oral invited talk**

## Three-body decays in the BeEST

*Wednesday, 14 May 2025 16:40 (20 minutes)*

We will provide a status update of three-body decay searches in the BeEST data set, focusing on the anticipated sensitivity in the current data set.

**Primary author:** HAYEN, Leendert (LPC Caen)

**Presenter:** HAYEN, Leendert (LPC Caen)

**Session Classification:** New Physics Searches with BeEST

Contribution ID: 137

Type: **Oral invited talk**

## Enhancing Thermal Stability in Dilution Refrigeration at TRIUMF

*Wednesday, 14 May 2025 11:55 (20 minutes)*

This contribution will discuss the operation of the VeriCold Dilution Refrigerator (DR) at TRIUMF, a crucial cryogenic instrument for experiments that need ultra-low temperatures and long-term operational duration. A significant challenge was achieving and maintaining stable millikelvin temperatures, essential for effectively operating our Superconducting Tunnel Junction (STJ) detectors for BeEST Experimentation.

A primary focus of this work was optimizing the cooldown procedure and system to improve thermal stability. Several enhancements played a vital role in increasing the refrigerator's performance. Key actions included thoroughly cleaning the DR system, removing potential heat bridges, examining the thermal effects from varying turbo pump speeds from the mixing chamber, and resolving a helium leak issue. Additionally, we meticulously refined the timing of each transition stage in the cooling process. After conducting multiple cooldowns and revising our procedures, we successfully lowered the previous minimum achievable temperature of approximately 40 mK to a more stable range of 19-20 mK at the MC plate.

The methodologies we developed and refined not only enhanced the DR's operational efficiency but will now serve as useful references for future troubleshooting, scheduling, and upgrades for time-dependent experiments involving millikelvin environments. This includes a brief discussion of the next steps in outfitting and commissioning the DR for STJ operation.

**Primary author:** EVANGELISTA, Ashley Marie (TRIUMF)

**Presenter:** EVANGELISTA, Ashley Marie (TRIUMF)

**Session Classification:** BeEST setups at collaborating facilities

Contribution ID: 138

Type: **Oral invited talk**

## **Influence of the environment on electron capture decay: update**

*Wednesday, 14 May 2025 08:45 (20 minutes)*

We will present our latest results on (i) the calculation of electron capture decay probabilities, focusing on the effect of atomic electronic structure modelling and shaking processes [1] (ii) the influence of the tantalum matrix on the  $P_L/P_K$  ratio [2].

[1] A. Andoche, L. Mouawad, P.-A. Hervieux, X. Mougeot, J. Machado, and J. P. Santos, Physical Review A 109, 032826 (2024).

[2] In preparation.

**Primary author:** HERVIEUX, Paul-Antoine (University of Strasbourg)

**Presenter:** HERVIEUX, Paul-Antoine (University of Strasbourg)

**Session Classification:** Material Effects



Contribution ID: 139

Type: **Oral contributed talk**

## Studying systematics in BeEST with phonon-mediated detectors

*Wednesday, 14 May 2025 14:30 (20 minutes)*

The broadening for nuclear recoils observed in BeEST's STJ experiments is as-yet unexplained. We are working to investigate the origins of this broadening with two proposed control experiments: 1) repeating the  $^7\text{Be}$  measurements with a phonon-mediated detector, rather than direct pair-breaking, and 2) measuring nuclear recoils from gamma ray emission rather than electron captures. I will describe progress towards the first of these measurements, which we hope to complete this summer. I will also discuss our recent LDRD submission, which offers opportunities to leverage detector designs and ongoing low-Tc junction fab R&D led by the SLAC DM-QIS group to build improved detectors for future experiments.

**Primary author:** LENARDO, Brian (SLAC)**Presenter:** LENARDO, Brian (SLAC)**Session Classification:** Simulations/Systematics/New Avenues

Contribution ID: **140**Type: **Oral contributed talk**

## Progress on low-energy Auger scattering simulations

*Wednesday, 14 May 2025 10:25 (20 minutes)*

Poor knowledge of incomplete energy deposition of Auger electrons are a limiting factor in the BeEST's sensitivity to sterile neutrinos. We will present state of the art low-energy scattering simulations and focus on how current approximations determine systematic uncertainties.

**Primary author:** KANAFANI, Mohamad (LPC Caen)**Presenter:** KANAFANI, Mohamad (LPC Caen)**Session Classification:** Material Effects