



Contribution ID: 621 Contribution code: **contribution ID 621**

Type: **Poster**

‘cait’: New Data Augmentation Features for Cryogenic Particle Detectors

Novel cryogenic scintillating calorimeters, used in rare event search experiments, achieve sub-keV recoil energy thresholds. Such low thresholds require a sensible raw data analysis of triggered events. This includes the identification of particle recoils among artifacts, and the reconstruction of the corresponding recoil energies, despite a low signal-to-noise ratio. For this purpose we developed the Python package cait (Cryogenic Artificial Intelligence Tools), which utilizes modern methods from data science and machine learning.

The implemented features include an interface for the user-friendly labeling of data, a range of event simulation tools, tailored data sets and data modules for PyTorch and PyTorch Lightning, as well as methods for fits, plots, triggering, and energy calibration. We will present the novelties of the v1.1 release with a particular focus on the data augmentation feature designed to improve the supervised training. The release is scheduled for autumn ‘21.

‘cait’ is an open source, fast, and production-ready package, designed to address all aspects of data analysis at cryogenic dark matter experiments, available via the Python Package index. It is tailored to the needs of the CRESST and COSINUS experiments, adaptations to similar experiments with time series data are possible.

Significance

‘cait’ is the first all-in-one analysis package for our detector type, which natively includes machine learning techniques. At ACAT21 we will present the v1.1 release for the first time. Our software is applicable to all cryogenic detectors with time series data.

References

<https://zenodo.org/record/5091416>

Speaker time zone

Compatible with Europe

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Session Classification: Posters: Crystal

Track Classification: Track 2: Data Analysis - Algorithms and Tools