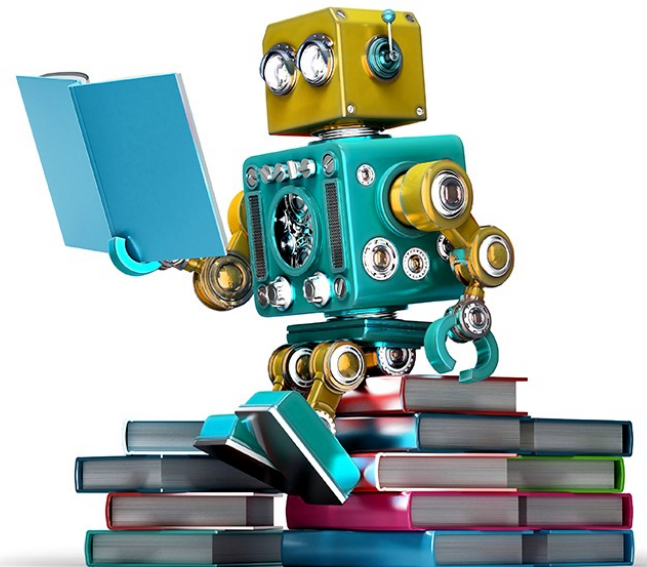# Machine learning challenge –

classify CRESST pulse shapes

Wolfgang Waltenberger
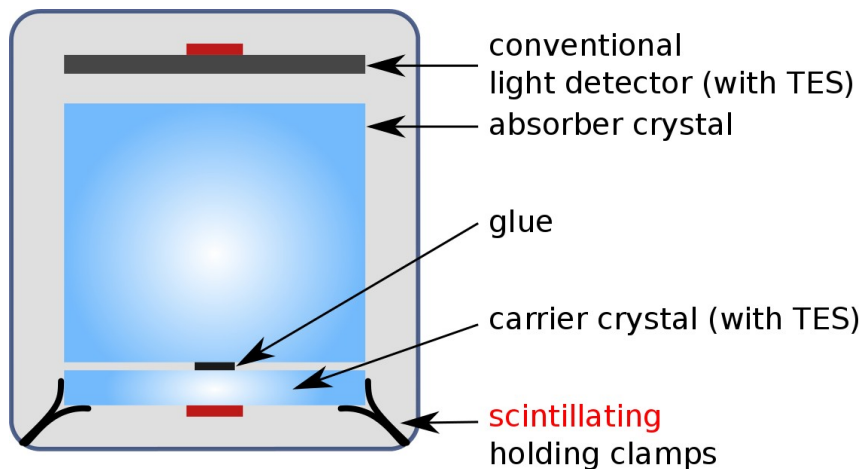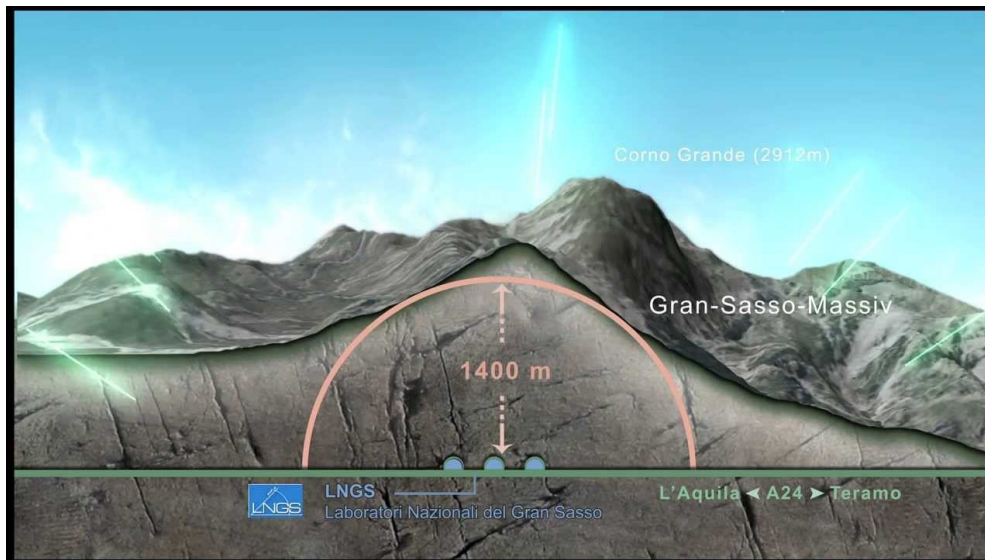
Wait – CRESST?

What is CRESST?

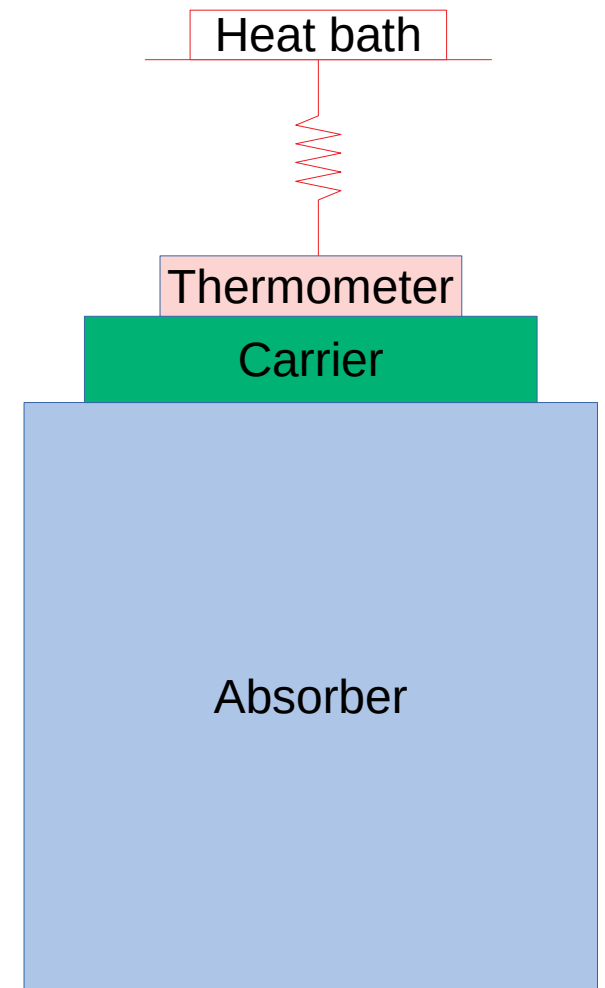# CRESST –

Cryogenic Rare Event Search with Superconducting Thermometers

Direct detection dark matter experiment beneath Gran Sasso in italy

- conventional light detector (with TES)
- absorber crystal
- glue
- carrier crystal (with TES)
- scintillating holding clamps

TUM40 detector design

Transition Edge Sensor (TES)
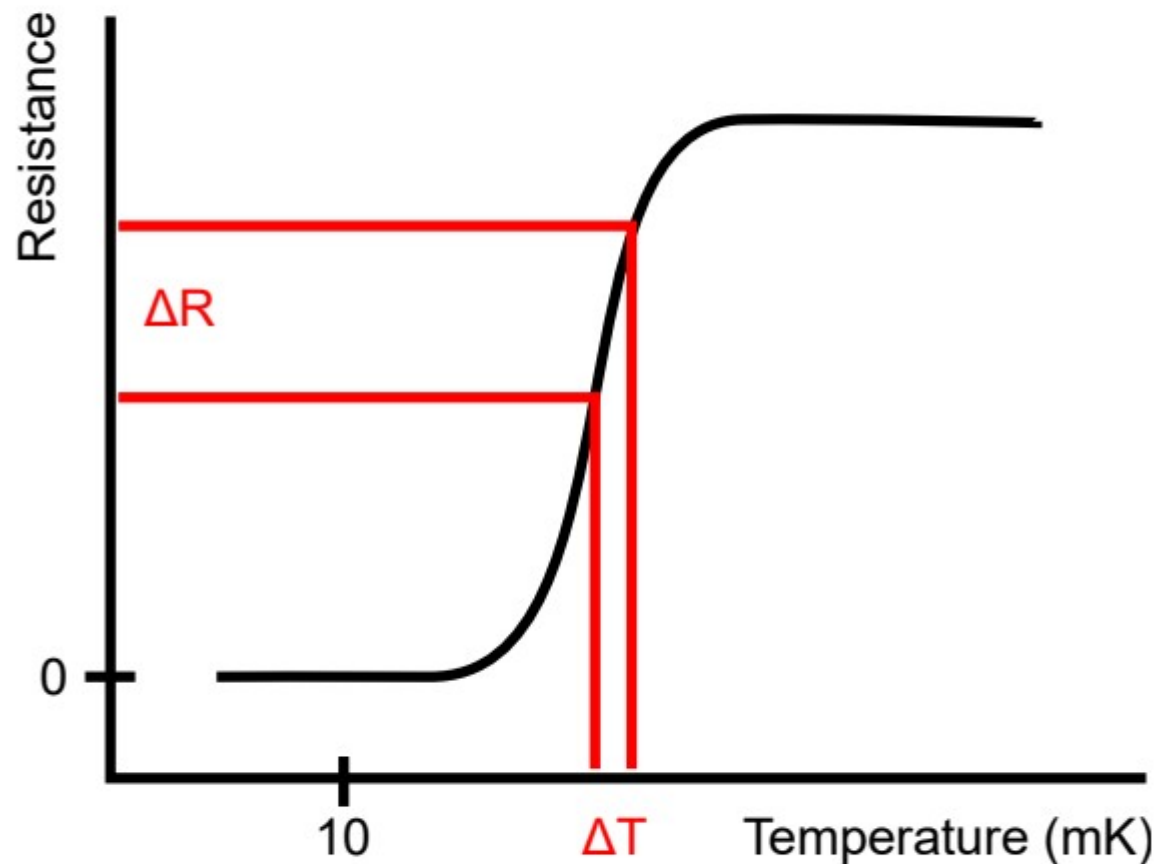
Energy deposition
~ keV
↓
Temperature rise
~μK
↓
Resistance change
~mΩ

TUM40 detector design
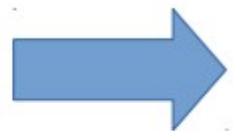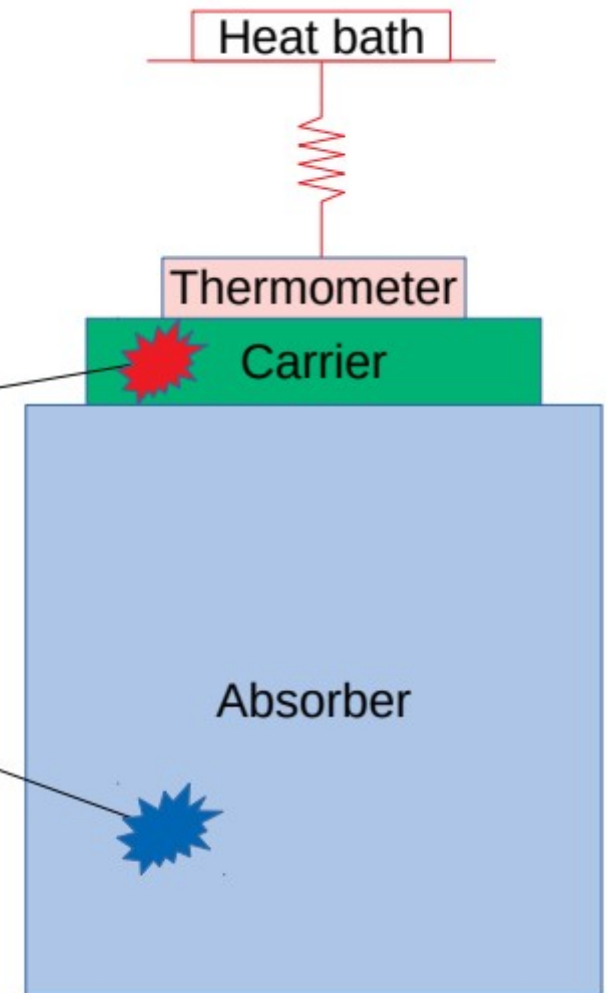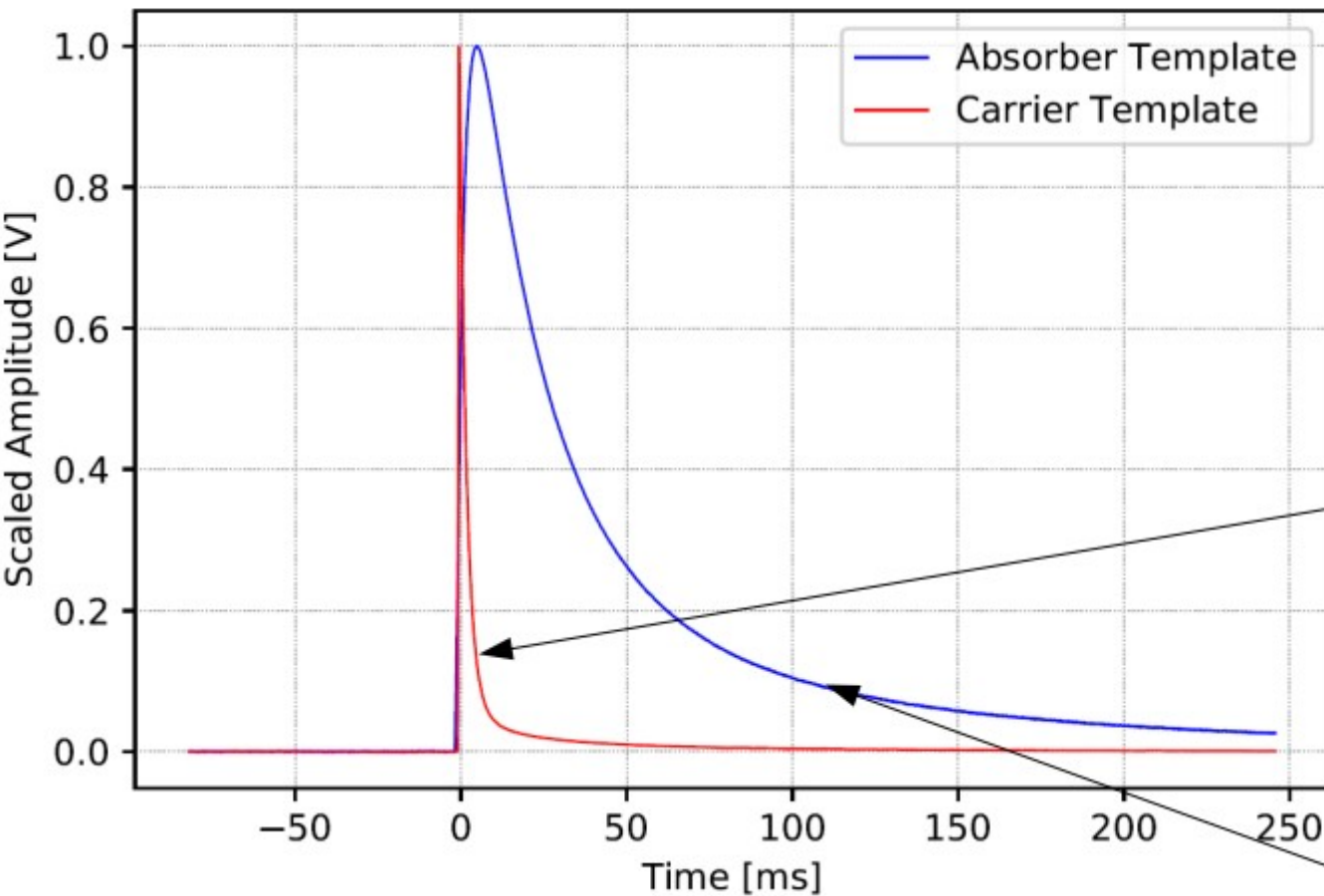
THE CHALLENGE

- You are given a training sample of 500 pulse shapes, 250 of which are absorber events, the others are carrier events. And a similar validation sample.
  Many thanks to the HEPHY CRESST team for providing the data!

- The challenge.ipynb is code that runs but exhibits sub-optimal performance

- Improve the algorithm. Work in groups of two to five people. Be creative. Any method based on pytorch and neural networks that I can reproduce (see below) is allowed. You are allowed to train on any machine.

- Whoever has the lowest misclassification rate, wins the challenge! In case of a tie, the smaller network wins (Occam's razor).

- Send notebook (including the output fields) to me:
  wolfgang.waltenberger@gmail.com
  Specify a team name! Multiple submissions (<= 3) are allowed.

  The best submission counts.