Novel idea for enhanced sensitivity (n,γ) measurements: **COMPTON IMAGING**

One can use two stages of detection in time coincidence, and knowing the energy and the place of each interaction, find out the original gamma ray direction using the Compton principle [1].

- True Capture Event
- Background Event

**i-TED conceptual design:**
- It has four Compton modules surrounding the sample.
- Each module consists of two stages of detection: scatter + absorber.
- Both, scatter and absorber are formed by pixelated SiPMs optically coupled to monolithic crystals of LaCl₃.

**FIRST TESTS @n_TOF**

In order to technically validate the instrumentation, we developed an i-TED prototype (image on the left). It consists of one scatter and one absorber stage. Both connected to a frontend (inside electronics by PETSys [4]) and the latter connected to a PC by Ethernet.

First tests were performed in September of 2017 at n_TOF (CERN). Since we had problems to identify the start of each bunch, we could not obtain histograms of time of flight and energy. For the second tests in November of 2017 the electronics were modified and we could implement an external trigger signal from the CERN proton-synchrotron (PS), which enabled a good timing and hence to obtain proper neutron energy spectra.

**Ongoing work... Position reconstruction!**

In order to know the interaction location of the gamma ray in each of the detection stages, we adjust an analytical formula [5] to the charge distribution obtained with the SiPM sensors:

\[ L(F) = \frac{L_{true}}{P_{true}} \]  

Accumulating the reconstructed positions in a 2D histogram we obtain the following graphs.

During reconstruction we can use the Chi parameter as goodness of fit and reject events that do not fit well.

Scanning all the surface of the crystal one can check the linearity, as can be seen in the final figures on the right: on top, reconstructed positions are compared to real ones; in the bottom, its differences are plotted.