Imaging the crystals

“ Images” of the crystals can allow us to bring out possible local flaws or non-uniformity in the crystal response.

Example: Strong variation of collected light as a function of the tranverse position close to the photodiodes, due to different direct/diffuse light contibutions (Andrey).

Goal: Plot the average measured energy as a function of position within the crystal.
To do so, it is better to reject trajectories that incompletely cross the crystals, i.e. intersect the vertical sides (edge hits).

This is a simple task, the only problem consists in determining the actual trajectories accurately enough:

- long lever arm between upper Tkr layers and CAL
- multiple scattering

Note: This task has strong overlap with some other I&T works:

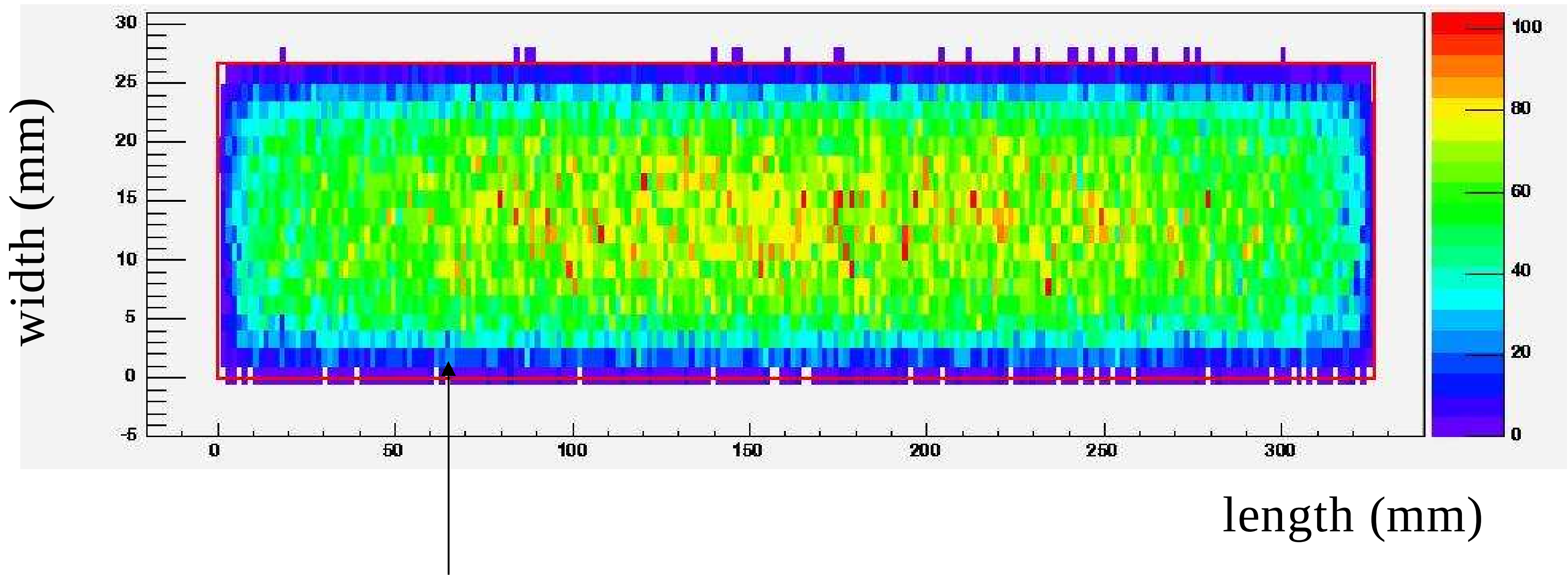
- light-tappering mapping (1D instead of 2D);
- correlation between TKR vs CAL position information;
- effect of CAL zero-suppression…

Crystal images

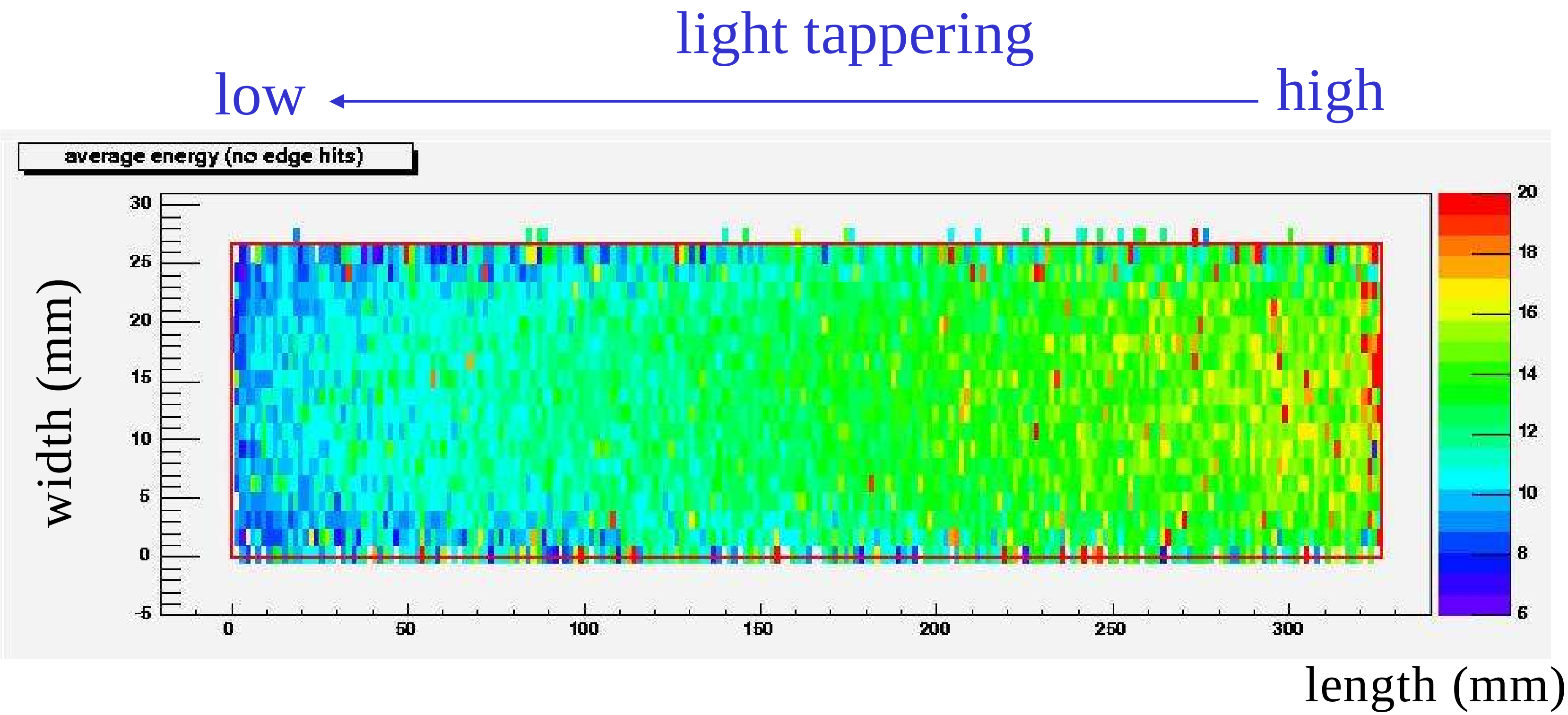
So far: Use of the TKR position and direction vectors and extrapolate the trajectory into CAL (disregarding the multiple-scattering problem)

Note: The energy per crystal is not available in the MeritTuple, so I used the Digi file kindly provided by Xin Chen.

distribution of events

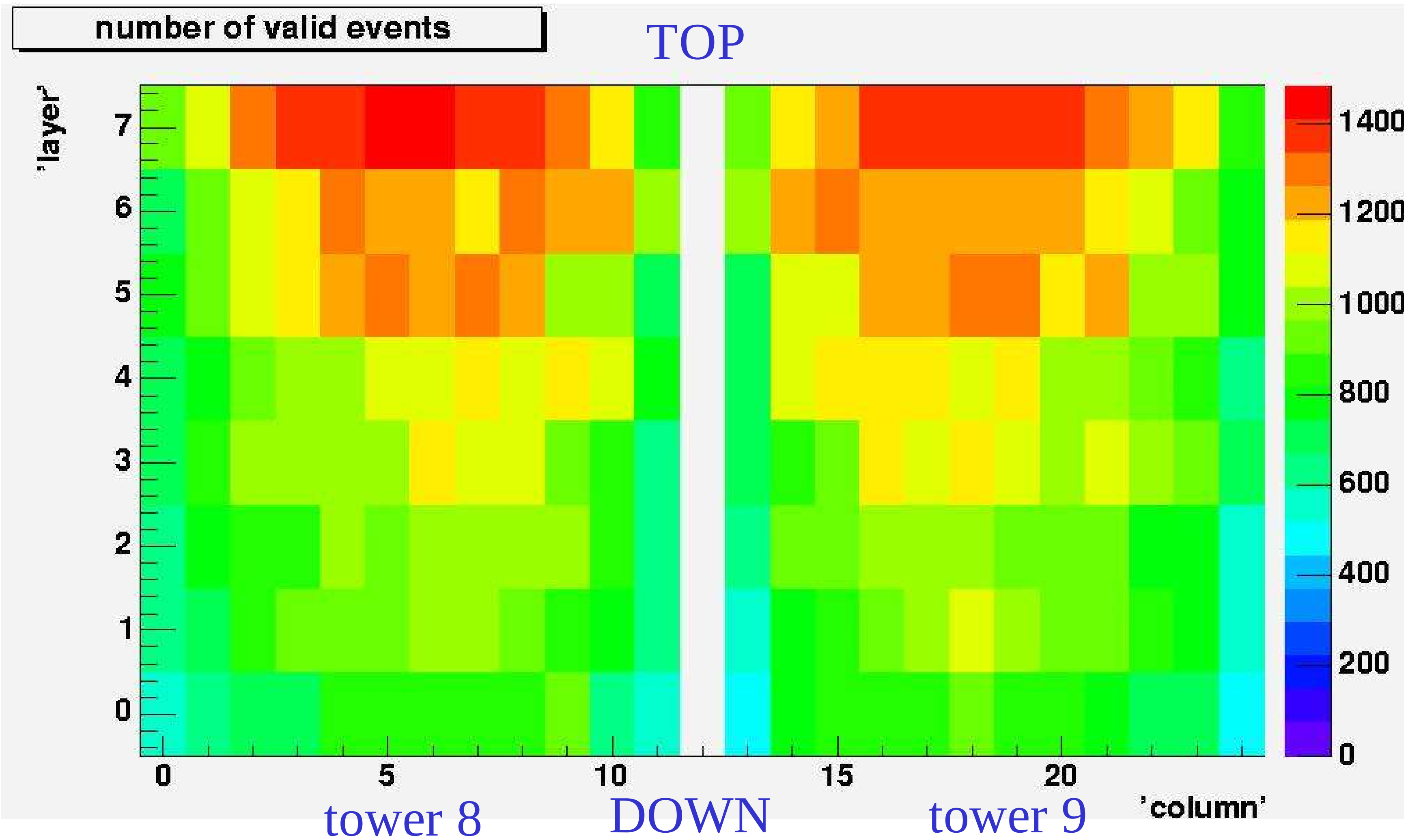


Crystal images: average energy as seen from one side



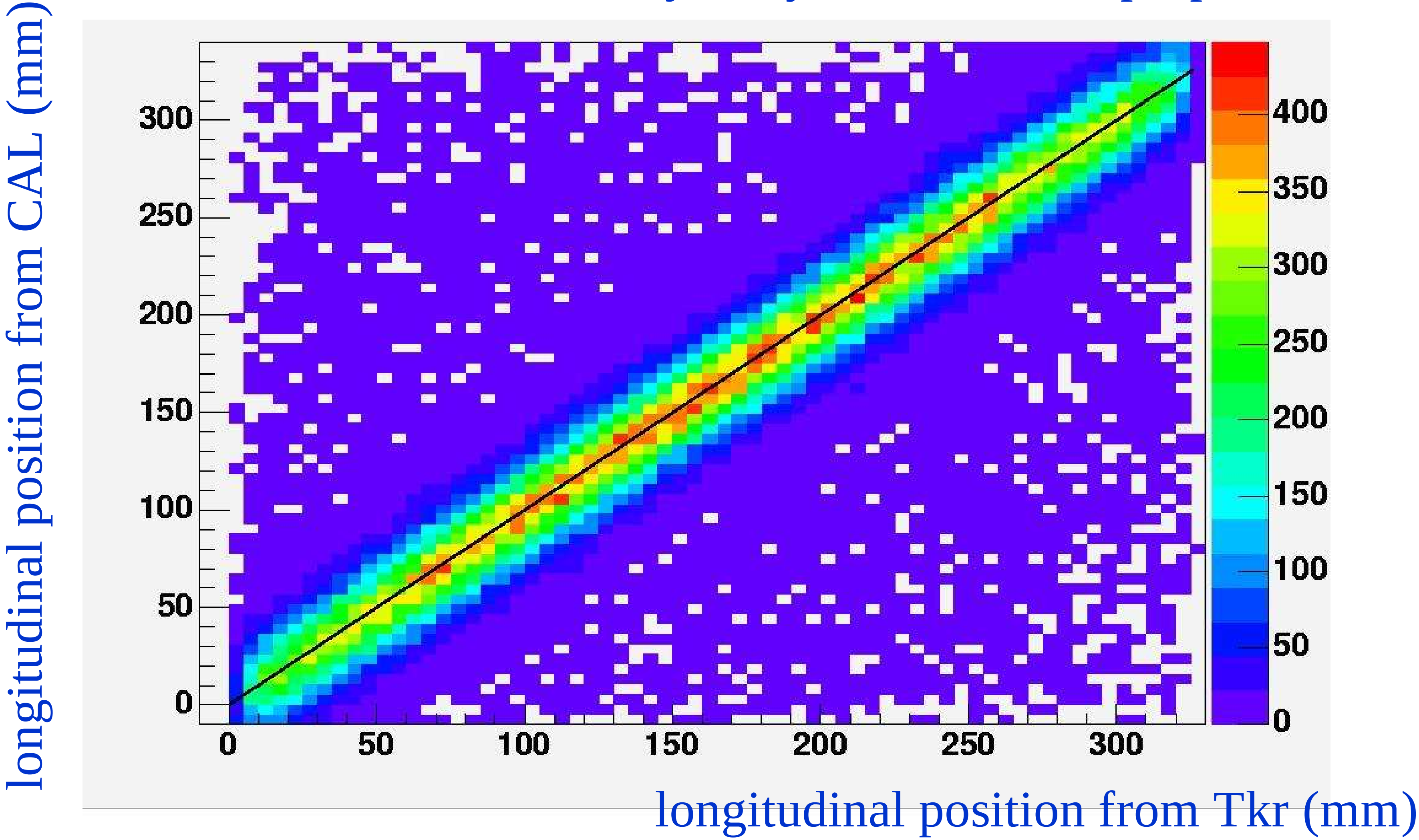
“ Valid events” for calibration

4M events in total, 219040 triggering events

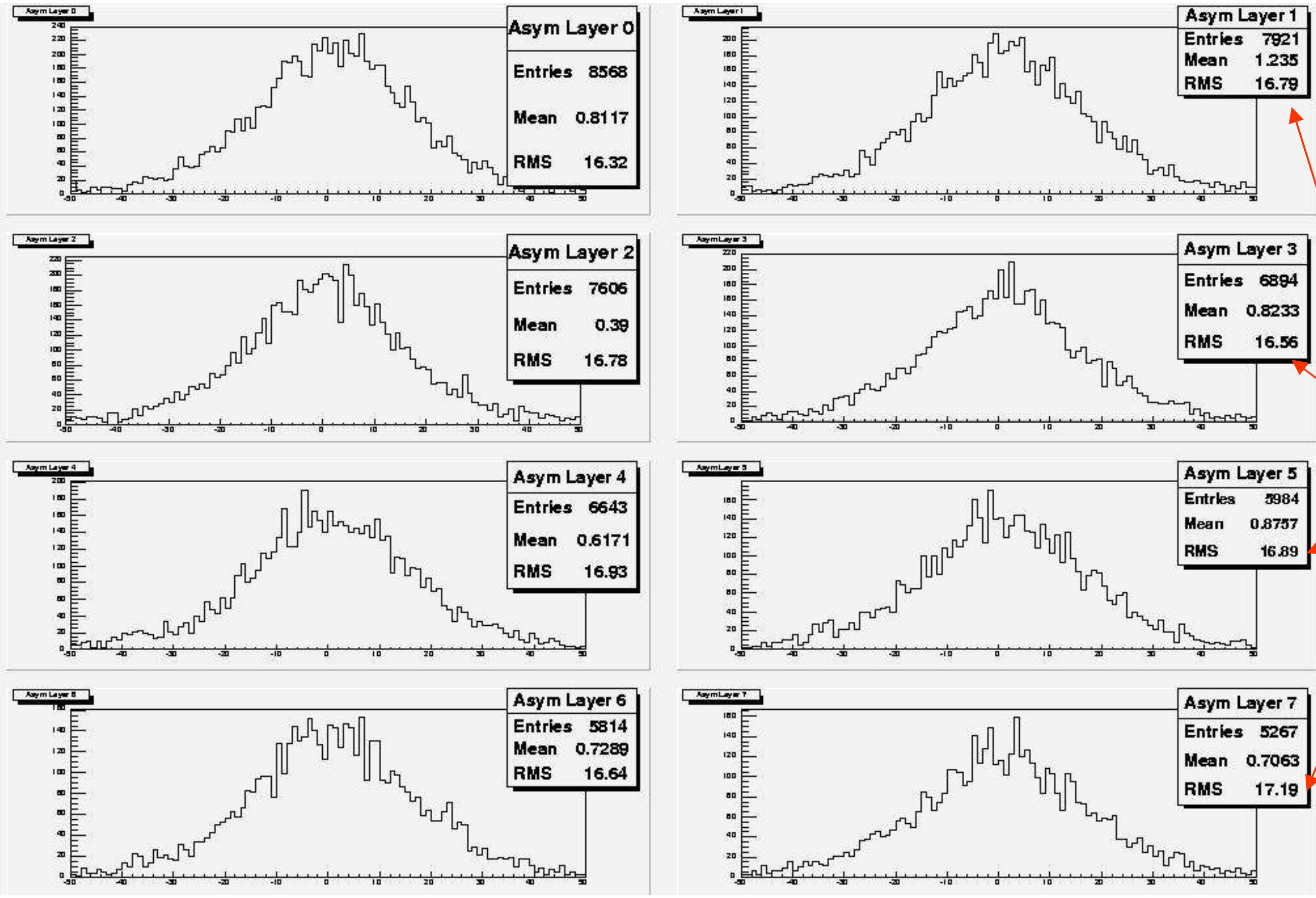


Localization: Tkr position vs CAL position

Question: what is the Tkr trajectory worth for this purpose?



Localization: « $l_{Tkr} - l_{CAL}$ » distributions



RMS are big and almost constant for all layers: little effect of multiple scattering in CAL

mean values are small

$l_{Tkr} - l_{CAL}$ (mm)

Localization: conclusion

The track reconstruction algorithm was designed to determine the initial direction of photons. It makes use of the information available as close as possible to the conversion point, to avoid the adverse effect of multiple scattering.

We use the same algorithm for cosmic muons. For those crossing the top plane of the towers, the direction is determined from the top part of the Tkr, before most multiple scattering takes place.
For the present purpose, it would be more sensible to use the information provided by the bottom trays.

Is the CAL information provided by the neighboring crystals any better? In principle yes, but:
- requires an iterative procedure,
- problem if we run in zero-suppression mode?
- resolutions probably very different along the two directions