Reconstruction with Light

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Light task in ICARUS

- **T_0 :** third coordinate of the event.

- **Trigger :** association of the event light pulse with the beam spill gate − possible exploitation of the beam bunched structure.

- **Localization :** rough localization of the event in the wire plane coordinates for cosmic rejection.

- **First classification of events :** sort the output into various streams (neutrino candidate trigger, cosmic trigger, etc…).
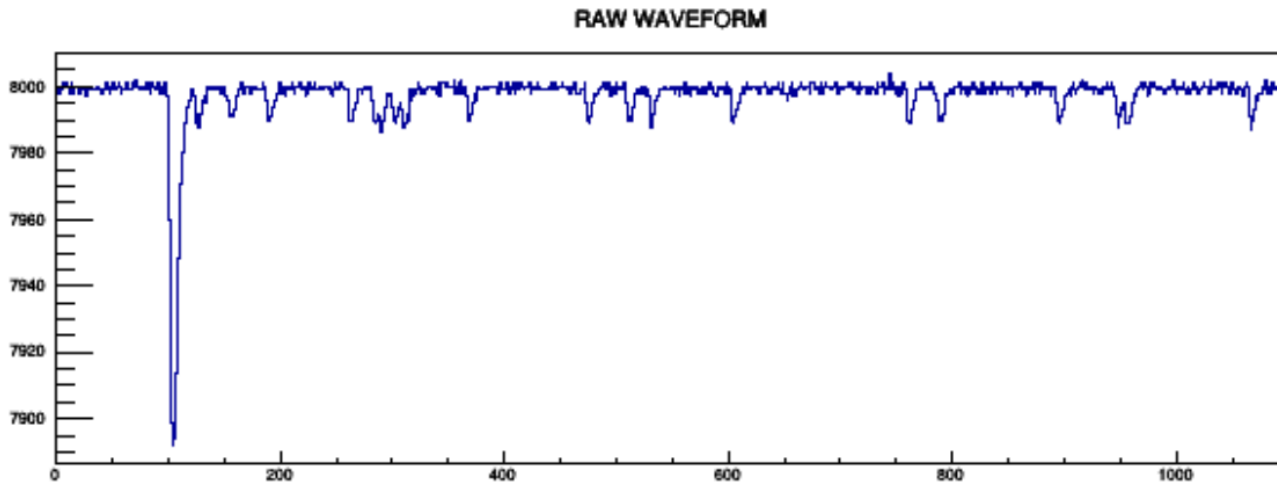
Where we are

- The photon library is completed and all the tools to re-built it are ready.

500 MeV ν_e
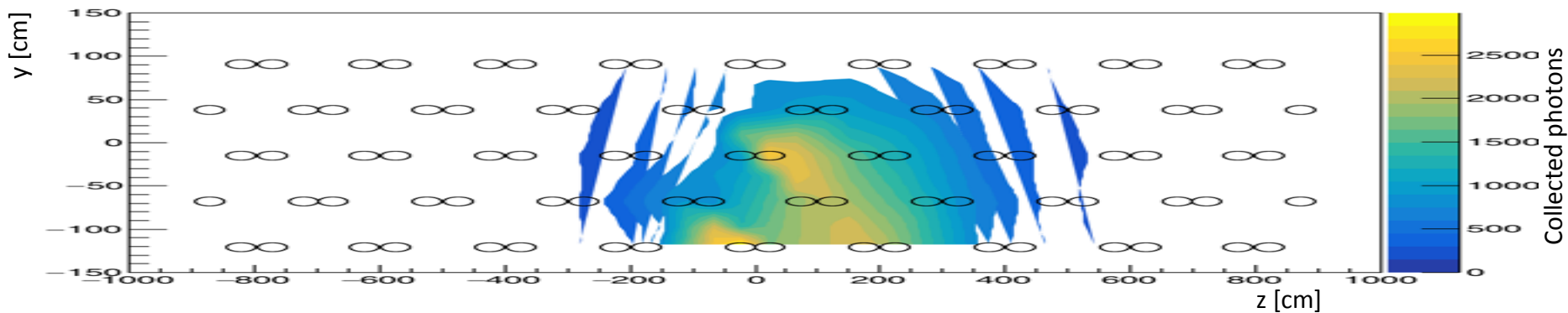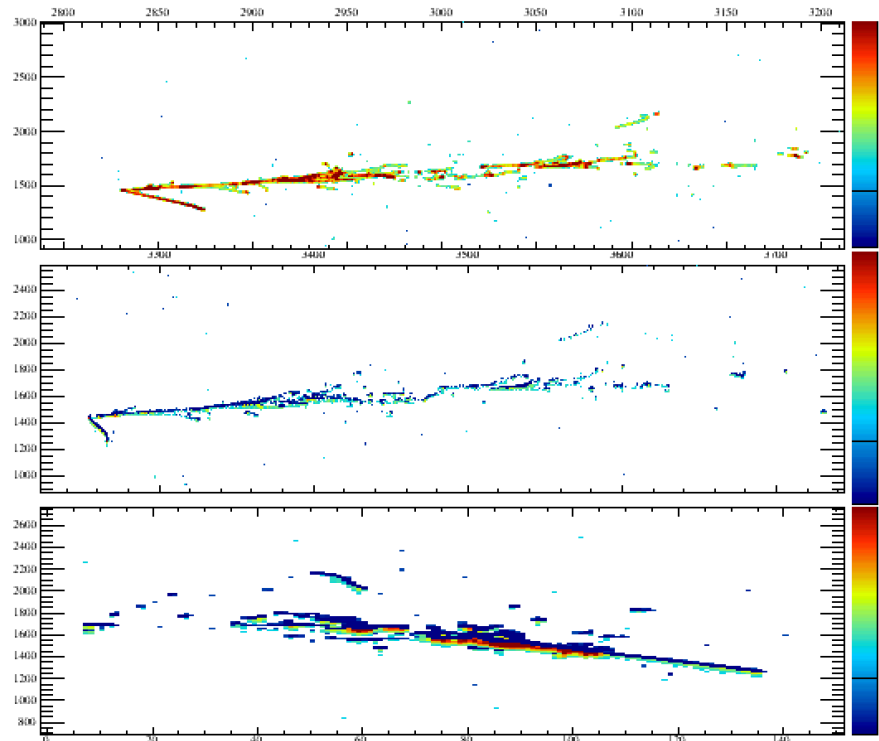
Where we are

- Digitalization of the signal simulated:
- 500 MHz sampling;
- baseline placed at 8000 ADC and SER peak signal at 10 ADC;
- leading edge (3.8 ns) and trailing edge (13.7 ns) as for SER signal: to be tuned for different signal;
- saturation at 3000 ADC;
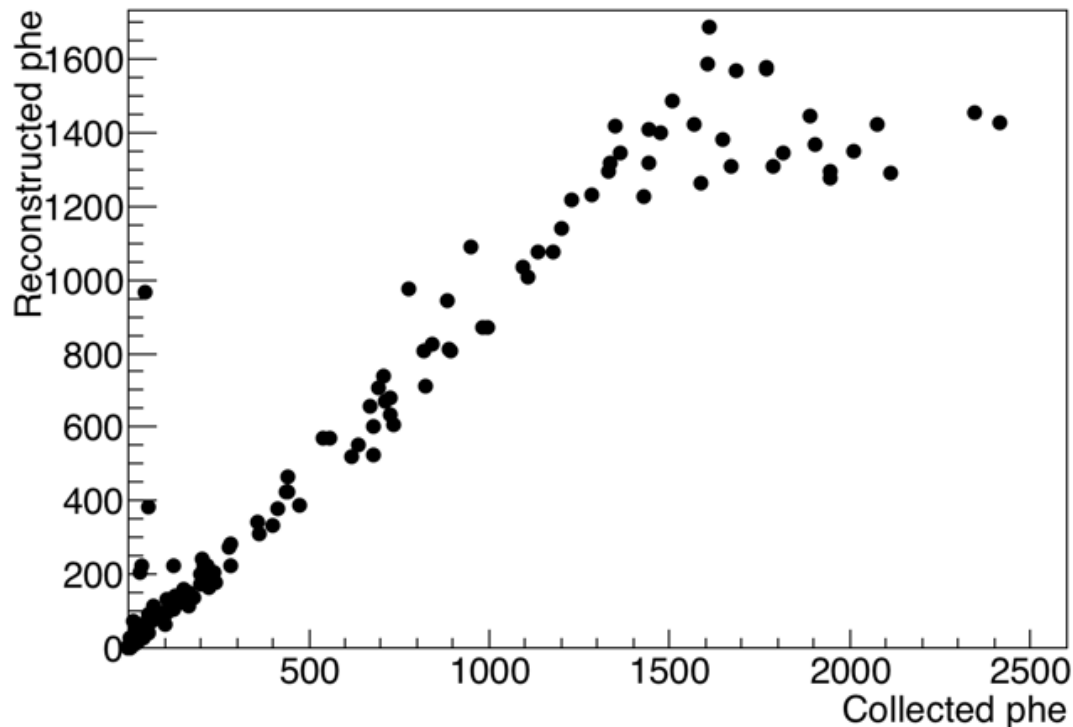- white noise and 1 kHz dark counts rate.

RAW WAVEFORM

Where we are

- Hit finding: a peak is considered a hit if it is above 10 ADC. Parameter to be adjusted.

Saturation threshold (3000 ADC – 300 phe)
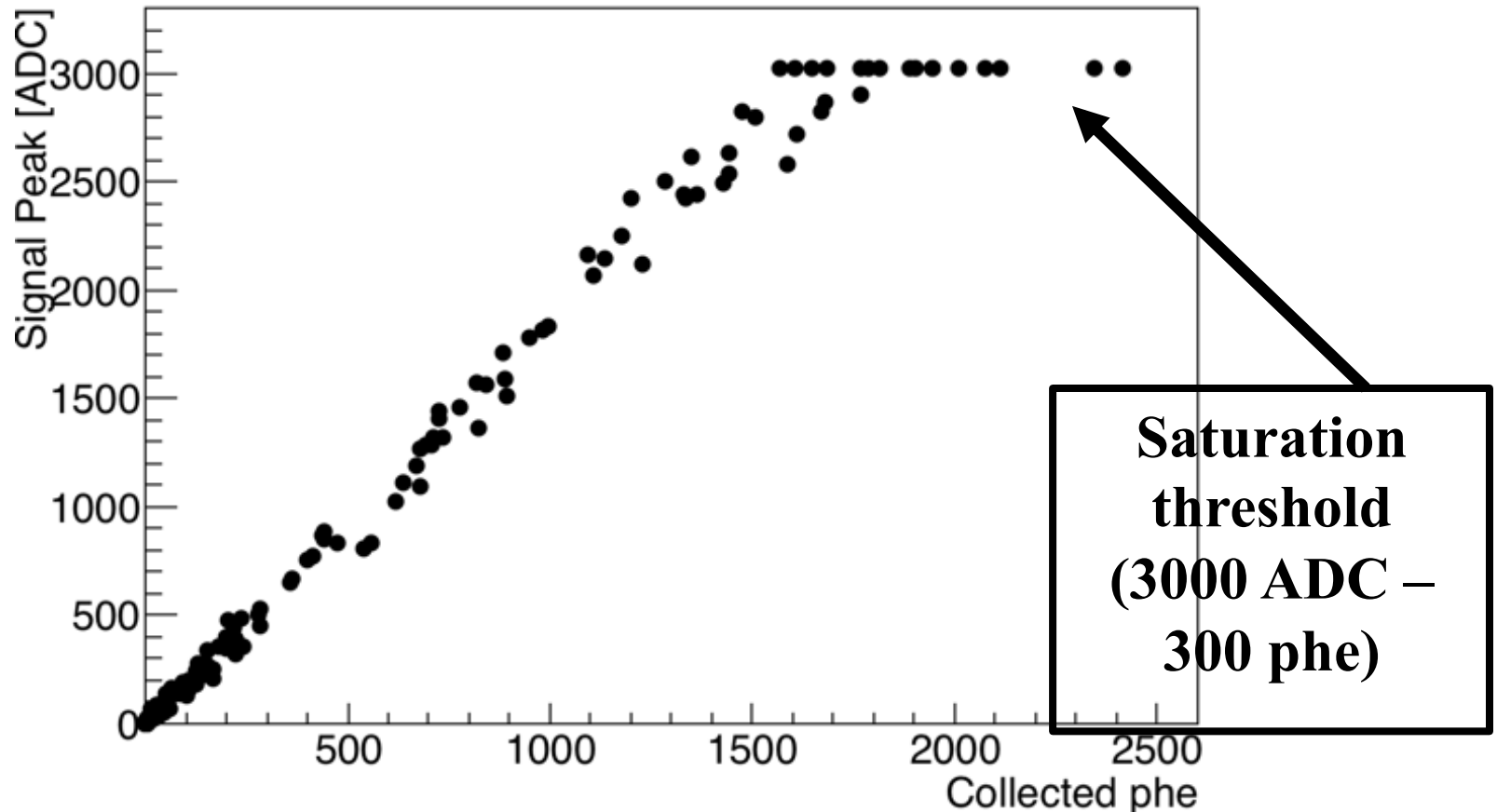
Where we are

- The fit of optical hit is now performed with two gaussians, one for the leading and one for the trailing edge.
- The fitting algorithm needs still some improvements.

Problems

- Some aspect of the geometry has to be improved:
- field cage are not present at the moment;
- PMT have to be described more realistically;
- TPB has to be added;
- cathode has to be described as semi-transparent.

- Time propagation has to be improved: now time effecs due to reflections and Rayleigh scattering effect are not considered.

- Reflectivity of the surface has to be defined in a realistic way.

T$_0$

- The arrival time of the prompt photons is now set when the optical hit pass 10 ADC, i.e. 1 phe.

- Algorithms based on the derivative of the fit function are under study.

- To fully understand the T$_0$ evaluation, the problem in the photon propagation has to be solved.

Localization

- Good performances seems to be possible.
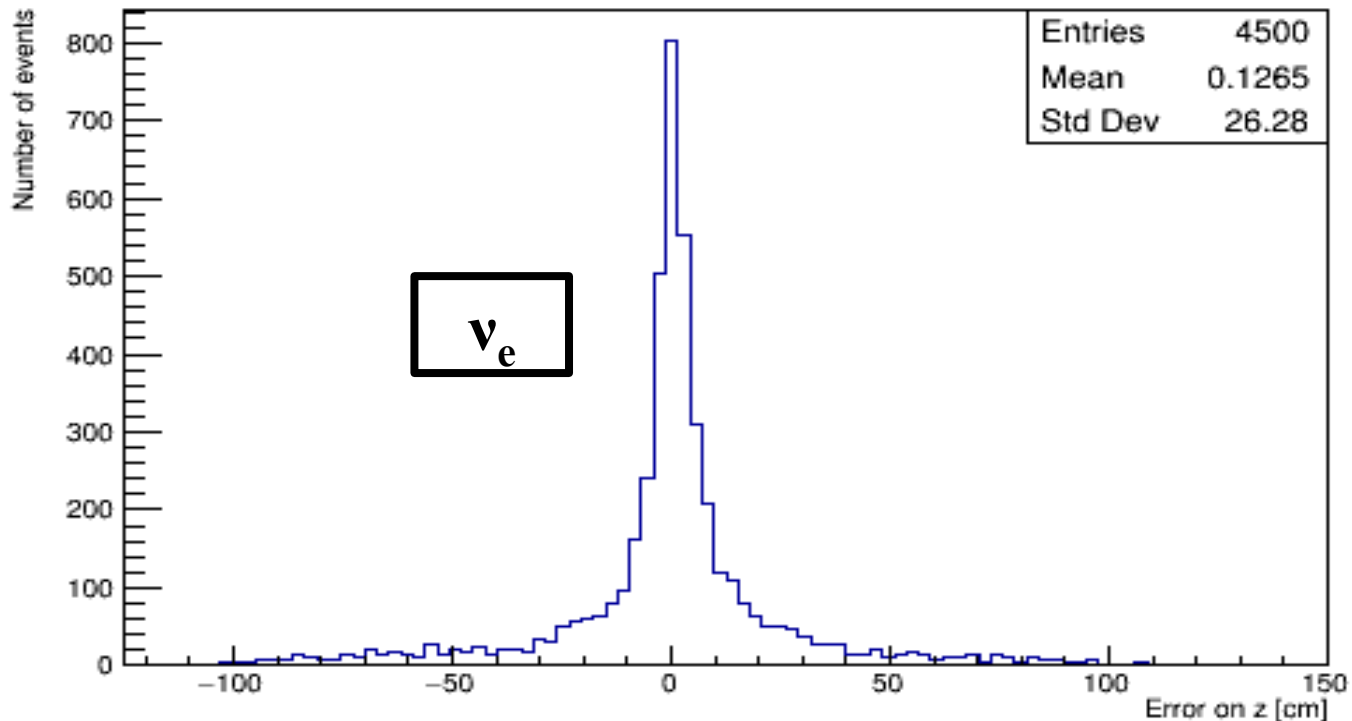
- To fully understand the localization the problem in the reflectivity and geometry have to be solved.

First classification of events

- The light, together with other systems like CRT, can be used to sort the output into various streams and create a software trigger:

- Tag CC event with a light signal followed by a CRT signal.
- If an interesting signal is recognized outside the beam spill (for example hint for DM produced in the beam[1]), the event can be tagged and recorded.

1-Dark Matter Search in a Proton Beam Dump with MiniBooNE –
A. A. Aguilar-Arevalo et al. Phys. Rev. Lett. 118, 221803

Thanks !