CRP gap in MC and reconstruction - status

A.Meregaglia (LP2I Bordeaux)

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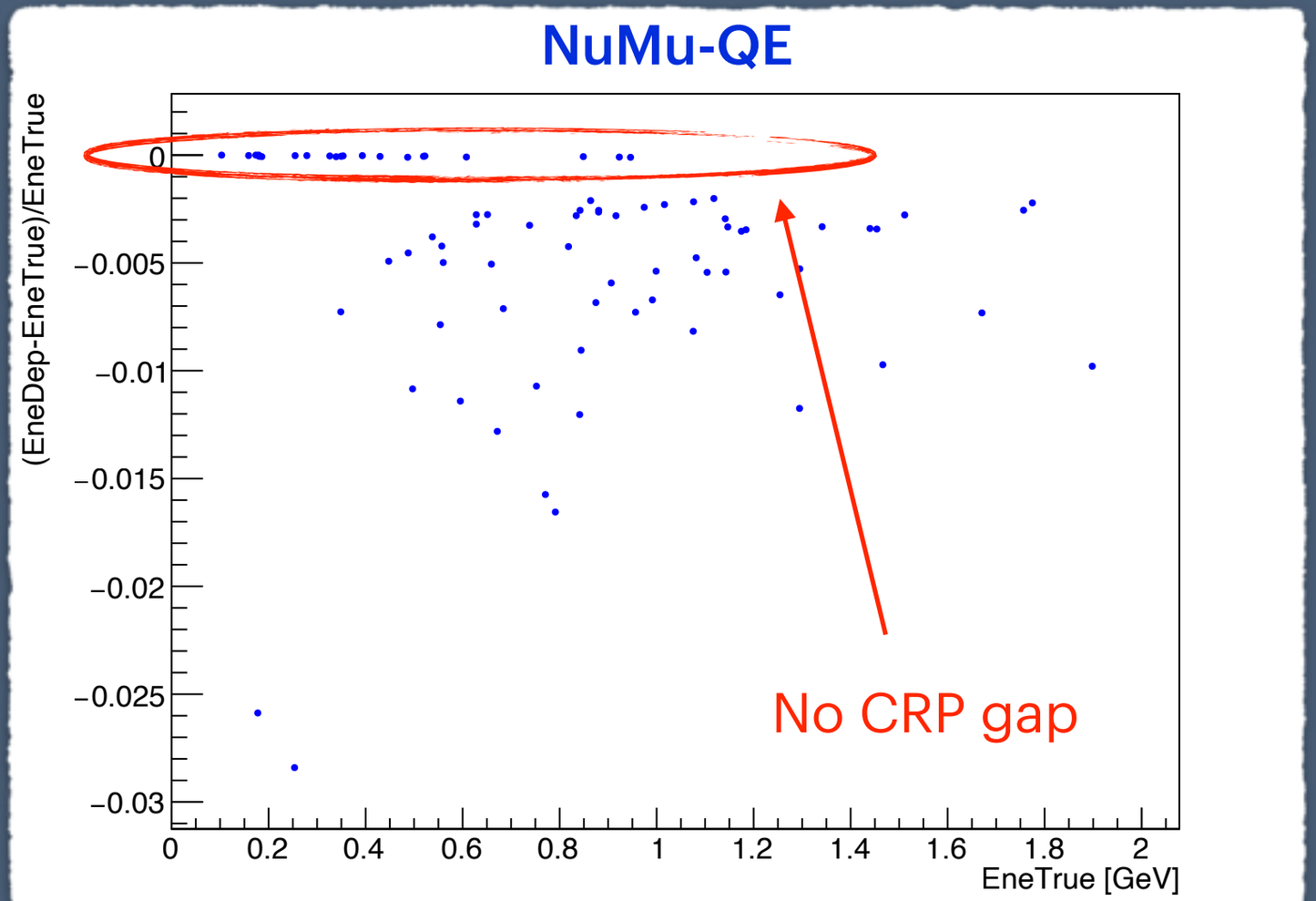
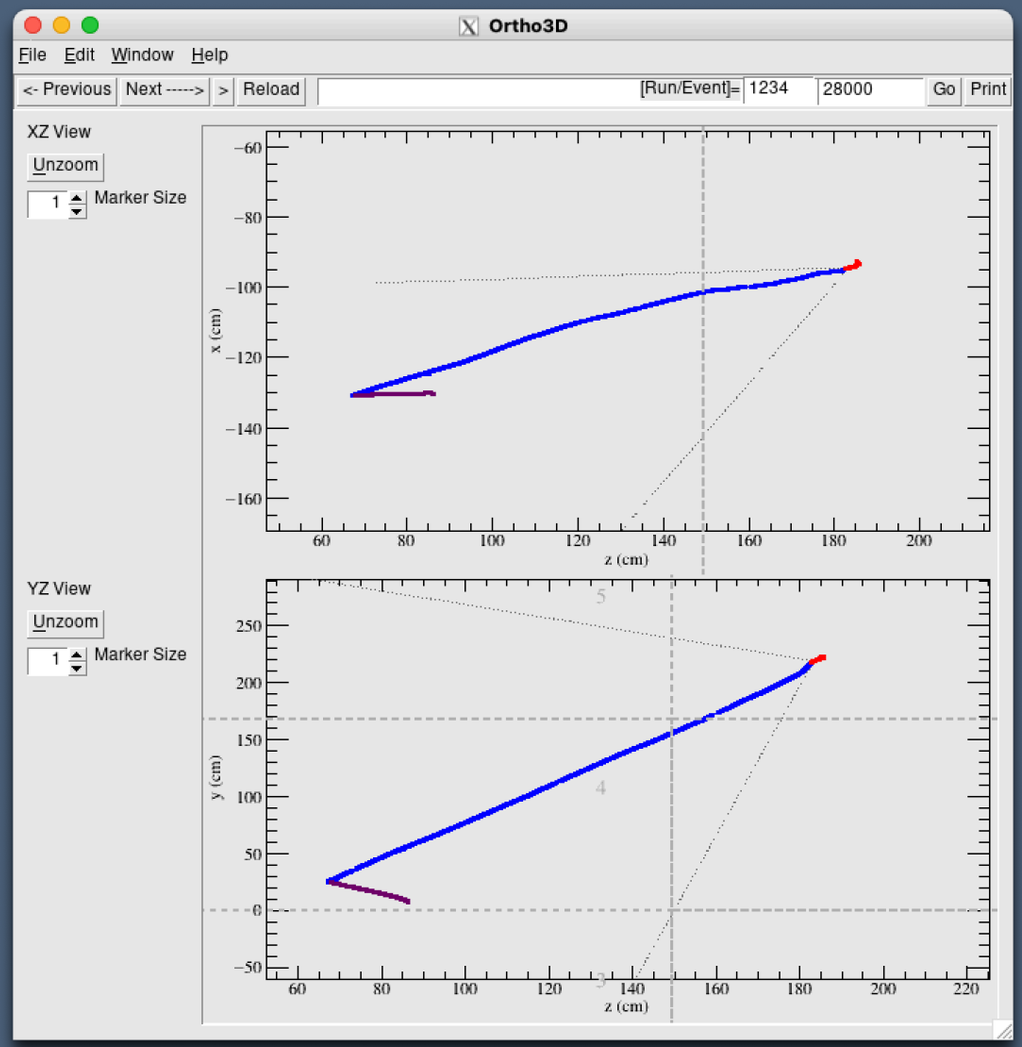
Reminder

- Studing the neutrino energy reconstruction we came across a discrepancy between the true particles energy and the Geant4 deposited one.
- After digging into the problem we found that the G4 deposits were not saved in a volume corresponding to CRP gaps, resulting in an underestimation of the energy.
- With respect to real life we have to issues:
  - ➡ CRP gaps geometry is not up to date in the simulation code.
  - ➡ In real life the (part of?) the charge will be collected in edge channels.

Energy deposited Vs Muon Energy



Event example



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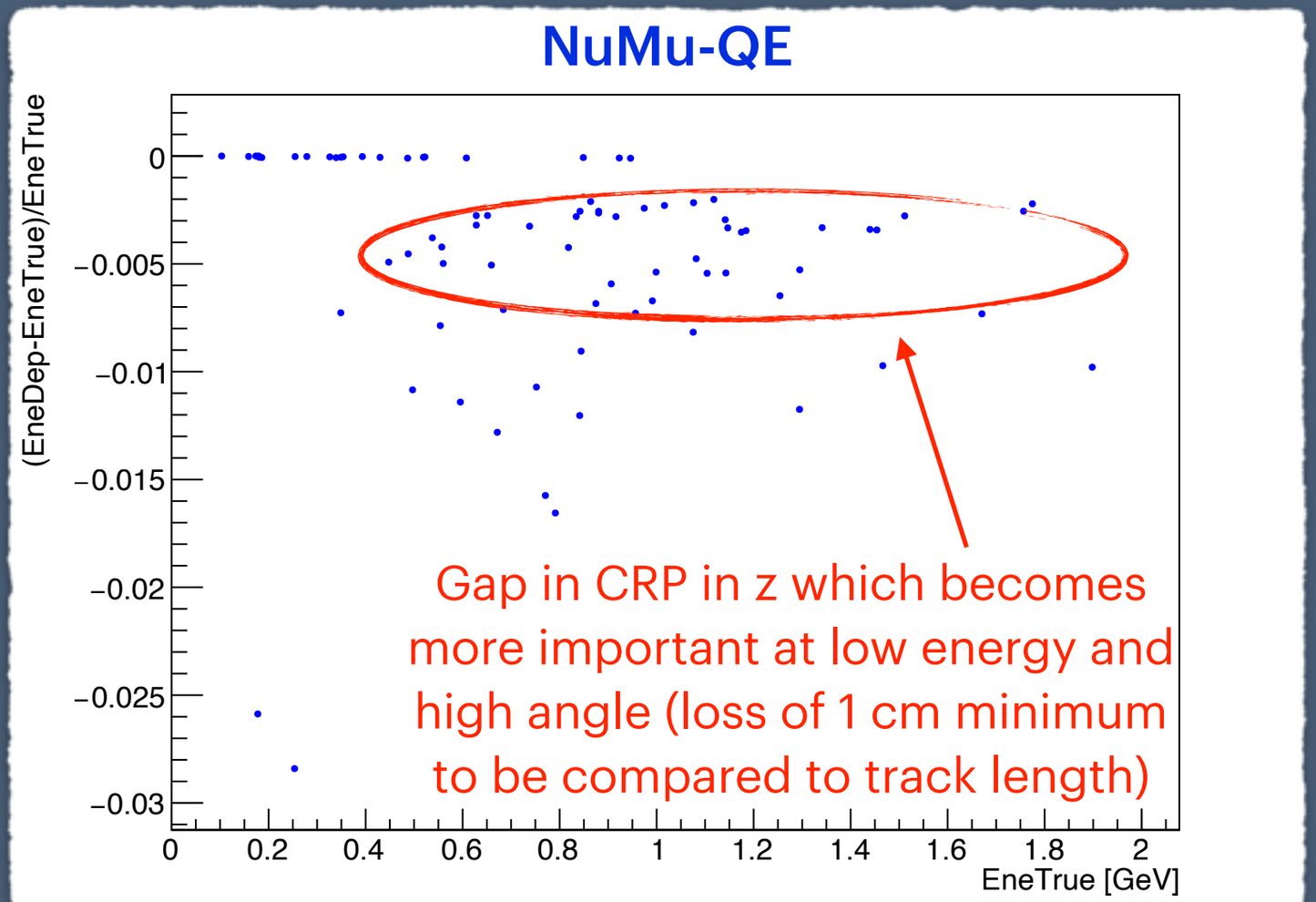
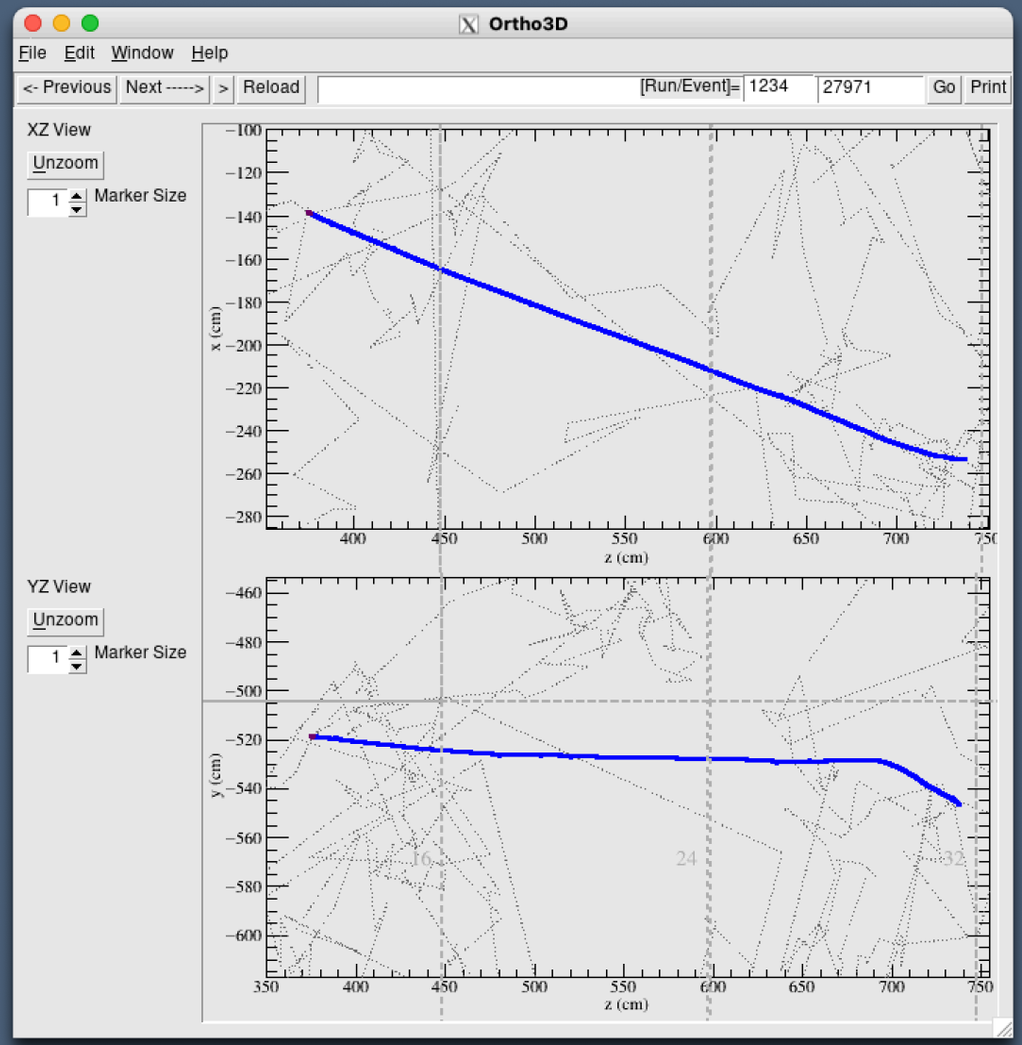


Event example



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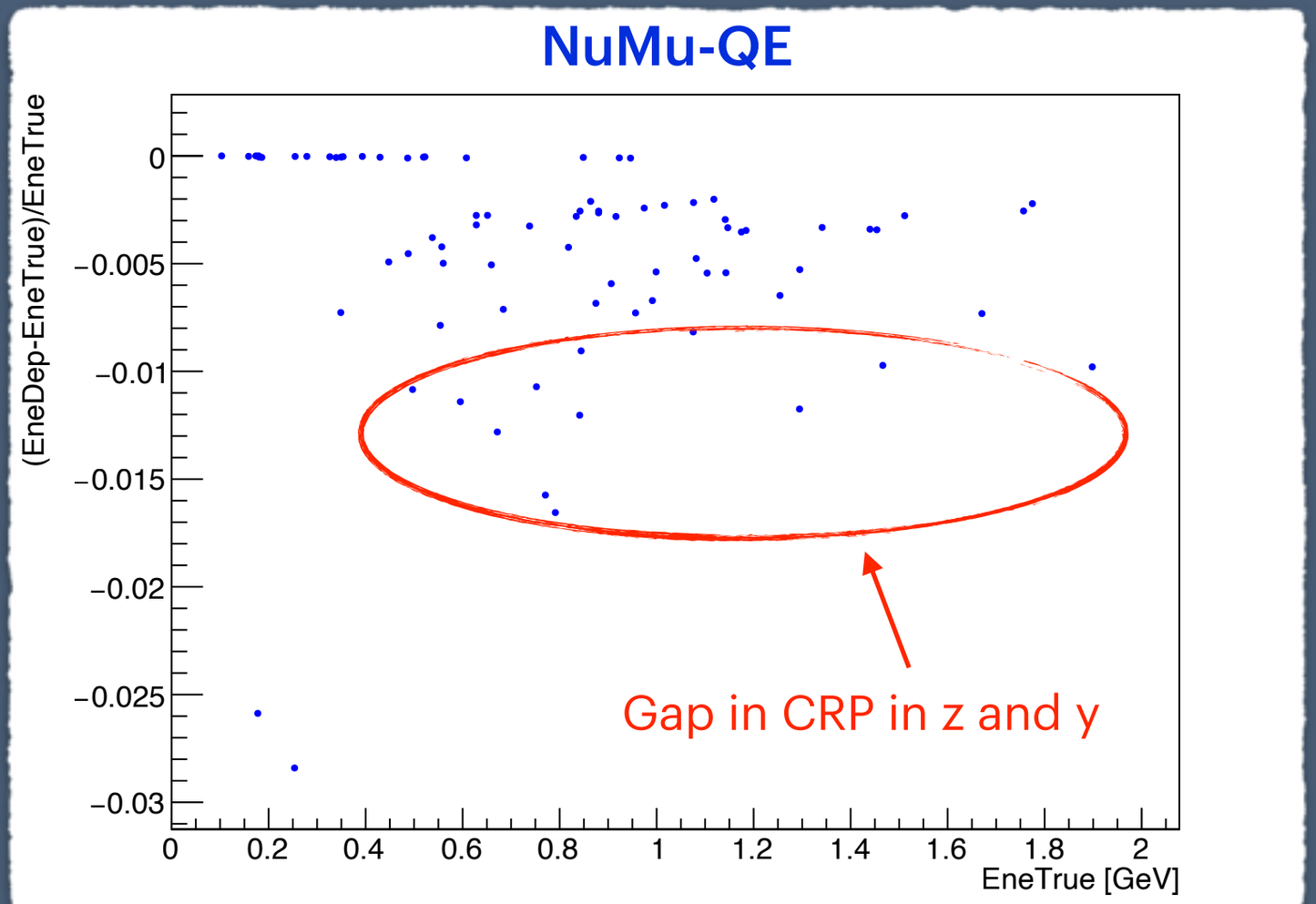
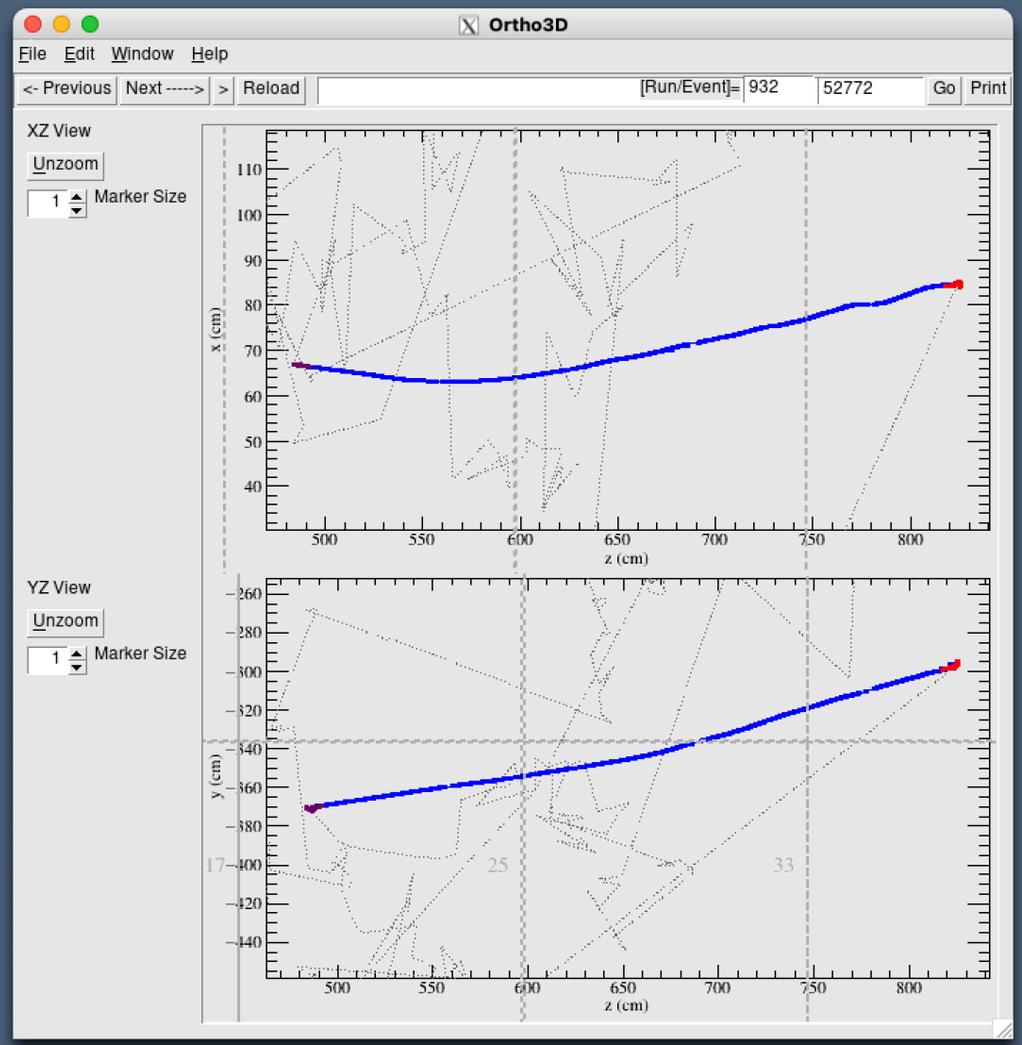


Event example



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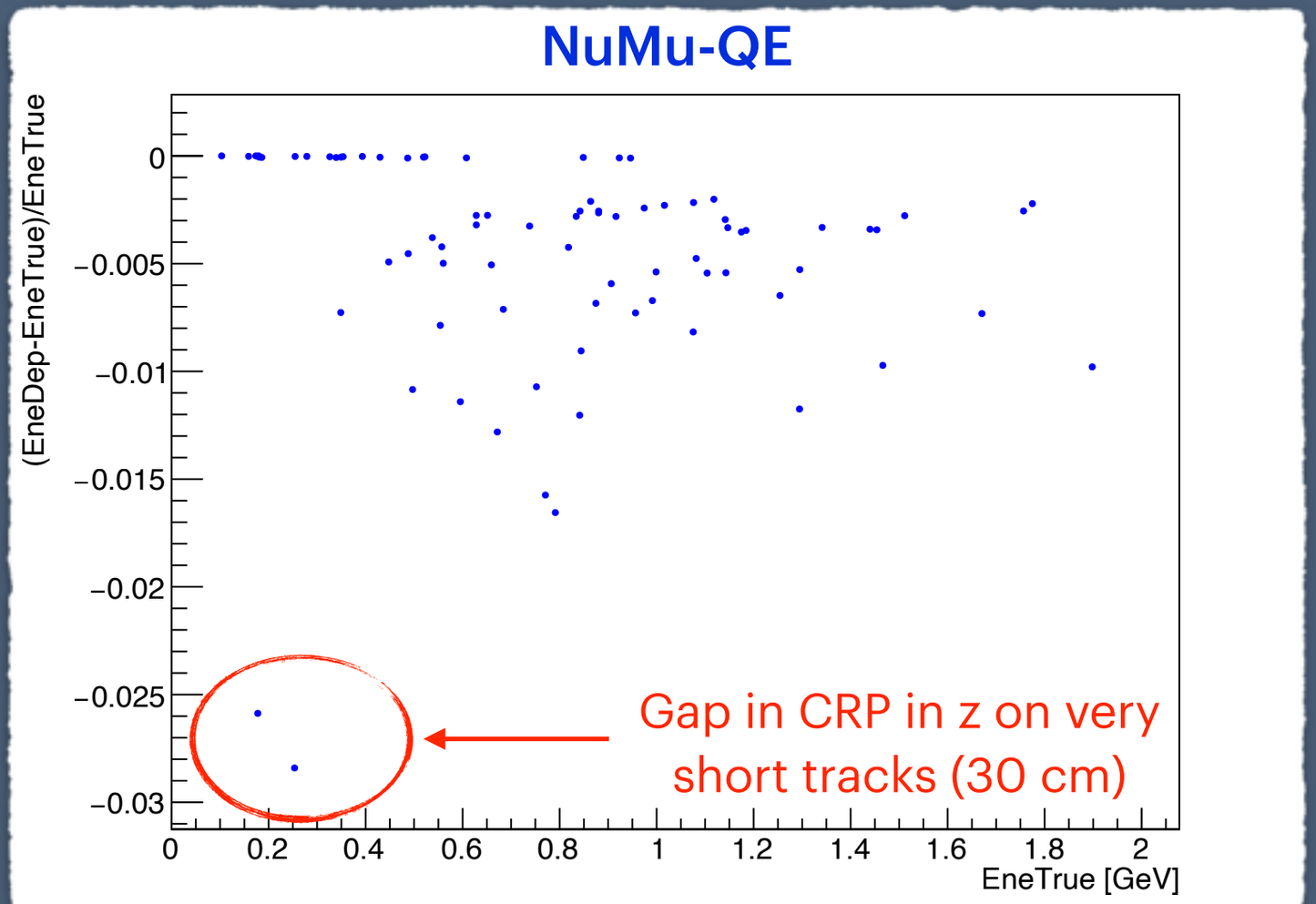
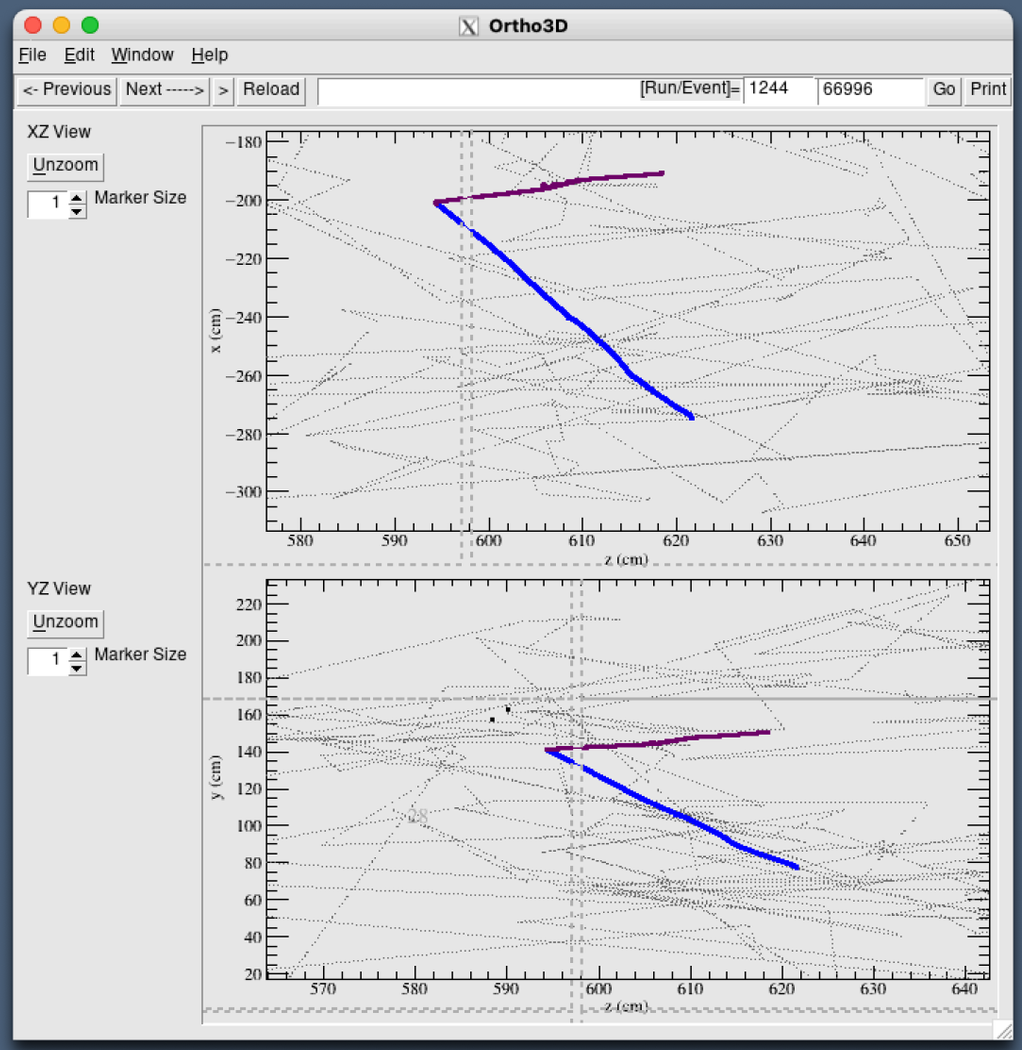


Event example



Geometry

- The **present gap** in the simulation is **10 mm**.
- Real life is different and from discussions with the experts we have:

  ➡ **Gap between 2 CRP** = 6mm (dead edge of each CRP) x 2 + 4mm (gap between CRPs) = **16mm** (values at cold **to be validated**)

  ➡ **Gap between super structures (beam axis)** = 2 x 6mm (dead edge of each CRP) + 22-24 mm (gap between CRPs) = **34-36mm** (values at cold **to be validated**)

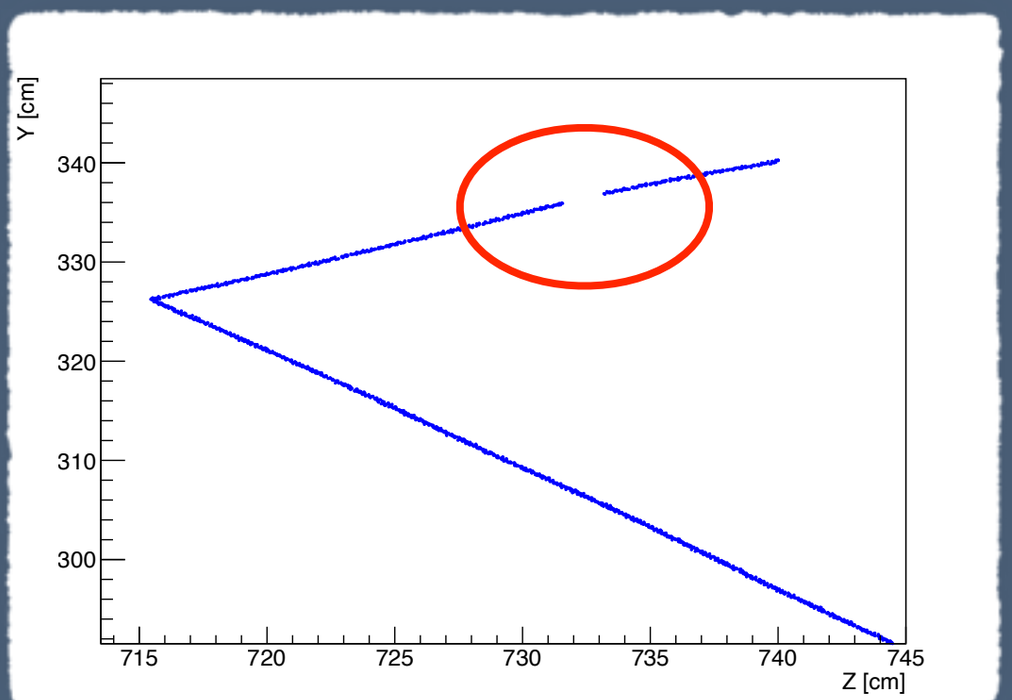
  ➡ **Gap between super structures (beam transverse axis)** = 2 x 6mm (dead edge of each CRP) + 29-31 mm (gap between CRPs) = **41-43mm** (values at cold **to be validated**)

- The geometry **should be corrected** (**who will do that???**) for next MC production (**when will it happen???**).

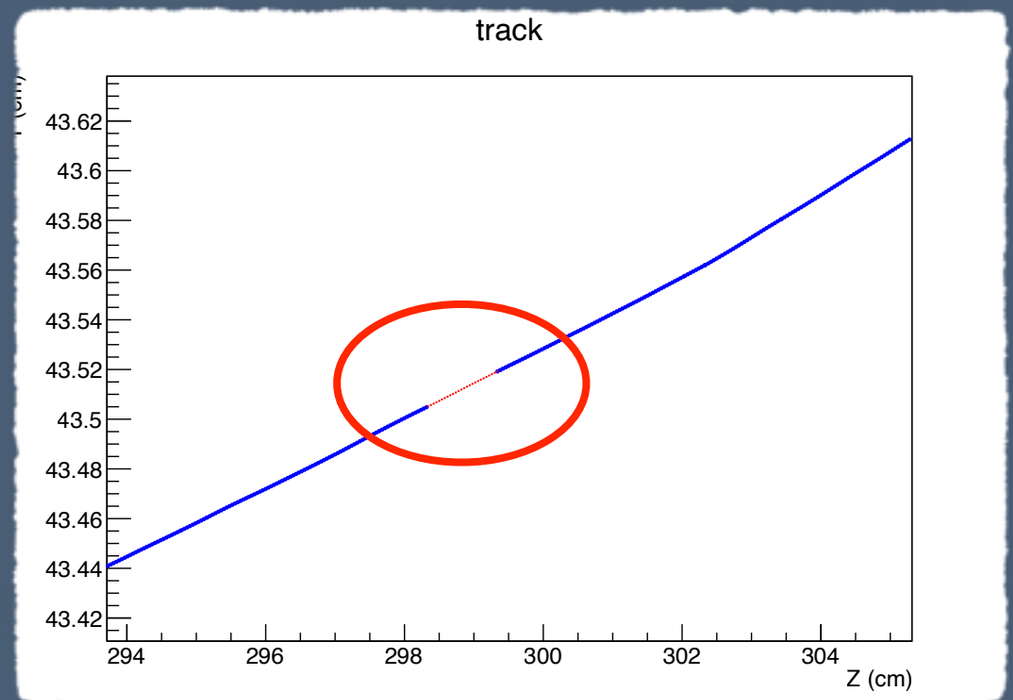
Simulation

- To fix the issue of the energy deposits not saved in the simulation at the Geant4 level in the CRP gap, a new volume was added by Victor and tested with muons of 5 GeV.
- The SimEnergyDeposits are saved in a specific branch allowing for a specific treatement in the digitization phase.

Example before correction



Example after correction



The issue is...SimEnergyDeposits are not used for the digitization!!!
IonAndScint is used instead!

Possible options

- The digitization of events in the gaps is done in a specific ad hoc way using for example a COMSOL map (work started by Yoann). In this case we need:

  ➡ A dedicated branch in IonAndSim (Laura said it is not straight forward but feasible.) → **L.Paulucci?**

  ➡ A detailed COMSOL map. → **Yoann?**

  ➡ An implementation of the digitization based on what has been developed for the space/charge simulation → **???**

- Wirecell takes care of the digitisation regardless of the fact that the deposits are in the gap or not. A new IonAndScint is not needed in this case.

  ➡ Discussion started by Dom on slack on the 21/5/24 with Haiwang and no replay since then.

  ➡ Decision to be taken → **Simulation WG?**

  ➡ Implementation → **Haiwang?**

Conclusions

- The **CRP gap** issue is clearly identified.
- First steps for a solution are taken but there is **no clear strategy, schedule and manpower**.
- We could wait from feedbacks from the Simulation WG, but we can be active actors in the process. The implementation of the geometry is clearly a task for the French groups (we have the geometry info), and we could help implementing the best solution.
- **Do we have the manpower in France**? Most of the people are busy with hardware and detector construction, but we should keep a useful and visible implication in the Simulation and Reconstruction if possible…