Current activities and plans

1. Development of algorithms in present tools.

2. Moving algorithms to LarSoft framework:
   - some work done remotely but…
   - now try to use LBNECODE from GitHub
   - installing on Fedora – great help from Brett Viren!

3. Start contribution to FastMC ☺
   - tests / crosschecks on MC truth?
   - parameterization of reco parts (PID, energy resolution – e.g. angular dep.)?
   - what else and how include current reco in parameterization?
   - …?

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Software integration

FLUKA – LarSoft interface may be **useful**.
Need to understand if possible to work on it.

- what info is in LarSoft MC; what is the format, etc..
- everything common, or we can profit from both MC?

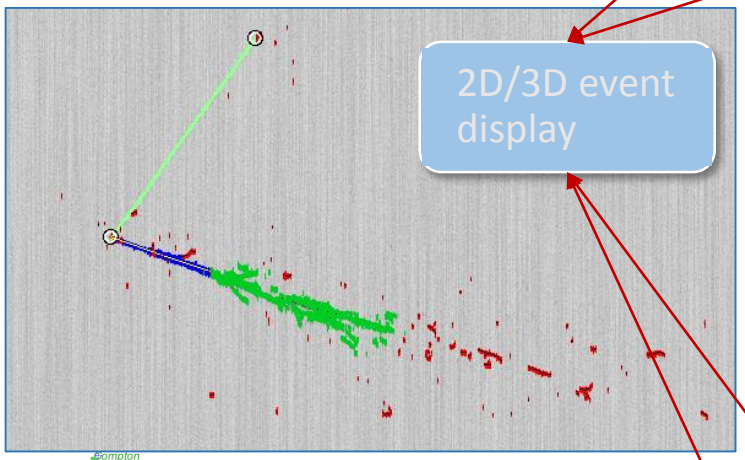
MC: FLUKA

Data

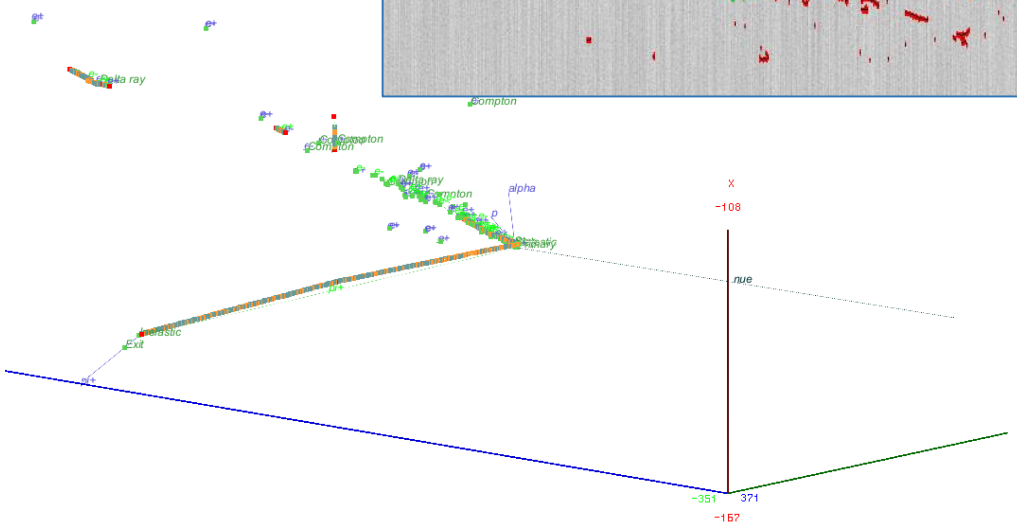
MC import interface

Data import interface

We use event display **a lot in the algorithms development**.
- very specific code, not the priority of the integration.



2D/3D event display



Reconstruction / Analysis modules

- integrate as modules:

producers: clusters, tracks, cascades

analyzers: PID, …

- start from reco-hit level

Reconstruction

closely coupled

Analysis

2D reco parts

Hits: fitted pulse shapes.

- peak position
- pulse begin/end range
- charge / energy

- specific to the electronics,
- the same basic information in LarSoft
- hit finding not priority of integration

Clusters – the segmentation algorithm.

- relies on hits 2D configuration (wire/drift in [cm])
- strict segmentation + merging
- track / cascade separation based on cluster features
- independent in each plane, interplays with 3D
- a lot of analysis done at this stage (*before* 3D)

quite standard requirements:
hits on 2D in [cm] domain

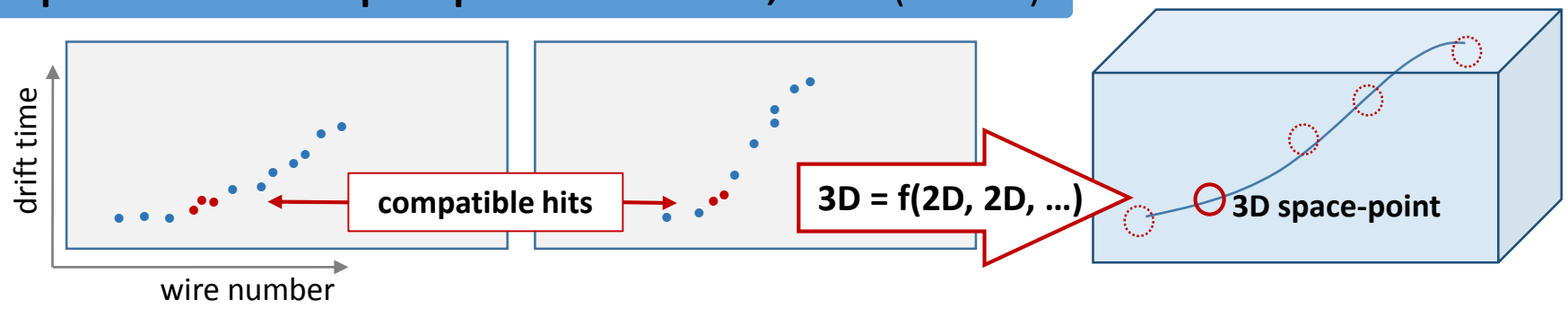
Raw 2D data.

- image processing – alternative approach
- sudies started, worth implementing in LarSoft when matured

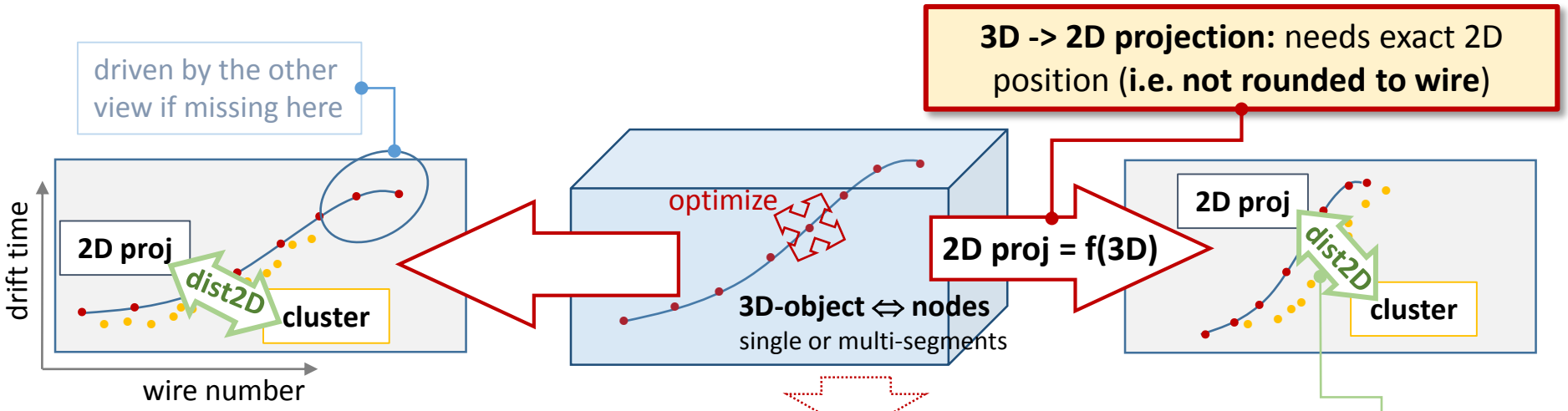
needs acces to wire ADC or better:
deconvoluted wire waveforms
probably not difficult in LarSoft

3D reco

Multiple 2D hits -> 3D space point -> 3D tracks, etc. (LarSoft)



Build / optimize 3D to minimize: Σ dist2D(proj – cluster)



- **no need for hit-hit assoc.** between 2D planes
- assoc. whole clusters -> opt. 3D -> validate 2D
- find and conect 3D structures -> reopt. 3D...
- **track dE/dx** -> quenching, PID, energy, ...

3rd plane 2D: used for validation

Possible contribution to FastMC

Simulation in LAr

- ν interaction on Ar, particles propagation in LAr – done in FLUKA.
- Dimensions of T600 – not exactly the CERN prototype, but we can simply limit the size.
- Easy to perform some MC crosschecks, *but* not everything is available in the output.
  - Full MC truth on primary vertex and reinteraction vertices up to some energy threshold; overall values of deposited energy, etc – **OK**.
  - Detailed trajectories – **OK** if we use isolated tracks,
  - dE/dx truth along the track – **NO**. (but **OK** on reco level!)

Detector simulation

- Projection to wires, electronics, noise – all very accurate, but specific to the T600 configuration.

Possible contribution to FastMC

Reconstruction / PID

- **Charge** will be based on Collection only or also on Induction planes (for dE/dx)?

- **Stopping particles via dE/dx:** p / K / pi+mu – efficient, pi / mu dificult: limited by the detector calibration requirements (<3%!),
- **μ signature** used in analysis: track with no inelastic interactions > 2.5m, then pi contamination ~3%; studies done on stopping muons from data – pi/mu id.
- **Stopping μ energy** by the calorimetry better than range. **Stopping proton energy** well understood, also the energy of reinteracting protons can be reconstructed.
- **Electron / gamma**

Angular dependencies

- W.r.t. the wire orientation (only Collection?)
- W.r.t. the drift direction;
  - deconvolution: S/N important, well known impulse response shape

Ask for plots – we can have them or produce on time.