Hot topics in software development

The software todo list…

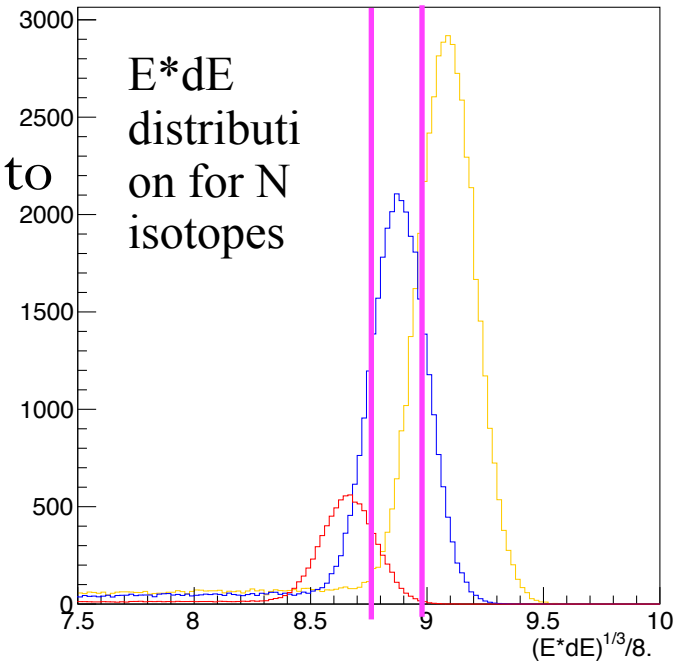
- Beside the development of the "single detectors" DAQ, simulation and reconstruction algorithms… there's already a list of topics of "high level reconstruction" interest, and hence the combination of information from multiple detectors, in which some work should start ASAP (since it will affect the assessment of the global FOOT performances):
  - Fragment identification
  - Global event reconstruction: forward tracking & global event fitting
  - Information matching in trackers: software inter-calibration strategies
    - Detector positioning and calibration….
  - Out of target fragmentation
  - Beam monitoring and pileup

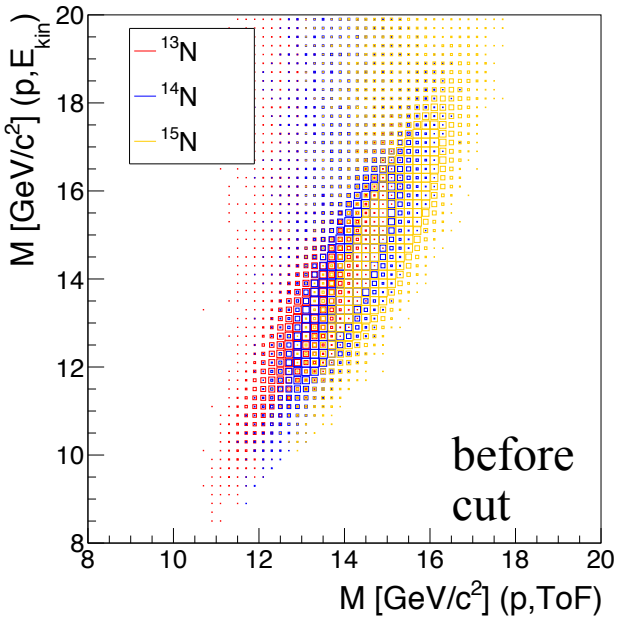
Fragment ID

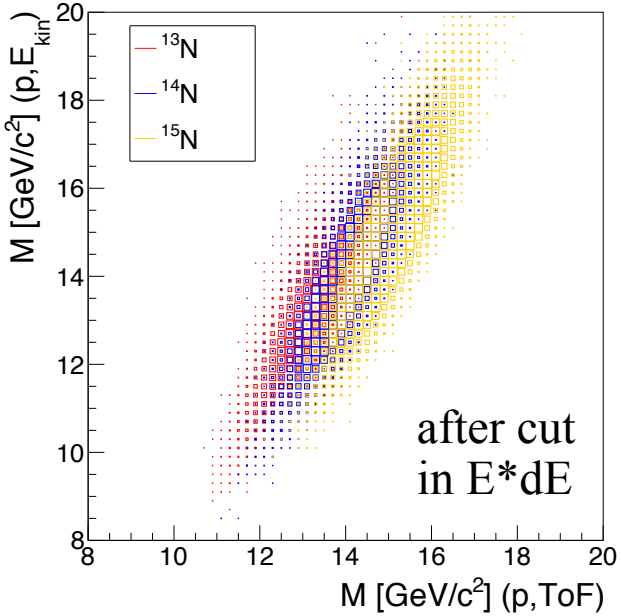
- There is a lot of information from different detectors that can be exploited to identify the charge of the fragment and its atomic number:
  - The size of the cluster formed in the VTX detector (helps separating high and low Z fragments)
  - The dE vs ToF released in the calorimeter/scintillator
  - The mass of the fragment, that can be reconstructed using several different / paired quantities:
    - Ekin, ToF, dE*E
- While the task is relatively easy for low charge fragments, when dealing with high Z, everything becomes more difficult.
  - Strategies (MC based) to account for cross-feed subtraction in the cross section will have to be defined.

Identifying Isotopes..

- The invariant mass (built using p, ToF) has a reasonable discriminating power only at "low" Z… For high Z the correlation with other variables has to be exploited…
  - p, Ekin and E*dE are two options… Quantities that are highly correlated t.
- Full reconstruction study is needed to identify the best strategy.







- Other variables, with more limited discrimination power could be exploited as well (cluster dimension in VTX detector, etc etc)

Global event reconstruction

- Once the basic building blocks are available (track in BM, vex + tracks in VTX tracker, track in tracker after 2nd magnet, hits/clusters in scintillator, hists/cluster in calo) an attempt has to be made to pair the info from the detectors, using a forward tracking algorithm and hence….
  - For each global track candidate we need to exploit in the smartest way the combined information that we have! ToF, Ekin, dE, cluster size, momentum, MS…. In this way we can profit from the redundancy and achieve a significant improvement in the fragment 4mom measurements, a crucial ingredient to keep the Ekin resolution below the limit set by our bio friends!
  - MultiVariate tools have to be explored to understand the impact of the different observable knowledge on the final performance achievable by FOOT.

Detectors intercalibration

- The impact of relative mis-positioning of our detectors on the global performances has to be assessed: this will give us an important feedback on the alignment strategies that we will have to put in place before, "during" and after the datataking…
  - Before: requirements on the mechanical precision that has to be achieved
  - During: dedicated calibration runs, with special beams/magnet/target/energy/ beamspread configuration to validate the alignment
  - After: dedicated survey of the experimental apparatus to Xchk and self -alignment procedure.
- This work is eagerly needed as it will put the basis to the common handling of the full FOOT geometry … Care will have to be taken in preparing a design suitable for handling the data decoding and MC (either in **production** and in decoding)
- The geometry implementation for MC production will need to proceed in parallel with MC developments…

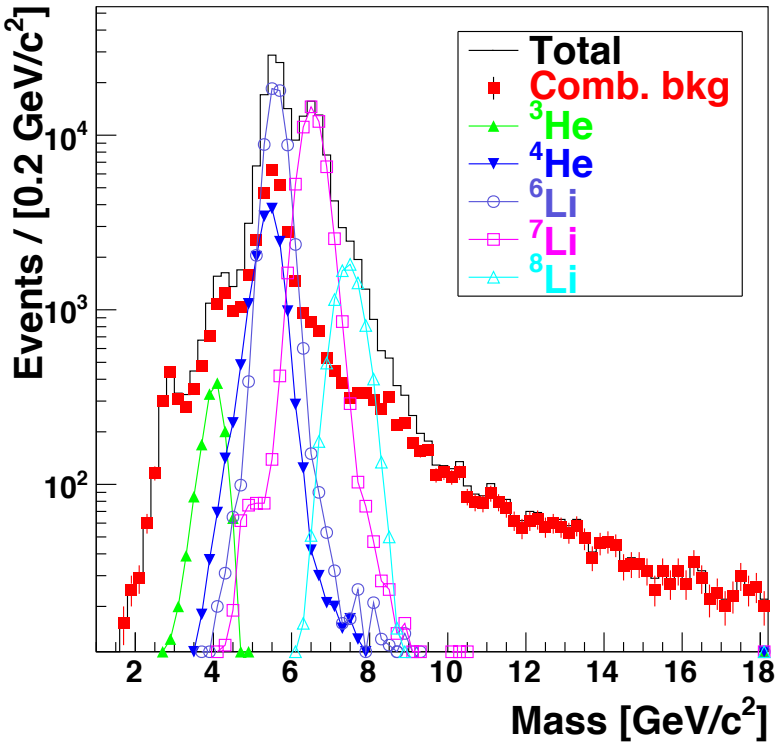
Calibrations

- Besides the positioning other detector calibration strategies will have to be defined, on the basis of the detector characteristics
  - Eg. : for ToF/energy equalization calibration runs in which fragments are produced directly on the scintillator or on the calorimeter will be needed, or calibration runs in which we can "paint" the scint+calo system with a particle beam in which no fragmentation occurs.
  - Runs without mag field will be needed as well for detector intercalibration
  - etc etc

Pile up/comb bkg. handling

- The impact of pile up events in the "slow" VTX detector has to be accounted for with a dedicated simulation. A strategy was developed in FIRST to account for such contribution, but we have to re-discuss it from scratch starting from the discussion of the VTX detector simulation detail that we want to reach. In all cases the coding will have to start from scratch as the old vex simulation is no longer functioning with the newest FLUKA.

- The study of pileup events, and the handles to reduce their impact using the VTX detectors alone or in combination with other detectors, has to proceed in parallel with the study of "out of target fragmentation events", that will contribute to the "combinatorial" background of candidates formed by the global reconstruction…



Resources and organization

- The L0 and HL reco task will need to start from a "blessed" and "constantly updated" sample of MC events that will be produced centrally (where?) and documented (in the Twiki pages?)
- As L0 classes rely on the info available in the MC tree output, the interplay of a new release of MC events and the related MC classes for decoding is important…
- It is important to discuss: where do we want to keep the events and how to make them available to the people that has to run its own code… And how to organize the code and event release in a synchronized way….