SiTrack performance on collision data

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Intro

Contents:

- studied recent collision runs with Silicons and solenoid on: focus on run 141811
- analysis performed with TrigInDetAnalysis trunk using SG containers: this is OK for reprocessed data, where FullScan instances are executed from each L1 trigger
- efficiency and resolution preliminary measurements are used to get an idea of the quality of the alignment and SiTrack robustness to misalignments
- a first attempt at tuning SiTrack on data is presented

Efficiency normalization - two different selections for offline tracks have been adopted:

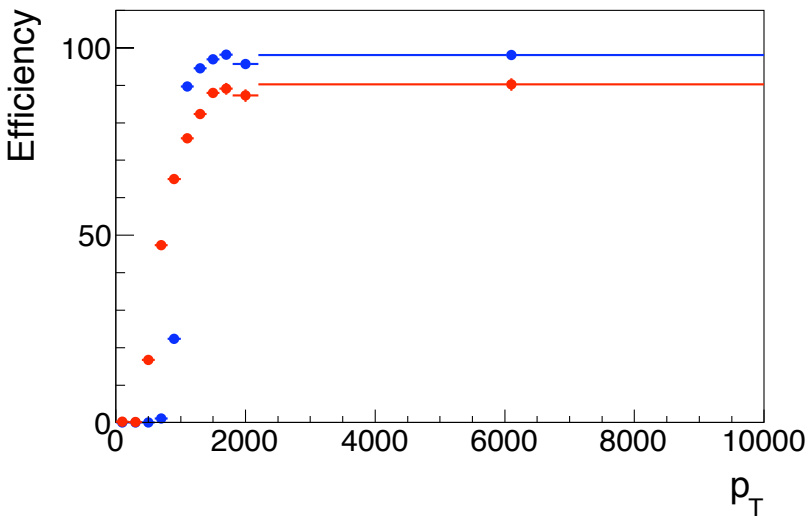
- good tracks: at least 14 Si hits and 1 pixel
- medium tracks: at least 8 Si hits and 1 pixel (used in the following)

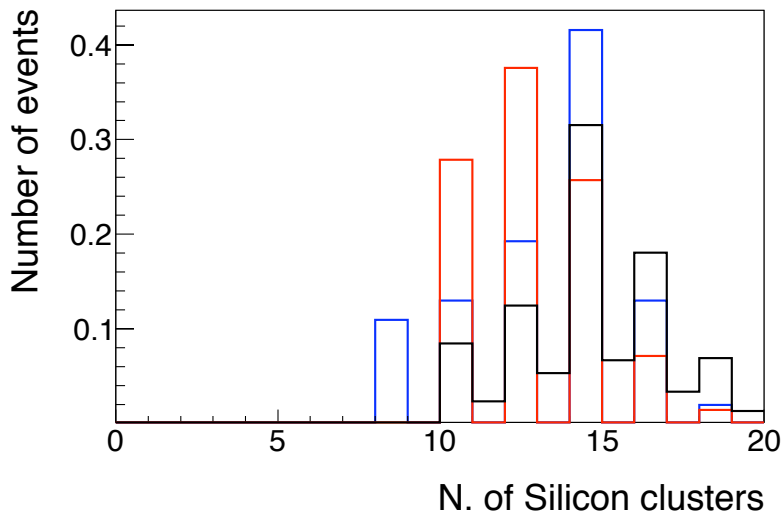
Samples:

- central reprocessing ESDs for run 141811, LB from 126 to 165, tag c1419
- privately produced ESDs for same run and LB, starting from RAW data for events containing at least one offline track with $|p_T| >$3GeV
- few events (22) in which an offline candidate electron track has been found, but for which SiTrack finds no tracks

Efficiency w.r.t. Offline

Evaluating efficiency on run 141811, SiTrack (in red) appears to be less efficient than IDScan (in blue) when reconstructing medium tracks.
This discrepancy can be traced back to the lower hit efficiency (can be desumed from the comparison of Si hit distributions), worsened by the fact that SiTrack requires at least 5 Si spacepoints on each track.





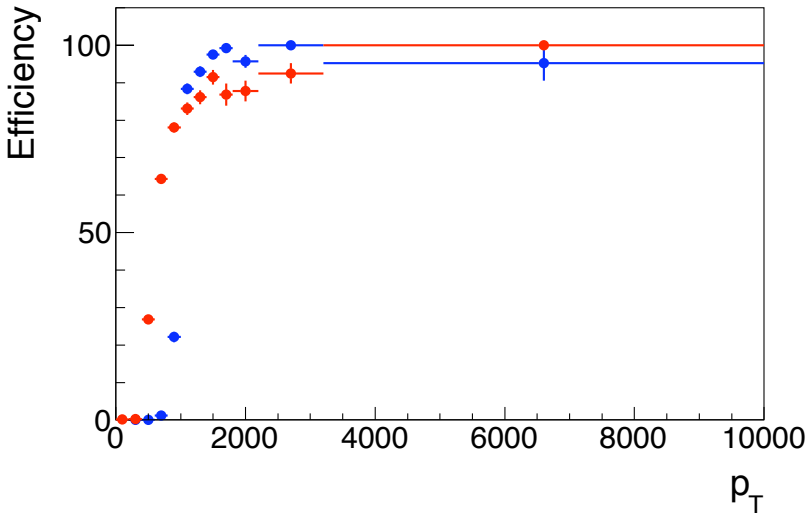
Residuals w.r.t. Offline

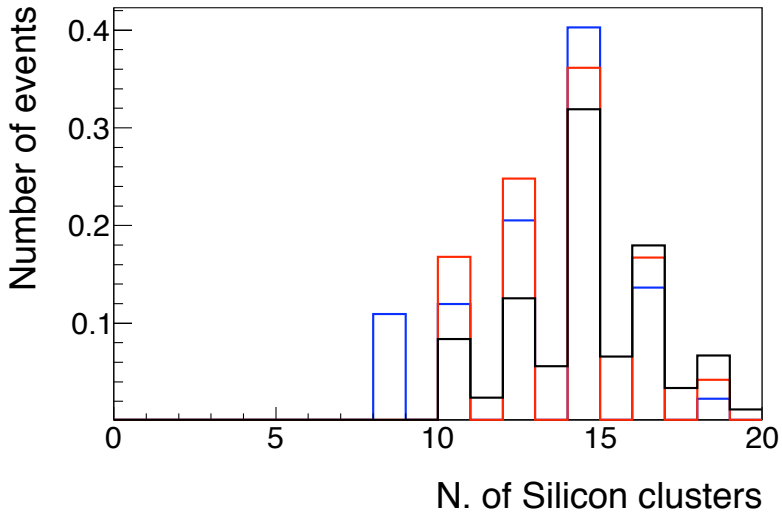
From first investigations it turned out that the lower hit efficiency is due to a low effectiveness of the internal triplet merging. Most likely cause of this is a reduced ϕ and η resolution for triplets and intermediate tracks, probably due to poor alignment. To check this, we measured the residuals of online SiTrack tracks w.r.t. best-matched offline tracks, which resulted almost an order of magnitude than in the ideal alignment case

... plots to come ...

Efficiency w.r.t. Offline with Error Scaling

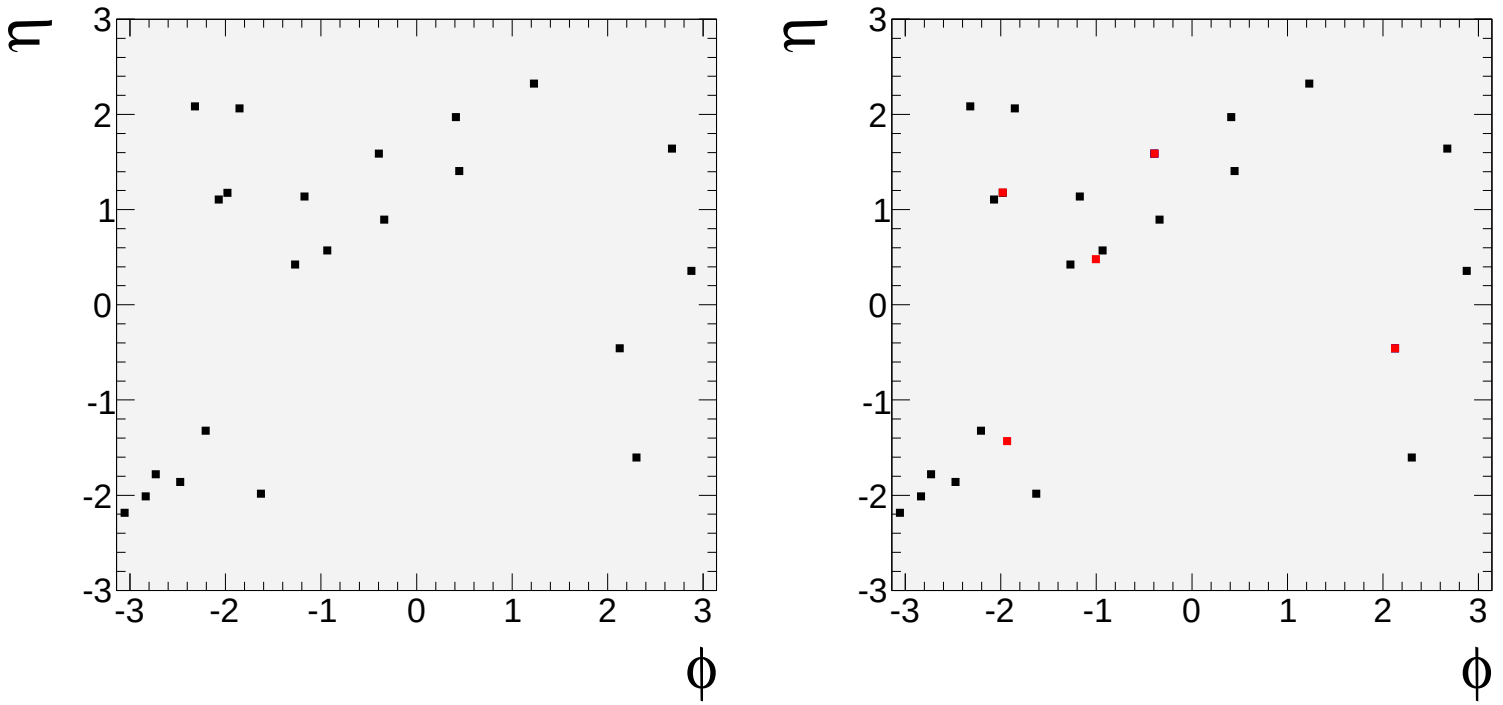
Applying the above rough estimate of η and ϕ residuals to the internal merging, via error scaling, we largely recover both hit and track efficiency





Missed Electrons

Applying the same enlarged cuts, some (5, in red) of the missed offline candidate electron tracks (22, in black) are recovered, even if, in some cases, with slightly displaced direction, probably due, once again, to misalignment effects



Summary and Outlook

Summary:

- track parameter resolution still seems far from optimal; examples reported for ϕ and η indicate large misalignment effects
- SiTrack shows some sensitivity to this misalignment level, resulting in lower hit and track efficiency, when confronted to IDScan
- this can be cured by applying error scaling to the internal merging procedure
- while a complete review of tuning parameters is still ongoing, a first rough test has been performed, demonstrating improved performance

Future studies:

- we will keep exercising our tuning procedures on the available collision data, to provide an optimal but not ad-hoc configuration of SiTrack instances
- as soon as available, we will monitor the effect of updated alignment constants
- once the expected alignment for restart will be assessed, we should provide a more robust tag and thoroughly test it, aiming at running it online