UNIVERSIDADE FEDERAL DE JUIZ DE FORA

PPEE
Programa de Pós-Graduação em Engenharia Elétrica UFJF

Directional-iDBSCAN

a proposal to CYGNO

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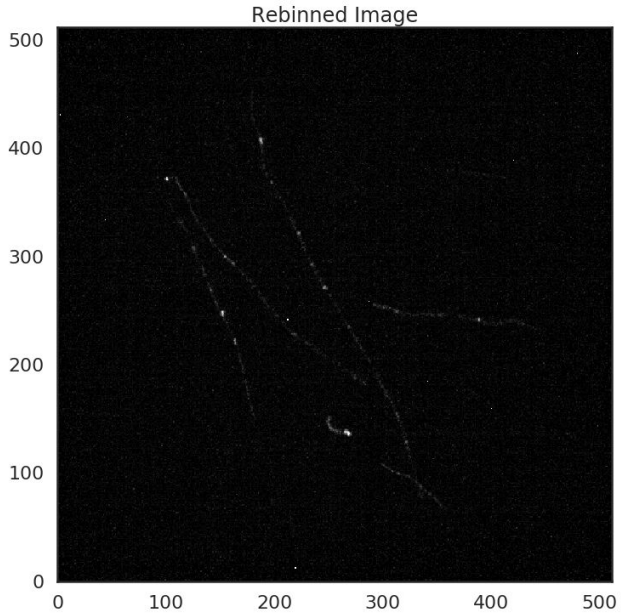
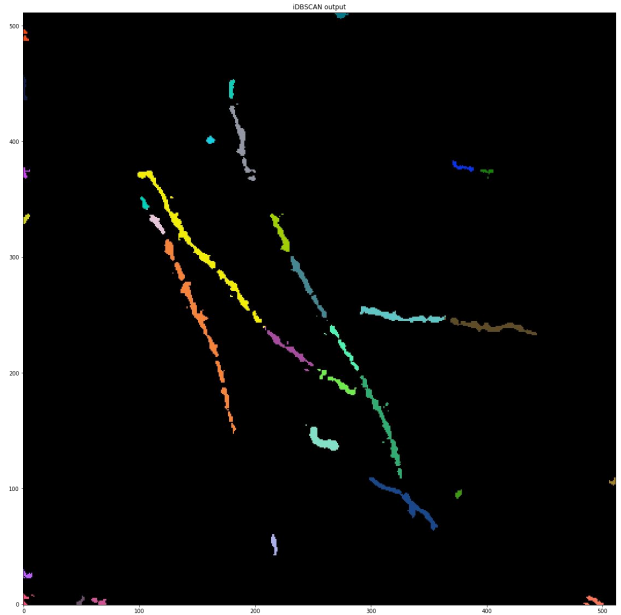
Last presentation

- More images were analyzed to have a visual feeling about the iDDBSCAN behavior in some particular cases, as overlapped tracks.
- Analyzed runs: 2097 and 2098 (“Dollar Trillogy” - 60/40 mixture); 2317, 2318 and 2320 (70/30 mixture).
    - The “Dollar Trillogy” runs had the same behavior as the run 2065.
    - The 2300s had a slightly different behavior, such as more tracks per events, including overlapped cases.

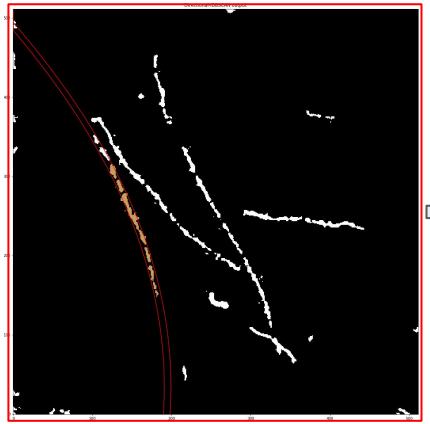
Run 2317 - Event 05



In this example the tracks aren’t so faint, so even being unable to find the entire tracks, the iDBSCAN output works well as the iDDBSCAN first step.

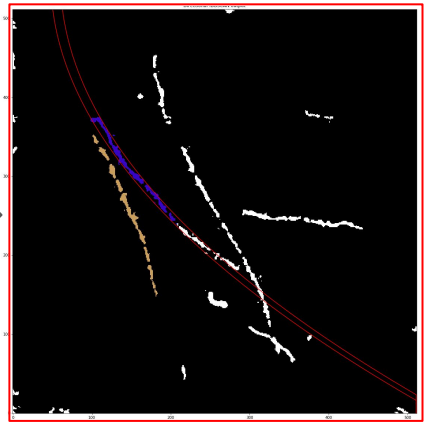


Run 2317 - Event 05

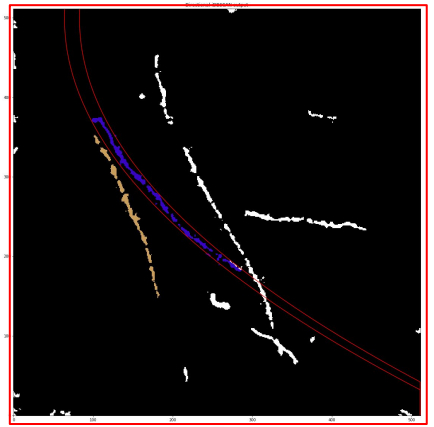


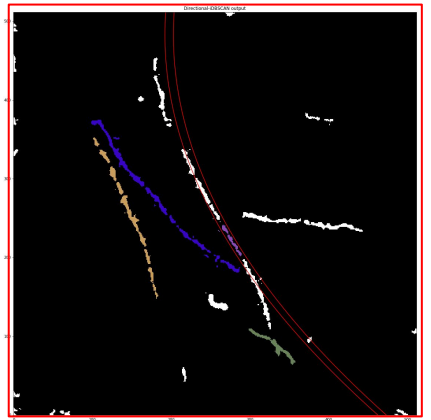
Starting from a cluster with a good fit model

Only one directional search was enough



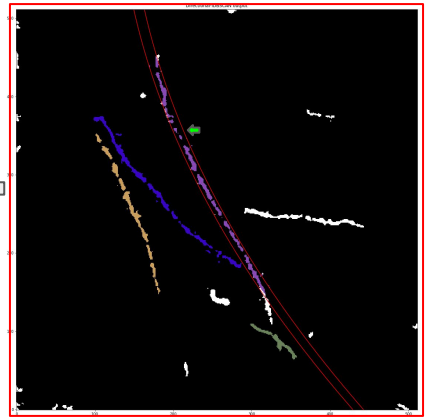
The next one needed more steps to finish





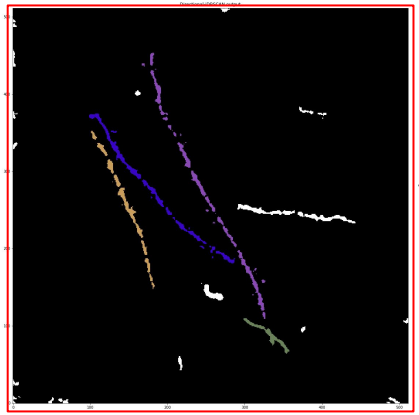
The last long track started from a small cluster

It found points previously marked as noise that belonged to this track[1]

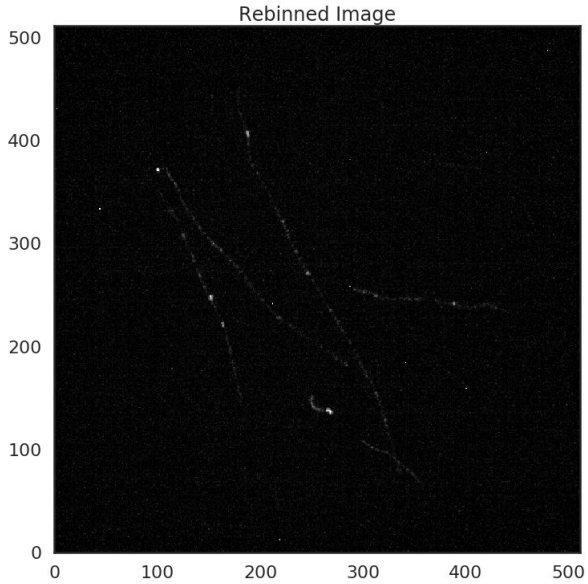


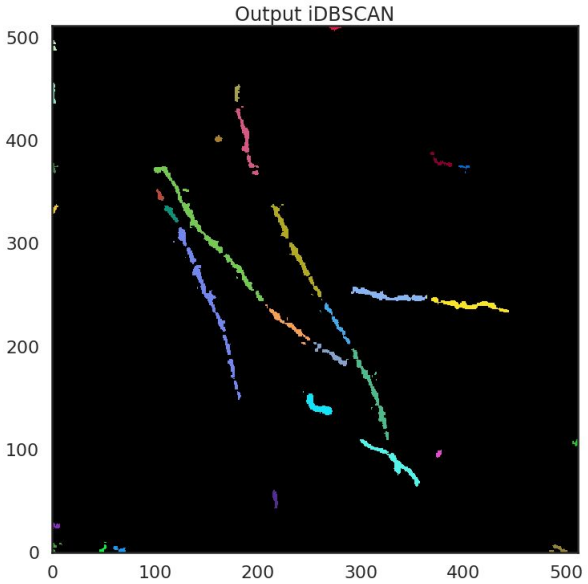
Here the directional search ends

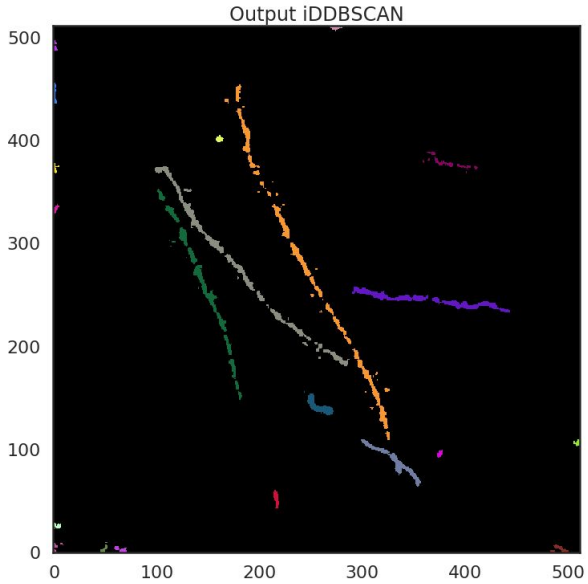
The other clusters will be found without directional search



Run 2317 - Event 05

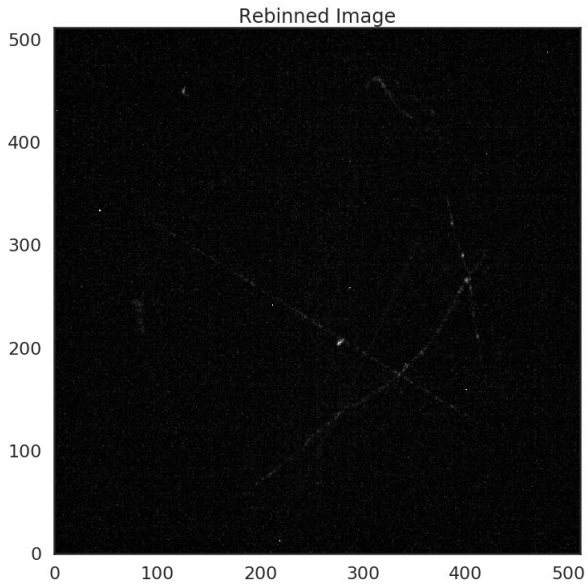


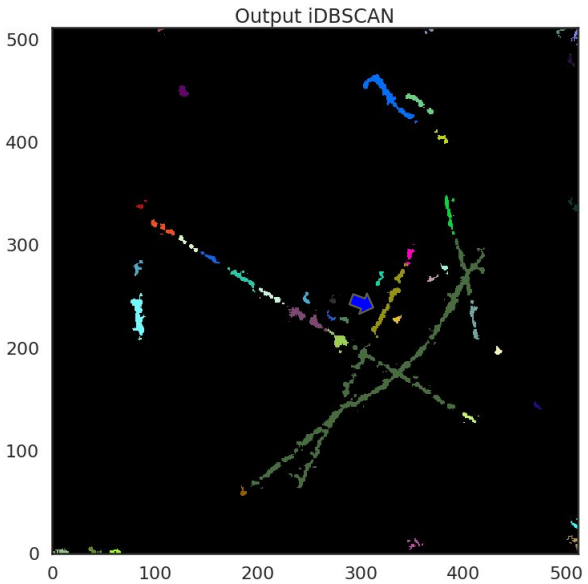


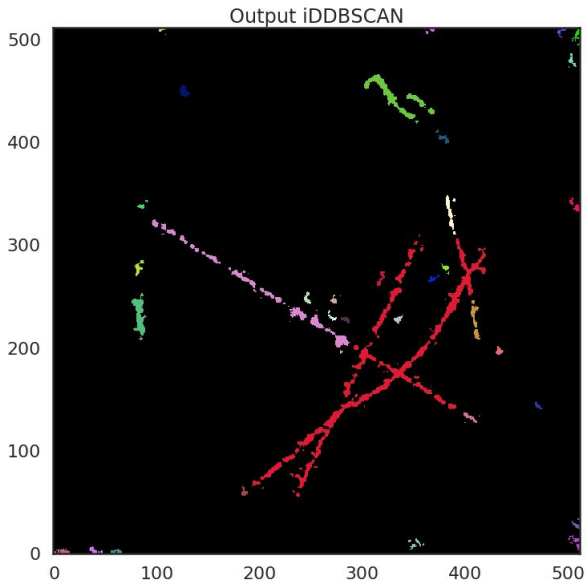


Here is an example of the iDDBSCAN working on non-overlapped tracks

Run 2320 - Event 24







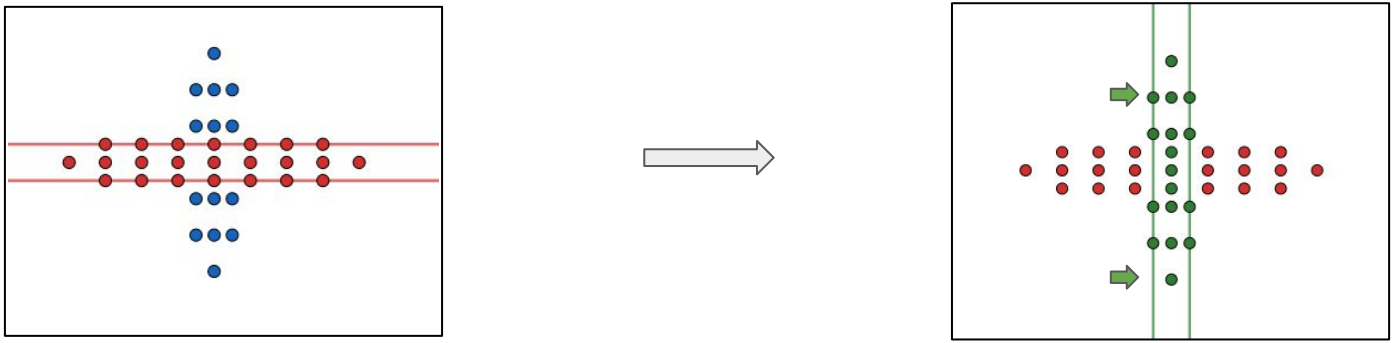
Here is an example of the overlapped tracks in the 2300s runs - As expected, the iDDBSCAN is pretty sensitive to the primary clusterization of the iDBSCAN.

Conclusions and agreed tasks

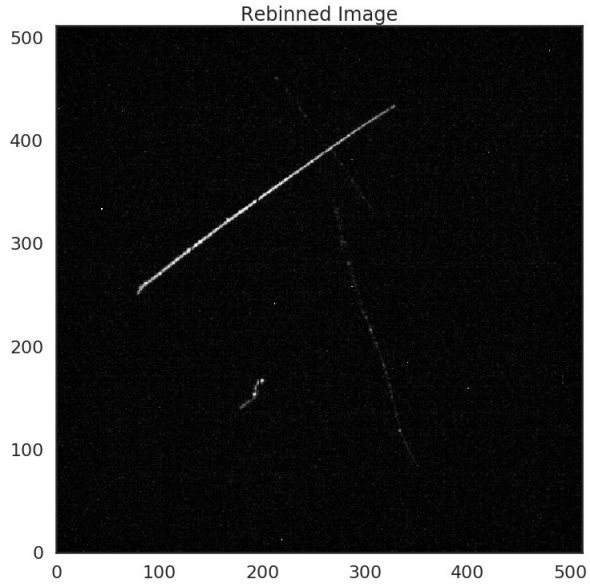
- The algorithm has good results on events with faint long tracks that the iDBSCAN can not recognize
- Events with overlapped tracks, in the best scenario, will only have part of the tracks recognized.
    - Emanuele’s suggestion: Modify the algorithm in order to separate overlapped tracks.

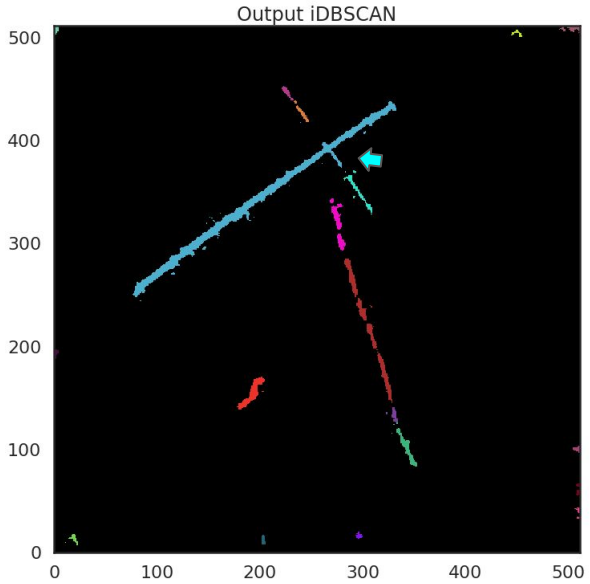
Modifications in iDDBSCAN

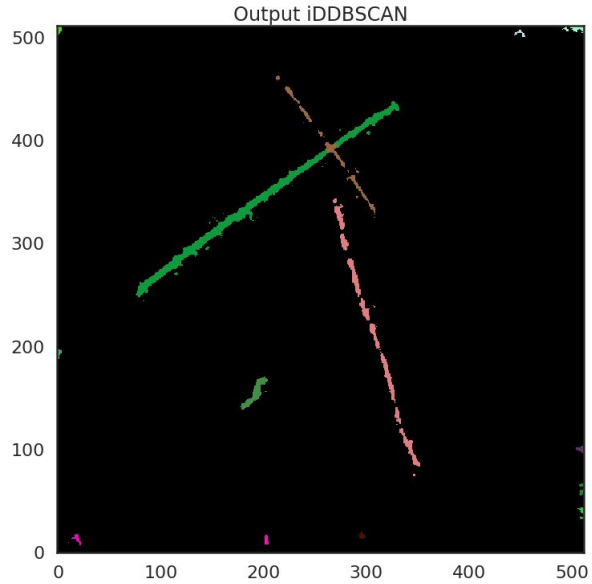
- The step responsible to put together close clusters ignoring the RANSAC fit was deleted.
- Points previously classified are now eligible for new clusterization.
- Clusters with less than 30 points are deleted.



Run 2317 - Event 38

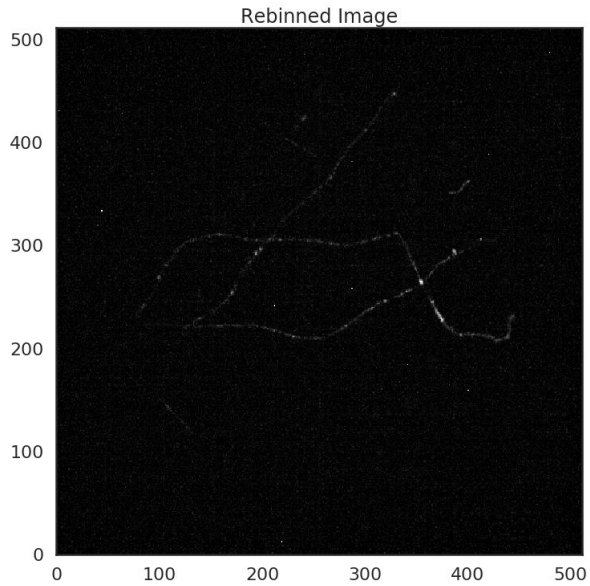


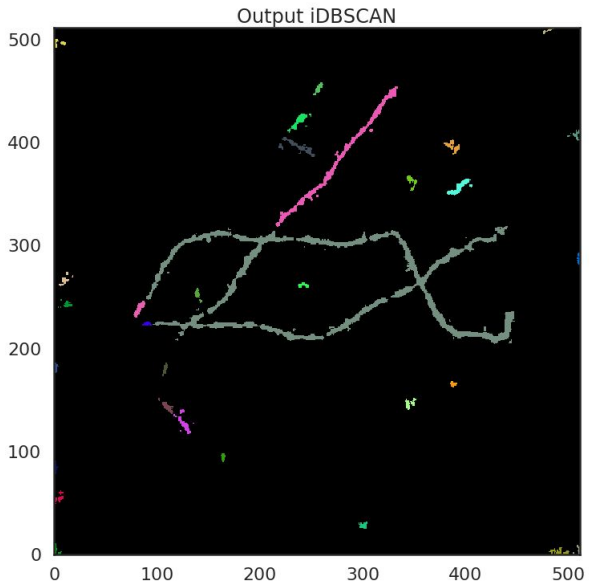


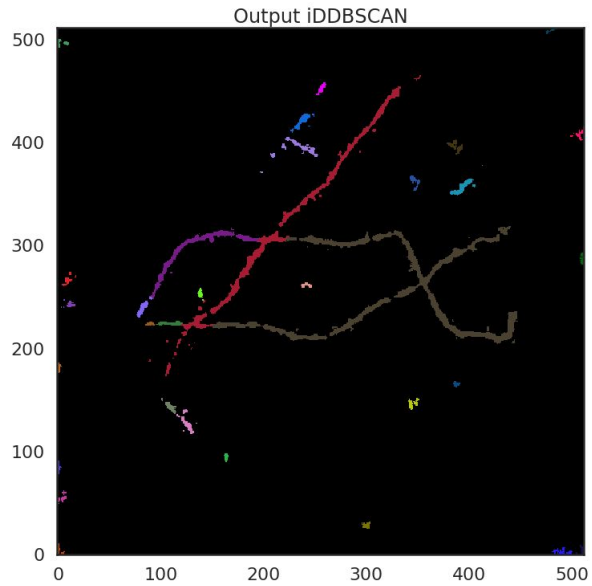


The algorithm works fine when the tracks are well defined, even if they are overlapped

Run 2317 - Event 22

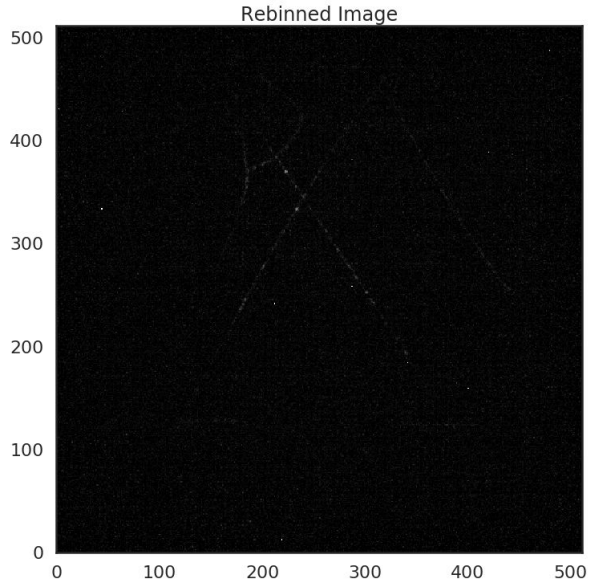


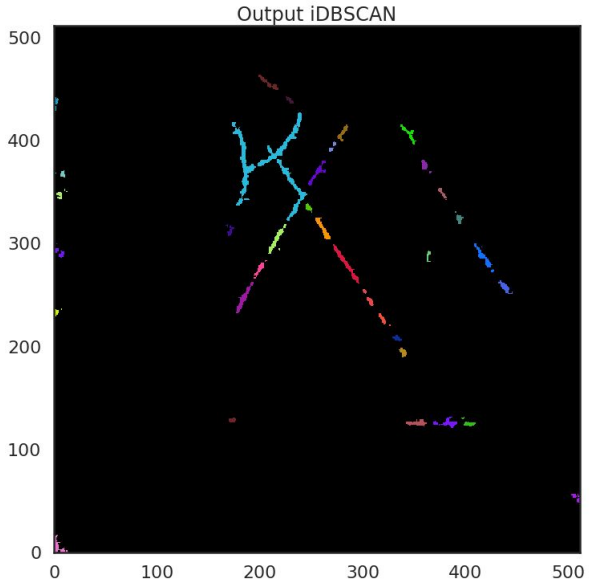


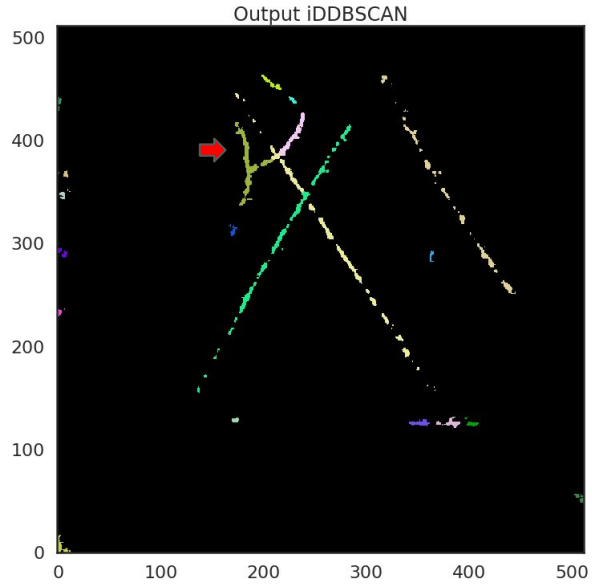


In this case, the algorithm could only find one long track separated, since it still depends on the output of the iDBSCAN

Run 2320 - Event 21

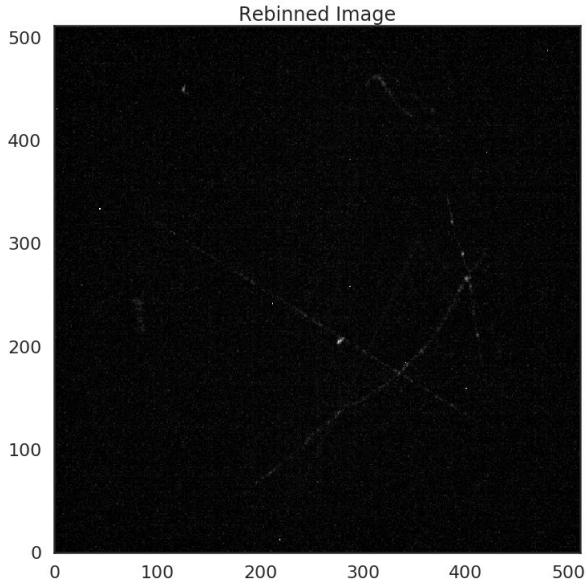


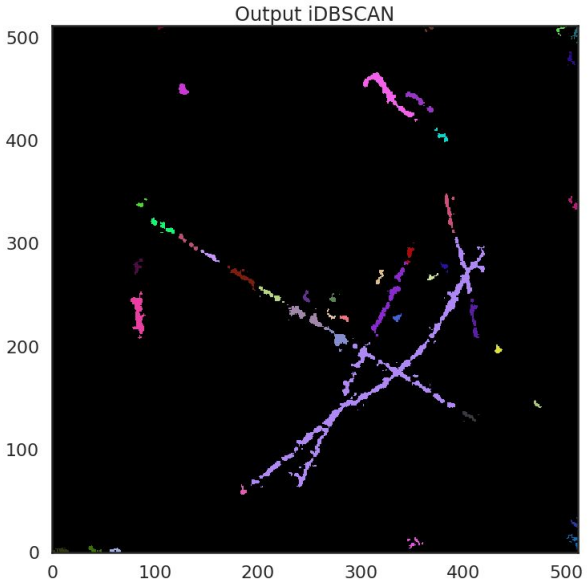


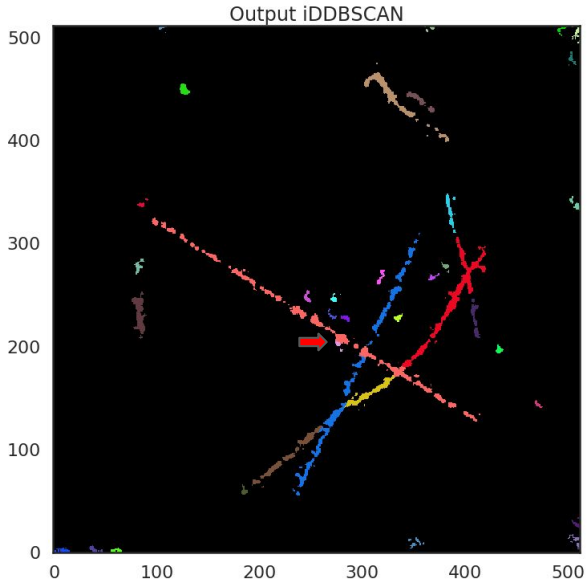


Only the tracks that can be explained as polynomial of degree up to 3 can be recognized

Run 2320 - Event 24

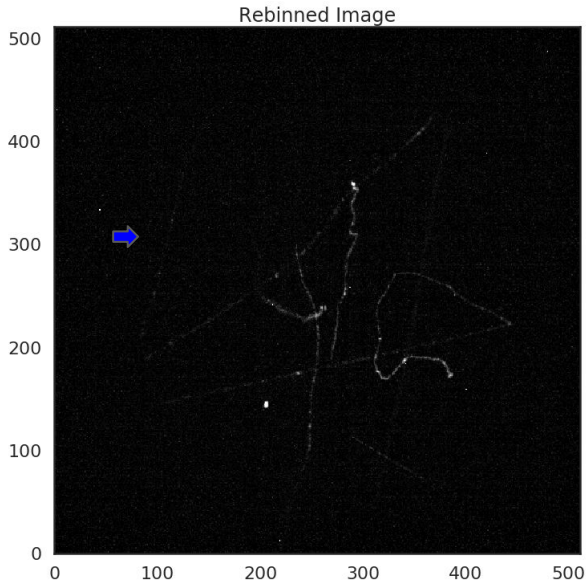


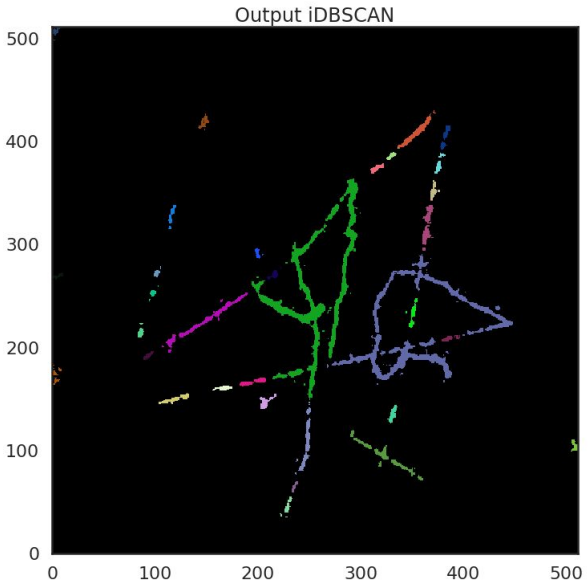


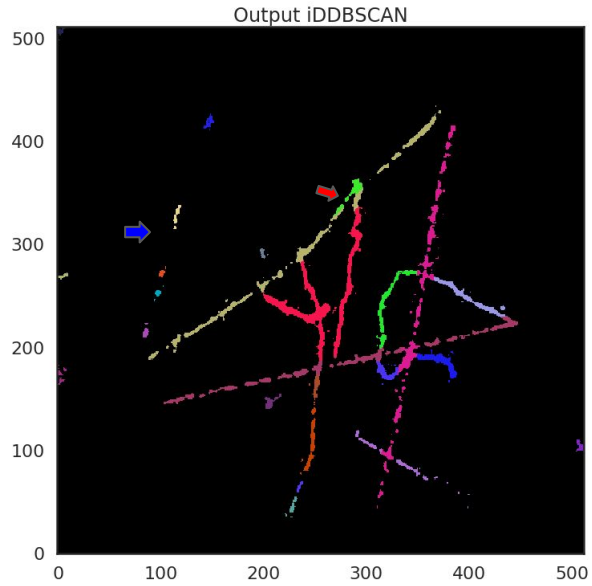


Only 2 of the 4 long overlapped cosmic tracks could be recognized here.

Run 2317 - Event 28

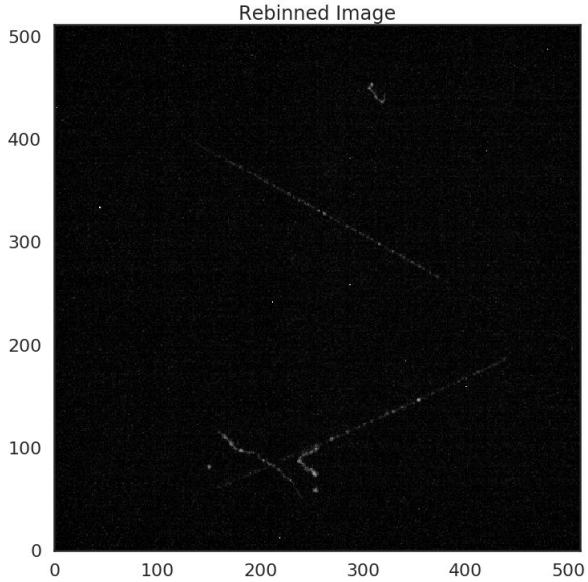


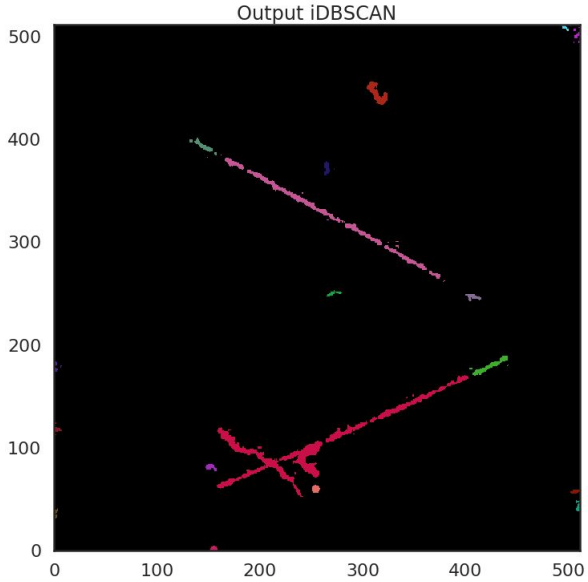


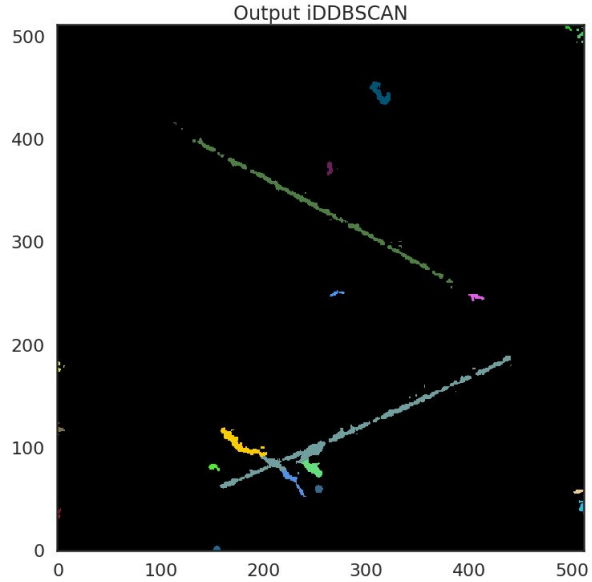


If the ransac can not find a model of the splitted tracks or the track does not respect a polynomial model, the result will not be the expected.

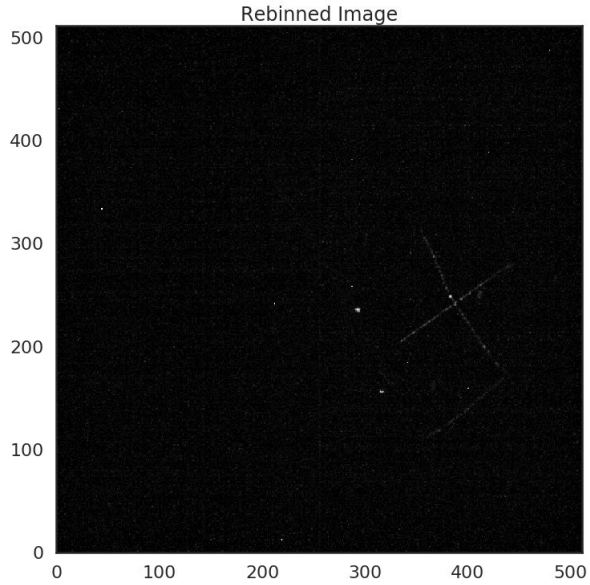
Run 2097 - Event 42

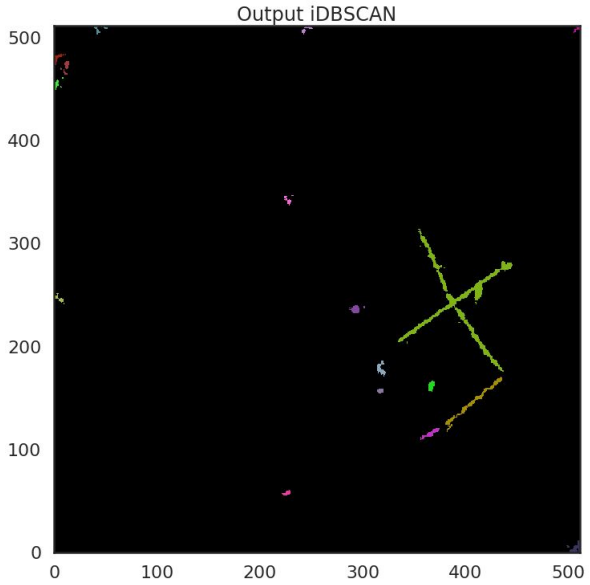


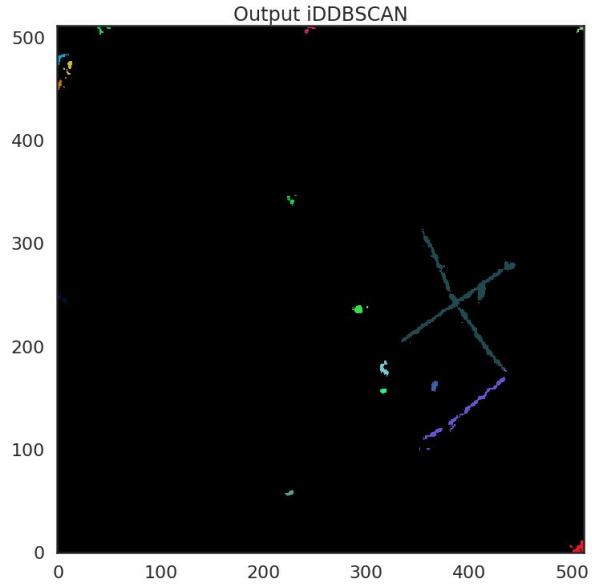




Run 2097 - Event 170

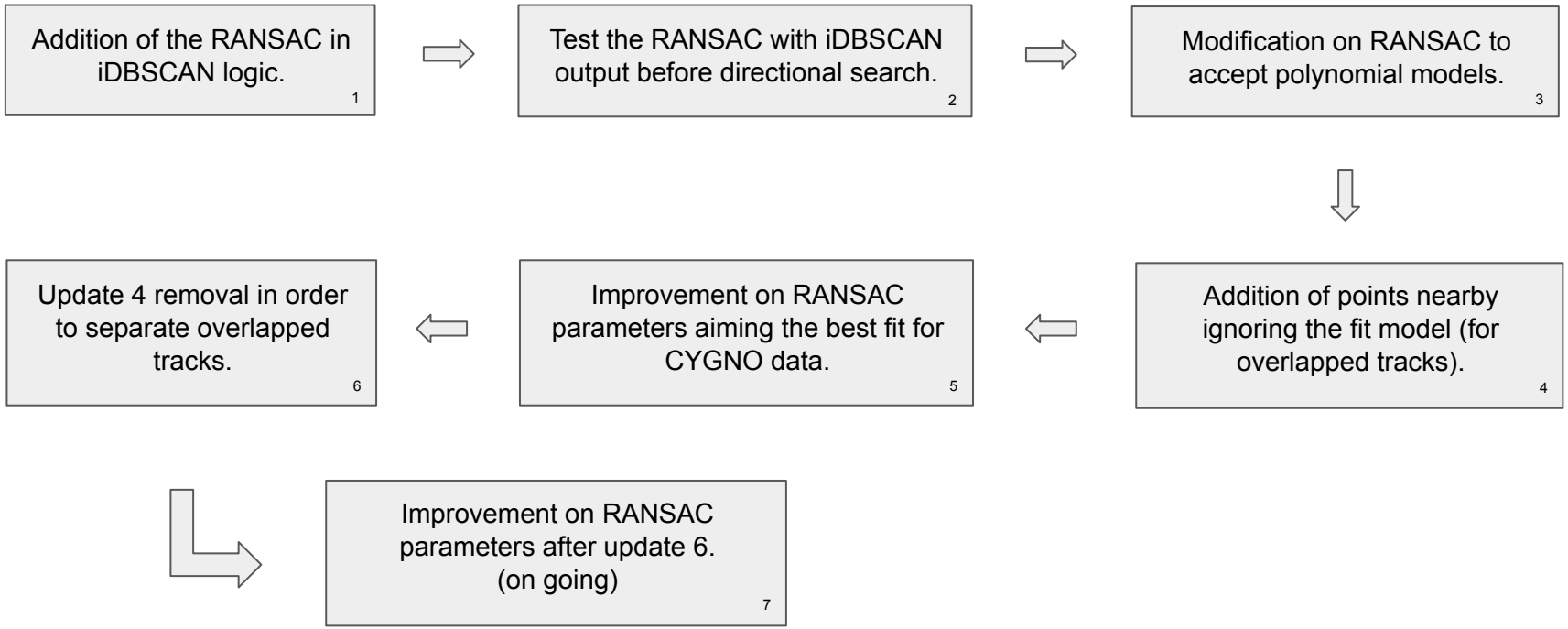






If the iDBSCAN output is compromised, the directional search will not solve the overlapped problem.

iDDBSCAN’s evolution



Next steps

- The “Dollar Trillogy” and 2300s runs needed slightly different parameters to work well.
  - The idea to solve this problem is refine the RANSAC fit model.
- See how this iDDBSCAN works with the supercluster.
- Optimize the algorithm to speed it up.