Connecting the dots

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Flash talk @ UU

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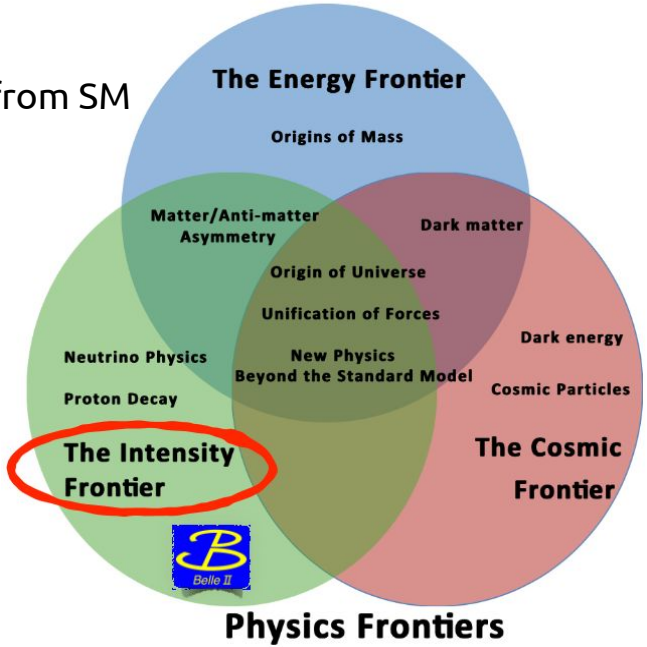
Hunting for New Physics

Belle II: particle physics experiment that belongs to the *Intensity Frontier*
New Physics (NP) is searched in:

- ➢ very high-precision measurements to detect (tiny) deviations from SM predictions produced by virtual New Physics particles
- ➢ SM-forbidden processes enabled by the presence of virtual NP particles in box / loops / …

What is needed at the intensity frontier?

- ➢ A larger dataset to minimise statistical uncertainty
- ➢ Keep systematics under control



Belle II
SuperKEKB
e+ e- collider at √s ~ 10 GeV
Y(4S) mass energy

27 countries
123 institutions
>1000 members
Belle II

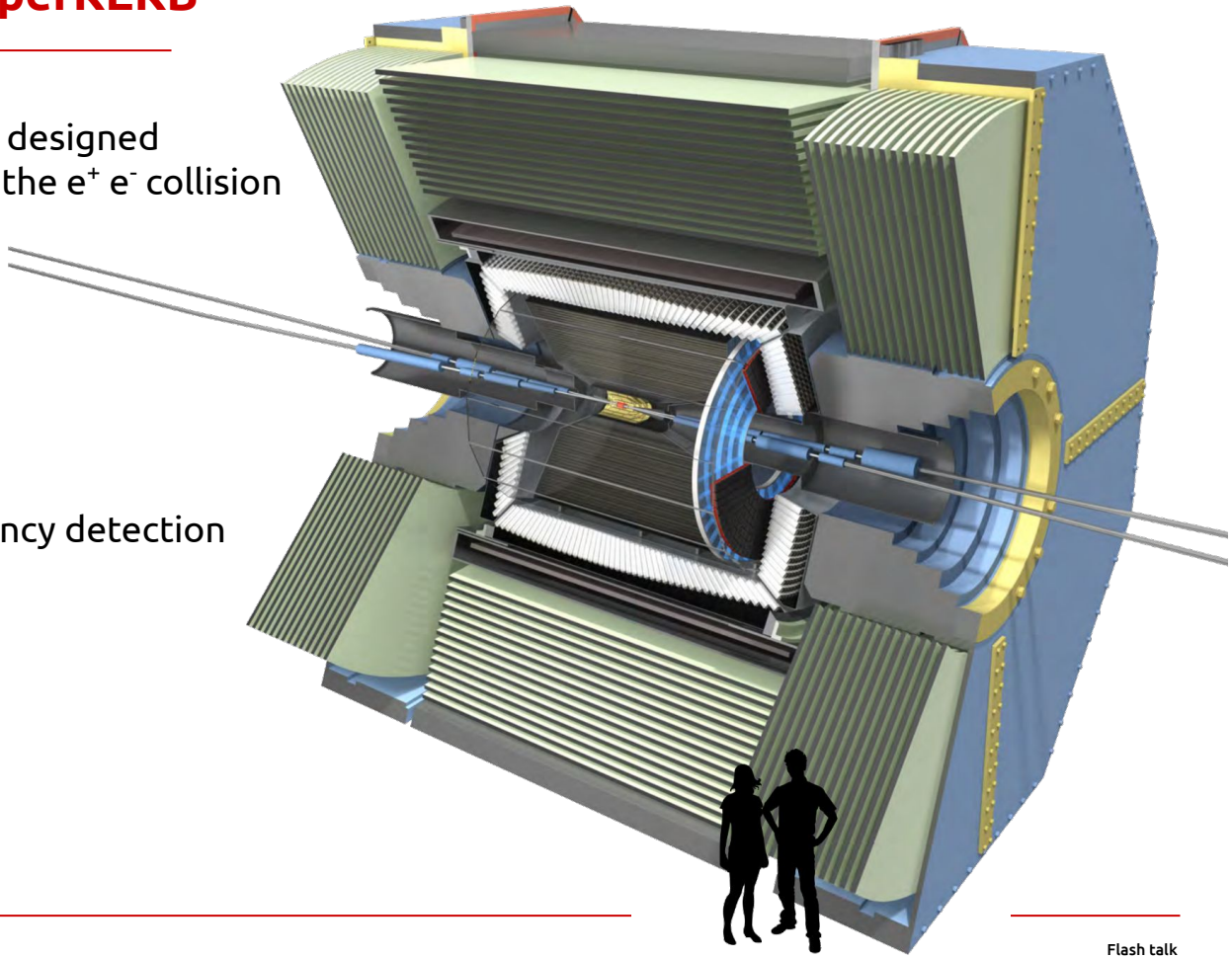
Belle II experiment @ SuperKEKB

Belle II: multi-purpose detector designed to reconstruct *all** particles from the e^+ e^- collision

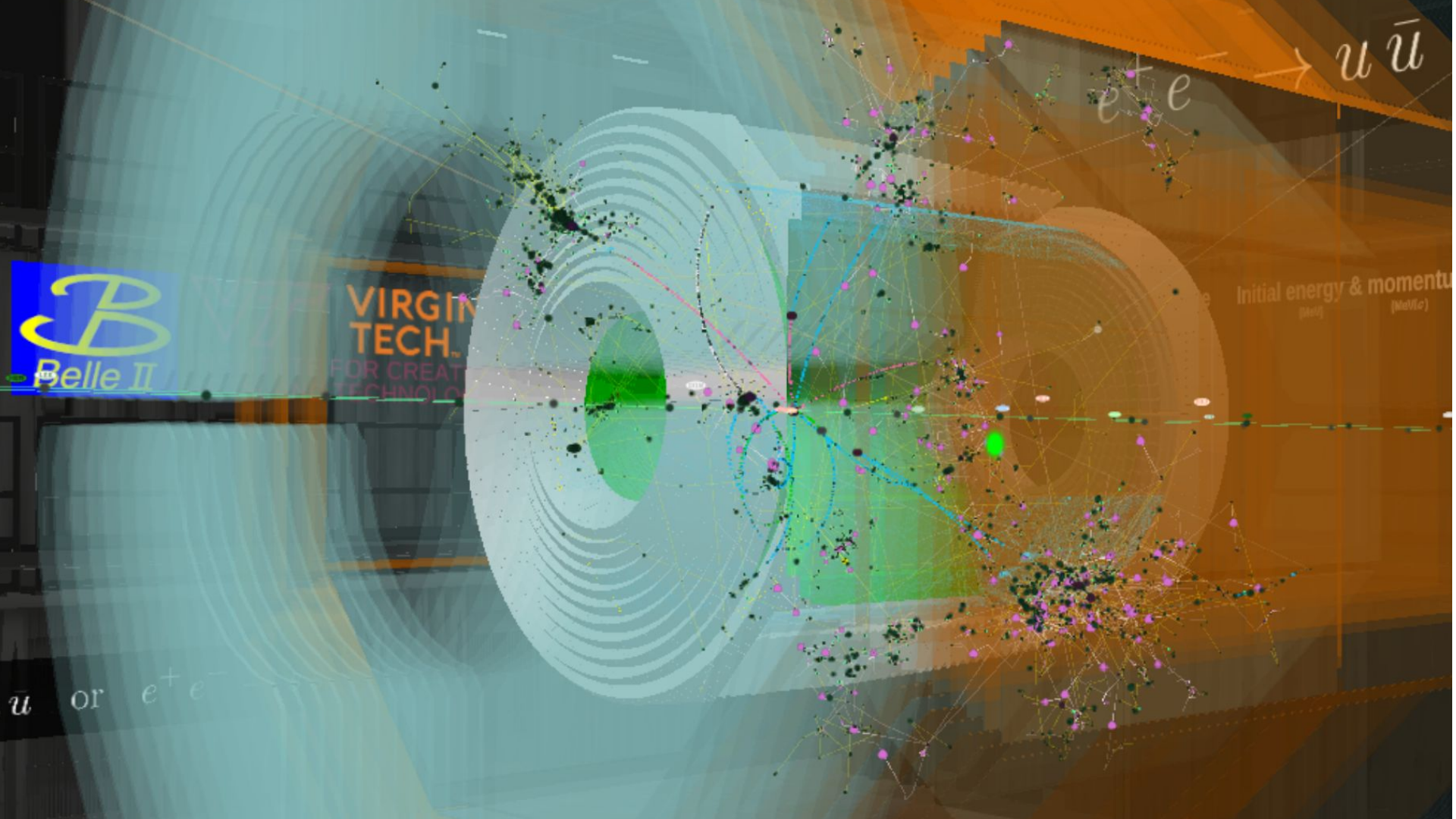
Well suited for inclusive analyses & missing energy measurements

➢ 90% solid angle coverage & known initial state

Excellent vertexing & high-efficiency detection of neutrals (γ, π0, η, η', …)



(*) particles that interact with the detector


$e^+e^- \to u\bar{u}$
Belle II
VIRGIN
TECH.
Initial energy & momentu
u or e^+e^-

“A bit like reading
tracks in the snow”

Detectors are giant 3D cameras.
We compare what comes out from the collisions (data) with the expectations (what we know, new physics models, etc.)
A bit like reading tracks in the snow
ATLAS
EXPERIMENT
15/02/2024
R. S. Gonzales
Celsius symposium

From Nature to Dots

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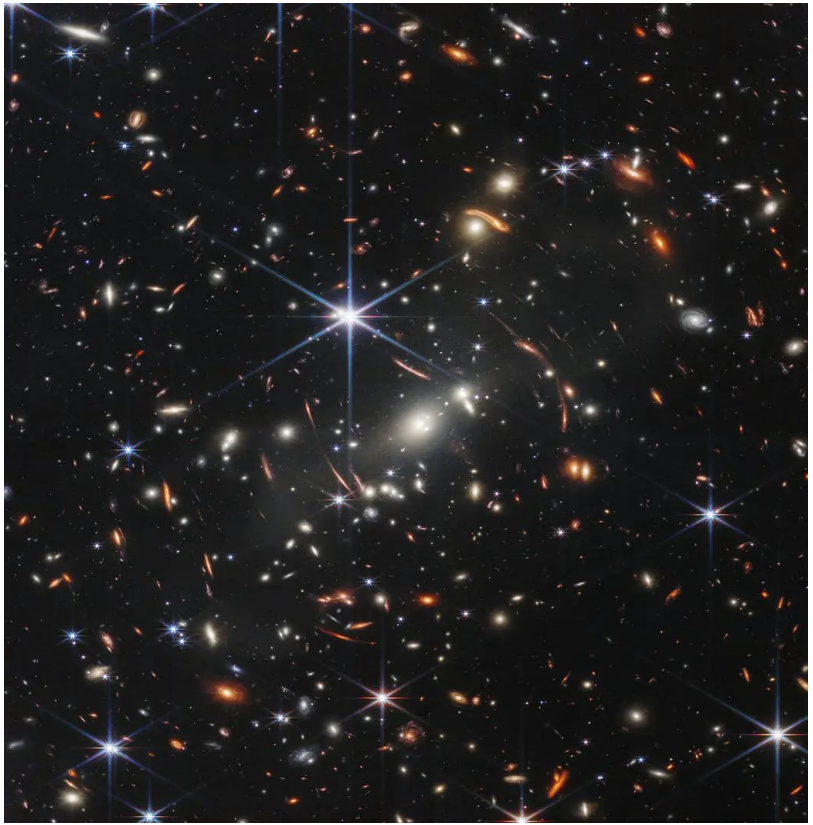

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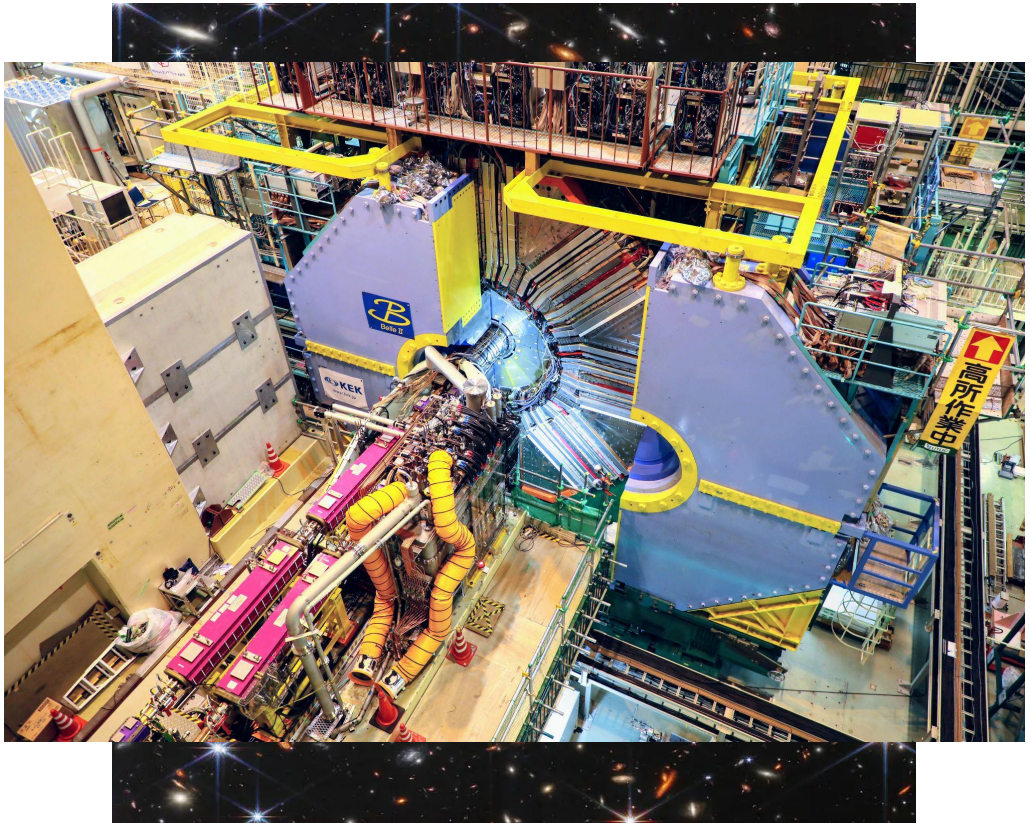

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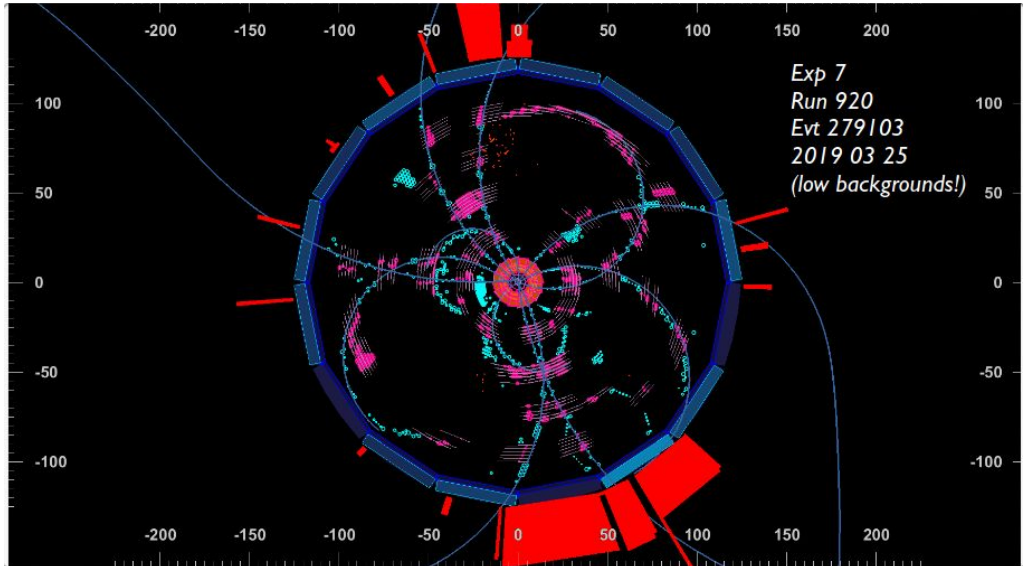
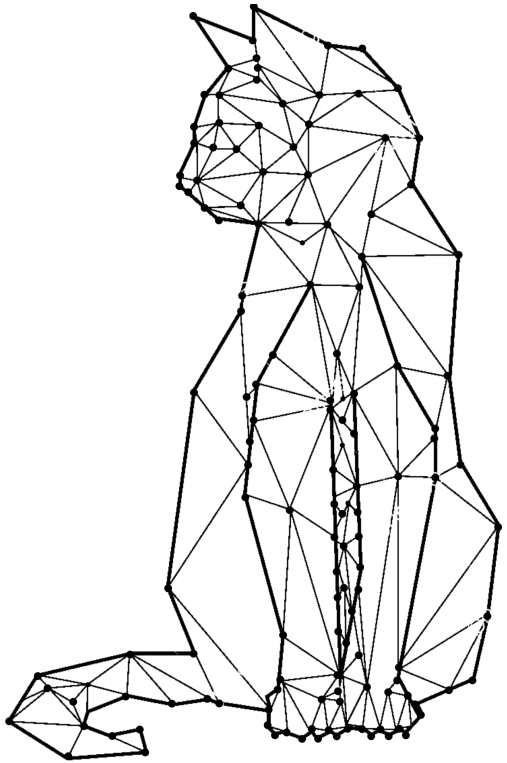


Let's focus on charged particles (*tracks*)



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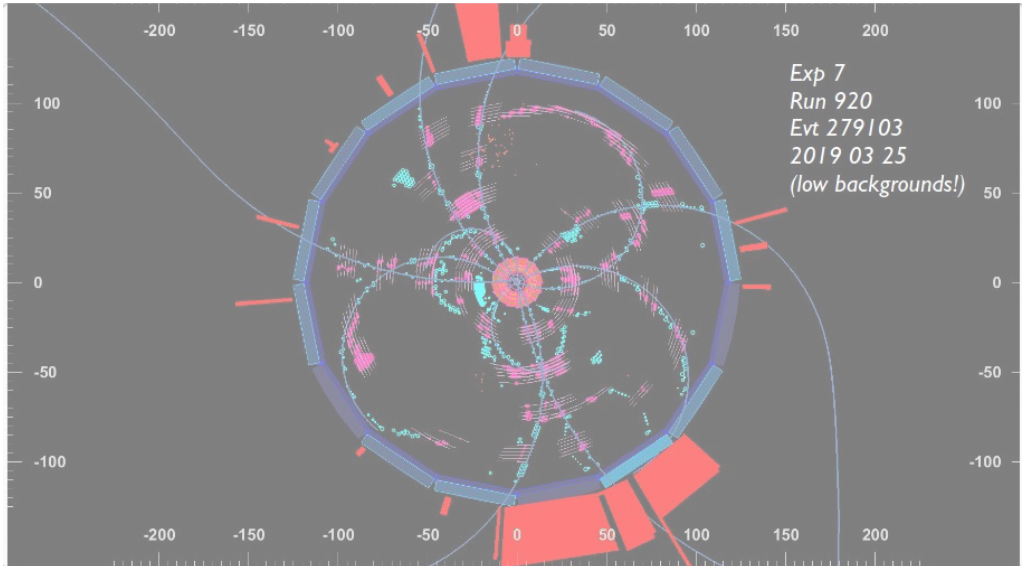

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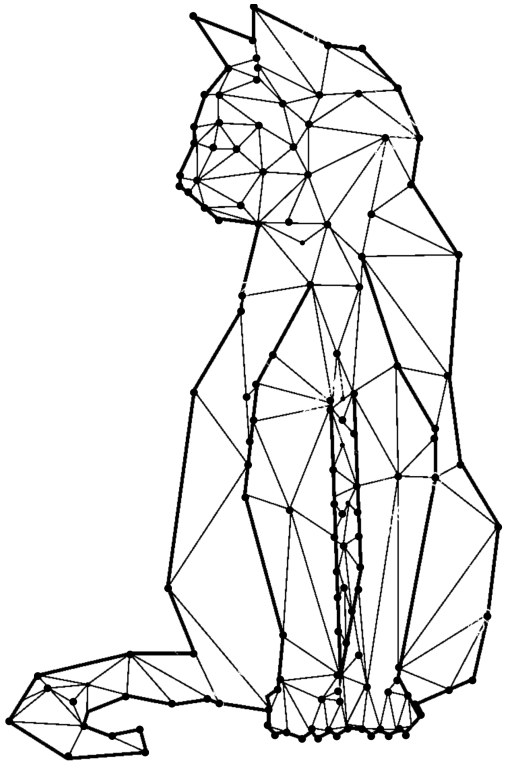
.. and on the cat only ..



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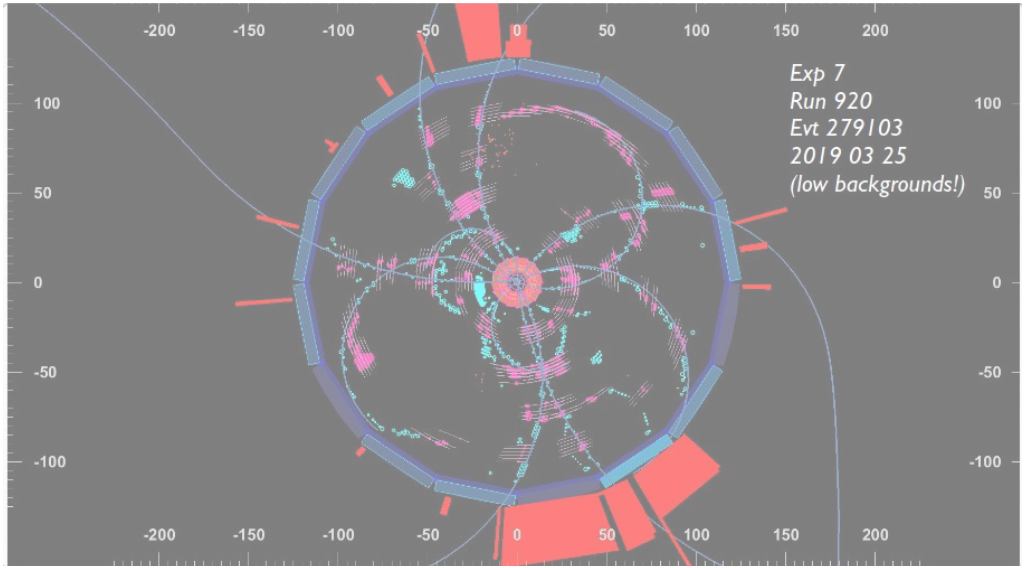

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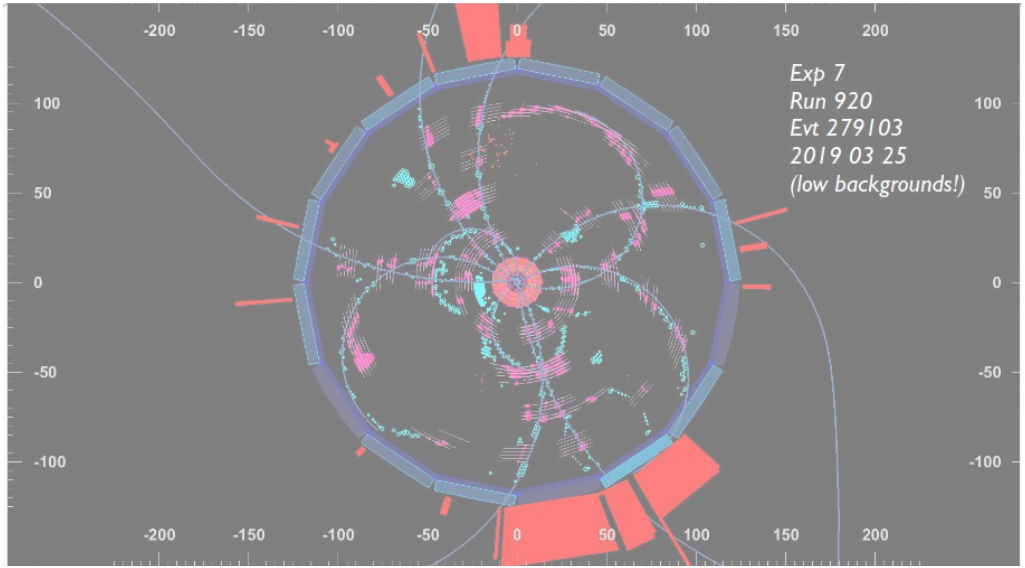

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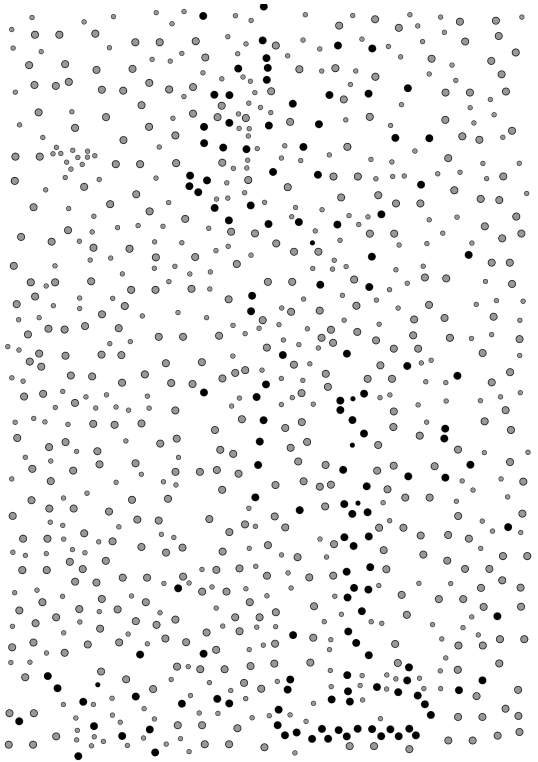

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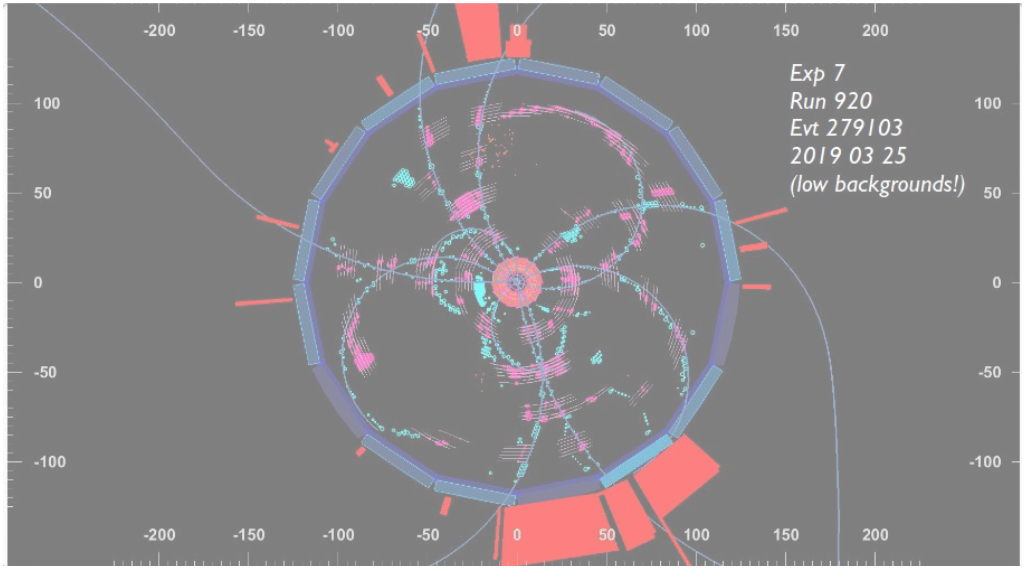

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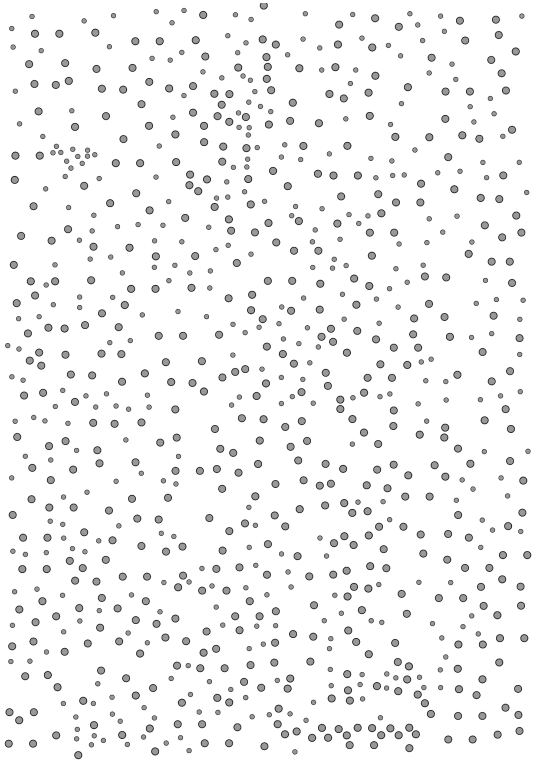

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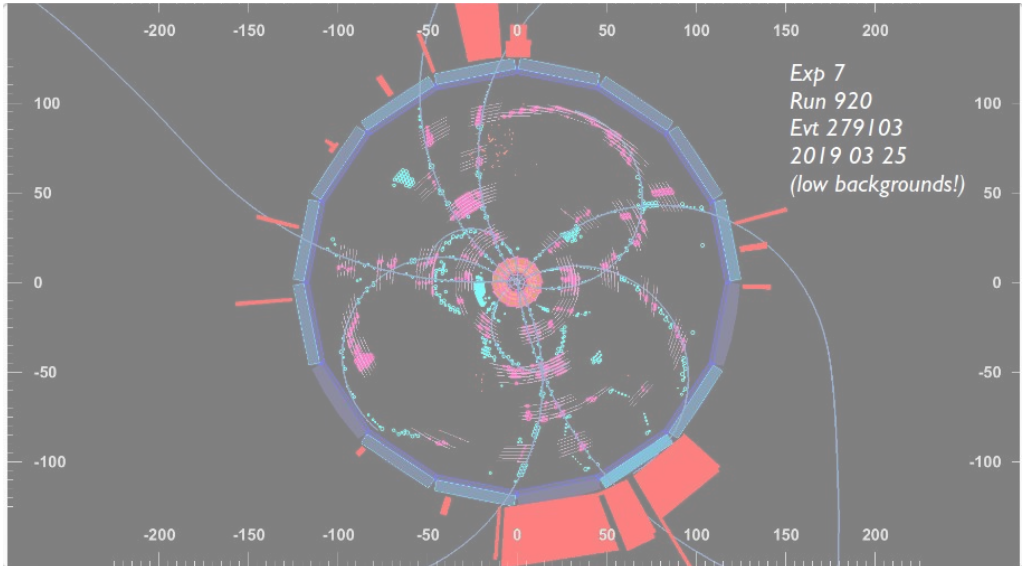
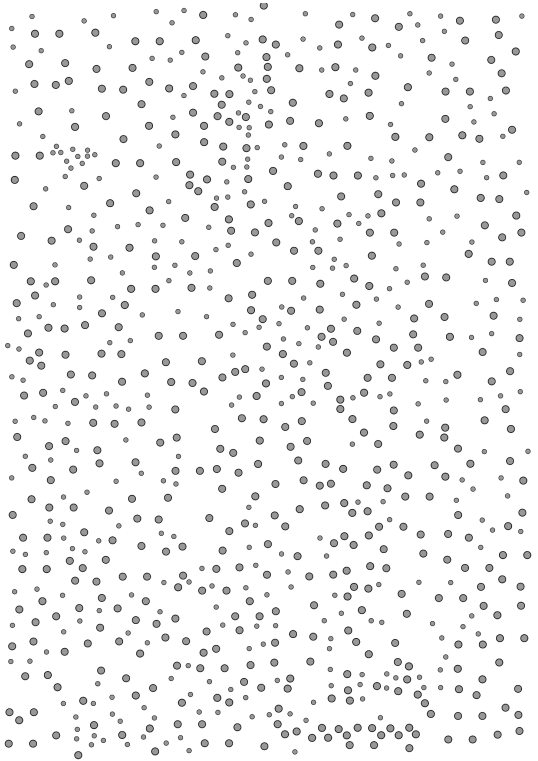
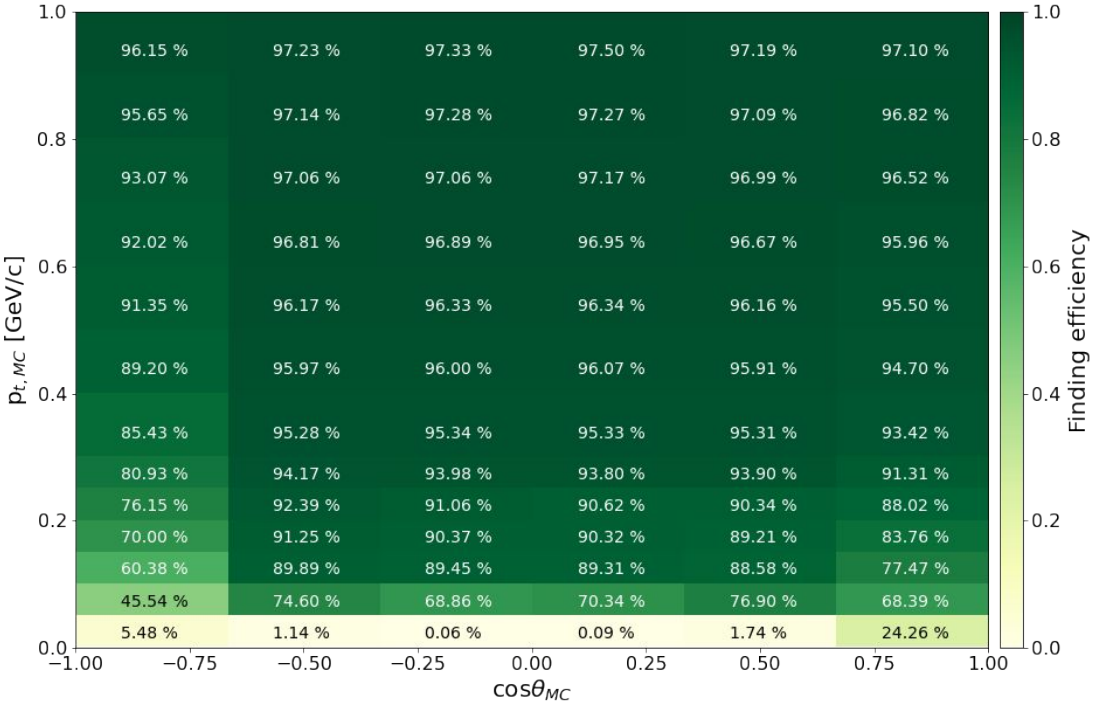
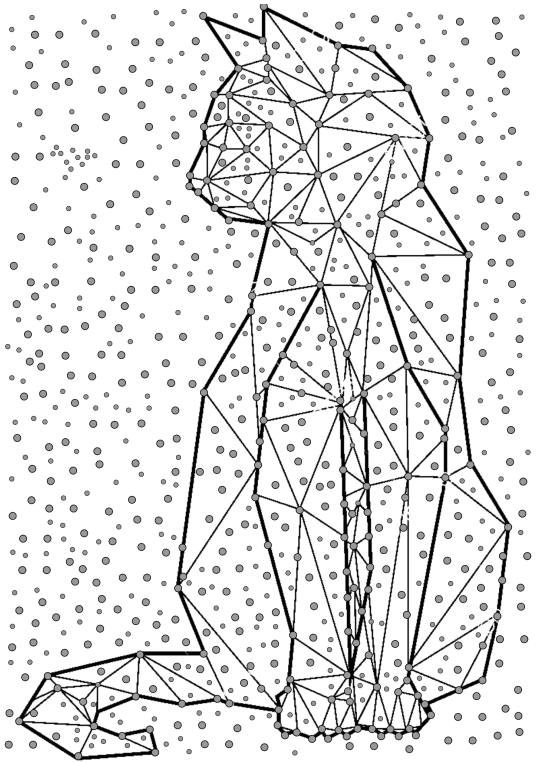


Tracking is a (fun) challenge!



Belle II tracking: excellent performance





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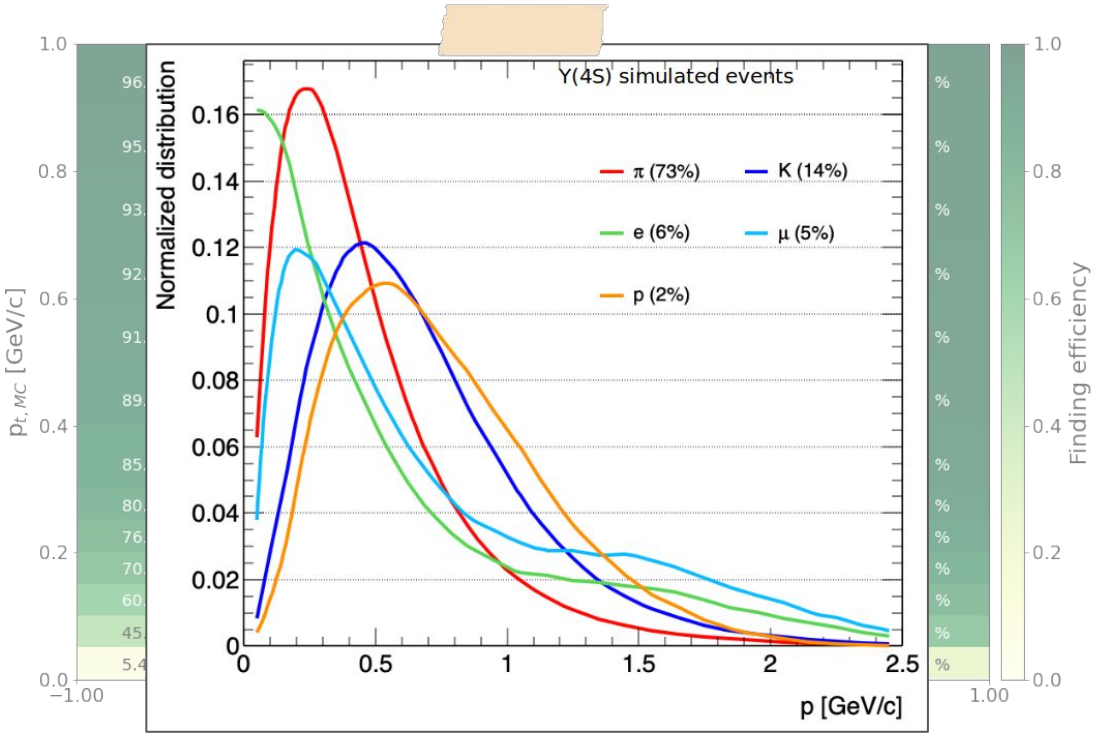
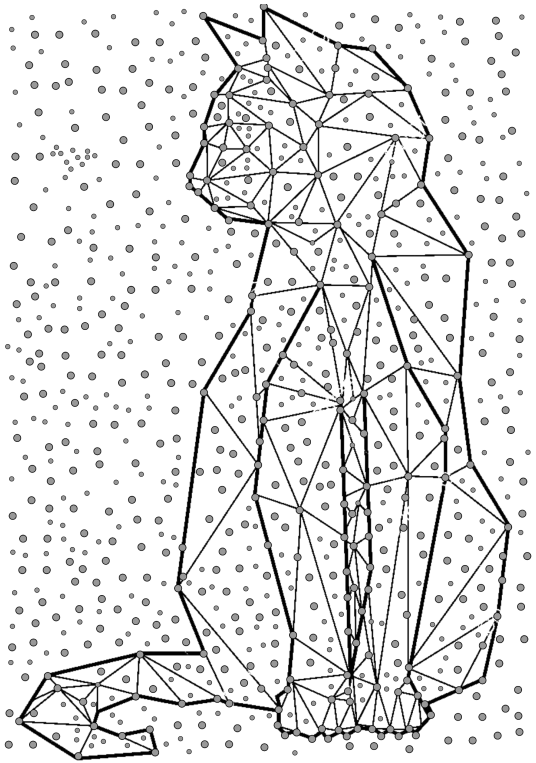
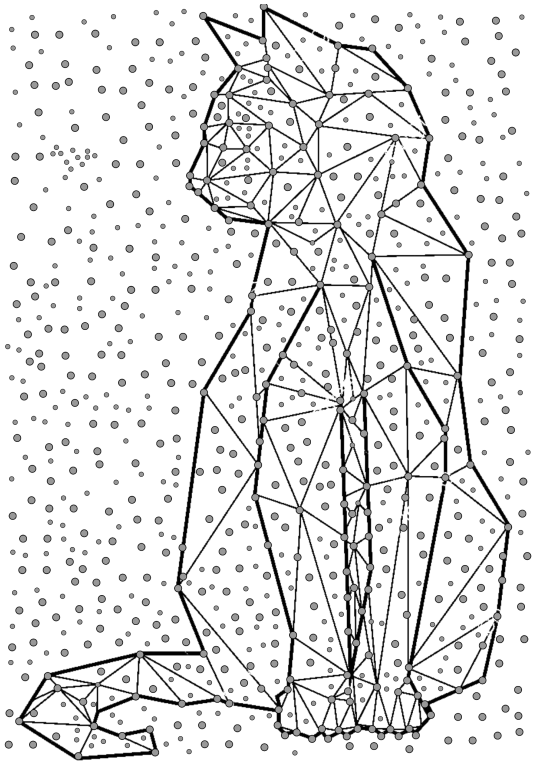




Belle II tracking: desirable improvement



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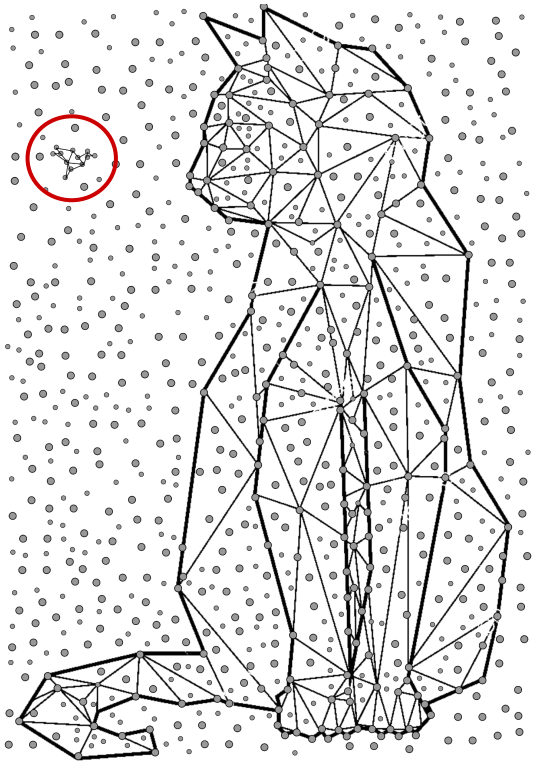
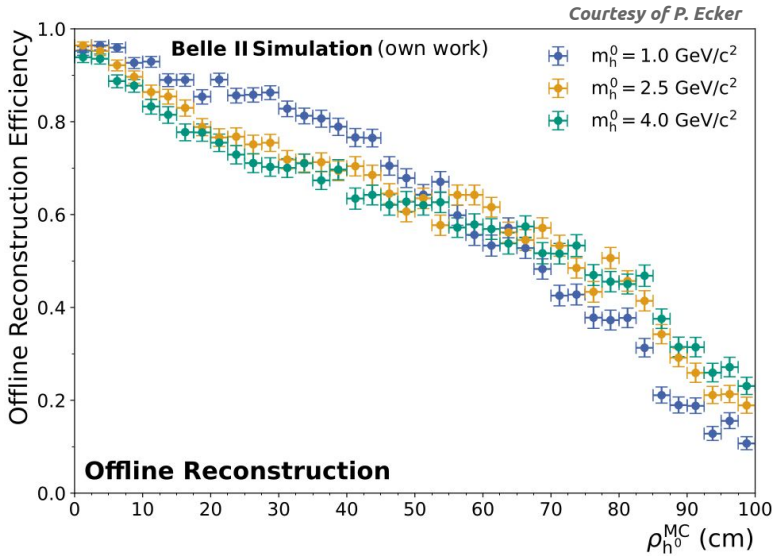
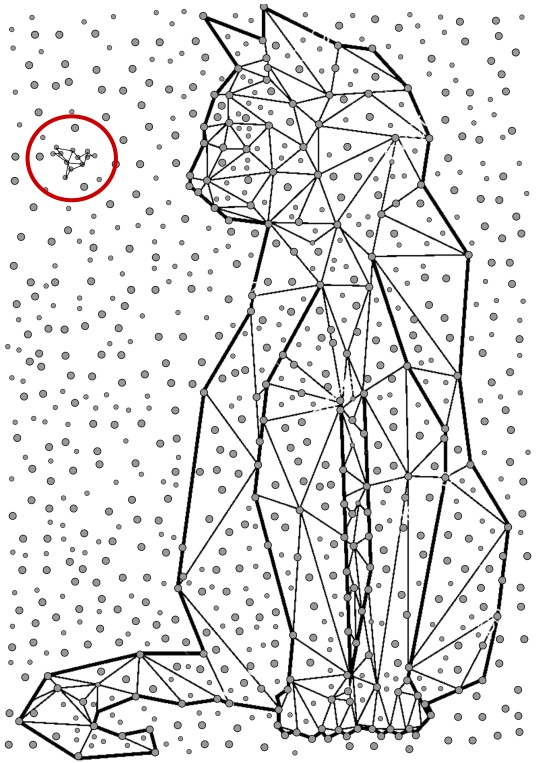


Belle II tracking: desirable improvement

Cellular Automaton (CA) as additional algorithm to improve track reconstruction of non-prompt tracks

➢ Displaced vertices are challenging





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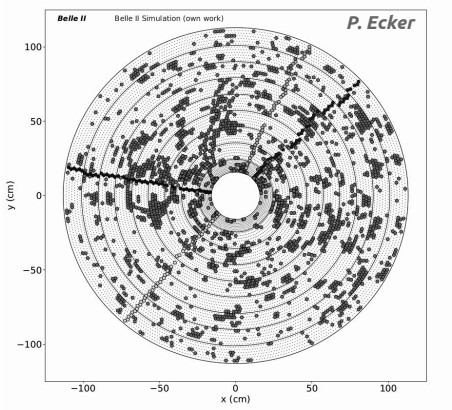
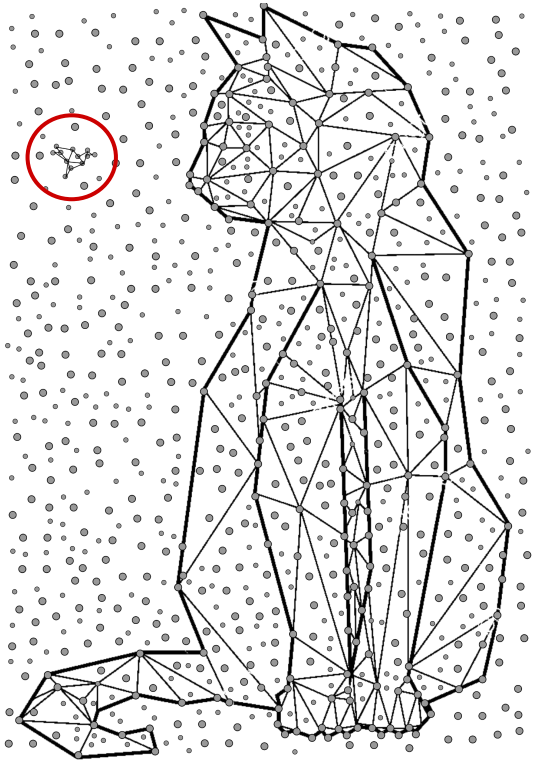
Main challenge

➢ Improve the track-finding efficiency without degrading the number of wrongly reconstructed track (*fake rate*)





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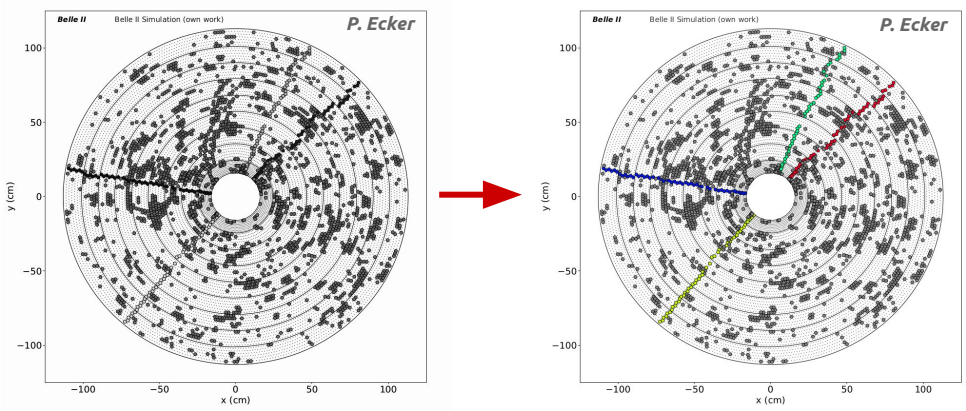

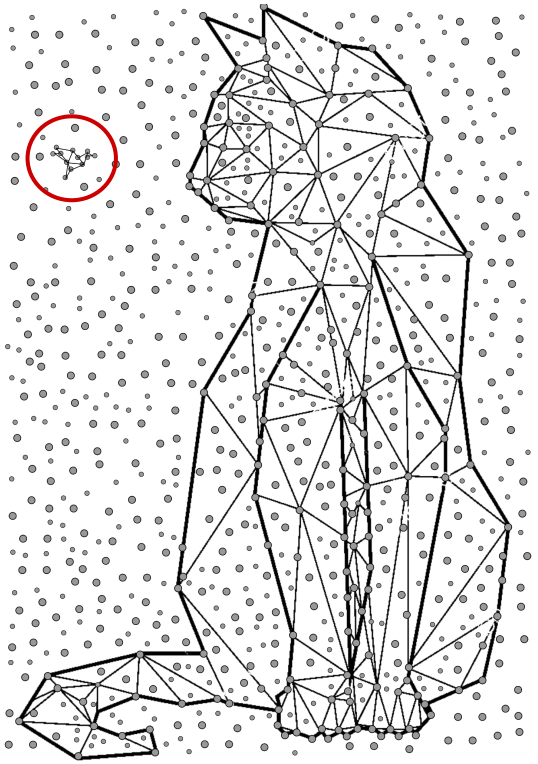

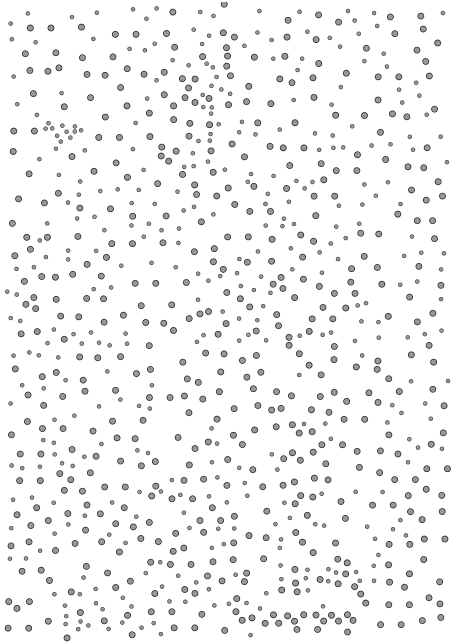

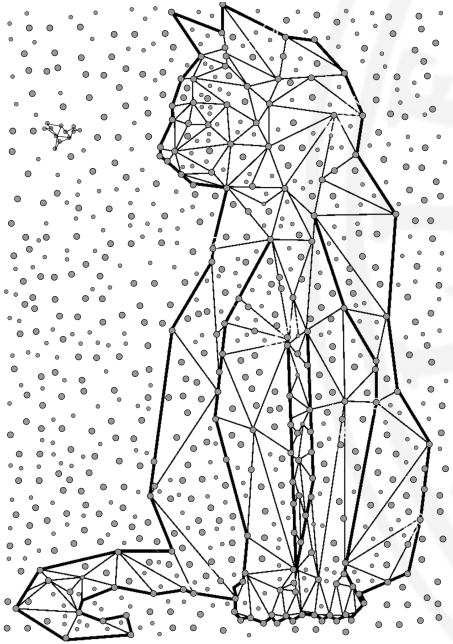

Details MATTER!

Keep connecting the dots!