Before we start…

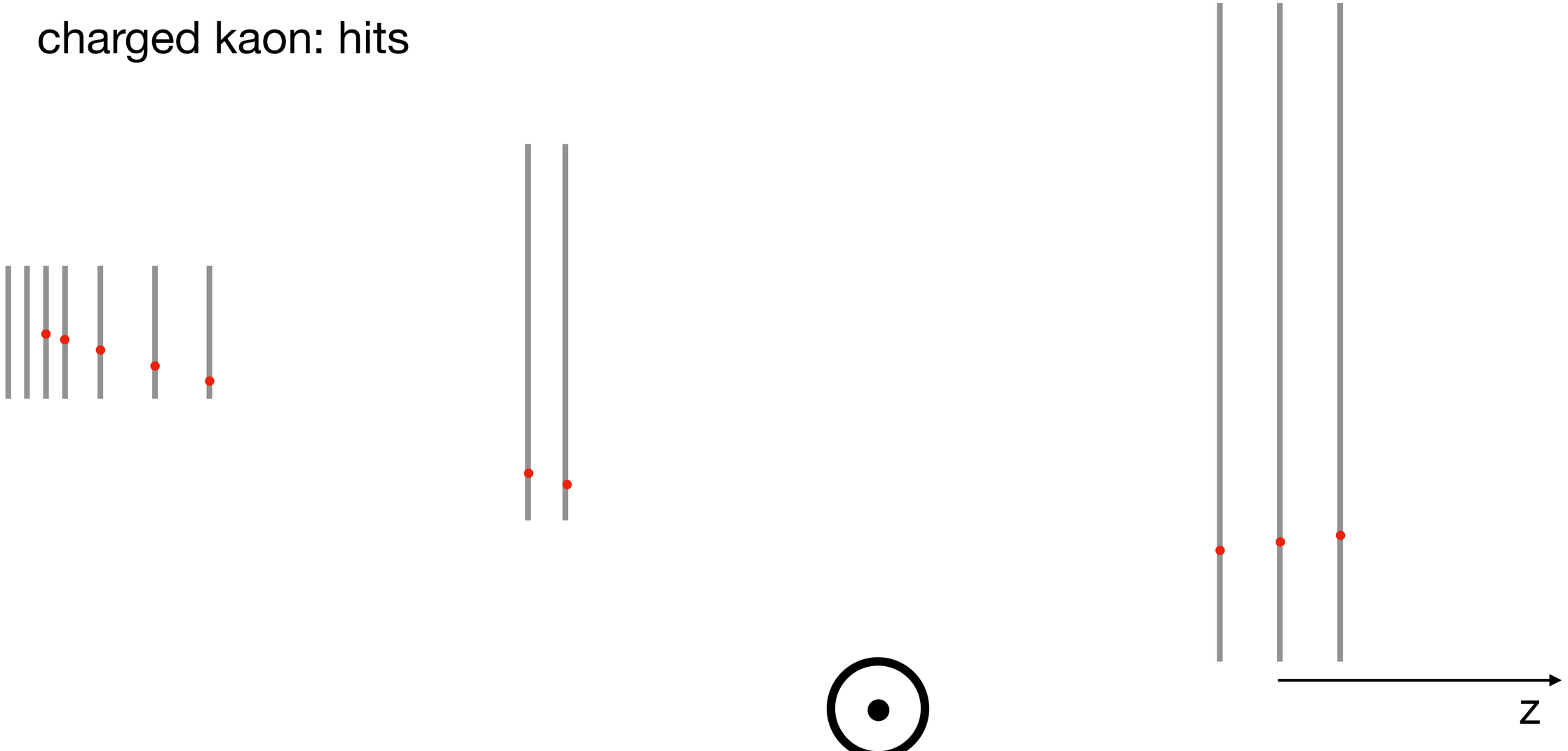
a very quick intro to LHCb tracking and PID

Vitalii
for Starterkit 2021

Ideal detector

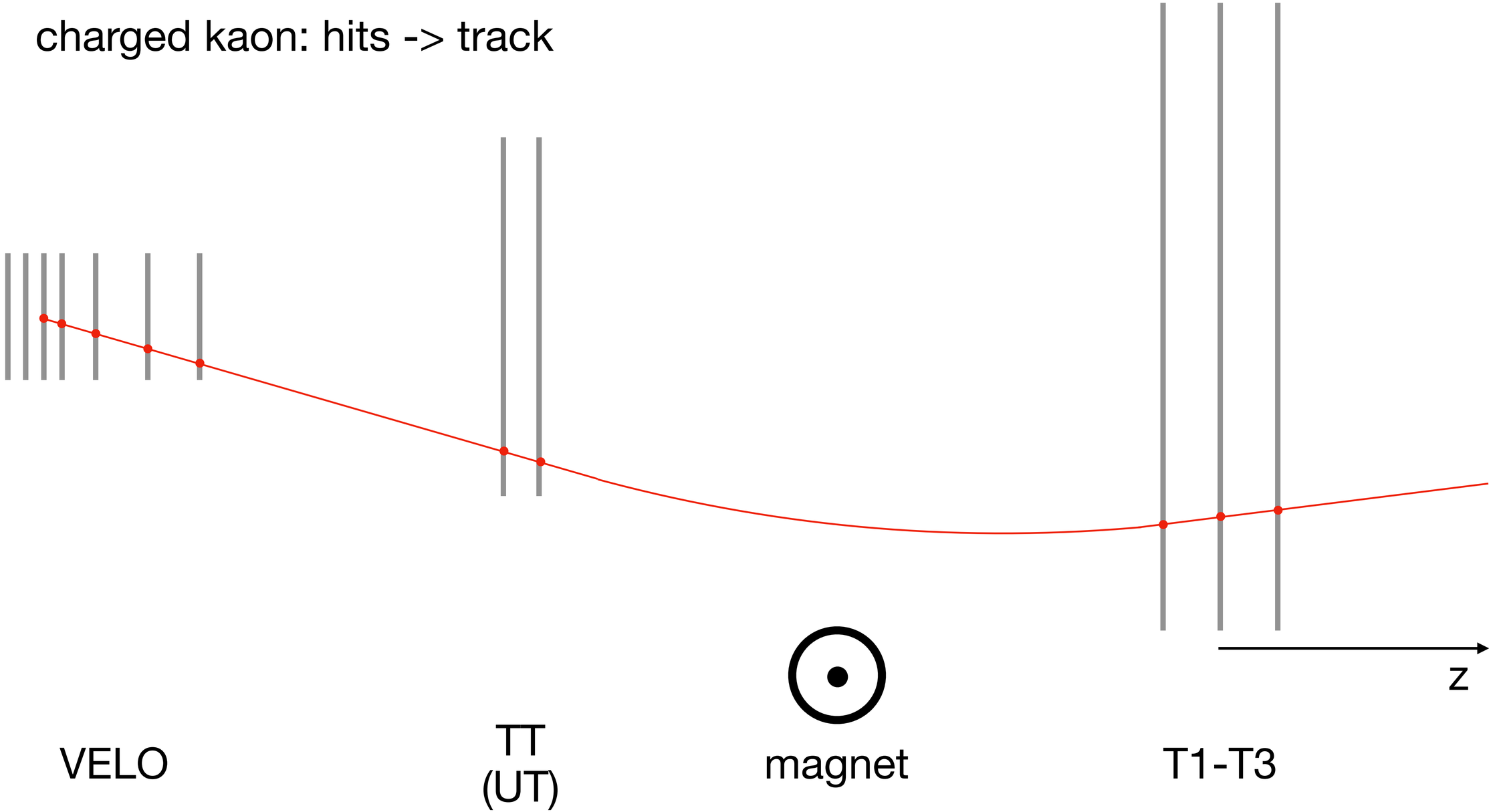
very simplified!

charged kaon: hits



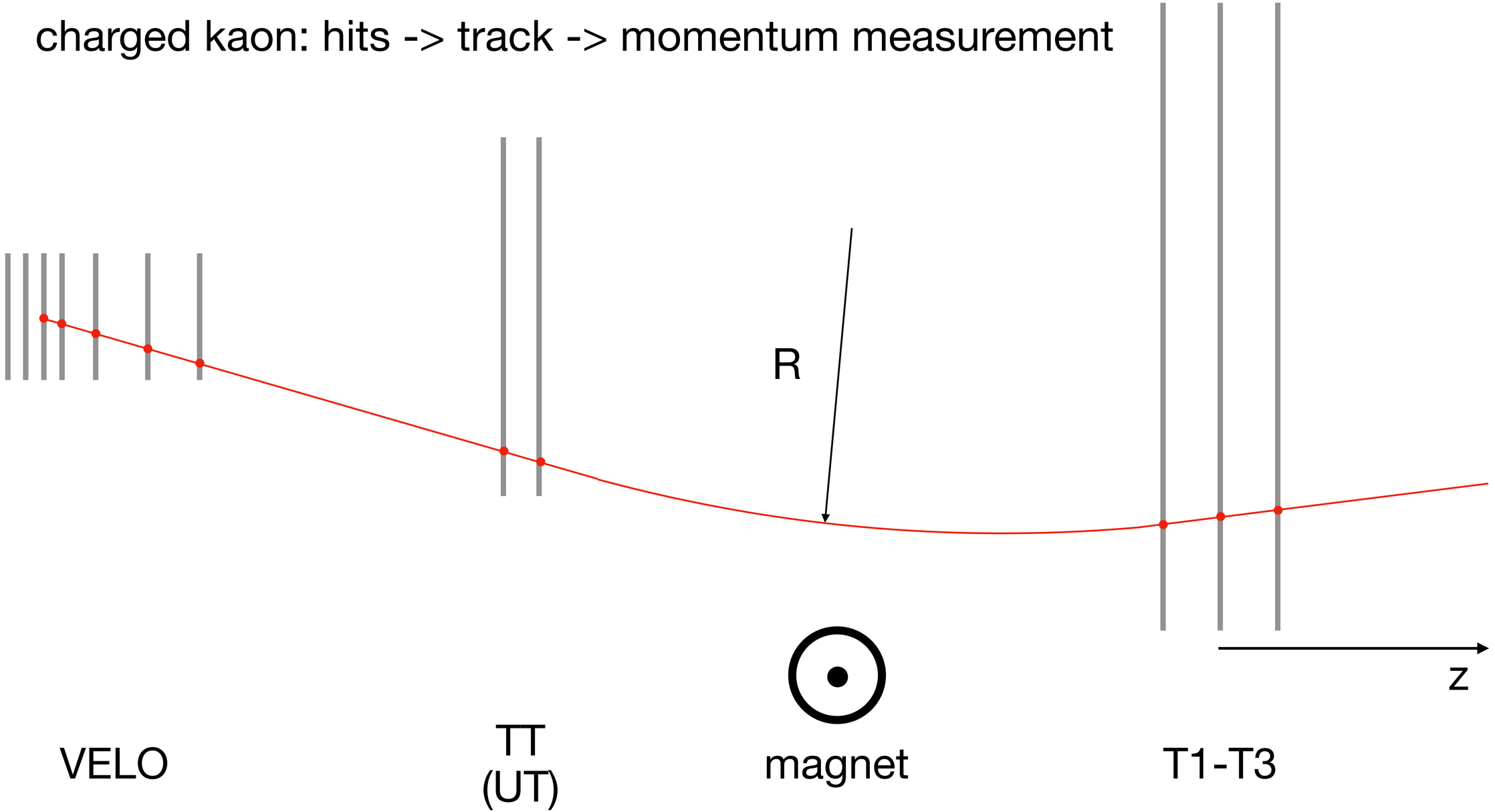
Ideal detector very simplified!

charged kaon: hits -> track



Ideal detector very simplified!

charged kaon: hits -> track -> momentum measurement

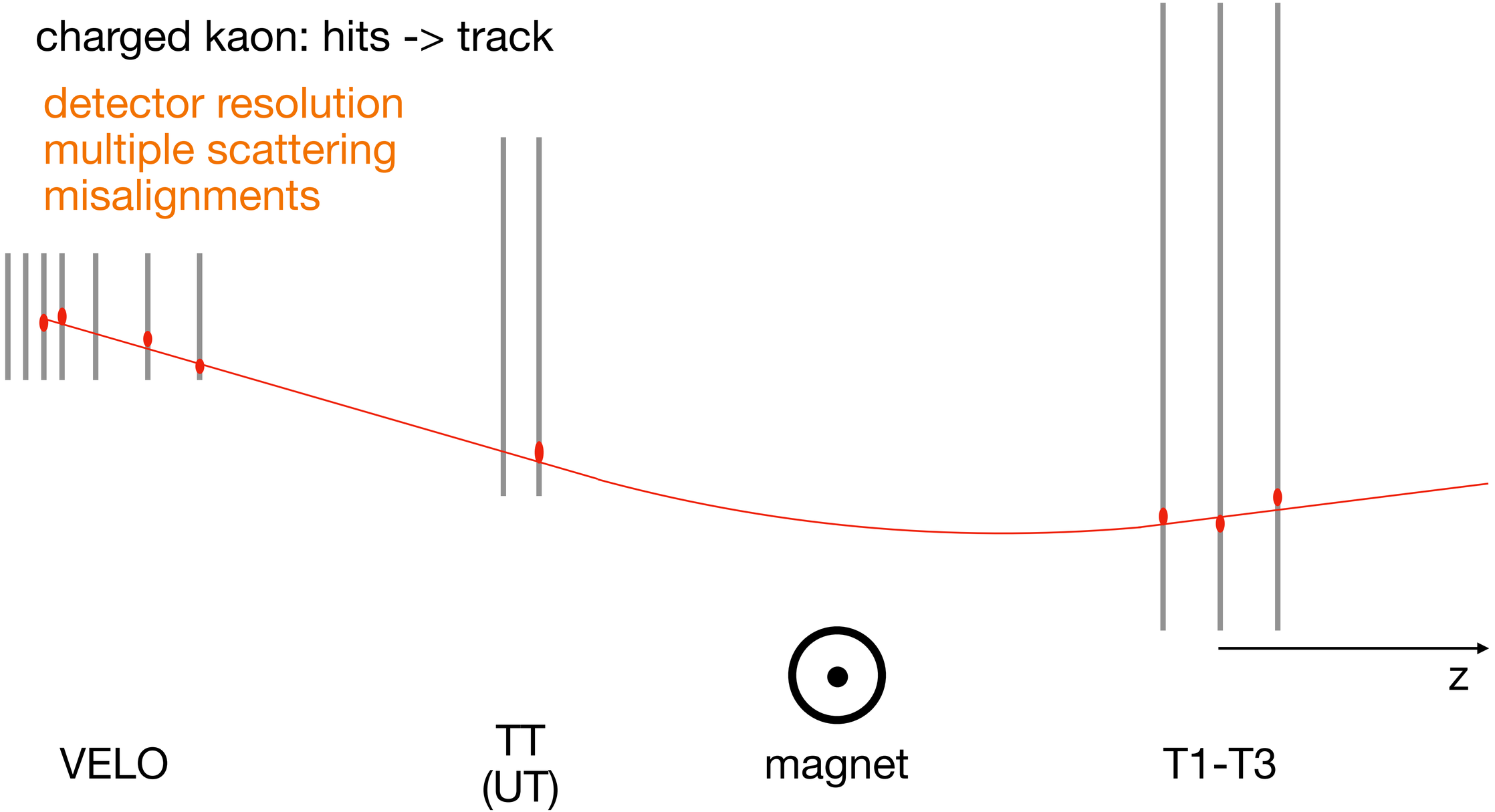


Realistic detector

very simplified!

charged kaon: hits -> track

detector resolution
multiple scattering
misalignments

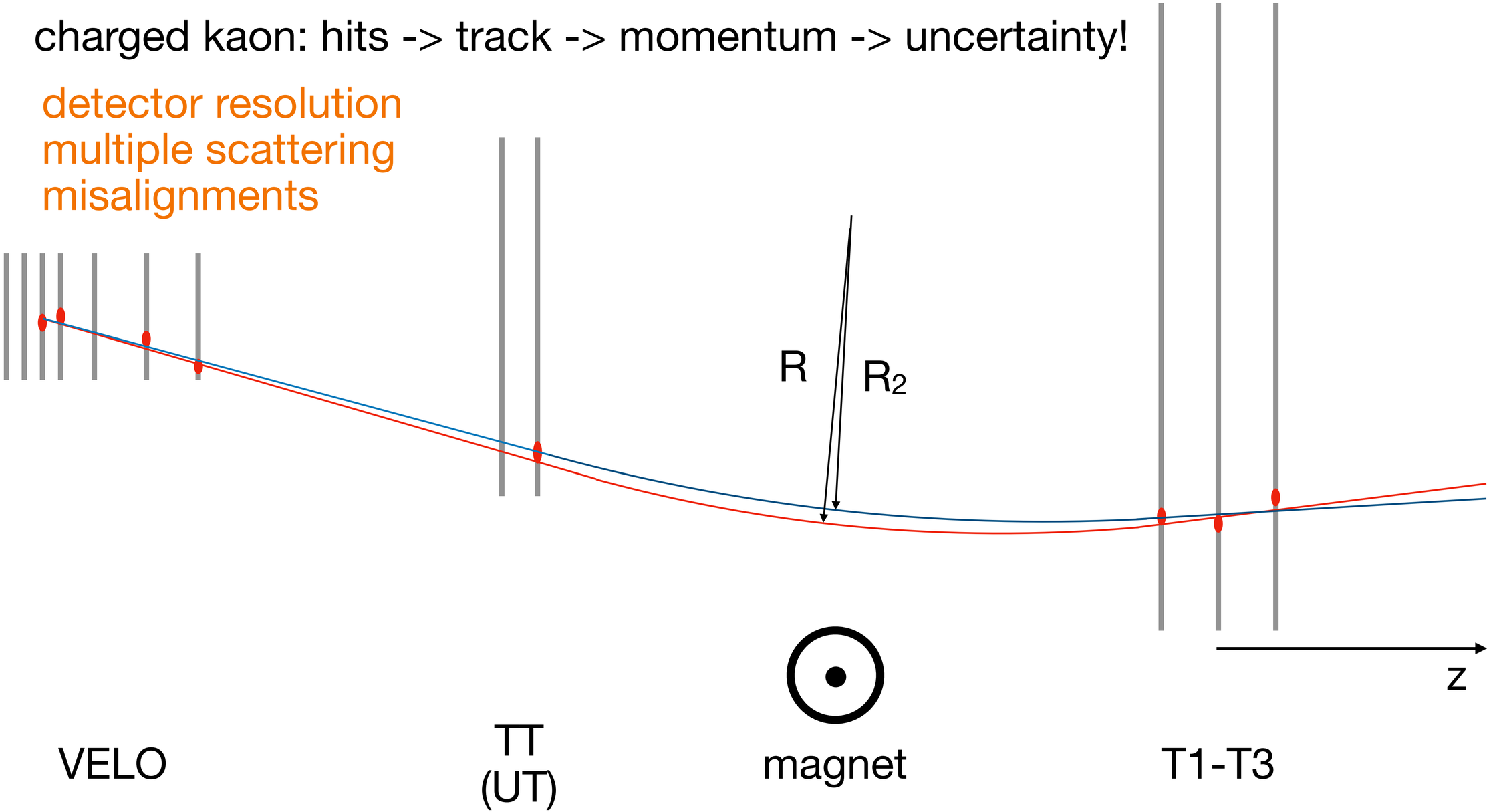


Realistic detector

very simplified!

charged kaon: hits -> track -> momentum -> uncertainty!

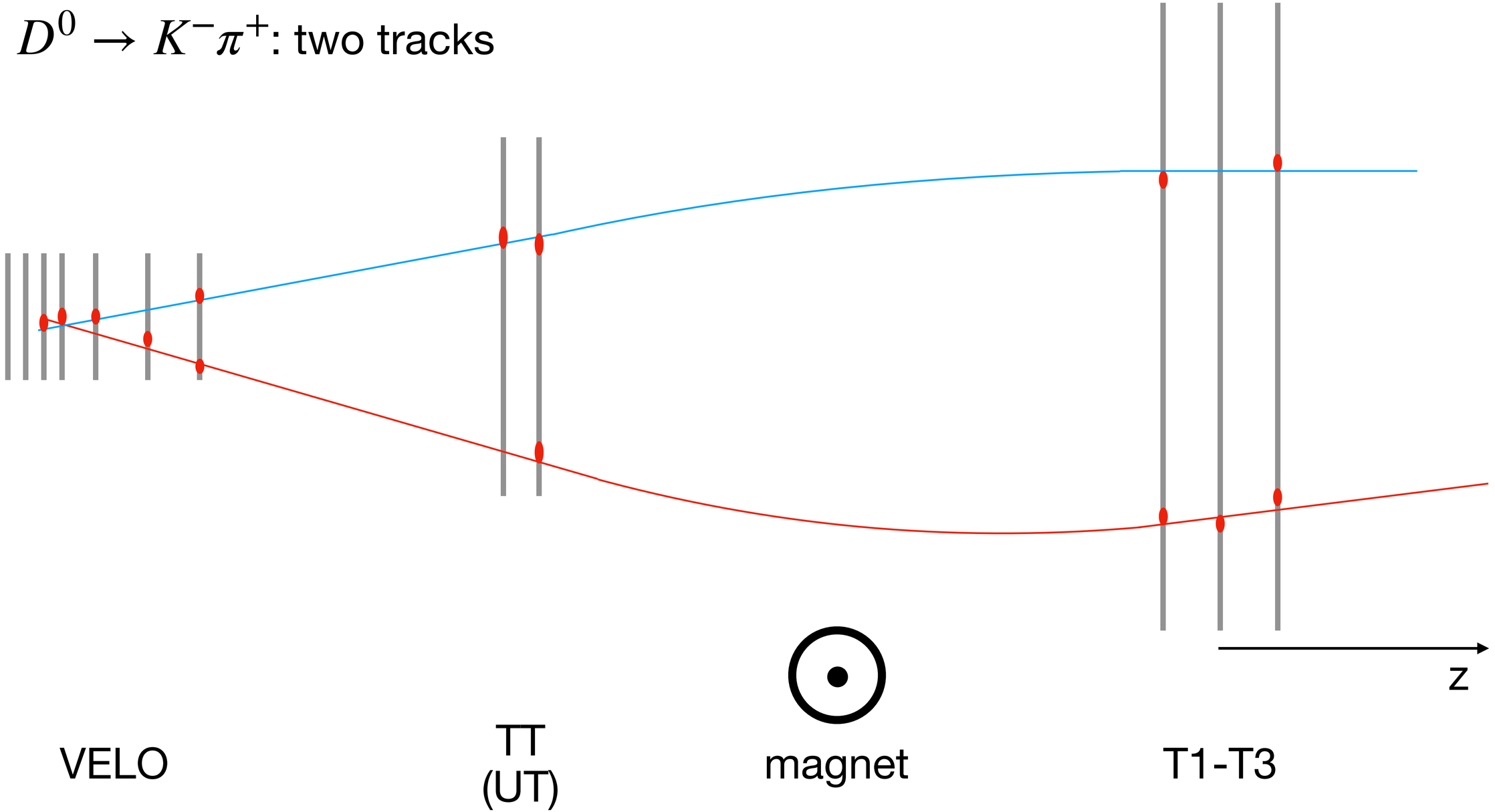
detector resolution
multiple scattering
misalignments



Realistic detector

very simplified!

$D^0 \to K^-\pi^+$: two tracks



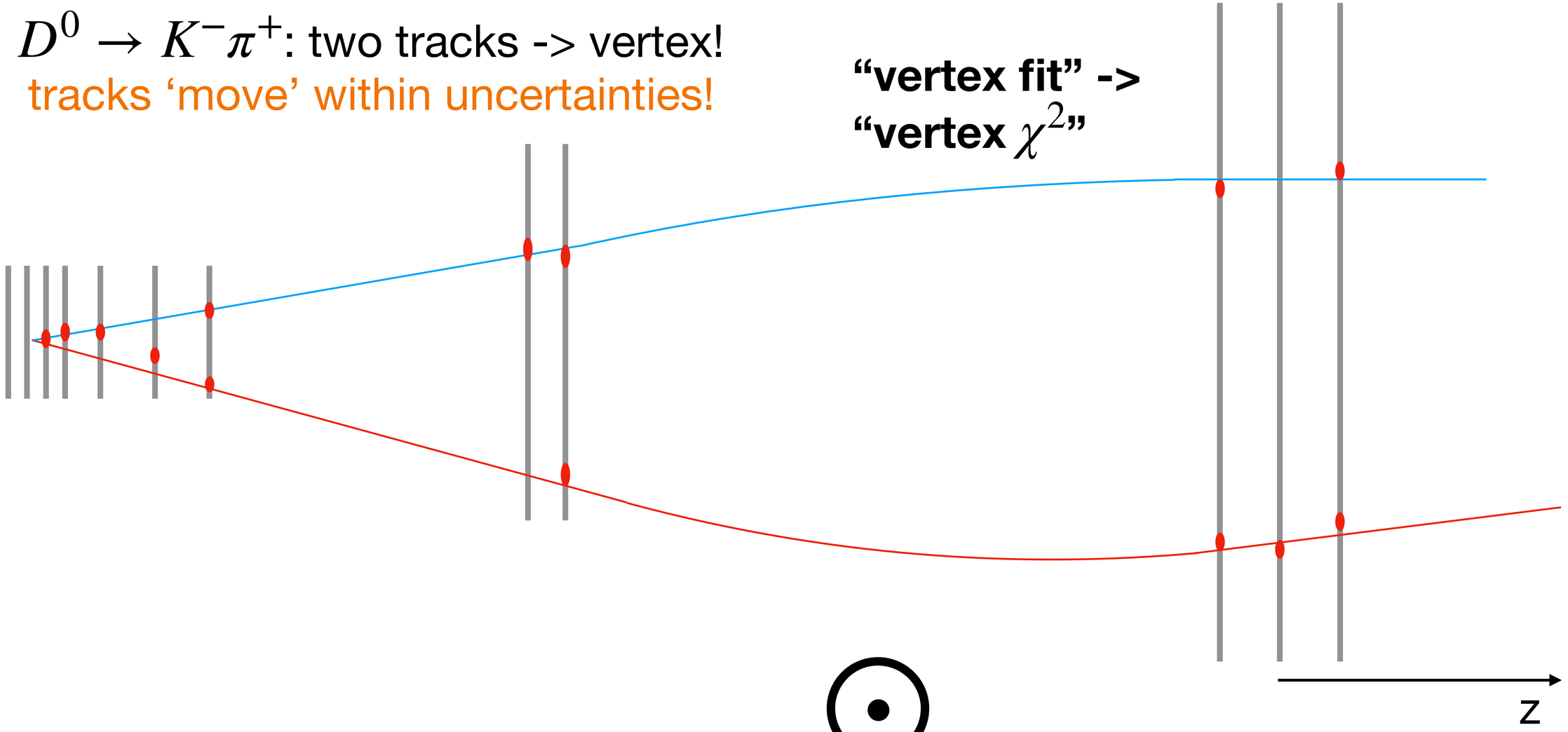
Realistic detector

very simplified!

$D^0 \to K^-\pi^+$: two tracks -> vertex!

tracks ‘move’ within uncertainties!

“vertex fit” ->
“vertex χ^2”

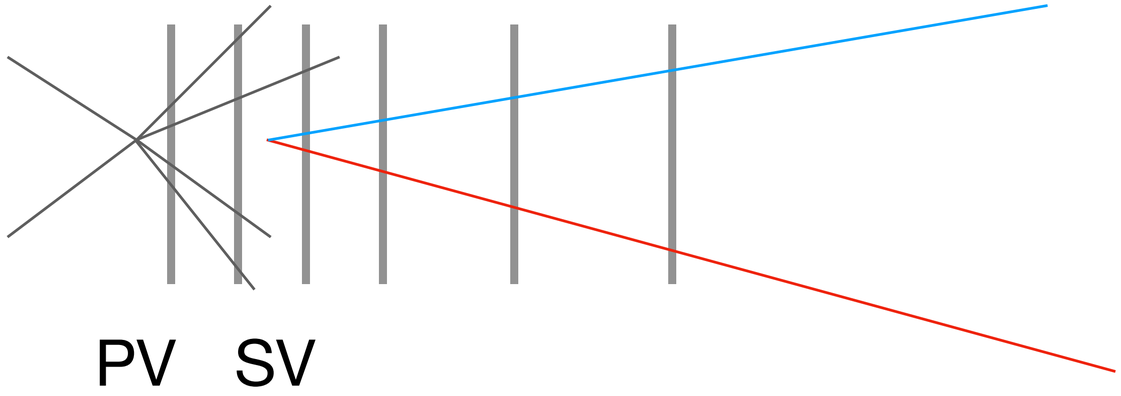


zoom at the VELO very simplified!

$D^0 \to K^-\pi^+$: two tracks -> vertex!

D^0 has lifetime ~ps: **displaced** vertex

hadronic collision
-> many tracks created
-> ‘easy’ to find PV

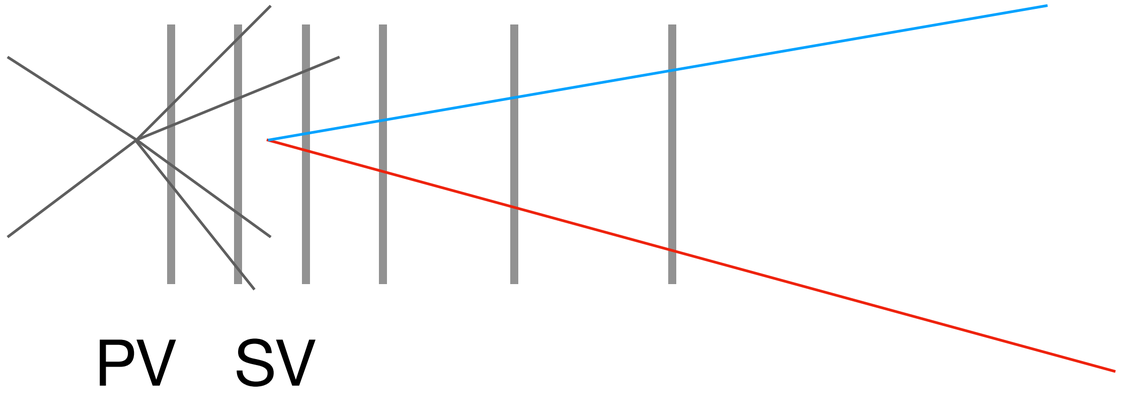


primary vertex (PV): proton-proton collision point
secondary vertex (SV): displaced decay position of a c- (b-) hadron

zoom at the VELO very simplified!

$D^0 \rightarrow K^-\pi^+$: two tracks -> vertex!

D^0 has lifetime ~ps: **displaced** vertex



Question: does D^0 leave a track?

zoom at the VELO very simplified!

$D^0 \to K^-\pi^+$: two tracks -> vertex!

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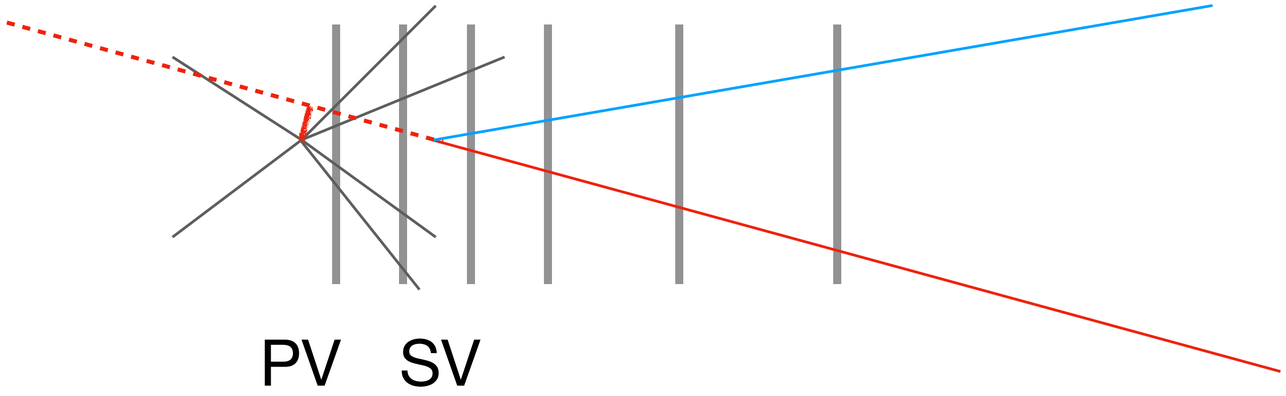
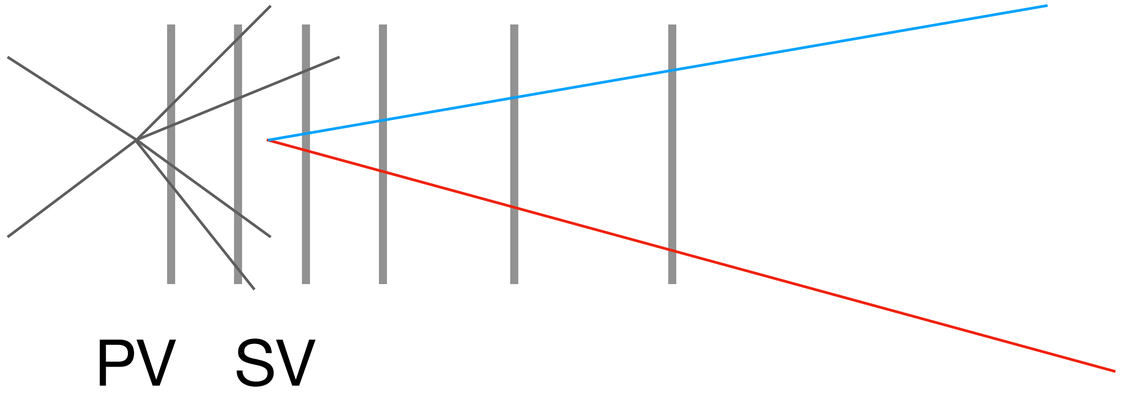


impact parameter (IP) of the track

zoom at the VELO very simplified!

What about $D^{*+} \to \pi^+(D^0 \to K^-\pi^+)$?

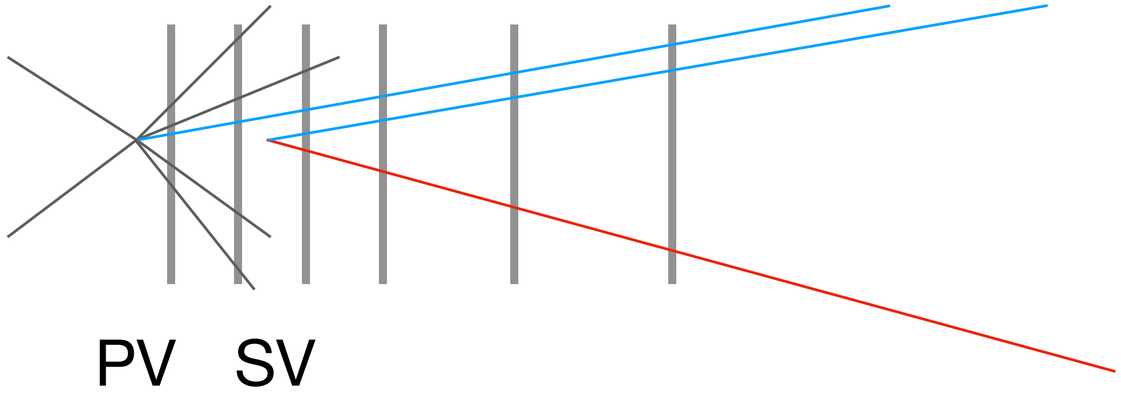


Question: does D^{*+} leave a track?

zoom at the VELO very simplified!

What about $D^{*+} \to \pi^+(D^0 \to K^-\pi^+)$?

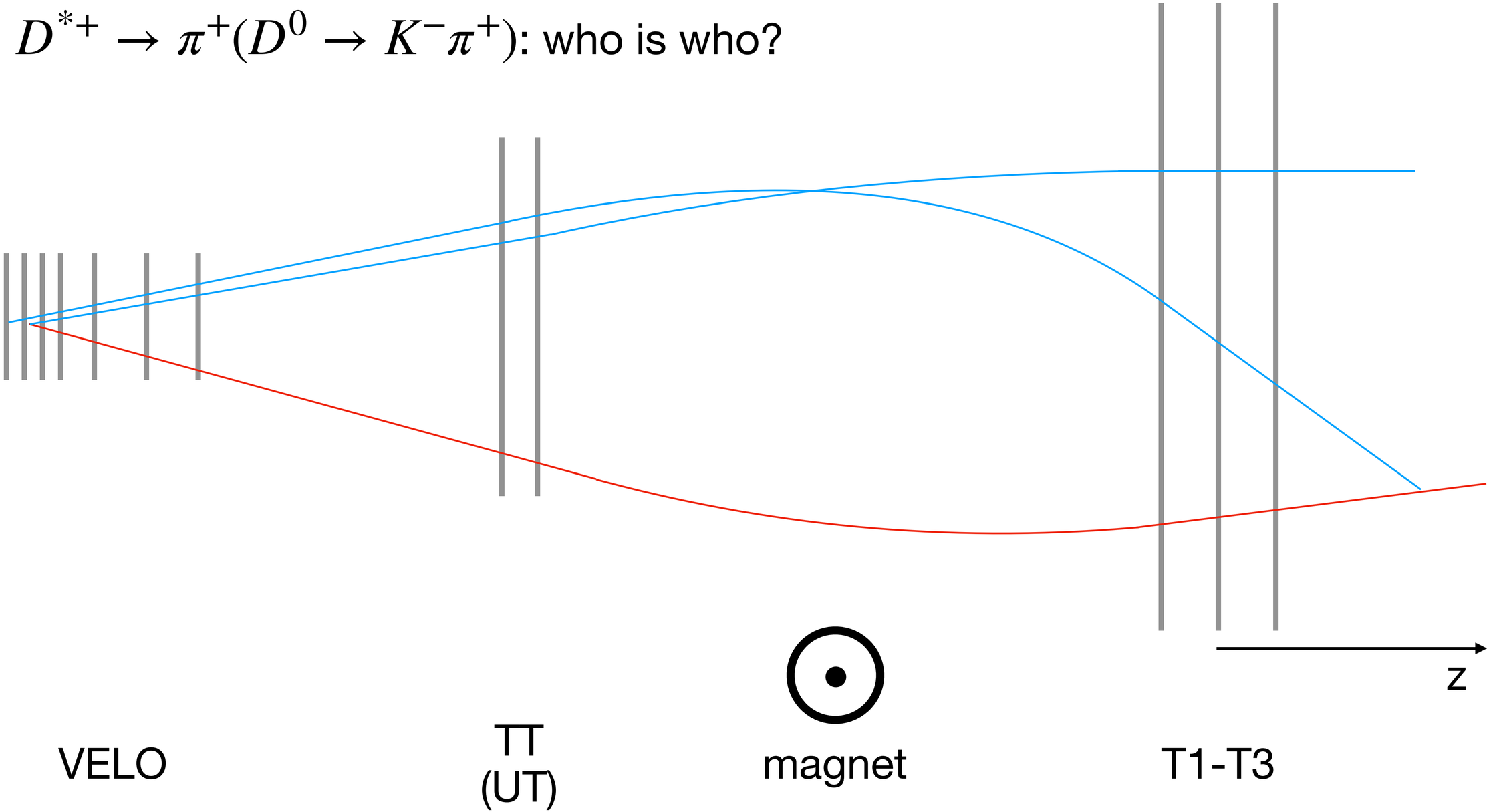
Not a weak decay -> D^{*+} lifetime << detector resolution



Identifying tracks

very simplified!

$D^{*+} \to \pi^+(D^0 \to K^-\pi^+)$: who is who?



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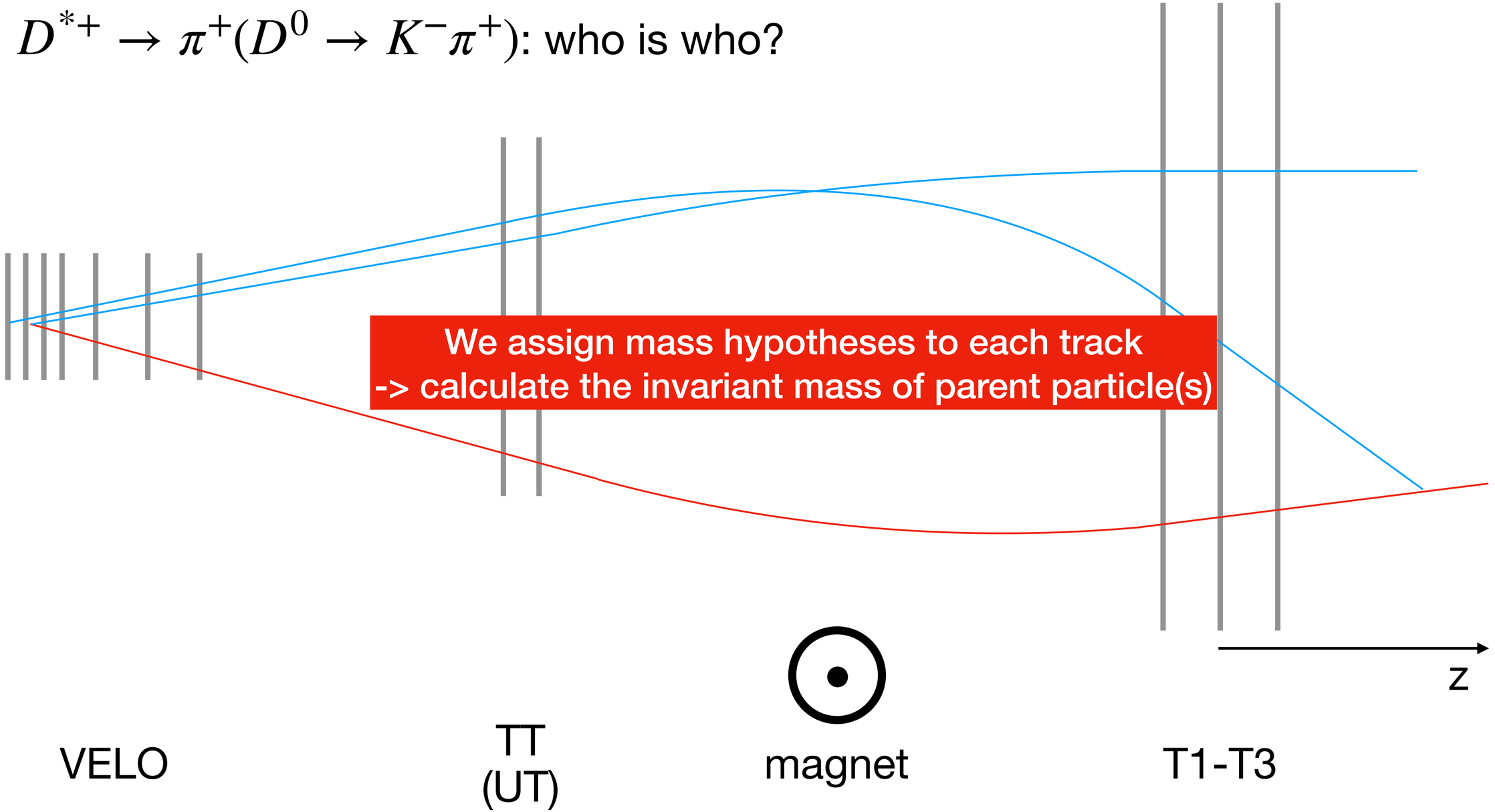

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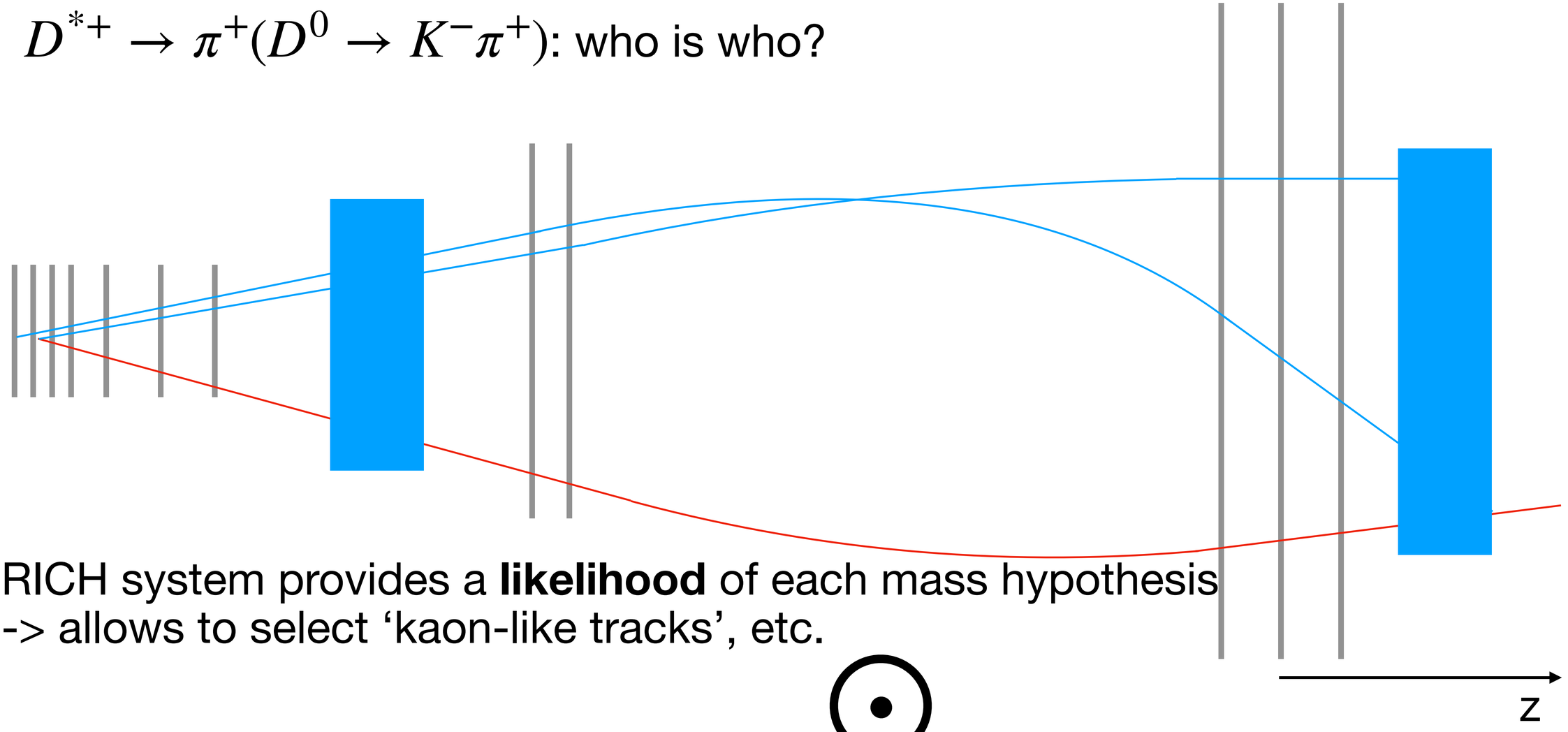

RICH system provides a **likelihood** of each mass hypothesis
-> allows to select ‘kaon-like tracks’, etc.

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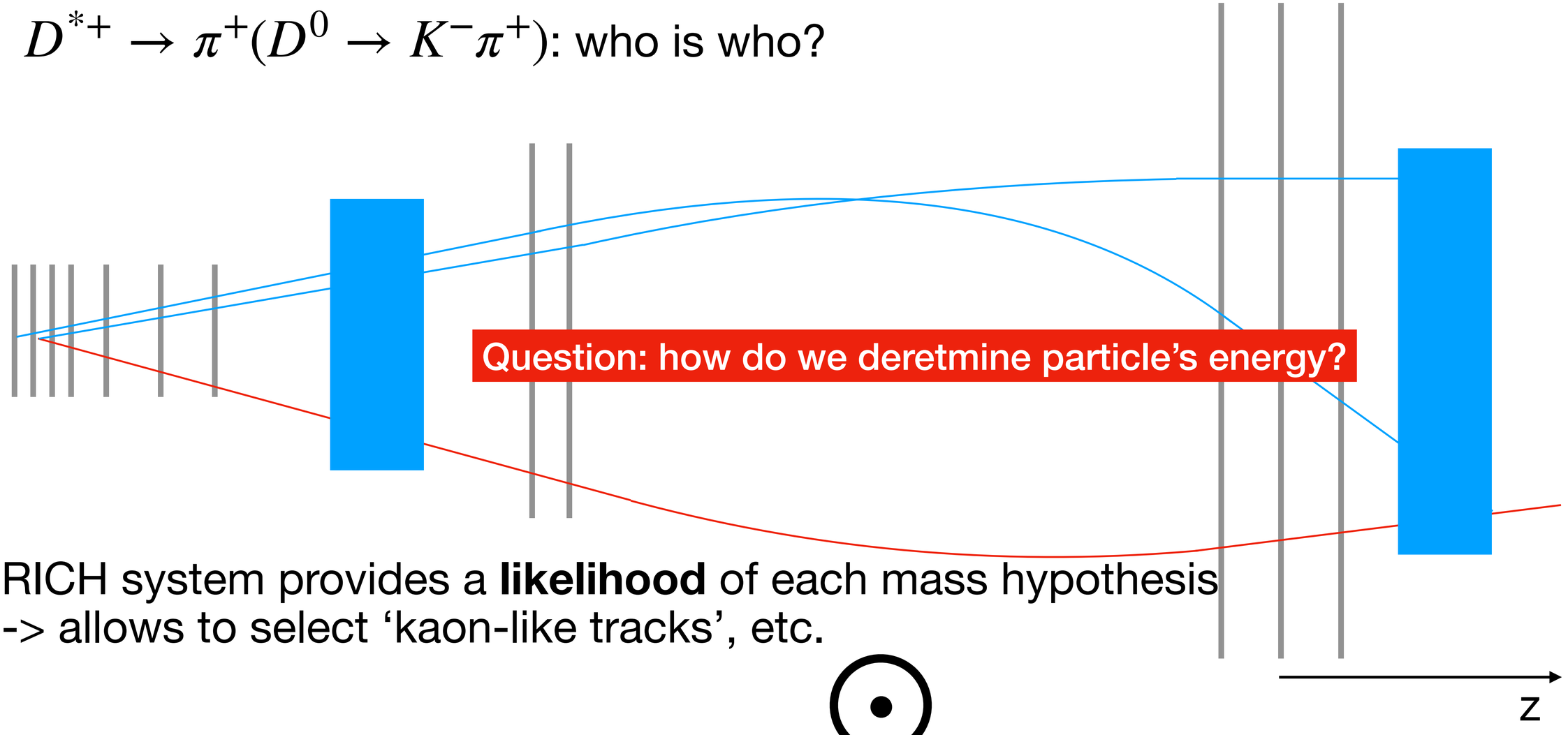

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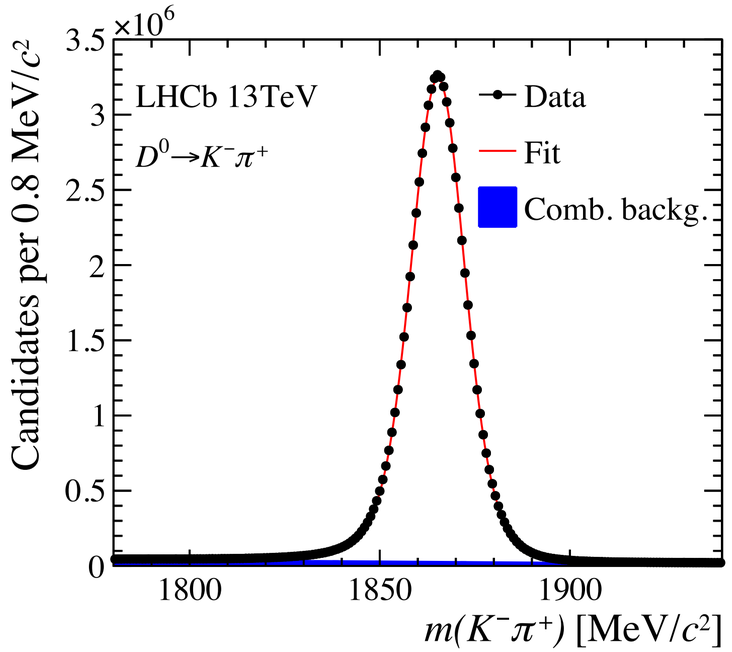

Today's lesson:

- how to get all this info in your tuple
- how to understand Stripping/trigger selections