Mighty Tracker Occupancies and Tracking studies

U2 Tracking Virtual Workshop

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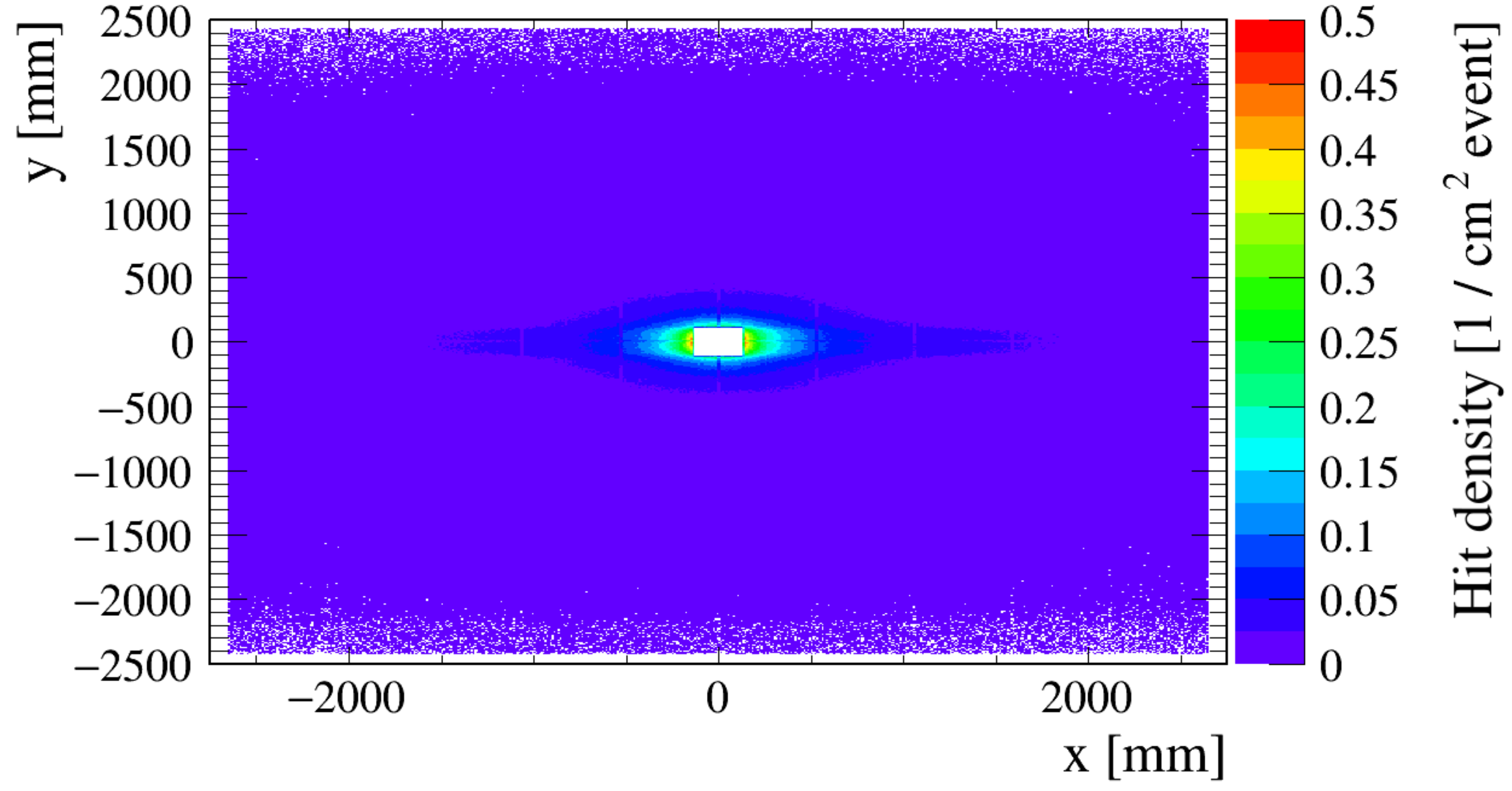
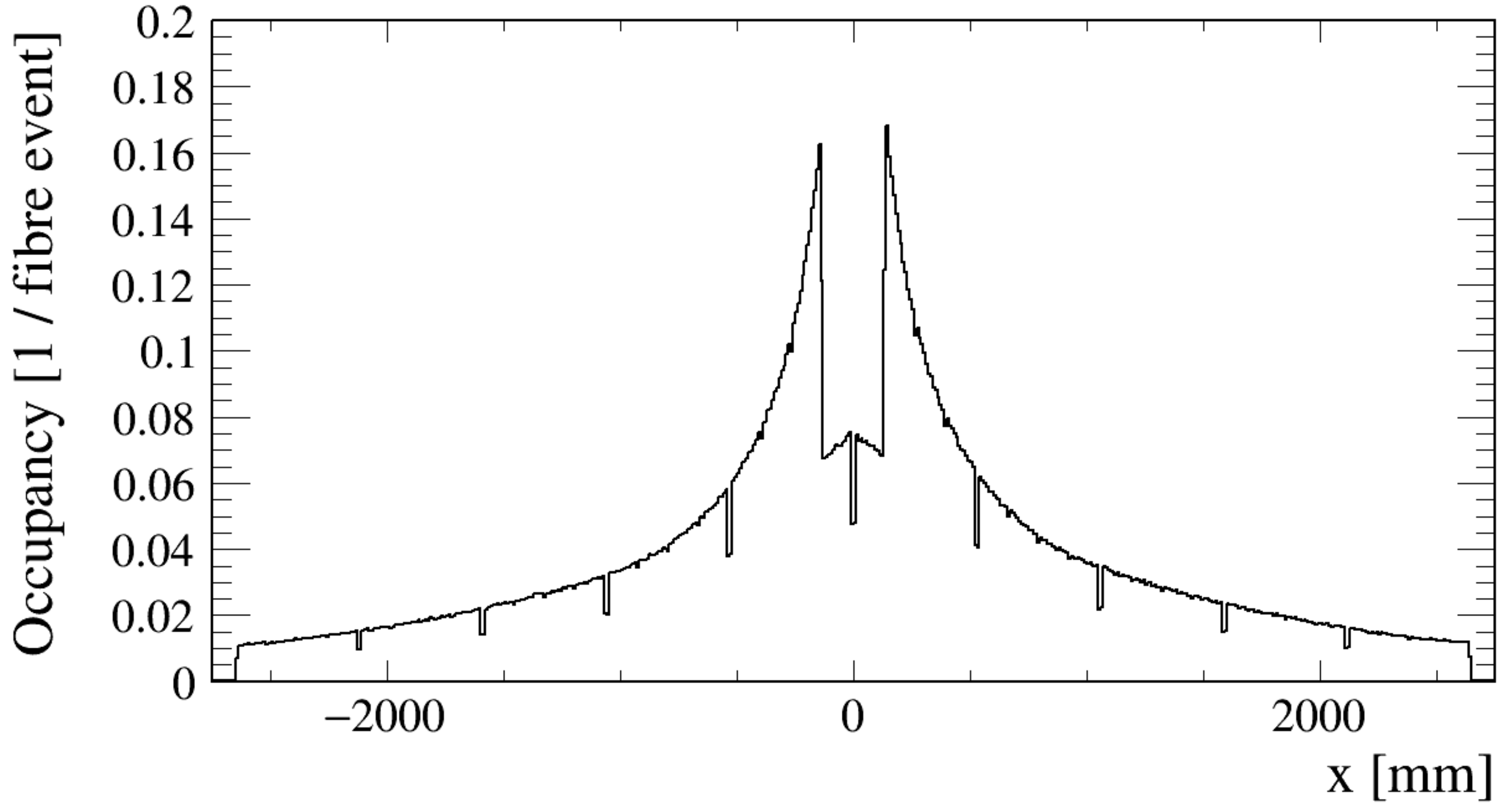
Motivation

Investigate if a "Track-Forwarding" approach could work for LHCb Upgrade II luminosity (1.5 • 10^{34} cm^{-2} s^{-1}):





LHCb-INT-2020-020

- *Spoiler:* Current PrForward does not perform well

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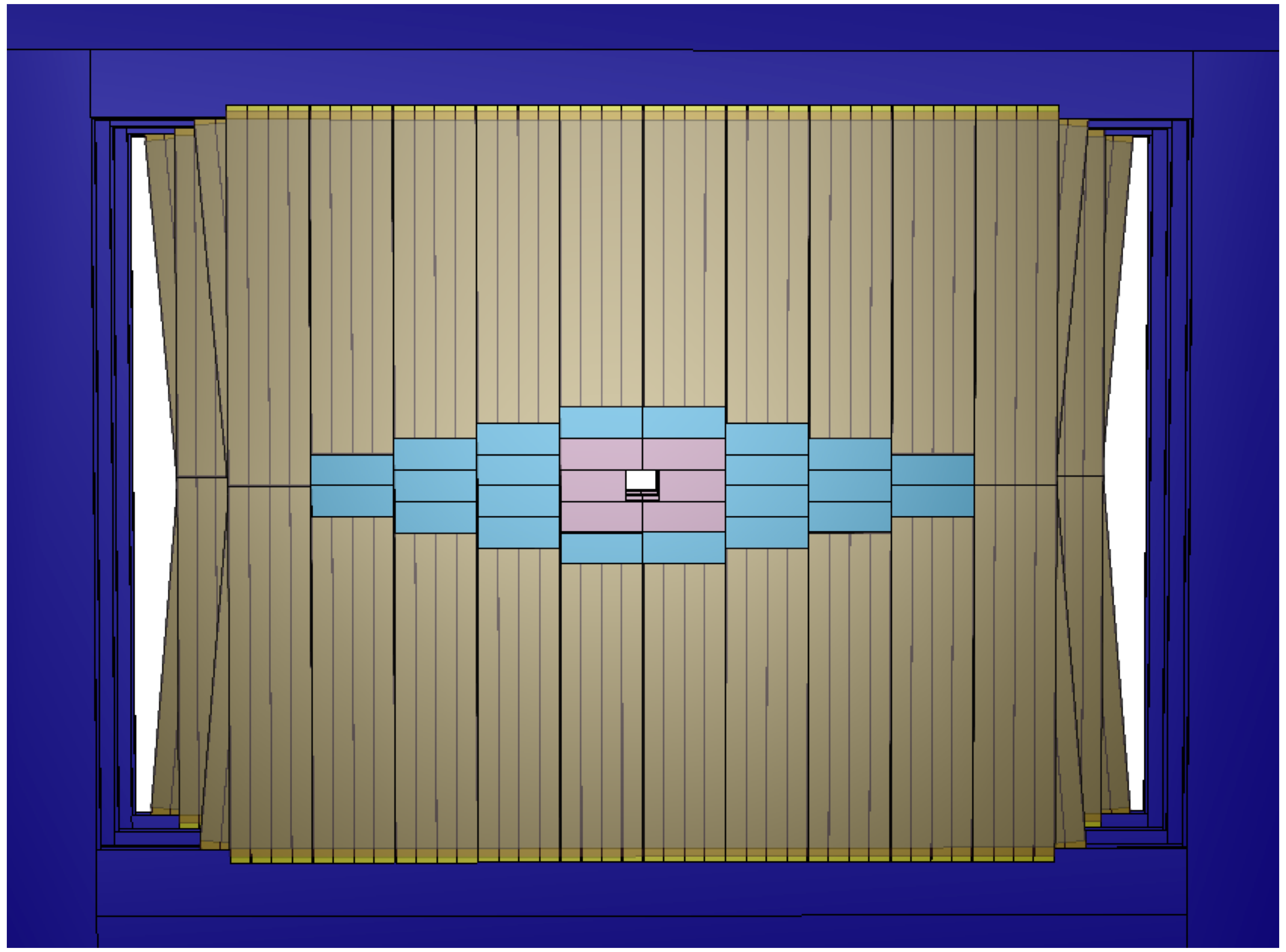
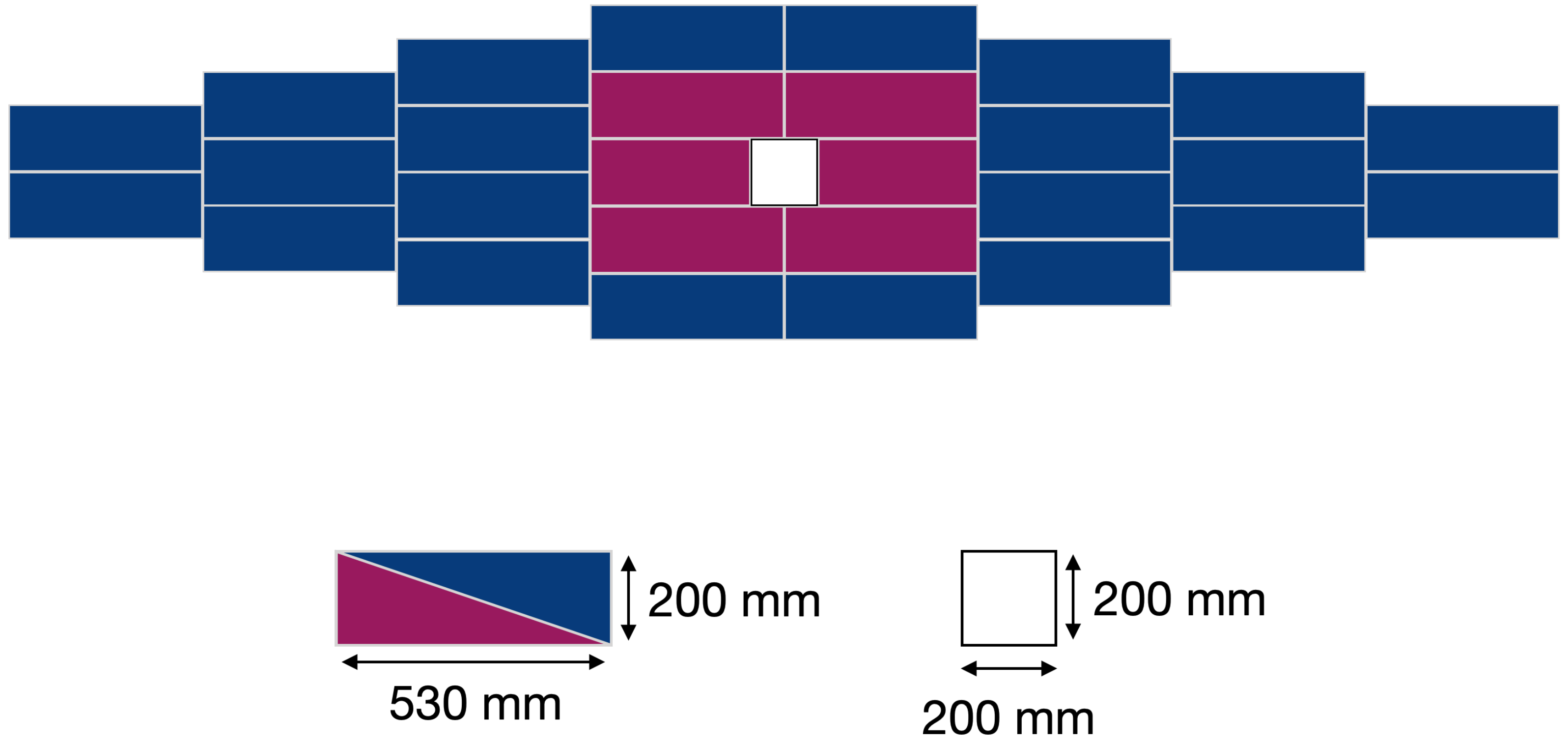


Author: Tai-Hua Lin



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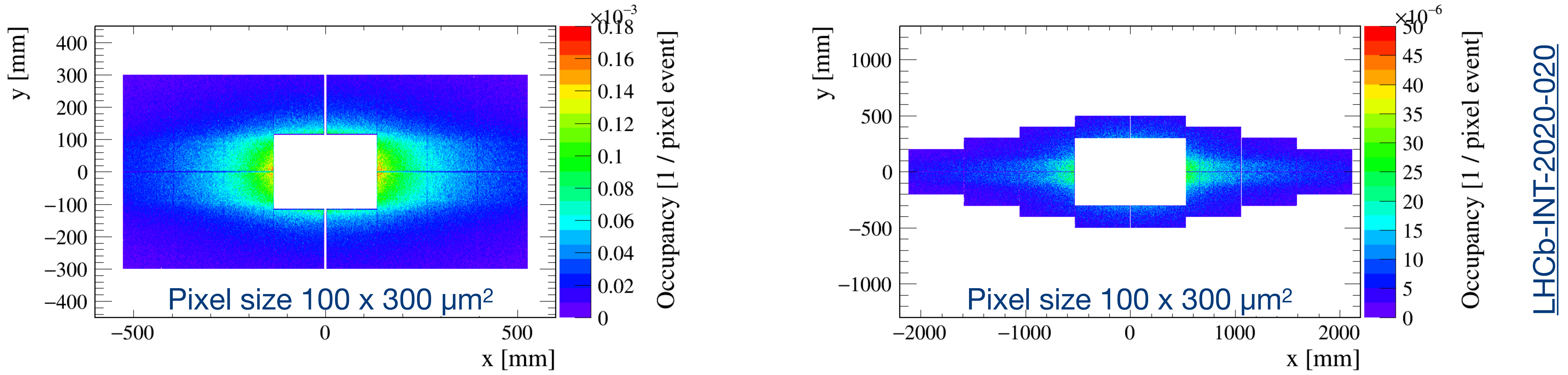
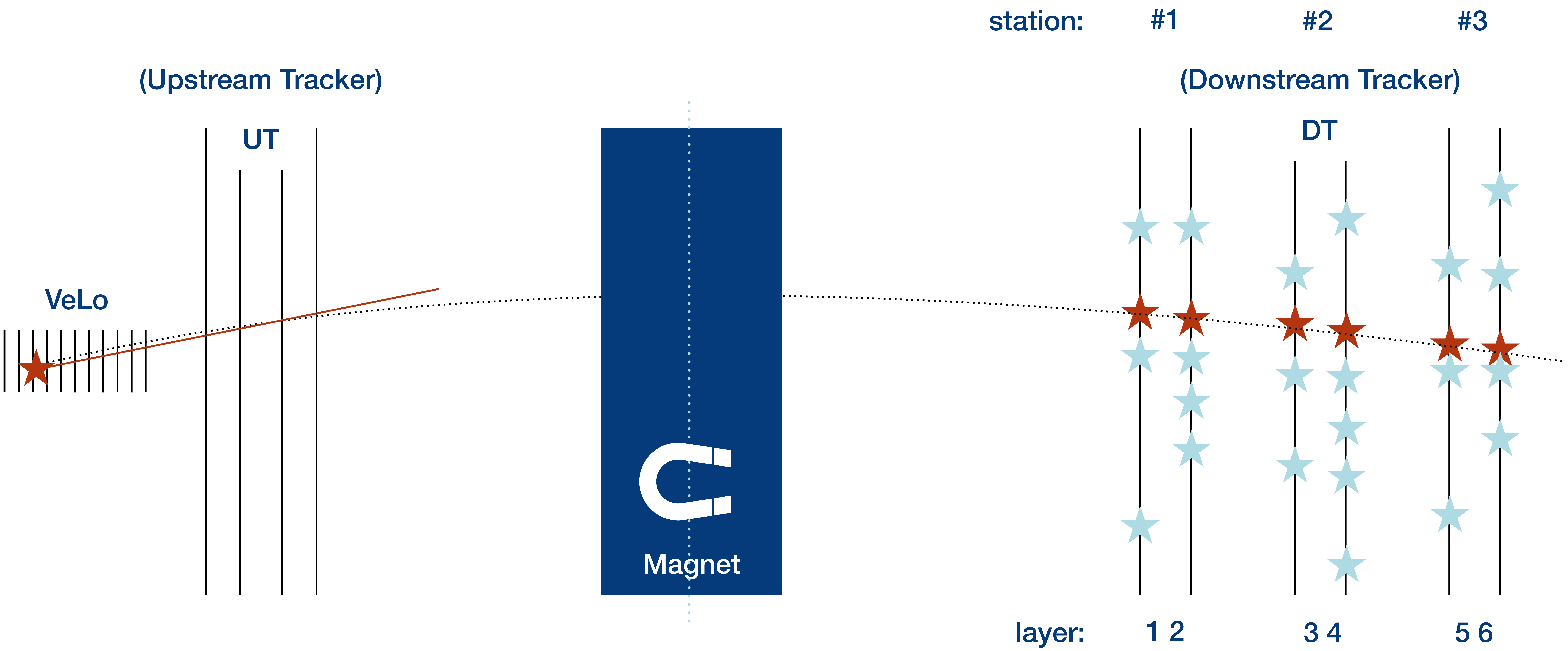


- Current PrForward does not perform well ->

  Find suitable Forward Tracking algorithm for Upgrade II scenario

Forward Tracking

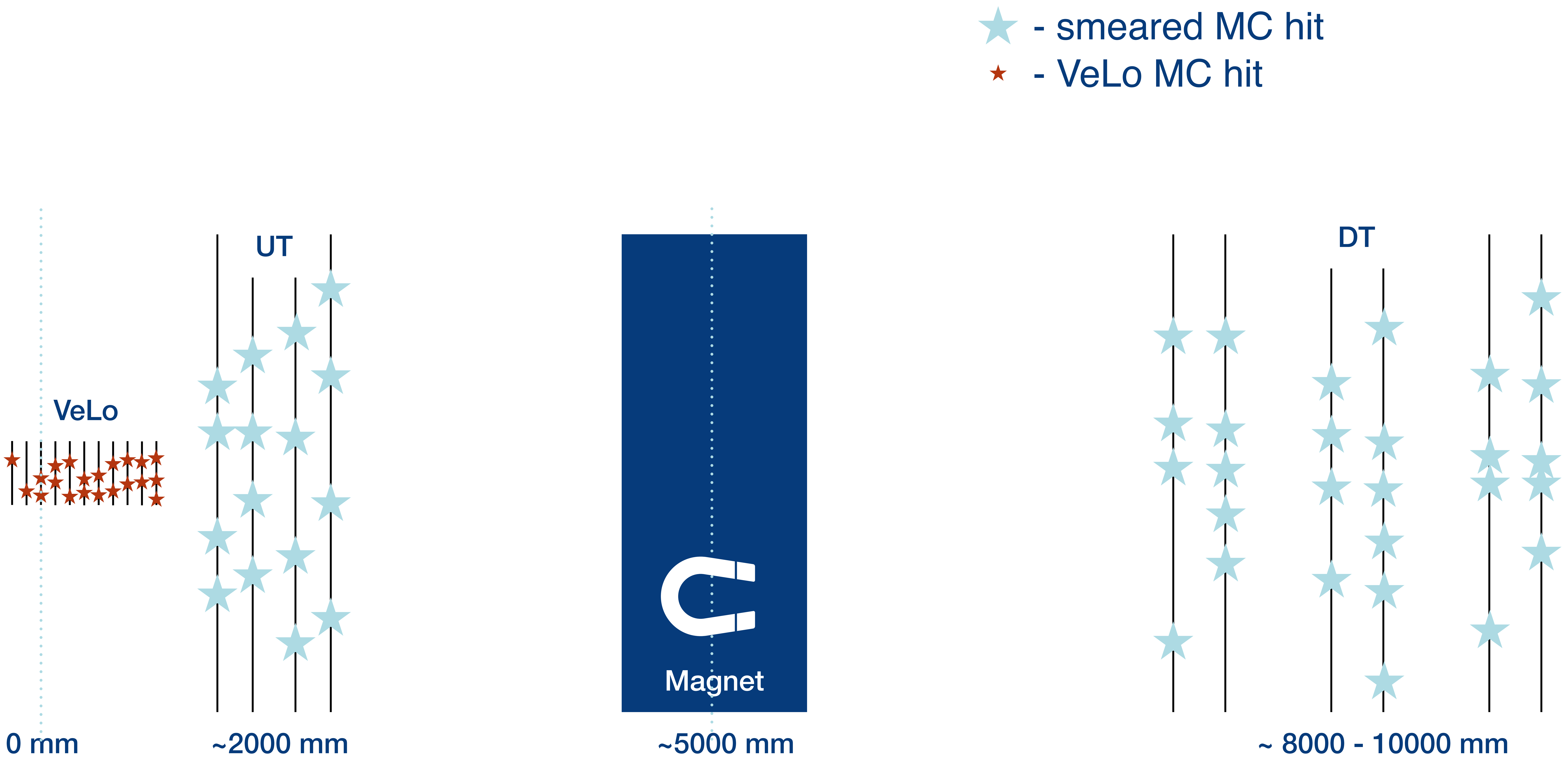


PrForwarTracking and SciFiTrackForwarding algorithms were used as a base

Assumptions

- Upgrade II simulated data i.e. $L = 1.5 \cdot 10^{34}\ cm^{-2}\ s^{-1}$;
- Optical model i.e. kink approach;
- Upstream segments: **VeLo / VeLo + UT cheated "tracks"**;
- **Smeared true particle momentum** (claimed 20% precision of the VeLo-UT momentum estimation);
- "Fully pixelated" downstream tracker -> **smeared MC hits** (100 x 300 μm^2 pixels).

Forward Tracking



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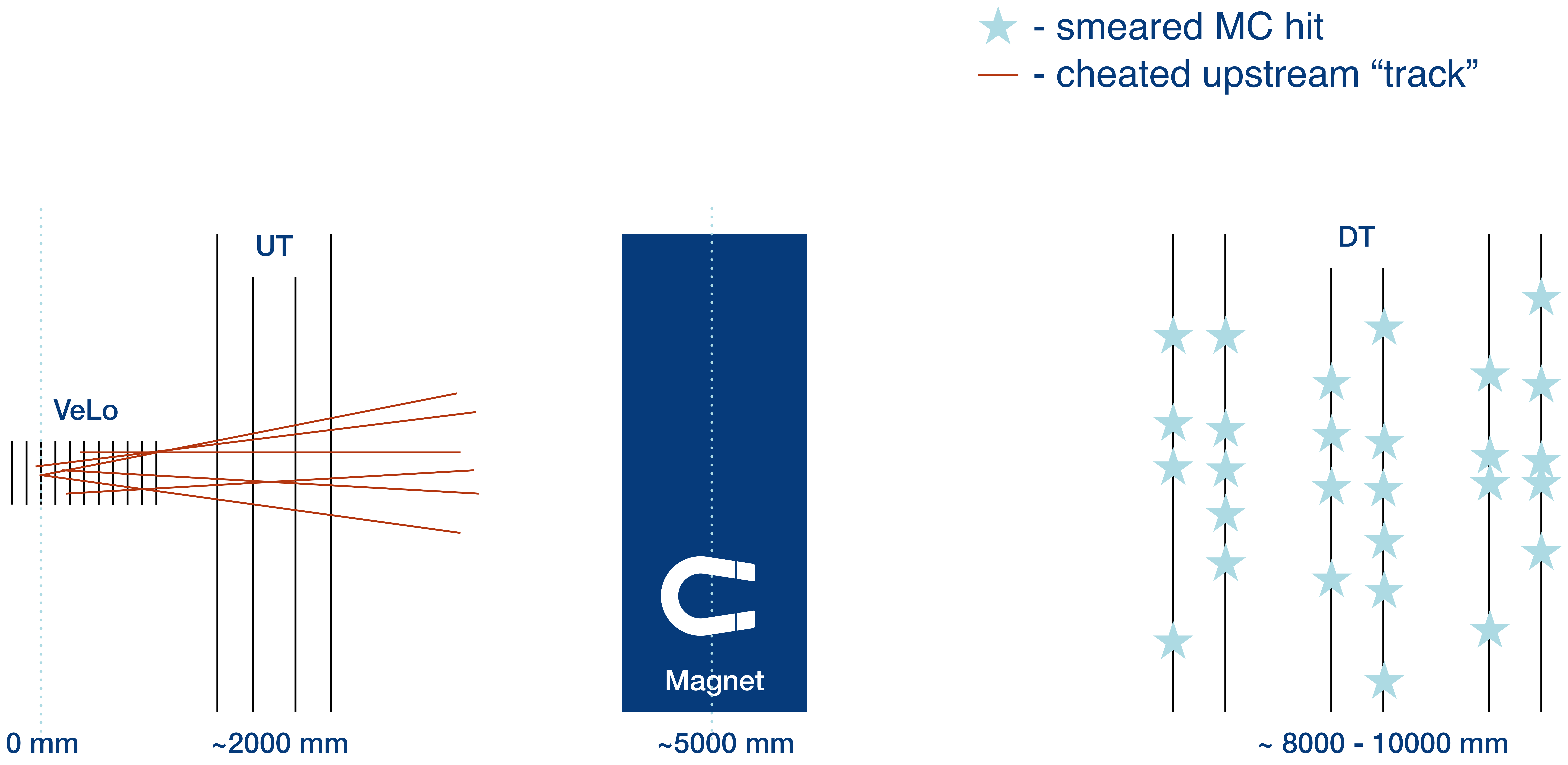

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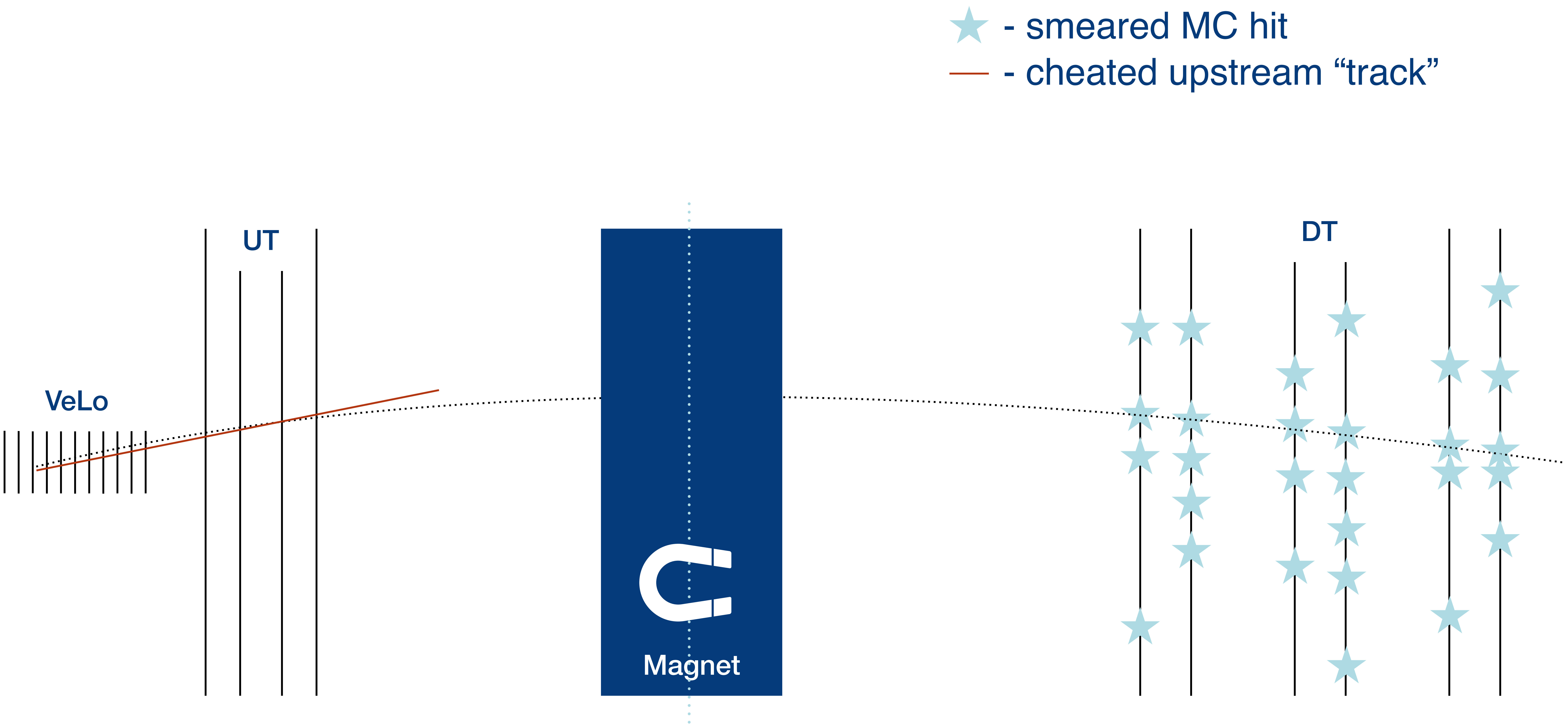

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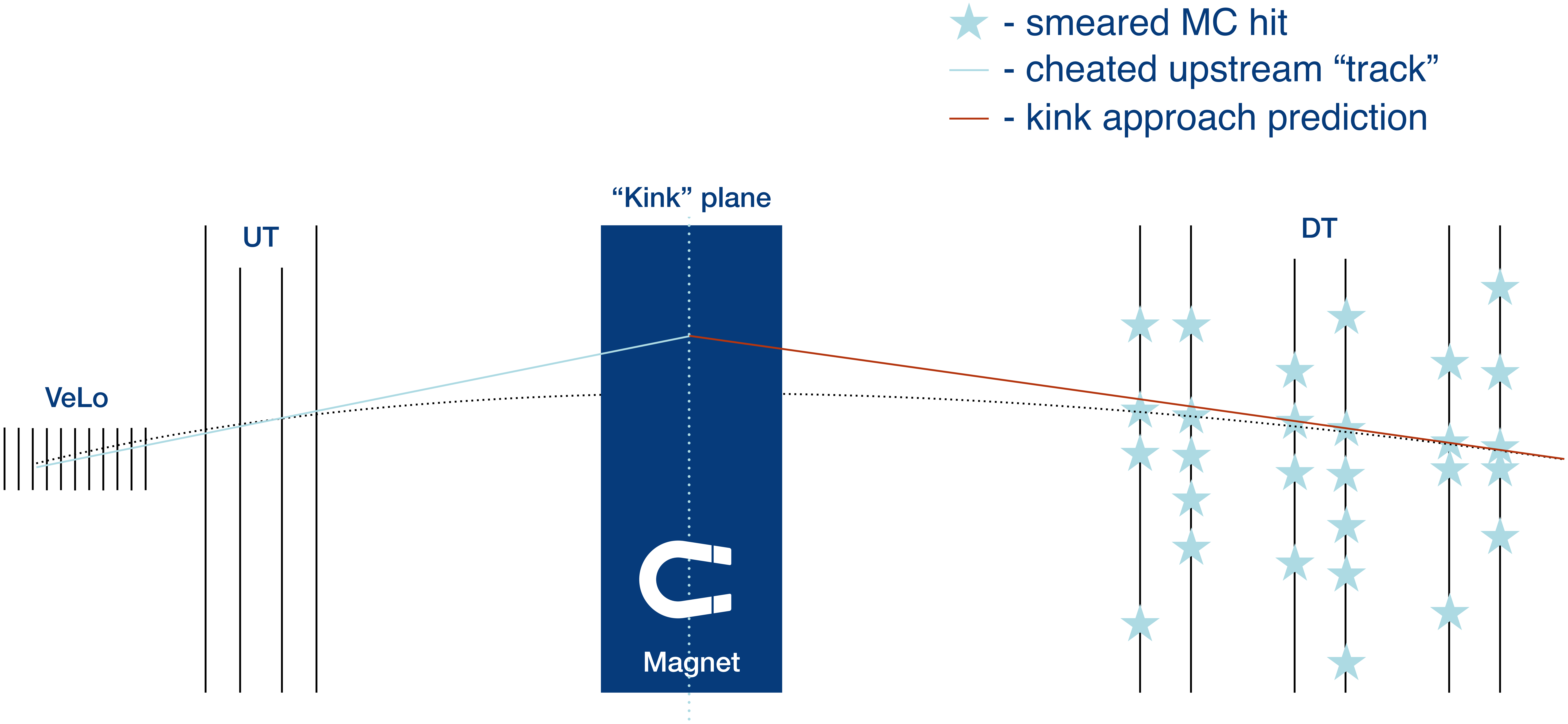
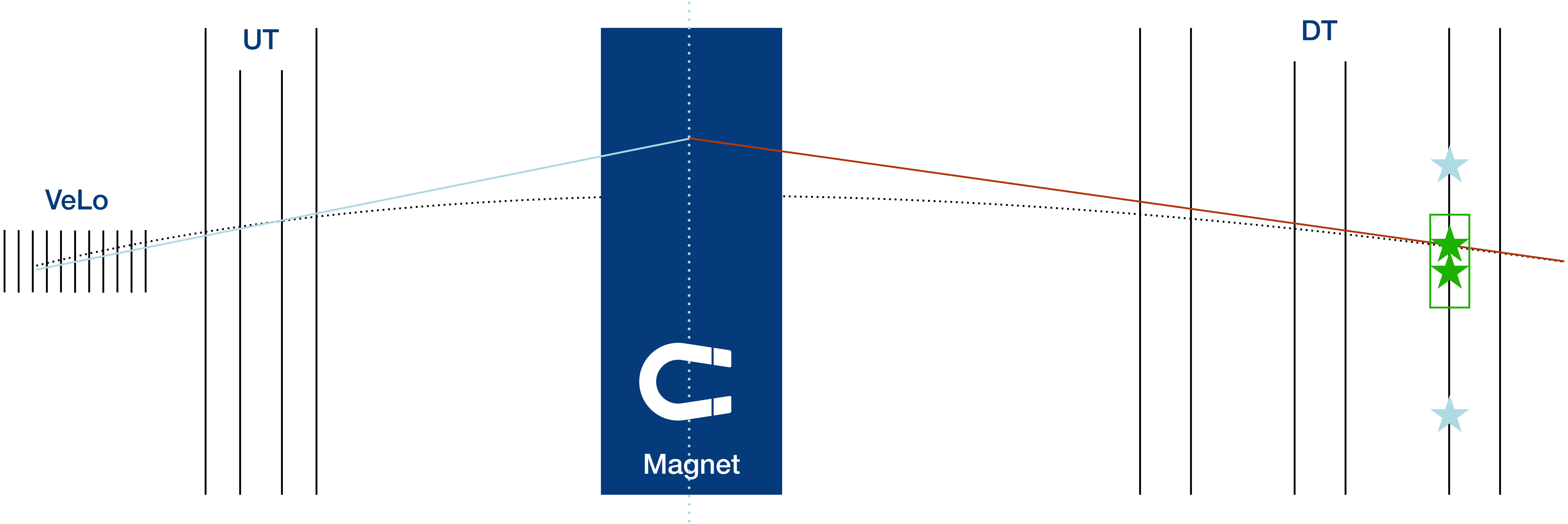


Forward Tracking

- hits inside search window
- kink approach prediction
- momentum dependent search window



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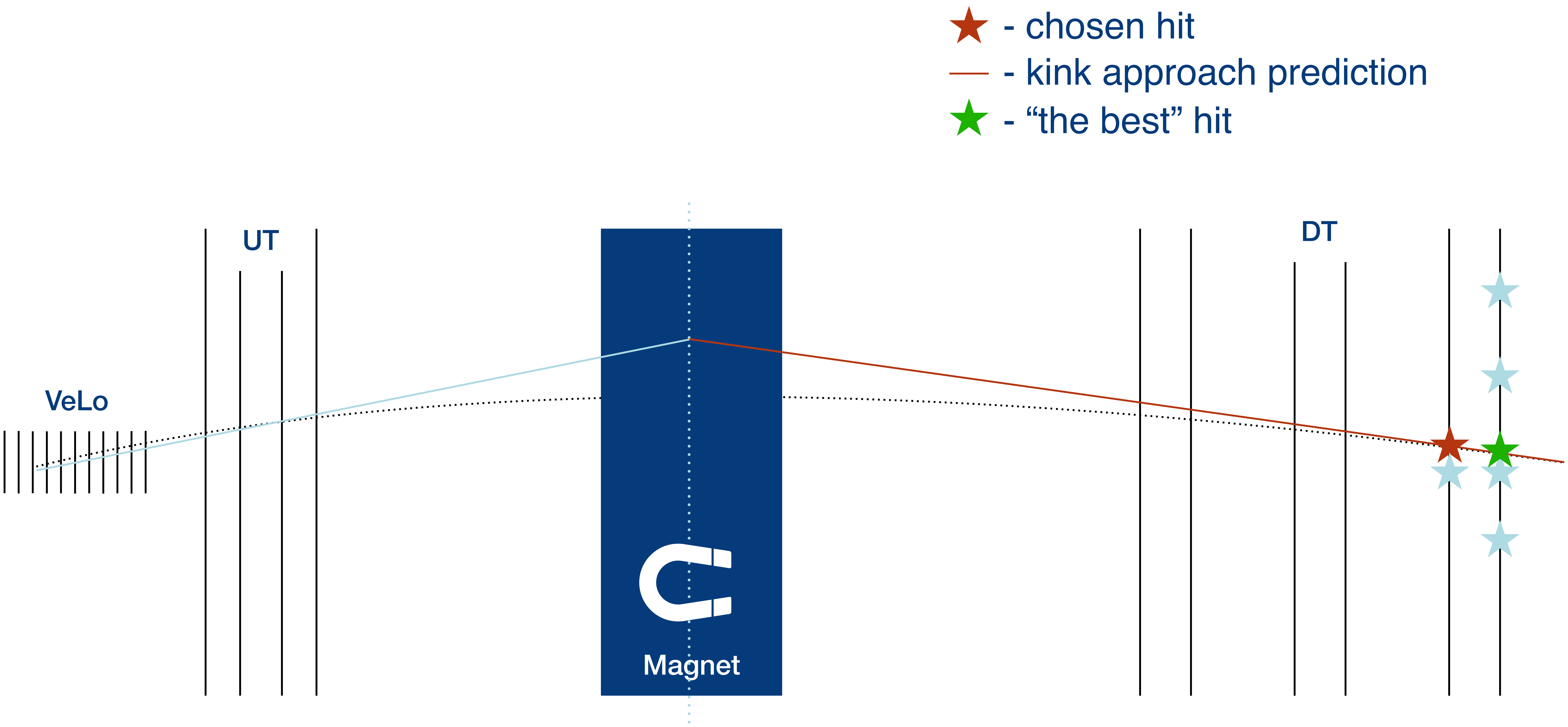

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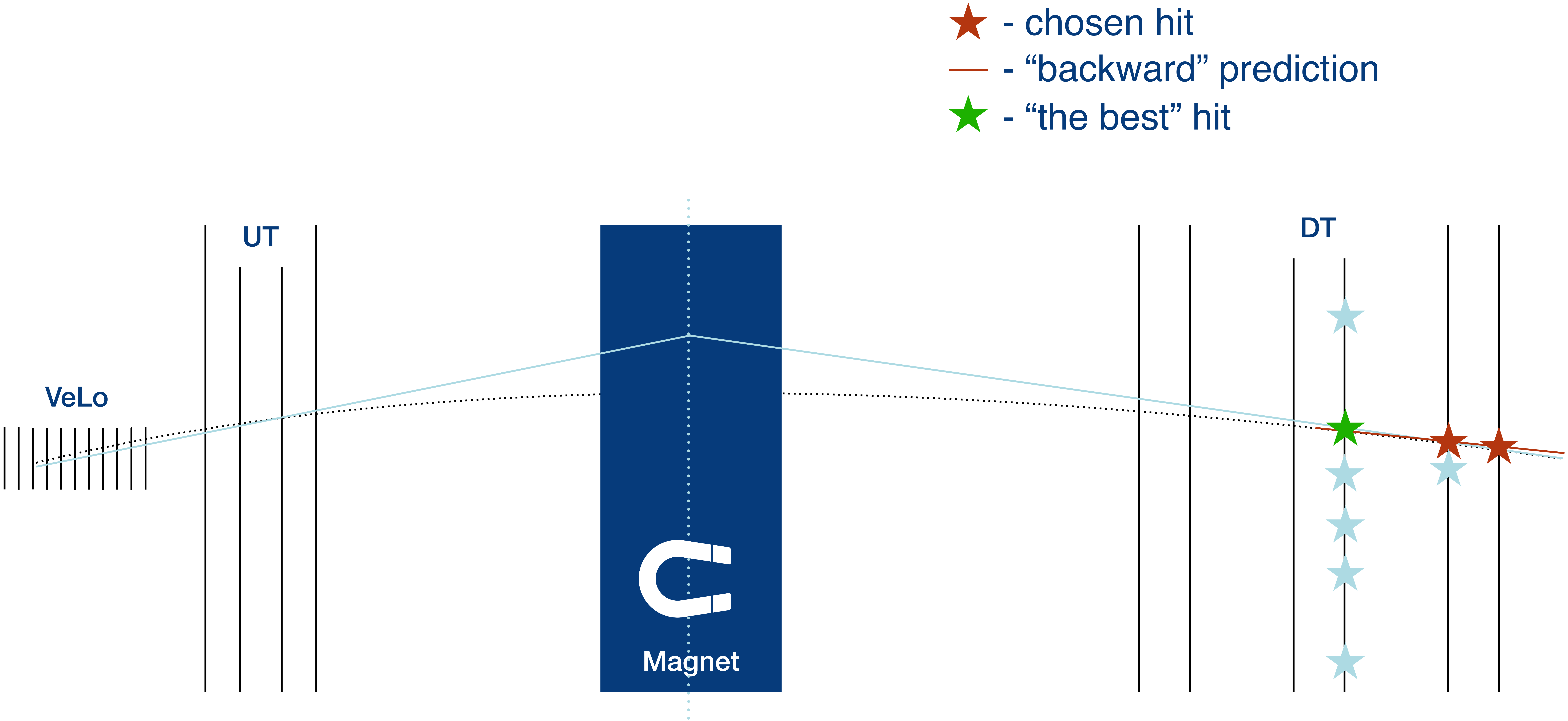

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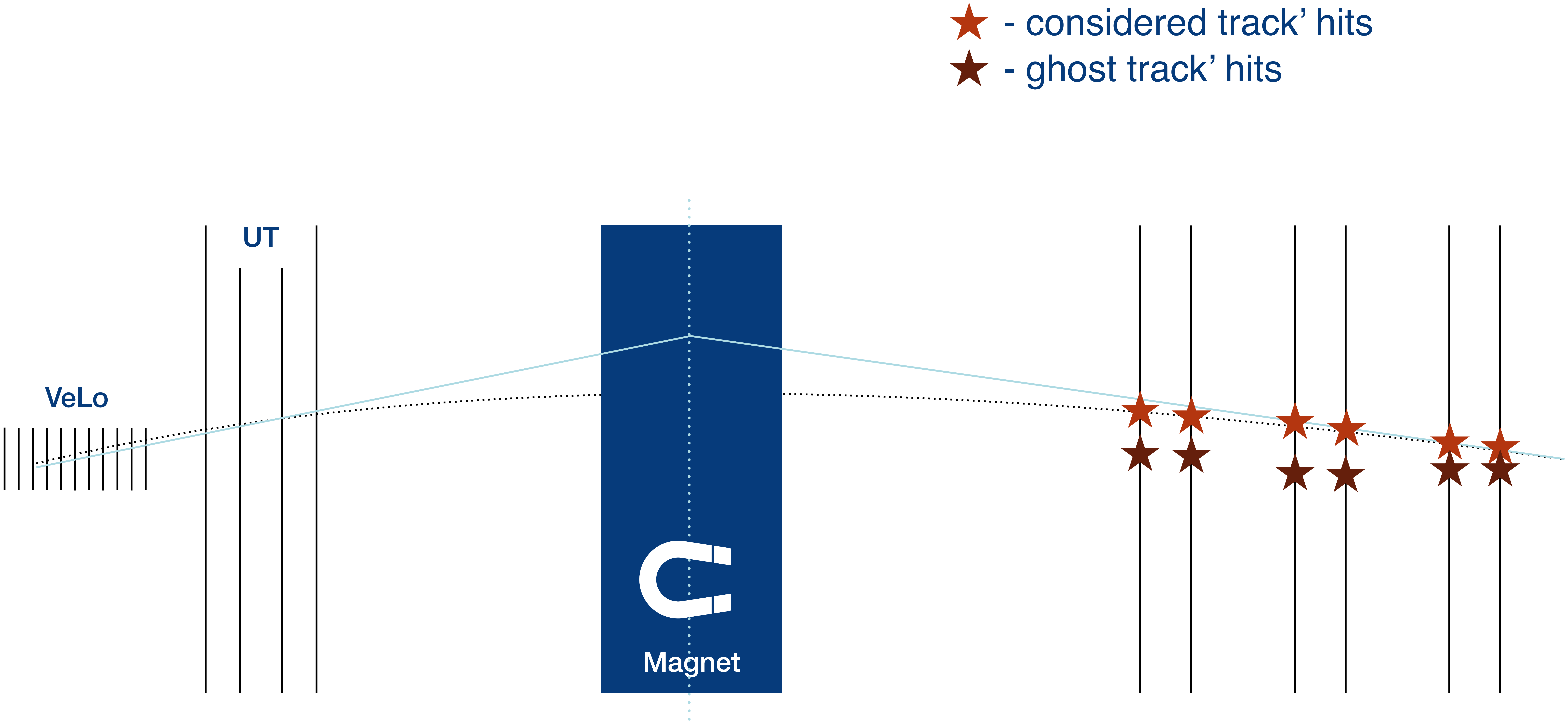


Forward Tracking

- **Reconstructed track** - upstream segment plus six hits in the DT (one hit in each DT layer).

- **Correctly reconstructed track** - a track that contains at least four hits (out of six hits found) that correspond to the upstream segment we are using (same particle).

- **Reconstructible track** - upstream segment plus six hits in the DT that corresponds to the upstream part (to the same particle).

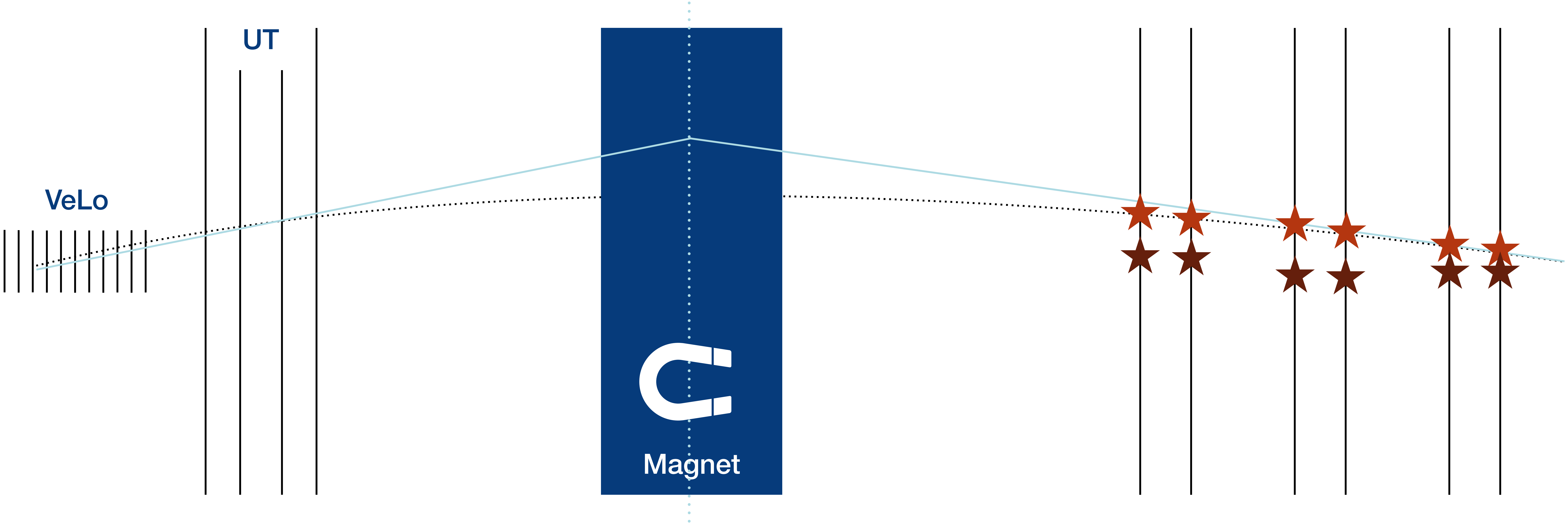
$$efficiency = \frac{correctly\ reconstructed\ tracks}{tracks\ used\ (reconstructible\ tracks)} * 100\,\%$$

$$ghost\ rate = \frac{wrongly\ reconstructed\ tracks}{reconstructed\ tracks\ (wrong + correct)} * 100\,\%$$

Forward Tracking

The first results:

$$< efficiency > \approx 99.2\,\% \qquad < ghost\ rate > \approx 85.0\,\%$$

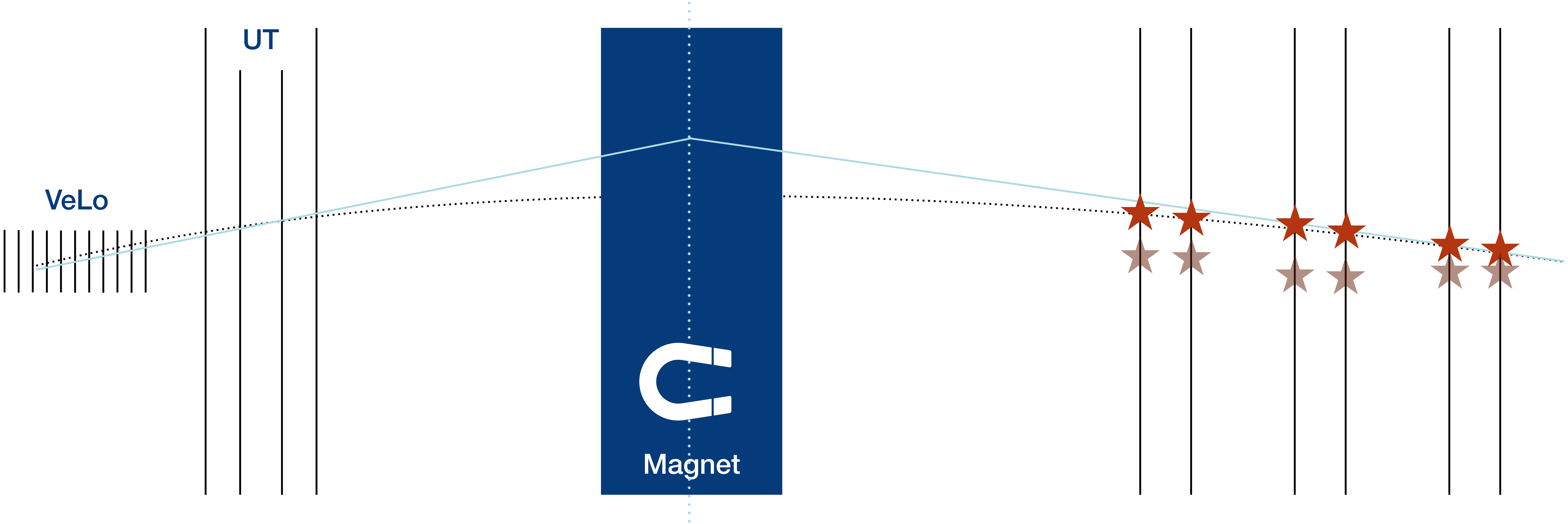


Forward Tracking

After rejecting some downstream segments that were found:

Based on the initial prediction, by simply comparing obtained parameters with predicted ones.

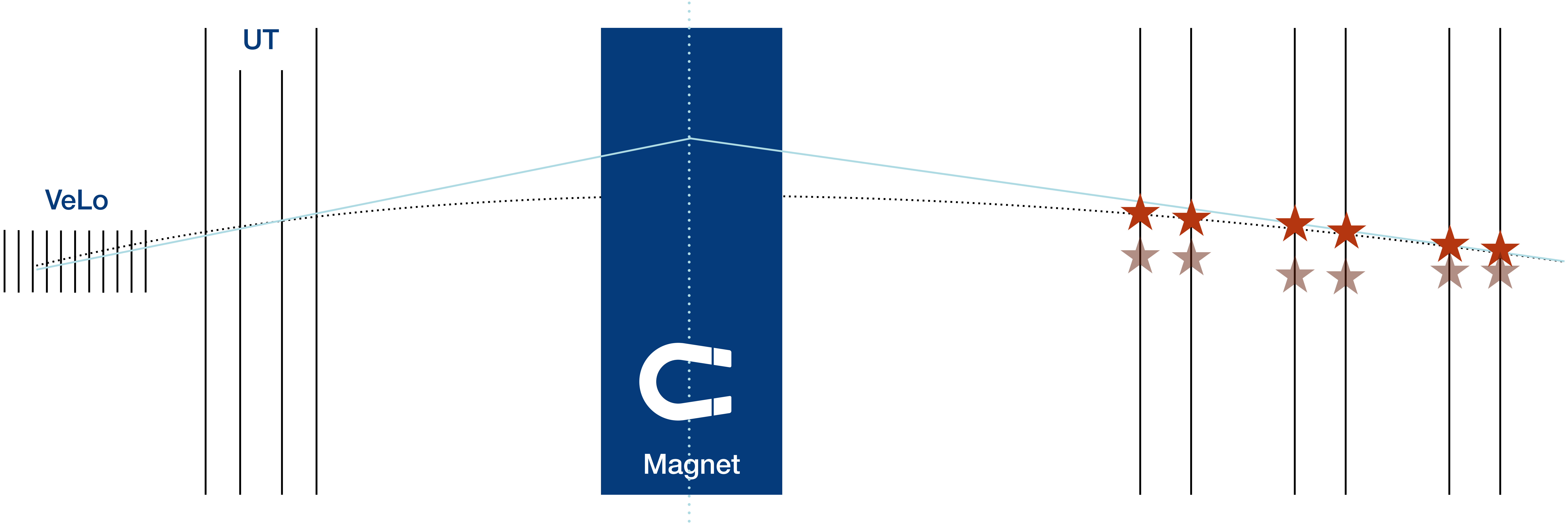
$$< efficiency > \approx 95.3\,\% \qquad < ghost\ rate > \approx 33.2\,\%$$



Forward Tracking

Possible approach to improve ghost rate rejection - **track matching** algorithm [LHCb-INT-2020-014].

$< efficiency > \approx ??.?\%$ $< ghost\ rate > \approx ??.?\%$



Thanks for your attention