

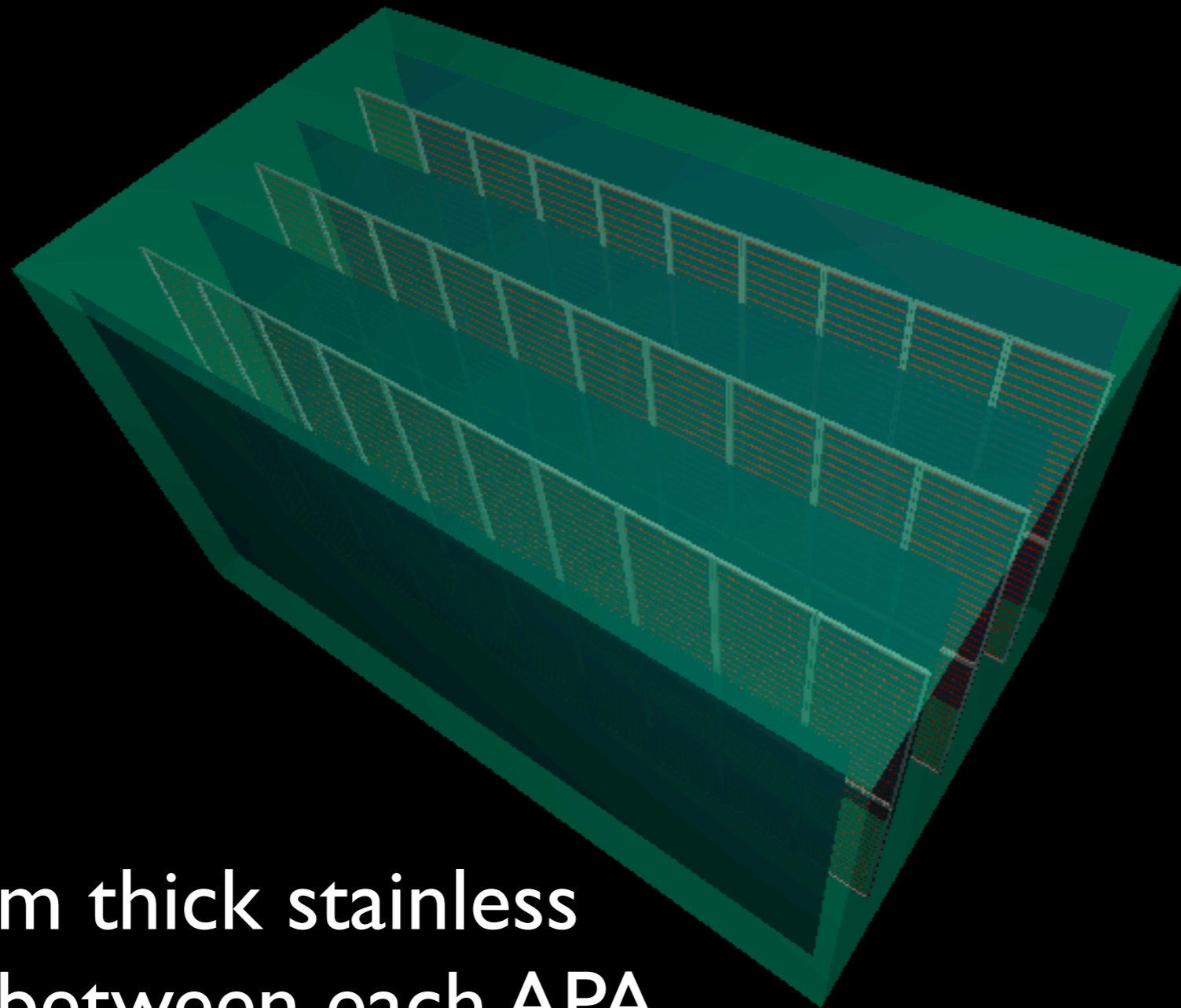
Reconstruction Ambiguity from Cathode Planes

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LBNE Simulation/Analysis Call
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The Cryostat (one more time)

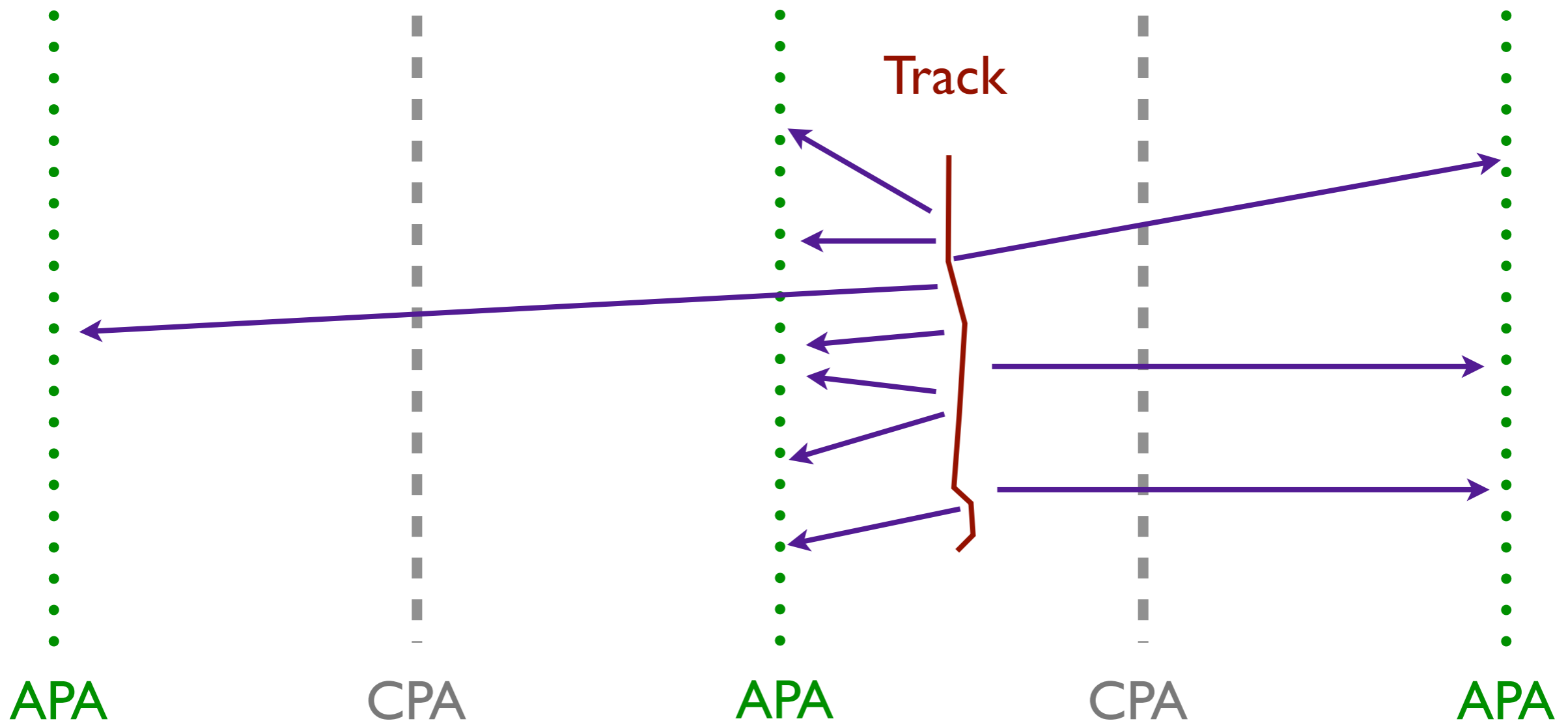
16m wide, 27m long, 16m tall



Solid, 3 mm thick stainless steel plates between each APA

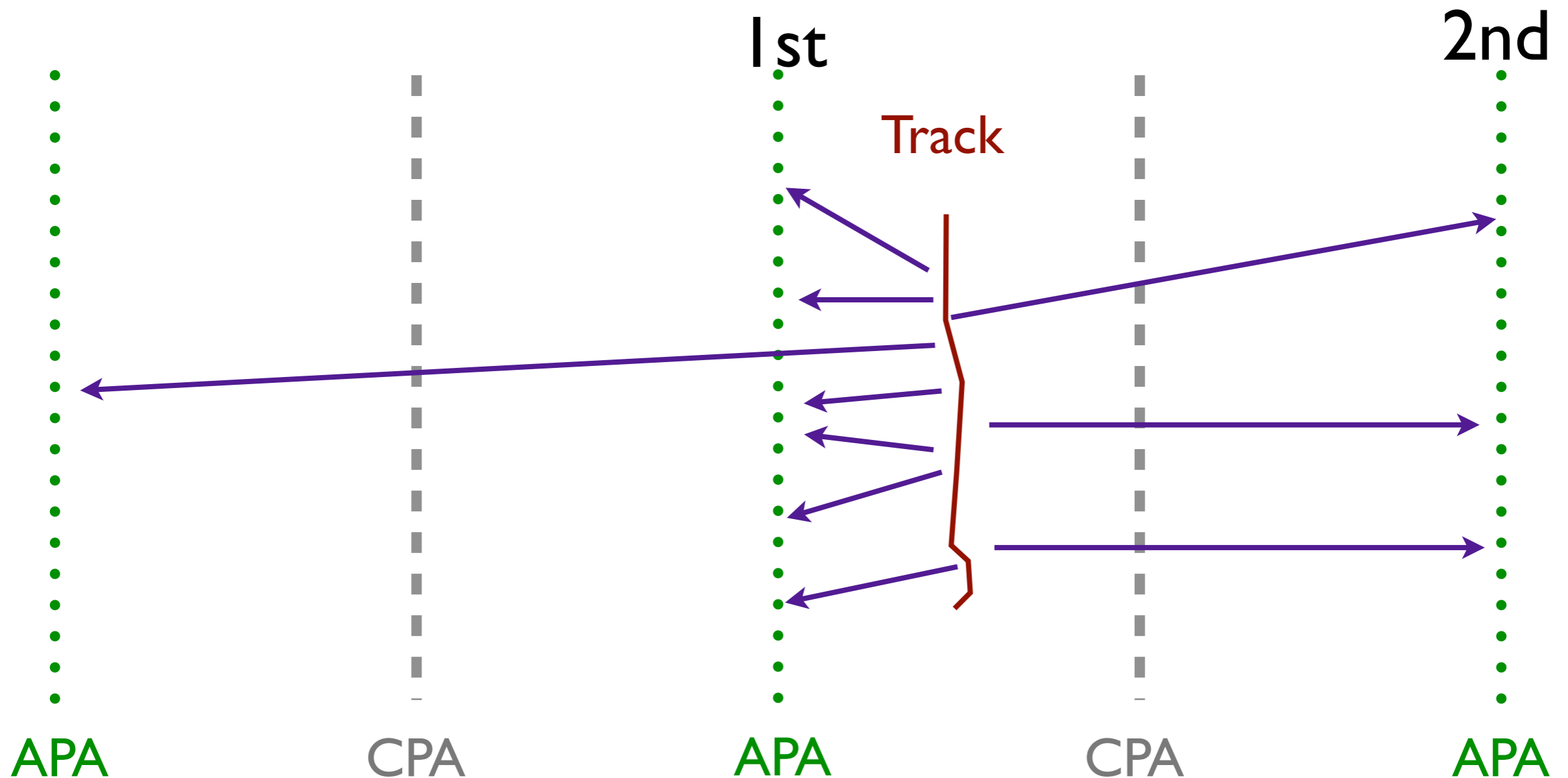
Finding a Unique Track Solution

- Transparent cathode planes (i.e. wires) would ensure that every track can be observed by at least two different APA planes:



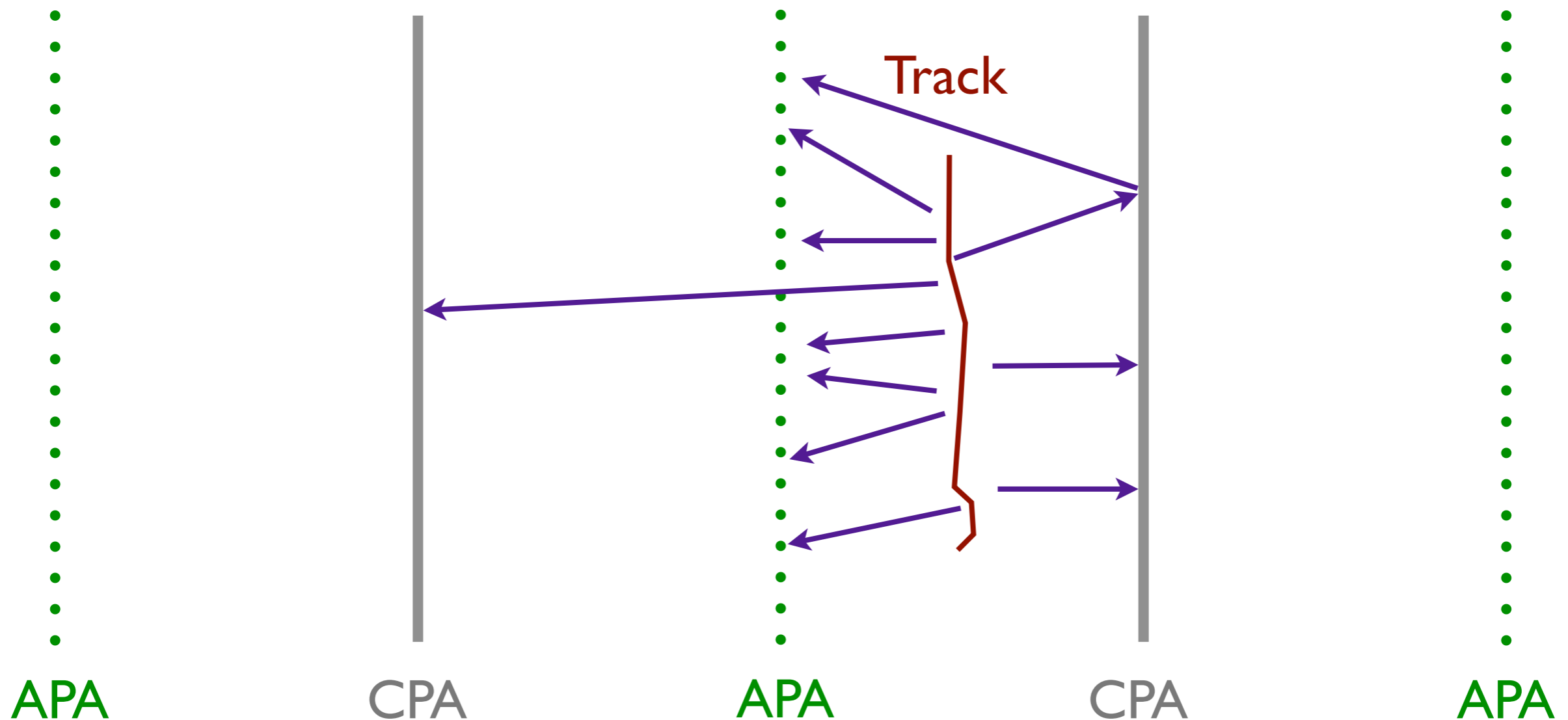
Finding a Unique Track Solution

- The light seen in the closest and second closest APA planes anchor the track in a unique region.



The Problem with Plates

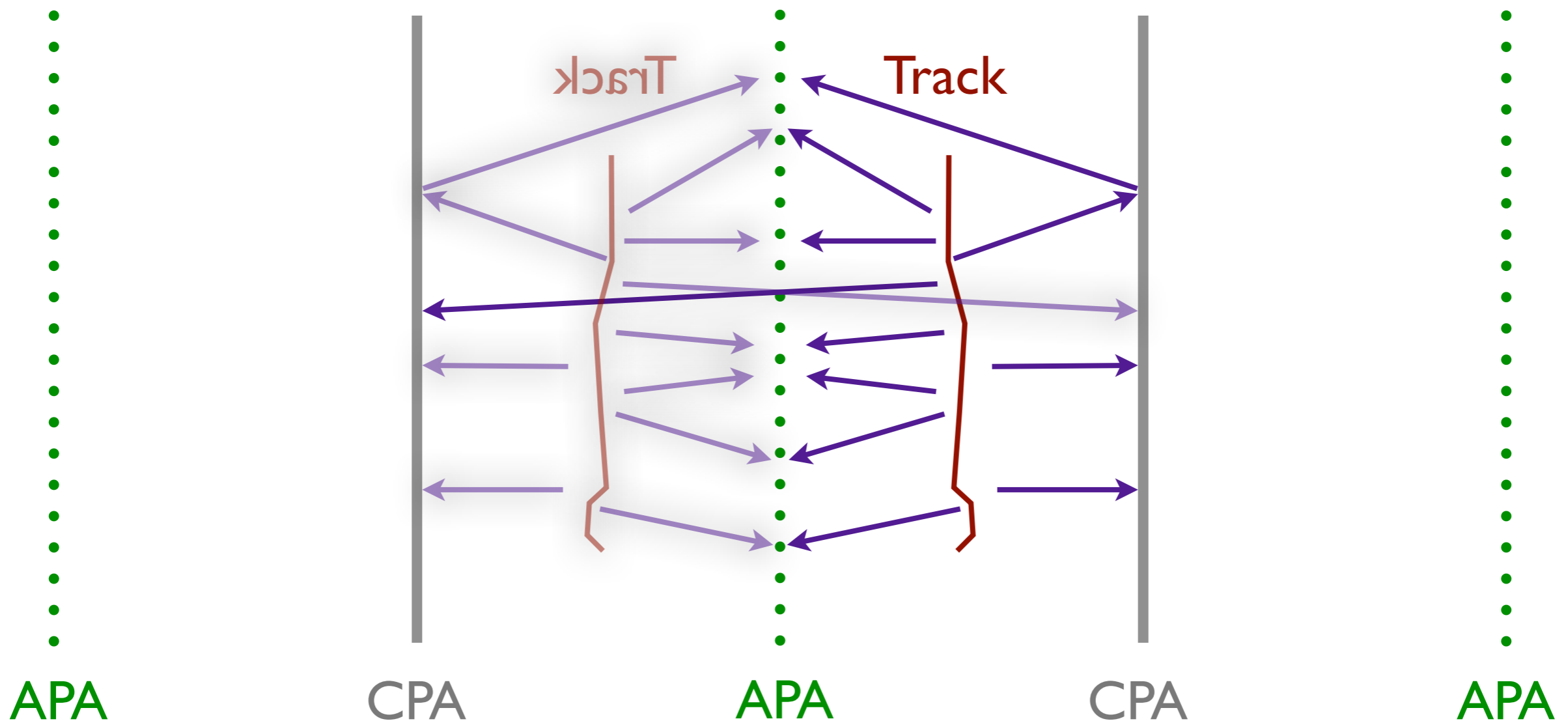
- With opaque cathode planes, this handle is lost, creating a degeneracy in the optical response of the detector..



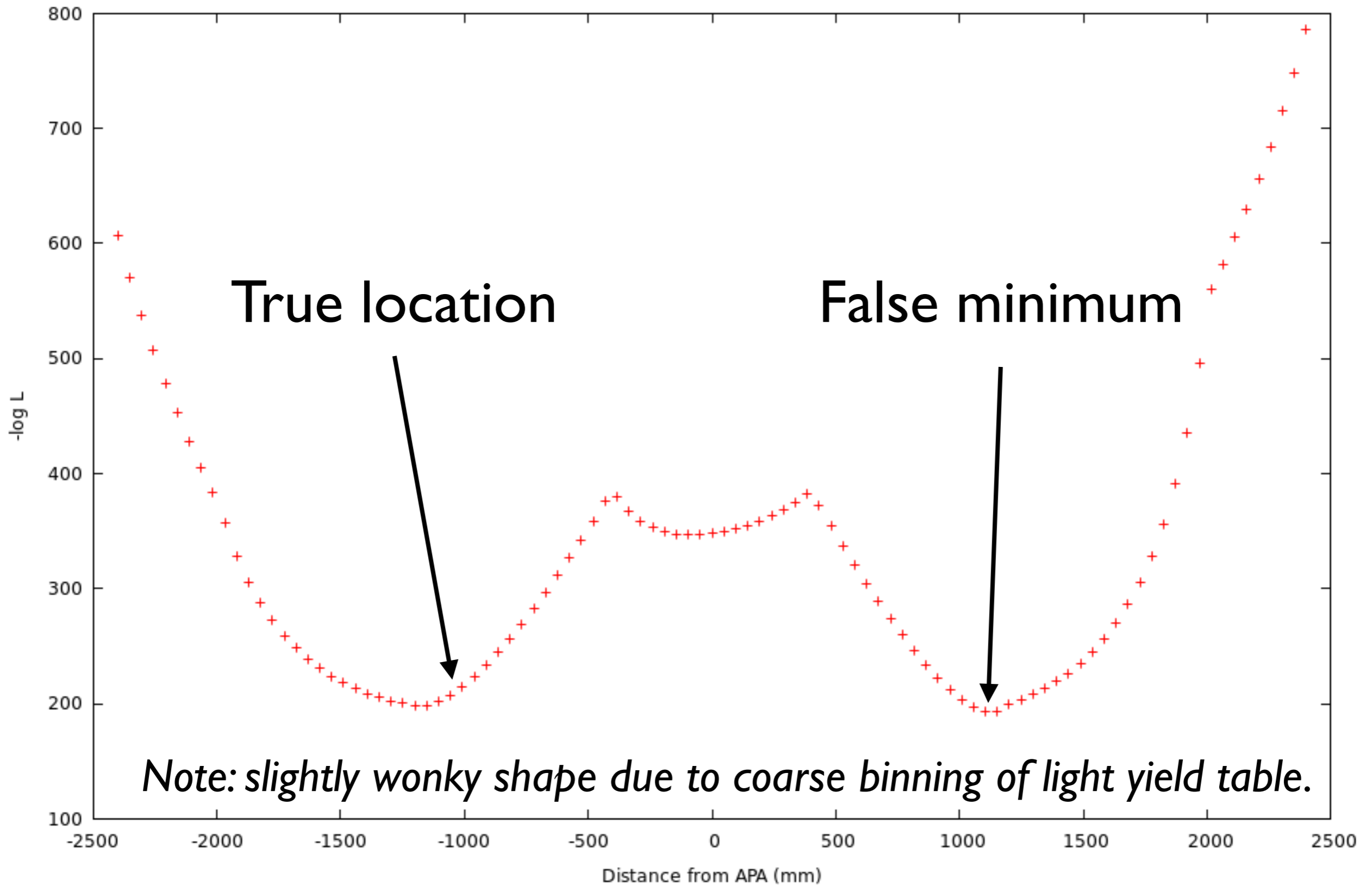
The Problem with Plates



- ...which allows a “mirror universe” track solution that would have the identical hit pattern:



Ambiguity in the Likelihood

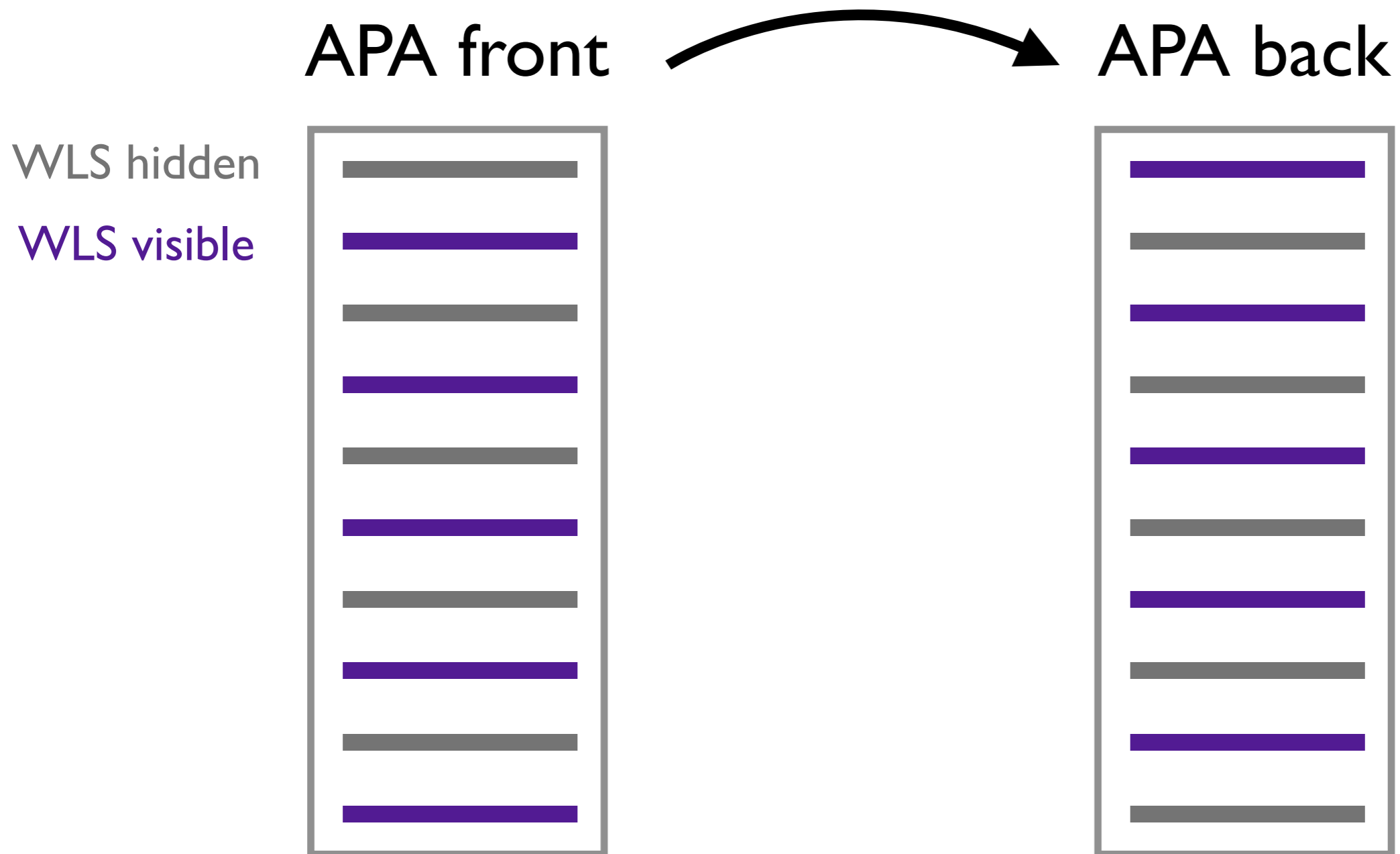


Breaking the Degeneracy

- Any solution to this problem has to *break the reflection degeneracy of the detector's optical response*.
- Possible solutions:
 1. Politely request that all cosmic rays traverse at least one cathode plane. (Nature unlikely to oblige...)
 2. Place wavelength shifting bars on the top or bottom of the cryostat. (Very difficult from engineering perspective...)
 3. Mask the bars to make their response asymmetric.

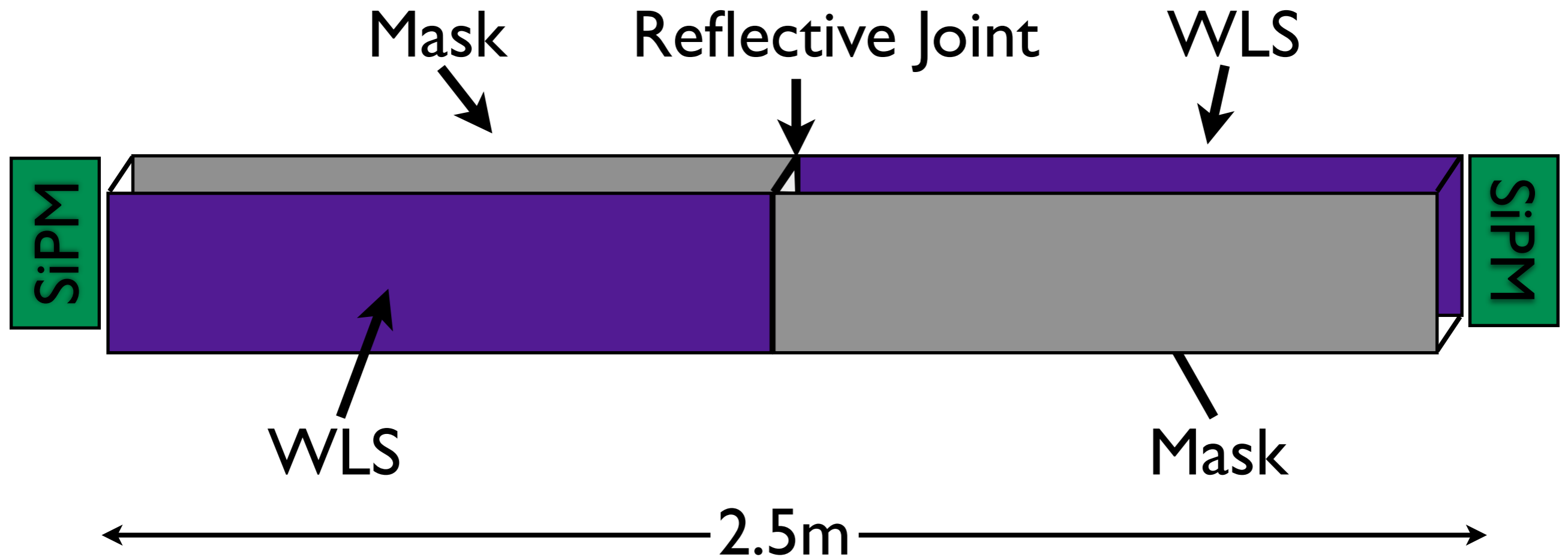
Masked Bars

Option 1: Preserve channel count (and cost), cut light yield in half.



Split-Masked Bars

Option 2: Double channel count, preserve light yield.



Readout from both ends of the bar.

Each end sees photons from a different side of the APA.

Next step...

- Generating per-channel light yield tables for both of these masking alternatives.
- Test whether this removes the reconstruction ambiguity and recommend one or both of these options to the photon detection system working group.