ML for Vertex Reconstruction For ALPHA-g

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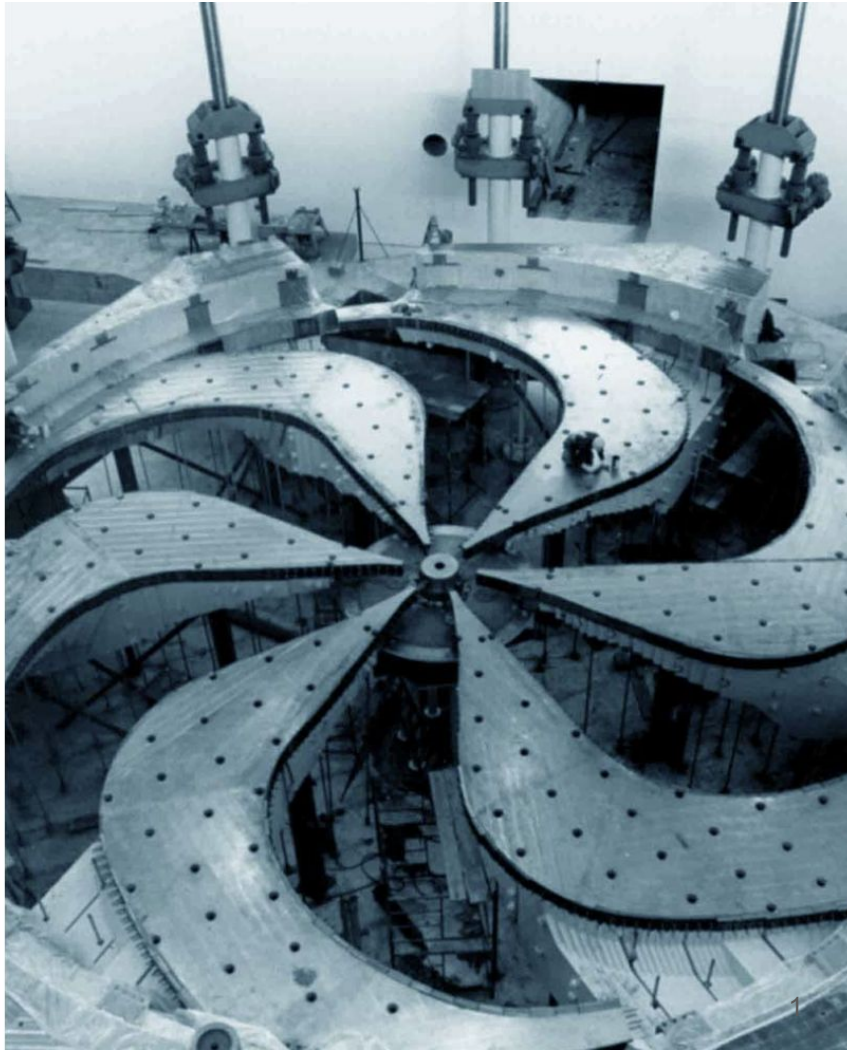
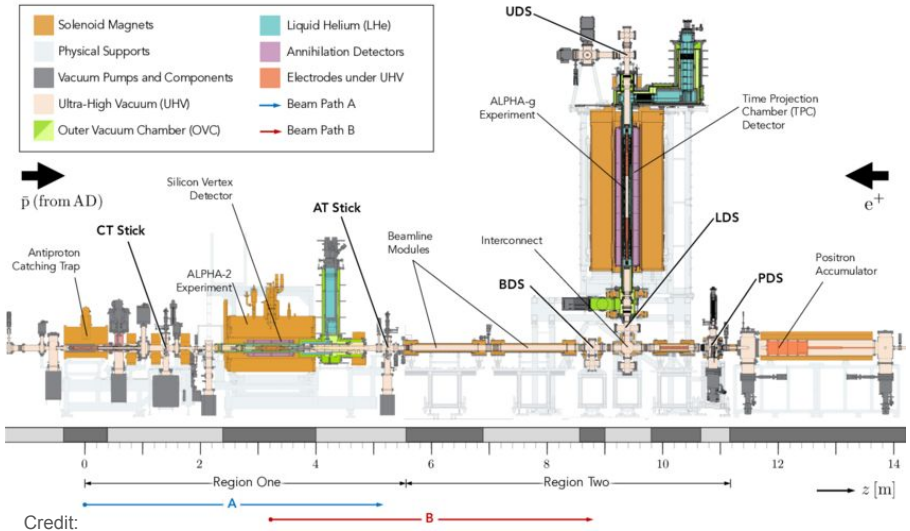


What is ALPHA-g?

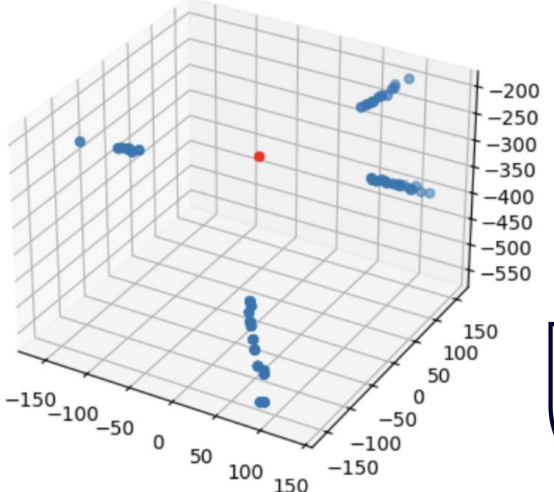
- Studying free-fall of antihydrogen - does gravity interact with matter and antimatter the same way?
- Trap particles with magnetic confinement, then release them
- We see charged pions, we want to know the origin point – where the antihydrogen annihilated



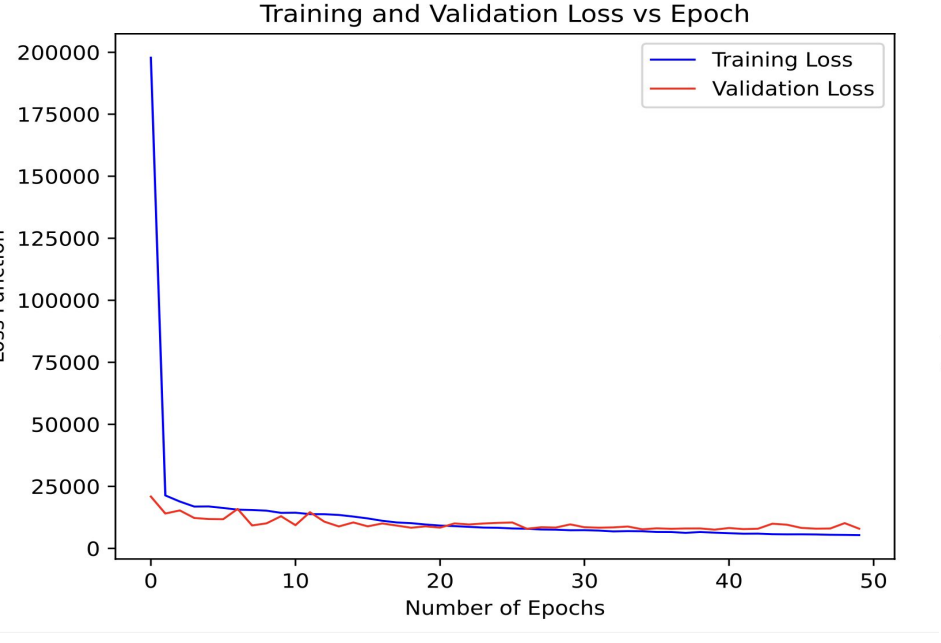
Credit: https://www.researchgate.net/figure/Schematic-showing-a-cross-section-view-of-the-ALPHA-apparatus-following-the-installation_fig1_365615655

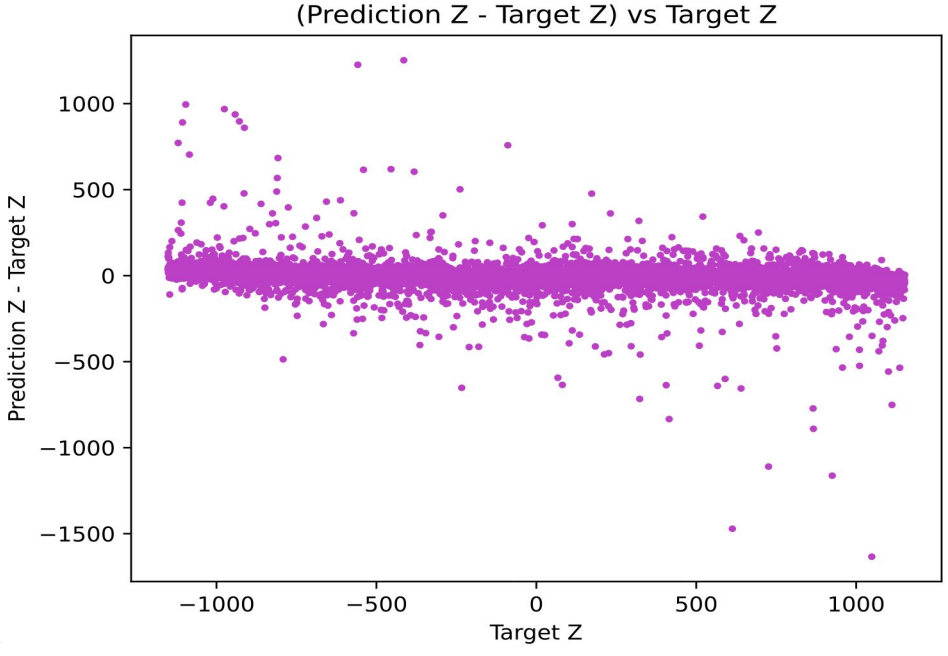
What did we do?

PointNet ML Model
Data: 100,000 Events (x,y,z), Input: Clouds of hits →
Output: z-vertex of origin point



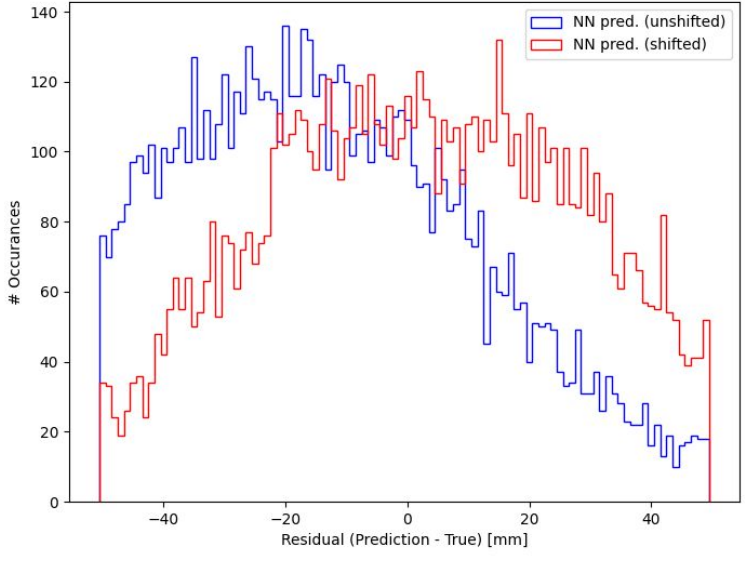
What did we do? Out-of-the-box performance:

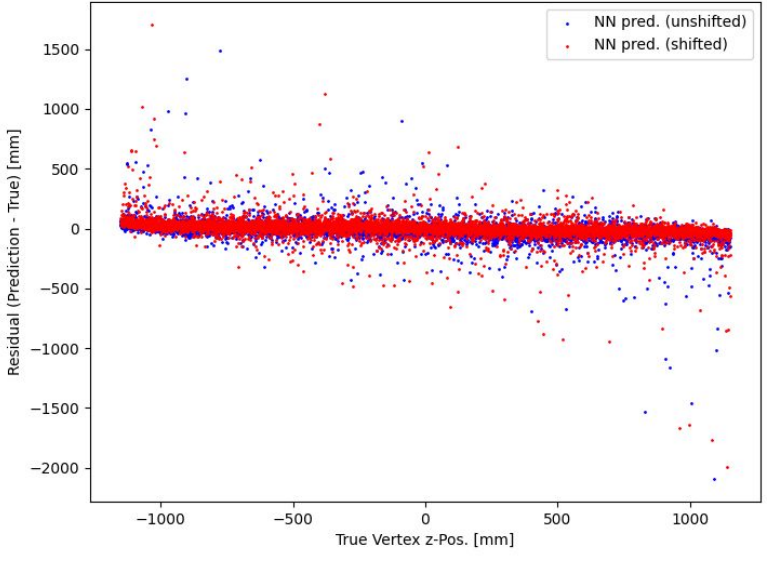




Improving the Model - Z Shift

- Z-coord. of reconstructed vertex differs from the true value.
- Train the model to adjust for this deviation!





Backup

- Input tensor shape: (Batch,C- number of channels,L-number of points)
- Simple Input: (2,3,4)
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