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SI LAB
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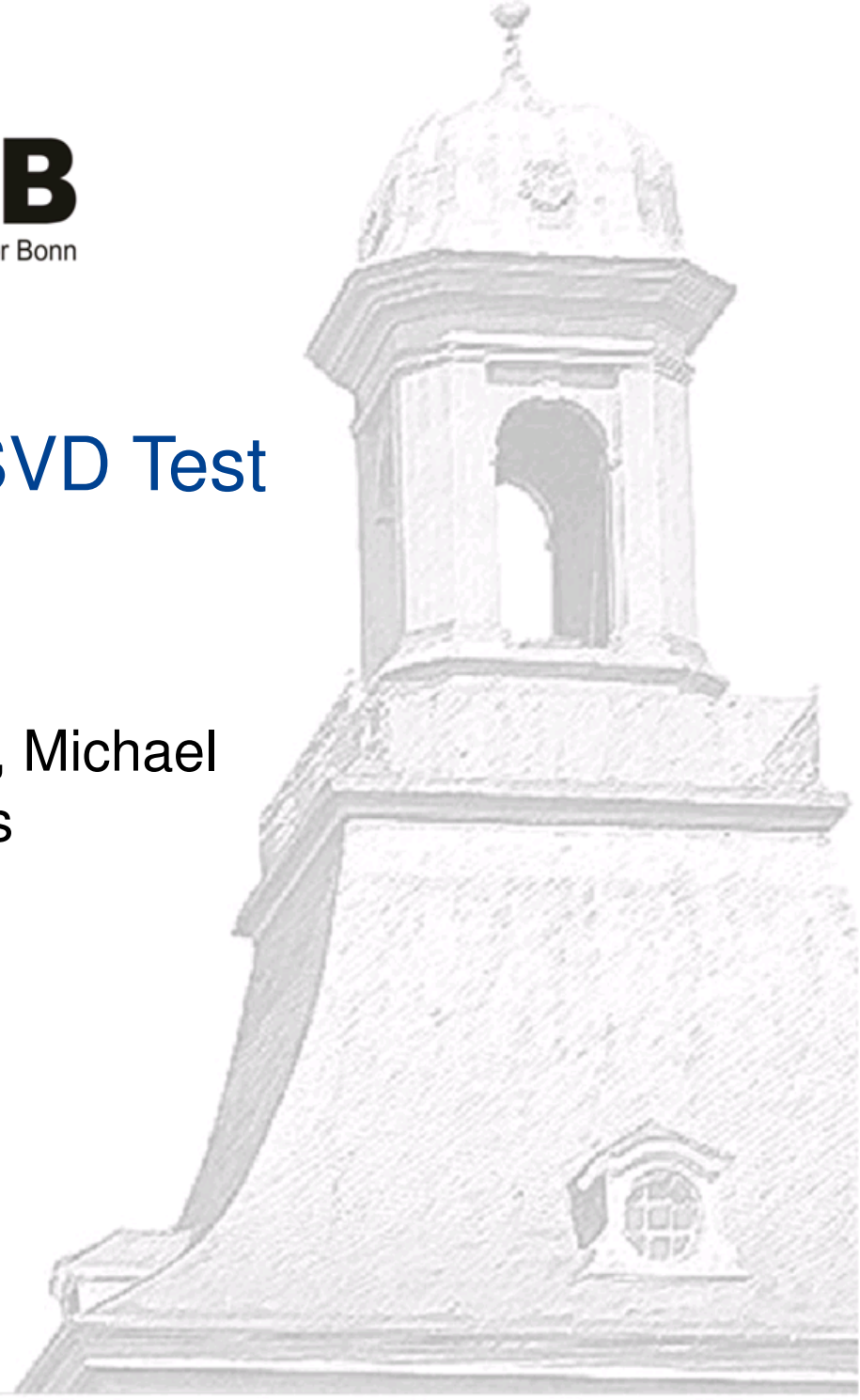
# DATCON Results from the SVD Test Beam at CERN

Jochen Dingfelder, Carlos Marinas, Michael Schnell, Bruno Deschamps

January 22nd, 2015



# Presentation

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- Bruno Deschamps.
- Electrical engineer, master degree ESIEE Paris. ‘
- New PhD Student at the University of Bonn;
- Continuation of Michael Schnell’s work on the DATCON
  $\Rightarrow$ Development of the **full scale** system.

# Belle II Vertex Detector

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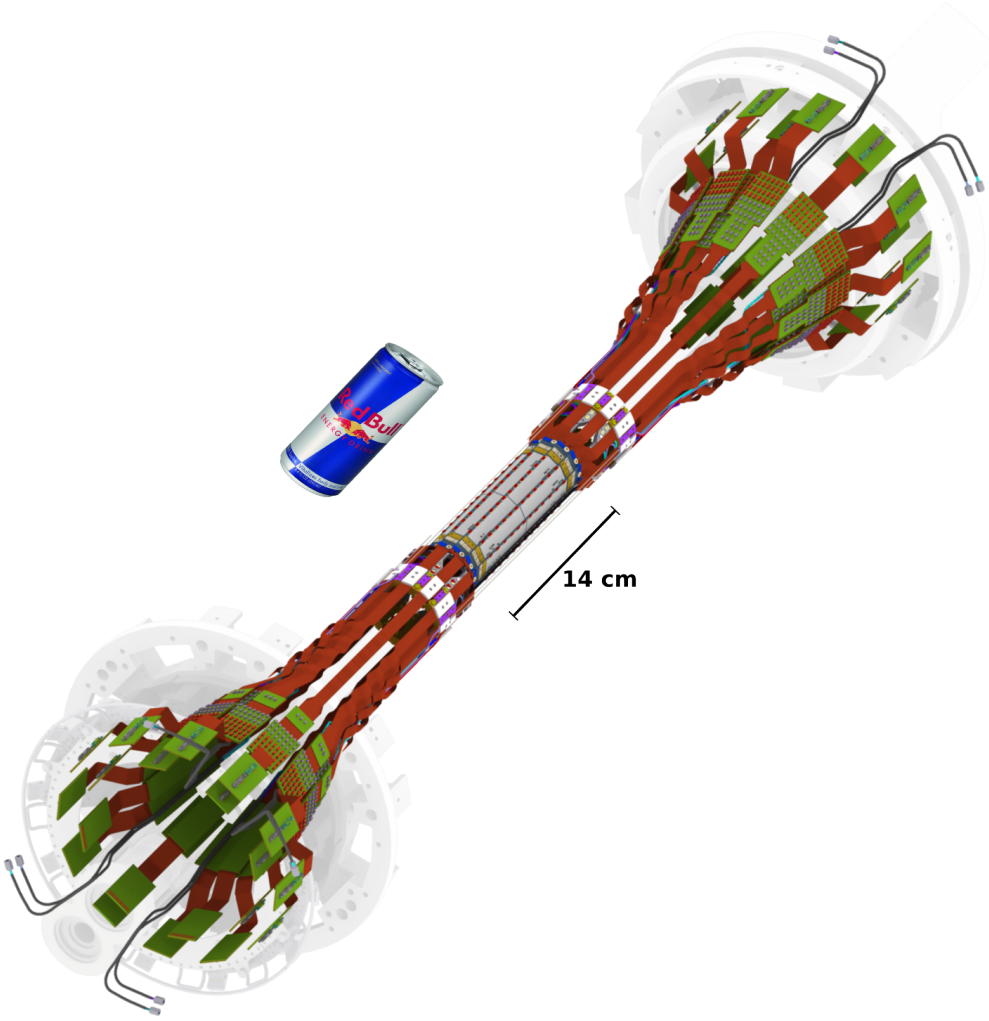


- 2 layers DEPFET Pixel Detector (PXD) with 8 million pixels (avg: 60 Gbps, max 256 Gbps)
- Data reduction required for PXD data (factor $\sim$ 10)
- 4 layers Silicon strip Vertex Detector (SVD)
- Idea: Use hits in the surrounding strip detector, and extrapolate them to the PXD to select usable Pixels

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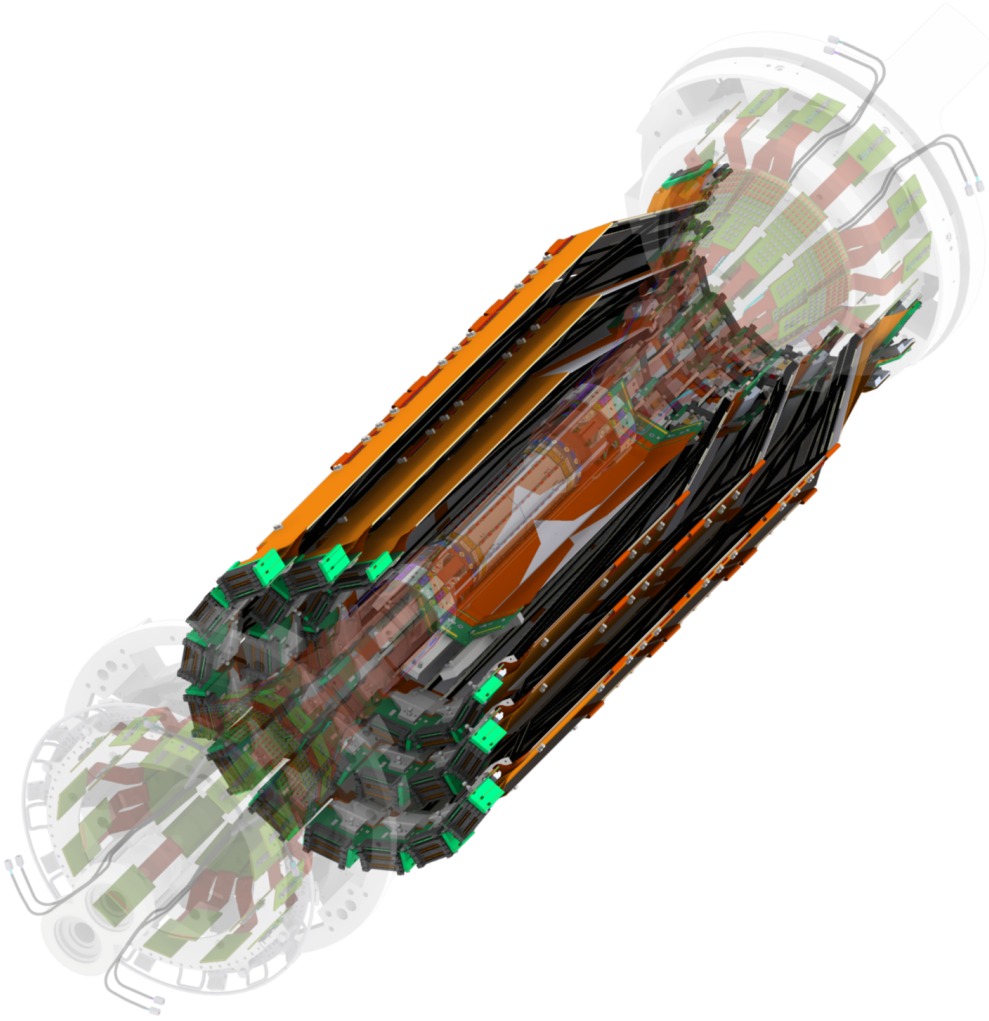

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# Data Reduction Idea with SVD Tracking

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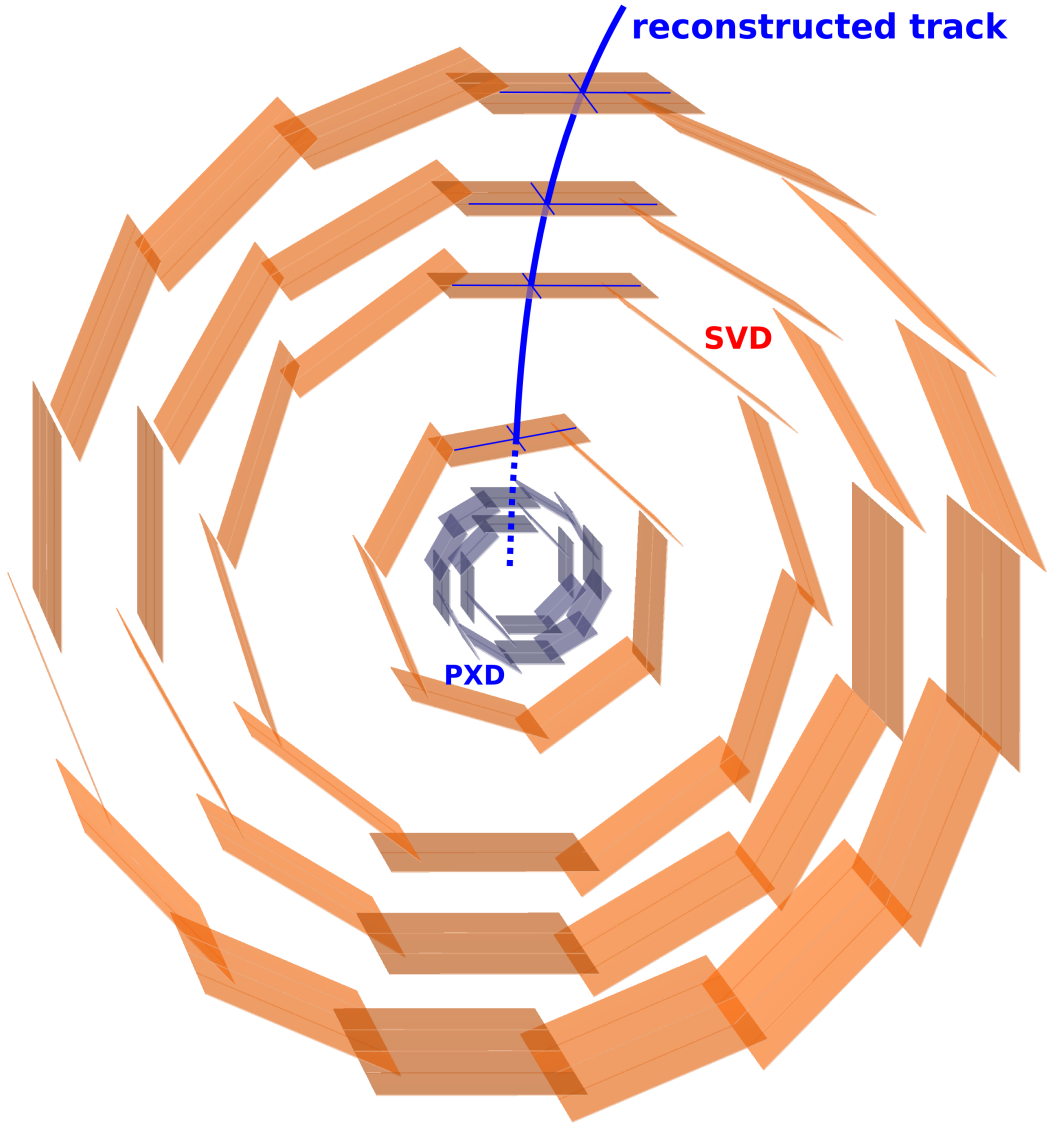
- Complementary approach with two systems to save as much physics data as possible
- HLT: Track reconstruction based on sector-neighbour finding and neural network
- DATCON: Fast FPGA-based track reconstruction system using the Fast Hough Transformation



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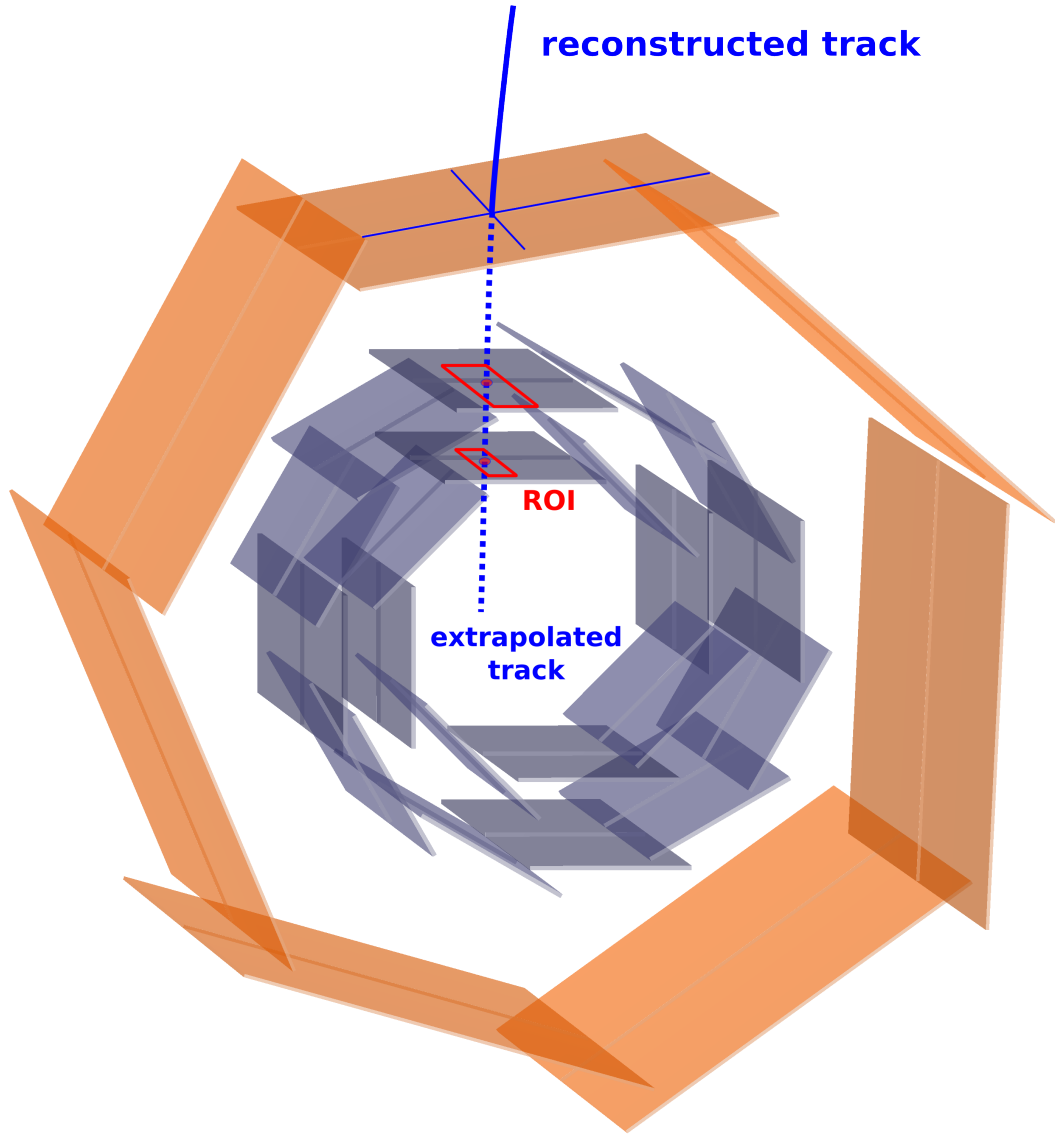

# Installation at CERN SPS line

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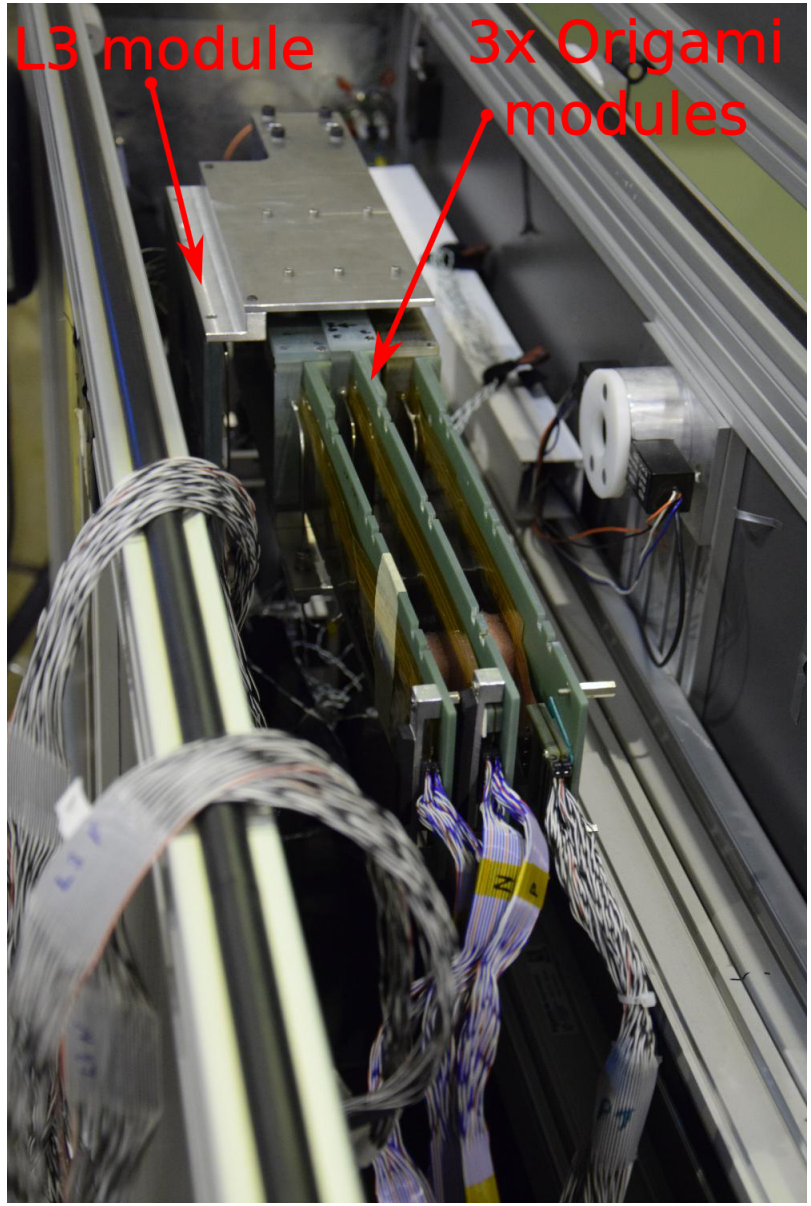
- DESY SVD sensor stack:
  - 120 GeV pions. Perpendicular incidence.
  - 4 SVD modules arranged with the same spacing as in Belle II
- New FADC ver. 2 and FADC Controller
- New FTB ver. 3 used for the first time with FADC
- DATCON setup as in DESY but with AMC ver. 3



# Setup Area

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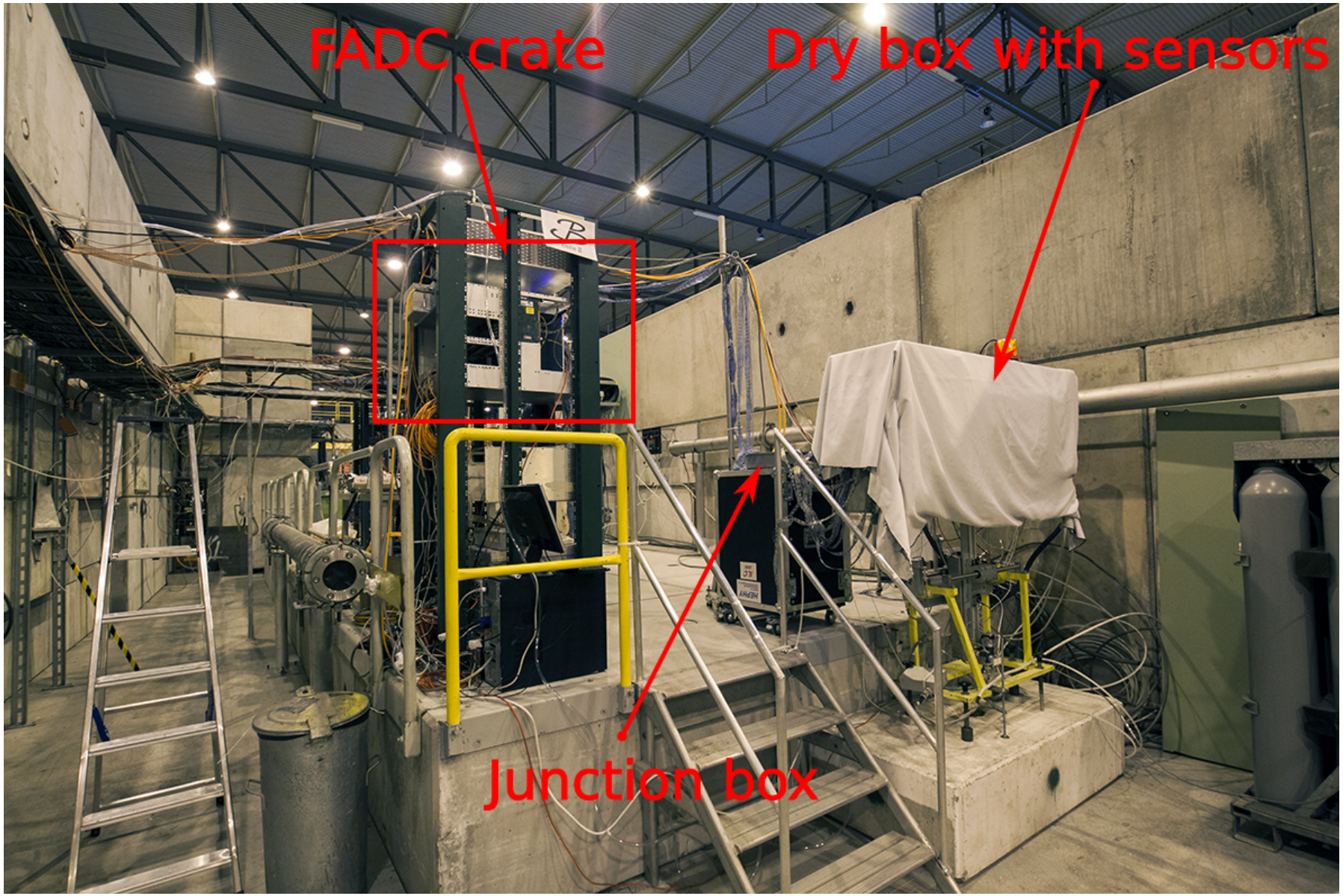

# FADC Crate and FTB

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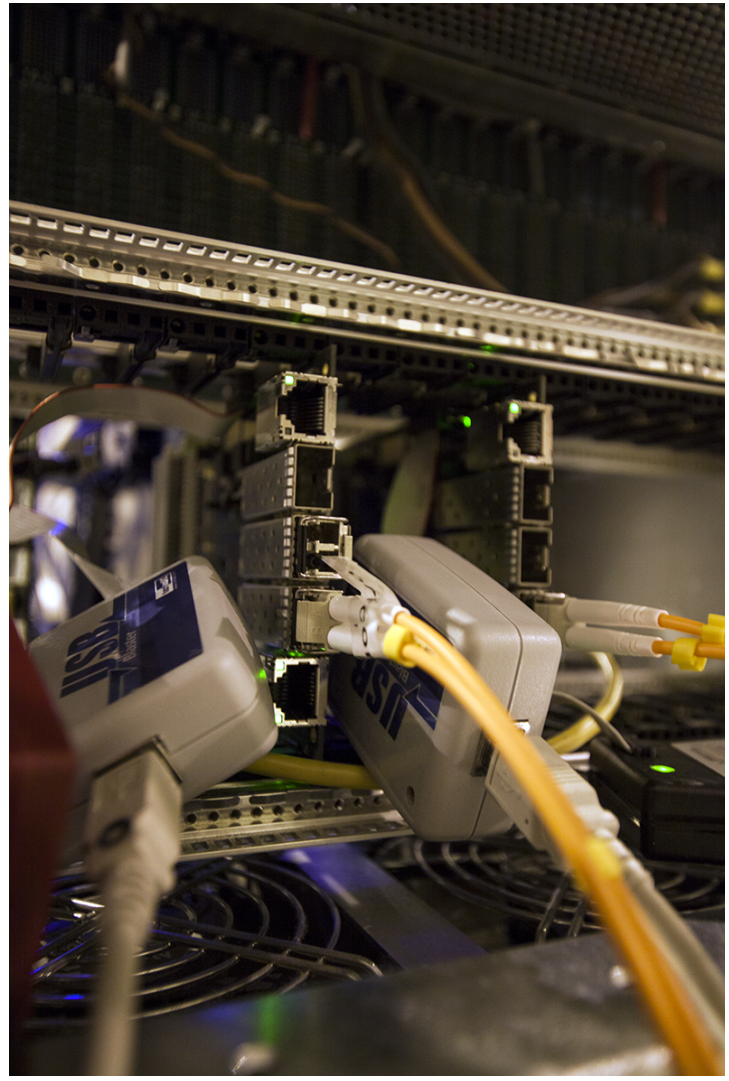
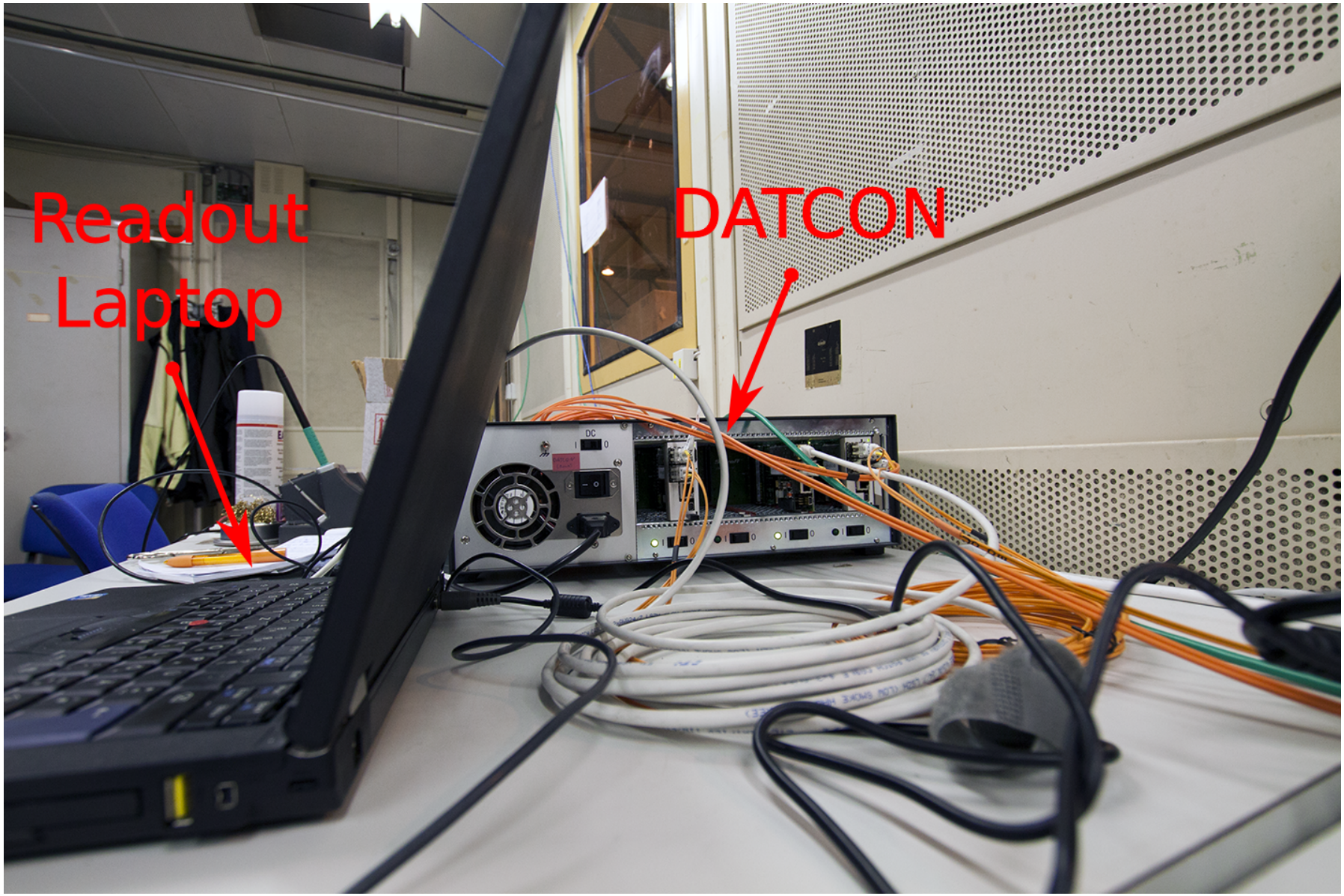
## FADC crate

## FTBs



# DATCON



# DATCON Development

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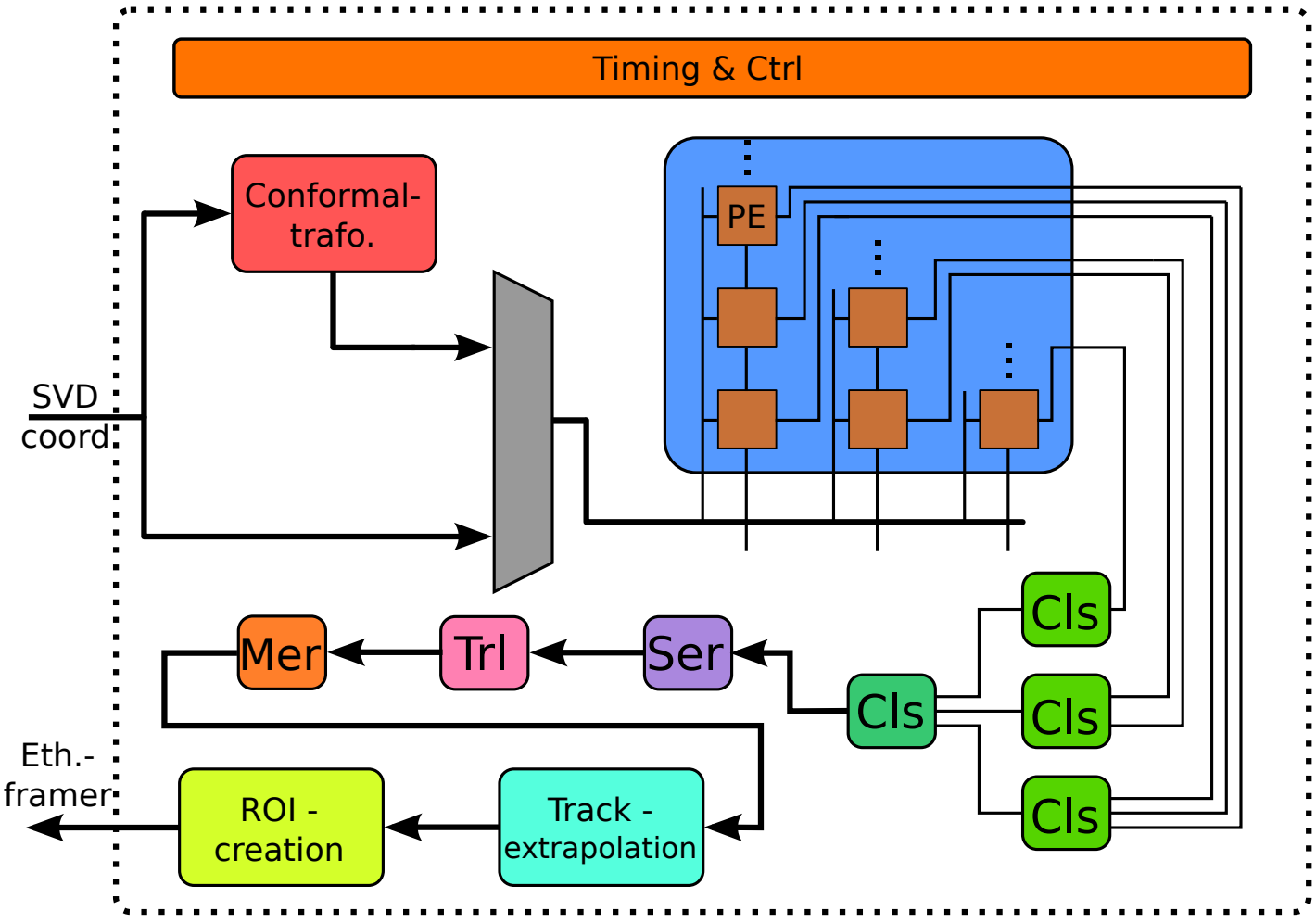
- Successfully developed/adapted and tested new FTB hardware/firmware to run in DATCON only mode (without COPPER and FTSW)
- L3-n side had often I2C configuration problems of the APV25
  $\rightarrow$ Deactivated, means we can test new 3 hit per layer (n-side)
- Run time estimate: 256 Hough cells and 1000 coordinates
  $\sim$ 10 $\mu s$ ($\sim$ 100 *ms* on PC)
- Hough space limited to 57...108° for this test beam configuration

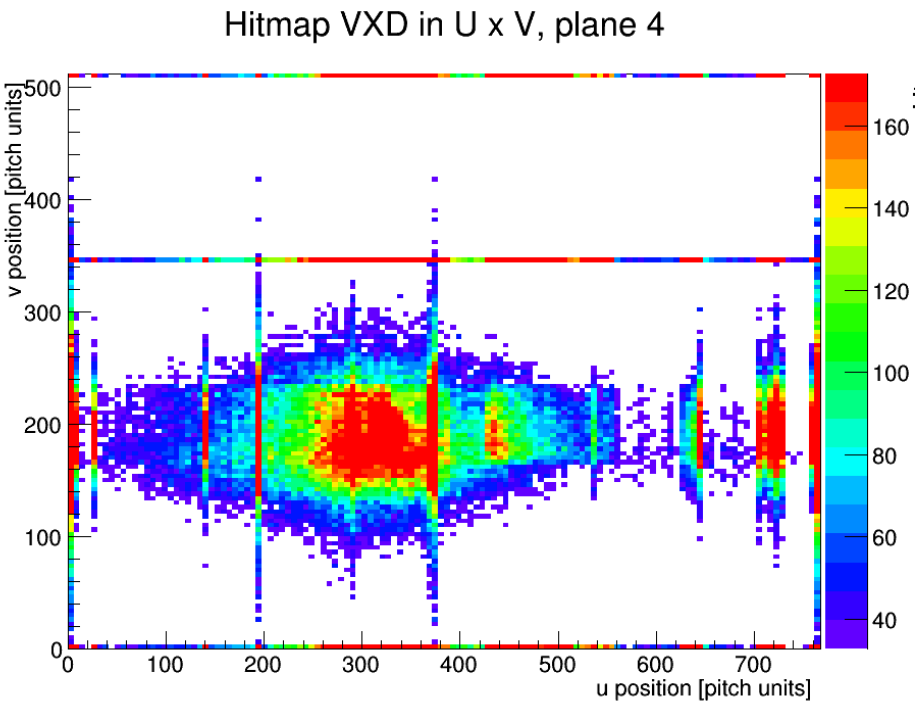
# New Implementation

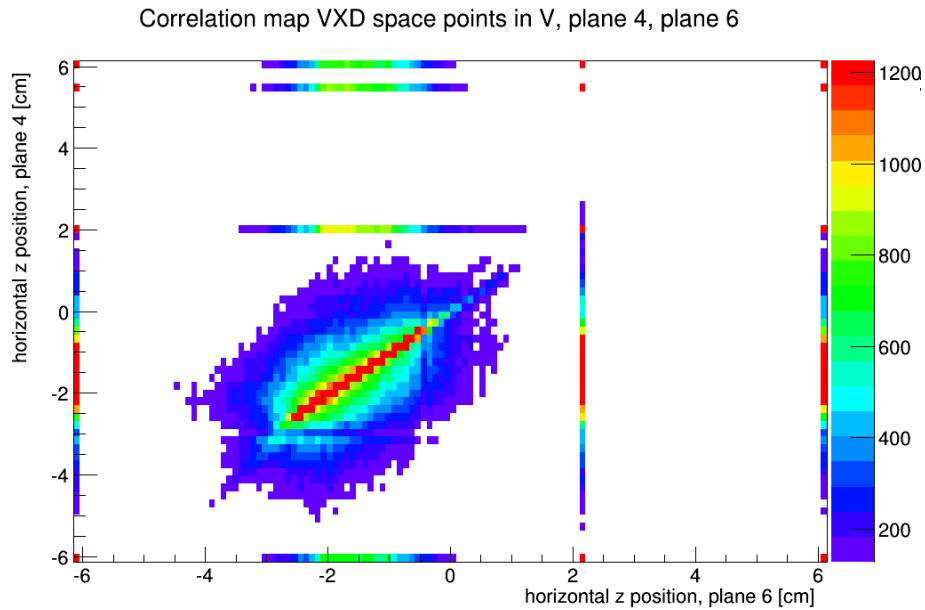



- PE: Processing Element. Comparator to detect intersecting lines in each cell, and layer filtering
- Cls: Clustering unit
- Ser: Serializer
- Trl: Translator
- Mer: Track merger

# Beamspot and Correlation

- Data obtained with TuxDAQ, processed with BASF2 DQM
- Deactivated noise filter
- No masking of bad strips, broken ZS threshold



# DATCON Results

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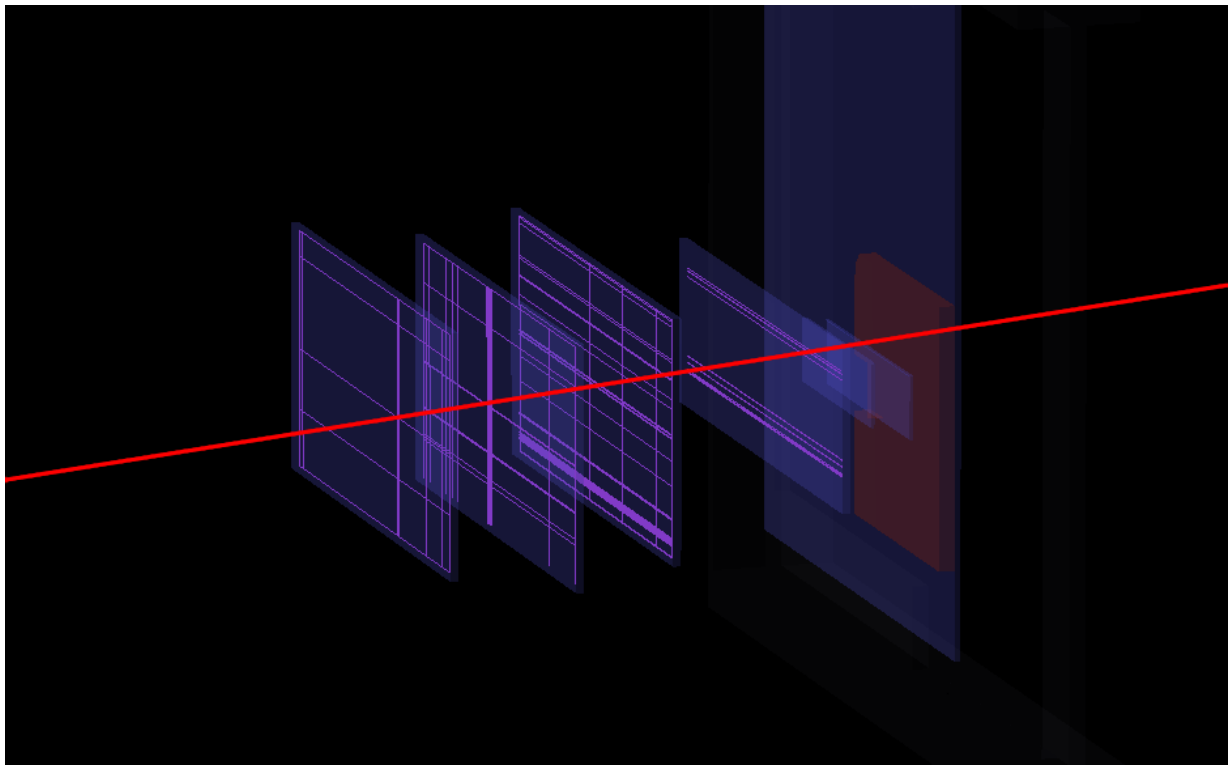
- Mostly working on FADC/FADC Controller/FTB firmware and SVD software
- Managed to get a hardware run for 30 minutes with a fixed ZS threshold. Stable Hough space data acquisition with DATCON.



# Summary

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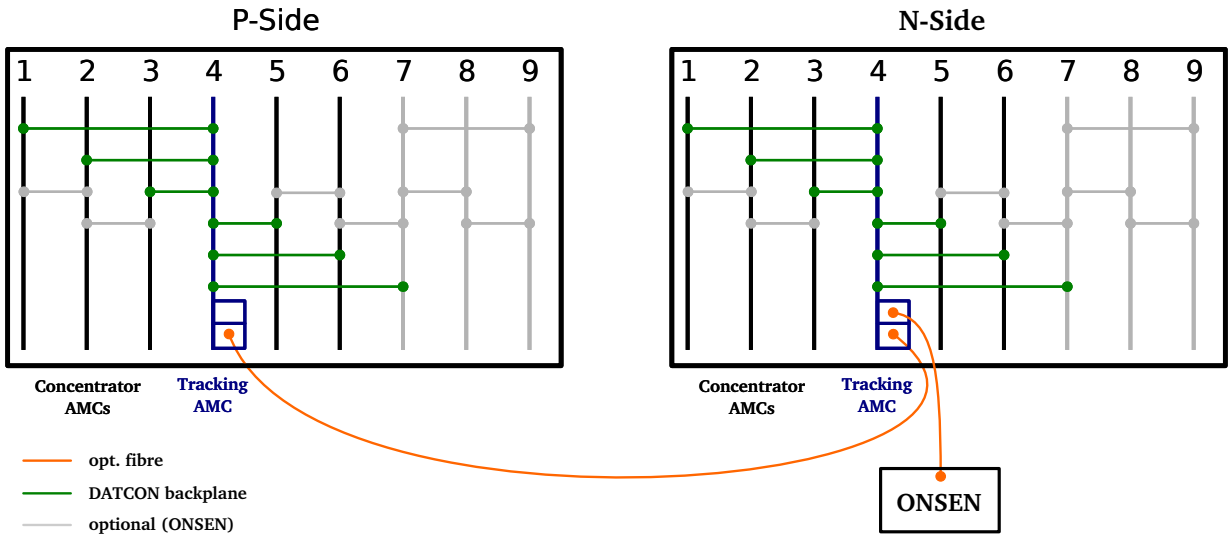
- Successful data acquisition with new FADC, FTB and AMCv3. Maximum trigger rate 270 Hz.
- Developed unpacker in basf2 for the TuxDAQ system (can be downloaded here: `http://asag.physik.uni-bonn.de/~michael/private/svd_tb_cern.tar.xz`)
- Data analysis ongoing.

# Outlook

- Additional AMCv3 cards from Beijing under test
- Further testing of the DHHC AMC as tracking unit
- Custom backplane design → In contact with Schroff. 3 9-slot mTCA crates needed for DATCON (2 for the experiment, 1 for debugging in Bonn)
- Layout of the backplane connection is designed



# BASF2 SVDHoughtracking Module

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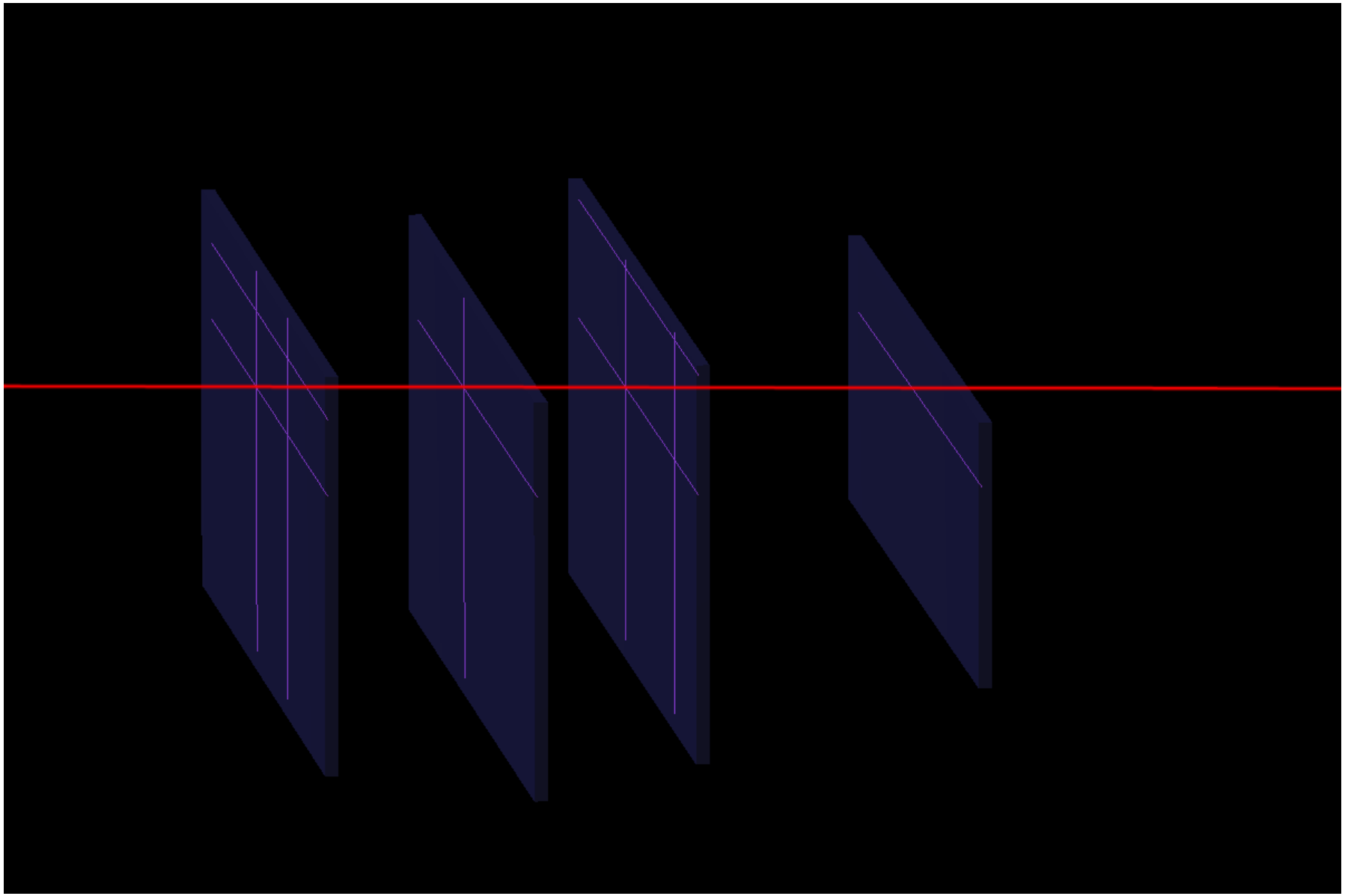

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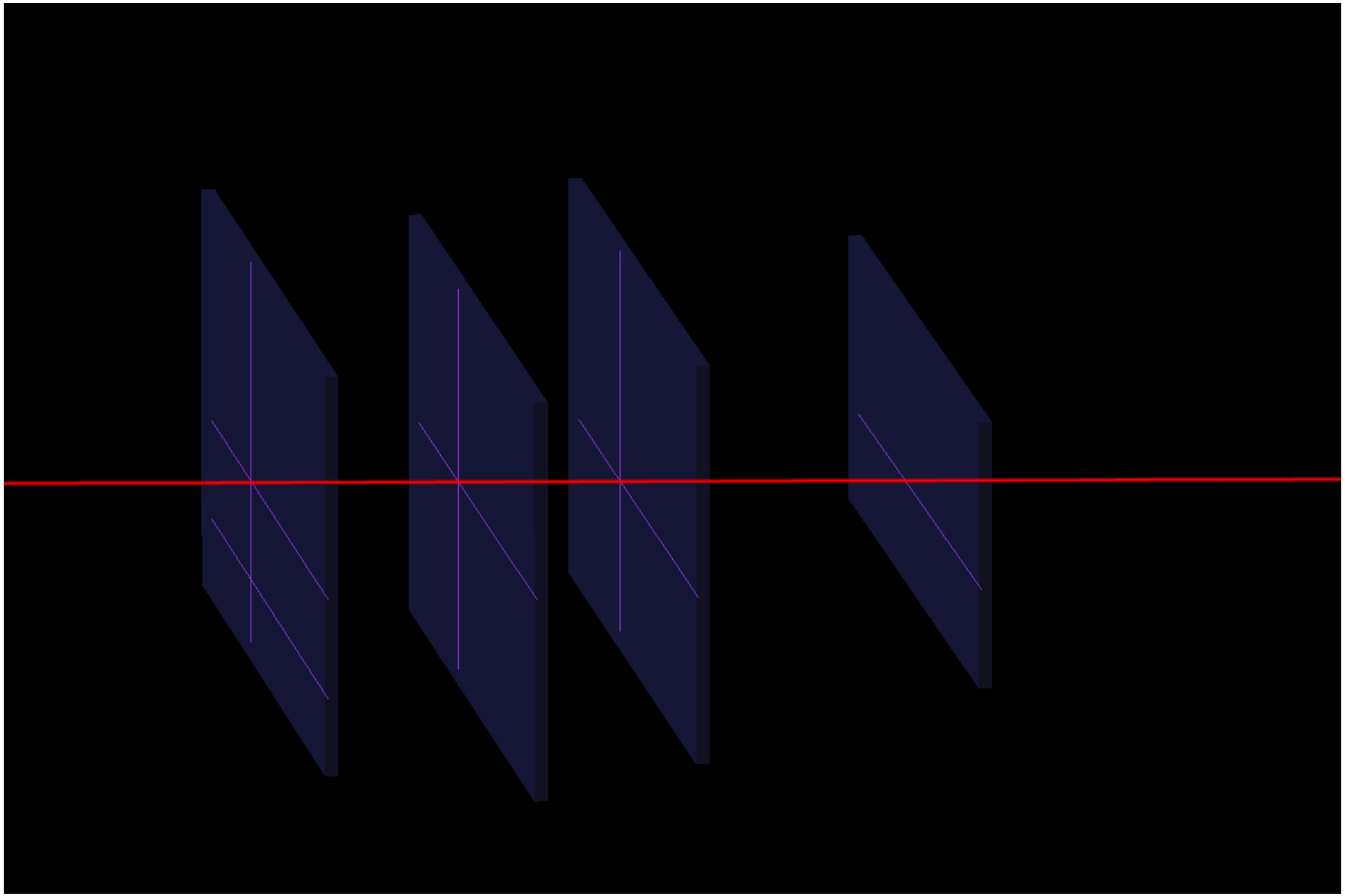

# Noise (Without Noise Filter)

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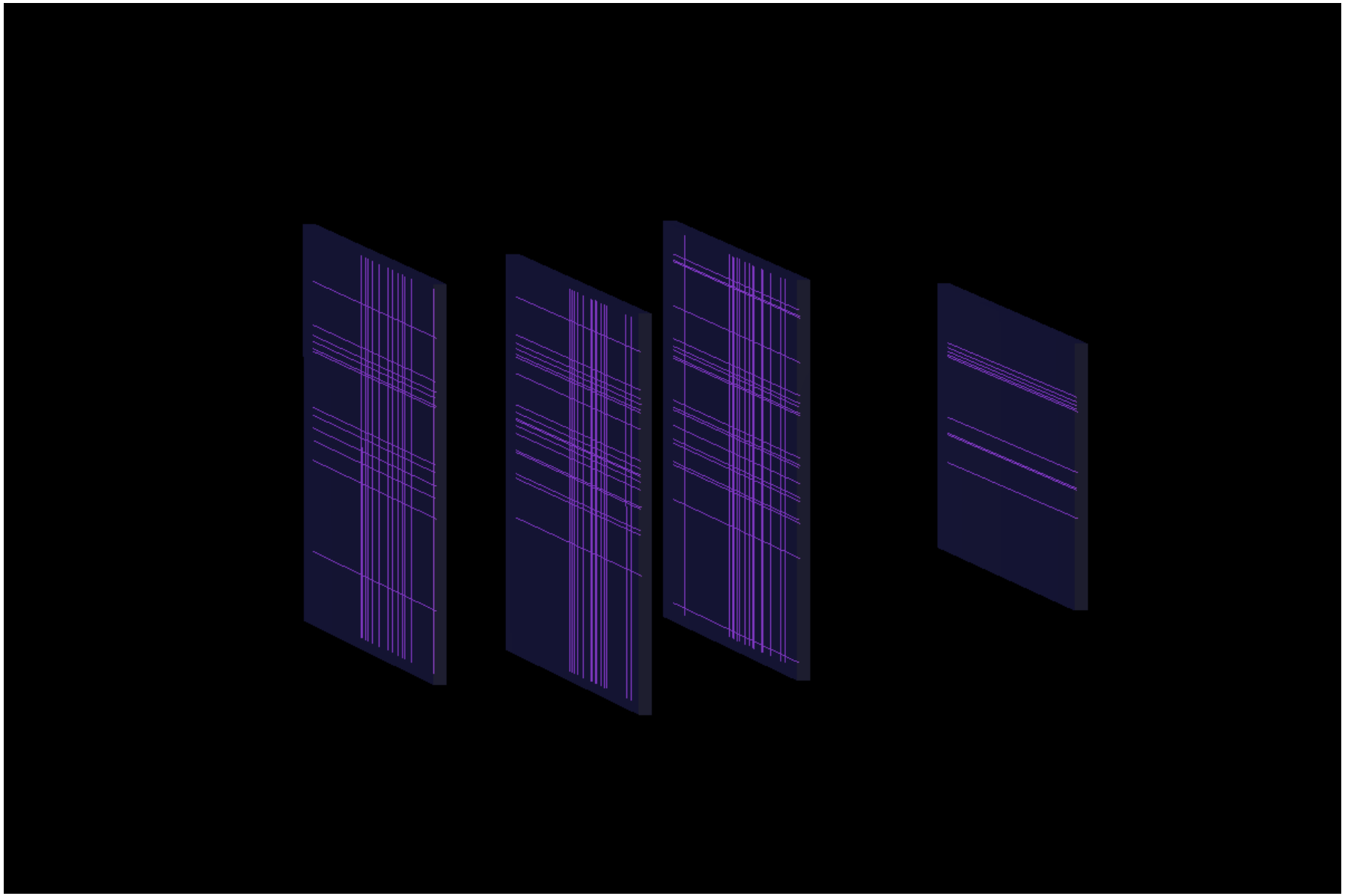

**Thank you for your attention!**

# Fish Beamspot

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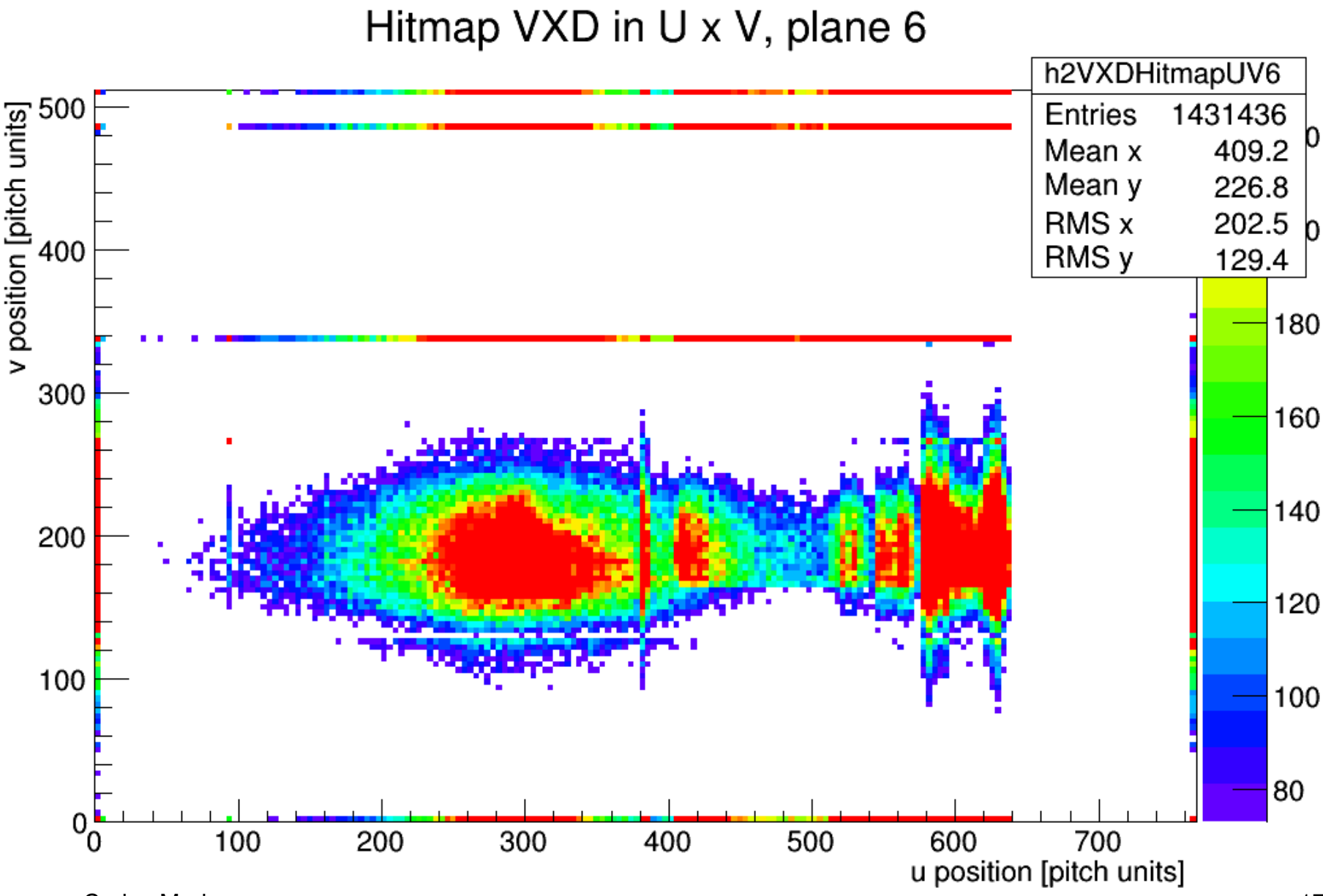

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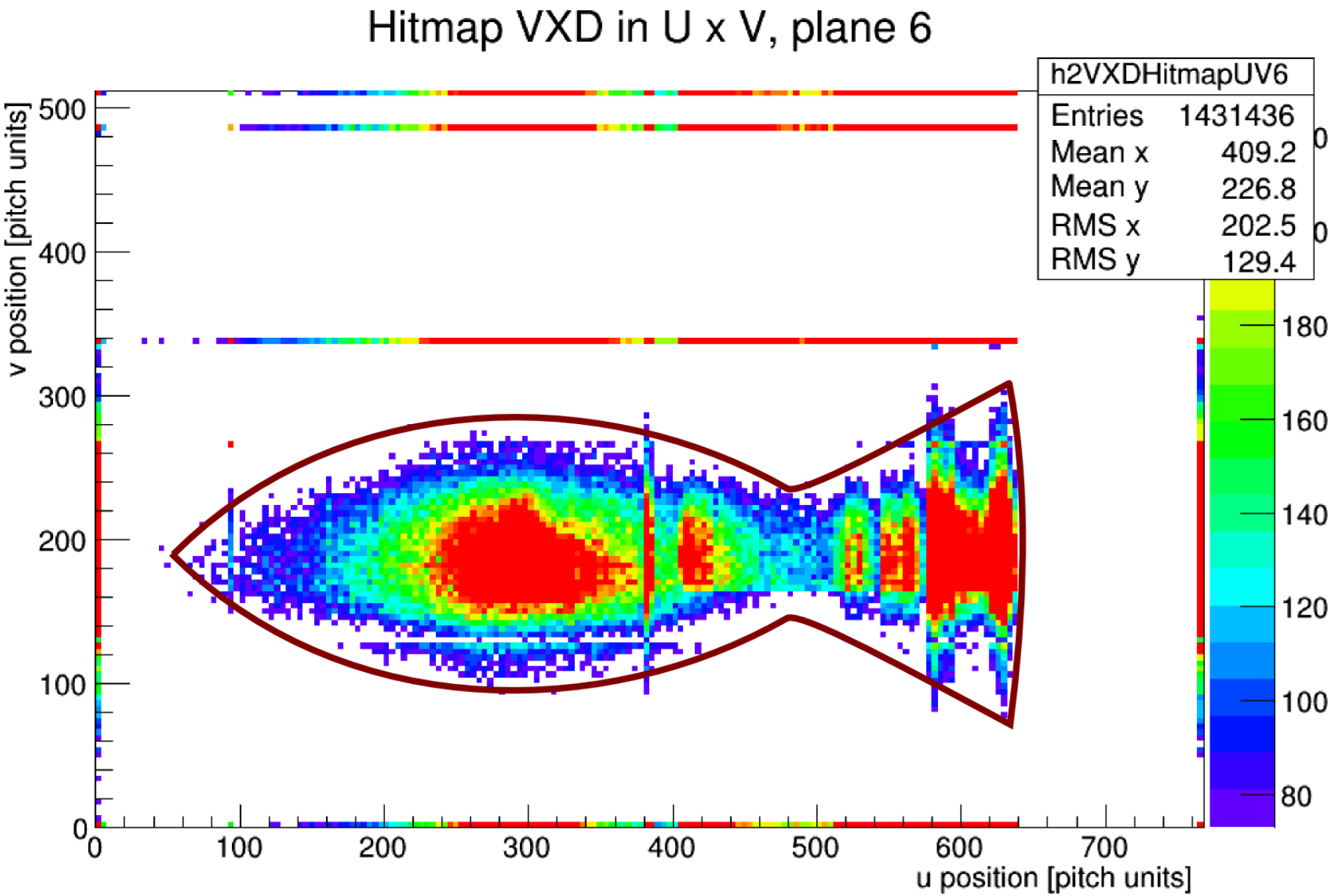

# BASF2 Reconstructed Tracks

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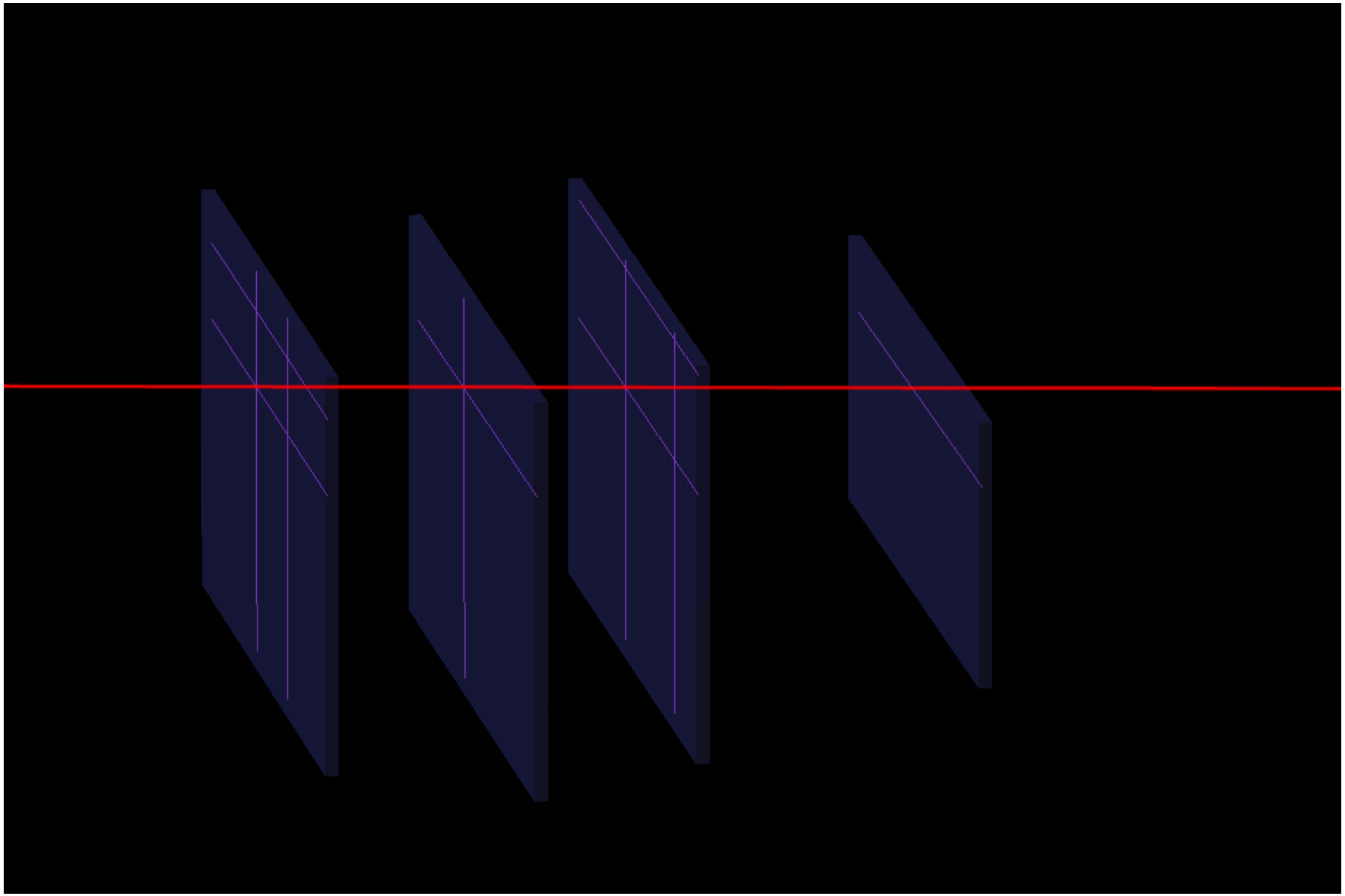

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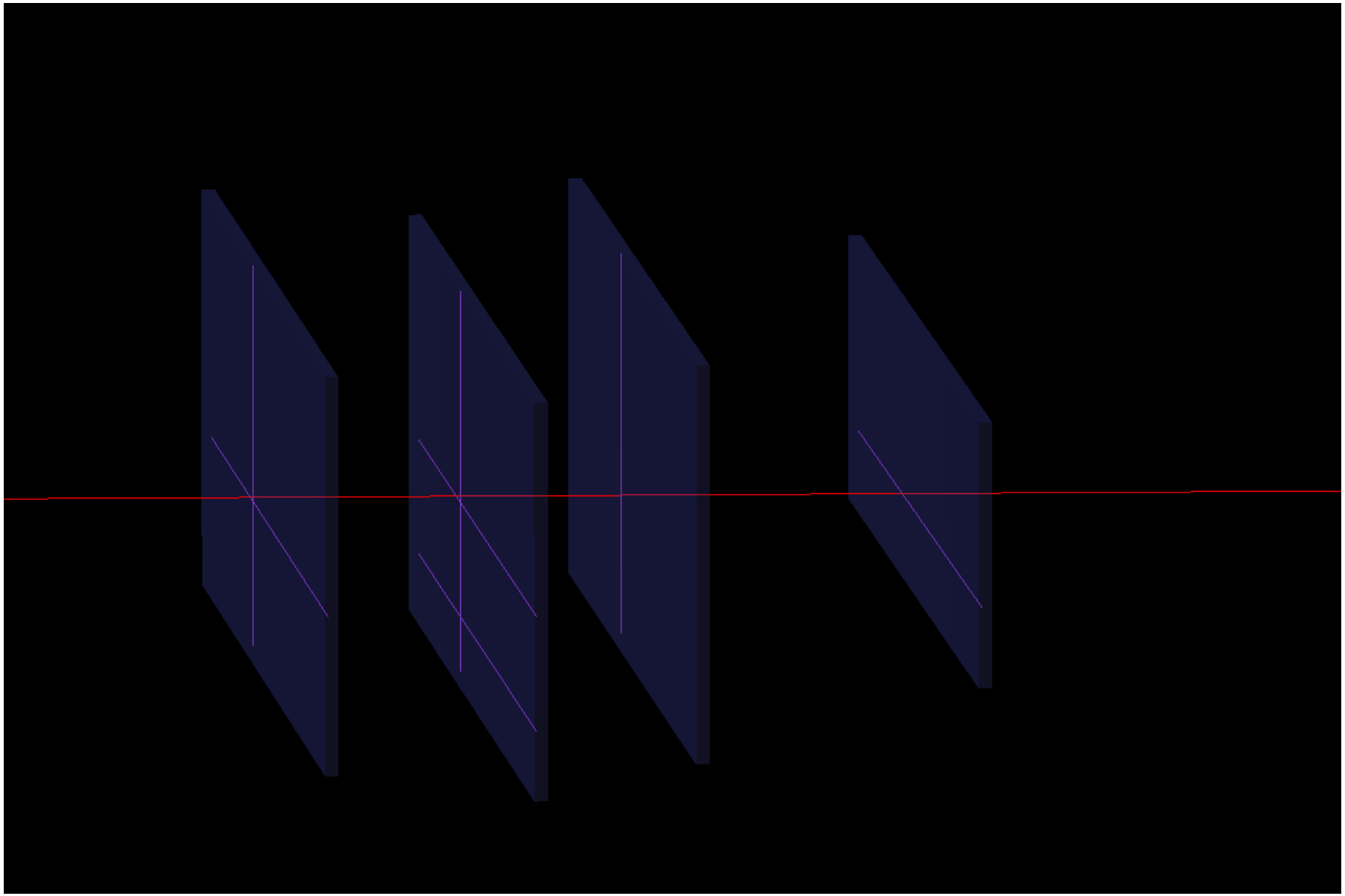

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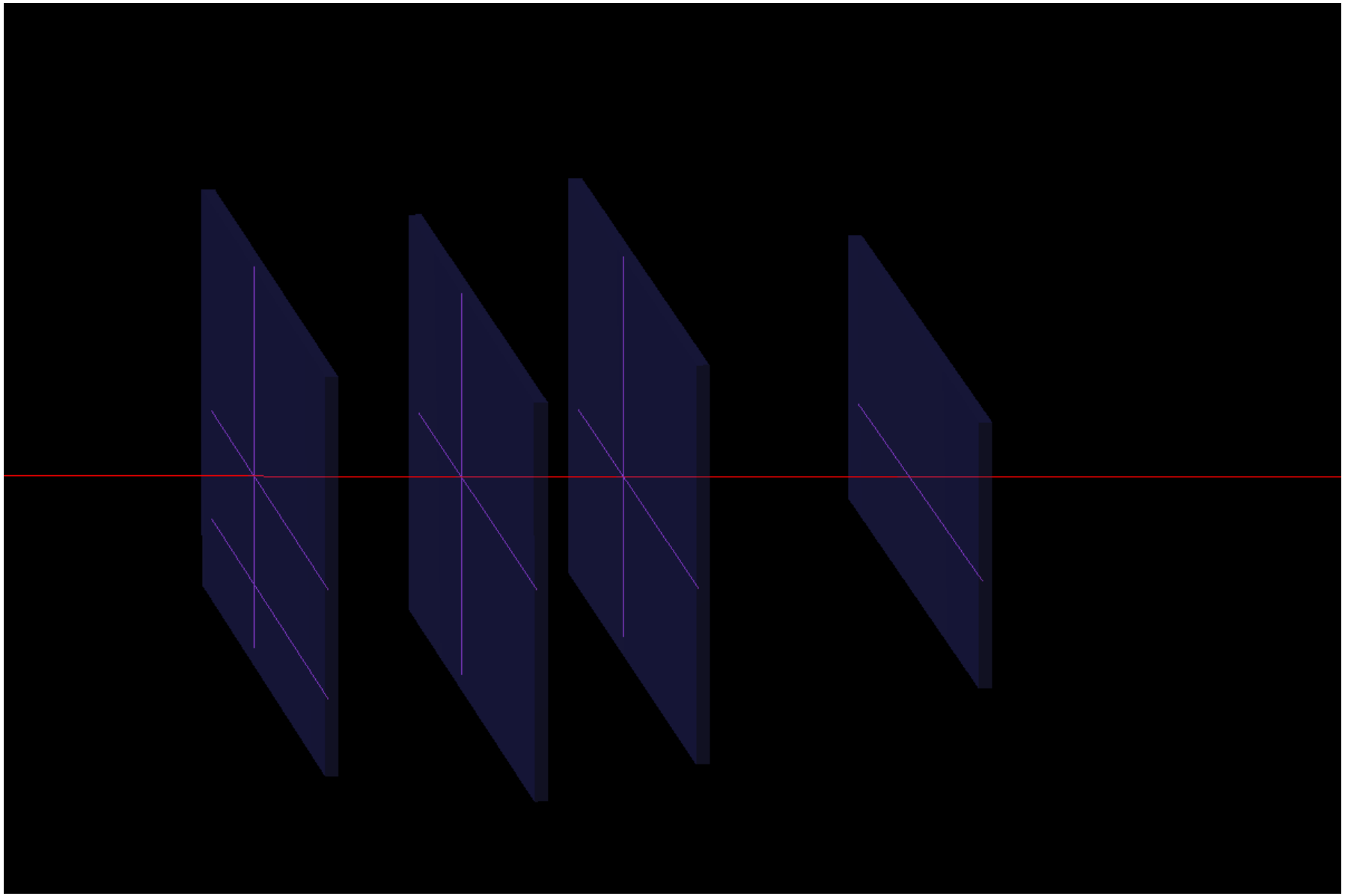

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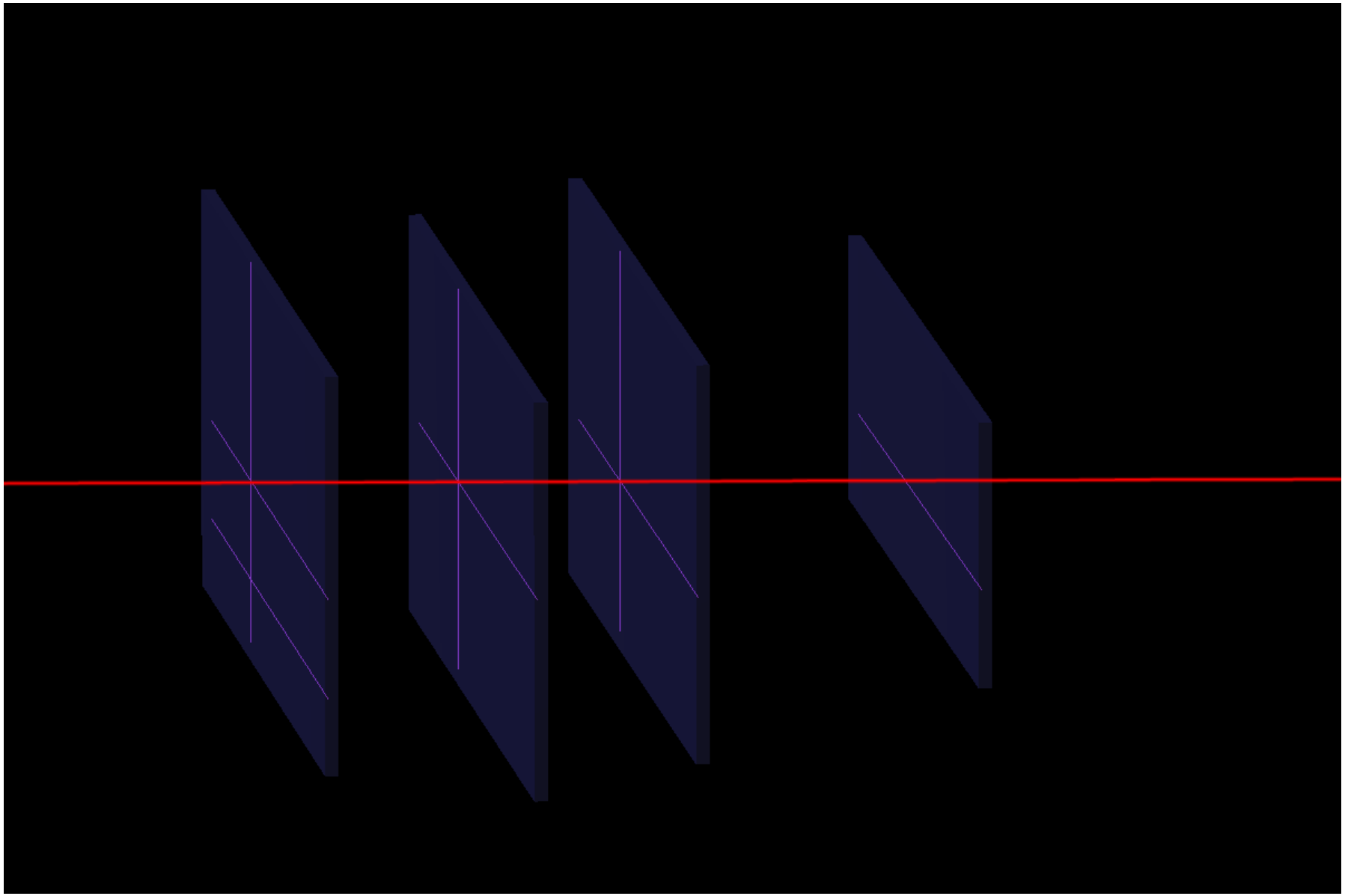
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