

Beam Test paper draft v1

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- Version 1 with line number is ready
- Link:
 - (Invenio, v1): <https://sphenix-invenio.sdcc.bnl.gov/records/gf2fy-0h617>
 - (Overleaf, view): <https://www.overleaf.com/read/kyfhznpxrhtv#fcfe3d>
- Questions and comments are welcome
- Additional todo:
 - Author list: a copy from INTT ladder NIM, need to be updated in the future version
 - Acknowledgments: copied from the ELPH report and INTT ladder NIM, need to be updated
 - References: format needs to be updated

- Title: Performance evaluation of the Intermediate Silicon Tracker for sPHENIX
- Abstract
- 1. Introduction
 - 1.1. The sPHENIX experiment
 - 1.2. The Intermediate Silicon Tracker (INTT)
 - 1.3. The beam test experiment at ELPH
- 2. Common analysis components
- 3. Signal-to-noise ratio
- 4. Residual distribution
- 5. Hit detection efficiency
- 6. Track reconstruction
- 7. Conclusion
- Acknowledgments
- References

1. Introduction

- The sPHENIX experiment
 - sPHENIX goal, design, acceptance
 - 2015 LRP, TDR, and sPHENIX prediction papers cited
- The Intermediate Silicon Tracker (INTT)
 - Brief barrel geometry (number of ladders, placements, etc)
 - Role of INTT in sPHENIX
 - INTT ladder design (chip, silicon strip geo., etc)
 - FPHX processing
 - Column definition
 - FPHX IEEE, INTT ladder NIM, and BEX-cable papers cited

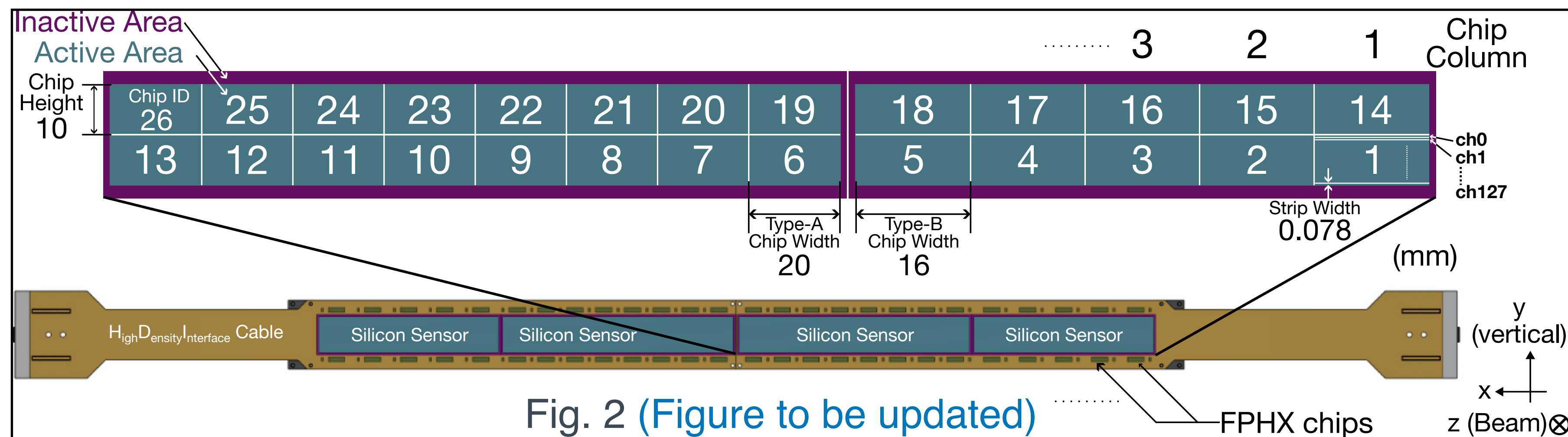
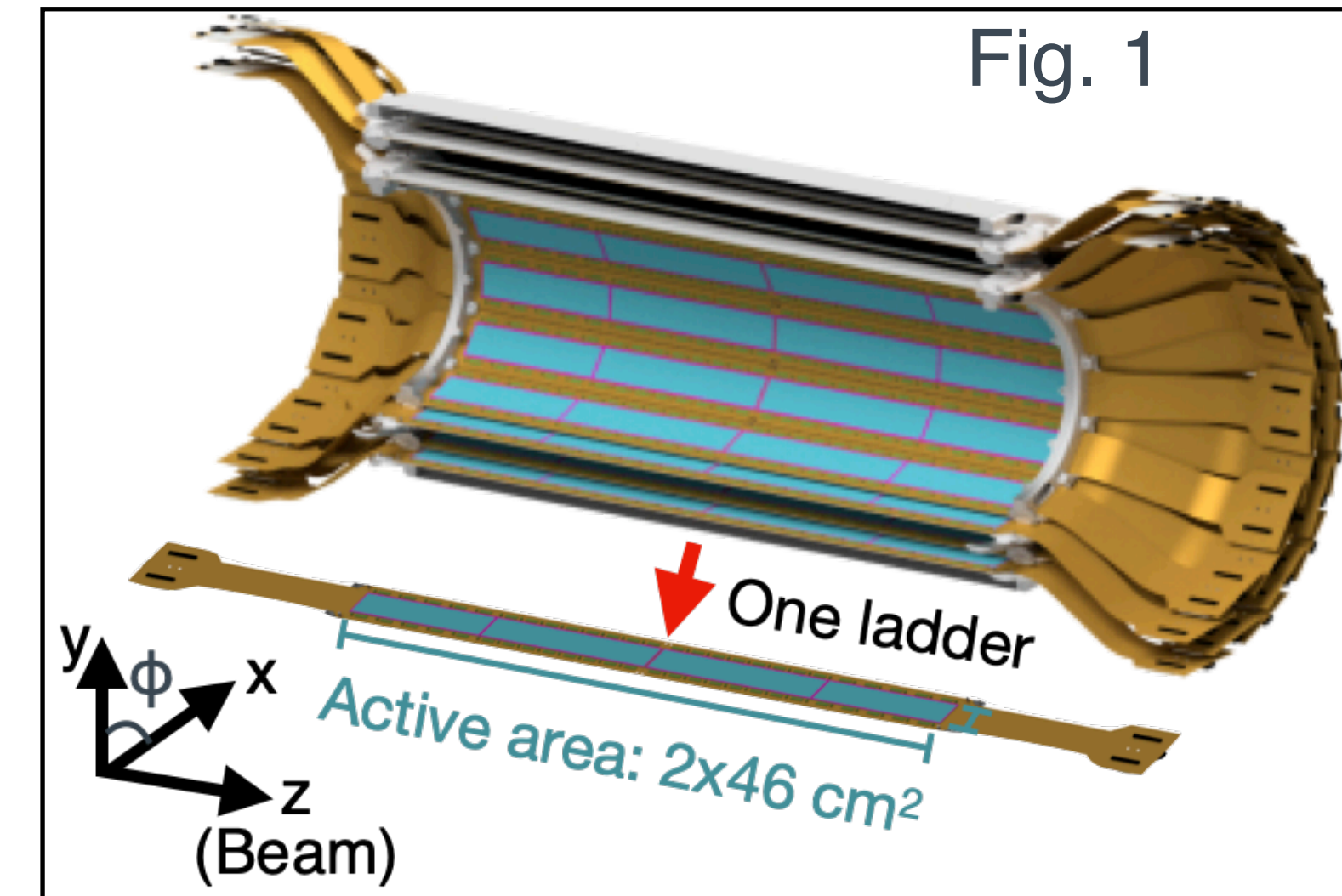
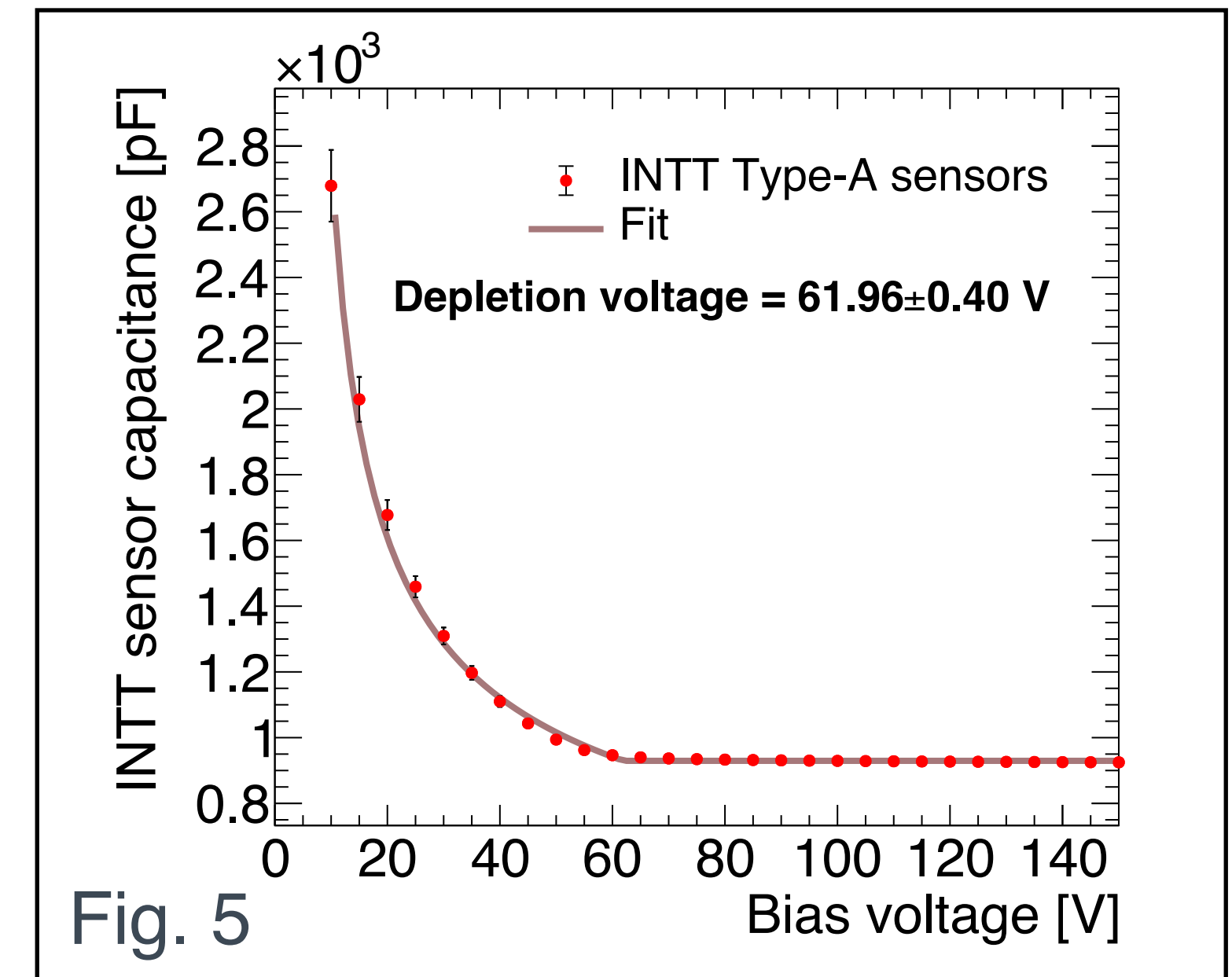
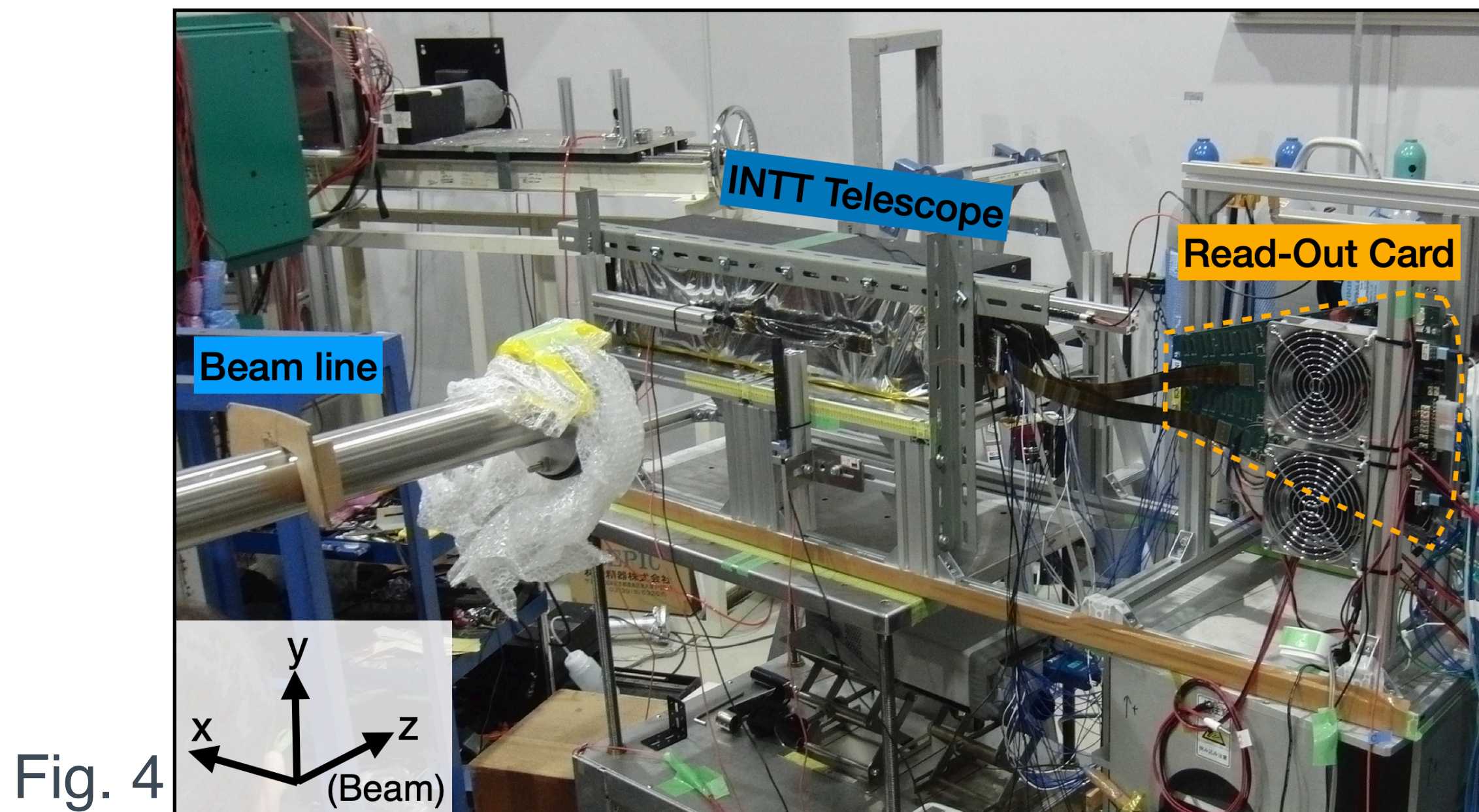
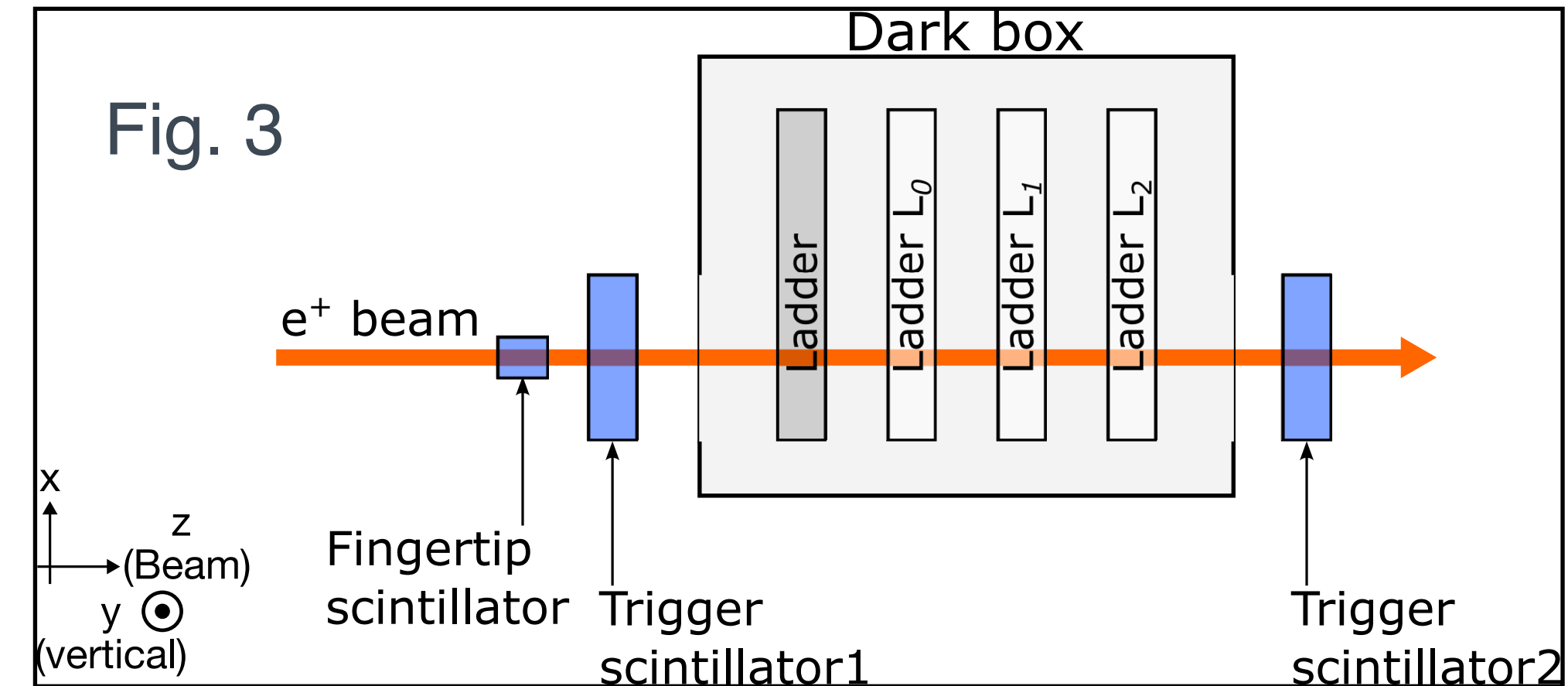


Fig. 2 (Figure to be updated)

1. Introduction

- The beam test experiment at ELPH
 - INTT telescope, scintillators, & location
 - ELPH positron beam
 - Readout chain & DAQ
 - First ladder not operated
 - Threshold, and hot channels
 - Supplied bias voltage (per Akiba san's comment)



2. Common analysis components

- Analysis-topic introduction
- Clustering algorithm and simulation setup introduced

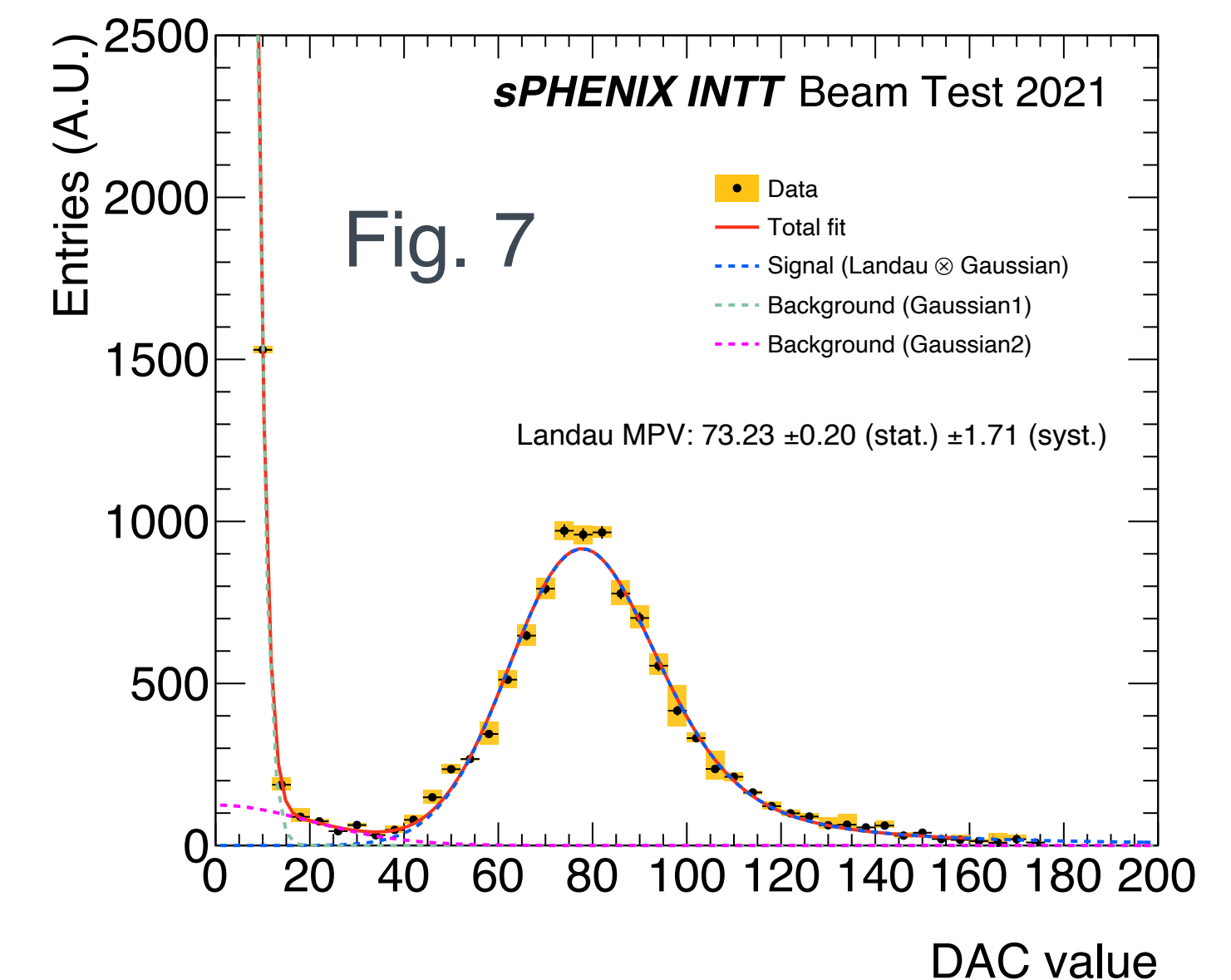
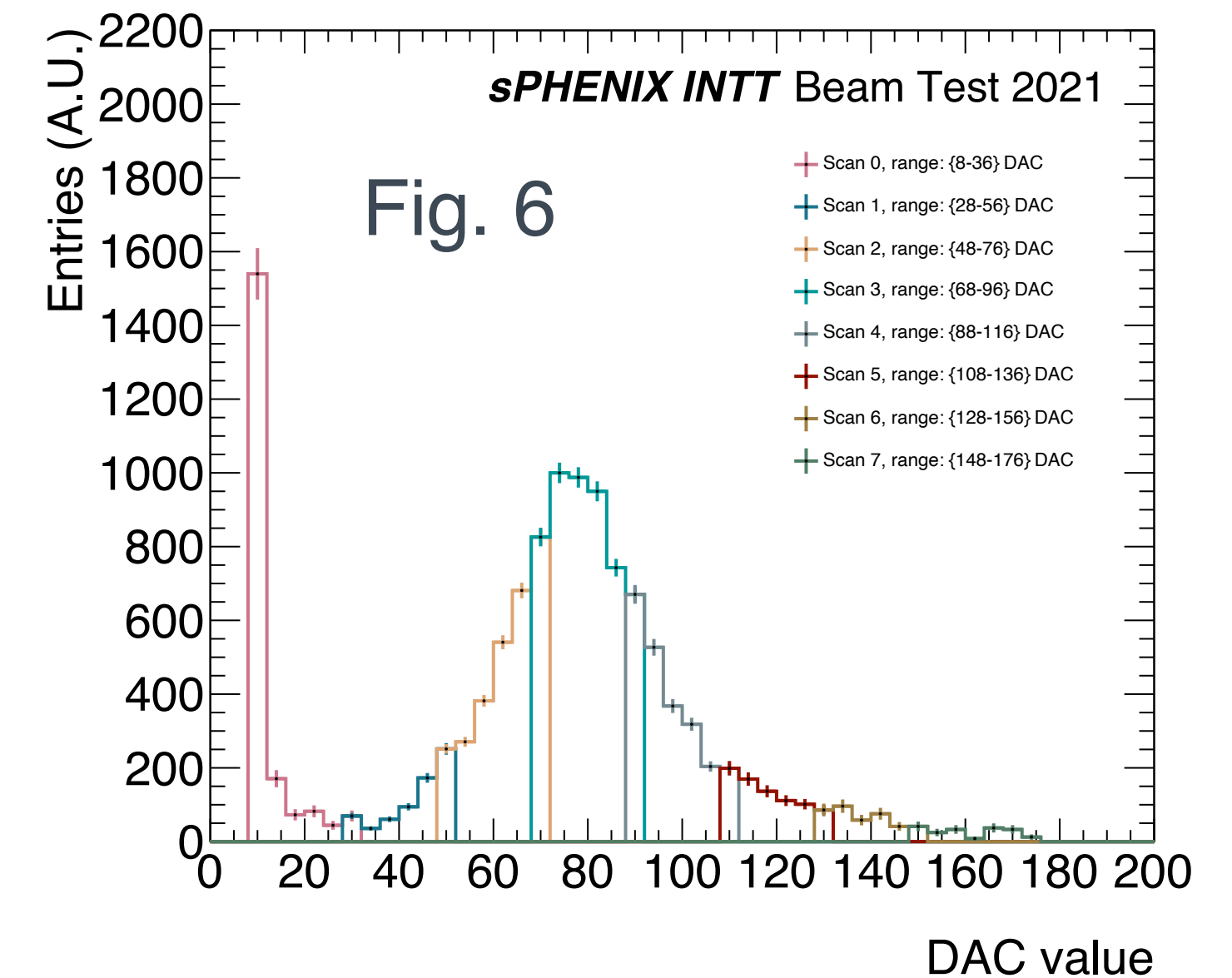
Equation 1

$$CluY = \sum_{i=1}^n (E_i \cdot y_i) / \sum_{i=1}^n E_i, \text{ and}$$

$$CluY \text{ Ampl.} = \sum_{i=1}^n E_i,$$

3. Signal-to-noise ratio

- Definition of S/N
- Reason of DAC Scan
- Procedure of DAC Scan
- Event selection
- Procedure of using histograms to construct the energy deposit distribution
- Combine results with fits
 - Fit is described as well
- MPV value: 73.23 ± 0.20 (stat.) ± 1.71 (syst.)
- Weighted average Gaussian width 4.56 ± 0.16
- Signal-to-noise ratio: > 15.1



4. Residual distribution

- Definition of residual: $r = (ClusY_{L1} + CorrY_{L1}) - Y_{pred}$
- The procedure to obtain the L1 misalignment correction
- Event selections
- Result, discussion & comparison with MC

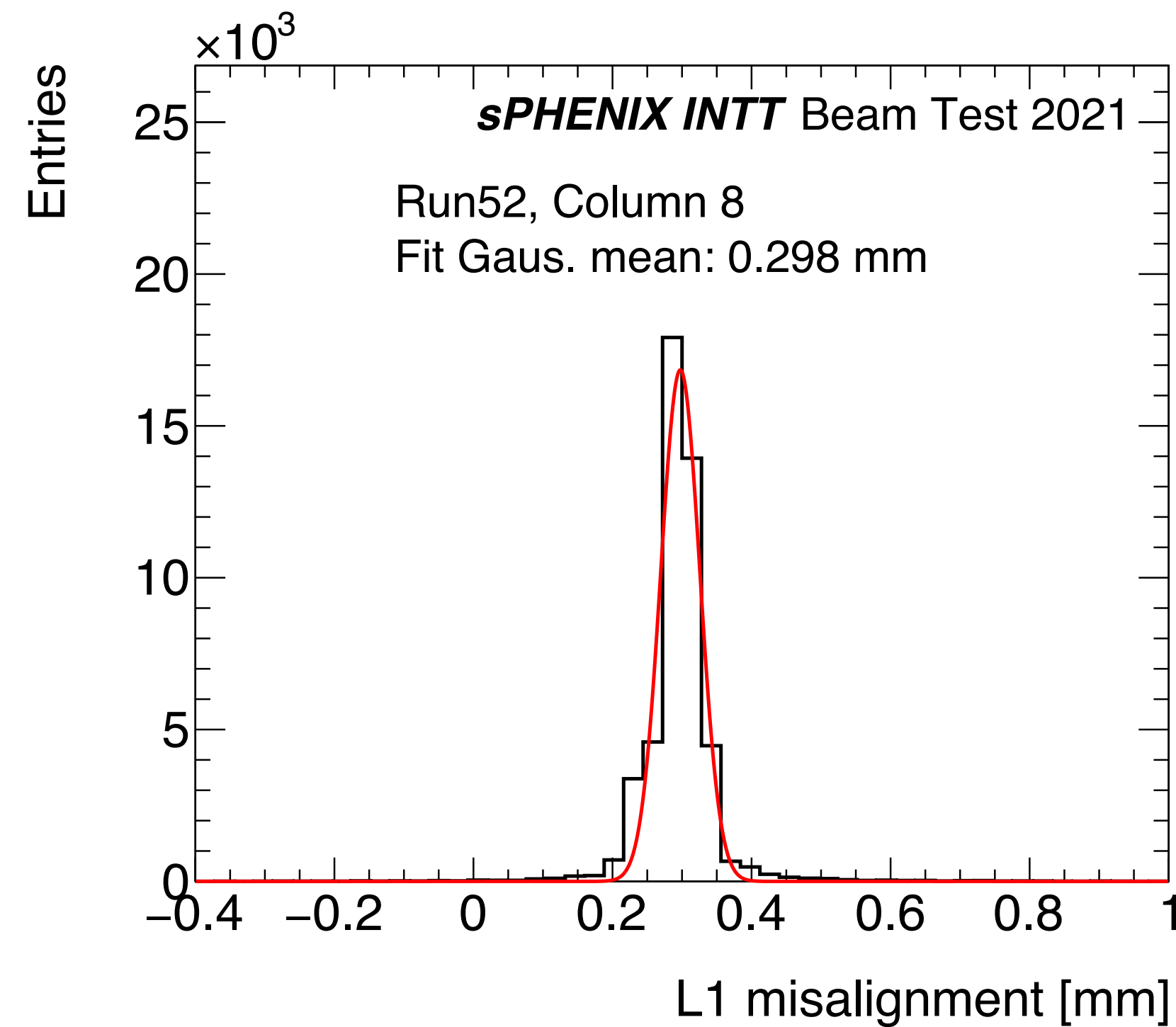


Fig. 8

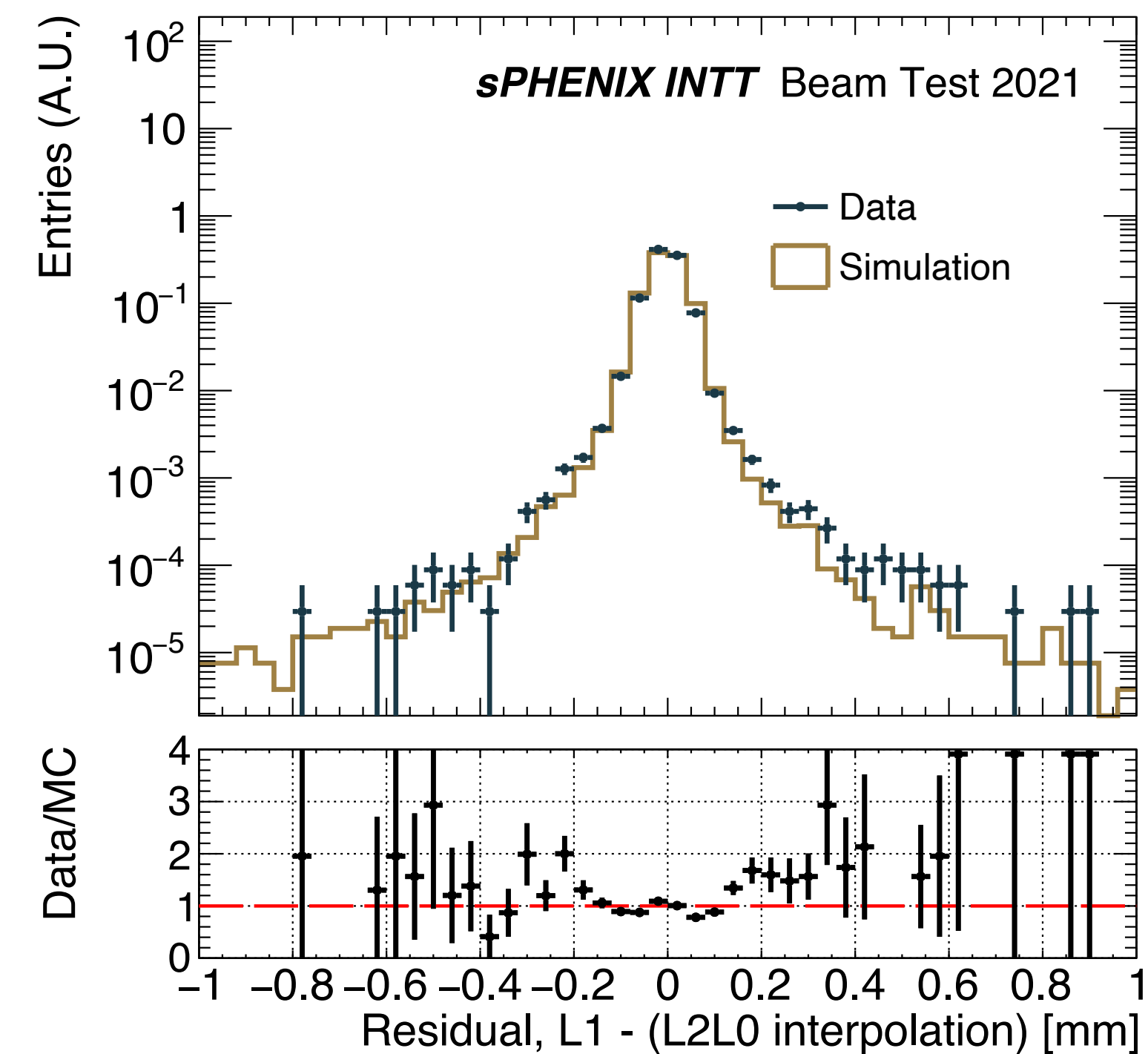


Fig. 9

5. hit detection efficiency

- Introduction to the DUT method
- Event selection & track reconstruction
- Definition of hit detection efficiency : $Effi. = \frac{N_{\text{matched DUT tracks}}}{N_{\text{Good events}}} = \frac{N(L0 \cap L1 \cap L2)}{N(L0 \cap L2)}$
- Systematic uncertainty
- Results & discussion
- The reported effi.: $99.61^{+0.02}_{-0.02}$ (stat.) $^{+0.05}_{-0.01}$ (syst.) %

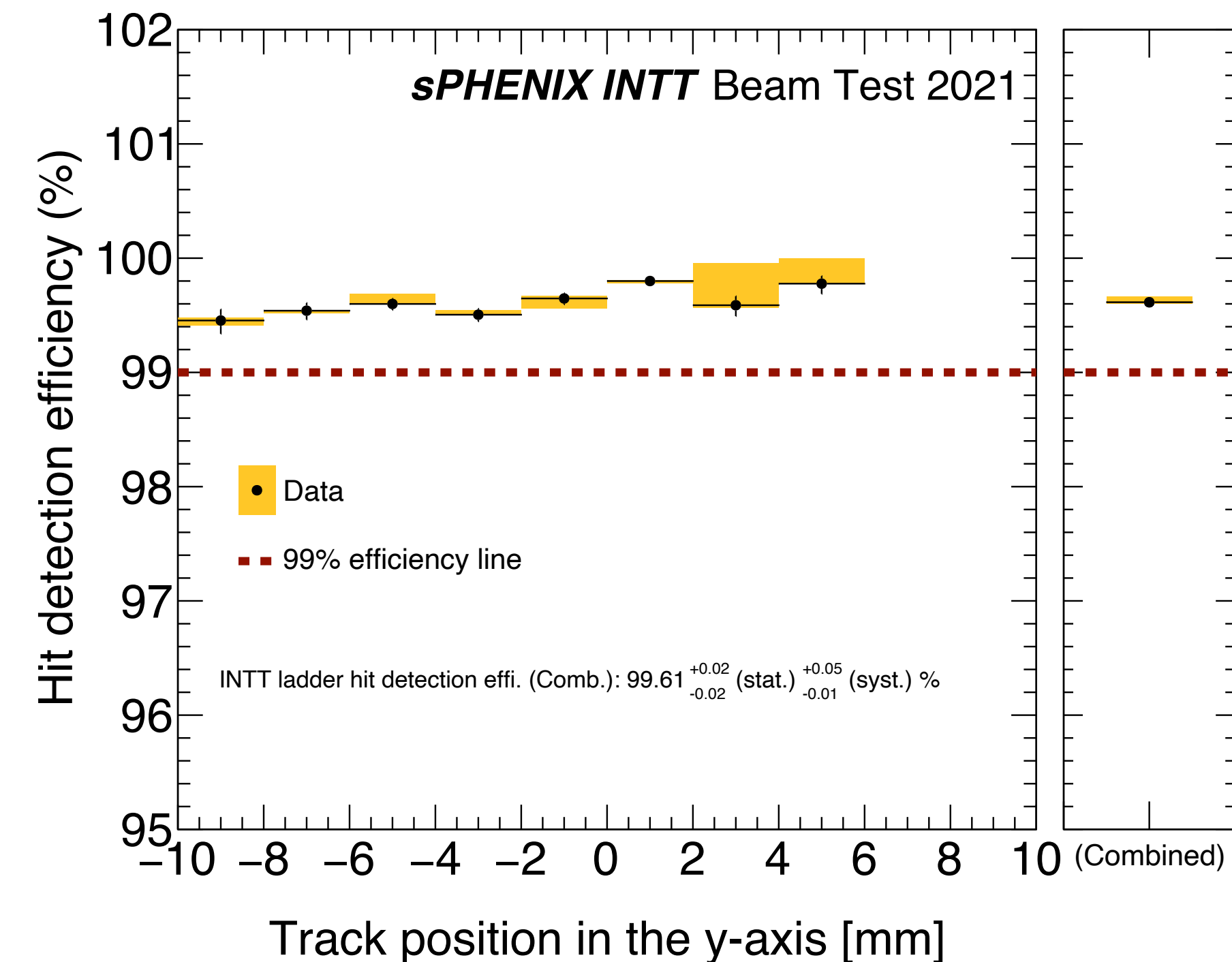


Fig. 10

6. Track reconstruction

- Track finding algorithm
- Result, comparison with MC & discussion
- Update: this is a new result with three hot channels masked in data and simulation
 - module 1, chip 26, channel 126 (layer 0)
 - module 5, chip 19, channel 119 (layer 2)
 - module 5, chip 4, channel 0 (layer 2)
- Result identical to the previous one

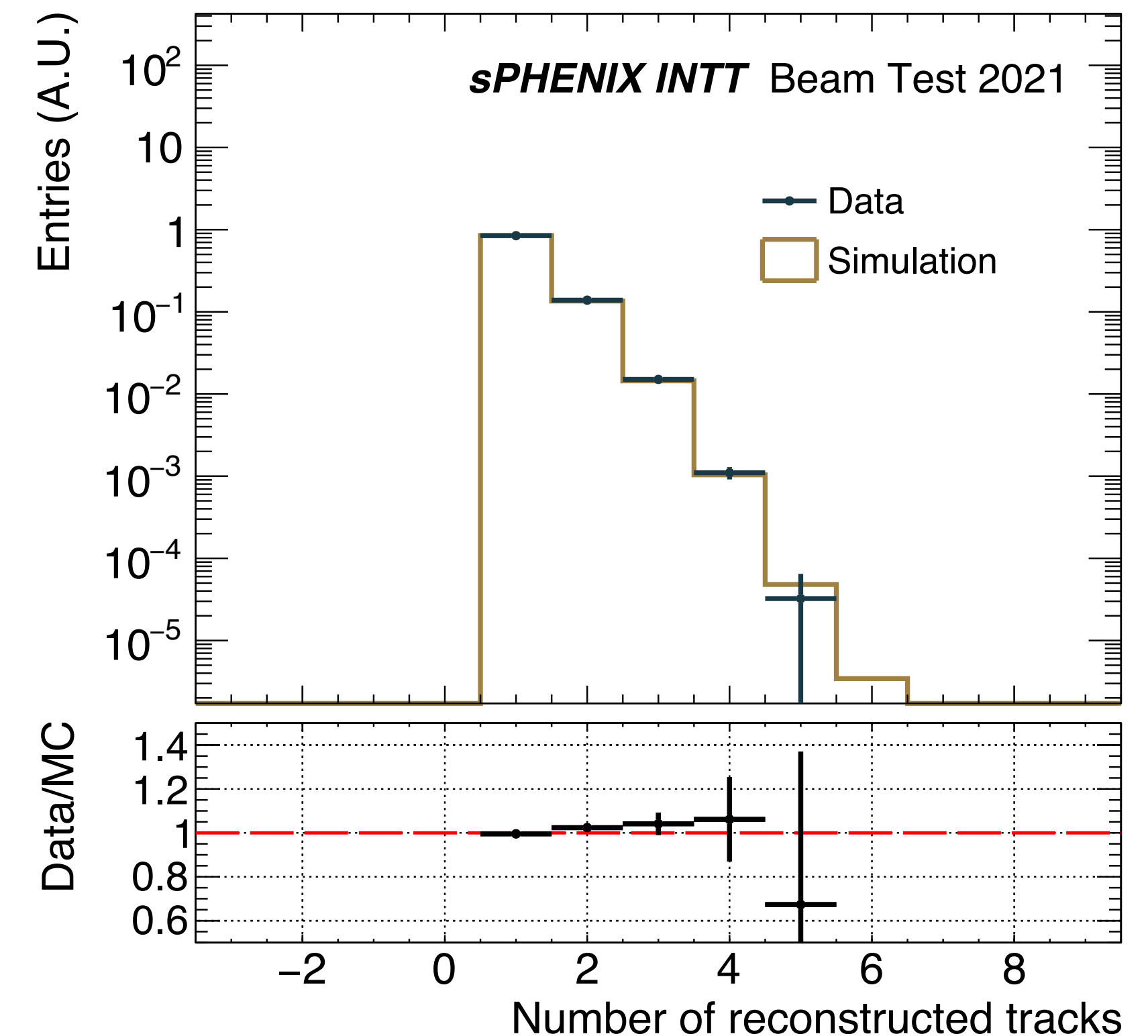


Fig. 11