

TB-2022

data integrity

Shan Huang (Tel Aviv University)

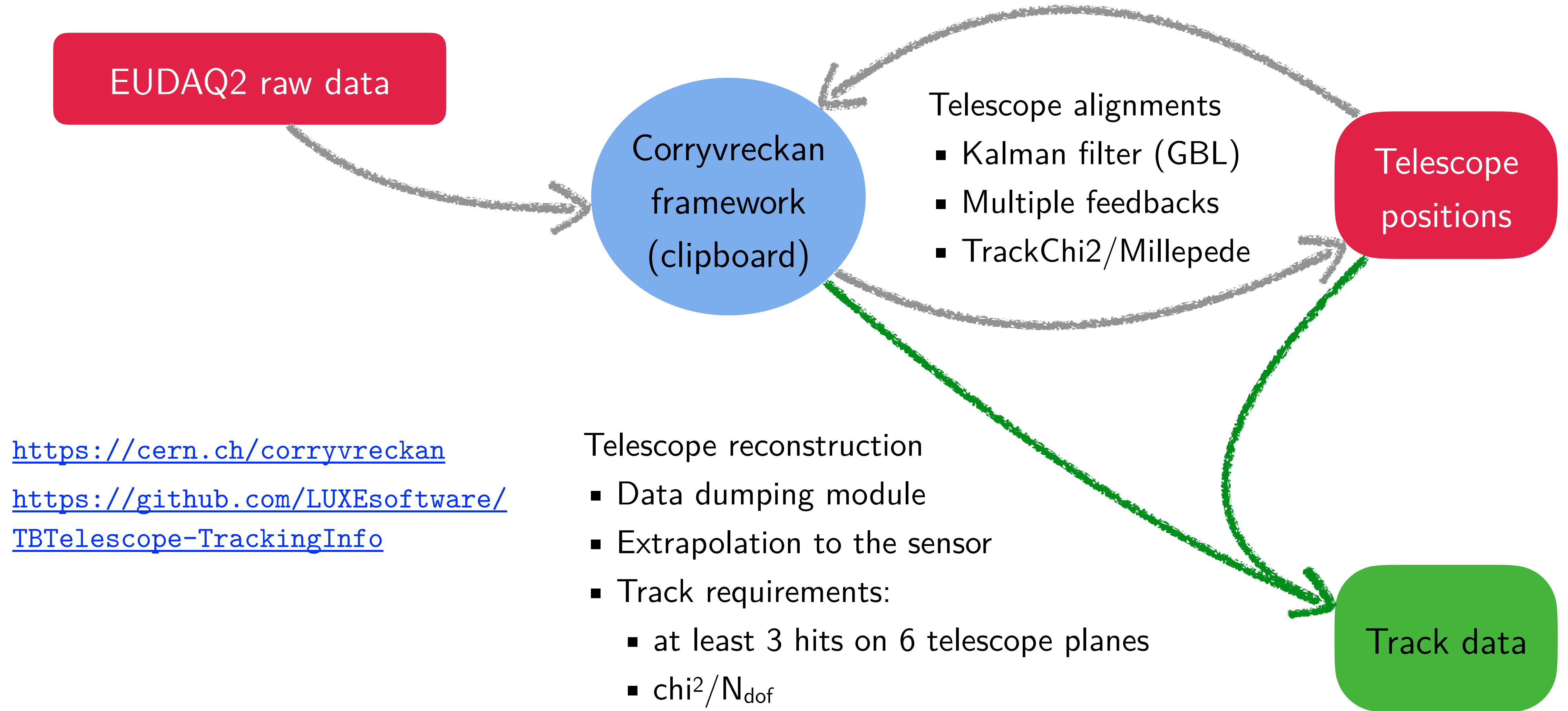
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LUXE ECAL Workshop

Outline

- Data flow
- Data structure
 - Telescope `telesc`/Sensor `sensor`
 - Merged `sentel`
 - Convention
- Status (as of Feb 2024)
 - Integrity check
- key4hep framework for ECAL-P (work plan)

Telescope



Sensor

FireDAQ raw data

Data processing

- Pulse shape deconvolution
- Gain calibration

ROOT
TreeOnFire

0	1	2	3	4	5	6
-150 ns	-100 ns	-50 ns	0 ns	50 ns	100 ns	150 ns

- Gain calibration
- (Extended) time stamp
- Time frames (using the central three)

Sensor data

FireDAQ libraries

<https://github.com/FireDAQ> (limited access)

[Slides from Jakub: Status of FLAME development \(2018\)](#)

Event building

Telescope `telesc.root`

Tracks

- Run ID
- Trigger ID
- Time (in ns)
- Number of tracks n
- Track arrays $n \times (4 + 1 + 1 + 12)$
 - track extrapolations (angle and position)
 - χ^2/N_{dof}
 - N_{hit} (position of the plane)
 - track intercepts (hit centres) on 6 planes
(set the intercept as null when no hit)

Sensor `sensor.root`

Hits

- Run ID
- Extended TLU number
- Time stamp (in integer, $1 = 50 \text{ ns}$)
- Plane ID
- Number of hits m
- Hit arrays $m \times 7$
 - pad indices
 - deposits in 7 time frames
- Raw data

Merged event

Synchronised and aligned sentinel.root

RunInfo

TrackInfo (histograms)

HitInfo (histograms)

Tracks (for debug)

Hits (for debug)

Names inherited from Sasha's lxsim

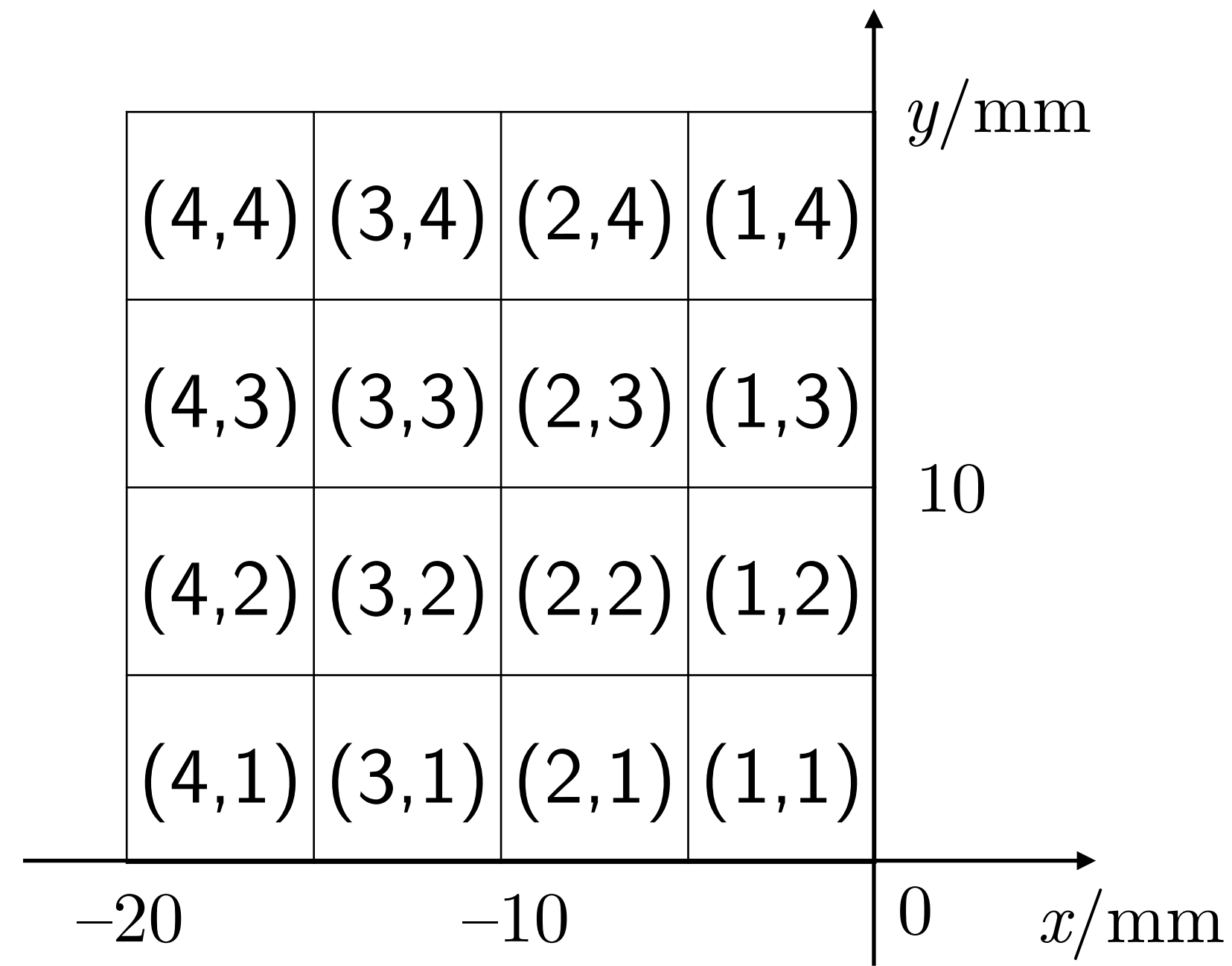
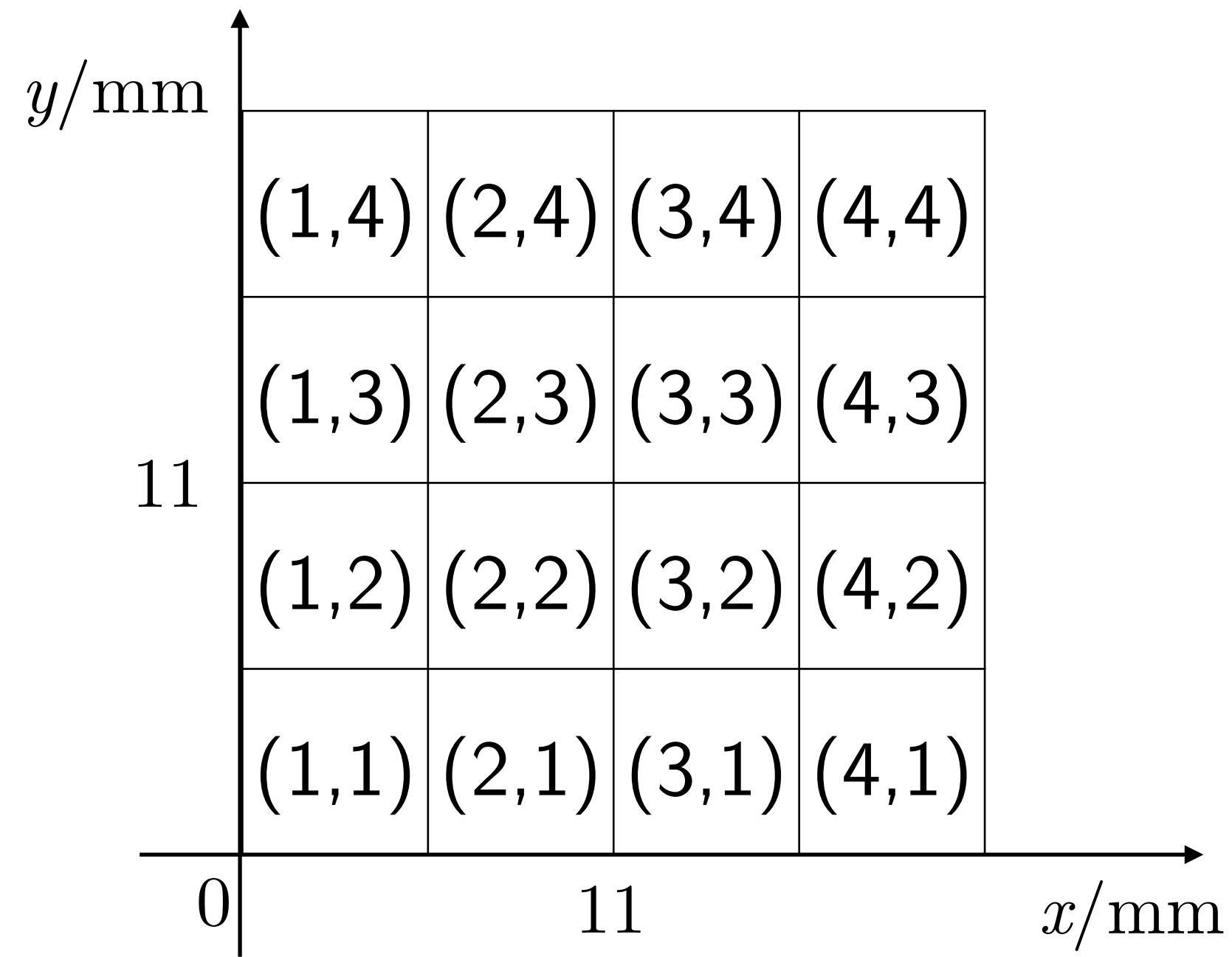
[GitLab repository for event building](#)

HitTracks

- Run ID
- Event ID
- Time (in ns)
- Number of hits m
- Hit arrays $m \times (a \times b \times 1)$
 - deposit = the first one if a channel recurs
- Number of tracks n
- Track arrays $n \times 2$
 - track extrapolation
 - track quality factor(s)

Convention

- Right-handed coordinates with $z = \text{beam direction}$
 - Telescope coordinates
 - Sensor pad index “coordinates”
 - Sensor coordinates
- Define: $\text{null} = 9999$
- Quality selection for analysis
 $m == 1 \ \&\& \ n == 1 \ \&\& \ N_{\text{hit}} == 6$

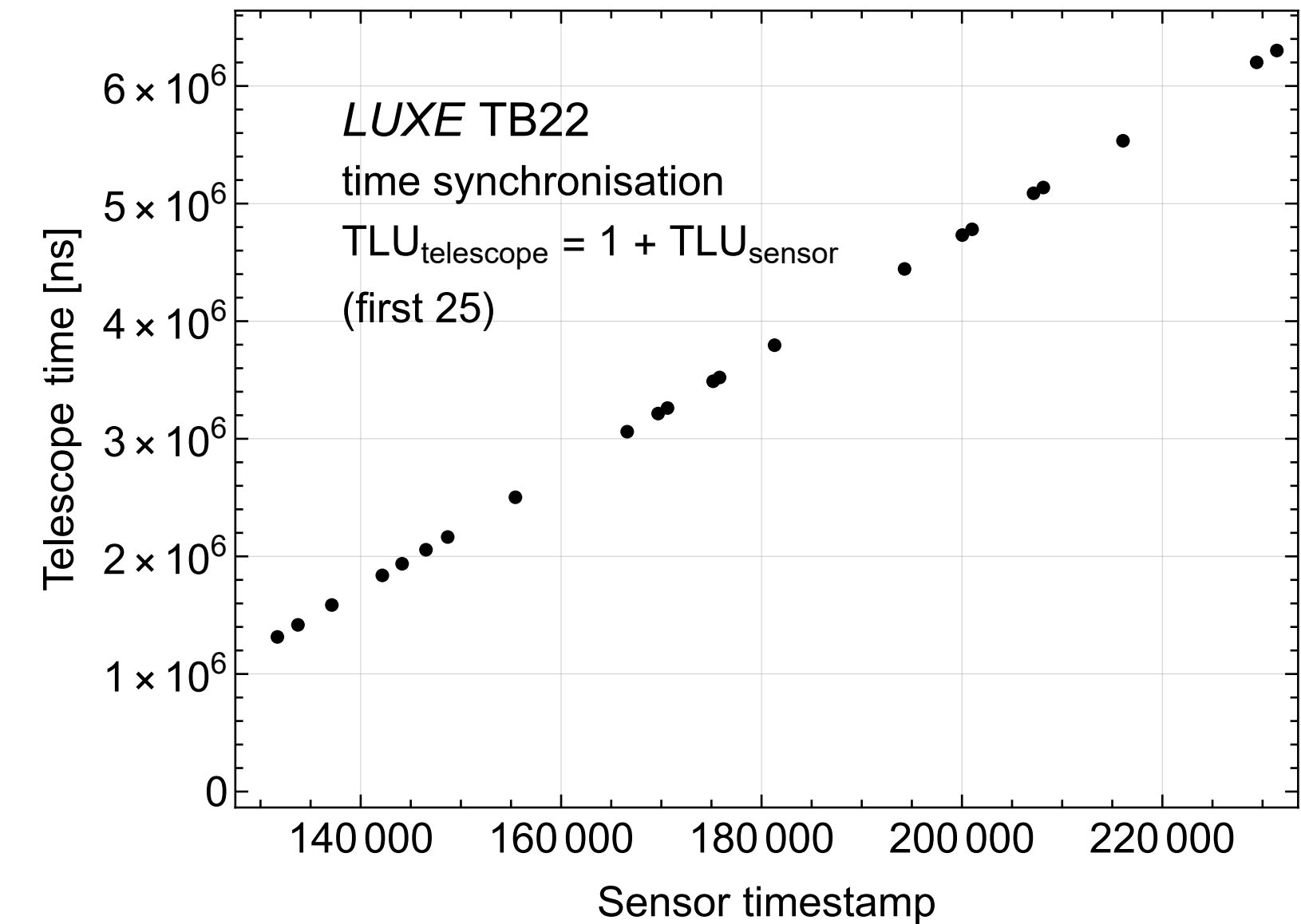


Synchronisation

- Linear dependency between telescope's time and sensor's time stamp

$$t = T * 50 + t_0 \pm \text{grace time [ns]}$$

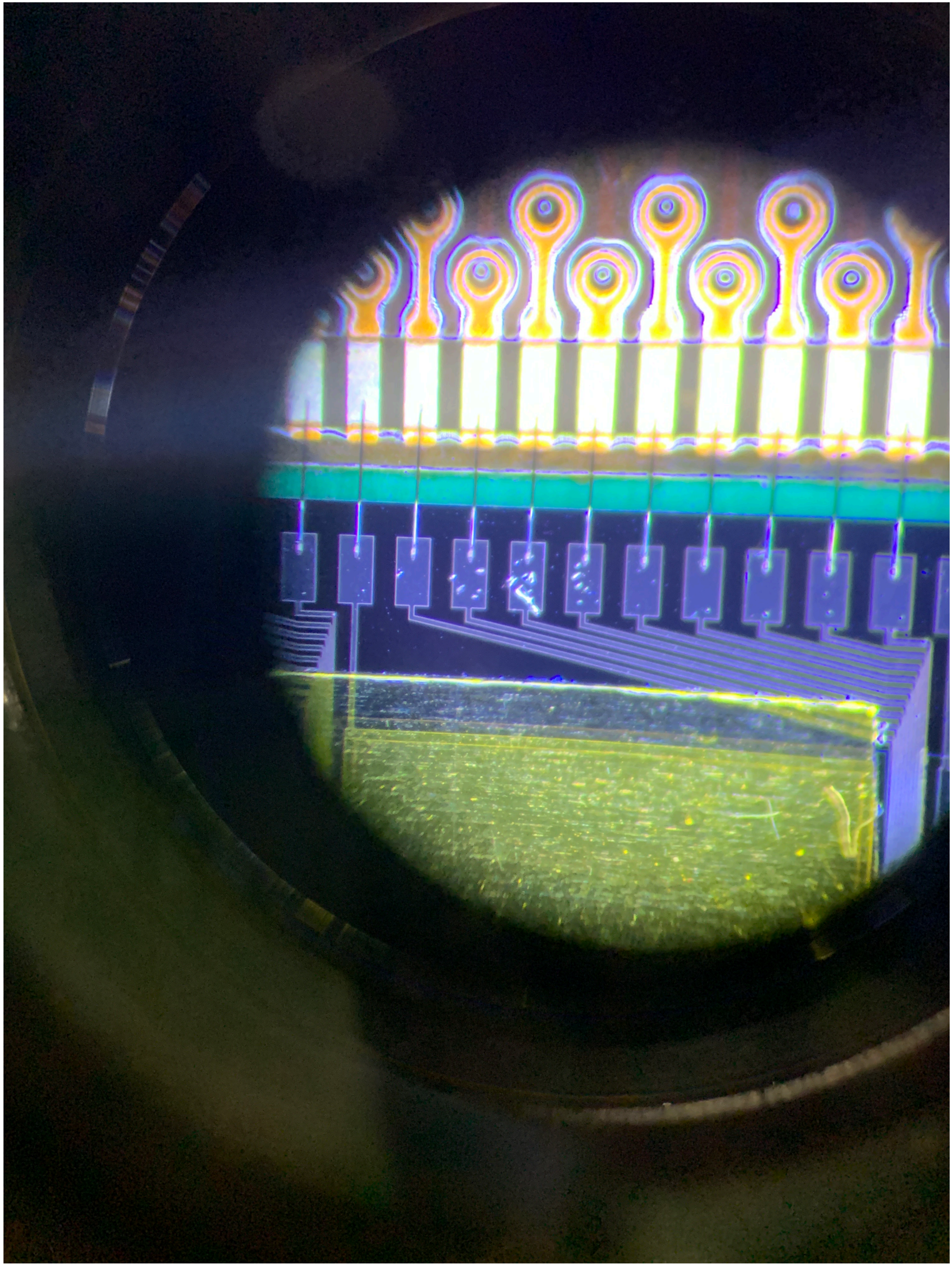
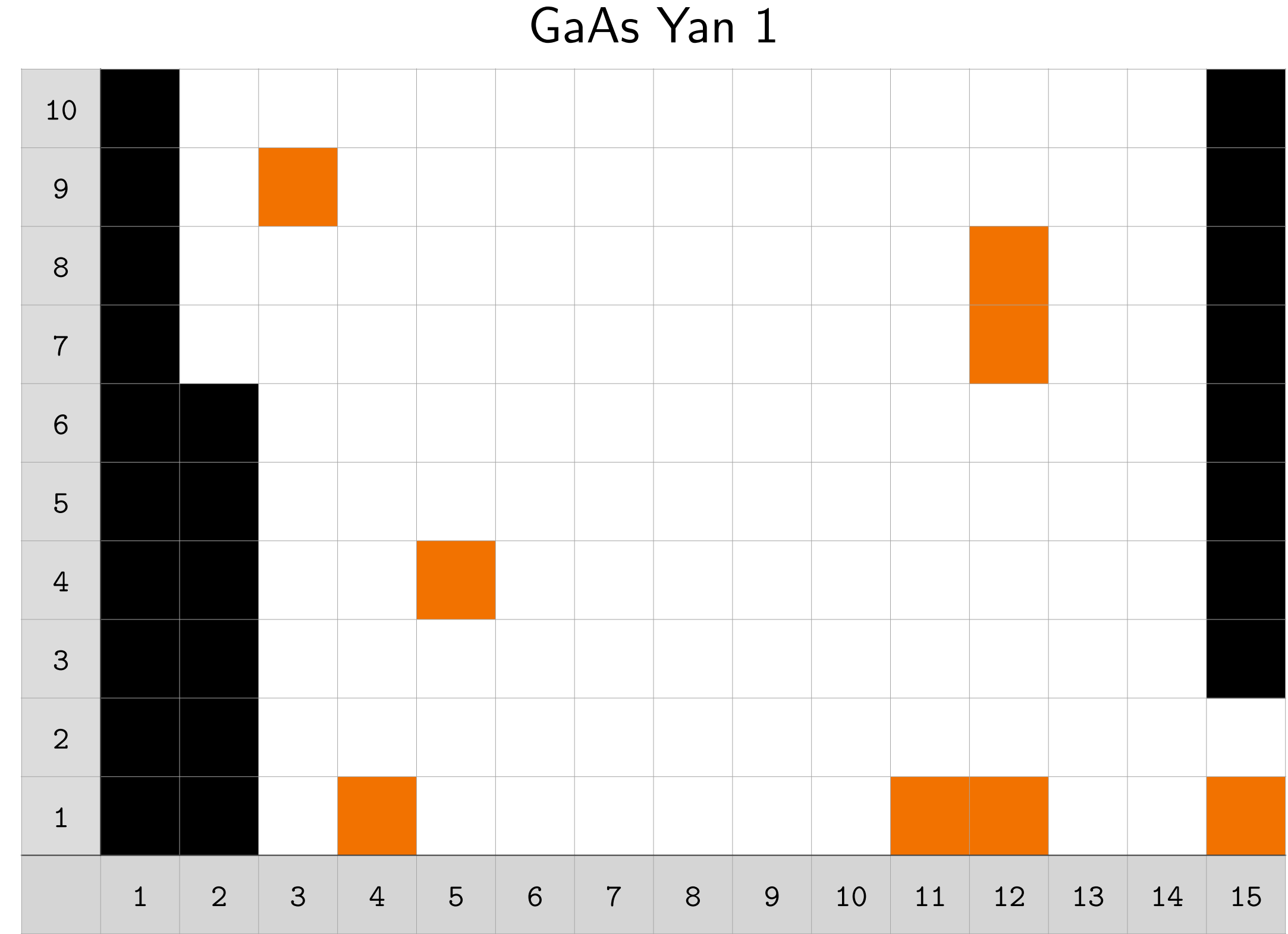
- Not always works:
 - T jumps occasionally; events excluded
 - T fails (only one run); run excluded



Run 4510 Event:	327679	327680	327681
T	288,988,679,310	288,988,679,974	288,988,682,162
t/ns	143,778,723,129.7	143,778,807,121.1	143,778,865,719.5
$\Delta T * 50 \text{ ns}$	33,200	109,400	142,600
Δt	83,991.4	58,598.4	142,589.8

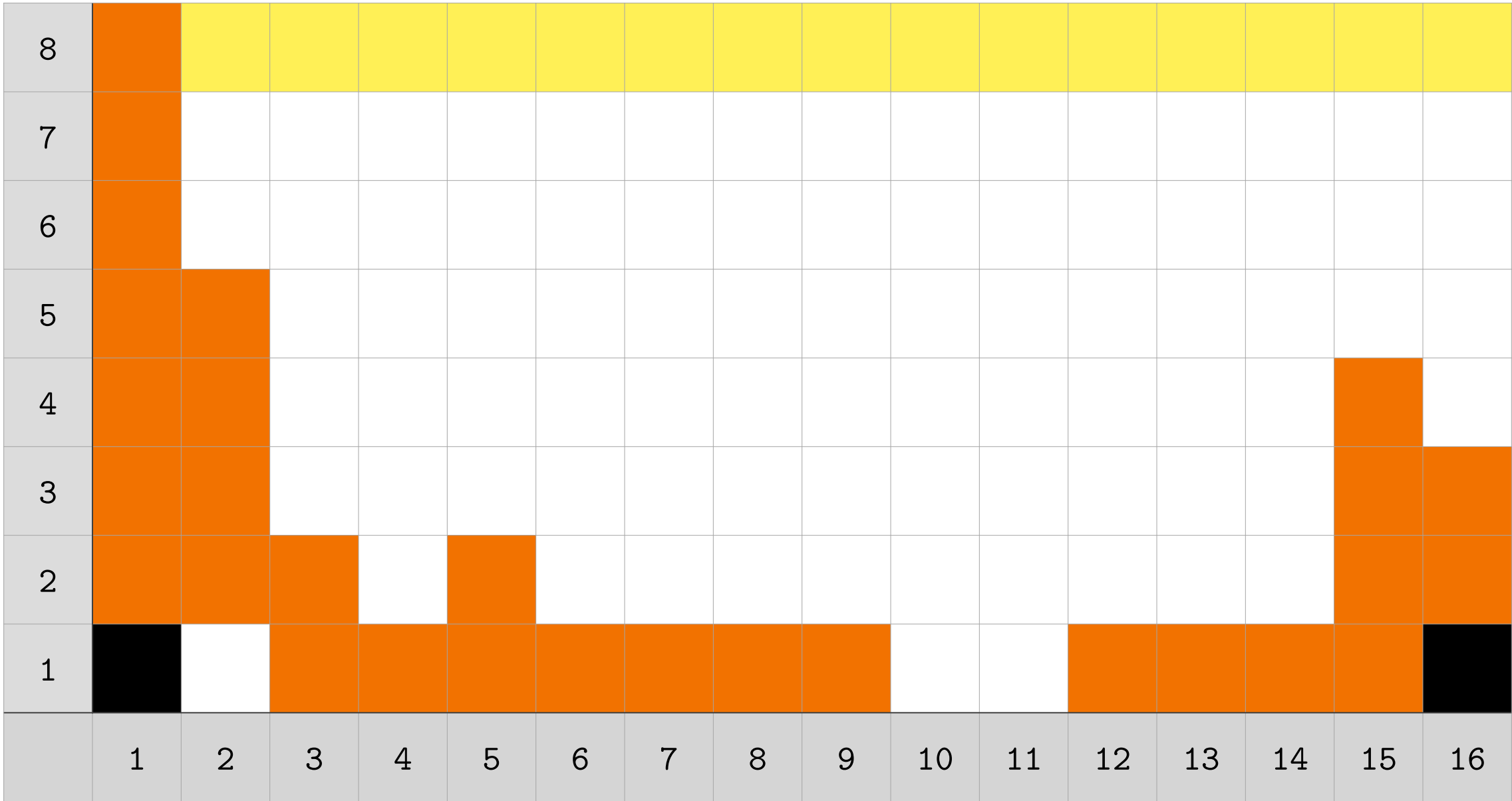
Irregular channels

- Dead channels
 - Physically disconnected (black)/damaged (orange)
 - Masked from reading out

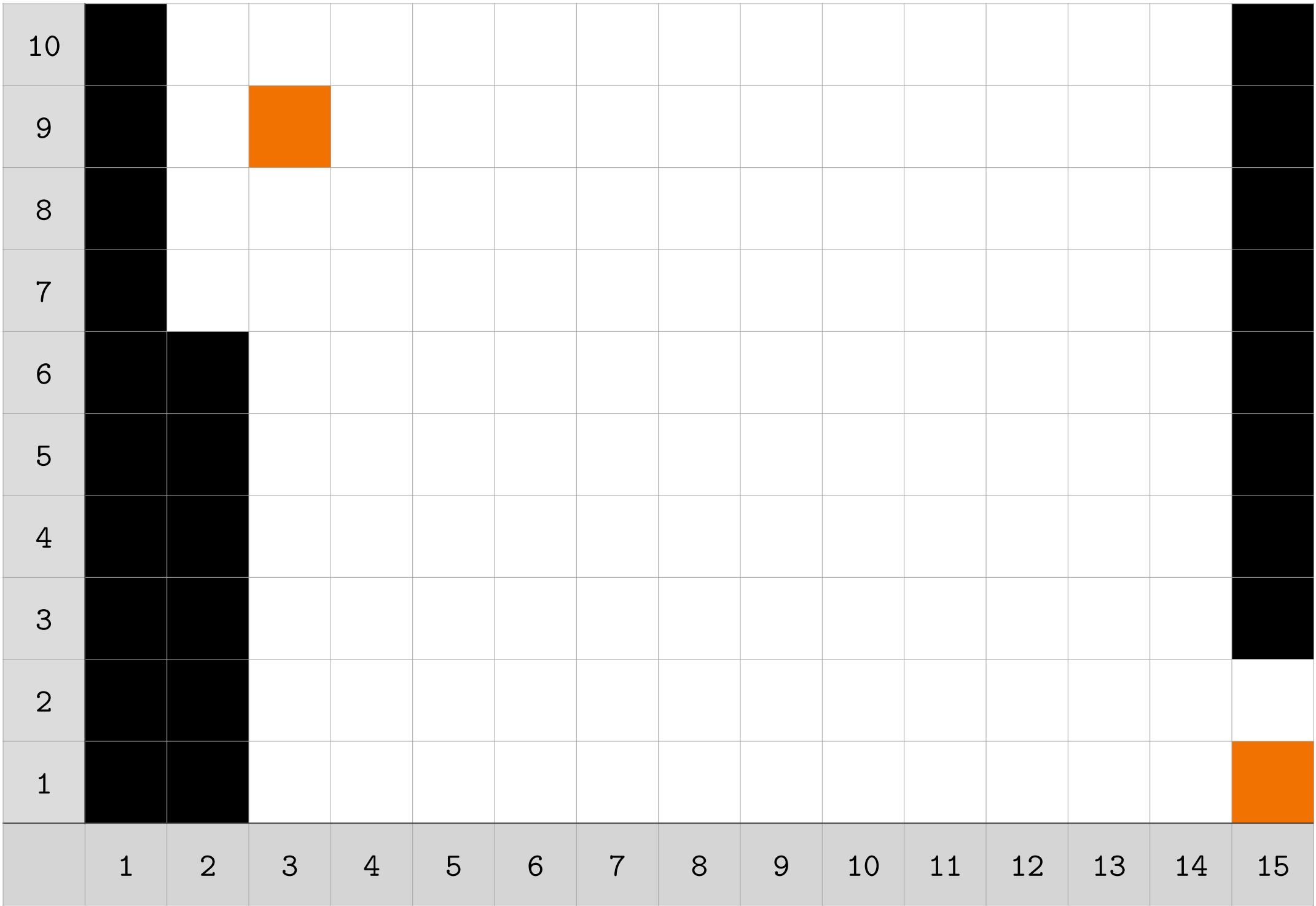


Irregular channels

CALICE 75

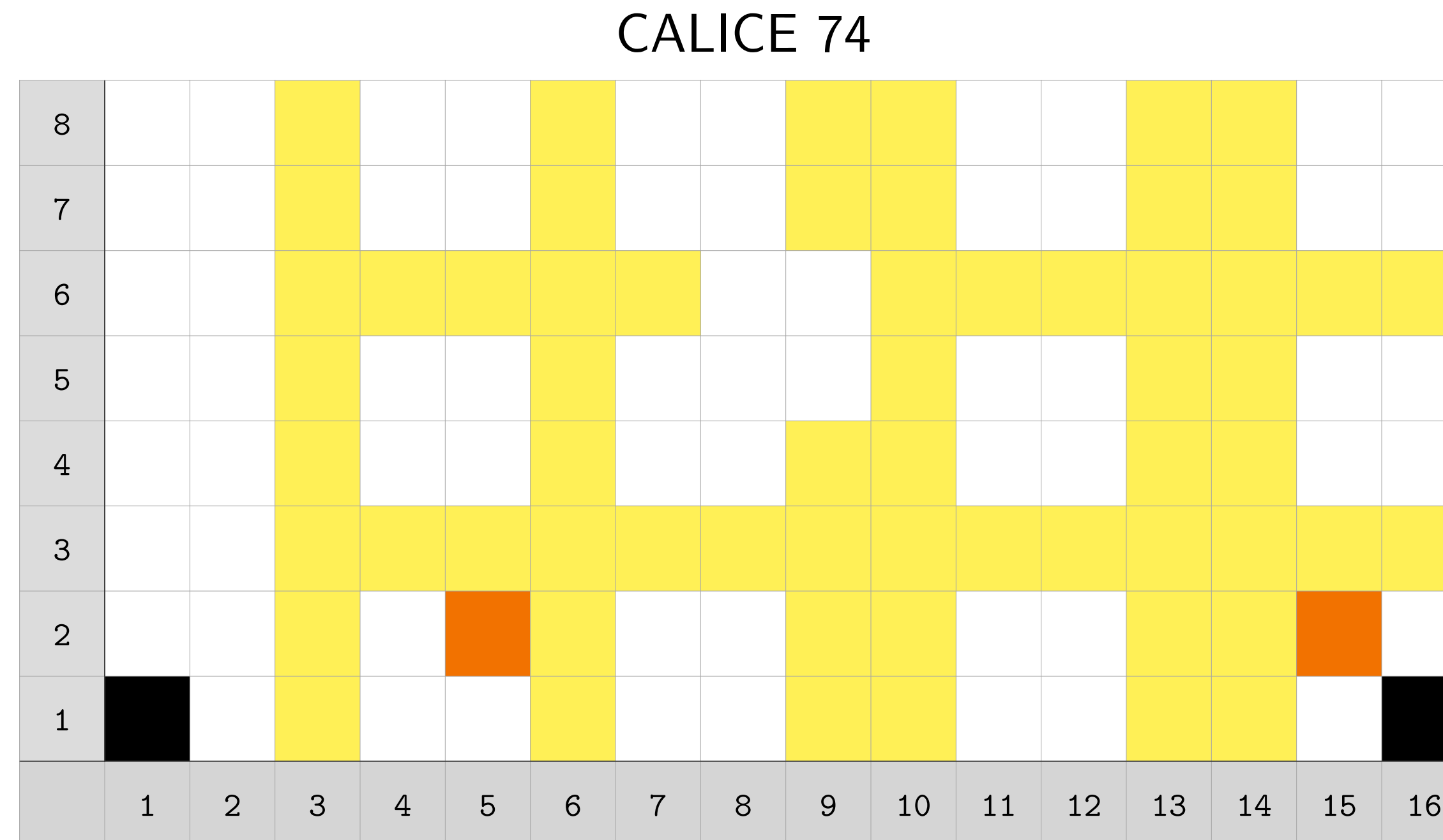


GaAs Anton 1



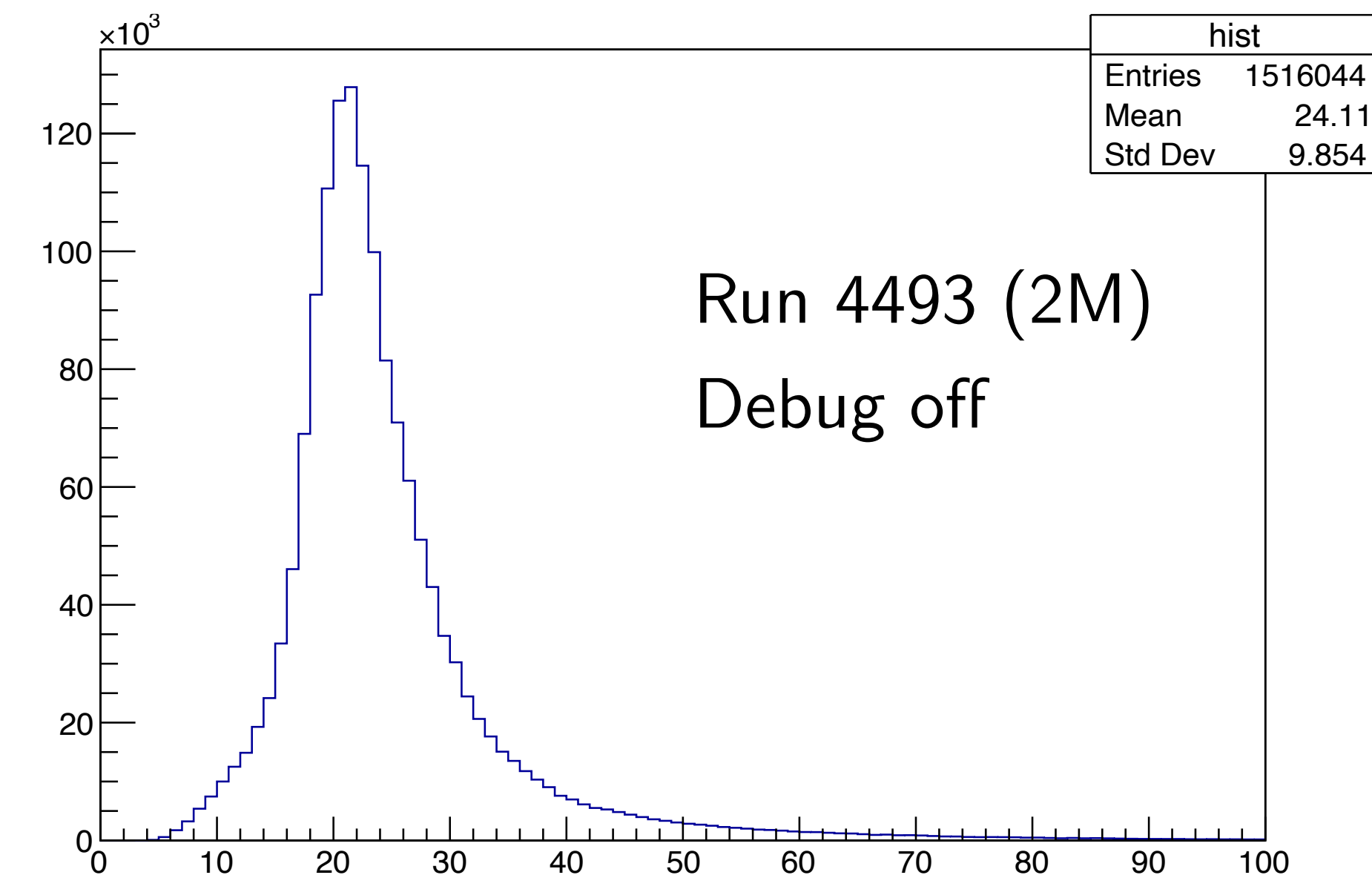
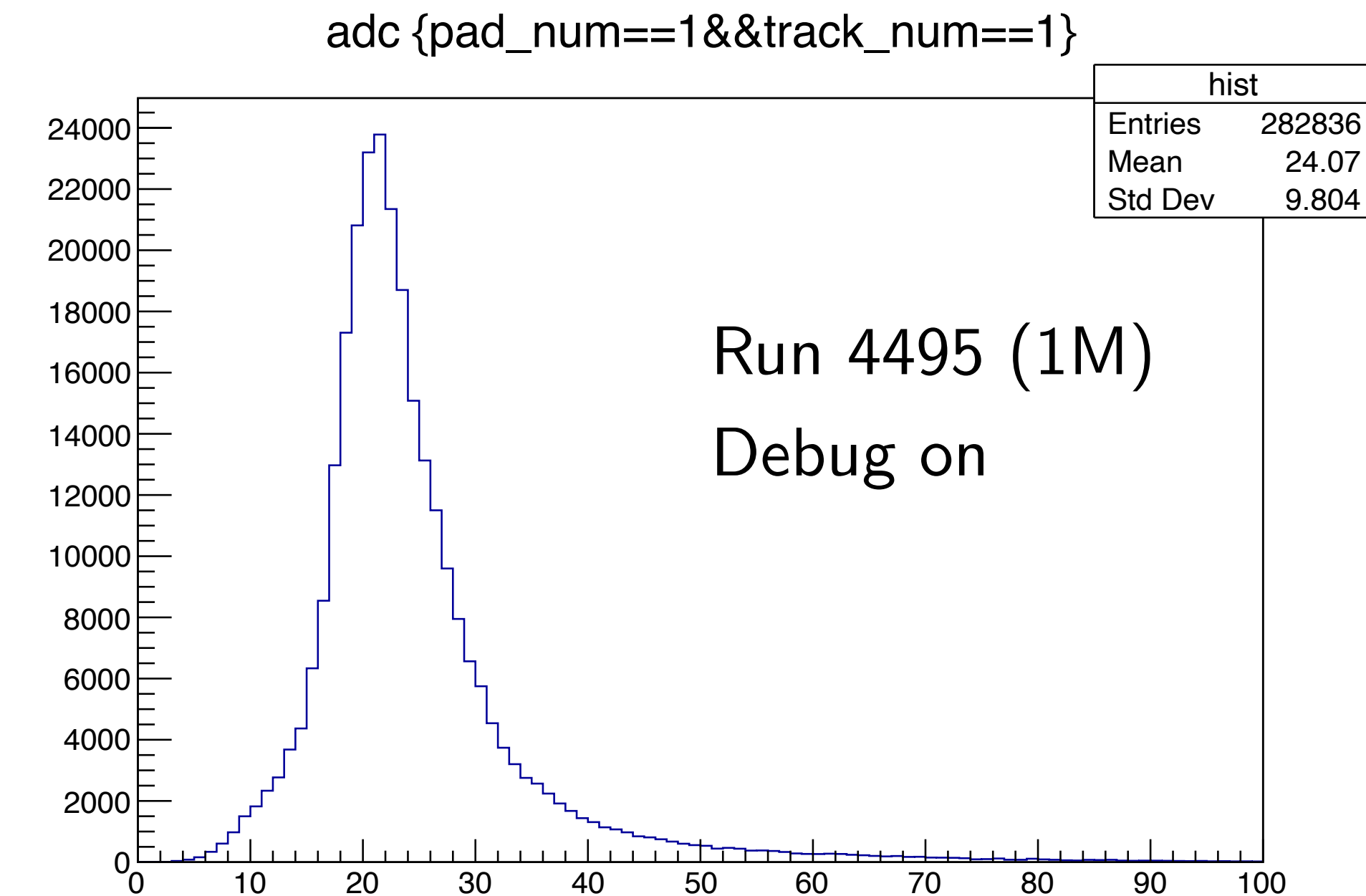
Irregular channels

- Under scanned channels (green-yellow)
- Noisy channels
 - Related to the channels with high pedestal sigma (?)



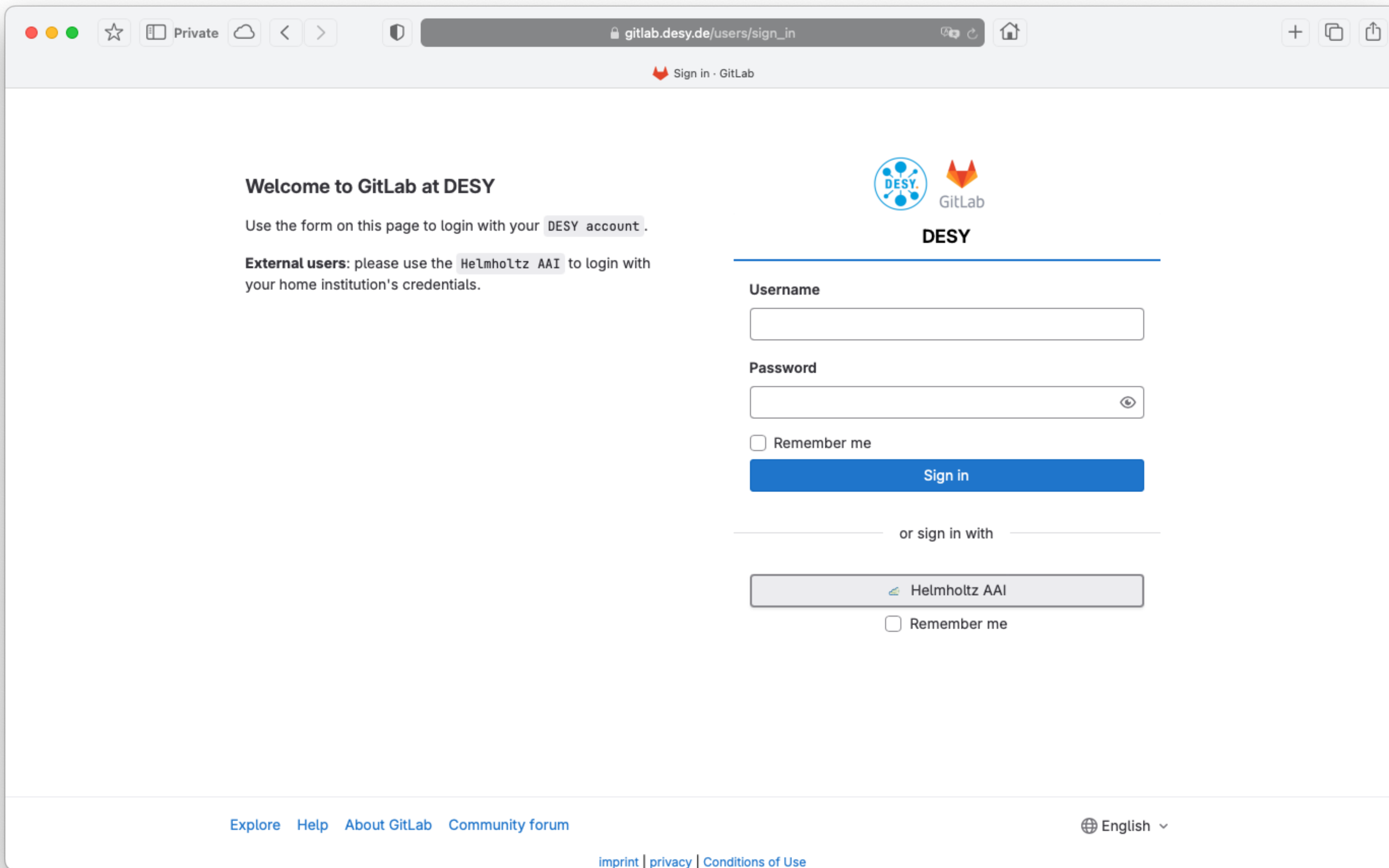
Irregular runs

- Empty runs
 - Michal's method: not a single entry in a recorded event
 - TB21 (data taking moment related)
 - Jakub's conclusions on [Dec 2021](#) and [Feb 2022](#)
 - TB22 (debug mode related, longer readout time)
 - 8 runs (1 millions per run, lost 66%)
 - “twin” runs with difference on the debug mode
 - no signal difference at a preliminary glance
 - All calorimetry runs (lost 30-70%)
 - needs confirms from Mihai



Availability

- Statistics: ~75% of the incoming triggers when applying the quality selection
- Storage
 - ISS: `/data3/shan/beamtest/sentel[_*]`
 - ATLAS-IL Tier3: `/storage/t3_data/luxe/TB22/sentel[_*]`
 - [WIP] To create group directories for easier access
- Instruction
 - ~~DESY~~ Confluence
 - [WIP] DESY X wiki
 - Log book
- Time line
 - New production in progress
 - Some pilot files available, no huge difference
 - Hopefully at the beginning of March (or earlier?)



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


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Some thoughts

- Crosstalk “control group”
 - The connection of the top-row ($y=10$) pads is different
 - Less likely they will have crosstalk?
- ECAL-P data frame
 - An analysis frame for both TB and the experiment
 - EDM4hep (Thomas) Marlin [RealisicCaloReco](#)
- Codes sharing and maintenance

Enjoy 20°C Western Mediterranean!

