



ALICE



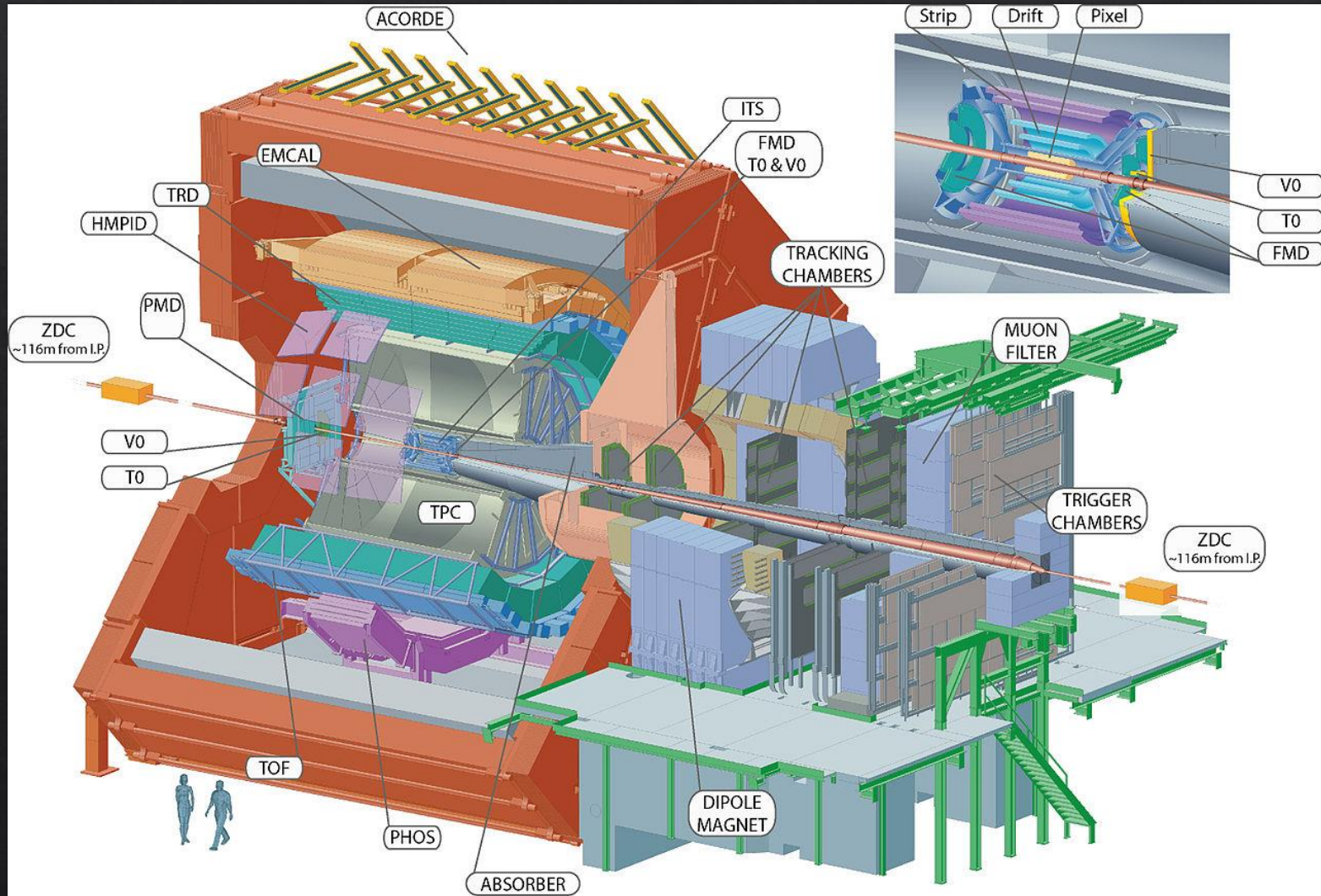
ALICE

Visualising Event Data from the Transition Radiation Detector in ALICE at CERN

Sameshan Perumal for the ALICE Collaboration
and the University of Cape Town



A Large Ion Collider Experiment (ALICE)



Aim

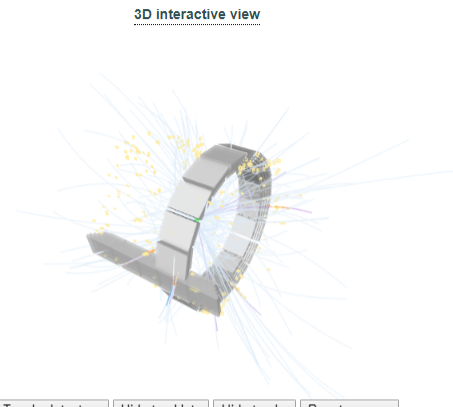
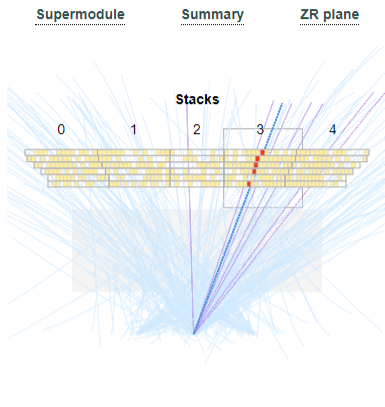
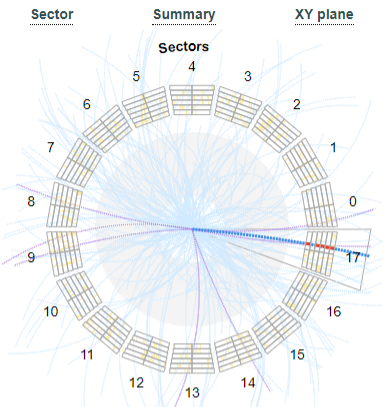
Create a simple, portable event display, focused on the TRD, that is useful to multiple audiences.

Motivation

- Fixed display with low learning curve
- Web based interface for greater collaboration
- Combined display of reconstructed and raw data
- Explore unusual visual representations
- ALICE is moving to O²

TRD Event Display

- Available Events**
- Track 3 [Stack 3, Sector 17]
 - Track 17 [Stack 4, Sector 9]
 - Track 31 [Stack 4, Sector 13]
 - Event 20
 - Track 3 [Stack 0, Sector 3]
 - Track 59 [Stack 1, Sector 4]
 - Track 11 [Stack 1, Sector 8]
 - Track 57 [Stack 3, Sector 0]
 - Track 1 [Stack 3, Sector 6]
 - Track 9 [Stack 4, Sector 11]
 - Event 98
 - Track 10 [Stack 0, Sector 5]
 - Track 100 [Stack 0, Sector 5]
 - Track 16 [Stack 0, Sector 17]



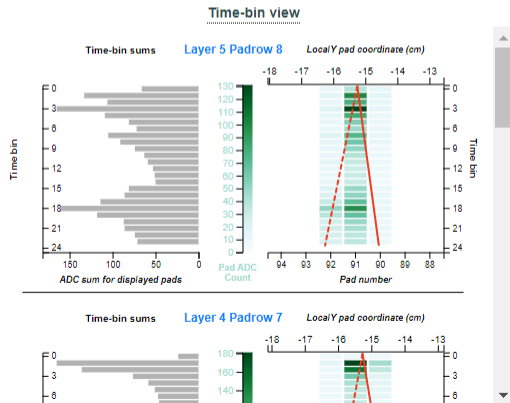
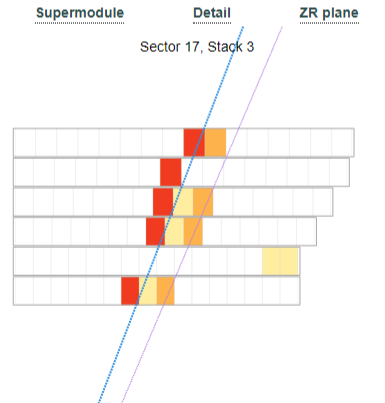
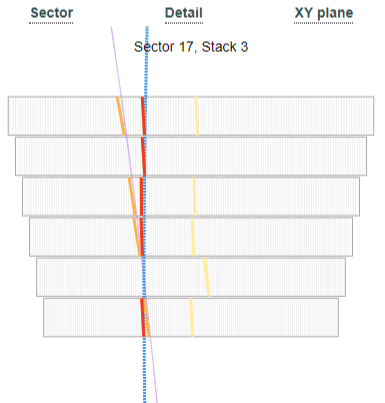
Information

Event
Collision between a proton and a lead nucleus at an energy of **4 TeV**

Track
Trd track E15_T2 traverses Sector 17, Stack 3 of the TRD with a transverse momentum of **5.05278 GeV**. The calculated PID value of 71 indicates this is likely a **pion** track.

Tracklets
5 of the 614 tracklets detected by the TRD have been matched to this track.

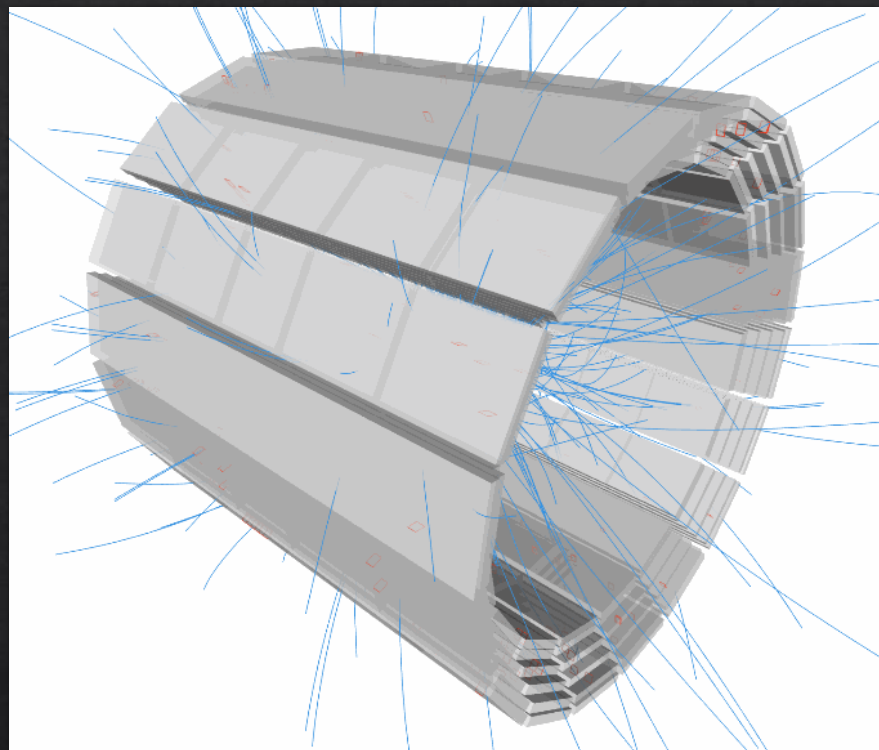
Triggers
16 high-level triggers fired for this event: 0VBA, 0VBC, 0TVX, 0VIR, 0STG, 0UBA, 0UBC, 0VHM, 0OM2, 0SH1, 0BPA, 0BPC, 1HCO, 1H12, 1ZED, 1ZMD



- Legend**
- Detector module
 - Detector pad
 - ALICE TPC
 - Selected TRD track
 - Other TRD track
 - Background track
 - Selected TRD tracklet
 - Matched TRD tracklet
 - Other TRD tracklet
 - Lorentz corrected tracklet
 - Raw reconstructed tracklet

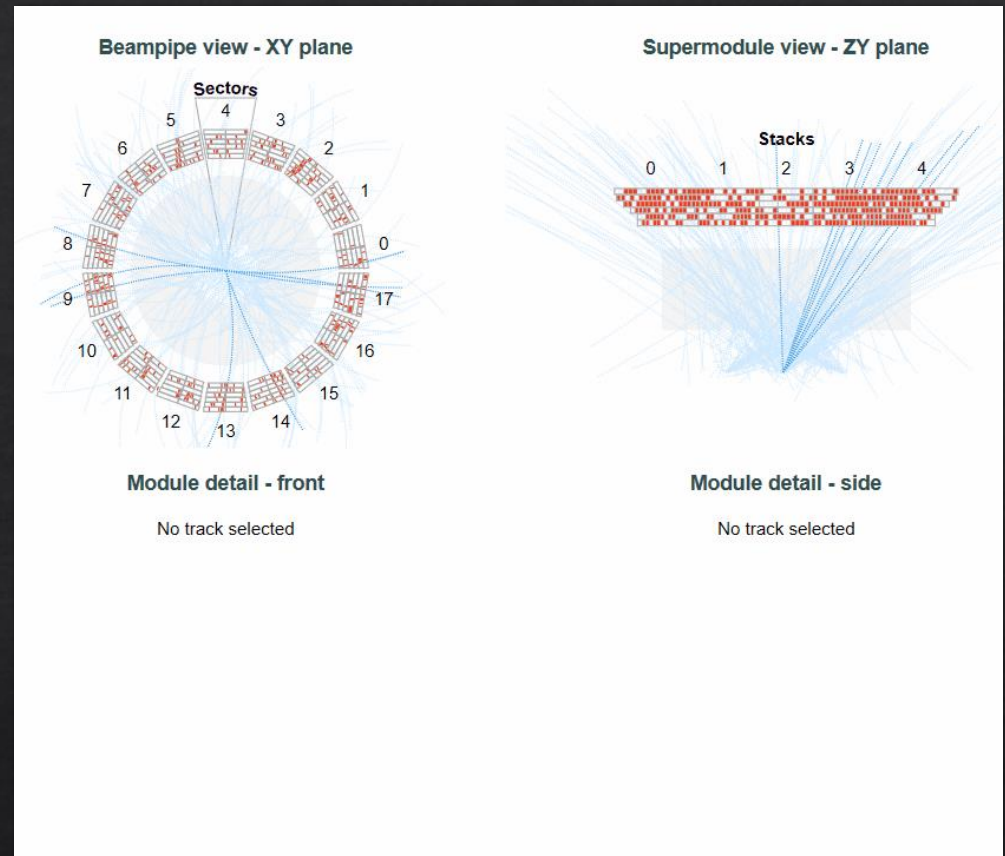
Interactive 3D View

- Contextualises data from other views
- Detector, tracks and tracklets can be visually toggled
- Zoom and pan to area of interest
- Added for CERN open days

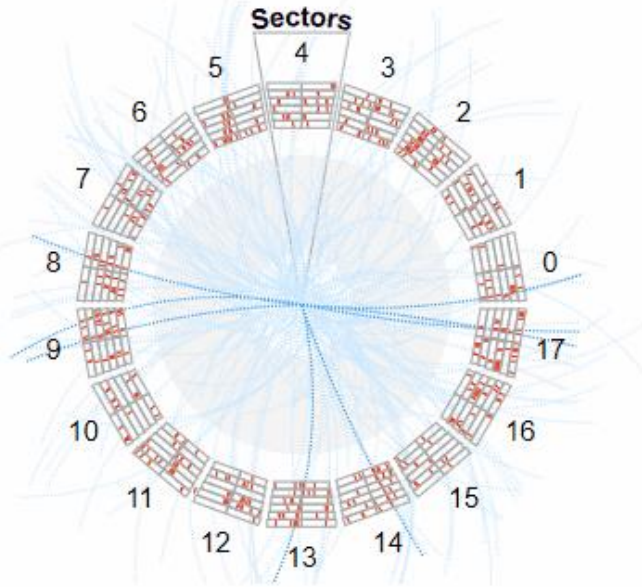


Tracks and Tracklets

- Overview of location
- Detail view on selection
- Animation for context
- Colour for relationship



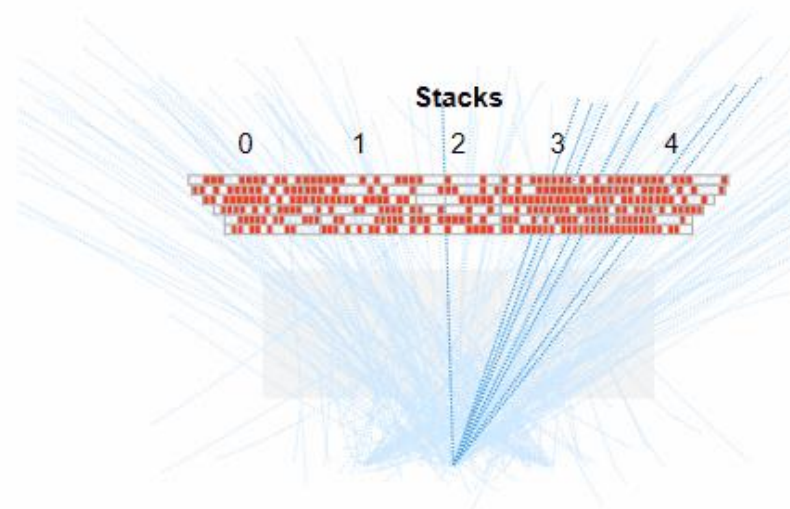
Beampipe view - XY plane



Module detail - front

No track selected

Supermodule view - ZY plane

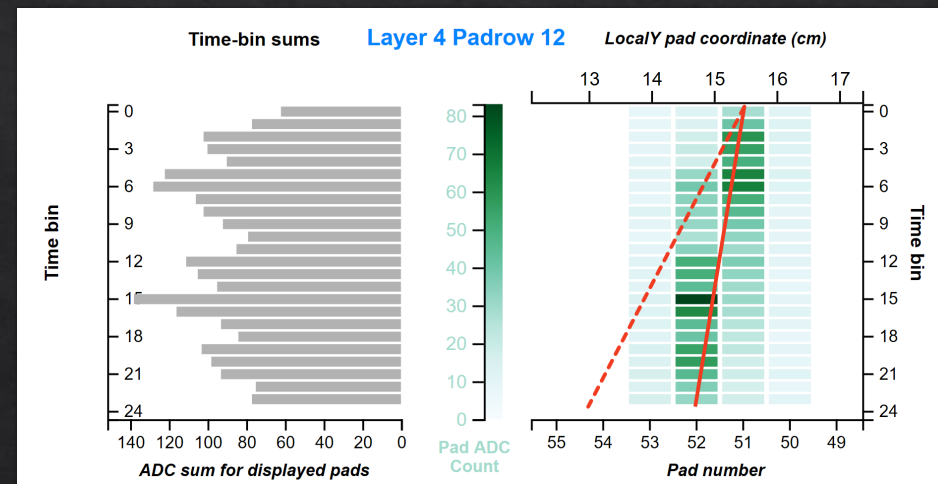


Module detail - side

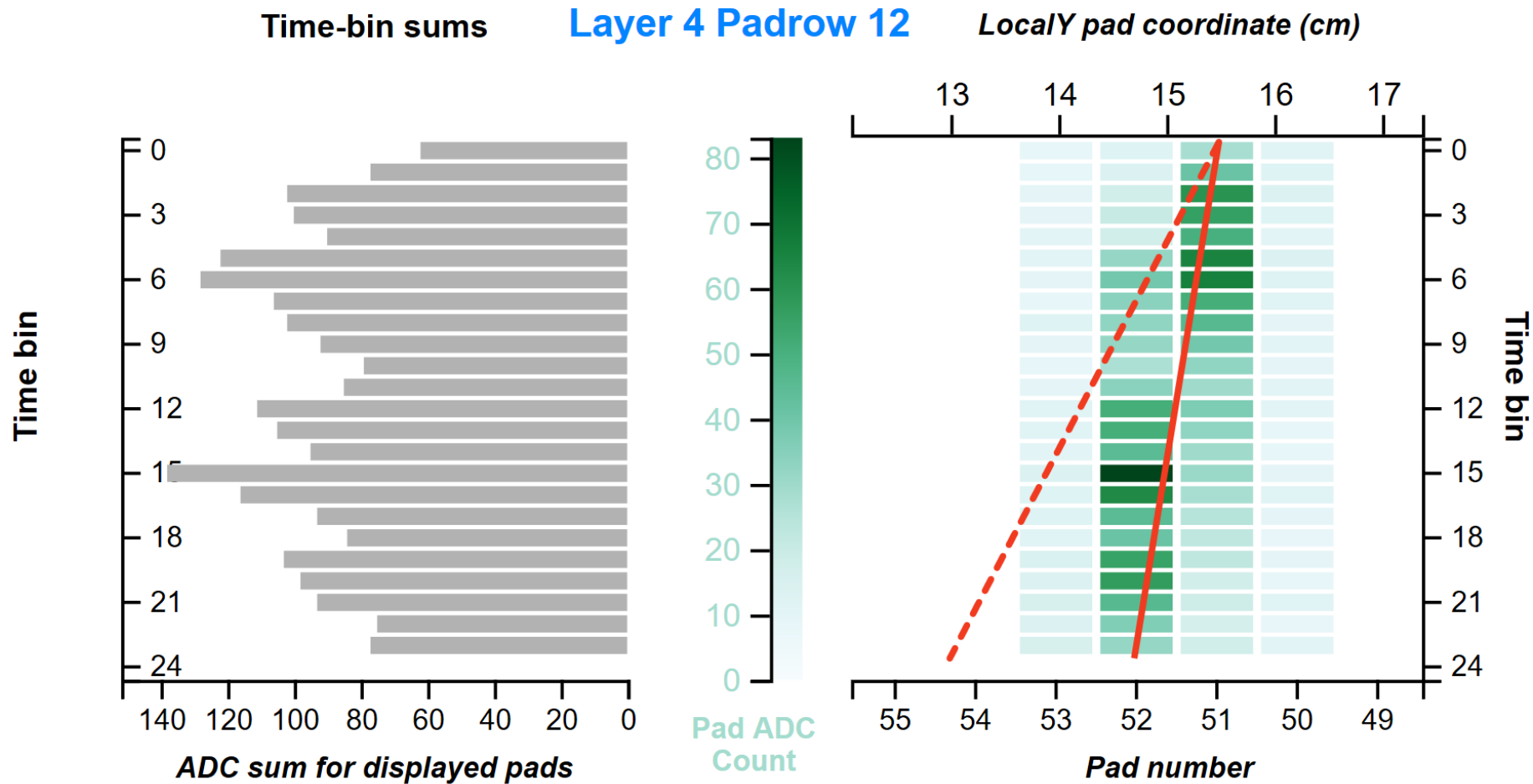
No track selected

Raw Data View

- Display ADC values
- Correlate time and position
- Link to track selection
- Overlay reconstructed tracklet



Detailed Raw Data View



JSON Data Interchange

- Web standard data format
- Source agnostic
 - Run 2, Run 3, Simulation
- Easy to read and generate
- Automated conversion from
Run 2 ROOT files

```
{  "id": "E15",
   "i": {
     "be": 4000,
     "bt": "p-A",
     "ft": " 0VBA  0VBC  0TVX  0VIR  0STG  0UBA  0UBC"
   },
   "tracks": [{
     "id": "E15_T0",
     "stk": 0,
     "sec": 3,
     "typ": "Esd",
     "path": [{ "x": -0.18, "y": 0.98, "z": 7.88 }]
   }],
   "trk1ts": [{
     "id": "E15_L0",
     "stk":0, "sec":0, "1yr":0, "row": 1,
     "1Y": -18.944, "dyDx": -0.0606667
   }
 ]}
```


Technical details

- Browser based, runs on any platform
- Web standard technologies
 - HTML, Javascript, SVG, d3.js, WebGL
- Can be used statically without internet
- JSON for reconstructed and raw data input
- Component based architecture for extensibility and customisation

CERN Open Days



Availability

Demo version

<https://datacartographer.com/alice-js/>

Github repository

<https://github.com/samperumal/alice-js>

Thank you

Technologies

HTML

Runs everywhere, no installation, lightweight footprint

JavaScript

Modern scripting language of the web

<SVG> and <canvas>

Scalable, crisp graphics, minimal processing overhead, good performance

D3.js (<https://d3js.org/>)

Powerful data visualization library

JQuery (<https://jquery.com/>) and JQueryUI (<https://jqueryui.com/>)

Standard javascript utility library

WebGL and ThreeJS (<https://threejs.org>)

Standard for displaying 3D graphics on the web

Data Interchange

AliESDAnalysisTask

Allows for arbitrary event selection with custom cuts

Processes both `AliESDs.root` and `TRD.FltDigits.root`

Outputs JSON files to disk

<https://github.com/samperumal/msc-cpp>

JSON event data

Fixed format, required

JSON digits data

Loaded on request, if available

TRD Chamber

