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ALICE

ALICE Track visualisation options for LHC Run 3

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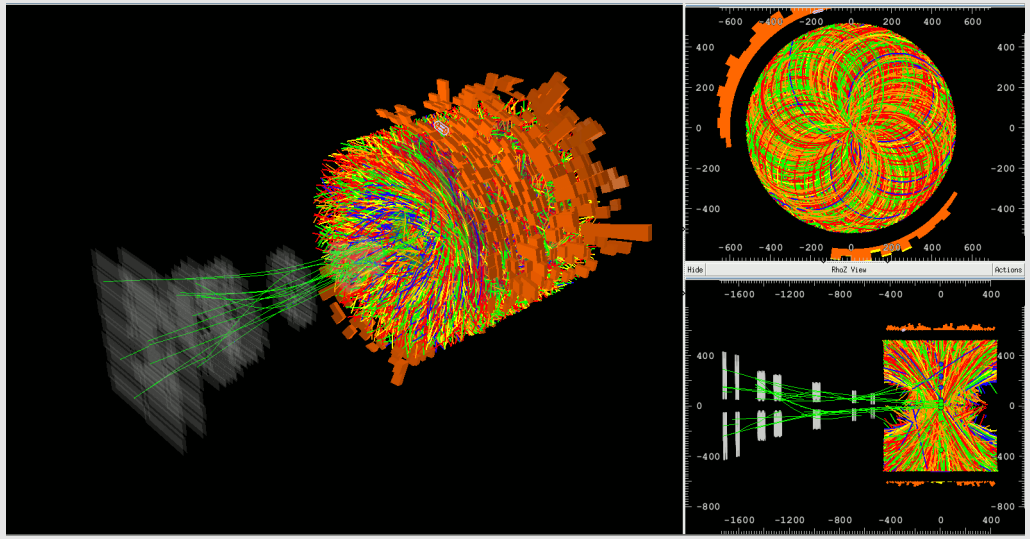
Agenda

1. Run 3 demands
2. Time in visualisation
3. Progressive visualisations
4. Do we really need to visualise tracks
5. Improvements in track visualisations
6. Results

Visualisation

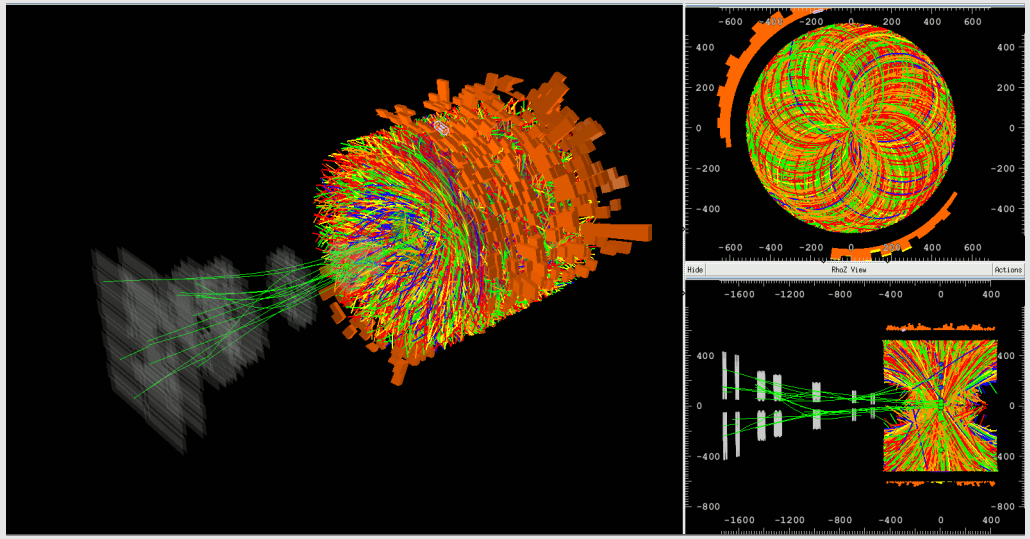
- Current – drawing tracks
- Pros
  - Looks nice
  - Easy to imagine for non-professionals
- Cons
  - Difficult to see details if there are many tracks
  - Everybody is doing it for years



ALICE run 3

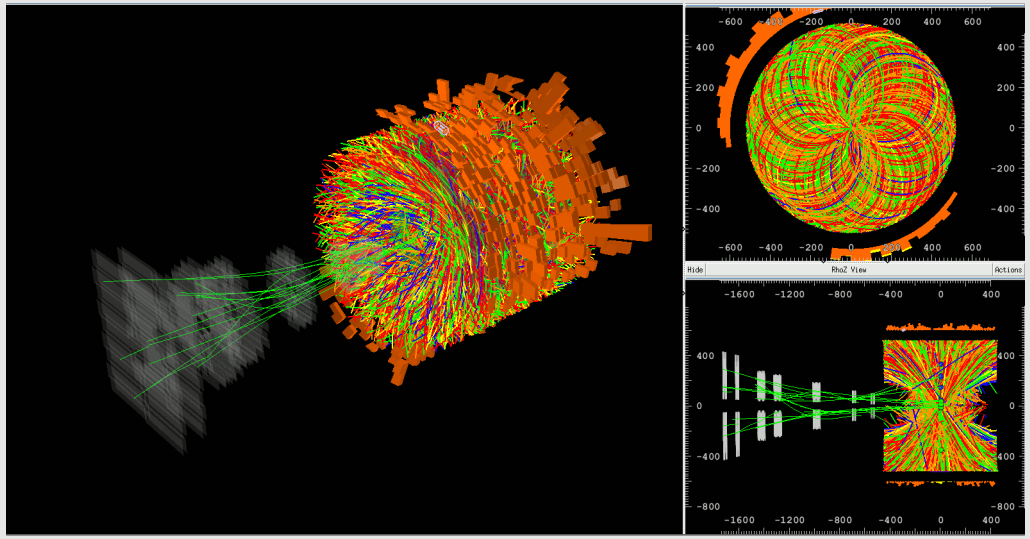
ALICE Run 3

- real time filters
- time dimension
- challenges
- hierarchical navigation
- possibility to debug algorithms and detectors



Visualisation – dynamics

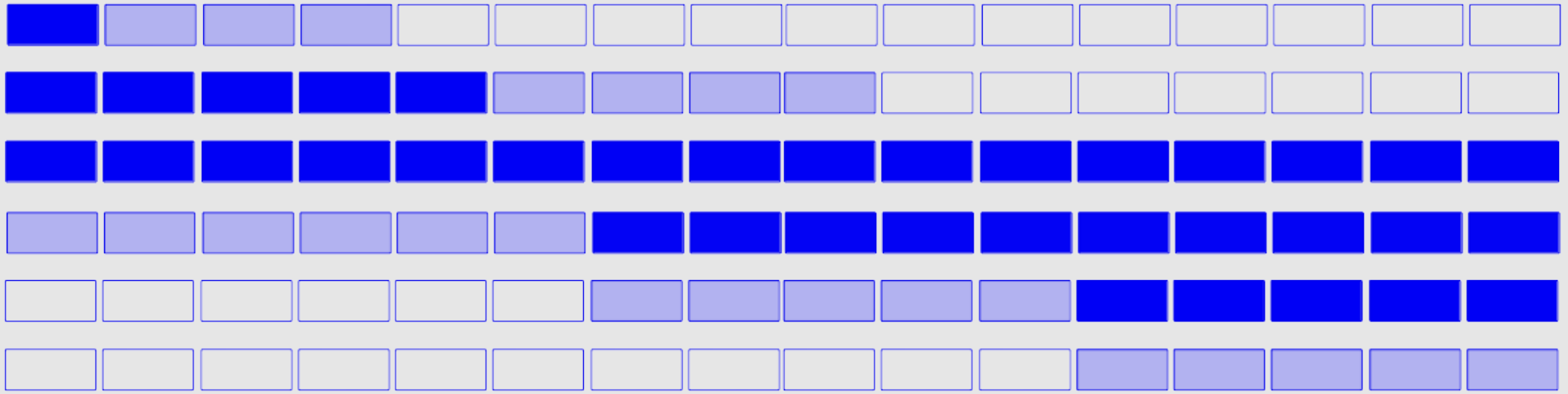
- We see a cumulative snapshot of the event
- It is interesting to observe how the system evolve in the time
  - Adding track filtering
  - Adding the animation – the incremental drawing
  - Drawing consequitive frames on the same image, but moved by (time frames)



Incremental drawing

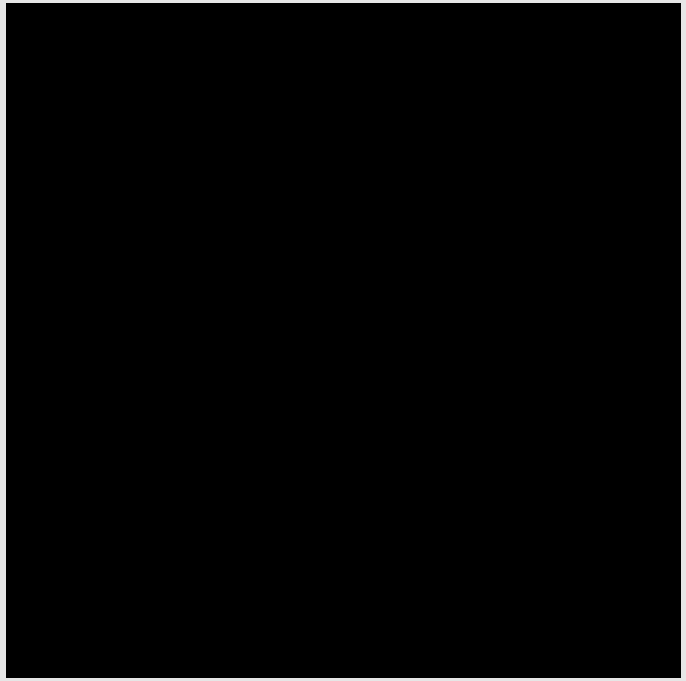
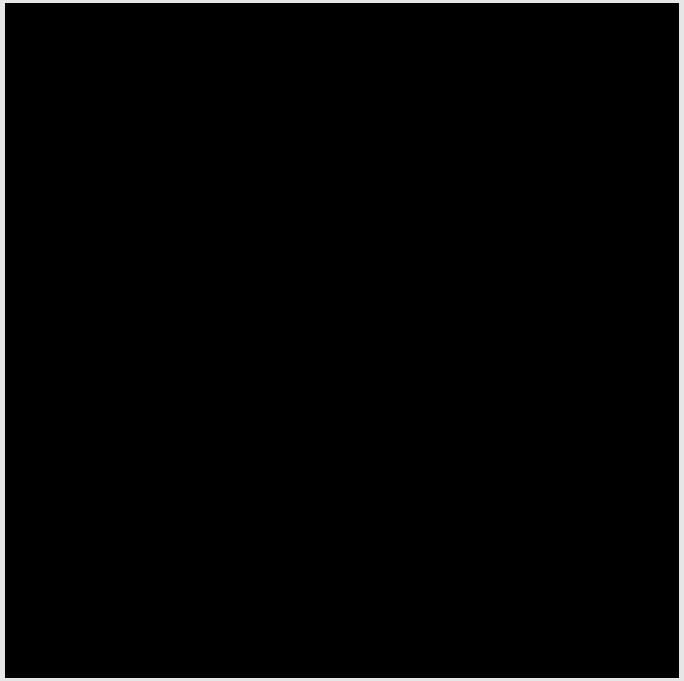
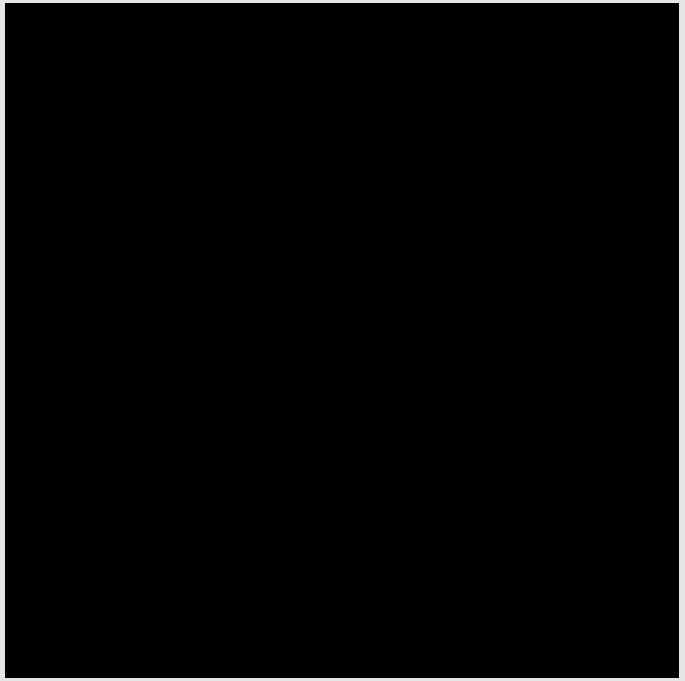
Incremental drawing

- Current visualization shows whole tracks
- Track animation may improve visual atractiveness for visitors



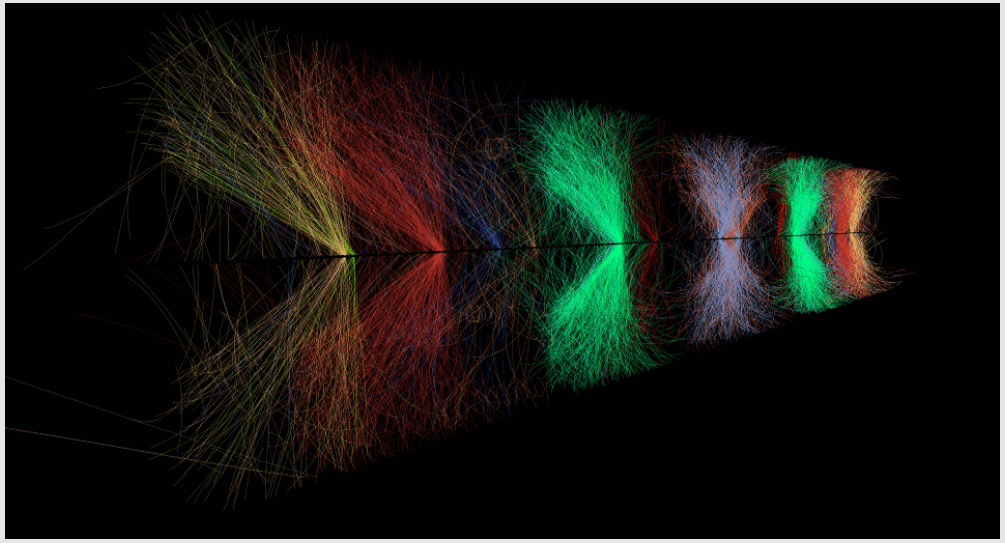
Incremental drawing

- Tracks parts appear and disappear

Visualisation – Time frames

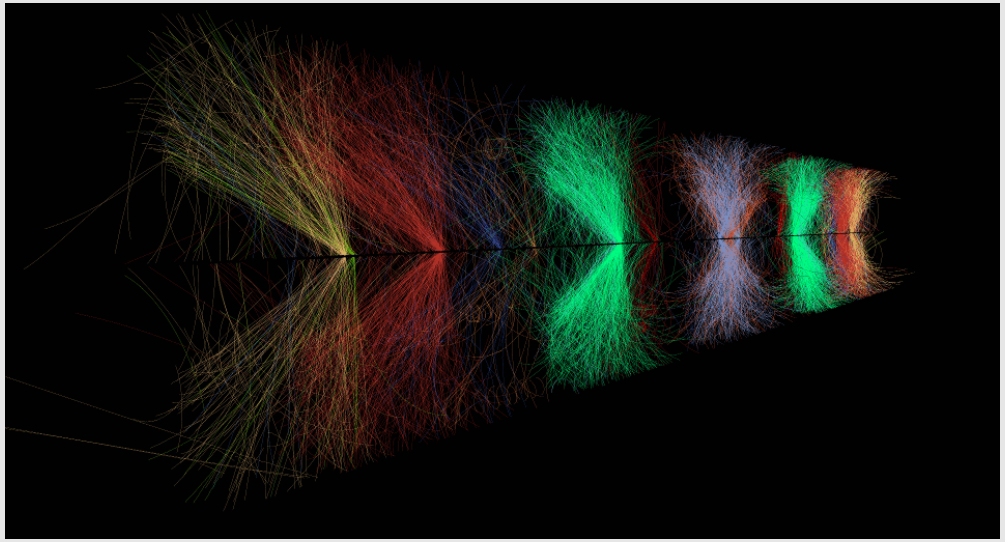
- We can show visualisation evolving by drawing several snapshots on the same visualisatiion
- This technique valid for tracks and for non-tracks visualisation



https://alice-o2.web.cern.ch/node/171

Visualisation – without a tracks

- We can abandon drawing tracks altogether
- Straightforward – live (cumulative?) statistics
- Combined – draw non-tracks information spatially (energy, particle types)
- Drawing volumes instead of the tracks



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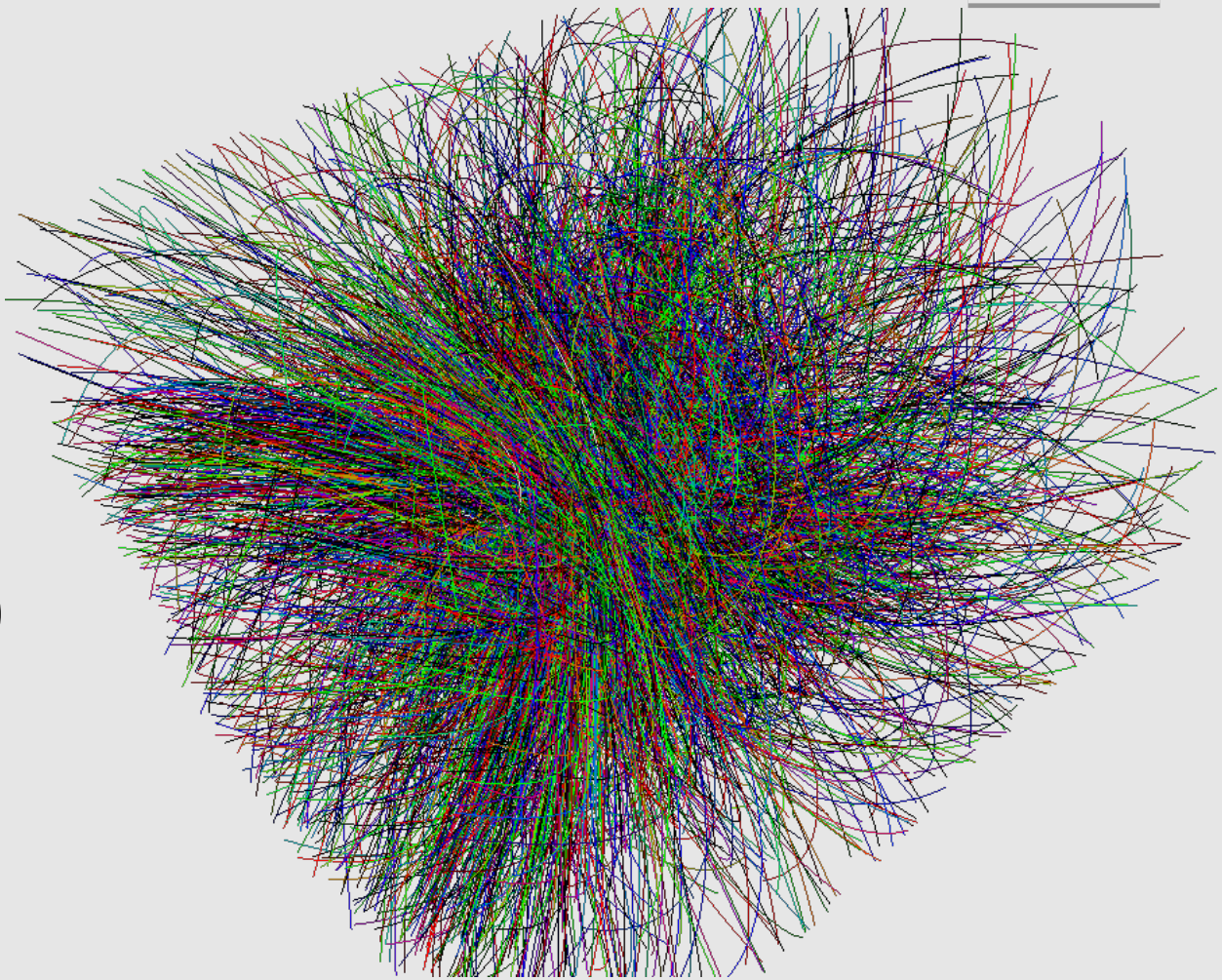
Improvements on track drawing

Track visualisation

- Improvements in track drawing still important
  - Event registered 25-11-2015 (Pb-Pb)
  - 6364 particles
  - Window size: 1280x720px
  - Measured frame rate in 10 seconds, averaged on 10 measures



Algorithms – OpenGL + Vulcan

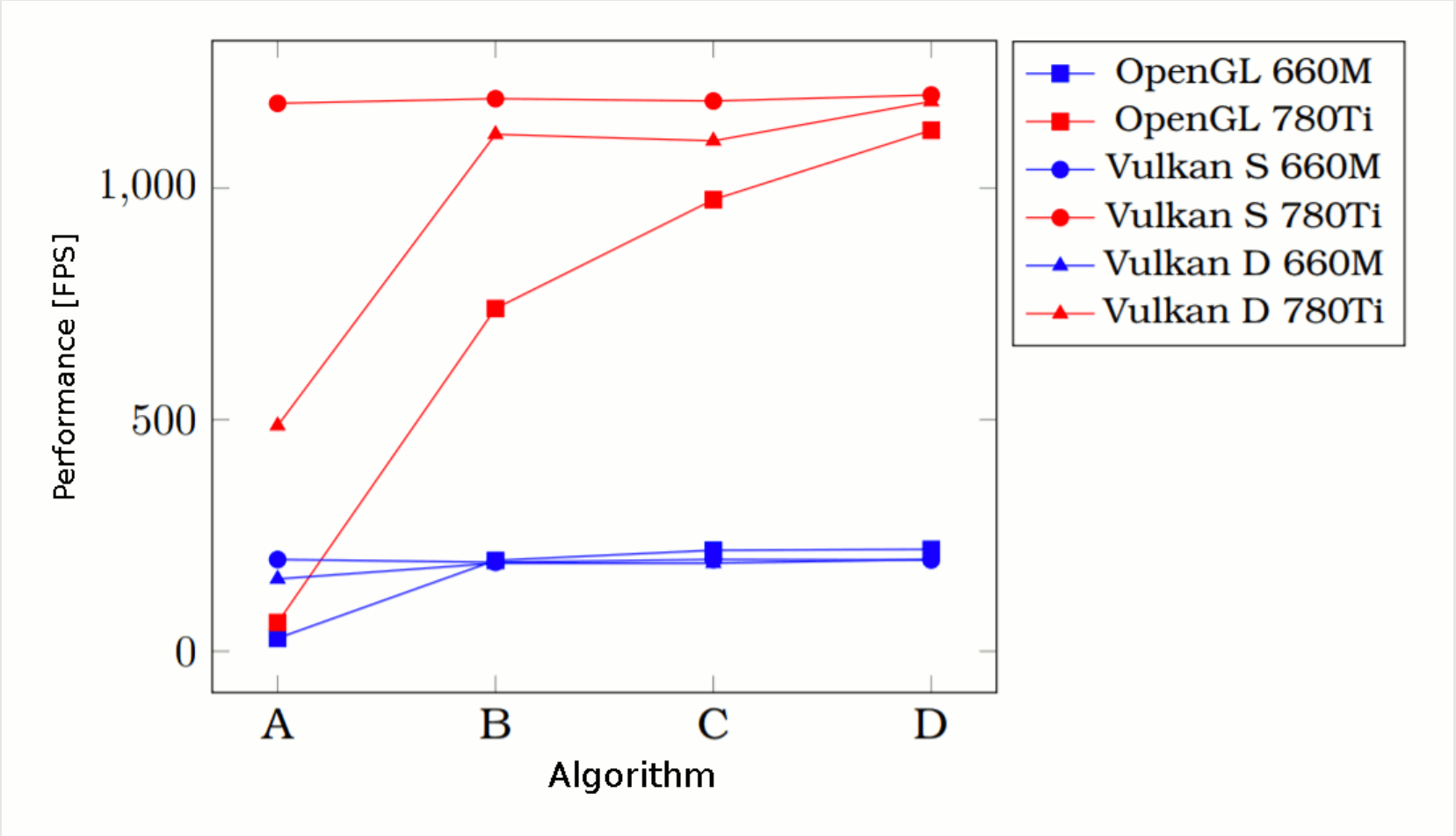
- Two technologies were compared
  - OpenGL (A 25 year old, but evolving standard, Linux,Windows, IOS)
  - Vulcan (A new Graphis API for Linux/Windows giving a much more control over the visualisation hardware)
- Four versions of drawing tracks
  - Version A (independent paths)
  - Version B (single buffer)
  - Version C (single command)
  - Version D (indirect drawing)

Support from the card vendors

Graphic Card	OpenGL 4	Vulkan	Metal
Intel (integrated)	*Ivy Bridge* (2012)	*Broadwell* (2015)*	
NVIDIA (dedicated)	*Fermi* (2010)	*Kepler* (2012)	
AMD (integrated)	*Llano* (2011)	*Graphics Core Next* (2011)	
AMD (dedykowana)	*TeraScale 2* (2009)	*Graphics Core Next* (2011)	
Apple Inc.**	iMac, Mac Pro (2010)		iMac, Mac Pro (2015)

* For Linuxt here are open-source driver supporting *Ivy Bridge* (2012)
** Apple warns that it will discontinue support for OpenGL, but will support OpenGL ES for some time

Track drawing performance results



Summary

- Drawing tracks (summary) in not enough any longer
- Adding information about changes in time is a new factor
- Not only tracks may be visualized
- There still no alternative for OpenGL