

# Pulse shape and snippets

Yoann Kermaïdic

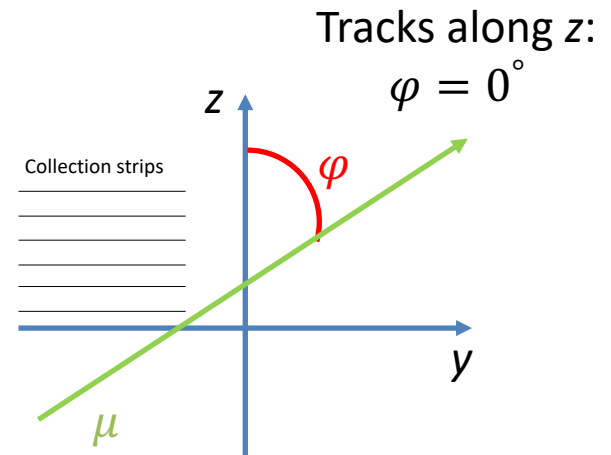
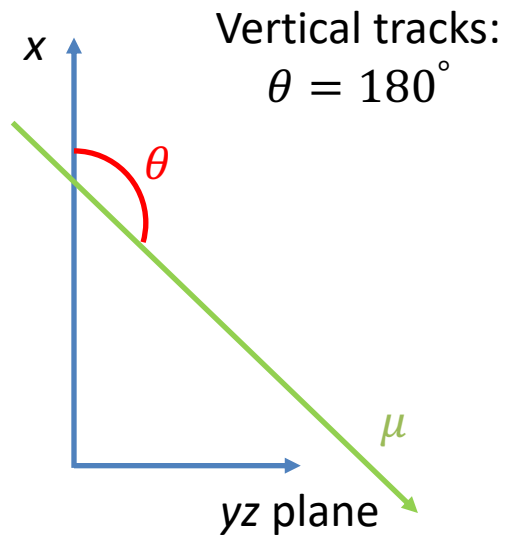
DUNE-France analysis workshop

April 19<sup>th</sup>, 2023

# Angles definition

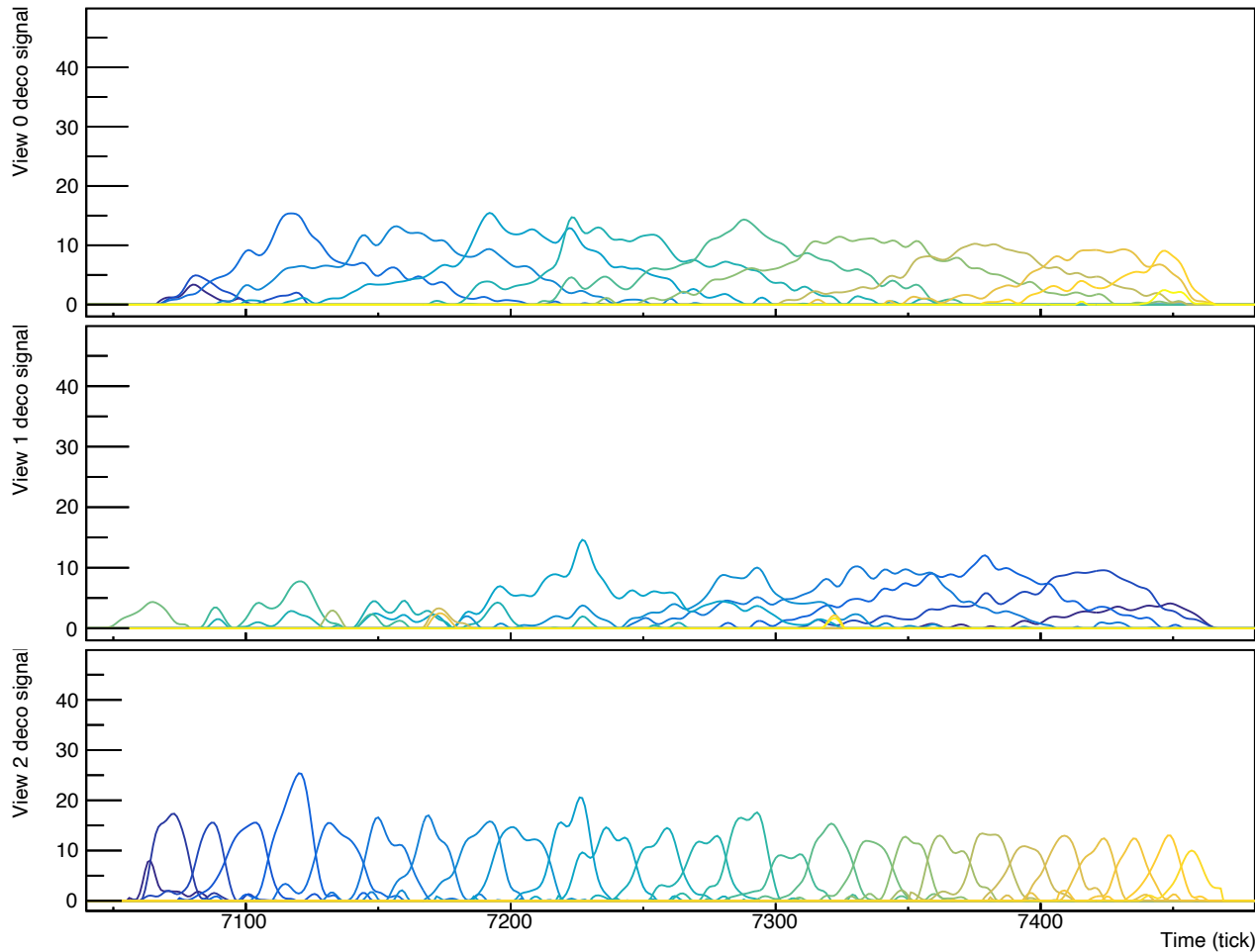
- Theta:

- Phi:



- The beam is along the z-axis
- The  $e^-$  drift is along the x-axis

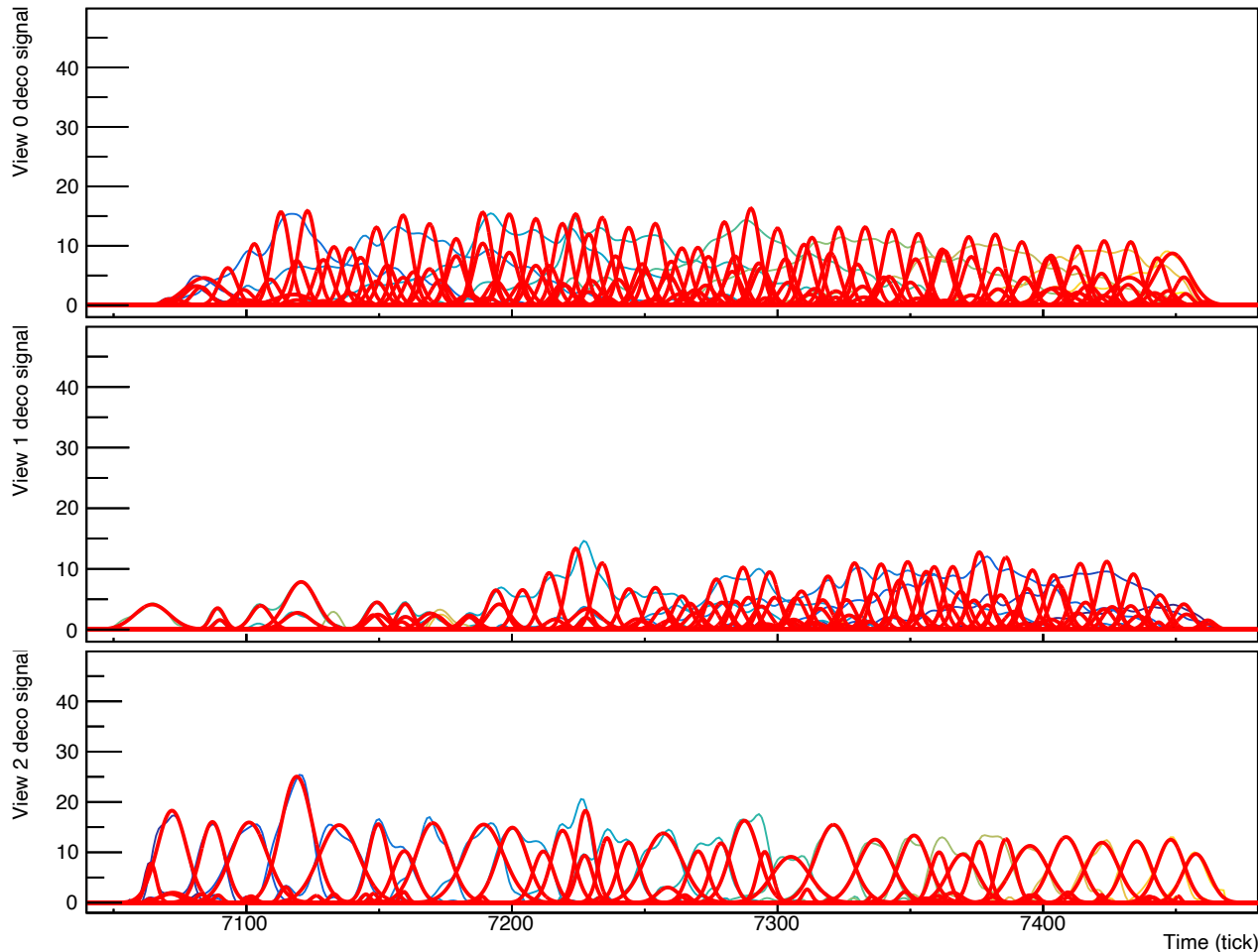
# Perpendicular pulse 3 deg.



Signals associated to tracks

Each color shows a different channel

# Perpendicular pulse 3 deg.



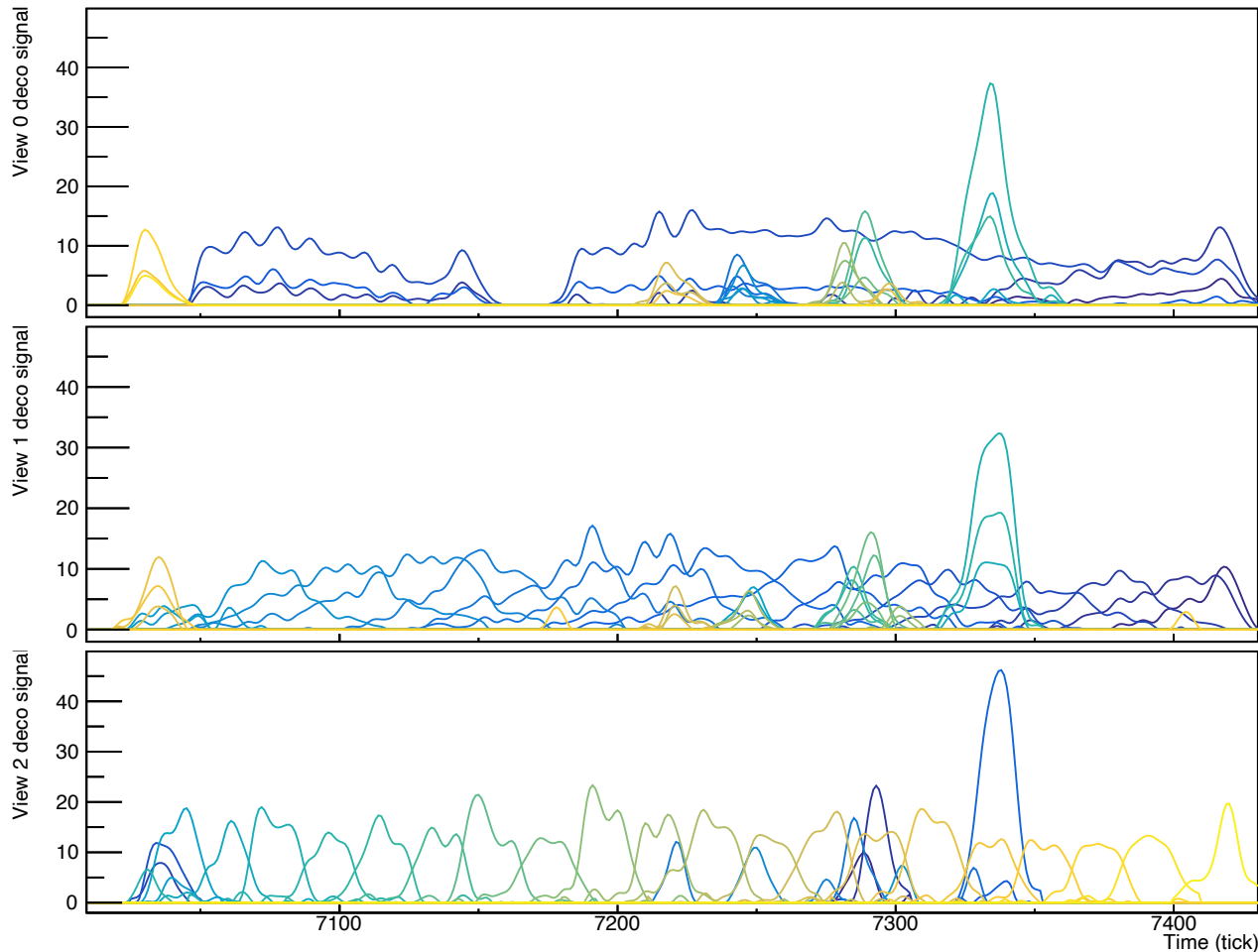
Signals associated to tracks

Each color shows a different channel

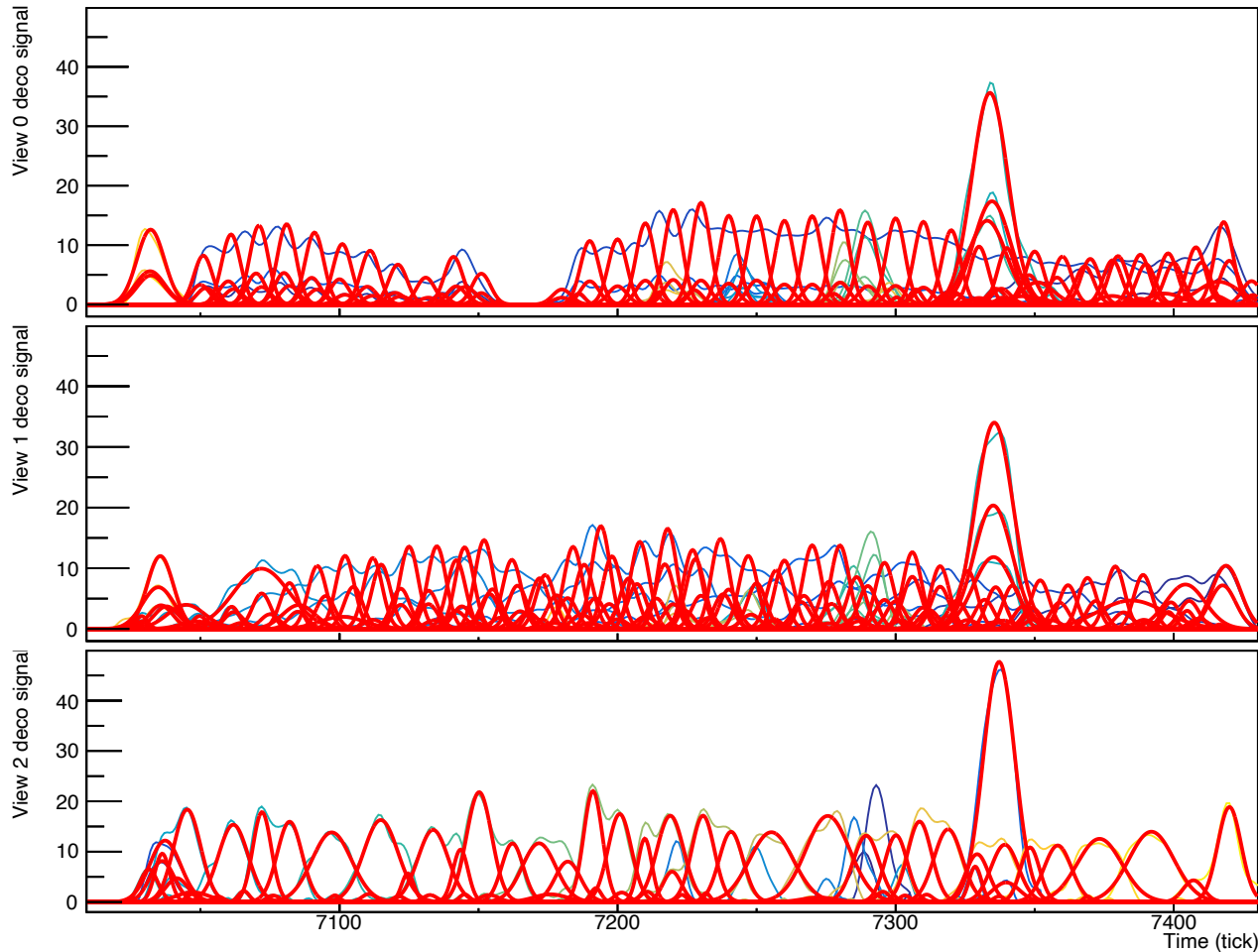
Red lines depict the reconstructed hit (from 'gaushit')



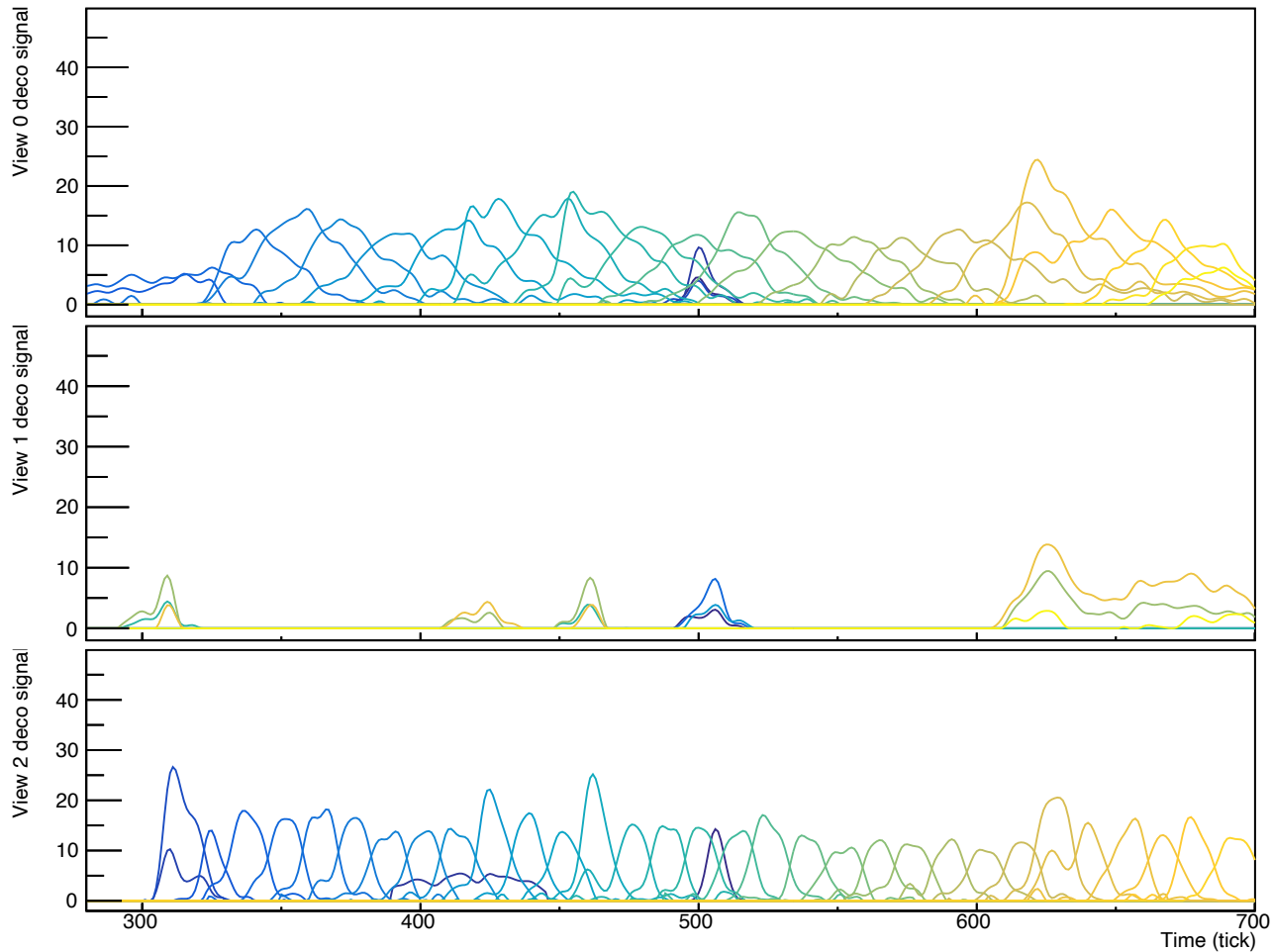
# Along view 0 pulse –30 deg.



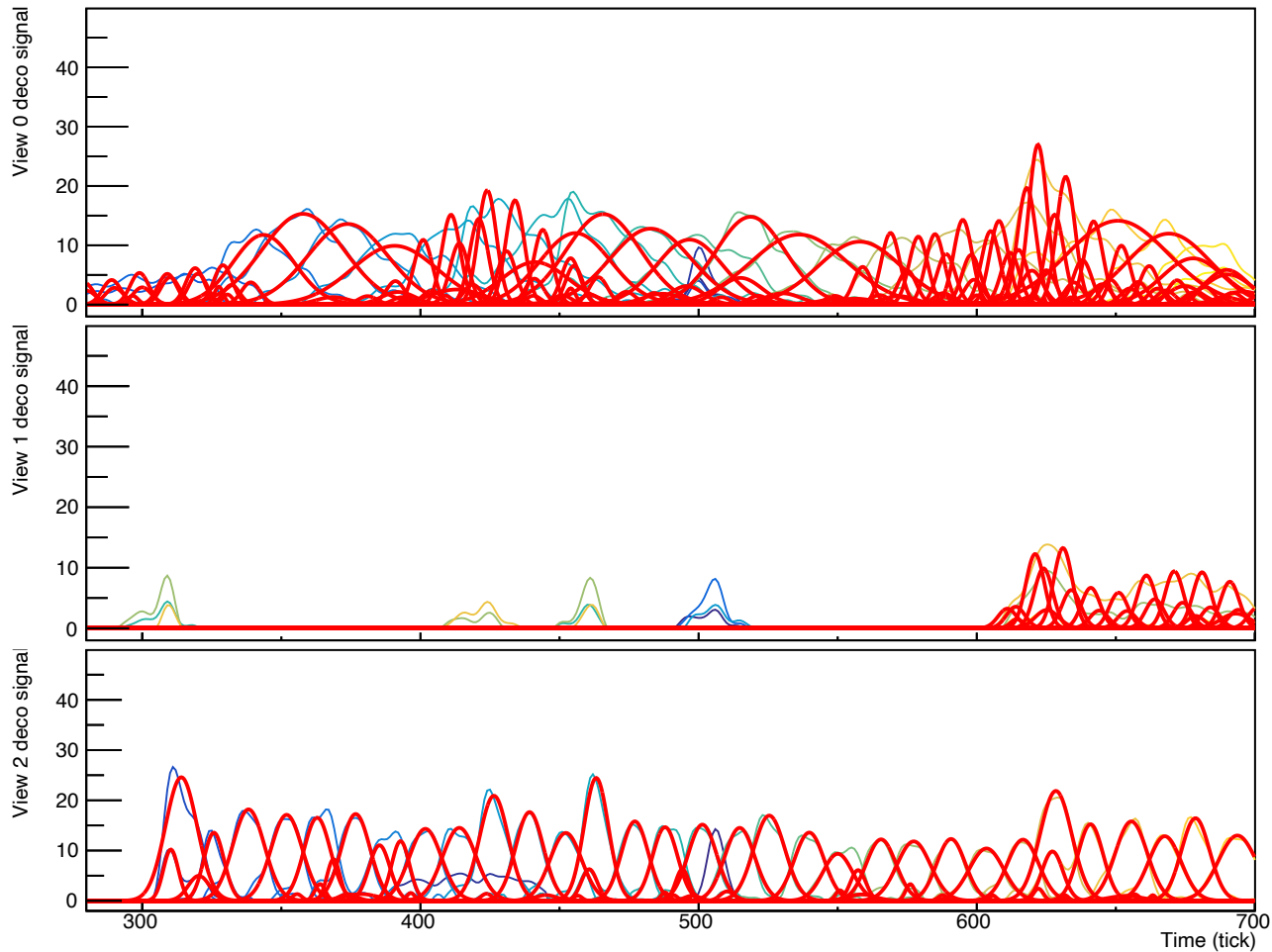
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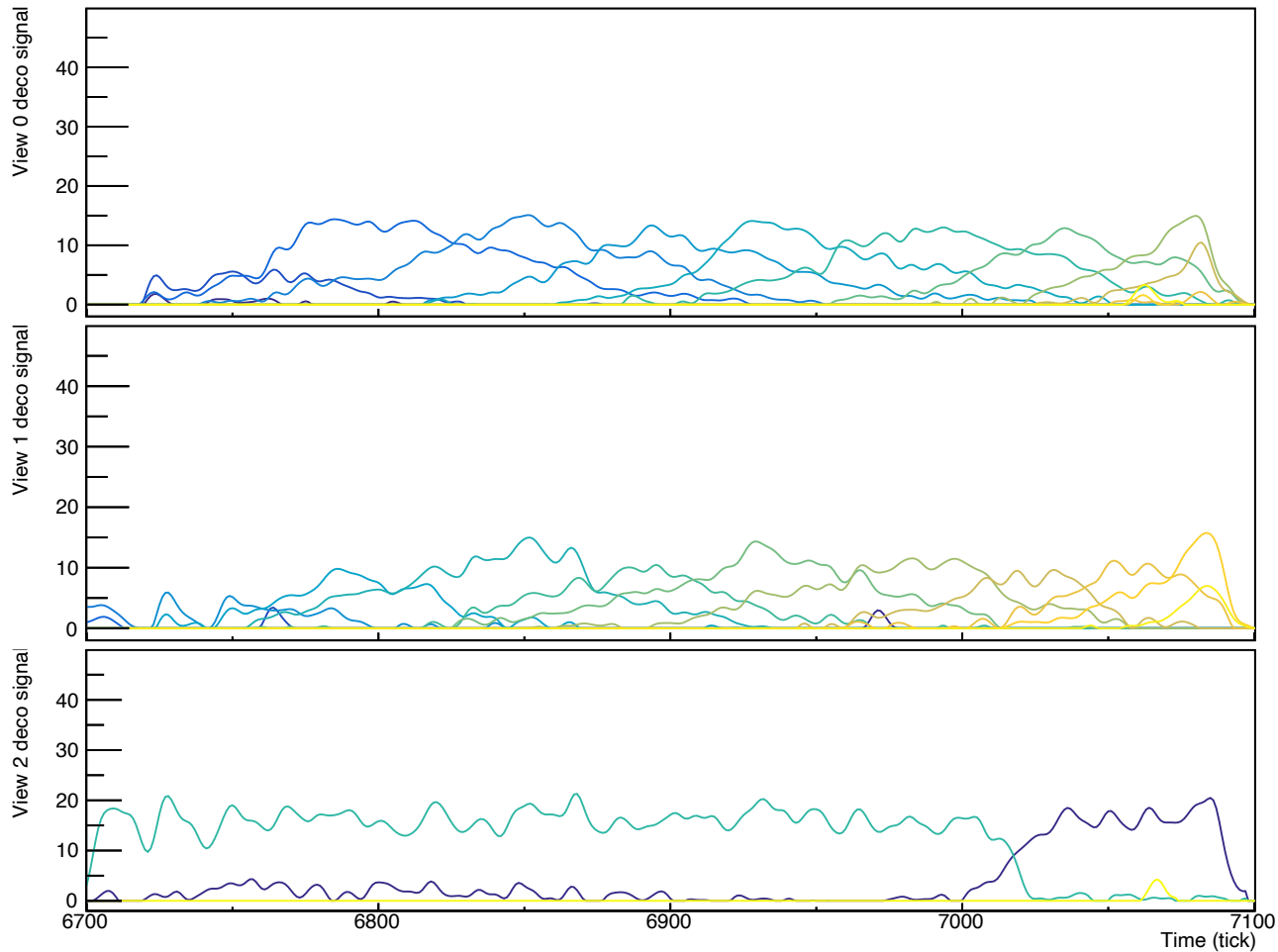
# Along view 1 pulse 30 deg.



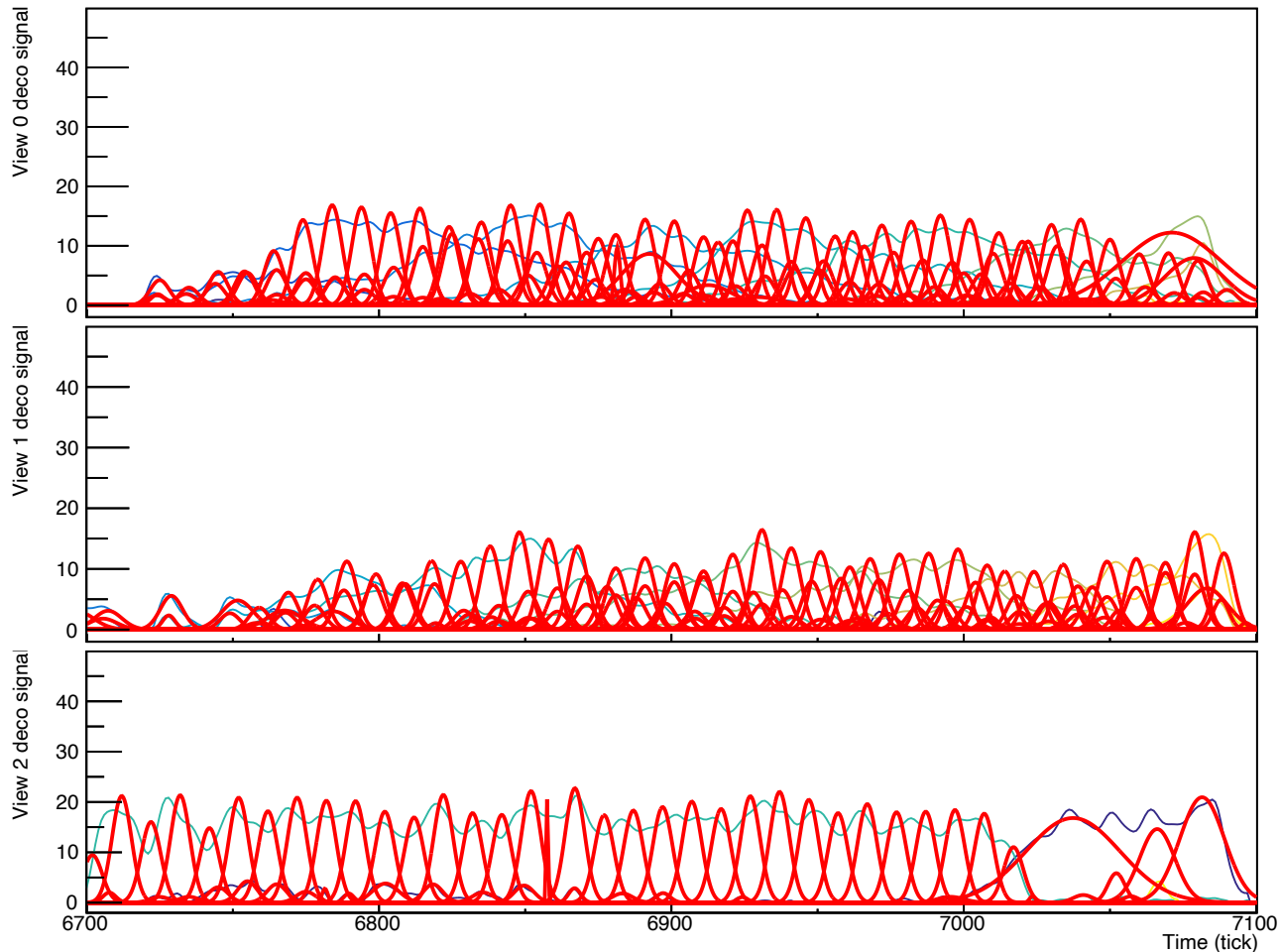
# Along view 1 pulse 30 deg.



# Along view 2 pulse 90 deg.



# Along view 2 pulse 90 deg.



# How to estimate the charge?

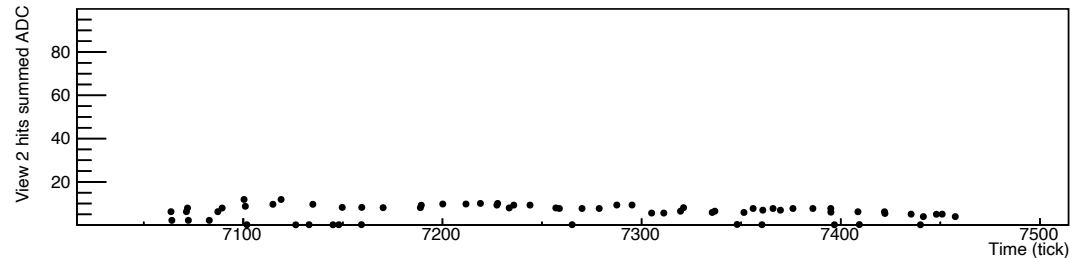
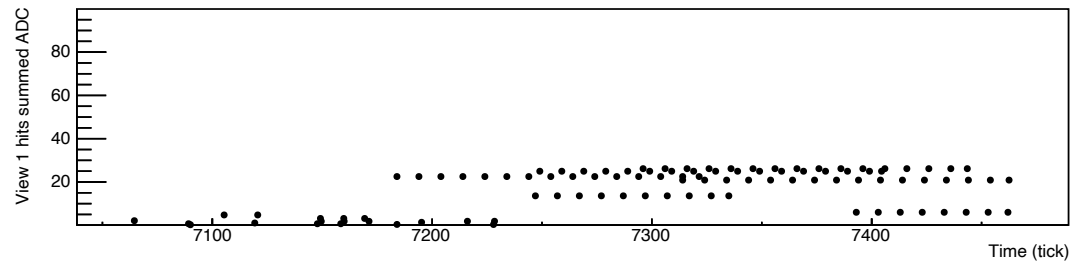
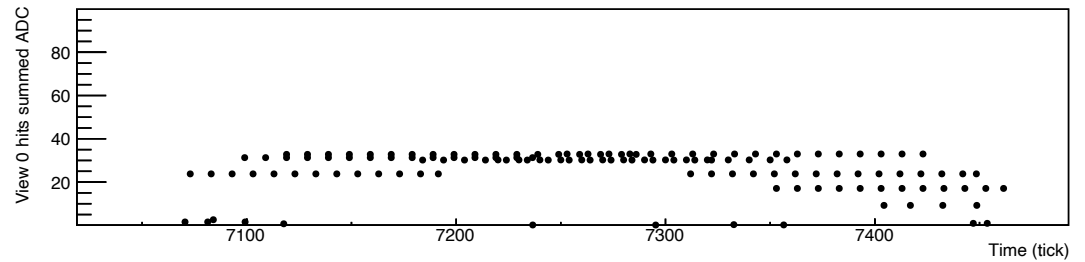
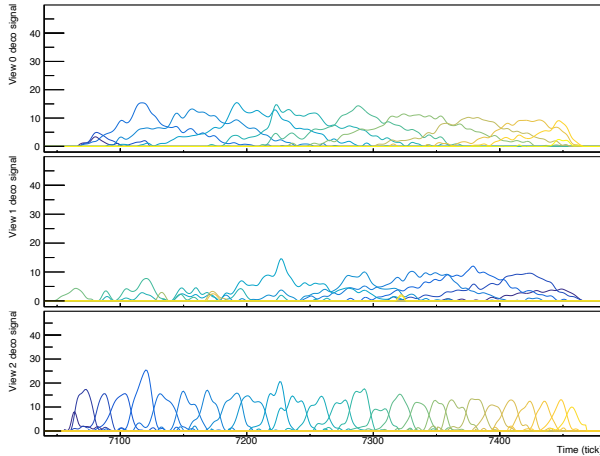
- **Hit->Integral()**

- Sum of the integral of perfect gaussians
- Obviously not ideal for vertical tracks
- May have benefits for noise filtering in « horizontal » tracks

- **Hit->SummedADC()**

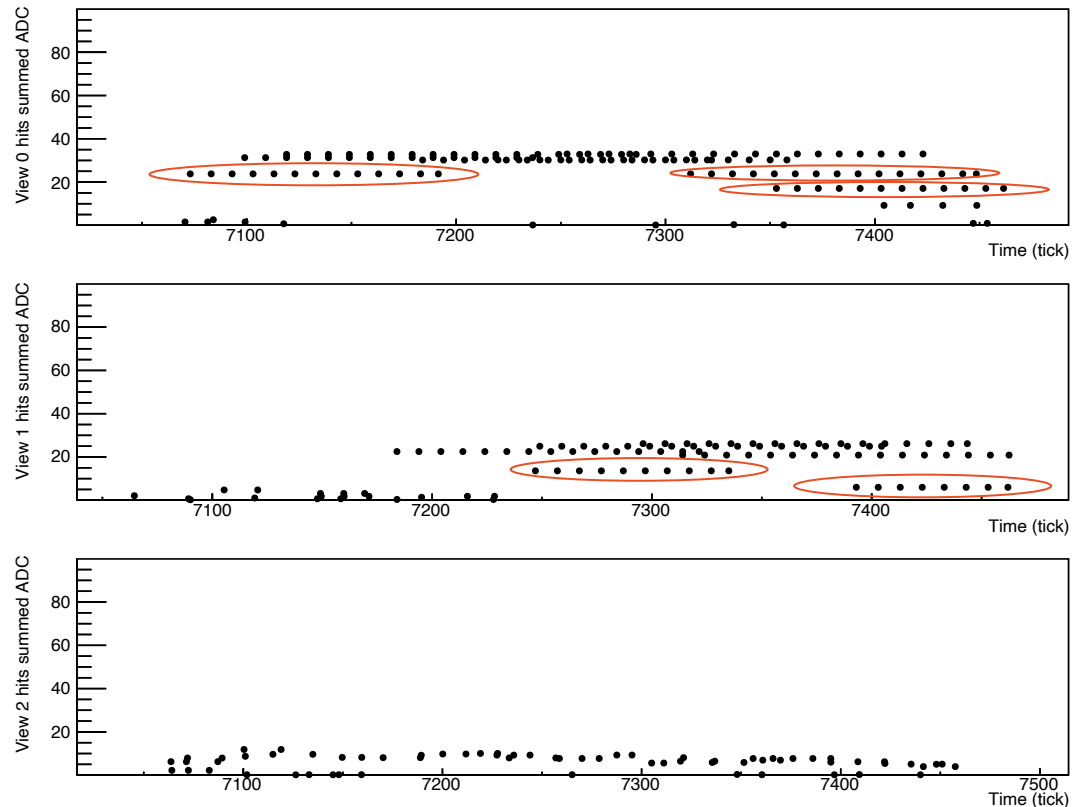
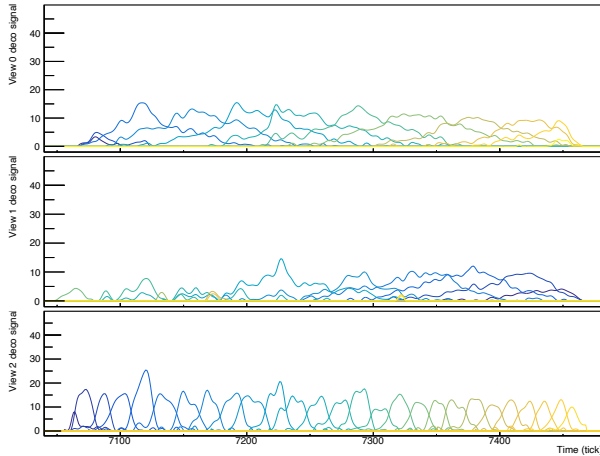
- Sum of signal from start to end hit tick
- More accurate (no assumption on charge deposit profile)
- More sensitive to noise hence why hit integral is used by default?

# Perpendicular pulse 3 deg.



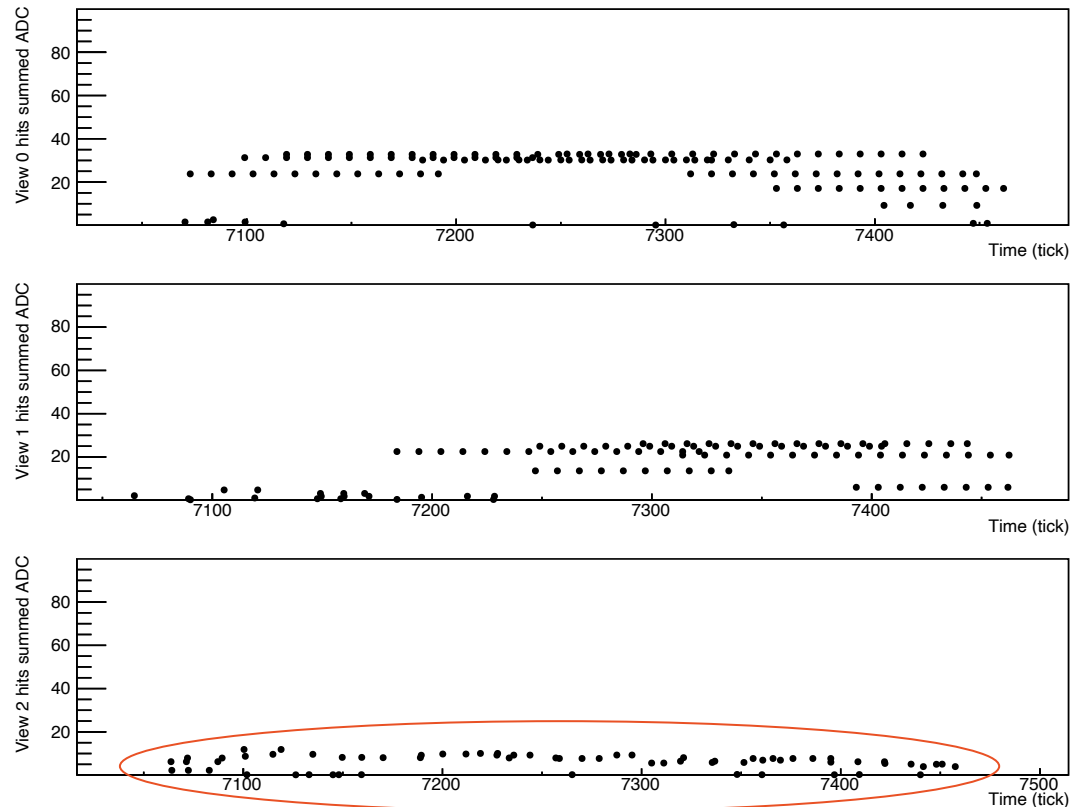
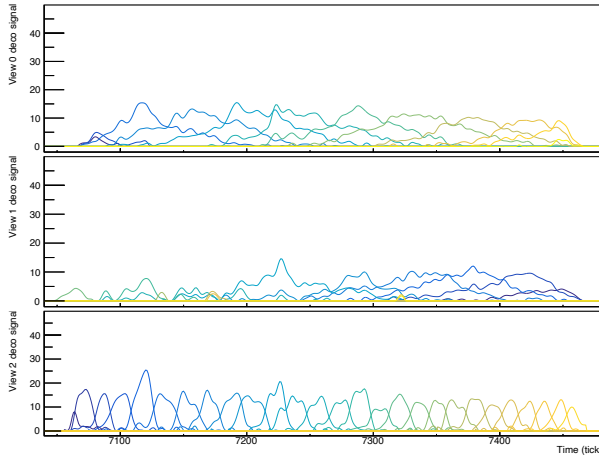


# Perpendicular pulse 3 deg.



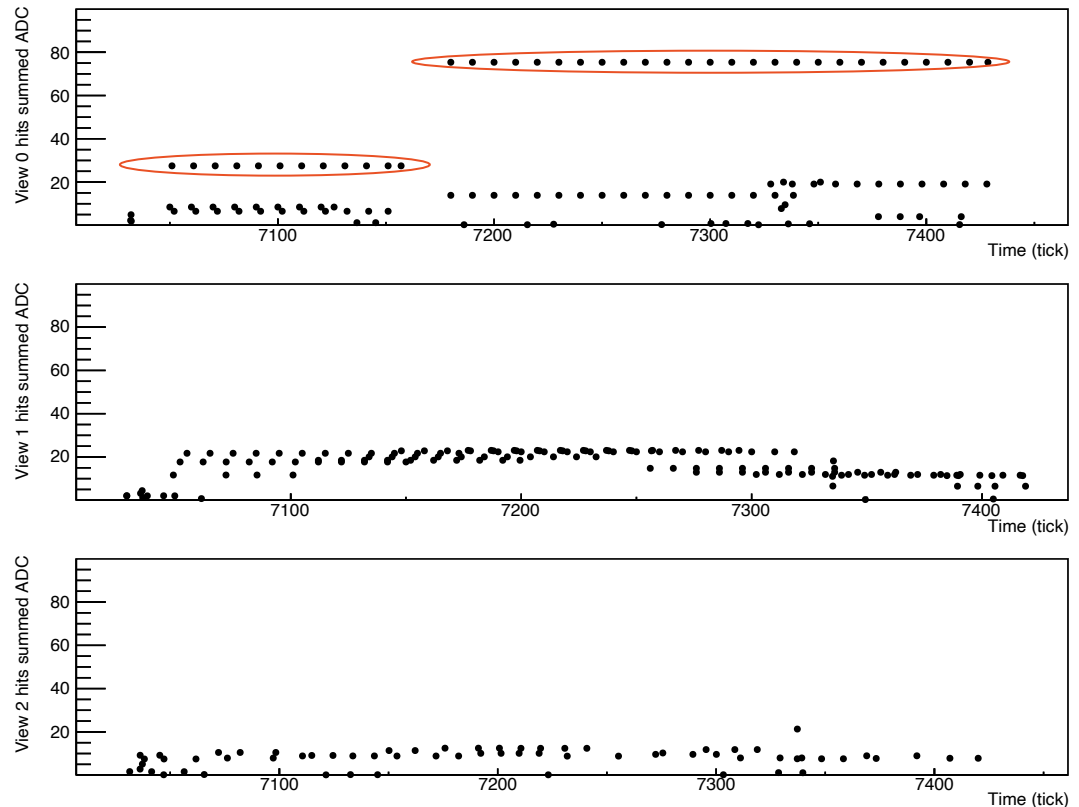
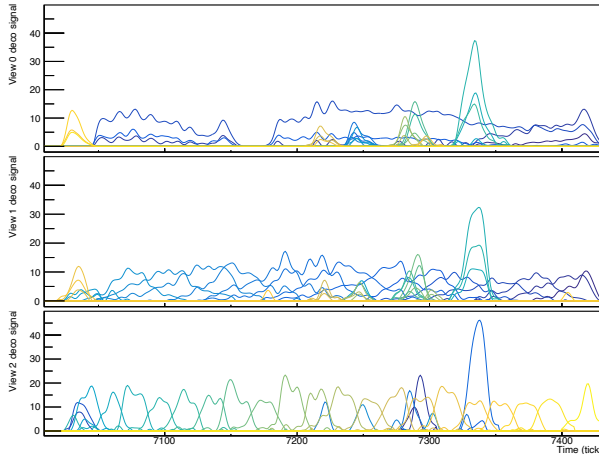
- Extended induction view pulses lead to snippets
- The *SummedADC* is identical for a bunch of hits

# Perpendicular pulse 3 deg.



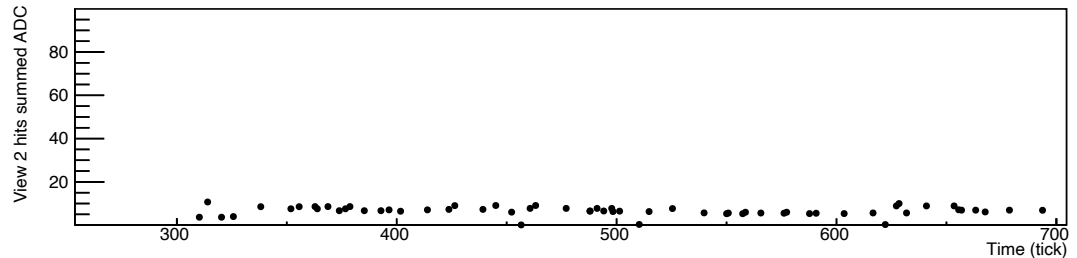
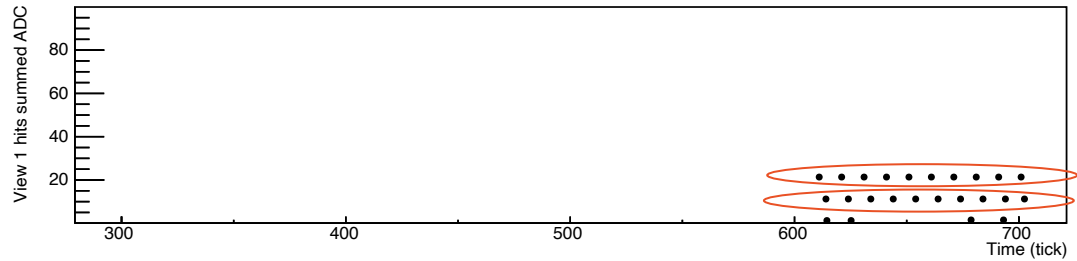
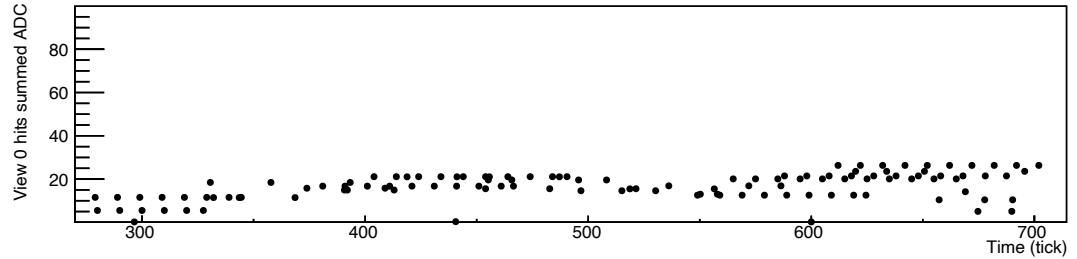
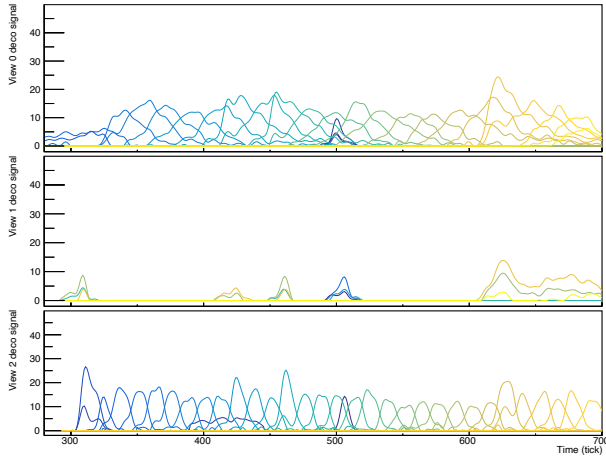
- Extended induction view pulses lead to snippets
- The *SummedADC* is identical for a bunch of hits
- About no snippet in the collection view in this particular event

# Along view 0 pulse –30 deg.



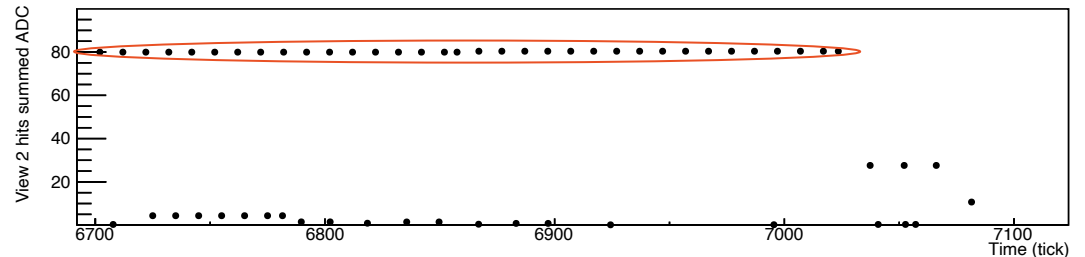
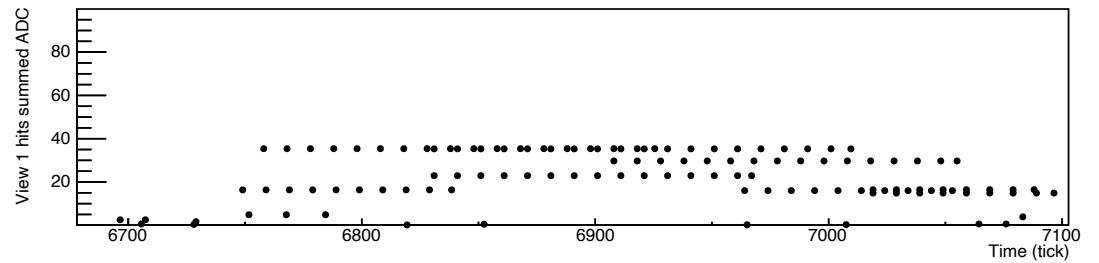
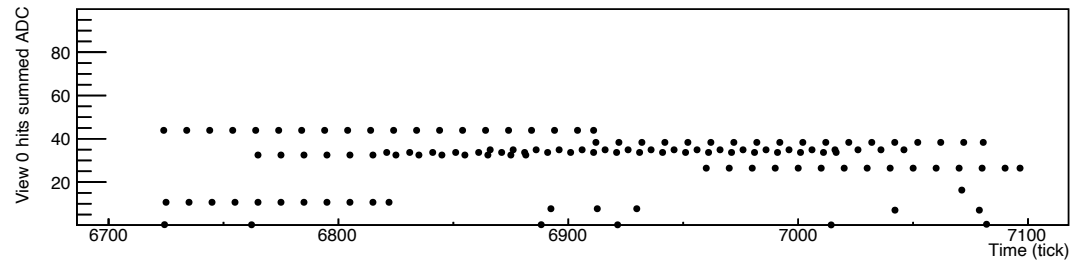
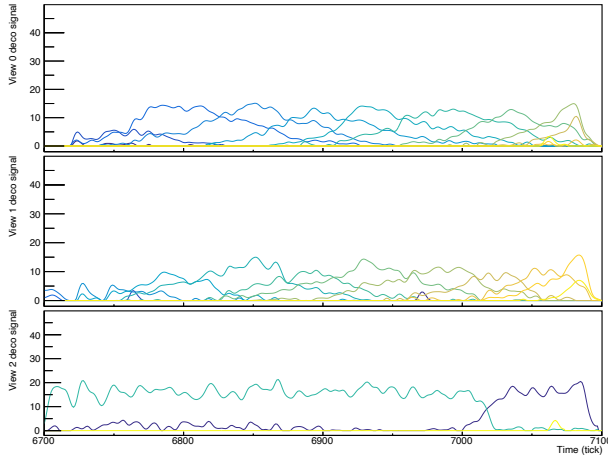
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# Along view 1 pulse 30 deg.



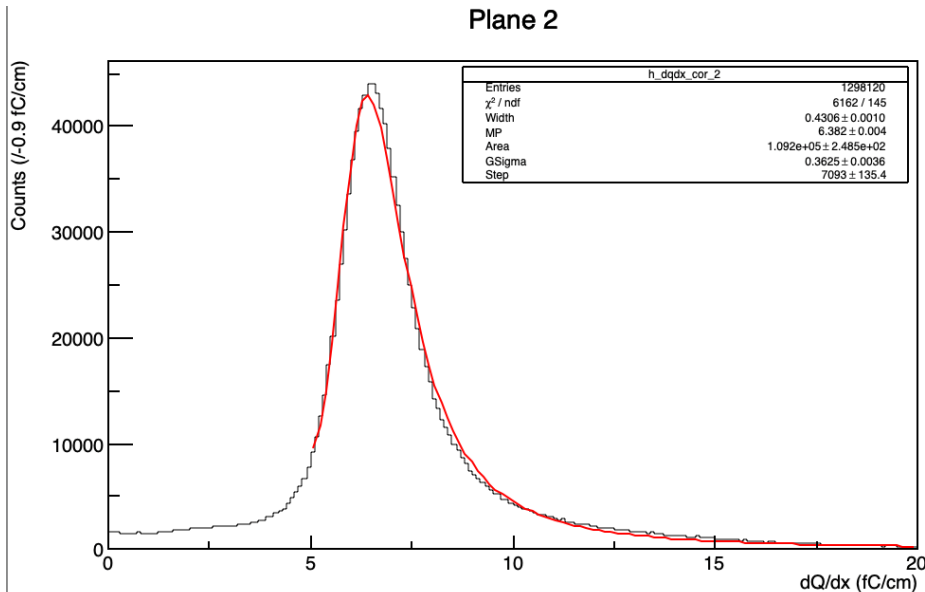
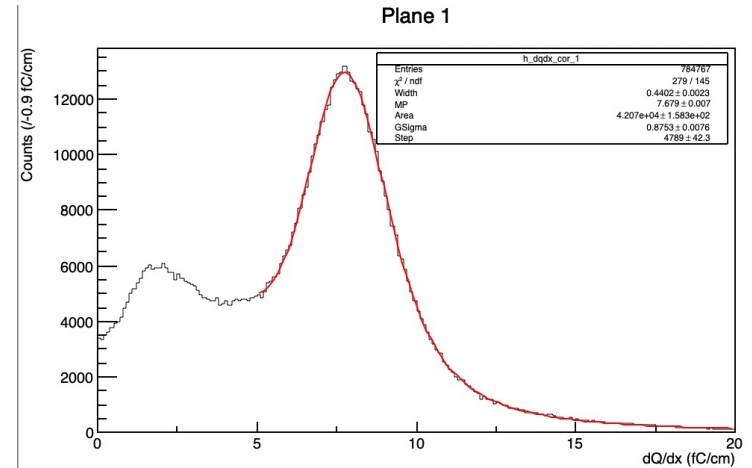
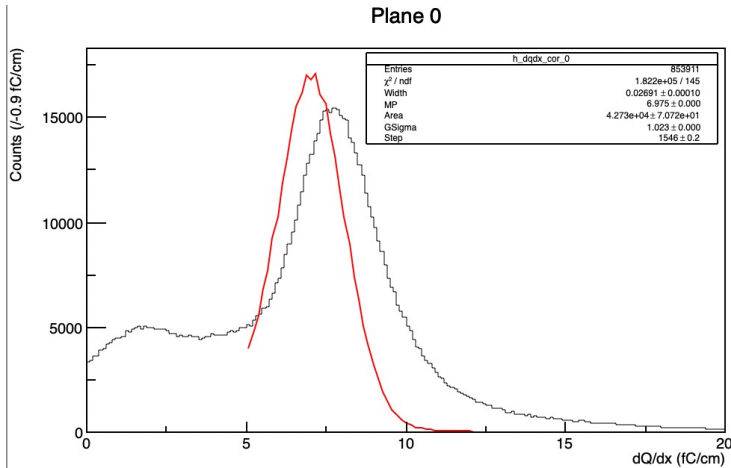
- Extended induction view pulses lead to snippets
- The *SummedADC* is identical for a bunch of hits
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# Along view 2 pulse 90 deg.



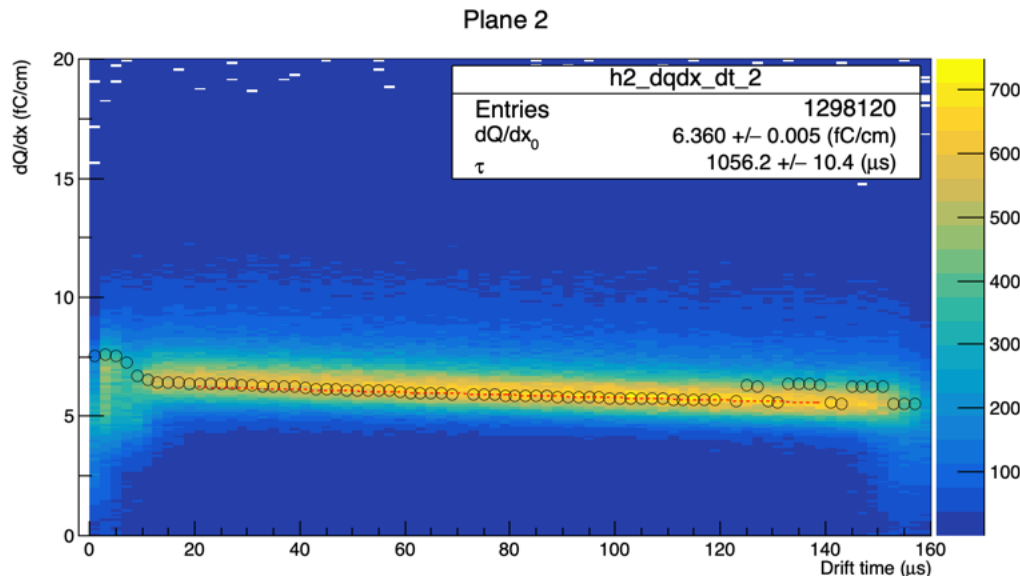
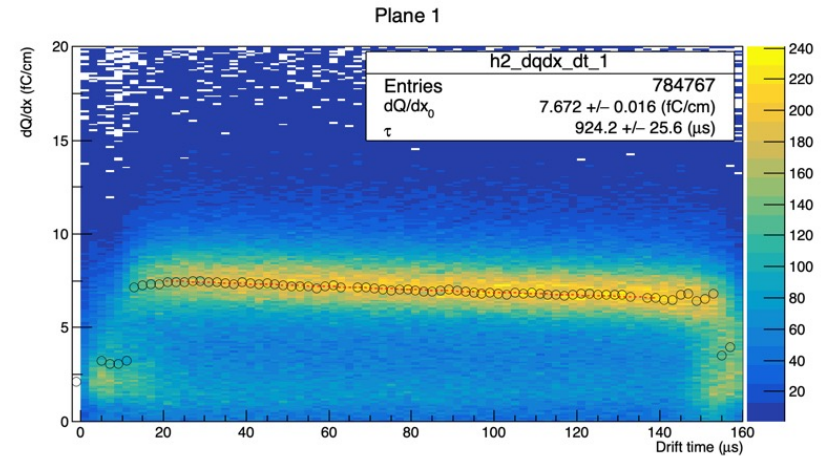
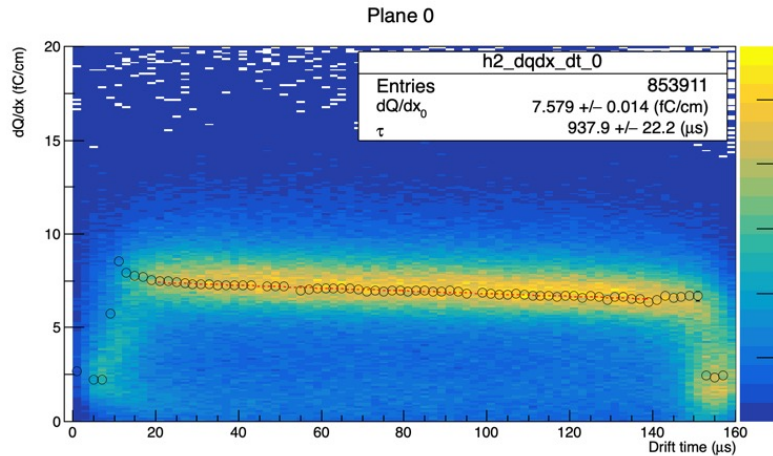
- Track along the collection view lead to almost a single snippet
- What happens in the ind. views depends on theta angle

# dQ/dx distributions



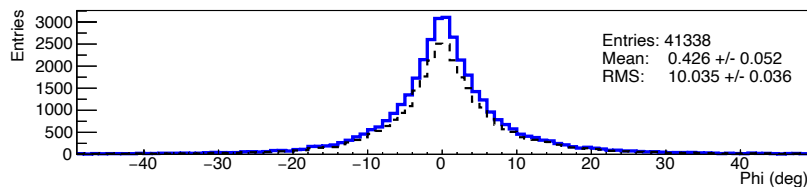
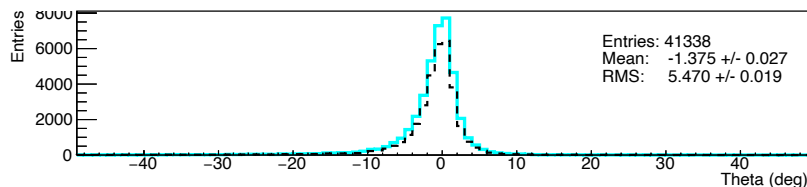
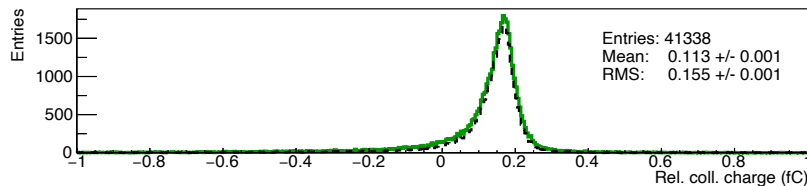
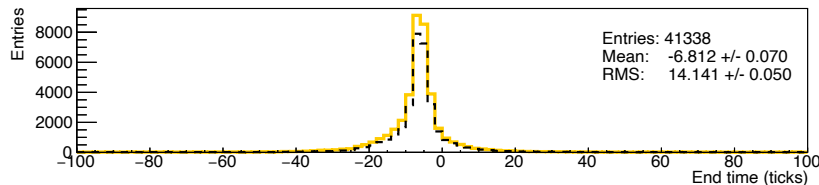
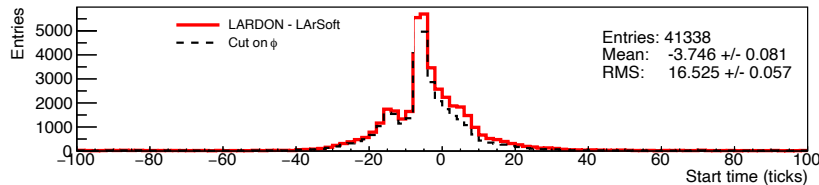
- Using the *SummedADC*, one gets reasonable distribution, « fittable » with a (gaussian x landau)
- No peak a low dQ/dx peak as seen with the « standard calo » that uses the hit integral
- Quite good induction view charge loss resolution wrt HD design (shield)

# dQ/dx versus drift time



- Most sensitive e- lifetime is through dQ/dx vs drift time fit
- Latest CB run 1727 shows an unexpected discrepancy between coll. and ind. view -> pulse shape simulation (WireCell field response) under study

# Benchmark with LARDON



- What we should aim at to make sure we understand our reconstruction

## Example for CRP3 dataset (run 1727)

- Tracks geometrical parameters typically agree well
- Integrated charge bias of 11%
  - Call for more checks on WireCell
  - Needs for simulation =)



# Moving forward

- Lots of high level analysis modules found at

<https://github.com/DUNE/protoduneana/tree/develop/protoduneana/singlephase>