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RCE Channel Map

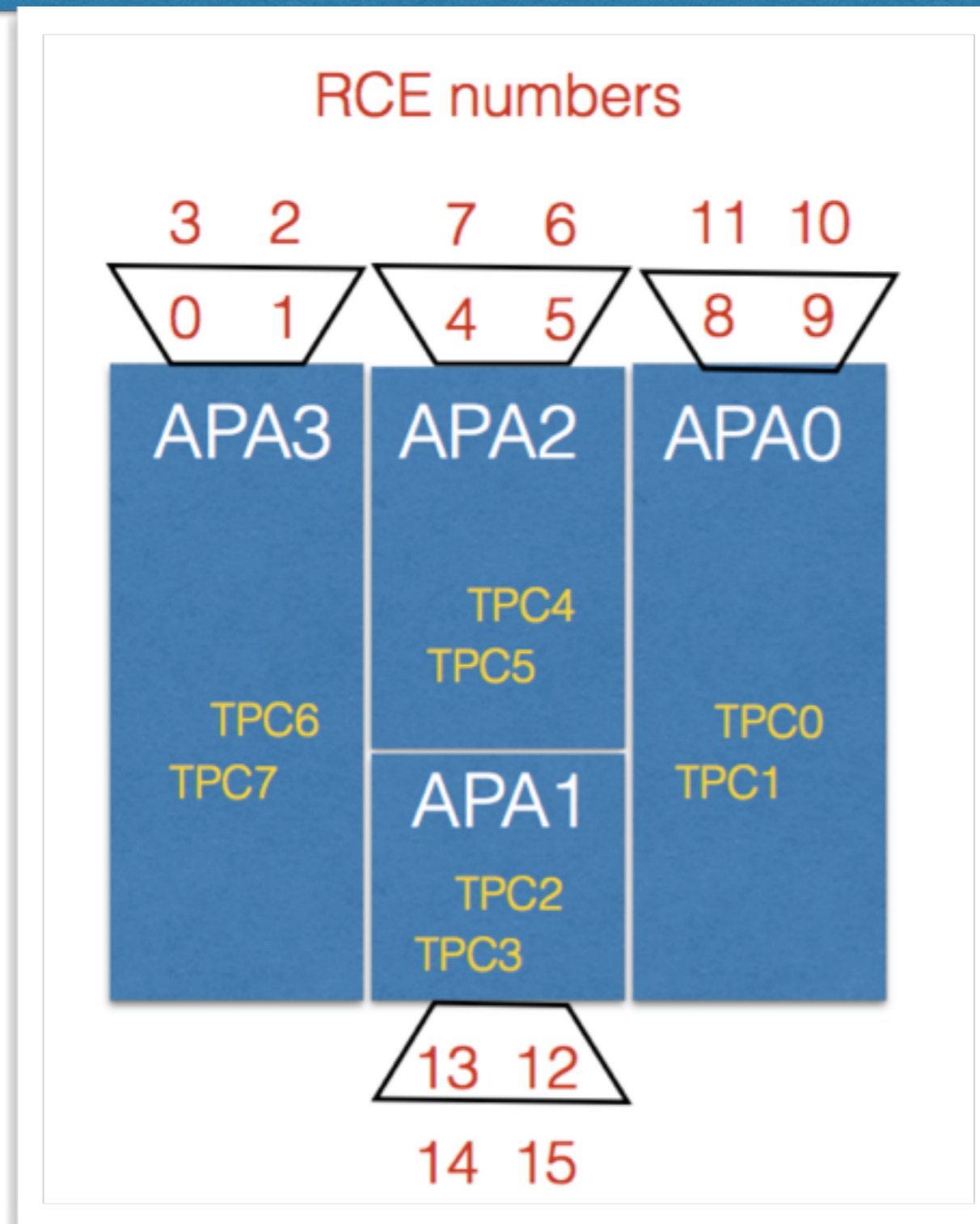
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The Need for a Channel Map

- The channels read out by the DAQ are numbered by RCE and connector.
- Offline, the channels are numbered within LArSoft using its own convention.
- These will not be the same!
- Need a map to take the online channels and convert to the channels which are used in LArSoft.
 - Essential before any meaningful (physics) look at the data can take place.
 - Crucial to all offline work, including analyses etc.

How Does It Work 'Online'?

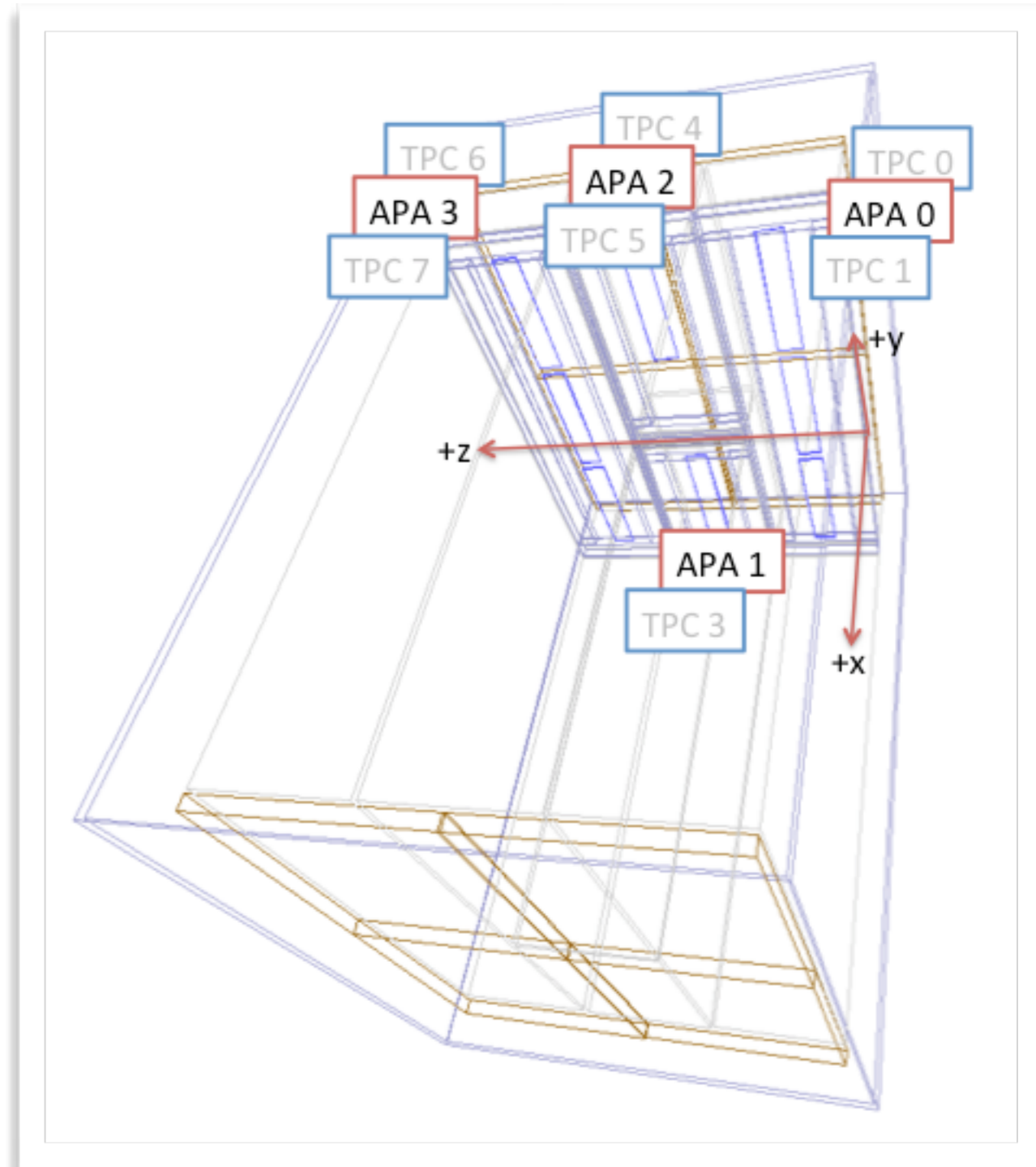
- Each RCE reads out 128 channels.
- There are 16 RCEs (4 per APA).
- The setup is identical for each APA, and for all the wires connected to each RCE.
- Each online channel is therefore uniquely defined by an RCE number and a connector on that RCE.



Tingjun Yang

How Does It Work 'Offline'?

- The LArSoft geometry numbers channels from APA0 --> APA3 (backwards to the online convention).
- The ordering is sequential across an APA face (not the case online due to the random positioning of the electronics).



Tyler Alion

Mapping Between The Two

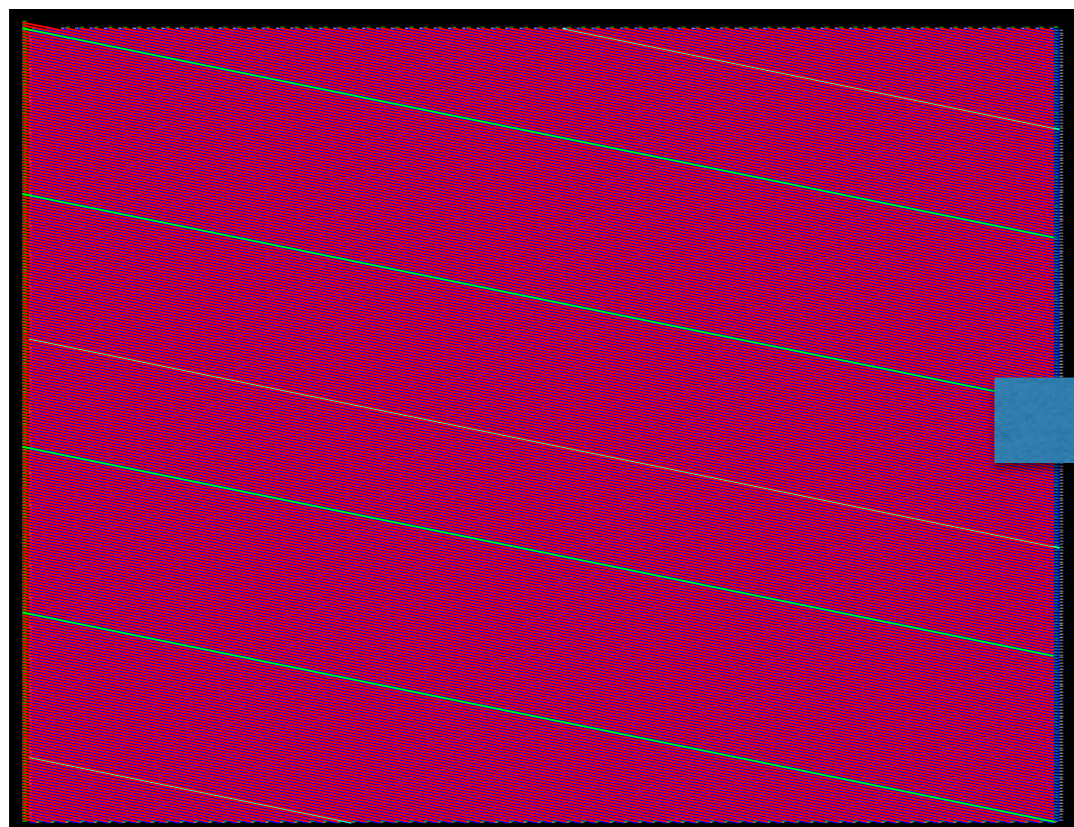
- Have three resources:
 - The LArSoft geometry.
 - Dan Wahl's 'online' wire maps. Maps between the physical positioning of each channel segment in the detector and the RCE connection for that channel.
 - See lbne-docDB 10145.
 - Brian Kirkby's RCE connector map (same for all RCEs). Maps the connection on an RCE to the DAQ channel associated with it.
 - See lbne-docDB 11184.

Issues

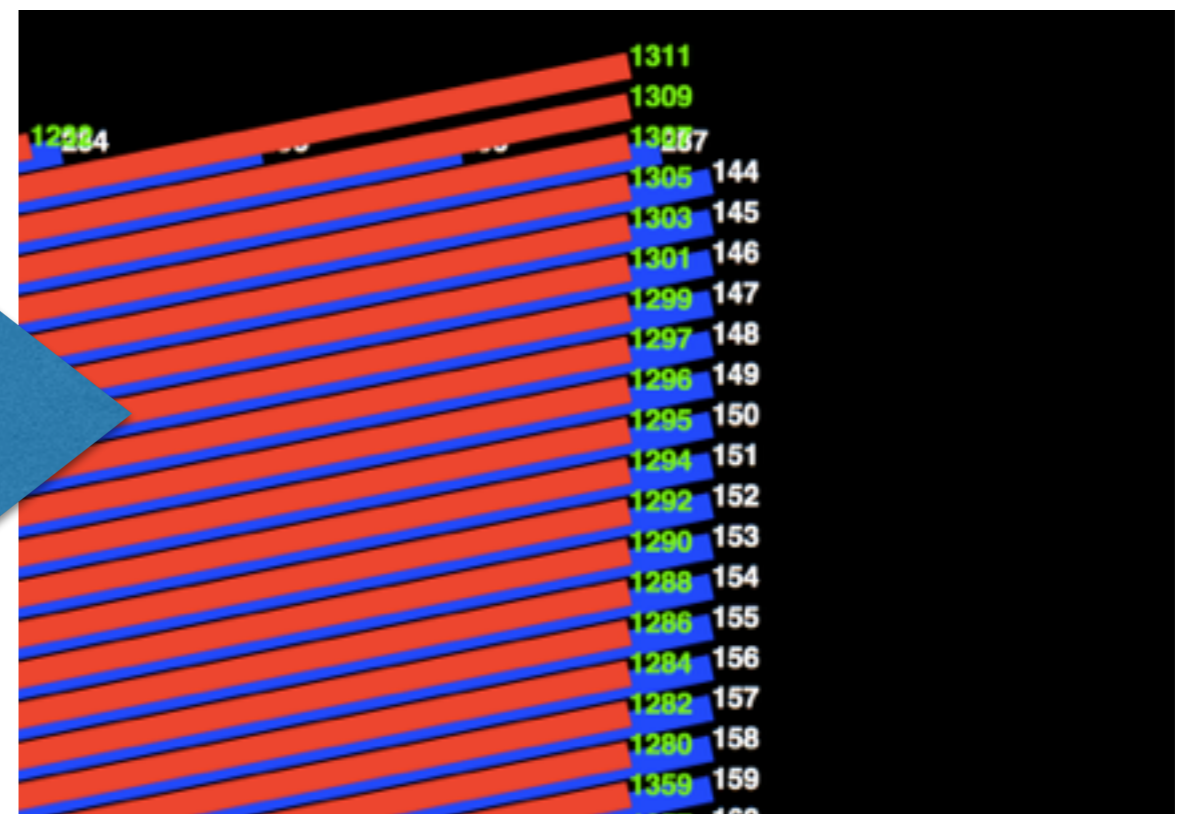
- Use slightly different coordinate systems. Out by ~8cm in the drift direction.
- The online coordinates are not corrected for cold (whereas they obviously are in LArSoft).
- Seems to be an issue with channel ordering for collection wires on the long drift volume in Dan's maps -- order is reversed.
 - Huge thanks to Alan for noticing and spending the time understanding this!
- All these are corrected for.

Mapping Method

- Use the position of each wire segment in the detector coordinate system as the link between the online and offline.
- $\text{OnlineChannel} = (\text{RCENumber} * 128) + \text{RCEChannel}$.
OfflineChannel -- defined in LArSoft.



Confirmation of wire positionings.
Three channels highlighted.



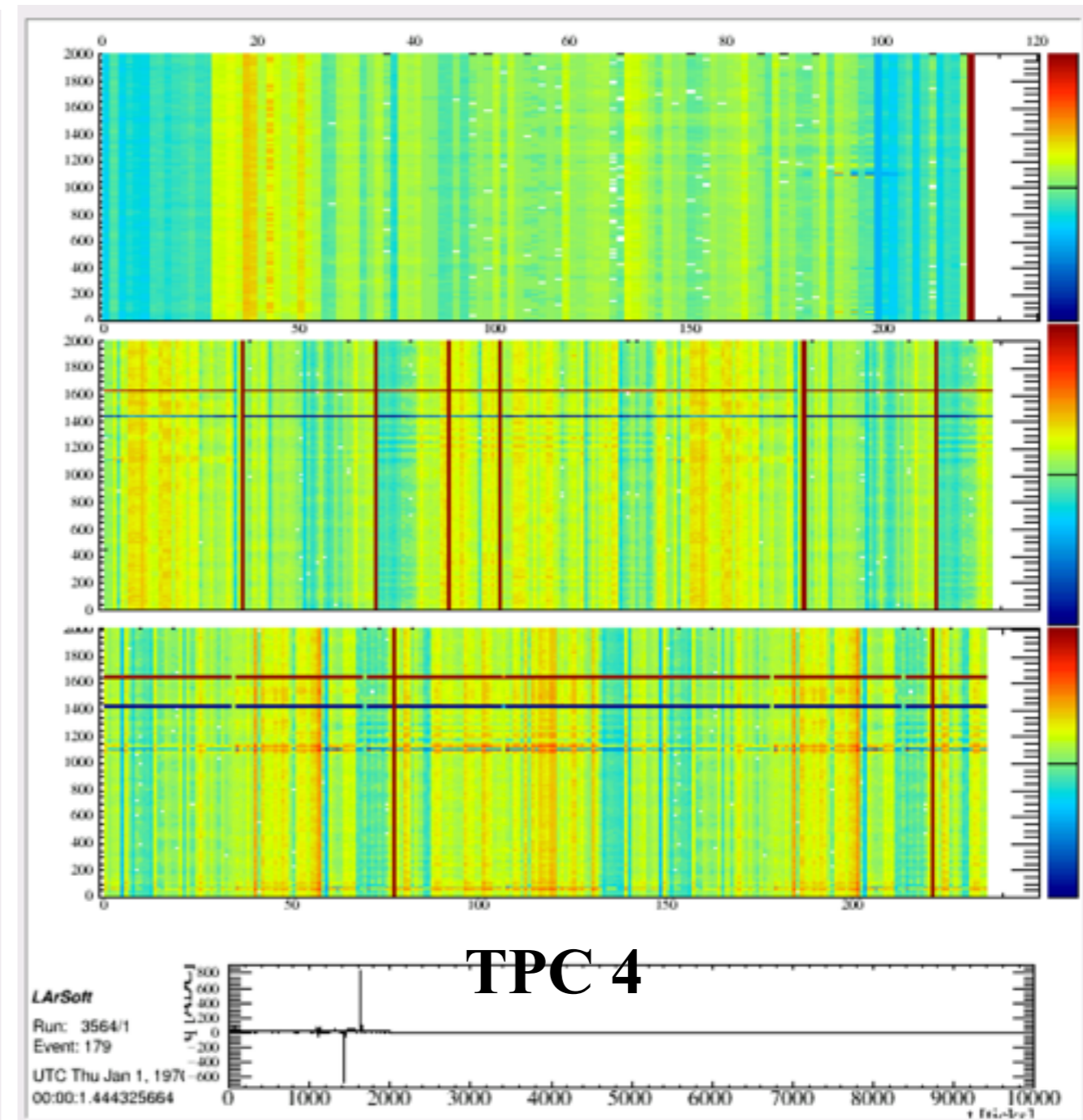
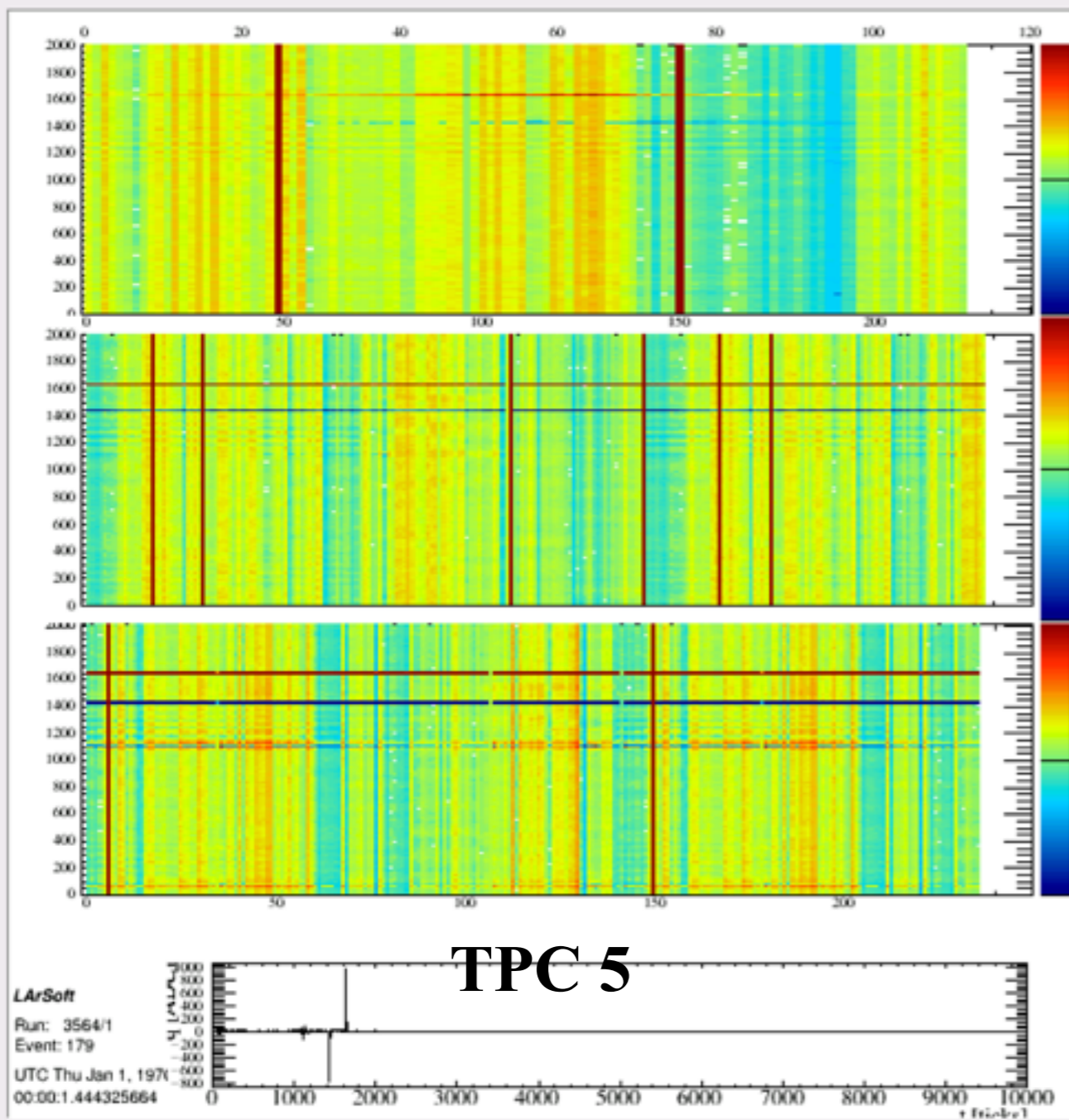
Zoomed in on the edge. Each wire with its associated channel.

Output

- Produce a channel map from this!
- See https://cdcvcs.fnal.gov/redmine/projects/35ton/wiki/Channel_map for details and to download the maps.
- Different maps:
 - channelMap_vX.txt: basic look-up; two columns for online channel to offline channel. [Up to v2 as of yesterday.]
 - detailedMap.txt: bit more information; APA, RCE, RCE channel etc.
 - offlineChannelToRCEConnectorMap.txt: not on wiki but can be if necessary.

Testing the Map

- Been using Mark's tickler data to test the map (see if things make sense).



Implementation in LArSoft

- I have implemented this in LArSoft in an analogous way to how Alex treated the SSP channel map.
- The converter algorithm (`tpcFragmentsToRawDigits.cc` in this case) has a method `BuildChannelMap`.
- The function takes a map as an argument to the algorithm call.
- Anything that uses the converter algorithm can make the map first and then pass it to the method.
- Currently on my branch `feature/wallbank_RCEChannelMap`
 - Can merge at some point
 - Has anything similar to this already been implemented somewhere? Mark?

What If Things Change?!

- This won't happen! (Or else...). But if it does, I have built contingency into the plan for things changing.
- There is a map `offlineChannelToRCEConnectorMap.txt` which links each offline channel to a specific RCE connector.
 - This WILL NOT change, as long as the RCE numbers remain true to the convention on slide 3.
- I have a script which takes as input the online channel to RCE connector (Brian's map) and generates the full channel map. [This is what may change.]
 - Currently assumes the RCE mapping is the same for each RCE, but it doesn't have to.
 - Any changes will necessitate a change in this map, from which the full channel map can be remade.

Summary

- Have a 'working' channel map to read TPC data into LArSoft!
- A couple of issues have been fixed, but to my knowledge at this moment the map is correct! (Obviously more issues will involve a new version of the map.)
- We have read raw data into LArSoft and looked at it with event displays.
- Any issues: please let me know!