

Raw Decoder Update

Tom Junk
Fermilab

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ProtoDUNE-SP Raw Decoder Tool

- Basic functionality of PDSPTPCRawDecoder_module.cc duplicated in `dunetpc/dune/Protodune/singlephase/RawDecoding/PDSPTPCDataInterface_tool.cc` and `PDSPTPCDataInterface.h`
- Built as a standard *art* tool
https://cdcv.sfnal.gov/redmine/projects/art/wiki/Guide_to_writing_and_using_tools
but it had to inherit from a base class, so see `PDSPTPCDataInterfaceParent.h`
- Three data retrieval methods:
 - `retrieveData`: unpacks all data on a specified input label
example label: "daq:ContainerTPC"
 - `retrieveDataAPAListWithLabels`: unpacks data for specified APA's given an input label
 - `retrieveDataForSpecifiedAPAs`: Uses the fcl-defined input label list (separate for each APA plus a "miscellaneous" category) to look for data for a specific APA
- `raw::RawDigits`, `raw::RDTimeStamps`, and associations passed back by reference, not as elements of the `art::Event`.
- Input `artdaq::Fragments` are dropped from cache after tool is called.

Input Labels for ProtoDUNE-SP

From pdsprd_tool.fcl

```
APA1InputLabels: [ "daq:TPC001", "daq:ContainerTPC001", "daq:FELIX001", "daq:ContainerFELIX001", "daq:TPC",  
"daq:ContainerTPC", "daq:FELIX", "daq:ContainerFELIX" ]
```

```
APA2InputLabels: [ "daq:TPC002", "daq:ContainerTPC002", "daq:FELIX002", "daq:ContainerFELIX002", "daq:TPC",  
"daq:ContainerTPC", "daq:FELIX", "daq:ContainerFELIX" ]
```

```
APA3InputLabels: [ "daq:TPC003", "daq:ContainerTPC003", "daq:FELIX003", "daq:ContainerFELIX003", "daq:TPC",  
"daq:ContainerTPC", "daq:FELIX", "daq:ContainerFELIX" ]
```

```
APA4InputLabels: [ "daq:TPC004", "daq:ContainerTPC004", "daq:FELIX004", "daq:ContainerFELIX004", "daq:TPC",  
"daq:ContainerTPC", "daq:FELIX", "daq:ContainerFELIX" ]
```

```
APA5InputLabels: [ "daq:TPC005", "daq:ContainerTPC005", "daq:FELIX005", "daq:ContainerFELIX005", "daq:TPC",  
"daq:ContainerTPC", "daq:FELIX", "daq:ContainerFELIX" ]
```

```
APA6InputLabels: [ "daq:TPC006", "daq:ContainerTPC006", "daq:FELIX006", "daq:ContainerFELIX006", "daq:TPC",  
"daq:ContainerTPC", "daq:FELIX", "daq:ContainerFELIX" ]
```

```
MISCAPAIInputLabels: [ "daq:TPC", "daq:ContainerTPC", "daq:FELIX", "daq:ContainerFELIX" ] # use for example for coldbox-test  
data
```

Example module testing the new tool:

```
/nashome/t/trj/examplerawdecoderfordavid/PDSPTPCRawDecoder_module.cc
```

DataPrep doesn't use this yet as far as I know

Raw Decoder Tool Integrity Checks

- Some of the integrity checks in `PDSPTPCRawDecoder_module.cc` could not be implemented by the tool since the whole event is not available.
 - Checking if all channels are present (we gave up on this one long ago anyway)
 - Checking for duplicate channels (well, we can do this on each call, so duplicates within an APA...)
 - We can check for
 - short fragments
 - mal-formed crate, slot, fiber numbers
 - unusual numbers of ticks
 - mismatching numbers of ticks for different channels (we gave up on this one too due to FEMB 302)

Raw Decoder Tool Integrity Checks

- JJ Russell (SLAC engineer, RCE firmware author) had provided an isOkay check on a fragment, given its header on our request since we were getting truncated and otherwise corrupt fragments from the DAQ. We were just slow to use it.
- Checks the header consistency with the #bytes read
- Checks a trailer at the end of the fragment for consistency
- Some fragments that escaped our checks on size had caused segfaults in JJ's unpacker. Checking isOkay helps us keep the jobs from crashing.
- Action taken – drop the offending fragments. 2 FEMB's on one event per dropped fragment.
- Occurrence rate: <1%. But if you're processing a lot of events in each job, all of your jobs will fail without it. Improves reliability.
- Module, tool, and Iceberg decoder modules all updated.
- Tested on runs 4644, 5177, 5841, 7780, and a problematic Iceberg run.
- In develop. Should be released with dunetpc v08_23_00