Updated Base Processing Outline

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Updated: Aug 3, 2021

Thanks to S. Tilav for the initial slides!

original flow charts from Timo Karg, 2016
https://drive.google.com/file/d/0B9Z6J42T4vs3aUg5cnlyaDE4VGc/view?usp=sharing

Processing at Pole

- Apply calibration, feature extraction for InIce and IceTop
- Create SuperDST
  - Save Seatbelt Waveforms for poorly characterized DOM readouts
- Apply Realtime filters for alerts/GFU sample
  - Should use common splitting/processing tools as Nothern processing.
- Send ALL events North
  - Use compactified SuperDST + Seatbelt format.

Processing in the North

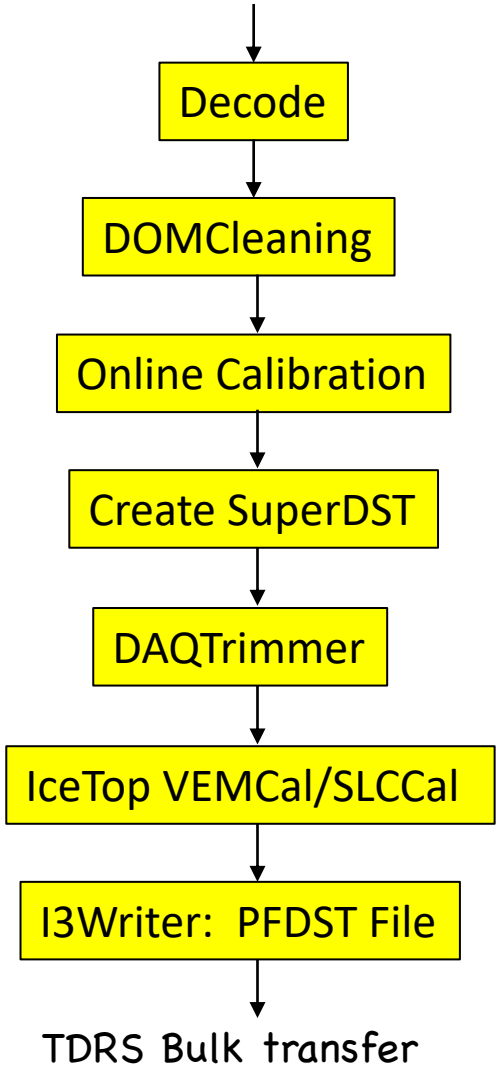
- Start from SuperDST Pulses from pole
  - DO NOT re-run calibration/feature extraction on Seatbelt Waveforms
- Standard splitting tools
  - InIce Split
  - IceTop Split
  - Null Split
- Some form of event characterization applied
- L1/L2 WG filters applied

Note: Code is currently on the filterscripts_v2_initial branch of icecube/icetray GitHub repo

Pole Processing

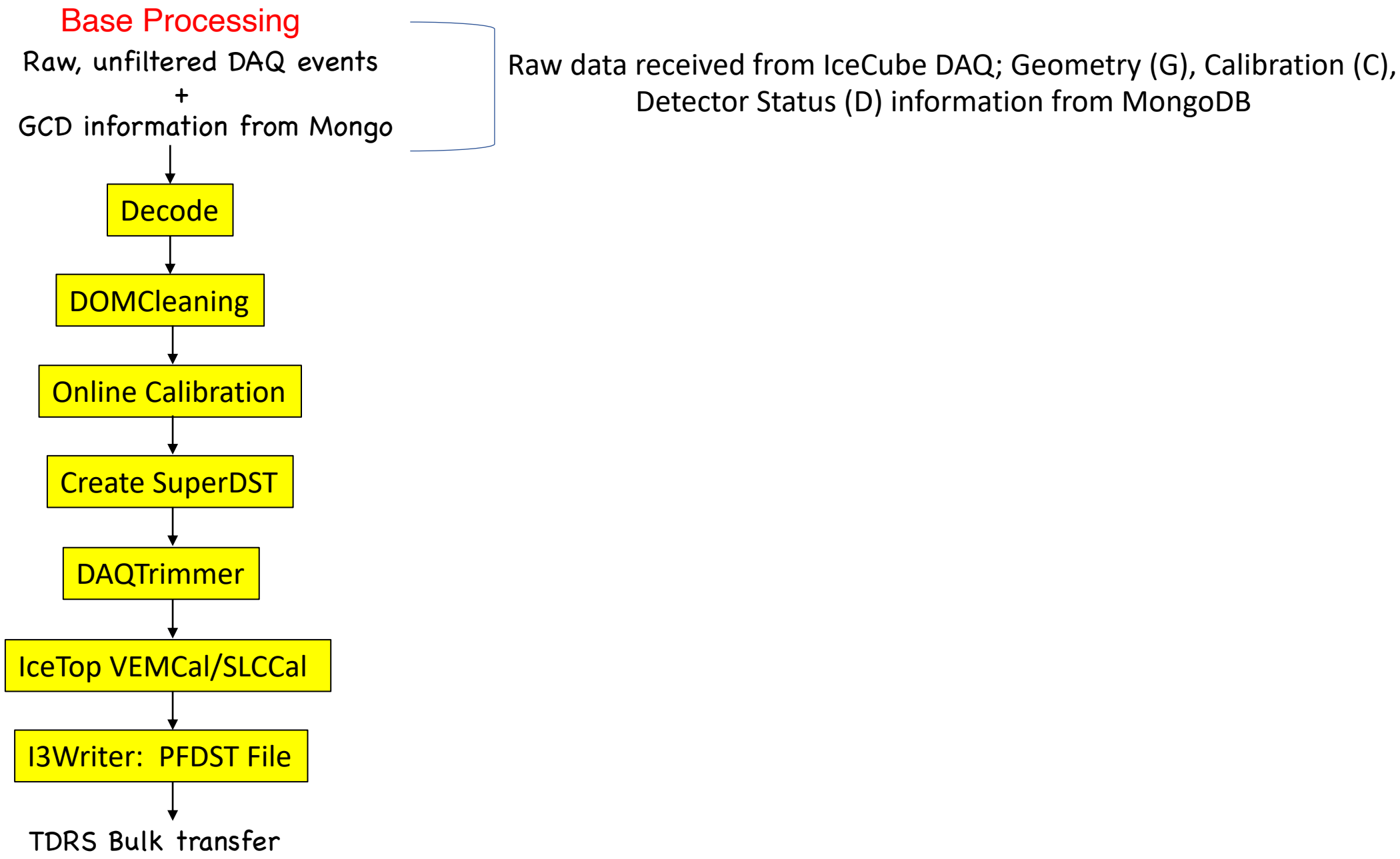
Base Processing

Raw, unfiltered DAQ events
+
GCD information from Mongo



Current example:
Filterscripts_v2/resources/scripts/PFRaw_to_DST.py

Pole Processing



Pole Processing

Base Processing

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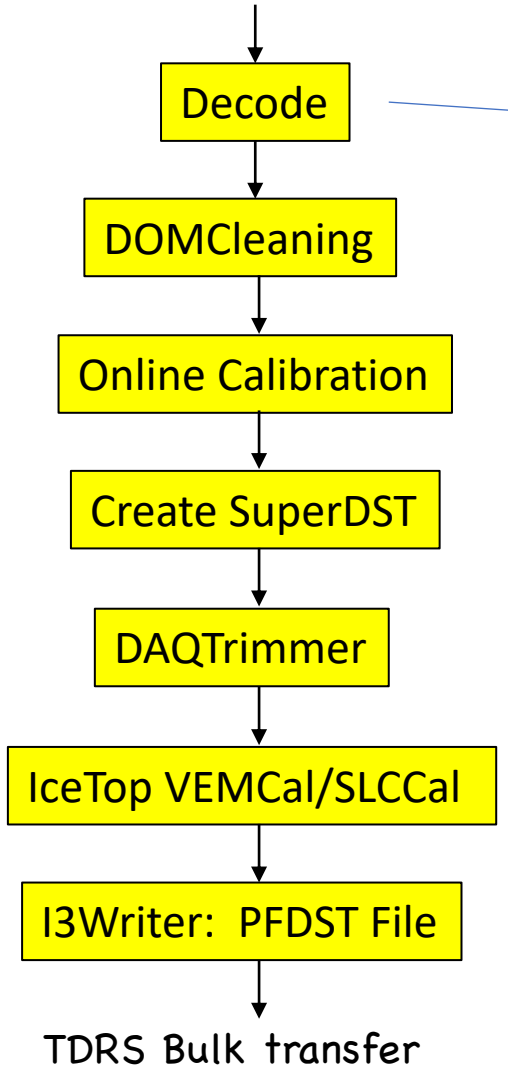

- payload_parsing.I3DOMLaunchExtractor
- Input: I3DAQData binary blob from I3DAQ
- Output: Decoded event objects
  - I3EventHeader
  - I3TriggerHierarchy
  - I3DOMLaunches
    - InIceRawData
    - IceTopRawData
    - (InIce|IceTop)MinBiasData – min Bias triggered DOMLaunches
    - SpecialHits - Readouts of special devices (scintillators, IceAct Trigger MB)
- Job: Decode binary blob into IceTray objects

Pole Processing

Base Processing

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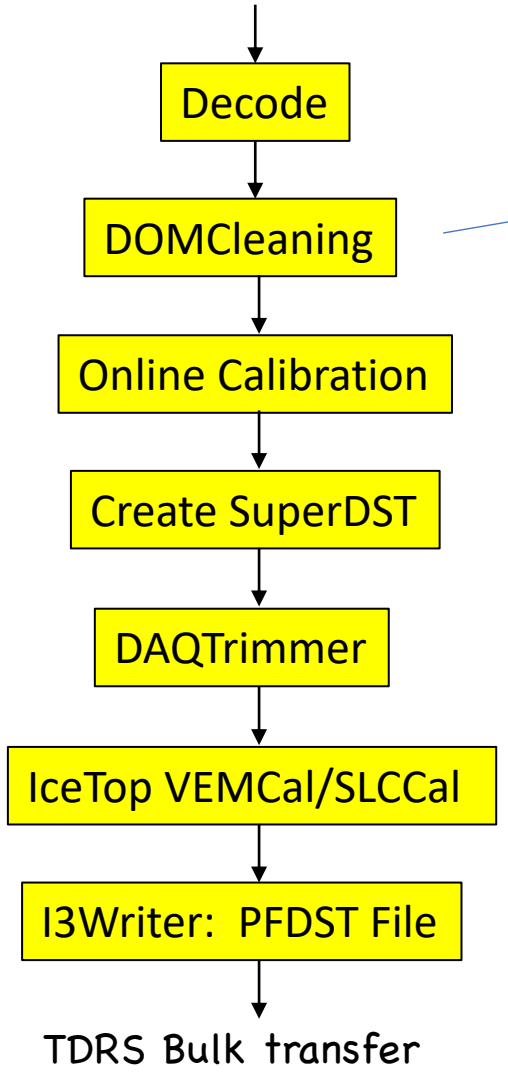

- filterscripts_v2.base_segments.onlinecalibration.DOMCleaning
- Input: InIceRawData, IceTopRawDAta
- Output: CleanedInIceRawData, CleanedIceTopRawData
- Job: Remove readouts from a handful of DOMs that are known to be turned on (for LC connections, etc), but should NEVER make physics hits.
  - OMKey(1, 46), # Dovhjort
  - OMKey(7, 34), # Grover
  - OMKey(7, 44), # Ear_Muffs
  - OMKey(22, 49), # Les_Arcs
  - OMKey(38, 59), # Blackberry
  - OMKey(60, 55), # Schango
  - OMKey(68, 42) # Krabba

Pole Processing

Base Processing

Raw, unfiltered DAQ events
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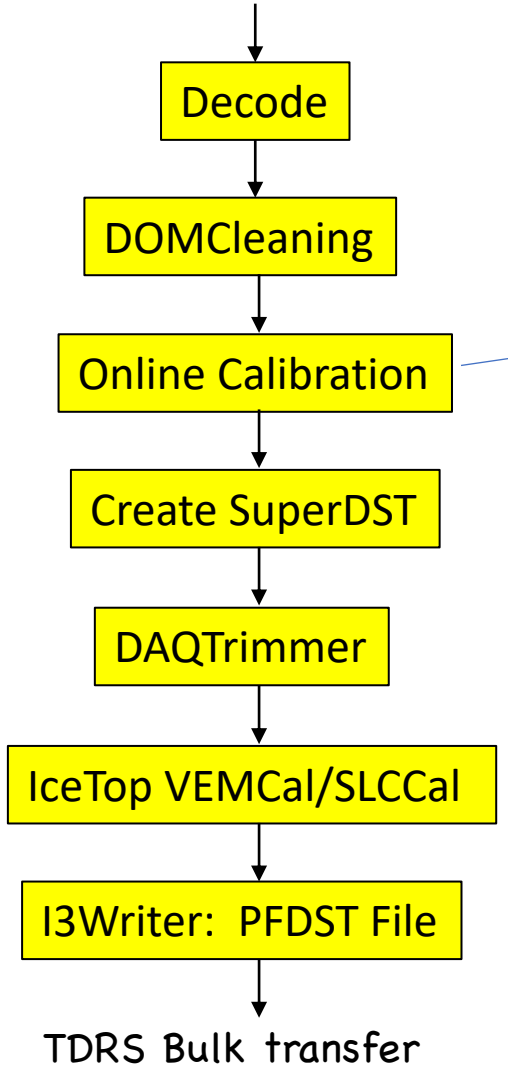
GCD information from Mongo



- filterscripts_v2.base_segments.onlinecalibration.OnlineCalibration
- InIce:
  - I3WaveCalibrator – calibrate raw DOM launches
  - I3PMTSaturationFlagger – identify saturated readouts time windows
  - Wavedeform – extract RecoPulses from calibrated WFs
    - New: Using “Reduce = True” option
- IceTop:
  - I3WaveCalibrator – calibrate raw DOM launches
  - I3WaveformSplitter – separate HLC/SLC readouts
  - I3TopHLCPulseExtractor – extract HLC pulses in PE
  - I3TopSLCPulseExtractor – extract SLC pulses in PE
  - Unify – glue SLC/HLC pulses into one collection

Pole Processing

Base Processing

Raw, unfiltered DAQ events
+
GCD information from Mongo

- Decode
- DOMCleaning
- Online Calibration
- Create SuperDST
- DAQTrimmer
- IceTop VEMCal/SLCCal
- I3Writer: PFDST File

TDRS Bulk transfer

IceTop

- CleanIceTopRawData
- WaveCalibrator → IceTopErrata
- IceTopCalibratedWaveforms
- WaveformSplitter
  - CalibratedIceTopATWD_HLC → HLCPulseExtractor → IceTopHLCPulseInfo
  - CalibratedIceTopATWD_SLC → SLCPulseExtractor
- IceTopPulses_HLC (charge in PE)
- IceTopPulses_SLC (charge in PE)
- Unify
- IceTopPulses (charge in PE)

InIce

- CleanIceTopRawData
- WaveCalibrator → InIceErrata
- InIceCalibratedWaveforms
- I3SaturationFlagger → SaturationWindows
- Wavedeform → InIcePulsesTimeRange
- InIcePulses

Pole Processing

Base Processing

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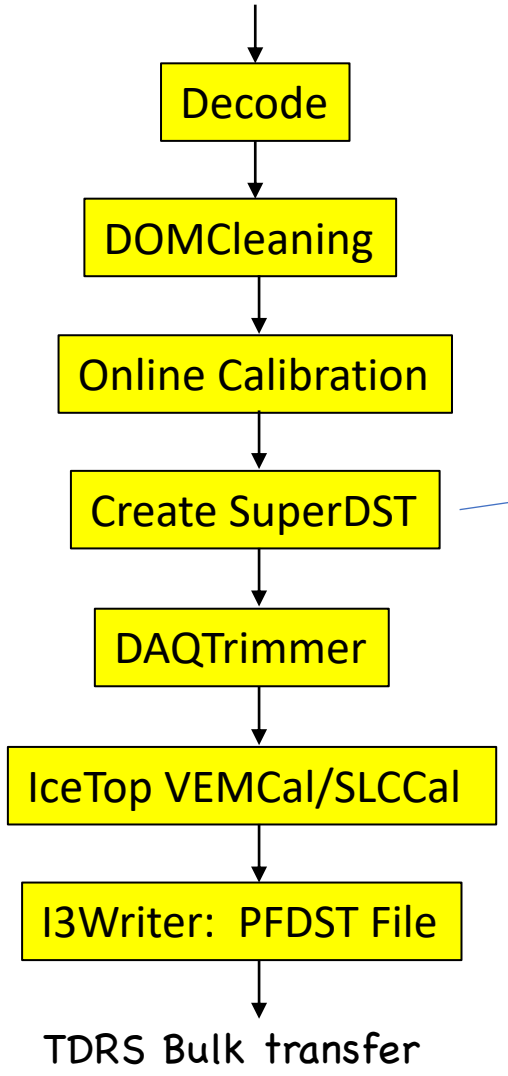

- filterscripts_v2.base_segments.superdst.SuperDST
- Job: pack RecoPulese and TriggerHierarchy objects into compact SuperDST records
- Inputs: InIcePulses, IceTopPulses, TriggerHierarchy
- Outputs:
  - I3SuperDST – encoded compact RecoPulses
    - Unified InIcePulses + IceTopPulses as input
  - DSTTriggers – encoded compact Triggers
    - Uses the GCD info as map – required to encode/decode DSTTriggers

Pole Processing

Base Processing

Raw, unfiltered DAQ events
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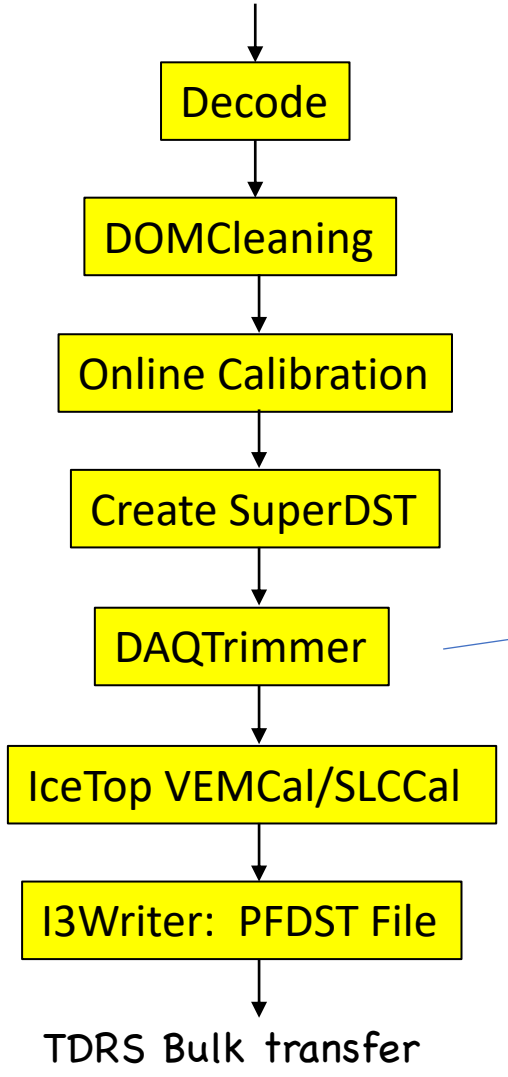
GCD information from Mongo



- filterscripts_v2.base_segments.daqtrimmer.DAQTrimmer
- Job: extract Seatbelt waveforms from I3DAQData blob as insurance for poorly characterized waveforms
- Inputs: SuperDST, Calibrated waveforms, raw waveforms
- Outputs: I3DAQDataTrimmed
- Several tests made*:
  - Wavereform Chi^2 test: Threshold is 1000
  - Multi-channel readouts: Any DOMlaunch with >1 ATWDs
  - HighCharge: any Pulses with more than 10 PE in 1000ns window
  - Errata: In WaveCalibrator errata
  - In Special Hits: always save Scintillator or IceAct trigger MB readouts

* Note: these settings are being studied and will likely change

Pole Processing

Base Processing

Raw, unfiltered DAQ events
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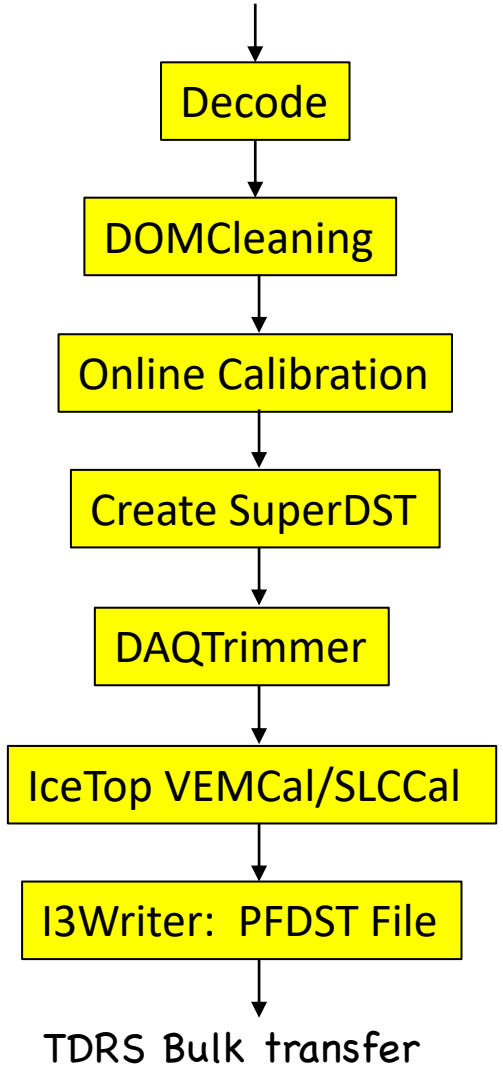
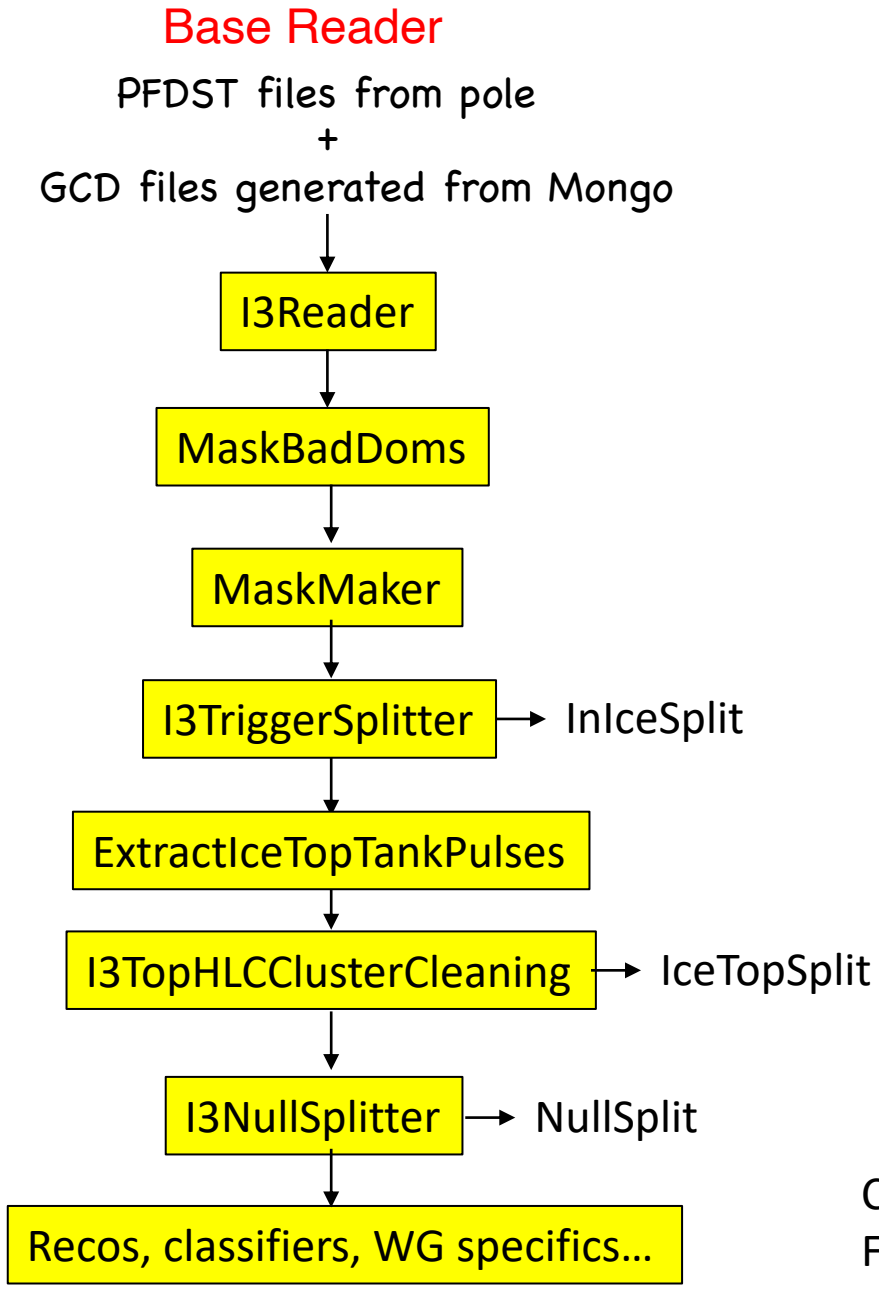
GCD information from Mongo



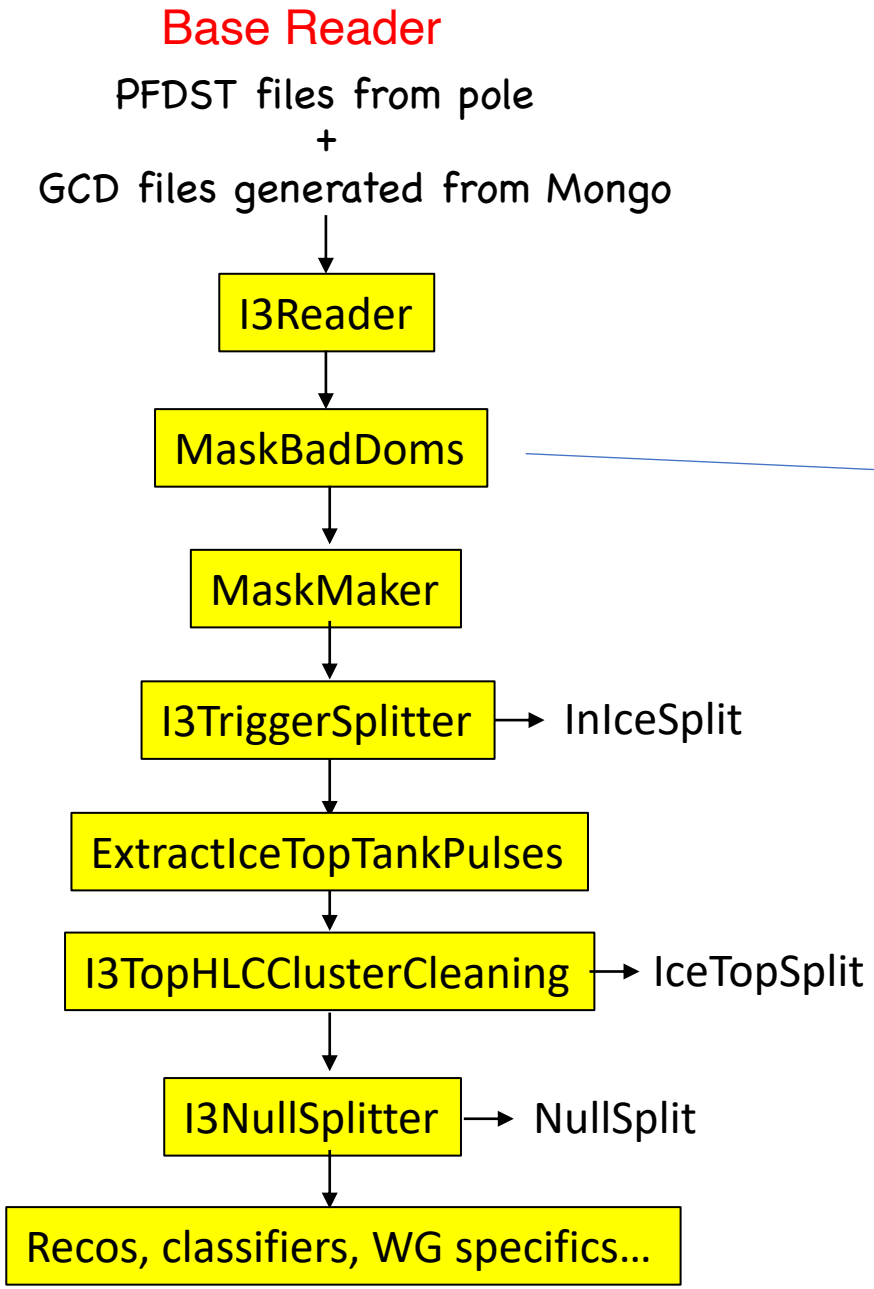
- filterscripts_v2.base_segments.vemcal.IceTopVEMCal
- Job: extract Vertical-equivalent-muon (VEM) calibration data from min-bias IceTop readouts. Here we just extract VEM events and save their info for histogramming in the north. There, Mean PE for a VEM are found and used to (re)calibrate IceTop pulses to VEM.
- Inputs: IceTopMinBias
- Outputs: I3VEMCalData
- filterscripts_v2.base_segments.icetop_slccal.ExtracHLCsAsSLCs
- Job: Treat IceTop HLC DOMLaunches as SLC ones to generate a series of SLC-calibrations to cross calibrate the per OM IceTop SLC integrated response.
- Inputs: IceTopRawData
- Outputs: I3ITSLCCalData

Northern Processing



Current example:
Filterscripts_v2/resources/scripts/UnpackDST.py

Northern Processing

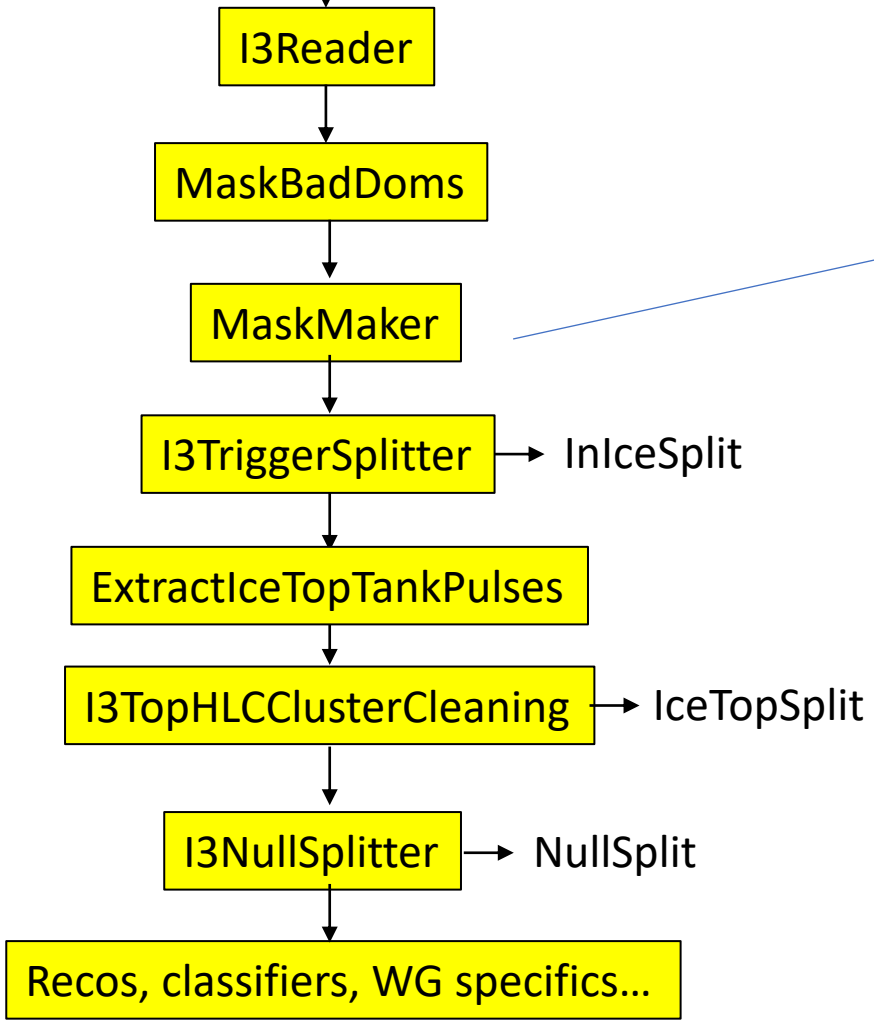


- Remove pulses from DOMs identified as Bad.
- Detector operations group lists per-run bad DOMs in I3Live, these are extracted into L2 GCD files
  - BadDomsListSLC – Bad DOMs, NOT removing the SLC-only DOMs
  - Note: we should NOT use BadDomsList from pass2 – excludes SLC only DOMS
  - Request: Can we rename this??
  - Use: IceTopBadDOMs? IceTopBadTanks?
- Input: I3SuperDST
- Output: CleanSuperDST

Northern Processing

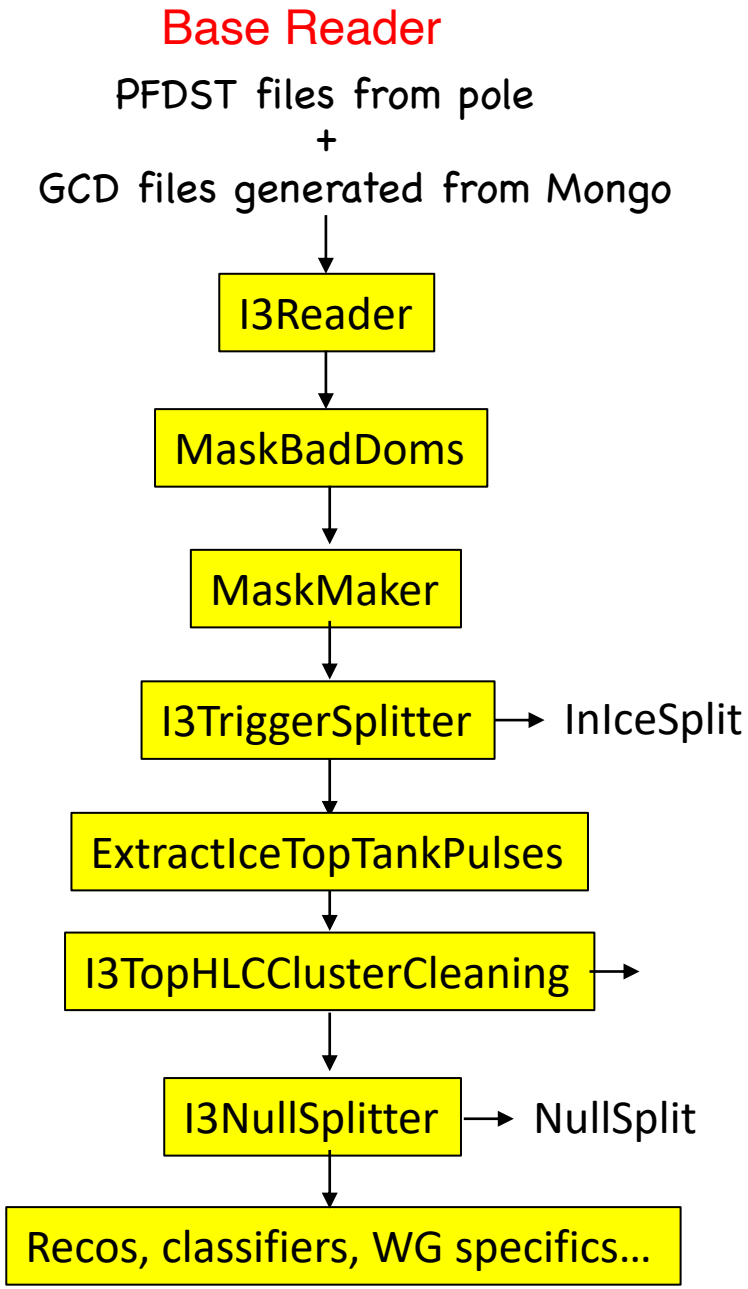
Base Reader

PFDST files from pole
+
GCD files generated from Mongo



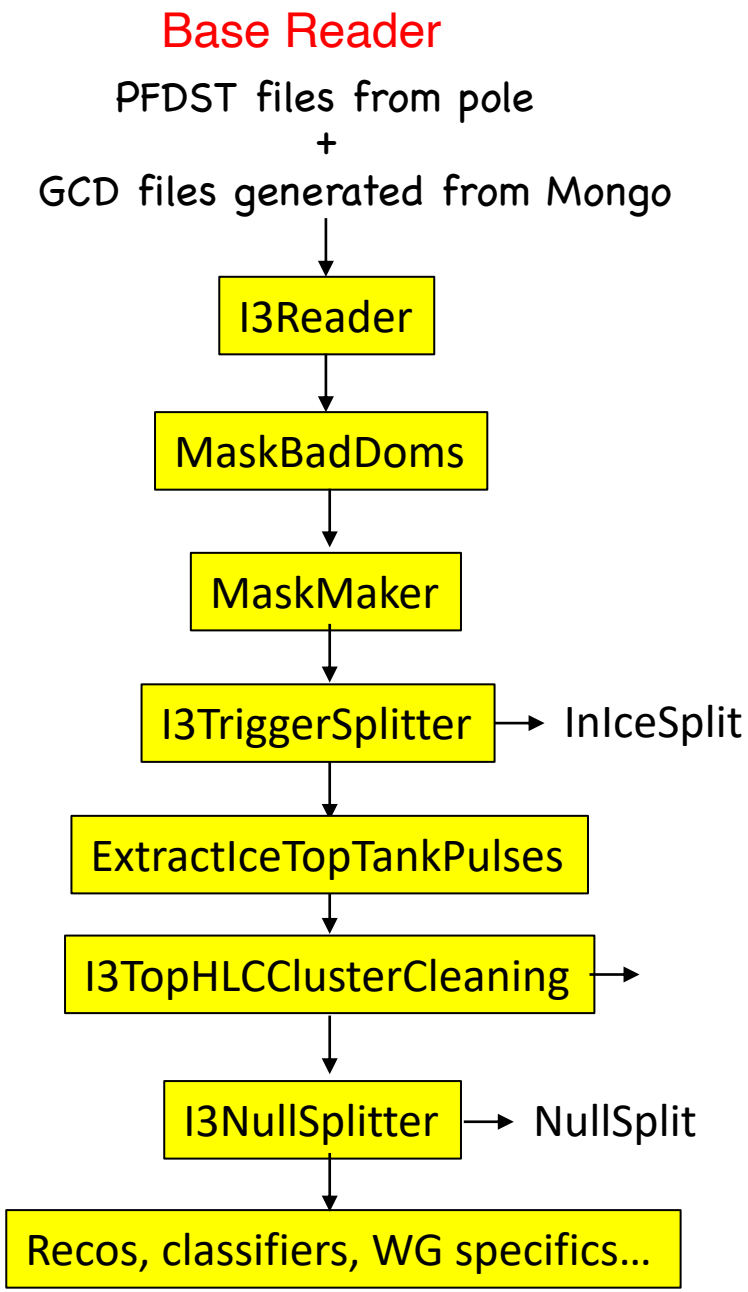
- filterscripts_v2.base_segments.superdst.MaskMaker
- Make standard InIce and IceTop masked versions of SuperDST pulses
- Input: CleanSuperDST
- Output: InIceDSTPulses, IceTopDSTPulses

Northern Processing

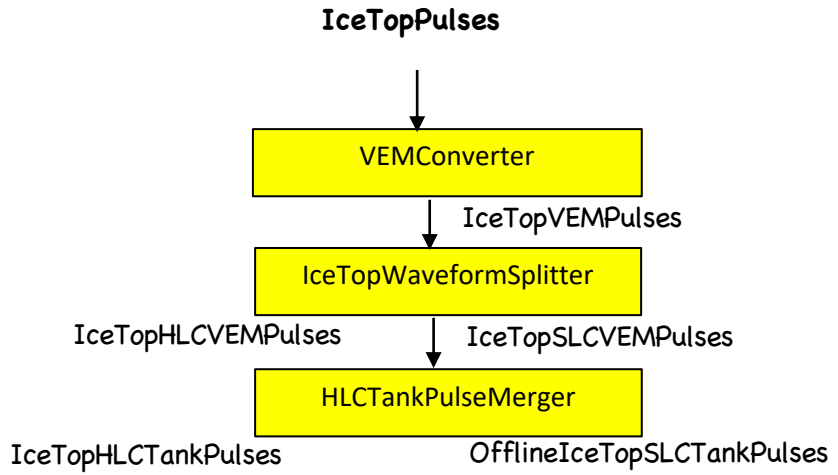


- Trigger-splitter
- Split DAQ (Q) frame into 1 or more P frames based on InIce triggers. Splits on these triggers:
  - DeepCore SMT
  - InIce SMT8
  - InIce String
  - IceIce Volume
- Output: P frames with split pulses: SplitInIcePulses and identified on the “InIceSplit”

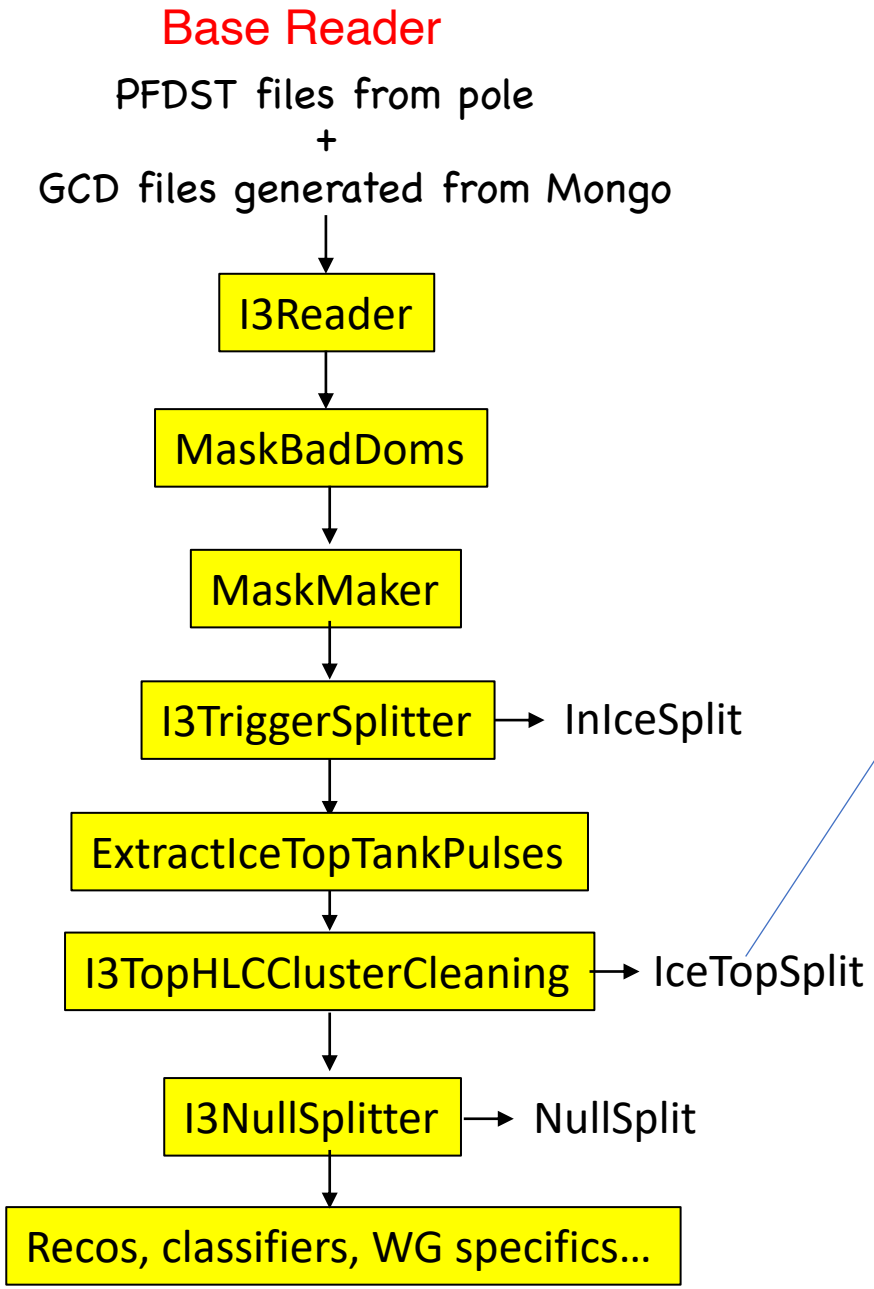
Northern Processing



- filterscripts_v2.base_segments.icetop_pulse_extract.ExtractIceTopTankPulses
- Handle the conversion from DOM-based PE pulses to Tank-based VEM signals

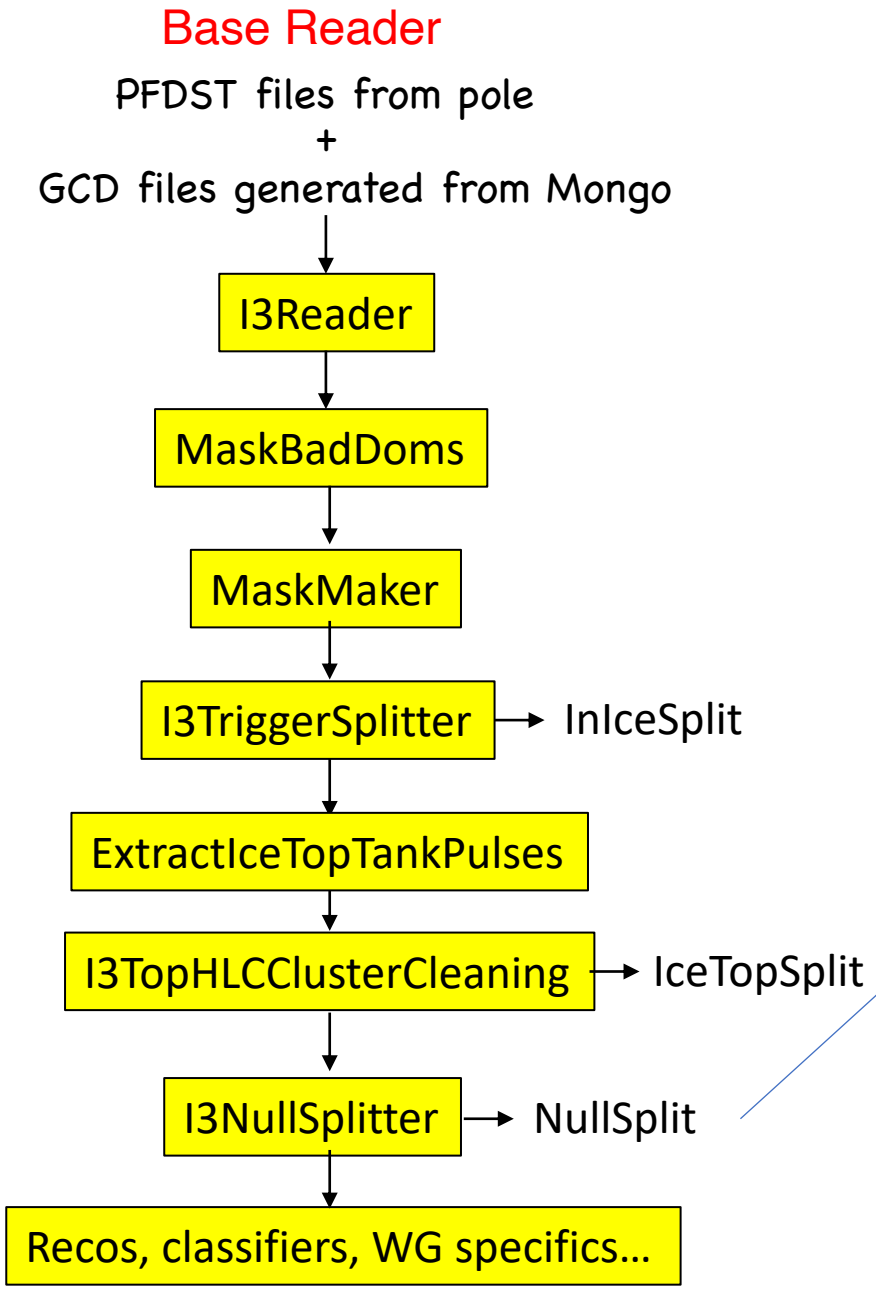


Northern Processing



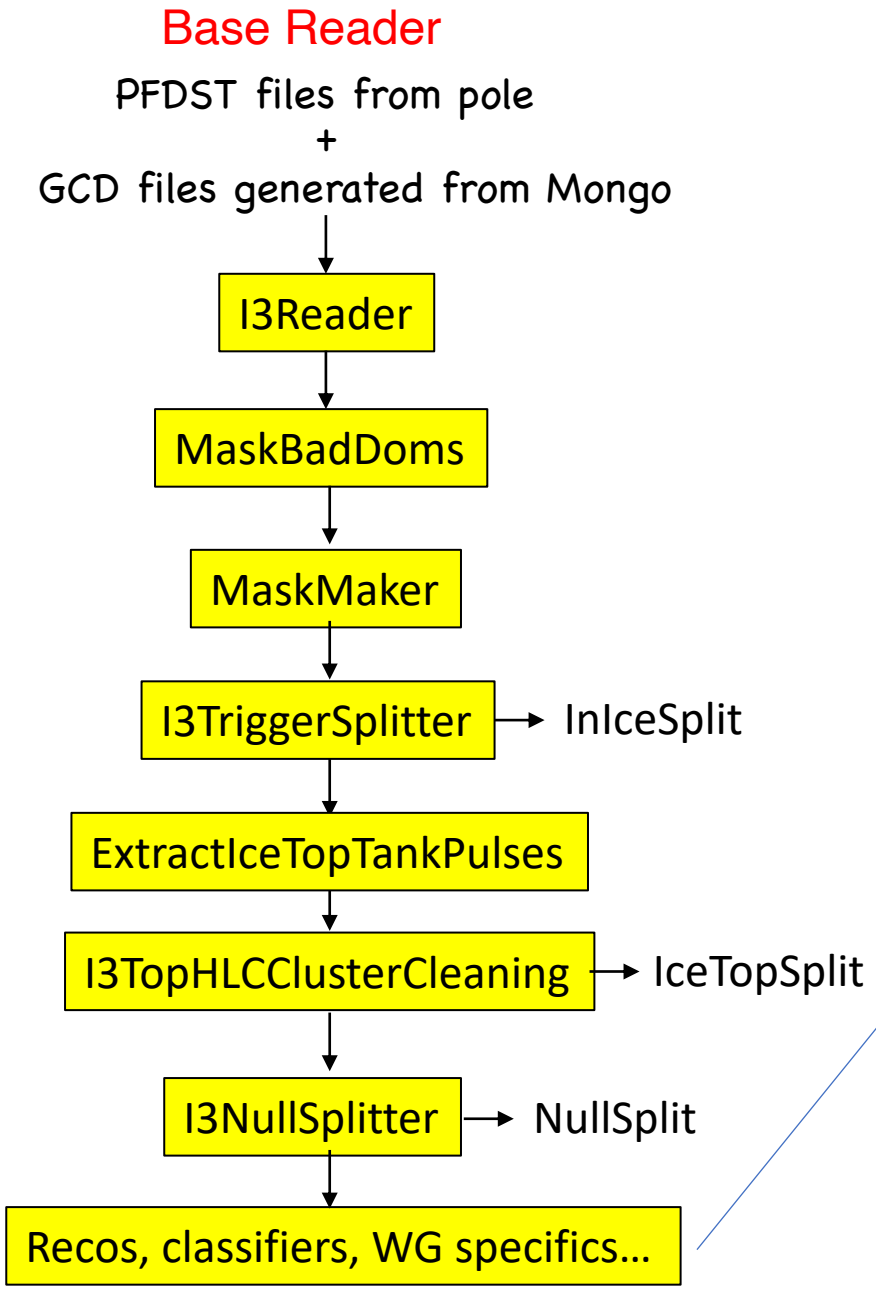
- I3TopHLCClusterCleaning
- Split DAQ (Q) frame into 1 or more P frames based on IceTop HLC Tank Pulses.
- Output: P frames with split tank pulses: 'CleanedIceTopHLCTankPulses' and identified on the "IceTopSplit"

Northern Processing



- I3NullSplitter
- Split DAQ (Q) frame into *1* P frame containing contents of all DAQ frame pulses
- Output: P frame with unsplit pulsesand identified on the “NullSplit”

Northern Processing



- This currently (Aug 2021) needs more work.
- filterscripts_v2.old_inice_reco.RunOldInIceReco optionally added to perform older Improved Linefit, LLH_SPE reco, and MuE from Pass1/2 processing
- Christian/Theo's DNN classifier can run here
- WG input needed…