Status report on

DNNROI sigproc

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Truth offset issue – debugging

- Changed the reference_time in the funcs.jsonnet (default value is set as 0 us)
  - Hard coding

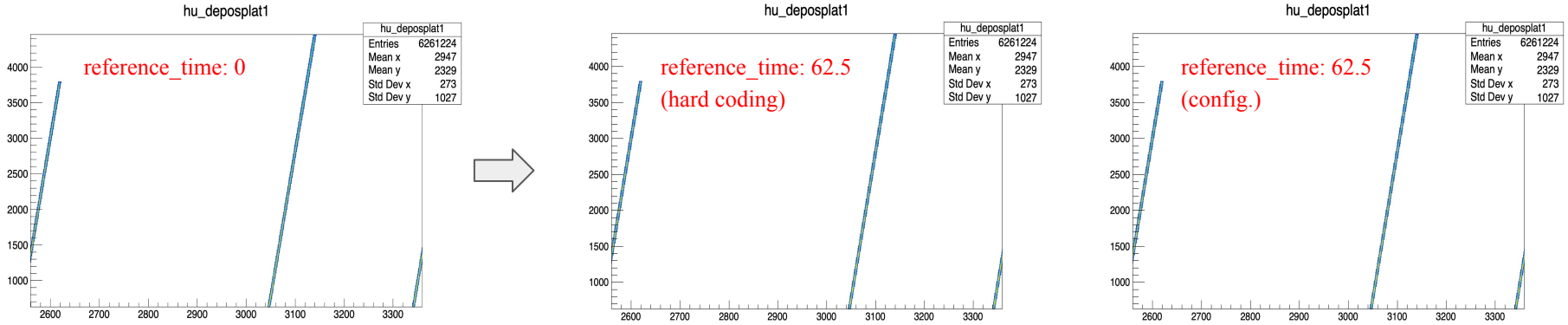
```
[  gen   ] <DepoFluxSplat:0> speed=1.565 mm/us, origin=100 mm, tbins: 6125 0.5us ticks: [-312.5,2750]us, reftime=62.5 us, tick offsets=(0,0,0)
```

```
reference_time: 62.5 * wc.us,
```

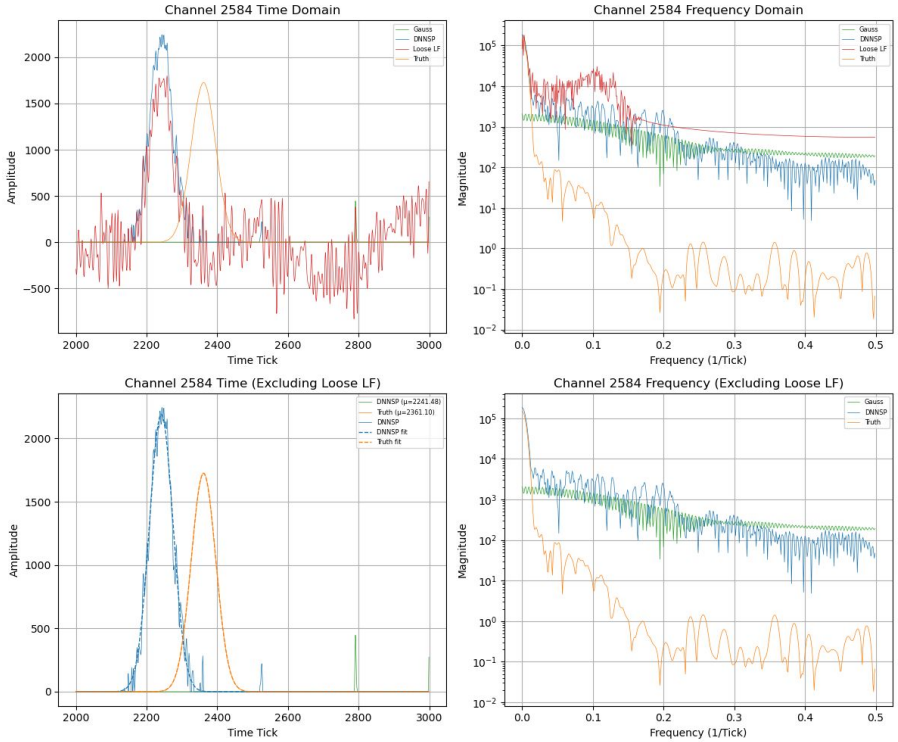
  - Configuration-based

```
[  gen   ] <DepoFluxSplat:0> speed=1.565 mm/us, origin=100 mm, tbins: 6125 0.5us ticks: [-312.5,2750]us, reftime=62.5 us, tick offsets=(0,0,0)
```

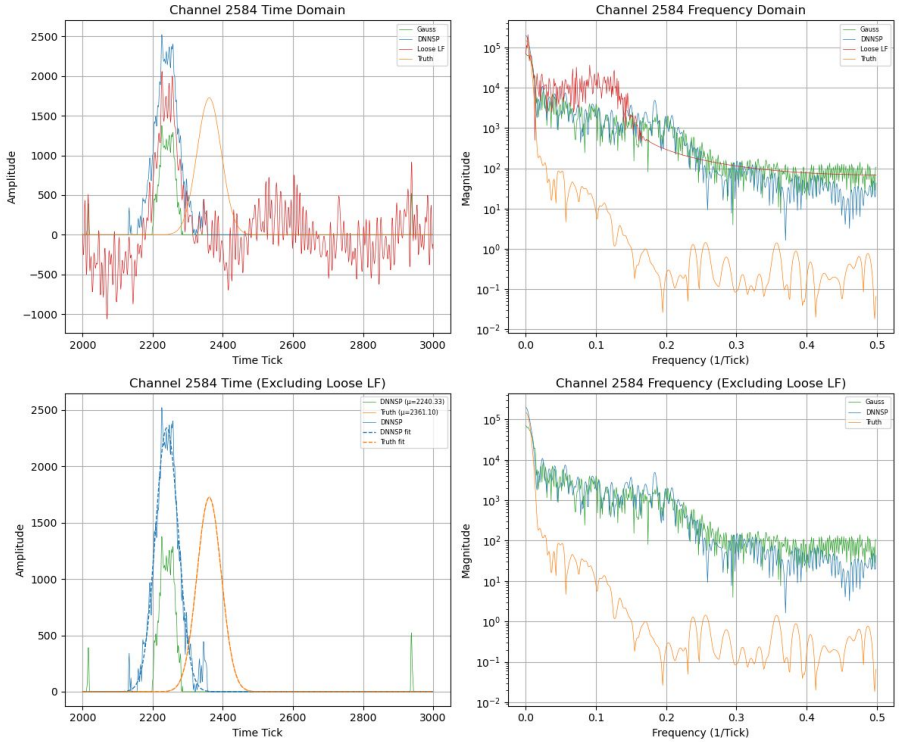
```
reference_time: params.det.response_plane / params.lar.drift_speed,
```



Truth offset issue – debugging



- reference time = 0 us



- reference time = 62.5 us

- The change in reference_time has no impact on the time offset → Potential bug?

Memory and Time consumption

PD-HD Run		VmPeak (MB)	RSS Peak (MB)	Elapsed Time (s)
26763 - 0008	SP	3,680.78	2,251.37	77.36
	DNN SP	11,395.80	9,128.28	184.71
27673 - 0000	SP	3,174.17	1,742.09	55.74
	DNN SP	9,213.96	6,945.05	137.48
27673 - 0000	SP	3,176	1,745.21	56.72
	DNN SP	9,285.25	7,014.49	165.44
27673 - 0000	SP	3,164.97	1,742.46	55.61
	DNN SP	9,396.65	7,127.31	125.62
28588 - 0019	SP	3,157.36	1,725.07	52.93
	DNN SP	9,060.37	6,783.75	163.30

- Signal Processing only

Metric	SP (avg.)	DNN SP (avg.)	Ratio (DNN SP/SP)
RSS Peak	1,841.24 MB	7,399.78 MB	**4.02x**
Elapsed	59.67 s	155.31 s	**2.60x**

- For DNN SP,
  - the FHICL file only save the dnn related waveform in the output file

Memory and Time consumption

PD-HD Run		VmPeak (MB)	RSS Peak (MB)	Elapsed Time (s)
26763 - 0008	SP	5,255.37	2,545.61	110.34
	DNN SP	12,332.6	9,622.21	221.77
27673 - 0000	SP	4,755.79	2,057	97.01
	DNN SP	9,855.99	7,150.4	180.40
27673 - 0000	SP	4,772.51	2,075.27	99.47
	DNN SP	9,927.52	7,221.17	208.26
27673 - 0000	SP	4,761.49	2,063.09	81.40
	DNN SP	10,038.4	7,335.74	164.16
28588 - 0019	SP	4,743.74	2,041.69	87.87
	DNN SP	9,702.41	6,993.94	160.52

- Signal Processing + Pandora reco.

Metric	SP (avg.)	DNN SP (avg.)	Ratio (DNN SP/SP)
RSS Peak	2156.53 MB	7664.69 MB	**3.55x**
Elapsed	95.22 s	187.02 s	**1.96x**

- For DNN SP,
  - the FHICL file only save the dnn related waveform in the output file
  - input of the Pandora is replaced: wclsdatahd:gauss → wclsdatahd:dnnsp

Plan

- Re-compile local WCT and print out offset values in DepoFluxPlat.cxx
  - m_tick_offsets

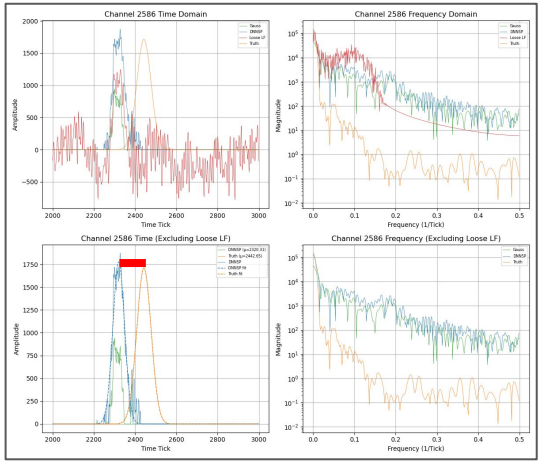
- Train different DNN model and compare the performance
  - UNet vs EfficientNet (MobileNetV2) vs Transformer (SegFormer)

- Re-measure the memory/time consumption with GPU on the WC cluster

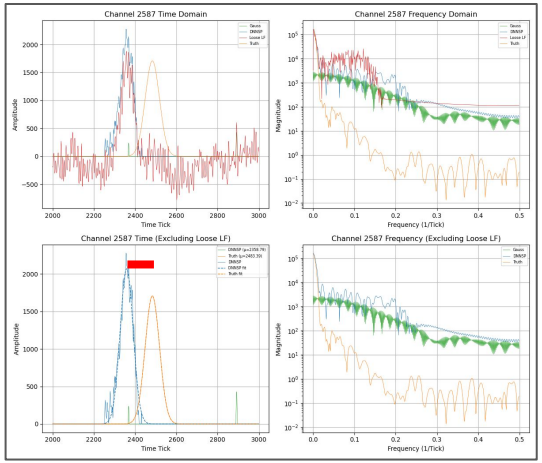
Back Up

Truth offset issue – debugging

```
Channel 2586: DNNSP fit μ = 2320.31
Channel 2586: Gaussian fit mean for waveform_truth_new = 2442.65
Channel 2586: Truth–DNNSP mean diff = 122.34
Saved waveform plot to 'plots_waveform_04212025_xz80/APA2_u/waveform_channel_2586.png'
Processing channel 2587...
Channel 2587: DNNSP fit μ = 2358.79
Channel 2587: Gaussian fit mean for waveform_truth_new = 2483.39
Channel 2587: Truth–DNNSP mean diff = 124.60
Saved waveform plot to 'plots_waveform_04212025_xz80/APA2_u/waveform_channel_2587.png'
```




```
Average (Truth – DNNSP) mean across channels: 124.90
```



- Scanned channel 2580 - 2597 (APA2, u plane)
- Averaged offset from the simulation: ~ 125 time tick
- 0.5 us * 125 = 62.5 us

Truth offset issue – debugging

```
[  gen   ] <DepoFluxSplat:0> speed=1.565 mm/us, origin=100 mm, tbins: 6125 0.5us ticks: [-312.5,2750]us, reftime=0 us, tick offsets=(0,0,0)
```

```
[  gen   ] <DepoFluxSplat:1> speed=1.565 mm/us, origin=100 mm, tbins: 6125 0.5us ticks: [-312.5,2750]us, reftime=0 us, tick offsets=(0,0,0)
```

```
// Arbitrary time added to tbin of traces on per plane basis.
m_tick_offsets.clear();
m_tick_offsets.resize(3,0);
auto jto = cfg["time_offsets"];
if (jto.isArray()) {
    if (jto.size() == 3) {
        for (int ind = 0; ind < 3; ++ind) {
            m_tick_offsets[ind] = jto[ind].asDouble() / wtick;
        }
    }
    else if (!jto.empty()) {
        THROW(ValueError() << errmsg{"DepoFluxSplat: time_offsets must be empty or be a 3-array"});
    }
}
log->debug("speed={} mm/us, origin={} mm, tbins: {} {}us ticks: [{},{}]us, reftime={} us, tick offsets=({},{},{})",
           m_speed / (units::mm/units::us), m_origin/units::mm,
           m_tbins.nbins(), m_tbins.binsize()/units::us,
           m_tbins.min()/units::us, m_tbins.max()/units::us,
           m_reftime/units::us,
           m_tick_offsets[0],m_tick_offsets[1],m_tick_offsets[2]);
```

```
// Acceptance window
const double wtick = get(cfg, "tick", 0.5 * units::us);
const double wstart = cfg["window_start"].asDouble();
const double wduration = cfg["window_duration"].asDouble();
const int nwbins = wduration / wtick;
m_tbins = Binning(nwbins, wstart, wstart + nwbins * wtick);
```

- gen/src/DepoFluxSplat.cc
- Where the -312.5 comes from?