

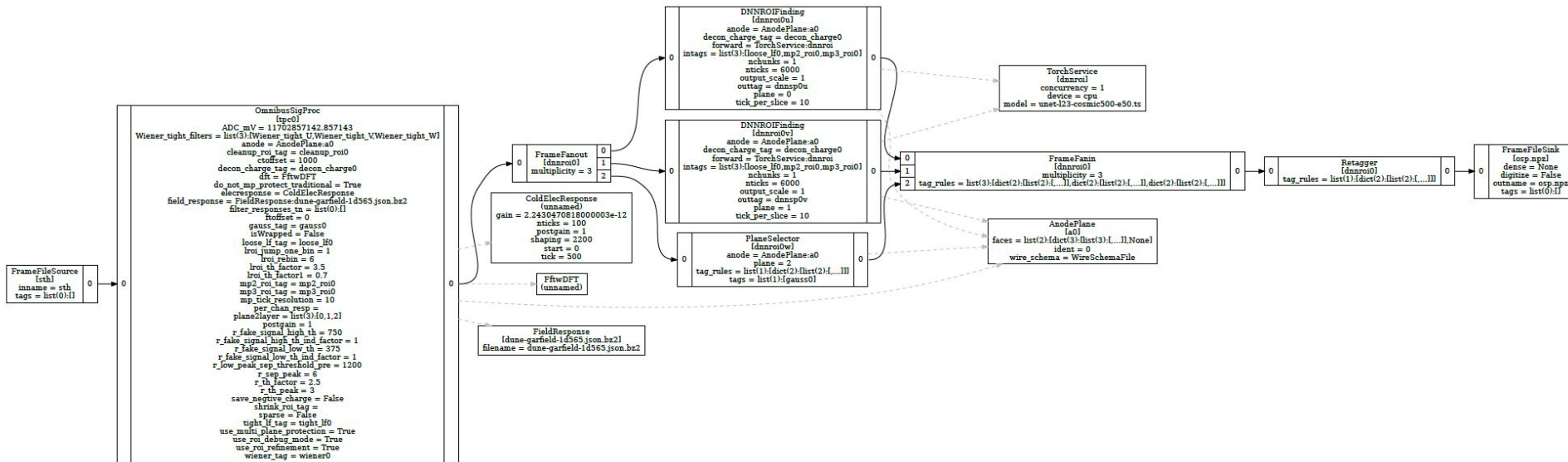
Performance Comparison between OSP and SPNG (DUNE)

Context

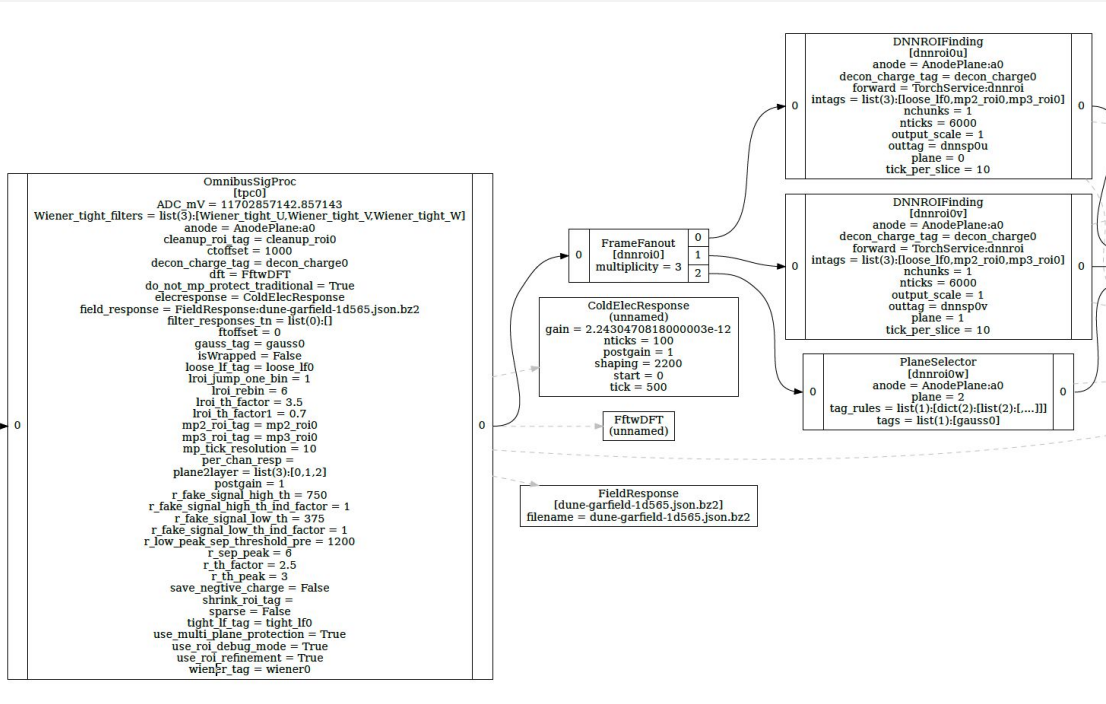
- This comparison of OSP and SPNG is done after the previous issue of slow down of SPNG nodes in GPU compared to CPU was addressed.
- A thorough analysis of the issue and the subsequent mitigation/solution is discussed in this github [issue](#)

OSP : Original Signal Processing

- Current State of the art signal processing used by wire-cell → Original Signal Processing (OSP)



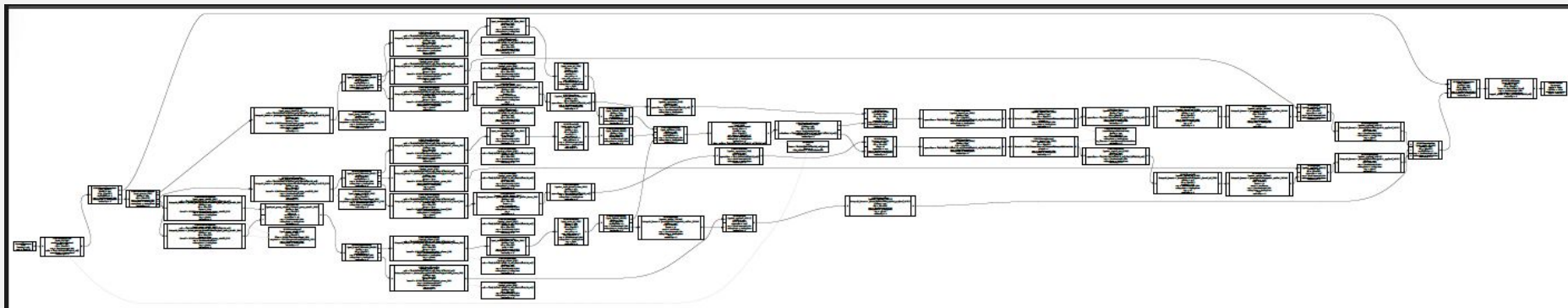
Original Signal Processing



CPU Heavy

Inference done via GPU in DNNROIFinding Node.

SPNG



Profiling SPNG and OSP

- 10 “events”
- SPNG: adc-to-spng.jsonnet
- OSP: adc-to-osp.jsonnet
- Hostname: `wcgpu0.phy.bnl.gov`
- CPU: AMD Ryzen Threadripper 7970X 32 cores
- Architecture: `x86_64`
- GPU: NVIDIA GeForce RTX 4090
- NVIDIA Driver: `555.42.06`
- CUDA Driver: `12050`
- Profiling was done end to end for both SPNG and OSP workflows

| Metric | ADC-to-SPNG (wall) | ADC-to-OSP (wall) |
|------------------------------|--------------------|-------------------|
| Full Profile Span | 13.410 sec | 46.332 sec |
| CUDA Kernels launched | 326,703 | 3194 |
| CUDA kernel Time | 2975.235 ms | 286.106 ms |
| CUDA runtime/API calls | 386824 | 6055 |
| CUDA runtime/API time | 3774.143 ms | 350.662 ms |
| Synchronization events | 1127 | 504 |
| Synchronization time | 2506.186 ms | 164.713 ms |
| Memory copy operations | 56572 | 578 |

Breaking down the Memcpy operations

| Copy Kind | SPNG Count | SPNG Bytes (MB) | SPNG Time (ms) | OSP Count | OSP Bytes (MB) | OSP Time (ms) | Time Ratio (SPNG/OSP) |
|------------------|------------|-----------------|----------------|-----------|----------------|---------------|-----------------------|
| Device-to-Device | 55,425 | 30,906.804 | 92.650 | 74 | 4,300.800 | 7.519 | 12.32x |
| Host-to-Device | 351 | 806.821 | 43.082 | 150 | 168.813 | 6.637 | 6.49x |
| Device-to-Host | 796 | 768.106 | 43.257 | 354 | 38.403 | 1.776 | 24.36x |

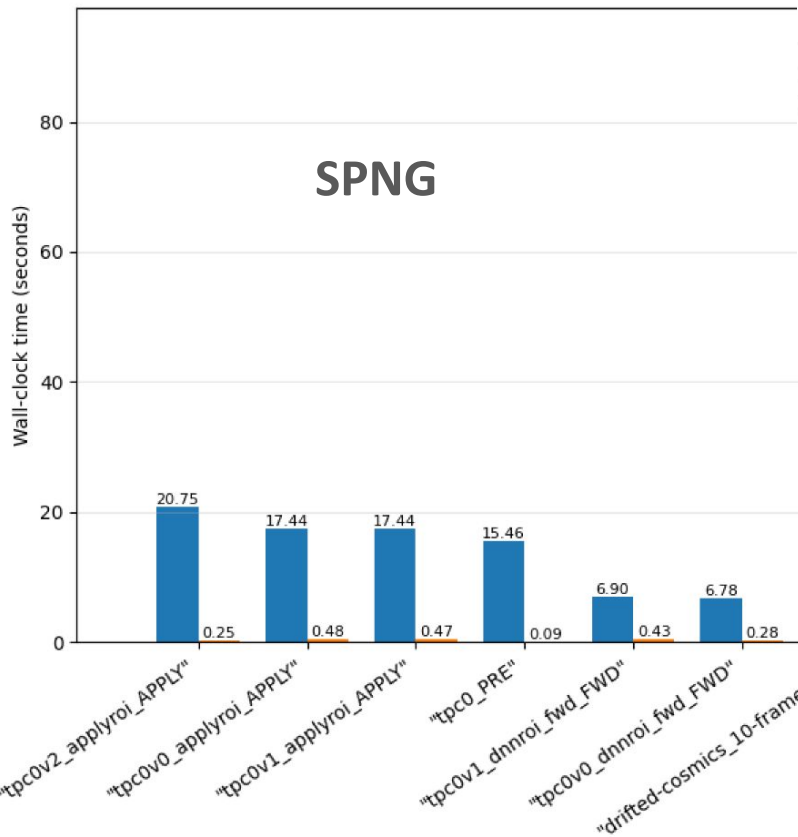
OSP and SPNG Running in CPU and GPU

| SP type | CPU | GPU | Speed up |
|---------|----------|----------|----------|
| SPNG | 92.8 sec | 10.9 sec | 8.5x |
| OSP | 51.47 | 46.58 | 1.10x |

Breakdown (if needed)

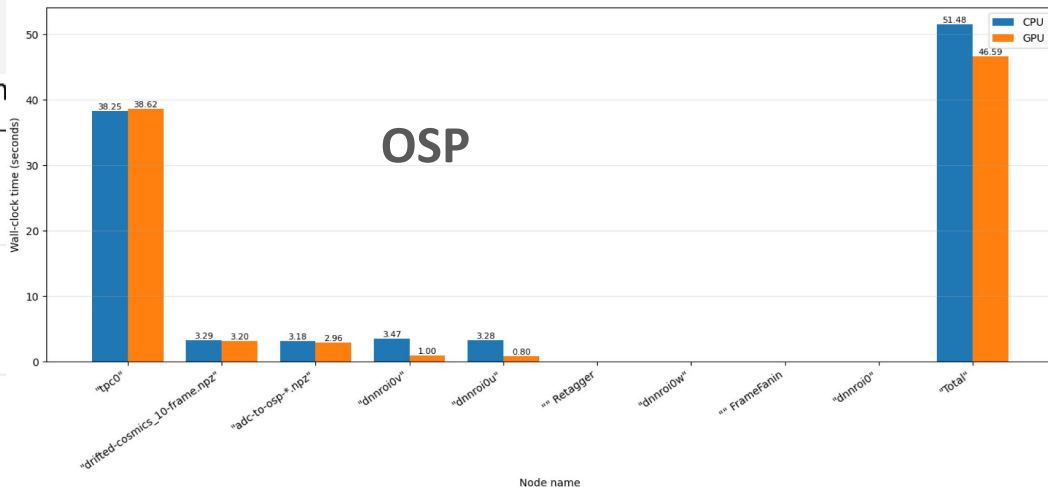
adc-to-spng.jsonn

SPNG



adc-to-osp.jsonnet workflow wall-clock time: CPU vs GPU

OSP



Node name