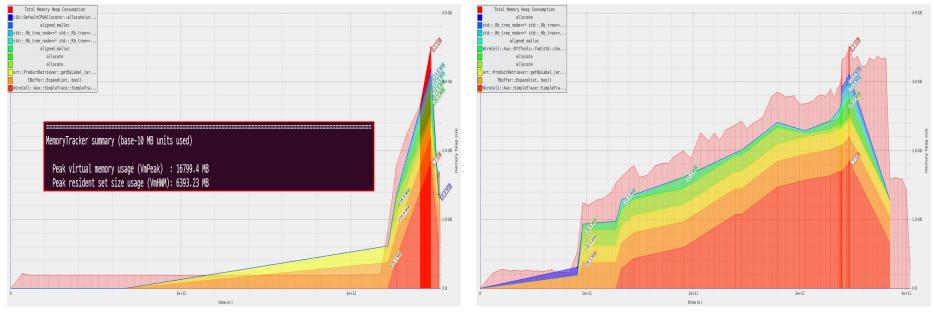
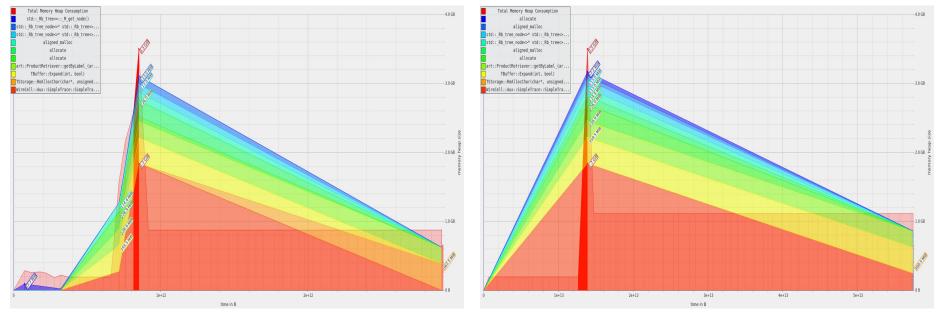


Status report on **DNNROI sigproc**

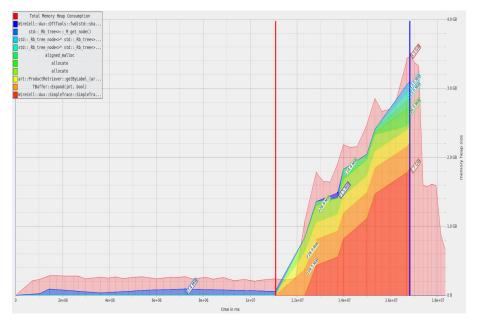
Hokyeong Nam Chung-Ang University



- Profiled twice over DNN SP (MobileNetV2) with a PD-HD data file (one event)
- Time unit: i instructions (default)
- The left is what I shared in the last meeting, the right one is newly generated
- The peak appears near the end of the instructions
- The peak memory from Valgrind (~ 3.3 GIB) is different from LArSoft's MemoryTracker (~6.4 GB)



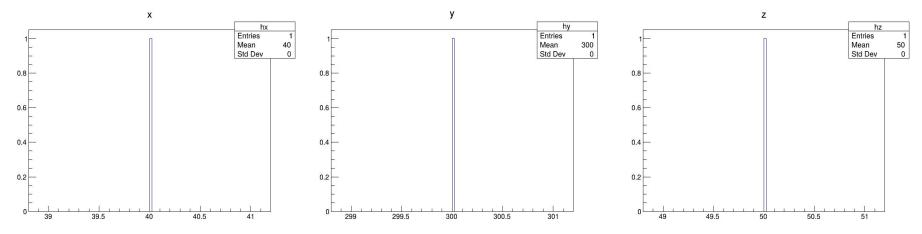
- Profiled twice over DNN SP (MobileNetV2) with a PD-HD data file (one event)
- Time unit: B Bytes
- For the same data processing, total amount of heap memory allocated is different
- The peak appears abruptly, and there is low memory usage after the peak



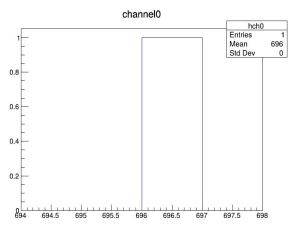
```
MemoryTracker summary (base-10 MB units used)
  Peak virtual memory usage (VmPeak) :
%MSG-s ArtException: RootOutput:out1@EndJob 15-Jul-2025 15:33:06 PDT ModuleEndJob
    SQLExecutionError BEGIN
  unique value expected of non-unique query.
  -- SOLExecutionError END
Art has completed and will exit with status 1.
Command exited with non-zero status 1
        Command being timed: "valgrind --tool=massif --time-unit=ms --massif-out-file=massif_output_mobilenetv2_timems2.out --stacks=yes
-log-file=valgrind timems2.log lar -n1 -c my standard reco stage2 calibration protodunehd keepup dnnroi.fcl -s ../../../data/stage1/run
027673/np04hd raw run027673 0000 dataflow0 datawriter 0 20240704T050545 reco stage1.root"
        User time (seconds): 6884.62
        System time (seconds): 11417.65
        Percent of CPU this job got: 99%
        Elapsed (wall clock) time (h:mm:ss or m:ss): 5:06:16
        Average shared text size (kbytes): 0
        Average unshared data size (kbytes): 0
        Average stack size (kbytes): 0
        Average total size (kbytes): 0
        Maximum resident set size (kbytes): 6398684
        Average resident set size (kbytes): 0
        Major (requiring I/O) page faults: 73
        Minor (reclaiming a frame) page faults: 1606802
        Voluntary context switches: 307636
        Involuntary context switches: 122524
        Swaps: 0
        File system inputs: 0
        File system outputs: 241944
        Socket messages sent: 0
        Socket messages received: 0
        Signals delivered: 0
        Page size (bytes): 4096
Massif output file: massif output mobilenetv2 timems2.out
Valgrind log file: valgrind timems2.log
```

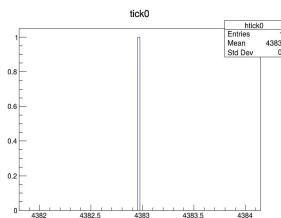
- Profiled twice over DNN SP (MobileNetV2) with a PD-HD data file (one event)
- Time unit: ms milliseconds
- Profiling stopped due to error: unique_value expected of non-unique query
- Run time is almost 5 hours but the memory usage is low for 3 hours (red line)
- The peak snapshot is taken within very short time (blue line)

ShowerAna module

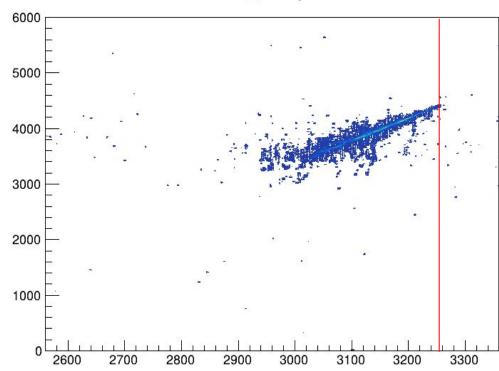


- Get the information of the primary electron, and save the followings:
 - \circ initial position (x, y, z) and corresponding wire channels and time ticks
 - o momentum (px, py, pz), pid, tpc id
 - \circ normalized momentum \rightarrow unit direction (dirx, diry, dirz)
 - extrapolated position (x_ex, y_ex, z_ex) and corresponding wire channels and time ticks ex) x = x + step * dirx
- Detector Geometry (@local::protodunehdv6_geo) from fcl files below:
 - o standard g4 protodunehd.fcl
 - standard_detsim_protodunehd.fcl

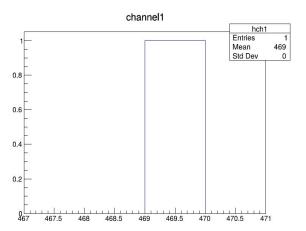


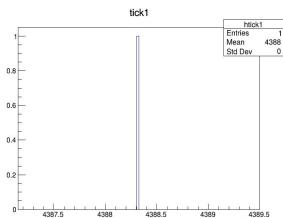


hu_dnnsp1

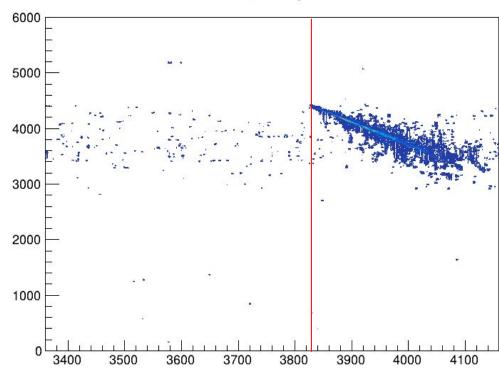


- For u plane of APA2, the (wire channel, time tick) is
 - \circ wire channel: 2560 + 696 = 3256
 - o time tick: 4383

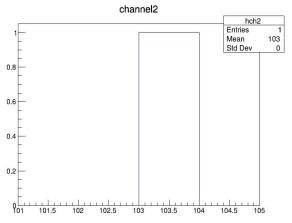


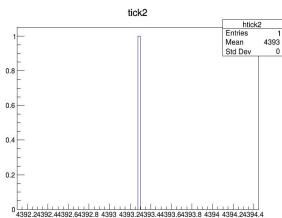


hv_dnnsp1

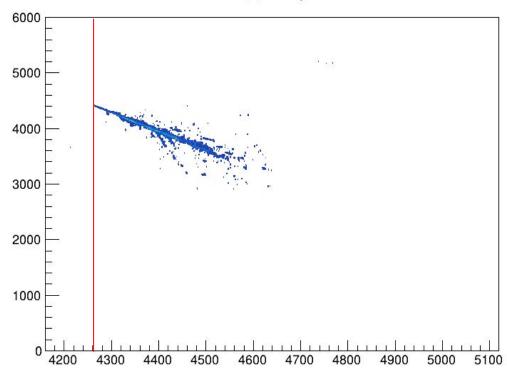


- For v plane of APA2, the (wire channel, time tick) is
 - \circ wire channel: 2560 + 800 + 469 = 3256
 - o time tick: 4388

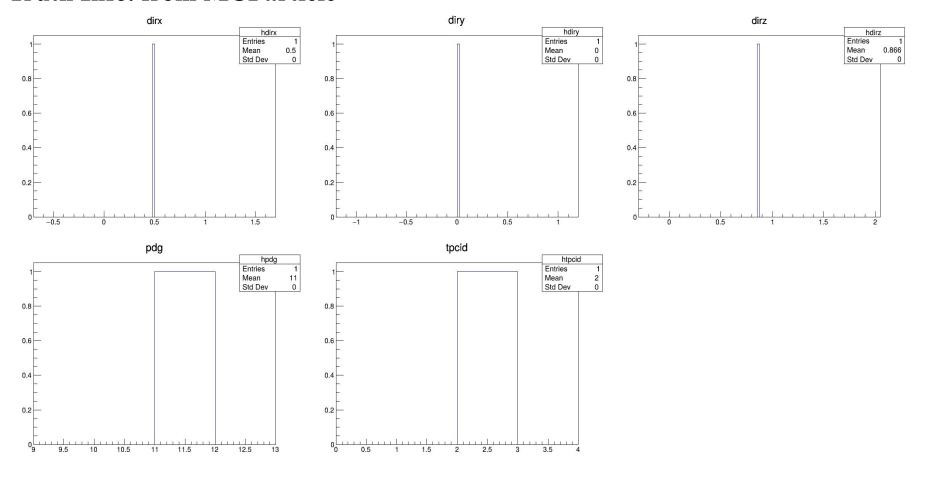




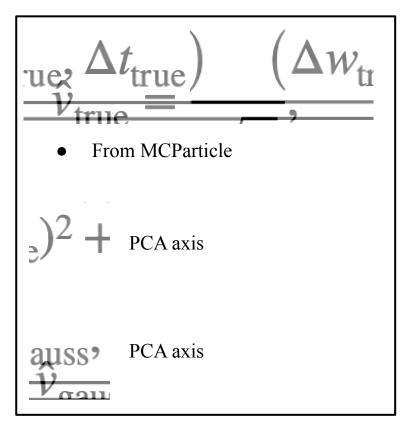
hw_dnnsp1

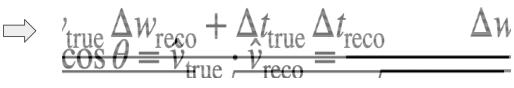


- For w plane of APA2, the (wire channel, time tick) is
 - \circ wire channel: 2560 + 800 + 800 + 103 = 3256
 - o time tick: 4393



Angle between reco and true direction

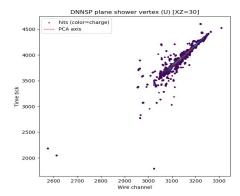


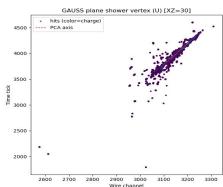


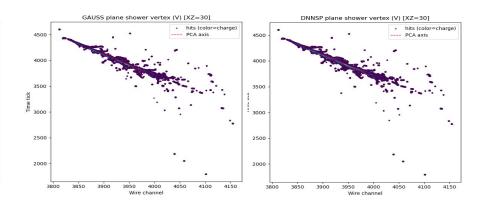


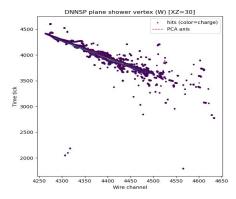


Angle between reco and true direction (E = 5 GeV, XZ = 30)



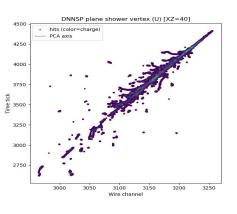


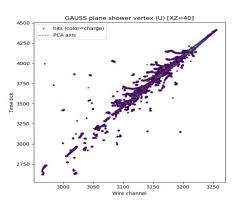


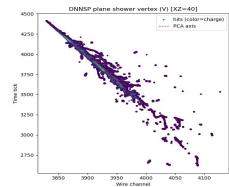


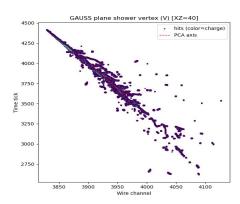
	Angle diff	
	Gauss (deg.)	DNN (deg.)
U plane	0.58	0.53
V plane	1.10	0.83
W plane	2.52	

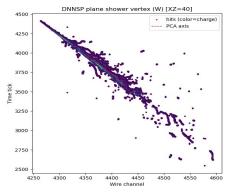
Angle between reco and true direction (E = 5 GeV, XZ = 40)





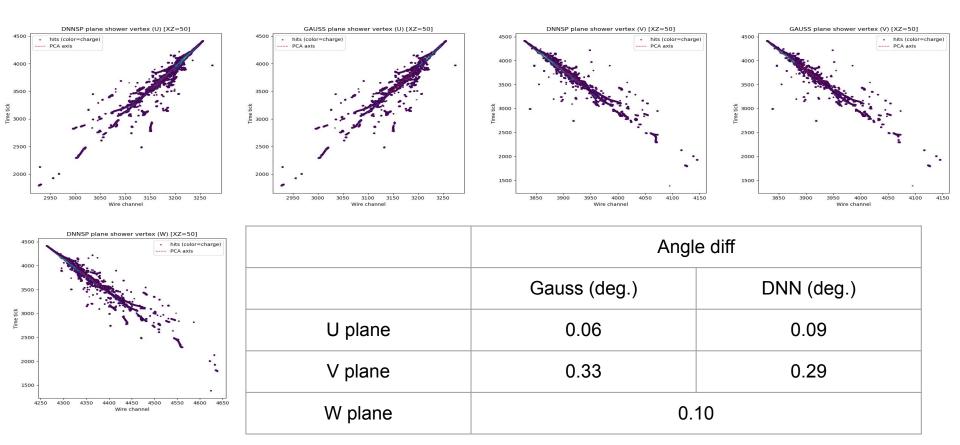




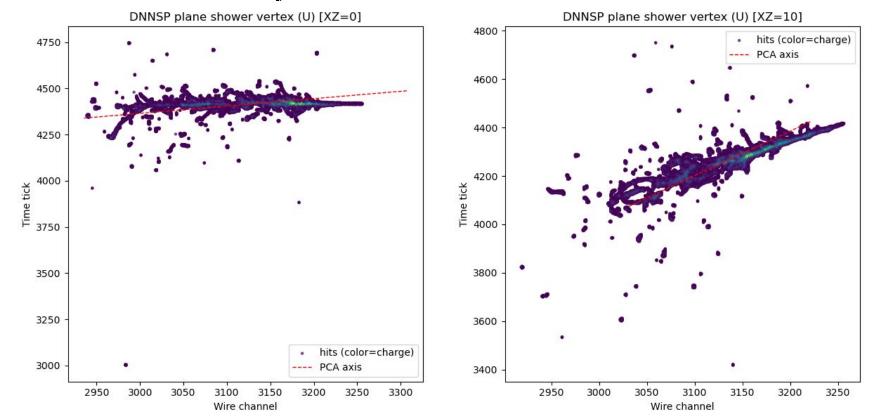


	Angle diff	
	Gauss (deg.)	DNN (deg.)
U plane	0.74	0.82
V plane	0.52	0.51
W plane	1.22	

Angle between reco and true direction (E = 5 GeV, XZ = 50)



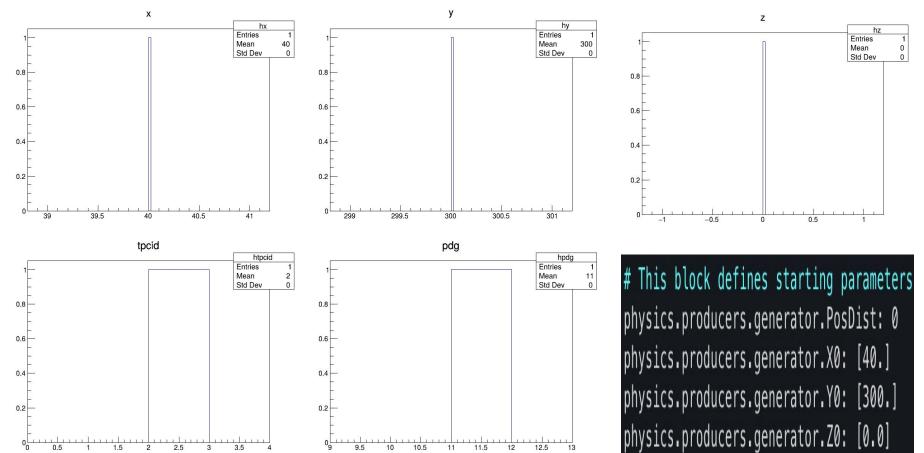
Issues in PCA axis analysis

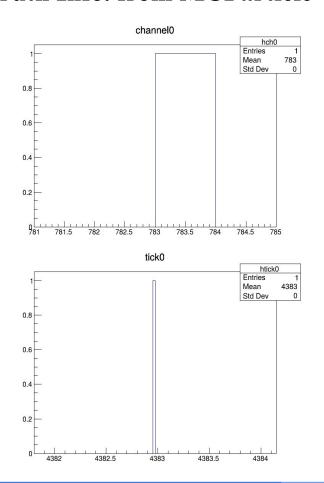


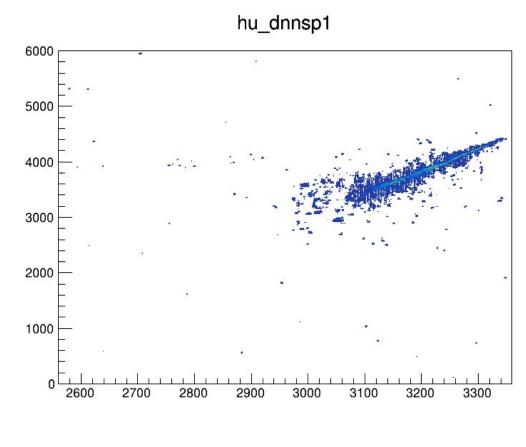
• PCA fails particularly for lower angles

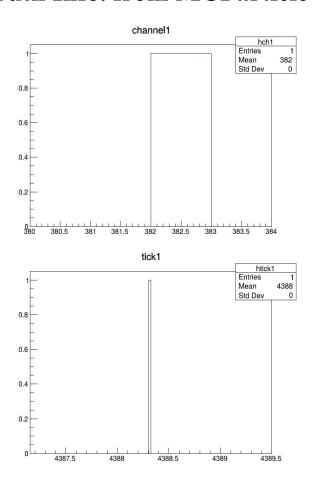
Back Up

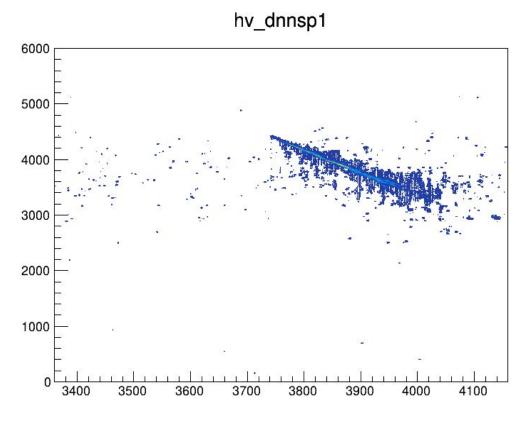
ShowerAna module

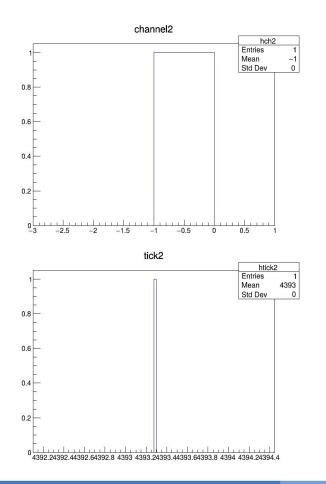


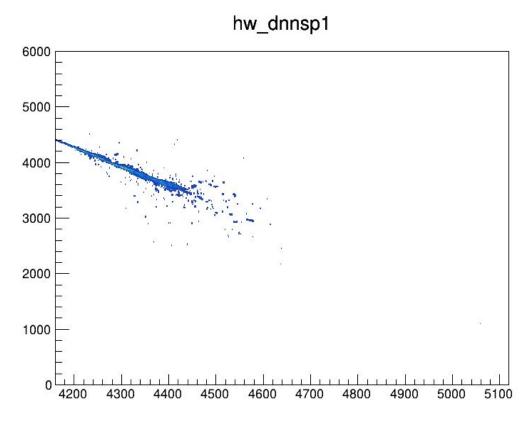


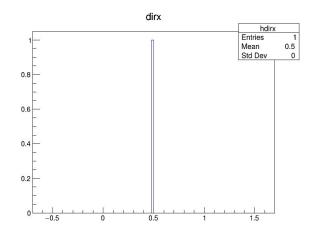


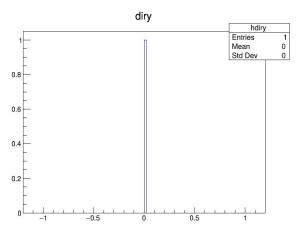


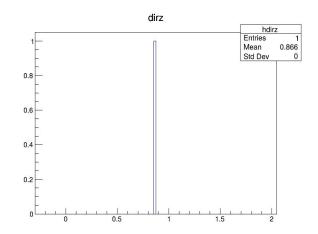


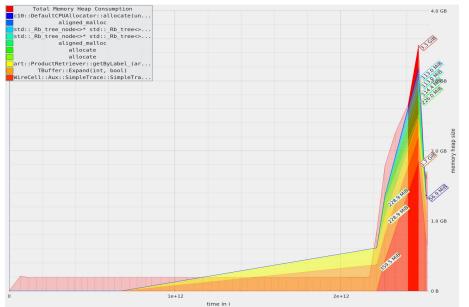


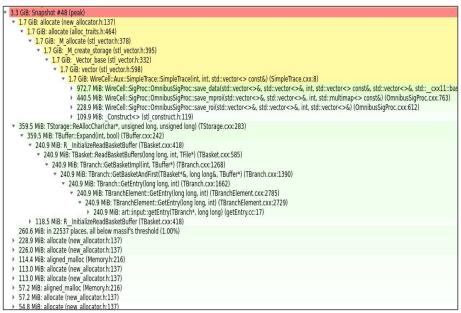






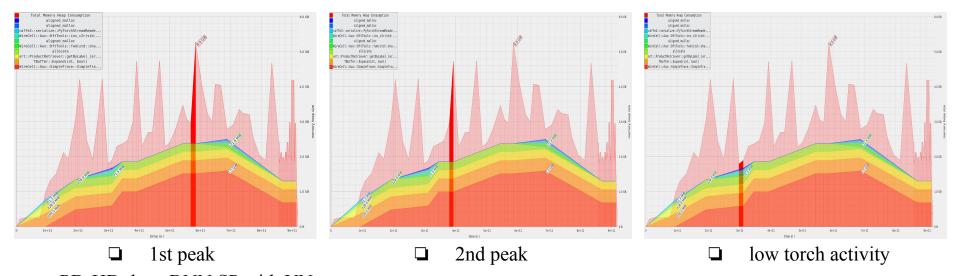






do not mp protect tradtional is set to true

- PD-HD data, DNN SP with MobileNetV2
- The peak memory recorded is 3.3 GiB
- Almost half of the memory (\sim 1.7 GiB) is due to:
 - WireCell::SigProc::OmnibusSigProc::save_data (972 MiB out of 1.7 GiB)
 - WireCell::SigProc::OmnibusSigProc::save_mproi (440 MiB out of 1.7 GiB)



- PD-HD data, DNN SP with UNet
- The peak memory recorded is 4.9 GiB
- Not like a MobileNet result, the total cost graph has several peaks
- Almost half of the memory (~2.5 GiB) is allocated to libtorch_cpu.so around the peak
- Another major contributions are from:
 - WireCell::SigProc::OmnibusSigProc::save_data (853 MiB out of 1.4 GiB)
 - WireCell::SigProc::OmnibusSigProc::save_mproi (343 MiB out of 1.4 GiB)

2.5 GiB: c10::alloc cpu(unsigned long) (in /cvmfs/larsoft.opensciencegrid.org/products/libtorch/v2 1 1b/Linux64bit+3.10-2.17-e26/lib/libc10.so) 25 GB: Citraloc cyulunisped long lin (confarestruperscience) diognosius (blood) v2.1 lub inusAkk+1.0e2.1-e3 filolikcitus) 25 GB: Citraloc (CAUDeInt/CRAI) concrate (original long cons (in pronfarestruperscience) diognosius (blood) v2.1 lub inusAkk+1.0e2.17-e16 filolikcitus) 565.9 MiB: allocate (new allocatorh:137) v 2.5 GB: c10::DefaultCPUAllocator::allocate(unsigned long) const (in (cvmfs/larsoft.opensciencegrid.org/products/libtorch/v2_1_b)Linux64bit+3.10-2.17-e26/lib(libc10.so) * 2.3 GB: c10::StorageImpl::StorageImpl:(c10::StorageImpl::use_byte_size_t, c10::Symint const&, c10::Allocator*, bool) (in [cvmfs/larsoft.opensciencegrid.org)products/ ▼ 565.9 MiB: allocate (alloc traits h:464 2.3 GB: CD: StorageImpl:StorageImpl: Description: StorageImpl: use byte size t, cD::Sprint coretis, cD::Alborator; bod] (in pomis/arsoft operacience; of only products/lotorchy2.1 Explanoidation (Arbitration of Storage Implication) 2.3 GiB: at:/TensorBase at::detail:: empty_generic<>(c10::ArrayRef<>, c10::Allocator*, c10::DispatchKeySet, c10::ScalarType, c10::optional<>) (in /cvmfs/larsoft.org) * 23 GB st:TensorBase st:detail: empty generic > (c10:AmarifeFc), c10:Albostor*, c10:Dispatchle/Set, c10:ScalarType, c10:optimal > (in jointsfarsoft operation conductsfiniture) / 1 1 hibroof-Albostory 2.3 GiB: at::detail::empty_generic(c10::ArrayRef<>, c10::Allocator*, c10::DispatchKeySet, c10::ScalarType, c10::optional<>) (in (cvmfs/larsoft.opensciencegrid) ▼ 565.9 MiB: M allocate (stl vector.h:378 2.3 GiB: at::detail::empty cpu(c10::ArrayRef<>, c10::ScalarType, bool, c10::optional<>) (in /cvmfs/larsoft.opensciencegrid.org/products/libtorch/v2 1 1b/Lin * 23 GB at statal: empty generic(10: Arrayllet <> , c.10: Alocator*, c.10: Dispatch VerSet, c.10: ScalarType, c.10: ordinal <>) (in) (umfs]arsult coenscience and unproducts (later (1) 2 1 1 biblious 4 bit 3.10-2.17-e2 ▼ 565.9 MiB: M create storage (st) vector.h:395 2.3 GiB: at::detail::empty_cpu(c10::ArrayRef<>, c10::optional<>, c10::optional * 23 GBt at: detail: empty coulct0: ArrayRef<>, ct0: Scalarilpe, bool, ct0: reburel<>) (in prints larget repercence and project objects (bloomly 2.1 b) Linux Add; 13.10.2.17-2.05 (b) (bloomly couls) 2.1 GiB: at::native::empty coulc10::ArrayRef<>, c10::optional<>, c10::optional • 2.3 GB. abdetail:empty cpu(cD:AmayRef<>, cD:optional<>, cD:optional<>, cD:optional<>, cD:optional<>, cD:optional<>, cD:optional<>) in journal@aractiverscience.jrid optional ▼ 565.9 MiB: Vector base (stl vector.h:332) 2.1 GiB: c10::impl::wrap kernel functor unboxed <>::call(c10::OperatorKernel*, c10::DispatchKeySet, c10::ArrayRef<>, c10::optional<>, c10::optional 2.1 GB: at:native:empty gov[cl/chmayRef<>, cl/ccc/comal<>, cl/ccc/cmal<>, cl/ccc/cmal<>, cl/ccc/cmal<>, cl/ccc/cmal<>) (in |cmfs|asset operations) products (introducts) 2.1 GiB: at:: ops::empty memory format::redispatch/c10::DispatchKeySet, c10::ArrayRef<>, c10::optional<>, c10::optional<>, c10::optional 565.9 MiB: vector (st) vector.h:5981 2.1 GiB: c10::impl::wrap kernel functor unboxed <>::call/c10::OperatorKernel*, c10::DispatchKeySet, c10::ArrayRef<>, c10::optional<>, c 2.1.68: cl0:impl:imax lemel fundur unbowed cl0:informative imel, cl0:informative imel cl0:informative i 565.9 MiB: WireCell::Aux::SimpleTrace::SimpleTrace(int, int, std::vector<> const&) (SimpleTrace.cox:8) 2.1 GiB: at:: ops::empty memory format::call(c10::ArrayRef<>, c10::optional<>, c10::optional<>, c10::optional<>, c10::optional<>, c10::optional<> * 2.1 GR. st. ous:endo menos fomat:refssatch(cl):Dispatch(enset.cl):AmayRefo.cl):notional-o.cl): 2.1 GiB: at::emotv(c10::ArravRef<>, c10::TensorOptions, c10::optional<>) (in /cvmfs/larsoft.opensciencegrid.org/products/libtorch/v/s/larsoft.opensciencegrid.org/products/larsoft.opensciencegrid.org/products/larsoft.opensciencegrid.org/products/larsoft.opensciencegrid.org/products/larsoft.opensciencegrid.org/products/larsoft.opensciencegrid.org/products/larsoft.opensciencegrid.org/products/larsoft.opensciencegrid.org/products/larsoft.org/products/larsoft.opensciencegrid.org/products/larsoft.opensciencegrid.org/products/larsoft.org/products/larsoft.org/products/larsoft.org/products/larsoft.org/products/larsoft.org/products/larsoft.org/products/larsoft.org/products/larsoft.org/products/larsoft.org/products/larsoft.org/products/larsoft.org/products/larsoft.org/products/larsoft.org/products/larsoft.org/products/larsoft.org/products/larsoft.org/products/larsoft.org/products/l * 2.1 GB: CIC implication between functor unbowed local (clt.:Operatoritemell', clt::Obspationie)se, clt::ArrayReflox; cl0::optional(x); cl0::optional(x); cl1::optional(x); c * 357.6 Mile: WireCell:SinProc::OmnibusSinProc::save data/std::vector<>&.std::vector<>&.int.std::vector<> const&.std::vector<>&.std:: cxx11:: 2.1 GiB: at::native::(anonymous namespace)::compute_columns2d(at::Tensor const&, c10::ArrayRef<>, c10::ArrayRef<>, c10::ArrayRef > 2.1 GBt at: ous:endy memory formatical ICD: ArrayRefo, c.Ut:outional >, c.Ut:outional >, c.Ut:outional >, c.Ut:outional >, c.Ut:outional >) (in), confisians of in), confisians of incoming a confision of incoming a conf 2.1 GiB: at::native::slow_conv2d forward out_cou(at::Tensor const&, at::Tensor const&, c10::ArrayRef<>, c10::optional<> const + 93.0 MiB: WireCell::SigProc::OmnibusSigProc::operator()(std::shared_ptr<> const&, std::shared_ptr<>&) (OmnibusSigProc.:cox:1669) > 245.4 MB: at:rietal:empty coulcili:Arra/Ref<>, cilo:TensorOptions consts) (in journis/arsoft.openscienceprid org/products/laborch/V2_1 lb_Linux/Abit+3.10.2.17-2.6 fib/fibtorch couss) 2.1 GiB: at::native::slow_conv2d forward_cpu(at::Tensor_const&, at::Tensor_const&, c10::ArrayRef<>>, c10::optional<> const 117.2 MB: at:native:resize bytes cut(cl0:StorageImpl*, unsigned long) (in journ's larsoft operacience and comproducts (laborative 2.1.16), in un 64bit + 3.10-2.17-e26 (biflaturch course) 2.1 GIB: c10::impl::wrap kernel functor unboxed <>::call(c10::OperatorKernel*, c10::DispatchKeySet, at::Tensor const& > 71.5 MiB: WireCell::SigProc::OmnibusSigProc::operator()(std::shared ptr<> const&, std::shared ptr<>&) (OmnibusSigProc::oc::1678) 245.4 MiB: at::detail::empty_cpu(c10::ArrayRef<>, c10::TensorOptions const&) (in /cvmfs/larsoft.opensciencegrid.org/products/libtorch/v2 1 1b/Linuxl > 51.3 Milk caffe2:serialize:PyTordiStreamReader:qetRecord(std: cxx11:tesic stimp<> consta) in (confisiarisut operaciencegrid anglorobuts/filtorchyt2 1 lb(cinud4bit+3.10-2.17-e26/fb)fobrorh quusal * 117.2 MiB: at::native::resize_bytes_cpu(c10::StorageImpl*, unsigned long) (in /cvmfs/larsoft.opensciencegrid.org/products/libtorch/v2_1_1b/Linux64bit+3.10-2.17-e26/l > 57.2 MB: WireCell::SioProc::OmnibusSioProc::operator()(std::shared_ptr<> const&, std::shared_ptr<>&) (OmnibusSioProc.cox:1822) 952.1 ViB: alocate (new allocator fr:137) > 117.2 MiB: c10::TensorImpl* at::native:: resize impl <>(c10::TensorImpl*, c10::ArrayRef<>, c10::OptionalArrayRef<>, bool) (in Jovmfs/larsoft.opensciencegrid.org) 952.1 MiB: allocate (alloc traits.h:464) > 57.2 MiB: WireCell::SigProc::OmnibusSigProc::operator()/std::shared_ptr<> const&, std::shared_ptr<>&) (OmnibusSigProc.cox:1800) > 51.3 MiB: caffe2::serialize::PyTorchStreamReader::getRecord(std:: cxx11::basic string<> const&) (in /cvmfs/larsoft.opensciencegrid.org/products/libtorch/v2 1 1b/Lin 952.1 MiB: M allocate (stl vector.h:378) 1.4 GiB: allocate (new allocator.h:137) > 57.2 MiB: WireCell::SigProc::OmnibusSigProc::operator()/std::shared_ptr<> const&, std::shared_ptr<>&) (OmnibusSigProc.cox:1814) 952.1 MiB: M create storage (stl vector.h:395) 1.4 GiB: allocate (alloc traits.h:464) > 21.5 MiB: WireCell::SigProc::OmnibusSigProc::operator()(std::shared_ptr<> const&, std::shared_ptr<>&) (OmnibusSigProc.coc:1693) 1.4 GiB: M allocate (stl vector.h:378 952.1 MiB: Vector base (stl vector h:332) ▼ 1.4 GiB: M create storage (stl vector.h:395) 952.1 MiB: vector (stl vector h:598) 114.4 MiB: WireCell::SioProc::OmnibusSioProc::save morolistd::vector > 6. std::vector > 6. int. std::multimao >> const6.) (OmnibusSioProc.coc763 1.4 GiB: Vector base (stl vector.h:332) 952.1 MB: WireCel::Aux:SimpleTrace:SimpleTraceInt. int. std::vector<> const&) | SimpleTrace.cox3| 1.4 GiB: vector (stl vector.h:598) → 57.2 MiB: WireCell::SiaProc::OmnibusSiaProc::save roi(std::vector > 6, std::vector > 6, int. std::vector > 6) (OmnibusSiaProc.cocc612) * 5722 MB: WineCell-SurProc-OrnibusSurProcessive data(std:webtor ⇔ 6, std:webtor ⇔ 6, int. std:webtor ⇔ constá, std:webtor ⇔ 6, std:: cxcl1:basic string ⇒ constá, bobl (OrnibusSurProc.cxc512) 1.4 GiB: WireCell::Aux::SimpleTrace::SimpleTrace(int. int. std::vector<> const&) (SimpleTrace.cxx:8) > 114.4 MB: WreCel:SigProc:OmnbusSigProc:operator()(std:shared.ptr > consté, std:shared.ptr > 6/ (OmnbusSigProc.coc:1022) 36.6 MiB: Construct<> (stl construct.h:119) 858.3 MiB: WireCell::SigProc::OmnibusSigProc::save_data(std::vector<>&, std::vector<>&, int, std::vector<> const&, std::vector<>&, std:: cxx11::b > 171.7 MiB: WireCell::SigProc::OmnibusSigProc::operator()(std::shared ptr<> const&, std::shared ptr<>&) (OmnibusSigProc.cxx:1822) > 114.4 MB: WreCel:SuProc:OmnibusSuProc:operator()(std:shared ptr > consté, std:shared ptr > 6) (OmnibusSuProc:coc:1669) 359.5 MiB: TStorage::ReAllocChar(char*, unsigned long, unsigned long) (TStorage.cxx:283) > 171.7 MiB: WireCell::SigProc::OmnibusSigProc::operator()(std::shared_ptr<> const&, std::shared_ptr<>&) (OmnibusSigProc.cxx:1669) → 114.4 MB: WreCel:SigProc:OmnibusSigProc:operator()/std:shared.ptr<> consti, std:shared.ptr<>6//>6/ (OmnibusSigProc.cor.1800) 171.7 MiB: WireCell::SioProc::OmnibusSioProc::operator()(std::shared_ptr<> const&, std::shared_ptr<>&) (OmnibusSioProc.cxx:1800) 228.9 MiB: allocate (new allocator.h:137) > 114.4 MB: WireCel:SupProc:OmnibusSupProc:operator()/std:shared.ptr > constit, std:shared.ptr > 6/ | OmnibusSupProc.coc.1814) > 171.7 MiB: WireCell::SigProc::OmnibusSigProc::operator()(std::shared_ptr<> const&, std::shared_ptr<>&) (OmnibusSigProc.cxx:1814) > 71.5 WB: WireCell:SupProc:OrmibusSupProc:operator()(std::shared ptr<> const6, std::shared ptr<>6| (OrmibusSupProc.oox.1678) 107.3 MiB: WireCell::SigProc::OmnibusSigProc::operator()(std::shared_ptr<> const&, std::shared_ptr<>&) (OmnibusSigProc.cxx:1678) 228.9 MiB: allocate (new allocator h: 137) > 64.4 MiB: WireCell::SigProc::OmnibusSigProc::operator()(std::shared_ptr<> const&, std::shared_ptr<>&) (OmnibusSigProc.:cxx:1693) 42.9 MiR: in 1 place, below massiffs threshold (1.00%) 207.8 MiB: in 22540 places, all below massif's threshold (1.00%) 343.3 MiB: WireCell::SigProc::OmnibusSigProc::save mproi[std::vector<>&, std::vector<>&, int, std::multimap<> const&) (OmnibusSigProc.:coc:763) > 228.9 MiB: WireCell:SigProc:OmnibusSigProc:save mpmi(std:vector>6, std:vector>6, int, std:multimap<> const6) (OmnibusSigProc.coc:763) ▶ 171.7 MiB: WireCell::SigProc::OmnibusSigProc::save roi(std::vector<>&, std::vector<>&, int, std::vector<>&) (OmnibusSigProc.cxx:612) 114.4 MB: WineCell-SinProc:OmnibusSinProc:save milistri-vector-o-6, std:vector-o-6, int. std:vector-o-6 i/OmnibusSinProc.com(12) 71.5 MiB: aligned malloc (Memory.h:216) > 73.2 MiB: Construct<> (stl construct.h:119) 36.6 MB: in 1 place, below massifs threshold |1.00%| 359.5 MiB: TStorage::ReAllocChar(char*, unsigned long, unsigned long) (TStorage.cxx:283) 53.6 MiB: aligned malloc (Memory:h:216) 359.5 MB: TStorage: ReAllocChar(char*, unsigned long, unsigned long) [TStorage.cox 283] > 359.5 MiB: TBuffer::Expand(int. bool) (TBuffer.cxx:242) 228.9 MB: allocate (new allocatoch: 137) 51.3 MB: c10::alloc cpu(unsigned long) (in /cvmfs/larsoft.opensciencegrid.org/products/libtorch/v2 1 1b/Linux64bit+3.10-2.17-e26/lib/libc10.so) > 228.9 MiB: allocate (new allocator.h:137) > 228.9 MiB: allocate (new allocator.h:137) 228.9 MR: allocate (new allocatoch: 137) 35.8 MiB: aligned malloc (Memory.h:216) 220.9 MiB: in 22544 places, all below massifs threshold (1.00% 2nd peak low torch activity 1st peak