

Towards performance benchmarks for VT26 on Virgo

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07/08/2026

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Example output on VIRGO – Event-based

Unpacking

```
Unpack
  Memcpy(h2d): 0.000 ms
  Memcpy(d2h): 0.000 ms
  Memset: 0.000 ms
  TRD2D
    Memcpy(h2d): 0.000 ms
    Memcpy(d2h): 0.000 ms
    Memset: 0.000 ms
    Sort: 0.002 ms
    Resize: 0.000 ms
    Merge: 0.016 ms
    Unpack: 0.145 ms
    Wall time: 0.179 ms
  TRD
    Memcpy(h2d): 0.000 ms
    Memcpy(d2h): 0.000 ms
    Memset: 0.000 ms
    Sort: 12.940 ms ( 8.803 GB/s)
    Resize: 0.013 ms
    Merge: 8.548 ms ( 13.327 GB/s)
    Unpack: 229.386 ms ( 0.497 GB/s)
    Wall time: 251.302 ms ( 0.453 GB/s)
  TOF
    Memcpy(h2d): 0.000 ms
    Memcpy(d2h): 0.000 ms
    Memset: 0.000 ms
    Sort: 9.053 ms ( 13.621 GB/s)
    Resize: 0.015 ms
    Merge: 9.258 ms ( 13.319 GB/s)
    Unpack: 162.075 ms ( 0.634 GB/s)
    Wall time: 190.355 ms ( 0.540 GB/s)
  STS
    Memcpy(h2d): 0.000 ms
    Memcpy(d2h): 0.000 ms
    Memset: 0.000 ms
    Sort: 37.025 ms ( 6.696 GB/s)
    Resize: 0.036 ms
    Merge: 18.497 ms ( 13.402 GB/s)
    Unpack: 928.358 ms ( 0.267 GB/s)
    Wall time: 984.435 ms ( 0.252 GB/s)
  MUCH
    Memcpy(h2d): 0.000 ms
    Memcpy(d2h): 0.000 ms
    Memset: 0.000 ms
    Sort: 0.001 ms
    Resize: 0.000 ms
    Merge: 0.019 ms
    Unpack: 0.049 ms
    Wall time: 0.087 ms
  RICH
    Memcpy(h2d): 0.000 ms
    Memcpy(d2h): 0.000 ms
    Memset: 0.000 ms
    Sort: 0.001 ms
    Resize: 0.000 ms
    Merge: 0.017 ms
    Unpack: 0.043 ms
    Wall time: 0.066 ms
  BMON
    Memcpy(h2d): 0.000 ms
    Memcpy(d2h): 0.000 ms
    Memset: 0.000 ms
    Sort: 3.342 ms ( 3.609 GB/s)
    Resize: 0.015 ms
    Merge: 1.132 ms ( 10.649 GB/s)
    Unpack: 19.943 ms ( 0.403 GB/s)
    Wall time: 24.706 ms ( 0.325 GB/s)
  Wall time: 1517.446 ms ( 0.311 GB/s)
```

Trigger and EventReco

```
TimeClusterTrigger
  Memcpy(h2d): 0.000 ms
  Memcpy(d2h): 0.000 ms
  Memset: 0.000 ms
  Wall time: 7.291 ms ( 5.638 GB/s)
EventBuilder
  Memcpy(h2d): 0.000 ms
  Memcpy(d2h): 0.000 ms
  Memset: 0.000 ms
  Wall time: 370.933 ms ( 1.340 GB/s)
EventReco
  Memcpy(h2d): 0.000 ms
  Memcpy(d2h): 0.000 ms
  Memset: 0.000 ms
  CA: 773.177 ms ( 0.041 GB/s)
  BuildHits: 2596.996 ms ( 0.003 GB/s)
  DigiModuleSort: 67.246 ms
  ToFHitfind: 34.748 ms ( 0.064 GB/s)
  ToFHitfindChanSort: 3.390 ms
  ToFCalibrate: 25.413 ms ( 0.094 GB/s)
  Sort Hits: 5.287 ms
  Flatten Digis: 3.507 ms ( 2.074 GB/s)
  Allocate: 286.113 ms
  Flatten Hits: 47.043 ms ( 0.322 GB/s)
  Count Digis By Module: 7.997 ms ( 0.910 GB/s)
  Wall time: 4263.779 ms
Total
  Memcpy(h2d): 0.000 ms
  Memcpy(d2h): 0.000 ms
  Memset: 0.000 ms
  Kernel time: 0.000 ms
  Wall time: 6178.954 ms ( 0.076 GB/s)
[13:41:27] INFO: Total Processing time (Wall): 19138 ms
```

Results for CPU scaling on VIRGO – Event-based

- Recent Cbmroot, including „tracking window“
- Setup from /lustre/cbm/users/szharko/vt/vt26/pars_vt26/
- „exclusive“ used for „work“ partition (nodes ccexe0131, ccexe0148)
- Largest contribution from BuildHits!

NODELIST	CPUS	MEMORY	AVAIL_FEATURES
ccexe[0131,0148]	256	772000	amd,epyc,9555,main_long

Num. of OpenMP threads	Unpack wall time (in ms)	BuildHits runtime (in ms)	CA runtime (in ms)	Total wall time (in ms), rate
1	2317	143730	51348	231492 (0.002 GB/s)
2	2012	73377	26728	119962 (0.004 GB/s)
4	1780	36683	13548	61313 (0.008 GB/s)
8	1677	18455	6919	32059 (0.015 GB/s)
16	1630	9448	3539	17511 (0.027 GB/s)
32	1572	4840	1696	9811 (0.048 GB/s)
64	1517	2596	773	6178 (0.076 GB/s)
128	1508	1436	430	4703 (0.100 GB/s)
256	1710	1160	304	4497 (0.105 GB/s)

Reco steps:

Unpack

DigiTrigger

EventReco

KfpSelector



Not visible

Example output on VIRGO – Time-based

Unpacking

```
Unpack
Memcpy(h2d):      0.000 ms
Memcpy(d2h):      0.000 ms
Memset:           0.000 ms
TRD2D
Memcpy(h2d):      0.000 ms
Memcpy(d2h):      0.000 ms
Memset:           0.000 ms
Sort:            0.002 ms
Resize:          0.000 ms
Merge:           0.019 ms
Unpack:          0.113 ms
Wall time:       0.149 ms
TRD
Memcpy(h2d):      0.000 ms
Memcpy(d2h):      0.000 ms
Memset:           0.000 ms
Sort:           14.853 ms ( 7.669 GB/s)
Resize:          0.014 ms
Merge:          11.337 ms ( 10.048 GB/s)
Unpack:        220.619 ms ( 0.516 GB/s)
Wall time:     247.151 ms ( 0.461 GB/s)
TOF
Memcpy(h2d):      0.000 ms
Memcpy(d2h):      0.000 ms
Memset:           0.000 ms
Sort:           13.772 ms ( 8.954 GB/s)
Resize:          0.014 ms
Merge:          11.109 ms ( 11.100 GB/s)
Unpack:        160.952 ms ( 0.638 GB/s)
Wall time:     194.211 ms ( 0.529 GB/s)
STS
Memcpy(h2d):      0.000 ms
Memcpy(d2h):      0.000 ms
Memset:           0.000 ms
Sort:           41.731 ms ( 5.941 GB/s)
Resize:          0.040 ms
Merge:          18.707 ms ( 13.252 GB/s)
Unpack:        931.303 ms ( 0.266 GB/s)
Wall time:     992.238 ms ( 0.250 GB/s)
MUCH
Memcpy(h2d):      0.000 ms
Memcpy(d2h):      0.000 ms
Memset:           0.000 ms
Sort:           0.002 ms
Resize:          0.000 ms
Merge:           0.016 ms
Unpack:          0.041 ms
Wall time:       0.075 ms
RICH
Memcpy(h2d):      0.000 ms
Memcpy(d2h):      0.000 ms
Memset:           0.000 ms
Sort:           0.000 ms
Resize:          0.000 ms
Merge:           0.016 ms
Unpack:          0.079 ms
Wall time:       0.102 ms
BMON
Memcpy(h2d):      0.000 ms
Memcpy(d2h):      0.000 ms
Memset:           0.000 ms
Sort:           3.277 ms ( 3.680 GB/s)
Resize:          0.012 ms
Merge:           1.132 ms ( 10.656 GB/s)
Unpack:        22.462 ms ( 0.358 GB/s)
Wall time:       27.149 ms ( 0.296 GB/s)
Wall time:     1524.647 ms ( 0.310 GB/s)
```

Time-based Reco

```
STS Reco
Memcpy(h2d):      0.000 ms
Memcpy(d2h):      0.000 ms
Memset:           6.522 ms ( 20.149 GB/s)
Sort Hits:       9.379 ms
Flatten Digis:   6.662 ms ( 37.216 GB/s)
Allocate:        0.052 ms
Flatten Hits:    4.431 ms (110.077 GB/s)
Count Digis By Module: 3.040 ms ( 81.553 GB/s)
sts::SortDigis:  103.602 ms ( 2.393 GB/s)
sts::ChannelOffsets: 1.559 ms (159.017 GB/s)
sts::CreateDigiConnections: 301.054 ms ( 0.823 GB/s)
sts::CreateClusters: 363.966 ms ( 0.681 GB/s)
sts::SortClusters: 18.469 ms ( 4.504 GB/s)
sts::FindHits:   99.742 ms ( 2.502 GB/s)
Kernel time:     888.392 ms ( 0.279 GB/s)
Wall time:       918.884 ms ( 0.270 GB/s)
TOF Reco
Memcpy(h2d):      0.000 ms
Memcpy(d2h):      0.000 ms
Memset:           0.000 ms
TofHitfind:      12.343 ms ( 8.906 GB/s)
TofHitfindChanSort: 76.226 ms
TofCalibrate:     294.718 ms ( 0.418 GB/s)
Wall time:       402.073 ms ( 0.307 GB/s)
TRD Reco
Memcpy(h2d):      0.000 ms
Memcpy(d2h):      0.000 ms
Memset:           0.000 ms
BuildHits:       37.567 ms ( 3.032 GB/s)
DigiModuleSort:  432.377 ms
Wall time:       521.277 ms ( 0.219 GB/s)
CA
Memcpy(h2d):      0.000 ms
Memcpy(d2h):      0.000 ms
Memset:           0.000 ms
CA:              1645.253 ms ( 0.296 GB/s)
Wall time:       1765.841 ms ( 0.470 GB/s)
```

Trigger and EventReco

```
CA
Memcpy(h2d):      0.000 ms
Memcpy(d2h):      0.000 ms
Memset:           0.000 ms
CA:              1645.253 ms ( 0.296 GB/s)
Wall time:       1765.841 ms ( 0.470 GB/s)
TimeClusterTrigger
Memcpy(h2d):      0.000 ms
Memcpy(d2h):      0.000 ms
Memset:           0.000 ms
Wall time:       7.347 ms ( 5.594 GB/s)
EventBuilder
Memcpy(h2d):      0.000 ms
Memcpy(d2h):      0.000 ms
Memset:           0.000 ms
Wall time:       366.430 ms ( 1.357 GB/s)
EventReco
Memcpy(h2d):      0.000 ms
Memcpy(d2h):      0.000 ms
Memset:           0.000 ms
CA:              753.013 ms ( 0.042 GB/s)
BuildHits:       2500.168 ms ( 0.003 GB/s)
DigiModuleSort:  46.669 ms
TofHitfind:      33.635 ms ( 0.066 GB/s)
TofHitfindChanSort: 3.215 ms
TofCalibrate:     24.944 ms ( 0.096 GB/s)
Sort Hits:       4.844 ms
Flatten Digis:   3.380 ms ( 2.152 GB/s)
Allocate:        281.514 ms
Flatten Hits:    46.345 ms ( 0.326 GB/s)
Count Digis By Module: 5.053 ms ( 1.440 GB/s)
Wall time:       4220.671 ms
Total
Memcpy(h2d):      0.000 ms
Memcpy(d2h):      0.000 ms
Memset:           6.522 ms ( 20.149 GB/s)
Kernel time:     888.392 ms ( 0.532 GB/s)
Wall time:       9774.372 ms ( 0.048 GB/s)
[13:52:23] INFO: Total Processing time (Wall): 22912 ms
```

Results for CPU on VIRGO - Time-based

- „exclusive“ used for „work“ partition (nodes ccexe0131)
- Largest contribution from **BuildHits in EventReco** step
- No proper scaling from 128 to 256 threads

Reco steps:

Unpack
DigiTrigger
LocalReco
Tracking
EventReco
KfpSelector

Num. of OpenMP threads	CA runtime (before EventReco)	BuildHits (in EventReco)	CA runtime (in EventReco)	Total wall time (in ms), rate
1	18130	143400	51427	278210 (0.002 GB/s)
2	10216	72412	26476	149413 (0.003 GB/s)
4	5944	36020	13279	78060 (0.006 GB/s)
8	3619	18377	6864	42488 (0.011 GB/s)
16	2441	9433	3562	24278 (0.019 GB/s)
32	1897	4788	1691	14368 (0.033 GB/s)
64	1645	2500	753	9774 (0.048 GB/s)
128	1568	1820	420	8323 (0.057 GB/s)
256	1707	1294	626	8395 (0.056 GB/s)