

# TRD Memory Usage for mCBM digitisation

Adriana Rujo-Nan  
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# Problem:

```
root -l '$VMCWORKDIR/macro/mcbm/mcbm_digi.C(1000,
"/home/adriana/data/mcbmSimulations/benchmark", 1.e7, 1.e7, 0)'
```

```
adriana@Monster2: ~
```

```
[INFO] TrdDigitize: Finsh run
[INFO] TrdDigitize: Processing analogue buffers
[INFO] TrdDigitize: 251 digits created and sent to DAQ
[INFO] TrdDigitize: Run summary
[INFO] =====
[WARN] FairRootManager::GetOutFile() deprecated. Use separate file to store additional data.

[INFO] =====
[INFO] TofDigitize: Run summary (Time includes Hist filling)
[INFO] Events processed : 16
[INFO] TofPoint / event : 83.9
[INFO] TofDigl / event : 32.6
[INFO] Digits per point : 0.388558
[INFO] Real time per event : 8.82149e-05 s
[INFO] cbmTofDigitize::WriteHists == Control histograms will not be written to disk!
[INFO] cbmTofDigitize::WriteHists == To change this behavlor please provide a full path with the SetHistoFileName method
[INFO] =====

[INFO] Daq: Finish run
[INFO] Buffer status: 1537 data from t = 168.115 to 7834 ns
STS Status DAQ buffer: 788 data from t = 1002 to 2305 ns
RICH Status DAQ buffer: 15 data from t = 168.115 to 2289.24 ns
TRD Status DAQ buffer: 408 data from t = 1800 to 7834 ns
TOF Status DAQ buffer: 326 data from t = 1809.93 to 2317.46 ns
[INFO] Daq: Closing Time slice [0, 10000000] ns, data: [168.115, 7834.000] ns, STS 788 RICH 15 TRD 408 TOF 326 , MC events 11
[INFO] Daq Buffer status: empty

[INFO] =====
[INFO] Daq: Run summary
[INFO] Events: 10
[INFO] Digits: 1537 from 168.1 ns to 7834.0 ns
[INFO] Digits ignored: 0
[INFO] Time slices: 1 from 0.0 ns to 10000000.0 ns
[INFO] Empty slices: 0
[INFO] =====

[INFO] MCEventList: 10 MC events in list

[INFO] CbmDigitization: Run finished.
[INFO] CbmDigitization: Output file is /home/adriana/data/mcbmSimulations/benchmark.raw.root
[INFO] CbmDigitization: Parameter file is /home/adriana/data/mcbmSimulations/benchmark.par.root
[INFO] =====

[INFO] CbmDigitization: CPU consumption
[INFO] -I DELETING fSpectrum

Macro finished successfully.
Output file is /home/adriana/data/mcbmSimulations/benchmark.raw.root
Parameter file is /home/adriana/data/mcbmSimulations/benchmark.par.root
Real time 0.7792 s, CPU time 0.74 s
```

```
root -l '$VMCWORKDIR/macro/mcbm/mcbm_digi.C(1000,
"/home/adriana/data/mcbmSimulations/benchmark", 1.e7, 1.e4, 0)'
```

```
adriana@Monster2: ~
```

```
[INFO] Daq Buffer status: 134706 data from t = 1.025e+07 to 1.05262e+07 ns
[INFO] Daq Buffer status: 129814 data from t = 1.026e+07 to 1.05262e+07 ns
[INFO] Daq Buffer status: 125006 data from t = 1.027e+07 to 1.05262e+07 ns
[INFO] Daq Buffer status: 120807 data from t = 1.028e+07 to 1.05262e+07 ns
[INFO] Daq Buffer status: 115249 data from t = 1.029e+07 to 1.05262e+07 ns
[INFO] Daq Buffer status: 110458 data from t = 1.03e+07 to 1.05262e+07 ns
[INFO] Daq Buffer status: 105592 data from t = 1.031e+07 to 1.05262e+07 ns
[INFO] Daq Buffer status: 100822 data from t = 1.032e+07 to 1.05262e+07 ns
[INFO] Daq Buffer status: 95959 data from t = 1.033e+07 to 1.05262e+07 ns
[INFO] Daq Buffer status: 91116 data from t = 1.034e+07 to 1.05262e+07 ns
[INFO] Daq Buffer status: 86236 data from t = 1.035e+07 to 1.05262e+07 ns
[INFO] Daq [ 0.092 s] Transported digits: 82793, Buffer status: 86236 data from t = 1.035e+07 to 1.05262e+07 ns

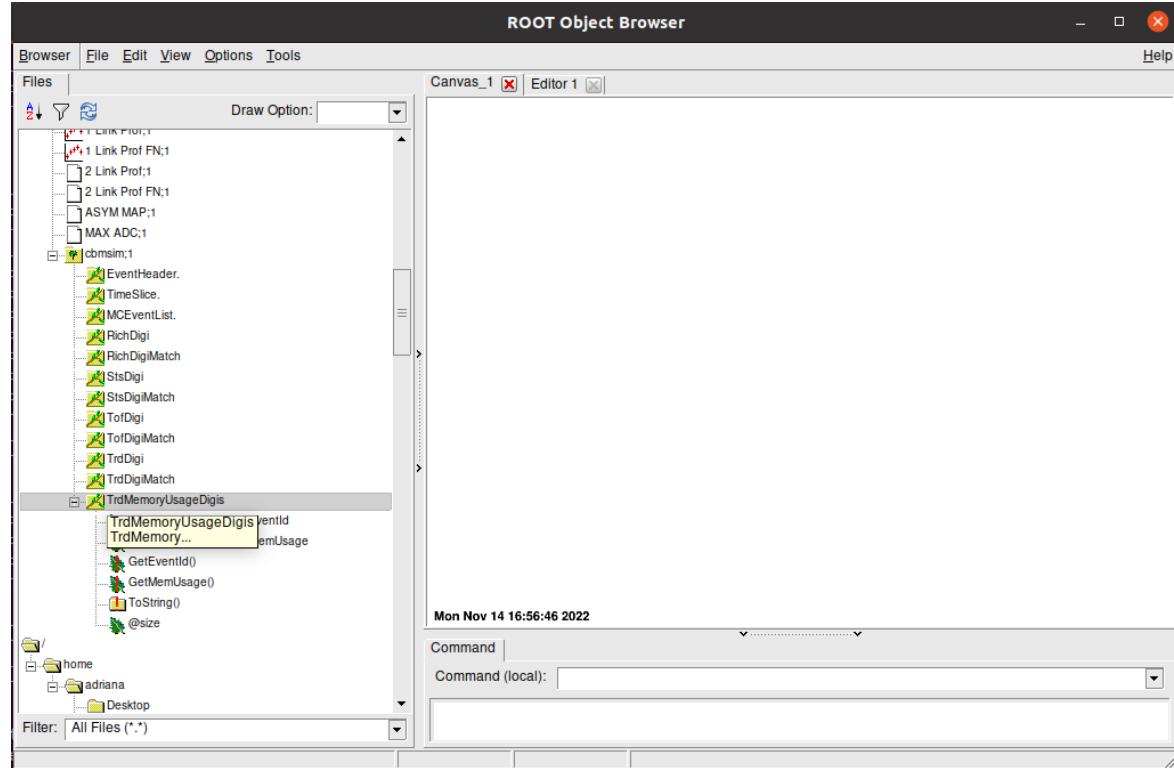
[INFO] StsDigitize: Finlsh run
[INFO] StsDigitize: 438 signals in analogue buffers ( from 10525372.408 ns to 10526202.295 ns )
[INFO] StsDigitize: Processing analogue buffers
[INFO] StsDigitize: 436 digits created and sent to DAQ ( from 10525365.000 ns to 10526210.000 ns )
[INFO] StsDigitize: 0 signals in analogue buffers

[INFO] =====
[INFO] StsDigitize: Run summary
[INFO] Events processed : 100
[INFO] Points processed / evt : 3.5
[INFO] Points ignored / evt : 0.0
[INFO] Signals / event : 17.07 / 17.19
[INFO] StsDigl / event : 51506.9
[INFO] Digits per point : 14886.4
[INFO] Digits per signal : 1503.41
[INFO] Noise digits / event : 52400.7
[INFO] Noise fraction : 1.01735
[INFO] Real time per event : 0.0623148 s
[INFO] =====

[INFO] =====
[INFO] RichDigitize: Run summary
[INFO] Events processed : 100
[INFO] RichPoint / event : 8
[INFO] RichDigl / event : 216.27
[INFO] Digits per point : 25.9006
[INFO] Real time per event : 0.0102444 s
[INFO] =====
[INFO] TrdDigitize: Finish run
[INFO] TrdDigitize: Processing analogue buffers
[adriana@monster2: ~]
```

# Development

- Added new class to cbmroot (CbmTrdMemoryUsage)
- CbmTrdMemoryUsage contains:
  - EventId
  - MemoryUsage
- Added new class to “core/data/CmakeLists.txt” and “core/data/CbmDataLinkDef.h” in order for it to be recognized
- Added a new branch to the output of the mcbm\_digi macro run (**TrdMemoryUsageDigis**)
- Added the current memory usage to a buffer, after each run of the exec function of CbmTrdDigitizer – the processing of each event (also added the memory usage value – as human readable - at the end of the log message)
- When filling each timeslice with data, the buffer containing memory usage values is read and written to the newly added branch



# Results

```

root [6] cbmsim->Scan("TrdMemoryUsageDigis.eventId:TrdMemoryUsageDigis.memUsage", "Entry$==1")
*****
* Row * Instance * TrdMemory * TrdMemory *
*****
* 1 * 0 * 0 * 6991380948 *
* 1 * 1 * 1 * 716505088 * Type <CR> to continue or q to quit ==
* 1 * 2 * 2 * 730021888 * 1 * 50 * 50 * 1.272e+0
* 1 * 3 * 3 * 732454912 * 1 * 51 * 51 * 1.273e+0
* 1 * 4 * 4 * 739753984 * 1 * 52 * 52 * 1.274e+0
* 1 * 5 * 5 * 755433472 * 1 * 53 * 53 * 1.303e+0
* 1 * 6 * 6 * 768139264 * 1 * 54 * 54 * 1.343e+0
* 1 * 7 * 7 * 777330688 * 1 * 55 * 55 * 1.368e+0
* 1 * 8 * 8 * 792739840 * 1 * 56 * 56 * 1.379e+0
* 1 * 9 * 9 * 818151424 * 1 * 57 * 57 * 1.383e+0
* 1 * 10 * 10 * 819503104 * 1 * 58 * 58 * 1.432e+0
* 1 * 11 * 11 * 850862080 * 1 * 59 * 59 * 1.454e+0
* 1 * 12 * 12 * 851402752 * 1 * 60 * 60 * 1.459e+0
* 1 * 13 * 13 * 865730560 * 1 * 61 * 61 * 1.460e+0
* 1 * 14 * 14 * 871137280 * 1 * 62 * 62 * 1.461e+0
* 1 * 15 * 15 * 874110976 * 1 * 63 * 63 * 1.461e+0
* 1 * 16 * 16 * 895197184 * 1 * 64 * 64 * 1.465e+0
* 1 * 17 * 17 * 907362304 * 1 * 65 * 65 * 1.467e+0
* 1 * 18 * 18 * 912498688 * 1 * 66 * 66 * 1.486e+0
* 1 * 19 * 19 * 941424640 * 1 * 67 * 67 * 1.499e+0
* 1 * 20 * 20 * 947642368 * 1 * 68 * 68 * 1.505e+0
* 1 * 21 * 21 * 959537152 * 1 * 69 * 69 * 1.506e+0
* 1 * 22 * 22 * 967106560 * 1 * 70 * 70 * 1.507e+0
* 1 * 23 * 23 * 1.001e+09 * 1 * 71 * 71 * 1.513e+0
* 1 * 24 * 24 * 1.002e+09 * 1 * 72 * 72 * 1.513e+0
Type <CR> to continue or q to quit ==
* 1 * 25 * 25 * 1.002e+09 * 1 * 73 * 73 * 1.531e+0
* 1 * 26 * 26 * 1.011e+09 * 1 * 74 * 74 * 1.534e+0
* 1 * 27 * 27 * 1.035e+09 * Type <CR> to continue or q to quit ==
* 1 * 28 * 28 * 1.064e+09 * 1 * 75 * 75 * 1.540e+0
* 1 * 29 * 29 * 1.066e+09 * 1 * 76 * 76 * 1.546e+0
* 1 * 30 * 30 * 1.068e+09 * 1 * 77 * 77 * 1.554e+0
* 1 * 31 * 31 * 1.081e+09 * 1 * 78 * 78 * 1.572e+0
* 1 * 32 * 32 * 1.100e+09 * 1 * 79 * 79 * 1.607e+0
* 1 * 33 * 33 * 1.106e+09 * 1 * 80 * 80 * 1.608e+0
* 1 * 34 * 34 * 1.129e+09 * 1 * 81 * 81 * 1.610e+0
* 1 * 35 * 35 * 1.141e+09 * 1 * 82 * 82 * 1.637e+0
* 1 * 36 * 36 * 1.146e+09 * 1 * 83 * 83 * 1.663e+0
* 1 * 37 * 37 * 1.150e+09 * 1 * 84 * 84 * 1.700e+0
* 1 * 38 * 38 * 1.154e+09 * 1 * 85 * 85 * 1.715e+0
* 1 * 39 * 39 * 1.160e+09 * 1 * 86 * 86 * 1.719e+0
* 1 * 40 * 40 * 1.171e+09 * 1 * 87 * 87 * 1.723e+0
* 1 * 41 * 41 * 1.176e+09 * 1 * 88 * 88 * 1.723e+0
* 1 * 42 * 42 * 1.180e+09 * 1 * 89 * 89 * 1.725e+0
* 1 * 43 * 43 * 1.190e+09 * 1 * 90 * 90 * 1.735e+0
* 1 * 44 * 44 * 1.202e+09 * 1 * 91 * 91 * 2.605e+0
* 1 * 92 * 92 * 2.605e+0
* 1 * 93 * 93 * 2.605e+0
* 1 * 94 * 94 * 2.605e+0
* 1 * 95 * 95 * 2.605e+0
* 1 * 96 * 96 * 2.605e+0
* 1 * 97 * 97 * 2.605e+0
* 1 * 98 * 98 * 2.605e+0
* 1 * 99 * 99 * 2.423e+0

```

```

StsDigitize [0.188 s] Points: processed 4, ignored 0, signals: 12 / 13, digis: 162520
+ RichDigitize: Event 84 at 9784264.591 ns, points: 0, digis: 635. Exec time 0.000931 s.
+ TrdDigitize: Event 84 at 9784264.591 ns, points: 16, digis: 28. Exec time 0.000613 s. MemoryUsage Trd: 1703MB
+ TofDigitize: Event 84 at 9784264.591 ns, points: 80, digis: 31. Exec time 0.000109 s.
Daq [0.000 s] Transported digis: 0, Buffer status: 4811361 data from t = 997 to 9.78429e+06 ns

DigitizationSource: Event 85 at t = 9925857.610 ns from input 0 (entry 85)
+ StsDigitize: Generated 70670 noise signals from t = 9.78426e+06 ns to 9.92586e+06 ns
StsDigitize [0.071 s] Points: processed 2, ignored 0, signals: 5 / 4, digis: 69419
+ RichDigitize: Event 85 at 9925857.610 ns, points: 0, digis: 307. Exec time 0.000590 s.
+ TrdDigitize: Event 85 at 9925857.610 ns, points: 14, digis: 64. Exec time 0.006351 s. MemoryUsage Trd: 1719MB
+ TofDigitize: Event 85 at 9925857.610 ns, points: 100, digis: 33. Exec time 0.000110 s.
Daq [0.000 s] Transported digis: 0, Buffer status: 4881184 data from t = 997 to 9.92589e+06 ns

DigitizationSource: Event 86 at t = 9960259.043 ns from input 0 (entry 86)
+ StsDigitize: Generated 17176 noise signals from t = 9.92586e+06 ns to 9.96026e+06 ns
StsDigitize [0.017 s] Points: processed 0, ignored 0, signals: 0 / 0, digis: 16884
+ RichDigitize: Event 86 at 9960259.043 ns, points: 0, digis: 80. Exec time 0.000236 s.
+ TrdDigitize: Event 86 at 9960259.043 ns, points: 6, digis: 0. Exec time 0.003436 s. MemoryUsage Trd: 1723MB
+ TofDigitize: Event 86 at 9960259.043 ns, points: 71, digis: 29. Exec time 0.000139 s.
Daq [0.000 s] Transported digis: 0, Buffer status: 4898177 data from t = 997 to 9.96028e+06 ns

DigitizationSource: Event 87 at t = 9995383.666 ns from input 0 (entry 87)
+ StsDigitize: Generated 17523 noise signals from t = 9.96026e+06 ns to 9.99538e+06 ns
StsDigitize [0.018 s] Points: processed 10, ignored 0, signals: 40 / 38, digis: 17194
+ RichDigitize: Event 87 at 9995383.666 ns, points: 0, digis: 78. Exec time 0.000212 s.
+ TrdDigitize: Event 87 at 9995383.666 ns, points: 27, digis: 0. Exec time 0.009208 s. MemoryUsage Trd: 1727MB
+ TofDigitize: Event 87 at 9995383.666 ns, points: 120, digis: 57. Exec time 0.000144 s.
Daq [0.000 s] Transported digis: 0, Buffer status: 4915506 data from t = 997 to 9.99555e+06 ns

DigitizationSource: Event 88 at t = 9997946.081 ns from input 0 (entry 88)
+ StsDigitize: Generated 1357 noise signals from t = 9.99538e+06 ns to 9.99795e+06 ns
StsDigitize [0.004 s] Points: processed 4, ignored 0, signals: 14 / 15, digis: 1347
+ RichDigitize: Event 88 at 9997946.081 ns, points: 0, digis: 6. Exec time 0.000066 s.
+ TrdDigitize: Event 88 at 9997946.081 ns, points: 11, digis: 118. Exec time 0.007107 s. MemoryUsage Trd: 1727MB
+ TofDigitize: Event 88 at 9997946.081 ns, points: 80, digis: 29. Exec time 0.000090 s.
Daq [0.000 s] Transported digis: 0, Buffer status: 4917006 data from t = 997 to 9.99797e+06 ns

DigitizationSource: Event 89 at t = 10011471.191 ns from input 0 (entry 89)
+ StsDigitize: Generated 6726 noise signals from t = 9.99795e+06 ns to 1.00115e+07 ns
StsDigitize [0.009 s] Points: processed 4, ignored 0, signals: 28 / 27, digis: 6676
+ RichDigitize: Event 89 at 10011471.191 ns, points: 0, digis: 32. Exec time 0.000114 s.
+ TrdDigitize: Event 89 at 10011471.191 ns, points: 16, digis: 63. Exec time 0.008959 s. MemoryUsage Trd: 1728MB
+ TofDigitize: Event 89 at 10011471.191 ns, points: 85, digis: 31. Exec time 0.000130 s.
Daq [0.000 s] Transported digis: 0, Buffer status: 4923808 data from t = 997 to 1.00115e+07 ns

DigitizationSource: Event 90 at t = 10114740.793 ns from input 0 (entry 90)
+ StsDigitize: Generated 51366 noise signals from t = 1.00115e+07 ns to 1.01147e+07 ns
StsDigitize [0.050 s] Points: processed 10, ignored 0, signals: 25 / 27, digis: 50466
+ RichDigitize: Event 90 at 10114740.793 ns, points: 0, digis: 229. Exec time 0.000365 s.
+ TrdDigitize: Event 90 at 10114740.793 ns, points: 29, digis: 66. Exec time 0.009053 s. MemoryUsage Trd: 1739MB
+ TofDigitize: Event 90 at 10114740.793 ns, points: 154, digis: 53. Exec time 0.000179 s.

```

# Results

