JTuneHV Revision

Summary

- Plotting removed from JTuneHV.sh

- Several modifications of JTuneHV.cc:

  1. JTuneHV no longer looks up vendor high-voltages for failures
  2. Sets result for failed evaluations to zero
  3. Inter-/extrapolation moved entirely to `interpolator` data structure

- Three new applications:

  1. JPrintTuneHV.cc
     - For printing JSON output of JTuneHV
     - Can be used to write out all entries with the FAILED label (other than dead modules) to a separate JSON file

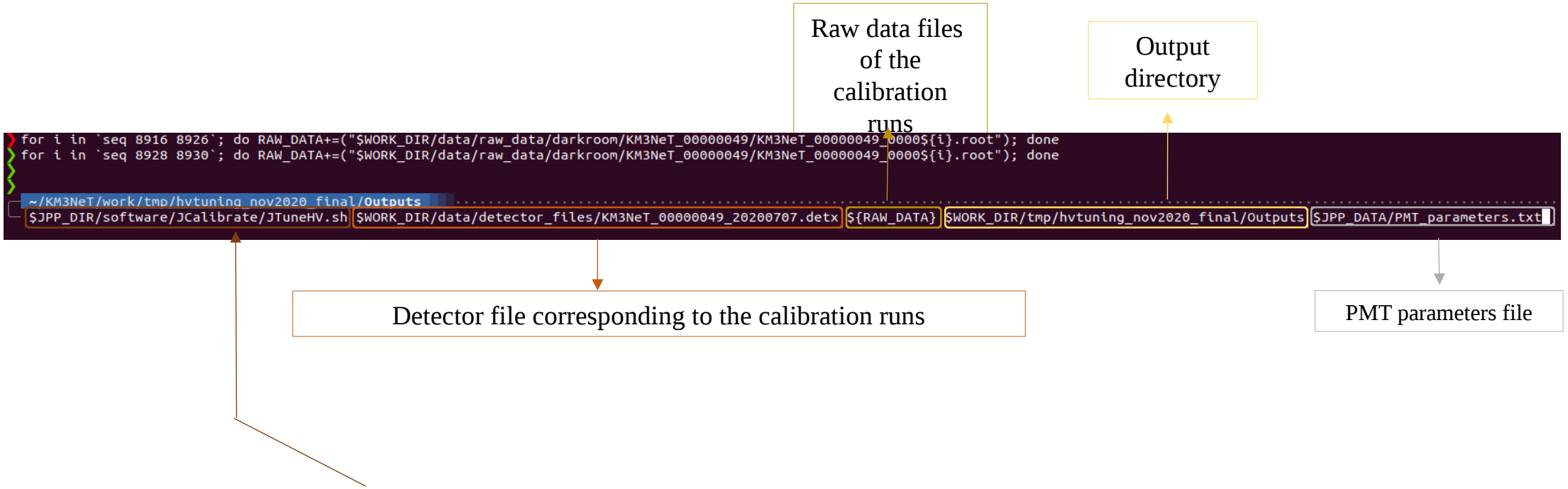
  2. JEditTuneHV.cc
     - For treating all entries labeled FAILED within a given JSON file
     - Three options:
       a. Vendor
       b. run HV-settings,
       c. manual specifications

  3. JMergeTuneHV.cc
     - For merging two or more JSON output files into one

JTuneHV

- HV-tuning analysis chain consists of three steps:

1. Generating ToT-distributions for all calibration runs, using single photo-electron hits (JCalibrateToT)
2. Fitting the gains for each calibration run (JFitToT)
3. Matching the gain-estimates with the corresponding high-voltages for each run
   and performing a linear interpolation of the high-voltage corresponing to a gain of 1.0 on log-log scale



- A bash script called **JTuneHV.sh**, incorporating the full analysis chain, can be found in software/JCalibrate
  - Main output: JSON file (to be uploaded to the database) + ROOT file (with HV-gain diagrams)

JPrintTuneHV

- Loops over all HV-calibrations within a given JSON file and prints all corresponding data entries

```
❯ JPrintTuneHV -f "HVtuning.json" -D 49
UPI                                (identifier / location)                    HV      gain    status
3.4.2.3/HAMA-R12199/2.8496    (a.k.a. 806451572.25 / 1000.60.25):          -1156.1       1.0        OK
3.4.2.3/HAMA-R12199/2.9131    (a.k.a. 806451572.90 / 1000.60.90):          -1106.6       1.0        OK
3.4.2.3/HAMA-R12199/2.9141    (a.k.a. 806451572.70 / 1000.60.70):          -1201.5       1.0        OK
```

```
------------------------------------------------------------------------------------ List of failures
3.4.2.3/HAMA-R12199/2.5867    (a.k.a. 806465101.26 / 2000.15.26):              0.0       0.0    FAILED
3.4.2.3/HAMA-R12199/2.3992    (a.k.a. 806487231.14 / 2000.13.14):              0.0       0.0    FAILED
3.4.2.3/HAMA-R12199/2.4004    (a.k.a. 806487231.19 / 2000.13.19):              0.0       0.0    FAILED
3.4.2.3/HAMA-R12199/2.6132    (a.k.a. 806487231.13 / 2000.13.13):              0.0       0.0    FAILED
3.4.2.3/HAMA-R12199/2.6138    (a.k.a. 806487231.21 / 2000.13.21):              0.0       0.0    FAILED
3.4.2.3/HAMA-R12199/2.6095    (a.k.a. 808432835.14 / 1000.18.14):              0.0       0.0    FAILED
3.4.2.3/HAMA-R12199/2.7177    (a.k.a. 808447180.26 / 2000.80.26):              0.0       0.0    FAILED
3.4.2.3/HAMA-R12199/2.7404    (a.k.a. 808447180.29 / 2000.80.29):              0.0       0.0    FAILED
3.4.2.3/HAMA-R12199/2.2339    (a.k.a. 808472265.21 / 2000.90.21):              0.0       0.0    FAILED
WARNING: No successful calibrations found for module 808488997 (dead module?)
3.4.2.3/HAMA-R12199/2.2116    (a.k.a. 808949742.24 / 3000.40.24):              0.0       0.0    FAILED
```

```
------------------------------------------------------------------------------------------ SUMMARY
Number of evaluated PMTs:                                3348
Number of successful evaluations:                        3200
Number of failed evaluations:                             148
                  - in missing modules:                   124
                  - other:                                 24
```

- The option `-o ${OUTPUTFILE}` can be used to write all failures (other than dead modules) to a separate JSON file for further evaluation/treatment

JEditTuneHV

- Collects all HV-calibrations within a given JSON file with the FAILED status label and adjusts the `supply-voltage` field according to either:

1. The high-voltage settings corresponding to a specific DAQ run,
   if both detector ID and run number are specified
2. The vendor high-voltage settings
   if the detector ID is specified, but the run number is left unspecified
3. Manually specifiable values
   if both detector ID and run number are left unspecified

If successful,
update status label to OK

```
❯ JEditTuneHV -D 49 -r 7943 -f "failures1.json" -o "treated1.json"
Setting high-voltages corresponding to run 7943 for failed evaluations...
❯ JEditTuneHV -D 49 -f "failures1.json" -o "treated2.json"
Setting vendor high-voltages for failed evaluations...
❯ JEditTuneHV -f "failures1.json" -o "treated3.json"
Setting manual high-voltage values for failed evaluations...
Please specify high-voltage for     3.4.2.3/HAMA-R12199/2.5867:
-1234

Please specify high-voltage for     3.4.2.3/HAMA-R12199/2.3992:
+1502
WARNING: Specified high-voltage is not within range [-1500, -800]; skip.
Please specify high-voltage for     3.4.2.3/HAMA-R12199/2.4004:
```

JMergeTuneHV

- Takes two or more HV-calibration JSON files and merges them into one
- N.B.: if a PMT appears in multiple files, only the calibration of the first specified file is kept

```
~/KM3NeT/work/tmp/hvtuning_nov2020_final/Outputs
❯ JMergeTuneHV -f "treated1.json HVtuning.json" -o "HVtuningOK.json"
❯ JPrintTuneHV -f "HVtuningOK.json" -D 49
UPI                                (identifier / location)                    HV      gain    status
3.4.2.3/HAMA-R12199/2.5867    (a.k.a. 806465101.26 / 2000.15.26):          -1101.6       0.0        OK
3.4.2.3/HAMA-R12199/2.3992    (a.k.a. 806487231.14 / 2000.13.14):          -1117.3       0.0        OK
```

```
------------------------------------------------------------------------------------------ List of failures
WARNING: No successful calibrations found for module 808488997 (dead module?)
WARNING: No successful calibrations found for module 808956883 (dead module?)
WARNING: No successful calibrations found for module 808976277 (dead module?)
WARNING: No successful calibrations found for module 808992657 (dead module?)

------------------------------------------------------------------------------------------ SUMMARY
Number of evaluated PMTs:                                3348
Number of successful evaluations:                        3224
Number of failed evaluations:                             124
                  - in missing modules:                   124
                  - other:                                  0
```