TELLIE PCA: Processing Automation

Report
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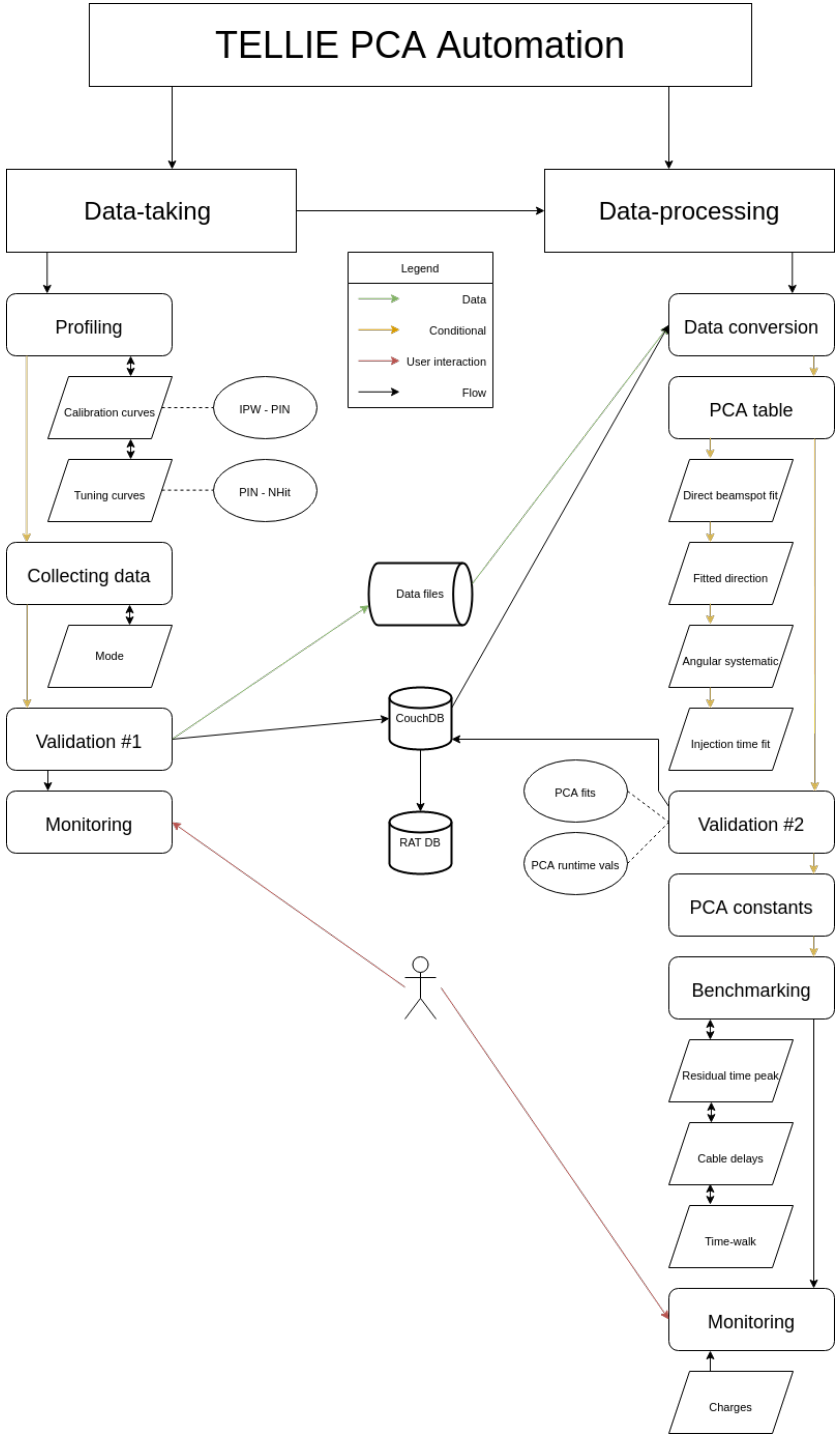
Processing automation - Why

- extracting and validating PCA constants from data is complex...
- **Goal**: streamline (possibly speed up) the process of obtaining the PCA constants from data
  - regardless of the method to obtain the data
  - modular
  - require minimum human input
  - provide monitoring


TELLIE PCA Automation
Data-taking
Data-processing
Legend
Data
Conditional
User interaction
Flow
Profiling
Calibration curves
IPW - PIN
Tuning curves
PIN - NHit
Collecting data
Mode
Validation #1
Monitoring
Data files
CouchDB
RAT DB
Data conversion
PCA table
Direct beamspot fit
Fitted direction
Angular systematic
Injection time fit
PCA fits
PCA runtime vals
Validation #2
PCA constants
Benchmarking
Residual time peak
Cable delays
Time-walk
Monitoring
Charges

Processing automation - What

- validates data is ‘good enough‘ for PCA → *validate #1*
- fits for required corrections: beamspot fit, fibre direction, angular systematic, injection time → *PCA table*
- compare these fits and runtime values to previous set (stability) → *PCA table*
- validates fits are ‘sensible‘ → *validate #2*
- extracts PCA constants (PCA processor) → *PCA constants*
- benchmarks the constants against previous set → *Benchmarking*
- provides monitoring of each step, and between datasets (!) → *Monitoring*

Processing automation - Validations

Run series of checks:

- Validation #1:
  - correct fibre, number of events (EXTA), passed hits, cuts on PMTs, checks on LPC, run length, frequency
  - NHit distribution, NHit over time, delays
  - time of hits over time, # peaks, PMTs in beamspot, PMT occupancy
  - PIN, PIN vs NHit, events over subruns, ... (21 total)
- Validation #2:
  - for each correction: check mean, rms, min, max
  - residual times: distribution, # peaks, function of angle
  - evaluate trends (12 total)
- this is available on monitoring page (flags $\rightarrow$ bitword)

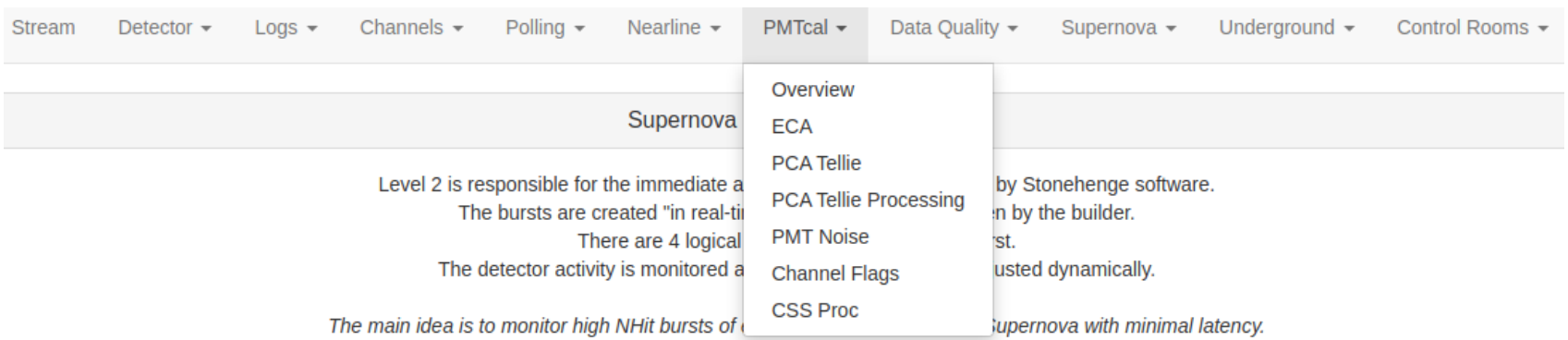
Processing automation - Benchmarking

- compare PCA values (cable delays, TW fit) to previous set
- apply these constants to a well understood run
- extract the residual hit times distribution
- monitor charges: threshold, peak, hhp for QHS & QHL

Processing automation - How

- *simple* → only requires to provide a runlist
- *modular* → master script that spawns subprocesses, individual steps can be (re)run. Also allows for easier changes to modules
- *submission platform* → can queue processes, submit (up to a limit), monitor their status
- *customizable* → thresholds (other settings) are loaded from environment (tuning)
- *linked* → stores data in couchdb, ratdb, redis, provides plots to minard
- *regulation* → unifies cuts, data checks, event selection, ranges, ...
- *evaluative* → provides bitwords (flags) for fits / checks

Processing automation - Minard



Processing automation - Minard: PCA processing

TELLIE PCA datasets

Name	Run range	PCA tables	PCA processor	Benchmarking
Sep 2021	[275082, 275158]	275082 table	275082	[275082, 275158]

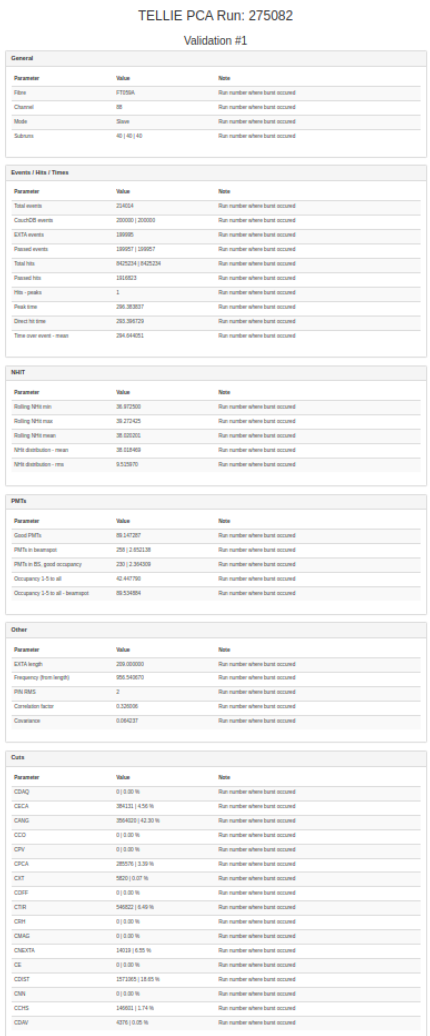
Limits

Parameter	Value	Note
DIR_LIGHT_ANG	48	Run number where burst occured
REF_LIGHT_ANG	20	
LOCALITY	10	
ANG_SYS_ANG	24	
MIN_DIST	900	
TOT_EVS	200000	
TOT_EVS_DEV	1	
TOT_HITS	20	
TH_EXTA	10	
TH_BADCHAN	1.75	
TH_BADECA	10	
TH_BADPCA	5	
TH_XTALK	0.1	
TH_NOTEN	0.1	
TH_QEFRMT	0.1	

Processing automation - Minard: PCA dataset

FT047B	275158	11111111111111111011110110100111110001	31.47 ± 0.077 | 204.08 ± 1.366	111111110100
FT048A	N/A	bitword	fits	bitword
FT049A	N/A	bitword	fits	bitword
FT050A	N/A	bitword	fits	bitword
FT051A	N/A	bitword	fits	bitword
FT052A	N/A	bitword	fits	bitword
FT053A	N/A	bitword	fits	bitword
FT054A	N/A	bitword	fits	bitword
FT055A	N/A	bitword	fits	bitword
FT056A	N/A	bitword	fits	bitword
FT057A	N/A	bitword	fits	bitword
FT058A	N/A	bitword	fits	bitword
FT059A	275082	11111111111111111111111111111111110	17.03 ± 0.080 | 210.03 ± 1.373	111111111101

Processing automation - Minard: validation 1


TELLIE PCA Run: 275082

Validation #1

General

Parameter	Value	Note
Fibre	FTI55A	Run number where burst occured
Channel	68	Run number where burst occured
Mode	Slave	Run number where burst occured
Subruns	40 | 40 | 40	Run number where burst occured

Events / Hits / Times

Parameter	Value	Note
Total events	214614	Run number where burst occured
CouchDB events	200000 | 200000	Run number where burst occured
EXTA events	199985	Run number where burst occured
Passed events	199957 | 199957	Run number where burst occured
Total hits	8425234 | 8425234	Run number where burst occured
Passed hits	1816823	Run number where burst occured
Hits - peaks	1	Run number where burst occured
Peak time	296.383837	Run number where burst occured
Direct hit time	283.398729	Run number where burst occured
Time over event - mean	294.644051	Run number where burst occured

NHIT

Parameter	Value	Note
Rolling NHit min	36.972500	Run number where burst occured
Rolling NHit max	39.272425	Run number where burst occured
Rolling NHit mean	38.020201	Run number where burst occured
NHit distribution - mean	38.018469	Run number where burst occured
NHit distribution - rms	0.522670	Run number where burst occured

PMTs

Parameter	Value	Note
Good PMTs	89.147287	Run number where burst occured
PMTs in beamspot	259 | 2.852138	Run number where burst occured
PMTs in BS, good occupancy	230 | 2.364309	Run number where burst occured
Occupancy 1-5 to all	42.447790	Run number where burst occured
Occupancy 1-5 to all - beamspot	89.534884	Run number where burst occured

Other

Parameter	Value	Note
EXTA length	209.000000	Run number where burst occured
Frequency (from length)	956.540870	Run number where burst occured
PIN RMS	2	Run number where burst occured
Correlation factor	0.326596	Run number where burst occured
Covariance	0.064237	Run number where burst occured

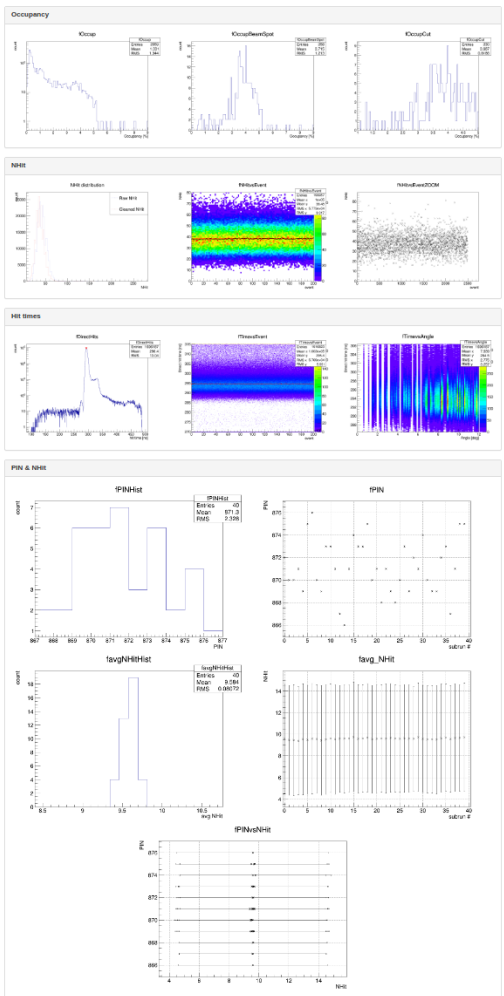
Cuts

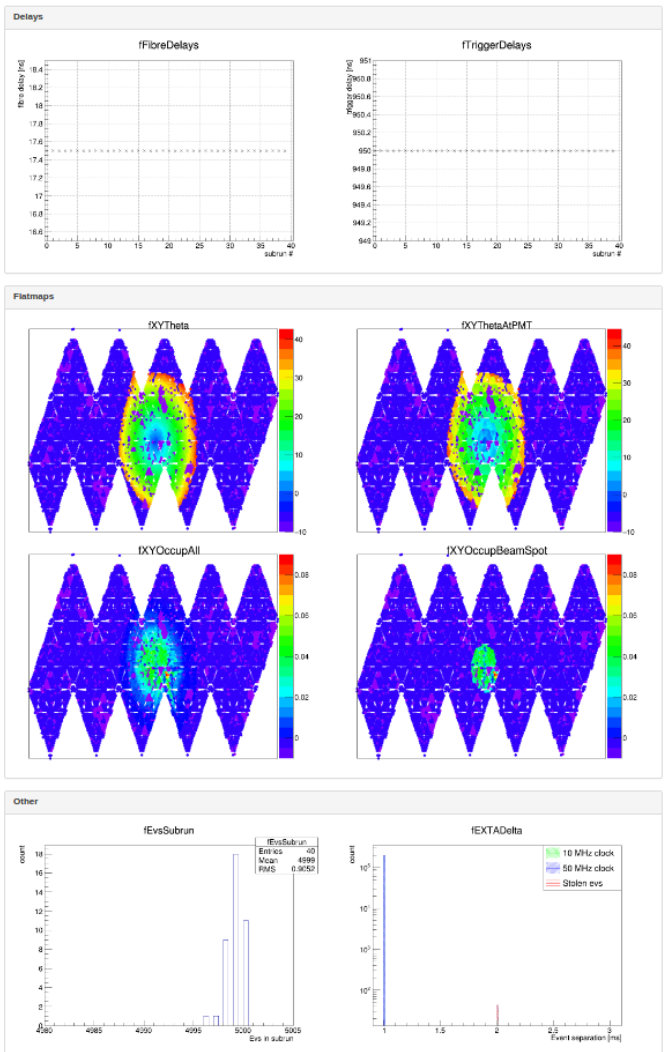
Parameter	Value	Note
CDAQ	0 | 0.00 %	Run number where burst occured
CECA	384131 | 4.56 %	Run number where burst occured
CANG	3564020 | 42.30 %	Run number where burst occured
CCO	0 | 0.00 %	Run number where burst occured
CPV	0 | 0.00 %	Run number where burst occured
CPCA	285576 | 3.39 %	Run number where burst occured
CXT	5820 | 0.07 %	Run number where burst occured
CDFF	0 | 0.00 %	Run number where burst occured
CTIR	546822 | 6.49 %	Run number where burst occured
CRH	0 | 0.00 %	Run number where burst occured
CNAG	0 | 0.00 %	Run number where burst occured
CNEXTA	14019 | 6.55 %	Run number where burst occured
CE	0 | 0.00 %	Run number where burst occured
CDIST	1571065 | 18.65 %	Run number where burst occured
CNN	0 | 0.00 %	Run number where burst occured
CCHS	146601 | 1.74 %	Run number where burst occured
CDAV	4376 | 0.05 %	Run number where burst occured

Flags

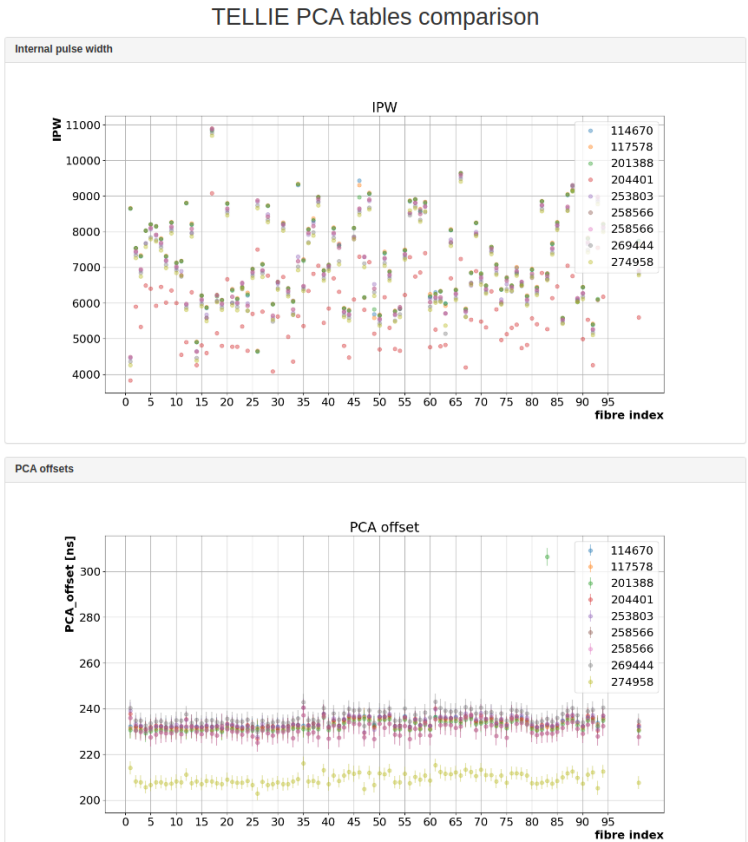
Parameter	Value	Note
Not DAQ enabled	1	Run number where burst occured
NHit distribution	1	Run number where burst occured
Peak check flag	1	Run number where burst occured
Stable NHit	1	Run number where burst occured
Bad PMT position	1	Run number where burst occured
Occupancy all"	1	Run number where burst occured
Trigger delay dev	1	Run number where burst occured
Time over event	1	Run number where burst occured
Offline channel	1	Run number where burst occured
Beamspot PMTs	1	Run number where burst occured
Frequency"	1	Run number where burst occured
Event	1	Run number where burst occured
PIN RMS	1	Run number where burst occured
Bad channel	1	Run number where burst occured
NHit distribution over subruns	1	Run number where burst occured
Offline PMT	1	Run number where burst occured
Bad ECA	1	Run number where burst occured
LPC locality	1	Run number where burst occured
PIN-NHit cov and corr	0	Run number where burst occured
Check on PMTs (beamspot / occupancy)	1	Run number where burst occured
LPC weird path (not AV)	1	Run number where burst occured
Runtime	1	Run number where burst occured
Not enabled flag	1	Run number where burst occured
Not normal PMT	1	Run number where burst occured
EXTA	1	Run number where burst occured
X-talk	1	Run number where burst occured
LPC TIR	1	Run number where burst occured
LPC invalid path	1	Run number where burst occured
Subruns	1	Run number where burst occured
Bad PCA	1	Run number where burst occured
Hit	1	Run number where burst occured
Angular cut	1	Run number where burst occured
Near reflection	1	Run number where burst occured
Fibre delay dev"	1	Run number where burst occured
Hit peak	1	Run number where burst occured
Occupancy beamspot	1	Run number where burst occured
Check on evens in subruns	1	Run number where burst occured

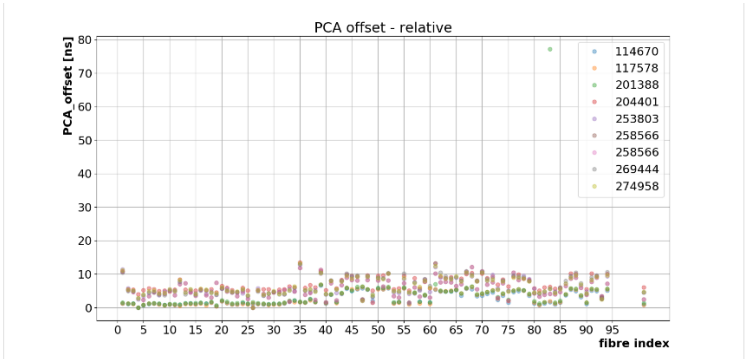
Processing automation - Minard: validation 1

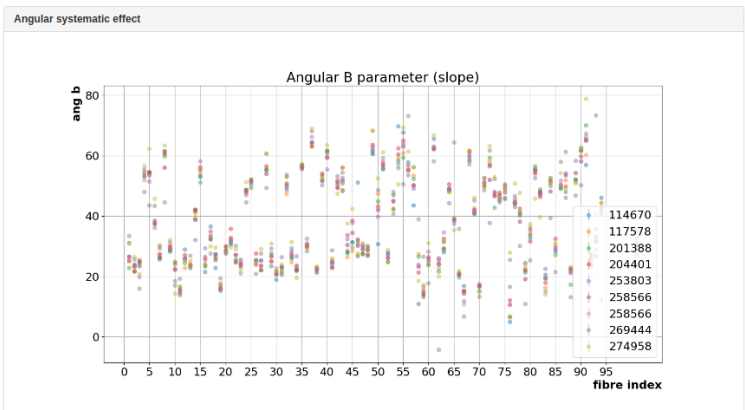




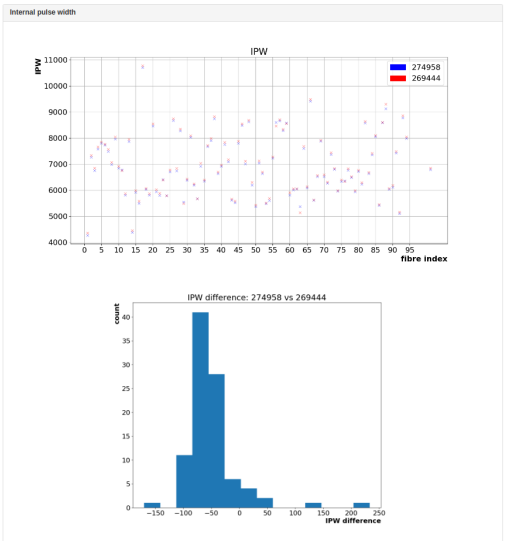
Processing automation - Minard: PCA tables

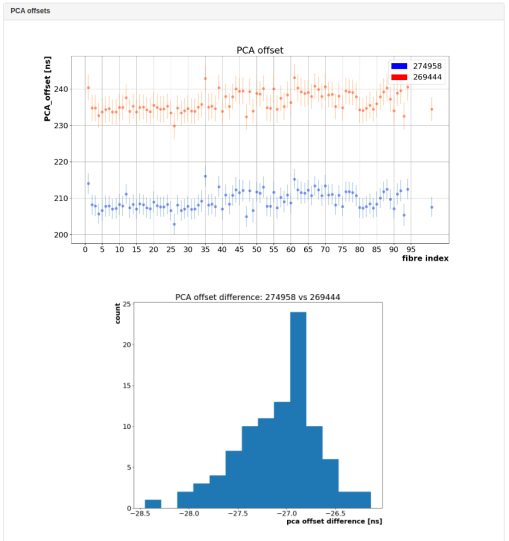


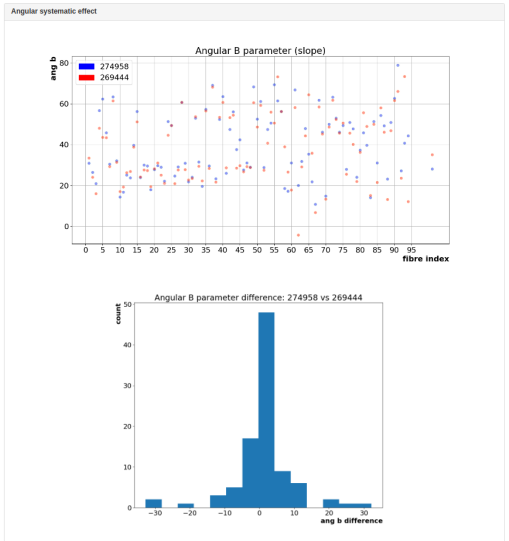


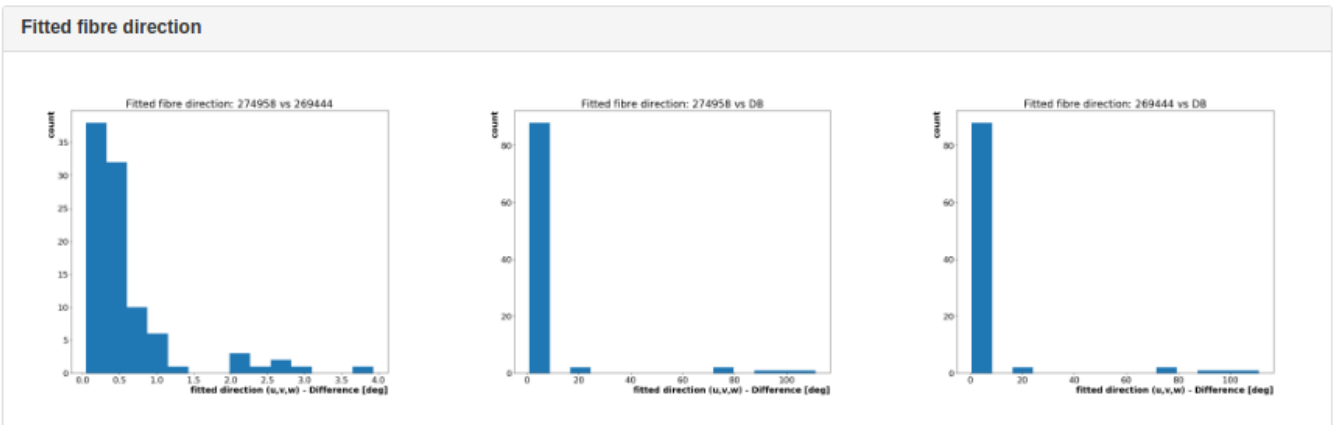


Processing automation - Minard: PCA table

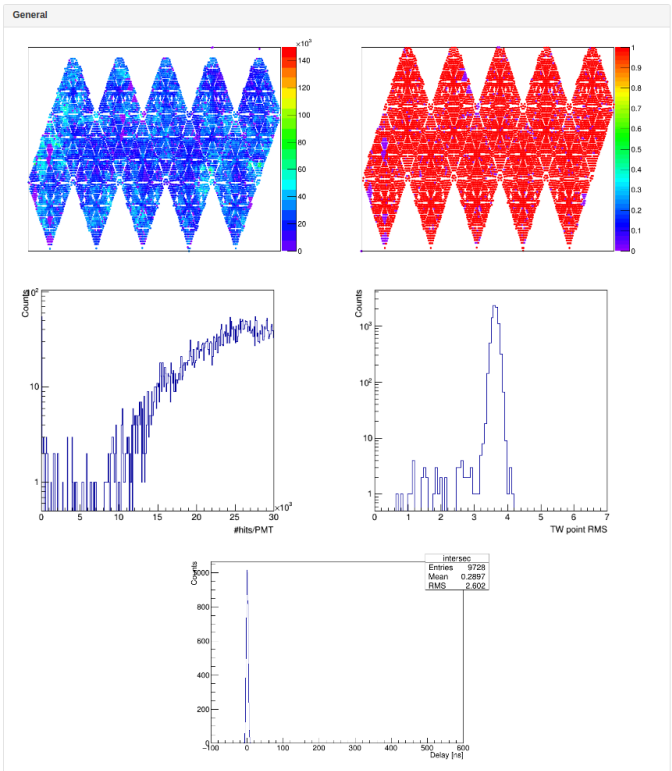


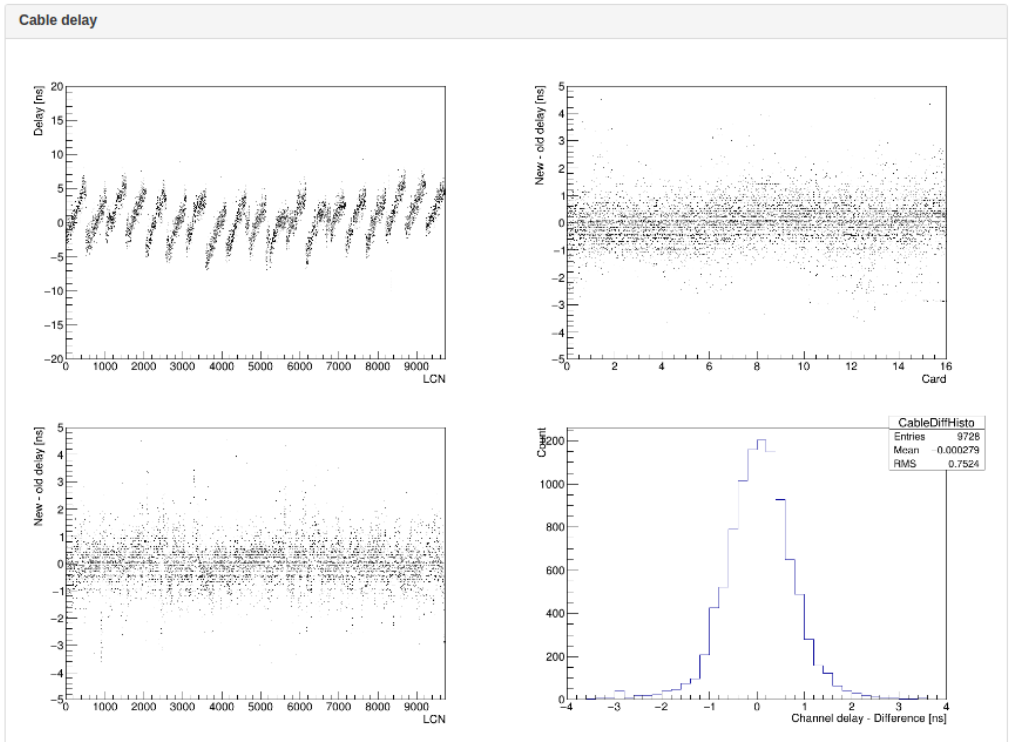




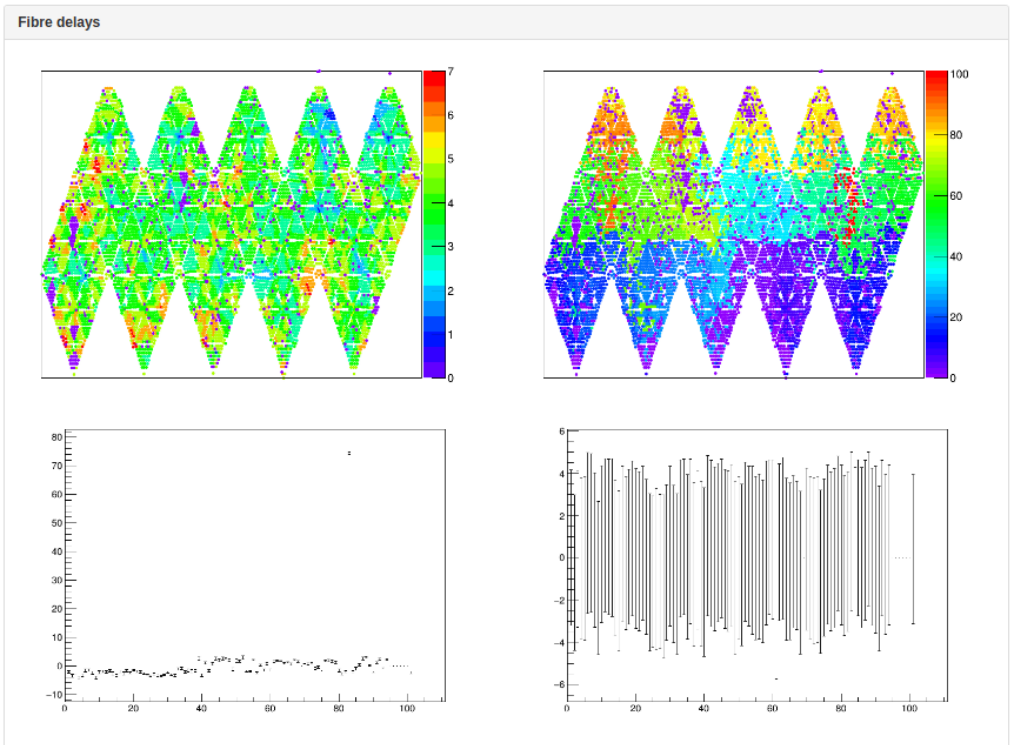


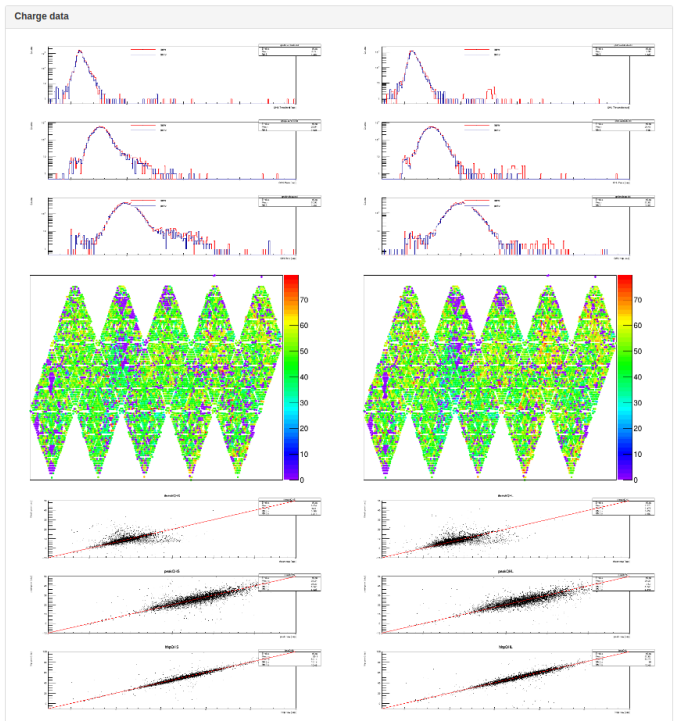
Processing automation - Minard: PCA processor



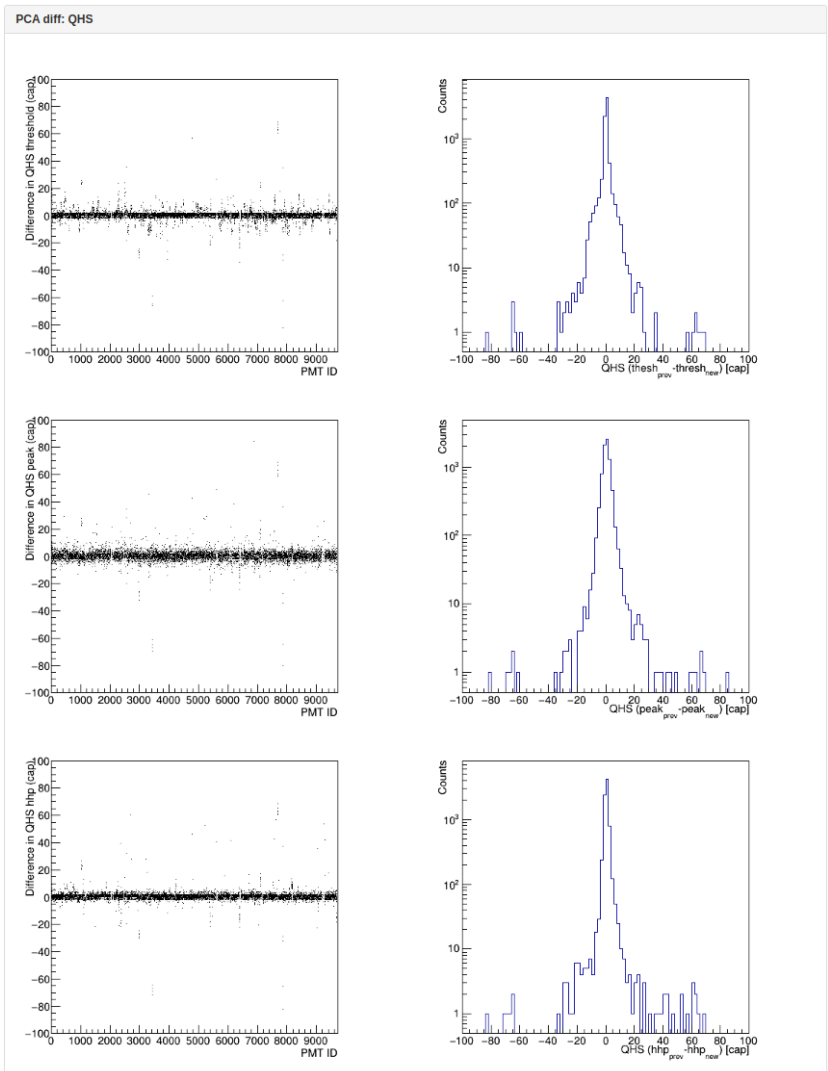


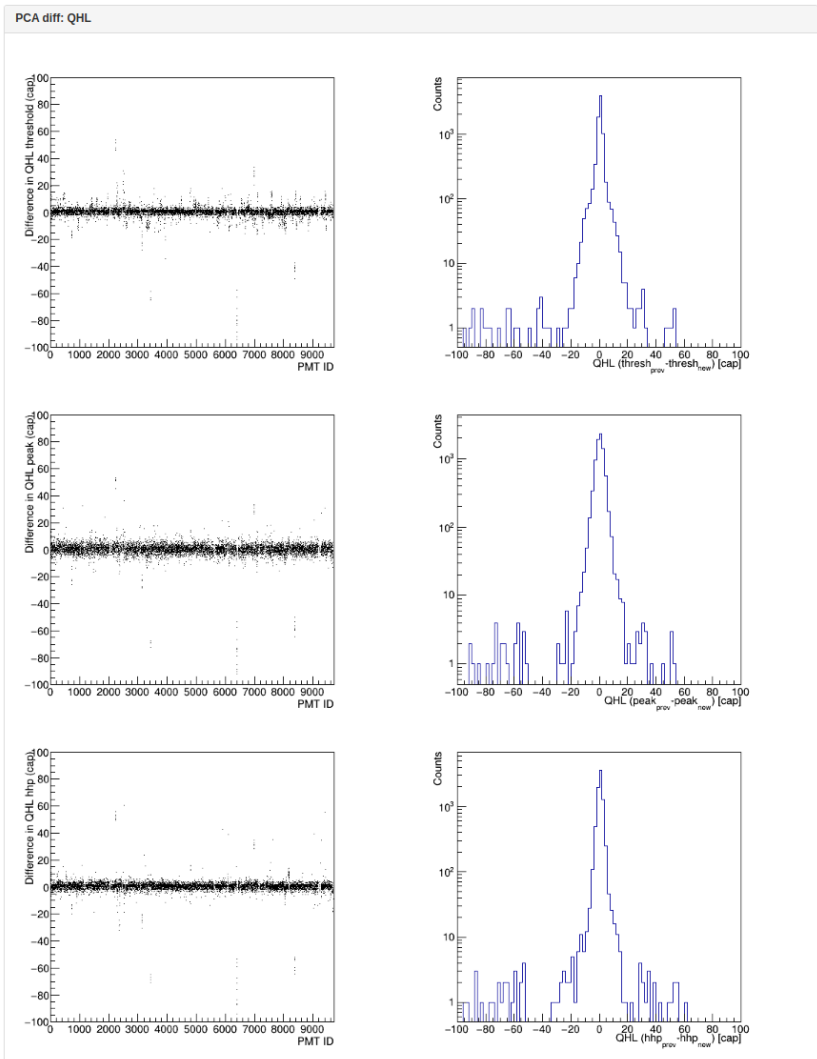
Processing automation - Minard: PCA processor





Processing automation - Minard: charge monitoring





Processing automation - Next steps

- missing from monitoring: page for PMT, parsing of log files
- comments, descriptions, nicer grouping ...
- documentation
- tuning of the threshold values
- test over datasets
- ...
- profit (?)