

A Spreadsheet Tool for the Visualization of Long Term Calibration Series Parameters



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(Poster Abstract number 3111)

Introduction

On creating the 1st generation DOS-based 10 Hz software for the SLR 7841 Potsdam, the goal was to extract and record the maximum possible information from all the observational parameters.

It was decided to calculate and record, following the ILRS standards:

- all the moments from the calibration set.
- the derived statistical parameters.
- the number of laser shots used, accepted for and filtered.
- the calibration epoch.

The information is added in a single formatted line per calibration in an detector dependent yearly file.
This file is one of the sources for the generation of the XML format raw data input file for pass analysis.
The same calibration information output format has been kept on the kHz Linux-based software created by Spacetech.
(http://www.spacetech-i.com/) for the SLR 7841, Potsdam.

Main Characteristics

- A suite of Excel 97® spreadsheets with automatic links among them.
- The inputs are Excel-compatible ASCII files generated by the pass filtering and target calibration programs.
- Data transfer to the Excel® spreadsheets is by cut-and-paste (macros will be added soon).
- All graphical outputs are dynamical.

The multiyear long term Excel® spreadsheets

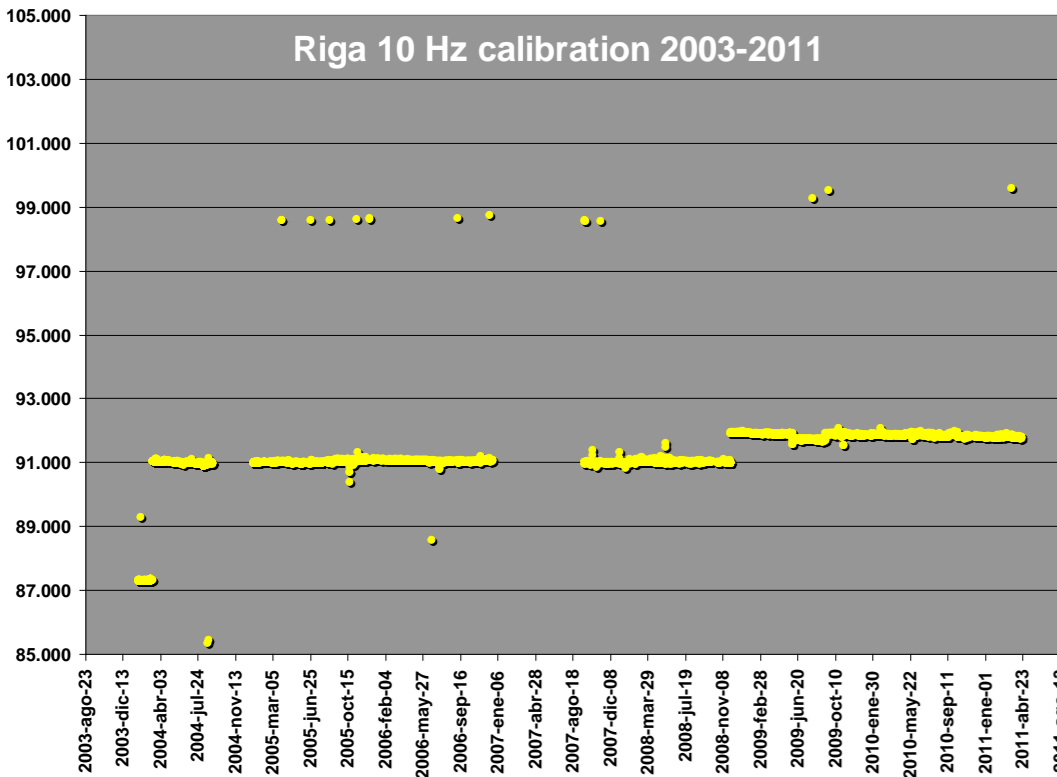
A similar Excel can be generated with all the calibrations for a given SLR configuration, for example the Potsdam 2004-2011 10 Hz version with 14000+ calibrations or the Riga 2001-2014 recently generated with 10000+.

A global qualitative operational stability index

If the station operates at single photon level, it is possible to calculate and plot the calibration monthly mean return rate. This plot serves as a visual indicator of the global operational stability of the system.

Any change on the laser energy level, filter transmission, system optical alignment etc. will affect this mean return rate index.

Uses of multiyear series information



The full calibration history for Potsdam@10 Hz configuration. The long term stability is clearly visible. The 2008 jump is due to a PMT voltage change.

3 groups of Excel® spreadsheets

Pass counting spreadsheets.

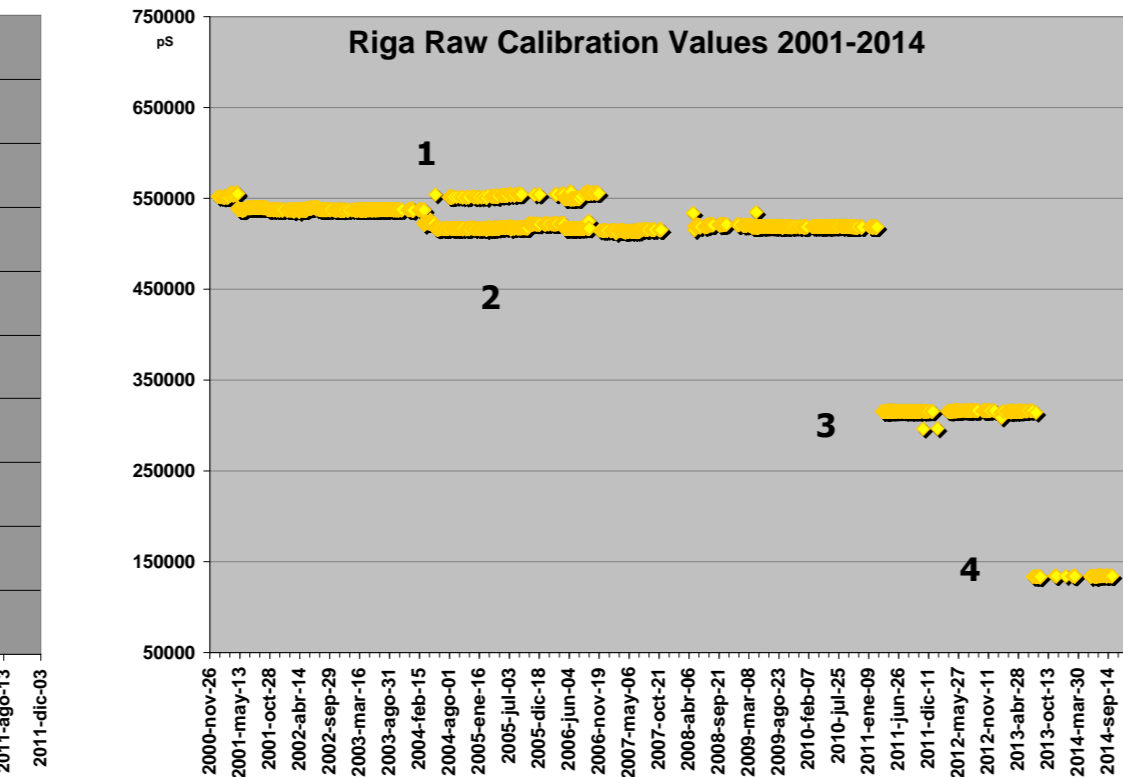
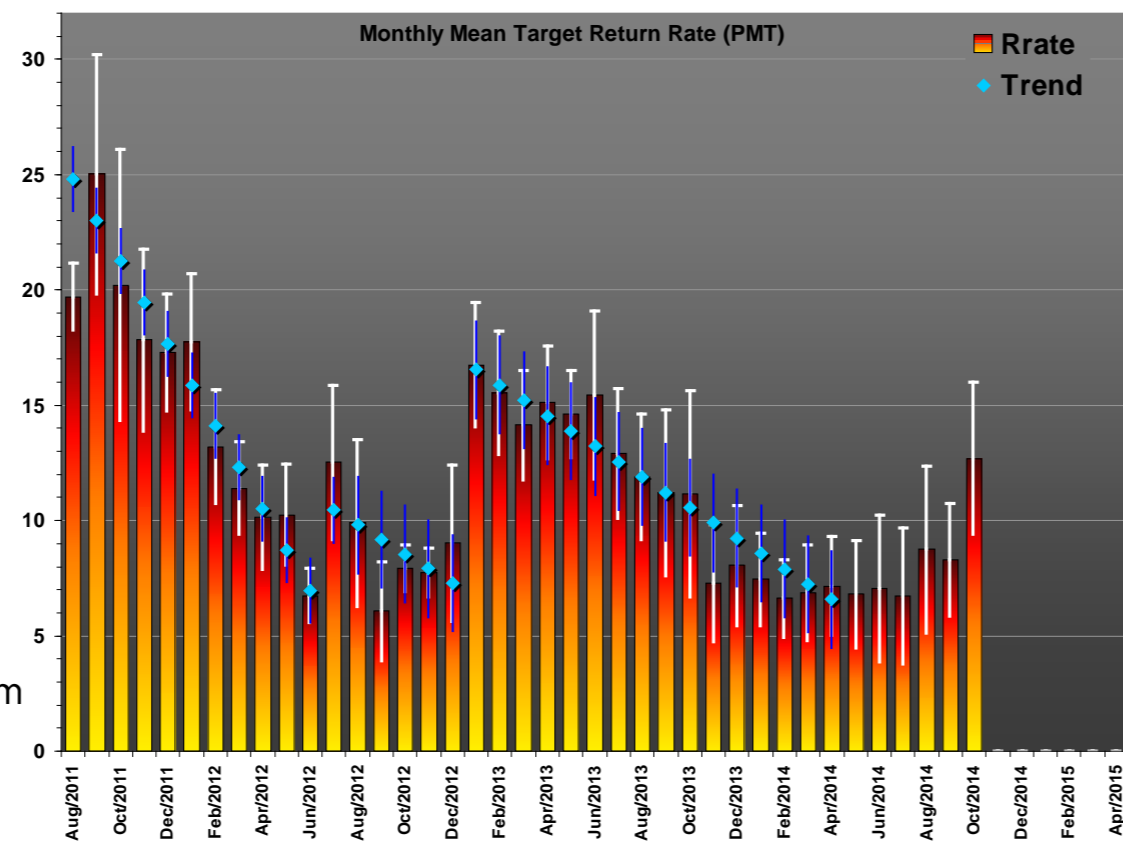
- Monthly and yearly pass results per type of satellite including:
 - Pass information for individual satellites.
 - Satellite categories and subcategories:
 - Lageos, HEO, LEO, LEO geodetic, Tandem pairs, etc (All GNSS of a Network counted as one).
 - Days observed.
 - Passes/day.
 - Monthly and yearly mean RMS per satellite.
 - ILRS tracking goals.
 - End-of-year prognosis of number of passes and days of observation.

Daily observations spreadsheets.

- For individual satellites, groups (LEO, HEO, Lageos) and true tandem passes.
- Prognosis of when the ILRS goals can be/were reached for the LEO, HEO, Lageos categories.

Calibration results (by detector) spreadsheets.

- Yearly and long term series of all statistical parameters.
- Parameters Histograms.
- Housekeeping statistics:
 - Results by day of week, month, year.
 - Number of days with N calibration.
 - Number and rates calibration/passes, monthly and yearly results.



By filtering again the Riga raw calibration readout values, we could identify the hardware changes and confirm them with the station journals. We could zeroed into a small time frame for searching the information.

- End of external target, a long multimode optical fiber as target.
- Testing 2 exemplars of the Riga event timer.
- Using a shorter length multimode optical fiber.
- New shorter singlemode optical fiber as target.

Example of the Spacetech Linux-based calibration program output.

The data framed in yellow is imported into the main Excel page

56658	1	64156	149094	11839	10616	90.383	0.049	0.040	0.08911	2.57	0.00118	0	1700	det1	las1	tim1
56658	1	67927	181155	11885	10493	90.394	0.047	0.038	0.10465	2.55	0.00091	0	1700	det1	las1	tim1

The main page, the calibration data is pasted in columns C-N

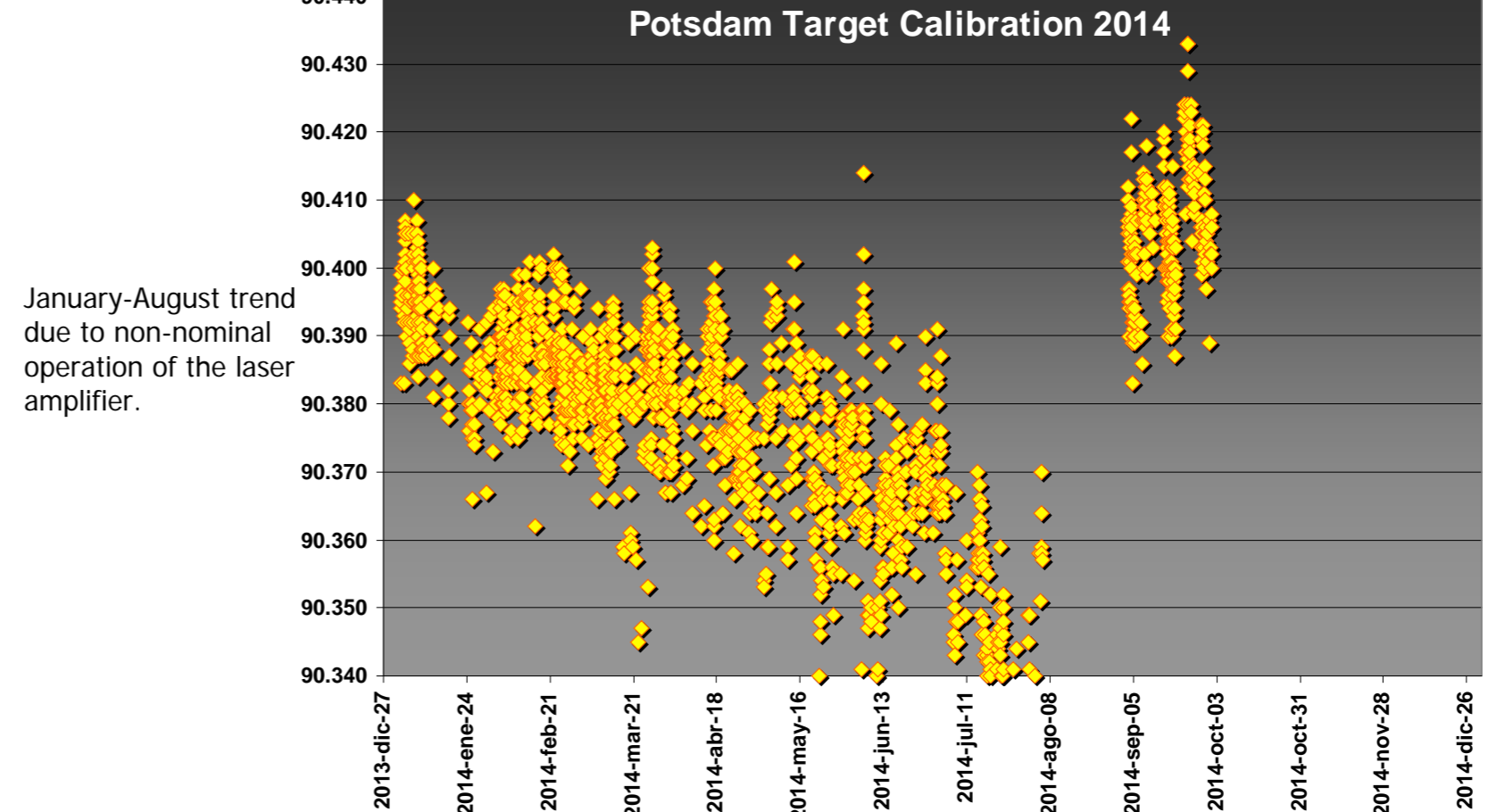
Date of 1st and last target
Number of target calibrations
Laser shots (millions) on Dec 31st
Target calibrations on Dec 31st

Statistic information for each parameter

Automatic alternating color background for faster month location

Columns B, C & D are shown/hidden using Ctrl-/Ctrl+ macros for cut-and-pasting the data

Potsdam 2014: Calibration Temporal Series

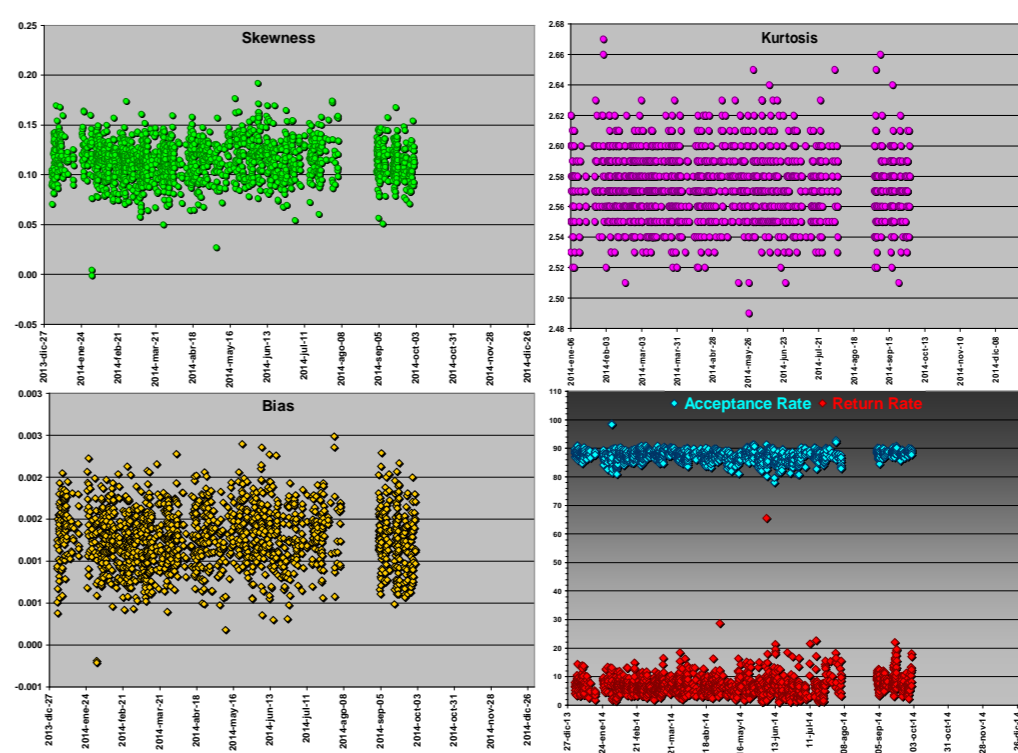


January-August trend due to non-nominal operation of the laser amplifier.

September: laser restored to nominal operation

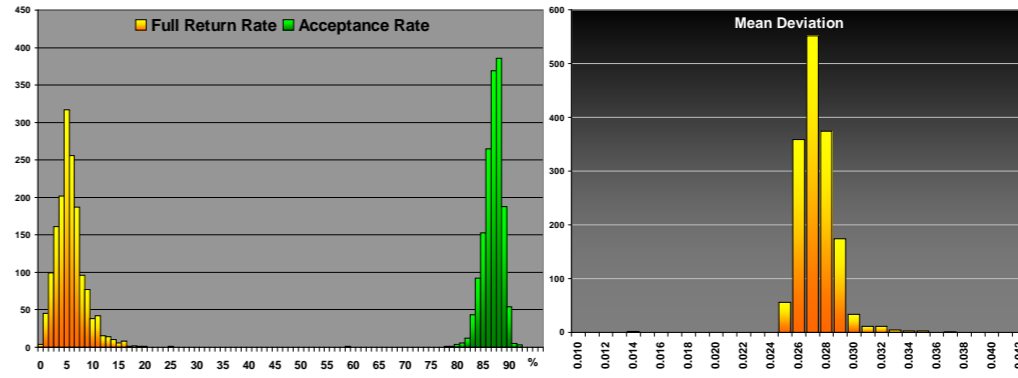
August: Full laser breakdown

Examples of Temporal Series, Potsdam 2014



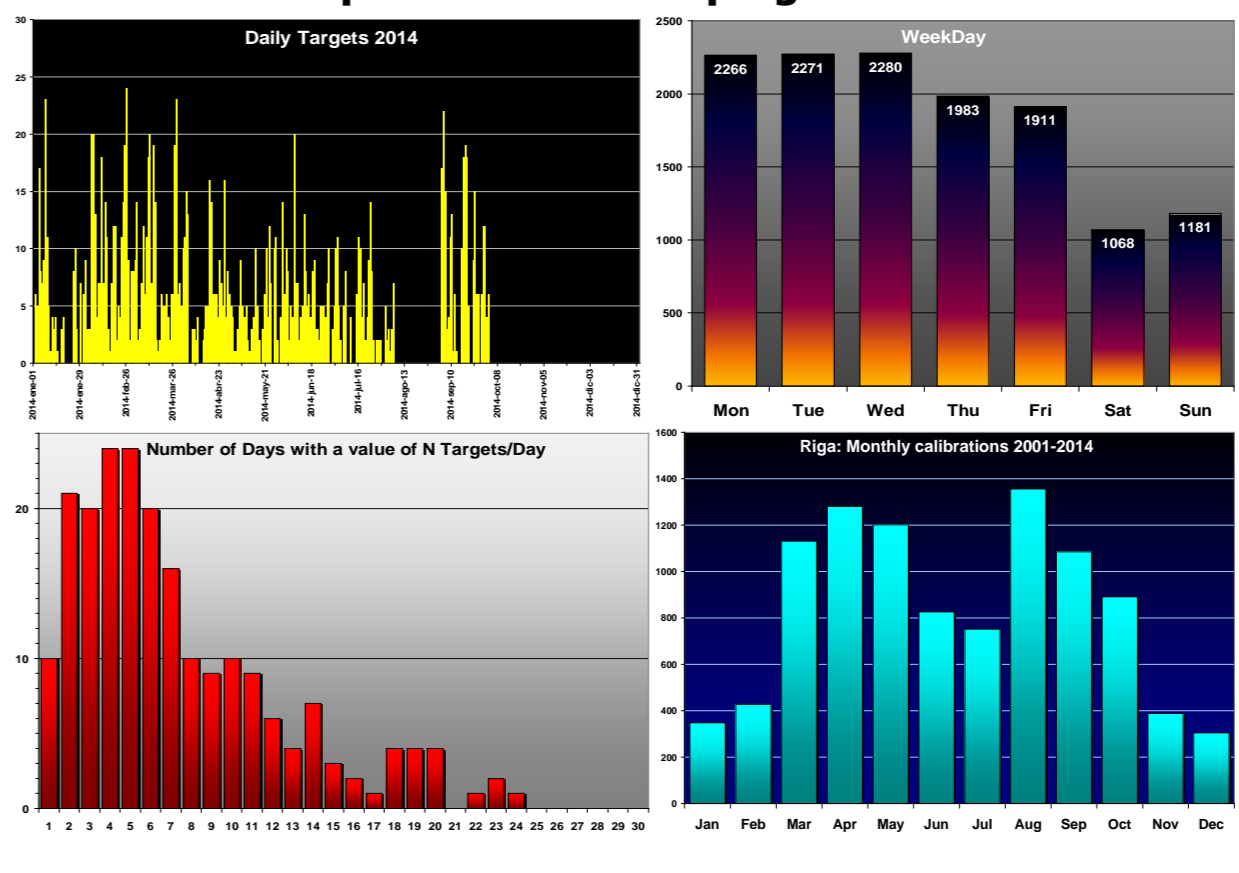
Return Rate: % of accepted echoes during calibration.
Acceptance rate: % of echoes remaining after filtering the accepted ones.

Examples of Histograms



As the plots, they are automatically redrawn every time new data is added.

Examples of Housekeeping information



Potsdam's classical weekend effect, fewer daylight observations Saturday/Sunday

In Riga there are data dips in summer (nights too short) and in winter (long nights/ extensive cloud cover)
Tracking only by night.

This is useful to schedule maintenance stops or holidays while reducing its impact on the amount of data

Target Day	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Jan	31	29	29	29	29	29	29	29	29	29	29	29	296
Feb	28	28	28	28	28	28	28	28	28	28	28	28	224
Mar	31	31	31	31	31	31	31	31	31	31	31	31	272
Apr	30	30	30	30	30	30	30	30	30	30	30	30	240
May	31	31	31	31	31	31	31	31	31	31	31	31	272
Jun	30	30	30	30	30	30	30	30	30	30	30	30	240
Jul	31	31	31	31	31	31	31	31	31	31	31	31	272
Aug	31	31	31	31	31	31	31	31	31	31	31	31	272
Sep	30	30	30	30	30	30	30	30	30	30	30	30	240
Oct	31	31	31	31	31	31	31	31	31	31	31	31	272
Nov	30	30	30	30	30	30	30	30	30	30	30	30	240
Dec	31	31	31	31	31	31	31	31	31	31	31	31	272
Total	365	354	354	354	354	354	354	354	354	354	354	354	3540

Targets	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
1	116	154	154	154	154	154	154	154	154	154	154	154	1540
2	92	99	99	99	99	99	99	99	99	99	99	99	990
3	126	170	151	184	233	242	277	319	279	265	236	236	2360
4	86	238	112	141	251	260	116	229	180	182	182	182	1820
5	92	177	208	236	165	143	139	227	153	117	117	117	1170
6	143	133	152	244	191	345	288	299	178	193	193	193	1930
7	118	128	204	214	259	319	381	270	135	198	198	198	1980
8	232	169	154	174	193	289	49	301	30	6	192	192	1920
9	232	169	154	174	193	289	49	301	30	6	192	192	1920
10	172	139	145	131	33	154	343	310	209	180	180	180	1800
11	13	161	160	112	179	166	131	296	103	147	147	147	1470
12	82	68	77	57	169	109	178	160	160	160	160	160	1600
Total	1387	1767	1875	332	2066	2434	2523	2267	3178	2374	2374	2374	23740

The auxiliary global tabulation Excel® spreadsheet

By automatically linking the different Excel® spreadsheets, the monthly pass and calibration information can be resumed in a tabular form.

The number of calibration days per month is also tabulated. This annual number of calibration days is close to, but not equal, to the total amount of clear days observed.

For what it is useful?

- Fast visualization of trends, jumps and data fluctuations.
- Overview of the mean, median, σ , minimum and maximum values for each parameter.
- Housekeeping information in numerical and graphical forms.
- A set of standardized graphs, useful for reports, presentations and articles.
- End-of-year prognosis on values.

Why Excel 97®?

- I have a old registered copy of Office 97®.
- The first spreadsheets versions were created in 2001.
- This group of spreadsheets are compatible with any newer Office Version.
- Using any newer Office version means learning a new layout for the commands.
- This newer Office version will not improve the Excels functionality.
- If it ain't broke, don't fix it!
- I am lazy, very lazy!