

Attenuation Length Data Analysis: A Brief Guide Version 1

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Raw Data Files

- Data spreadsheets are to be saved as .txt (tab delimited) files with three columns (from left to right): location of LED on fibre, current reading, current error.
- The titles of the saved files must include the batch/lot number, pouch number and fibre number. Note that usually only one fibre is pulled from a pouch so the fibre number is typically just 1. (A few times a second or third fibre was tested from the same batch.) The batch number is indicated as a three-digit number (XXX).
(ex. JS056-8-1.txt, batch=056, lot number=8, fibre number=1)
- The data files must be saved in a specific location on the 'doulos' computer because the analysis program will only look there. Currently, the directory for the data files are organized such as:

/home/glueX/work/production/YY.MM.DDshipment/raw/JSXXX/

*note any zeros preceding the batch number must be included to always have three digits

Running Analysis (everything is under directory /home/glueX/work which is indicated as “./”)

- Programs for analyzing production fibre data are located on 'doulos' in the following directory
./analysis/production/
- In order to run the analysis you must first enter the CERN program ROOT. To do so open a Konsole window and go to the directory of the program you wish to run. Type '*root -q -l -b ShipmentAnalysis.C*' on a terminal command line to start the analysis. Once the analysis is finished type '!q' to exit root.

There are two analysis programs in the directory:

1. SingleFibre.C – This program is useful only for the investigation of suspicious or anomalous fibres. It will prompt user for shipment date, batch number and fibre code then display a graph of the fibre data along with the long, short and effective attenuation lengths. Note that the graph is only displayed, and not saved, by this program.
2. ShipmentAnalysis.C- This ROOT script is useful for the analysis of an entire shipment. It will pass through all batches in a given shipment directory, although it also has provision to analyze only a range of batches or even a single batch. In addition to these tasks ShipmentAnalysis.C will create a histogram of the effective attenuation lengths for the entire shipment. The histogram output will include the number of entries, mean effective attenuation and RMS. Ideally the histogram should be a Gaussian curve if adequate statistics are

at hand. The histogram will be saved as a .png image file in the following location, together with the accompanying .txt file:

```
/production/YY.MM.DDshipment/processed/YY.MM.DDcumulativehist.png
/production/YY.MM.DDshipment/processed/YY.MM.DDcumulativetext.txt
```

*note that it is not necessary to create any parent directories in *./production/processed* before running any analysis program as they will create the necessary parent directories themselves.

- **Quality check:** The data are plotted as blue points. A single exponential fit is done in the 100-280 cm source distance range and displayed as a red curve, and a double-exponential fit over the entire range (10-400cm) and displayed as a green curve. The statistics from both fits are printed at the top right and bottom left corner of each plot, respectively, for every fibre. There are different limits placed on the fit results (see Figs. 1 and 2, as examples):
 - Single-exponential. If the χ^2/NDF is less than 15, all is ok and the (top right) statistics panel is coloured steel grey. If the χ^2/NDF is more than 15 but less than 20 the statistics panel is coloured yellow. If the χ^2/NDF is more than 20 OR the extracted attenuation length is outside the $250 \text{ cm} < \lambda_{Eff} < 530 \text{ cm}$ range, the statistics panel is coloured red. **‘Red’ fibres are re-measured with top priority, ‘yellow’ if time permits.**
 - Double-exponential. If the χ^2/NDF is more than 20 the (bottom left) statistics panel turns green. At present we do not re-measure ‘green’ fibres, as this is not directly applicable to the contract and feedback to Kuraray.
- **Sorting results:** The results from the fits are also sorted in text files, based on the outcome:


```
/production/YY.MM.DDshipment/processed/JS159/JS159_RED.vec
/production/YY.MM.DDshipment/processed/JS159/JS159_YEL.vec
/production/YY.MM.DDshipment/processed/JS159/JS159_OK.vec
```

 and cumulatively


```
/production/YY.MM.DDshipment/processed/09.10.05summary_OK.vec
/production/YY.MM.DDshipment/processed/09.10.05summary_RED.vec
```
- **Re-measurements:** The re-measured data is uploaded from the laptop to ‘doulos’ in a new directory with the letter ‘a’, ‘b’, etc., added after the shipment date, e.g. 09.10.05ashipment, 09.10.05bshipment, etc. The old fibre data is superseded in these directories with the re-measured data, and the analysis script is then run on the new directory.

Troubleshooting:

- If the program fails to run try exiting and re-entering root. If it cannot find the data be sure to check that the raw data is located in the correct directory and that the proper letters are capitalized.
- If the program is giving nonsense results check the raw .txt files to make sure they are sound.

- If there are bad data points or anomalies in the best fit line check the data file.
- If edits to the program must be made be sure to save the edited program under a different name and not overwrite the old program. Never delete older versions of the program, they may prove useful at a later time. There is a unix soft link called ShipmentAnalysis.C pointing to the newest/stable release of the script.

Data Backup and Tarballs:

- All data, analysis, programs and other documents are backed up by AS or ZP, by copying the working directory to /home/gluex/backup after a stable software release and/or conclusion of a shipment test. This directory is backed up via the unix command 'rsync' automatically each morning to a remote backup server (lambda) in another building.
- Should you need to compress documents for anyone tarballs can be made in command line or using the GUI. In the GUI you can right click to compress files. In command line you can type 'tar --help' for more information.

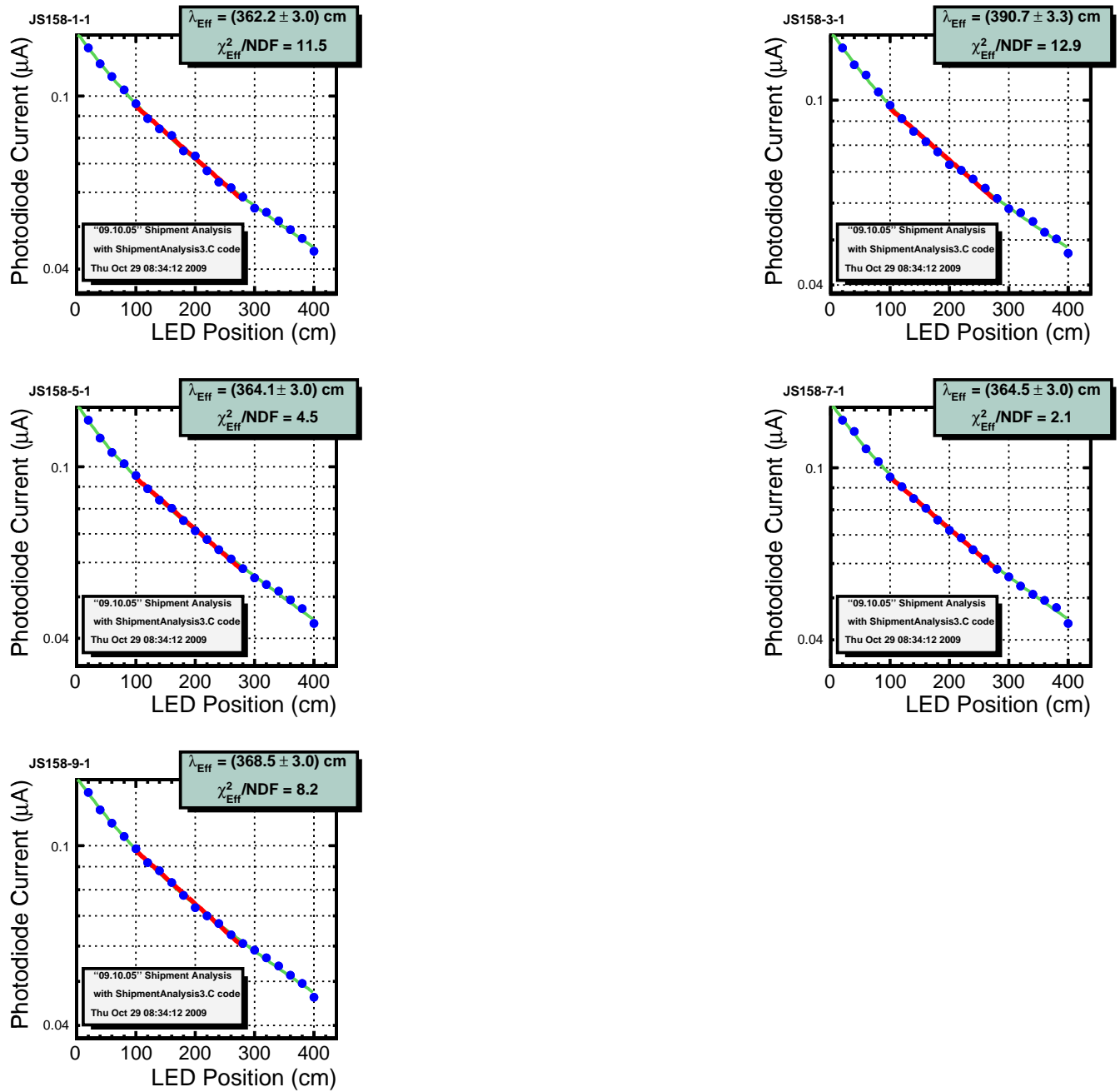


Figure 1: The fibre fits from batch/lot JS158. All fits were successful (statistics panel is coloured steel grey).

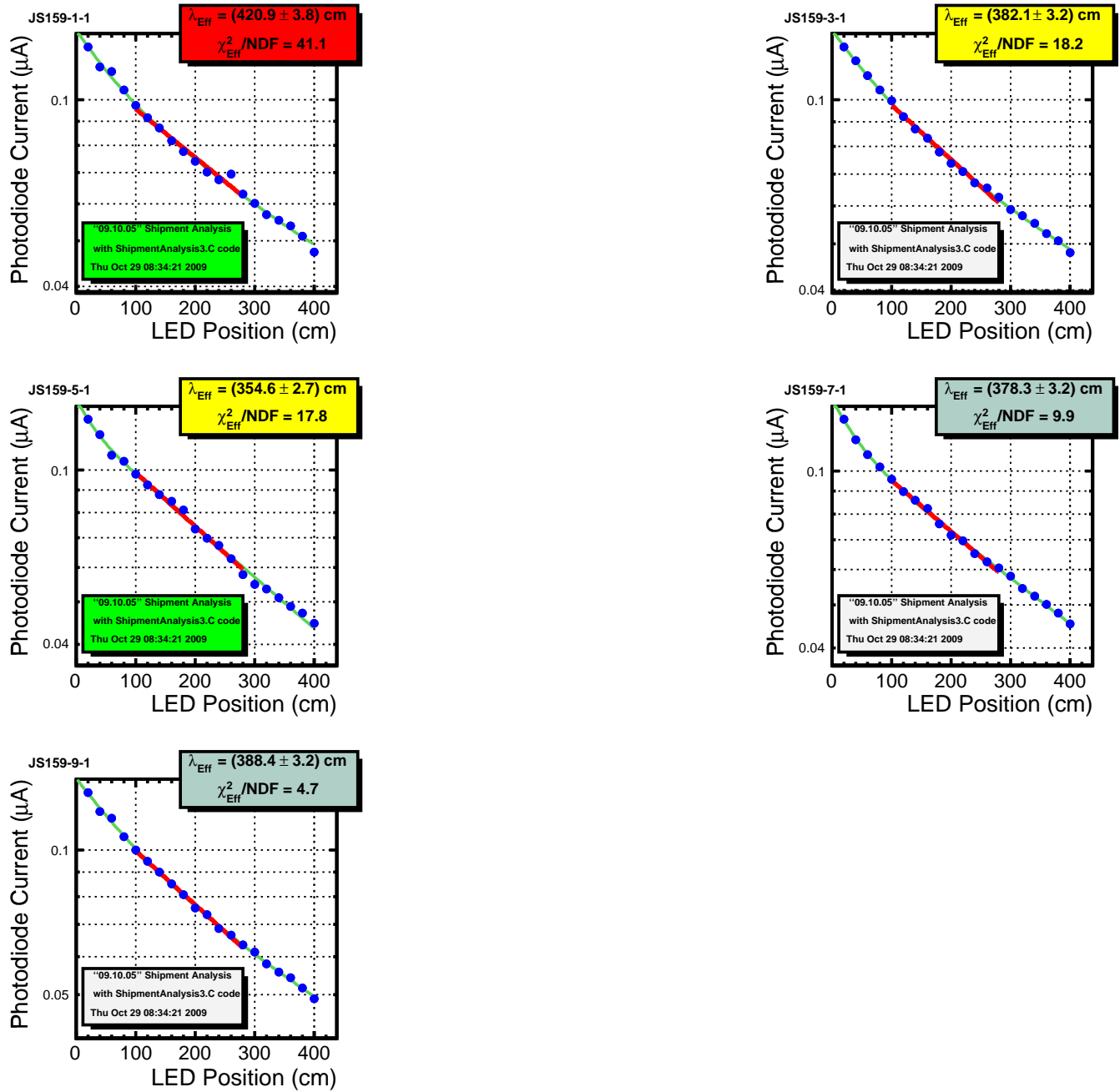


Figure 2: The fibre fits from batch/lot JS159. Several failures are observed, as explained in the text, this prompting re-measurement of fibres with ‘red’ panels.