PhotonSTR-18

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1. PC requirements.

Since this program is developed in LabVIEW2017, it can run in any operative system capable of running this version of LabVIEW; nevertheless, it is preferable to execute the code in a computer with more or equal to 8 Gb of RAM.

2. Objective.

The objective of this program is the statistical analysis of processes that vary over time. PhotonSTR-T18 is capable of handling large data batches of scattered photon history and calculating not only the intensity correlation and structure functions in auto-mode but also from two independent channels in the cross-mode.

3. Scope.

PhotonSTR-T18 can be used to obtain the calculation of the intensity correlation and structure functions from the measurement of the time of arrival of scattered photons described in the Dynamic light scattering theory.

This software can be used in the field of photon correlation spectroscopy, which is possibly the most popular technique used in the study of structural, dynamic, and mechanical properties of soft condensed matter systems.

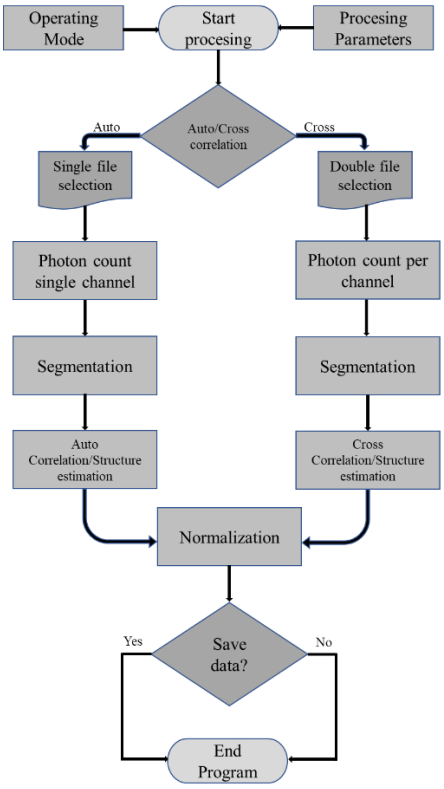
4. Software installation

To install this program, the user must copy the project placed in https://github.com/CINVESTAV-T18/PhotonSTR-18 in a computer folder. This software uses 13 sub-Vis (Auto_corr.vi, beta.vi, Correlation_PM1.vi, Correlation_PM2.vi, Cross_corr.vi,

Data_select.vi, Menu, multi-tau_time.vi, n3.vi, Normalizer.vi, PhotonCount.vi, ReadFilesOnes.vi, Segmentation.vi) placed in the folder with the name subVis in the same project. The first time that Photon-STR18.vi is executed, LabVIEW Will ask for the subVis location. The user must then select the folder where the subVis are located. It will automatically load all the necessary files in the computer's memory to be available every time the main Vi is initialized.

5. Program operation.

5.1. Flux diagram



5.2. Main screen elements.

The main screen has the following elements:

a) Open File: upload of data to be processed.

b) Save Data: save the output correlation and structure function data.

c) Exit: Exits the code.

d) Parameters:

I) P: set the P parameter in the multi-τ scheme [1].

II) m: set the m parameter in the multi- τ scheme [1].

III) Sample Time: set the size of the lag-time at which the P channels increase.

e) Operation Mode

IV) Analysis: options for the calculation, auto-correlation of channel A, auto-correlation of channel B, cross-correlation of channel A x B, or cross-correlation of channel B x A.

V) Data type: This software version can process data in the form of ASCII (typically obtained from hardware correlators) or Binary (a stream of bits typically obtained from photon counting units).

VI) Half data: This switch allows cutting the data vector by half in case that the computer cannot process the amount of data.

f) Duration: Estimates the time of the experiment based on the amount of data in the file.

g) Total of Photons: Estimates the total number of measured photons.

h) Size: Estimates the size of the stream of data of the file.

i) Number of Channels: Estimate the number of channels of the multi-tau scheme provided the P and m configuration.

j) Elapsed time: Estimate the time used to obtain the correlation and structure function.

k) Graphics: The obtained correlation and structure function are presented in the bottom graphs

Each part of the program described above is presented in Fig. 1.

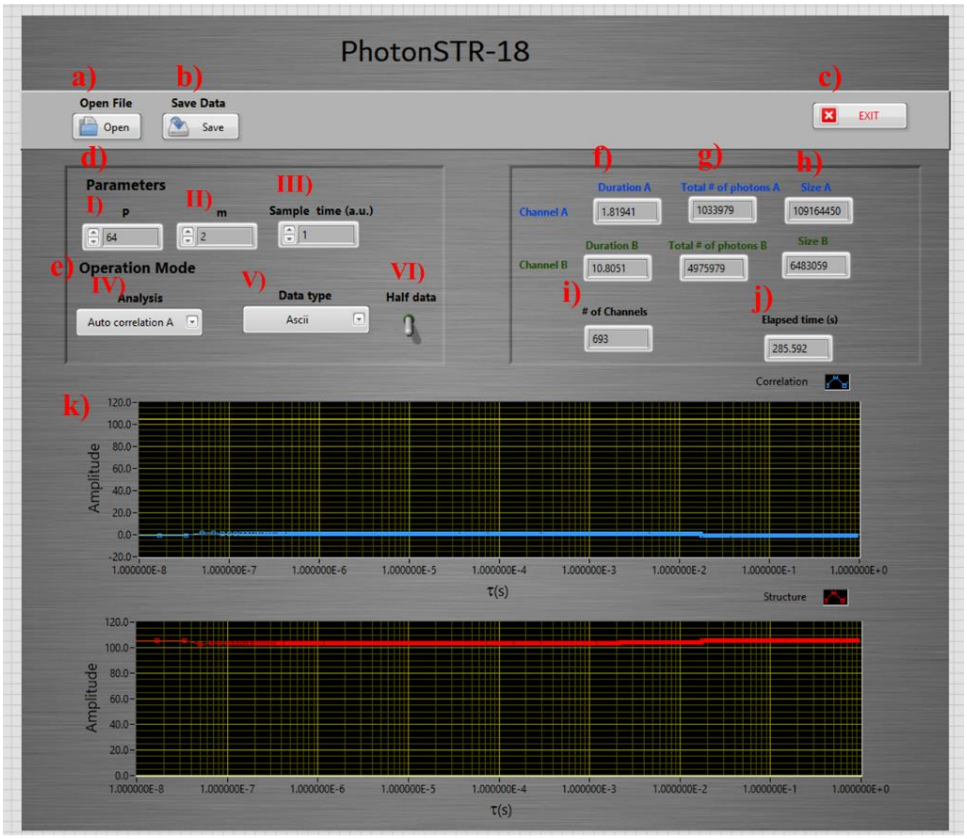


Figure 1. Main window of the *Photon STR-18* code.

5.3. Operation:

1) Start the Vi.

2) Set the parameters and operation mode.

3) Select Open File

4) From the pop-up menu, select the file(s) to operate.

5) When the program finishes the computation of the data, it asks the user if he wants to save the output. If the user answer yes, then he must select the location and the name of the file to be created. Even if the user selects no, he can save the last generated data with the save button.

6) The correlation and structure function will be presented at the bottom of the main window, as shown in Figure 2.

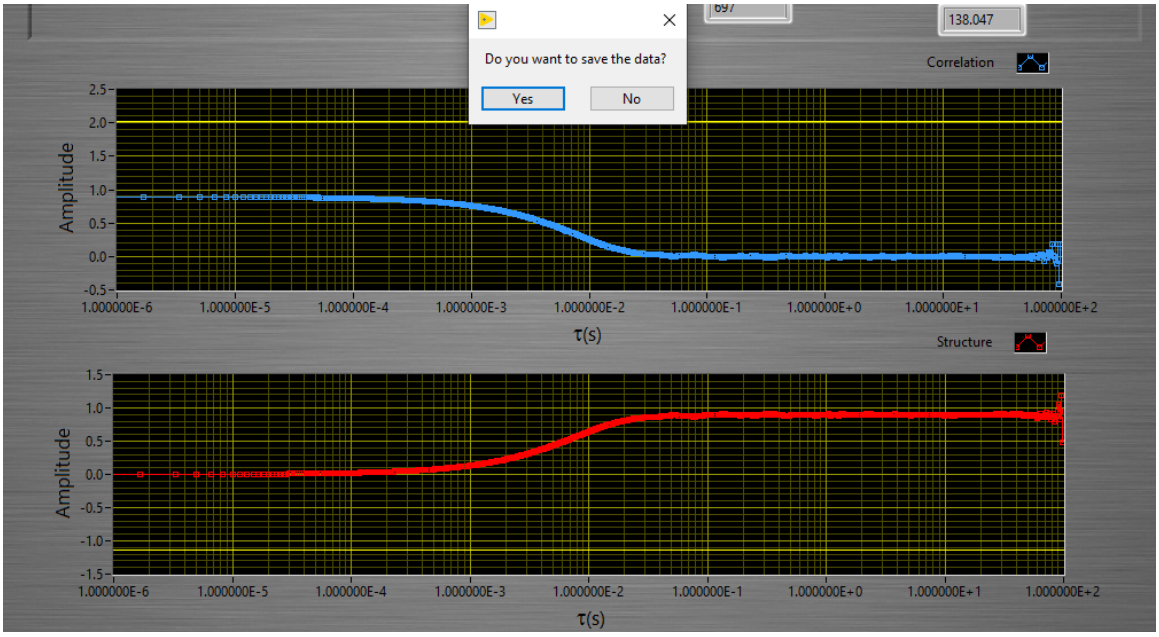


Figure 2. Typical output of the correlation and structure function.

7) The output data that can be saved contains:

- First column: the logarithmic time generated from the total amount of time estimated from the original data.

- Second column: the estimated correlation function.

- Third column; the estimated structure function.

References

[1] D. Magatti and F. Ferri, "Fast multi-tau real-time software correlator for dynamic light scattering" Appl. Opt. 40 (2001) 4011-4021.