

## Control and data acquisition for the Thomson scattering diagnostics on the XuanLong-50 experiment

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The Thomson Scattering (TS) control and data acquisition system consists of six subsystems connected by a local network and a control PC: the laser operation control including safety interlock, the laser beam alignment system, the digitizers, the Field Programmable Gate Array (FPGA) controller, the Stanford Research Systems (SRS) DG645 pulse generator, and the control software.

Firing of the laser and triggering of the digitizers must be strictly timed with detailed consideration of the time delays. The timing control is achieved by the implementation of the DG645 pulse generator. A FPGA controller is used to deploy different instruments in a pre-defined sequence during experiments. The FPGA also receives time reference from the SRS DG645. The control software is developed based on LabVIEW, which communicates with the EXL-50 central control system to receive configuration information for the TS deployment, and manages data local storage and uploading to the database. The entire laser path is sealed off, and the laser alignment is achieved by motorized mirror mounts together with cameras and movable alignment targets. All the components can be remotely controlled. For each laser pulse, the CAEN V1742 digitizers record the waveforms with an acquisition window of 400ns. The advantages of waveform acquisition are that it retains the original system information which can help system debugging in the minimization of stray light, and that it reveals the flying time difference of the stray light and the TS or Rayleigh scattering (RS) light such as that shown in Fig. 1, enabling optimum stray light subtraction. The details of the control and data acquisition for the TS diagnostic system will be presented, together with initial experimental results.

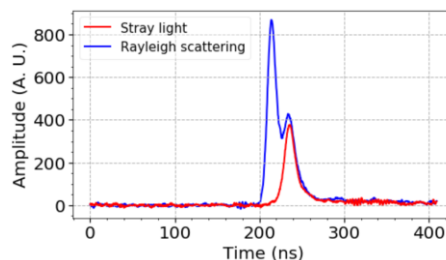


FIG. 1. Acquired waveforms of the polychromator channel centered at the laser wavelength of 1064 nm with 3.5 Torr argon gas Rayleigh scattering (blue) and without argon gas (red).