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Innovative Teaching Approaches in development of Software Designed Instrumentation and its application in real-time systems

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Course „Advanced LabVIEW Applications“

Laboratory no 2 - Master/Slave Design Pattern

Leader Partner: [1]Warsaw University of Technology
Authors: Dariusz Tefelski[1], Angelika Tefelska [1]

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1 High-energy physics experiment controller

1.1 Goal

Create an application, which simulate collecting data from the fixed-target experiment at Super Proton Synchrotron.

1.2 General requirements

- The application should be hierarchical and scalable. Remember to use subVIs.
- Use the Master/Slave Design Pattern.
- Avoid using the local, global or shared variables if it is possible.
- Close all opened references and handles.
- Application shouldn't crash. Inform the user about the errors using the error cluster or a dialog box.
- Remember to prepare well documented code. Especially remember about: labels on long wires, description showing in context help, tip strips of controls and labels of constant values.

1.3 Description

- The beam of particles is simulated as rounded Boolean indicator named *Beam*. When the application is started, the *Beam* terminal should round on the Super Proton Synchrotron (circle shown on picture). The *Beam* indicator should start rounding on BA1 position.

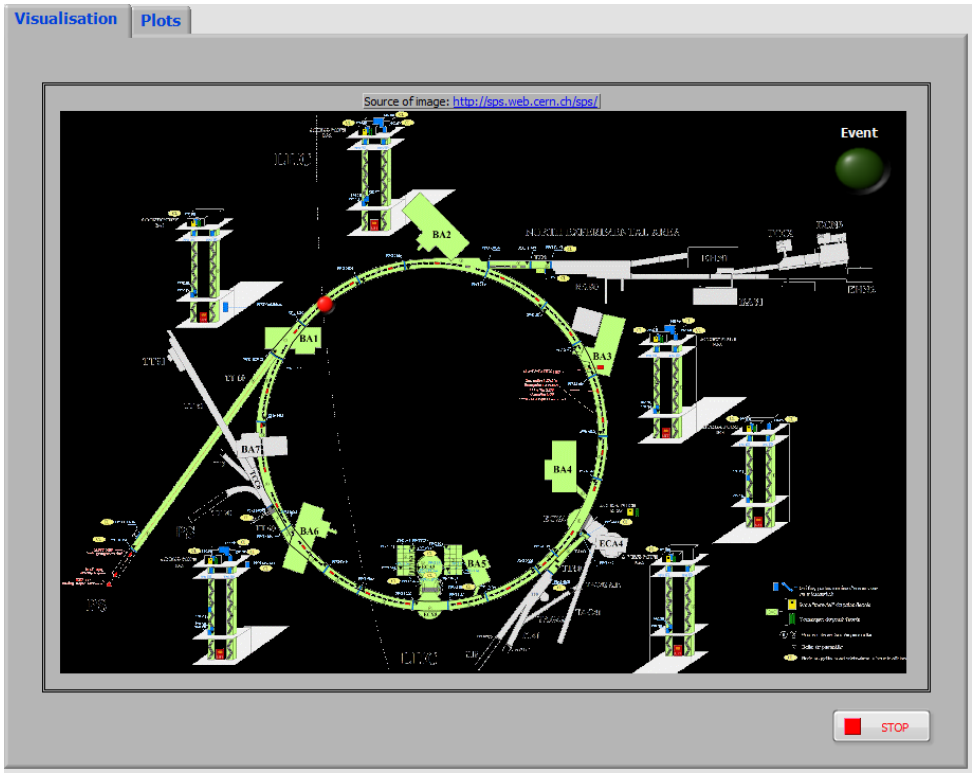

Figure 1: The first tab of *front panel*.

- When beam position is near the North Experimental Area (behind the BA2 building in the picture), the collision happens and the *Event* indicator should be turned on. The *Event* indicator should be turned off before and after collision.
- After the collision, the *Beam* indicator should still be rounding on the Super Proton Synchrotron.
- During the collision, the data from Beam Position Detectors (BPD) 1, 2 and 3 should be displayed on *Waveform Graph*. The data from BPD1 are saved in file *data1.csv*, in which first column is x position and second column is y position. After starting the application, you should read these data from file and display on *Waveform Graph* only when the collision occurred. Before and after collision, the *Waveform Graphs* should be empty. The data from BPD2 are saved in file *data2.csv* and from BPD3 in *data3.csv*. Add noise to data during each event.
- During the collision, the produced particles momenta should be displayed on *Waveform Graph*. The values of momentum are saved in file *data4.csv*. Before and after the collision, the *Waveform Graph* should be empty.

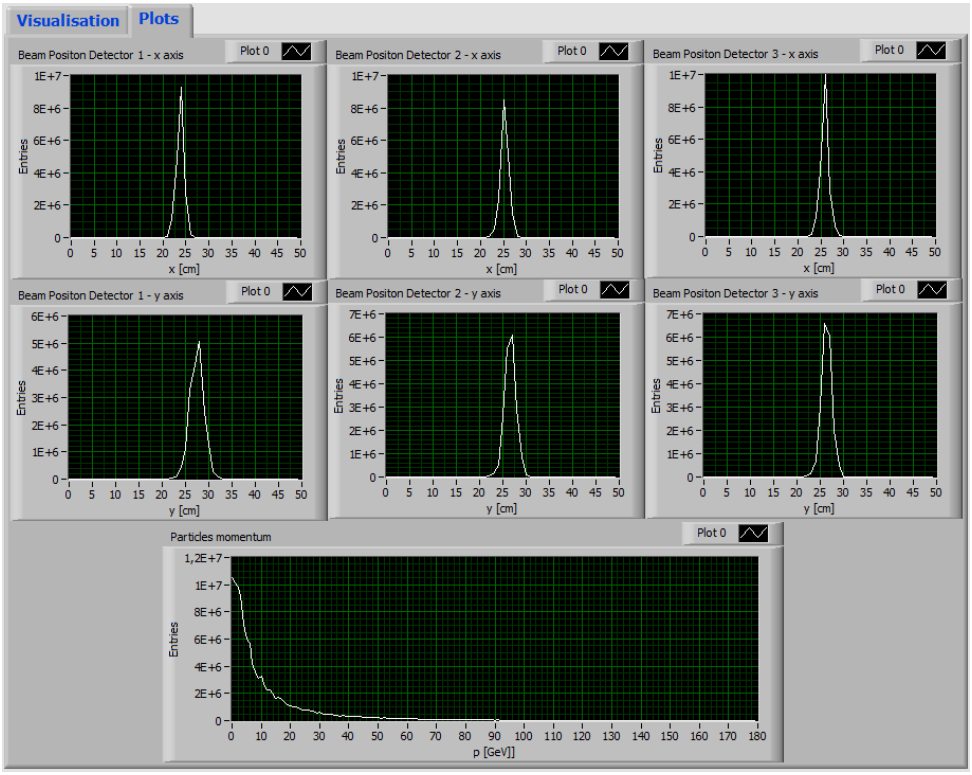

Figure 2: The second tab of *front panel*.

1.4 Realization

- Use the Master/Slave Design Pattern, which should have one master loop and 4 slave loops (one for BPD1, second for BPD2, third for BPD3 and fourth for momentum displaying).
- The notifier should be used to communicate between loops.
- The *Beam* indicator position should be changed inside the master loop. When its position is near the North Experimental Area, the proper message should be sent to all slave loops.
- The slave loops should wait for notification and when it appears, the proper data should be displayed on *Waveform Graphs*.

- Add the different delays for master and slave loops e.g. 100 ms for master loop and 50 ms for slave loops.

Please use the front panel from public folder.