

Emulation of Cluster-Jet Beam-Dump Slow-Control

An Introduction

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Why emulation seems to be a necessary step in the project:

- Safety considerations:

To avoid damage of the costly components of the cluster-jet generator (and the beam-dump) vacuum system by erroneous operation of the slow-control system in the course of its development,

- Organizational considerations:

To decouple development of the cluster - jet generator proper, at least temporarily, from the development of the slow-control system. Such a situation is met right now; the generator has been moved from Uni-Münster to FZ-Jülich for installation on the proton beam of COSY.

Tests of the beam-target interaction have been conducted in August 2018 and are planned to be continued in the nearest future (more on that from A.Kh. presentation).

Why to start with the cluster-jet beam-dump emulation rather than with the very cluster-jet generator?

One can mention at least two reasons:

- It is much simpler by its content, yet it allows to test the basic concepts of emulation,
- The NCBJ team made acquaintance with this subsystem of the target when it resided at GSI, after being delivered there from Genova. Yet, a more complete forevacuum system is foreseen now for its evacuation than was available at GSI.

Taking these two reasons into account, we think we will rapidly get experience to undertake the cluster-jet generator slow-control emulation.

THANK YOU FOR YOUR ATTENTION!

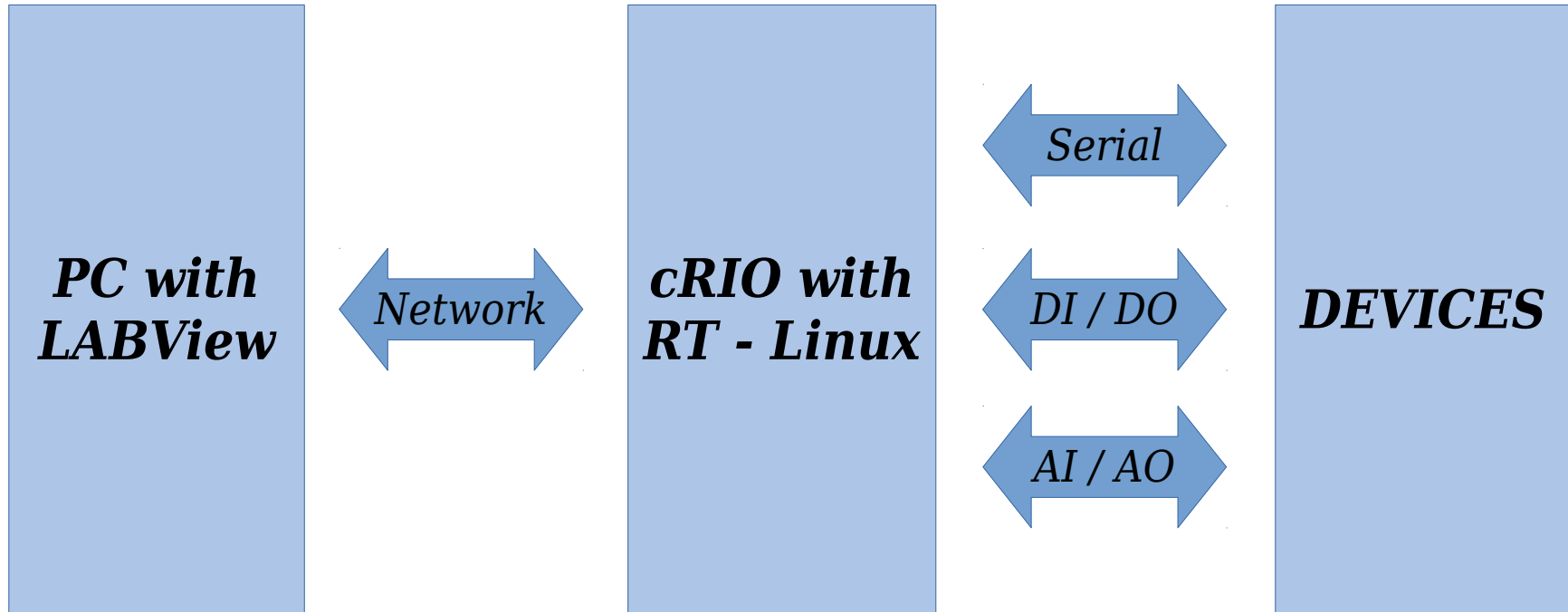
***Emulation of Beam-Dump and its tests
with prototype of controller***

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Jet target slowcontrol scheme



***PC with LABView 2018 for controlling & programming cRIO
NI cRIO 9082 with DI, DO, AI, AO, RS-485 modules***

cRIO 9082 fulfills all our hardware requirements

Undesired features:

Non open source software

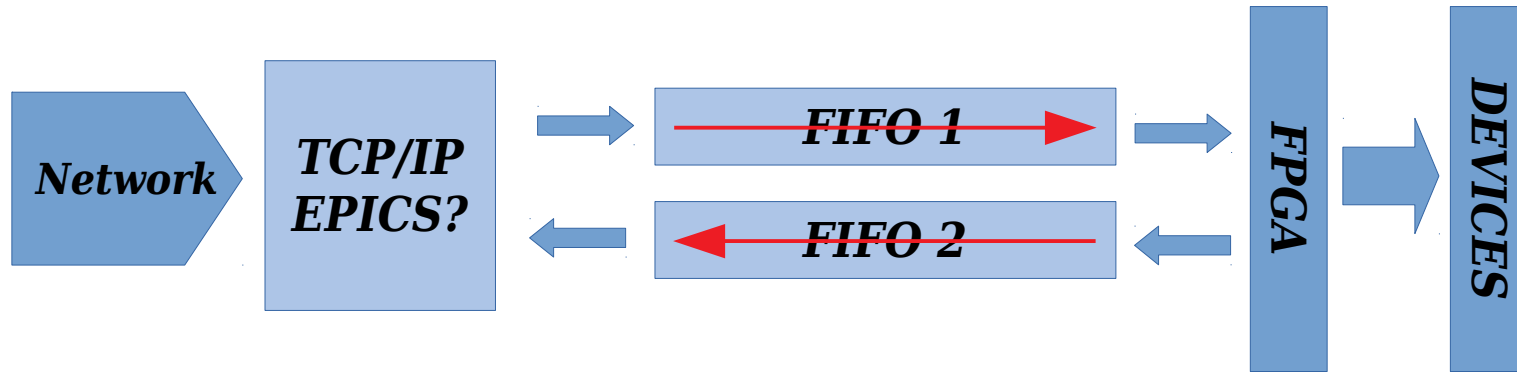
Difficult programming

Limited resources (1.3 GHz Intel Atom, 2GB memory)

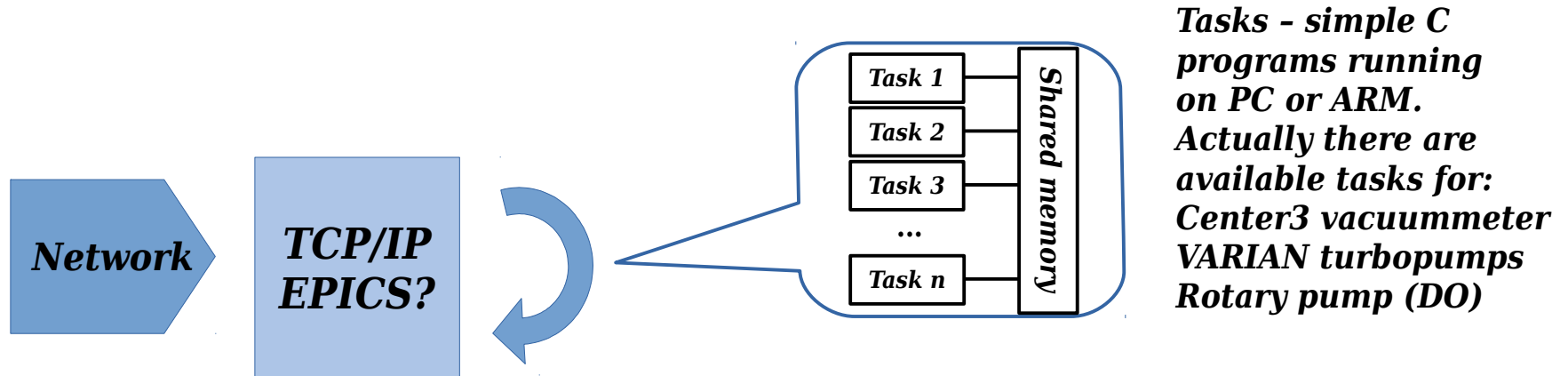
Complicate data transfer to and from FPGA

Compatibility with other open source software (EPICS)

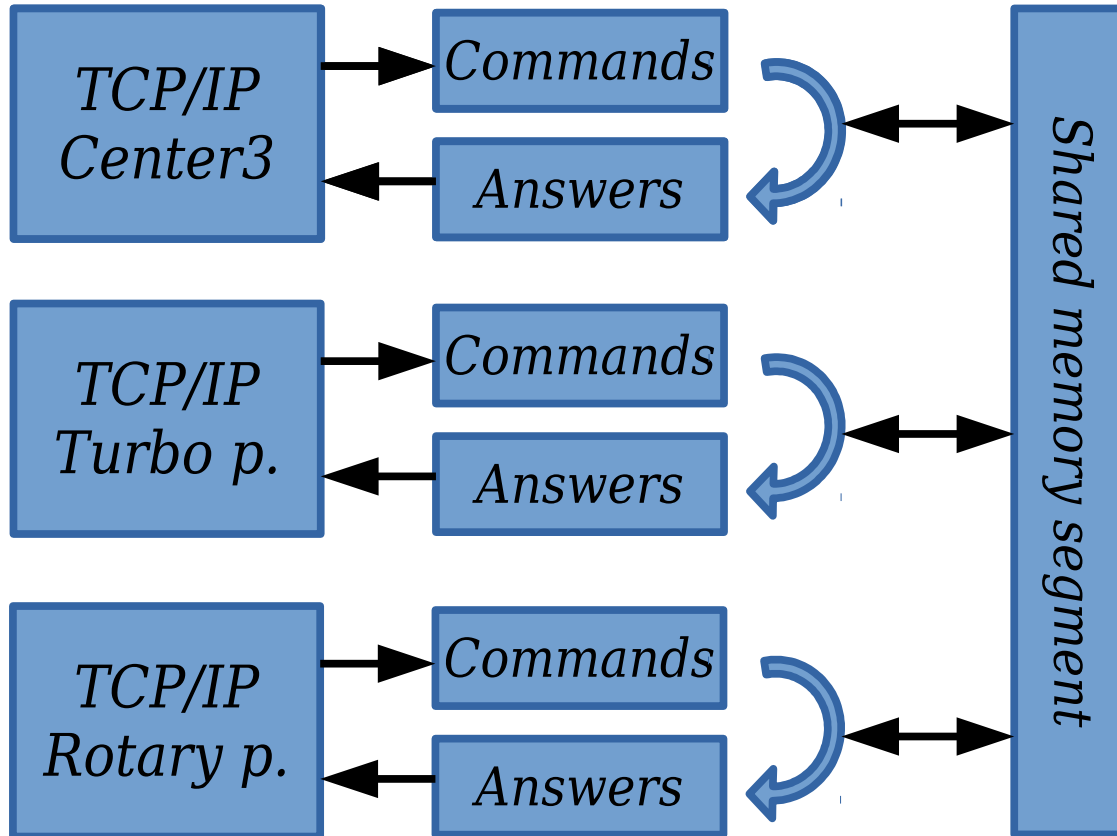
Standard cRIO data transfer task and its emulation



Emulation task on PC or ARM



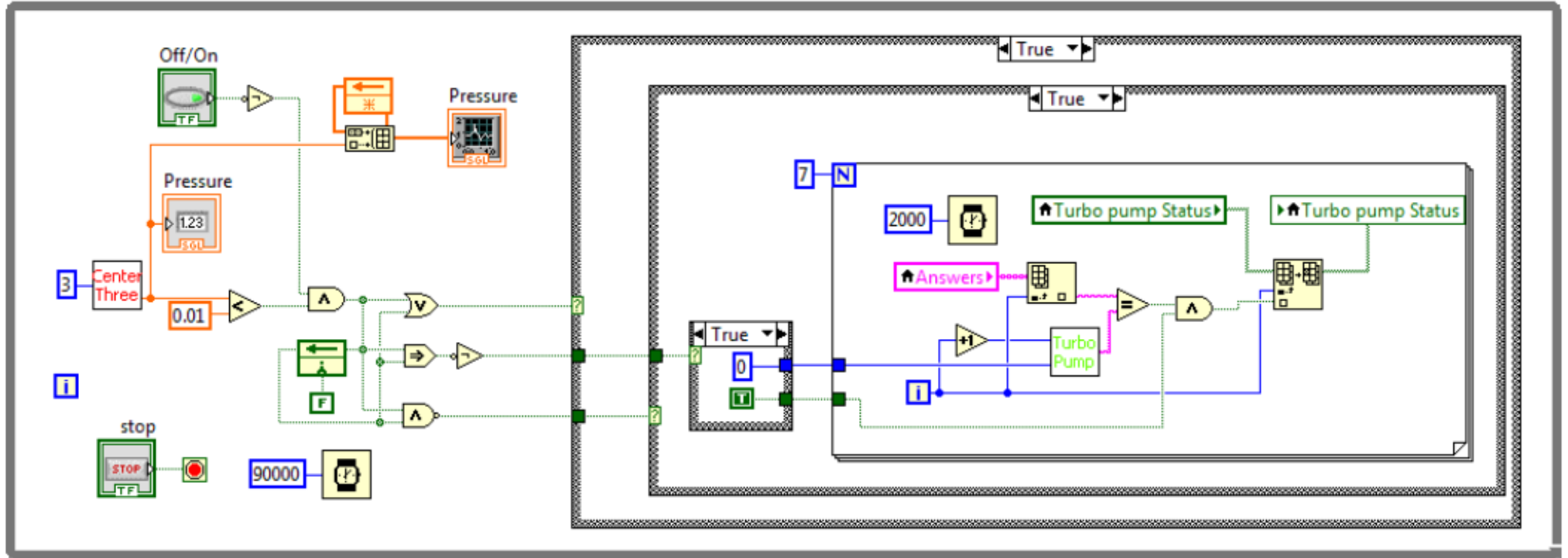
Software emulation with interaction between devices



Interaction between devices allows for realistic tests of slow-control controllers. Extraordinary situations can be tested without risk of the hardware damage.

For example Center3 task Depends on start or stop time of pumps.

LABView diagram of Beam-dump controller

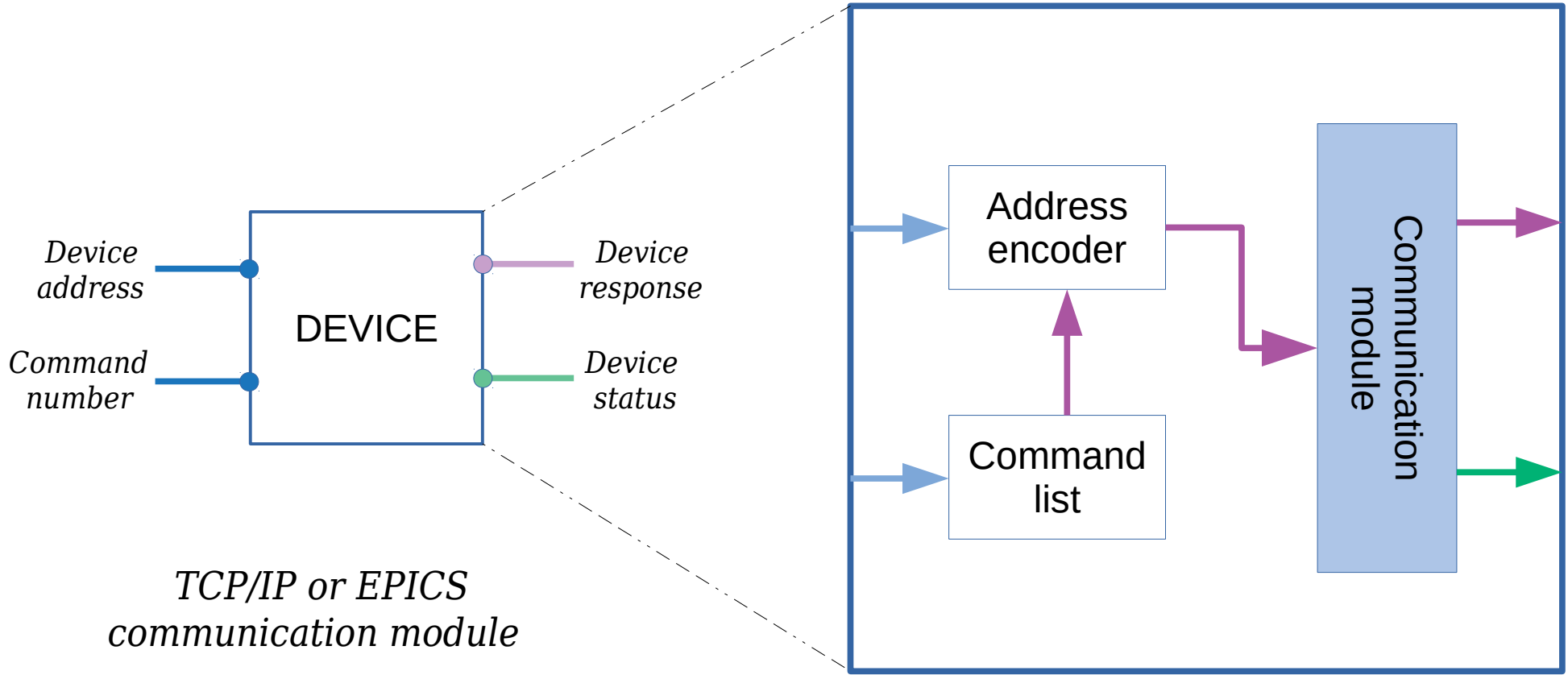


Four state machine:

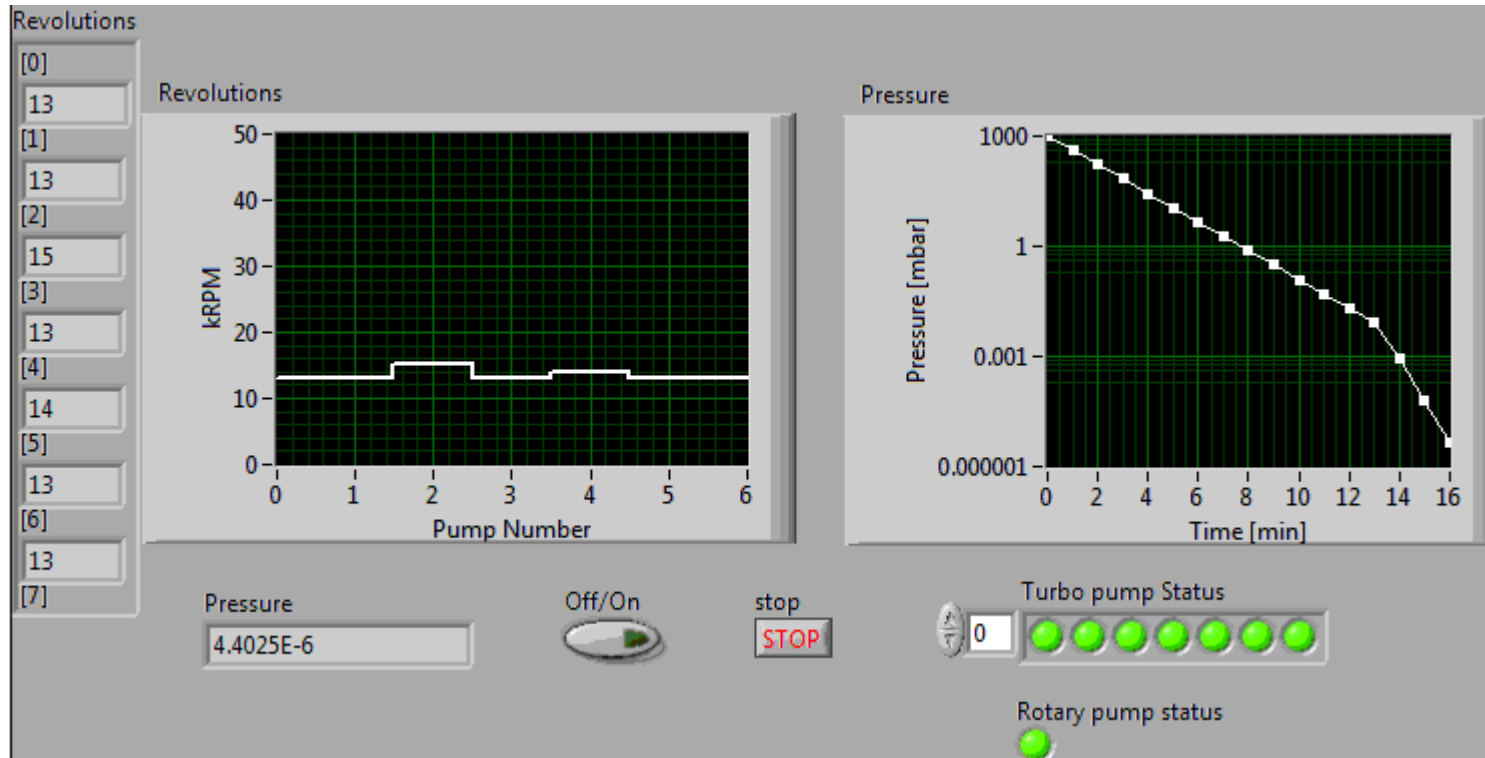
1. Bad vacuum: wait, do nothing
2. Change bad→good: start pumps

3. Good vacuum: monitoring pumps
4. Change good→bad: stop pumps

Diagram of device sub-VI



Front panel of Beam-dump controller



TO DO

Construction of sub-VI for other devices

Learning of control procedures

Compatibility between standard and LabView EPICS

Possible using of EPICS protocol for cRIO