Preliminary Test of EPICS Waveform Supports for TPS

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Abstract

The TPS (Taiwan Photon Source) is newly proposed the 3 GeV synchrotron light source project. The control system of TPS is based upon EPICS framework. Waveform displays on control console and data acquisition are essential for the commissioning and operation of TPS. The EPICS IOCs, scope IOCs, digitizers and oscilloscopes can support to acquire waveform through EPICS channel access. The EDM is used to implement the operation interface of control console and will provide waveform display from EPICS scope IOC, digitizers and oscilloscopes with various sampling rate and vertical scale. The environment is implemented and tested at the existed 1.5 GeV Taiwan Light Source (TLS). The efforts will be summarized at this report.

Introduction

- The EPICS framework was selected as control system infrastructure for the TPS project.
- The EPICS platform has been gradually built and tested to control and monitor the subsystems of TPS.
- There are many waveforms alike signals which should be observed in synchrotron light sources including current waveform variation.
- Acquiring waveform data should be based upon EPICS waveform supports. One of the advantages on EPICS waveform support is the remote control and monitor of various instrumentations.
- Through PV (Process Variable) channel access the client console can monitor the waveform by using various toolkits (EDM, MEDM, MATLAB and etc).
- Ethernet interface LXI based instrumentations will be adopted extensively therefore building EPICS modules which can be communicated with these instrumentations would be necessary.
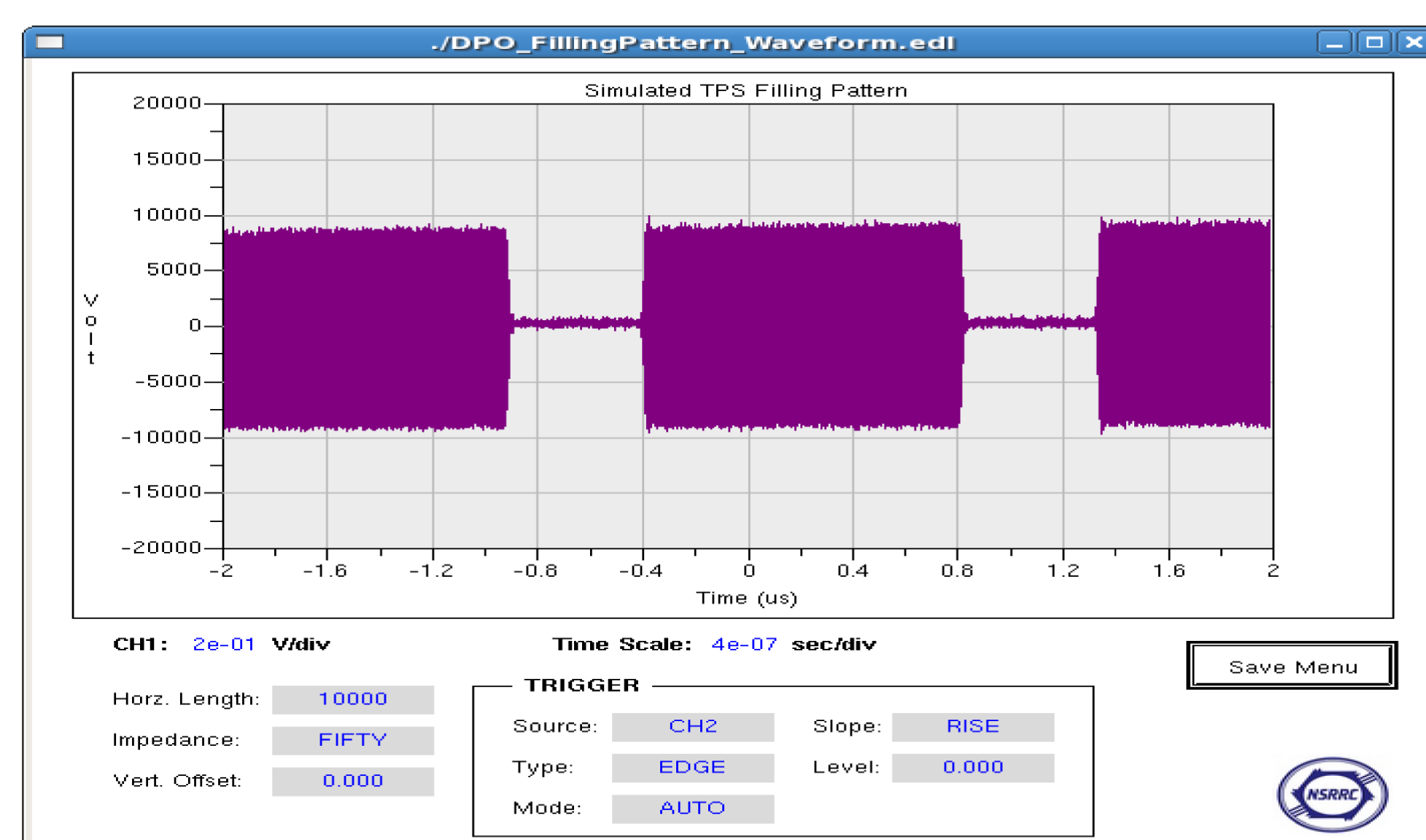
EPICS Waveform Supports

- An EPICS support IOC can interface various instrumentation devices anytime and anywhere.
- By the EPICS channel access the clients can use the specific toolkits to access IOCs which communicate with instrumentation devices.
- The basic functions of EPICS waveform support include monitor and control pages that show channel status, select display input channel, save and load configuration, save waveform to file, waveform hardcopy and etc.
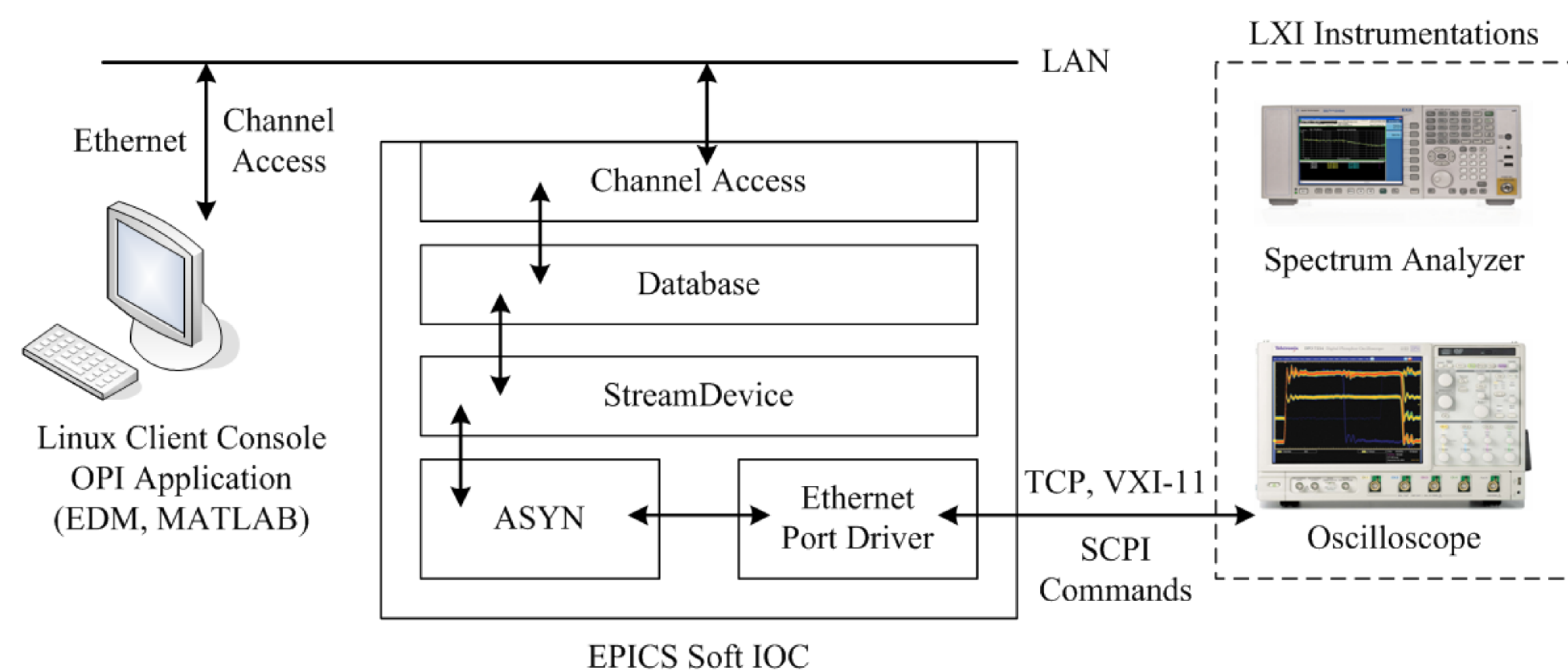
LXI Oscilloscope

- The StreamDevice and ASYN modules are needed, and employed to communicate with LXI based oscilloscope through Ethernet interface.
- At the StreamDevice module, the protocol file is used to describe the communication of various devices, and contains each function of the device type and variables which affect how the commands in a protocol work.
- The output function in protocol files can send the ASCII-based SCPI (Standard Commands for Programmable Instruments) command to the instrument devices for communicating.
- The ASYN module can set the communication protocol (TCP or VXI-11) to connect various instrument devices.
- DPO7254 as the EPICS waveform support test-bench of LXI based oscilloscope is launched.

LXI Spectrum Analyzer

- N9010A EXA is used as the EPICS waveform support test-bench of LXI based spectrum analyzer.
- The StreamDevice and ASYN modules are applied to communicate through TCP network protocol.
- According to the SCPI commands of spectrum analyzer, establish the specific protocol file with the StreamDevice modules.
- The console host with EDM or MATLAB toolkit can observe the waveform acquired from IOC through PV channel access.
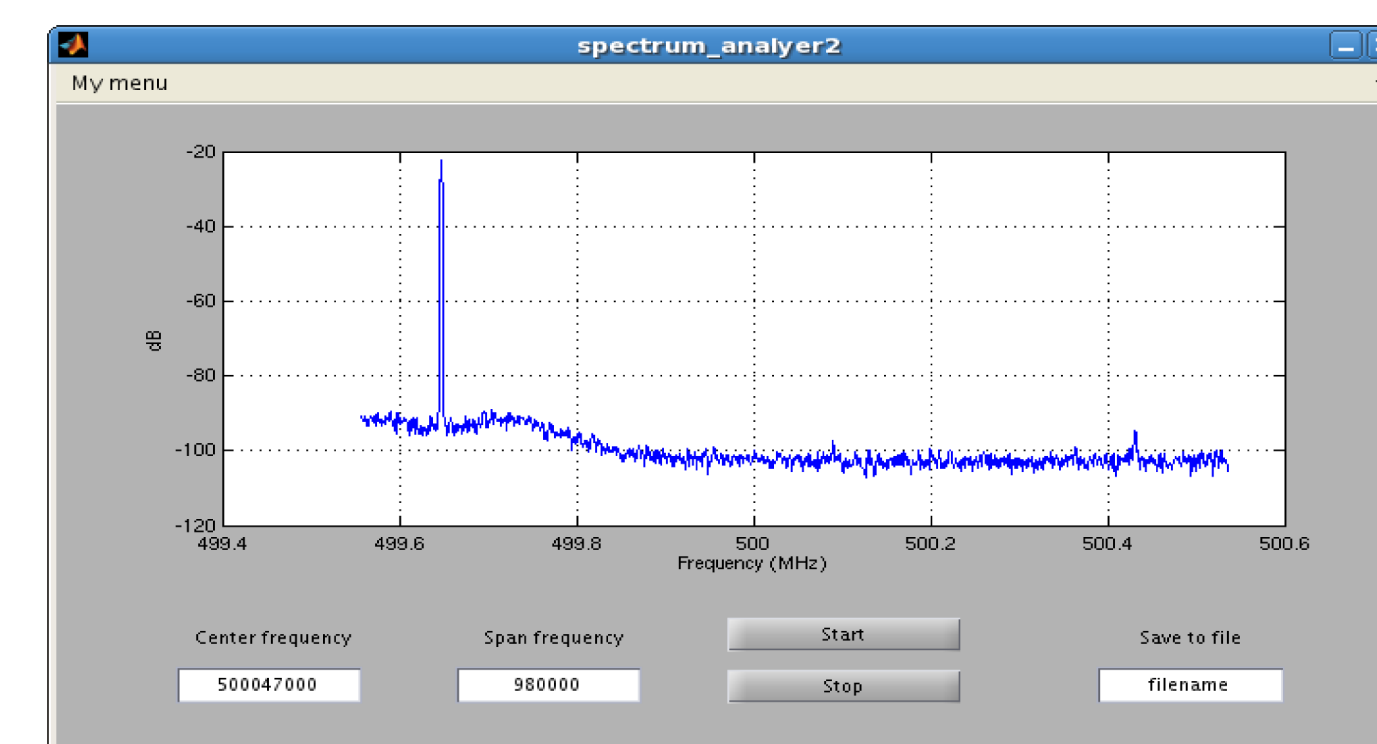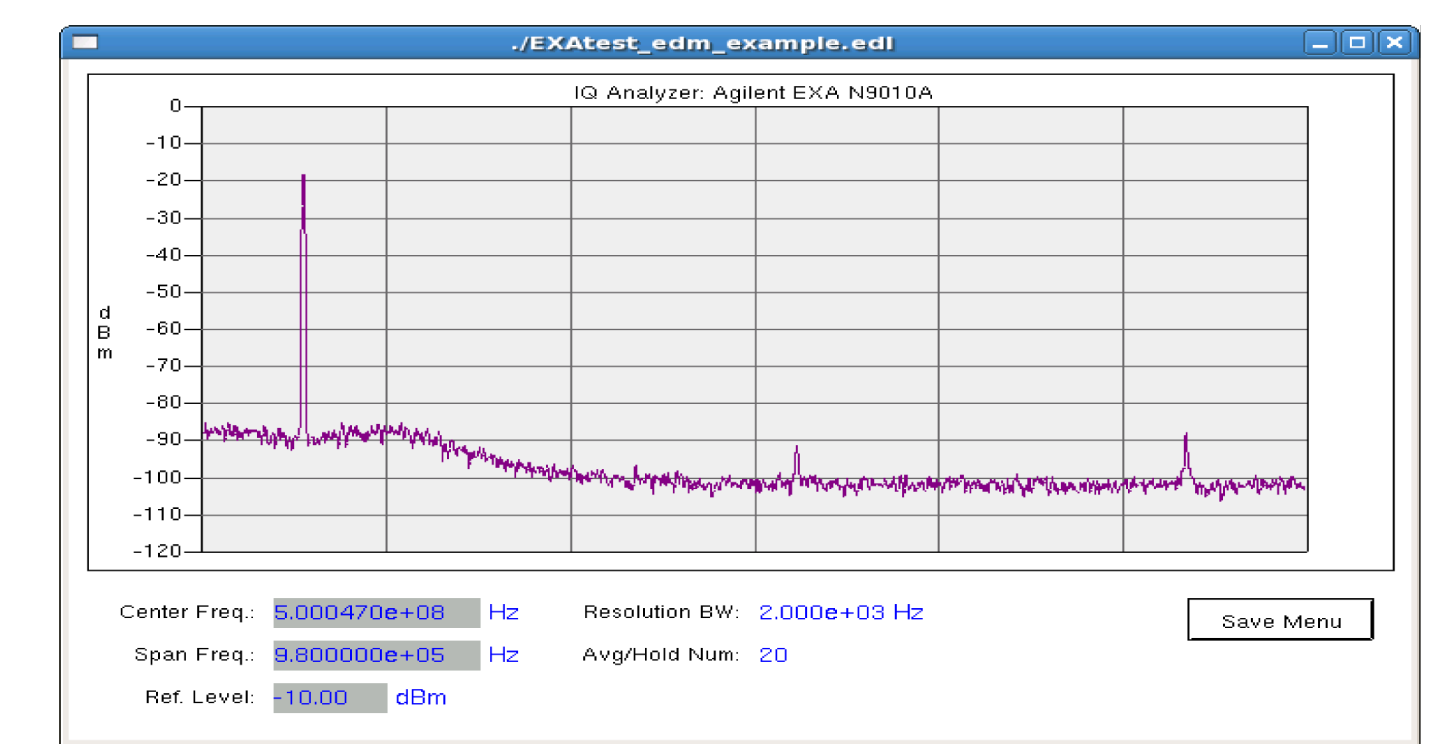

Figure: MATLAB display page

Figure: EDM display page

EPICS Oscilloscope

- ZT4612 scope has built into EPICS framework as an IOC. The PVs can support complete oscilloscope control attached the EPICS mechanism.
- The preliminary test of EPICS waveform supports are applied on the actual signals of TLS to observe the measured waveform of Linac current transformer with building the specific EDM control page.
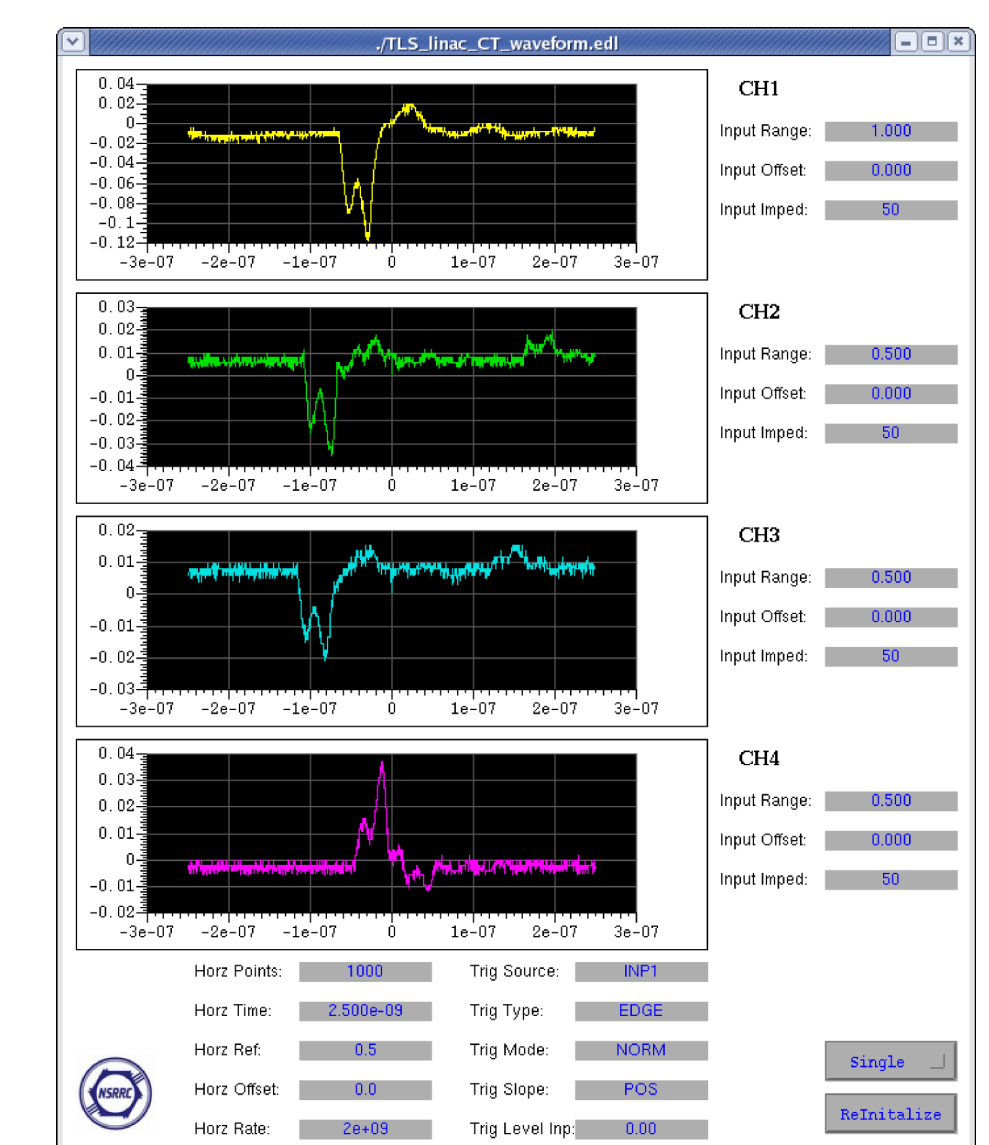
cPCI Digitizer and Power Supply Built-in Data Buffer

- **cPCI Digitizer:**
  - The cPCI digitizer is used to capture waveform up to 128 kHz rate with 24 bits or 500 kHz rate with 16 bits ADC resolution.
  - ACQ196CPCI digitizer which is a networked Linux system and embedded with EPICS IOC is adopted and used to record the beam trip signals of the TLS.
- **Power Supply Built-in Data Buffer:**
  - Intermediate current power supply for the TPS quadrupoles and sextupoles will be built with waveform capture buffer.
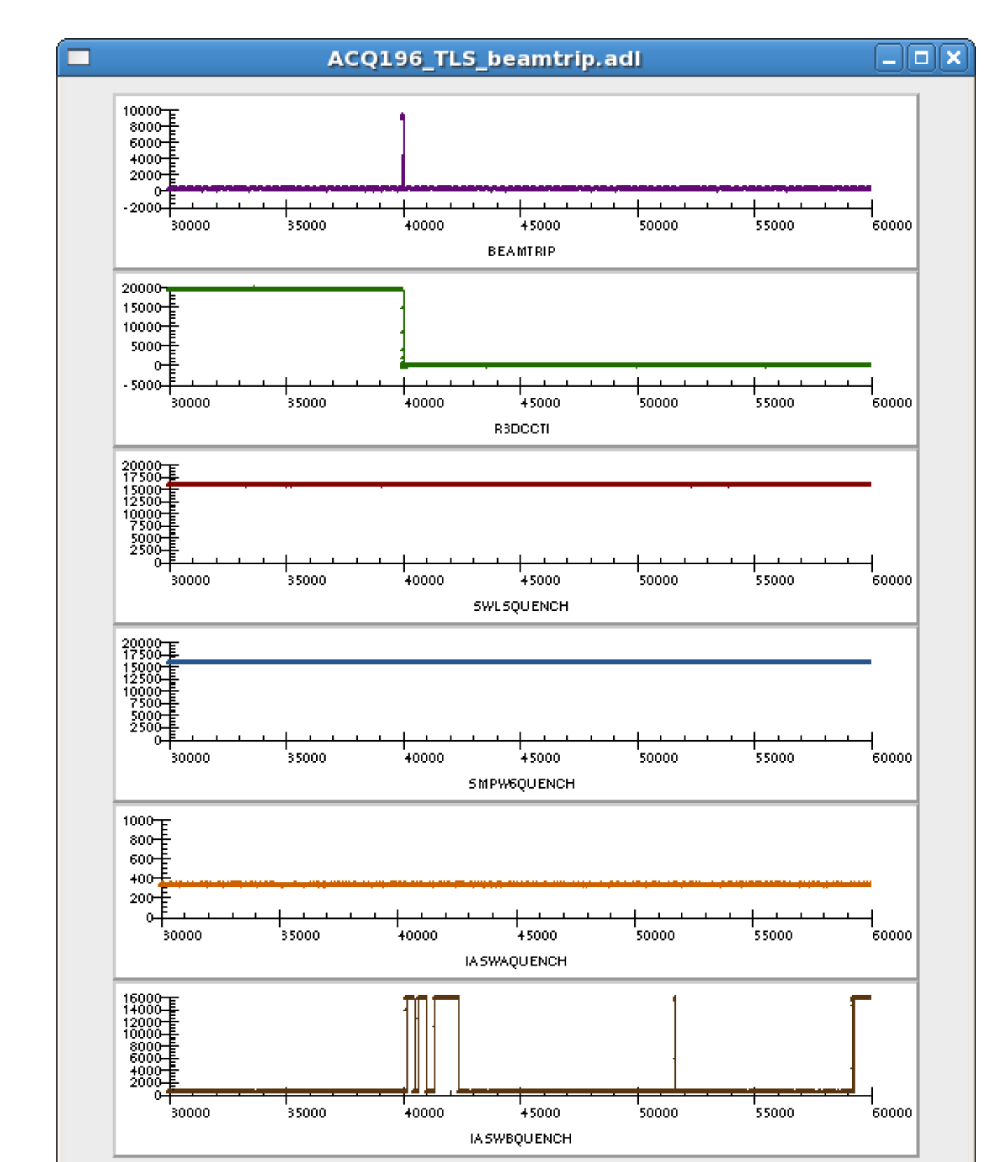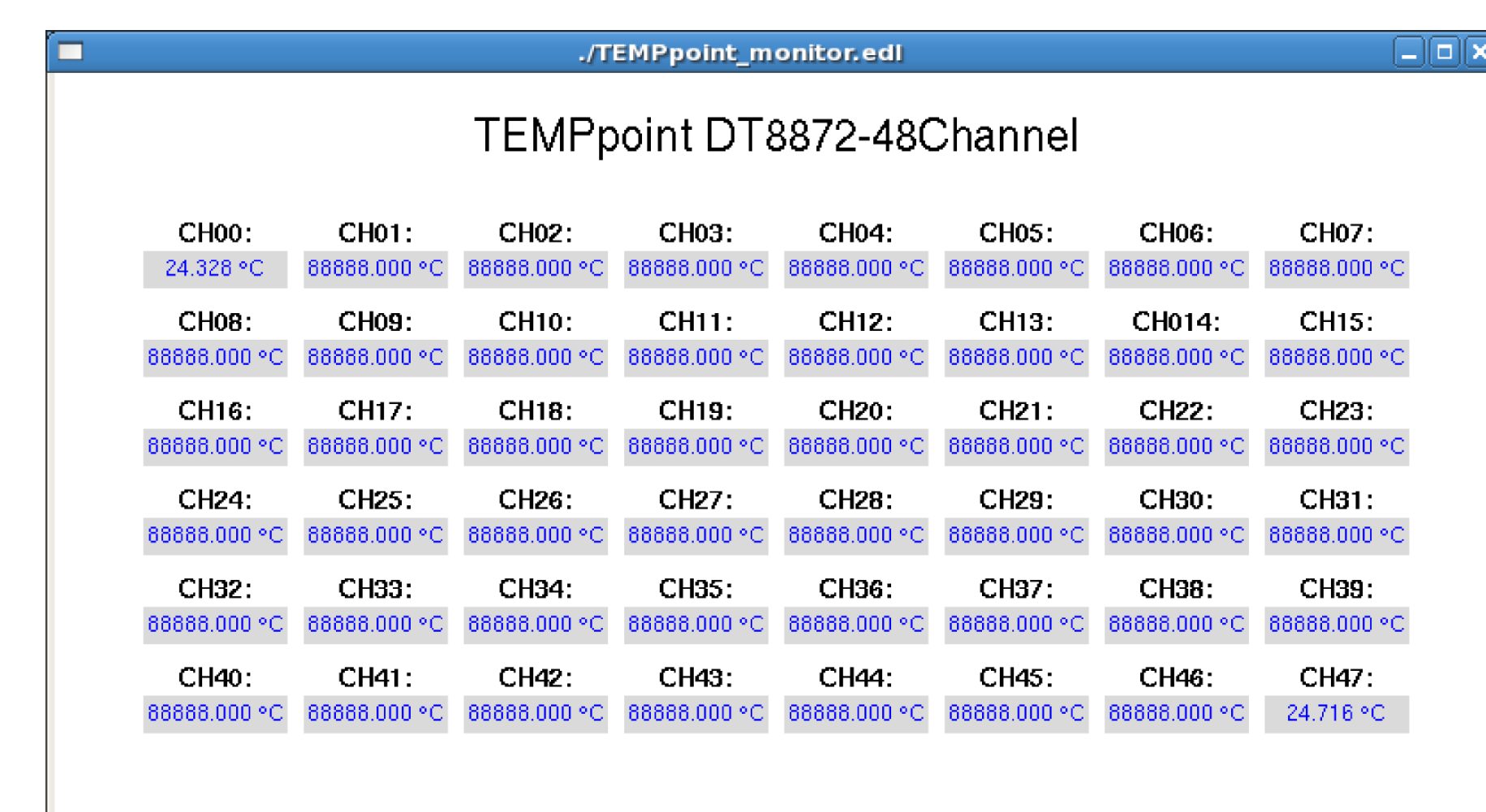 - The sampling rate is planed at 10 KHz with up to 10 sec data buffer.

Figure: MEDM page for Beam trip observation from ACQ196CPCI

Miscellaneous Devices

- The EPICS support for TEMPpoint/VOLTpoint/MEASpoint to measure temperature, voltage, or both is established by using the mentioned LXI based implemented method.

Summary

- Remote operations of all waveform acquisition instrumentations for the TPS are planned to eliminate long distance cabling and improves signal quality.
- The EPICS waveform support evaluation consists of the embedded EPICS oscilloscope and several different kinds of LXI instruments.
- The prototype IOCs modules to communicate with the specific LXI instrumentations are built and the different display control pages with PV channel access under Ethernet interface are depicted.