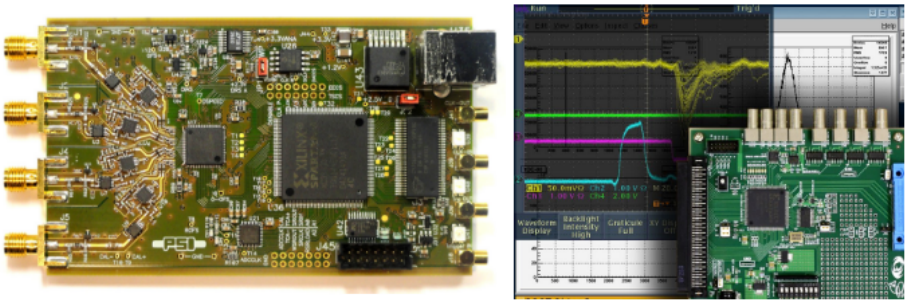
International School in Real Time Systems 2016



Report of Contributions

https://indico.cern.ch/e/rts2016

Contribution ID: **4** Type: **not specified**

Introduction: What is Real Time

Tuesday 19 July 2016 10:40 (1h 20m)

The lectures start with a definition of Real Time , its terminology and its applications in the different technical worlds from fundamental physiscs to the day to days life illustrated by typical examples.
Moving to the experimental Physics world, a short description of the basic fundamental detectors for vertexing, tracking, and calorimetry will be giving with their main electronics and read out features. Then, a little history of the trigger and data acquisition evolution over the last 30 years will be presented with simple examples (SPS-NA3, LEP-OPAL,TEVATRON CDF/DO) followed by some conceptual architectures for the future next linear colliders (ILC/CLIC).
In conclusion, it will be shown that modern state of that art read out architectures,tools and technologies could be applied to other fields from security scanners ,severe nuclear accident monitoring instrumentation to medical imaging systems like Positron Emission Tomography and particle therapy.

Presenter: LE DÛ, Patrick

Session Classification: Lecture

Contribution ID: **5** Type: **not specified**

Introduction to readout, trigger and control architecture –From resistor to high energy physics experiment -

The world of frontier physics experiments challenges system design in all its aspects from the definition of the architecture, to data structures and general technology choices, all the way down to the the electronics components. The control and readout are based on very large and complex systems composed of many different technologies which are developed in different environments and cultures. Ultimately, they must meet in a well-integrated system for operational efficiency, and allow maintenance and upgrades over a very long period of time, often without the original designers. This translates into a number of considerations and guidelines which should be taken into account from day one in the development of each of the sub-components.
The first part of the lecture gives an introduction to the design of the general architecture of readout, trigger and control systems of the physics experiments, and outlines the definition and functionality of each of the sub-systems. Particular emphasis is put on the functional and environmental criteria which drives the technological choices and the development strategy in view of the long life cycle of the experiments and the many different phases.
In the second part, we will have a look at a number of actual implementations, and examine different choices in electronics, data structures, compression technologies, communication protocols, and how these areas have evolved of the last decade.

Edit July, 21: By popular demand I have added a simple example how to use the RPC (remote procedure call) protocol.

Presenter: PURSCHKE, Martin Lothar (Brookhaven National Laboratory (US))

Session Classification: Lecture

Contribution ID: **6** Type: **not specified**

Waveform digitising and signal processing

Data acquisition in nuclear and particle physics requires the precise measurement of signal amplitudes and time from detectors. This lecture first gives an overview of traditional methods using signal shaping, various discriminators and analog-to-digital converters (ADC) and time-to-digital converters (TDC). It then moves over to high speed waveform digitizing, a field which recently made tremendous progress due to faster ADCs and so-called switched-capacitor array integrated circuits. These novel devices allow the direct digitisation of detectors with several gigasamples per second (GSPS) and resolutions up to 12 bits. The lecture introduces various signal processing methods to extract the signal amplitude and time from detector signals in the presence of noise.

Presenter: RITT, Stefan (Paul Scherrer Institut (CH))

Session Classification: Lecture

Contribution ID: **7** Type: **not specified**

Real-time data visualization and control using modern Web technologies

Wednesday 20 July 2016 09:00 (1h 20m)

This tutorial teaches modern web technologies for real time visualization and control of processes and experiments. The course starts from basic HTML elements, and then covers modern HTML5 technologies and their usage to display any graphical data. An embedded web server on a Raspberry Pi computer is written from scratch, which can be controlled from any browser using the above technologies to read sensors and switch outputs.

Every attendee is encouraged to bring her/his own laptop to
interactively develop and test all examples. A wireless private network will be available. It is recommended to have a quick look at JSFiddle (https://jsfiddle.net) since this tool will be used throughout the course.

Presenter: RITT, Stefan (Paul Scherrer Institut (CH))

Session Classification: Lecture

Contribution ID: **8** Type: **not specified**

Unix Shell basics

At the start of the school I will give a very brief introduction to the Unix shell. Most of the exercises during the school will make use of the shell in one way or another, so it is important to be comfortable with it. I will explain why the shell is so powerful, and give some every-day use examples so it is easier for novices to get around on the system.

Presenter: PURSCHKE, Martin Lothar (Brookhaven National Laboratory (US))

Session Classification: Lecture

Contribution ID: **9** Type: **not specified**

An Introduction to Networks

Monday 25 July 2016 11:00 (40 minutes)

I will give a brief introduction to the basics of the networking setups we will be using during the exercises of the school. I will explain IP address, netmasks and broadcast addresses, gateways, and explain the concepts of networks to the extent that we will need them during the school.

Presenter: PURSCHKE, Martin Lothar (Brookhaven National Laboratory (US))

Session Classification: Lecture

Contribution ID: **10** Type: **not specified**

Exercise 1

Wednesday 20 July 2016 13:30 (1h 20m)

Session Classification: Exercise

Contribution ID: **11** Type: **not specified**

Exercise 1

Wednesday 20 July 2016 15:10 (1h 20m)

Session Classification: Exercise

Contribution ID: **12** Type: **not specified**

Exercise 1

Thursday 21 July 2016 09:00 (1h 20m)

Session Classification: Exercise

Contribution ID: **13** Type: **not specified**

Exercise 1

Thursday 21 July 2016 10:40 (1h 20m)

Session Classification: Exercise

Contribution ID: **14** Type: **not specified**

Exercise 1

Thursday 21 July 2016 13:30 (1h 20m)

Session Classification: Exercise

Contribution ID: **15** Type: **not specified**

Exercise 1

Thursday 21 July 2016 15:10 (1h 20m)

Session Classification: Exercise

Contribution ID: **16** Type: **not specified**

Exercise 2

Friday 22 July 2016 13:30 (1h 20m)

Session Classification: Exercise

Contribution ID: **17** Type: **not specified**

Exercise 2

Friday 22 July 2016 15:10 (1h 20m)

Session Classification: Exercise

Contribution ID: **18** Type: **not specified**

Exercise 2

Saturday 23 July 2016 09:00 (1h 20m)

Session Classification: Exercise

Contribution ID: **19** Type: **not specified**

Exercise 2

Saturday 23 July 2016 10:40 (1h 20m)

Session Classification: Exercise

Contribution ID: **20** Type: **not specified**

Exercise 2

Saturday 23 July 2016 13:30 (1h 20m)

Session Classification: Exercise

Contribution ID: **21** Type: **not specified**

Exercise 2

Saturday 23 July 2016 15:10 (1h 20m)

Session Classification: Exercise

Contribution ID: **22** Type: **not specified**

An Introduction to the RCDAQ data acquisition system

Tuesday 19 July 2016 13:30 (40 minutes)

I will give an introduction to the DAQ system which we will use frequently during the school. I will talk about the designs (and some of the design features of a DAQ system in general that I find essential), and teach you about the setup, use, and analysis of the data.

Presenter: PURSCHKE, Martin Lothar (Brookhaven National Laboratory (US))

Session Classification: Lecture

Contribution ID: **23** Type: **not specified**

Front-end Electronics, Waveform Digitizing and Signal Processing

Tuesday 19 July 2016 15:10 (1h 20m)

Presenter: RITT, Stefan (Paul Scherrer Institut (CH))

Session Classification: Lecture

Contribution ID: **24** Type: **not specified**

The ATLAS Detector at LHC

Friday 22 July 2016 09:00 (1h 20m)

Presenter: BOHM, Christian (Stockholm University (SE))

Session Classification: Lecture

Contribution ID: **25** Type: **not specified**

Getting started with Raspberry Pi

Monday 25 July 2016 09:00 (20 minutes)

Presenter: RITT, Stefan (Paul Scherrer Institut (CH))

Session Classification: Lecture

Contribution ID: **26** Type: **not specified**

Raspberry Pi Sensors

Monday 25 July 2016 10:40 (20 minutes)

Based on questions from the students, I will explain a number of sensors that can easily be used with the Raspberry Pi. I will show how to control GPIO pins, connect an infrared sensor, and to connect a DS180B20 temperature sensor.

Presenter: PURSCHKE, Martin Lothar (Brookhaven National Laboratory (US))

Session Classification: Lecture

Contribution ID: **27** Type: **not specified**

Statistics and error propagation

Primary author: NOMACHI, MASAHARU

Presenter: NOMACHI, MASAHARU

Contribution ID: **28** Type: **not specified**

Timepix experiments