

IEEE NPSS International School for Real Time Systems in Particle Physics 2018



Contribution ID: 39

Type: **not specified**

From Resistor to High Energy Physics Experiments

Monday, 9 July 2018 09:15 (45 minutes)

This series of 2 lectures introduces some basic concepts in modern 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 in the last decade.

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