Applications of FPGA Reconfiguration for Experiments in High Energy Physics

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Physicists either like huge or extremely small numbers. In our case a particle detector in ALICE Experiment consists of 1.16 million analogue channels producing terabytes of data per second. All this data needs to be analyzed within microseconds on the first level. At higher levels, large compute farms including FPGA-based accelerators are other challenges our designers are faced with. Finally, the nature of these experiments implies time frames of more than ten years for construction and another ten years for running all experiments.

The need of flexibility in algorithmic designs makes FPGAs a good candidate for fast event recognition. However a couple of new questions arise: How should we manage to configure thousands of FPGA devices? How can we make FPGAs radiation tolerant?

Partial reconfiguration is a new tool which may give an answer to these questions.

The presentation addresses some applications of (dynamic) runtime reconfiguration in our future detectors at CERN and GSI. These applications include configuration refresh techniques for FPGA-based fault tolerant designs and configuration management techniques for networks of thousands of FPGAs.