INTEGRATION OF PLC AND PXI CONTROL SYSTEMS

THPHA145

A. Antoine, C. Boucly, T. Gharsa, CERN, Geneva, Switzerland
Alain.antoine@cern.ch, Christophe.boucly@cern.ch, Thierry.gharsa@Cern.ch

Abstract

 Engineers are often challenged with the need to integrate several technologies to find optimal solutions when designing new control architectures. Generally, the technical solutions chosen require the combination of various industrial products such as PXI systems for applications requiring fast acquisition, analysis and reaction times, while PLCs are commonly used for their reliability and their ability to withstand industrial environments. The needs to exchange information between these different technologies can today be solved by using industrial fieldbuses such as Profibus DP or Profinet IO. This paper describes the technical aspects of the two options, focussing on their advantages and constraints. The experience gained with integrating PXI and PLC systems as part of the 2016 consolidation project of the control of the kicker systems of the Antiproton Decelerator (AD) at CERN will be presented.
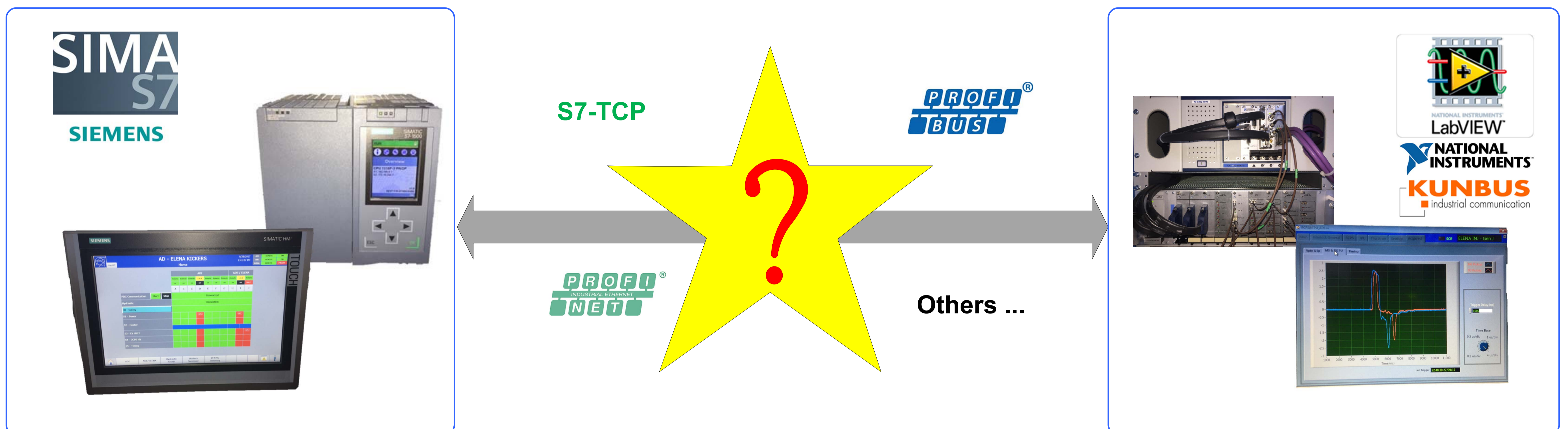
 The original study initiated by TE-ABT considers three communication solutions: the Profibus DP, the Profinet IO and the S7-TCP. This last was quickly excluded as a viable operational solution as it requires separate configuration/settings routers, higher programming technique and usable only in homogeneous SIMATIC environment. On the other hand, the Control group (BE-CO) at CERN provides a communication solution that could also be consider to build a communication channel between a PLC and a PXI through their Front-End Software Architecture (FESA). Unfortunately, the choice of such a solution would lead to additional software layers, more complexity and dependence on external services, which would not allow the exchange of critical data such as interlocks.

Process Field Bus Decentralized Periphery

- Standardized in IEC 61158
- GSD file as device description (ASCII)
- Line topology nework supported
- Maximum network speed of 12 Mbit/s
- Maximum number of devices of 126

- Data frame up to 244 Byte/frame
- Master/slave bus
- Wireless possible via proprietary solutions
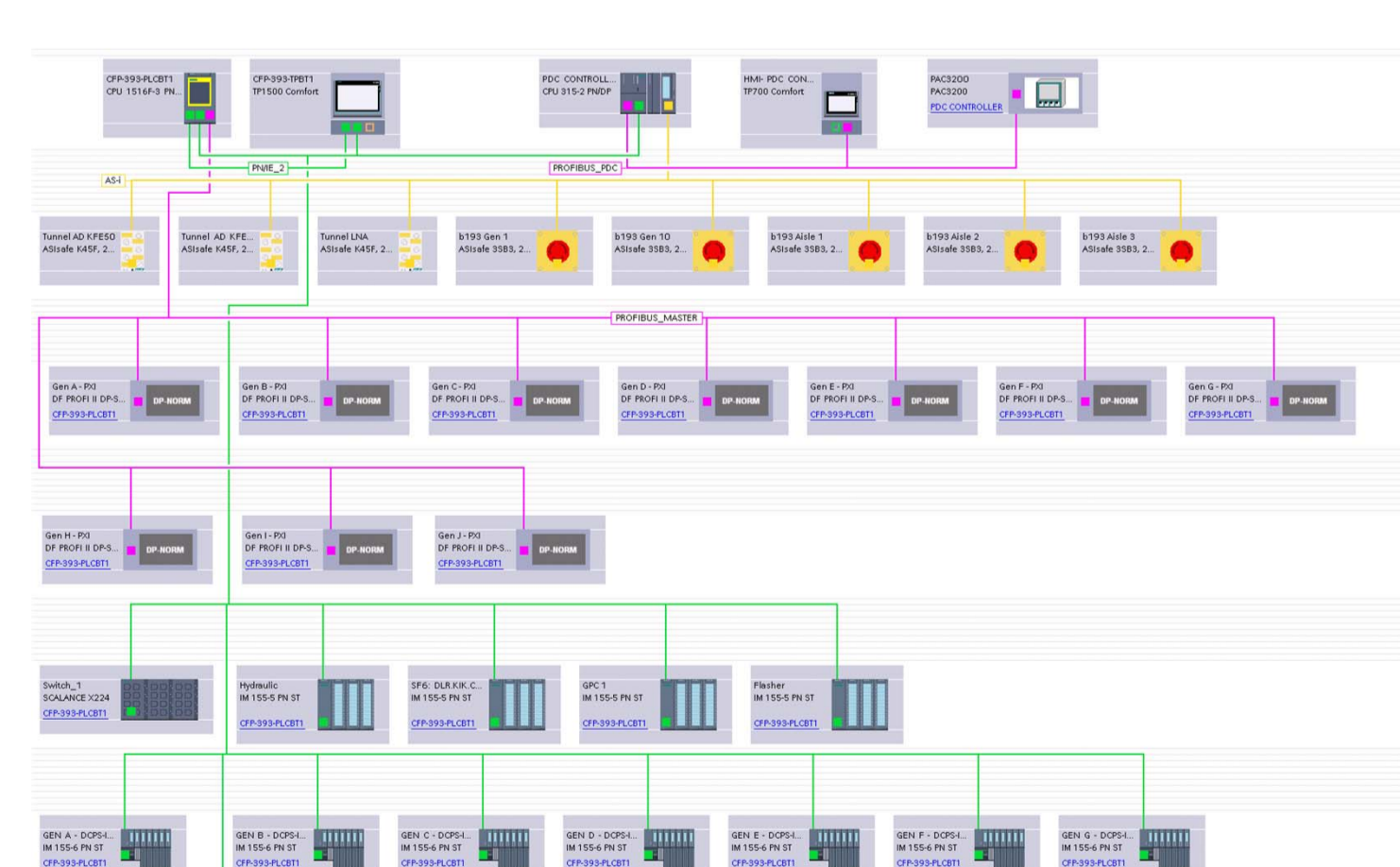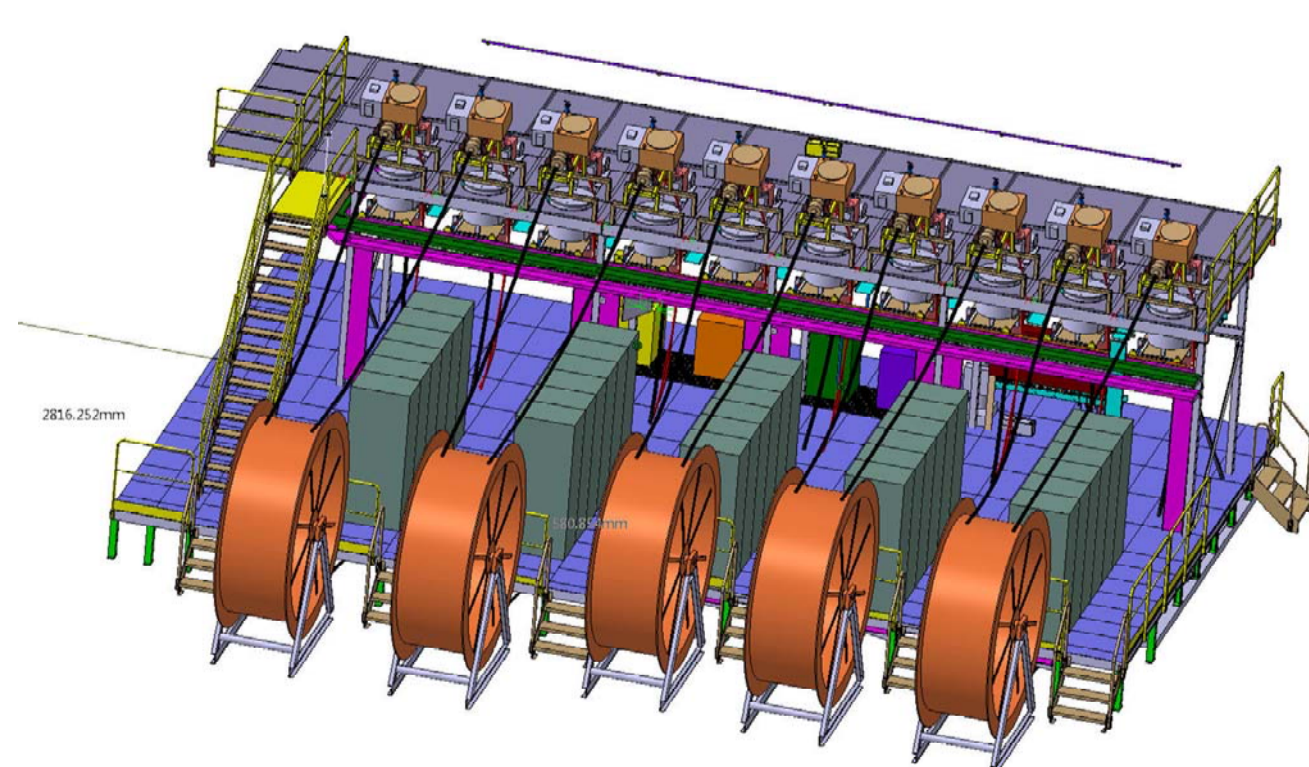- 32 axes capabilities for motion
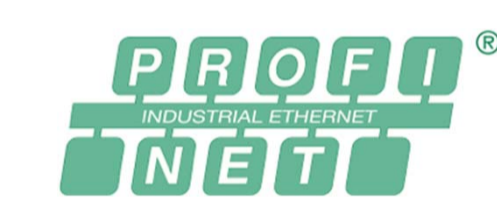
Process Field NET Input Output

- Standardized in IEC 61158 and IEC 61784
- GSDML file as device description (XML)
- Line, tree, ring, star topology nework supported
- Maximum network speed of 100Mbit/s
- Maximum number of devices unlimited (depends on the subnet mask)
- Data frame up to 1440 Byte/frame
- Provider/consumer bus (multi masters allowed)
- Wireless via wifi (IEEE802.11)
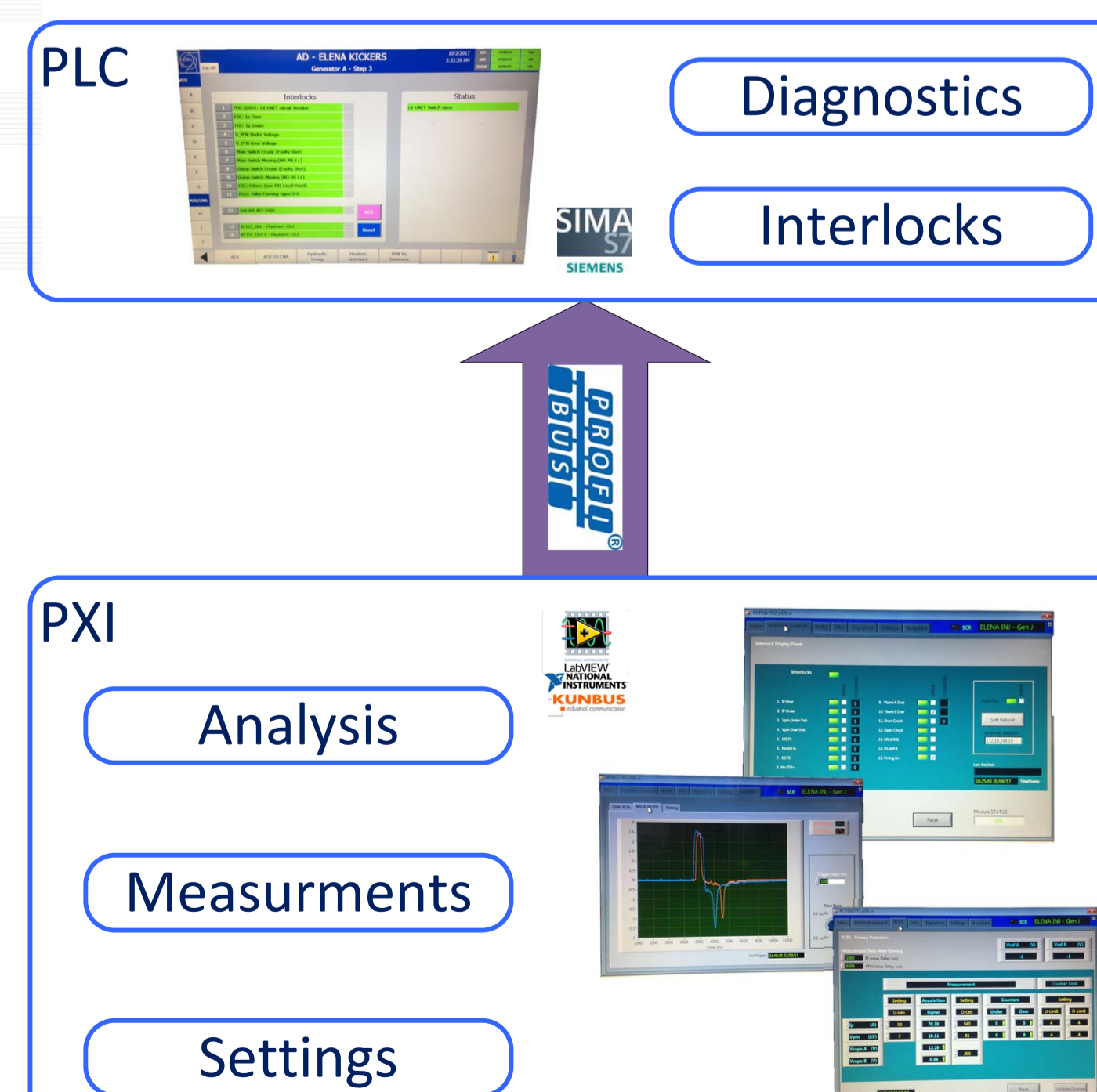- 150 axes capabilities for motion

Antiproton Decelerator (AD) Kicker Experience

The AD and ELENA kickers are made of 10 identical high voltage generators.

The new AD control kicker system with 10 PXI slaves connected to the Siemens master S7-1516F CPU is in service for 2 years and no major failures have been reported during operation.

PLC — Diagnostics / Interlocks

The slow control is the centre of the control architecture and links all sub-systems together (Electrical distribution, Safety, Timing, Fast control, diagnostics, HMI, SCADA). This leading responsibility requires assigning it to the master of the fieldbus and therefore only the Profibus DP fieldbus can be used as Kunbus Profinet card doesn't support the slave role.

PXI — Analysis / Measurments / Settings

Summary

 The needs for different types of technologies to exchange data is a challenge that found solutions in the use of standard fieldbuses. The use of Profibus DP and/or Profinet IO standards are solutions to integrate heterogeneous hardware. These standards are supported by 1400 manufacturers guarantying the openness of the technology used for data collection and for process control. The success of the consolidation of the AD kickers with the integration of Siemens PLC and PXI hardware highlights the efficiency of using such solution and has proven its robustness with no major failure since its commissioning in 2015.