



FlexRHINO - streamlined service for FlexRIO-based high performance applications

Pasi Karppinen



Pasi Karppinen

- Chief Technology Officer (4 years)
- Certified Labview Developer
- Background in industrial physics





ProtoRhino

- Founded 2009
- Focused on the high-end measurement technology market
 - Custom measurement systems
 - Specialty in high-end FPGA systems
 - Strong instrumentation expertise with rigorous scientific measurement background





What this presentation is about

- What this presentation is about
 - Measuring natural events
- What this presentation is NOT
 - No artificially generated events
 - No RF communication
 - No digital communication

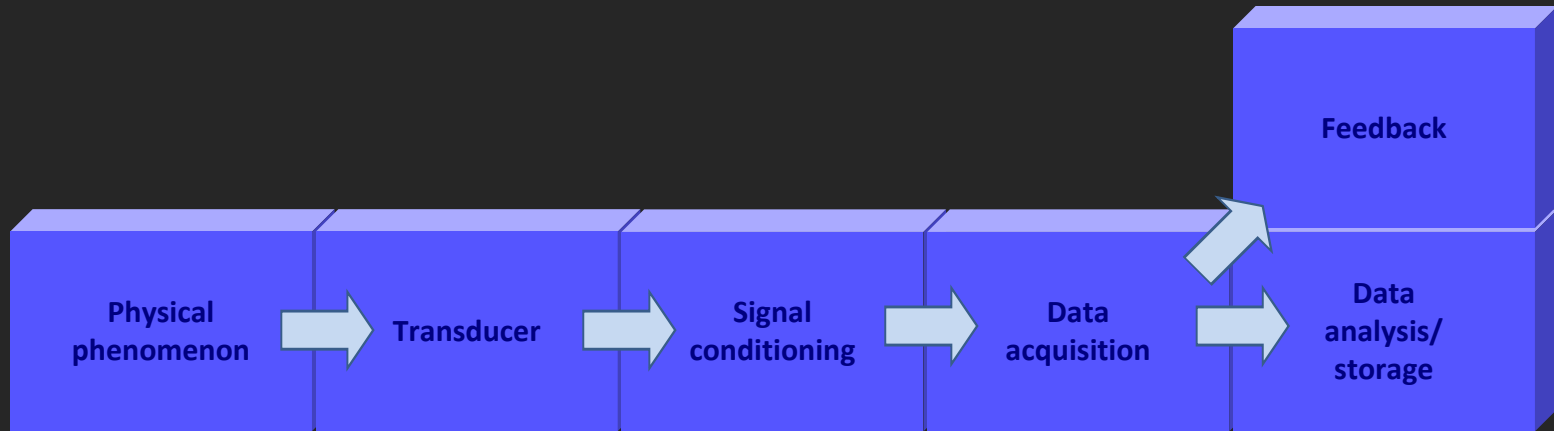


Outline

- What is measurement
- Quantities of measurement
- Tools of National Instruments
- FlexRHINO

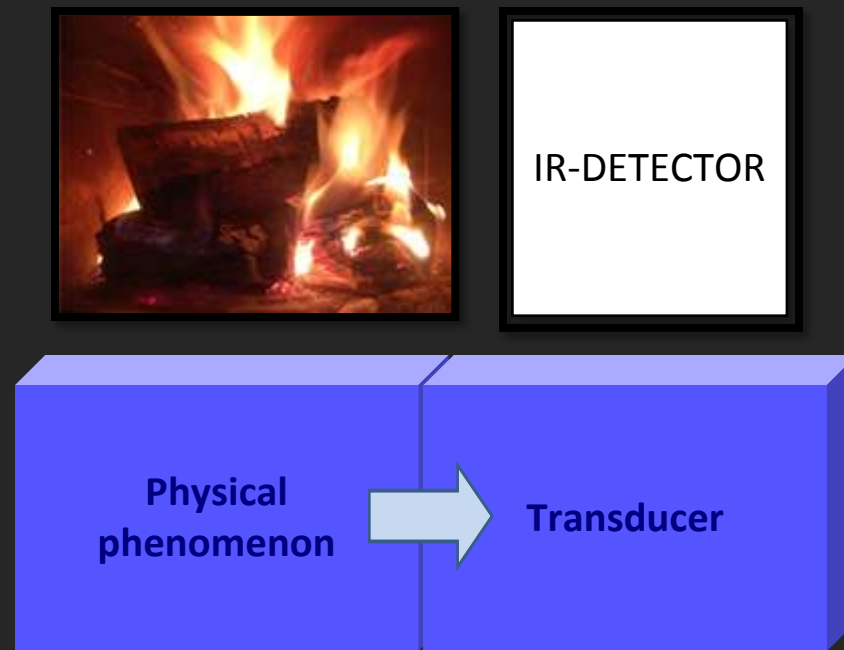


What is measurement





A closer look at what is actually measured



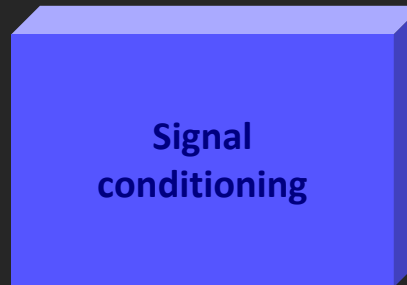


A closer look at what is measured

- What we are actually measuring
 - Thermocouple measures the temperature at the thermocouple
 - Ultrasound transducer measures the deformation of the transducer
 - Long and shear (always both)
 - Particle detector measures the interaction between the particle and the detector



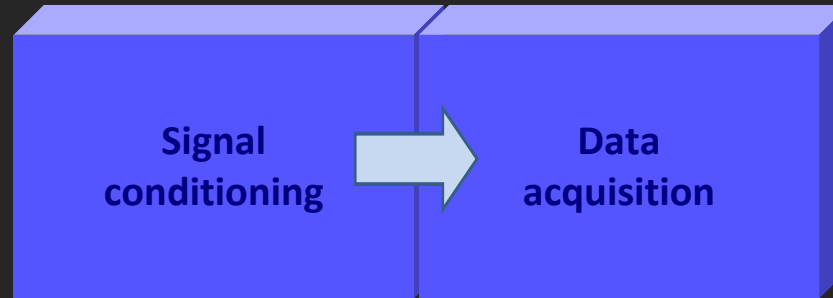
Signal conditioning



- Amplification
- Filtering
- Isolation



Quantities related to digitizing



- **Samplerate**
 - How rapidly a signal can be measured
- **Resolution**
 - How precisely a signal can be measured
- **Channel count**
 - How many channels can signals be measured from at once



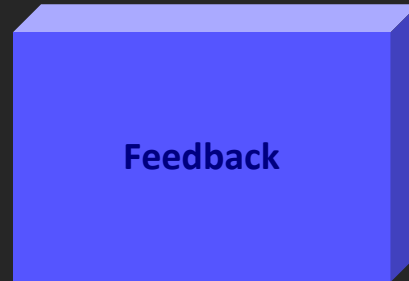
Digital realm



- Datarate
 - How fast collected data can be transmitted
- Data-analysis speed
 - How fast data can be analyzed
 - Latency
 - Time



Digital realm



- Feedback speed
 - How fast the analyzed results can be put to use back in the real world



NI FlexRIO



- State of the art FPGA circuit with multiple different possible front-end modules with varying connectors
 - Fast A/D converters available
 - Multichannel digitizers



Labview FPGA



- Easy-to-use visual programming language
 - Also modular



FlexRIO modules

Digital



100 Mbps
SE DIO



300 Mbps
LVDS DIO



300 Mbps
SE/LVDS DIO



1 Gbps
LVDS DIO



Camera Link



RS-485/422

Analog



2 ch. 1.6 GS/s,
12-bit AI



2 ch. 3 GS/s,
8-bit AI



2 ch. 100 MS/s,
14-bit AI / 16-bit AO



4 ch. 250 MS/s,
14-bit AI



2 ch. 250 MS/s,
16-bit AI



32 ch. 50 MS/s,
12-bit AI



16 ch. 50 MS/s,
14-bit AI



2 ch. 40 MS/s,
12-bit AI



2 ch. 80 MS/s,
14-bit AI



2 ch. 120 MS/s,
16-bit AI

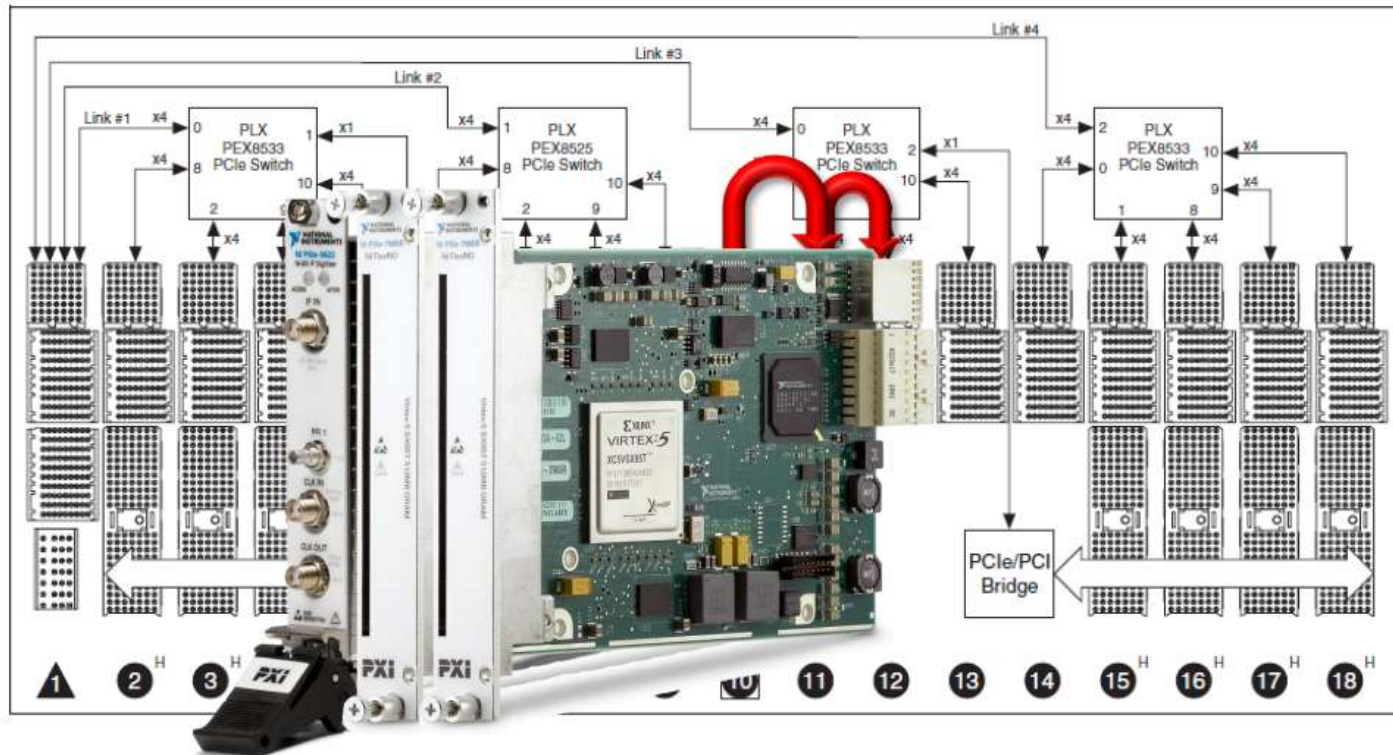


4 ch. 120 MS/s,
16-bit AI



FlexRIO Streaming

- >800 MB/s one-way
- >700 MB/s both ways
- ~10 us latency
- Up to 16 streams per FPGA





FlexRHINO

- For challenging measurement tasks
 - High data rate on multiple channels
 - Fast feedback





FlexRHINO

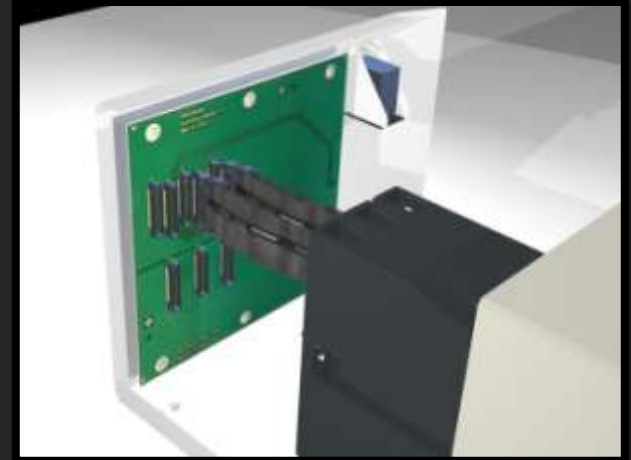
- Service/hardware template that **increases productivity** with

- multiple channels
- high data rates
- real-time analysis





What is FlexRHINO



- FlexRHINO includes
 - One box turnkey solution
 - Signal conditioning/connectors
 - Integrated NI FlexRIO modules
 - Software templates



FlexRhino

Template



Prototypes



Products





ProtoRhino and FlexRHINO

- ProtoRhino
 - In-depth understanding of what is measured
- FlexRHINO
 - One easily scaling box
 - Signal conditioning
 - Data acquisition
 - FPGA-based data-analysis
 - Fast feedback



FlexRHINO's greatest strength: adaptability

The solution to all kinds of problems



Q&A

