THE EUDAQ DATA ACQUISITION SYSTEM.

Introduction to Concepts and Integration

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Features of the EUDAQ Data Acquisition System

➢ Generic framework for data acquisition
➢ OS independent: Linux, Mac OSX, (Windows)
➢ Allows full integration of device under test (DUT) independent of its technology including pre-existing DAQ systems
➢ Modular and flexible design
➢ DAQ control via GUI, but CLI interface also available
➢ Online DQM using the OnlineMonitor
➢ All hardware communication done by “Producers” with equal rights
  - e.g. “NiProducer” for the MIMOSA26 sensors via National Instruments Crate
➢ Used by many groups:
  - Altro (Bonn), APIX (Atlas Pixels), Atlas (TRT), CMS Pixel (DESY), DEPFET (Bonn), FORTIS/SPIDER (Bristol), MimoRoma (INFN), MVD (DESY), PixelMan (Freiburg), SITRA (Santander), Taki (Mannheim), Timepix (Bonn)
  - and more (NA62, Alfa, Alice, etc.) ...
The EUDAQ System Architecture

Hardware
- TLU Control
- DUT1 DAQ
- DUT2 DAQ
- Telescope DAQ

Software
- TLU Producer
- Data Collector
- Online Monitor
- Log Collector
- DUT1 Producer
- DUT2 Producer
- Telescope Prod.
- Run Control
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Running EUDAQ

➢ All components communicate via TCP stack
  ▪ can be run on different networked machines

➢ User interaction via Run Control

➢ Processes:
  ▪ Run Control
  ▪ Log Collector
  ▪ Data Collector
  ▪ Producers for hardware communication (e.g. TLU, Telescope, DUT)
  ▪ [Online Monitor]

➢ Start scripts are provided which fire up all necessary processes
Running EUDAQ
EUDAQ Data Formats

- Basic EUDAQ event data format: RawDataEvent
  - Generic container for unaltered, encapsulated detector response
  - Data input: raw block of memory or vector
  - Storage of additional information possible (custom tags, trigger numbers...)
  - Correct data decoder is chosen by unique identifier string for each producer

- Alternative: StandardEvent
  - Decoded detector data
  - Consists of StandardPlanes with set pixel dimensions of the respective detector
  - Can be read by e.g. the Online Monitor for direct processing

- Final analysis in EUTelescope: LCIO (Linear Collider I/O)
  - Usually done within EUTelescope
Integrating a DUT into EUDAQ

▶ DUT Producer
  ▪ Talk to the DAQ hardware, receive events from there
  ▪ Receive commands from Run Control: OnConfigure, OnStartRun, OnStopRun, Terminate
  ▪ Send data to the Data Collector (either RawDataEvent or StandardEvent)
  ▪ Configure itself with parameters received before data taking
  ▪ Send log messages to the Log Collector

▶ [DUT DataConverterPlugin]
  ▪ Convert the specific native detector data into StandardEvents
  ▪ Needed e.g. for online monitoring of the DUT
  ▪ Can be used to convert into LCIO for the final analysis using EUTelescope

▶ Example code showing the usage of the base classes is provided.
Summary

➢ EUDAQ
  ▪ offers a modular and flexible framework for data acquisition
  ▪ is well documented (see below)
  ▪ is used and supported within AIDA

➢ Both simple and full integration of a DUT and its DAQ possible (only producer or additional DataConverterPlugin)

➢ Also usable for detector DAQ w/o AIDA telescopes

➢ Future plans: add slow control elements for beam monitoring
  ▪ Enables e.g. the storage of beam energy settings into the respective data files

➢ SVN repository: http://eudaq.hepforge.org/svn/trunk

➢ Extensive documentation (~60p) available in SVN, build PDF using
  ▪ cd doc/ && make manual