The distributed Acquisition system used at LNL: XDAQ

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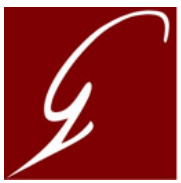
UNIVERSITÀ
DEGLI STUDI
DI PADOVA



Dipartimento
di Fisica
e Astronomia
Galileo Galilei

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- Starting from release 14.0 $\rightarrow$ compatible **CentOS7**

Practical example: The data acquisition of the GALILEO γ-ray array

The GALILEO array in few words

- 25 Compton-Suppressed HPGe $\Longrightarrow\sim$ 300 kHz
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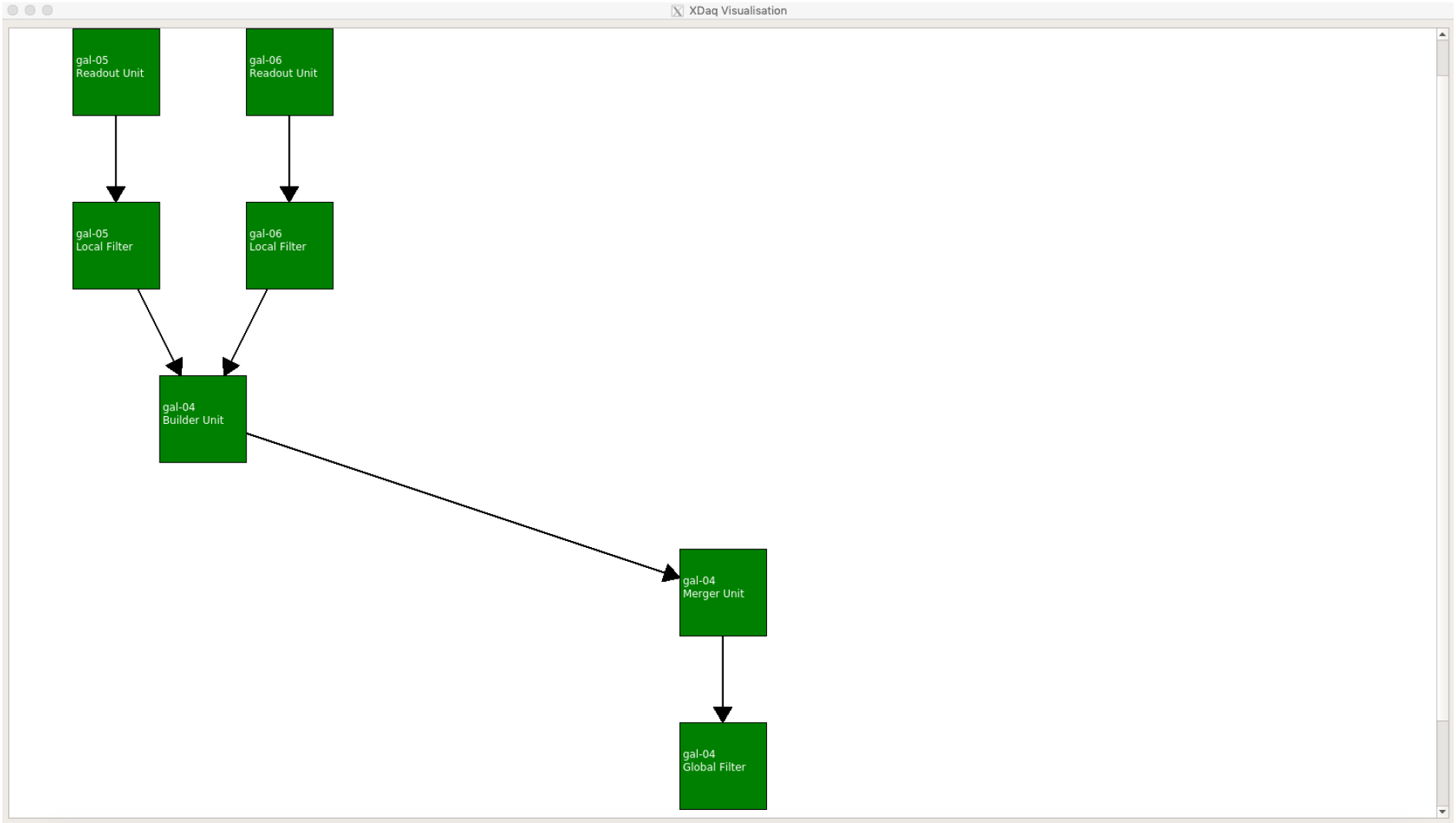
All of this translates into ONE single XML files (similar to Narval/DCOD approach)

- Definition of the different actors $\rightarrow$ RU, LF, BU, MU, GF
- Network connections between the actors
- Parameters (buffer size, data file, spy, ...)

The GALILEO Topology file

```
<?xml version="1.0"?>
<xc:Partition xmlns:soapenc="http://schemas.xmlsoap.org/soap/encoding/"
              xmlns:xc="http://xdaq.web.cern.ch/xdaq/xsd/2004/XMLConfiguration-30"
              xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">

        <i2o:protocol xmlns:i2o="http://xdaq.web.cern.ch/xdaq/xsd/2004/I2OConfiguration-30">
       <i2o:target class="rubuilder::ru::Application" instance="0" tid="100"/>
              <i2o:target class="rubuilder::ru::Application" instance="1" tid="110"/>
              <i2o:target class="LocalFilter" instance="0" tid="200"/>
              <i2o:target class="LocalFilter" instance="1" tid="210"/>
              <i2o:target class="rubuilder::bu::Application" instance="0" tid="500"/>
              <i2o:target class="rubuilder::merger::Application" instance="0" tid="600"/>
              <i2o:target class="GlobalFilter" instance="0" tid="610"/>
        </i2o:protocol>

        <xc:Context url="http://gal-05.lnl.infn.it:50000">
              <xc:Module>$XDAQ_ROOT/lib/libxdaq2rc.so</xc:Module>
              <xc:Endpoint protocol="atcp_00" service="i2o" hostname="192.168.45.7" port="40000" network="net_atcp0"/>
              <xc:Application class="pt::atcp::rcvl_00::PeerTransportATCP" id="10" instance="0" network="local">
                    <properties xmlns="urn:xdaq-application:pt::atcp::rcvl_00::PeerTransportATCP" xsi:type="soapenc:Struct">
                          <syncronousSend xsi:type="xsd:boolean">true</syncronousSend>
                          <blockingReceive xsi:type="xsd:boolean">true</blockingReceive>
                          <nonBlockingConnection xsi:type="xsd:boolean">false</nonBlockingConnection>
                          <maxPacketSize xsi:type="xsd:unsignedInt">262140</maxPacketSize>
                    </properties>
              </xc:Application>
              <xc:Application class="rubuilder::ru::Application" id="30" instance="0" network="local">
                    <properties xmlns="urn:xdaq-application:rubuilder::ru::Application" xsi:type="soapenc:Struct">
                          <runNumber xsi:type="xsd:unsignedInt">0</runNumber>
                          <inputFilepath xsi:type="xsd:string">/galileodisks/rData/rudata_gal-05</inputFilepath>
                          <detInputMask xsi:type="xsd:string">ff</detInputMask>
                          <dataOutput soapenc:arrayType="xsd:ur-type[2]" xsi:type="soapenc:Array">
                                <item soapenc:position="[0]" xsi:type="xsd:string">network</item>
                                <item soapenc:position="[1]" xsi:type="xsd:string">local</item>
                          </dataOutput>
                          <packetLength xsi:type="xsd:unsignedInt">464</packetLength>
                          <driverBuffLength xsi:type="xsd:unsignedInt">928000</driverBuffLength>
                          <writeDataFile xsi:type="xsd:boolean">false</writeDataFile>
                          <idleEventOnFile xsi:type="xsd:boolean">false</idleEventOnFile>
                          <dfile xsi:type="xsd:boolean">false</dfile>
                          <lfile xsi:type="xsd:boolean">false</lfile>
                          <sfile xsi:type="xsd:boolean">false</sfile>
                          <outputFilepath xsi:type="xsd:string">/galileodisks/xData/rudata</outputFilepath>
                          <LocalFilterInstances soapenc:arrayType="xsd:ur-type[1]" xsi:type="soapenc:Array">
                                <item soapenc:position="[0]" xsi:type="xsd:unsignedInt">0</item>
                          </LocalFilterInstances>
                    </properties>
                    <xc:Unicast instance="0" class="LocalFilter" network="net_atcp0"/>
              </xc:Application>
              <xc:Module>$XDAQ_ROOT/lib/libptatcprcvl00.so</xc:Module>
              <xc:Module>$XGAL_ROOT/lib/librubuilderutils.so</xc:Module>
              <xc:Module>$XGAL_ROOT/lib/librubuilderru.so</xc:Module>
        </xc:Context>

        ...

</xc:Partition>
```

The GALILEO Topology



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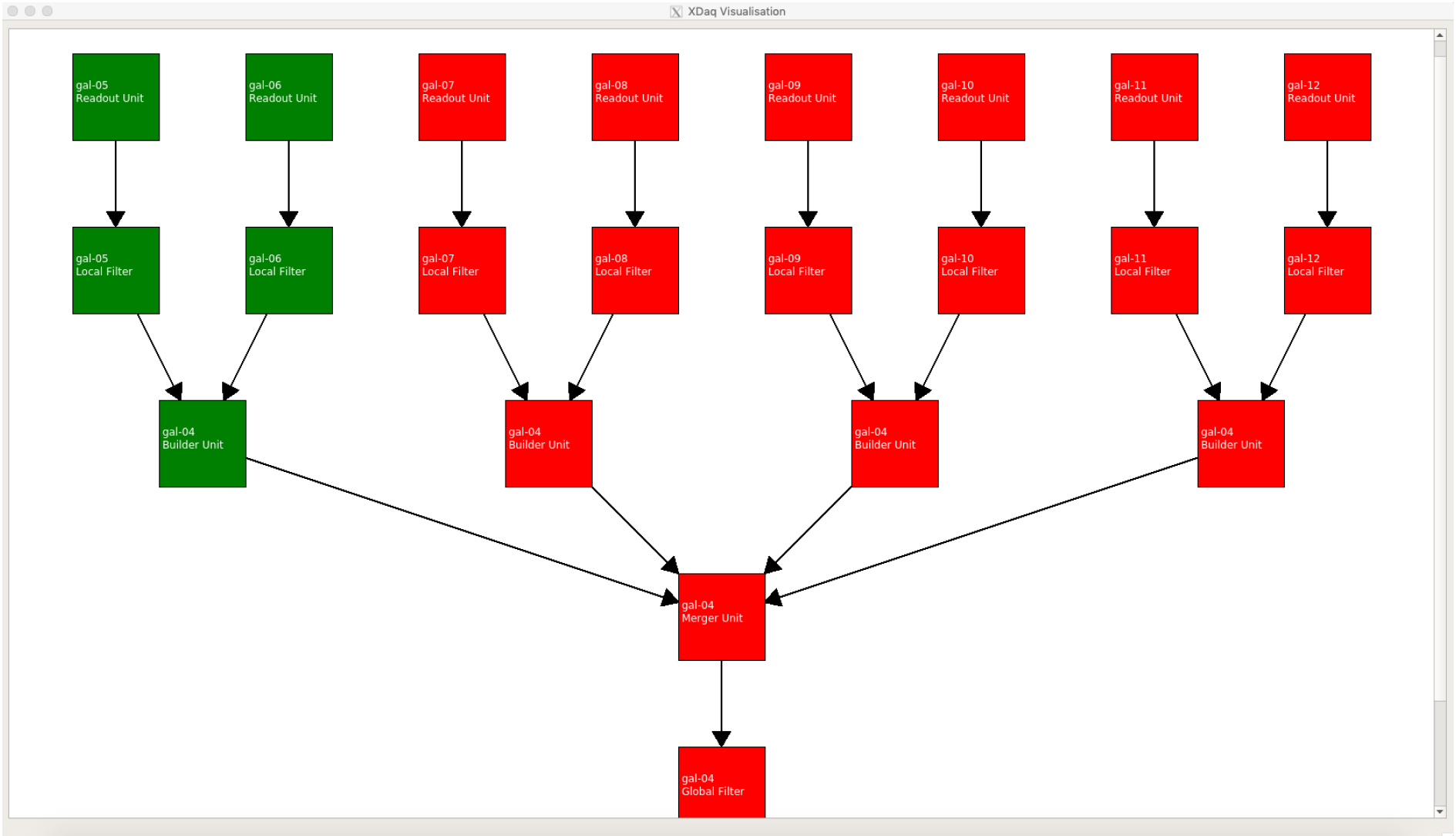


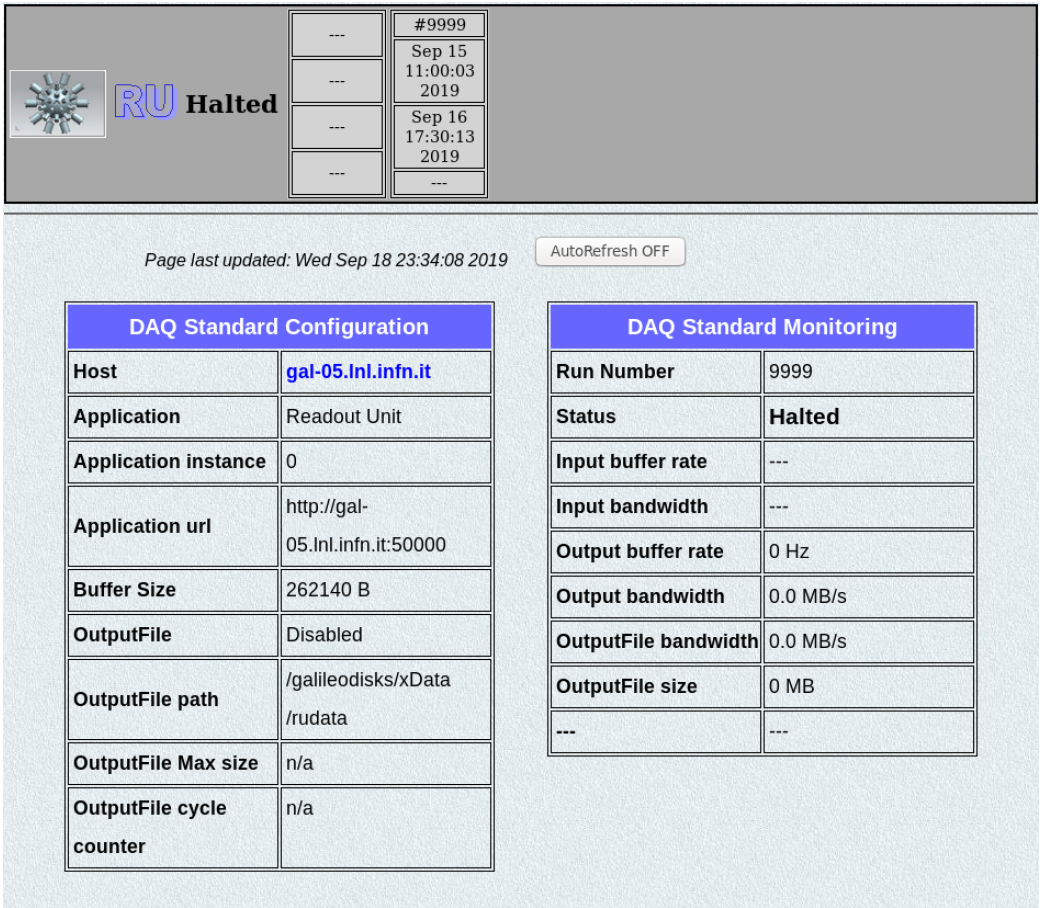
Readout units (RU)

Interface to the front-end electronic:

- GGP readout
- VME readout for ancillaries

$\Longrightarrow$ Application developed in C++

Accessible web interface with the important parameters



RU Halted

---	#9999
---	Sep 15 11:00:03 2019
---	Sep 16 17:30:13 2019
---	---

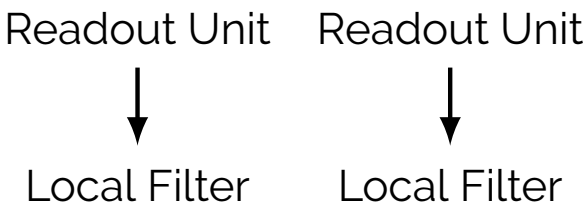
Page last updated: Wed Sep 18 23:34:08 2019 AutoRefresh OFF

DAQ Standard Configuration	
Host	gal-05.lnl.infn.it
Application	Readout Unit
Application instance	0
Application url	http://gal-05.lnl.infn.it:50000
Buffer Size	262140 B
OutputFile	Disabled
OutputFile path	/galileodisks/xData/rudata
OutputFile Max size	n/a
OutputFile cycle counter	n/a

DAQ Standard Monitoring	
Run Number	9999
Status	**Halted**
Input buffer rate	---
Input bandwidth	---
Output buffer rate	0 Hz
Output bandwidth	0.0 MB/s
OutputFile bandwidth	0.0 MB/s
OutputFile size	0 MB
---	---

Builder units (BU, MU)

Event reconstruction based on timestamp information



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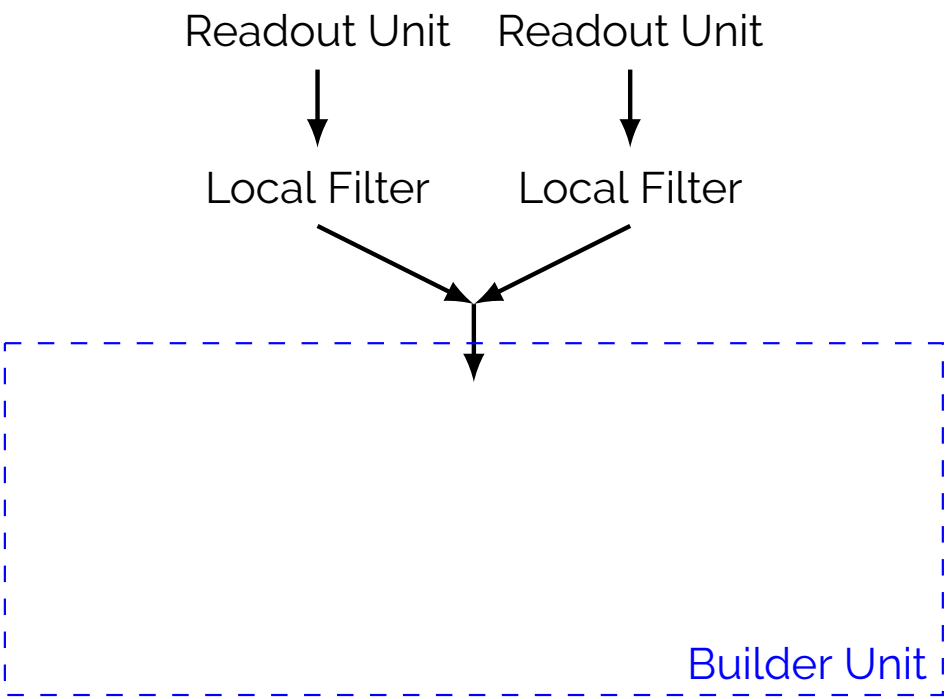

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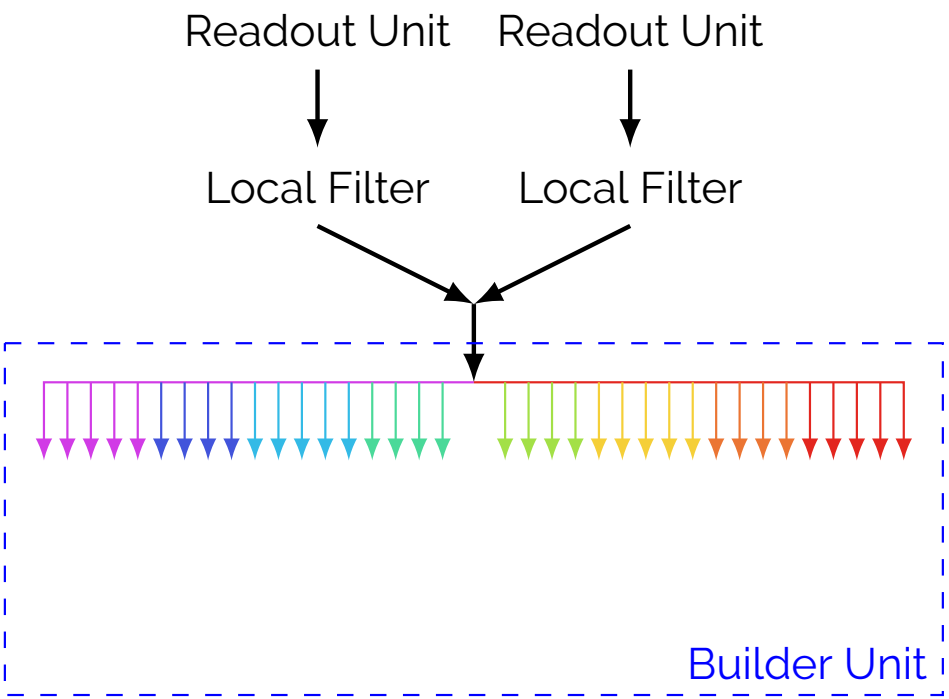

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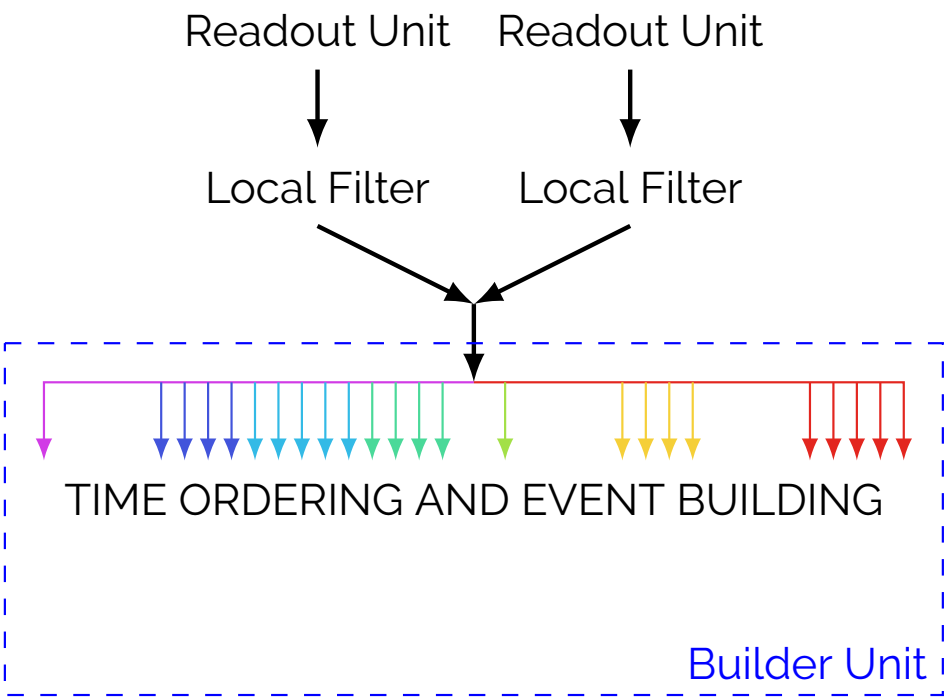

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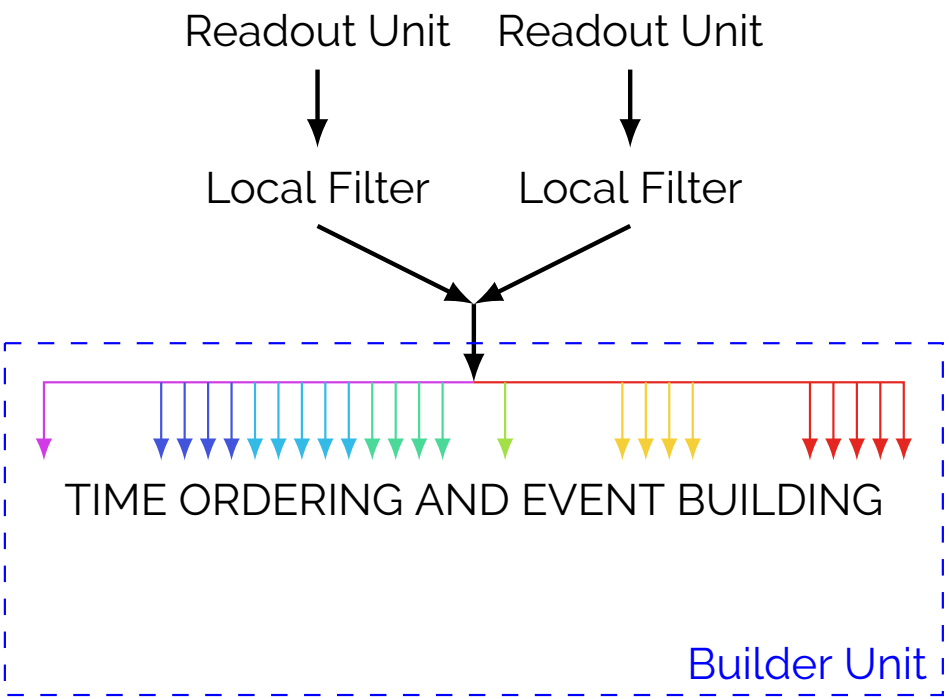

- Configurable inputs
- Configurable time window via XML file

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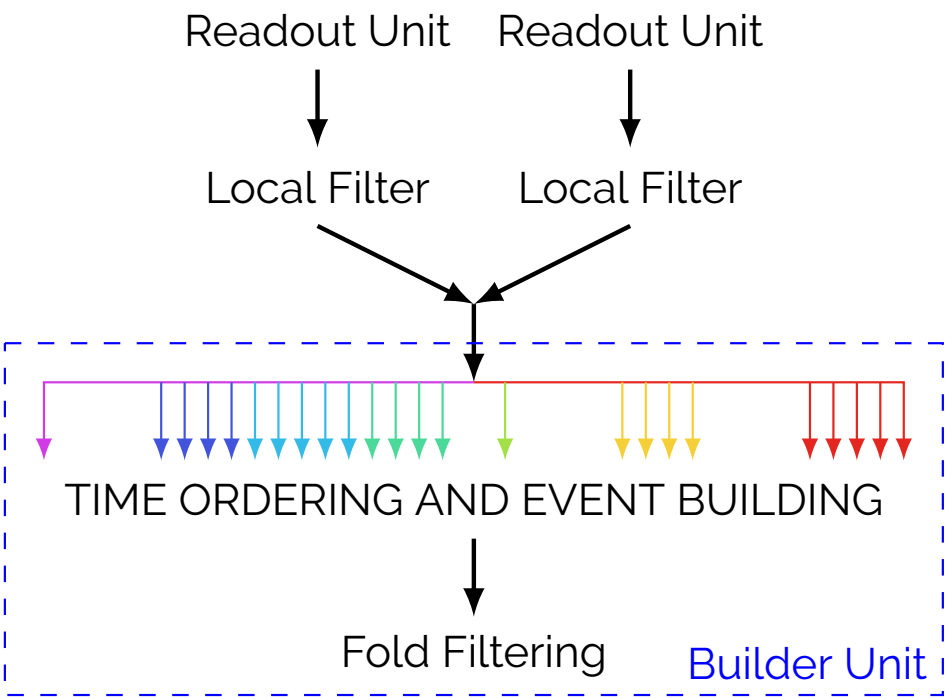

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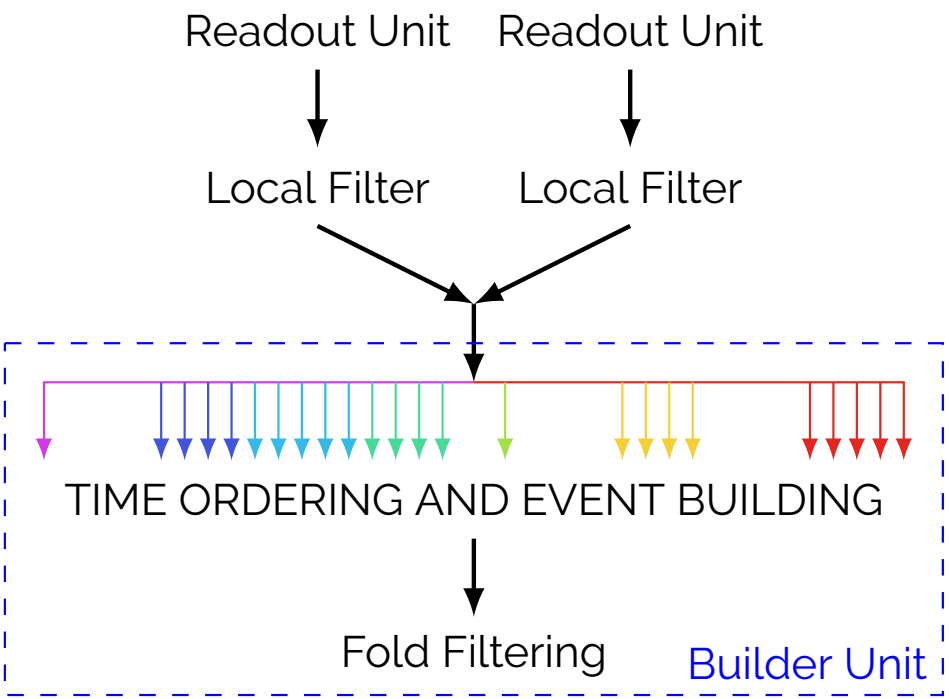

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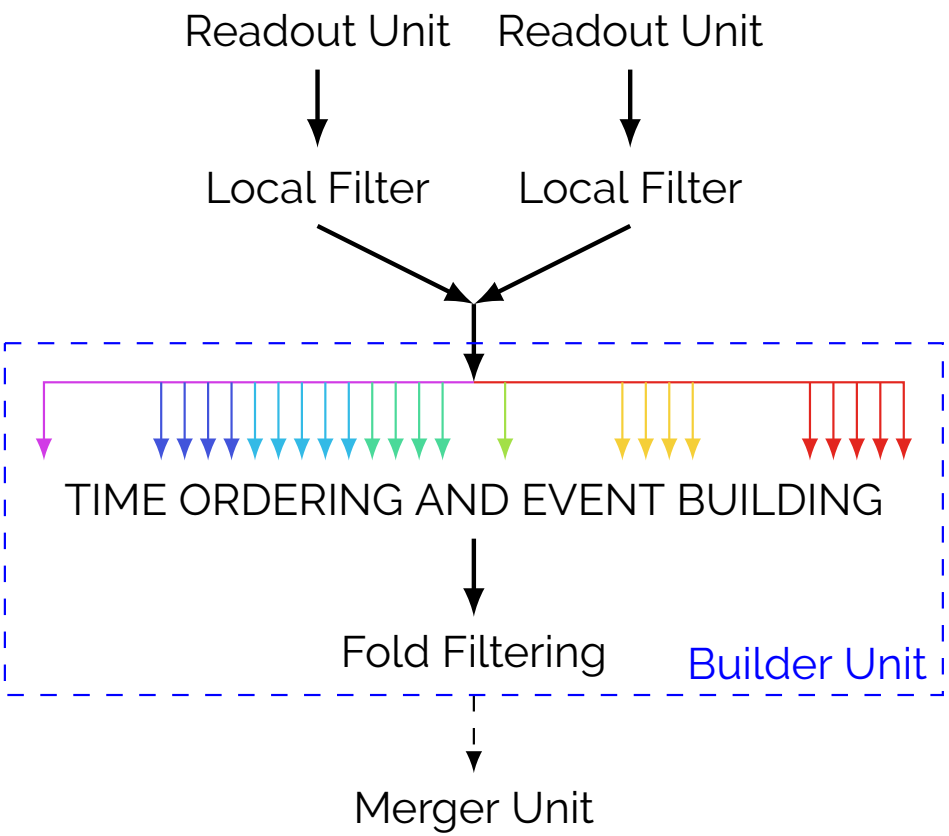

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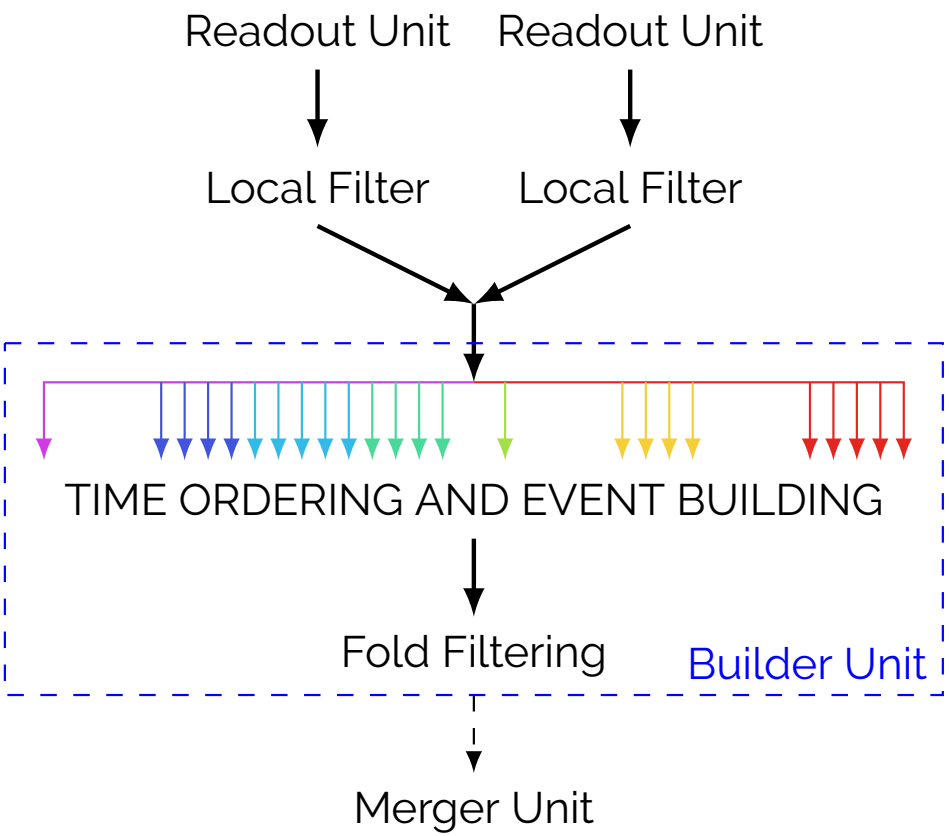

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- Composite frames with configurable keyword

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Separation of Data Flow and Data Treatment:

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Slow control & Readout for the CAEN digitizers

Still on-going development:
$\Longrightarrow$ Coupling of GALILEO with $LaBr_3$ detectors (High energy or Fast timing)
$\Longrightarrow$ Detectors with fast signals $\rightarrow$ Sampling from 100 to 500 Msps

Slow Control

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- SOAP client on remote PC
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Readout

- Architecture for all available firmwares
- Preliminary test for **DPP-PSD**
- Support of list-mode (LM)
- Support of mixed-mode (MM)
- Preliminary test with Fast-Timing detectors
  $\rightarrow \sim$ 230 ps resolution
- PLL at 100 MHz available
- On-going coupling with the GTS

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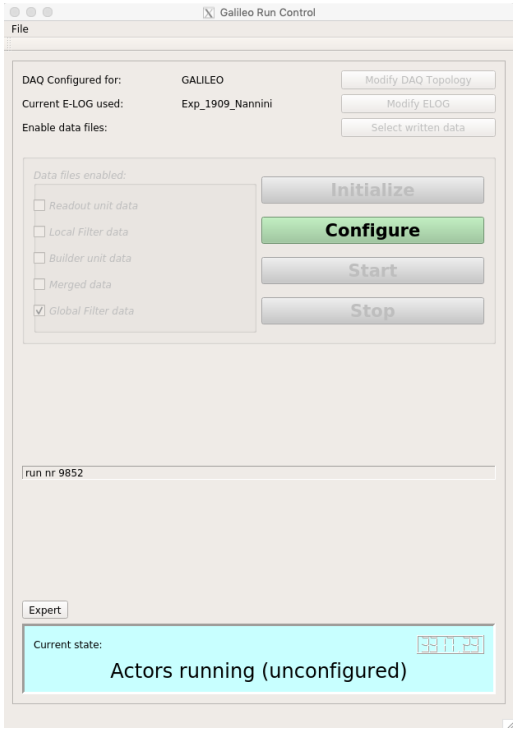
- Simple graphical interface with **limited** possible actions
- Developed in C++ / Qt5



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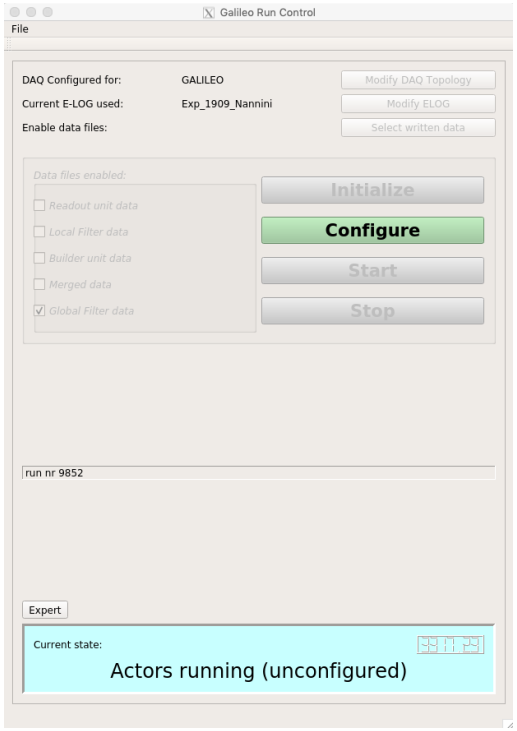

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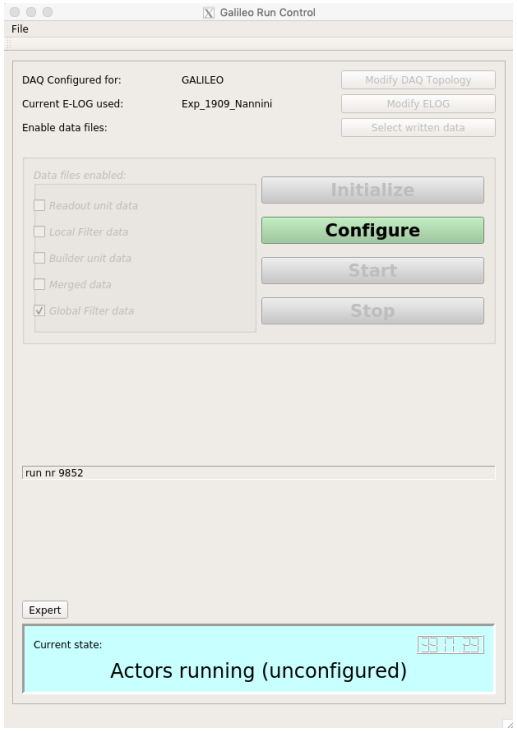

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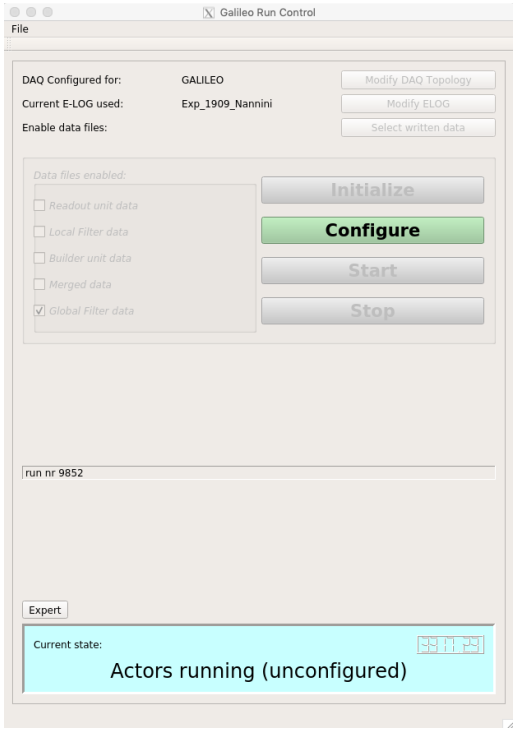

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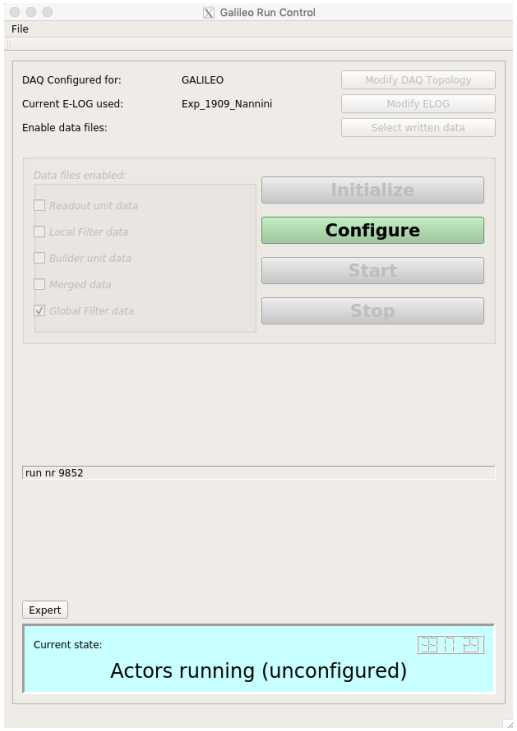

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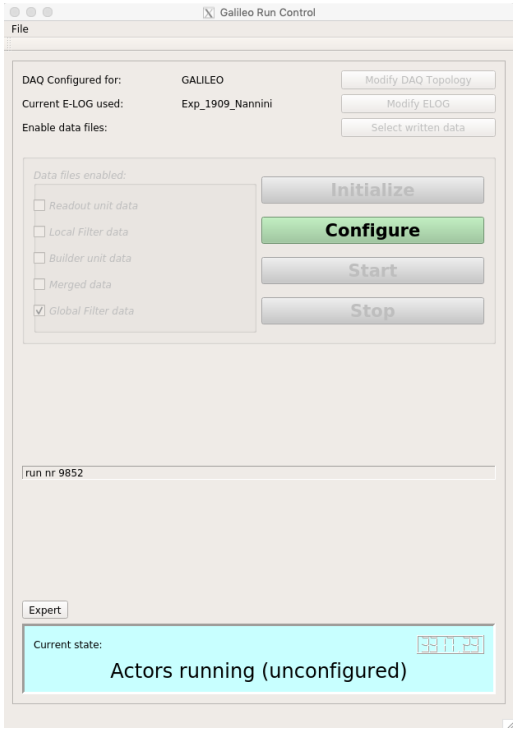

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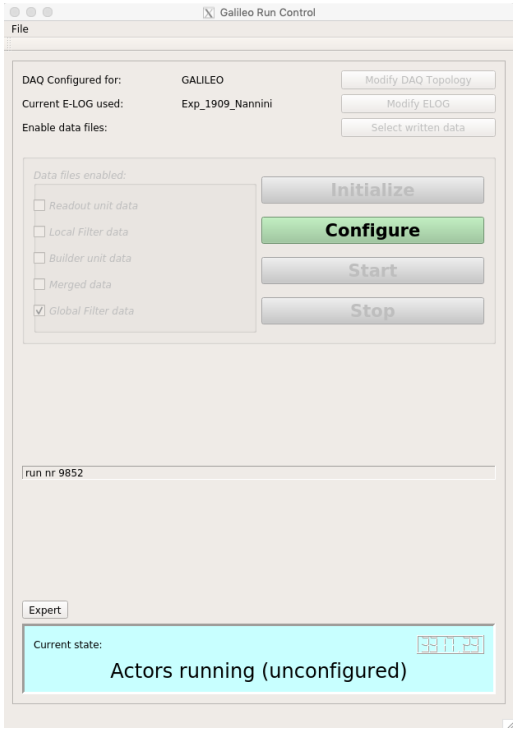

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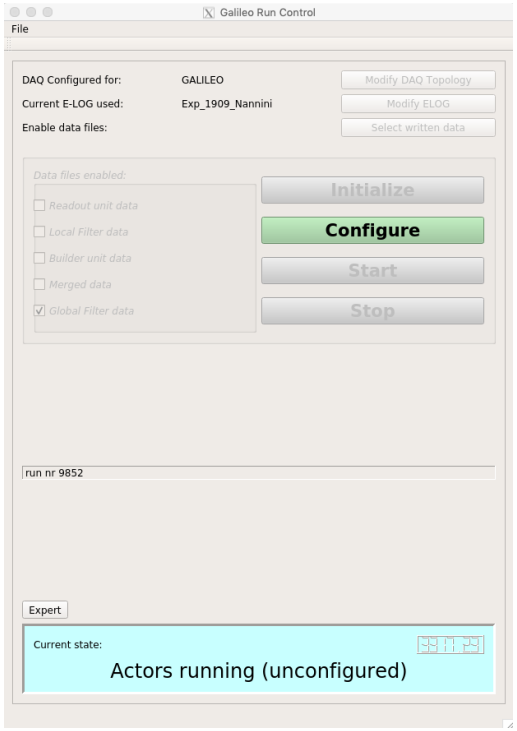

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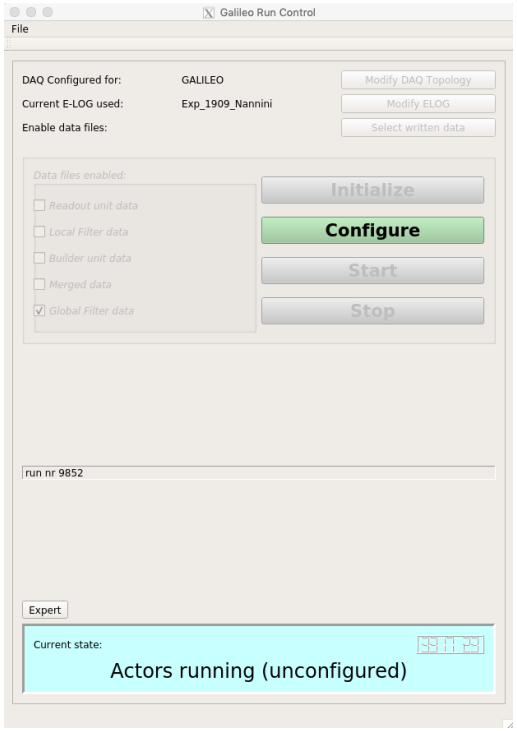
- Always willing to improve it



Run Control

Based originally on the run control developed by J. Grebosz **relying on bash scripts :(**

- Simple graphical interface with **limited** possible actions
- Developed in C++ / Qt5
- Reads XML file to determine the list of actors
- Direct communication with the XDAQ actors using SOAP messages
- Selection of files written on disk
- E-LOG capable $\Longrightarrow$ automatic post at Start/Stop
- Rate Monitoring $\Longrightarrow$ Interface Grafana
- ...
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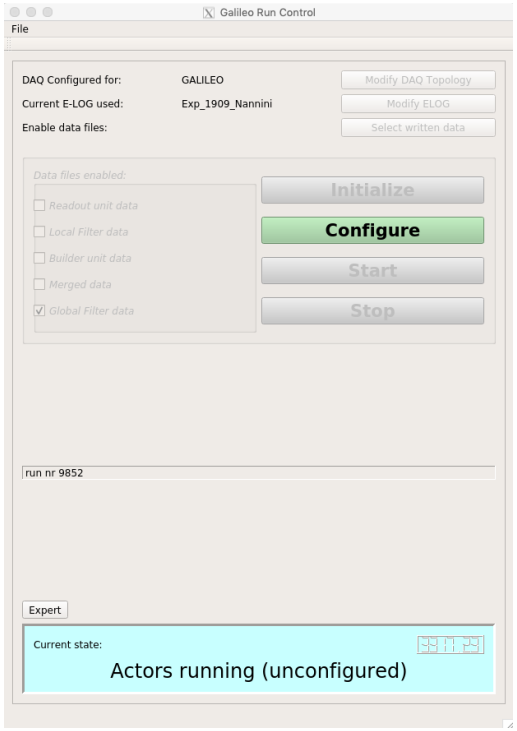

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THANK YOU FOR YOUR ATTENTION

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