NUSTAR DAQ
and
FAIR IT TDR

Stephane Pietri

Outline

2 parts :

1) Status of NUSTAR DAQ TDR – on behalf of Andreas Heinz (mosts slides from him and Alexandre Charpy)
2)Presentation of FAIT IT TDR and NUSTAR part of it

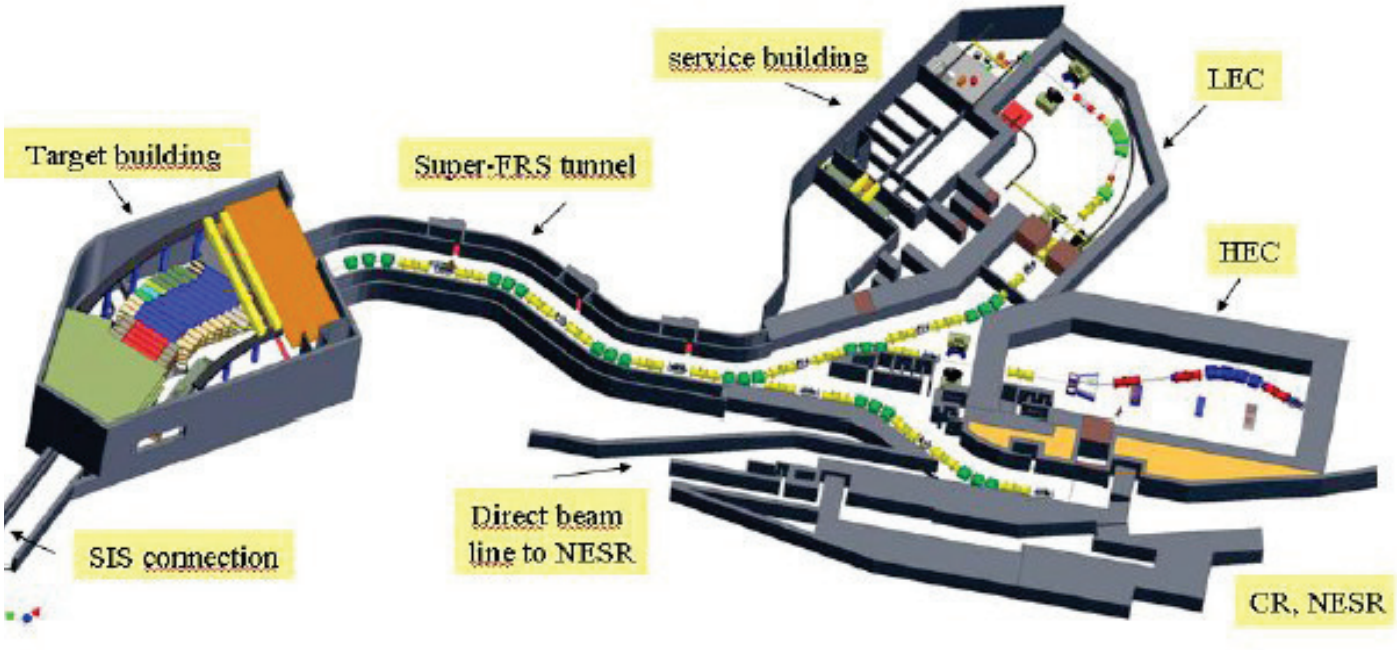
NUSTAR DAQ

Stephane Pietri
on behalf of
Andreas Heinz and Alexandre Charpy

Motivation

NUSTAR experiments : all need Super-FRS for indentification

Need to correlate data ⇒ same system
Pull resource together ⇒ same system



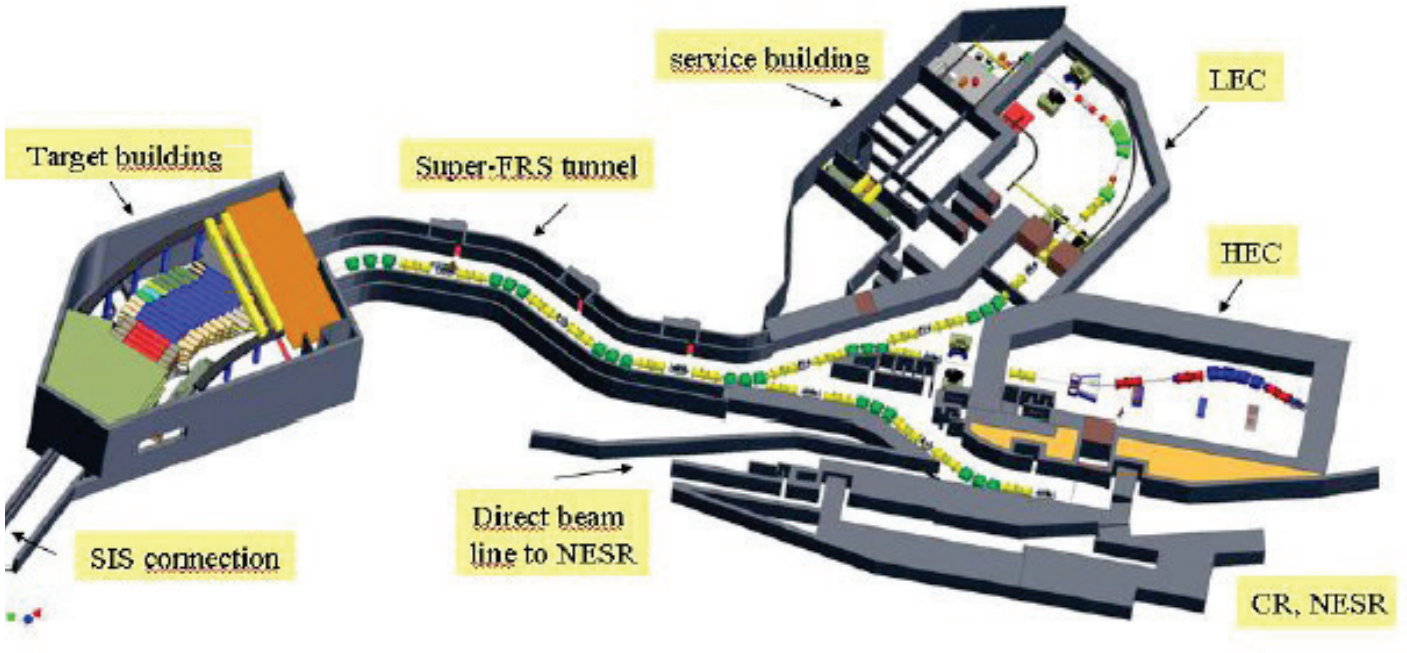
Common DAQ TDR for Super-FRS/R3B/HI-DESPEC(/ILIMA?)

Requirements

NDAQ (Nustar DAQ) should have :

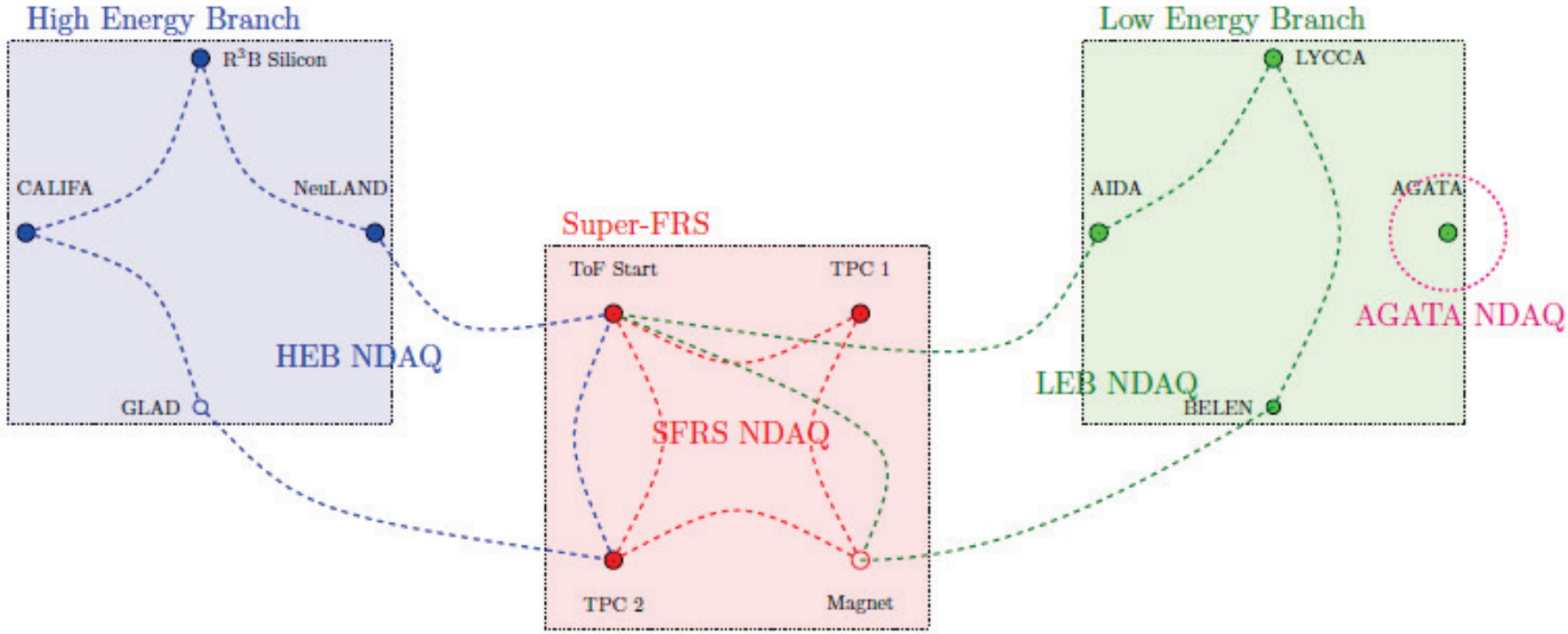
- **Easily configurable**
- **Fixed infrastructure**
- **Maximun interoperability**

Specifications based on the needs of collaboration and DAQ operators

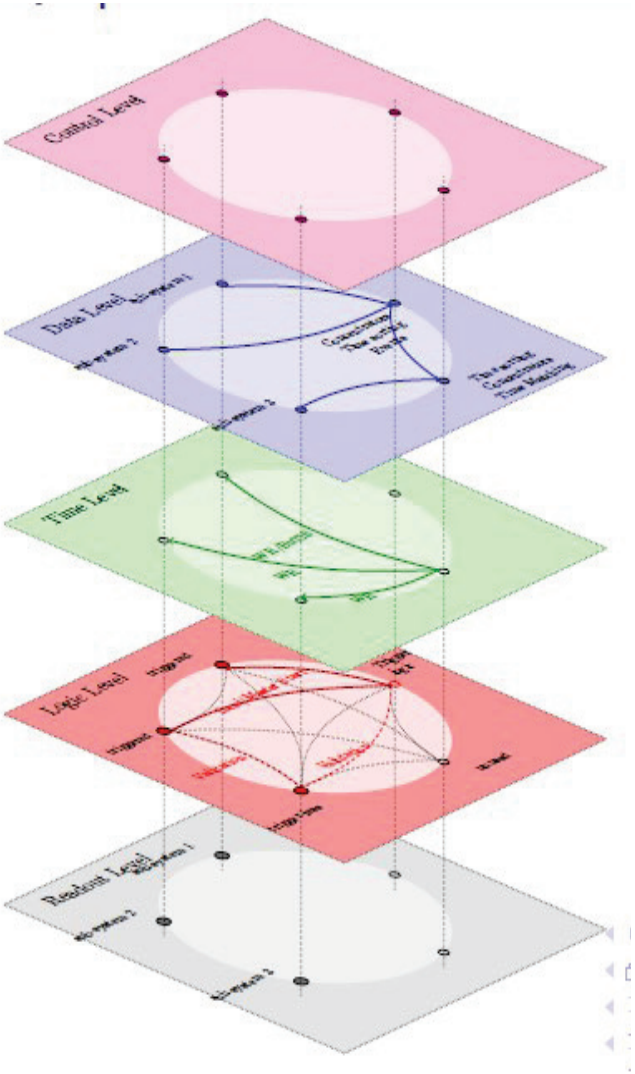


What is NUSTAR DAQ

Global NDAQ : many nodes distribured along the facility
A NDAQ running : a combinasion of nodes
A setup/experiment can be composed of one or several nodes
Forseen to run several NDAQ in //



How does it works



Each experimental component is connected to a NDAQ node

Each node has five « layers »

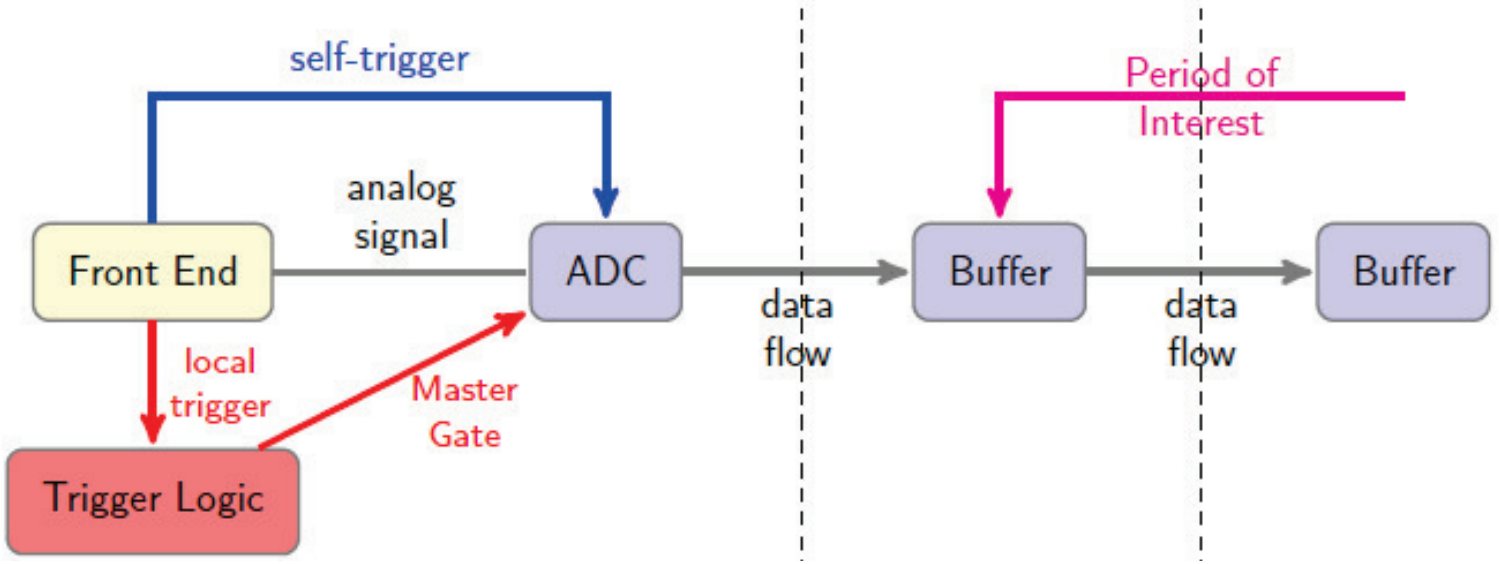
Each NDAQ node interacts along 5 optional interaction levels:

- control/command
- data flow
- time
- logic
- readout

Operating modes

Integrates existing and new detector generations with different operating modes:

- triggered (single or multi-event)
- trigger-less
- hybrid mode (triggered and trigger-less)



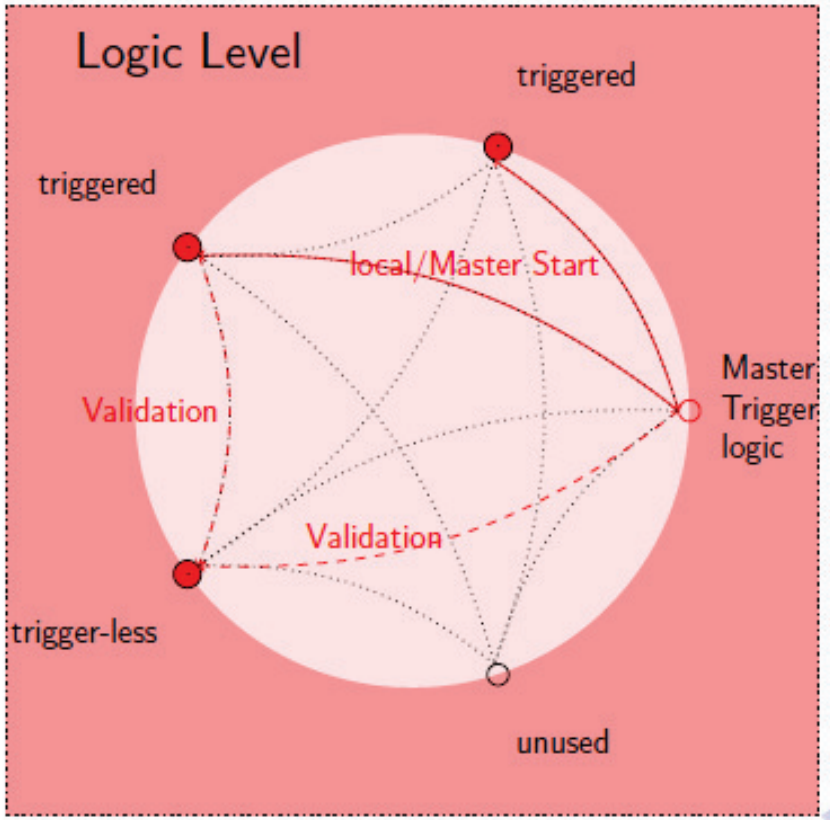
Trigger logic configuration

Trigger Logic Topology

A NDAQ needs to be robust and flexible:

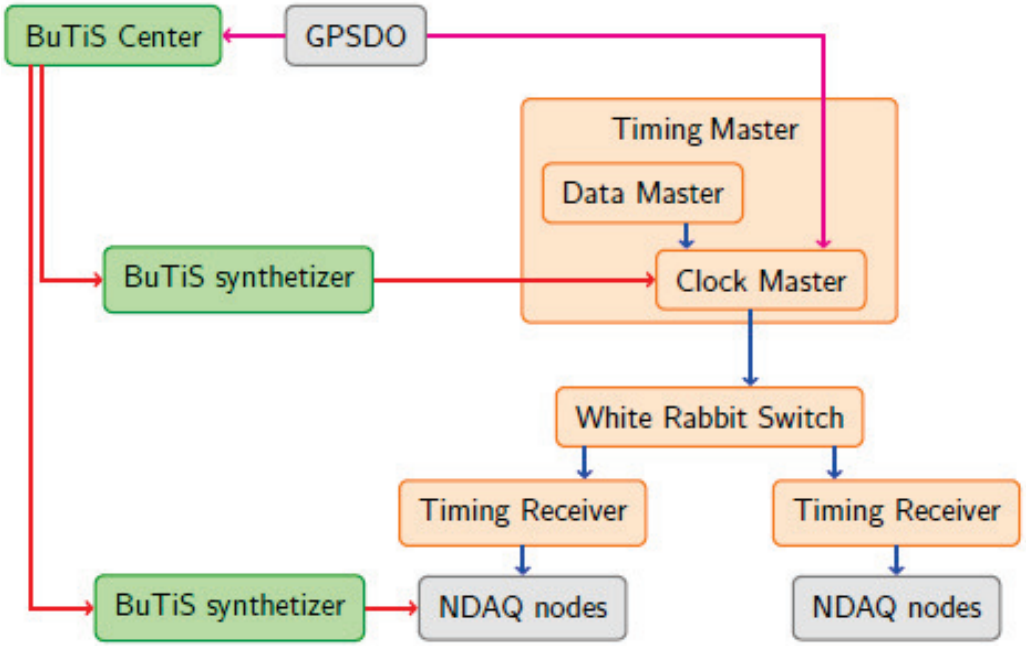
- maximum of **permanent** optical inter-connection between NDAQ nodes
- **topology switch requires software commands only**

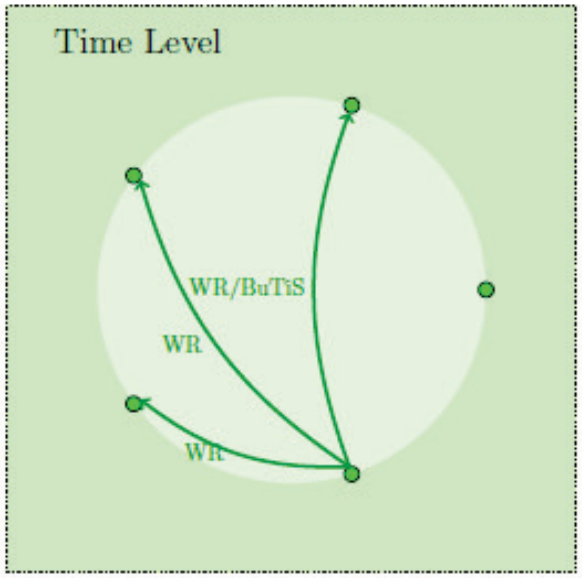
Logic topology customised via FPGAs



Timming system

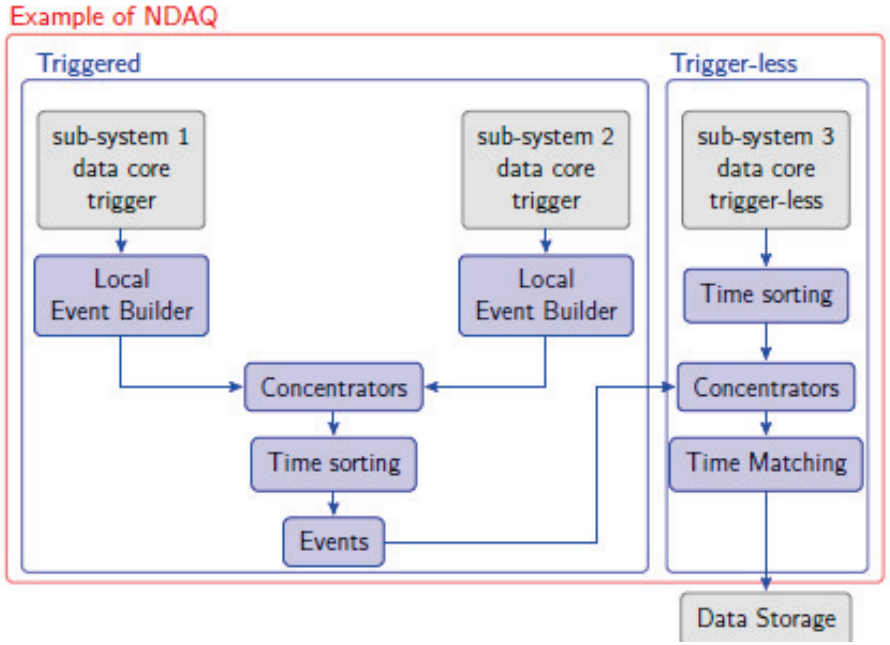
1. White Rabbit (WR) for an absolute time reference between components
   - time-stamping events and trigger signals
   - time sorting and merging all meta-data
2. BuTiS for high-accuracy time measurements
   - generation and distribution of a common clock (jitters $\sim$ 100 ps.km^{-1})

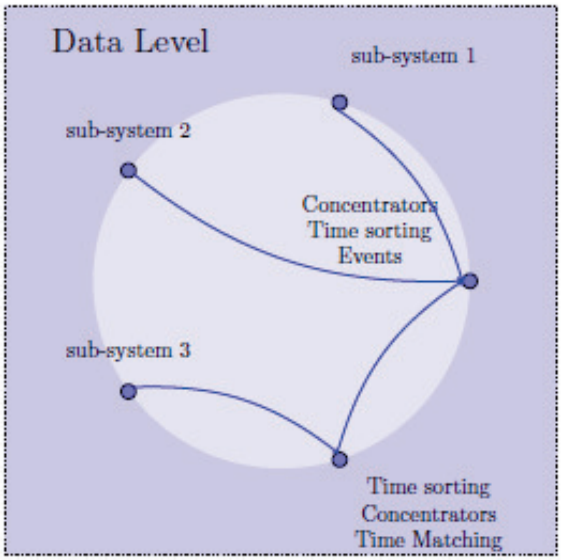




Data flow

- every NDAQ consists of different tasks over the network (*time sorting*, *event matching*, *data concentration/dispatch* ...)
- data flow correlated to the logic layer topology
- dynamic redirection (a NDAQ is running continuously)
- data integrity check based on check-sums performed at every stage





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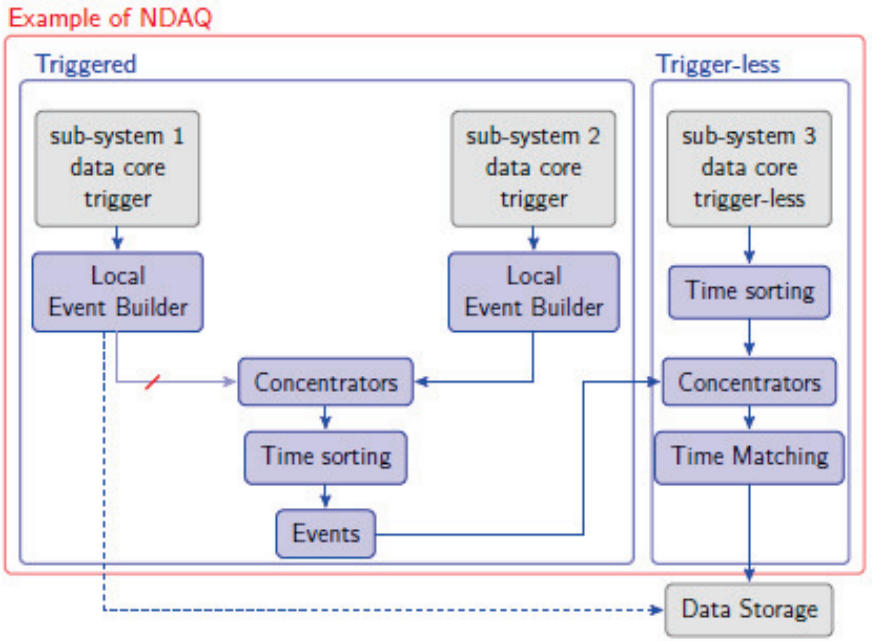
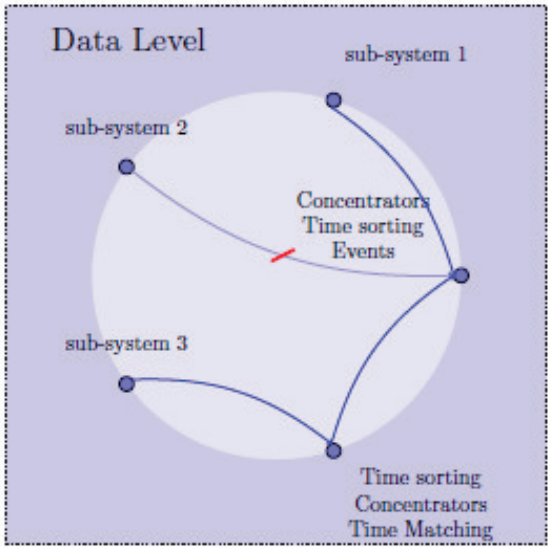




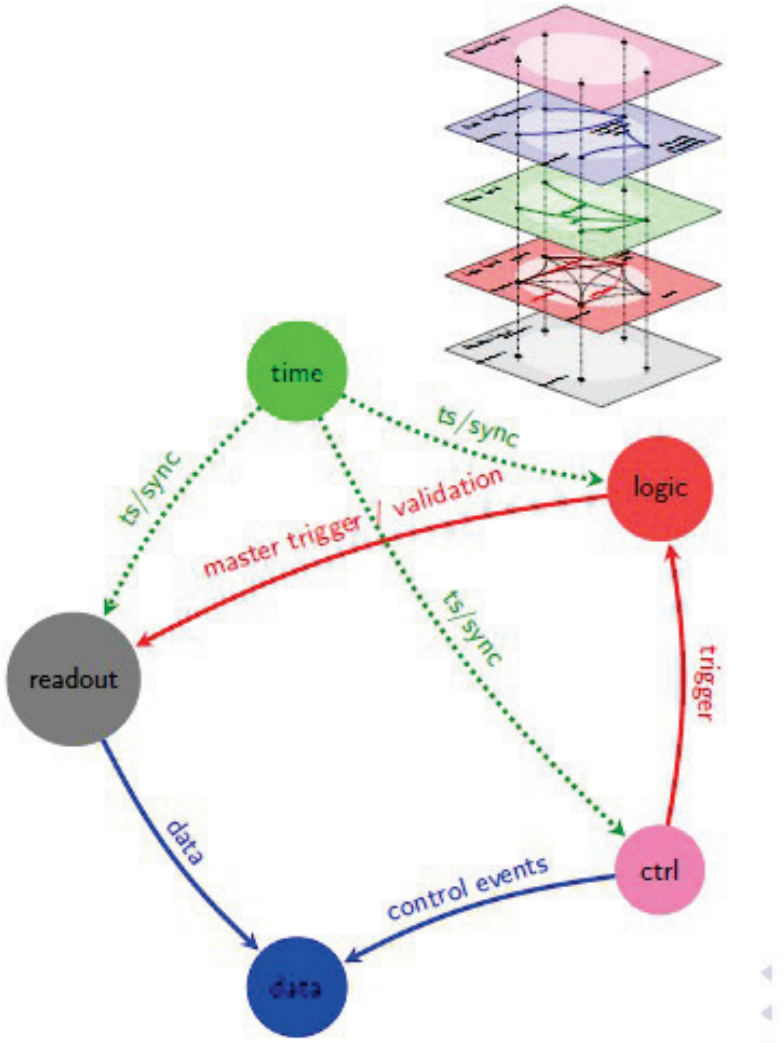
… to meta data flow

Control Events

- *events* affecting analysis (e.g. accelerator settings, data flow topology)
- time-ordered and *sticky*
- allow for calibration routines (e.g. ramping a magnet)

Requirements

- Control Event data use the same stream as raw data
- raw data format to build a coherent file structure

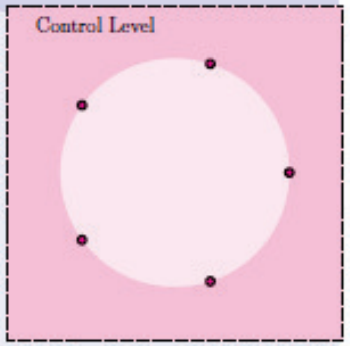


Slow control integrated

General

Slow Control is detector specific

- monitor and adjust crucial detector/component parameters
- prevent fatal hardware failures
- restore parameter values



NDAQ properties

- EPICS will support the NDAQ slow control infrastructure
- open system → user can provide open access
- propose advanced features (e.g. automatic modification as function as time)

allows general monitoring.. and logs

- allow to visualise the logic and data flow topology with their monitored parameters
- local and global dead-time of the connected logic cores
- back pressure at every stage (buffer occupancy, CPU usage, bandwidth, ...)
- distribution/notification of Control & Command messages
- data integrity before event building
- display the sub-systems status (warnings, errors ...)
- on/off-line analysis is responsibility of experimentalists
- web-application

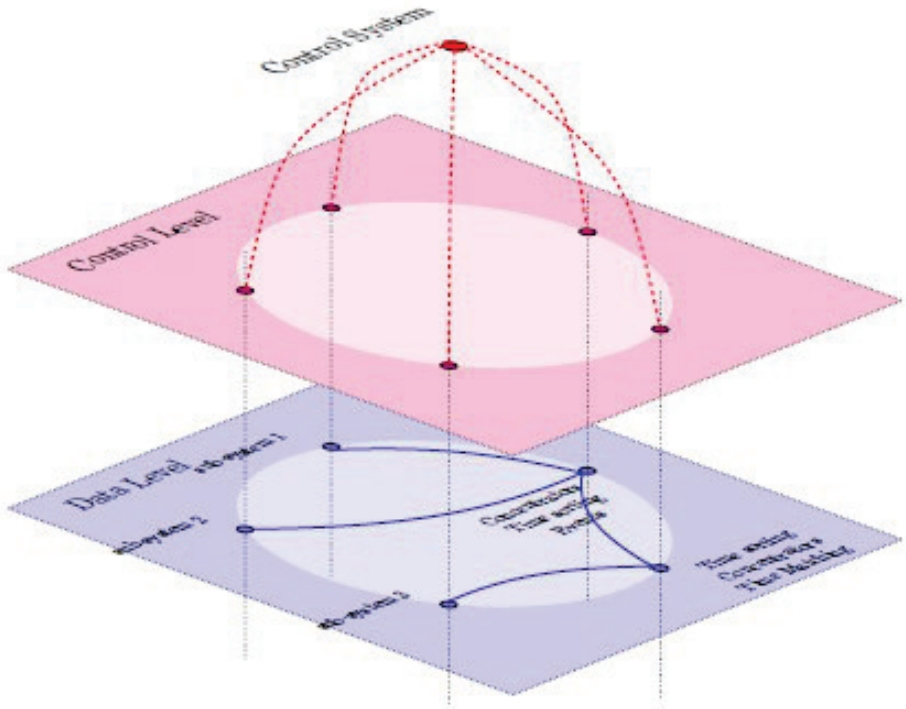
Centralized run control

Control & Command

- NDAQ nodes are configured individually
- NDAQ nodes are configured via **setup files**
- generate "control events"

NUSTAR Run Control

- client related to one NDAQ
- unify global control & command



Authors

Contacts (so far)

- A. Charpy, A. Chatillon, R. Gernhaeuser, A. Heinz, H.T. Johansson, N. Kurz, I. Lazarus, T. Le Bleis, B. Loeher, C. Nociforo, S. Pietri, C. Pucknell, H. Schaffner, H. Simon

Other **active** parties are welcome!!!

DAQ TDR conclusion

1. NDAQ infrastructure provides a unified DAQ solution
2. specification defined according to the DAQ operators and to the needs of experimentalists
3. new features (DAQ always running, setup changes in-flight, control event...)
4. documentation in progress $\rightarrow$ input and suggestions are very appreciated

FAIR IT TDR

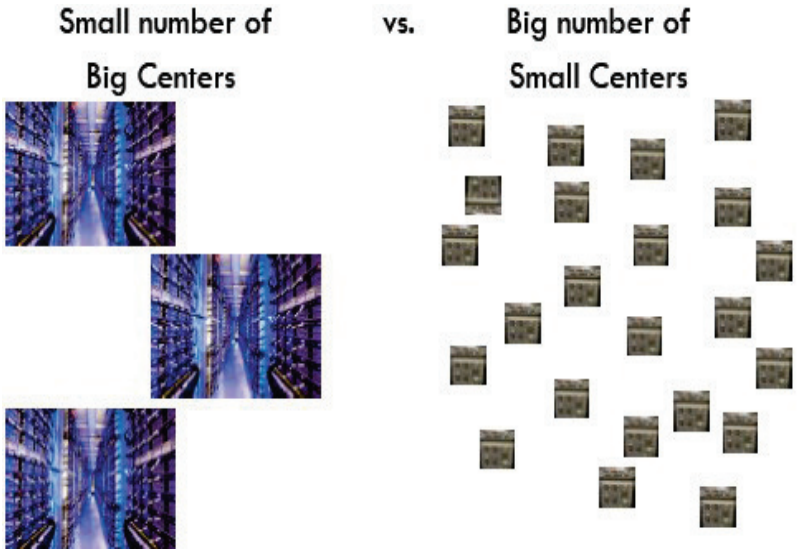
Stephane Pietri

And the GREEN cube came

General idea : GRID concept limits

⇒ FAIR as CERN goes for « big data center »

The GREEN cube was born



Cost money ⇒ requires a FAIR TDR

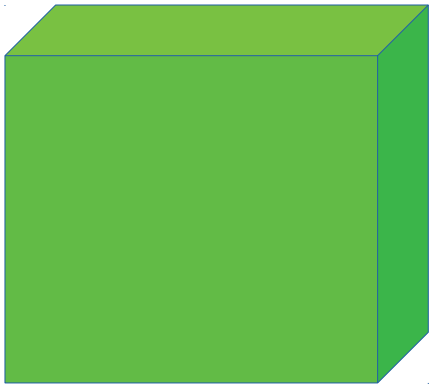
Need input from the « four FAIR pillars »

FAIR IT TDR WG formed
(Haik Simon and myself are the NUSTAR representatives)

Specifications

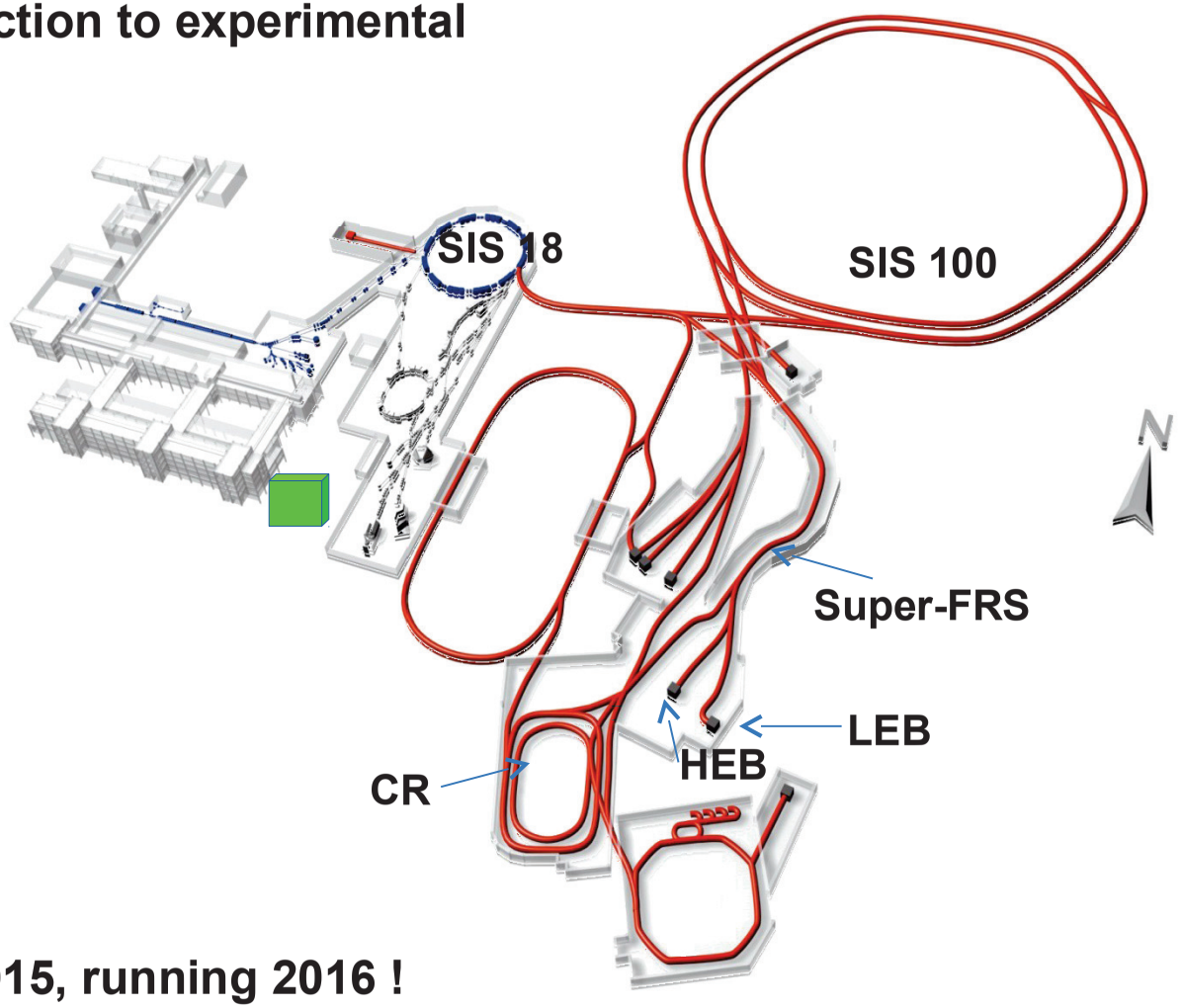
- 6 floors (starting with only 2)
- 128 racks each floor (8 rows with 16 racks)
- Each rack can provide:
  - Data: 0.6 PB
  - Cores: 1800

- Further floors on demand, but needs time for buying & installing cooling, power and racks (>1 year)



Location

High band width connection to experimental areas



Building finished in 2015, running 2016 !

TDR WG

- One TDR including sections for each FAIR pillar
- Joint development
- Develop common computing model
- Develop common distributed computing model
- Data management

TDR plan

1. Introduction
2. Experiment requirements (APPA, CBM, NUSTAR,PANDA)
3. Over all architecture
4. Technology and Infrastructure
5. Common Appplication, Common Infrastructure
6. Prototypes, Evaluations
7. Resource requirements
8. Project organization, management

2.3 NUSTAR

2.3.1 Logical Dataflow,
2.3.2 Event Recontruction
2.3.3 Event Simulation
2.3.4 Analysis requirement, Plans
2.3.5 Resource requirement (on and off line)
2.3.6 Setup-up, Staging

Full document for end 2015

General plans

NUSTAR DAQ has its own network

Some PC for data flow handling are on the caves (Event Builder/Time Sorter)

Fast connection to the Green cube (special optical fibers?)

Data logging on GREEN cube one our servers

Small processing possible done before logging (region of interest)

Data backed up on « tape robot »

Keep data on tape for 3 years

Two open points

Data policy for the collaboration

Band width requirement, data storage

R3B ⇒ 100 MB/s
HISPEC ⇒ 100 MB/s
DESPEC ⇒ 100 MB/s

⇒ Peak close to 1 GB/s
⇒ Peak analysis (online) 4000 cores

ILIMA, MATS, LASPEC smaller

Storage : 1PB for hot data, 2PB for storage

Conclusion IT

Data processing defined from the DAQ (and very basic)

Data size/band width dimensioned by discussion inside sub-collaborations

Ideas open for discussion (last chance next Nustar week)