DCS and TDAQ for AFP

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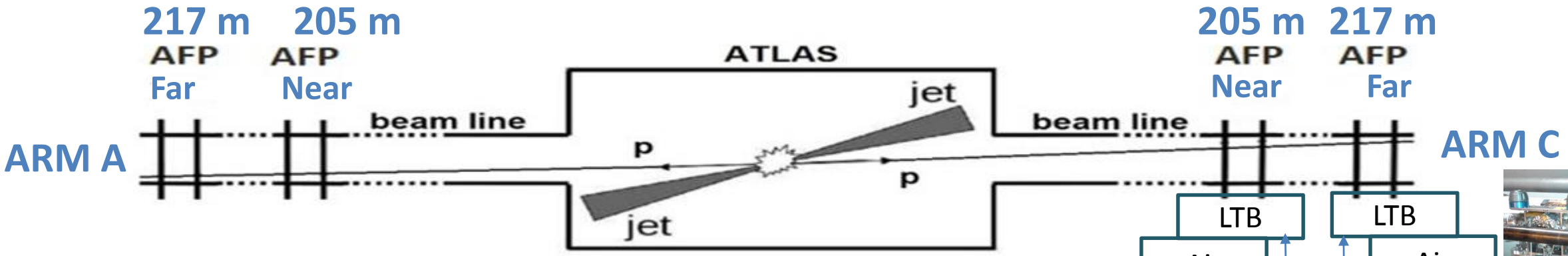
Outline

- DCS
  - status after installation in the tunnel
  - plans
- L1 Trigger
  - full system project
  - status after installation in the tunnel
  - plans
- DAQ
  - full system project
  - status after installation in the tunnel, status in SR1
  - plans

DCS: overview of installed AFP Hardware Structure



USA15

Positioning

Cooling, Vacuum

VME

HV

Optoboard PS

Interlock
Temp Meas

LV stage 1

DCS PC, SLC6 + VM2008
WinCCOA

330 m

LTB

Air
Cooler

LTB

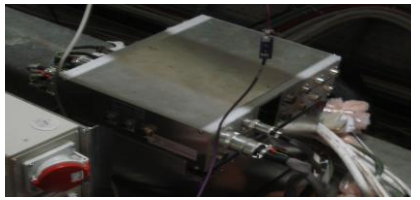
Air
Cooler

LV
HV
T

Distribution

Optoboard

LV stage 2

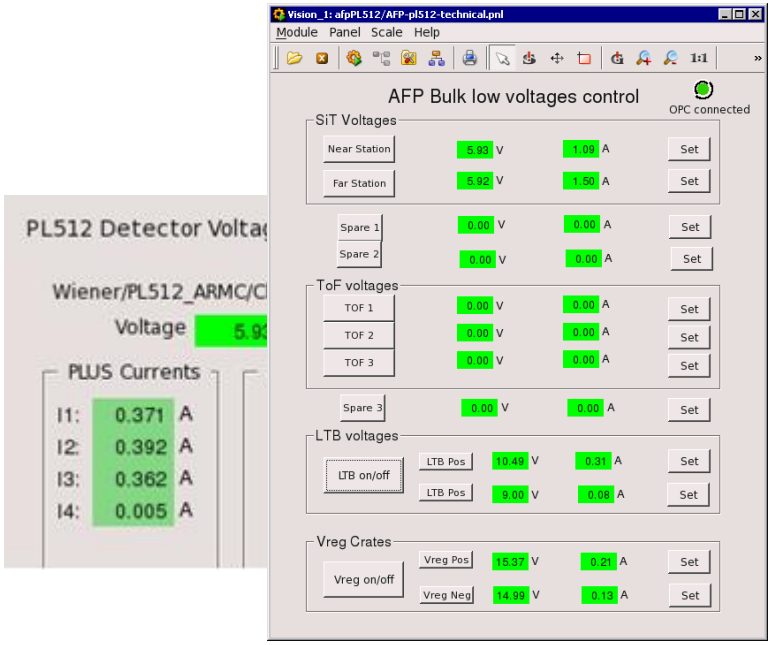


Low Voltage Supply

1st stage: USA 15

- Wiener PL512, Ethernet controlled , OPC DA server in VM2008
  Framework software + technical panels **READY**

- LVPP 4 *(IBL like)* – split each voltage line to 4 lines,
  with precise current measurement
  ELMB, OPC UA server
  Framework software + technical panels **READY**

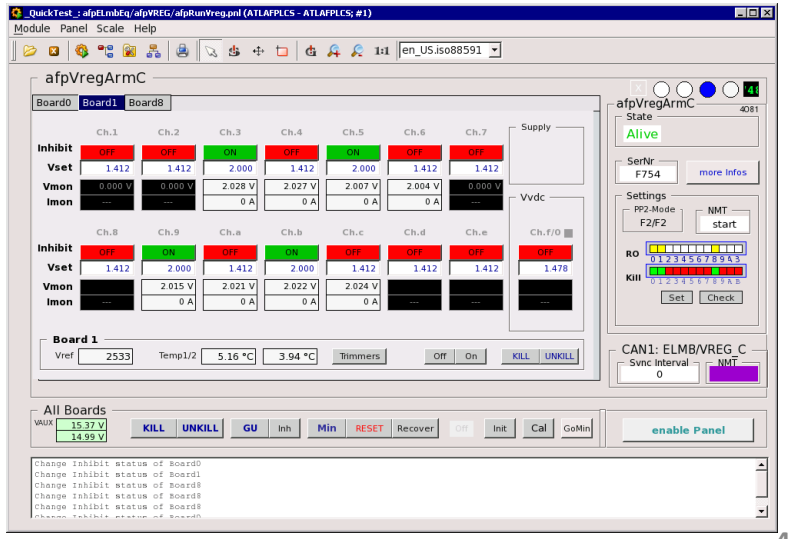


2nd stage: tunnel

Voltage Regulators Crate VREG (*IBL like*)

- 2 LV boards for supply FE-I4 chips in Near and Far Stations
- 1 V_{VDC} board for optoboard
- 1 controller board
- Radiation hard voltage regulators,
  control – ELMB with non standard firmware, OPC UA server

IBL software – technical panels **READY**

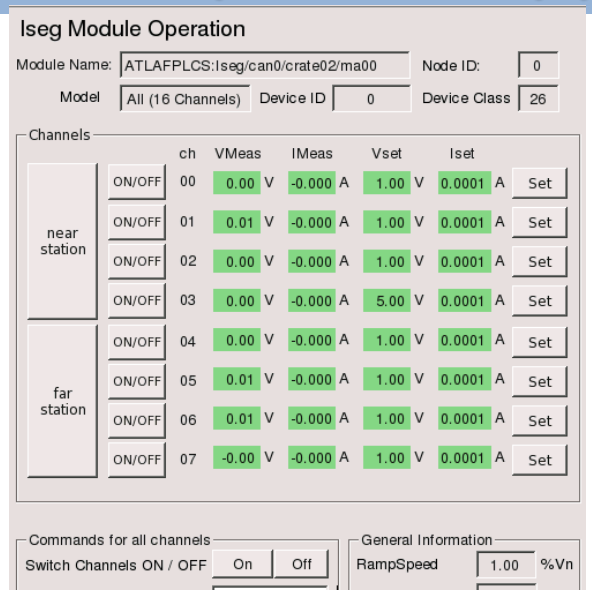


High Voltage Supply, Optoboard power supply

ISEG HV System:

- Crate: ECH 238_1200W-UPS
- EHS F405n 16 channels module
  CAN-controlled,
  OPC UA server (new design)

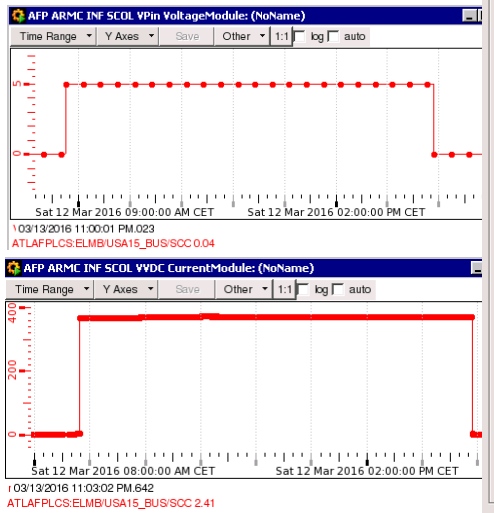
Framework software + technical panels **READY**

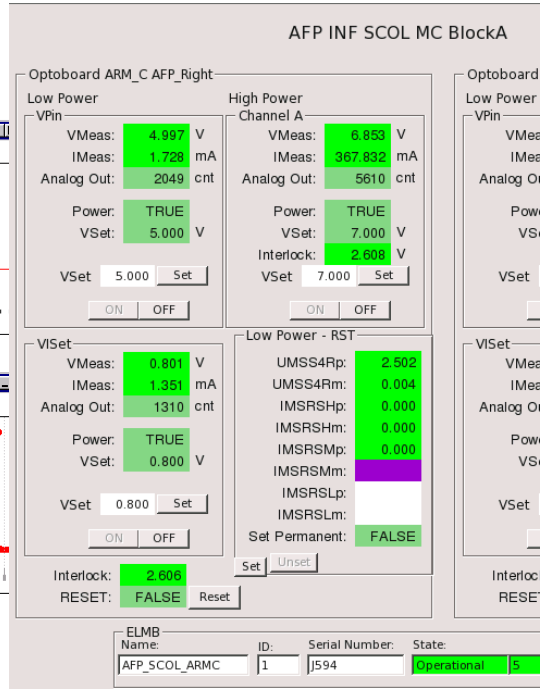


SCOL – power supply for optoboard (IBL-like)

- 3 different supply voltages:
  - V_{VDC} – main supply (1st stage)
  - V_{pin} – depletion voltage for the PIN receiver diode
  - V_{iset} – operation point of the VCSELs
- Optoboard Reset Signal

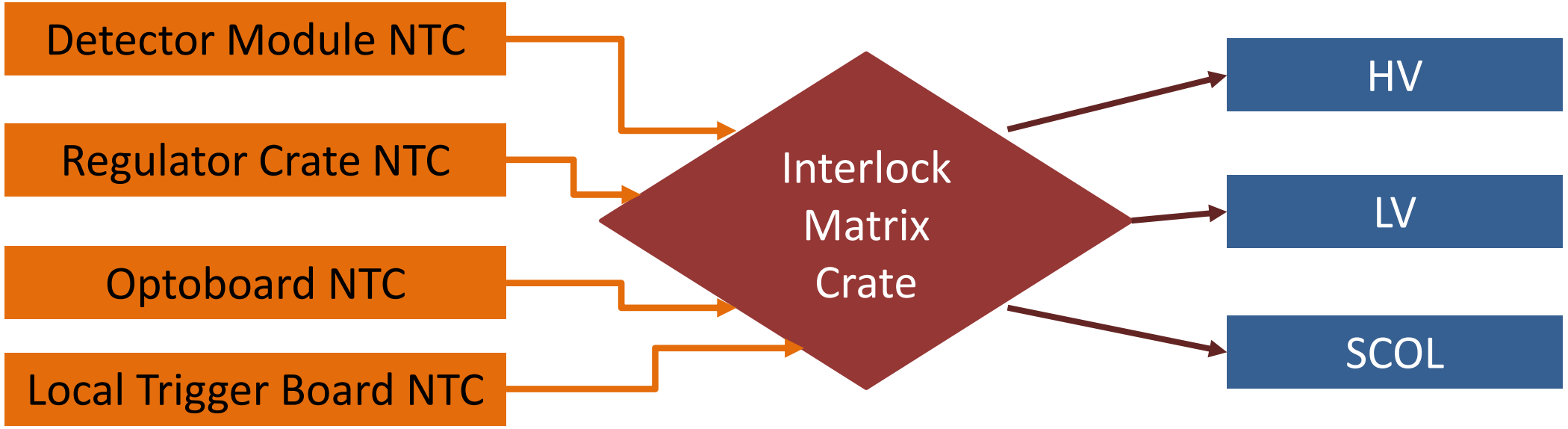
Framework software + technical panels **READY**





Interlock Matrix Crate and temperature monitoring

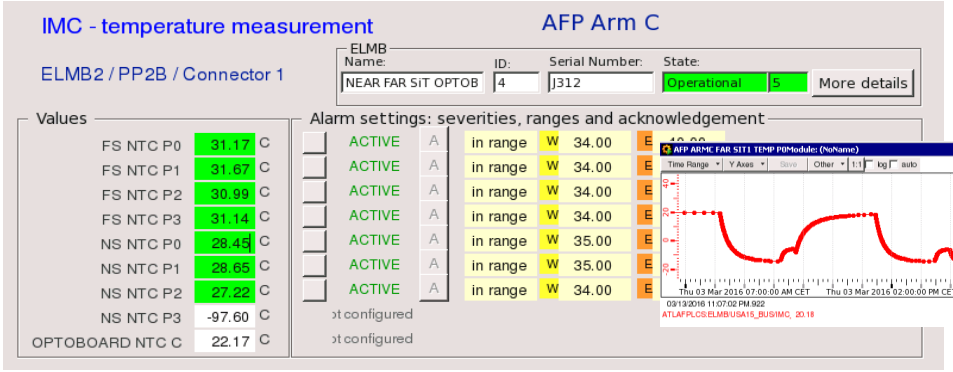
All power supplies are interlockable



Temperature sensors - 45 for one Arm:

detector, heat exchanger, pot wall, stepper motor, Air Cooler, Local Trigger Board, optoboard, VREG -> connected to Interlock Matrix Crate

- Crucial sensors - Hardware interlock action
  Defined and tested **READY**
- Monitoring
  ELMB, CanOpen UA OPC server
  Framework software + technical panels **READY**



Secondary Vacuum and Cooling

Covered by Roman Pot Instrumentation and Control system - Xavier Pons (PH-DT)

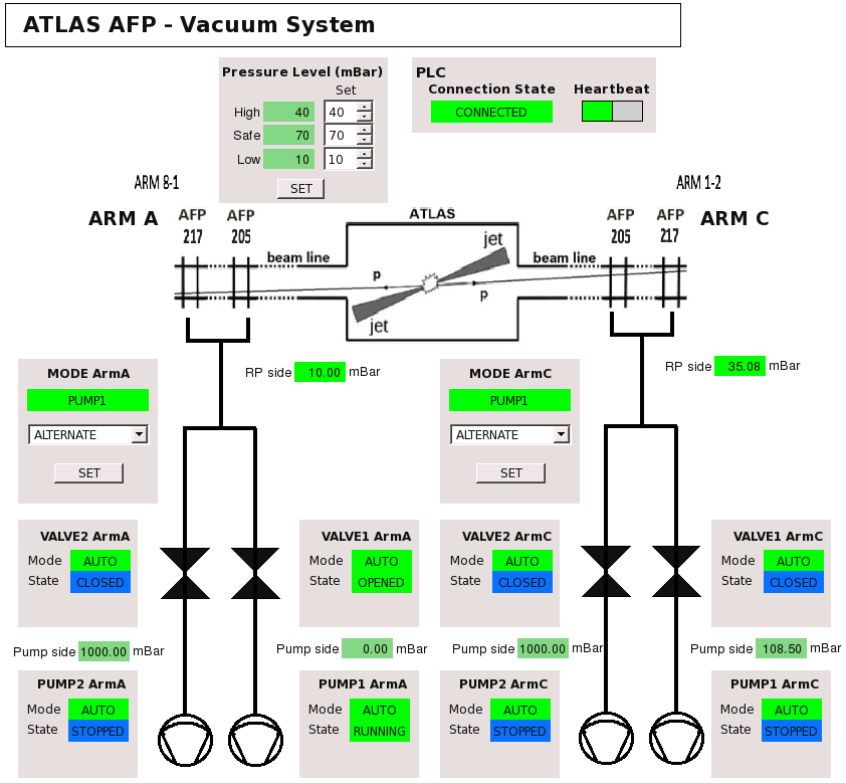
Monitoring and control via PLC Siemens S7 1200, USA15, native S7 WinCCOA Driver

Vacuum

Very similar to ALFA system

PLC program – operating

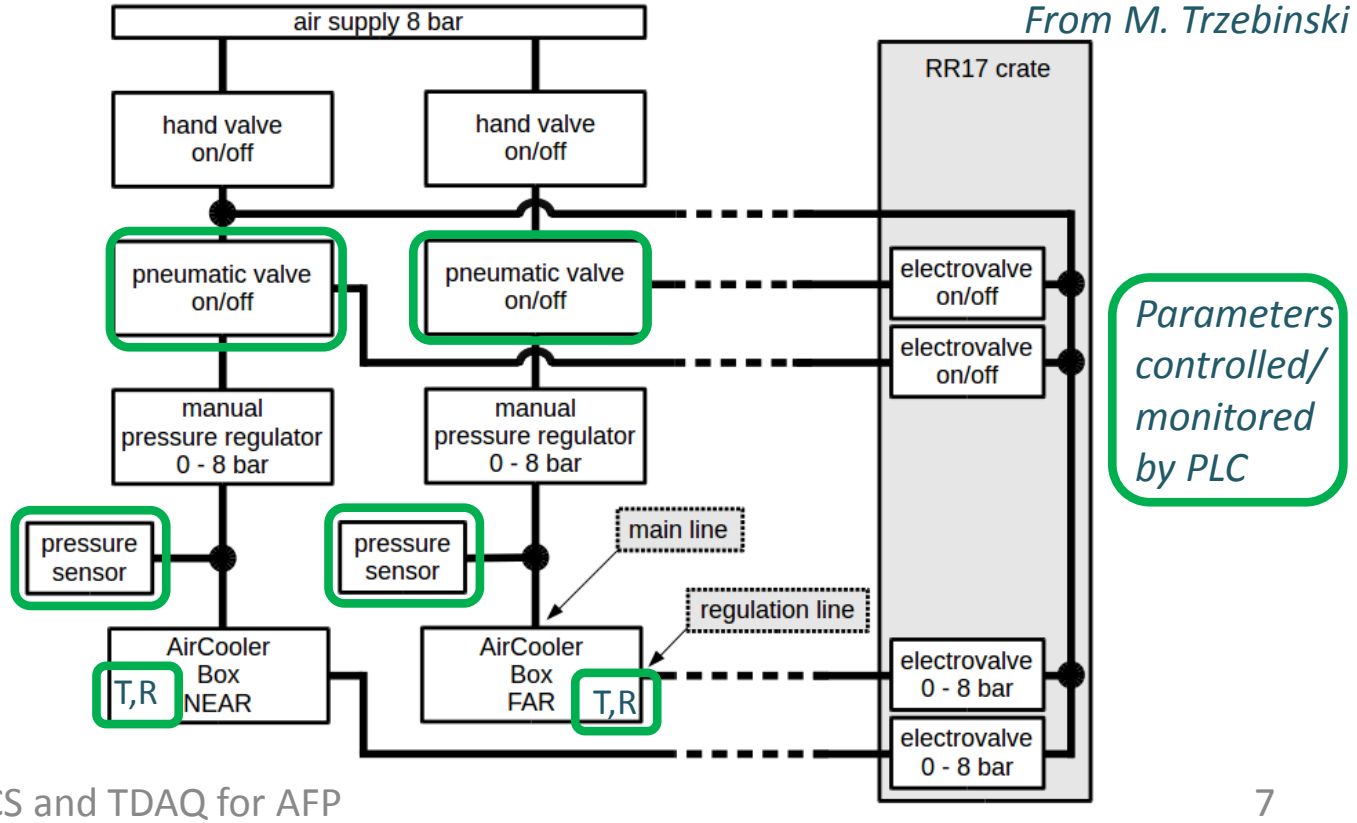
DCS software – technical panels **READY**



Cooling

- PLC program – operating
- Integration with DCS – ongoing

Connection and PLC control/monitoring scheme
From M. Trzebinski



Parameters controlled/ monitored by PLC

Movement and Positioning control

- Document draft distributed (1 comment received):
  "Specification and Validation of the Motion Control System of the ATLAS Forward Proton Roman Pots"

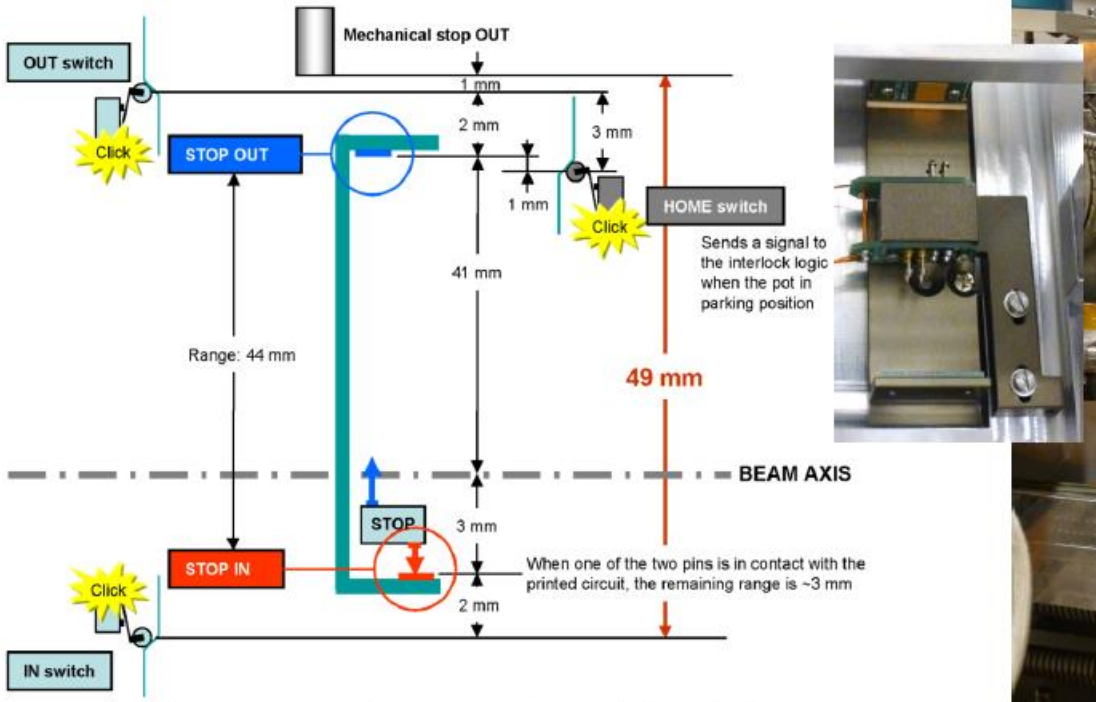


Figure 2. The IN, OUT, and HOME switches and their ideal ranges settings. In addition the electrical STOP needle switch (and photo insert) is shown and its relation to the positions of the other switches.

Courtesy of M. Rijssenbeek, AFP Technical Meeting, 08.03.16

08MAR2016 AFP-TM 2

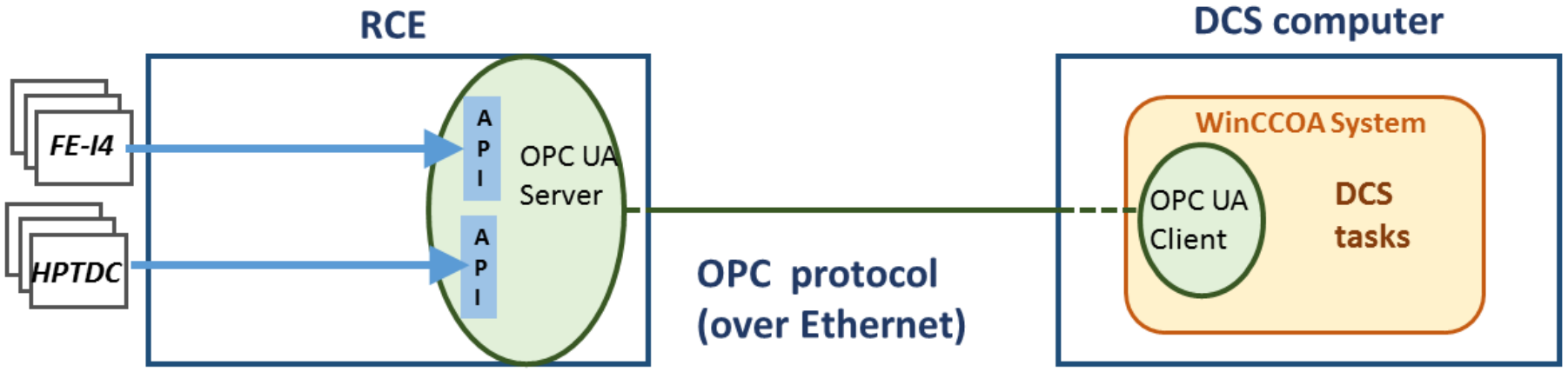
Covered by Roman Pot Instrumentation and Control system - Xavier Pons (PH-DT)

Last hardware commissioning tests done

Integration with DCS – to be started soon

Front-end chips FE-I4 / HPTDC Health Parameters

Goal:
internal FE chips parameters (temperature, supply voltage, current, …) are collected by DAQ and transferred to DCS



OPC UA server embedded in RCE will acquire health parameters via dedicated API's:

- OPC UA server framework installed on RCE, ready for development
- Access to test station for API development is setup
- Calibration constants will be provided by detector experts

Status - ongoing

DCS Status and plans

- DCS production project is setup in Point1 environment
  - Archiving

- Communication protocols, hardware access **READY**
  - OPC UA servers in SLC6: HV and CanOpen
  - OPC DA server in VM 2008: LV Wiener PL512
  - S7 Native Driver for PLC S7 1200 control

- Hardware Interlock – implemented **READY**

- Technical panels for detector powering – **READY**

- Technical panels for vacuum – **READY**

for Cooling - ongoing

- Integration with Movement an Positioning System – to be done

- FSM – started, ongoing

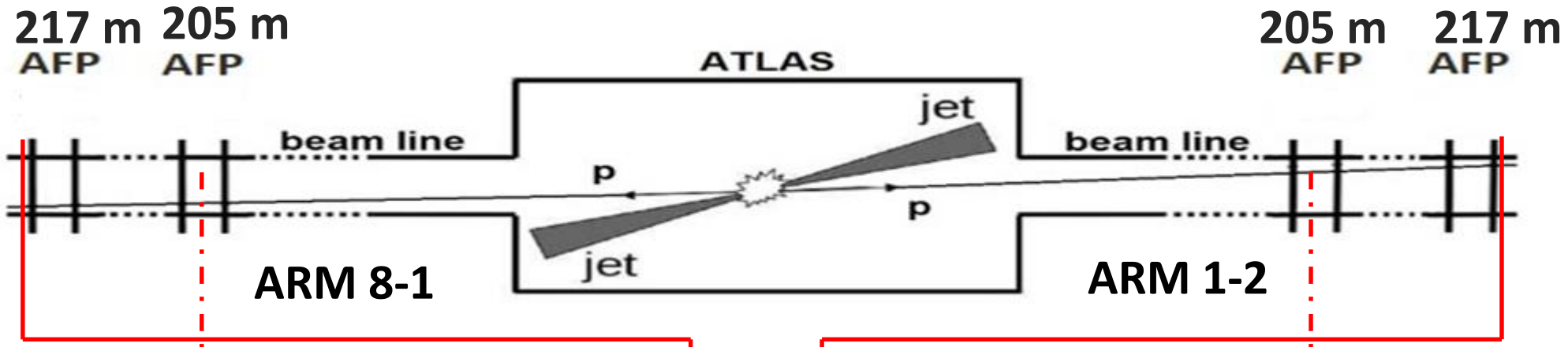
- Automatic emergency actions- software interlock – started, ongoing

- Notification system – started, ongoing

- Integration with ATLAS Central DCS - to be done

- Documentation….

AFP LVL1 trigger



Current ATLAS L1 latency: **84** BCXs

Protons from P1 to 217 m: **29** BCXs

Fast air-core cable (300m): **43** BCXs

ATLAS CTP work: **6** BCXs

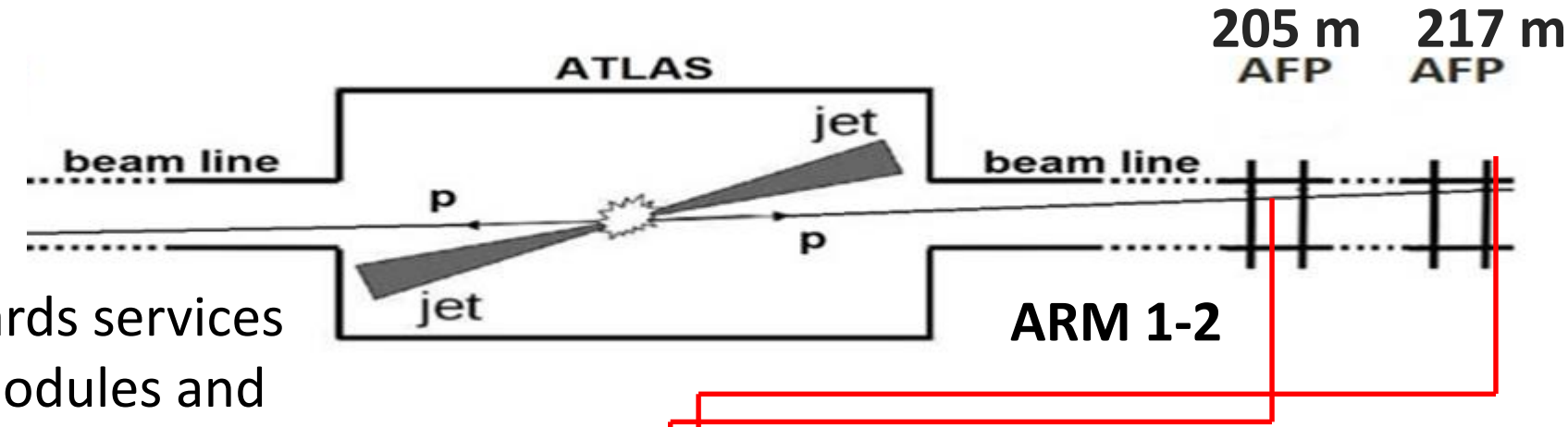
Trigger logic: **6** BCXs

NIM signals with encoded information from timing detectors

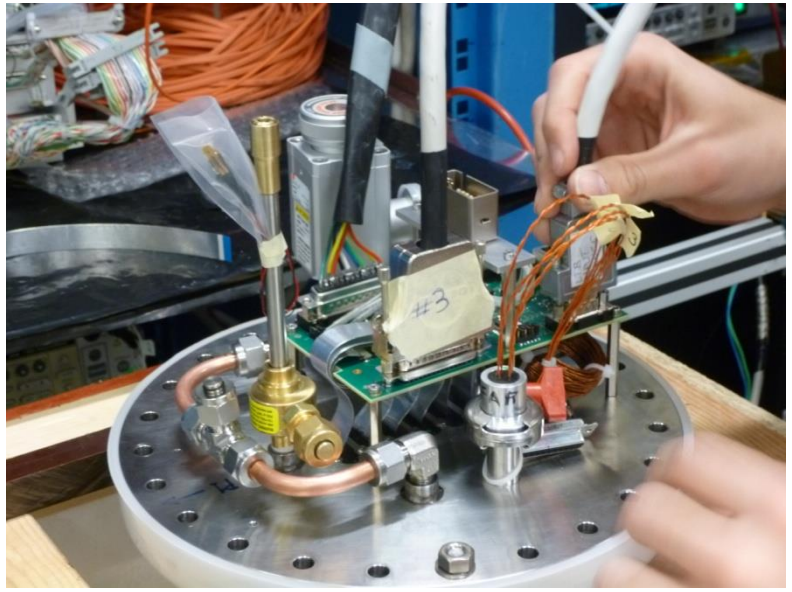
AFP_CTPIN

ATLAS Central Trigger Processor

AFP2+0 LVL1 trigger



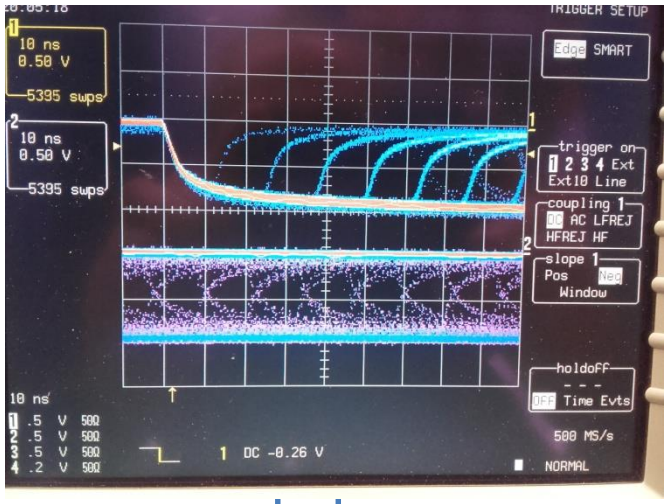
The LTB board forwards services (LV, HV) for the FE modules and houses HitBus chip

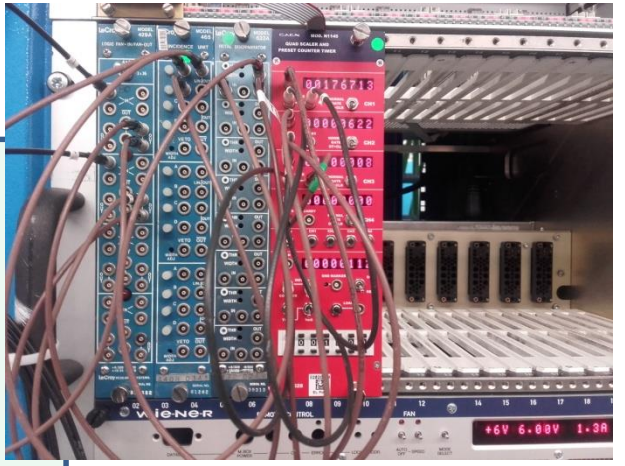


3 out of 4 FE-I4 HitOR outputs are connected to HitBus chip (DBM) to make logic function (AND/OR, single module) . The HitBus output is then converted into NIM level and sent to CTP.

ATLAS
Central Trigger Processor

AFP2+0 LVL1 trigger





NIM

Discriminator
30 ns pulse

ATLAS
Central Trigger Processor

ATLAS CTP rack in USA15

Main CTP-AFP trigger connection for synchronization in combined runs (not installed yet)

NIM

in/out

coinc

discr

VME

LTP

TTC

ROD Busy

RCE

HSIO logic

16 data

8 conf/cmd

AFP rack in USA15

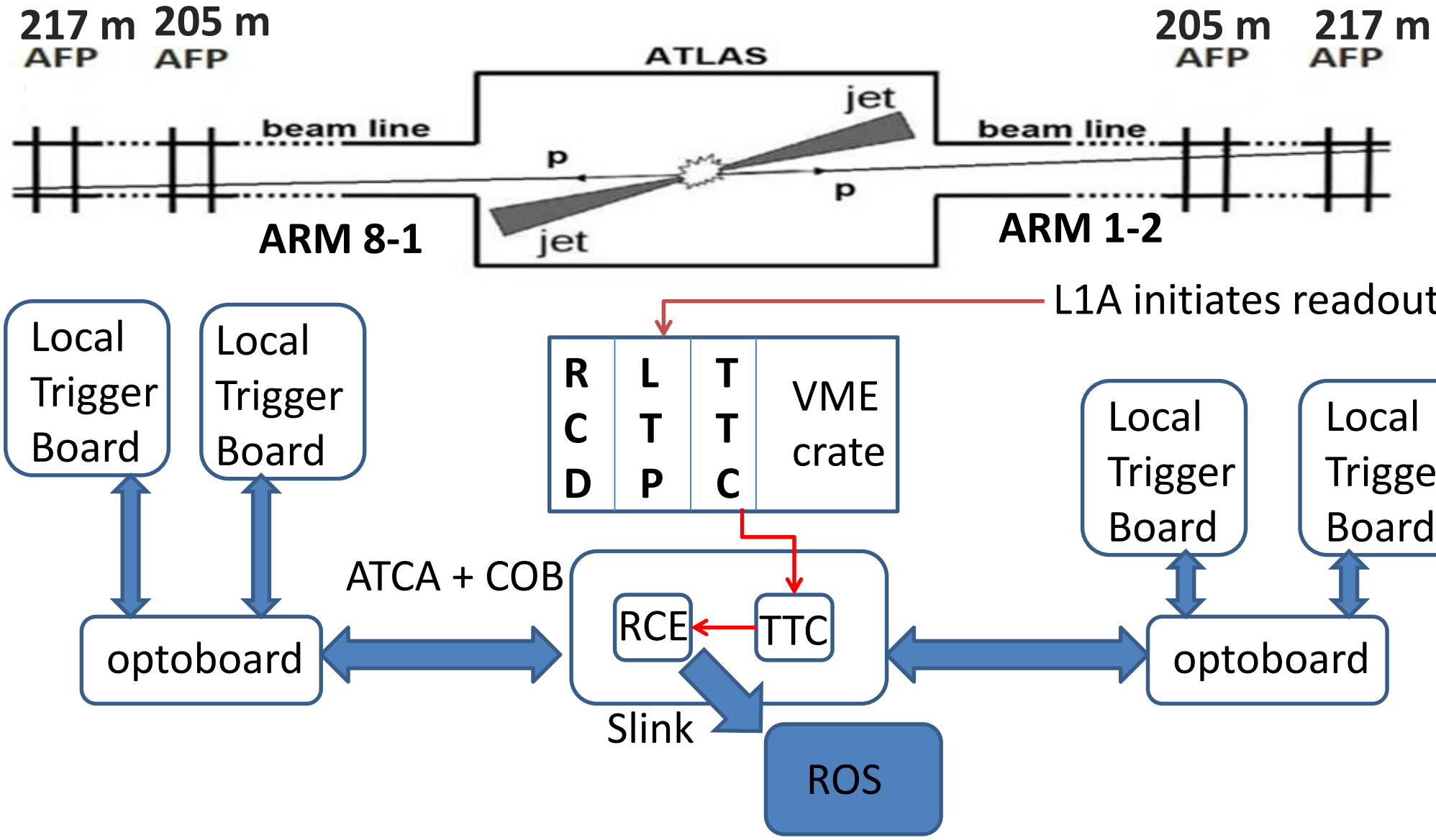
AFP LVL1 trigger status and development

- AFP LTB boards commissioned and installed in the tunnel

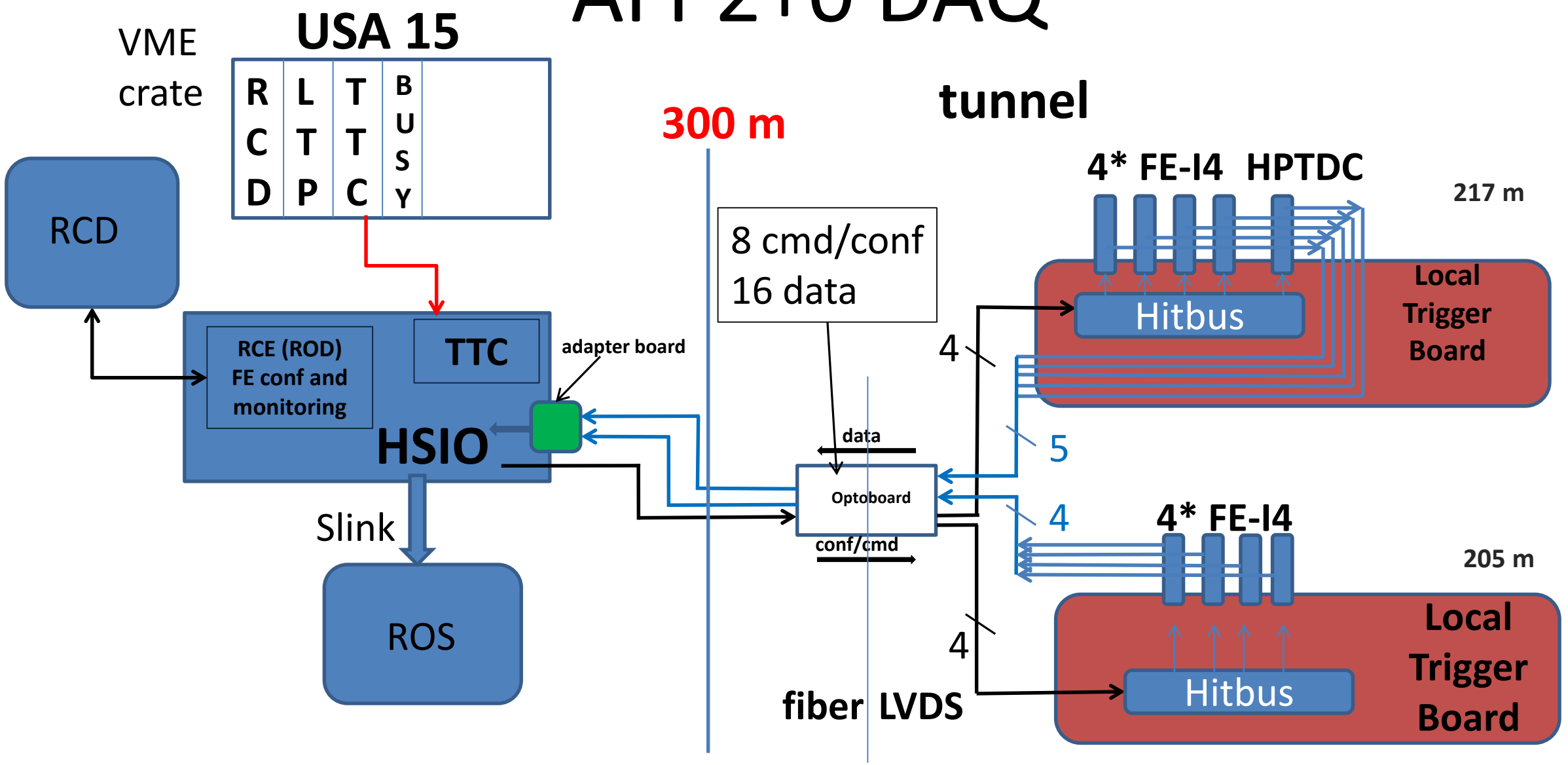
- trigger signals from the LTBs arrive at CTP in decent form (after 250 m of air-core cables)
    - NIM logic in CTP crate discriminates signals to make 23 ns pulses
    - copies for standalone runs arrive at AFP rack and can be used as triggers
        - as single stations or in coincidence

- AFP LVL1 trigger ready for commissioning

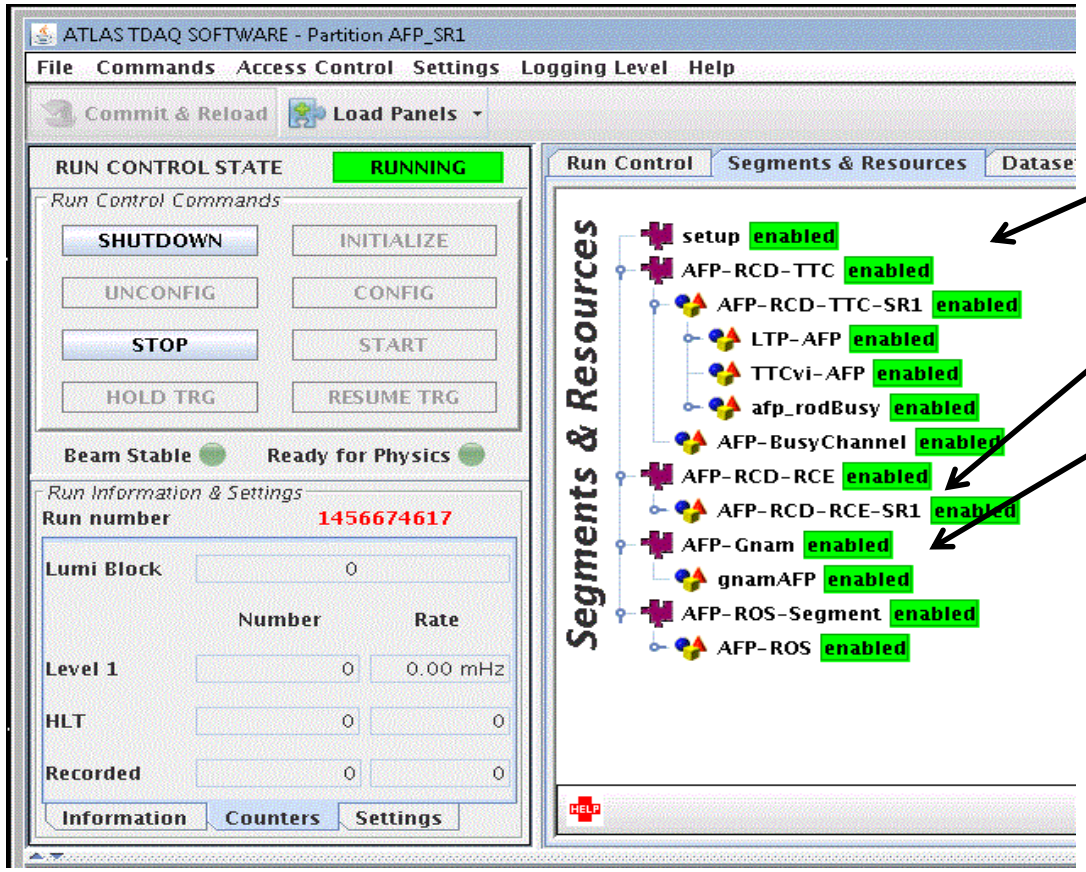
AFP DAQ


217 m
AFP
205 m
AFP
ATLAS
205 m
AFP
217 m
AFP
beam line
jet
beam line
p
p
jet
ARM 8-1
ARM 1-2
L1A initiates readout
Local Trigger Board
Local Trigger Board
R C D
L T P
T T C
VME crate
Local Trigger Board
Local Trigger Board
ATCA + COB
optoboard
RCE
TTC
optoboard
Slink
ROS

AFP2+0 DAQ


VME crate
USA 15
RCD
LTP
TTC
BUSY
RCD
RCE (ROD) FE conf and monitoring
TTC
HSIO
adapter board
Slink
ROS
300 m
tunnel
8 cmd/conf
16 data
data
conf/cmd
Optoboard
4* FE-I4 HPTDC
217 m
Hitbus
Local Trigger Board
4
5
4
4* FE-I4
205 m
4
Hitbus
Local Trigger Board
fiber LVDS

Status of standalone AFP TDAQ



@ SR1

Controls LTP+TTC in VME crate

Controls RCE to configure and run FE-I4

Monitoring data quality via sampler @ DCM

Firmware at HSIO controlled from RCE

- interfaces with TTC
  - L1A, BCR, ECR
- requests FE data, formats fragments then forwards to ROS
- copies of events sent to RCE for monitoring
- test data files written via ROS with full ATLAS formatting

@ USA15

- fast trigger cables reach CTP rack; signals discriminated, copies sent to AFP rack
- CTP signal cable between CTP and AFP racks arrived, but needed to be tested
- TTC system from SR1 moved to USA15 for commissioning detectors in the tunnel
- OKS configuration for standalone partition ready for data from detectors - waiting for ROS PC
- standalone programs calibGui and cosmicGui will be used in commissioning until partition starts controlling RCE