

# Beamline for Schools DAQ and shift responsibilities

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## T9 facilities

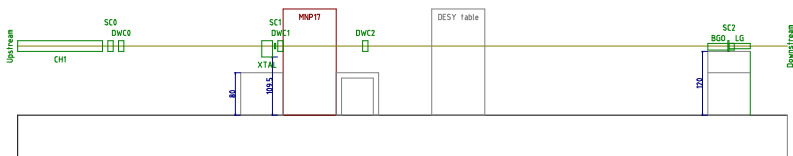
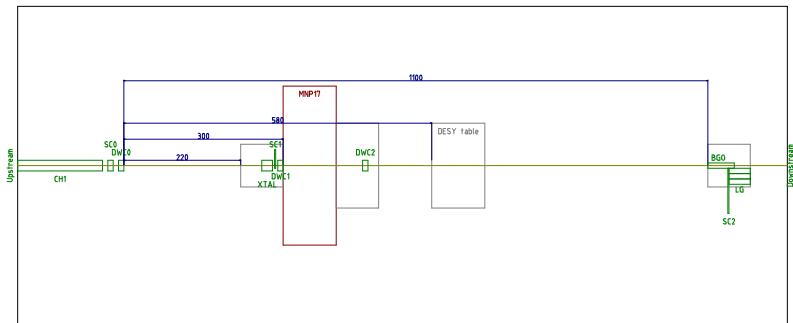


T9 control room



T9 experiment zone access door

# Experiment set-up



We (ab)use acronyms to refer to detector elements:

Detector type	Names
Cherenkov	CH0, CH1
Scintillator	SC0, SC1, SC2
Delay Wire Chamber	DWC0, DWC1, DWC2
Lead Glass Calorimeter	LG0, LG1, LG2, LG3
Bismuth Germanate Calorimeter	BGO

## PMT threshold detectors



Scintillating plastic



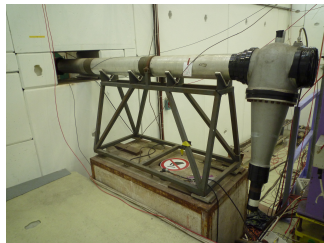
Light guide



Photo-Multiplier Tube



Scintillator assembly- charged particle timing



Cherenkov detector- charged particle identification

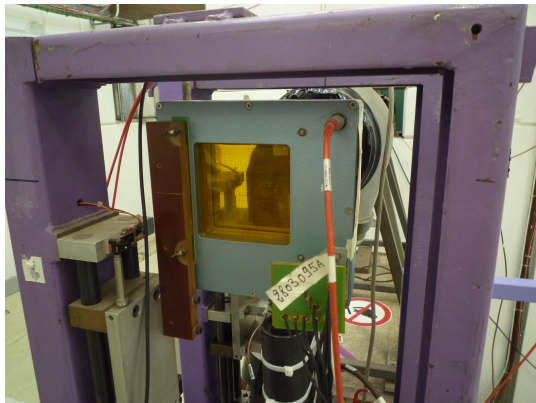
## PMT integral detectors

- Absorb electromagnetic particles fully
- Energy converted to light
- PMT converts light into electrical pulse
- Integrate pulse to recover the particle energy



Calorimeter blocks

## Delay wire chamber



Delay Wire Chamber (DWC0)

- Multi-Wire Proportional Chamber (MWPC)
- Charged particles ionise gas
- On board 'Front-end' electronics
- Two outputs per axis
- Compare the timing of signals on an axis
- Gives an X-Y location of hit

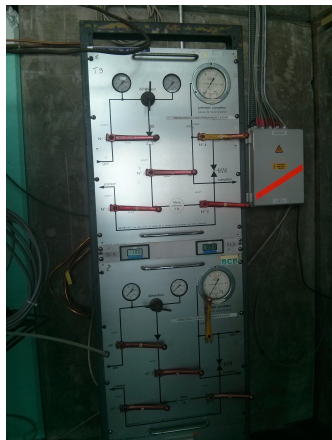
## Gas supply

The Delay Wire Chambers require gas to ionise

A supply of Argon and Carbon Dioxide ( $\text{Ar} + \text{CO}_2$ ) is provided from a distribution panel behind the beam control room

The Cherenkov detectors may be filled with Nitrogen or  $\text{CO}_2$

They can also be evacuated by vacuum pumps



Cherenkov gas panel



## Power supply



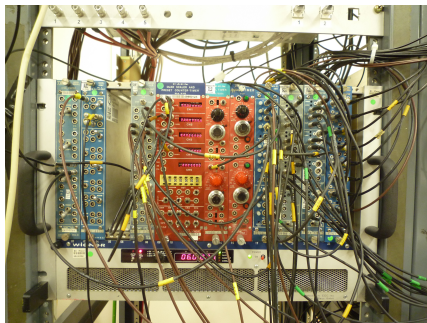
HV crate and modules

- Modular power supply unit
- Rack mount 'crate' holds modules, provides power and controls output
- Modules:
  - A1833P 12 channels, 4 kV positive, 2 mA
  - A1833N negative voltage version of above
- Modules monitor voltage and current usage, tripping off in case of problems

The Delay Wire Chamber also needs low voltage power from a bench top power supply

## Analog electronics: NIM

- Nuclear Instrumentation Module (NIM)
- Modular standard for analog electronic components
- Rack mount 'bin' holds modules and provides power
- Modules:
  - Amplifier
  - Fan-in (logical OR), Fan-out
  - Discriminator
  - Coincidence (logical AND)
  - Timer
  - Counter



NIM bin and modules

## Analog electronics: NIM

### Discriminator

A discriminator has two settings; a 'Threshold' and a 'Width'

Noise with a voltage below the Threshold is ignored

If the input signal crosses the Threshold, a pulse is generated with the desired Width

### Coincidence module

Many pulses are not interesting but if two detectors see a signal at the same time, there may be something interesting

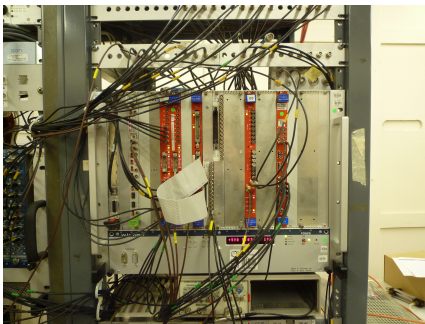
A coincidence is the logical AND of some signals

If we use inverted signals, we can 'Veto' a certain detector

# Trigger

- We will generate too much data to store everything
- Particles will cross the detector in a few nano-seconds
- A trigger is needed to only record interesting 'Events'
- By combining signals from the detectors we can detect a particles 'Signature' and begin recording
- Big experiments have higher level triggers that look in more and more detail at the data before keeping or rejecting events

## Digitisation: VME



VME crate and modules

- Versa Module Europa
- Originally designed for Motorola 68k computers
- Rack mount 'crate' holds modules, provides power and hosts a data bus
- Modules:
  - Scaler/Counter
  - Analog to Digital converter (ADC)
  - Charge to Digital converter (QDC)
  - Time to Digital converter (TDC)

# Digitisation: VME

## V560 Scaler

- Counts pulses from the NIM apparatus
- Gives the Rate for threshold detectors
- Records coincidences, triggers
- Labels events coming from the same spill

## V785 ADC

- Measures the Peak voltage of its input
- Considers pulses in a window of time - 'gated'

# Digitisation: VME

## V792 QDC

- Integrates charges in gate window
- Internal 'Pedestal' current must be calibrated

## V1290 TDC

- Records leading edge of signal
- Also saves additional leading edges if a second signal is close by
- 25 ps time resolution ( $25 \times 10^{-12}$ !)
- Can save up to a microsecond before and after the trigger

## Digitisation: VME

### CORBO trigger module

- Receives trigger to start recording
- Sends a busy signal to prevent subsequent triggers
- Signals computer to start readout

### Single board computer

- Bus master - controls the other modules
- Complete computer in a module
- 2GHz Intel Core i7 processor
- 4GB of RAM
- Laptop size hard drive



# Deadtime

- Electronics take time to digitize signals
- We can't generate any signals while the digitizers are busy
- Veto triggers using the busy output
- The period while the DAQ is busy is the 'Deadtime'
- Typically we take  $100 \mu\text{s}$  to readout
- Our trigger has to be careful to pick the best events

# High voltage control

The HV panel can be opened from a desktop icon on the control room PCs

## BL4S-HV-01

```

- Main Utility Setup Groups View                               Admin
Group 00
Channel Name  VOSet      IOSet      VMon      IMon      Pw  Status      Ch#
DWC1          2850.00 V 100.00 uA  0.00 V    0.00 uA  Off  Ext-Dis    00.0000
DWC2          2850.00 V 100.00 uA  0.00 V    0.00 uA  Off  Ext-Dis    00.0001
BG0           480.00 V 150.00 uA  0.00 V    0.00 uA  Off  Ext-Dis    00.0002
-03           0.00 V 20.00 uA  0.00 V    0.00 uA  Off  Ext-Dis    00.0003
-04           0.00 V 20.00 uA  0.00 V    0.00 uA  Off  Ext-Dis    00.0004
-05           0.00 V 20.00 uA  0.00 V    0.00 uA  Off  Ext-Dis    00.0005
-06           0.00 V 20.00 uA  0.00 V    0.00 uA  Off  Ext-Dis    00.0006
-07           0.00 V 20.00 uA  0.00 V    0.00 uA  Off  Ext-Dis    00.0007
-08           0.00 V 20.00 uA  0.00 V    0.00 uA  Off  Ext-Dis    00.0008
-09           0.00 V 20.00 uA  0.00 V    0.00 uA  Off  Ext-Dis    00.0009
-10           0.00 V 20.00 uA  0.00 V    0.00 uA  Off  Ext-Dis    00.0010
-11           0.00 V 20.00 uA  0.00 V    0.00 uA  Off  Ext-Dis    00.0011
LG00          1062.00 V 500.0 uA  0.00 V    0.0 uA  Off  Ext-Dis    01.0000
LG08          1208.00 V 500.0 uA  0.00 V    0.0 uA  Off  Ext-Dis    01.0001
LG03          1151.00 V 500.0 uA  0.00 V    0.0 uA  Off  Ext-Dis    01.0002
LG04          1090.00 V 500.0 uA  0.00 V    0.0 uA  Off  Ext-Dis    01.0003
CH0           2000.00 V 1500.0 uA  0.00 V    0.0 uA  Off  Ext-Dis    01.0004
CH1           2000.00 V 1500.0 uA  0.25 V    0.0 uA  Off  Ext-Dis    01.0005
SC1           1800.00 V 1500.0 uA  0.25 V    0.0 uA  Off  Ext-Dis    01.0006
Channels Display/Edit Screen                               LocEn V0 IO  N  CAEN SY2527

```

# Data Acquisition software

ATLAS TDAQ SOFTWARE - Partition part\_BL4S (on lxplus0061.cern.ch)

File Commands Access Control Settings Logging Level Help

Commit & Reload Load Panels

RUN CONTROL STATE: NONE

Run Control Commands:

SHUTDOWN INITIALIZE  
UNCONFIG CONFIG  
STOP START  
HOLD TRG RESUME TRG

Beam Stable ●

Run Information & Settings

Run number: 1441988475

Run type: Physics

Super Master Key:

LHC Clock Type:

Recording: Disabled

Start time: 11-Sep-2015 18:21:15

Stop time: 11-Sep-2015 18:24:40

Total time: 0 h, 3 m, 24 s

Information Counters Settings

Run Control Segments & Resources Dataset Tags

RootController

- Online Segment
- Infrastructure
  - BL4SSegment
    - ABSENT BL4SApp
    - ABSENT Physics\_Monitor
    - ABSENT Detector\_Monitor
    - ABSENT DAQ\_Monitor
    - ABSENT Test\_env

RootController

- CHIP
- DDC
- DF
- DFConfig
- DQM
- Histogramming
- ISRepository
- MTS
- Monitoring
- PMG
- RDB
- RDB\_POOL\_1
- RDB\_RW

TestResults Advanced

End:  Match Case  Repeats

Subscription criteria  WARNING  ERROR  FATAL  INFORMATION  Expression  Subscribe

TIME	SEVERITY	APPLICATION	NAME	MESSAGE
01:16:32	INFORMATION	IGUI	INTERNAL	All done! IGUI is going to appear...
01:16:32	INFORMATION	IGUI	INTERNAL	Waiting for the "Dataset Tags" panel to initialize...
01:16:32	INFORMATION	IGUI	INTERNAL	Waiting for the "Segments & Resources" panel to initialize...
01:16:32	INFORMATION	IGUI	INTERNAL	Waiting for the "Run Control" panel to initialize...
01:16:32	INFORMATION	IGUI	INTERNAL	Creating panel "Igui_DSPanel"...
01:16:32	INFORMATION	IGUI	INTERNAL	Creating panel "Igui_SegmentsResourcesPanel"...
01:16:32	INFORMATION	IGUI	INTERNAL	Creating panel "Igui_RunControlMainPanel"...
01:16:32	INFORMATION	IGUI	INTERNAL	Waiting for the "Igui_Dialogs" panel to initialize...

Clear Message format Visible rows: 100 Current ERS subscription: sev=ERROR or sev=WARNING or sev=FATAL

ATLAS DAQ software

# Data Acquisition software

ATLAS TDAQ SOFTWARE - Partition part\_BL4S (on lxplus0061.cern.ch)

File Commands Access Control Settings Logging Level Help

Commit & Reload Load Panels

**RUN CONTROL STATE** RUNNING

Run Control Commands

SHUTDOWN INITIALIZE

UNCONFIG CONFIG

STOP START

HOLD TRG RESUME TRG

Beam Stable

Run Information & Settings

Run number 1442013588

Lumi Block 0

	Number	Rate
Level 1	672	105.00 Hz

HLT 0 0

Recorded 0 0

Information Counters Settings

Run Control Segments & Resources Dataset Tags

Run Control

- RUNNING RootController
  - Online Segment
    - Infrastructure
      - RUNNING BL4SSegment
        - RUNNING BL4SApp
          - UP Physics\_Monitor
          - UP Detector\_Monitor
          - UP DAQ\_Monitor
          - ABSENT Test\_env

RootController

- BL4SSegment
- CHIP
- DDC
- DF
- DFConfig
- DQM
- Histogramming
- ISRepository
- MTS
- Monitoring
- PMG
- RDB
- RDB\_POOL\_1

TestResults Advanced

Find: Match Case Repeats

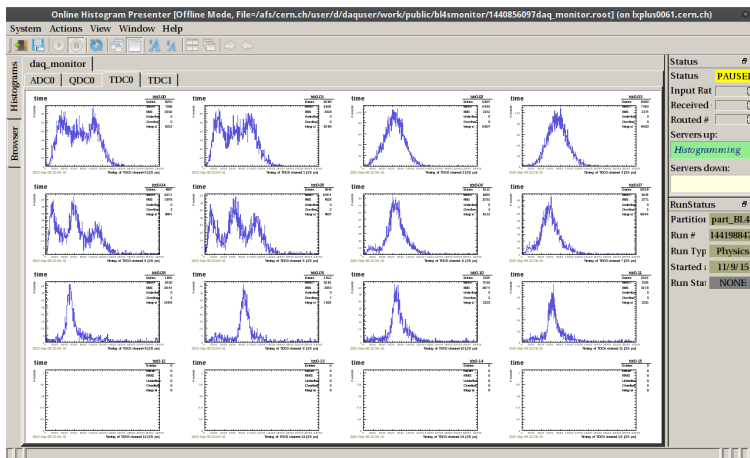
Subscription criteria  WARNING  ERROR  FATAL  INFORMATION  Expression Subscribe

TIME	SEVERITY	APPLICATION	NAME	MESSAGE
01:19:49	WARNING	RootController	rc:MasterTrigger...	Master Trigger not defined
01:19:48	WARNING	RootController	rc:RunNumber	No Run Number Server provided: check the "TDAQ_RUN_NUMBER_CONNECT" variable in the DB. A dummy run number will be provided.
01:16:32	INFORMATION	IGUI	INTERNAL	All done! IGUI is going to appear...
01:16:32	INFORMATION	IGUI	INTERNAL	Waiting for the "Dataset Tags" panel to initialize...
01:16:32	INFORMATION	IGUI	INTERNAL	Waiting for the "Segments & Resources" panel to initialize...
01:16:32	INFORMATION	IGUI	INTERNAL	Waiting for the "Run Control" panel to initialize...
01:16:32	INFORMATION	IGUI	INTERNAL	Creating panel "Igui DSPanel"...

Clear Message format Visible rows 100 Current ERS subscription sev=ERROR or sev=WARNING or sev=FATAL

## ATLAS DAQ software

# Monitoring software



Online Histogram Presenter (OHP)

## Log book

Home - BL4S Experi... x

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Tim Brooks

CERN BL4S Experiment E-Log 2015

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Categories

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Cherenkov

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Lead Glass Calorimeter

Monitoring

New Run

Physics Run

Run Control

Scintillator

Shift Leader

Shift Summary

Webcam

Experimental Electronic log book of 2015 Beam Line For Schools

**Welcome to BL4S E-Log!**  
by Cenk Yildiz on 08/09/2015 05:33 PM

To begin using your site, click [Create a Post](#) under [Blog Tools](#).

**What is a E-Log?**

E-Log is a Web site designed to help you share information related to BL4S experiment progress in the form of text, images, links, and other media such as video.

E-Log posts usually consist of frequent short postings and are typically displayed in reverse chronological order (newest entries first). E-Log encourage site visitors to interact with one another by leaving comments on posts.

E-Log is also used as a team communication tool. Keep team members informed by providing a central place for links and relevant news.

0 Comment(s)

RSS Feed Alert Me

**About this blog**

beamline for schools CERN

Welcome to BeamLine For Schools 2015 Elog. Click on "Create a Post" to make a new post...

**Blog Tools**

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- Launch blog program to post

**Documents**

<input type="checkbox"/>	Type	Name	Modified	Modified By
<input type="checkbox"/>		BeamlineCERN	08/09/2015 05:56 PM	Cenk Yildiz

[Add document](#)

https://espace.cern.ch/project-blfs/bl4s-e-log-2015/default.aspx [-] [1/1]Top

BL4S online log book - it's only science if you write it down!

# Shift tasks

- 1 Check run plan - online whiteboard
- 2 Check detector set-up - access:
  - HV must be disabled
  - Magnet switched off
  - Shift leader will check the zone first
  - All shifters can then key into the zone
- 3 Ensure HV (and LV) is on
- 4 Collect calibration data - pedestal programs
- 5 Check run settings before starting to record
- 6 Check monitoring histograms
- 7 Write a log entry when:
  - Changing settings
  - Starting/stopping a run
  - Ending your shift

# Help

- 1 Pay attention and ask questions in the morning meeting
- 2 Check the log book - some problems may be known already  
<http://espace.cern.ch/project-blfs/bl4s-elog-2015/>
- 3 Documentation is available on our twiki:  
<http://twiki.cern.ch/twiki/bin/view/BL4S>
- 4 If you're unsure - ask your shift leader
- 5 Contacts:
  - Markus Joos (160663)
  - Tim Brooks (167969)
  - Candan Dozen (167970)