

# AIDA Update

*presented by*  
Tom Davinson  
*on behalf of the AIDA collaboration*  
*(Edinburgh – Liverpool – STFC DL & RAL)*

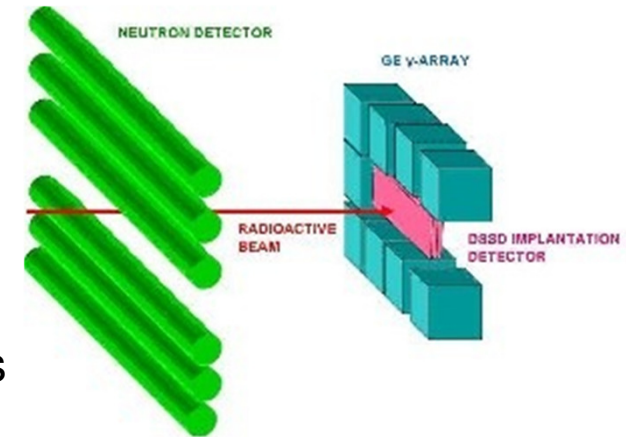
Tom Davinson  
School of Physics & Astronomy  
The University of Edinburgh

# AIDA: Introduction

## Advanced Implantation Detector Array (AIDA)

UK collaboration: *University of Edinburgh, University of Liverpool, STFC Daresbury Laboratory & STFC Rutherford Appleton Laboratory*

- SuperFRS
- Exotic nuclei  $\sim 50 - 200\text{MeV/u}$
- Implant – decay correlations
- Multi-GeV implantation events
- Subsequent low-energy decays
- Tag events for gamma and neutron detector arrays



**Detector:** multi-plane Si DSSD array

wafer thickness 1mm

8cm x 8cm (128x128 strips) *or* 24cm x 8cm (384x128 strips)

**Instrumentation:** ASIC

low noise ( $<12\text{keV FWHM}$ ), low threshold (0.25% FSR)

20GeV FSR *plus* (20MeV FSR *or* 1GeV FSR)

fast overload recovery ( $\sim\mu\text{s}$ )

spectroscopy performance

time-stamping

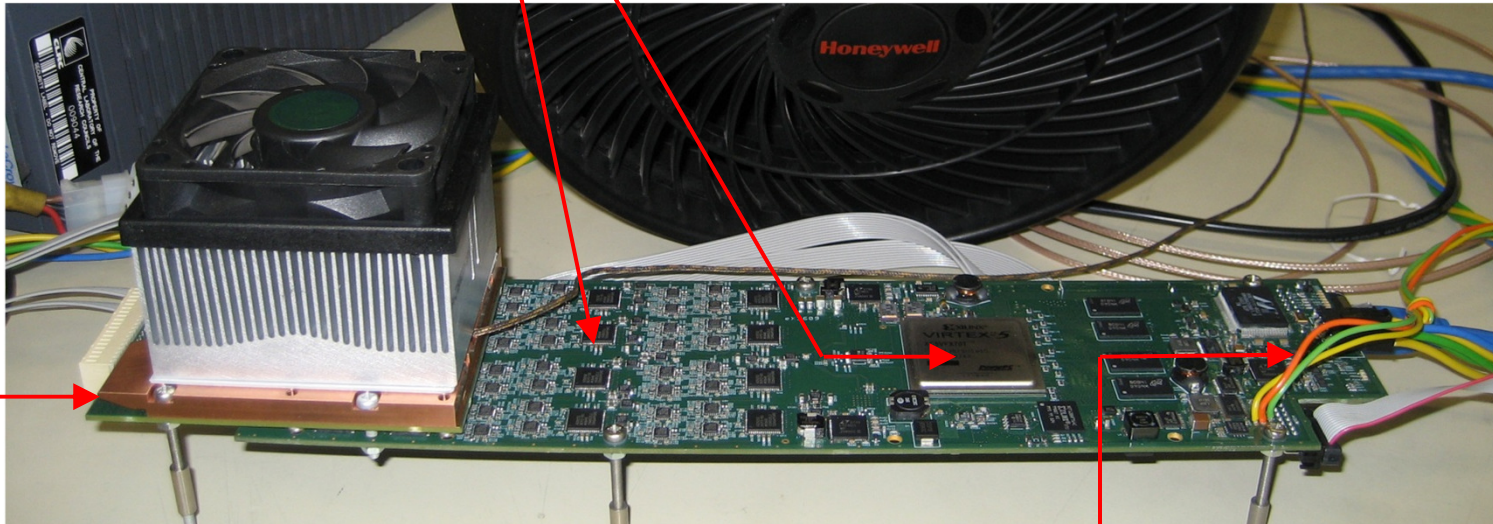
# AIDA Hardware

## Mezzanine:

4x 16 channel ASICs  
Cu cover  
EMI/RFI/light screen  
cooling

## FEE:

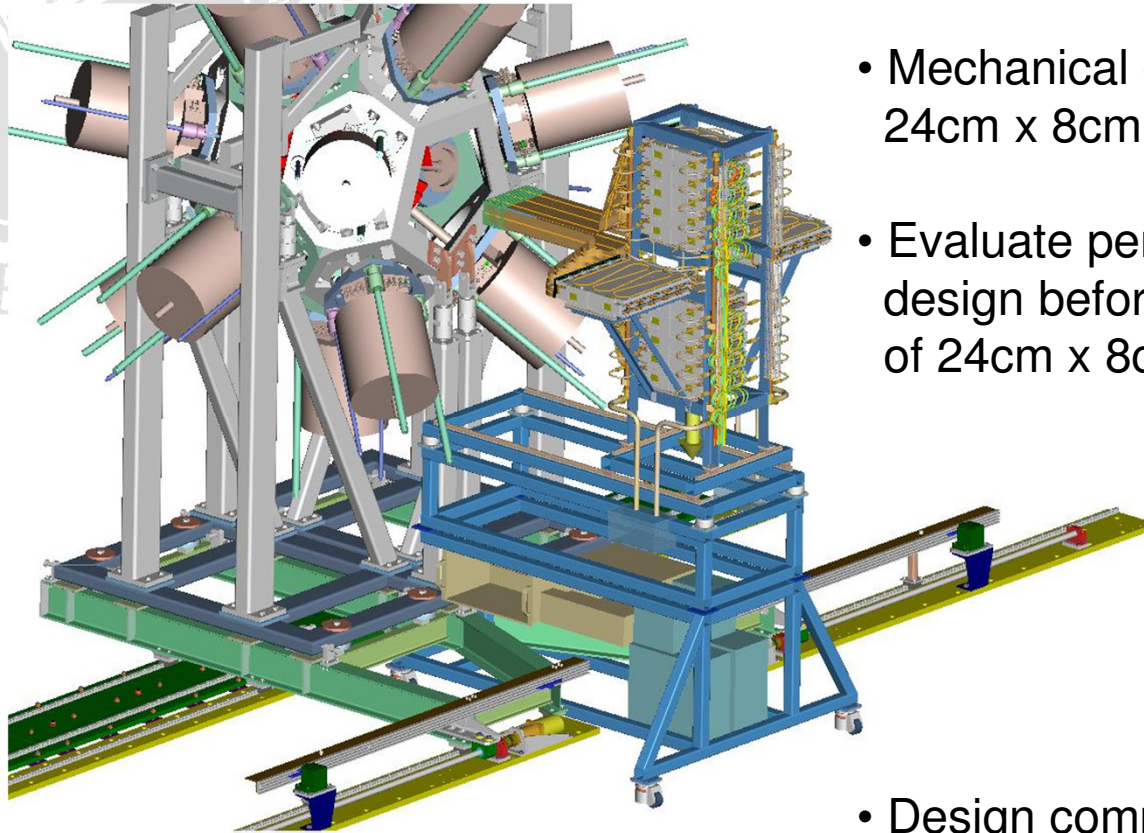
4x 16-bit ADC MUX readout (not visible)  
8x octal 50MSPS 14-bit ADCs  
Xilinx Virtex 5 FPGA  
PowerPC 40x CPU core/Linux OS – DAQ



FEE width: 8cm  
Prototype – air cooling  
Production – recirculating coolant

Gbit ethernet, clock, JTAG ports  
Power

# AIDA Mechanical



- Mechanical design for 8cm x 8cm and 24cm x 8cm DSSSDs is complete
- Evaluate performance of 8cm x 8cm design before proceeding to manufacture of 24cm x 8cm design
- Design compatible with BELEN, TAS, MONSTER , RISING, FATIMA etc.

- Design drawings (PDF) available  
<http://www.eng.dl.ac.uk/secure/np-work/AIDA/>

## AIDA: status

- DSSSD with sub-contractor (MSL)
  - 8cm x 8cm & 24 x 8cm mechanical samples
  - 4x 8cm x 8cm prototypes delivered
  - 10x 8cm x 8cm wafers + additional 0.5 $\mu$ m passivation  
*production batch in progress*  
*5 @ QA, 5 @ processing*
- Production hardware (ASIC, FEE Mezzanine PCB, FEE PCB) delivered by sub-contractors
- FEE64 Mezzanine assembly
  - 78 completed and delivered
- FEE64 PCB
  - 50 OK
  - 19 (1 of 64) channels noisy, otherwise OK
  - 6 with faults requiring further tests
- FEE module assembly
  - 12 complete and tested OK
  - 20 queued

## AIDA: status

- MACB timestamp distribution system for FEE modules
  - delivery complete
- Mechanical design and infrastructure (HV, PSUs, cooling etc.)
  - detector HV, FEE PSUs, cooling & FEE crates delivered
  - support assembly completed

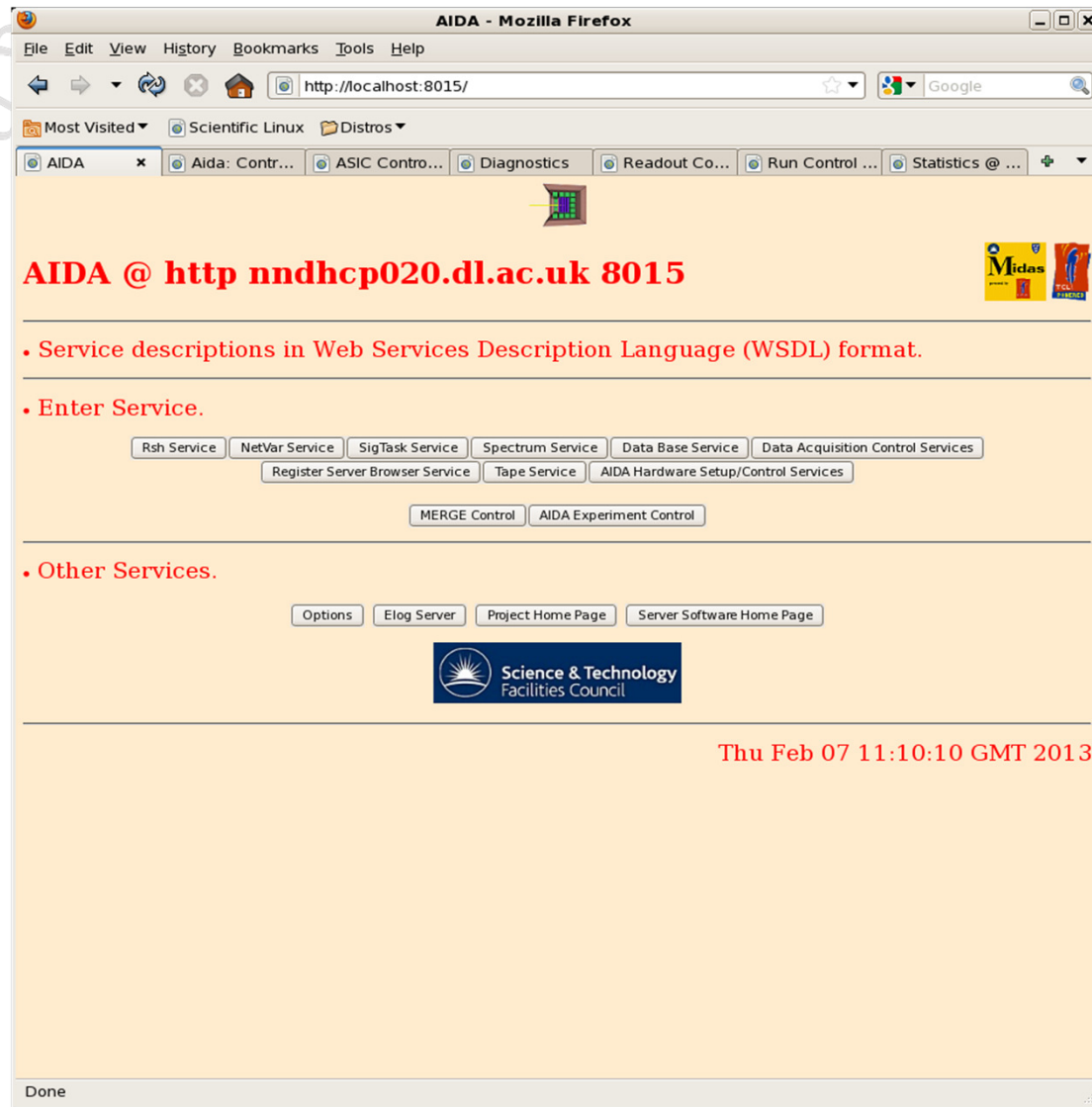


## AIDA: outlook

- AIDA production hardware was available for commissioning on schedule in 2011/Q3
- Performance of 20GeV & 1GeV ranges meets specification
  - *need to optimise DSSSD-FEE coupling for 20MeV range*
  - *progress very encouraging*
- Basic data merge with MBS successfully demonstrated during AIDA+LYCCA test May 2011
  - *further work required*
- Continuing FEE firmware development work in progress
  - *DSP (64 channel digital CFD being tested)*
- DAQ software development work in progress
  - interface migrated from Tcl/Tk to XML/SOAP (web-based)
  - control and management of multiple FEE modules
  - timestamp-ordered data merge (GREAT format)

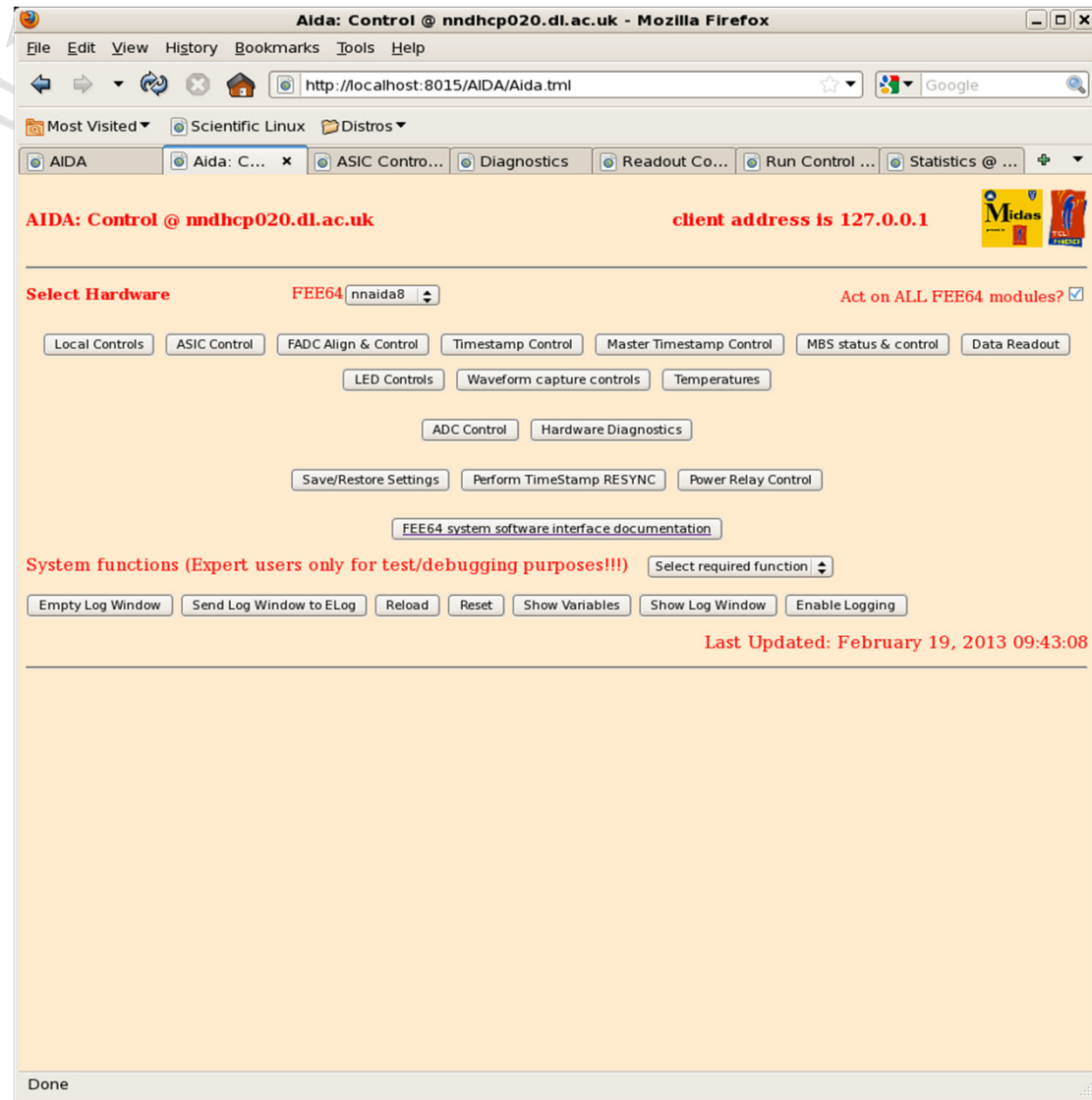
*Bottom line – AIDA is ready and needs to be scheduled on FRS*

# AIDA: homepage





# AIDA: DAQ main menu



# AIDA: experiment control

Run Control @ nndhcp020.dl.ac.uk - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://localhost:8015/DataAcquisitionControl/DataAcquisitionContro

Most Visited Scientific Linux Distro

AIDA Aida: Contr... ASIC Contro... Diagnostics Readout Co... Run Co... Statistics @ ...

Data Acquisition Run Control @ http nndhcp020.dl.ac.uk 8015 client address is 127.0.0.1

Acquisition Servers nnaida8 Act on ALL Data Acquisition Servers? ☒

**RESET** **STOP**

nnaida12	going	H	nnaida11	going	H	nnaida10	going	H	nnaida9	going	H
nnaida8	going	H	nnaida7	going	H	nnaida6	going	H	nnaida4	going	H

Histogramming   Data transfer

System functions (Only use if you know what they do!!!)

Last Updated: February 18, 2013 15:02:57

[Home](#) [Service Definition](#)

Done

*Note – illustrates configuration controlling 8x FEE64 cards*

# AIDA: DAQ statistics

Statistics @ nndhcp020.dl.ac.uk - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://localhost:8015/DataAcquisitionControl/DataAcquisitionStats.tr

Most Visited Scientific Linux Distro

AIDA Aida: Contr... ASIC Contro... Diagnostics Readout Co... Run Control ... Statistic...

**Data Acquisition Statistics @ http nndhcp020.dl.ac.uk 8015** client address is 127.0.0.1

Acquisition Servers **nnaida4** Current Acquisition Server **nnaida4** Show ALL Data Acquisition Servers? ☐

### Counters

Poll	1055208436	Empty events	0	Histogram increments	61243633	Transmit buffers	0
Transmit data	0	Null events	0	FIFO empty	0	No Data	0
FIFO part full	0	Bad Data	0	Event not accepted	0	TX2 buffers	0
Good Events	88230460	Transfer Error	0	Transfer Wait	0	Disc data blocks	0
TX2 data	0	TX2 errors	0	TX2 wait	0	AIDA data	162817984
ASIC data blocks	0	AIDA ASIC events	0	AIDA errors	0	AIDA Time Warp	0
SYNC Time Warp	150	ASIC data	0	DISC data	0	AIDA bad data #4	0
AIDA bad data #1	0	AIDA bad ASIC	0	AIDA bad range	0	AIDA PAUSE	4544
AIDA bad data #5	0	Discriminator data	78926068	AIDA SYNC	111168700	MBS Scaler H	0
AIDA RESUME	4544	MBS Scaler L	0	MBS Scaler M	0	WAVE DMA Blocks	2022
ASIC Events	88230460	WAVE Events	403810	ASIC DMA Blocks	1347	WAVE item skipped	805936
WAVE event empty	3160	WAVE not accepted	3160	WAVE good events	29137634	WAVE SYNC	28733821
WAVE buffer too short	1578	WAVE format error #1	0	WAVE format error #2	4		
WAVE PAUSE	3	WAVE RESUME	0				

### Rates

Poll	12858	Empty events	0	Histogram increments	12706	Transmit buffers	0
Transmit data	0	Null events	0	FIFO empty	0	No Data	0
FIFO part full	0	Bad Data	0	Event not accepted	0	TX2 buffers	0
Good Events	12858	Transfer Error	0	Transfer Wait	0	Disc data blocks	0
TX2 data	0	TX2 errors	0	TX2 wait	0	AIDA data	35196
ASIC data blocks	0	AIDA ASIC events	0	AIDA errors	0	AIDA Time Warp	0
SYNC Time Warp	0	ASIC data	0	DISC data	0	AIDA bad data #4	0
AIDA bad data #1	0	AIDA bad ASIC	0	AIDA bad range	0	AIDA PAUSE	4
AIDA bad data #5	0	Discriminator data	15628	AIDA SYNC	600	MBS Scaler H	0
AIDA RESUME	4	MBS Scaler L	0	MBS Scaler M	0	WAVE DMA Blocks	0
ASIC Events	12858	WAVE Events	0	ASIC DMA Blocks	1	WAVE item skipped	0
WAVE event empty	0	WAVE not accepted	0	WAVE good events	0	WAVE SYNC	0
WAVE buffer too short	0	WAVE format error #1	0	WAVE format error #2	0		
WAVE PAUSE	0	WAVE RESUME	0				

Empty Log Window Send Log Window to ELog Reload Reset Show Variables Show Log Window Enable Logging

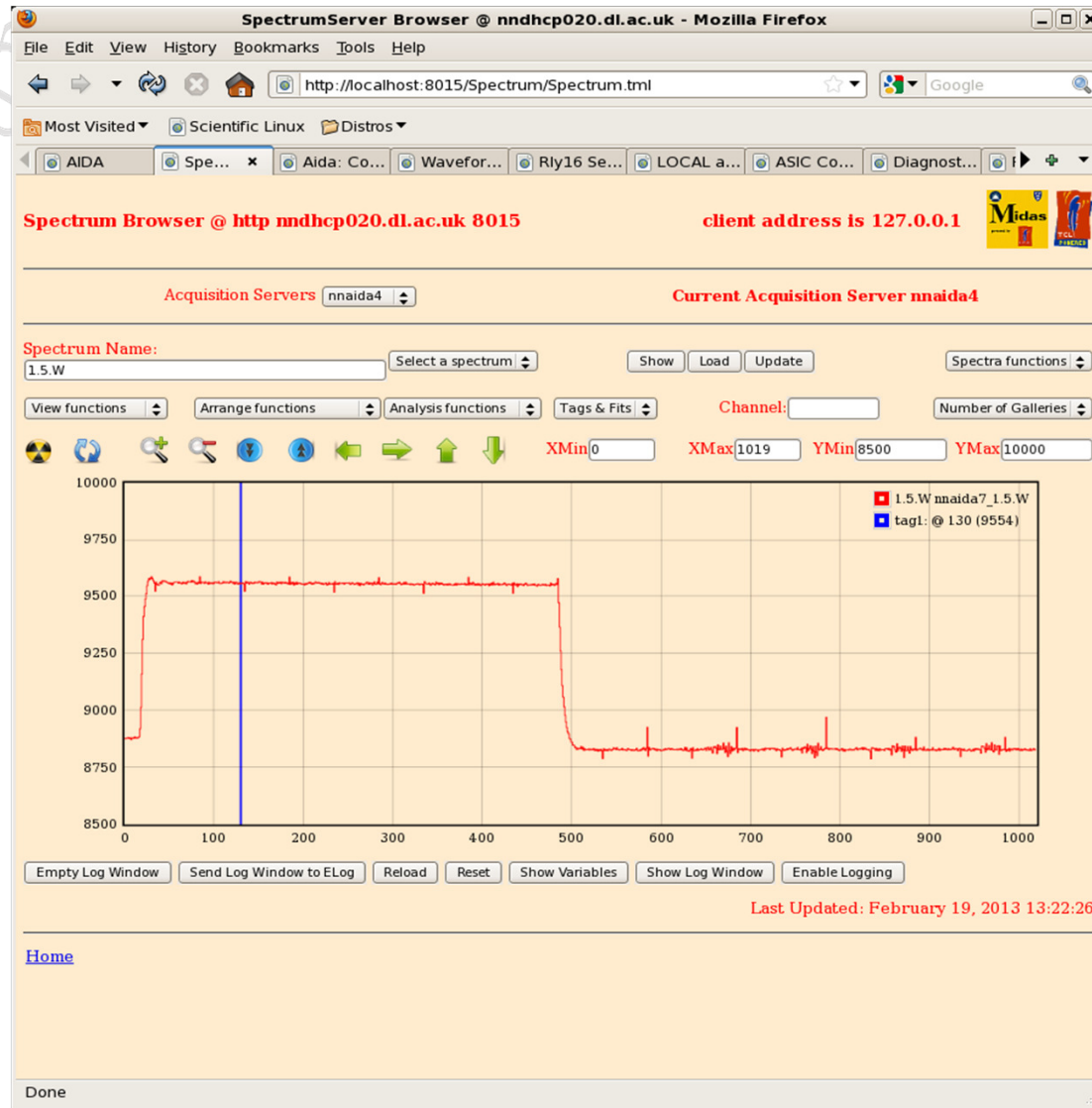
Zero Statistics Update Once AutoUpdate On

Last Updated: February 19, 2013 11:54:34

[Home](#)

Done

# AIDA: preamplifier waveform capture



## AIDA Plans

*S390 “In-beam test of the AIDA detector system for DESPEC”*

- 23 shifts parasitic
- investigate ASIC response to high energy, heavy-ion implants
- evaluate and optimise fast overload recovery performance
- optimise ASIC parameters for fast decay-decay correlations

*S416 Search for proton emitters in the trans-lead and sub-uranium region*

- 15 shifts primary, 9 shifts parasitic
- search proton emitters  $^{203}\text{Ac}$ ,  $^{197}\text{Fr}$  and  $^{189,190,191}\text{At}$
- study alpha decay of other nuclei
- need physics outputs

*PRESPEC umbrella proposal*

*“Test of different setups for the HISPEC/DESPEC collaboration”*

*FATIMA, TAS, BELEN, MONSTER, AGATA ...*



## AIDA: Support Assembly



*'All up' tests in T4 laboratory STFC Daresbury Laboratory  
Note Julabo Recirculating Chiller to side of assembly*



## AIDA: MACB



*Timestamping hardware with HDMI cabling to AIDA FEE modules*

## AIDA: FEE Power Supply



*Power Supply Unit (bottom) controlled by Relay unit (top).  
Note Raspberry Pi on top of Relay Unit which provides remote control via web*



# AIDA: Relay Control

Rly16 Service @ nnrpi1 - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://193.62.115.7:8015/AIDA/Rly16/

Most Visited Scientific Linux Distros

AIDA Aida: Co... Rly1... LOCAL a... ASIC Co... Diagnost... Readout ... Run Con...

**Rly16 Control @ http nnrpi1 8015** **client address is 193.62.115.20**

Port: /dev/ttyUSB0 Version: 0901 DC: 12.2V

Switch ON Switch OFF

Relay 1 Relay 2 Relay 3 Relay 4 Relay 5 Relay 6 Relay 7 Relay 8

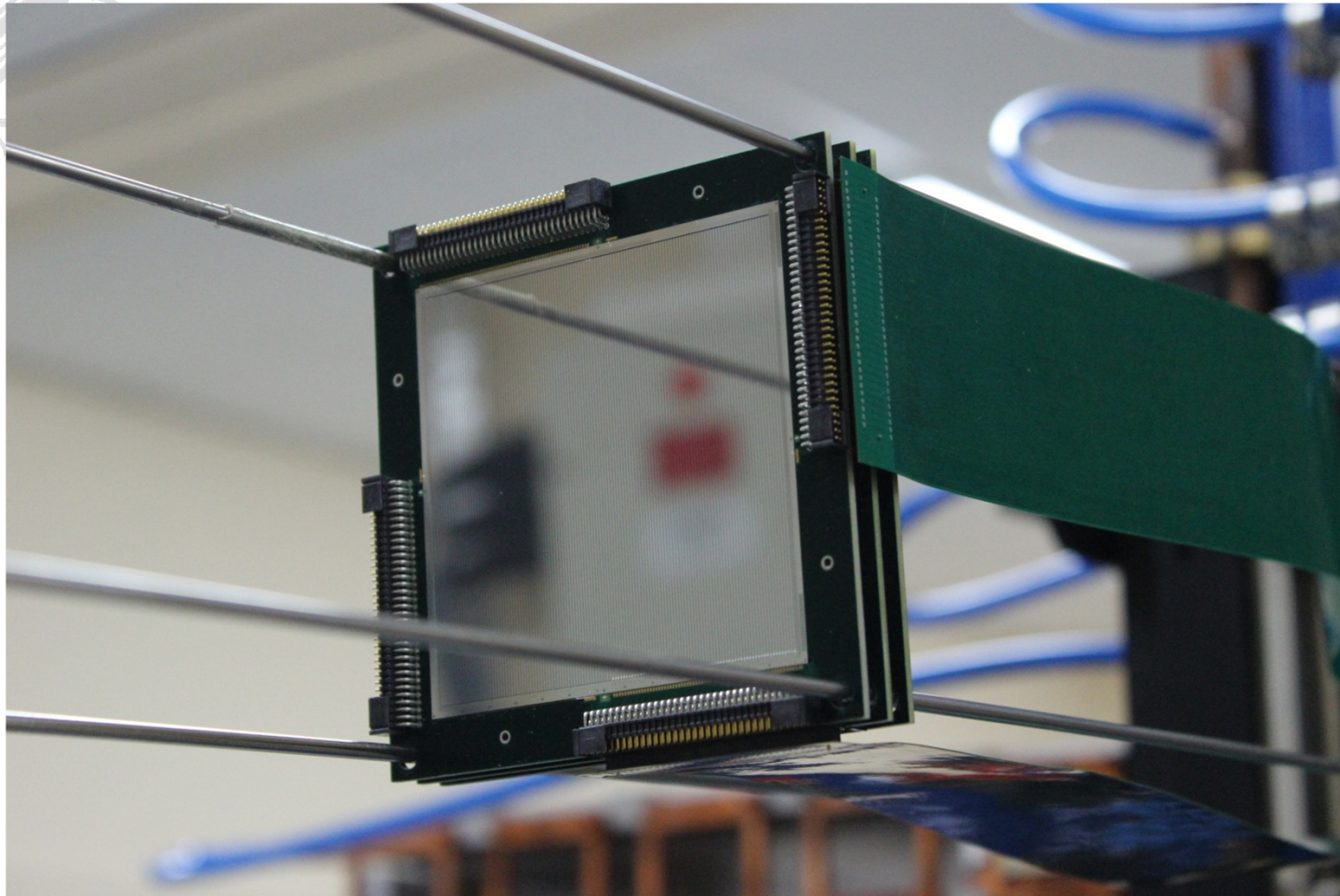
Switch ALL On Switch ALL Off

Empty Log Window Send Log Window to ELog Reload Reset Show Variables Show Log Window Enable Logging

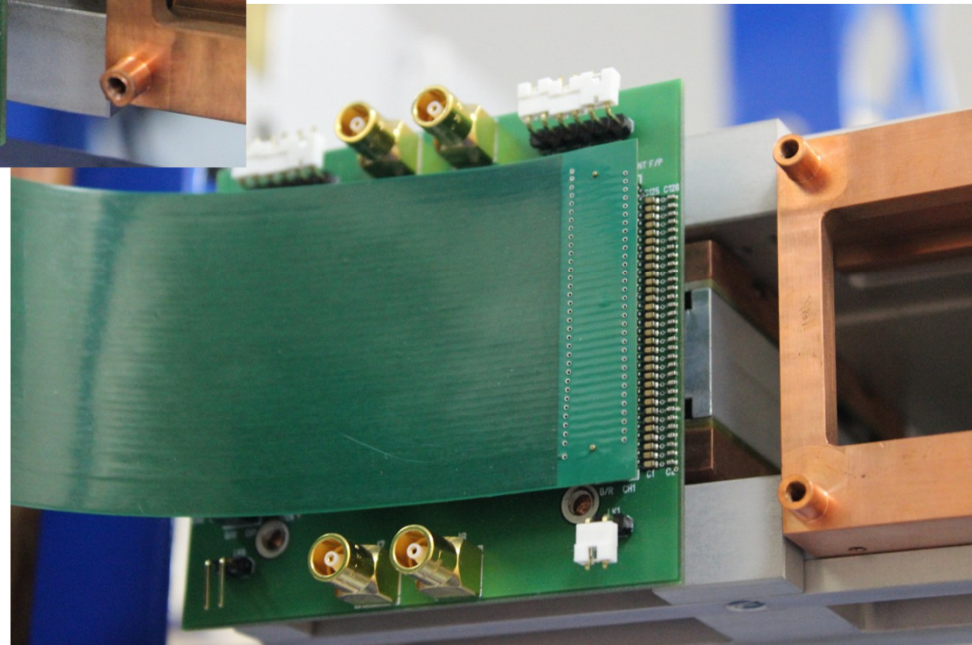
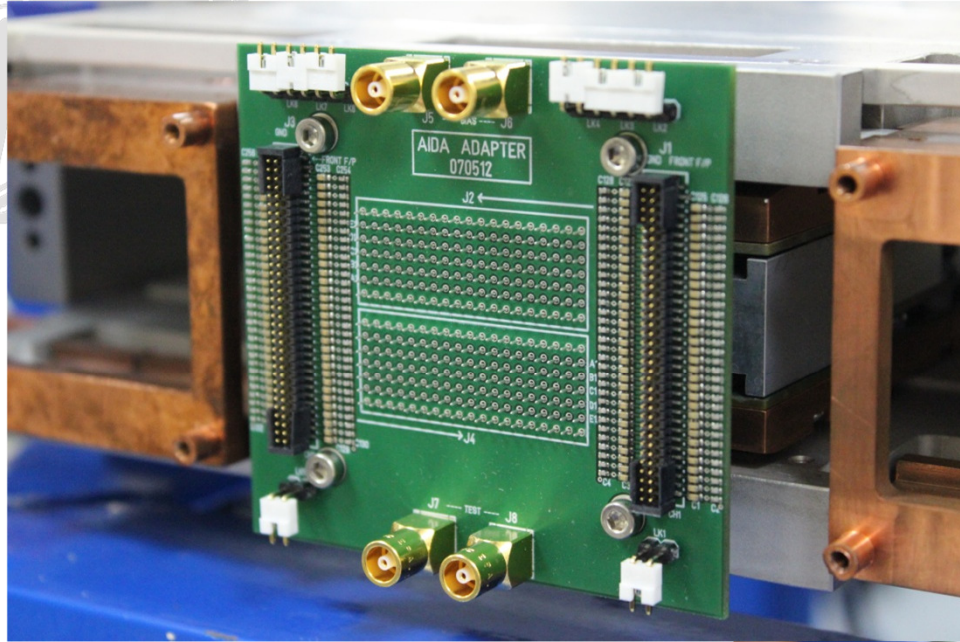
Last Updated: February 19, 2013 11:58:36

Done

## AIDA: MSL type BB18-1000 + Kapton cabling



## AIDA: Adaptor PCB with Kapton Cabling





# Acknowledgements

*My thanks to:*

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# AIDA: Project Partners

- The University of Edinburgh (lead RO)

*Phil Woods et al.*

- The University of Liverpool

*Rob Page et al.*

- STFC DL & RAL

*John Simpson et al.*

Project Manager: *Tom Davinson*

Further information: <http://www.ph.ed.ac.uk/~td/AIDA>

TDR - November 2008:

[http://www.ph.ed.ac.uk/~td/AIDA/Design/aida\\_tdr.pdf](http://www.ph.ed.ac.uk/~td/AIDA/Design/aida_tdr.pdf)