Summary of AIDA Tests 2022-3

Tom Davinson

School of Physics & Astronomy

Background

The 2022 campaign highlighted some AIDA issues – in particular

24cm x 8cm ‘triple’ AIDA DSSSD
strip lengths – p+n side 7.5cm, n+n side 22.5cm
n+n Ohmic strip noise higher than expected & unstable

Subsequent detailed, systematic tests at GSI (S4 & CRYRING), STFC DL, CERN (n_TOF/EAR2 & HIE-ISOLDE) of all AIDA system components and DESPEC ac mains power during 2022/3 identified issues with

- pulser
- sum & invert amplifier
- detector bias
- AC coupling

New AIDA adaptor PCB

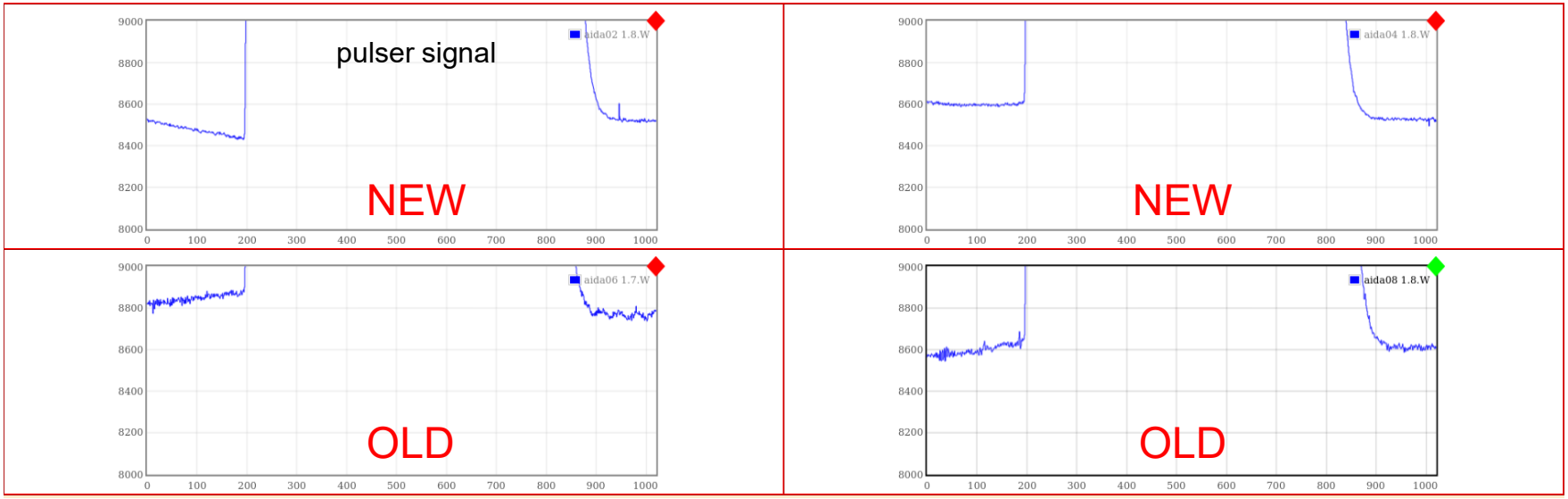
AIDA adaptor PCB

- connects AIDA front end electronics (FEE64) to DSSSD
- provides AC coupling for ASIC
- provides connections for test and detector bias

OLD rev A 120418 design improvements identified by tests

NEW rev B specification completed March 2023

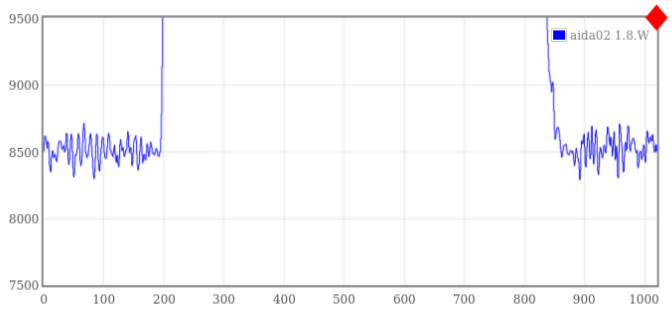
rev B 120623 PCBs available for tests July 2023

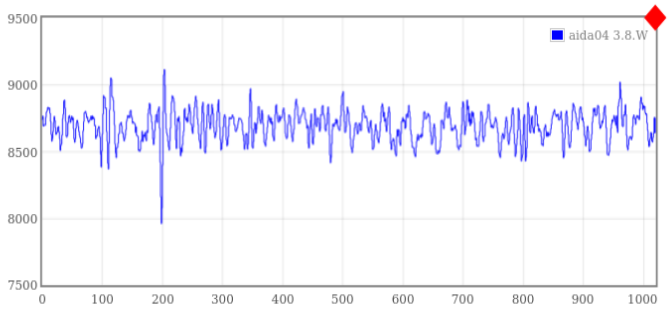


Per strip preamplifier outputs – no cabling or DSSSD – y-axis = 122mV, x-axis = 20μs

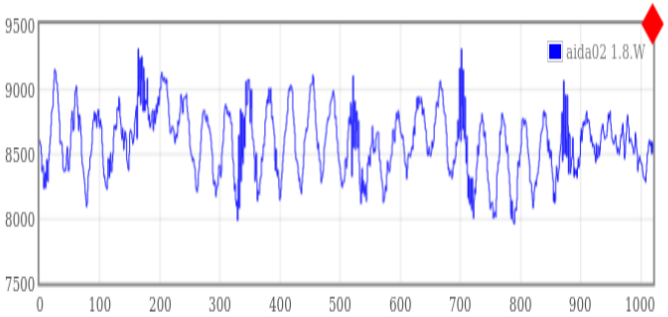
24cm x 8cm 'triple' DSSSD – n+n Ohmic strips

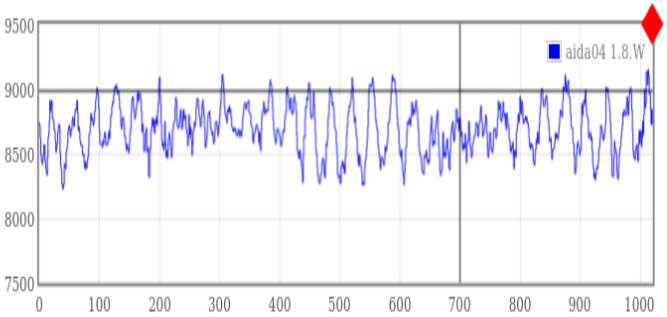
NEW
Oct 2023





OLD
May 2022

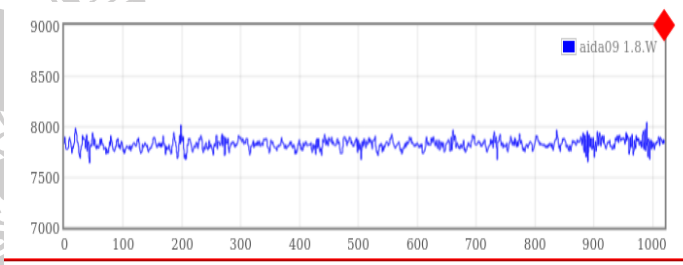


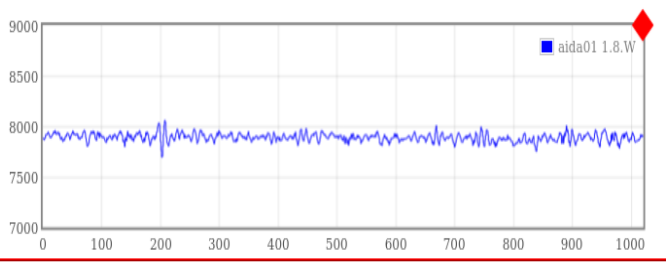


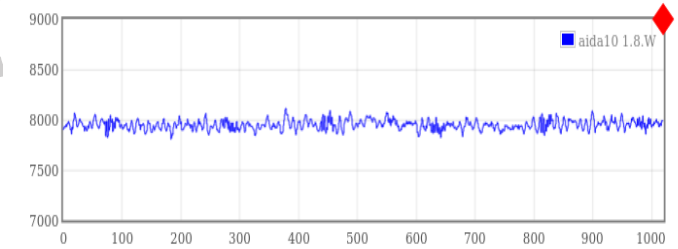
Per strip preamplifier outputs – y-axis range = 244mV, x-axis range = 20μs

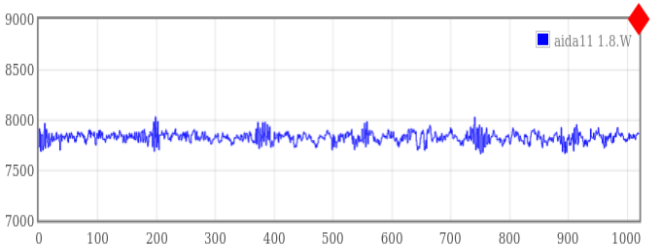
24cm x 8cm ‘triple’ DSSSD – p+n junction strips

NEW
Oct 2023

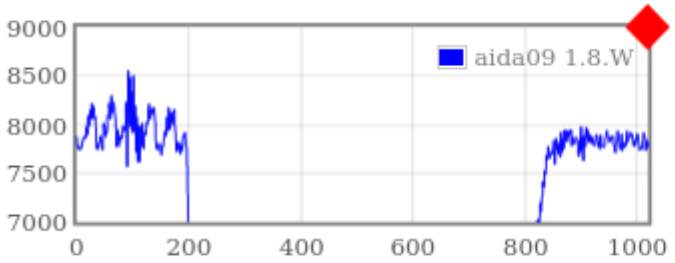


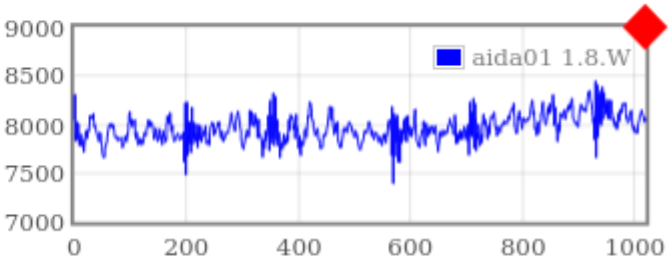


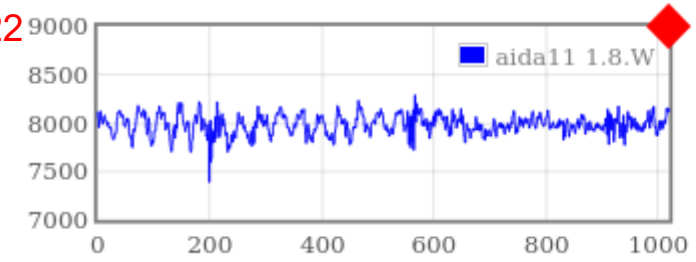


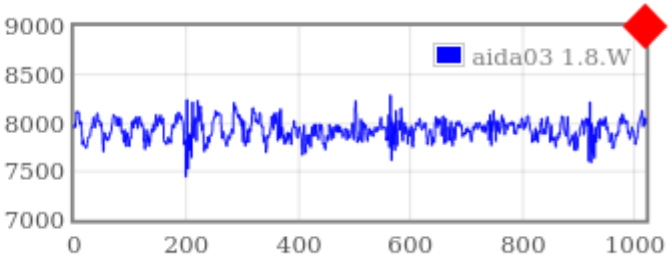


OLD
May 2022







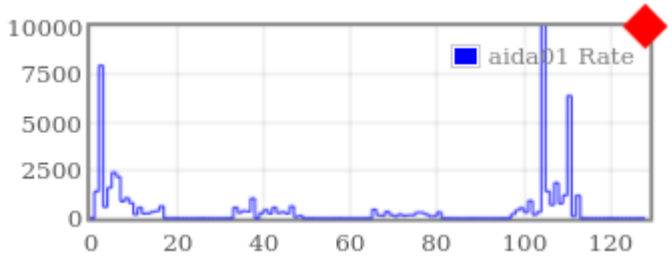


Per strip preamplifier outputs – y-axis range = 244mV, x-axis range = 20μs

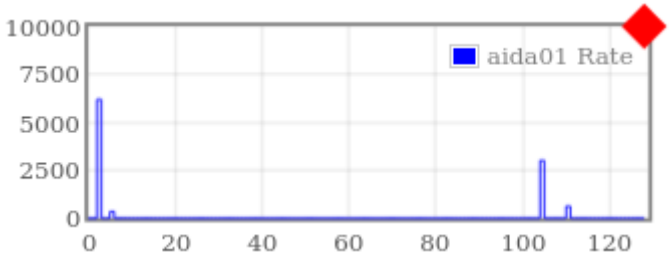
24cm x 8cm ‘triple’ DSSSD – p+n junction strips

Rate/ASIC channel (Hz)

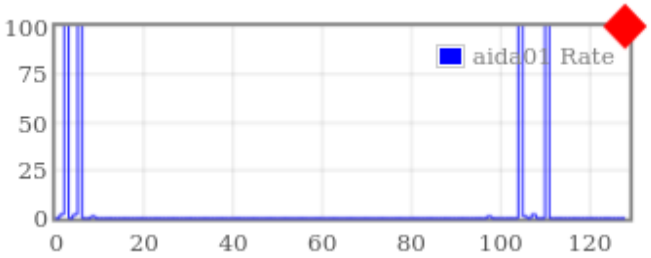
OLD
May 2022



NEW
Oct 2023



NEW
Oct 2023



x100 change in y-scale

FEE64 aida01 rate/channel (Hz) – 100keV threshold

Further tests with thresholds 50-90keV confirm 5σ threshold *c.* 90-100keV
Most channels (~ 60-62 of 64) < 1Hz
2-4 ‘hot’ channels per FEE64 at physical boundaries of FEE64
– ‘hot’ channels less hot

Summary

Typical electronic noise (keV FWHM) 24cm x 8cm ‘triple’ DSSSD

OLD May 2022

- p+n junction strip ~ 90
- n+n Ohmic strip ~ 300

NEW Oct 2023

- p+n junction strip ~ 45
- n+n Ohmic strip ~ 75

New values consistent with calculated noise for ‘triple’ DSSSD input load (capacitance and leakage current). Will continue to optimise.

Noise of ‘hot’ channels ~ 70-80 keV FWHM

Further information see

https:/elog.ph.ed.ac.uk/DESPEC/522
https://elog.ph.ed.ac.uk/AIDA/907

Thanks

Many thanks to

Edinburgh - Oscar Hall, Richard Taylor

GSI – Helena Albers, Jeroen Bormans, Carole Chatel, Nic Hubbard

Postscript – December 2023

- AIDA noise stable with respect to multiple mechanical assembly cycles
  improvements are robust

- AIDA noise stable with respect to installation and operation of bPlas
  AIDA and bPlas interoperable