Using the HADES readout system for the PANDA & WASA DIRCs

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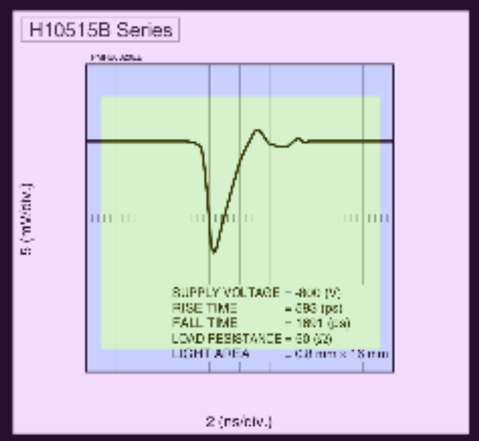
Photo sensor

Type No.	Anode Type		Dimensional Outline	Effective Area per Channel (mm)	Channel Pitch (mm)	Ⓐ Dynode Structure / No. of Stages	Weight (g)	Ⓑ Insulation Cover Material
H10515B SERIES	16-Channel Linear Array		See Fig.7	0.8 × 16	1	MC/10	49.0	P.O.M.

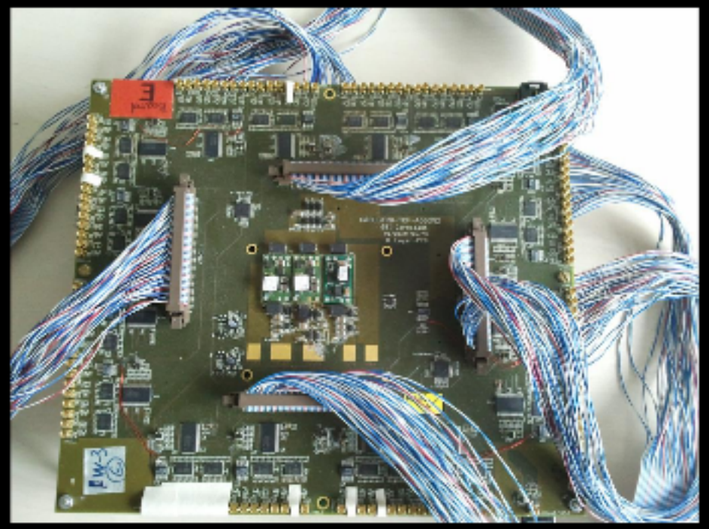
Type No.	Spectral Response		Ⓖ	Ⓗ	Cathode Characteristics					Supply Voltage
					Luminous		Blue Sensitivity Index (CS 5-58) Typ.	Red /White Ratio (R-68) Typ.	Ⓘ Radiant	
	Range (nm)	Peak Wavelength (nm)	Photocathode Material	Window Material	Min. (μA/lm)	Typ. (μA/lm)			Typ. (mA/W)	(V dc)
H10515B-100	300 to 650	400	SBA	B	90	105	13.5	—	110	-800

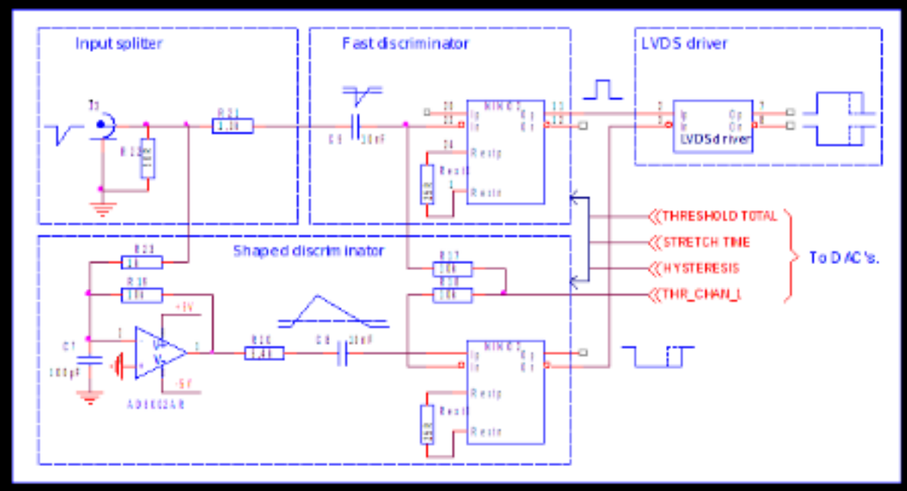
Anode Characteristics Ⓙ							Pulse Linearity per Channel (±2 % deviation) (mA)	Cross-talk Typ. (%)	Uniformity Between Each Anode		Type No.
Luminous		Gain	Dark Current per Channel (After 30 min.)		Time Response						
Min. (A/lm)	Typ. (A/lm)	Typ.	Typ. (nA)	Max. (nA)	Rise Time Typ. (ns)	Transit Time Spread (FWHM) Typ. (ns)			Typ.	Max.	
90	315	3×10^6	0.2	2	0.6	0.18	0.8	3	1: 1.5	1: 2	H10515B-100



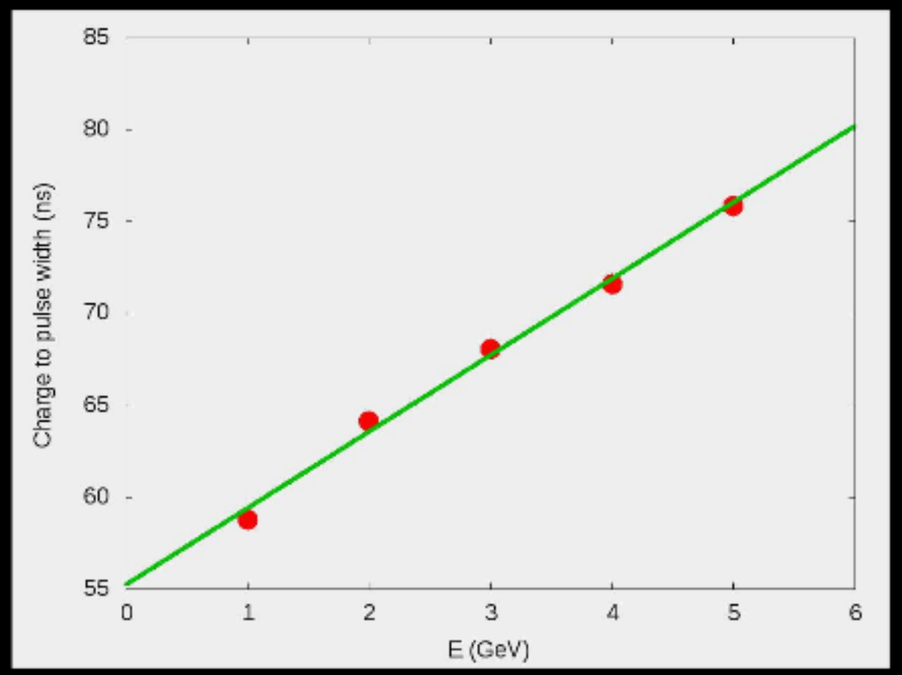
http://sales.hamamatsu.com/assets/pdf/catsandguides/UBA_SBA_TPMH1305E06.pdf

Frontend electronics/HADES TOF addon

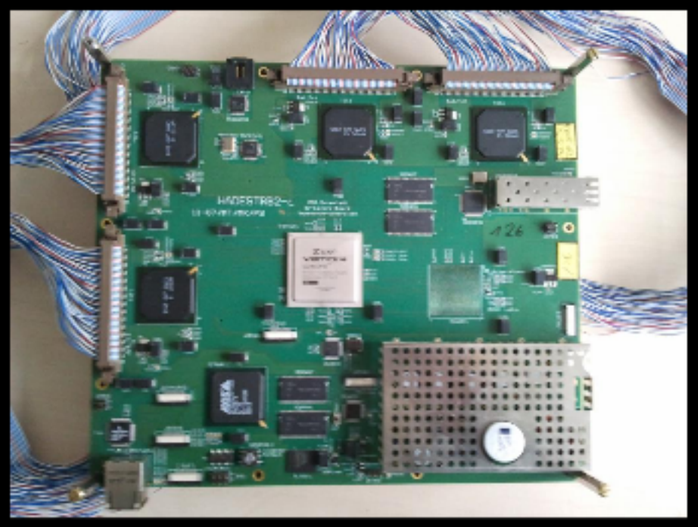




- 32 NINO ASICs -> 128 channels:
  reamp
- Discriminator with individual threshold level
- Charge to pulse width measurement
- LVDS output signals



Digital electronics/HADES Trigger Readout Board (TRB2)

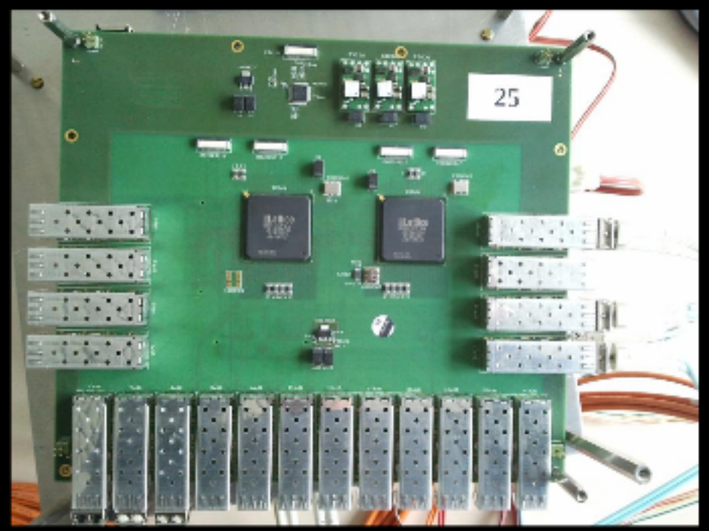


- 124(128) channels
- LVDS input (e.g. from TOF addon)
- HPTDC, 100ps bin size
- Optical link for data stream
- Ethernet for control
- Up to 10MHz signal hit rate

Trigger logic/HADES Central Trigger System (CTS)

- Many inputs for HADES trigger logic
- Individual delays for trigger inputs
- CTS Monitor for control and observation

Data concentrator/HADES HUB2



- Collects data from TRB boards
- Twelve fiber inputs
- One fiber output
- Ethernet control

Gigabit switch/Commercial device

- Interface between TRB system and PC
- Gigabit uplink for data stream
- Ethernet ports for TRB control

daqel

- Connected via Gigabit ethernet to switch
- TRB system control
- Event Builder: daq_netmem receives subevents from HUBs,
  daq_evtbuild builds complete event
- CTS monitor: Central Trigger System

New Trigger Readout Board/TRB3

- 256 channels
- TDC in FPGA
- Signal hit rate: >10MHz
- Time resolution: 14ps RMS (measured with test PCB between two channels)
- Can be used as HUB with 20 channels
- Replacement for TOF addon with better charge measurement in development

TRB system for WASA@COSY

- 4000 channels
- Synchronization: connect HADES readout directly to WASA main sync system with adapter board
- Data transfer: TRB PC converts data stream into WASA compatible data and sends to WASA's event builder

Cost estimates for TRB system

TRB2:	1400 Euro
TOF addon:	1900 Euro
HUB2:	900 Euro
CTS:	1000 Euro
TRB control for HUB2 and CTS:	400 Euro
TRB3 (256 channels):	1800 Euro
Addon for charge measurement:	1000...4000 Euro