

Forward Endcap Production Status

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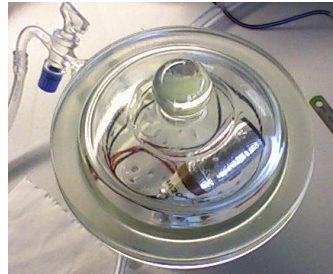


Outline

- 1 Glueing of Photosensors
- 2 VPTTs
- 3 APDs
- 4 LV Power Supply
- 5 Temperature Sensors
- 6 Mechanics

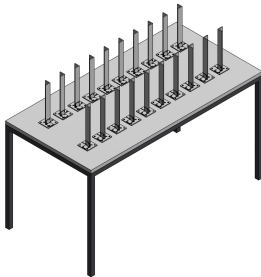
Glueing of Photosensors to Crystals

- All photodetectors will be irreversibly glued to the crystals with Dow Corning 3145
- Optimal parameters for glueing (pressure, duration, needed amount of glue, evacuation of glue, ...) have been evaluated
- Dispenser system is available in Bochum
- First VPTT test glueings are currently made using a prototype glueing tool

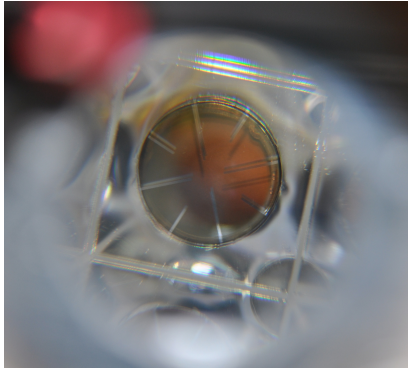


Glueing Tool

- VPTT is centered on crystal by tightly fitting aluminium 'insert'
- Crystal is held in position by o-ring
- Glueing can be checked with camera
- White LED illuminates crystal and glueing for camera check



Glueing Tests

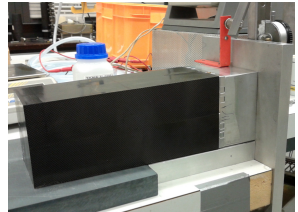
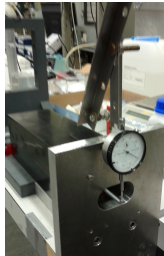
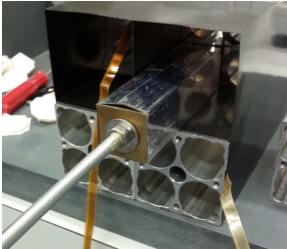


Hamamatsu VPTT glued to crystal with Elastasil (reversible)

Mechanical Safety of Glueing inside Subunit

- Once APD/VPTT is glued to crystal, both form one mechanical unit
 - When a subunit is mounted to the backplate, the deflection due to gravitational forces might lead to a slight descent or tilt of the crystal-detector-unit
- Investigated, whether play in insert is sufficient to accept this movement:
- Mounted brass dummy with threaded pin into alveole equipped with crystals
 - Mounted subunit to 'Mini'-Backplate
 - Measured tilt of brass dummy for different positions in alveole

Mechanical Safety of Glueing inside Subunit



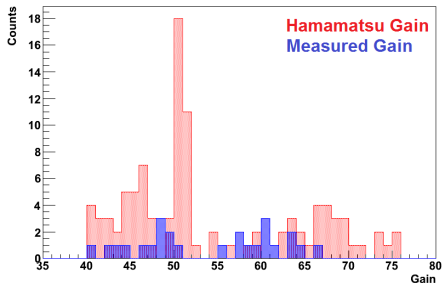
→ Play in inserts is large enough for all measured positions

First 100 VPTTs delivered!

- Hamamatsu delivered the first 100 final VPTTs
- 50 pcs. are now in Bochum, 50 in Bonn
- Gain is being measured at the moment (Quality Check)
- Mean gain (Hamamatsu) of all 100 tubes: ≈ 54



Gain of first final VPTTs



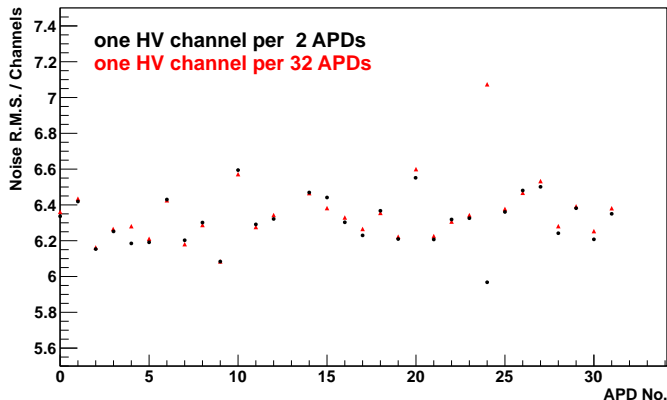
Serial Number	Hamamatsu Gain	Measured Gain	Difference [%]
UA0021	66.10	60.91	7.86
UA0024	63.74	60.04	5.81
UA0025	62.75	57.56	8.27
UA0027	64.93	59.53	8.32
UA0029	63.00	58.49	7.16
UA0038	51.89	50.74	2.22
UA0053	47.05	46.54	1.08
UA0066	59.77	57.61	3.61
UA0067	51.23	47.49	7.30
UA0074	45.25	43.40	4.10
UA0104	64.89	63.12	2.43
UA0113	69.57	66.47	4.45
UA0117	67.66	64.54	4.61
UA0124	49.85	48.11	3.49
UA0134	62.50	60.04	3.93
UA0136	42.84	42.51	0.76
UA0138	49.94	49.52	0.85
UA0147	46.97	44.16	5.98
UA0156	51.00	48.54	4.82
UA0157	42.43	40.59	4.34
UA0162	58.37	55.42	5.06
UA0171	51.79	48.83	5.72
UA0306	51.65	49.74	3.70
UA0315	66.92	61.84	7.60
UA0341	66.22	63.03	4.81

Red: 100 tubes (measured by Hamamatsu)
Blue: 25 tubes (measured in Bochum)

APD Matching

- Proto192:
 - Two APDs on one crystal are supplied by one HV channel
 - APDs were matched for the voltage at gain $M=100$, -25°C
- FW endcap:
 - Supply more than two APDs with one HV
 - ⇒ This can save a lot of money
 - But: different HV supplies for the APDs on one crystal foreseen
- Question: How many APDs can be supplied together, without affecting the noise significantly?

Test: 32 APDs - one HV Channel



Difference of noise rms is in the order of ≈ 0.1 channel

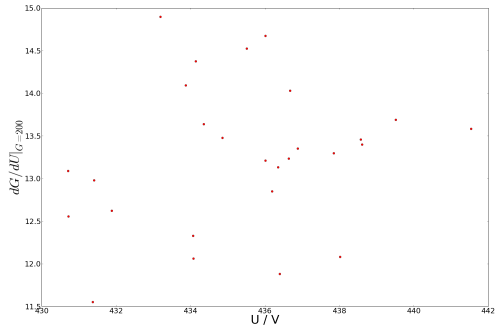
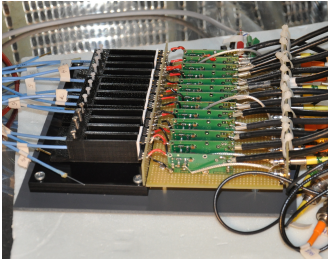
⇒ No problem to supply 32 APDs with one HV channel

Remaining problem: Match APDs according to their gain(voltage)

Screening of APDs

- Plan to test final glued crystal-APD-preamp units in test beam
- Setup in Bochum to measure parameters of APDs to perform matching
- DC and pulsed gain curves are taken automatically for 12 APDs in parallel
- Setup in climate chamber, measurements at $+25^{\circ}\text{C}$ (for normalization to gain $M = 1$) and -25°C
- APDs shall be operated at $M = 200$ in the FW endcap
- comparison of bias voltage and slope for $M = 200$ @ -25°C shows how many APDs can be matched to be supplied by a single HV channel

Screening of APDs



Low Voltage Power Supply

- Basel preamplifiers require +6 V, -6 V and GND
- Power consumption: ≈ 180 mW per preamp (maximum rate)
- Total current for all 6944 preamps:
167 A at +6 V, 42 A at -6 V
- Investigated options:
 - Wiener MPOD Crate with MPOD LV-Module
 - Wiener PL512



Low Voltage Power Supply

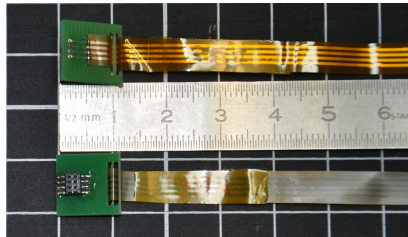
MPOD LV-Module	PL512
8 channels/module	12 channels
0 – 8 V, 50 W per channel	2-8 V, 210 W per channel (5-15 V modules available)
Rack space: 8U	Rack space: 3U
Full FW endcap:	
- 1 MPOD crate $\approx 4.7 \text{ k€}$	- 1 PBX (controller/supply) $\approx 1.9 \text{ k€}$
- 6 MPOD LV modules (max. 10) $\approx 6 \times 2.2 \text{ k€} = 13.2 \text{ k€}$	- 6 MDH 2-8V modules $\approx 6 \times 0.6 \text{ k€} = 3.6 \text{ k€}$
	- Rack mounting bin $\approx 0.6 \text{ k€}$
$\Sigma = 17.9 \text{ k€}$	$\Sigma = 6.1 \text{ k€}$

Low Voltage Power Supply

- RMS of noise was measured with both supplies for VPTTs and APDs inside the Proto192:
- No measurable effect (compared to Basel-LV power supplies)
- Only 1 PL512 needed to supply all preamps for the whole FW endcap
- PL512 saves a lot of precious rack space compared to MPOD
- Same devices also suitable to supply...
 - ADCs
 - Light pulser systems
 - THMPs
- If we can agree to use one type of supply e.g. for the whole EMC, we will get a discount (info by Wiener)

Ultrathin Temperature Sensors - Mass Production

- Introduced small PCB at the end of each sensor as a connector
- Sensors are much easier and safer to connect now (consequence from experience with Proto192)
- 10-15 sensors are produced per week
- ≈ 500 sensors needed for full FW endcap



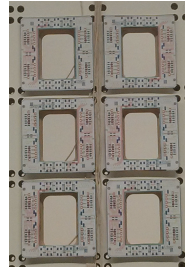
Ultrathin Temperature Sensors - Mass Production



≈200 sensors are already produced and waiting for calibration

Fibre and Cable Routing

- Plan for fibre routing exists (KVI)
 - Checked and verified lengths of fibre bundles at wooden 1:1 backplate mockup
 - Design of adapter PCB for subunit cabling (signals, LV, HV, sensors) in progress at U. Bonn
 - Design is not finalized, but size of PCBs shouldn't change any more
- Investigating options for routing of LV, HV, signals and thickness/shape of fibre bundles now



Backplate Production

- Backplate, stiffener ring and support structure have been ordered at KVI
- Production starts now
- Expecting assembled parts in 06/2014!

