



Elettra Sincrotrone Trieste

The **ESS** WS scintillator
PDR02

Sandi G.

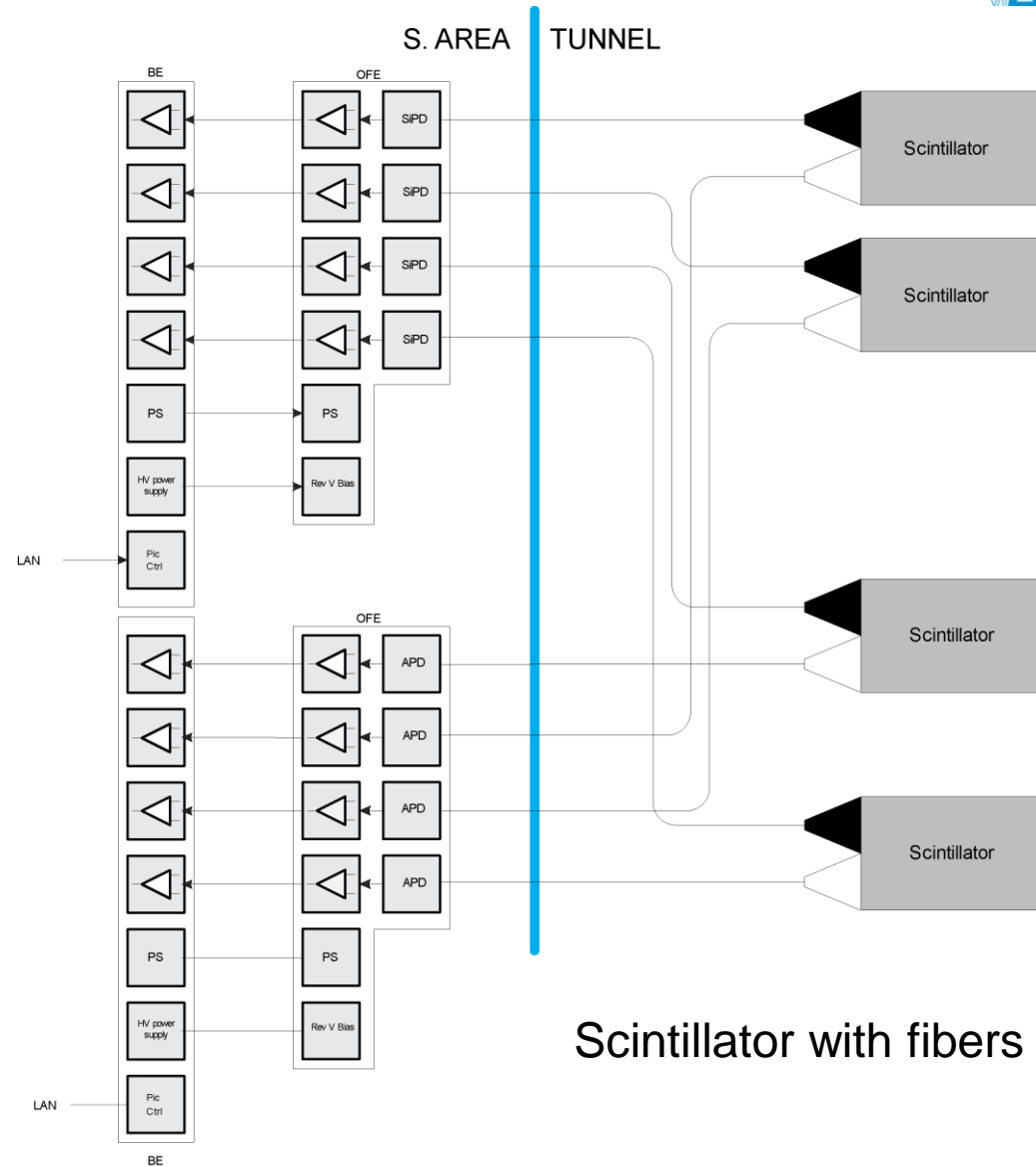
Master view of presentation:

- WS Scintillator schematic and cabling
- OFE Component specifications and schematic design
- OFE prototype specification and electrical tests
- OFE Mechanical design
- Scintillator design



OFE block schematic

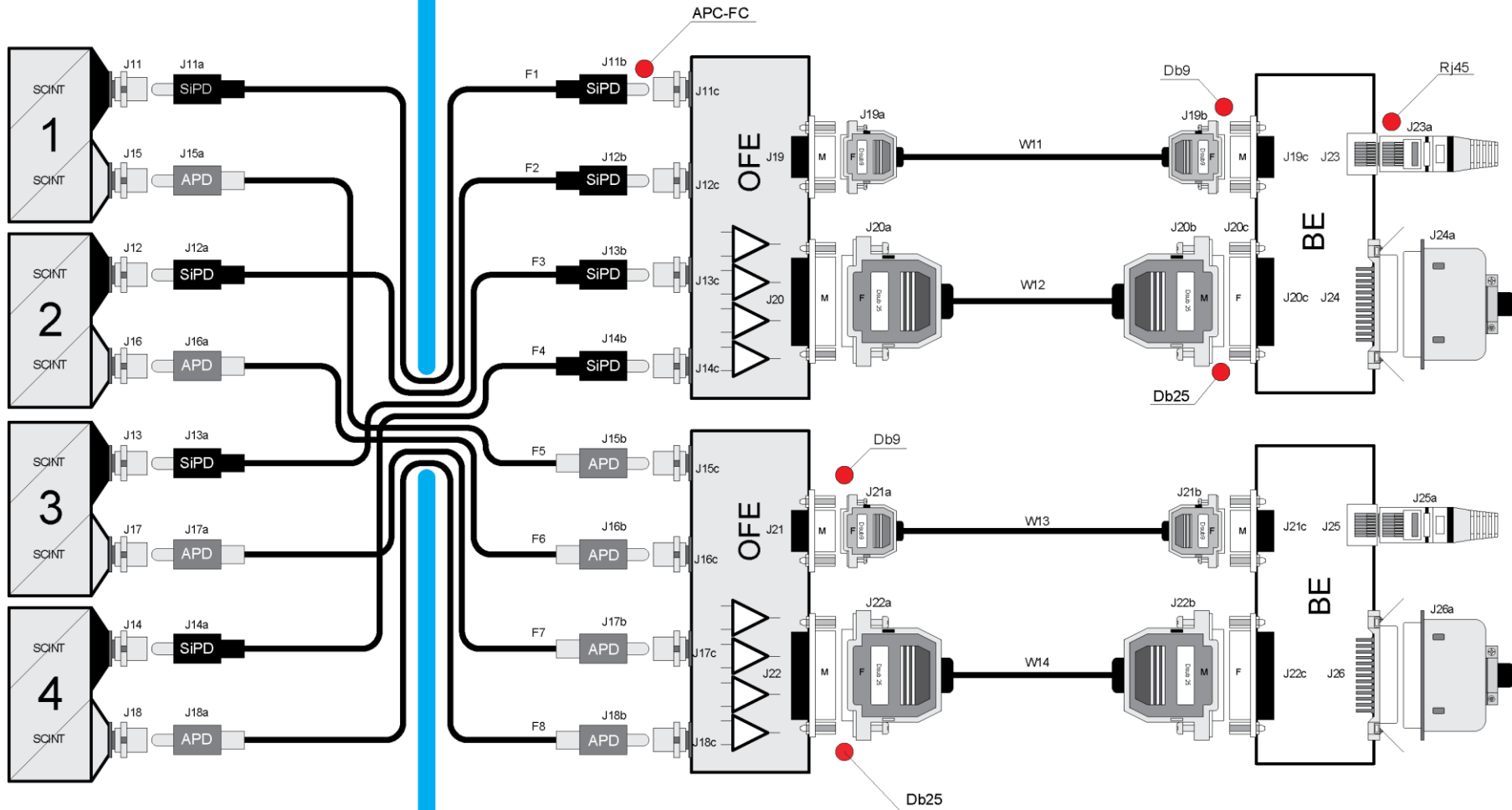
- Two separated units
- 4 optical inputs for SiPd
- 4 optical inputs for SiAPD
- Low voltage power supply
- Remotely controlled 200V Bias



Scintillator with fibers



General view of control



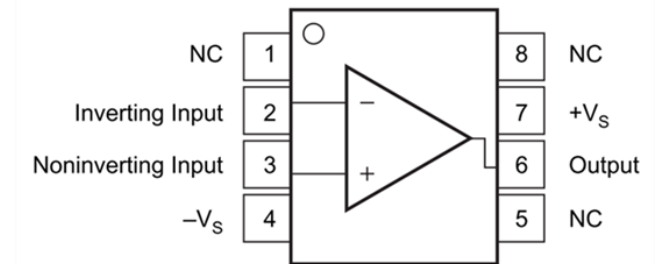
OPA657 1.6-GHz, Low-Noise, FET-Input Trans Impedance Amplifier

Features:

- High Gain Bandwidth Product: 1.6 GHz
- High Bandwidth 275 MHz
- Slew Rate 700 V/ μ s
- Operating Temperature Range: -40° C to 85° C
- Low-Input Offset Voltage: ± 250 μ V
- Low-Input Bias Current: 2 pA
- Low-Input Voltage Noise: 4.8 nV/ \sqrt Hz
- Low input noise current of 1.8 pA/ \sqrt Hz
- High-Output Current: 70 mA

Supply voltage:

± 5 V DC



SiPD - HAM S1226-44BQ Characteristics:

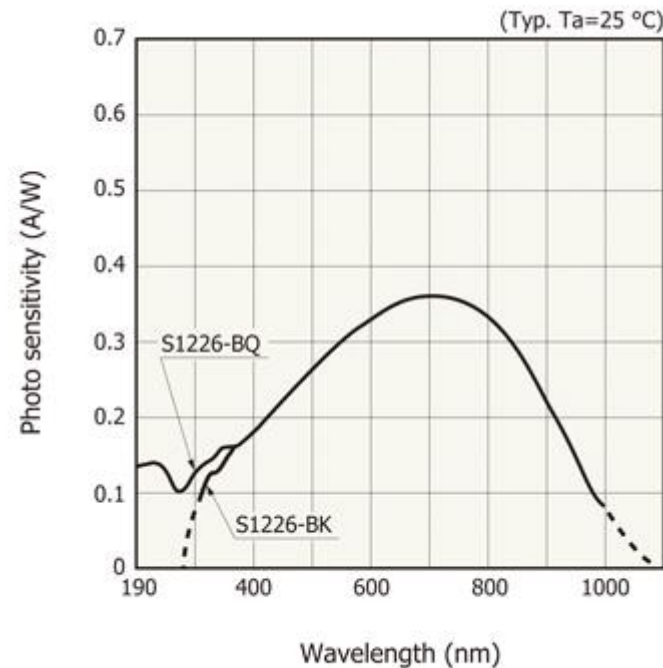
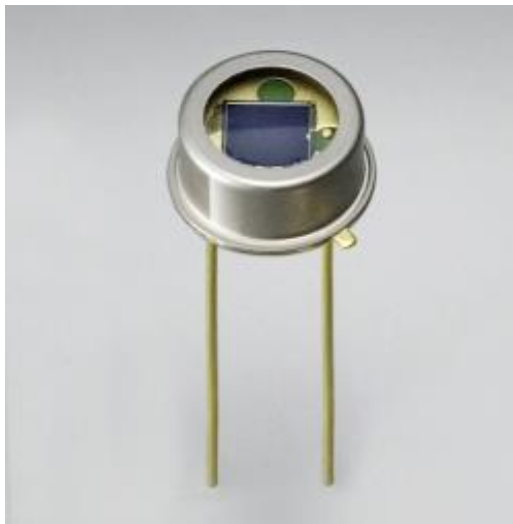
- Active Area of photo diode 3.6 x 3.6 mm
- Reverse bias voltage 5V
- Wave length 190 to 1000nm peak 720nm
- Photo sensitivity - 0.36A/W
- Dark current I_d 10pA
- Cd 500pF

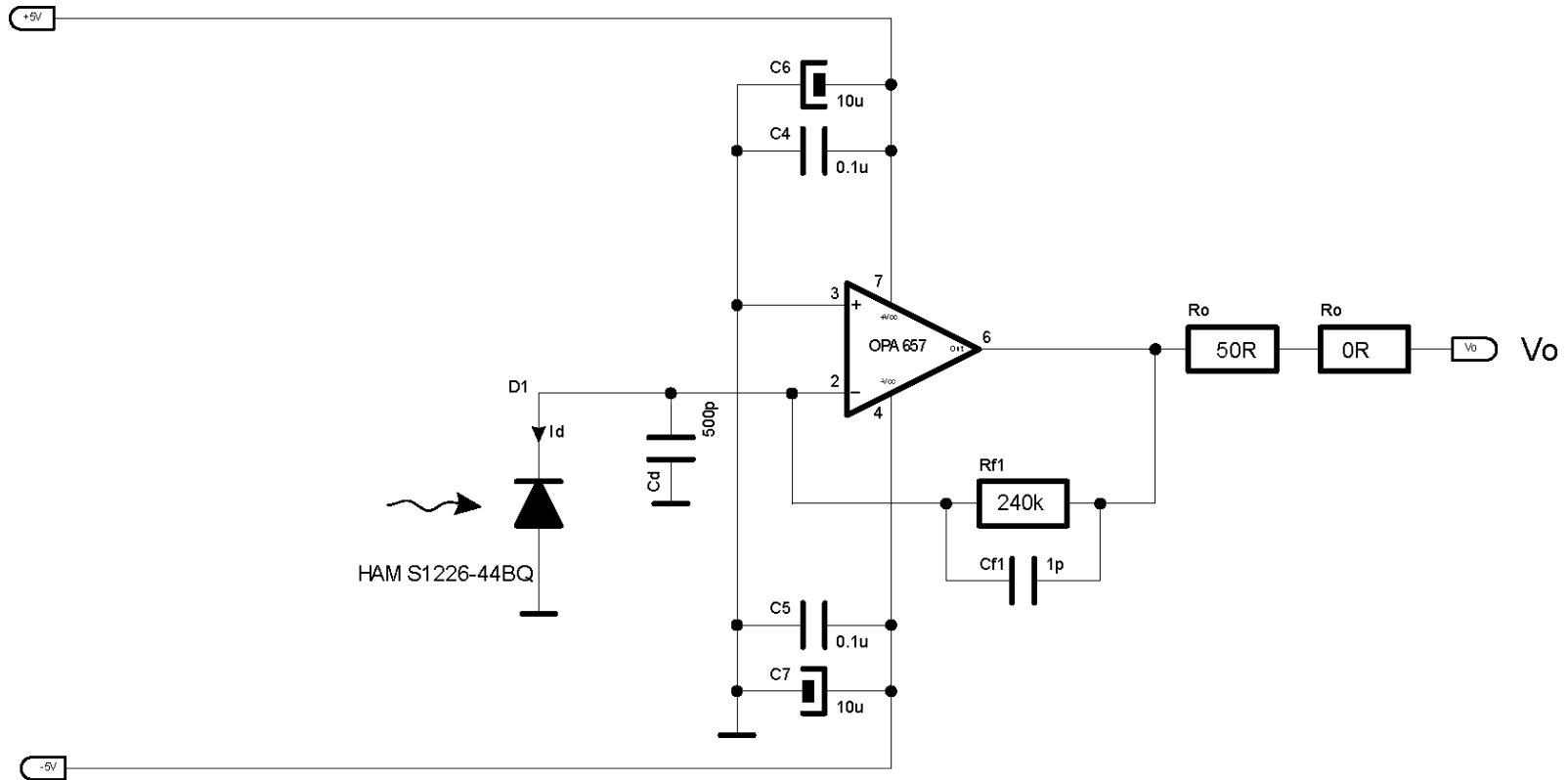
$$\text{Responsivity}_{PhD} = \frac{I_d}{W}$$

$$\text{Area} = a^2(\text{cm}^2)$$

$$O_p = \frac{W}{\text{Area}}$$

SiPD I_d 5uA = 107.25uW of optical power





Current to Voltage converter for Si photodiode

SiAPD - HAM S5344 Characteristics:

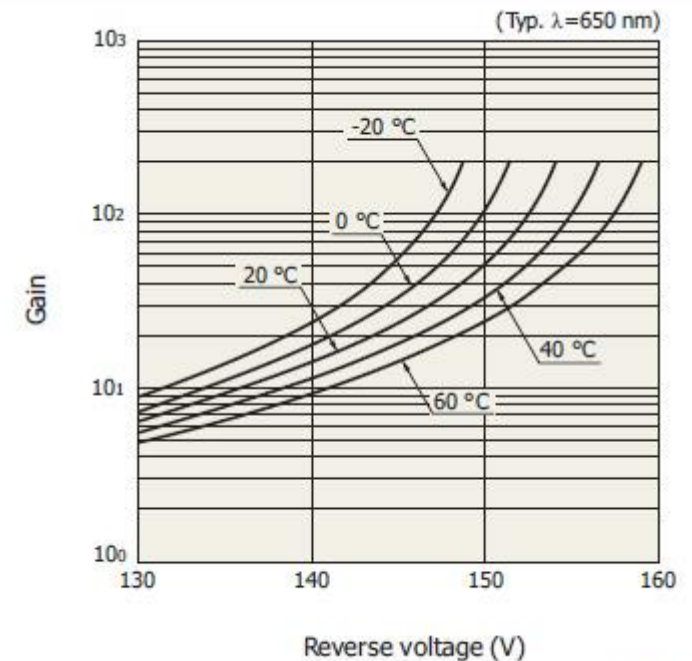
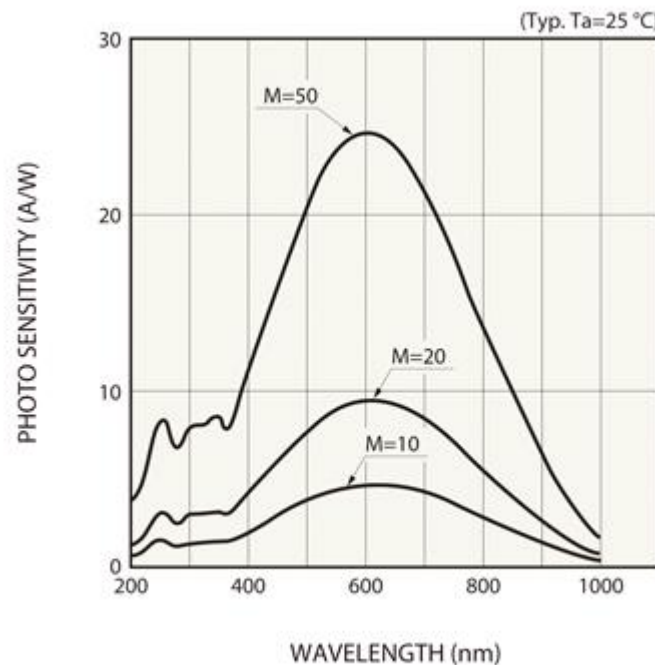
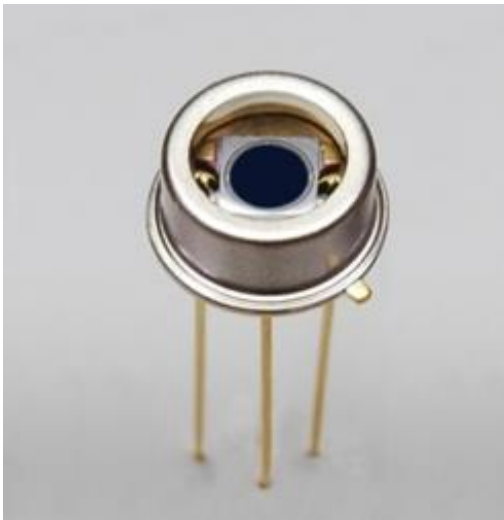
- Active Area of photo diode ϕ 3mm
- Breakdown voltage 150V I_d 100uA
- Wave length 200 to 1000nm peak 620nm
- Photo sensitivity - 0.42A/W
- Dark current I_d 1nA
- Cd 120pF

$$\text{Responsivity}_{PHD} = \frac{I_d}{W}$$

$$\text{Area} = \pi r^2 (cm^2)$$

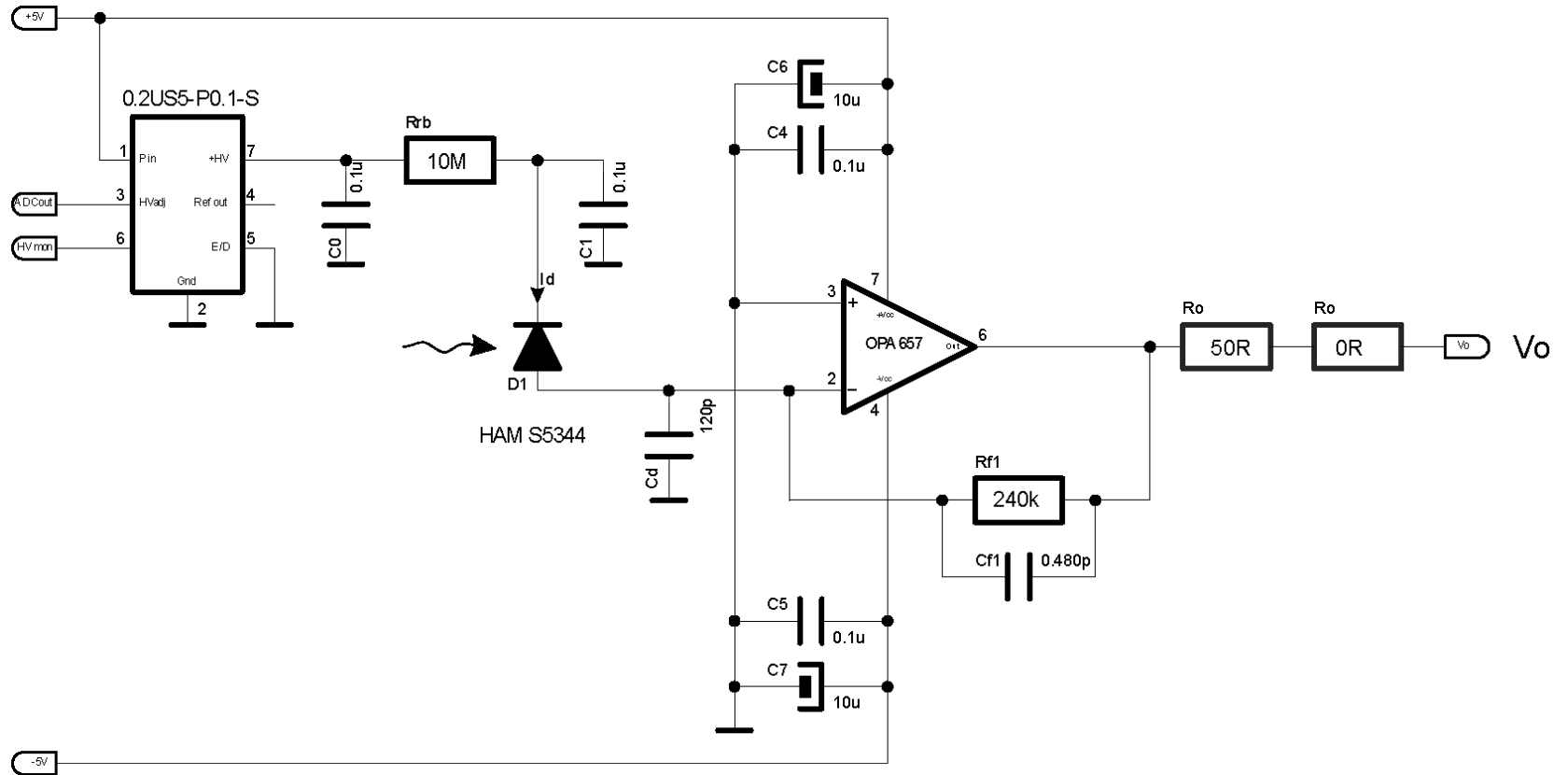
$$O_p = \frac{W}{\text{Area}}$$

SiAPD I_d 5uA = 168.36uW of optical power





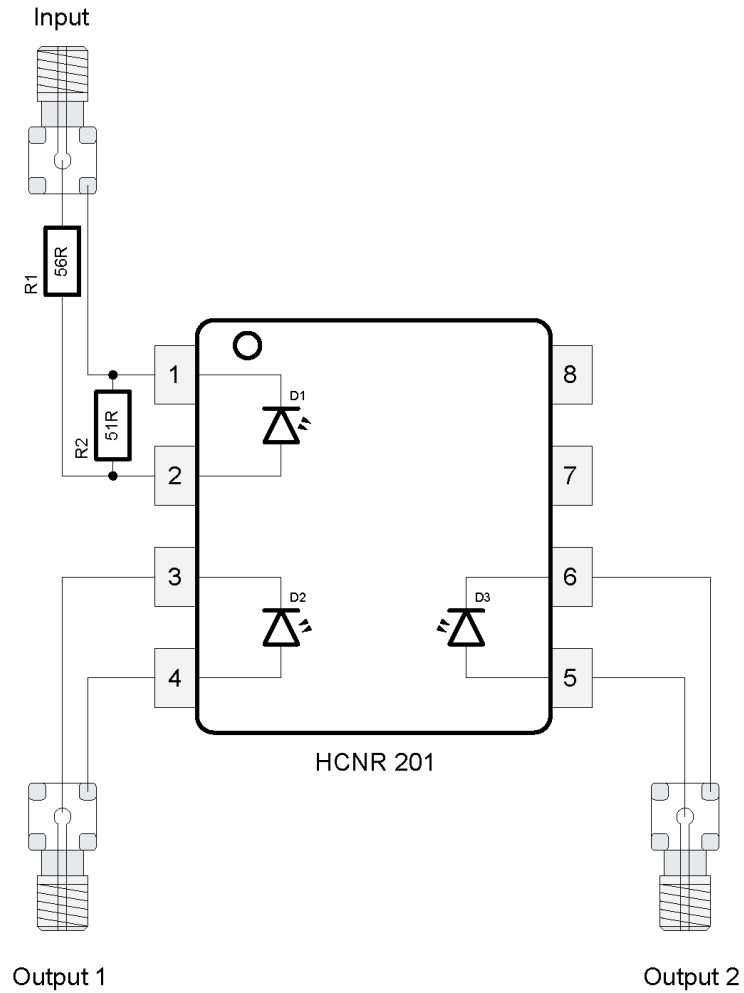
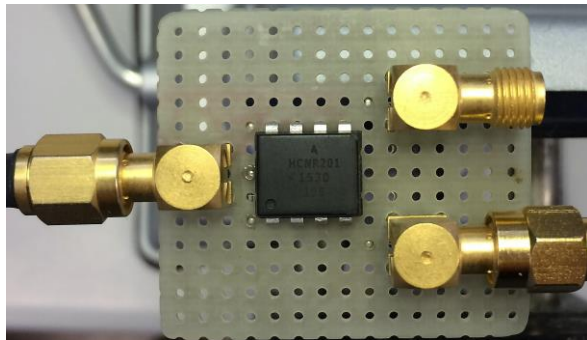
OFE electronic schematic for SiAPD



Current to Voltage converter for SiAPhotodiode



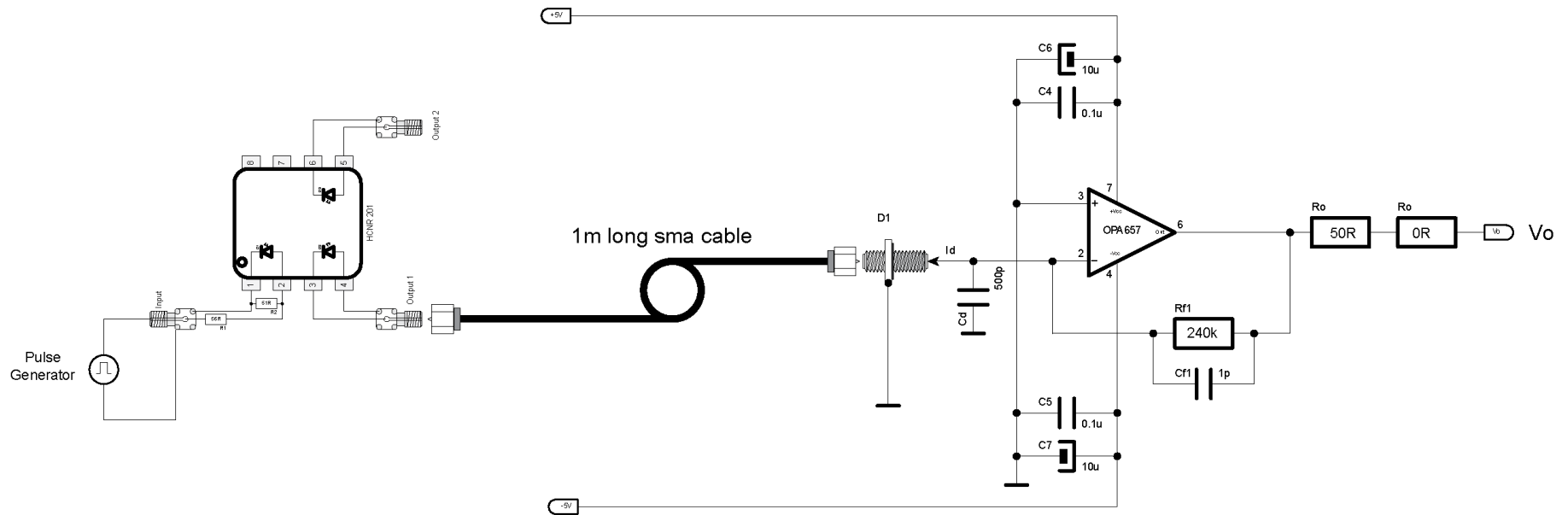
Photodiode current source for test



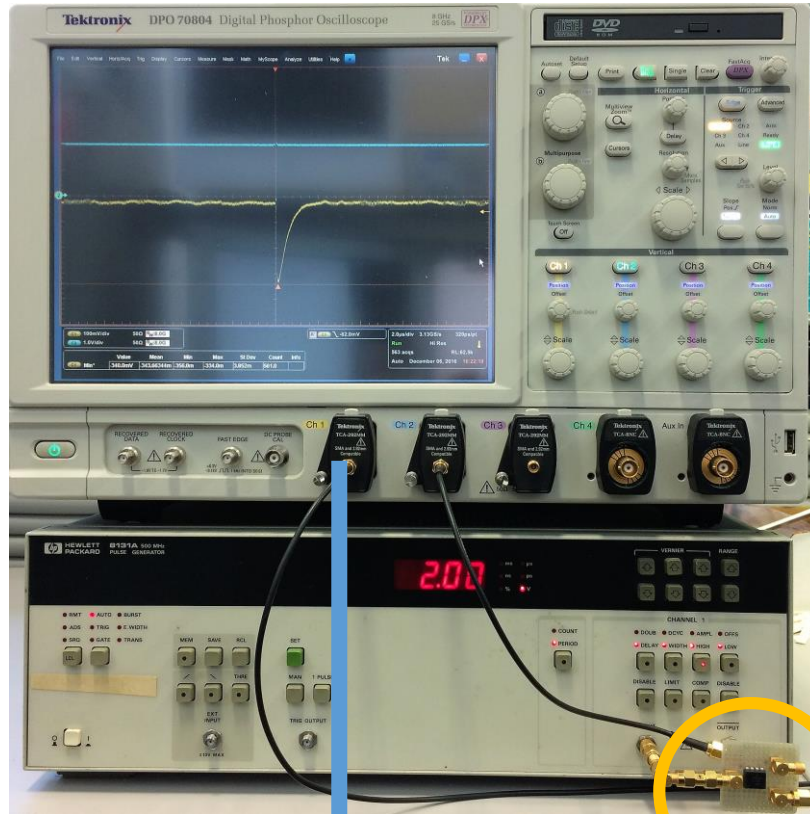


Measurement

Configuration 1 schematic



DPO70804

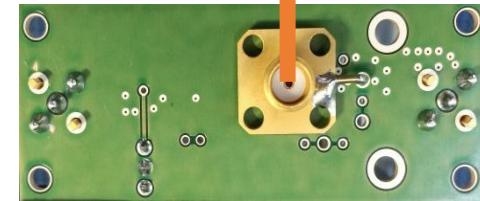


HP8131A

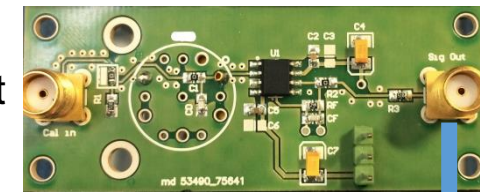
1m long sma cable

Photo diode input

Rear



Front



OFE prototype

Photo Current Generator



Results of configuration 1



Vin	Vout100	Vout50	Vout V
1	0.095	0.02	
1.5	0.393	0.144	
2	0.699	0.284	
2.5	1.011	0.429	
3	1.308	0.583	
3.5	1.608	0.733	
4	1.809	0.874	
4.5	1.822	1.021	
5	1.823	1.165	

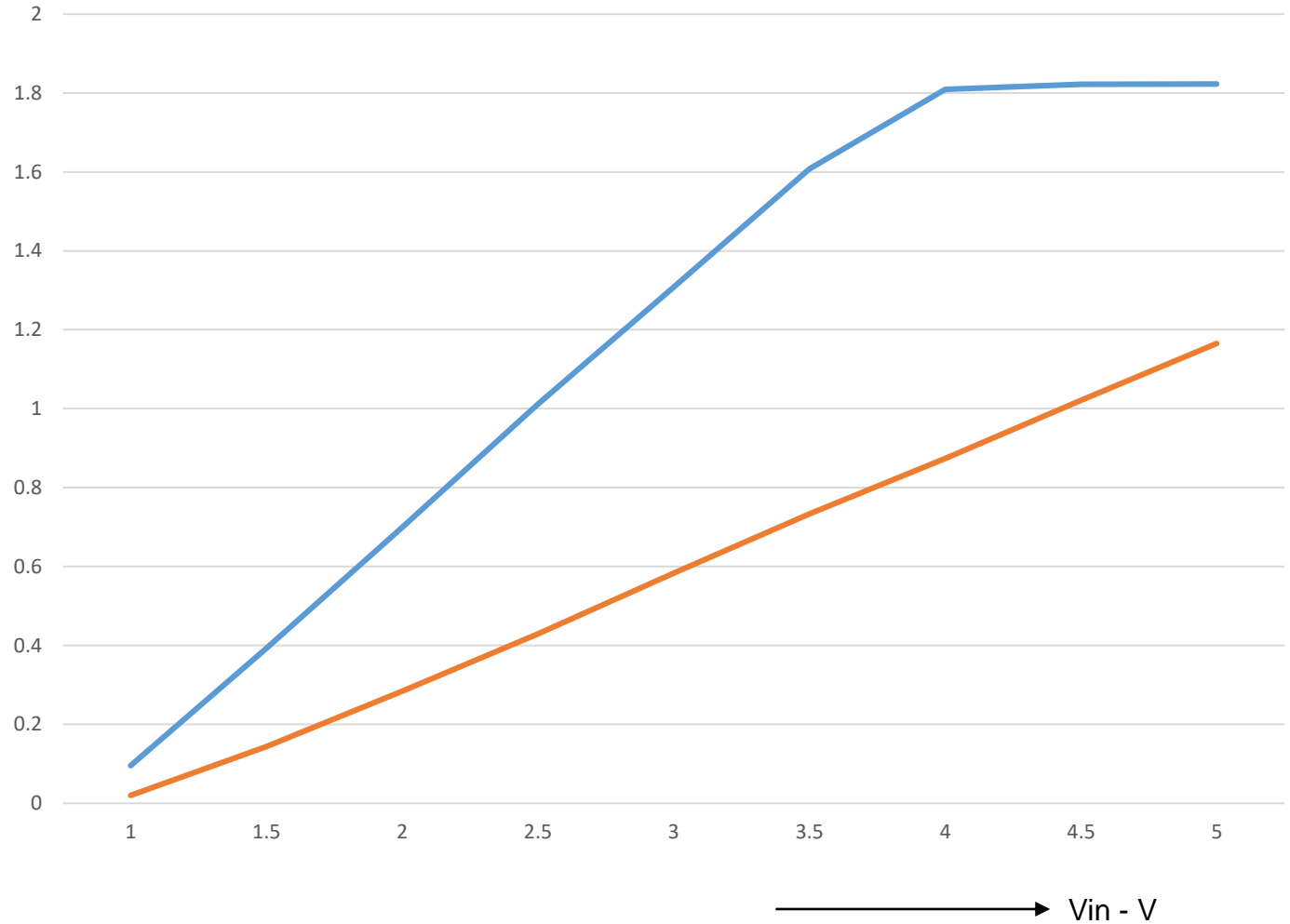
50Hz pulses to photo diode current generator



Pulse width 100ns



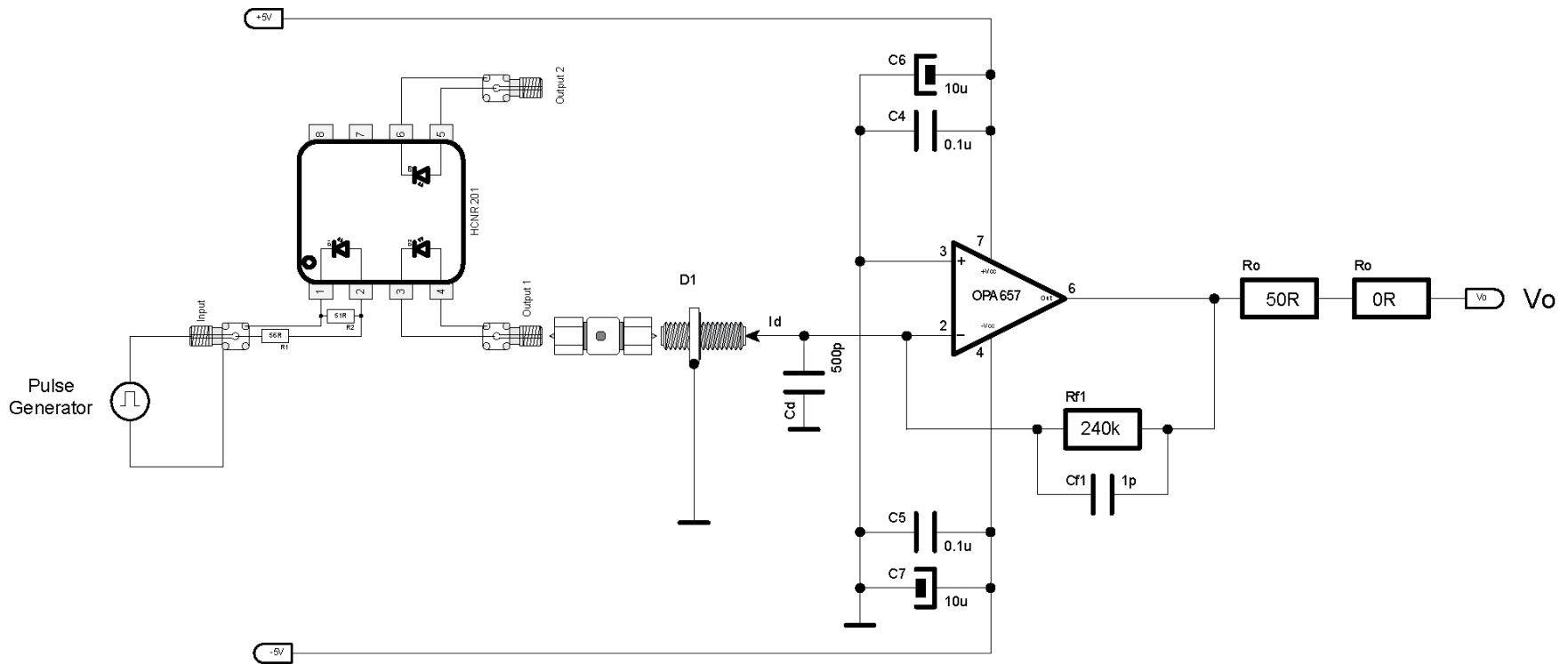
Pulse width 50ns





Measurement

Configuration 2 schematic





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Measurement

Configuration 2



Photo diode input

Rear

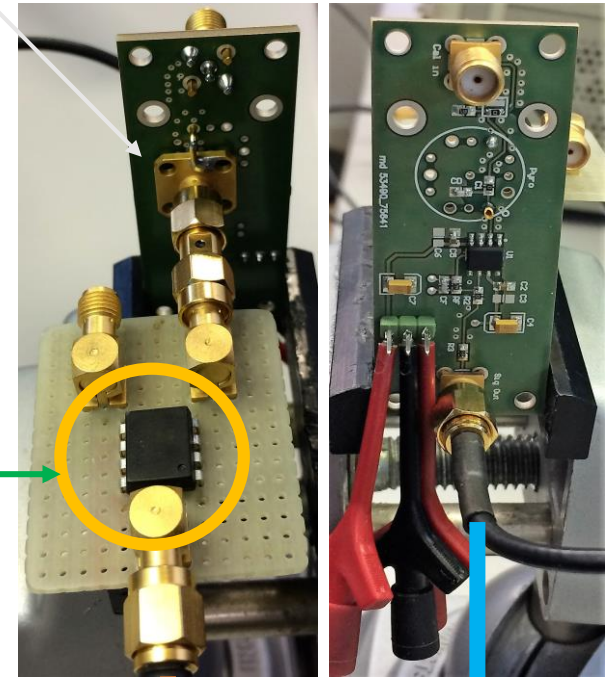
Front

DPO70804



HP8131A

Photo Current Generator



OFE prototype

1m long sma cable



ESS WS Sintillator PDR-2

Sandi G., December 13, 2016





Results of configuration 2



Vin	Vout100a	Vout50a	Vout V
1	0.096	0.021	
1.5	0.395	0.14	
2	0.702	0.281	
2.5	1.01	0.427	
3	1.306	0.573	
3.5	1.607	0.722	
4	1.806	0.868	
4.5	1.833	1.025	
5	1.834	1.169	

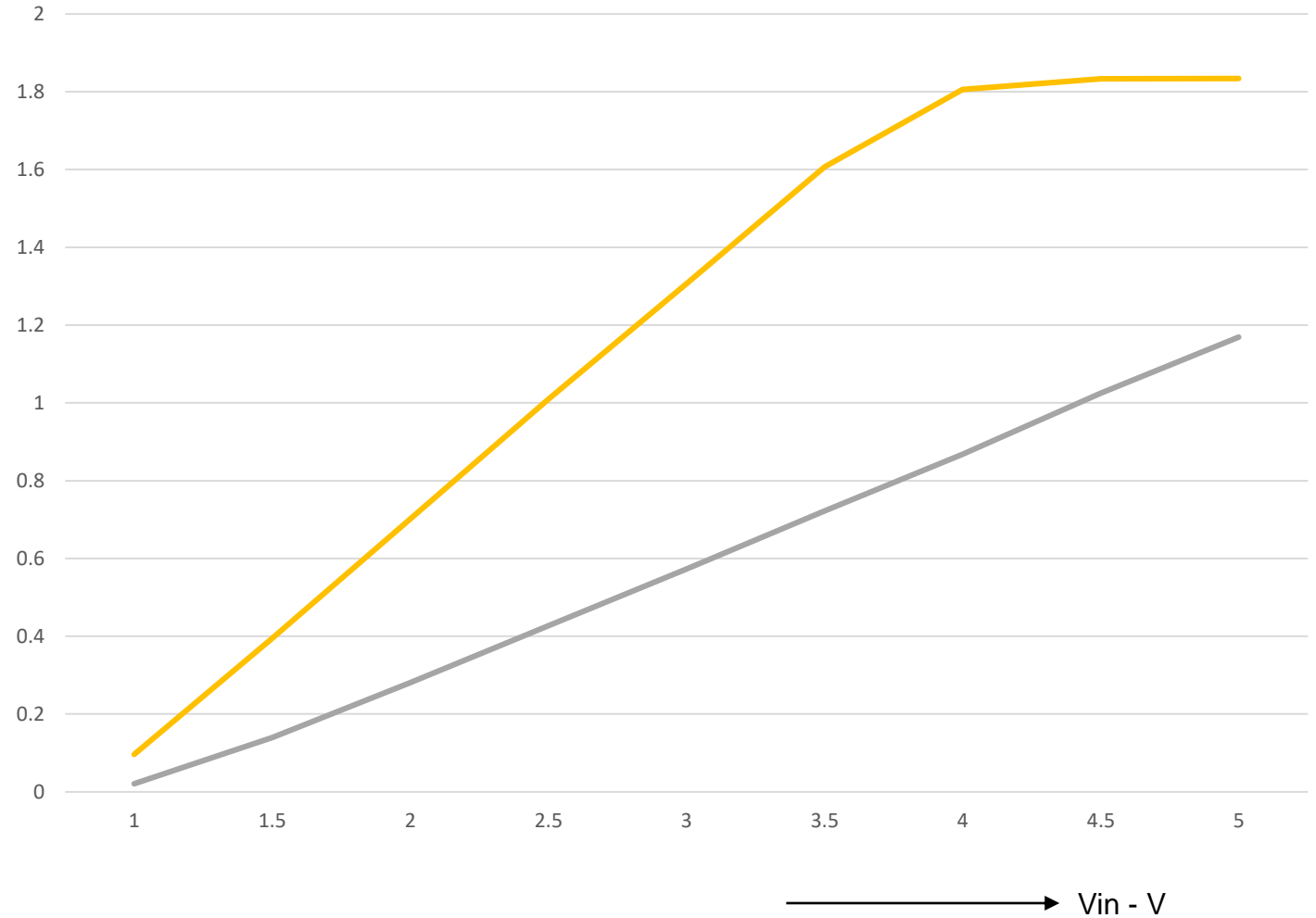
50Hz pulses to photo diode current generator



Pulse width 100ns

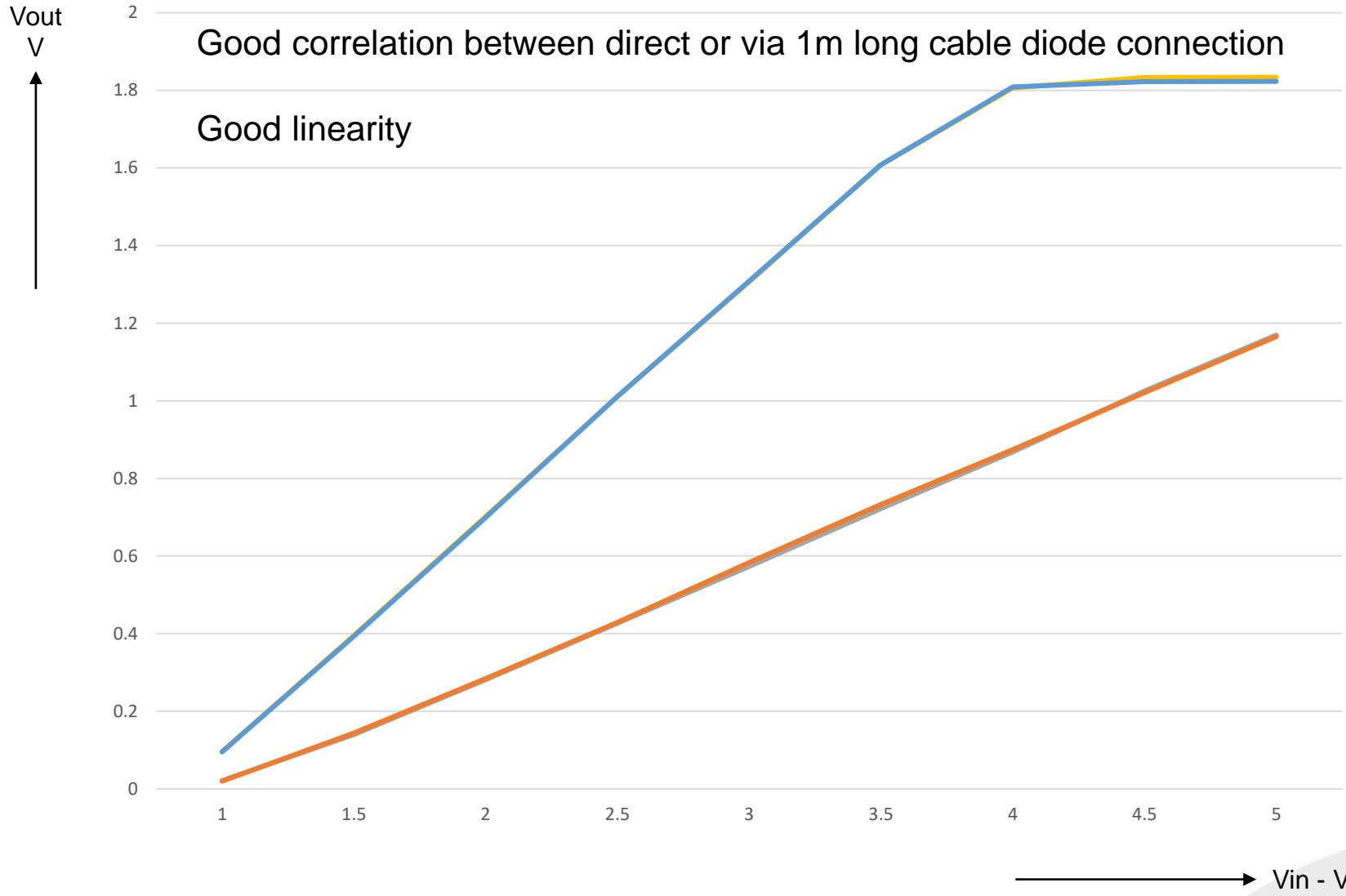


Pulse width 50ns

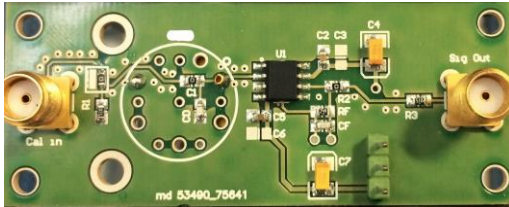




Comparison between both



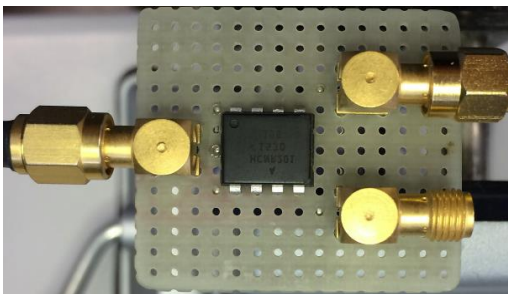
OFE front view



OFE back view



Photo diode current generator



Prototype mechanical dimension:
L62.88mm x W25.62mm

Two layers - SMD components

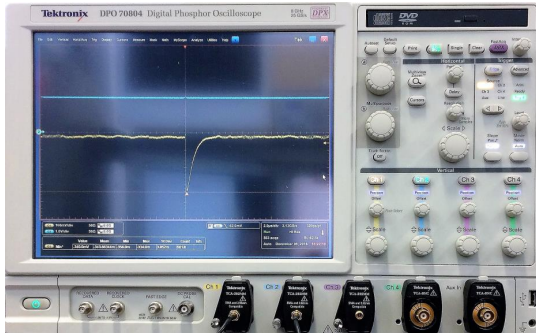
SMA connectors

50 Ohm output load

Dual 5V power supply– total current consumption +- 13mA

Ambient temperature during test 22° C

Ambient humidity during test 60%



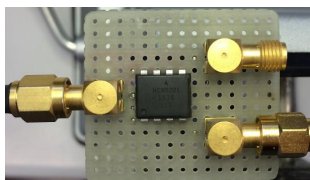
Oscilloscope Tektronix DPO 70804



Pulse generator HP 8131A



Power supply Agilent E3645A



Photodiode current source HCNR 201- in house design



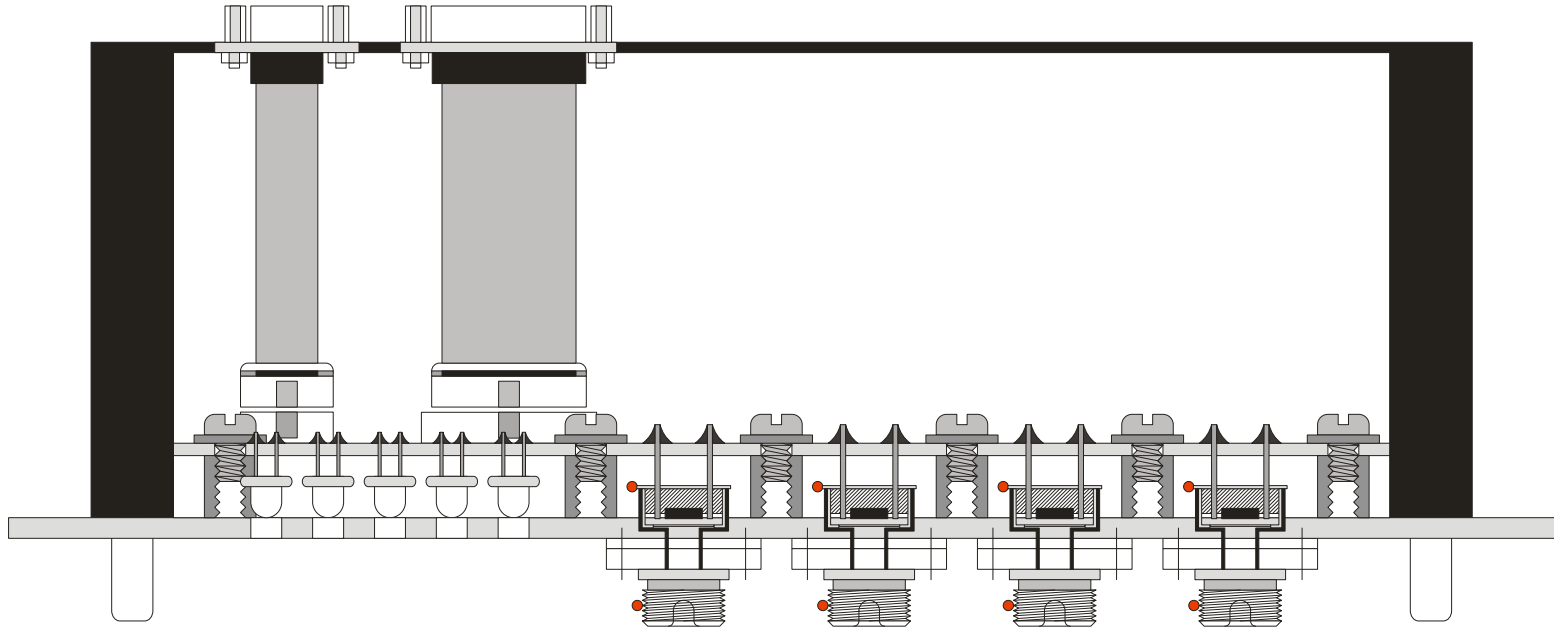
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Mechanical design

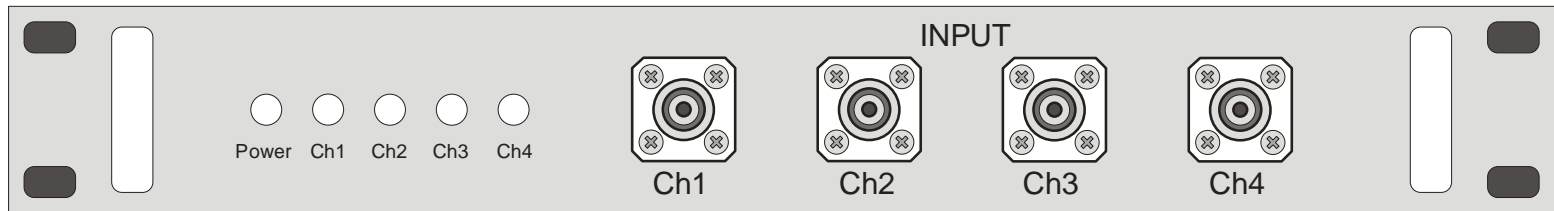
OFE



Top view



Front view



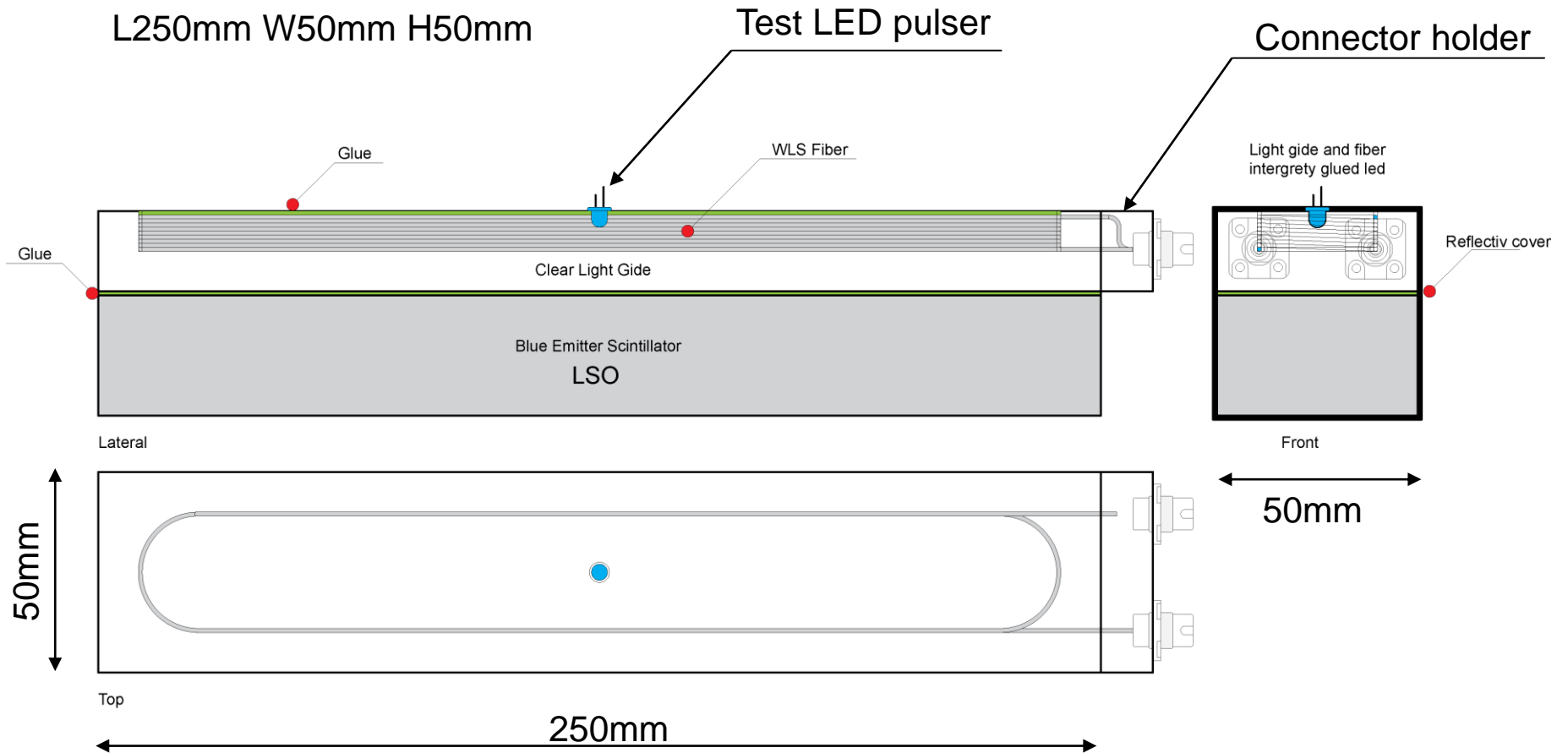
Rear view





Scintillator design

Total Mechanical dimensions:
L250mm W50mm H50mm





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Final Words



QUESTIONS



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Thank you !

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