

## ANNEX 1

### TECHNICAL DESCRIPTION OF THE OFFERED PERFORMANCE

ADVAPIX TPX3 modules were designed with special emphasis to performance and versatility which is often required in a scientific experimental work. They contain latest CERN detector Timepix3 for particle tracking and imaging. The fast modules with Si or CdTe pixel detectors Timepix3 can be used in different configurations such as stack of several layers or tiling to cover larger area. Each module contains single Timepix3 device with ultra-fast sparse data readout to acquire up to 40 Mhits per second. A separate USB 3.0 channel for each device assures fast read-out of the whole modular system. The sensor type and thickness is of customer's choice.

ADVAPIX TPX3 can be used in a variety of applications such as energy resolved radiography (X-rays, neutrons, ions), particle tracking, time-of-flight imaging, multilayer Compton camera and many other. The sensors can be adapted for neutron imaging by deposition of converter layers. Recording individual hits together with advanced data processing allows increasing the spatial resolution in some applications to units of microns or even sub-micrometric level (for ions).

Compared to the older Timepix chip the Timepix3 detector offers 6 times better time resolution, 2 times better energy resolution, 2 times lower minimum energy threshold, zero dead time and 10x faster data transfer.

### Main Features:

- Readout chip type..... Timepix3
- Pixel size .....55 x 55  $\mu\text{m}$
- Sensor resolution.....256 x 256 pixels
- Time resolution..... 1,6 ns
- Power..... External or via second USB 3.0
- Interface.....USB 3.0(Super-Speed)
- Maximum readout speed..... 40 million pixels / s
- Dimensions .....125 x 79 x 25.5 mm
- Weight ..... 503 g

**ADVAPIX TPX3 meets all the required criteria stated in Technical requirements for a pixel radiation detector.**



EUROPEAN UNION  
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**ANNEX 2**
**TECHNICAL SPECIFICATIONS**
**Device Parameters**
**Operating Conditions**

Symbol	Parameter	Min	Typ	Max	Units	Comment
T <sub>A</sub>	Temperature Range	0	50	70	°C	
Φ	Humidity			60	%	Not condensing

**Electrical Specification**

 T<sub>A</sub> = 25°C, USB voltage V<sub>CC</sub> = 4.8V

Symbol	Parameter	Min	Typ	Max	Units	Comment
V <sub>CC</sub>	Supply Voltage	4.0	5.0	5.5	V	
I <sub>CC</sub>	Supply Current					
I <sub>CC1</sub>	Chip disabled		800	1500	mA	
P <sub>1</sub>	Power Dissipation			2.5	W	
<b>I/O Conn. Input CMOS (pin 4,6,8,10)</b>						
V <sub>INL</sub>	Voltage Low	0		1.15	V	
V <sub>INH</sub>	Voltage High	2.15		3.3	V	
<b>I/O Conn. Input LVDS (pin 3,5,7,9)</b>						
V <sub>IN</sub>	Voltage Range	0		2.5	V	
V <sub>INDIFF</sub>	Differential Voltage	250		600	mA	
<b>Bias Voltage Source for Sensor Diode</b>						
V <sub>BIAS</sub>	Bias Voltage	0		±450	V	Polarity is sensor dependent

**Performance Characteristics for Timepix3**

Symbol	Parameter	Min	Typ	Max	Units	Comment
f	Hit-rate			40	MPixels/s	with USB 3.0 cable
	Data rate			2.4	Gbit/s	with USB 3.0 cable
T <sub>READ</sub>	Frame Readout Time		33		ms	with USB 3.0 cable
dT	Time resolution	1.56			ns	
F <sub>READ</sub>	Read-out frequency		320		MHz	½ of maximum ROC freq



## Sensor parameters

$T_A = 25^\circ\text{C}$

Symbol	Parameter	Si				CdTe	Units	Comment
		100	300	500	675			
	Thickness	100	300	500	675	1000	$\mu\text{m}$	
$\sigma$	Energy resolution of energy discrimination threshold ( $\sigma$ @ 23 keV)	0.5				1.1	keV	
$\sigma$	Energy resolution of energy discrimination threshold ( $\sigma$ @ 60 keV)	0.6				1.5	keV	
$\sigma$	Energy resolution in full spectral mode ( $\sigma$ @ 23 keV)	0.7				3.0	keV	
$\sigma$	Energy resolution in full spectral mode ( $\sigma$ @ 60 keV)	1.0				3.6	keV	
	Typical detectable energy range for X-rays <sup>2</sup>	1.0				3 to 600	keV	See chart below
	Pixel size	55				55	$\mu\text{m}$	

