Results of TRITIUM-IFIC 2 prototypes

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Outline

Tritium-IFIC 2 Prototype

Figure: TRITIUM-IFIC 2, laboratory prototype

Figure: TRITIUM-IFIC 2, Arrocampo cell

Tritium-IFIC 2 (Prototypes + Cosmic Vetos)

FOTOOS PROTOTIPO CON VETOS

Tritium-IFIC 2 read-out electronic system

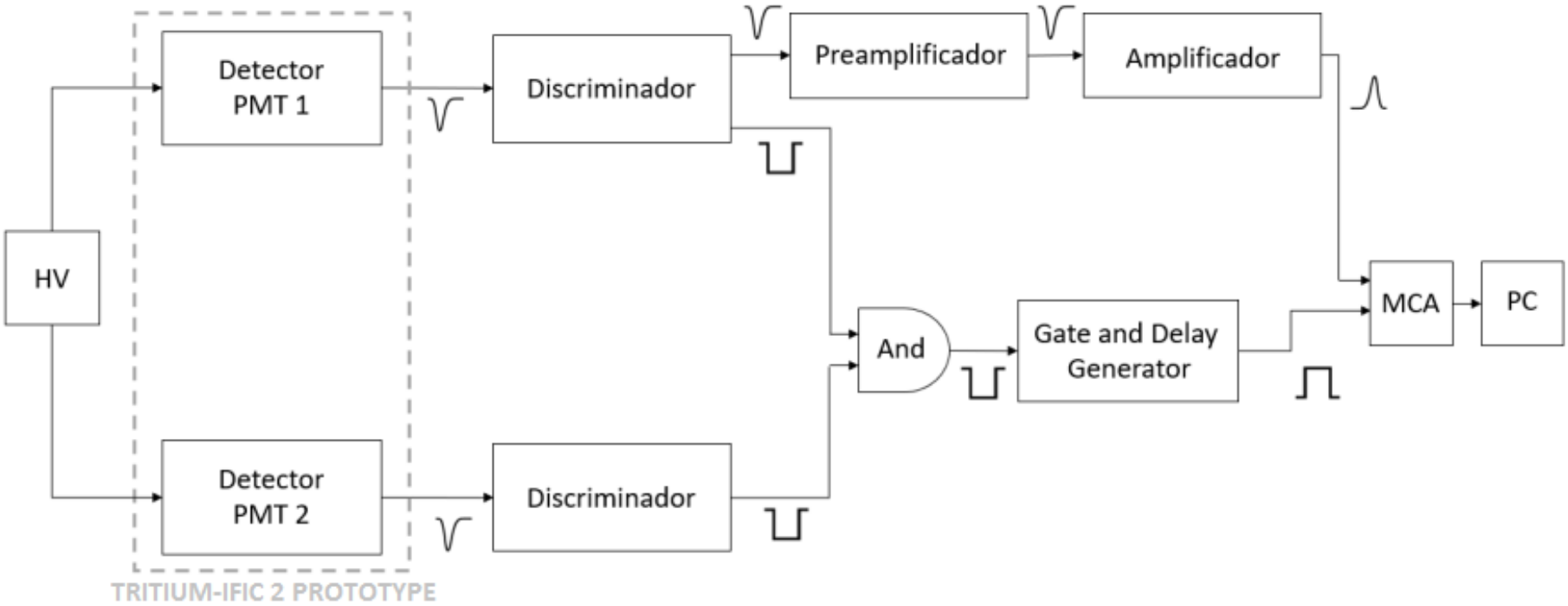

Figure: Scheme of the read-out electronic system

Tritium-IFIC 2 read-out electronic system

Figure: Read-out electronic system

Prototype efficiency measurement

Parameter	Numerical value
Number of fibers in each prototypes	800
Distance of fibers in each prototypes	20 cm
Diameter of the fibers in each prototype	1 mm
Activity of tritium solution	10 kBq/L
Date (signal)	20/07/2020
Air conditioned (signal)	ON (18 °)
Fans inside the black box (signal)	ON
Date (background)	22/05/2020
Air conditioned (background)	ON (18 °)
Fans inside the balck box (background)	ON
Low Level discrimination channel (MCA)	$100 \approx 122$ mV

Table: Relevant information for the measurement

Prototype efficiency measurement

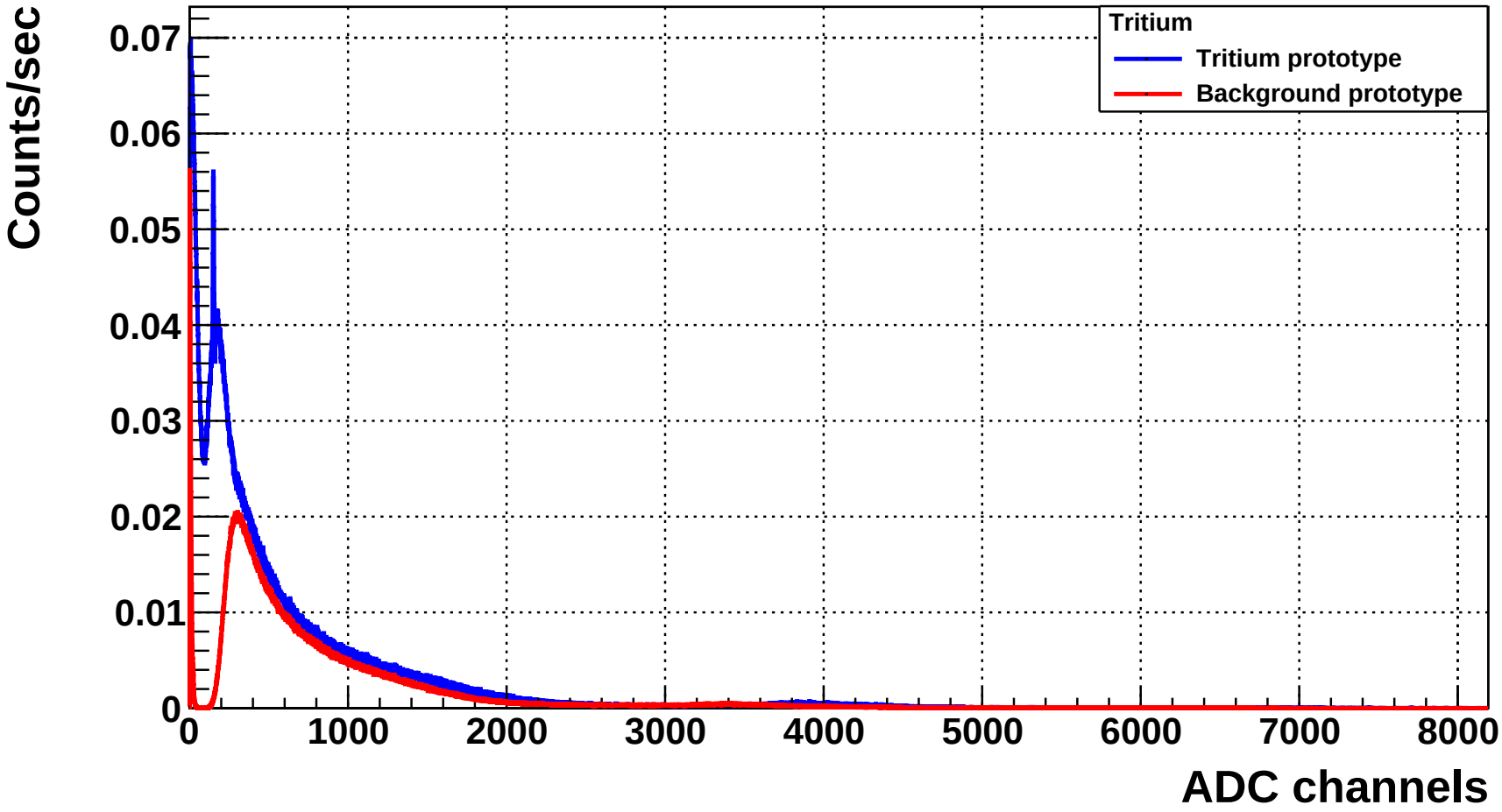

Figure: Signals of both TRITIUM-IFIC 2 prototypes

Prototype efficiency measurement

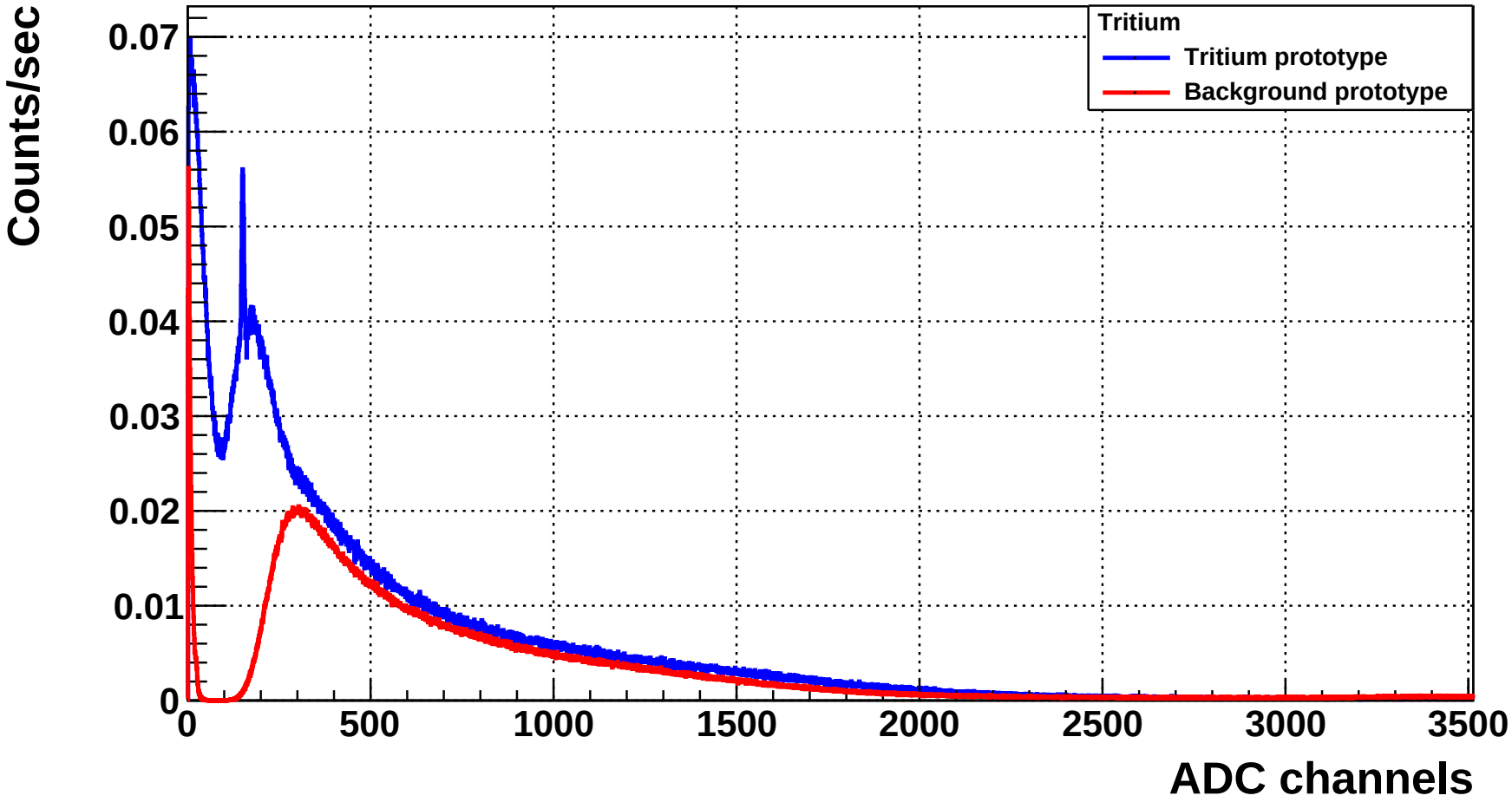

Figure: Signals of both TRITIUM-IFIC 2 prototypes (Zoom 0-4000 channels)

Prototype efficiency measurement

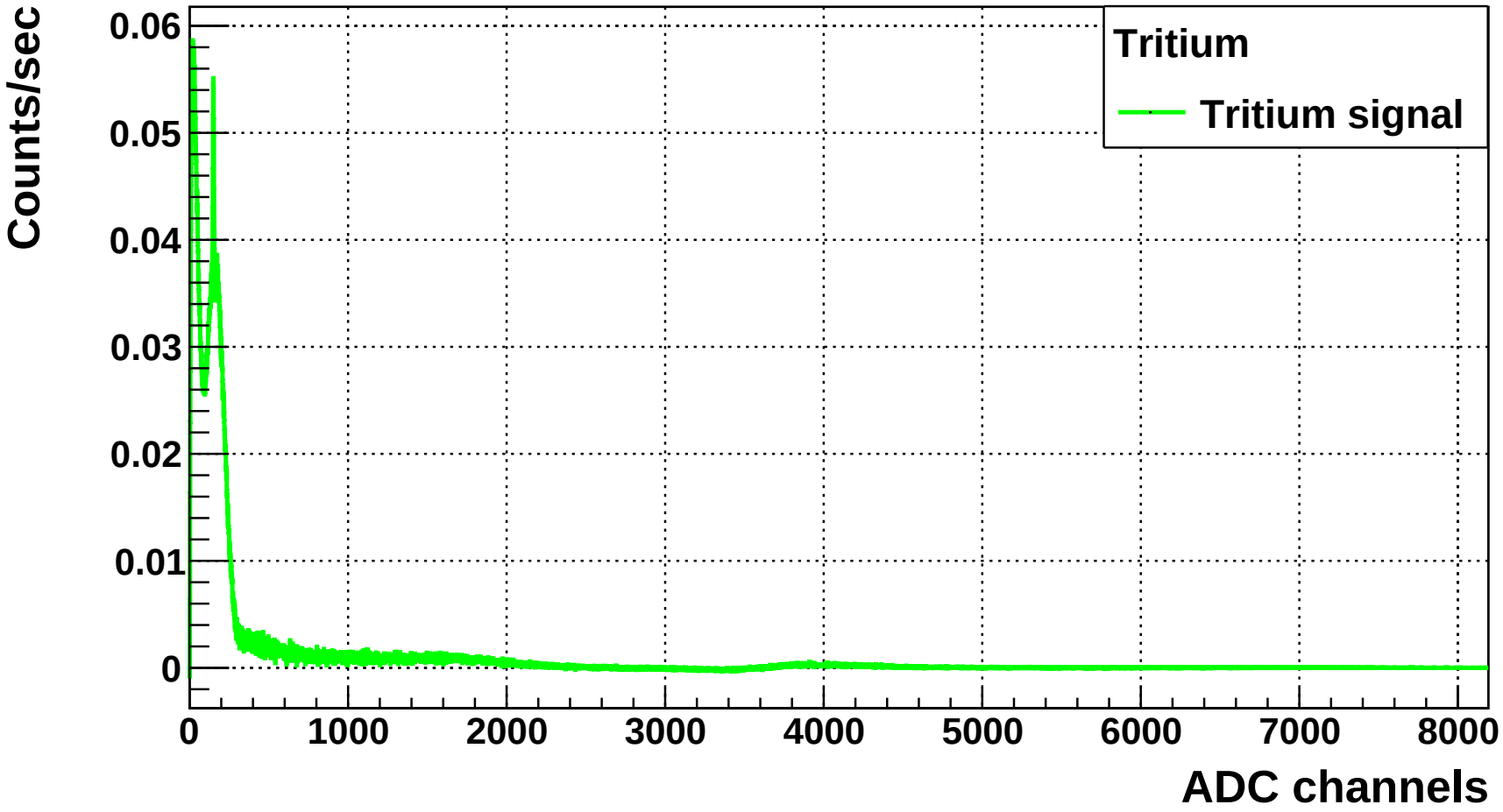

Figure: Tritium signal measured in TRITIUM-IFIC 2 prototypes

Prototype efficiency measurement

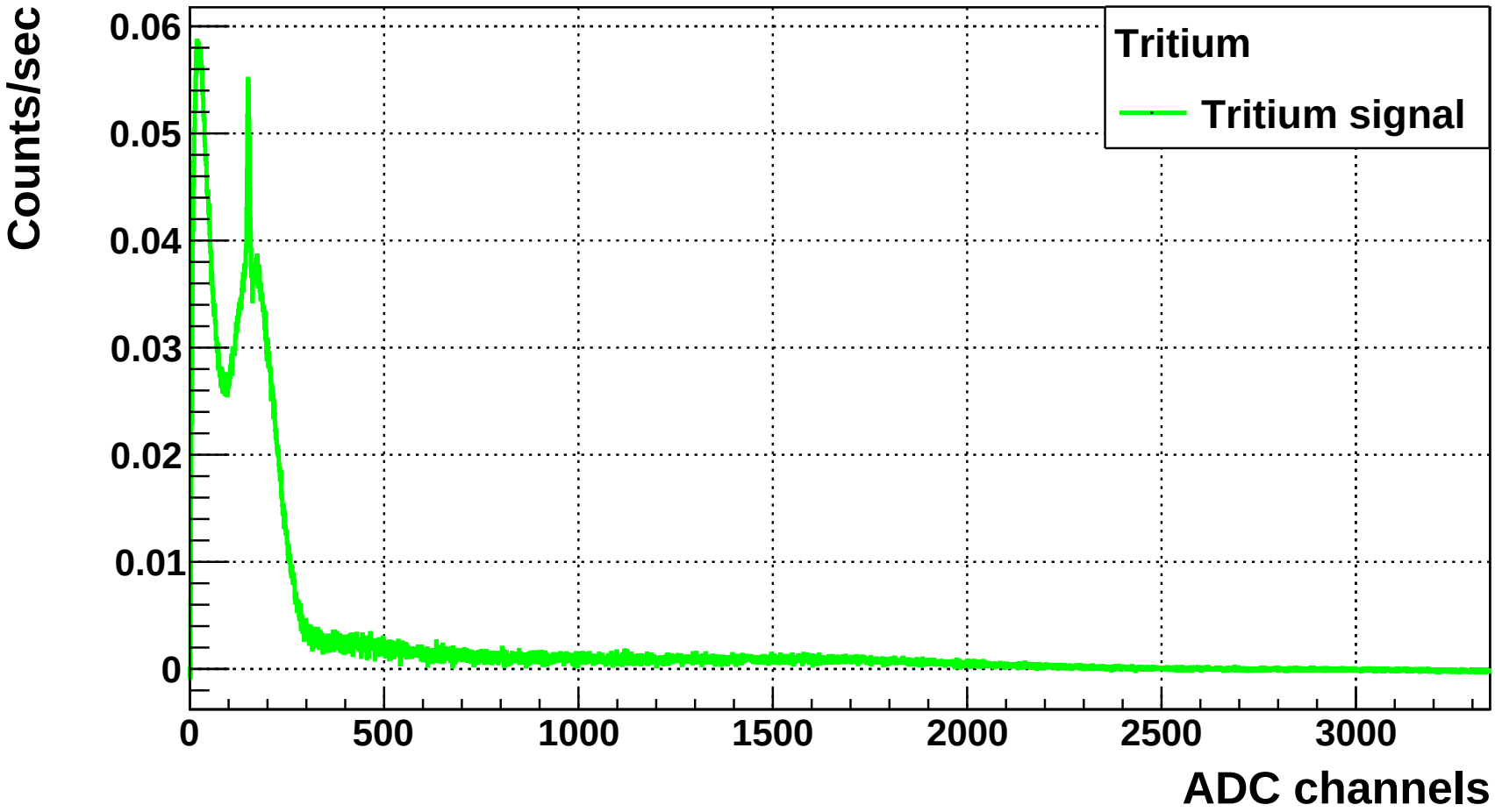

Figure: Tritium signal measured in TRITIUM-IFIC 2 prototypes (Zoom 0-4000 channels)

Prototype efficiency measurement

Parameter	Numerical value
Counts/sec (signal)	19.0522
Counts/sec (background)	11.9419
Counts/sec (Tritium)	7.11032
Nominal activity	10 kBq/L
Efficiency	$0.711\ \frac{c/s}{\text{kBq/L}}$
Active area/fiber	$2\pi\ \text{cm}^2$
Specifical efficiency	$1.415 \cdot 10^{-4}\ \frac{c/s}{\text{cm}^2\text{kBq/L}}$

Table: Results of Tritium-IFIC 2 prototype

Prototype efficiency measurement

	Efficiency, η_{det} $(cps/(\text{kBq/L}))$	Surface F_{sci} (cm^2)	Specific efficiency $\varepsilon_{det} = \eta_{det}/F_{sci}$	LDL (kBq/L)
Muramatsu	$3.85 \cdot 10^{-4}$	123	$3.13 \cdot 10^{-6}$	370
Moghissi	$4.5 \cdot 10^{-3}$	> 424.1	$< 1.06 \cdot 10^{-5}$	37
Osborne	0.012	3000	$4 \cdot 10^{-6}$	37
Singh	0.041	3000	$1.37 \cdot 10^{-5}$	< 37
Hofstetter	$2.22 \cdot 10^{-3}$	$\sim$ 100	$< 2.22 \cdot 10^{-5}$	25
TRITIUM	0.711	1600π	$< 1.415 \cdot 10^{-4}$	10

Table: State-of-the-Art and comparison with our detector

Long-term stability of Tritium-IFIC 2 background prototype

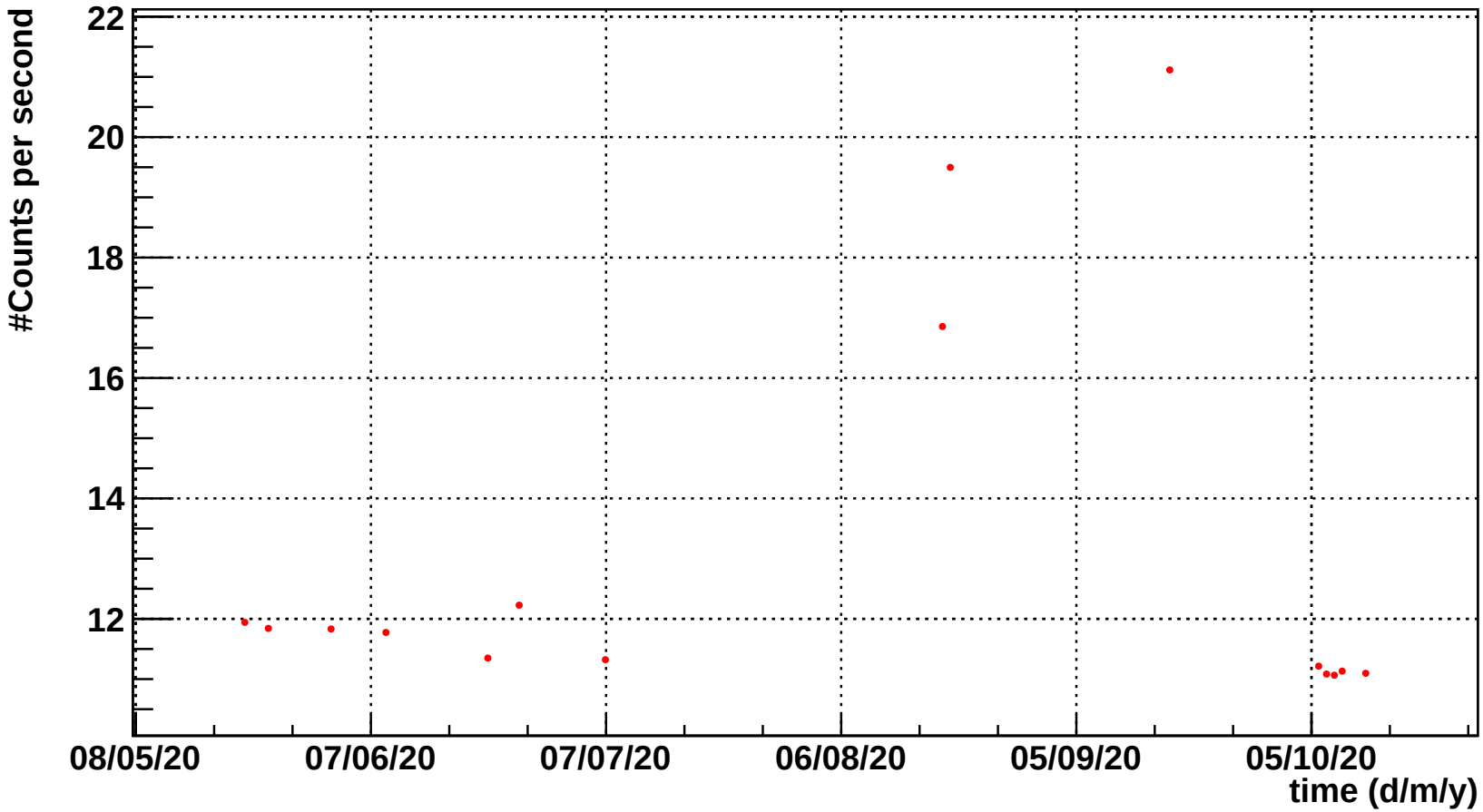

Figure: Long-term stability for TRITIUM-IFIC 2 prototype (background).

Long-term stability of Tritium-IFIC 2 background prototype

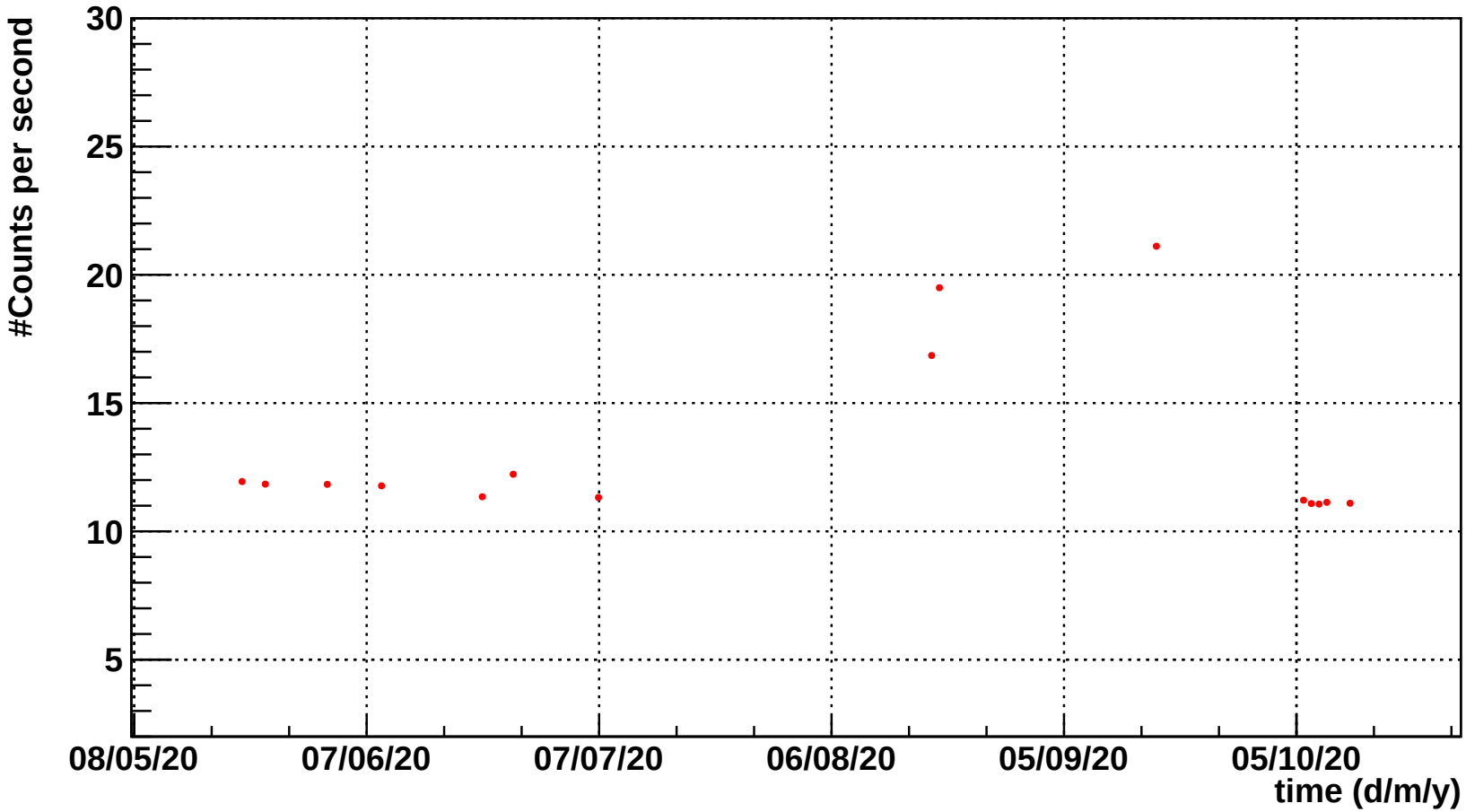

Figure: Long-term stability for TRITIUM-IFIC 2 prototype (background). Different ZOOM.

Long-term stability of Tritium-IFIC 2 background prototype

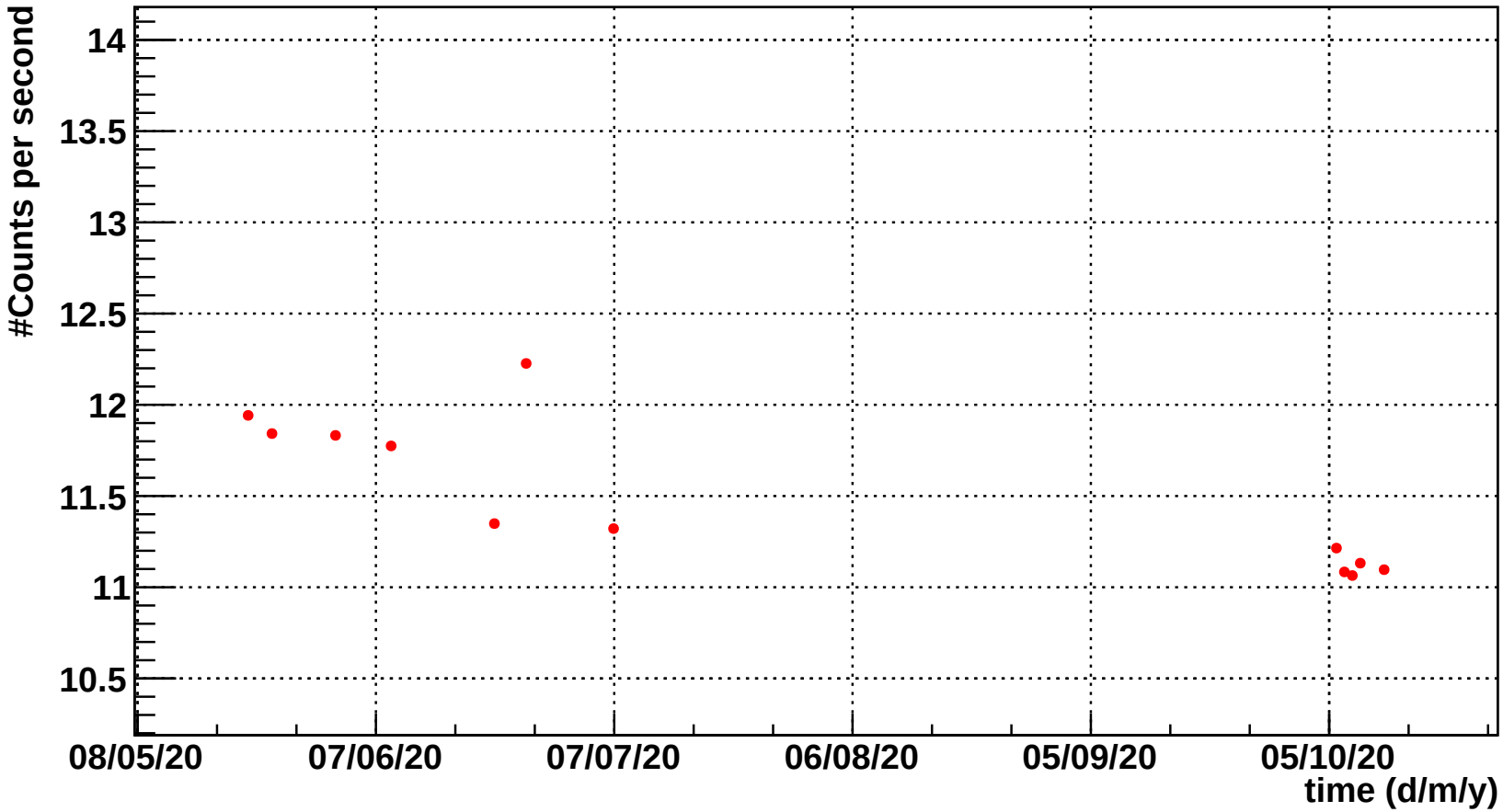

Figure: Long-term stability for TRITIUM-IFIC 2 prototype (background). Different ZOOM.

Long-term stability of Tritium-IFIC 2 signal prototype

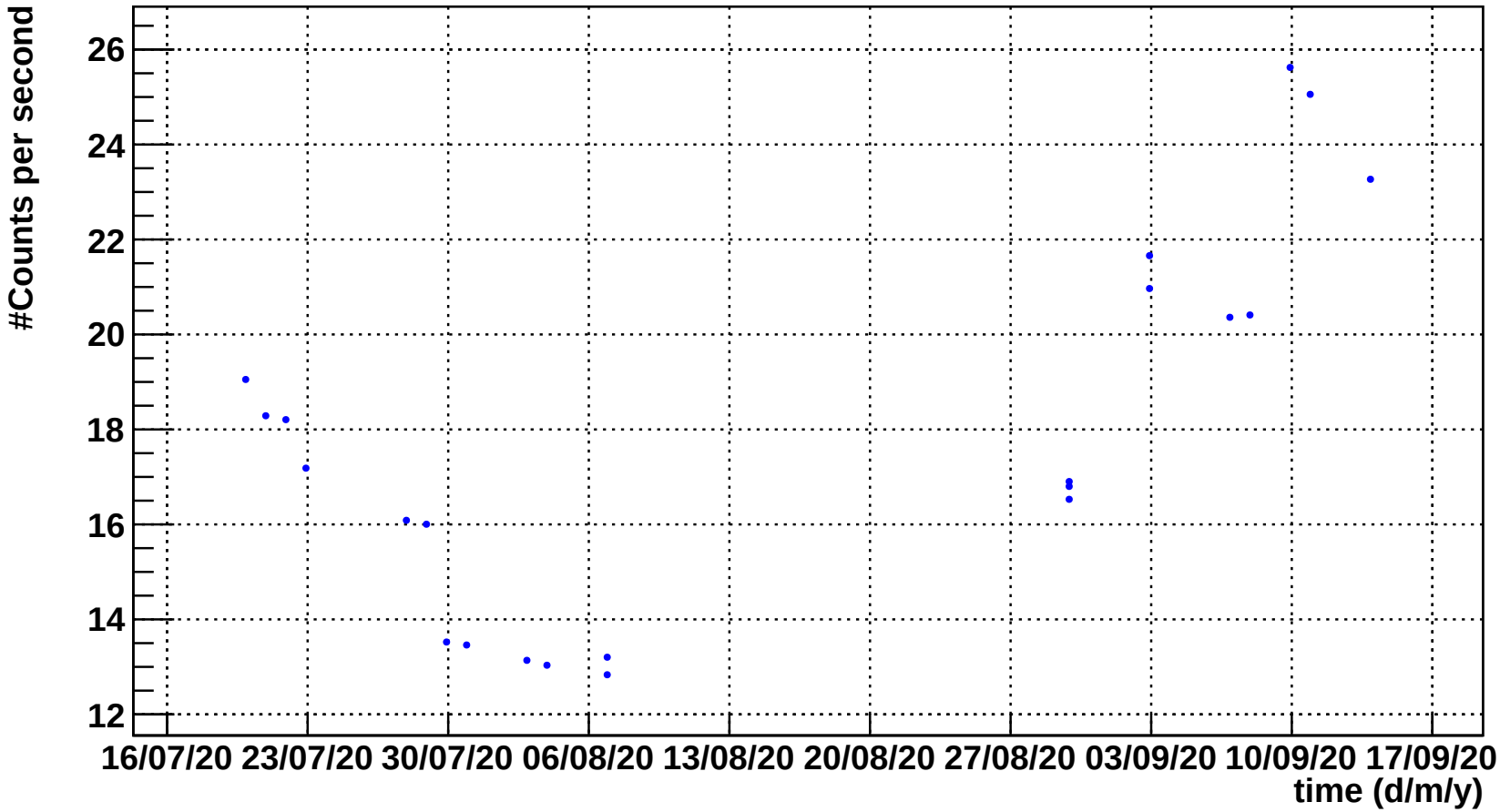

Figure: Long-term stability for TRITIUM-IFIC 2 prototype (signal).

Long-term stability of Tritium-IFIC 2 signal prototype

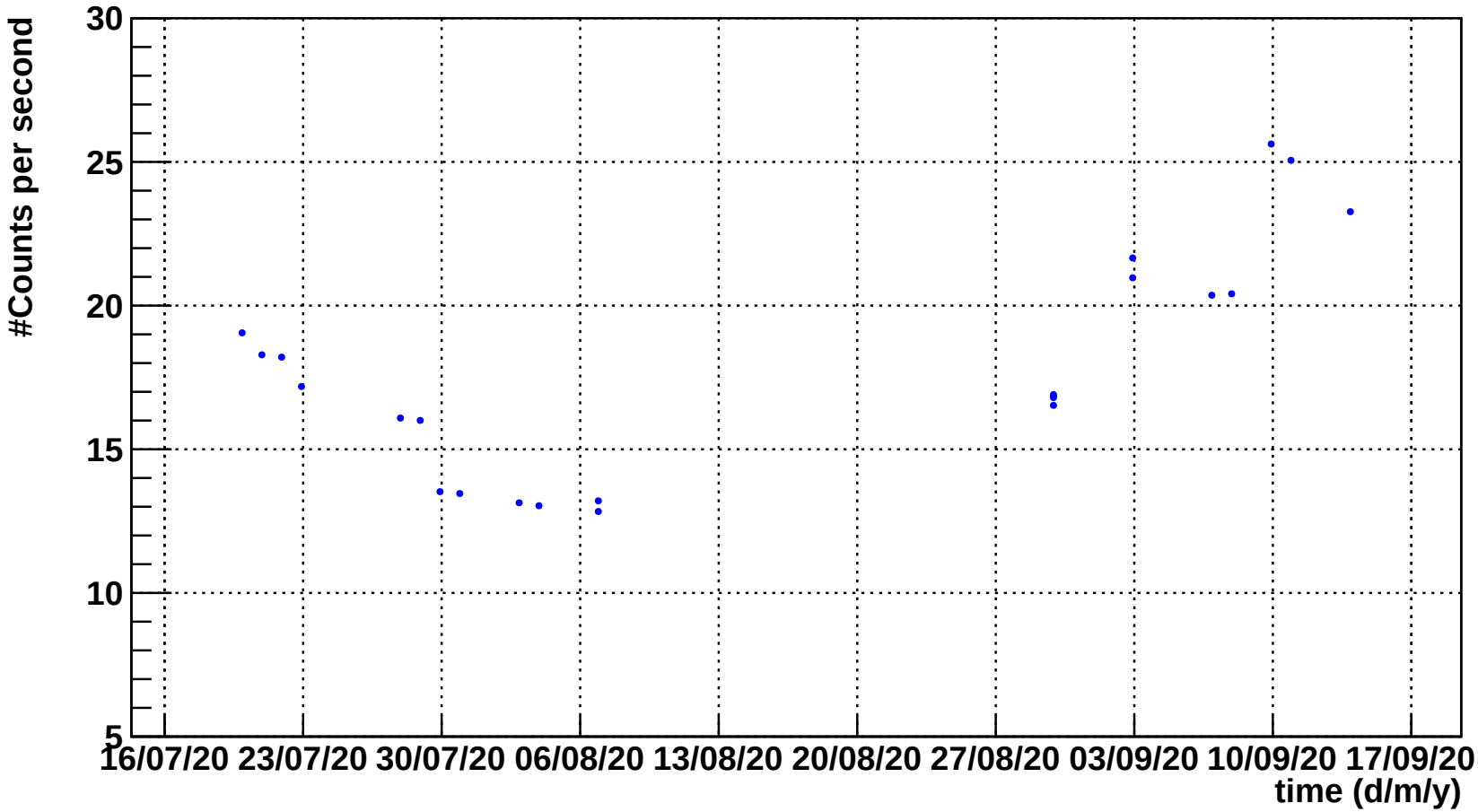

Figure: Long-term stability for TRITIUM-IFIC 2 prototype (signal). Different ZOOM.

Long-term stability of Tritium-IFIC 2 signal prototype

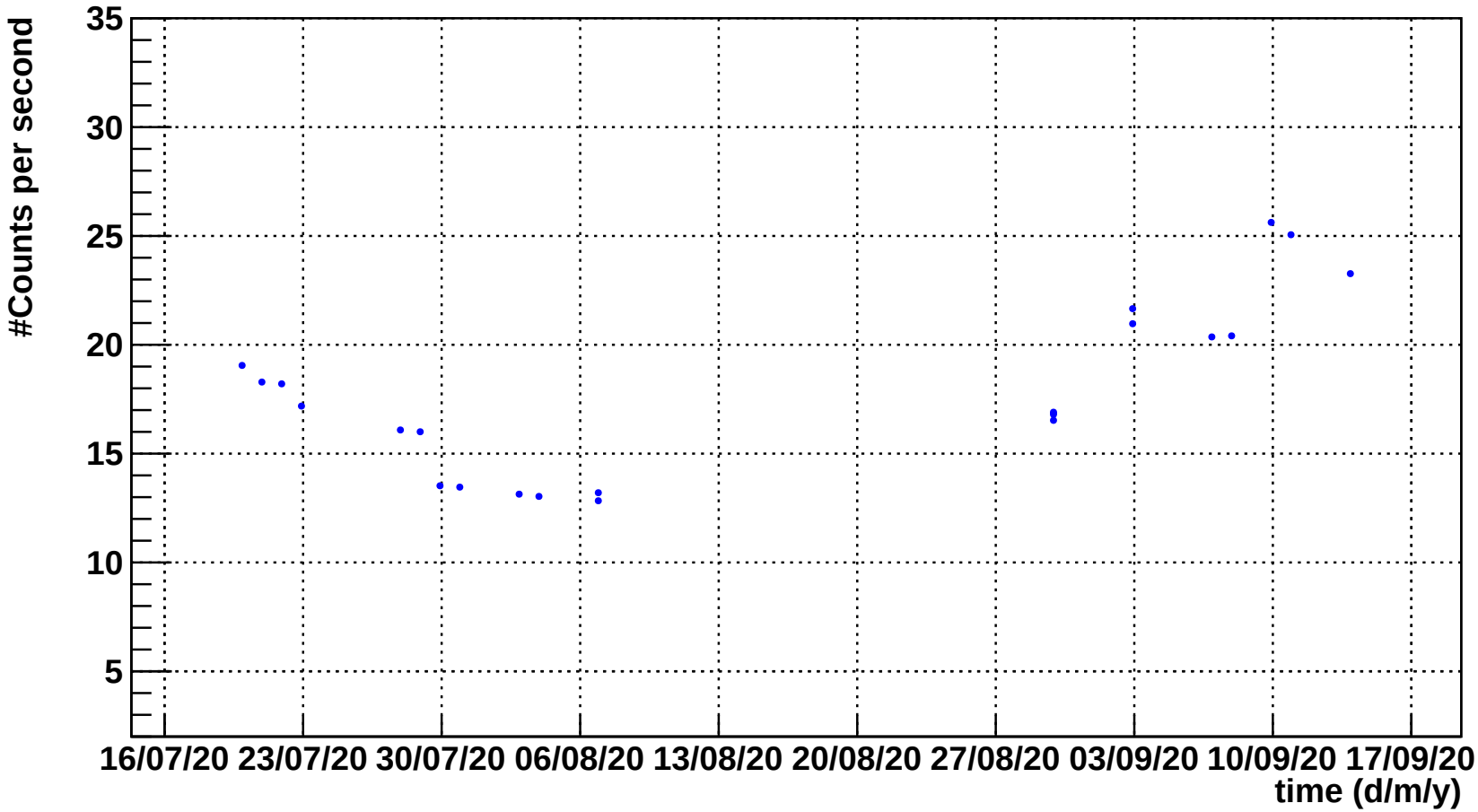

Figure: Long-term stability for TRITIUM-IFIC 2 prototype (signal).Different ZOOM.

Long-term stability of Tritium-IFIC 2 both prototypes

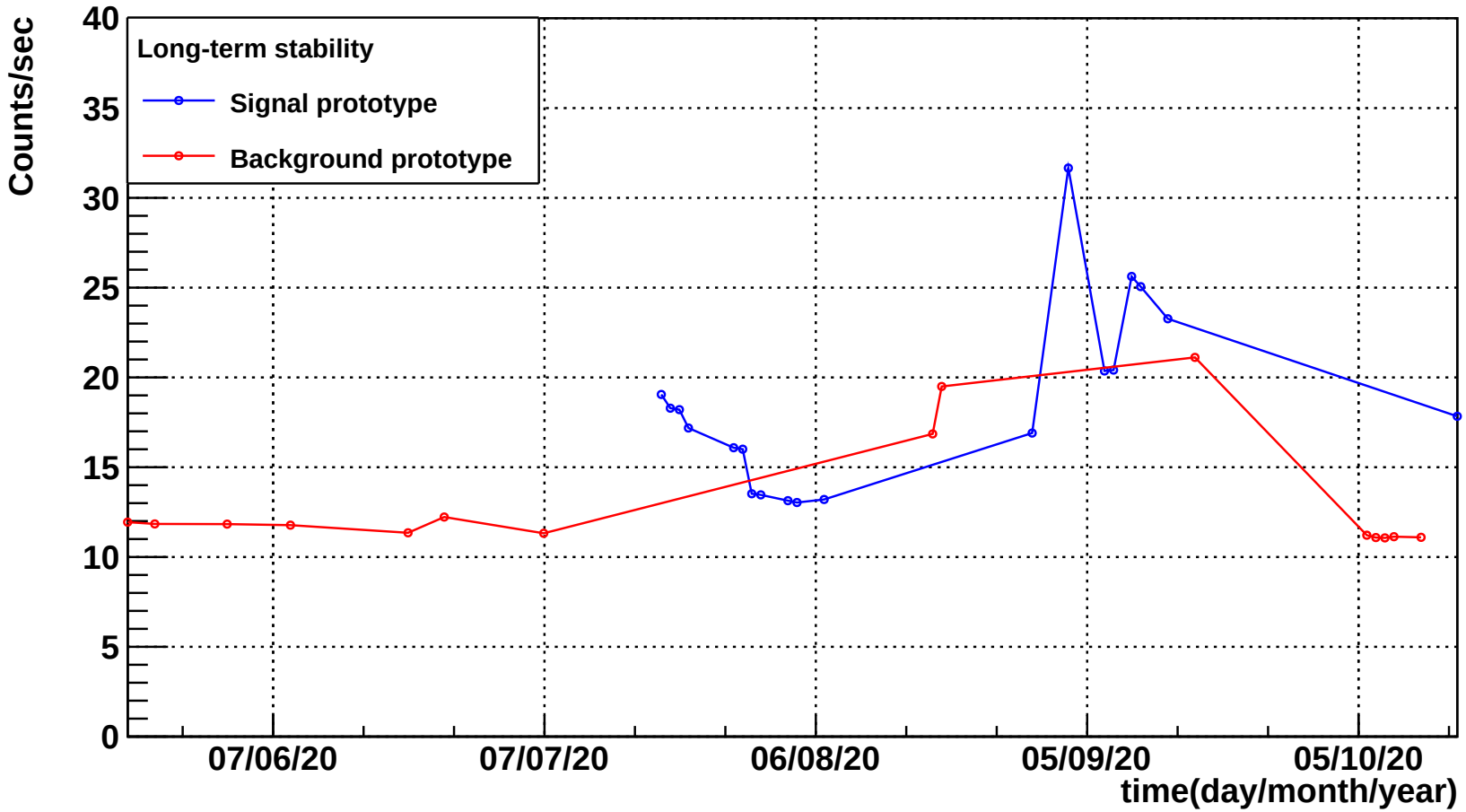

Figure: Long-term stability for TRITIUM-IFIC 2 prototype (signal and background).

Long-term stability of Tritium-IFIC 2 both prototypes

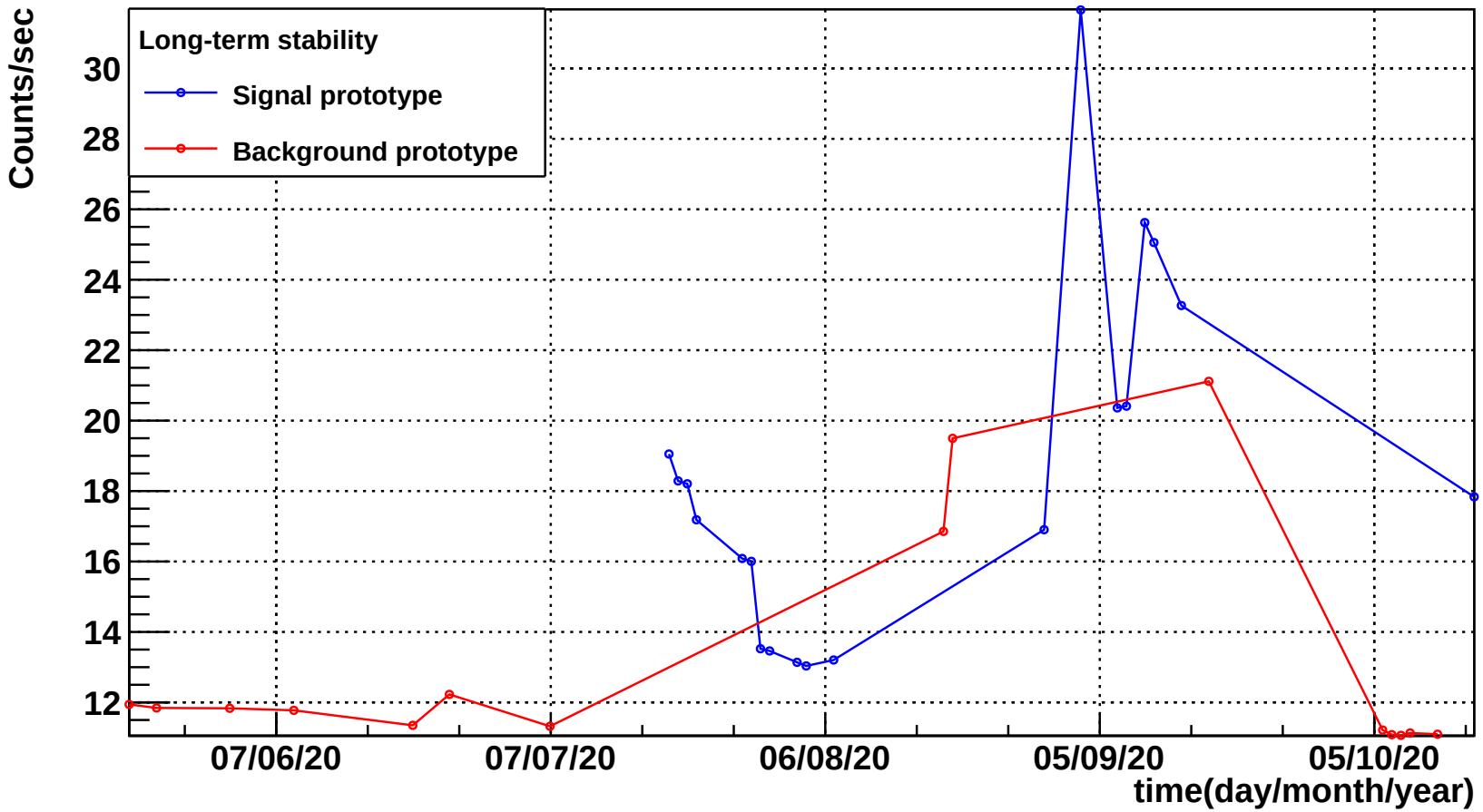

Figure: Long-term stability for TRITIUM-IFIC 2 prototype (signal and background). Different ZOOM

Next step

- Measurement of Tritium-IFIC 1:
  - V=-700V, -750V, -800V
  - ¿Make sense? $\rightarrow$ Refill $\rightarrow$ Measure again
- Refill Tritium IFIC 2 (signal) and measure $\rightarrow$ Friday
- Measure Tritium IFIC 2 (Background and signal) with vetos $\rightarrow$ next week
- Measure Tritium IFIC 2 (signal) with vetos and lead $\rightarrow$ in two weeks
- Build new Tritium IFIC 2 (signal) with less activity $\rightarrow$ ¿1kBq/L?
- Disassemble the first Tritium-IFIC 2 prototype (110 kBq/L) to clean it and rebuild it again, probably with new fibers.