

# Next step TRITIUM

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# Outline

## 1 PETSYS

- Bash code
- Id. Channels
- Scintillator Crystal
- Polishing effect with SiPM arrays
- Other possible studies

## 2 LARAM

- Polishing effect with PMTs

## 3 TRITIUM-IFIC 2

- Coincidence effect
- Effect to the lead

## 4 TRITIUM-IFIC 3

## 5 Future studies

# PETSYS. Bash code

- I have modified Configure-calibration.sh file

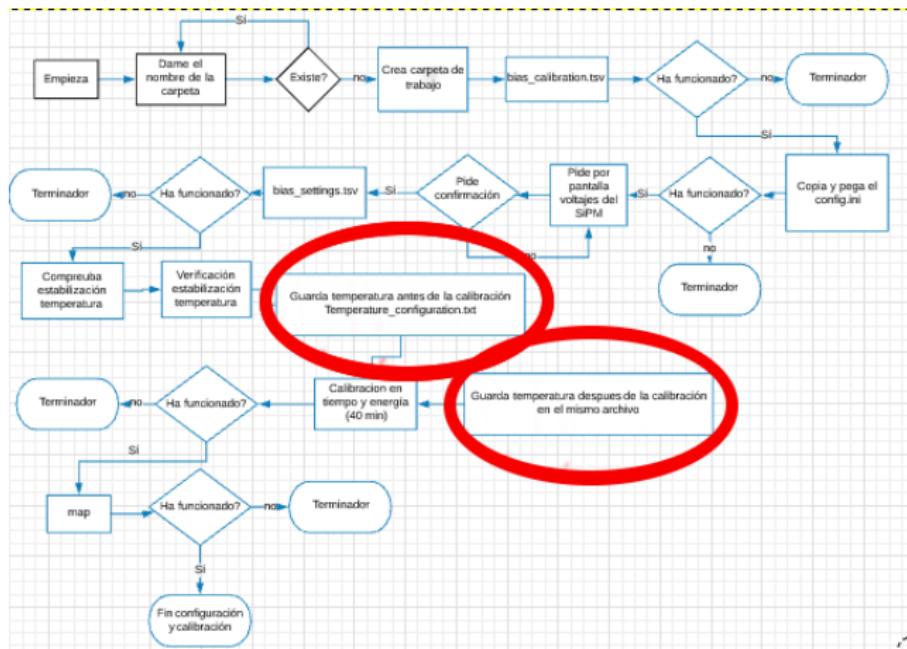


Figure: I save the temperature before and after calibration

# PETSYS. Bash code

- I have modified Acquire.sh file

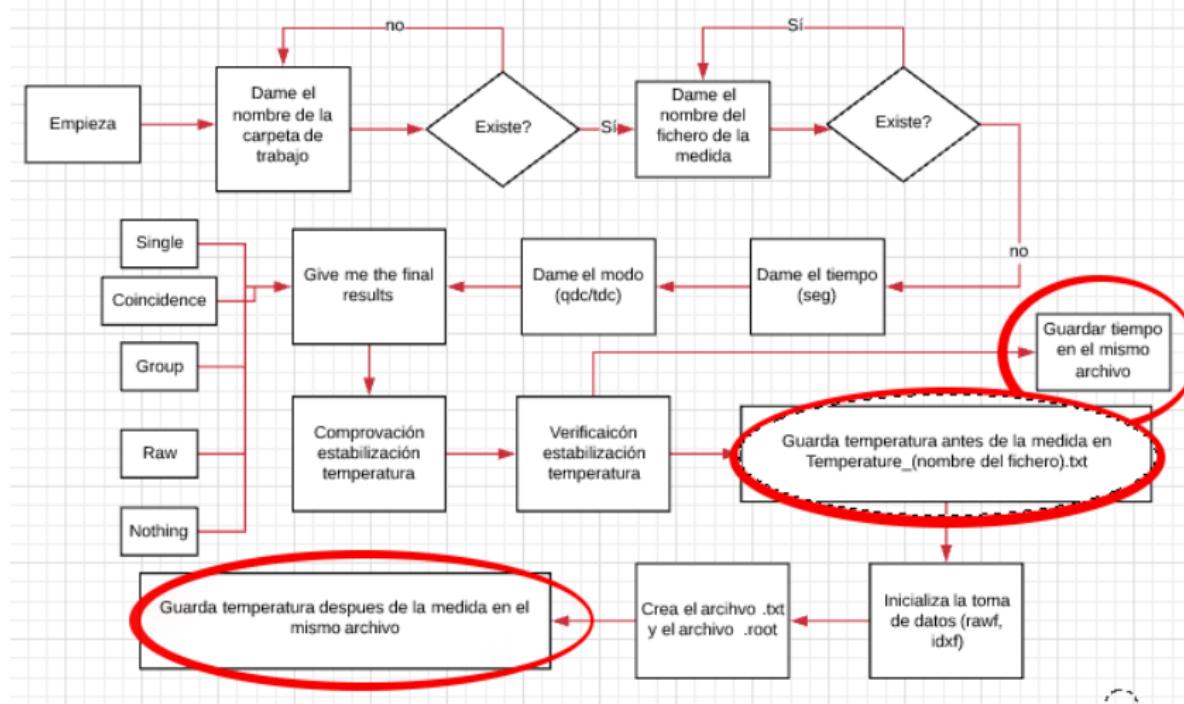


Figure: I save the temperature before and after measurement

# PETSYS. Id. Channel

- PETSYS system.



Figure: PETSYS system has 8 ports

Channel classification:

- ▶ 0-127 (0-63 and 64- 127)
- ▶ 128-255 (128-191 and 192-255)
- ▶ 256-383 (256-319 and 320-383)
- ▶ 384-511 (384-447 and 448-511)
- ▶ 512-639 (512-575 and 576-639)
- ▶ 640-767 (640-703 and 704-767)
- ▶ 768-895 (768-831 and 832-895)
- ▶ 895-1023 (895-959 and 960-1023)

# PETSYS. Id. Channel

- PETSYS system.



Figure: Each TOFPET has 128 channels (32x4)

- ▶ 2 symmetric parts each one with 64 channels (0-127):
  - ★ 0-63
  - ★ 64-127
- ▶ We connect a SiPM array in each part.
  - ★ If we use 8x8 SiPM arrays each channel correspond to a different SiPM (64 SiPMs)
  - ★ If we use 4x4 SiPM arrays we have to see how our SiPM give us this information (16 SiPMs) → Hammamatsu Photonics use four channels in each SiPM ( $16 \times 4 = 64$ )
  - ★ Question!!

# PETSYS. Id. Channel

- I have designed and built a 3D piece.

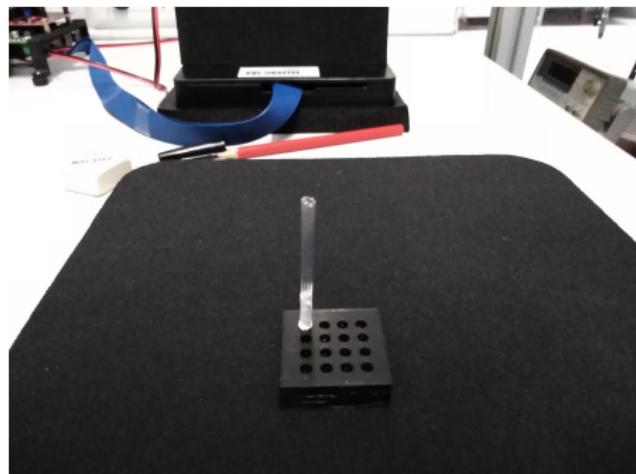


Figure: 3D piece for identification each channel



Figure: Bunch with 9 fibers each one with 5 cm

# PETSYS. Id. Channel

1414080533194	1.632755	244
4857973066344	1.709137	192
4857973066489	1.714790	194
4857973066446	1.745216	195
4857973066505	1.921764	196
10110692203987	1.131805	192
10110692204090	1.213676	196
10262456473138	1.519943	196
10262456473121	1.435490	194
10262456473037	1.593384	192
15693854233856	1.693001	232
15693854233850	1.508865	238
15693854234050	1.466034	246
15693854234401	1.362740	244
26379319698470	1.278378	244
61945435593966	1.450844	246
61945435594370	1.705029	244
62506701424402	2.311611	195
62506701424430	1.793392	196

Figure: Example output single file

# PETSYS. Id. Channel

- Pixel 1:

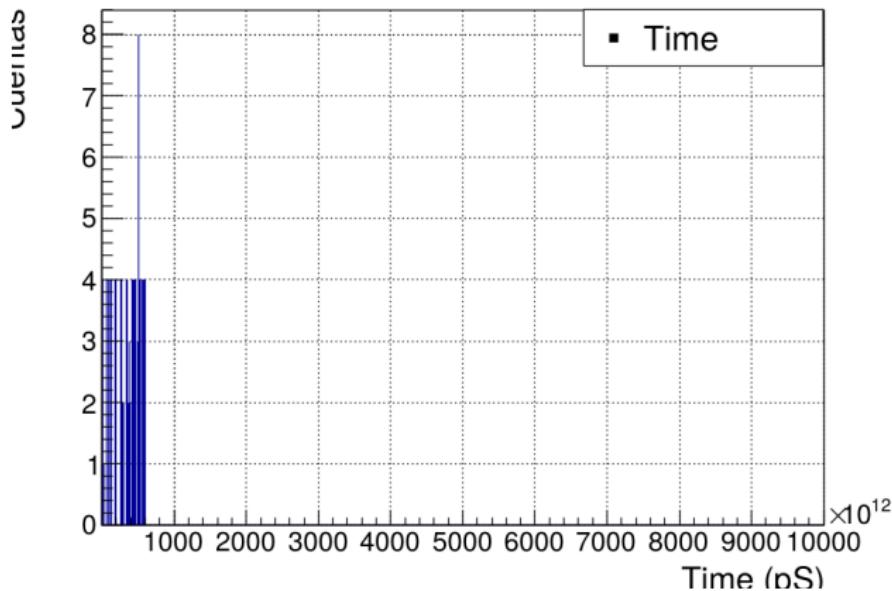


Figure: Time spectrum

# PETSYS. Id. Channel

- Pixel 1:

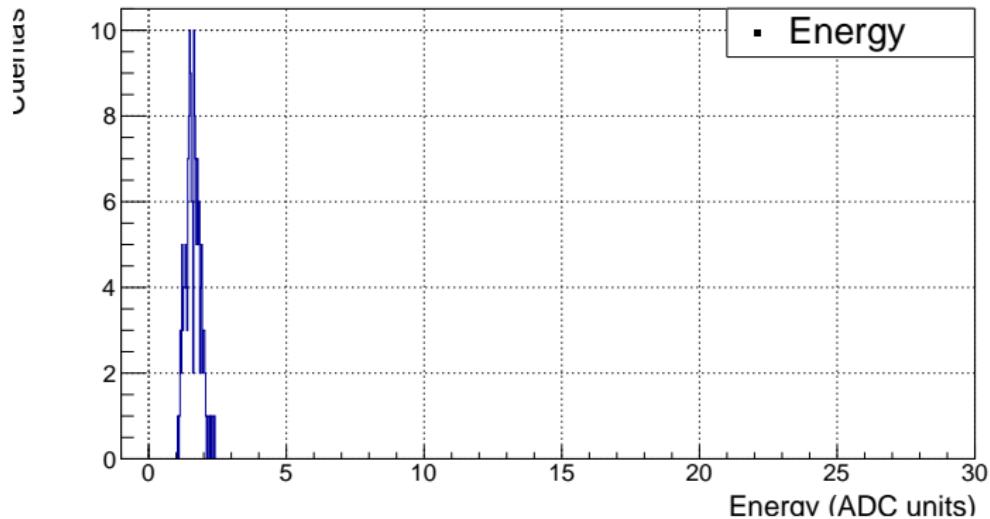


Figure: Energy spectrum

# PETSYS. Id. Channel

- Pixel 1:

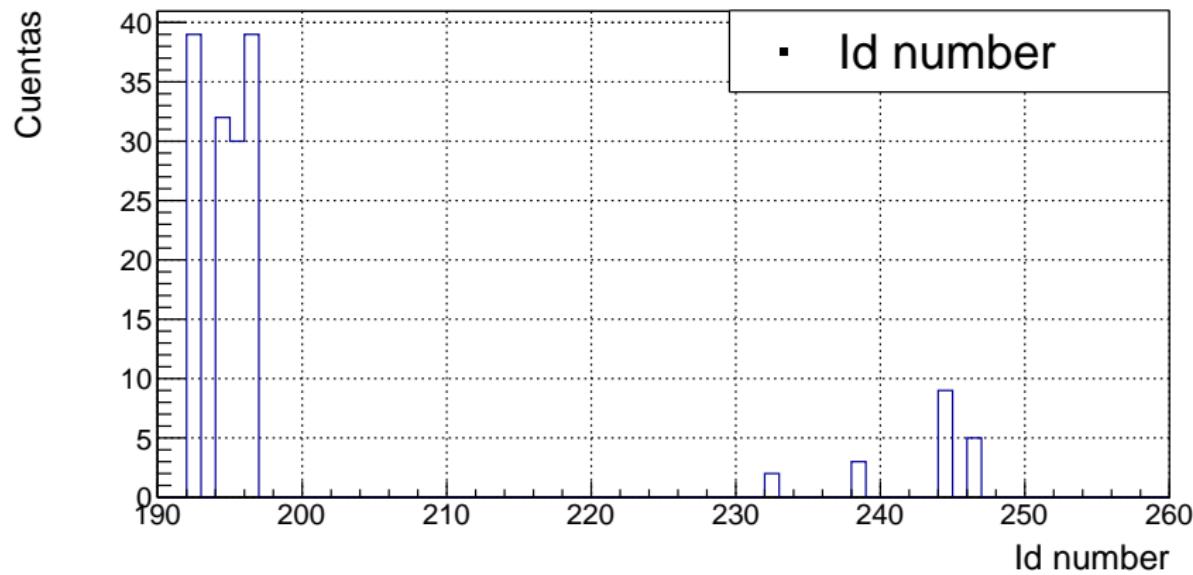


Figure: Channel histogram

# PETSYS. Id. Channel

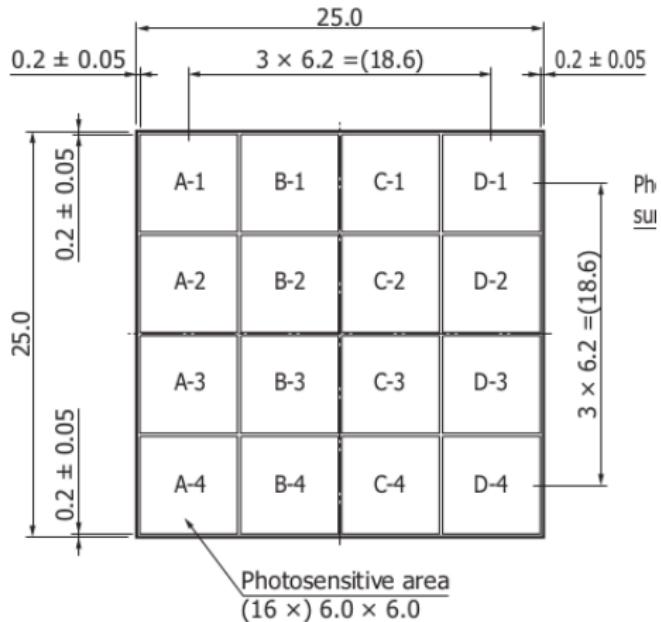


Figure: SiPM schematic

# PETSYS. Id. Channel

Connector 1		Connector 2	
Pin no.	Connection	Pin no.	Connection
40	K (D-1)	41	K (C-1)
39	K (D-1)	42	K (C-1)
38	NC	43	NC
37	A (D-1)	44	A (C-1)
36	A (D-1)	45	A (C-1)
35	A (D-1)	46	A (C-1)
34	A (D-1)	47	A (C-1)
33	NC	48	NC
32	K (D-1)	49	K (C-1)
31	K (D-1)	50	K (C-1)
30	K (D-2)	51	K (C-2)
29	K (D-2)	52	K (C-2)
28	NC	53	NC
27	A (D-2)	54	A (C-2)
26	A (D-2)	55	A (C-2)
25	A (D-2)	56	A (C-2)
24	A (D-2)	57	A (C-2)
23	NC	58	NC
22	K (D-2)	59	K (C-2)
21	K (D-2)	60	K (C-2)
20	K (D-3)	61	K (C-3)
19	K (D-3)	62	K (C-3)
18	NC	63	NC
17	A (D-3)	64	A (C-3)
16	A (D-3)	65	A (C-3)
15	A (D-3)	66	A (C-3)
14	A (D-3)	67	A (C-3)
13	NC	68	NC
12	K (D-3)	69	K (C-3)
11	K (D-3)	70	K (C-3)
10	K (D-4)	71	K (C-4)
9	K (D-4)	72	K (C-4)
8	NC	73	NC
7	A (D-4)	74	A (C-4)
6	A (D-4)	75	A (C-4)
5	A (D-4)	76	A (C-4)
4	A (D-4)	77	A (C-4)
3	NC	78	NC
2	K (D-4)	79	K (C-4)
1	K (D-4)	80	K (C-4)

Note: A=Anode, K=Cathode

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Figure: Relation between channels and SiPMs

# PETSYS. Id. Channel

- Pixel 1:

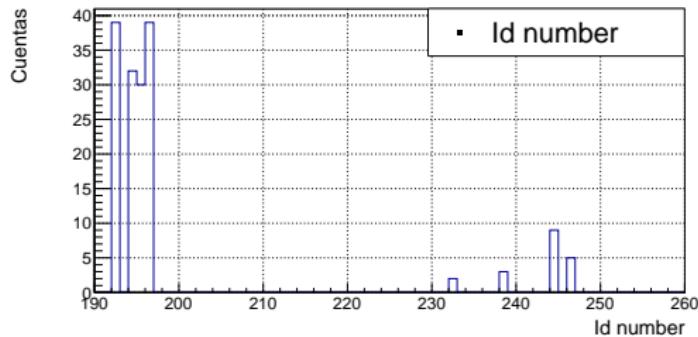


Figure: Channel histogram

This system work

We can identify the channel attached to each SiPM.

# PETSYS. Id. Channel

- Pixel 1:

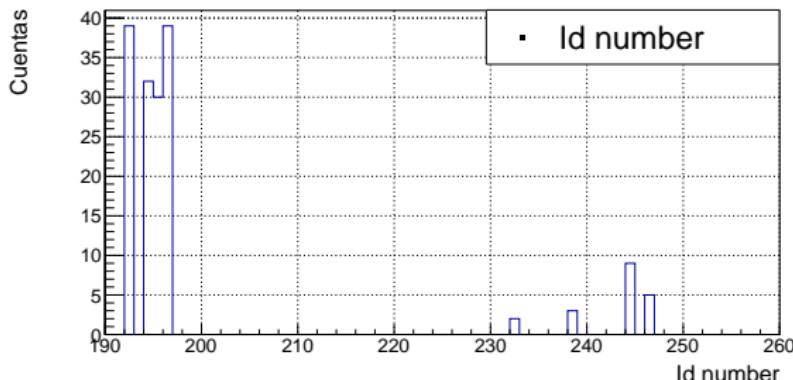


Figure: Channel histogram

## Problem

There is 1 channel, which correspond to the 15 SiPM, that has counts in all the cases.

# PETSYS. Id. Channel

- Channel identification:

SiPM num.	Channel num.	SiPM num.	Channel num.
1	192, 194, 195, 196	9	236, 241, 247, 251
2	193, 197, 199, 201	10	227, 231, 235, 237
3	198, 200, 206, 212	11	225, 229, 233, 239
4	202, 208, 214, 218	12	226, 230, 242, 243
5	203, 205, 209, 216	13	248, 250, 252, 254
6	213, 215, 219, 221	14	245, 249, 253, 255
7	207, 211, 217, 223	15	232, 238, 244, 246
8	204, 210, 220, 222	16	224, 228, 234, 240

Table: Channel identification

# PETSYS. Id. Channel

- Channel identification:
  - ▶ Channels apparently messy.
  - ▶ I try to look for some relation between channels → EXCEL

# PETSYS. Scintillator Crystal

- I have disassambled and reassambled and I obtain this double peak again.
  - ▶ Emission spectrum of this crystal ( $CaF_2$ )
  - ▶ Their size

# PETSYS. Polishing effect

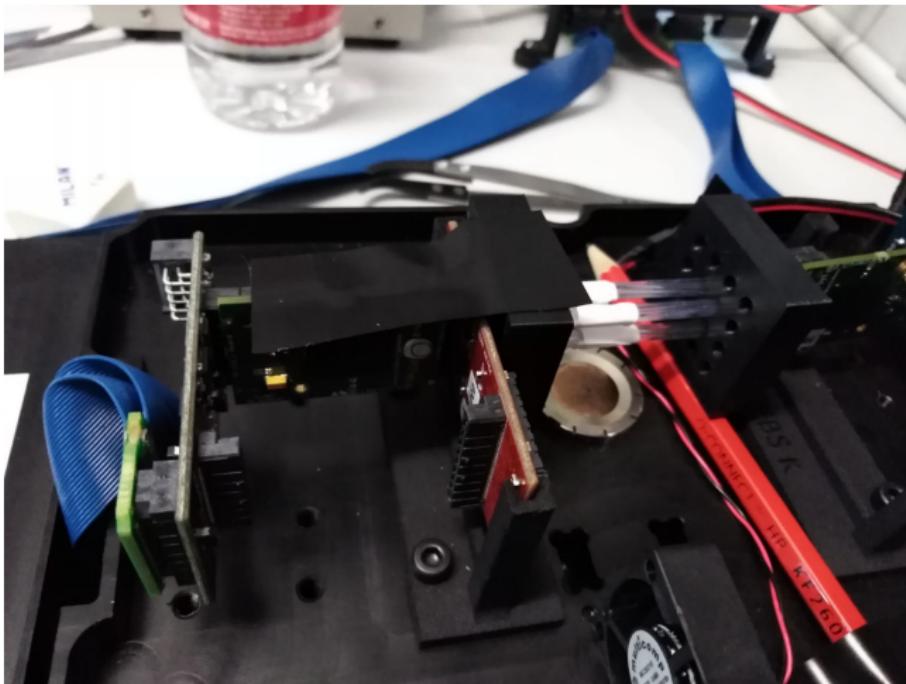
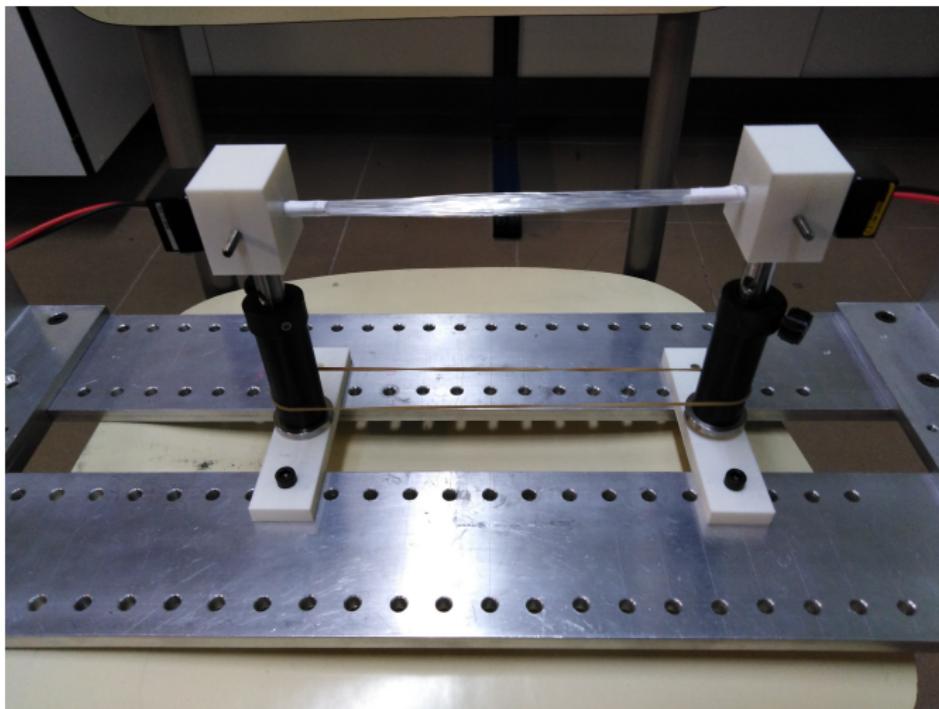


Figure: 4 bunch with 8 fibers each one. Pixels 6, 7, 10, 11

## PETSYS. Other possible studies

- I have cutted and polished near to 600 fibers of 5 mm.
- Any idea?

# LARAM. Polishing effect with PMTs



**Figure:** Bunch with 25 fibers with 15 cm

# LARAM. Polishing effect with PMTs

First try

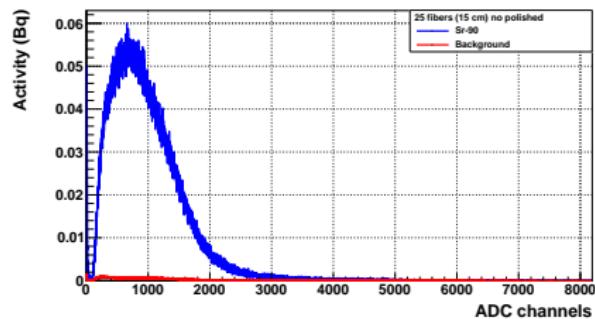


Figure: Sr-90 with fibers not polished

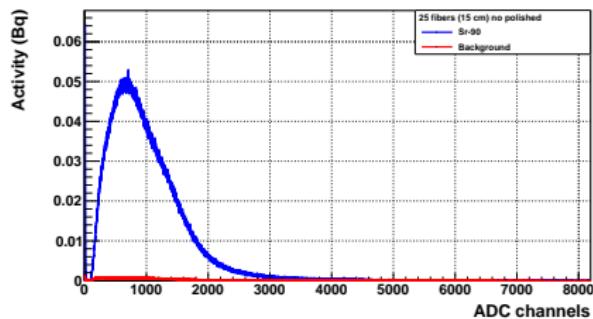


Figure: Sr-90 with fibers polished

# LARAM. Polishing effect with PMTs

First try

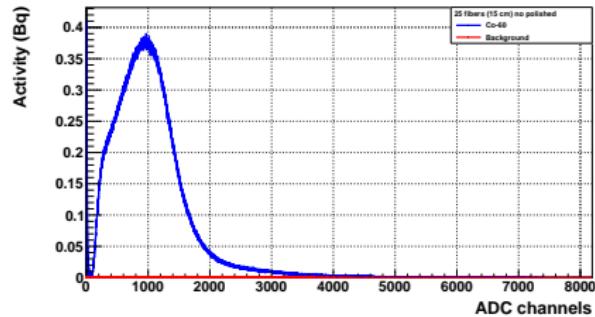


Figure: Co-60 with fibers not polished

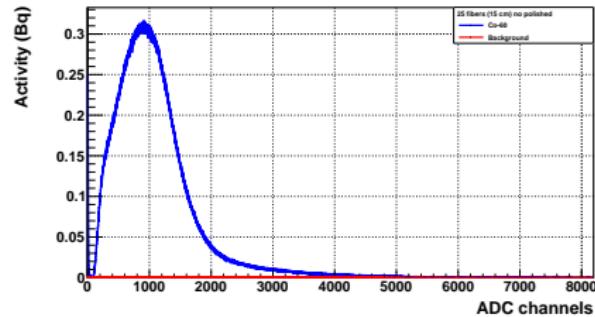


Figure: Co-60 with fibers polished

# LARAM. Polishing effect with PMTs

First try

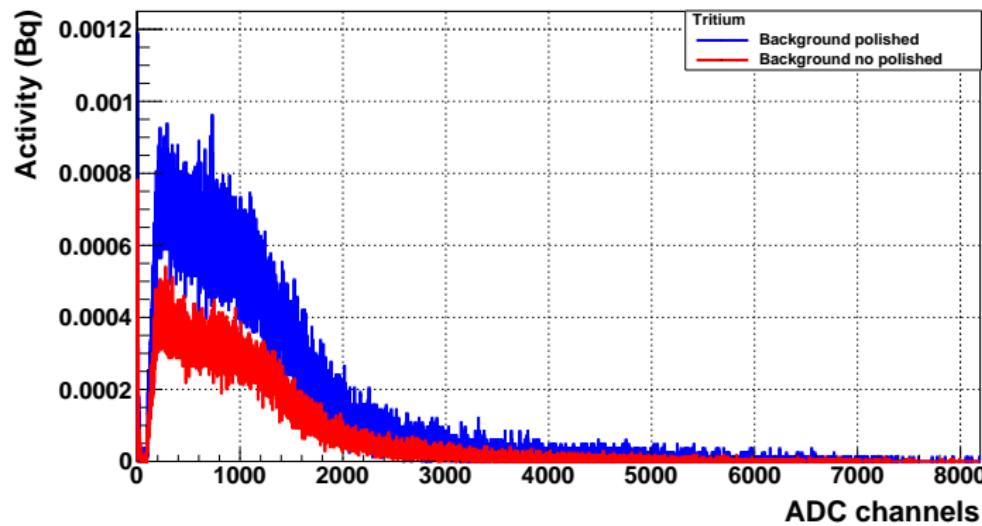


Figure: Bunch with 25 fibers with 15 cm

# LARAM. Polishing effect with PMTs

Second try (same bunch)

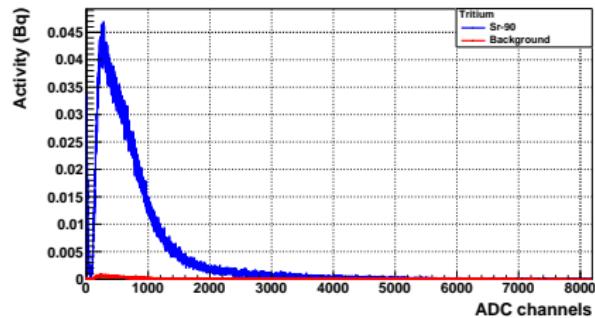


Figure: Sr-90 with fibers not polished

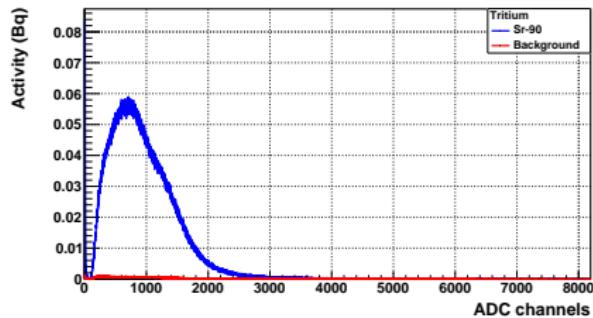


Figure: Sr-90 with fibers polished

# LARAM. Polishing effect with PMTs

Second try

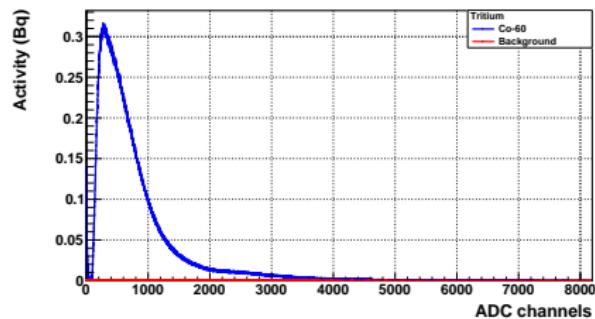


Figure: Co-60 with fibers not polished

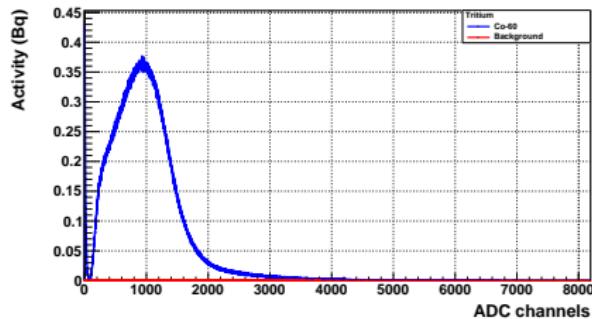


Figure: Co-60 with fibers polished

# LARAM. Polishing effect with PMTs

Second try

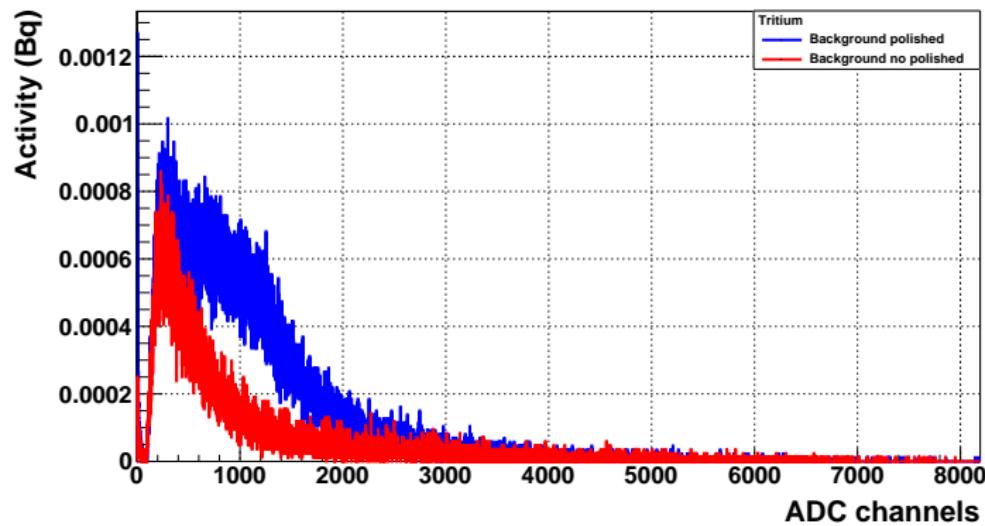


Figure: Bunch with 25 fibers with 15 cm

# LARAM. Polishing effect with PMTs

Second try

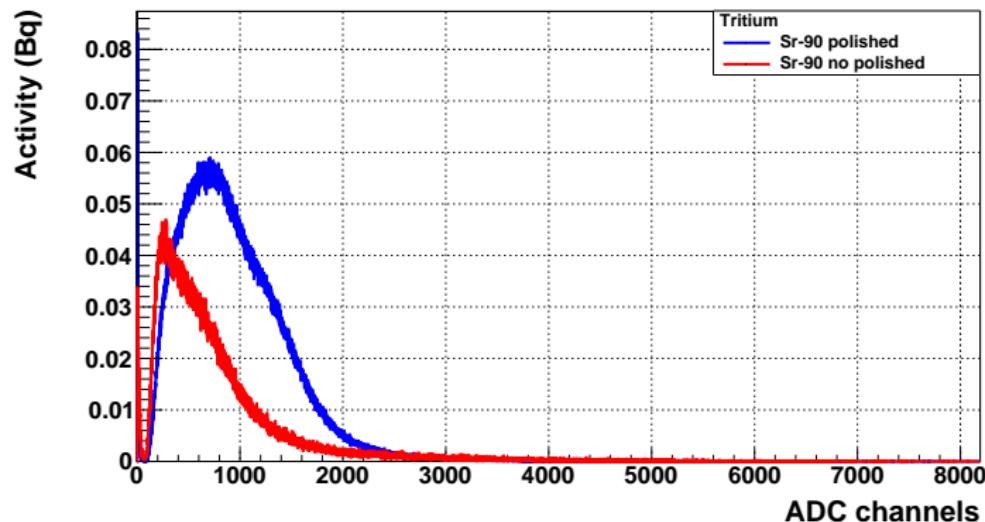


Figure: Bunch with 25 fibers with 15 cm

# LARAM. Polishing effect with PMTs

Second try

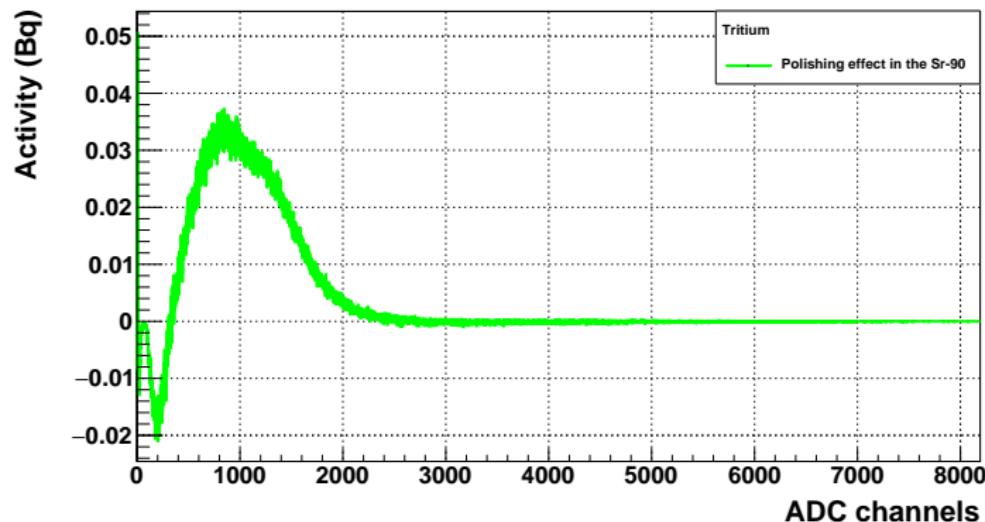


Figure: Bunch with 25 fibers with 15 cm

# LARAM. Polishing effect with PMTs

Second try

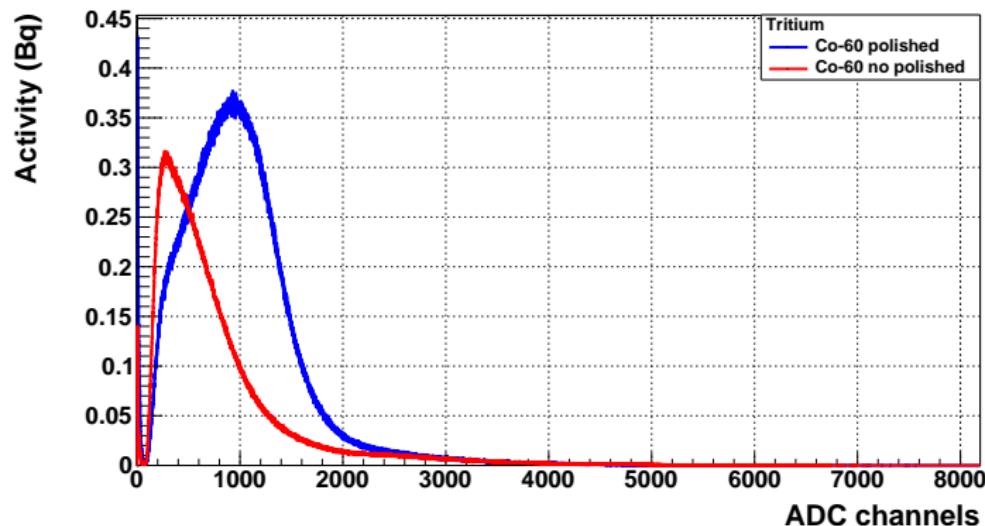


Figure: Bunch with 25 fibers with 15 cm

# LARAM. Polishing effect with PMTs

Second try

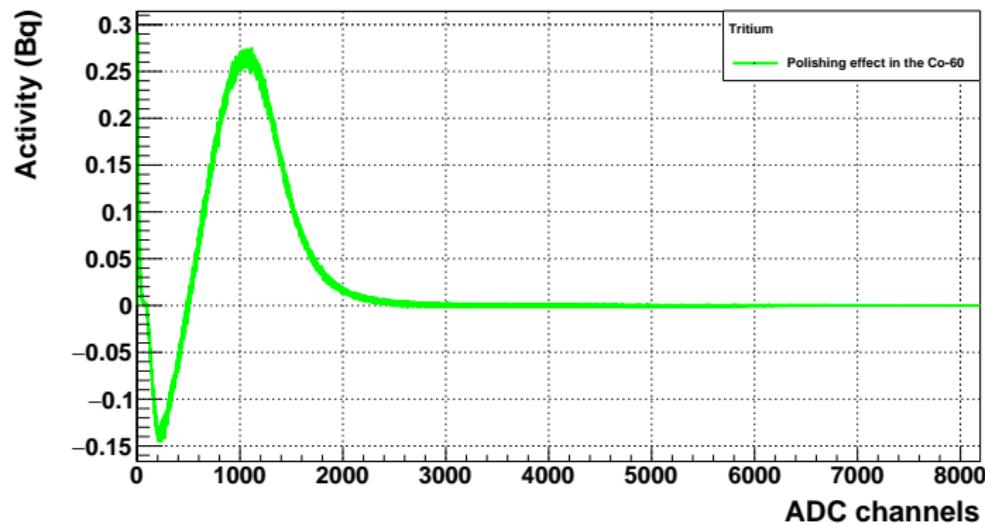


Figure: Bunch with 25 fibers with 15 cm

# LARAM. Polishing effect with PMTs

Second try

Source	Not polished	Polished
Sr-90	33	64
Co-60	243	424

Table: Counts/second due to each source

## LARAM. Future studies

- I want to quantify the effect of the clean process in the ICMOL room (Without ozone machine). I don't hope to obtain a better results but neither worse results.
- I want to quantify the damage due to the ozone machine (0, 30 seg, 1 min, 2 min, 5 min).
- I want to obtain the measuring for several lengths of the fibers (5 cm, 10 cm, 15 cm and 20 cm). I can do it with this new setup.
- other ideas?

# TRITIUM-IFIC 2. Coincidence effect

MACRO

## TRITIUM-IFIC 2. Effect to the lead

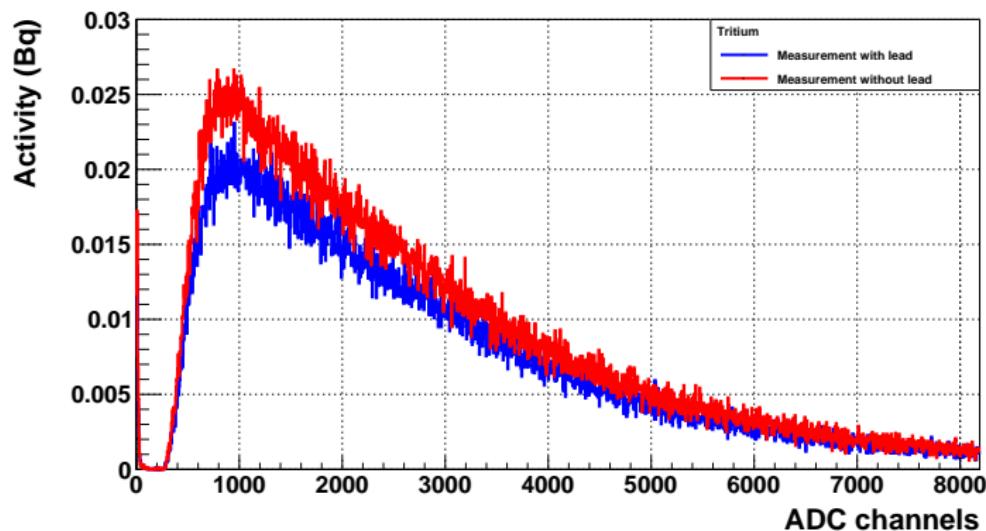


Figure: Bunch with 25 fibers with 15 cm

## TRITIUM-IFIC 2. Effect to the lead

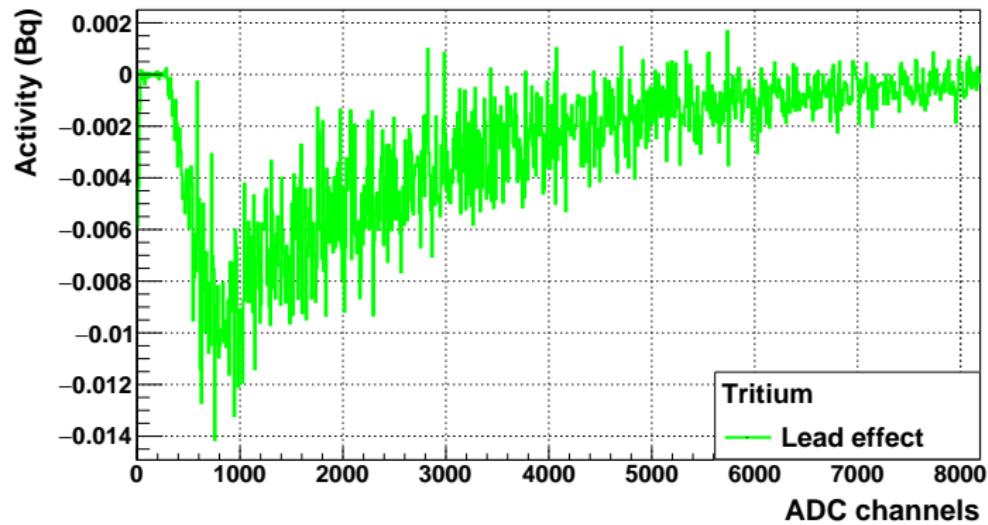


Figure: Bunch with 25 fibers with 15 cm

## TRITIUM-IFIC 3.

- I have managed the purchase of teflon, PMMA windows, belts and I/O water.
- The teflon have already arrived. The mechanism has started with the construction of this prototype. He is close to finish.
- I bought I/O water pieces from TEBYC company.
- I bought belts from TECNIMAN company.
- I have the PMMA windows from Hermanos Monge company (free).
- The best idea is build two detectors (one for the background and other for the tritium signal).
- I have 600 fibers polished. I will polish 600 fibers more.
- I have to obtain the transmision spectrum for this new windows.