# SET-UP OF THE SOFIA EXPERIMENT

## August 2012 - experiment s415

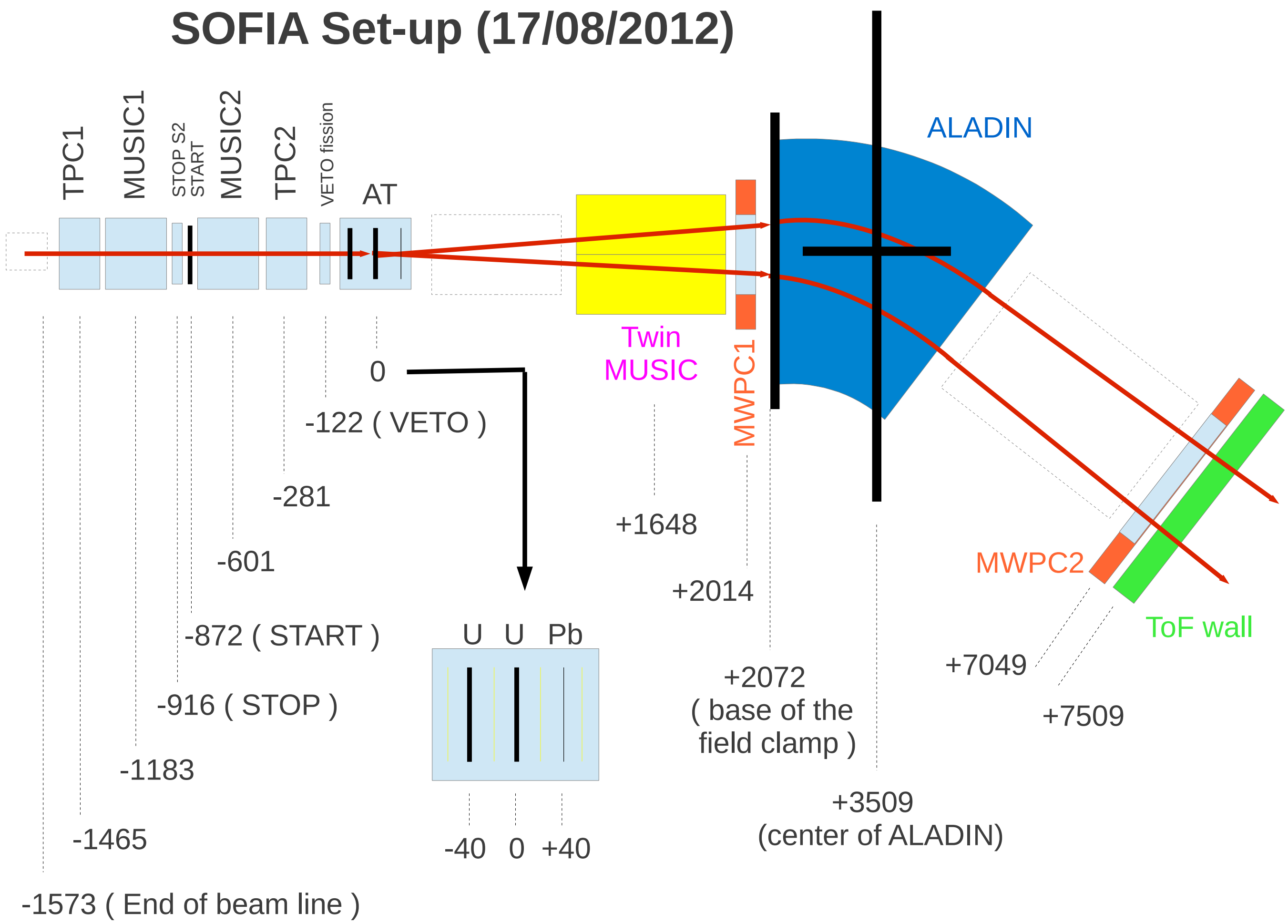


Figure 1: scheme of the SOFIA experiment (courtesy of Eric and Guillaume)

At S2 :

→ plastic 1 (dimension 3.2×300×1 mm$^3$): *START of incoming beam*

At cave C :

→ FRS TPC 1: *position of incoming beam*
→ FRS TUM MUSIC 1: $\Delta E$ *incoming beam*
→ plastic 2 (200×50×1 mm$^3$): *STOP of incoming beam*
→ plastic 3 (50×32×1.5 mm$^3$): *START of fission fragments*
→ FRS TUM MUSIC 2: $\Delta E$ *incoming beam*
→ veto segmented plastic (×50×0.250 mm$^3$ each): fission event rejection
→ FRS TPC 2 : *position of incoming beam on target*
→ Active Target (2 U targets + 1 Pb target)
→ *vaccum beam pipe*
→ TWIN-MUSIC: $\Delta E$ + $\theta_{FF}$
→ MWPC1 (Stan): *second position measurement*
→ *ALADIN*
→ *He-filled beam pipe*
→ MWPC2 (Oliver): *third position measurement*
→ ToF Wall: *STOP of fission fragments*

## plastic 1 @ S2, $3.2\times300\times1$ mm$^3$, START Incoming Beam

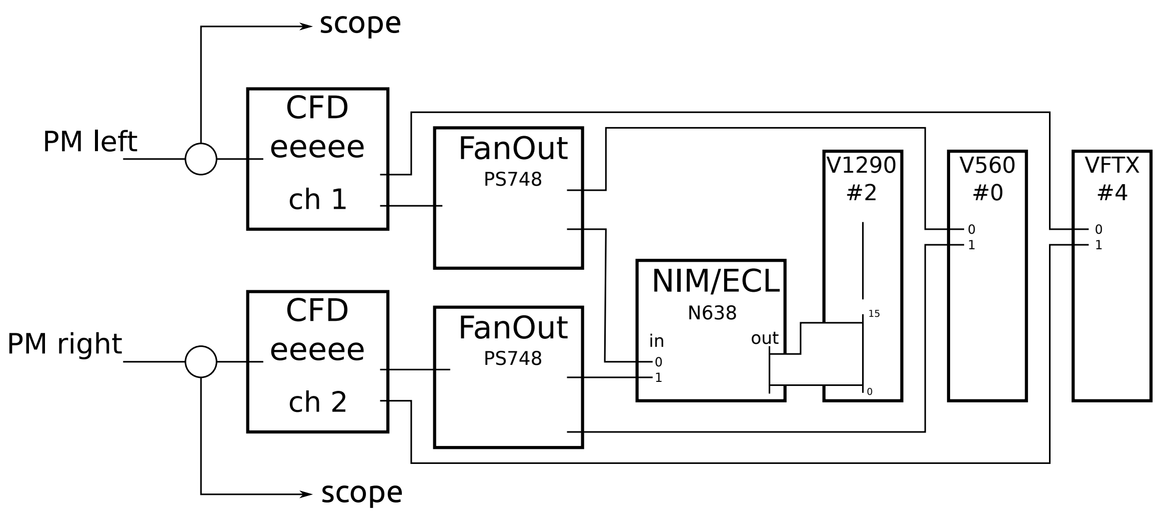


Figure 2: Electronic Scheme of the plastic at S2 for starting the ToF of the secondary beam

▷ *2 PMTs:* HAMAMATSU YYYY, HV = 1___ V.

▷ *CFD PS715:* NumSerie eeeee channel 1 (threshold) and 2 (threshold).

▷ *TDC-V1290:* start of the secondary beam ToF. It should be synchronised with the V1290 at cave C (same external clock @ 40 MHz).

▷ *scaler-V560:* to measure the counting rate at S2.

▷ *VFTX:* to measure precisely the position of the secondary beam at S2.

▷ *DAQ:* Moreover, this VME crate should be ran independantly and not as a slave branch of the master crate located at cave C. To keep synchronised both acquisition system, we should use TRIDI module (see Fig??).

**TPC 1 and TPC 2:**

**MUSIC 1 and MUSIC 2:**

## plastic 2 @ cave C, 50×200×1 mm$^3$, STOP Incoming Beam

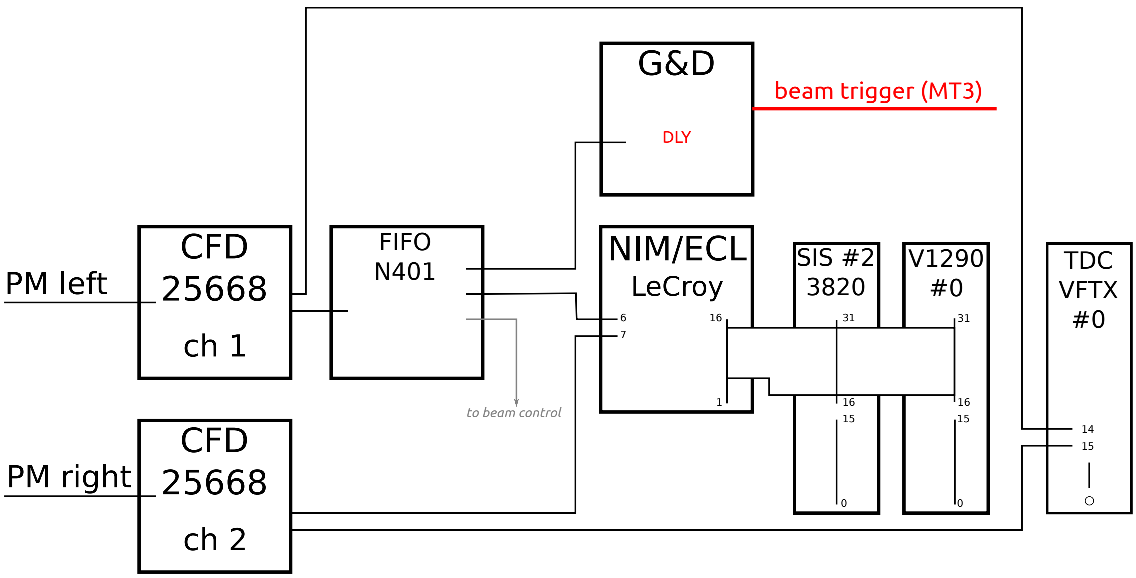


Figure 3: Electronic Scheme of the plastic at cave C for stoping the ToF of the secondary beam

- ▷ *2 PMTs:* HAMAMATSU YYYY, HV = 1___ V.
- ▷ *CFD PS715:* n° 25668, channel 1 and 2, threshold at -100 mV.
- ▷ *Gate and Delay PS:* MT3 is delayed of ___ ns to arrive 5 to 10 ns after the MT1.
- ▷ *TDC-V1290:* This will give the stop signal of the secondary beam.
- ▷ *TDC-VFTX:* This will give a high precision position in the plastic.
- ▷ *scaler-SIS3820:* counting rate of this plastic on channels 24 and 25 on this scaler.

The STOP plastic is used to provide the **beam trigger** for the calibration runs which need to be done with beam.

## plastic 3 @ Cave C, 3.2×50×1.5 mm$^3$, quenched, START Fission Fragments

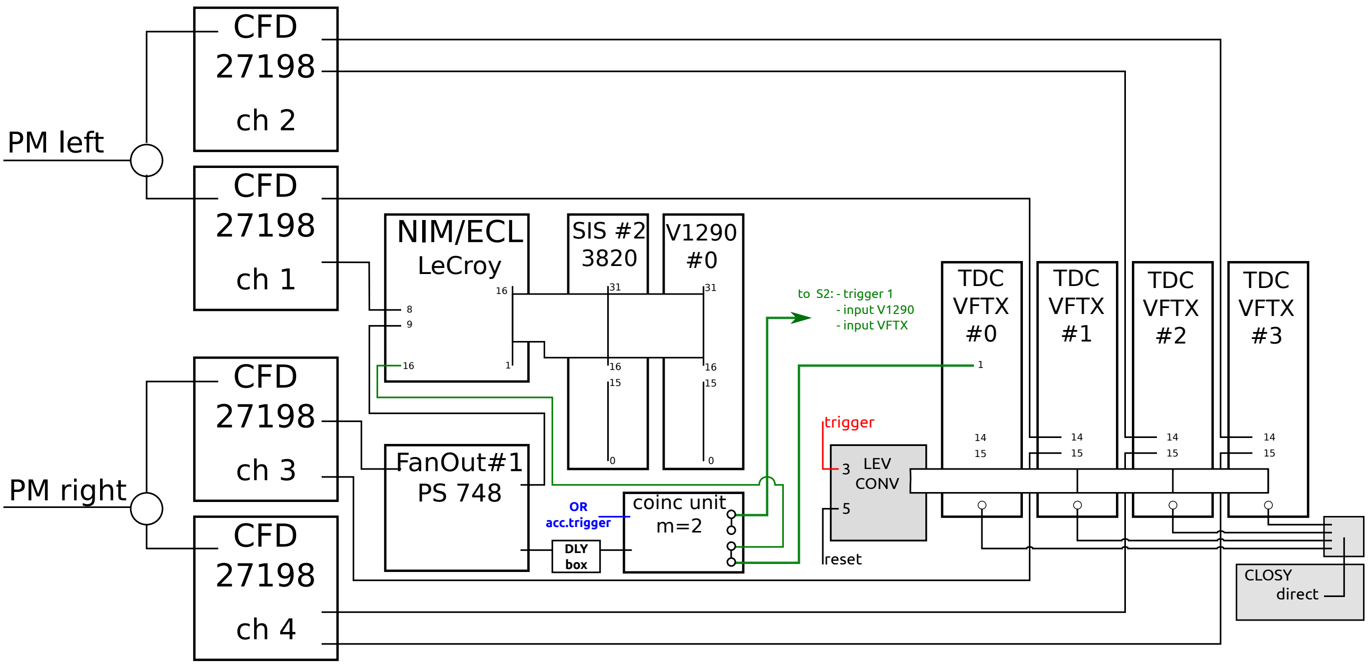


Figure 4: Electronic Scheme of the plastic at cave C for starting the ToF of the fission fragments

▷ *2 PMTs:* HAMAMATSU YYYY, HV = 1___ V.
▷ *CFD PS715* n° 27198, channels 1 and 2 for the left side, channels 3 and 4 for the right. Threshold at -100 mV
▷ *COINC PS755* only used to changed NIMbar signal into NIM
▷ *scaler-SIS3820:* counting rate of this plastic on channels 26 (left) and 27 (right) on this scaler.
▷ *TDC-V1290:* reference time for the drift time in the Twin-MUSIC.
▷ *TDC-VFTX:* start of the fission fragment ToF.

We get the four VFTX modules with an external clock (CLOSY clock). Start will be duplicated in the last three VFTX module, as shown in the scheme. For VFTX 0 and VFTX 1, ToF should be calculated versus the start of VFTX 1. In VFTX 0 (see fig 3), the last 2 channels are dedicated to the STOP incoming beam.

**If the VME crate is re-booted it is mandatory to send a NIM signal into the input 5 of the LEVCONV. This is necessary to synchronized all the clock counts of the VFTX.** The trigger of the module is going through the input 3 of the LEVCONV. The searching window is defined from this signal. The LEVCONV needs a +12V voltage. Never disconnect the +12V, if the +220V is still connected. This would break the LEVCONV.

## veto:

We want to reject at the acquisition level, events where fission occures prior to the Active Target. Therefore we use a segmented plastic. If both segment are hitted, this means a fission already occured before, and this event should be rejected from the acquisition. in order to decrease the total dead time.

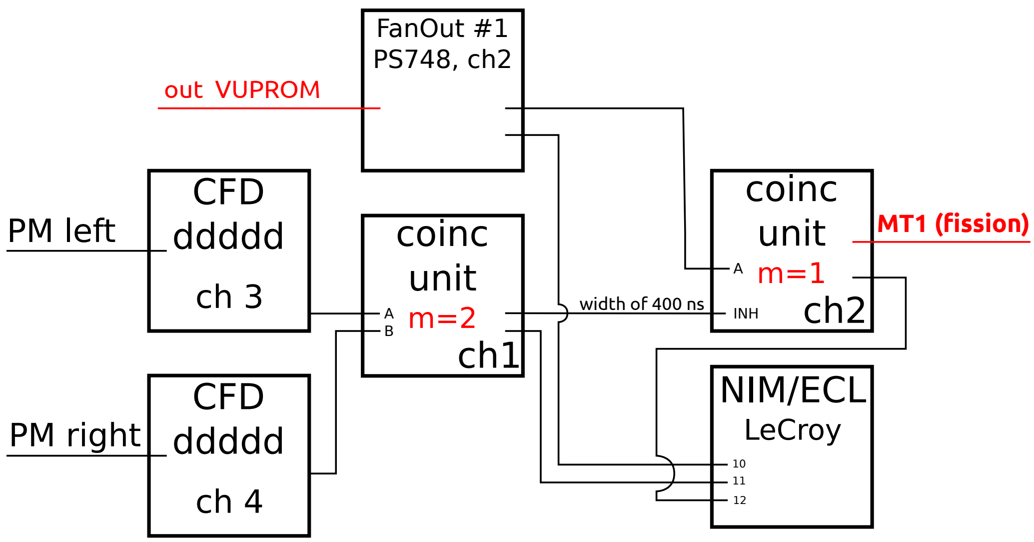


Figure 5: Electronic Scheme of the veto plastics. CHECK THE FCT (other option)

- ▷ *2 PMTs:* HAMAMATSU YYYY, HV = 1___ V.
- ▷ *CFD PS715* n° 25668, channels 4 and 5, threshold at -100 mV.
- ▷ *coincidence unit PS 755:* detection of two simultaneus fragment in the veto.

- ▷ width of the signal after the CFD : 100 ns
- ▷ width of the signal after the coincidence module : 400 ns

## Active Target:

Active target has 4 anodes and 3 target-cathods (cf. scheme in figure ). In total the active target has two thick uranium targets (0.6 mm) and 1 thin lead target (0.125 mm). The gas used is P10.

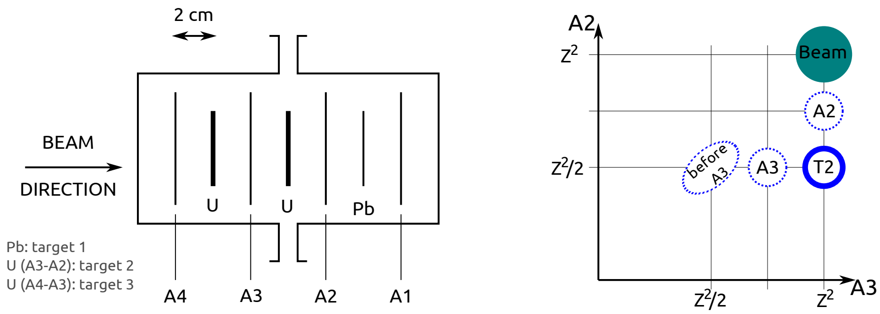


Figure 6: Schemes of the active target (left) and expected type of result (right).

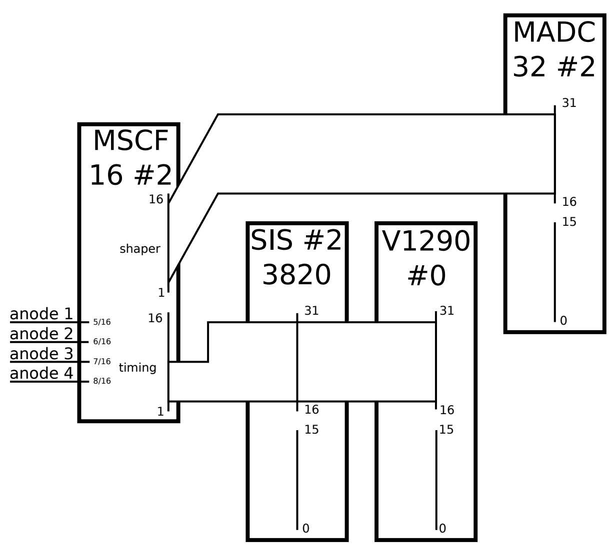


Figure 7: Electronic Scheme for the active target. The channel numbering for the MSCF-16 is going from 1 to 16, whereas for the VME modules it is going from 0 to 15.

▷ *4 anodes:* are connected to the ground and have PA with gain of 1.5V/pC (A1 and A4) and 1V/pC (A2 and A3).
▷ *3 cathodes (targets):* are polarised at HV = -280V.
▷ *MADC-32:* measurement of the energy lost by the beam or fission fragments between 2 electrodes.
▷ *SIS3820:* counting rate on each of the 4 anodes.
▷ *V1290:* connected, but not use in the analysis.
▷ *for the cabling,* details are written in the table 3.

## TWIN:

TWIN-MUSIC has 10 anodes (and 2 screen anodes not read out) on each side: odd numbers are attribuated to the left side, whereas even numbers are for the right side. The gas mixure used is composed by: Ne (84.7 %), $CH_4$ (12 %), $CO_2$ (3 %) and $N_2$ (0.3 %).

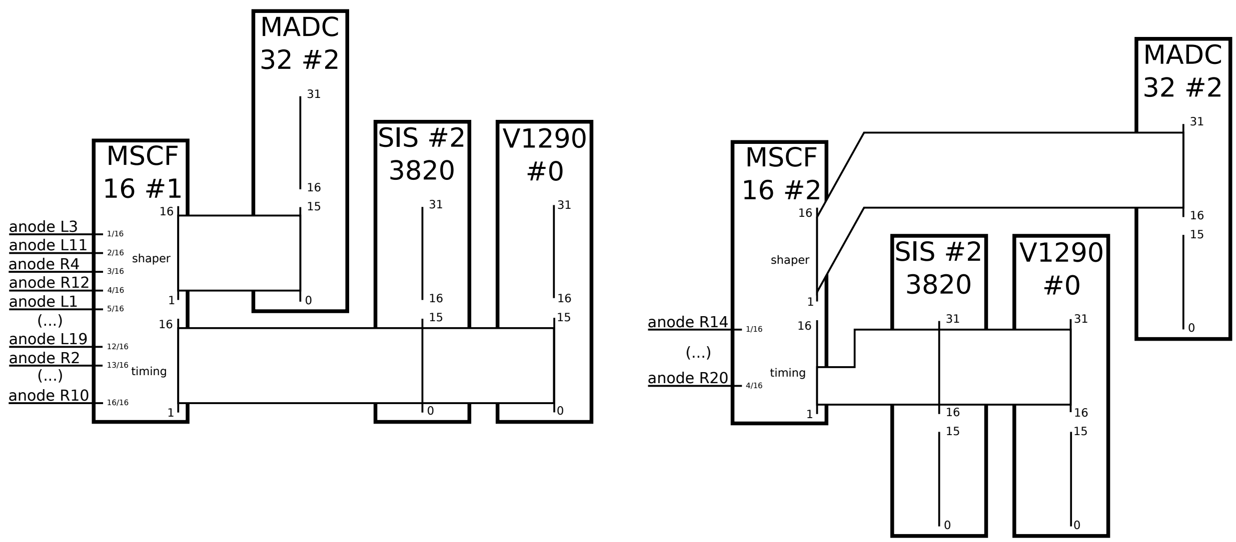


Figure 8: Electronic Scheme for the TWIN-MUSIC. The channel numbering for the MSCF-16 is going from 1 to 16, whereas for the VME modules it is going from 0 to 15.

- ▷ *cathode:* is polarised at HV = -4000 V.
- ▷ *anodes:* are polarised at HV = +400 V.
- ▷ *MADC-32:* measurement of energy deposit in the TWIN.
- ▷ *SIS3820:* counting rate on each anode.
- ▷ *V1290:* electron drift time in the TWIN.
- ▷ *for the cabling,* details are written in the table 3.

## MWPC 1 and MWPC2:

▷ *Mapping of the first chamber (MWPC1, Stan):* gassiplex are located as indicated in the figure 9 and the mapping as written in the table 7. Please note that this mapping is valid if the MWPC1 is mounting with HV distribution card on the right looking at the beam direction (as indicated in the figure 9)

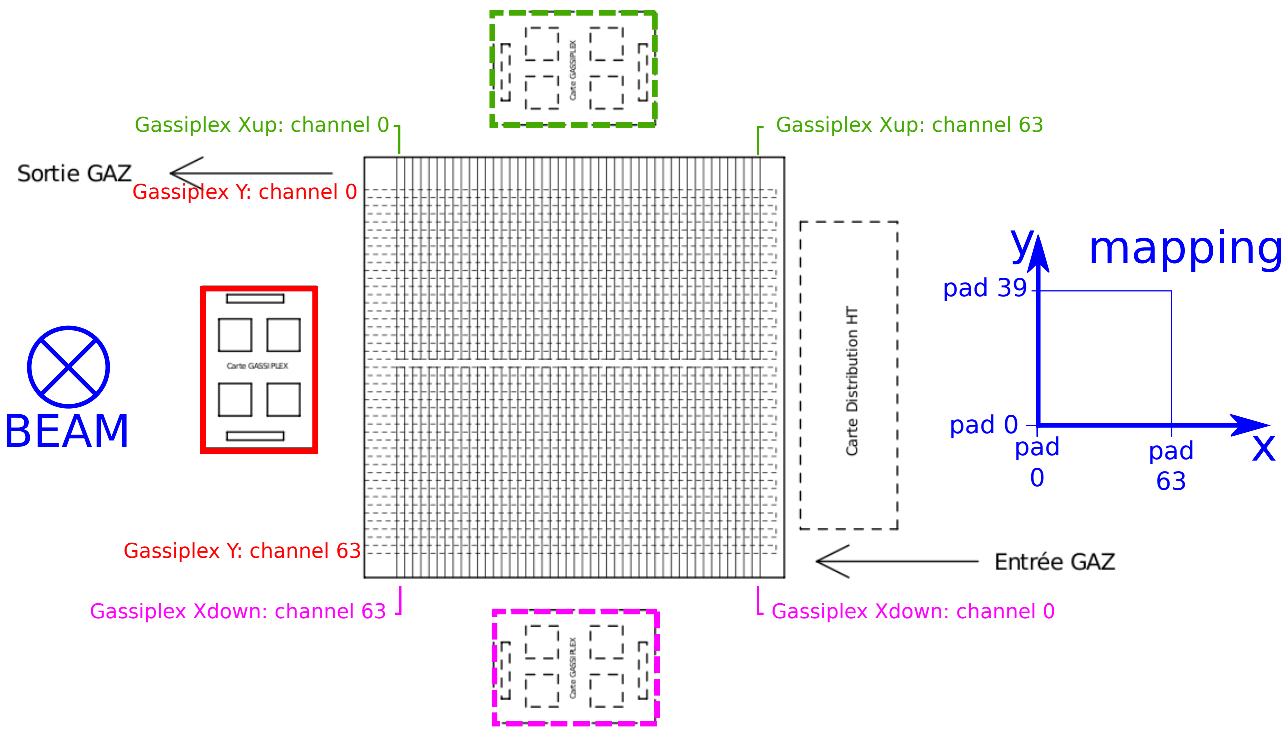


Figure 9: Drawing of the MWPC1

▷ *Mapping of the second chamber (MWPC2, Oliver):* The gassiplex are located as indicated in the figure 11 and the mapping as written in the tables 8 and 9 Please note that, if the 3 distribution cards for the HV are on the right side, when looking in the beam direction (as it was done during the FRS test in May), the pad numbers (which go from 0 to 288) will increase from right to left.

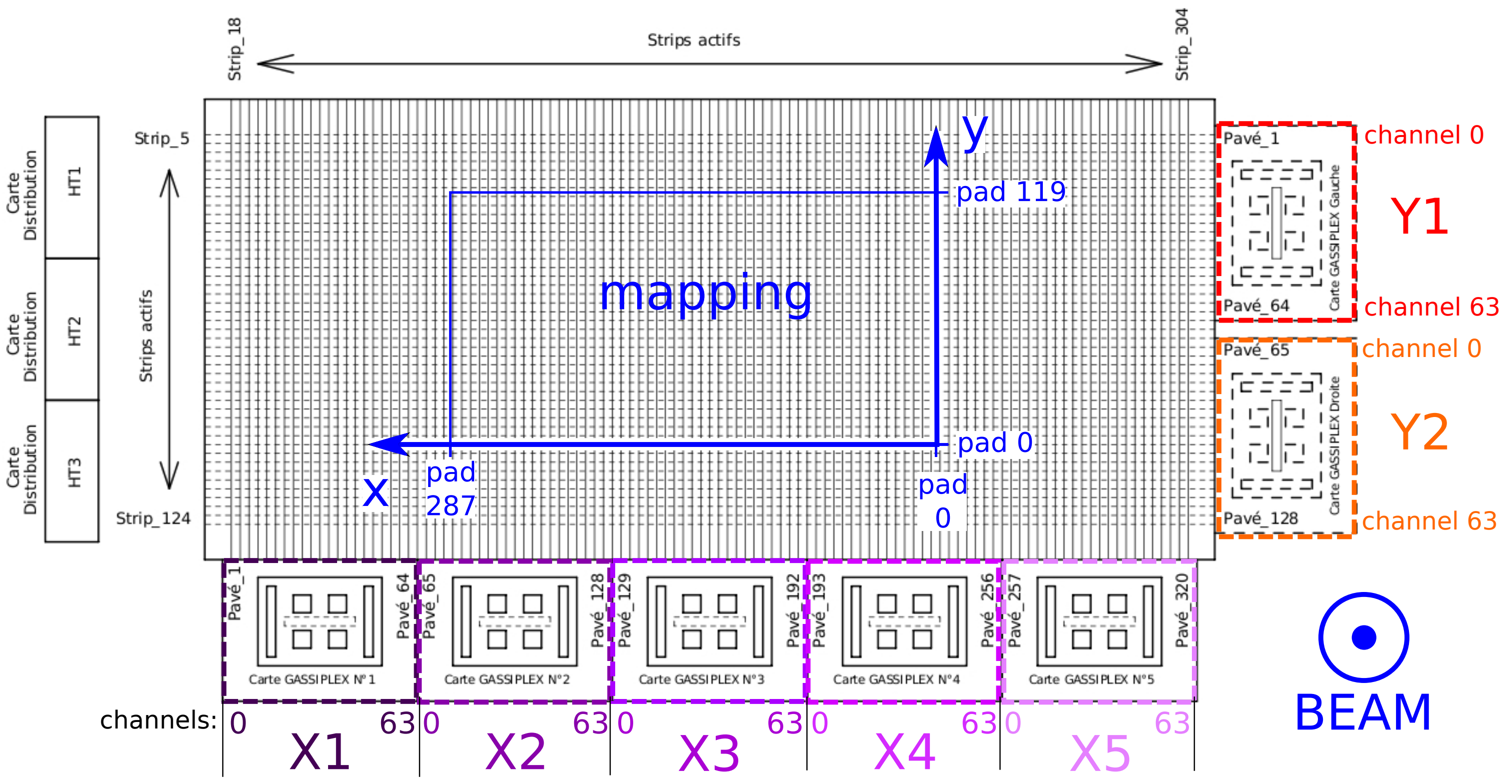


Figure 10: Technical drawing of the MWPC2, with the gassiplex channel order.

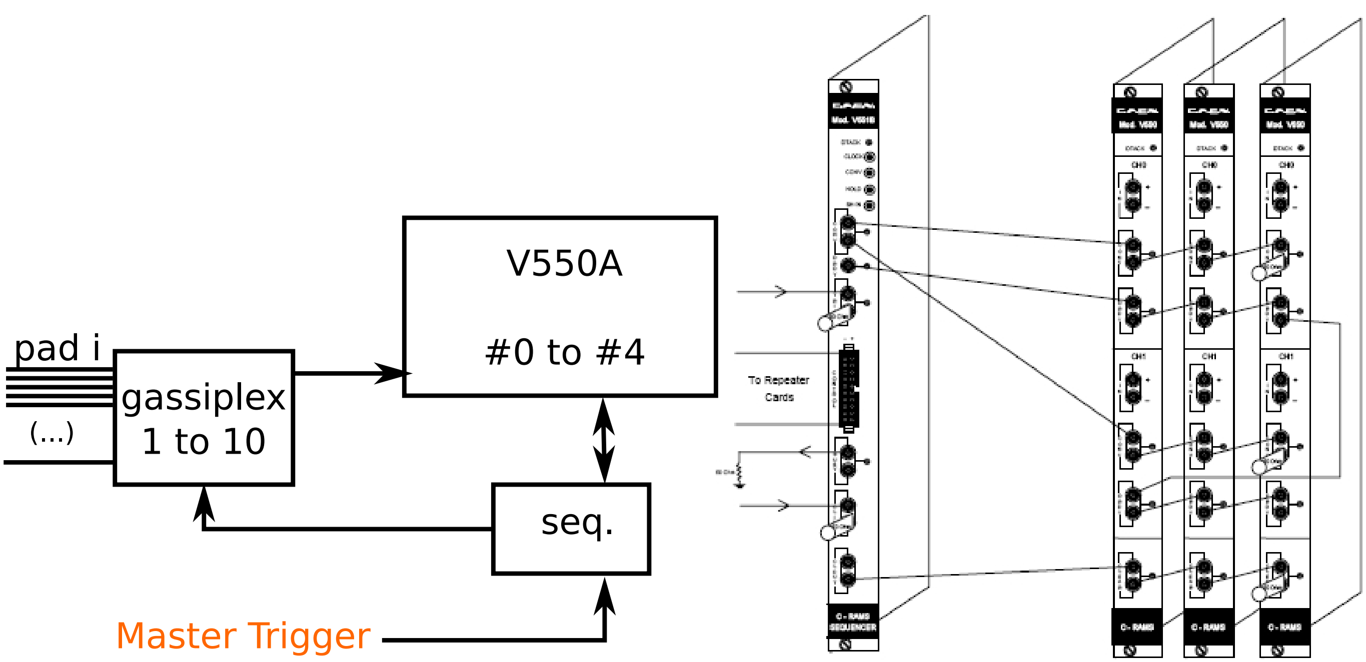


Figure 11: Electronic Scheme for MWPCs.

## ToF wall:

The ToF wall has 28 plastics of $32 \times 50 \times 600$ mm$^3$ numbered from left to right looking at the beam direction. The electronic scheme is represented in the figure 12 and the cabling is described in the tables 4 and 5.

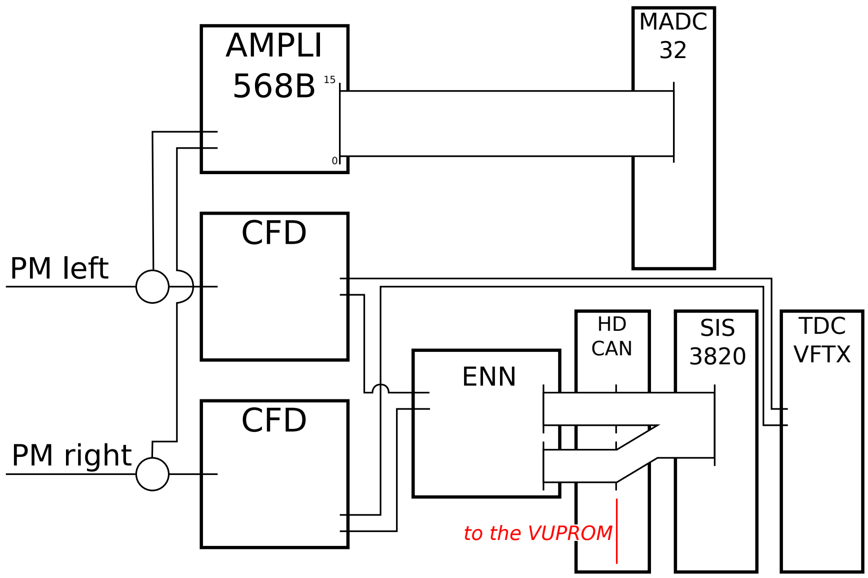


Figure 12: Electronic scheme for the ToF wall. This scheme is repeted 28 times, for each plastic.

**It is quite important to follow the order of cabling described in the tables 4 and 5 especially for the inputs on the ENN. Indeed the outputs go to the HDCAN1 whose outputs are connected to the VUPROM. Its FPGA is programmed in order to deliver a trigger if one pair of PM fired + 1 pair or 1 PMT. The pair is recognised to be two following channels. The first pair is starting from the electronic channel number 0 of the VUPROM, etc...**

## Trigger logic and gates at cave C:

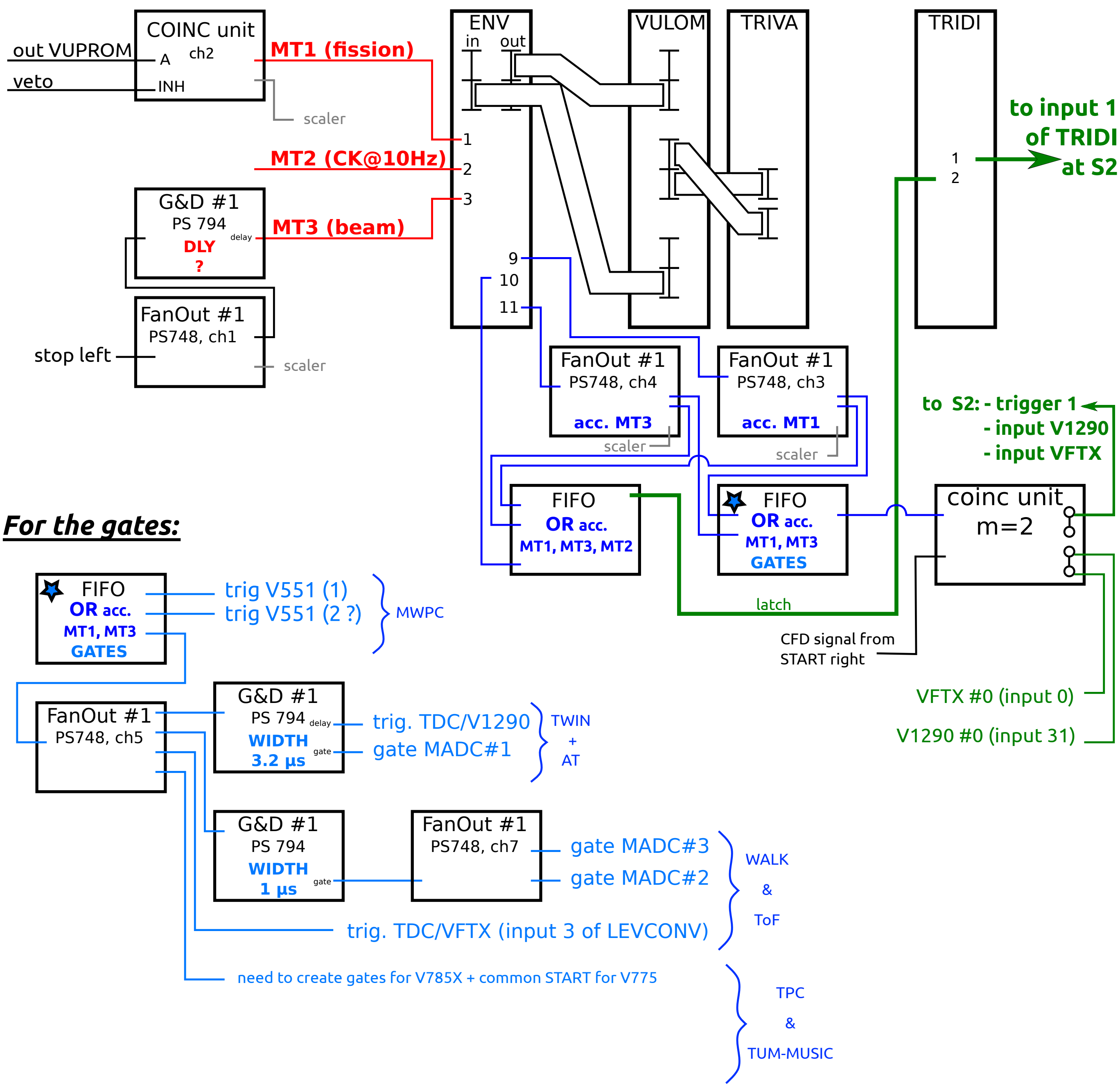


Figure 13: Electronic scheme of the trigger logic and gates of the data acquisition modules.

A common signal will be sent to one input of V1290 and VFTX at cave C and S2. This is how the synchronisation will be done. This signal is indicated as synchro S2.

Here is a summary of the last channels of the scaler. Most of these channels are indicated in light gray in the figure 13.

| **detector channel** | **LeCroy** | **SIS3820** |
|---|---|---|
| TWIN Right 14 | | 16 |
| TWIN Right 16 | | 17 |
| TWIN Right 18 | | 18 |
| TWIN Right 20 | | 19 |
| **MT3** STOP left | **6** | **21** |
| STOP right | 7 | 22 |
| START left | 8 | 23 |
| START right | 9 | 24 |
| out VUPROM (fission in ToFW) | 10 | 25 |
| coinc VETO (fission prior to AT) | 11 | 26 |
| **MT1** (VUPROM - VETO) | **12** | **27** |
| **accepted MT1** | **13** | **28** |
| **accepted MT3** | **14** | **29** |
| **acc. MT & STARTright** | 31 | 20 |

Table 1: channels for the LeCroy / SIS 3820 n°2 at cave C

## Trigger logic and gates at S2:

The accepted trigger will go through amplifier and should be distributed to V1290, VFTX and to the input 1 of the TRIVA.

## List of NIM modules:

At S2 : 1 NIM crate

- 1 CFD PS715
- 1 convertor NIM/ECL LeCroy
- 1 HT module for the PMTs
- 1 FanOut

At cave C - SOFIA set-up :

- 13 CFD PS715
- 4 AMPLI N568B
- 2 MSCF-16
- 1 NIM/ECL N638
- 4 NUM/ECL ENN
- 1 coincidence unit PS755
- 1 Gate and Delay generator PS795
-

At cave C - FRS set-up :

-
-

## List of VME modules:

At S2 : 1 VME crate

- 1 RIO4 (R3-52, from LAND)
- 1 TRIVA
- 1 ENV (send MT to TRIVA and get accepted MT from TRIVA)
- 1 TRIDI (synchronisation of the S2 DAQ with cave C)
- 1 scaler CAEN V560
- 1 TDC - VFTX: position secondary beam, *searching window =*
- 1 TDC V1290: start ToF secondary beam, *searching window =*

At cave C : 3 VME crates

| **MASTER vme_0**<br>Wiener *CEA*<br>trigger + Tof + Walk + scalers | **SLAVE 1 vme_1**<br>Wiener *LAND*<br>AT + TWIN + MWPC + scaler | **SLAVE 2 vme_2**<br>Wiener *CEA*<br>FRS TUM-MUSIC + TPC |
|---|---|---|
| - 1 RIO4 (r4-28) *slot 1*<br>- 1 TRIVA *slot 2*<br>- 1 VULOM *slot 3*<br>- 1 ENV *slot 4*<br>- 1 TRIDI *slot 5* | - 1 RIO4 (r4-33)<br>- 1 TRIVA | - 1 RIO4 (r4-38)<br>- 1 TRIVA |
| - 1 VUPROM<br>- 2 HDCAN1<br>- 2 SIS3820<br>- 4 TDC/VFTX<br>- 2 MADC-32 | - 1 SIS3820<br>- 1 V1290<br>- 1 MADC-32<br>- 1 V551<br>- 5 V550 | - 1 V775<br>- 1 V785N<br>- 1 V785A |

Table 2: VME crates at cave C. We should also add the fifth for LAND, if used.

# ANNEXES : CABLING AND MAPPING

## TWIN MUSIC and Active Target

| detector | PACI | MSCF-16 | | MADC-32 & SIS3820 | V1290 |
|---|---|---|---|---|---|
| **channel** | **n° (gain)** | **channel** | **set up** | **channel** | **channel** |
| TWIN Left 03 | IPN 32 (1V/pC) | n°1, ch1 | *block 1* | n°2, ch0 | n°0, ch0 |
| TWIN Left 11 | IPN 33 (1V/pC) | n°1, ch2 | shaping: 0 | n°2, ch1 | n°0, ch1 |
| TWIN Right 04 | IPN 39 (1V/pC) | n°1, ch3 | gain: 5 | n°2, ch2 | n°0, ch2 |
| TWIN Right 12 | IPN 60 (1V/pC) | n°1, ch4 | | n°2, ch3 | n°0, ch3 |
| TWIN Left 01 | IPN 81 (1.5V/pC) | n°1, ch5 | *block 2* | n°2, ch4 | n°0, ch4 |
| TWIN Left 05 | IPN 80 (1.5V/pC) | n°1, ch6 | shaping: 0 | n°2, ch5 | n°0, ch5 |
| TWIN Left 07 | IPN 37 (1.5V/pC) | n°1, ch7 | gain: 8 | n°2, ch6 | n°0, ch6 |
| TWIN Left 09 | IPN 82 (1.5V/pC) | n°1, ch8 | | n°2, ch7 | n°0, ch7 |
| TWIN Left 13 | IPN 18 (1.5V/pC) | n°1, ch9 | *block 3* | n°2, ch8 | n°0, ch8 |
| TWIN Left 15 | IPN 49 (1.5V/pC) | n°1, ch10 | shaping: 0 | n°2, ch9 | n°0, ch9 |
| TWIN Left 17 | IPN 38 (1.5V/pC) | n°1, ch11 | gain: 8 | n°2, ch10 | n°0, ch10 |
| TWIN Left 19 | IPN 44 (1.5V/pC) | n°1, ch12 | | n°2, ch11 | n°0, ch11 |
| TWIN Right 02 | IPN 78 (1.5V/pC) | n°1, ch13 | *block 4* | n°2, ch12 | n°0, ch12 |
| TWIN Right 06 | IPN 61 (1.5V/pC) | n°1, ch14 | shaping: 0 | n°2, ch13 | n°0, ch14 |
| TWIN Right 08 | IPN 72 (1.5V/pC) | n°1, ch15 | gain: 8 | n°2, ch14 | n°0, ch14 |
| TWIN Right 10 | IPN 73 (1.5V/pC) | n°1, ch16 | | n°2, ch15 | n°0, ch15 |
| TWIN Right 14 | IPN 47 (1.5V/pC) | n°2, ch1 | *block 1* | n°2, ch16 | n°0, ch16 |
| TWIN Right 16 | IPN 20 (1.5V/pC) | n°2, ch2 | shaping: 0 | n°2, ch17 | n°0, ch17 |
| TWIN Right 18 | IPN 23 (1.5V/pC) | n°2, ch3 | gain: 8 | n°2, ch18 | n°0, ch18 |
| TWIN Right 20 | IPN 65 (1.5V/pC) | n°2, ch4 | | n°2, ch19 | n°0, ch19 |
| AT A01 | IPN __ (1.5V/pC) | n°2, ch5 | *block 2* | n°2, ch20 | - |
| AT A02 | IPN __ (1.5V/pC) | n°2, ch6 | shaping: | n°2, ch21 | - |
| AT A03 | IPN __ (1.5V/pC) | n°2, ch7 | gain: | n°2, ch22 | - |
| AT A04 | IPN __ (1.5V/pC) | n°2, ch8 | | n°2, ch23 | - |

Table 3: Cabling of the TWIN-MUSIC and Active Target. Shaping time for the TWIN is 0.25 $\mu$s, as in May we get a better resolution (2.1%). **ATTENTION, THE ANODES OF THE TWIN ARE NOT ORDERED !!!!!**

Shaping time are the following :
- 0: shaping time of 0.25 $\mu$s
- 1: shaping time of 0.5 $\mu$s
- 2: shaping time of 1 $\mu$s

Moreover we could adjust the delay for the timing output with the sw1 and sw2 internal switches. The delay chosen are :
- MSCF1 = 100 ns
- MSCF2 = 100 ns

Concerning the SIS3820, please note that the **100 $\Omega$ terminations RN10 to RN80 has to be removed**.

## Time of Flight Wall

Numbering of the plastic is going from left to right when looking at the beam direction (see Fig. 14)

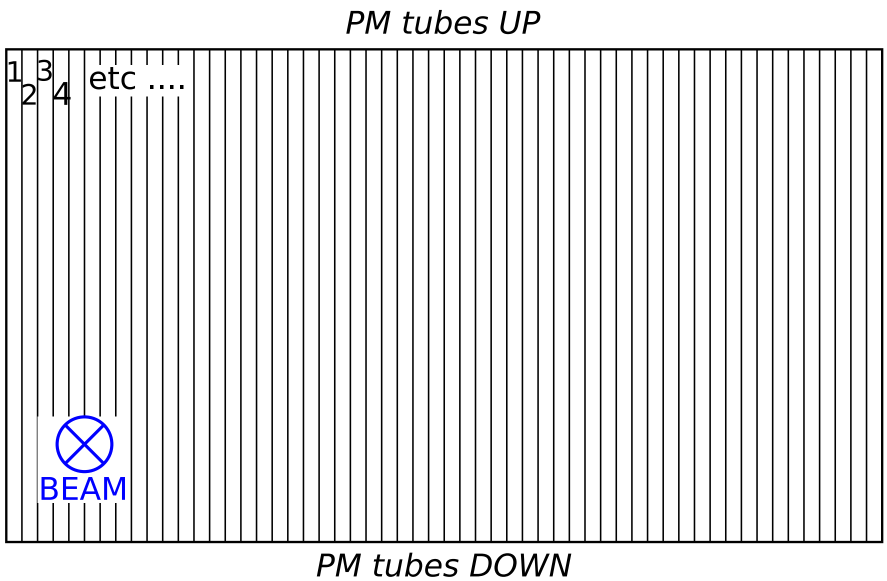


Figure 14: Numbering of the plastics: 1 is on the left, 28 is on the right.

**Again, the cabling to the ENN (therefore to the HDCAN1 and then the VUPROM) should be be done carefully to respect the logic of the code in the FPGA of the VUPROM (which produces the fission trigger). There are two choices in the trigger logic :**

**- 2 pairs of PM or,**

**- 1 pair of PM + 1 PM**

**A pair is defined as the two PM (up and down) of the same plastic and is corresponding to two following channels, starting from the very first of the VUPROM.**

| PMT | TDC-VFTX | CFD | ENN | HDCAN1 | SIS3820 | N568B | MADC-32 |
|---|---|---|---|---|---|---|---|
| 1 up | n°0, ch0 | n°27189, ch4 | n°1, ch1 | n°1, in 1 | n°0, ch0 | n°1, ch0 | n°0, ch0 |
| 1 down | n°0, ch1 | n°27189, ch5 | n°1, ch2 | n°1, in 1 | n°0, ch1 | n°1, ch1 | n°0, ch1 |
| 2 up | n°0, ch2 | n°27189, ch2 | n°1, ch3 | n°1, in 1 | n°0, ch2 | n°1, ch2 | n°0, ch2 |
| 2 down | n°0, ch3 | n°27189, ch3 | n°1, ch4 | n°1, in 1 | n°0, ch3 | n°1, ch3 | n°0, ch3 |
| 3 up | n°0, ch4 | n°27196, ch5 | n°1, ch5 | n°1, in 1 | n°0, ch4 | n°1, ch4 | n°0, ch4 |
| 3 down | n°0, ch5 | n°27189, ch1 | n°1, ch6 | n°1, in 1 | n°0, ch5 | n°1, ch5 | n°0, ch5 |
| 4 up | n°0, ch6 | n°27196, ch3 | n°1, ch7 | n°1, in 1 | n°0, ch6 | n°1, ch6 | n°0, ch6 |
| 4 down | n°0, ch7 | n°27196, ch4 | n°1, ch8 | n°1, in 1 | n°0, ch7 | n°1, ch7 | n°0, ch7 |
| 5 up | n°0, ch8 | n°27196, ch1 | n°1, ch9 | n°1, in 2 | n°0, ch8 | n°1, ch8 | n°0, ch8 |
| 5 down | n°0, ch9 | n°27196, ch2 | n°1, ch10 | n°1, in 2 | n°0, ch9 | n°1, ch9 | n°0, ch9 |
| 6 up | n°0, ch10 | n°27200, ch4 | n°1, ch11 | n°1, in 2 | n°0, ch10 | n°1, ch10 | n°0, ch10 |
| 6 down | n°0, ch11 | n°27200, ch5 | n°1, ch12 | n°1, in 2 | n°0, ch11 | n°1, ch11 | n°0, ch11 |
| 7 up | n°0, ch12 | n°27200, ch2 | n°1, ch13 | n°1, in 2 | n°0, ch12 | n°1, ch12 | n°0, ch12 |
| 7 down | n°0, ch13 | n°27200, ch3 | n°1, ch14 | n°1, in 2 | n°0, ch13 | n°1, ch13 | n°0, ch13 |
| 8 up | n°1, ch0 | n°27199, ch5 | n°1, ch15 | n°1, in 2 | n°0, ch14 | n°1, ch14 | n°0, ch14 |
| 8 down | n°1, ch1 | n°27200, ch1 | n°1, ch16 | n°1, in 2 | n°0, ch15 | n°1, ch15 | n°0, ch15 |
| 9 up | n°1, ch2 | n°27199, ch3 | n°2, ch1 | n°1, in 3 | n°0, ch16 | n°2, ch0 | n°0, ch16 |
| 9 down | n°1, ch3 | n°27199, ch4 | n°2, ch2 | n°1, in 3 | n°0, ch17 | n°2, ch1 | n°0, ch17 |
| 10 up | n°1, ch4 | n°27199, ch1 | n°2, ch3 | n°1, in 3 | n°0, ch18 | n°2, ch2 | n°0, ch18 |
| 10 down | n°1, ch5 | n°27199, ch2 | n°2, ch4 | n°1, in 3 | n°0, ch19 | n°2, ch3 | n°0, ch19 |
| 11 up | n°1, ch6 | n°27197, ch4 | n°2, ch5 | n°1, in 3 | n°0, ch20 | n°2, ch4 | n°0, ch20 |
| 11 down | n°1, ch7 | n°27197, ch5 | n°2, ch6 | n°1, in 3 | n°0, ch21 | n°2, ch5 | n°0, ch21 |
| 12 up | n°1, ch8 | n°27197, ch2 | n°2, ch7 | n°1, in 3 | n°0, ch22 | n°2, ch6 | n°0, ch22 |
| 12 down | n°1, ch9 | n°27197, ch3 | n°2, ch8 | n°1, in 3 | n°0, ch23 | n°2, ch7 | n°0, ch23 |
| 13 up | n°1, ch10 | n°27194, ch5 | n°2, ch9 | n°1, in 4 | n°0, ch24 | n°2, ch8 | n°0, ch24 |
| 13 down | n°1, ch11 | n°27197, ch1 | n°2, ch10 | n°1, in 4 | n°0, ch25 | n°2, ch9 | n°0, ch25 |
| 14 up | n°1, ch12 | n°27194, ch3 | n°2, ch11 | n°1, in 4 | n°0, ch26 | n°2, ch10 | n°0, ch26 |
| 14 down | n°1, ch13 | n°27194, ch4 | n°2, ch12 | n°1, in 4 | n°0, ch27 | n°2, ch11 | n°0, ch27 |
| 15 up | n°2, ch0 | n°27194, ch1 | n°2, ch13 | n°1, in 4 | n°0, ch28 | n°2, ch12 | n°0, ch28 |
| 15 down | n°2, ch1 | n°27194, ch2 | n°2, ch14 | n°1, in 4 | n°0, ch29 | n°2, ch13 | n°0, ch29 |
| 16 up | n°2, ch2 | n°27193, ch4 | n°2, ch15 | n°1, in 4 | n°0, ch30 | n°2, ch14 | n°0, ch30 |
| 16 down | n°2, ch3 | n°27193, ch5 | n°2, ch16 | n°1, in 4 | n°0, ch31 | n°2, ch15 | n°0, ch31 |

Table 4: Cabling of the ToF wall for the plastic 1 to 16. ATTENTION THIS MAPPING WILL CHANGE AS TWO CHANNELS of N568B ARE NOT WORKING.

| PMT | TDC-VFTX | CFD | ENN | HDCAN1 | SIS3820 | N568B | MADC-32 |
|---|---|---|---|---|---|---|---|
| 17 up | n°2, ch4 | n°27193, ch2 | n°3, ch1 | n°2, in 1 | n°1, ch0 | n°3, ch0 | n°1, ch0 |
| 17 down | n°2, ch5 | n°27193, ch3 | n°3, ch2 | n°2, in 1 | n°1, ch1 | n°3, ch1 | n°1, ch1 |
| 18 up | n°2, ch6 | n°27192, ch5 | n°3, ch3 | n°2, in 1 | n°1, ch2 | n°3, ch2 | n°1, ch2 |
| 18 down | n°2, ch7 | n°27193, ch1 | n°3, ch4 | n°2, in 1 | n°1, ch3 | n°3, ch3 | n°1, ch3 |
| 19 up | n°2, ch8 | n°27192, ch3 | n°3, ch5 | n°2, in 1 | n°1, ch4 | n°3, ch4 | n°1, ch4 |
| 19 down | n°2, ch9 | n°27192, ch4 | n°3, ch6 | n°2, in 1 | n°1, ch5 | n°3, ch5 | n°1, ch5 |
| 20 up | n°2, ch10 | n°27192, ch1 | n°3, ch7 | n°2, in 1 | n°1, ch6 | n°3, ch6 | n°1, ch6 |
| 20 down | n°2, ch11 | n°27192, ch2 | n°3, ch8 | n°2, in 1 | n°1, ch7 | n°3, ch7 | n°1, ch7 |
| 21 up | n°2, ch12 | n°27191, ch4 | n°3, ch9 | n°2, in 2 | n°1, ch8 | n°3, ch8 | n°1, ch8 |
| 21 down | n°2, ch13 | n°27191, ch5 | n°3, ch10 | n°2, in 2 | n°1, ch9 | n°3, ch9 | n°1, ch9 |
| 22 up | n°3, ch0 | n°27191, ch2 | n°3, ch11 | n°2, in 2 | n°1, ch10 | n°3, ch10 | n°1, ch10 |
| 22 down | n°3, ch1 | n°27191, ch3 | n°3, ch12 | n°2, in 2 | n°1, ch11 | n°3, ch11 | n°1, ch11 |
| 23 up | n°3, ch2 | n°27190, ch5 | n°3, ch13 | n°2, in 2 | n°1, ch12 | n°3, ch12 | n°1, ch12 |
| 23 down | n°3, ch3 | n°27191, ch1 | n°3, ch14 | n°2, in 2 | n°1, ch13 | n°3, ch13 | n°1, ch13 |
| 24 up | n°3, ch4 | n°27190, ch3 | n°3, ch15 | n°2, in 2 | n°1, ch14 | n°3, ch14 | n°1, ch14 |
| 24 down | n°3, ch5 | n°27190, ch4 | n°3, ch16 | n°2, in 2 | n°1, ch15 | n°3, ch15 | n°1, ch15 |
| 25 up | n°3, ch6 | n°27190, ch1 | n°4, ch1 | n°2, in 3 | n°1, ch16 | n°4, ch0 | n°1, ch16 |
| 25 down | n°3, ch7 | n°27190, ch2 | n°4, ch2 | n°2, in 3 | n°1, ch17 | n°4, ch1 | n°1, ch17 |
| 26 up | n°3, ch8 | n°27195, ch4 | n°4, ch3 | n°2, in 3 | n°1, ch18 | n°4, ch2 | n°1, ch18 |
| 26 down | n°3, ch9 | n°27195, ch5 | n°4, ch4 | n°2, in 3 | n°1, ch19 | n°4, ch3 | n°1, ch19 |
| 27 up | n°3, ch10 | n°27195, ch2 | n°4, ch5 | n°2, in 4 | n°1, ch20 | n°4, ch6 | n°1, ch22 |
| 27 down | n°3, ch11 | n°27201, ch4 | n°4, ch6 | n°2, in 4 | n°1, ch21 | n°4, ch7 | n°1, ch23 |
| 28 up | n°3, ch12 | n°27201, ch5 | n°4, ch7 | n°2, in 4 | n°1, ch22 | n°4, ch8 | n°1, ch24 |
| 28 down | n°3, ch13 | n°27195, ch1 | n°4, ch8 | n°2, in 4 | n°1, ch23 | n°4, ch9 | n°1, ch25 |
| START left | n°0,1,2,3, ch14 | n°27198, ch1-2 | N638, ch2 | - | n°2, ch26 | n°4, ch10 | n°1, ch26 |
| START right | n°0,1,2,3, ch15 | n°27198, ch3-4 | N638, ch3 | - | n°2, ch27 | n°4, ch11 | n°1, ch27 |

Table 5: Cabling of the ToF wall for the plastic 17 to 28 + START.ATTENTION THIS MAPPING WILL CHANGE AS TWO CHANNELS of N568B ARE NOT WORKING -¿ MAPPING CHANGED FROM CHANNEL 27 TO THE END.

## MWPC detectors

| gassiplex | V550 |
|---|---|
| Xup | n°1, ADC 0 |
| Xdown | n°1, ADC 1 |
| Y | n°2, ADC 0 |
| X1 | n°2, ADC 1 |
| X2 | n°3, ADC 0 |
| X3 | n°3, ADC 1 |
| X4 | n°4, ADC 0 |
| X5 | n°4, ADC 1 |
| Y1 | n°5, ADC 0 |
| Y2 | n°5, ADC 1 |

Table 6: Cabling of the MWPC detectors

| **gassiplex channel** | **Xdown** (pad) | **Xup** (pad) | **Y** (pad) | **channel** | **Xdown** (pad) | **Xup** (pad) | **Y** (pad) |
|---|---|---|---|---|---|---|---|
| 0 | 16 | 47 | 28 | 32 | 0 | 63 | 39 |
| 1 | 17 | 46 | - | 33 | 1 | 62 | - |
| 2 | 18 | 45 | - | 34 | 2 | 61 | 38 |
| 3 | 19 | 44 | - | 35 | 3 | 60 | - |
| 4 | 20 | 43 | - | 36 | 4 | 59 | 37 |
| 5 | 21 | 42 | 27 | 37 | 5 | 58 | 36 |
| 6 | 22 | 41 | 26 | 38 | 6 | 57 | - |
| 7 | 23 | 40 | 25 | 39 | 7 | 56 | - |
| 8 | 24 | 39 | - | 40 | 8 | 55 | 35 |
| 9 | 25 | 38 | 24 | 41 | 9 | 54 | 34 |
| 10 | 26 | 37 | - | 42 | 10 | 53 | 33 |
| 11 | 27 | 36 | 23 | 43 | 11 | 52 | 32 |
| 12 | 28 | 35 | 22 | 44 | 12 | 51 | 31 |
| 13 | 29 | 34 | 21 | 45 | 13 | 50 | - |
| 14 | 30 | 33 | - | 46 | 14 | 49 | 30 |
| 15 | 31 | 32 | - | 47 | 15 | 48 | 29 |
| 16 | 32 | 31 | 20 | 48 | 48 | 15 | 19 |
| 17 | 33 | 30 | 19 | 49 | 49 | 14 | 9 |
| 18 | 34 | 29 | - | 50 | 50 | 13 | 8 |
| 19 | 35 | 28 | 18 | 51 | 51 | 12 | - |
| 20 | 36 | 27 | 17 | 52 | 52 | 11 | 7 |
| 21 | 37 | 26 | - | 53 | 53 | 10 | 6 |
| 22 | 38 | 25 | 16 | 54 | 54 | 9 | - |
| 23 | 39 | 24 | 15 | 55 | 55 | 8 | 5 |
| 24 | 40 | 23 | 14 | 56 | 56 | 7 | - |
| 25 | 41 | 22 | 13 | 57 | 57 | 6 | 4 |
| 26 | 42 | 21 | 12 | 58 | 58 | 5 | - |
| 27 | 43 | 20 | 11 | 59 | 59 | 4 | 3 |
| 28 | 44 | 19 | - | 60 | 60 | 3 | 2 |
| 29 | 45 | 18 | - | 61 | 61 | 2 | 1 |
| 30 | 46 | 17 | - | 62 | 62 | 1 | - |
| 31 | 47 | 16 | - | 63 | 63 | 0 | 0 |

Table 7: Mapping of MWPC1 with X increasing from left to right and Y from bottom to up. This is valid only if HV distribution card is on the right, looking at the beam direction.

| gassiplex channel | X1 (pad) | X2 (pad) | X3 (pad) | X4 (pad) | X5 (pad) | channel | X1 (pad) | X2 (pad) | X3 (pad) | X4 (pad) | X5 (pad) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 287 | 223 | 159 | 95 | 31 | 32 | - | 239 | 175 | 111 | 47 |
| 1 | 286 | 222 | 158 | 94 | 30 | 33 | - | 238 | 174 | 110 | 46 |
| 2 | 285 | 221 | 157 | 93 | 29 | 34 | - | 237 | 173 | 109 | 45 |
| 3 | 284 | 220 | 156 | 92 | 28 | 35 | - | 236 | 172 | 108 | 44 |
| 4 | 283 | 219 | 155 | 91 | 27 | 36 | - | 235 | 171 | 107 | 43 |
| 5 | 282 | 218 | 154 | 90 | 26 | 37 | - | 234 | 170 | 106 | 42 |
| 6 | 281 | 217 | 153 | 89 | 25 | 38 | - | 233 | 169 | 105 | 41 |
| 7 | 280 | 216 | 152 | 88 | 24 | 39 | - | 232 | 168 | 104 | 40 |
| 8 | 279 | 215 | 151 | 87 | 23 | 40 | - | 231 | 167 | 103 | 39 |
| 9 | 278 | 214 | 150 | 86 | 22 | 41 | - | 230 | 166 | 102 | 38 |
| 10 | 277 | 213 | 149 | 85 | 21 | 42 | - | 229 | 165 | 101 | 37 |
| 11 | 276 | 212 | 148 | 84 | 20 | 43 | - | 228 | 164 | 100 | 36 |
| 12 | 275 | 211 | 147 | 83 | 19 | 44 | - | 227 | 163 | 99 | 35 |
| 13 | 274 | 210 | 146 | 82 | 18 | 45 | - | 226 | 162 | 98 | 34 |
| 14 | 273 | 209 | 145 | 81 | 17 | 46 | - | 225 | 161 | 97 | 33 |
| 15 | 272 | 208 | 144 | 80 | 16 | 47 | - | 224 | 160 | 96 | 32 |
| 16 | 271 | 207 | 143 | 79 | 15 | 48 | 255 | 191 | 127 | 63 | - |
| 17 | 270 | 206 | 142 | 78 | 14 | 49 | 254 | 190 | 126 | 62 | - |
| 18 | 269 | 205 | 141 | 77 | 13 | 50 | 253 | 189 | 125 | 61 | - |
| 19 | 268 | 204 | 140 | 76 | 12 | 51 | 252 | 188 | 124 | 60 | - |
| 20 | 267 | 203 | 139 | 75 | 11 | 52 | 251 | 187 | 123 | 59 | - |
| 21 | 266 | 202 | 138 | 74 | 10 | 53 | 250 | 186 | 122 | 58 | - |
| 22 | 265 | 201 | 137 | 73 | 9 | 54 | 249 | 185 | 121 | 57 | - |
| 23 | 264 | 200 | 136 | 72 | 8 | 55 | 248 | 184 | 120 | 56 | - |
| 24 | 263 | 199 | 135 | 71 | 7 | 56 | 247 | 183 | 119 | 55 | - |
| 25 | 262 | 198 | 134 | 70 | 6 | 57 | 246 | 182 | 118 | 54 | - |
| 26 | 261 | 197 | 133 | 69 | 5 | 58 | 245 | 181 | 117 | 53 | - |
| 27 | 260 | 196 | 132 | 68 | 4 | 59 | 244 | 180 | 116 | 52 | - |
| 28 | 259 | 195 | 131 | 67 | 3 | 60 | 243 | 179 | 115 | 51 | - |
| 29 | 258 | 194 | 130 | 66 | 2 | 61 | 242 | 178 | 114 | 50 | - |
| 30 | 257 | 193 | 129 | 65 | 1 | 62 | 241 | 177 | 113 | 49 | - |
| 31 | 256 | 192 | 128 | 64 | 0 | 63 | 240 | 176 | 112 | 48 | - |

Table 8: Mapping of MWPC2 X pads, with X increasing from left to right. This is valid only if HV distribution card is on the right, looking at the beam direction.

| **gassiplex channel** | **Y1** (pad) | **Y2** (pad) | **channel** | **Y1** (pad) | **Y2** (pad) |
|---|---|---|---|---|---|
| 0 | 107 | 43 | 32 | - | 59 |
| 1 | 106 | 42 | 33 | - | 58 |
| 2 | 105 | 41 | 34 | - | 57 |
| 3 | 104 | 40 | 35 | - | 56 |
| 4 | 103 | 39 | 36 | 119 | 55 |
| 5 | 102 | 38 | 37 | 118 | 54 |
| 6 | 101 | 37 | 38 | 117 | 53 |
| 7 | 100 | 36 | 39 | 116 | 52 |
| 8 | 99 | 35 | 40 | 115 | 51 |
| 9 | 98 | 34 | 41 | 114 | 50 |
| 10 | 97 | 33 | 42 | 113 | 49 |
| 11 | 96 | 32 | 43 | 112 | 48 |
| 12 | 95 | 31 | 44 | 111 | 47 |
| 13 | 94 | 30 | 45 | 110 | 46 |
| 14 | 93 | 29 | 46 | 109 | 45 |
| 15 | 92 | 28 | 47 | 108 | 44 |
| 16 | 91 | 27 | 48 | 75 | 11 |
| 17 | 90 | 26 | 49 | 74 | 10 |
| 18 | 89 | 25 | 50 | 73 | 9 |
| 19 | 88 | 24 | 51 | 72 | 8 |
| 20 | 87 | 23 | 52 | 71 | 7 |
| 21 | 86 | 22 | 53 | 70 | 6 |
| 22 | 85 | 21 | 54 | 69 | 5 |
| 23 | 84 | 20 | 55 | 68 | 4 |
| 24 | 83 | 19 | 56 | 67 | 3 |
| 25 | 82 | 18 | 57 | 66 | 2 |
| 26 | 81 | 17 | 58 | 65 | 1 |
| 27 | 80 | 16 | 59 | 64 | 0 |
| 28 | 79 | 15 | 60 | 63 | - |
| 29 | 78 | 14 | 61 | 62 | - |
| 30 | 77 | 13 | 62 | 61 | - |
| 31 | 76 | 12 | 63 | 60 | - |

Table 9: Mapping of MWPC2 Y pads, with Y increasing from bottom to up. This is valid only if HV distribution card is on the right, looking at the beam direction.