## EIA's DAPHNE V1 Firmware (VHDL) and Self trigger algorithms

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# **Trigger algorithm architecture**





# Link to the firmware repository

https://github.com/edgar-rincon-g/DAPHNE\_V1.git



## **Testbench setup**





#### DEEP UNDERGROUND NEUTRINO EXPERIMENT

# **Configuring the event template**

₩ WaveForms (Wave Gen)		– 🗆 X
Workspace Control Settings Window Help		
Welcome 🚽 🔮 Help 🕨 Wavegen 1 🔀		🕨 🖃 🔁 🔍
File Control Edit Window		6
▶ Run All	✓ For phased signals use Synchronized mode.	8
Channel 1 (W1)		🖻 🖸 💥
Run Enable Custom V Idle: Initial		
Tringer: None Wait: bon	Run: 50 us	
🦻 New 🔂 Import 🔯 Edit 🔫	Disabled	28.2
Custom1	Demo mode	2012
Sample Rate:	Output	18.2
62.5 MHz 🗸		8.2
Amplitude:		0.2
40 mV ~		-1.8
-71 8 mV		
Phase:		-11.8
0 ° ~		
Signal:		
Waveform ~		-31.8
		-41.8
		-51.8
	· · · · · · · · · · · · · · · · · · ·	-61.8
		71.0
~	0 us 10 us 20 us 30 us	40 us 50 us
	A Manual Trioger Discovery2 C DEMO	tatus: OK 🛛 💥 v3 21.3
		4405. OIC + 44 V3.21.5



## Statistical tests using matching filters

Board	DAPHNE V1		
Signal Type	Amplitude 40 mV - Offset -21,8 mV (Approx. 25 ADC Counts)		
Signal Generator	Analog Discovery 2 Digilent		
AFE5808A Config	100 Ohms Actv. Resistor + Clamp 1,5Vpp + LNA Integrator Enabled 12 dB + PGA Integrator Enabled PGA Gain 24 dB + VGAIN 4000		
Threshold Level	XCorr Value Above 5000		
Quantity of Generated Events	10000 Events		
Medida	Description	Range	Result
Events detected	How many events were detected with the above conditions	[0-100]	100,00%
Time for detection	How much time since the data arrives at the entrance of the detection module passes before asserting a trigger	[sec]	0,0000032
DSP's usage	How much available DSP resources were used	[0 - 100]	90,00%
FF o Lookup tables usage	How much FF's and lookup tables available resources were used	[0 - 100]	0,00%



#### DEEP UNDERGROUND NEUTRINO EXPERIMENT

#### **Event detected using matching filter algorithm**





## Statistical tests using neural networks

Board	DAPHNE V1		
Signal Type	Amplitude 40 mV - Offset -21,8 mV (Approx. 25 ADC Counts)		
Signal Generator	Analog Discovery 2 Digilent		
AFE5808A Config	100 Ohms Actv. Resistor + Clamp 1,5Vpp + LNA Integrator Enabled 12 dB + PGA Integrator Enabled PGA Gain 24 dB + VGAIN 4000		
Threshold Level	Neural Network Sigmoid Prediction Above 1, which means above $2^{(24)} = 16.777.216$		
Quantity of Generated Events	10000 Events		
Medida	Description	Range	Resultado
Events detected	How many events were detected with the above conditions	[0-100]	100,00%
Time for detection	How much time since the data arrives at the entrance of the detection module passes before asserting a trigger	[sec]	0,00000608
DSP's usage	How much available DSP resources were used	[0 - 100]	151351,35%
FF o Lookup tables usage	How much FF's and lookup tables available resources were used	[0 - 100]	0,00%



#### Event detected using neural network algorithm





## **Thanks!**

