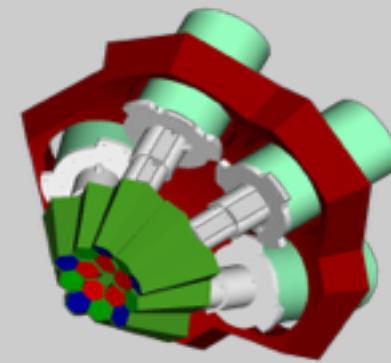
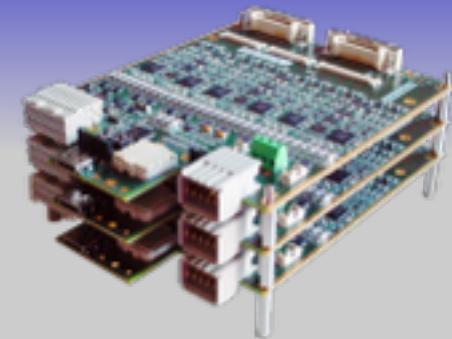




INFN - Milano
University of Milano
Department of Physics



Maintenance, status and Perspectives of Digi-Opt12 digitizer cards*



Alberto Pullia

* White paper available: **DIGI-OPT12: 12-channel 14/16-bit 100/125-MS/s Digitizer with Optical Output for AGATA/GALILEO - version 1.8**

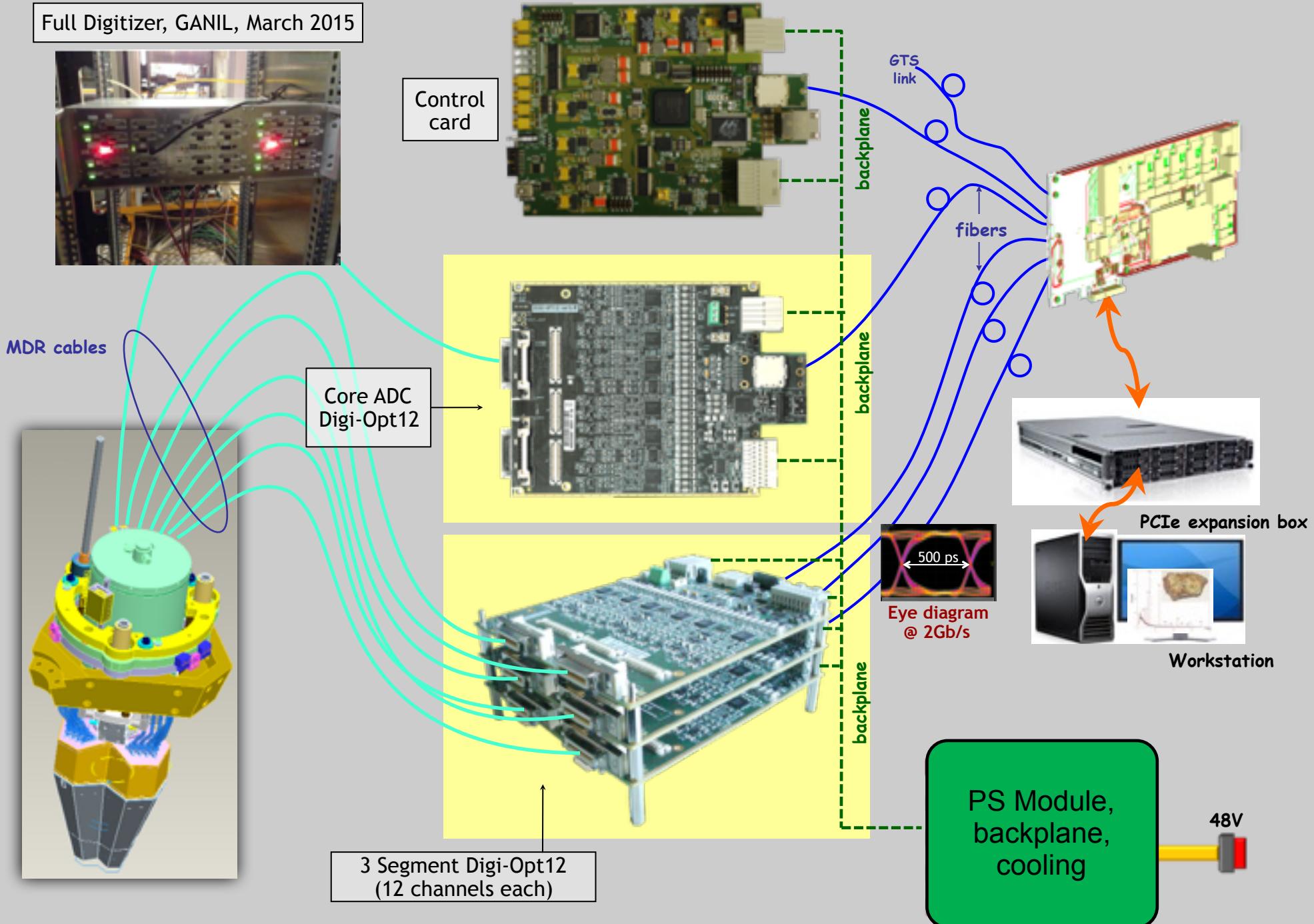
AGATA Week
3-7 October, 2016
Orsay, France

AGATA Week

October 6, 2016

AGATA Week

System parts and connections (1 AGATA crystal)



MAINTENANCE AND STATUS

Existing DIGI-OPT12 cards for AGATA

Serial	Bar Code	Version	Type	Fired	Control/Ck	All set*	Location	Owner
Production code: 440026773 - third run, type: segment								
3-1/44	40	3.6.1 AGATA+Tx	Segm	✓✓	backplane	Y++	GANIL/Valencia	INFN-MI
3-2/44	42	3.6.1 AGATA+Tx	segm	✓✓	backplane	Y++	GANIL/Valencia	INFN-MI
3-3/44	07	3.6.1 AGATA+Tx	segm	✓✓	backplane	Y++	GANIL/Valencia	INFN-MI
3-4/44	05	3.6.1 AGATA+Tx	segm	✓✓	backplane	Y++	GANIL/Valencia	INFN-MI
3-5/44	12	3.6.1 AGATA+Tx	segm	✓✓	backplane	Y++	GANIL/Valencia	INFN-MI
3-6/44	35	3.6.1 AGATA+Tx	segm	✓✓	backplane	Y++	GANIL/Valencia	INFN-MI
3-7/44	06	3.6.1 AGATA+Tx	segm	✓✓	backplane	Y++	GANIL/Valencia	INFN-MI
3-8/44	36	3.6.1 AGATA+Tx	segm	✓✓	backplane	Y++	GANIL/Valencia	INFN-MI
3-9/44	08	3.6.1 AGATA+Tx	segm	✓✓	backplane	Y++	GANIL/Valencia	INFN-MI
3-10/44	17	3.6.1 AGATA+Tx	segm	✓✓	backplane	Y++	GANIL/Valencia	INFN-MI
		3 vias fixed chs 1-2						
3-11/44	33	3.6.1 AGATA+Tx	segm	✓✓	backplane	Y++	GANIL/Valencia	INFN-MI
3-12/44	38	3.6.1 AGATA+Tx	segm	✓✓	backplane	Y++	GANIL/Valencia	INFN-MI
3-13/44	10	3.6.1 AGATA+Tx	segm	✓✓	backplane	Y++	GANIL/Valencia	INFN-MI
3-14/44	37	3.6.1 AGATA+Tx	segm	✓✓	backplane	Y++	GANIL/Valencia	INFN-MI
3-15/44	13	3.6.1 AGATA+Tx	segm	✓✓	backplane	Y++	GANIL/Valencia	INFN-MI
3-16/44	14	3.6.1 AGATA+Tx	segm	✓✓	backplane	Y++	GANIL/Valencia	INFN-MI
3-17/44	15	3.6.1 AGATA+Tx	segm	✓✓	backplane	Y++	GANIL/Valencia	INFN-MI
3-18/44	16	3.6.1 AGATA+Tx	segm	✓✓	backplane	Y++	GANIL/Valencia	INFN-MI
3-19/44	41	3.6.1 AGATA+Tx	segm	✓✓	backplane	Y++	GANIL/Valencia	INFN-MI
3-20/44	43	3.6.1 AGATA+Tx	segm	✓✓	backplane	Y++	GANIL/Valencia	INFN-MI
3-21/44	04	3.6.1 AGATA+Tx	segm	✓✓	backplane	Y++	GANIL/Valencia	INFN-MI
3-22/44	03	3.6.1 AGATA+Tx	segm	✓✓	backplane	Y++	GANIL/Valencia	INFN-MI
3-23/44	22	3.6.1 AGATA+Tx	segm	✓✓	backplane	Y++	GANIL/Valencia	INFN-MI
3-24/44	21	3.6.1 AGATA+Tx	segm	✓✓	backplane	Y++	GANIL/Valencia	INFN-MI
3-25/44	01	3.6.1 AGATA+Tx	segm	✓✓	backplane	Y++	GANIL/Valencia	INFN-MI
3-26/44	02	3.6.1 AGATA+Tx	segm	✓✓	backplane	Y++	GANIL/Valencia	INFN-MI
3-27/44	19	3.6.1 AGATA+Tx	segm	✓✓	backplane	Y++	GANIL/Valencia	INFN-MI
3-28/44	24	3.6.1 AGATA+Tx	segm	✓✓	backplane	Y++	GANIL/Valencia	INFN-MI
3-29/44	23	3.6.1 AGATA+Tx	segm	✓✓	backplane	Y++	GANIL/Valencia	INFN-MI
3-30/44	20	3.6.1 AGATA+Tx	segm	✓✓	backplane	Y++	GANIL/Valencia	INFN-MI
3-31/44	30	3.6.1 AGATA+Tx	segm	✓?	backplane	Y+	GANIL/Valencia	IFIC
3-32/44	11	3.6.1 AGATA+Tx	segm	✓?	backplane	Y+	GANIL/Valencia	IFIC
3-33/44	27	3.6.1 AGATA+Tx	segm	✓✓	backplane	Y+	GANIL/Valencia	IFIC
3-34/44	26	3.6.1 AGATA+Tx	segm	✓✓	backplane	Y+	GANIL/Valencia	IFIC
35/44	44	3.6.1 AGATA+Tx	segm	Old Firmware ?		Y+	GANIL/Valencia	IFIC
36/44	34	3.6.1 AGATA+Tx	segm	✓?	backplane	Y+	GANIL/Valencia	IFIC

Segment cards



Continue on
next page

34

Existing DIGI-OPT12 cards for AGATA

Segment cards

Serial	Bar Code	Version	Type	Fired	Control/Ck	All set*	Location	Owner
3-37/44	32	3.6.1 AGATA+Tx	Segm	✓✓	Backplane	Y++	GANIL/Valencia	IFIC
3-38/44	31	3.6.1 AGATA+Tx	Segm	✓✓	Backplane	Y+	GANIL/Valencia	IFIC
3-39/44	39	3.6.1 AGATA+Tx	Segm	✓✓	Backplane	Y+	GANIL/Valencia	IFIC
3-40/44	25	3.6.1 AGATA+Tx	Segm	✓✓	Backplane	Y++	GANIL/Valencia	IFIC
3-41/44	09	3.6.1 AGATA+Tx	Segm	✓✓	Backplane	Y+	GANIL/Valencia	IFIC
3-42/44	28	3.6.1 AGATA+Tx	Segm	✓✓	Backplane	Y+	GANIL/Valencia	IFIC

Repaired June 2015

Core cards

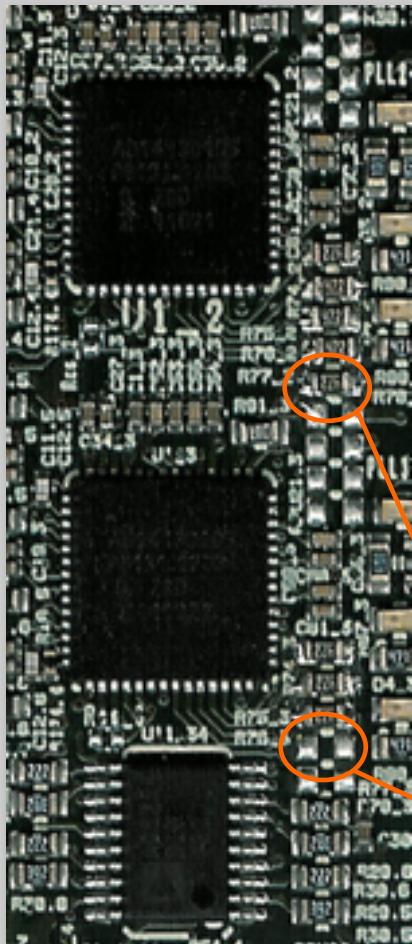
Serial	Bar Code	Version	Type	Fired	Control/Ck	All set*	Location	Owner
Production code: 440026772 - third run, type: core								
3-1/16 LOST	01 LOST	3.6.1 AGATA+Tx LOST	core LOST	✓ LOST	backplane	Y++ LOST	sent to Valencia undelivered	INFN-PD
3-2/16	02	3.6.1 AGATA+Tx	core	✓✓	backplane	Y++	GANIL/ Valencia	INFN-PD
3-3/16	06	3.6.1 AGATA+Tx many vias fixed in chs 1-2	core	✓✓	backplane	Y++	Salamanca	INFN-PD
3-4/16	05	3.6.1 AGATA+Tx	core	✓✓	backplane	Y++	GANIL/ Valencia	INFN-PD
3-5/16	03	3.6.1 AGATA+Tx	core	✓✓	backplane	Y++	GANIL/ Valencia	INFN-PD
3-6/16	15	3.6.1 AGATA+Tx	core	✓✓	backplane	Y++	GANIL/ Valencia	INFN-PD
3-7/16	13	3.6.1 AGATA+Tx	core	✓✓	backplane	Y++	GANIL/ Valencia	INFN-PD
3-8/16	11	3.6.1 AGATA+Tx	core	✓✓	backplane	Y++	Salamanca	INFN-PD
3-9/16	14	3.6.1 AGATA+Tx	core	✓✓	backplane	Y++	GANIL/ Valencia	INFN-PD
3-10/16	10	3.6.1 AGATA+Tx	core	✓✓	backplane	Y++	GANIL/ Valencia	INFN-PD
3-11/16	08	3.6.1 AGATA+Tx	core	✓✓	backplane	Y++	GANIL/ Valencia	INFN-PD
*Y++ = ready with sync bias; Y+ = ready without sync bias; y- = Vext filter to be adj, ADCs off at power on to be impl; n = anti aliasing, sign & polarity; 3.6.1 AGATA+Tx								
✓✓ = new firmware; ✓ = old firmware								
3-13/16	12	3.6.1 AGATA+Tx	core	✓✓	backplane	Y+	GANIL/ Valencia	IFIC
3-14/16	07	3.6.1 AGATA+Tx	core	✓✓	backplane	Y+	GANIL/ Valencia	IFIC
3-15/16	16	3.6.1 AGATA+Tx	core	✓✓	backplane	Y++	GANIL/ Valencia	IFIC
1-1/2	02	3.6 AGATA no TX	core	✓✓	backplane	Y+	GANIL/ Valencia	IFIC

Reworked for planar Ge Sept 2015

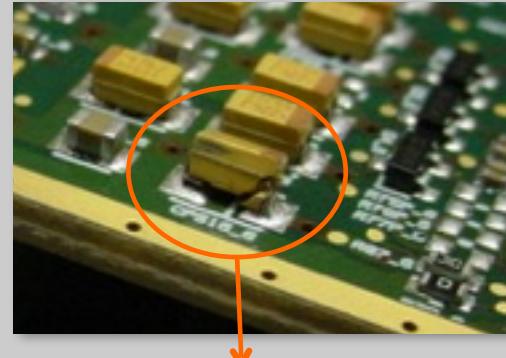
Trigger ch modified March 2016 (GANIL) and later (Milan, Valencia)

Delivered June 2016

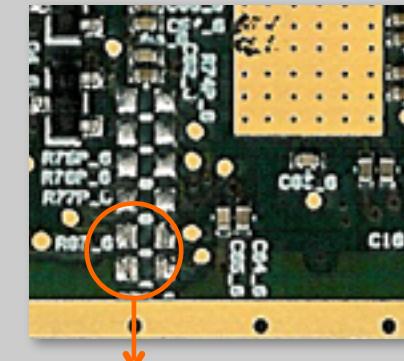
Repaired cards



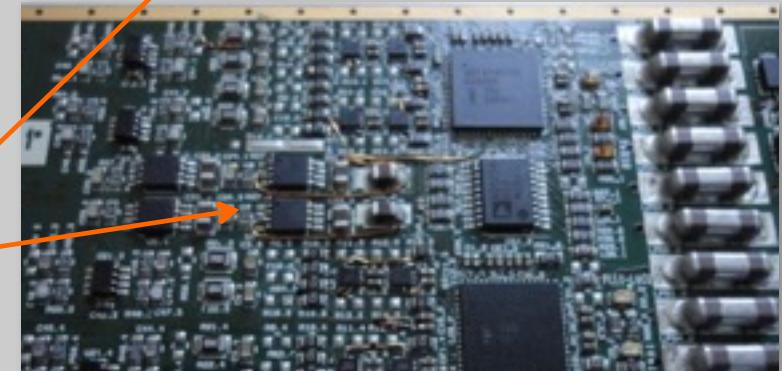
Card 40 segm - A missing resistor
and a wrong resistor installed



Card 37 segm - Cap cracked from a hit; two resistors detached
(hit?)



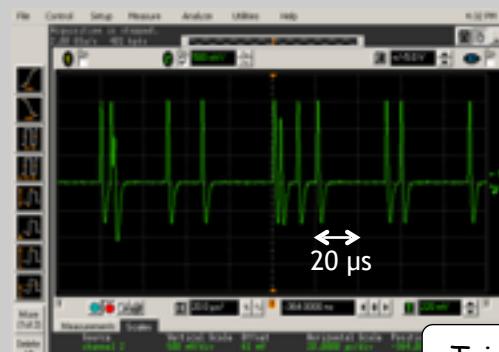
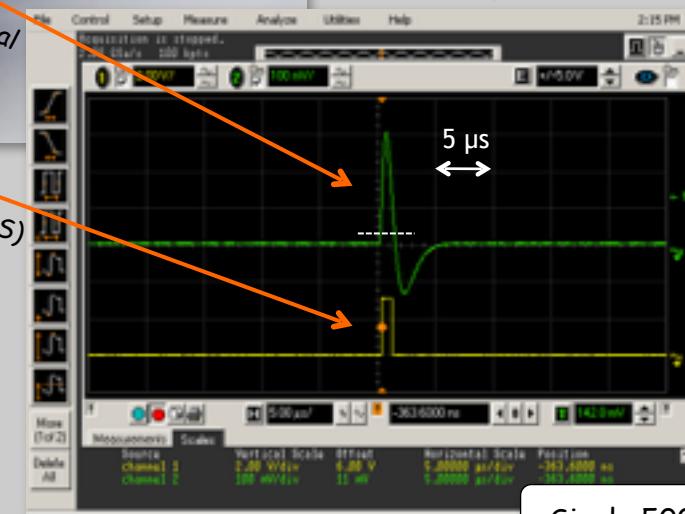
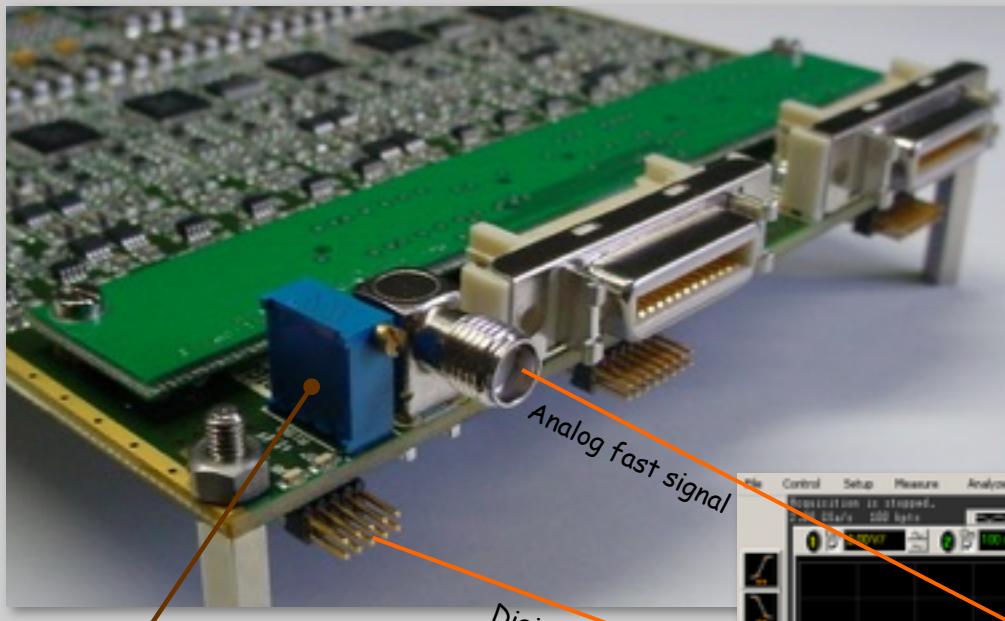
Card 3 core - Missing vias
shorted by “flying” wires



Note

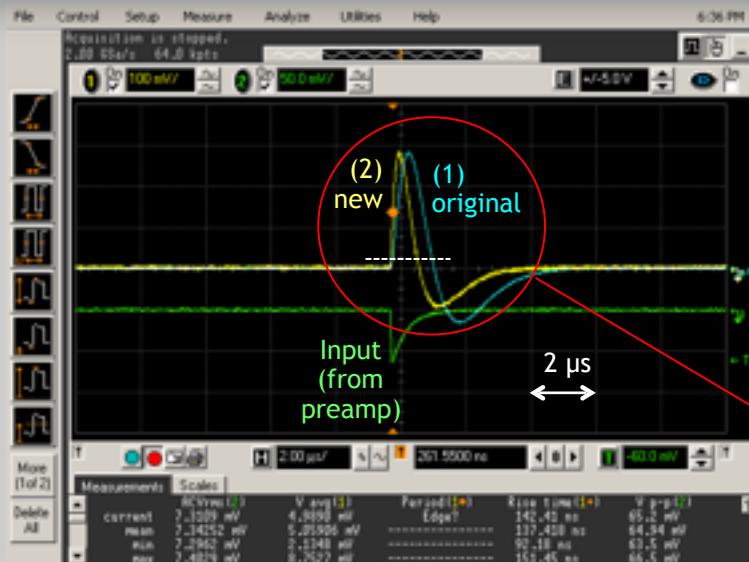
Some of the screws used to fix the optical TXs were wrong (metric) and have been changed with the proper ones #2-56 x 1/4"

Trigger signal for ancillaries (core digitizer only)

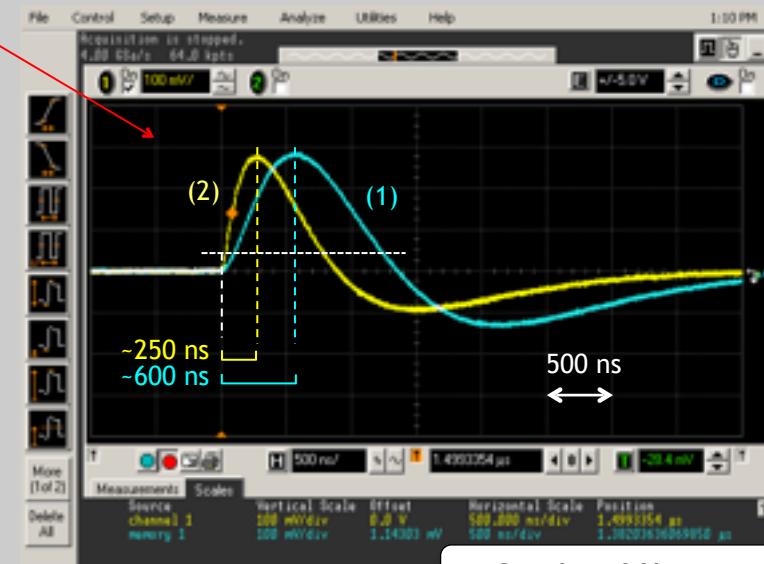
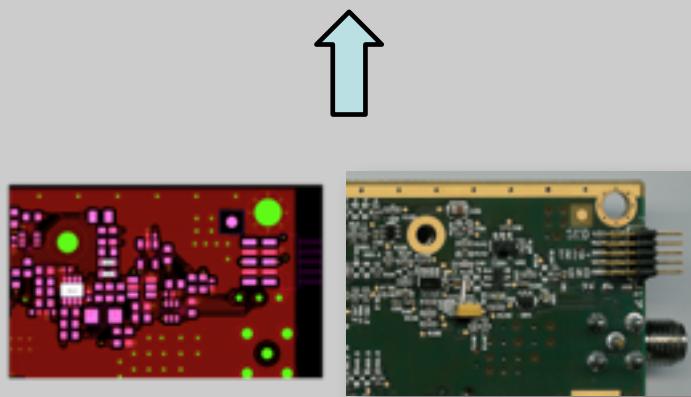


Trigger signal optimization (for VAMOS)

Trigger signal made faster in GANIL on 22-23 March 2016 for VAMOS coupling



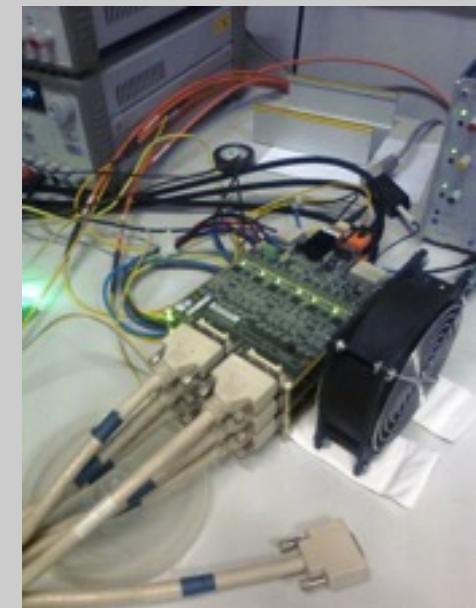
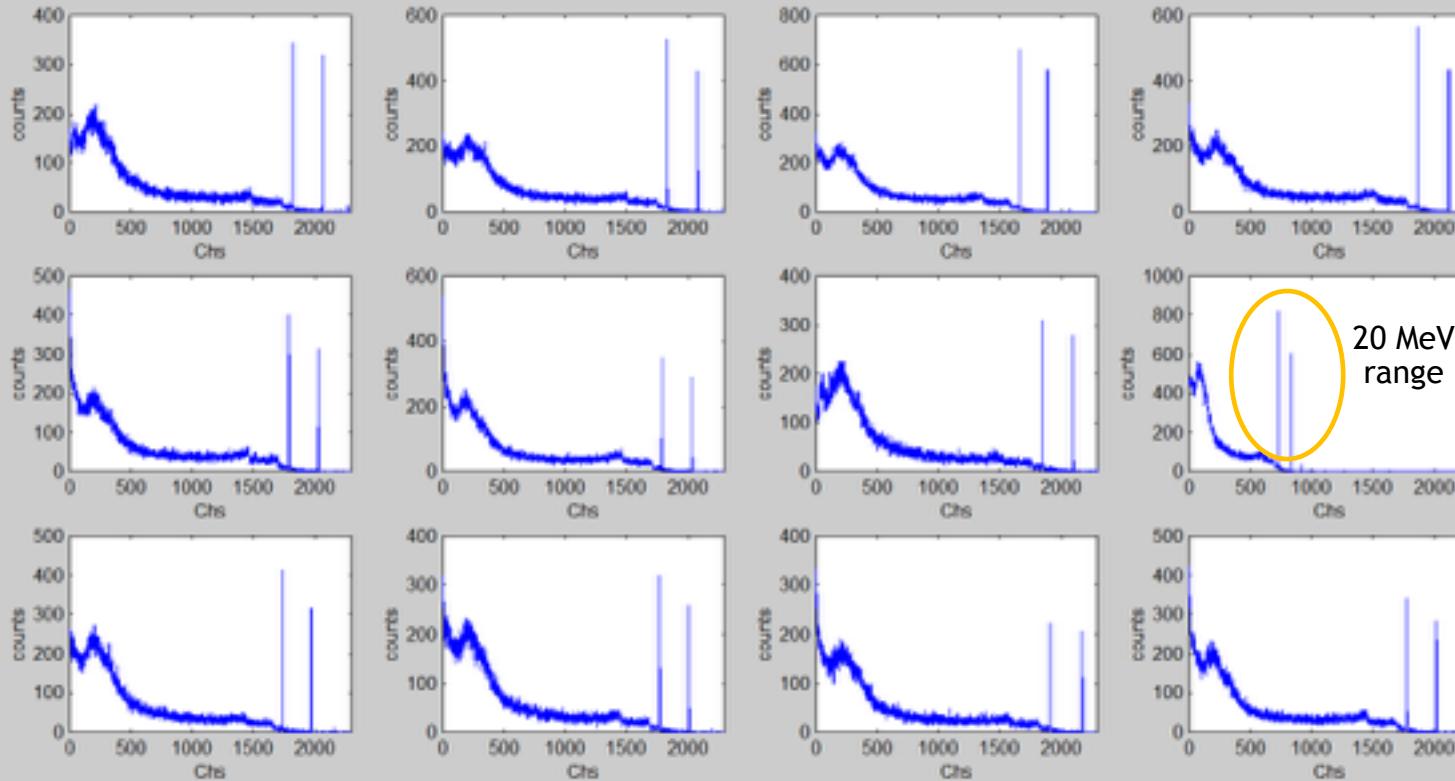
Starting from original setup (1) we empirically found a new setup (2) yielding a fast enough leading edge and a low-enough noise, i.e. a low-enough low-level discrimination threshold



Single 500keV trigger pulse

ISSUES AND PERSPECTIVES

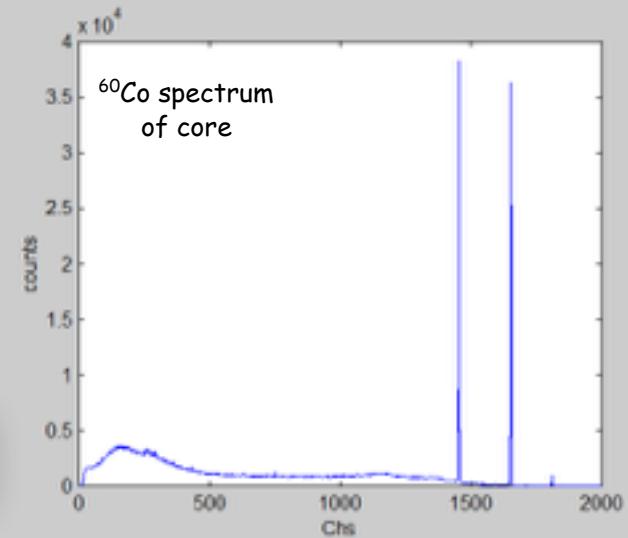
Spectra of ^{60}Co from AGATA crystal



7 MeV range selected for all shown segments but one in 20 MeV range

Segments

Core



0.8 keV /ch found in GANIL (Caterina, November 4, 2015)

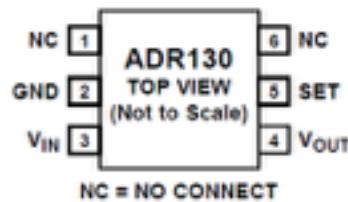
What is the optimal value? 0.4 keV /ch ?

How to adjust the conversion factor ?

- 1) By slow control, using ADC native feature available when internal Vref is used → from 0.8 down to 0.4keV/ch in -1dB steps
- 2) By hardware changes (requires rework), keeping use of an external Vref

I can change now (current production) the conversion factor of core DIGI-OPT12 if needed: please show me the wanted value !!

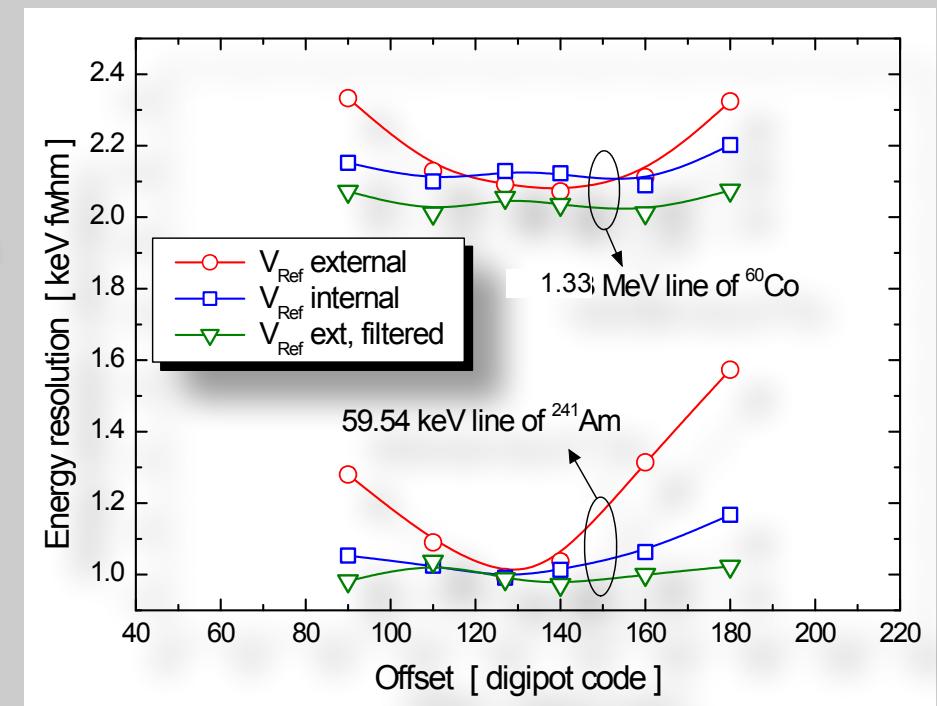
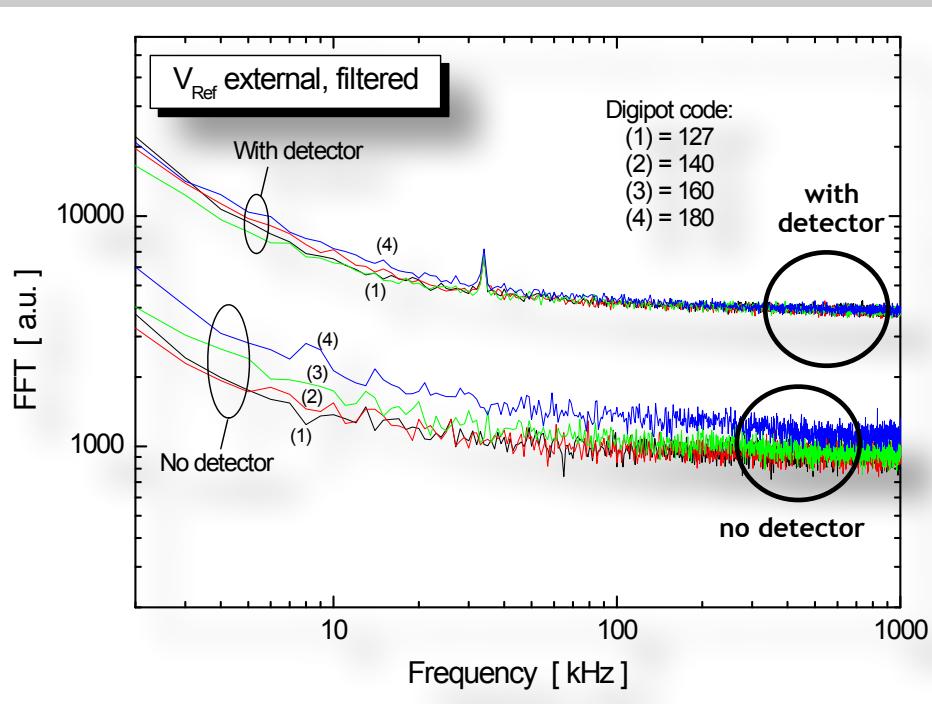
I could then implement later a modification which would allow to switch from 0.8 to 0.4 keV/ch by slow-control



For 0.5 V output, tie SET (Pin 5) to V_{OUT} (Pin 4). For 1.0 V output, tie SET (Pin 5) to GND (Pin 2).

Possible drawback when using internal Vref

Use of the internal Vref may yield some extra noise (~0.1keV) which tends to grow when a dc offset is introduced for dynamic range optimization.



Obsolete components: stock

1) ADC chip - n. 1305 stocked - enough for 54 crystals

2) Optical Tx (SNAP12) - n. 37 stocked
n. 23 bought by INFN in 2015
= n. 60 in total - enough for 15 crystals

Part Life Notification

Dear Valued Digi-Key Customer,

You have purchased the following part number from Digi-Key within the last two years. The manufacturer has announced an update to the part status.

Part Affected	
Manufacturer	FINISAR CORP
Description	MOD TX VCSEL 12X2.5G SNAP12
Manufacturer Part Number	FTXD02SL1C
Digi-Key Part Number	775-1148-ND
Your Most Recent P.O. Number	4374
Status	Obsolete
Substitutes	Please click here

End of Life
End of Life (EOL) refers to the planned demise of a product. Reasons for this may include market demands, technological innovation, and development driving changes in the product. The EOL process consists of a series of technical milestones and activities that, once completed, make a product obsolete.



Reflex Photonics SNAP 12

http://reflexphotonics.com/industrial_temperature_ppod_snap12/



SNAP 12 in 3.25 or
6.25 Gb/s speed
grade available!!

Reflex Photonics is proud to announce the launch of new data rate 3/5/6G [PPOD](#) and [SNAP12](#) modules with industrial and commercial temperature ratings for harsh environment applications. In addition, Reflex Photonics announces continued support for PPOD and SNAP12 optical modules.

PPOD and SNAP12 are offered in both industrial and commercial operating temperatures (-40 °C to 85 °C) at speeds up to [75 Gbps](#). These modules underwent extensive testing to meet requirements for harsh environments. The Reflex's PPOD and SNAP12 are 100% compatible with the industry standards.

PPOD and SNAP12 are 12 channel parallel optical modules with a standard chassis mount MPO interface. They are self-contained electrical to optical converters requiring no internal fiber management or handling.

Luis Perez, Sales Engineer, says, "Reflex is excited to support customers who want to keep PPOD and SNAP12 as their valuable choice within their existing and future designs. Also, we are fully committed to enhance this product line for higher data rates in both commercial and industrial operating temperatures as we understand that PPOD and SNAP12 optical modules continue to be an option for those commercial, defense and avionic customers looking for rugged and easy-to-use optics".

What next?

The Tx can be changed with newer models by reorganizing the pinout (**layout modification in the PCB**)

AVAGO TECHNOLOGIES AFBR-775BZ TRANSMITTER, FIBRE OPTIC, PPOD, 12X5G



Avago
TECHNOLOGIES

Produttore AVAGO TECHNOLOGIES
Codice Prodotto 2401123
Cod. produttore AFBR-775BZ

Technical Data Sheet (765.01KB) EN

L'immagine ha puramente scopi illustrativi.
Vedere la descrizione del prodotto.

Specifiche del prodotto, documenti e molto altro ancora

- Corrente Diretta Ifi: -
- Frequenza Dati Max: 10Gbps
- Distanza Trasmissione Dati: 150m
- Tipo di Connettore Fibra Ottica: MTP, MPO
- Tensione Diretta: -

Disponibilità
In attesa della consegna (0)
Controlla la disponibilità e i tempi di consegna
Contattatemi quando disponibile in magazzino

Prezzo per Pezzo: 1
Ordine minimo: 1
Quantità ordini multipli: 1

Prezzo: € 321,54

Quantità:

Ordina 4 unità in più con € 1.254,66 aggiuntivi e RISPARMIA € 31,50
[Aggiungi 4 in più +](#)

Prezzo

Quantità	Prezzo di listino
1 - 4	€ 321,54
5 - 9	€ 315,24
10+	€ 256,56

Optical Connector Side										
	1	2	3	4	5	6	7	8	9	10
A	Adr2	GND	GND	Intl.						
B	Adr1	GND	Din1p	GND	Din4p	GND	Din5n	GND	Din11n	GND
C	Adr0	GND	Din1n	GND	Din4n	GND	Din5p	GND	Din11p	GND
D	GND	Din0p	GND	Din3p	GND	Din6n	GND	Din10n	GND	SDA
E	GND	Din0n	GND	Din3n	GND	Din6p	GND	Din10p	GND	SCL
F	Reset	GND	Din2p	GND	Din5n	GND	Din7n	GND	Din9p	GND
G	DNC	GND	Din2n	GND	Din5p	GND	Din7p	GND	Din9n	GND
H	DNC	DNC	GND	DNC	GND	DNC	GND	DNC	GND	DNC
J	GND	GND	GND	DNC	DNC	DNC	DNC	GND	GND	GND
K	Vc25	Vc33	Vc33	DNC	DNC	DNC	DNC	Vc33	Vc33	Vc25

Figure 9. Host Board Pattern for Transmitter Connector – Top View

Pin-out is different...

Possible optical Txs:

- Avago 775xxx (2.5 - 5 Gb/s)
- Avago 776xxx (2.5 - 6.25 Gb/s)

Each single fiber could serve 2 ADC chs

i.e.

Each multi-fiber could serve 24 ADC chs

Alternative: AVAGO/Foxconn MicroPOD transceivers ?

Product/SearchByFamily?topClassID=Electronic%20Module&ProductClass=Fiber%20Optics&ProductFamily=Embedded
physics.infn.it Offerte PC E Software FX11LA-92S-SV(21) INFN-FISICA Calcolo Intesa Sanpaolo | Cc

Antenna Cable Connectors Electronic Module & Device

Fiber Optics > Embedded Optical Modules >

Product Series :

12-Channel **MicroPOD Embedded Optical Modules**

MiniPOD Embedded Optical Modules

Select All

Product Series : MicroPOD Embedded Optical Modules

Product Name :

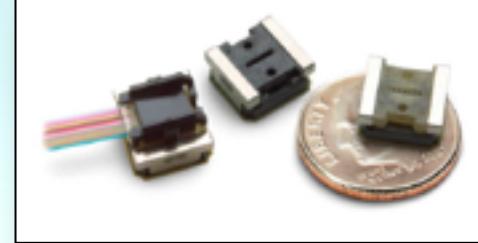
Part NO. : [AFBR-77D4SZ](#) Status : Active

Description :

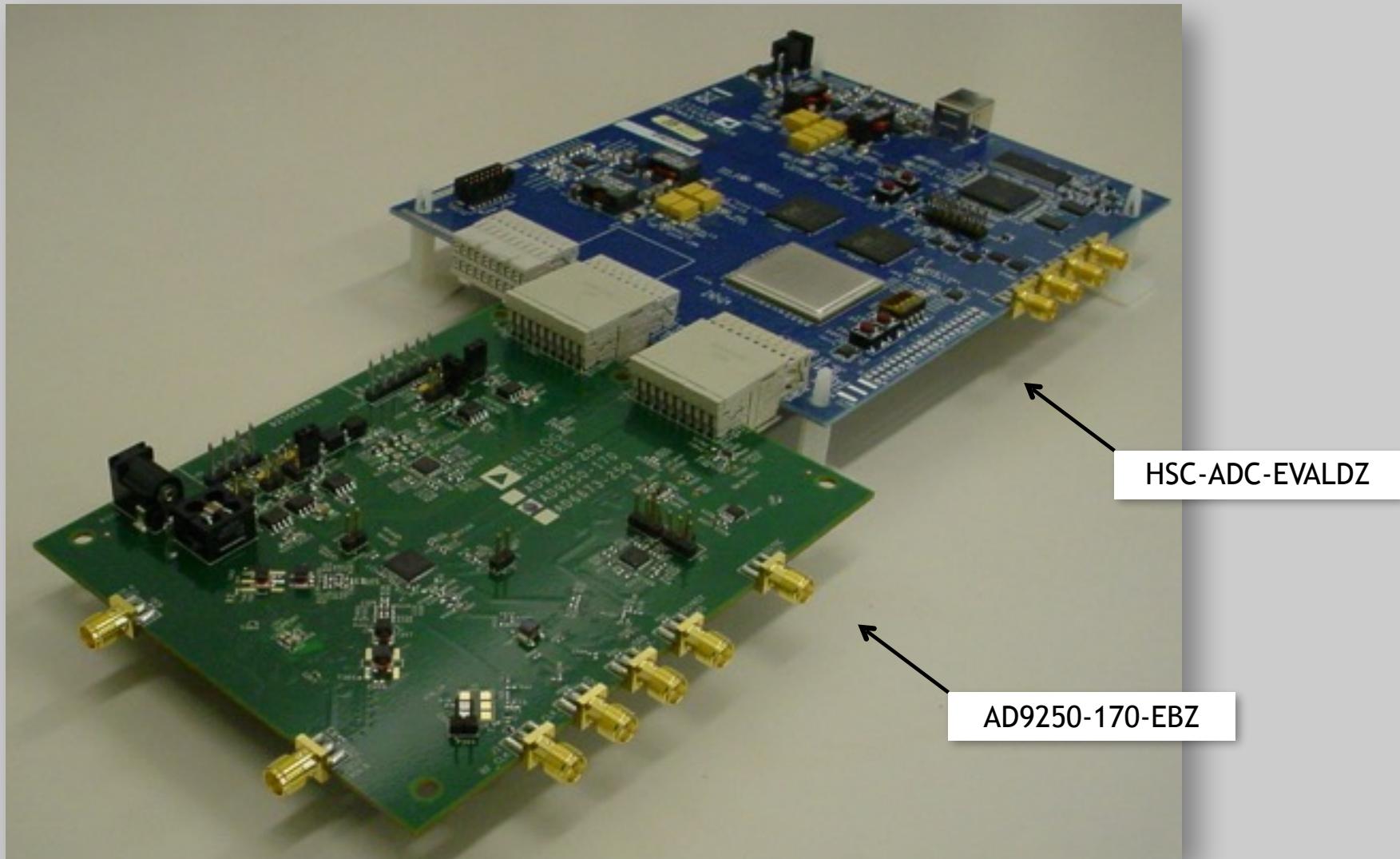
The AFBR-77D4SZ and AFBR-78D4SZ are a set of 12-channel, pluggable, parallel fiber optics transmitter and receiver modules set optimized for short-range parallel multi-lane data communication and interconnect applications. These high-speed, high density optical modules are designed to operate over multimode fiber systems using a nominal wavelength of 850 nm.

The optical interface requires the user to provide a custom designed optical turn 1x12 ribbon cable PRIZM® LightTurn® connector.

[Compare](#) [Request](#)

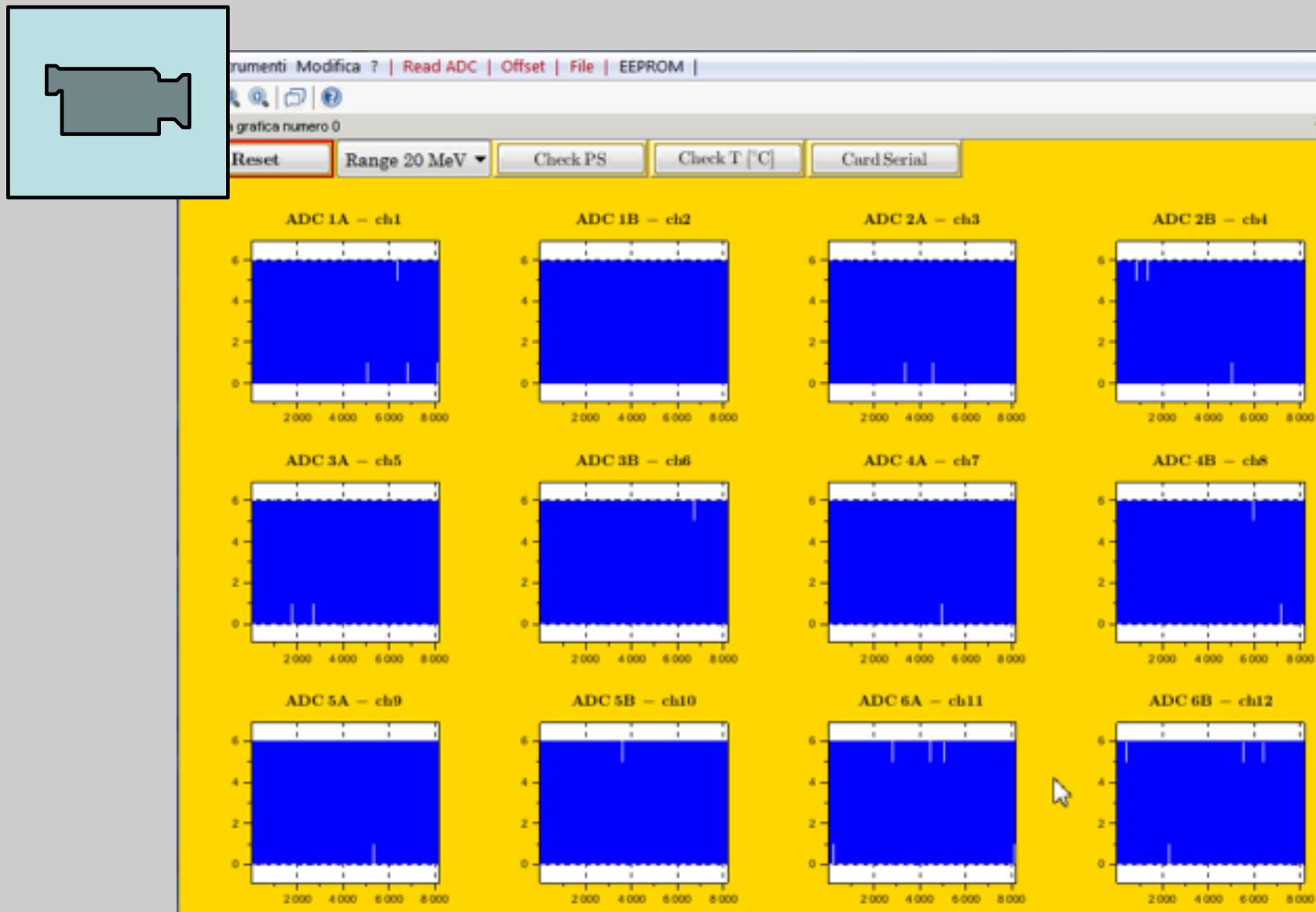


Possible new ADC: AD9250-170 - Demoboard acquired



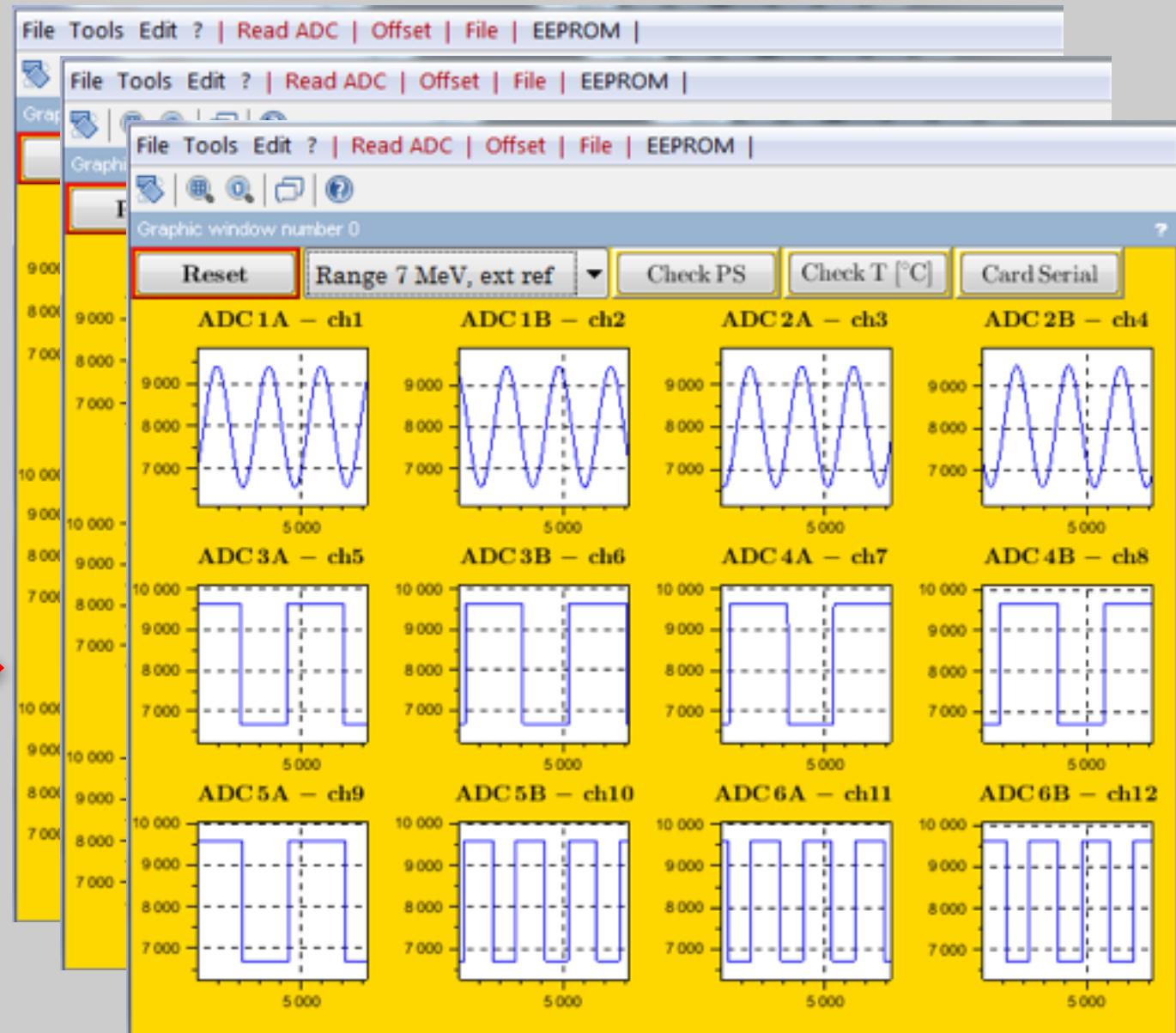
Scilab GUI for digitizer testing: basic features

The ADC chip contains an undocumented 16 kB RAM where the waveforms can be stored and read out via SPI, which is used in the demoboard. I gained full control on that by reverse engineering. Very useful functionality for test benching and diagnostic.



Scilab GUI for digitizer testing: new features needed

The ADC chip contains an undocumented 16 kB RAM where the waveforms can be stored and read out via SPI, which is used in the demoboard. I gained full control on that by reverse engineering. Very useful functionality for test benching and diagnostic.



In perspective:

- 1) Add oscilloscope mode on individual chs
- 2) Add fine control of the DC offset



Perspectives

- Transmit two ADC's signals chs over one lane/fiber (4 Gbps) using Reflex Photonics Tx's
- Get rid of fibers? To be discussed
- Change ADC model (lower power consumption)
- Use AVAGO/Foxconn MicroPODs?
- Improve the testbench system GUI adding new functionalities
- Long term R&D: Highly integrated digital preamplifier (4/8/12/16 chs per board)