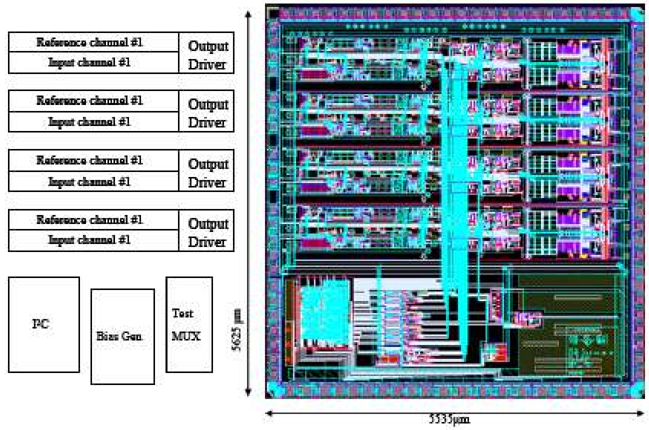
TG 3 Status Report

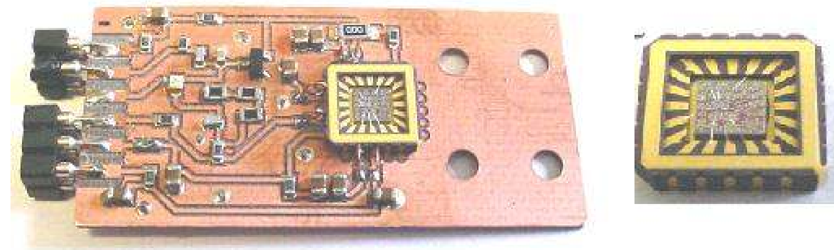
C. Cattadori on behalf of TG3

Status of FE circuits

	T [ns] Range[MeV]	ENC rms [e-]	R with crystal [keV]	Output
F-CSA104 Fully integrated	20 ns 0-11 MeV	270 @ LN (20 μs) 310 @ 20 C	5.4	Diff.
PZ -0 (holes readout) AMS HV 0.8 mm CZX FE FET not integrated Rf, Cf not integrated	15 ns 0-6 MeV	110 @ LN (10 μs)	No test availab le	Singl. Ended
PZ-1 (e-,h+ readout) AMS HV 0.8 mm CZX FE FET integrated Rf not integrated Active reset	12 ns 0-6 MeV	160 @LN (12 μs) 150 @LN (DPLMS)	No test availab le	Diff Singl. ended
IPA4 (e^-,h^+) Monolithic JFET Rf,Cf and polarizing components not integrated	40 ns 0- 5 MeV	100 @ LN (6 ms)	3.9 keV Crystal high LC	Singl. end

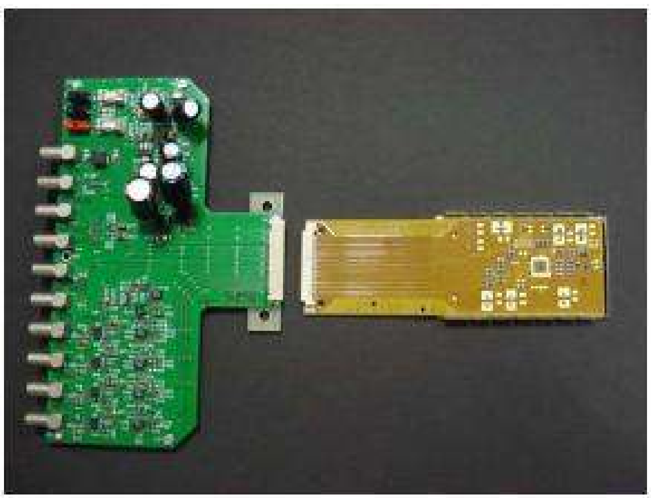
How they look like

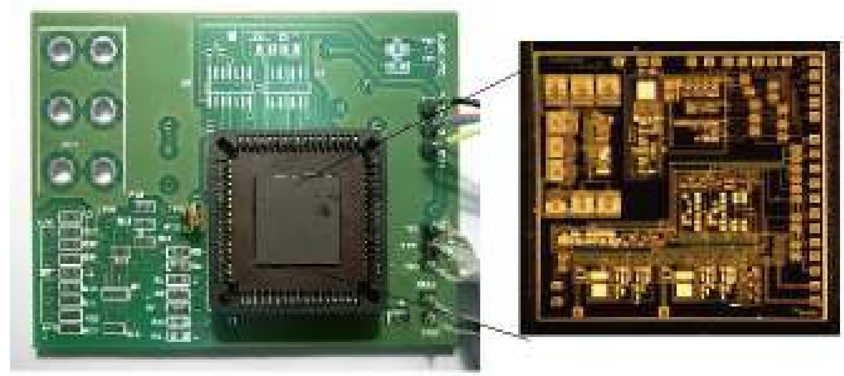




PZ-0

F-CSA104





PZ-1

Program to test the FE circuit with crystal

Along 2007 FE Test Program has been in conflict with study of LAriiLC. New bench test for FE electronic was prepared but we decided to use it to double the LAriiLC bench tests. → build another bench test and found another crystal.

Up to now INFN didn't funded a crystal for FE tests (because of our large engagement in plants and infrastructures we are not receiving money for detector/equippment).

After a long loan request procedure, on 18th October E. Bellotti and A. D'Andragora went to pick up in Cologne one of the Ge capsule of former EUROBALL (property of INFN Milano).

Purpose of new bench test: Perform test of

- FE circuits in same conditions and with same signal conditioning chain, cables (HV, LV, signal)
- HV feedthrough
- LV, signal feedthrough: Fisher 102 sealed series
- Junction box

→ comparison and choise

New Dewar + closed chamber ready (since 3 months) at LNGS to be the electronic test facility but crystal is missing. Urgent to start to build the first complete read-out chain, from FE to PSA.

Measured
resolution@ Cologne
(warm Agata CSA) =
2.2 keV -2.4 keV.

Cables: HV and signal. Work in progress

Criteria to choose them: Accomplish following requirements

- electrical (impedence at LAr T, and keep needed HV),
- radioactivity (< 10 mBq/kg),
- mechanical
- minimize the mass/ unit length (typical g/m)

	Coax	Impedence	Max V	HV test
Habia Teflon Subminiatur	yes	50Ω	-	
Teledyne Reynolds Teflon coated	no	-	5 kV	OK
Atlas Axon Subminiatur Kapton coated	yes	50Ω	-	
Caburn 1-CC-0712 Kapton coated	yes	50Ω	5 kV	OK
Caburn 1-CC-0710 Kapton coated	yes	$\approx 50\Omega$	2 kV	OK

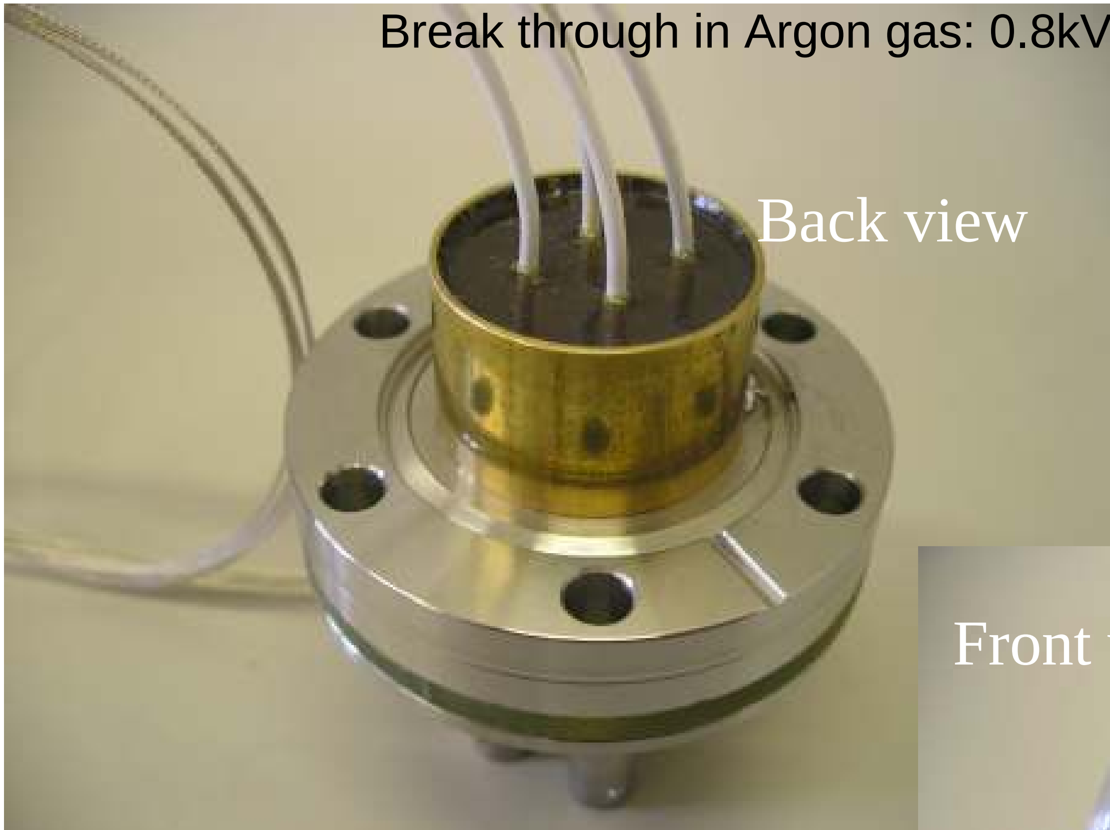
Cable sample	Specific activity [mBq/kg]					
	^{228}Th	^{228}Ra	^{226}Ra	^{40}K	^{108m}Ag	^{110m}Ag
Cuflon	< 7.2	< 6.5	< 9.3	61 ± 16		
Teflon coated HV cable	< 8.0	< 8.0	< 2.5	56 ± 12	1.8 ± 0.3	9.0 ± 2.0
ATLAS Axon	< 12	< 15	< 12	230 ± 60	6.6 ± 2.1	
1-CC-0712 (50 Ohm)	< 11	< 8.0	< 11	610 ± 80	5.0 ± 1.2	
Habia Teflon Subm.	< 4.7	< 6.9	< 1.8	400 ± 40	0.78 ± 0.24	1.3 ± 0.2
Caburn 1-CC-0710	< 11	< 15	< 12	< 100		
Kapton flat cable	< 4.0		9 ± 6	130 ± 60		

Work and hardware needed to start up the encapsulated detector bench test

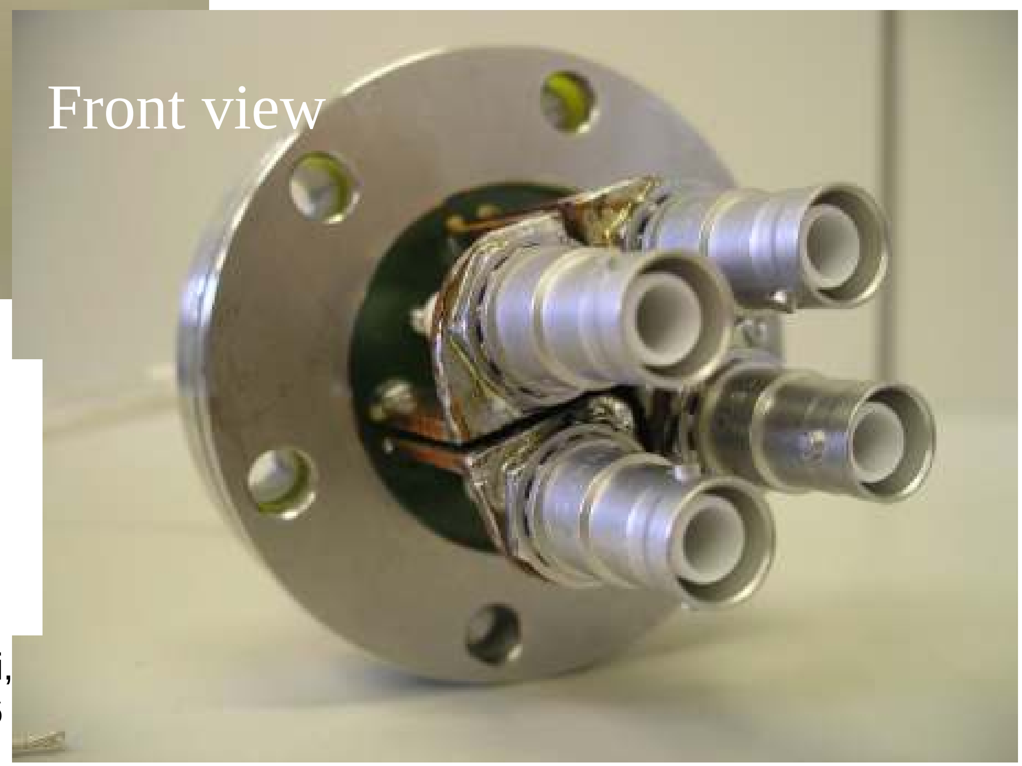
- Dewar 130 cm height (available): detector is encapsulated so we do not need any glove box above dewar
- Build a new cold finger (needed to regulate the cooling rate (10-20 ^{0}C/h) (ongoing)
- Build flange and suspension system (ongoing)
- Cooling down test (TBD)
- First Test of PZ-1 foreseen in week of 26 November (TBD): difficult to keep the schedule.
- Insulation from vibrations.

HV flanges against discharges:

Break through in Argon gas: 0.8kV/mm (Air: 4kV/mm)



Developed and patented by INFN-PD. 9 flanges 4-ch each in preparation for GERDA.
2 flanges 1-ch, available and dispersion to GND tested at pA level (OK)



Other option: SHV Stycast insulated. Demonstrated to work at LNGS 1 month run+ multiple HV cycles in Ar atmosphere

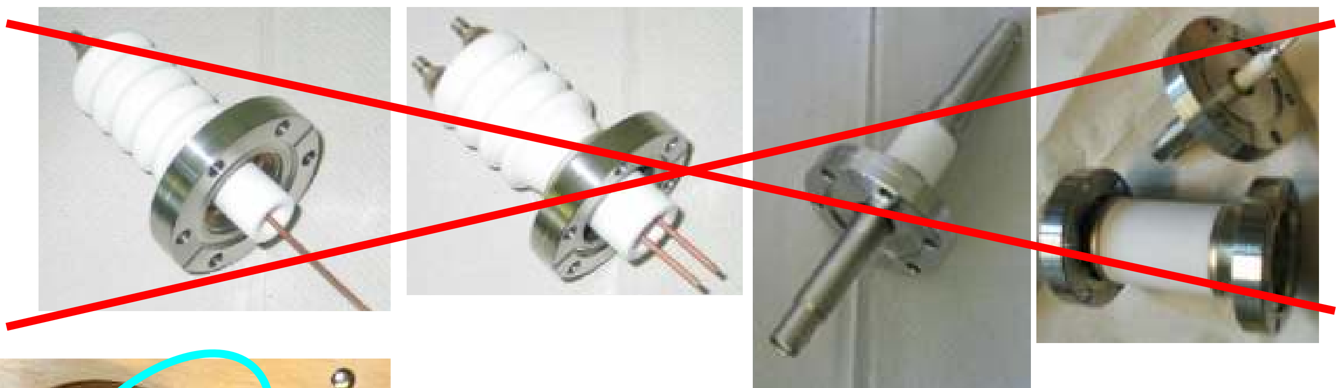
C. Cattadori,
LNGS 4-6

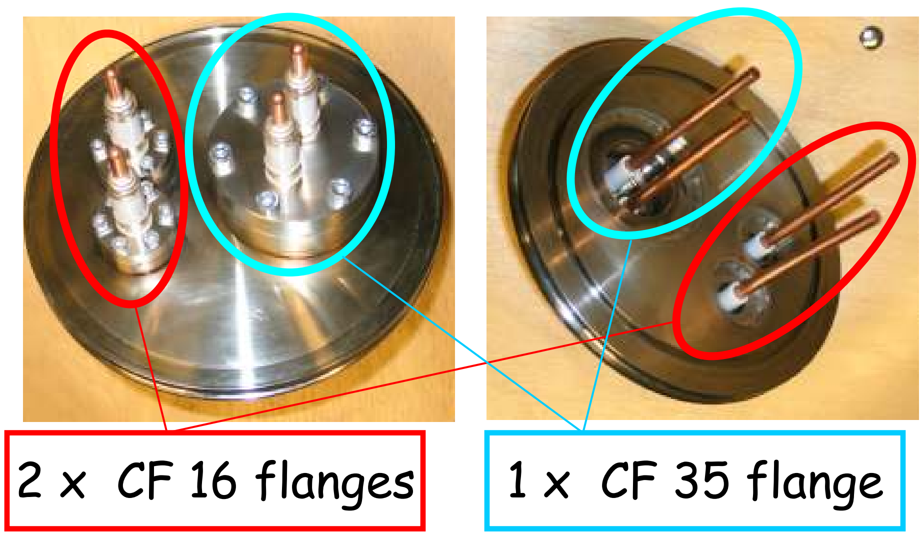
Cable Feed Through

HV feed through:

- Break through in Argon gas: 0.8kV/mm (Air: 4kV/mm)
→ Feed through needs a lot of space, 5mm for 6kV

- Many commercial feed-through were tested but only one was working.





- one big flange mounted on a vessel to check two feed through systems.
- Vessel was first evacuated and than filled with Argon gas.
- HV was applied to the feed through

→These are solutions for bringing HV into the GERDA system filled with Ar gas

Submission of revised versions of ASIC CSAs on 10.10.2007

3x3 mm² AMS HV CMOS 0.8 μm CZX technology chip layout

On chip:

• PZ-1v.2.1: Circuit consisting of two key elements: a very low-noise preamplifier with integrated input transistors and a fully differential operational amplifier with complete rail to rail output signal capability for light differential loads. Possibility of tuning of the fundamental bias currents by switching on/off parallel current generators controlled by digital signals (external pins).

•PZ-1v.2.2: A similar font-end electronics with a 1 pF feedback poly-capacitor which connect the output and the input of low-noise preamplifier stage to avoid to have an external component on PCB.

• PZ-0v.3.0: N° 4 front-end single transistor option (input FET is not on chip) preamplifier for string of germanium detectors, with 1.4 pF compensative capacitor.

• 300 MOhm fully integrated resistor so to have a feedback component determining τfall directly on chip in stead to use a discrete external component (to be used both with PZ-0 and PZ1)

Next steps

- Extensively test FE circuits mounted in final mountings and PCB (start with preliminar ones to choose circuits)
- Test junctions of
  - Crystal Cables - J –CSA –J – Signal cables
    - (POGO PINS vs others)
- Test the complete signal conditioning line up to FADC.

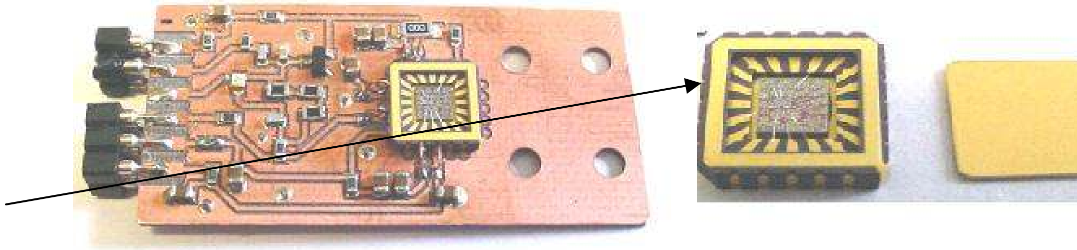
Schedule: answer in late spring 2008. In time for final production

FE for LARGE and string tests

16 +4 ch of PZ-0 available need to be bonded mounted in ceramic carrier PCB

8 ch of PZ-1v.0

What is urgently needed



γ-ray spectrometry of

- ceramic carriers for chips.
- components that we actually are going to use
- full circuit

All these samples will be available in low mass samples (10-50 g)