

R&D sui diamanti per progetti di fisica forward in ATLAS

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ATLAS upgrade Italia - Dic 2013

Why diamond sensors?

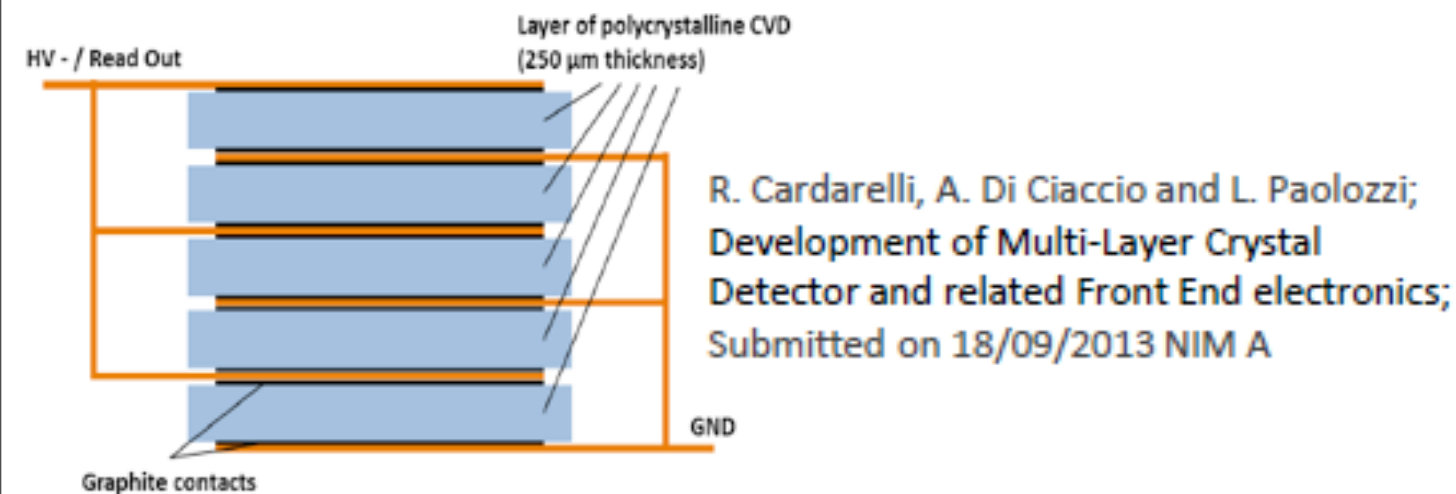
Main Goal: back-up solution for QUARTIC

Further goal: Phase II

- Rad-hard
- No leakage
- No cooling/Compact
- LVLI trigger/ Tracking
- Cost
- Procurement
- Small S/N for MIP
- Polarization

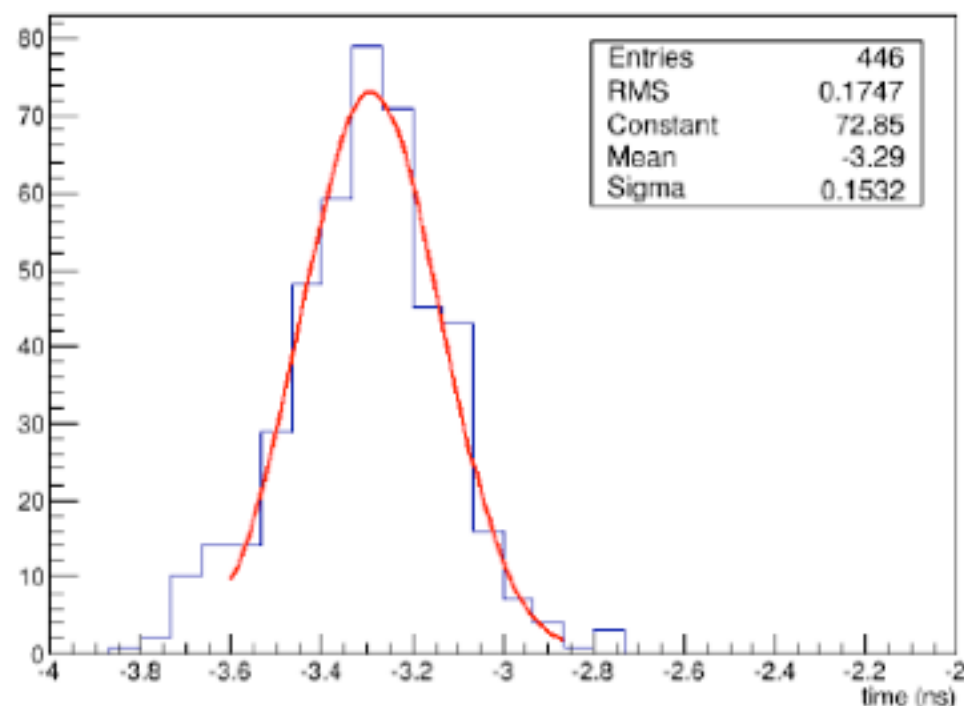
MLCD and Si-Ge FE

Multi-layer crystal detector (MLCD)



ToF measurement for a 5 layers MLCD.

Time of flight: Poli Multilayer 5x250 μm 45deg vs poli500 90deg



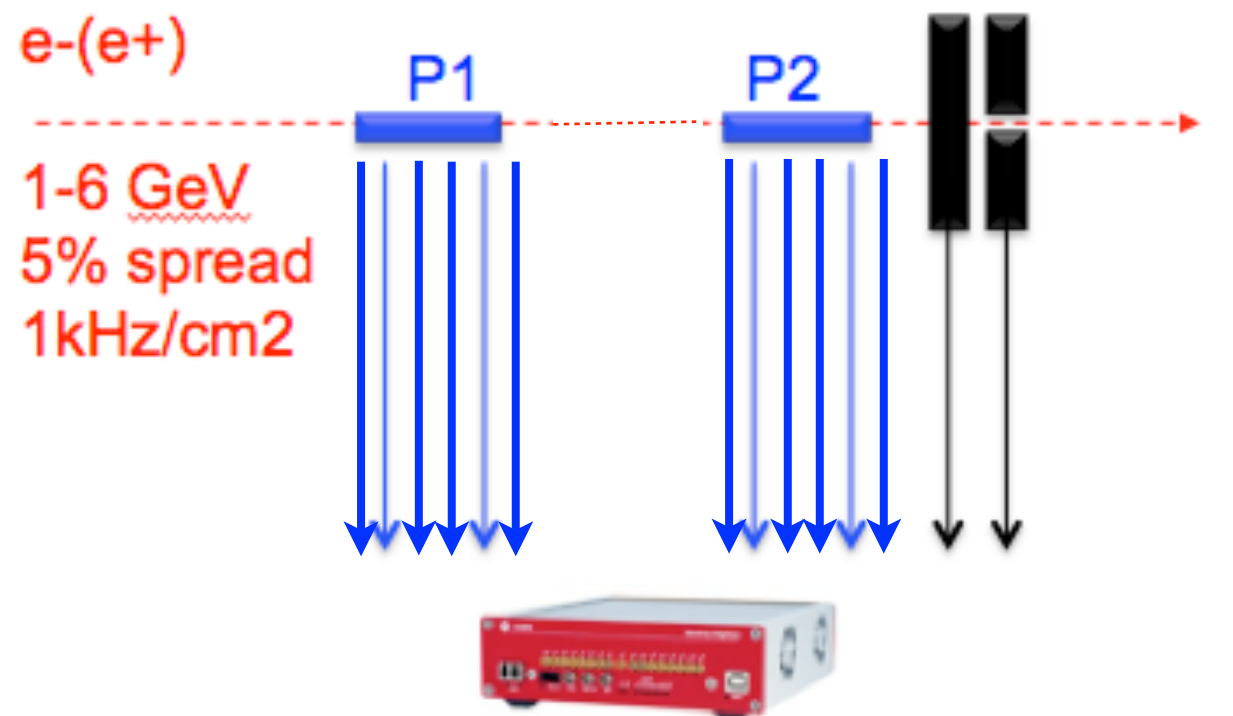
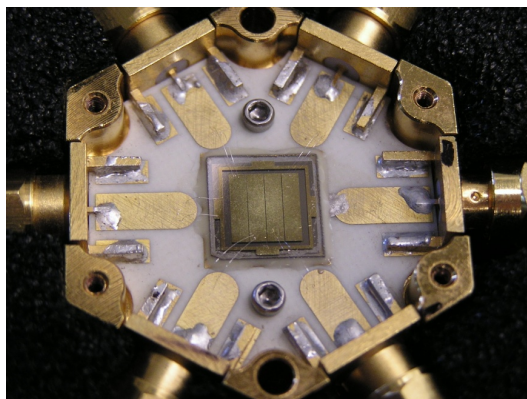
AFP ATLAS DIAMOND STATUS

- MLCD can improve time resolution a factor n :

$$\sigma_T = \frac{\text{noise}}{\frac{Q}{\text{thick}} v_{\text{drift}} n} = 1 \cdot \text{ns} \frac{\text{noise}(e^-)}{3600 e^- n}$$

- Thin diamond less polarization
- Testbeam with 500 MeV e^- at Frascati Beam Test Facility: 100 ps time resolution achieved.
- 8 channels SiGe chip just submitted.
- A factor of 3 improvement next : $n \uparrow$, Thickness $\downarrow$ and new F-E.

Testbeam with Grazing Diamond



DT5742

16+1 Channel 12 bit 5 GS/s Switched Capacitor Digitizer

- Grazing Diamond boost the signal enormously:

$$\sigma_T = \frac{\text{noise}}{\frac{Q}{\text{thick}^2} \text{Lenght} \cdot v_{\text{drift}}} = 1 \cdot \text{ns} \frac{\text{noise}}{3600e^- \frac{\text{Lenght}}{\text{thick}}}$$

- Testbeam at Desy scheduled on 27-th Jan 2014.
- 2 poly (P1-2) 4 strips (1.5 mm pitch) diamond detectors under test
- Commercial RF ampli and fast charge ampli in testbeam.

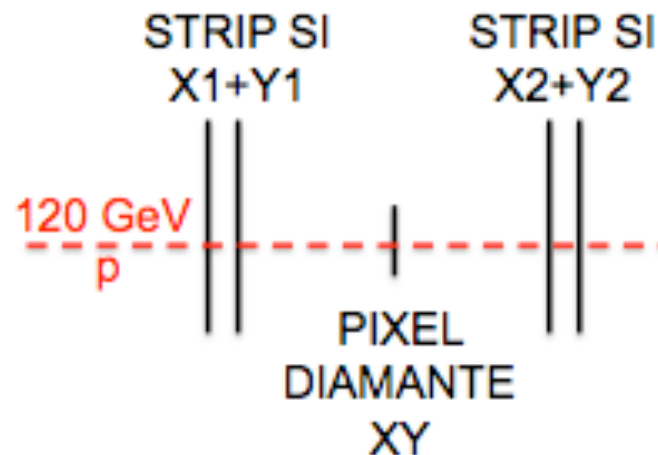
Diamond Pixel in DIAPIX

Bologna
Lecce

R.O. chip: Superpix0 130 nm CMOS sviluppato dalla Coll. SuperB (INFN Bo, Pv Pi)

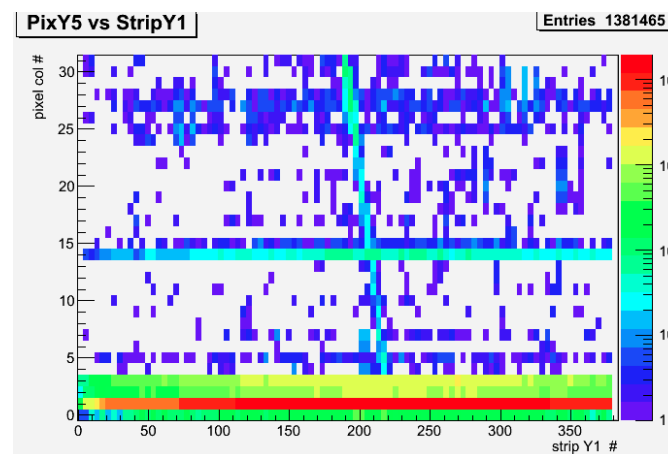
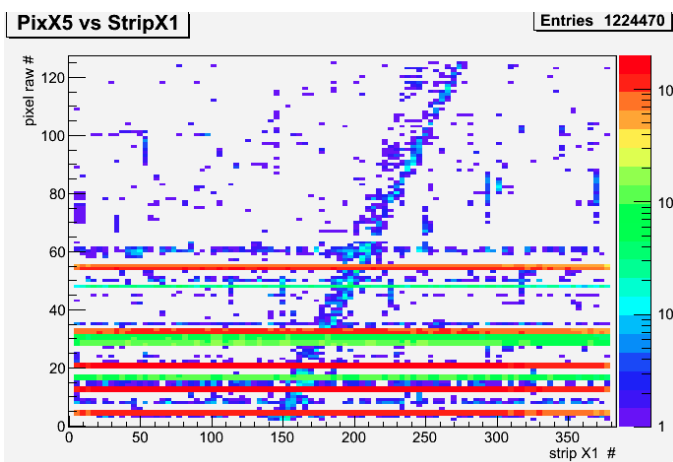
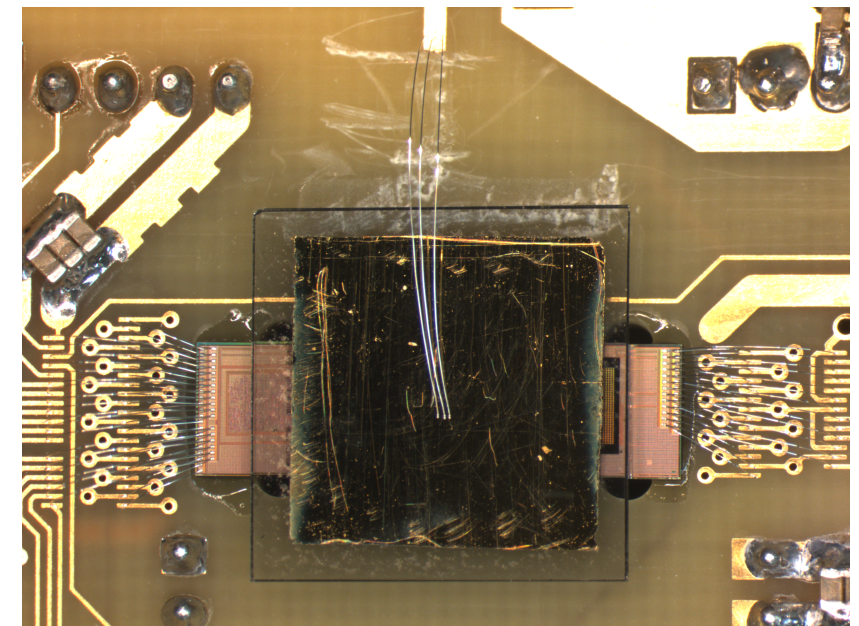
Tre rivelatori assemblati sulla carrier board di superPIX0 (Pisa).

Test di funzionalità a Pavia e Lecce.



Test veloce su fascio fatto dalla
Coll. SuperB del secondo
rivelatore durante test-beam di
SuperB@CERN-SP-H6 Nov2012.

FUNZIONANO !!!

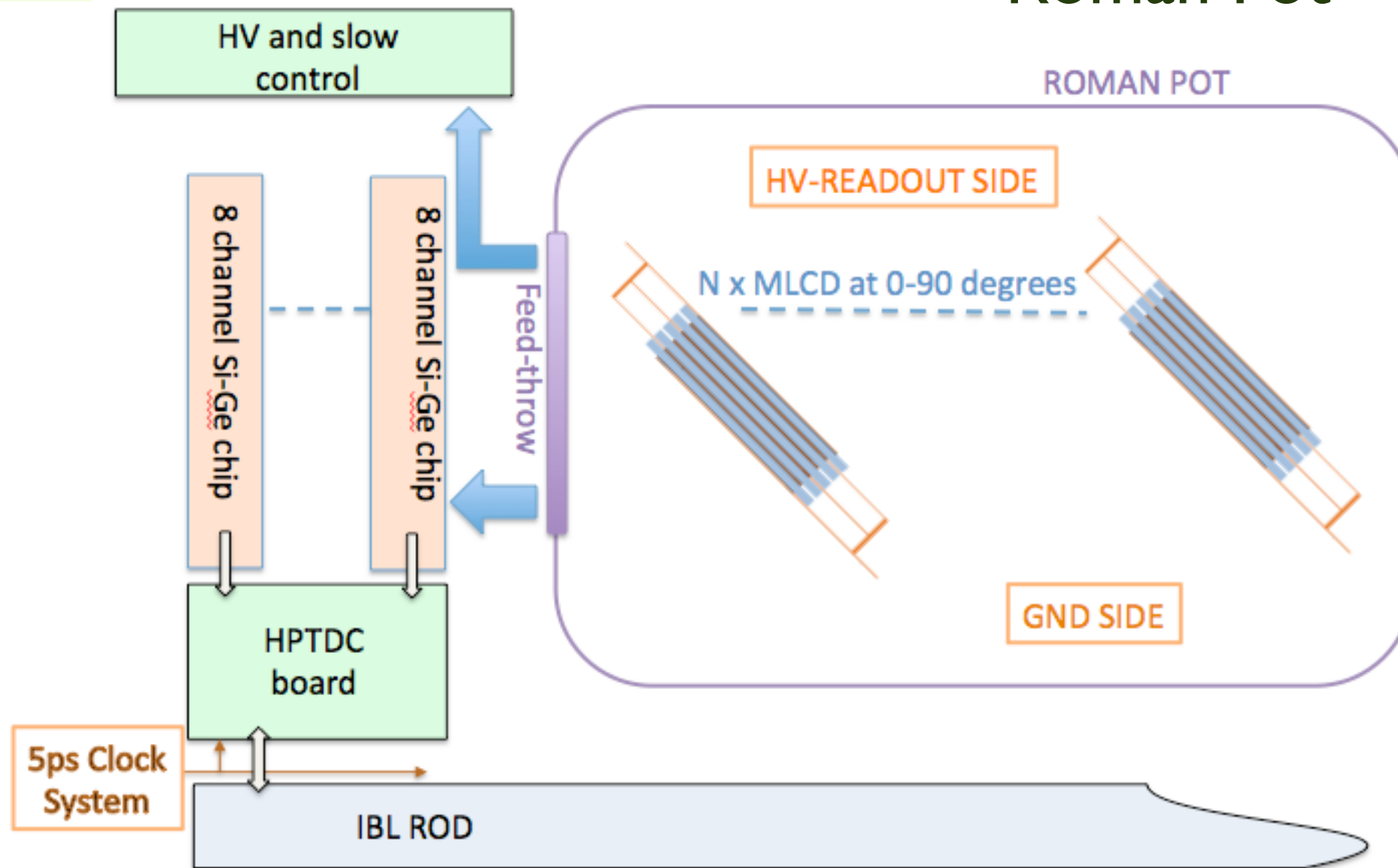


- Soglie troppo alte per MIP per chip Superchip0
- Testbeam ai LNS con p 62 MeV con segnale 5MIP nel 2014
- Interesse a costruire pixel ibridi al diamante con chip performante quale FEI4 dei pixel di ATLAS

Block diagram fo AFP

Bologna
Lecce
Roma Tor Vergata

No active electronics in
Roman Pot



Richieste/Fondi/Sinergie

Bologna

Lecce

Roma Tor Vergata

1. Possibili richieste

- 3 pixel ibridi al diamante con ATLAS-FE14 chip (25 ke)
- 3 MLCD instrumentati con nuova elettronica SiGe RM2 (15 ke)
- 5ps clock system+HPTDC+IBL ROAD (15 ke)

2. Finanziamenti

- DIAPIX in G5 e' finito nel 2013
- Lecce e' nel WP8 del PREMIALE IRPT (Innovation in Radio-and-Particle Therapy)
- Interessi a partecipare a AIDA 2 e/o altri bandi di H2020
- ...?

3. Sinergie

- Silicon Pixel: DAQ, readout-chip, testbeam
- CMS-Totem: hanno avuto finanziato prototipi e testbeam per il loro upgrade