IRPT WP8 diamond dosimetry (PI Mara Bruzzi): Report of CT, LE and MIB

Section	Local responsible	Role	FTE	TASK
Catania	Cristina Tuvè	Associated Professor	20%	Diamond procurement and testing
Lecce	Gabriele Chiodini	INFN Researcher	10%	Proton irradiation at high fluence
Milano-Bicocca	Mauro Dinardo	Uni. Researcher	10%	Automatized diamond qualification

The activity is mainly devoted to demonstrate the procurement capability and quality certification of large size polycrystalline diamond sensors to be used in IMRT (Imaging Modulated Radio Therapy).

FOUNDS

Catania : 20ke CO + 10 ke APP + 5ke MI

Lecce : 45ke CO + 32 ke INV + 5ke MI + 2y PostDoc

Milano-Bicocca : 53 ke INV

TOT : 65ke CO + 95 APP/INV +10ke MI =160 ke + 2y PostDoc

Gabriele Chiodini - INFN Lecce

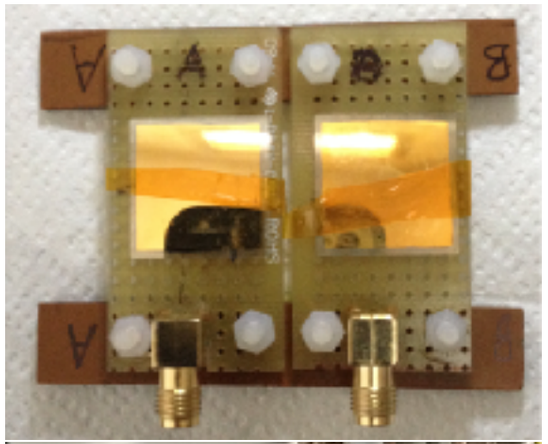
Diamond procurement (LE)

45 + 32 keuro

Large size high quality diamonds from II-VI USA (6ke/each)

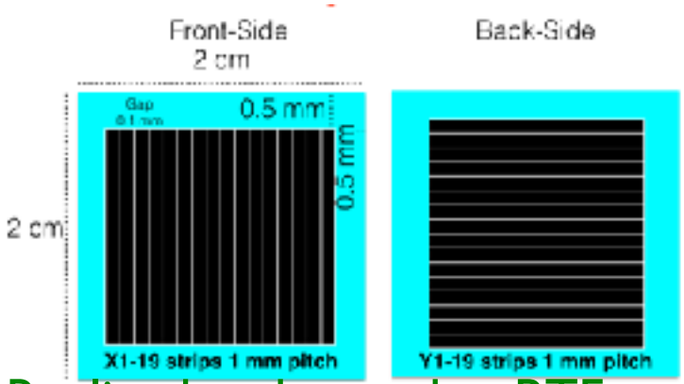
Your PO N°	Our PO N°	order date	P/N	Description	Ordered qty	Shipped qty	Founds
CA5335108	5466	07.02.2013	864625	diamond windows 20 x 20 x 0.5 mm	2	2	DIAPIX
CA5800201	5517	10.03.2014	864625	diamond windows 20 x 20 x 0.5 mm	6	0	IRPT
CA5854697	5526	12.02.2014	220398	diamond windows 25 x 25 x 0.5 mm	2	0	CMS

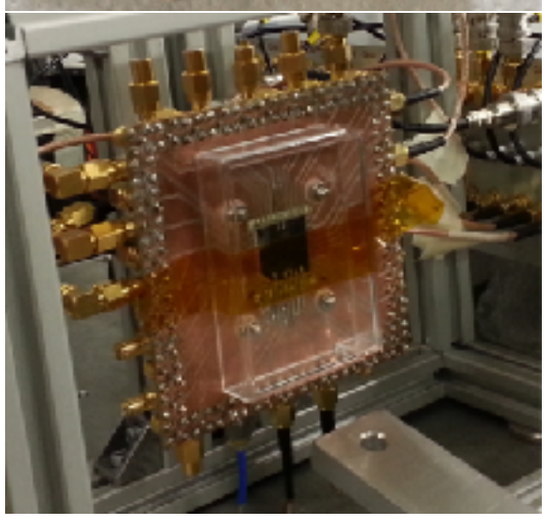
8 ordered but only 2 delivered so far after one year and half.
Likely due to our request to pass RD42 certification with ccd>300um everywhere.



Tests under way: charge collection distance (ccd)>300um

Two Large size, thin, "as grown" diamonds from Applied USA (2.5 ke/each)





Ohmic strips laser graphitized in Lecce on both sides

Realized and tested at BTF
a beam monitor in "Counting Mode":
Spin off: active target for PADME experiment at LNF

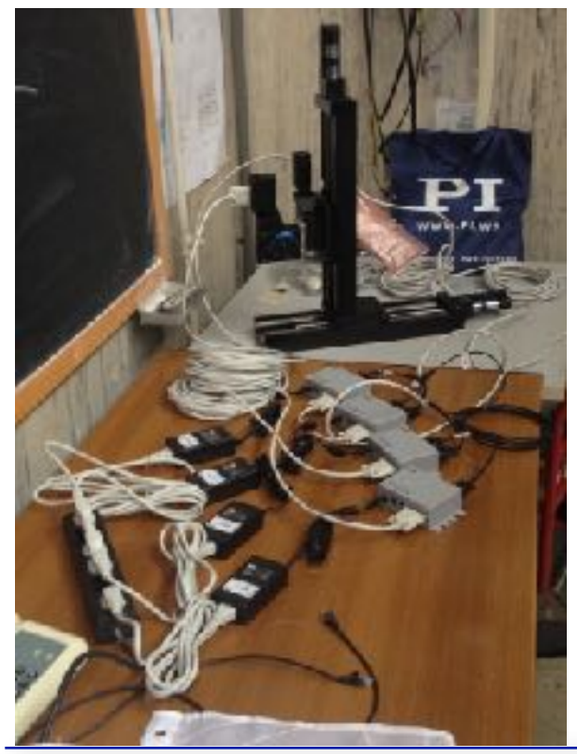
Lecroy oscilloscope + Beta source + alfa source + glue dispenser + vacuum pick-up tools, …

Proton irradiation high-flux (CT-LE)

30 keuro

Installed concrete shielding at zero degree line at LNS.

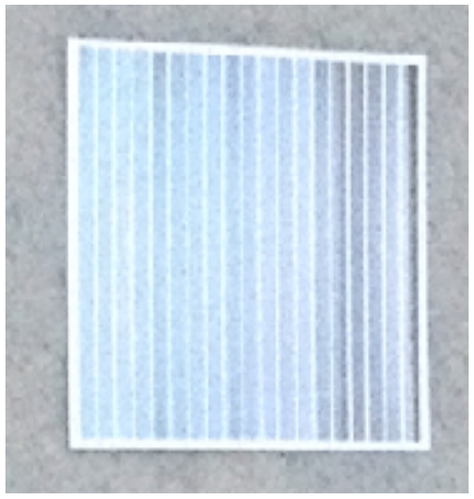
- Cyclotron current could be increased up to 50 nA
- Open a new irradiation regime suitable for LHC Phase II upgrade
- Already few irradiation tests: diamond and ATLAS Italia HVCMOS.



4 micrometric stages:

- Linear movements:X-Y
- Rotation angles:θ-ϕ
- Labview software

20x20x0.05mm graphitized diamond



DDC264EVM: 64-Channels, Current-Input, ADC

FE idea borrowed from FI (see M. Bruzzi talk)

High dose beam monitor in "Current Mode" or SEM mode for 2D irradiation map. Under realization

Diamond QA setting in MiBi

50 keuro

Automatised Diamond qualification setup is in place and working

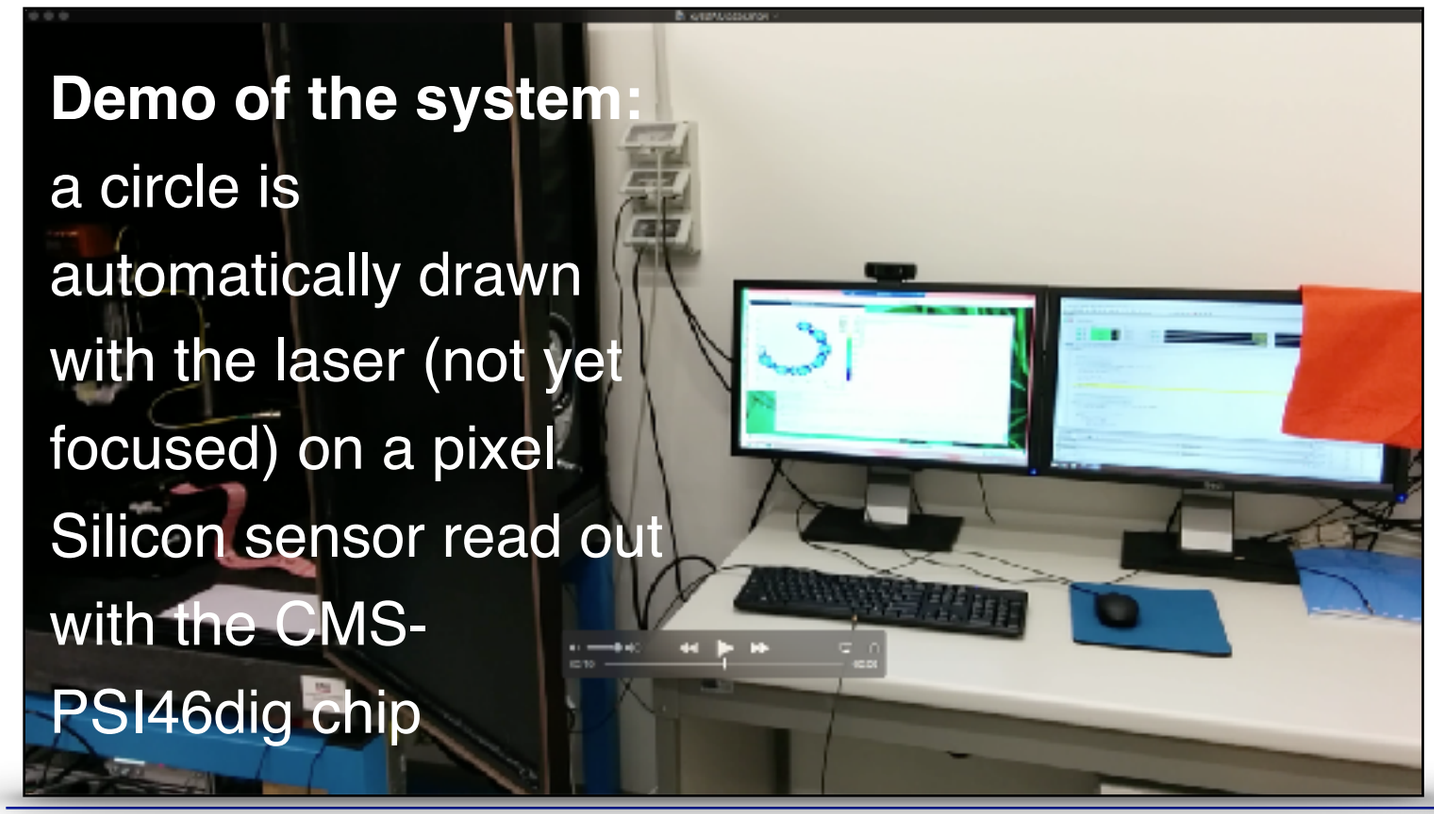
-two laser systems (each with its own optical heads) at 375 and 1064 nm respectively

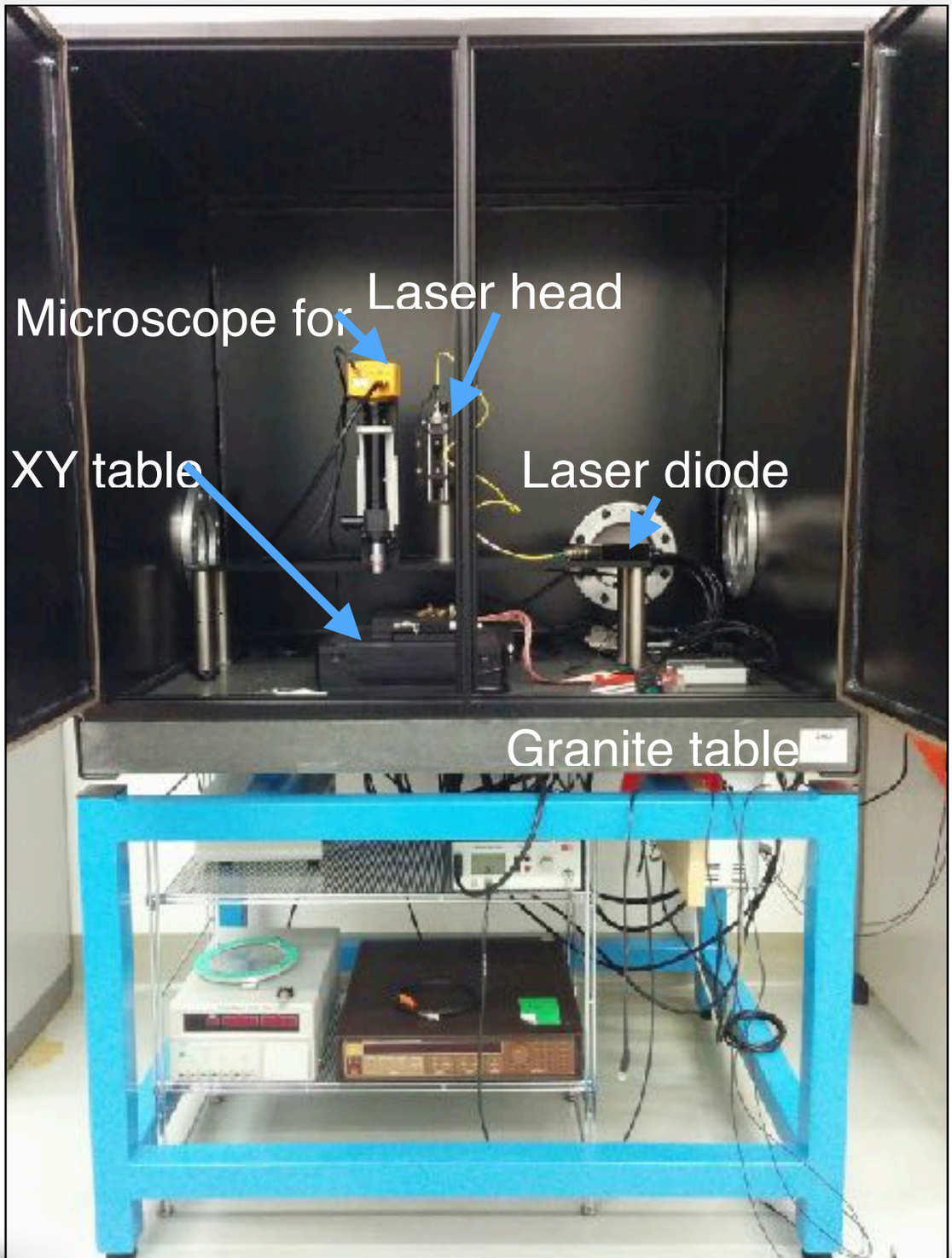
-S90 beta source of 1 MBq

Next

Automated (currently manual)

Z positioning for the laser / source heads





Conclusions

- The procurement of high quality (ccd>300um) large size (2cm x 2cm) diamond at a reasonable cost (5ke) is still not very fast.
- Nevertheless, if the requirement on ccd>300um is droped or even "as grown" diamond is acceptable the procurement is cheaper and much faster (< 2 months)
- The infrastracture for a automatic diamond certification is in place in MiBi.
- The infrastracture for HL-LHC like radiation test is in place at LNS zero degree lines of the Cyclotron and a high flux beam monitor based on large size "as grown" diamond is under development.