INSTRUMENTATION FOR BEAM DIAGNOSTICS

(from particle physics to medical applications)

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DITANET - POSTDOC

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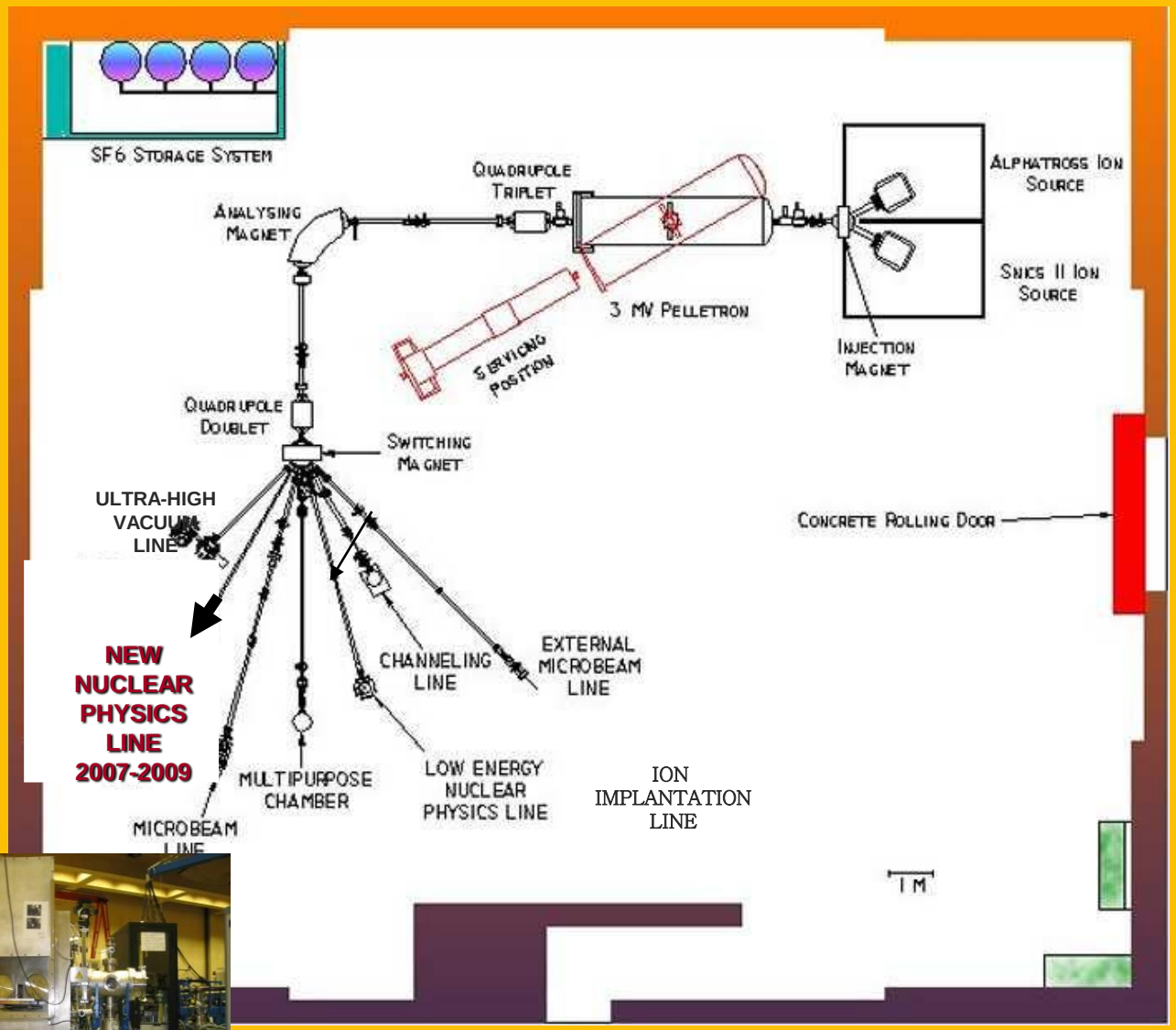
OUTLINE

- Facility for testing nuclear instrumentation
- Brief introduction on diamond detectors
- Medical applications
- Conclusions

TANDEM at CNA, SEVILLE



Currents 1pA - 1µA
Energies
500 keV – 25MeV
Ion beams p, He to Cu
Three different ion sources
Alphatross
SNICS
Duoplasmatron

Ions 0<A< 60
Energy is (Z+1)*3 MeV

Availability of time for testing instrumentation

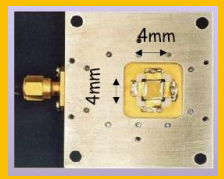
DIAMOND DETECTORS

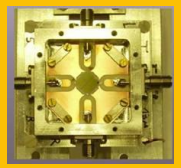
Investigation of the feasibility of performing tests with new diamond detector prototypes at CNA

Contacts with Diamond Detectors LtD. Company
(DITANET Partner)
in order to test diamond devices for:

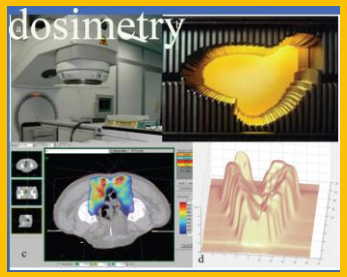
ION PARTICLE BEAMS DETECTION

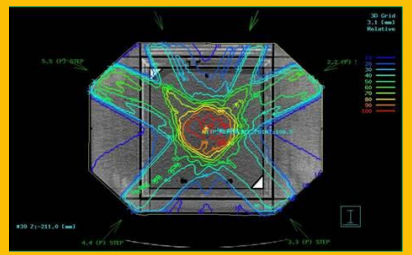
GSI samples





RADIOTHERAPY APPLICATIONS

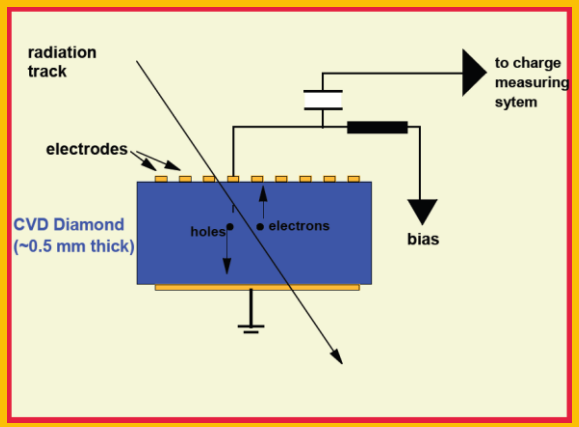




MOTIVATION FOR DIAMOND DEVICES

DIAMOND IS AN APPEALING MATERIAL FOR RADIATION DETECTORS

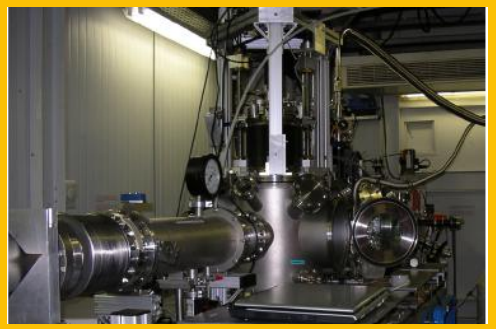
- Highly radiation hardness
- Chemical inertness
- Mechanically robust
- High electric charge mobility => fast response time
- Low dielectric constant => low capacitance => low noise
- Low dark currents (<1 pA) => low noise



DETECTION OF XUV PHOTONS, ION PARTICLE BEAMS

Diamond devices for its versatility allow their use in many fields:

SYNCHROTRON X-RAY BEAM MONITORING
PHOTON - ION SPECTROSCOPY
SPACE APPLICATIONS
RADIOTHERAPY APPLICATIONS
BEAM TRACKING
ETC.

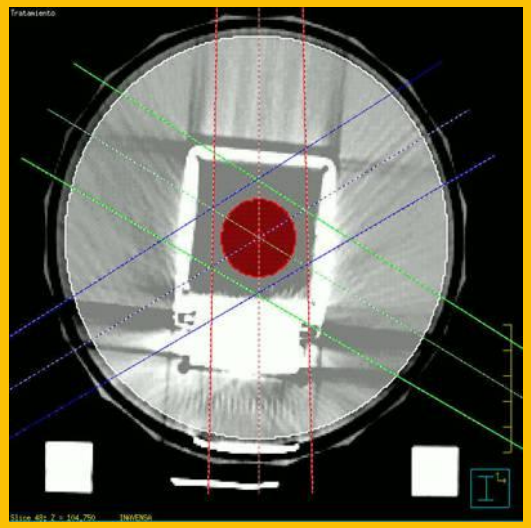


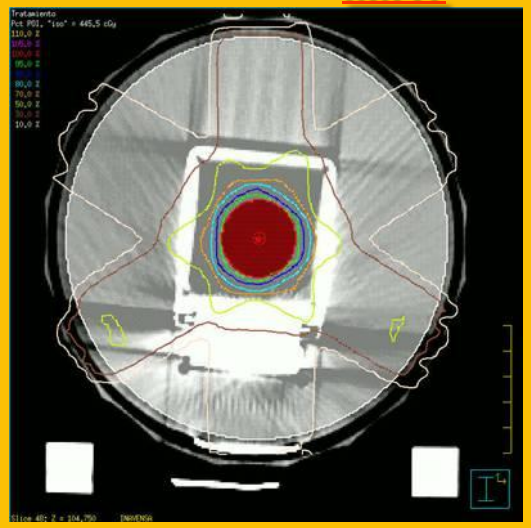
X-ray spectroscopy
GILDA Beamline (ESRF)
A.Bocci PhD Thesis

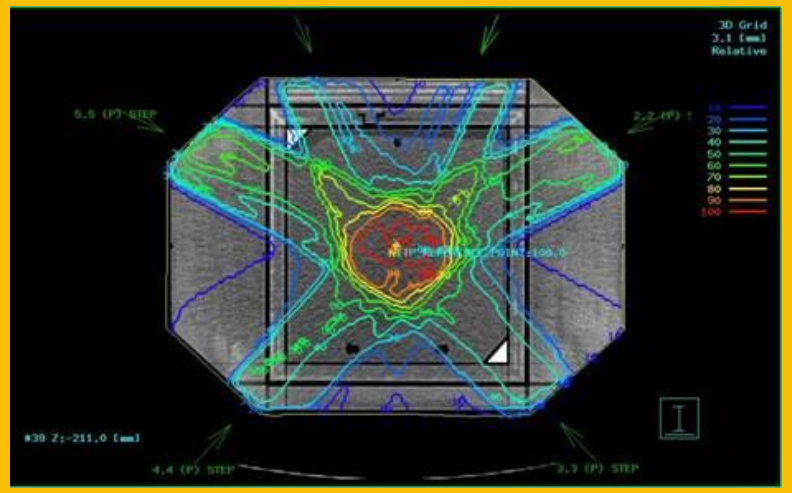
IMRT
INTENSITY MODULATED RADIATION-THERAPY

PROJECT RADIA

Study of feasibility of a new detection system for the verification of dose treatment with IMRT







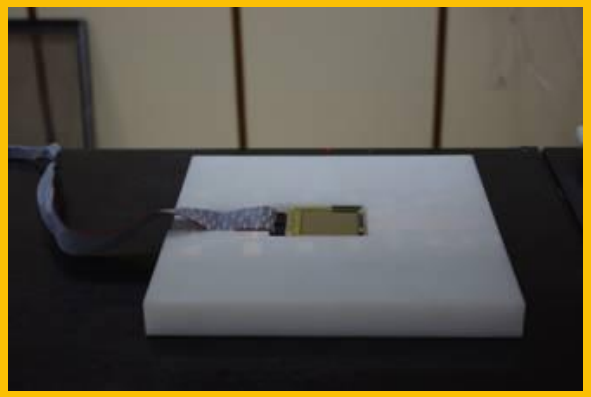
COLLABORATION BETWEEN

National Accelerator of Center - CNA
Department of Atomic, Molecular and Nuclear Physics
School of Engineer
(University of Seville)
Hospital Virgen Macarena (Seville)
Inabensa Company

DETECTORS FOR IMRT

A COMMERCIAL SINGLE-SIDED SSD IS USED FOR THE DETECTION SYSTEM

Phantom with inside the detector



Micron Semiconductor
Area 50 mm x 50 mm
Thickness 500 microns
16 strips

Linear accelerator

Phantom with inside the detector

Preliminary results are encouraging but an improvement in the spatial resolution is necessary (pixellated 2D detectors)

CONCLUSIONS

- A new Nuclear Physics line is available at CNA for testing any kind of nuclear instrumentations (detectors, electronics, acquisition systems)
- Investigation of the feasibility of performing tests with diamond detector prototypes at CNA
- A project dedicated to Medical applications is going. Measurements performed with a silicon strip detector and data analysis dedicated to a pre-treatment IMRT dose verification method are in progress
- Study on the implementation of a new detection system based on an array detector is planned for improving the spatial resolution of IMRT images
  (2D Silicon detectors, 2D Diamond detectors)

Thank you
for
your attention!