Nicola Pacifico

❑Nationality: Italian; age: 28

❑MSc in solid state physics at the University of Bari

    ❑Master Thesis defended at University of Bari (Italy) in March 2008

    ❑Thesis title: "Radiation damage study on MCz-substrate diodes irradiated with 24 GeV/c protons"

❑Short term contract for working at CERN, period May-October 2008.

    ❑Continuing thesis work and development of an electron-extraction Beam Condition Monitor for the CERN PS/Irradiation facility.

❑Currently:

    ❑PhD student since January 2009 at the University of Bari, supervisor Prof. Mauro De Palma

    ❑Since January 2010 MC-PAD ESR at CERN, project P1 / Radiation Tolerant Detectors

   Supervisor: Dr. Michael Moll

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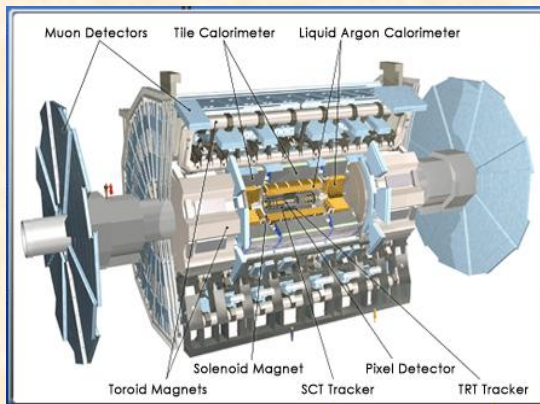
- Publications & conferences

Why silicon detectors?

spatial resolution, readout speed, make them the most suitable choice for detection close to the interaction point, where the track density is higher…
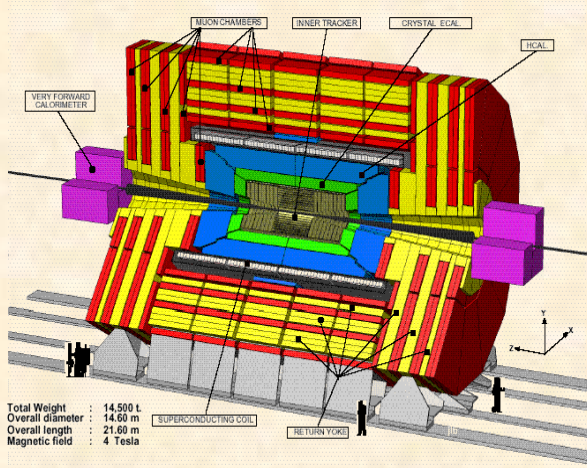
■ **CMS tracker**

■ **ATLAS tracker**
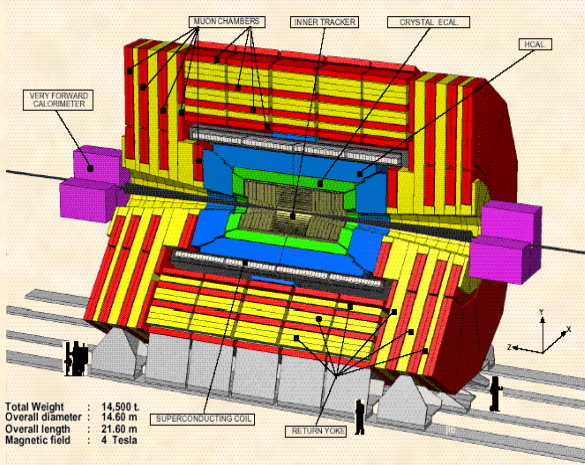

■ **LHC-b VELO detector**

Why silicon detectors?

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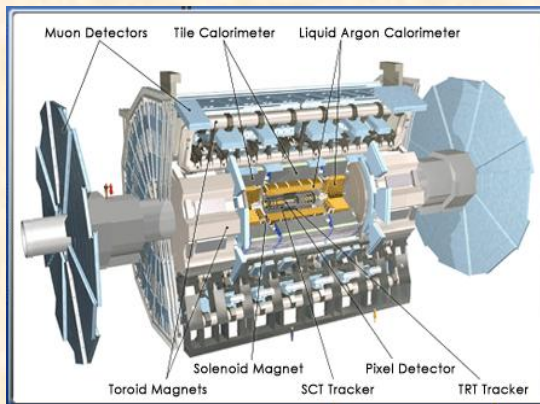
- **CMS tracker**

… but that's as well the place where radiation levels are higher!!!

- **ATLAS tracker**

- **LHC-b VELO detector**
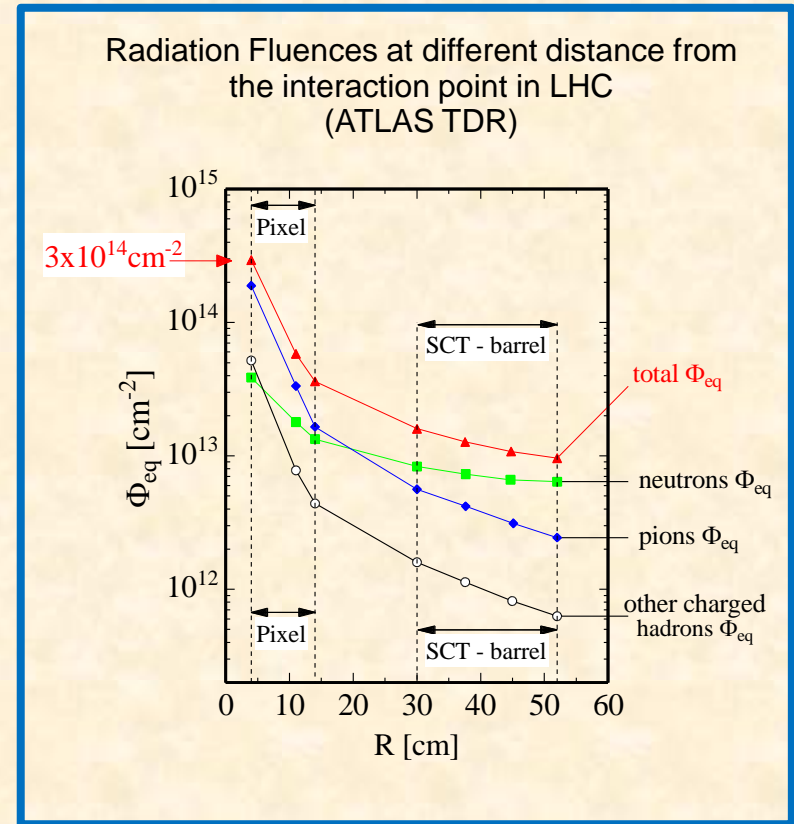
Aims

Research on material engineering:

- *Different kinds of silicon material: Magnetic Czochralski, Epitaxial*

    - *Lower depletion voltage needed*

    - *Less impact of annealing effects*

Research on detector technology

- n-on-p silicon detectors

    - No type inversion with irradiation

    - Field always developing on the readout side

Radiation Fluences at different distance from the interaction point in LHC (ATLAS TDR)

$3x10^{14}cm^{-2}$

Φ_{eq} [cm^{-2}]

Pixel

SCT - barrel

total Φ_{eq}

neutrons Φ_{eq}

pions Φ_{eq}

other charged hadrons Φ_{eq}

R [cm]

My work is focused on two subjects: a better understanding of the radiation damage to be expected on the current generation of silicon detectors and the R&D on a candidate silicon material for the next generation of LHC experiments (LHC upgrade),where a substantial increase in luminosity (and hence, radiation levels) is foreseen.

Tools

A good part of the activity of my first year of appointment has been focused on the development of two new setups for detector characterization. The setups are currently both operational and acquiring data.

Multi-technique (CCE/TCT) characterisation setup for microstrips and diodes (macroscopic detector characterization)
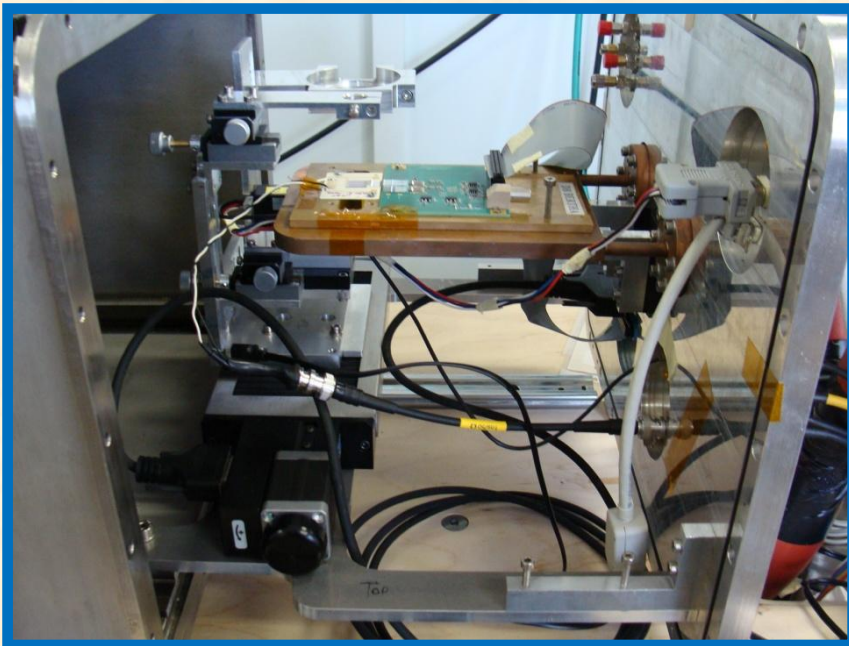
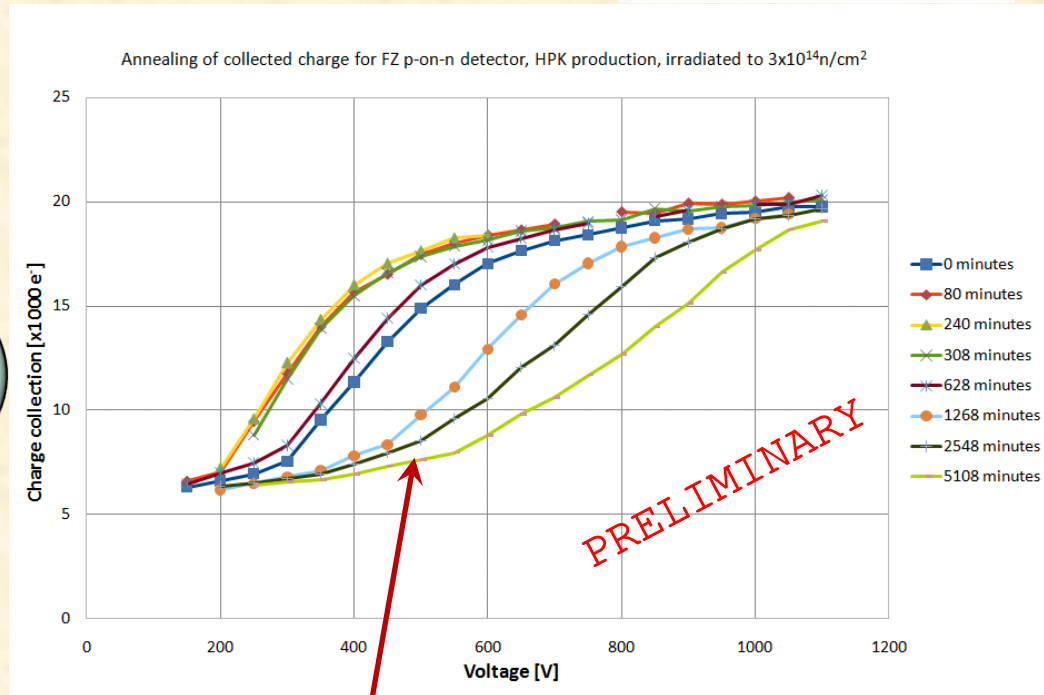EDGE-TCT setup (microscopic characterization of detectors parameters)
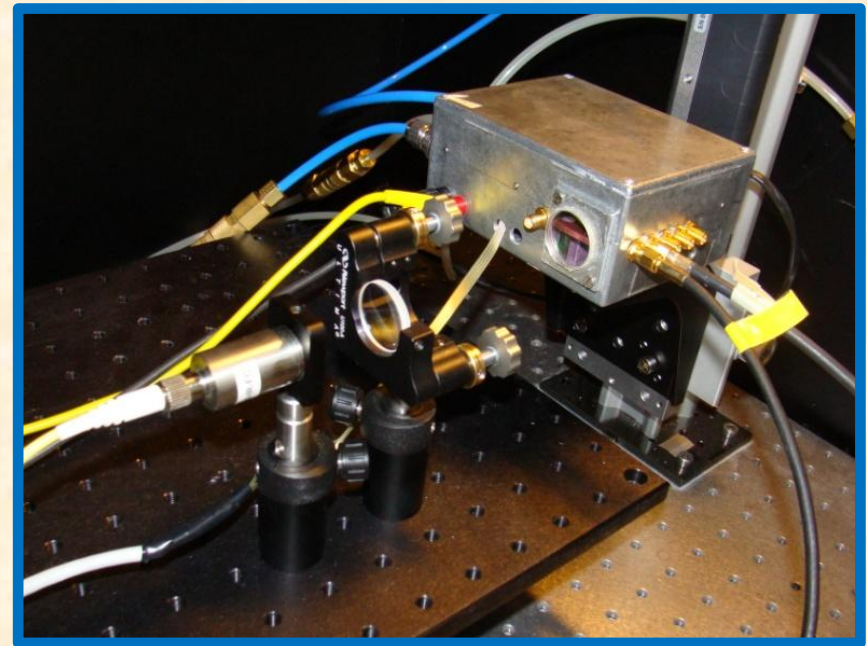
Results (1)
Radiation damage study on the current generation of silicon detectors for LHC

Aim: to study what the effect of irradiation and annealing will be on the current generation of silicon detectors exposed to expected LHC fluences:

Annealing of collected charge for FZ p-on-n detector, HPK production, irradiated to 3×10^{14} n/cm^2

PRELIMINARY

collected charge after 3e14 neutrons and annealing equivalent to 1 year at room temperature at 500 V (current LHC trackers PSU limit)
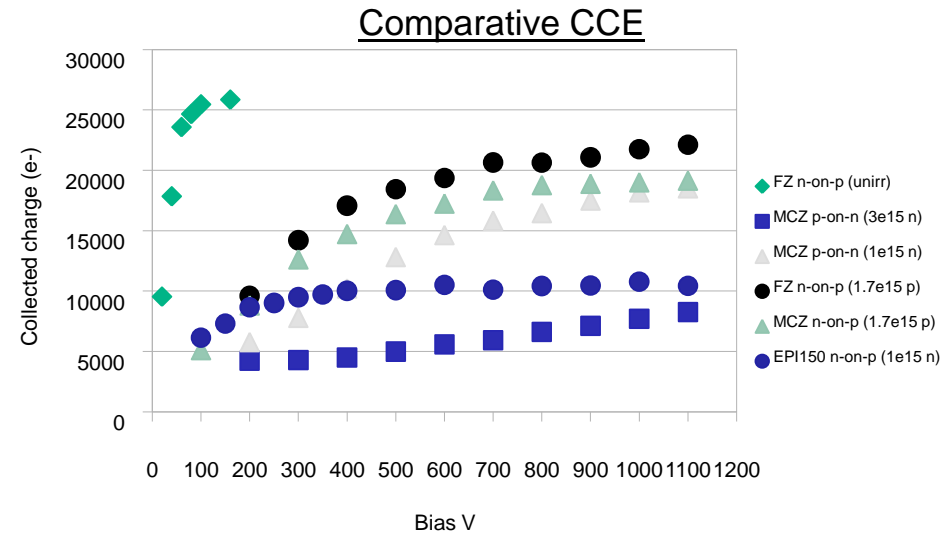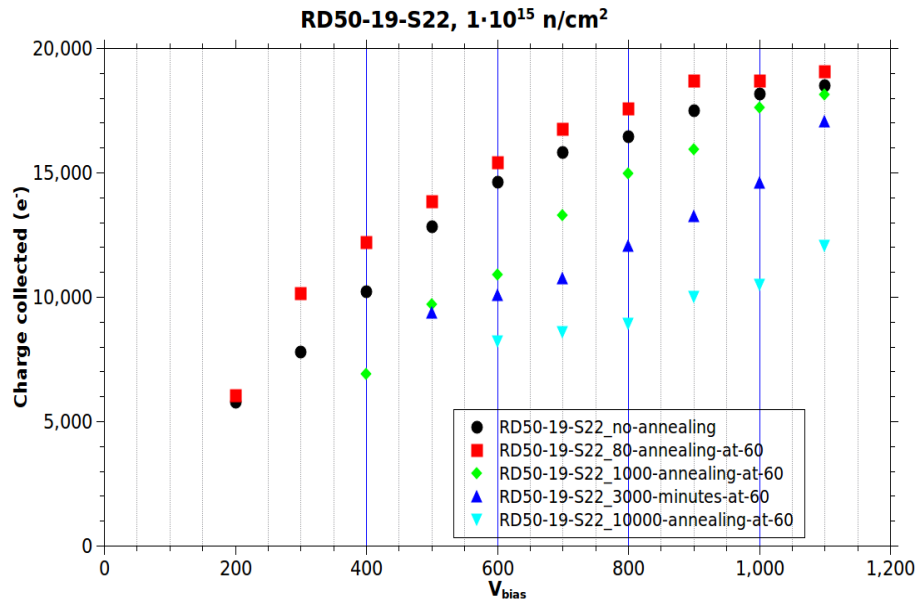
What I have done
• Irradiate the detector
• Heat up the detector to accelerate effects associated with defect recombination at room temperature (e.g. mantainance periods)
What I have found
Important degradation of detector performances with annealing! (preliminary data)

RD50-19-S22, $1 \cdot 10^{15}$ n/cm^2

- RD50-19-S22_no-annealing
- RD50-19-S22_80-annealing-at-60
- RD50-19-S22_1000-annealing-at-60
- RD50-19-S22_3000-minutes-at-60
- RD50-19-S22_10000-annealing-at-60

Comparative CCE

- FZ n-on-p (unirr)
- MCZ p-on-n (3e15 n)
- MCZ p-on-n (1e15 n)
- FZ n-on-p (1.7e15 p)
- MCZ n-on-p (1.7e15 p)
- EPI150 n-on-p (1e15 n)

What I have found
Outstanding radiation hardness of p-type detector, good behavior
of p-on-n Magnetic Czochralski at S-LHC fluences

Overview - Training

Network Training Events

17 – 19 September '09, AGH Cracow First Network Training Event on Electronics
28 – 30 January '10, DESY Hamburg Second Network Training Event on Detector Simulation and Data Analysis
27 – 29 September '10, Ljubljana Third Network Training Event on Processing and Radiation Hardness of Solid State Detectors

Other events/Trainings

- TREDI Workshop, Trento (Italy), February 2009
- French courses (CERN, level 1-3, throughout the first year of research)
- EIRO Forum School on instrumentation, CERN, May 2009
- 14th RD50 Workshop, Freiburg, June 2009
- Alibava readout system training, University of Liverpool - July 2009
- 15th RD50 Workshop, CERN, November 2009
- LabVIEW course, CERN, December 2010
- Training on communication skills and presentation techniques, CERN
- 16th RD50 Workshop, Barcelona, June, 2010

Foreseen:
- RESMDD10 Conference, Florence, October 2010

Overview - Results

Publications

N. Pacifico & al. - A TCT and annealing study on Magnetic Czochralski silicon detectors irradiated with neutrons and 24 GeV/c protons - *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment, Volume 612, Issue 3, 11 January 2010, Pages 549-554*

Activities have been presented in

TREDI Workshop '09 (Presentation)

EIRO Forum school on instrumentation (Poster)

15th RD50 Workshop, CERN, November 2009 (Presentation)

16th RD50 Workshop, Barcelona, June 2010 (Presentation)