

Radiation tests for ATLAS cold electronic

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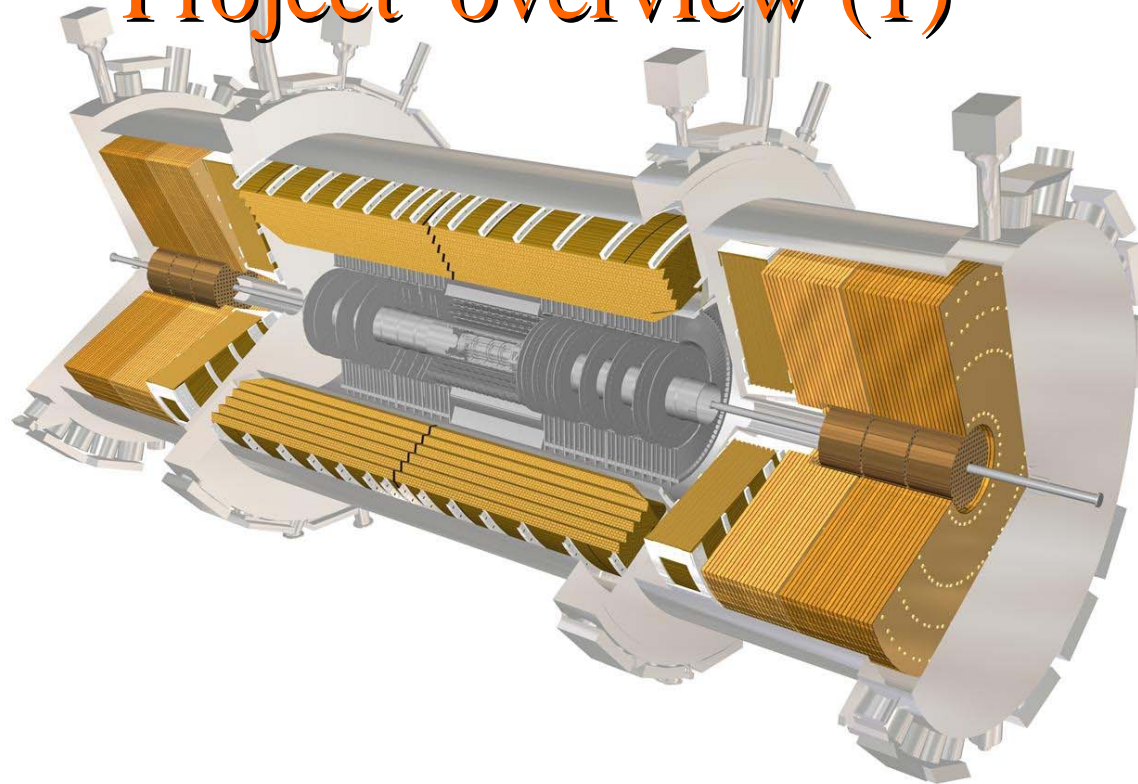


Things to talk about

- Project overview
- Process selection – strategy
- Measurement setup one transistor
- Radiation test setup in Rez
- Status & conclusions & plans



Project overview (1)



Inner part of the Atlas Detector
at CERN (Geneva) with the HEC (Hadronic End Cap)

- This part is cooled with liquid argon.
- The amplifiers for signal read out are placed at the outer side of the HEC wheel.
- The beam (proton proton collision) travels along the middle axis.

Project overview (2)



Photo of a small part of the HEC wheel:

- The Copper plates are the signal detector.
- The Amplifier boards are connected with coaxial cables.
- Several amplifier systems are assembled on one board.
- If the detector runs, the amplifiers have to operate for 10 years under radiation, without losing their characteristics.

Technology selection – strategy

- Goals:
- * *Radiation hardness should improve by a factor 10*
 - * *System should work both at room temperature & in liquid argon (-190°C)*

Radiation Hardness for 10years SLHC

50kGy

Gamma Ray

$1.5 \times 10^{15} \text{ cm}^{-2}$

Neutrons

$1.2 \times 10^{12} \text{ cm}^{-2}$

Protons

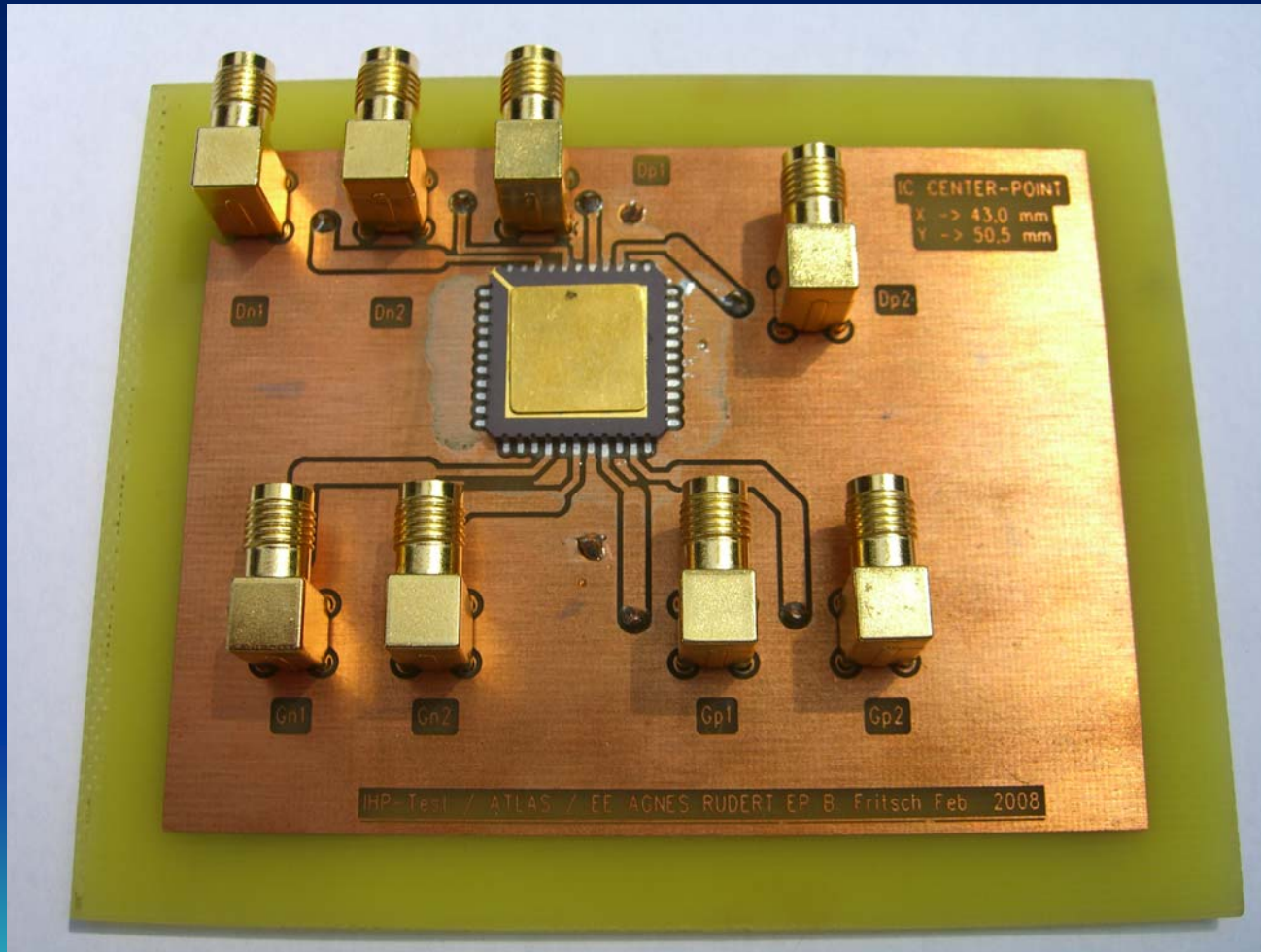
safety factor 20

(at the moment we measure Neutrons.)

Select a technology according to the following criteria:

- ⇒ Prove the transistors are radiation hard
- ⇒ Understand the temperature dependence
- ⇒ Study the Noise behaviour
- ⇒ Clarify the development surrounding with the company/ collaborator

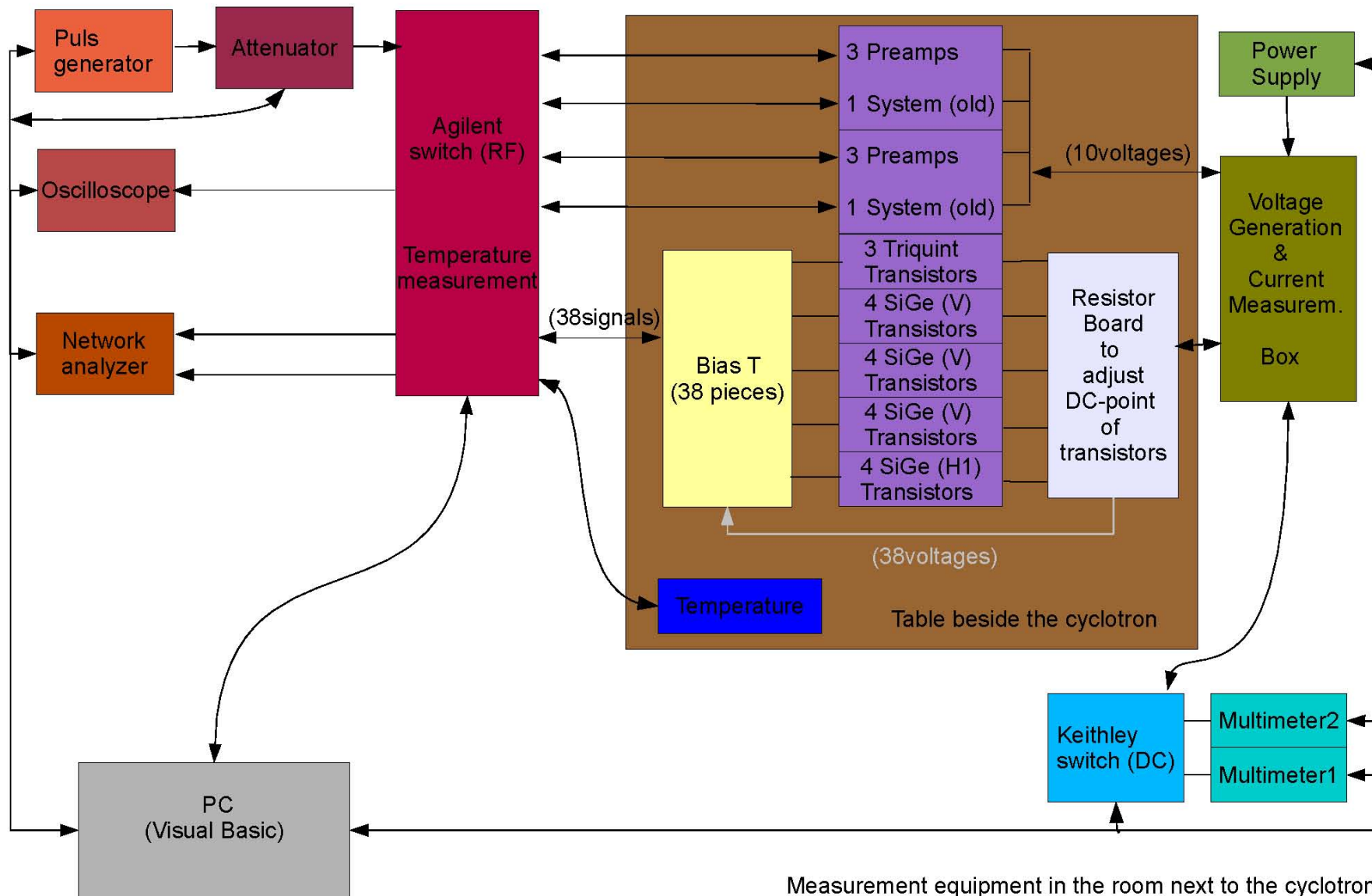
Measurement setup single transistors



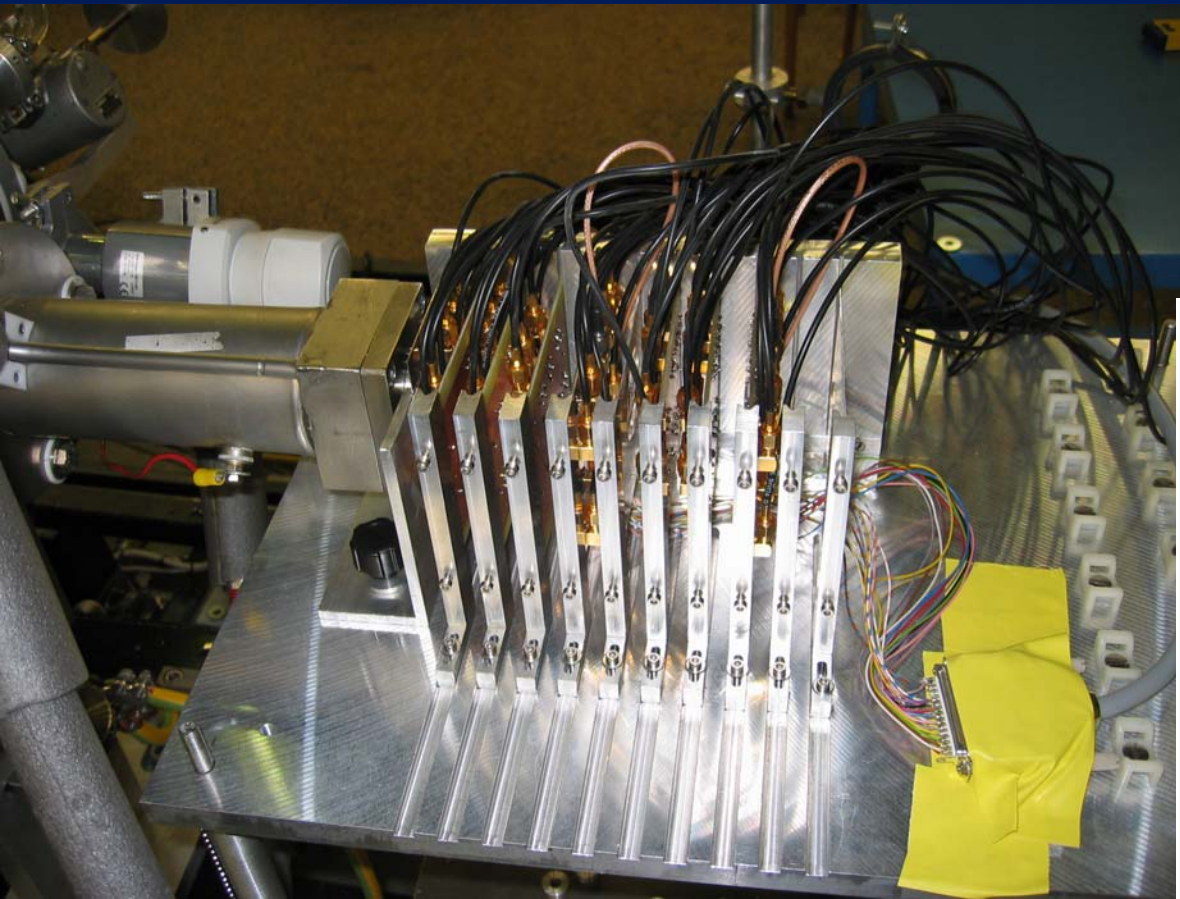
Testboard for transistors:

Four structures (2n, 2p) are bonded in this ceramic package.

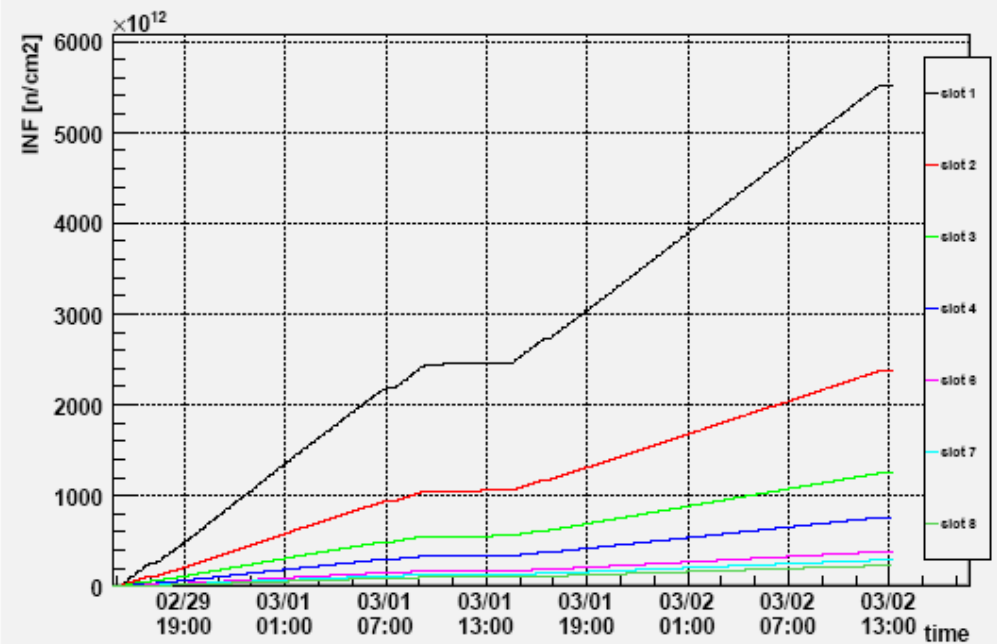
Radiation tests Setup in Rez (1)



Radiation tests Setup in Rez (2)



INF vs. time for all slot positions (slot 5 is free)





Status & Conclusions & Plans

- MOS & Bipolar transistors seem to be quite radiation hard in the range of test.
- Cold tests with liquid nitrogen show the temperature dependence of Bipolar Transistors. (Advantage for MOS)
- At the moment we measure noise figures of different transistors.
- After that we make a process selection and start with the circuit design.

