Lab-test measurements at CERN

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CERN

Systematic Lab-test measurements

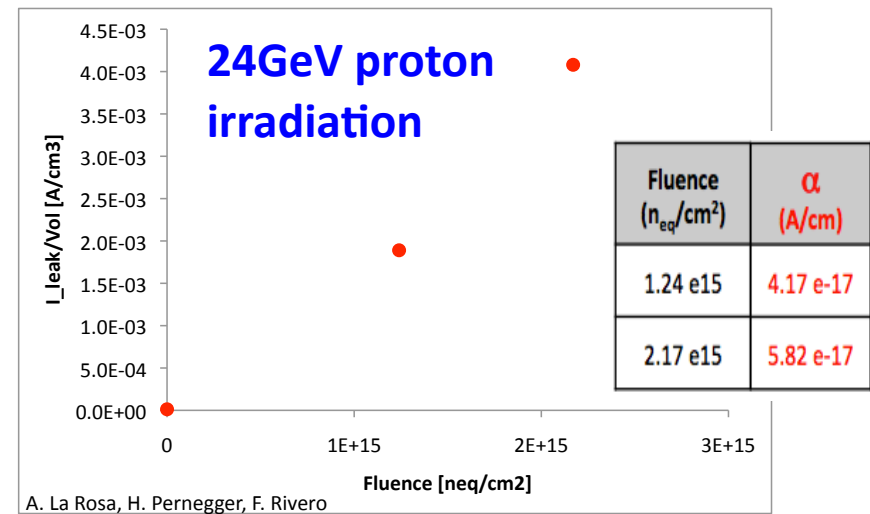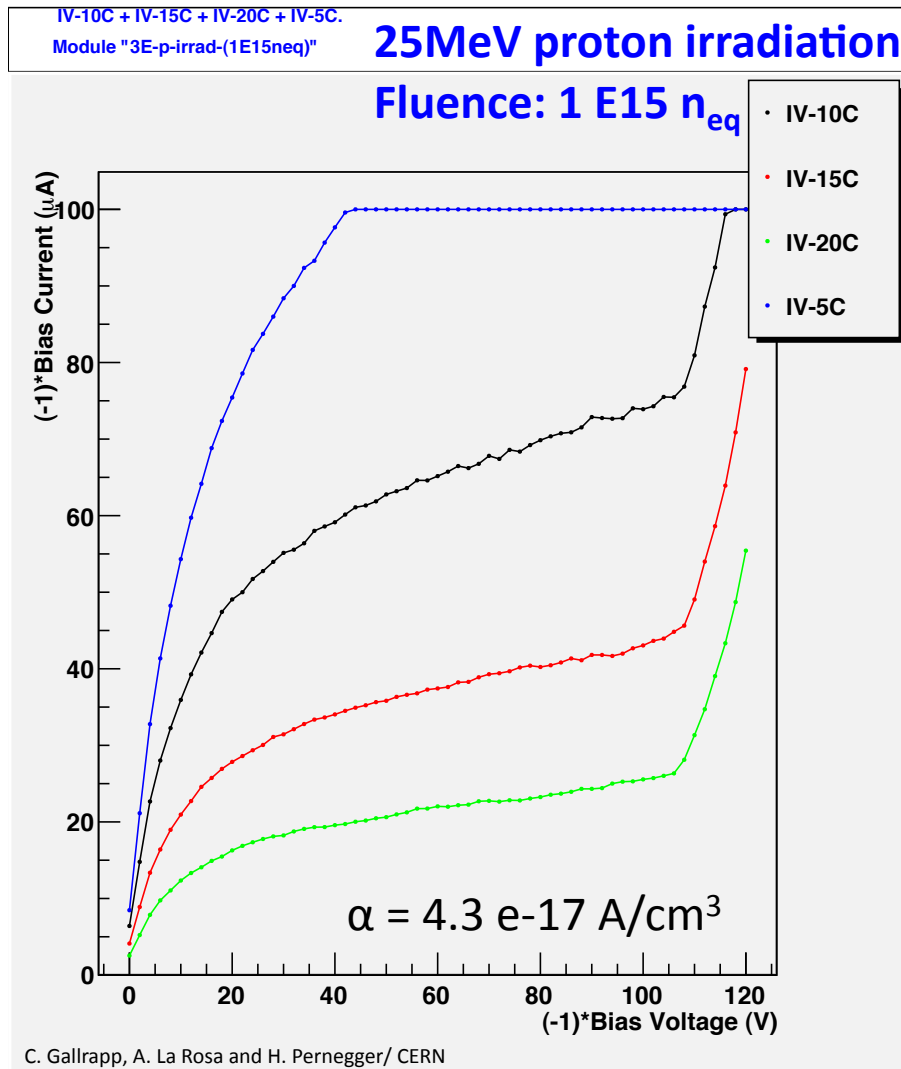https://twiki.cern.ch/twiki/bin/view/Main/CernAtlasPixelSensorsRD

Same measurements with Planar (n-in-n and n-in-p), 3D-Si and Diamond (pCVD and scCVD):
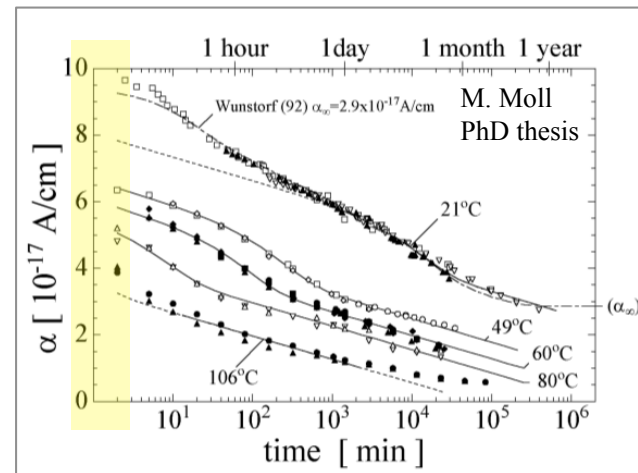
- **IV scan**: to measure the leakage current and to check for sensor damage and/or HV shorts.
  - Scan performed at different temperatures for irradiated devices
  - I_leak/Vol vs fluence estimation
  - Estimation of damage rate α
- **Monleak scan**: to measure of each pixel leakage current to look for excess due to localized earlier sensor breakdown
- **Minimal operational threshold:** to study the influence of the sensor capacitance on the minimal threshold.
- **Threshold and noise scan** (e.g.: with 60 ToT at 20ke and Th=3.2ke)
- **Noise vs bias voltages**
  - at different temperatures for irradiated devices
- **Noise occupancy studies**
- **Crosstalk scan**
- **Gamma source test (Am241 and Cd109) self triggered** at different bias voltage
  - at different temperatures for irradiated devices
- **Beta source test (Sr90) external triggered** at different bias voltage
  - charge collection and charge sharing studies at different bias voltages
  - at different temperatures for irradiated devices

Leakage current studies

- ## 3D/FBK 3E-type

IV-10C + IV-15C + IV-20C + IV-5C.
Module "3E-p-irrad-(1E15neq)"

25MeV proton irradiation
Fluence: 1 E15 n_{eq}

- IV-10C
- IV-15C
- IV-20C
- IV-5C

α = 4.3 e-17 A/cm^3

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24GeV proton irradiation

Fluence (n_{eq}/cm^2)	α (A/cm)
1.24 e15	4.17 e-17
2.17 e15	5.82 e-17

A. La Rosa, H. Pernegger, F. Rivero

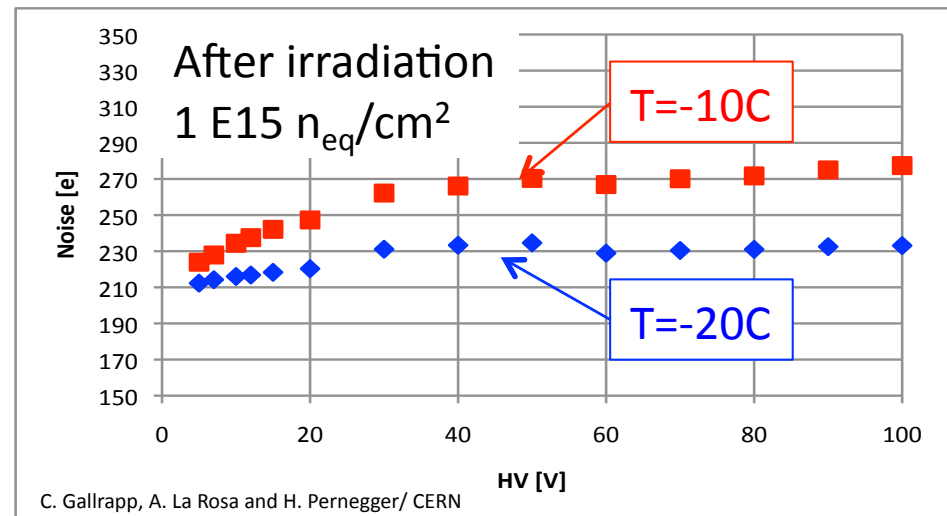$$\frac{I_{Vol}}{Vol} = \frac{I_{Vol,\phi=0}}{Vol} + \alpha\,\phi$$

M. Moll
PhD thesis

Threshold and noise measurements

- 3D/FBK sensors
- FE tuned with 60 ToT at 20ke and Th=3.2ke

Before irradiation

A. La Rosa et al. PoS(RD09)032
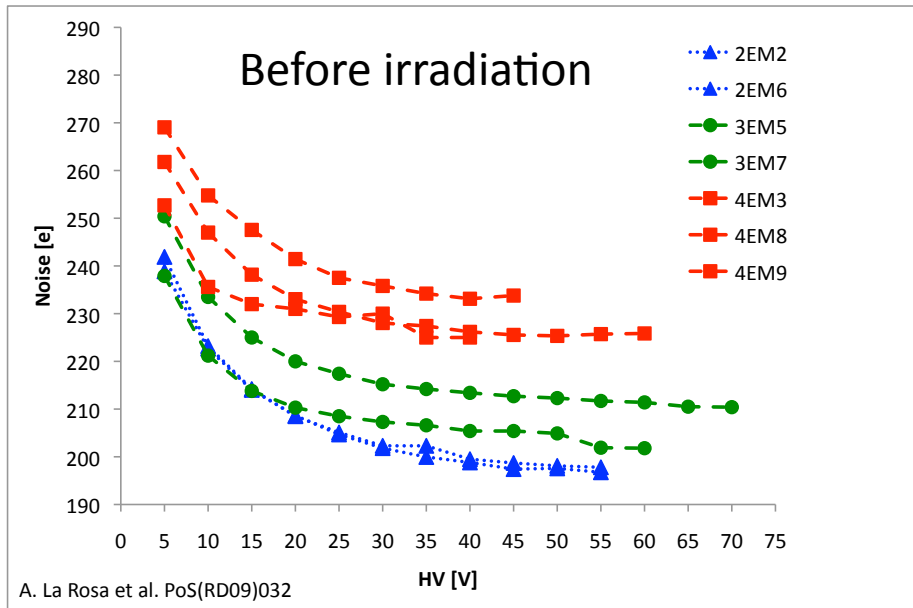
	Threshold [e]	Noise [e]	T [C]
Before irrad	3292 ± 57	214 ± 8	+ 22
After irrad	3152 ± 145	231 ± 14	- 20

C_low and C_high measured after irradiation

After irradiation
1 E15 n_{eq}/cm^2

T=-10C

T=-20C

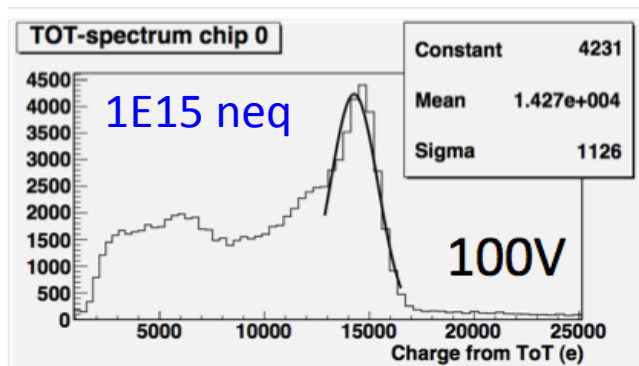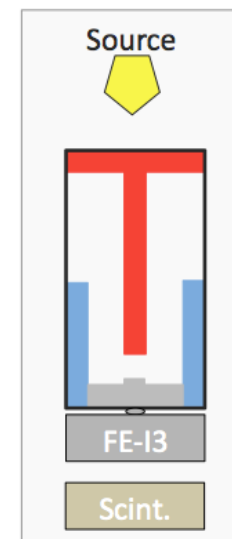C. Gallrapp, A. La Rosa and H. Pernegger/ CERN
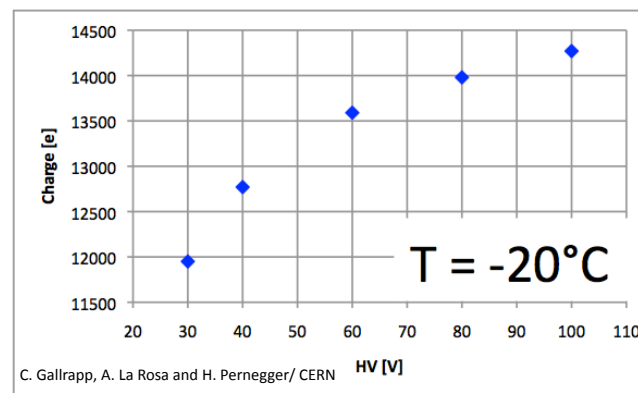
Source-test measurements

Detailed measurements with 3D/FBK are available at:

[CERN ATLAS Pixel R&D twiki page](#)

- **γ-source (Am241 and Cd109) – self triggered**
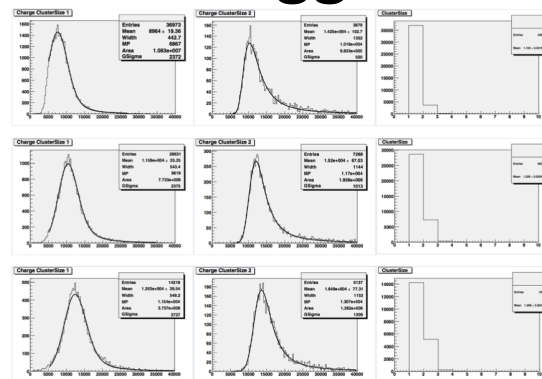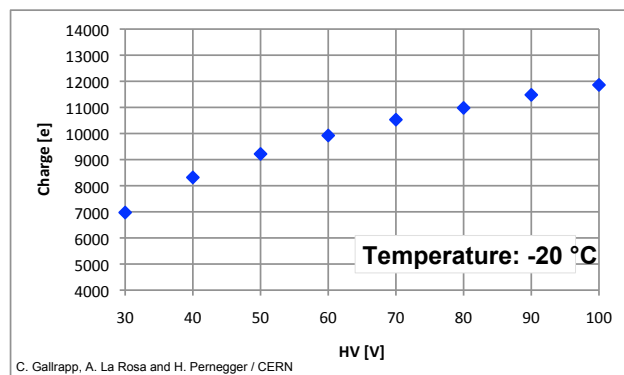

Am241
60keV

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- **β-source (Sr90) – external triggered**

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Bias voltage	30V	40V	60V	80V	100V
Lost charge	49%	40%	30%	21%	15%

25MeV proton irradiation
up to 5.4 e14 p/cm^2
(1 e15 n_{eq}/cm^2)