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INFN
SPOKE

Studies of radiation hardness of Silicon Carbide detectors at n_TOF

S. TUDISCO

Finanziato dall'Unione europea NextGenerationEU

Ministero dell'Università e della Ricerca

Italiadomani
PIANO NAZIONALE DI RIPRESA E RESILIENZA

CONTEXT

SiC detectors are an alternative for Silicon detectors for harsh environments that require higher durability and resistance to the damage of charge particles, gamma and neutrons.

While irradiation with ions have been already performed in the last years, studies involving neutrons (especially high energy) are lacking.

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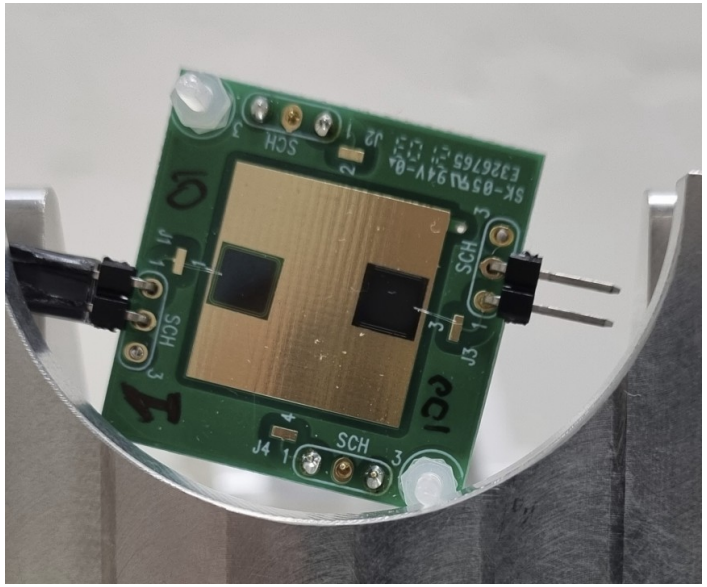
THE DETECTORS

Two SiC mounted on the same board were provided by LNS, both 5x5 mm^2 but different thickness (10 and 100 um).

New generation SiC with low deplation (about 350V, instead of 800V).



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IRRADIATION

Three irradiation were performed from July to October:

- 1 week in EAR1 with ^{6}LiF sample in air – active (high energy neutrons and low flux and to determine response to gflash)
- 1 week in NEAR – passive (high fluence)
- 4 weeks in EAR2 with ^{6}LiF sample in vacuum– active (response to thermal neutrons and gflash)

Analysis of the results is at the very (VERY!) beginning due to other activities ongoing with higher priority

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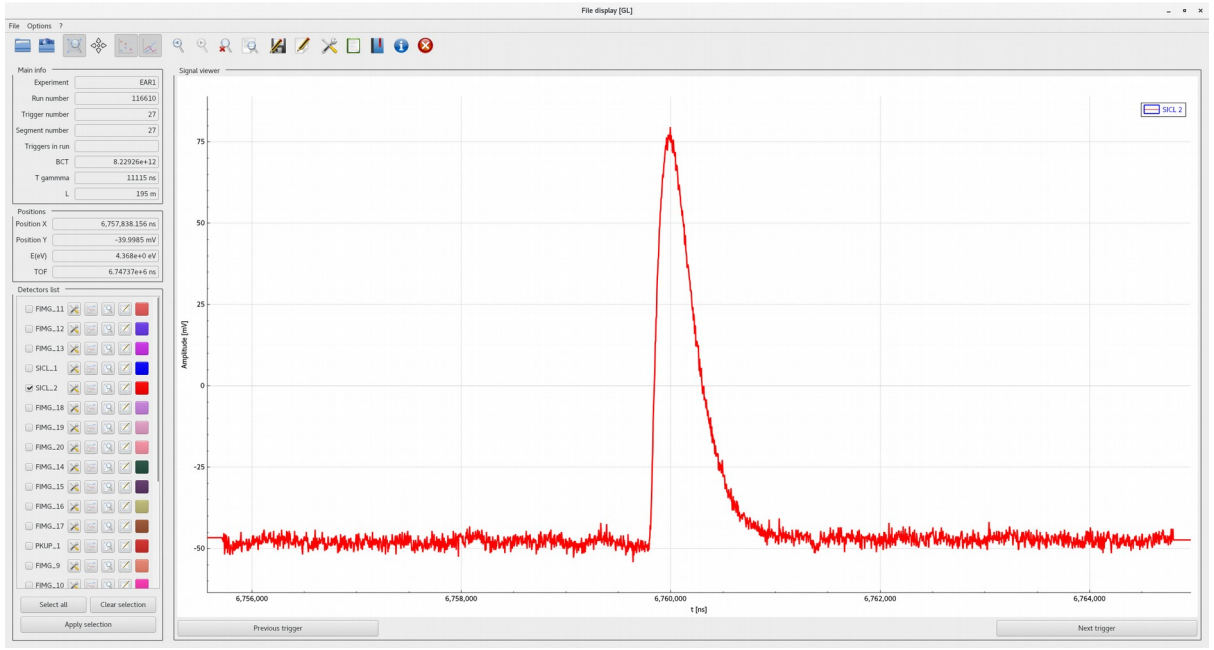
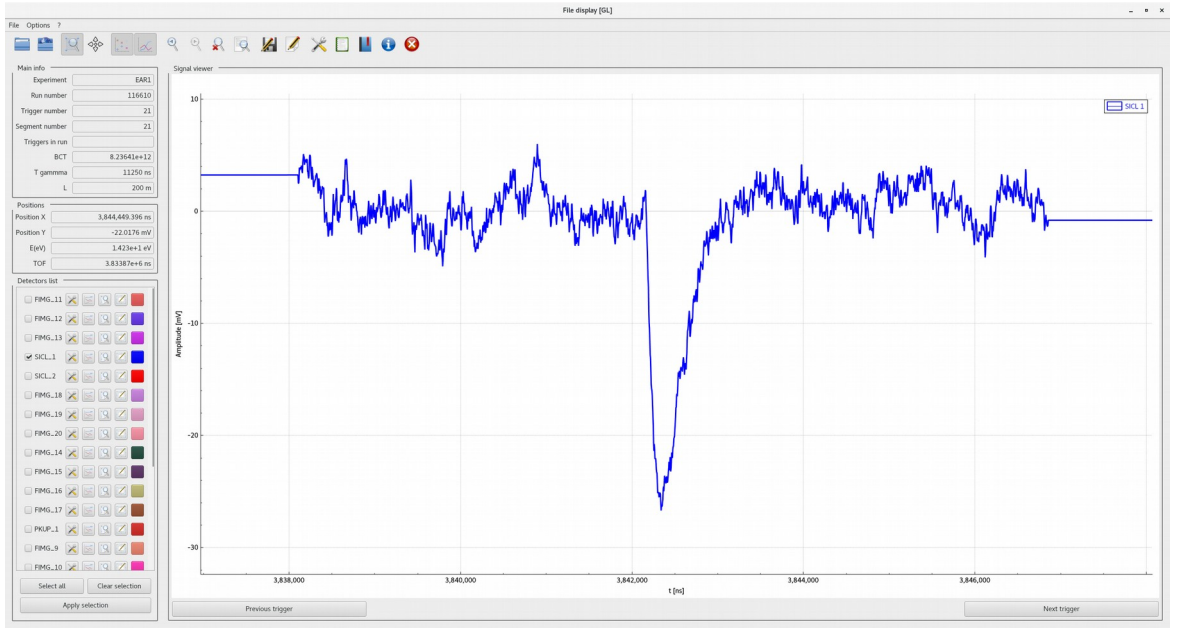
HIGHLIGHTS - EAR1

Data acquired with TFA, good signal/noise for the 100um, worst for 10um



100um



10um

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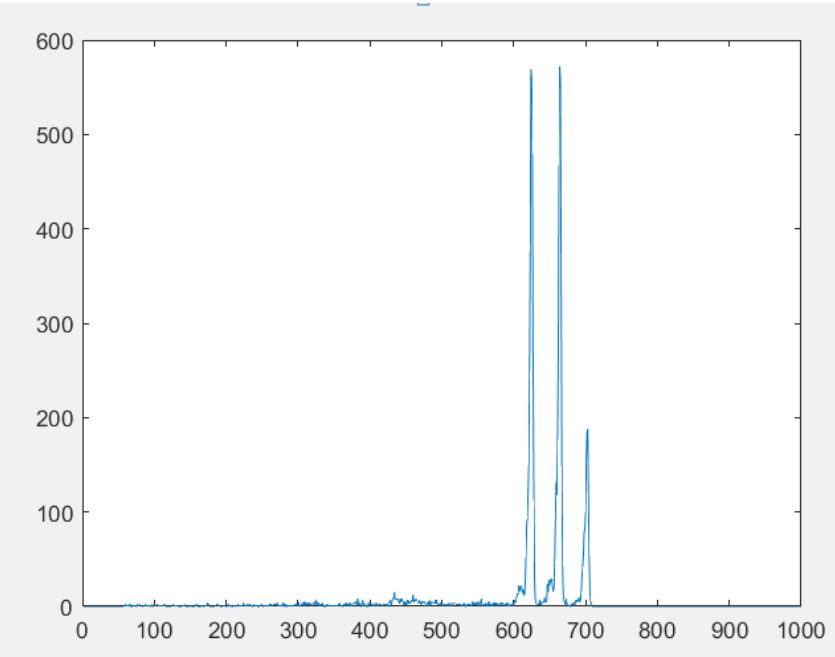
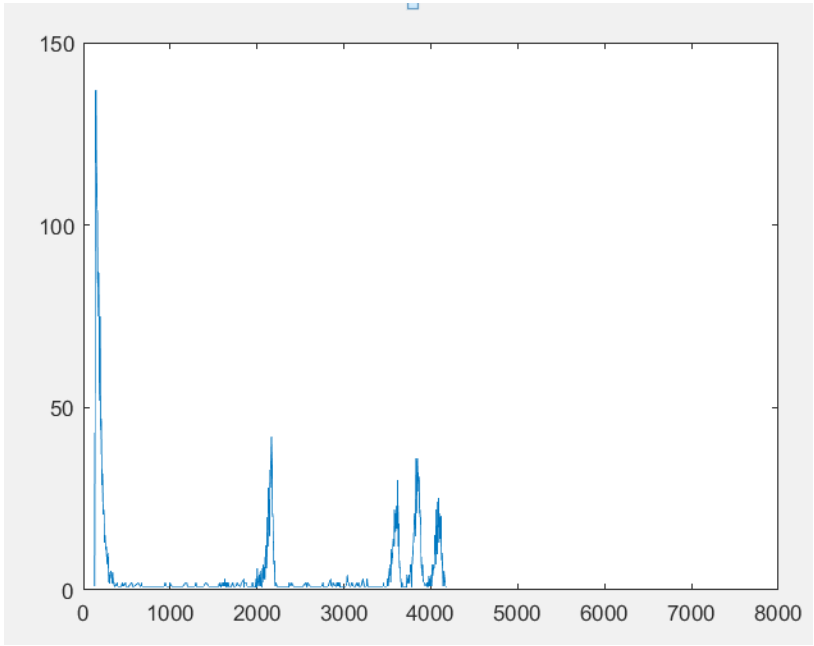
HIGHLIGHTS - NEAR

SPOKE

Degradation for the 100um after one week in NEAR is visible, resolution for the 241Am peak drops from 0.8% to 2.4% even if it can be partially compensated by increasing the Vbias.





Courtesy of C. Altana

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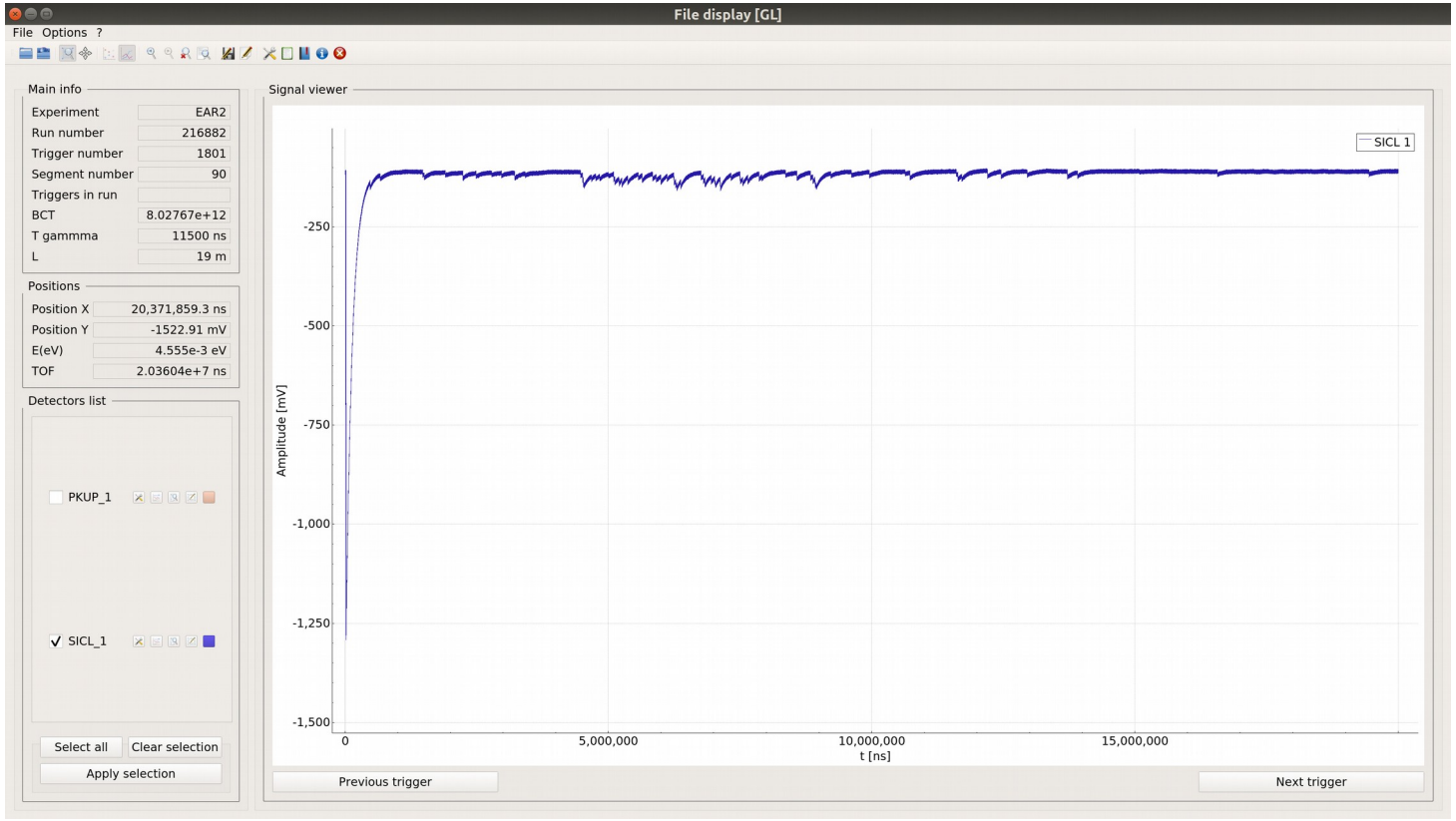
HIGHLIGHTS - EAR2

We acquired 1 run from the preamplifier, then used an amplifier.



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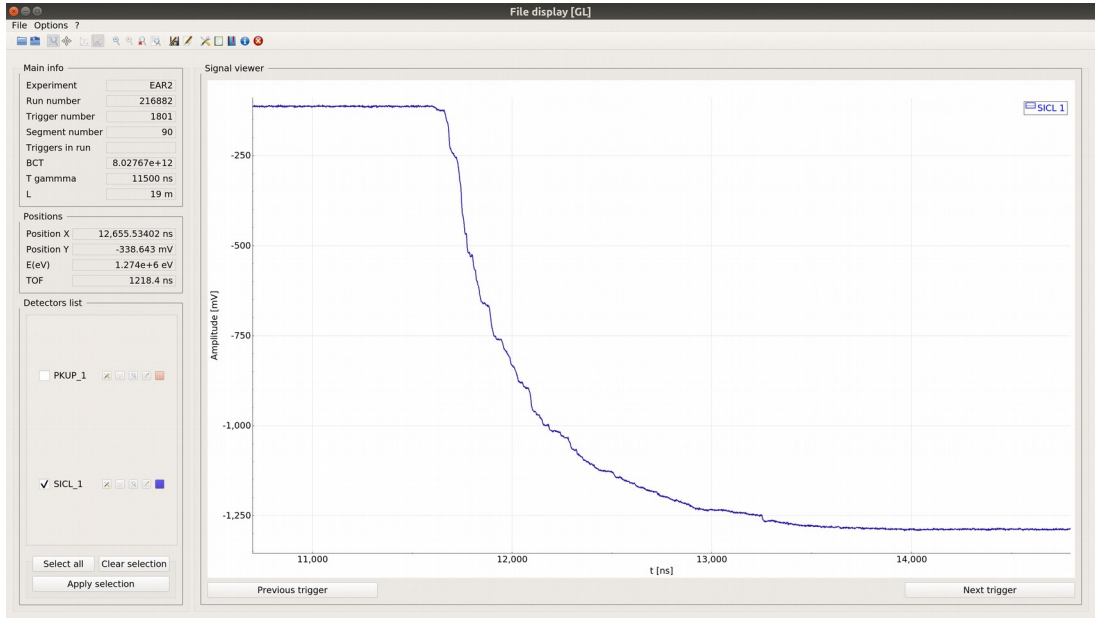
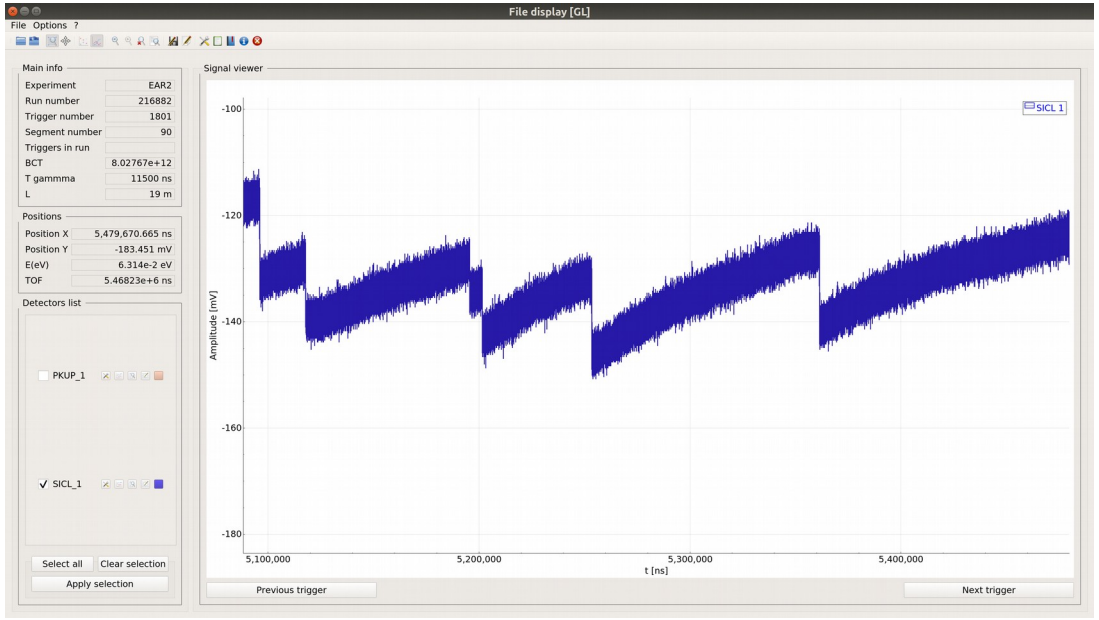
HIGHLIGHTS - EAR2

A bit tricky to judge the g-flash, we are ok after about 1 us (corresponding to 1 MeV), before we are affected by the material in front. We are perfectly ok at lower energies (of course).





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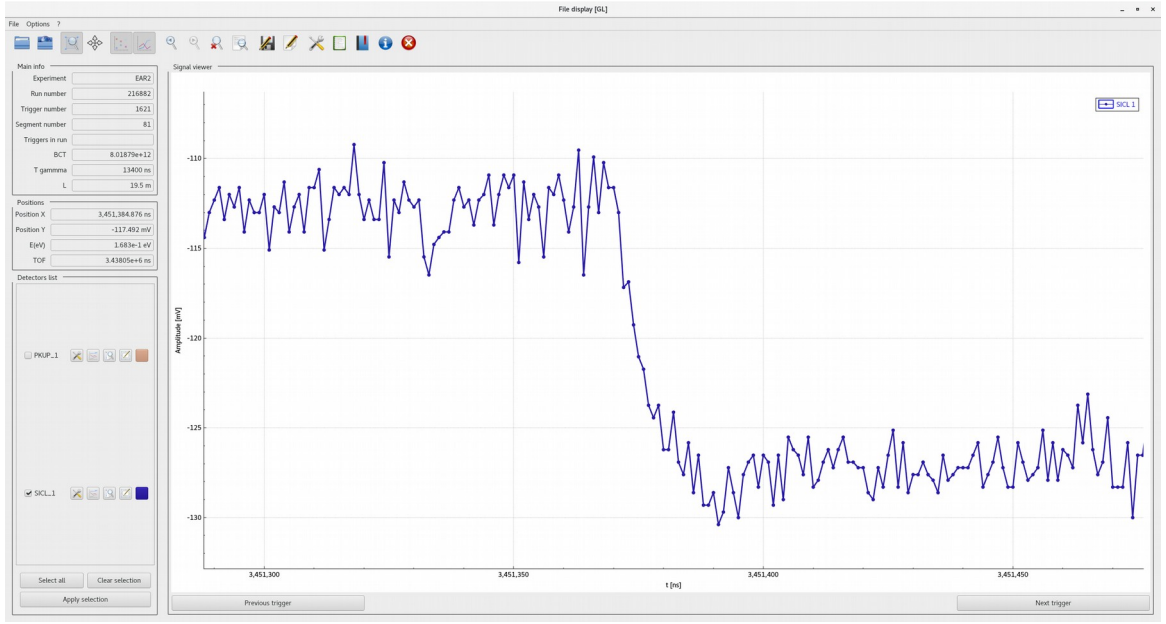
HIGHLIGHTS - EAR2

At 1 GHz sampling we can follow the rise front (pulse shape possibilities? Not from the anode but in the future…).



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FUTURE DEVELOPMENTS

When a more detailed analysis will be done new activities will be evaluated as:

- **active NEAR irradiation (diamond like)**
- **studies of pulse shape (we collected some data at ILL but nothing has been yet)**
- **longer parasitic run in EAR2 with a new detector (we used one that was already in NEAR, with degraded resolution) with background estimation to further investigate their use for physics.**

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