Experimental methods to localize the origin of SEL in V2 Digital core

1. Heavy-Ion tests with collimators
   - Developed 2 aluminum collimators with thickness of 2 mm.
   - 1. Dual collimator to irradiate SAMPA dual port SRAM IPs.
   - 2. Single collimator to irradiate only SAMPA single port SRAM IPs.

2. Backside irradiation with Pulsed-Laser
   - Pulsed-Laser automated scan showed that the SEL events trigger only inside the bit-cell circuits of the single port SRAM IPs, and not in the periphery circuits.
   - SEL events were detected up to 1025 pJ of laser energy.

Conclusions
- Heavy-Ion campaign indicated that SAMPA V2 prototypes were highly sensitive to SEL events.
- SEL LET > 3.3 MeV cm²/mg makes it critical to operate safely in the ALICE radiation environment.
- Both Heavy-Ion and Pulsed-Laser campaigns confirmed that the cause of SEL events was related to single port SRAM IPs in the V2 prototypes.
- The campaigns confirmed that SAMPA SEL sensitivity reduced linearly by decreasing the supply voltage and completely removed below 1.1 V.
- The campaigns assured that the final versions V3 and V4 of the SAMPA chip are unsensitive to SEL effects and fully qualify to operate in the ALICE radiation environment.

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