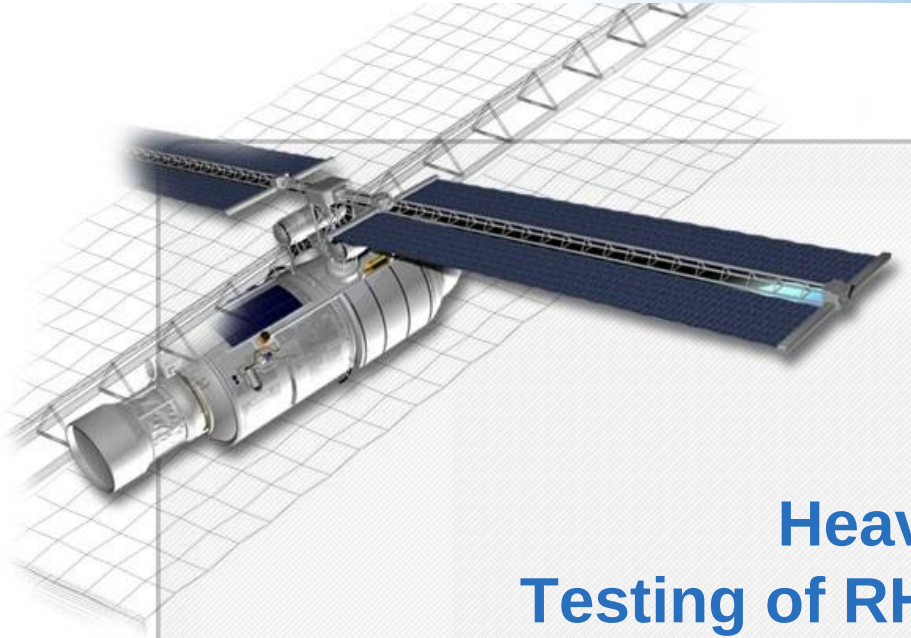


Heavy Ion SEE Testing of RHFPM4424 low side MOSFET driver from STMicroelectronics

Maxime VAILLÉ, Enoal LE GOULVEN and Pierre GARCIA, Athina VAROTSOU

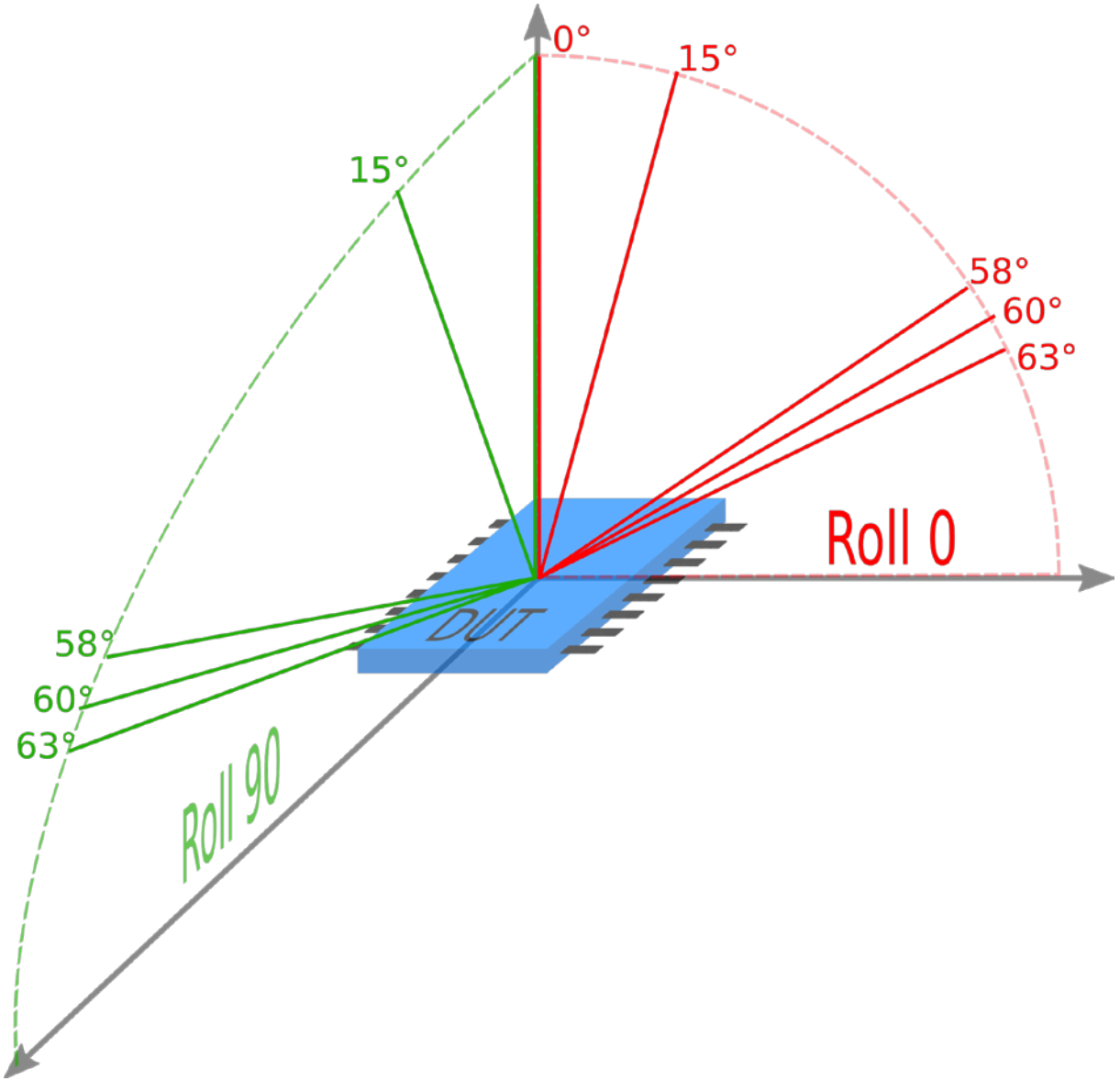
Outline

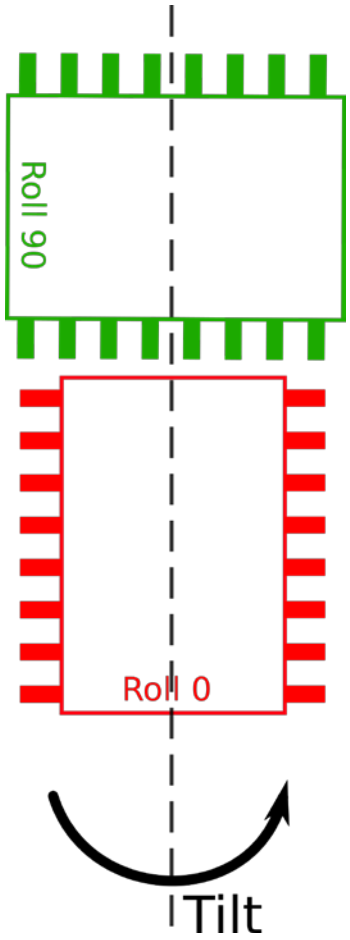
- The project
- Parts, beam description, test system
- Results
- Conclusions

The project

- The RHFPM4424 from STMicroelectronics is a flexible, high-frequency dual low-side driver specifically designed to work with high capacitive MOSFETs and IGBTs in a high radiation environment such as space.
- Goal: The objective of this study is to further characterize the RHFPM4424 concerning its SEE heavy ion tolerance and to characterize under heavy ion beam the new power MOSFET products versus SET and destructive SEB.

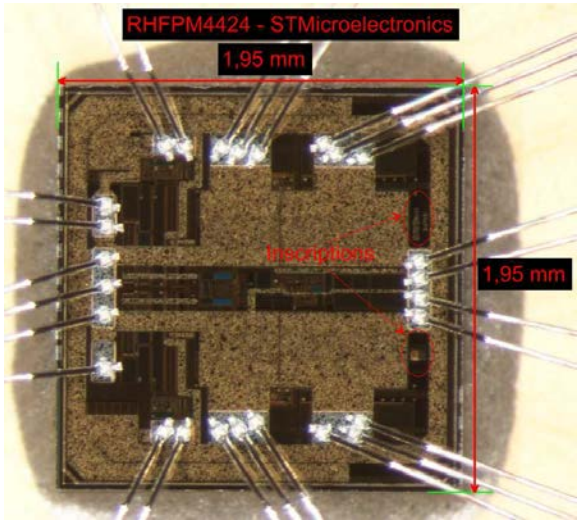
Rolls schematic description

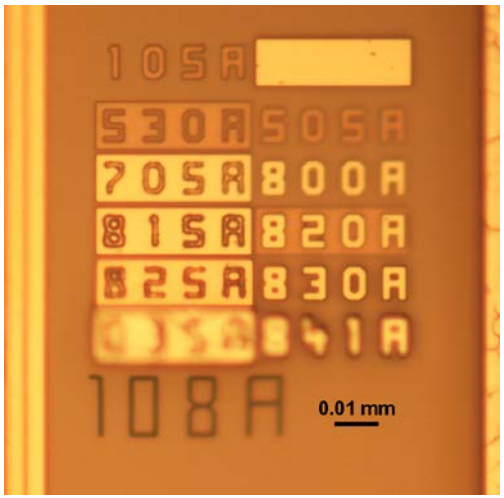




SEE tests: Parts description

PART IDENTIFICATION	
Type :	RHFPM4424
Manufacturer :	STMicroelectronics
Function :	Rad-Hard 4.5A Dual Low Side MOSFET driver
PARTS PROCUREMENT INFORMATIONS	
Packaging :	FP-16
Sample size:	15 irradiated samples



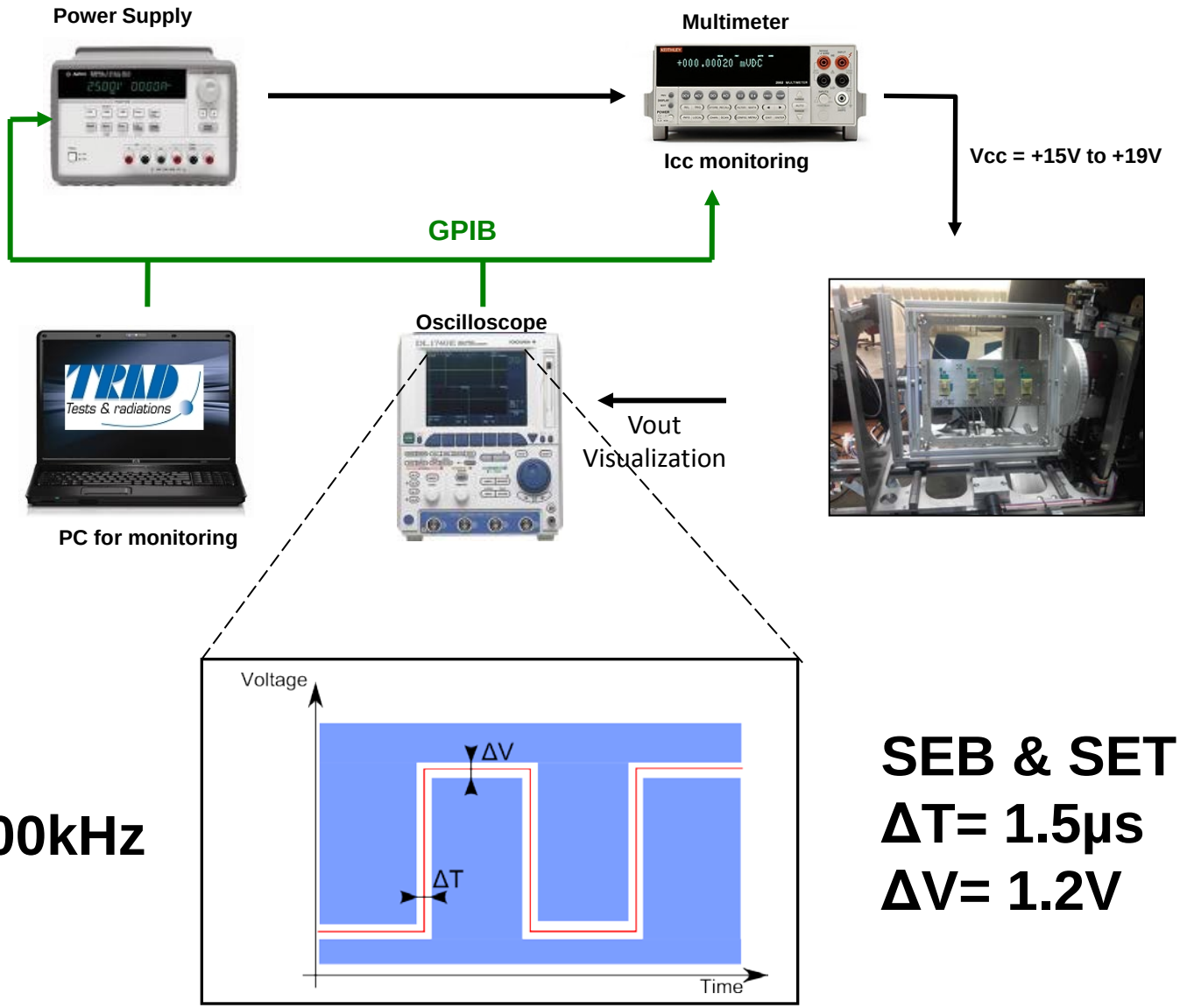


SEE tests: Beam description

Irradiation facility: U.C.L.

IRRADIATION BEAM CHARACTERISTICS	
Heavy Ions used :	High LET cocktail: $^{124}Xe^{26+}$ (67.7 MeV.cm²/mg) High range cocktail: $^{83}Kr^{25+}$ (32.6 MeV.cm²/mg) Fluence: 1.10^{7} cm^{-2}
Particle tilt angles :	High LET cocktail: 0°, 15°, 30°, 40°, 45° and 50° High range cocktail: 0°, 50° and 57°

SEE tests: Test system



Fin= 100kHz

SEB & SET
ΔT= 1.5µs
ΔV= 1.2V

SEE tests: SET & SEB test results

	Number of SET observed on Roll 0					Number of SET observed on Roll 90			
LET Eff (MeV.cm².mg⁻¹)	+15V	+16V	+17V	+18V	+19V	+15V	+16V	+17V	+18V
105.32 (50°)	-	-	-	5	-	-	-	-	-
95.74 (45°)	-	-	-	SEB	-	-	-	-	-
88.38 (40°)	-	-	-	3	-	-	-	-	-
78.17 (30°)	-	-	-	9	-	-	-	-	-
77.14 (65°)	-	-	-	-	-	-	-	-	8
71.81 (63°)	-	8	5	SEB	-	-	7	11	8
70.09 (15°)	4	9	3	5	6	8	7	6	5
67.7 (0°)	8	3	2	9	-	8	3	2	9
65.2 (60°)	-	7	6	6	-	-	-	-	4
61.52 (58°)	-	-	SEB	SEB	-	-	-	-	5
56.84 (55°)	-	-	-	7	-	-	-	-	4
46.1 (45°)	-	-	-	4	-	-	-	-	-

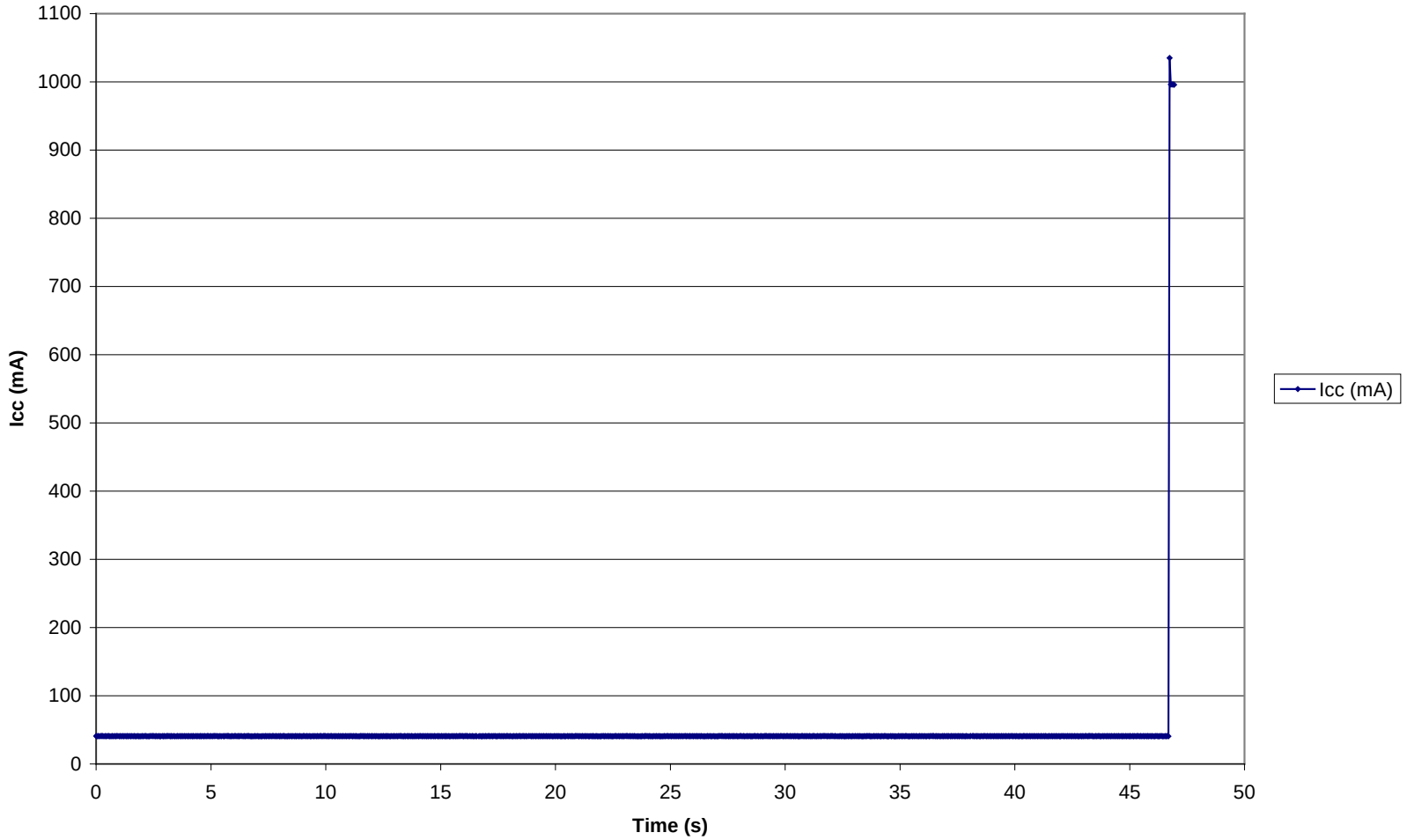
Fluence: 1.10^7 cm^{-2}

- **SET observed**
- **SEB observed ➔ Only on Roll 0**

SEE tests: Worst case SET

- **SET observed during irradiation**

SEE tests: Worst case SEB



- **Current limitation due to the test bench**

Conclusions

- SEB due to angle effect are observed
- No SEB observed at supply voltage below 17V
- SET observed regardless the tilt angle, the orientation or the supply voltage used

- **Thank you for your attention**

- **Any question ?**

SEE tests: SET & SEB test results

	Roll 0					Roll 90			
LET Eff ($MeV.cm^2.mg^{-1}$)	+15V	+16V	+17V	+18V	+19V	+15V	+16V	+17V	+18V
105.32 (50°)	-	-	-	5.00E-07	-	-	-	-	-
95.74 (45°)	-	-	-	5.50E-07	-	-	-	-	-
88.38 (40°)	-	-	-	3.00E-07	-	-	-	-	-
78.17 (30°)	-	-	-	9.00E-07	-	-	-	-	-
77.14 (65°)	-	-	-	-	-	-	-	-	8.00E-07
71.81 (63°)	-	8.00E-07	5.00E-07		-	-	7.00E-07	1.10E-06	8.00E-07
70.09 (15°)	4.00E-07	9.00E-07	3.00E-07	5.00E-07	6.00E-07	8.00E-07	7.00E-07	6.00E-07	5.00E-07
67.7 (0°)	8.00E-07	3.00E-07	2.00E-07	9.00E-07	-	8.00E-07	3.00E-07	2.00E-07	9.00E-07
65.2 (60°)	-	7.00E-07	6.00E-07	6.00E-07	-	-	-	-	4.00E-07
61.52 (58°)	-	-	1.20E-06	4.00E-07	-	-	-	-	5.00E-07
56.84 (55°)	-	-	-	7.00E-07	-	-	-	-	4.00E-07
46.1 (45°)	-	-	-	4.00E-07	-	-	-	-	-

- **SET observed**
- **SEB observed ➔ Only on Roll 0**