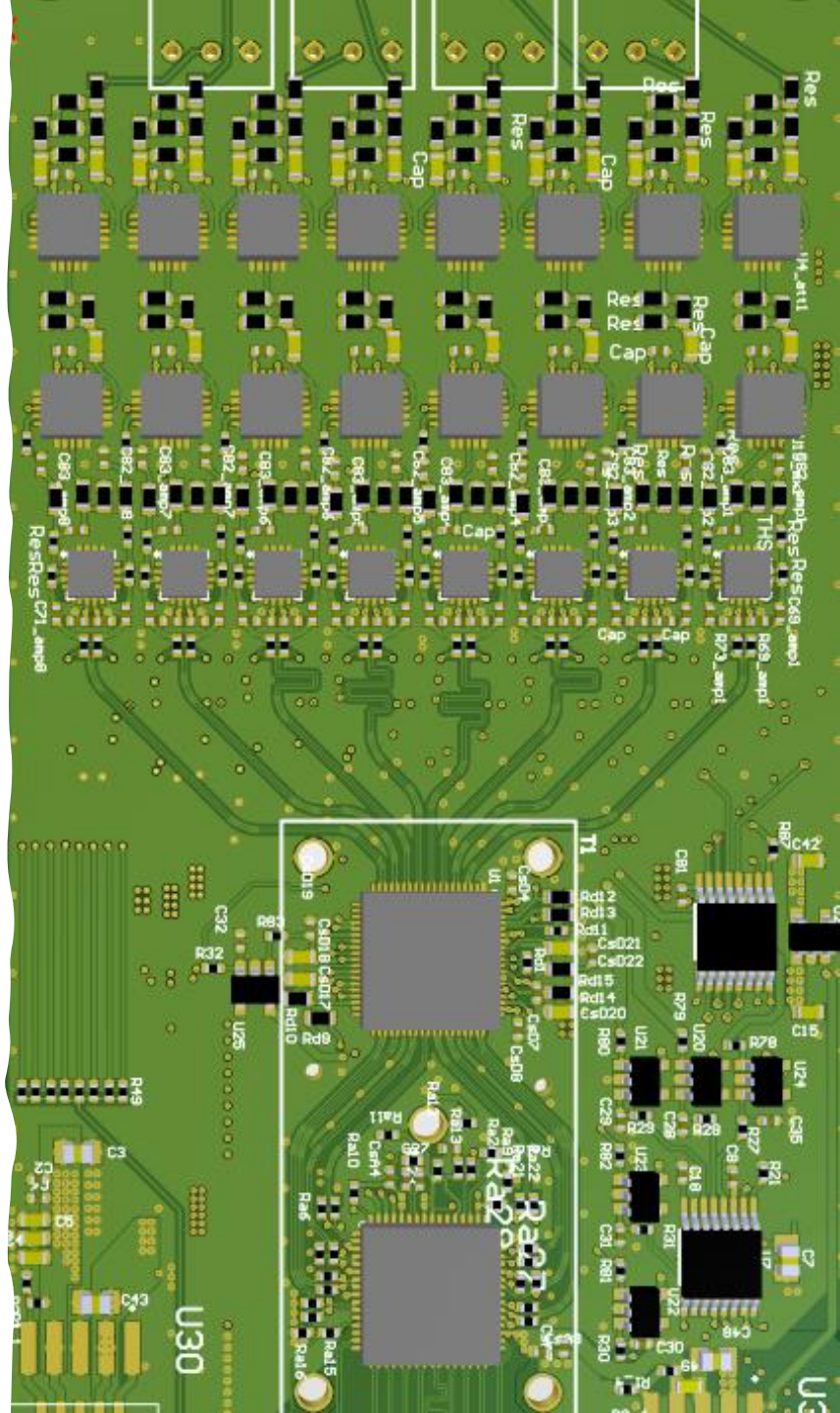
TGC-Charge Monitoring System

Resume Radiation test at CHARM of September

Victor Arredondo Quintana

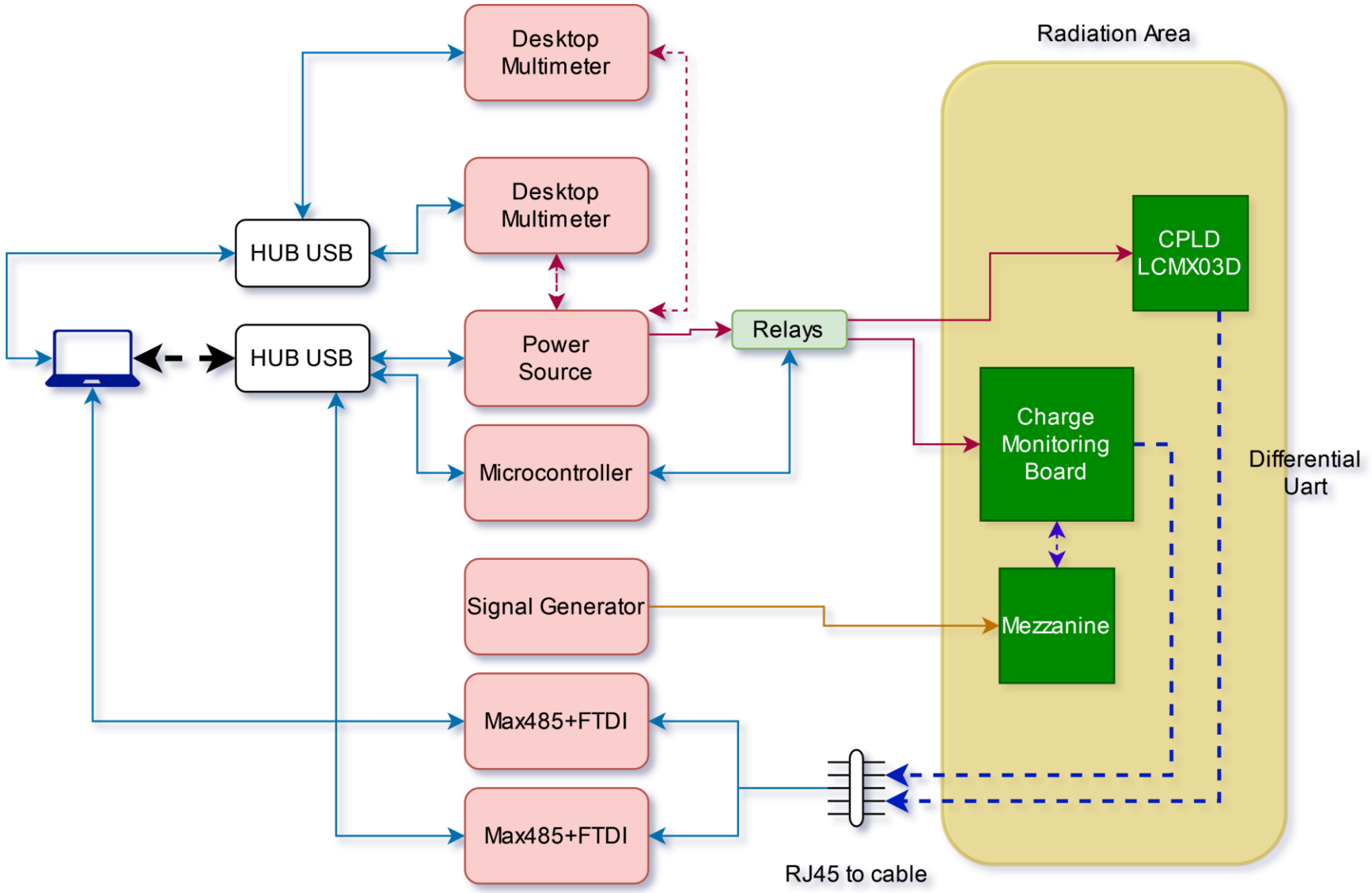
MILLENNIUM INSTITUTE
FOR SUBATOMIC PHYSICS
AT HIGH-ENERGY FRONTIER
SAPHIR



Test goals

- In the past test at CHARM in May, Mezzanine reached near 100 Gy and stop working well. Later, 3 weeks later, the board start working again. We will use the same setup, but changing the Zynq for a new one with no radiation on it to test new level of radiation on the Mezzanine.
- Part of the Charge Monitoring Board signal multiplexer is a CPLD lattice macho3d that could not be irradiated in May. A breakout produced and programmed with a benchmark will be placed and monitorized.

Electric Schematics



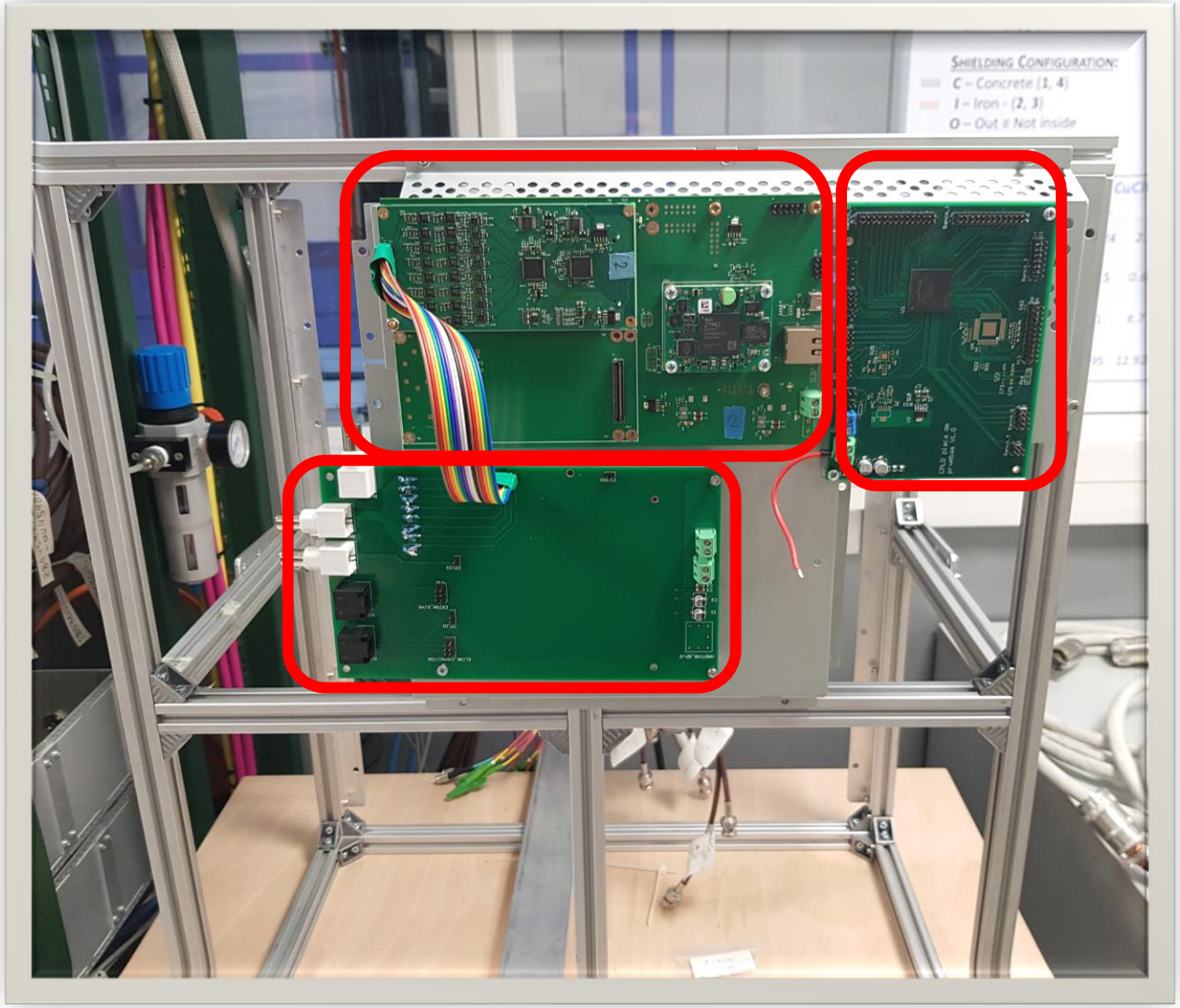
PCB to be tested

1 Mezz with **108 Gy** mounting on motherboard with **270 Gy** and controlled by Zynq07150 with no radiation

CPLD breakout board model LCMXO3D-9400HC-6BG484I

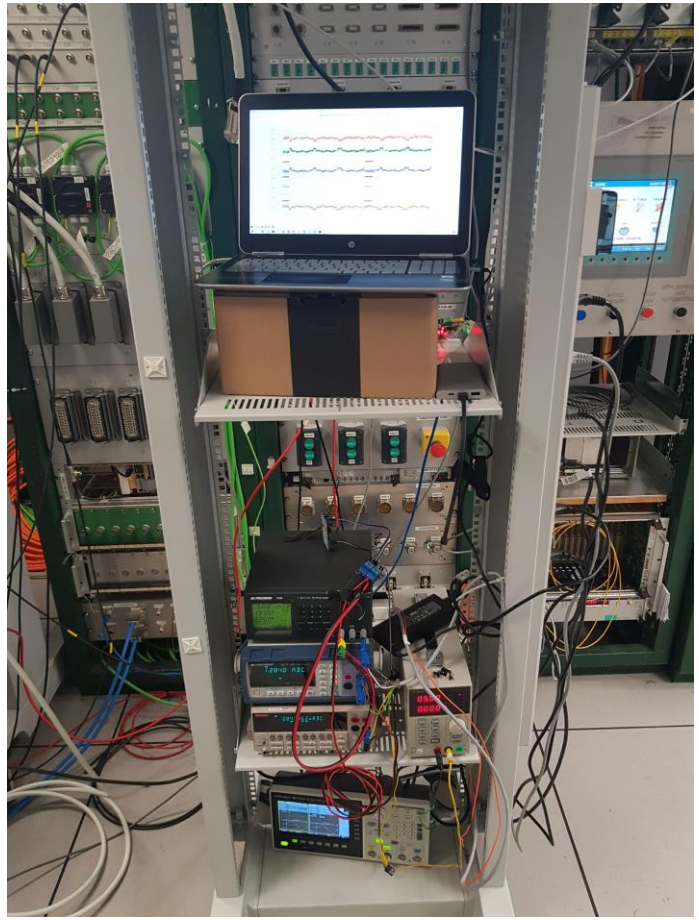
PCB board for split analog signal input in 8 output matching the input impedance of Mezzanine board with 270 Gy

Previous Dose of Mezzanine	
TID [Gy]	108
HeH [cm^-2]	2,58 e11
N1MeV [cm^-2]	1.74 e12

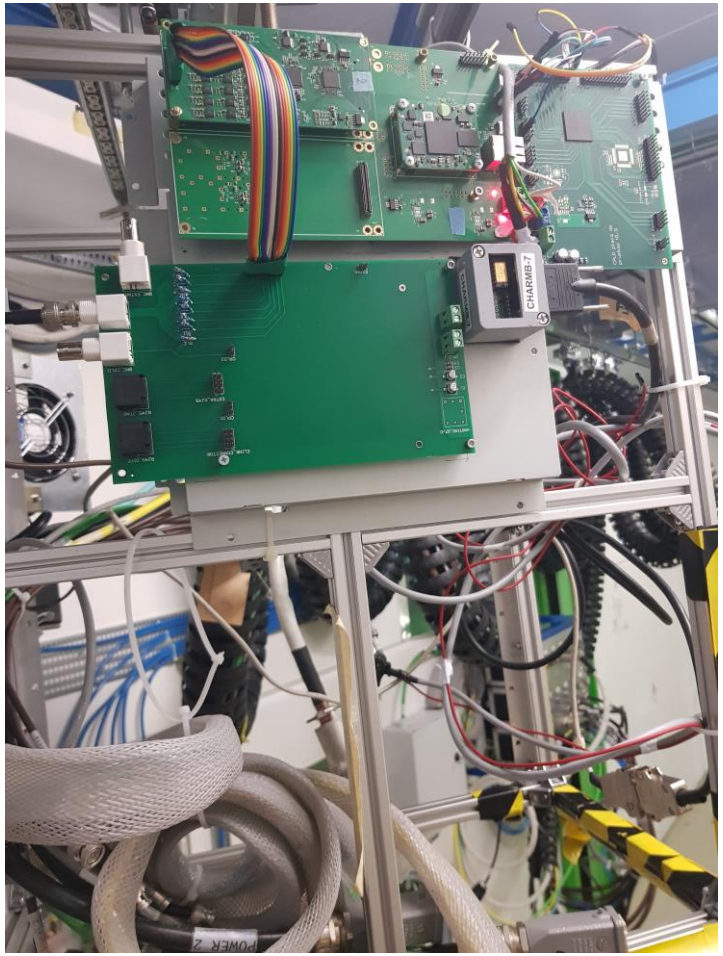


Position inside CHARM

Electronic equipment to power and monitor the setup inside radiation area



PCBs mounting inside irradiation area + RadMon



Normal functioning

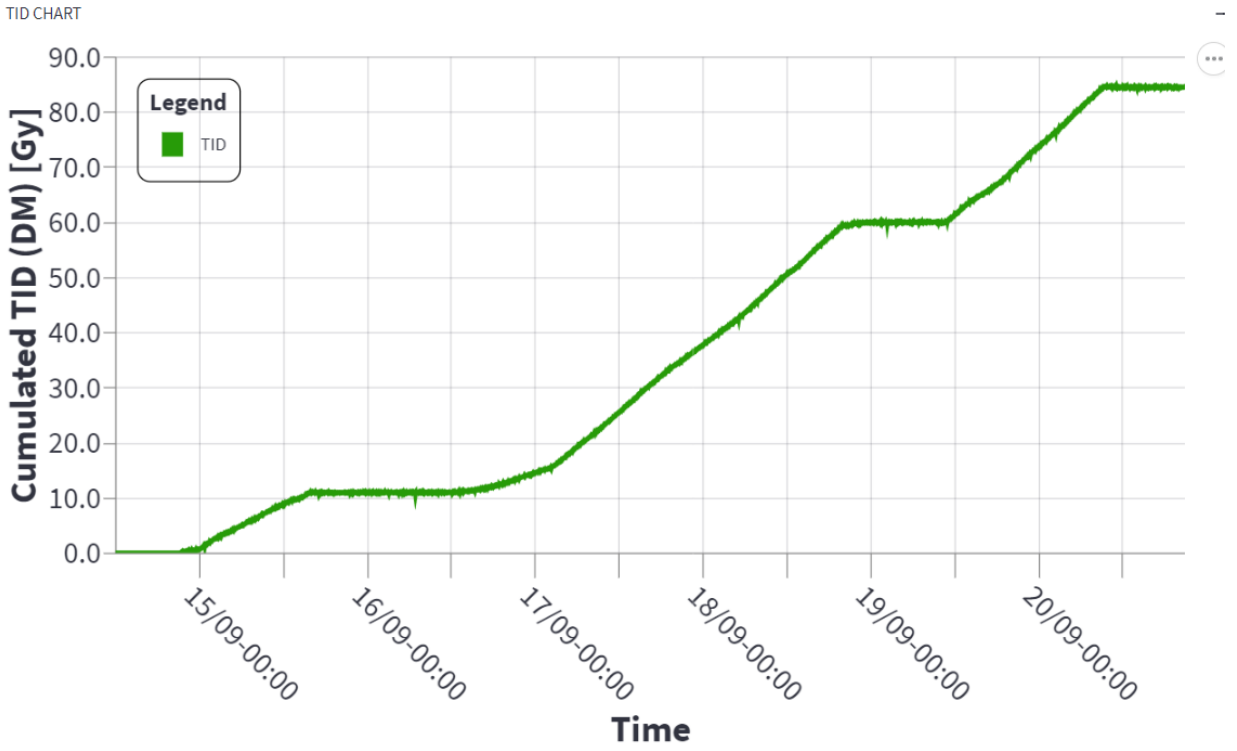
- Nominal Current CPLD : 83.75xx [mA]
  - Normal message: #0,FF00,FF00,FF00,FF00*\n
  - This message is received always that the beam is off
- Nominal Current Charge Monitoring board: 1.28xx[A]
- Beam start at 14/9/2022 21:00

Radiation Dose CPLD

Model: LCMXO3D-9400HC-6BG484I

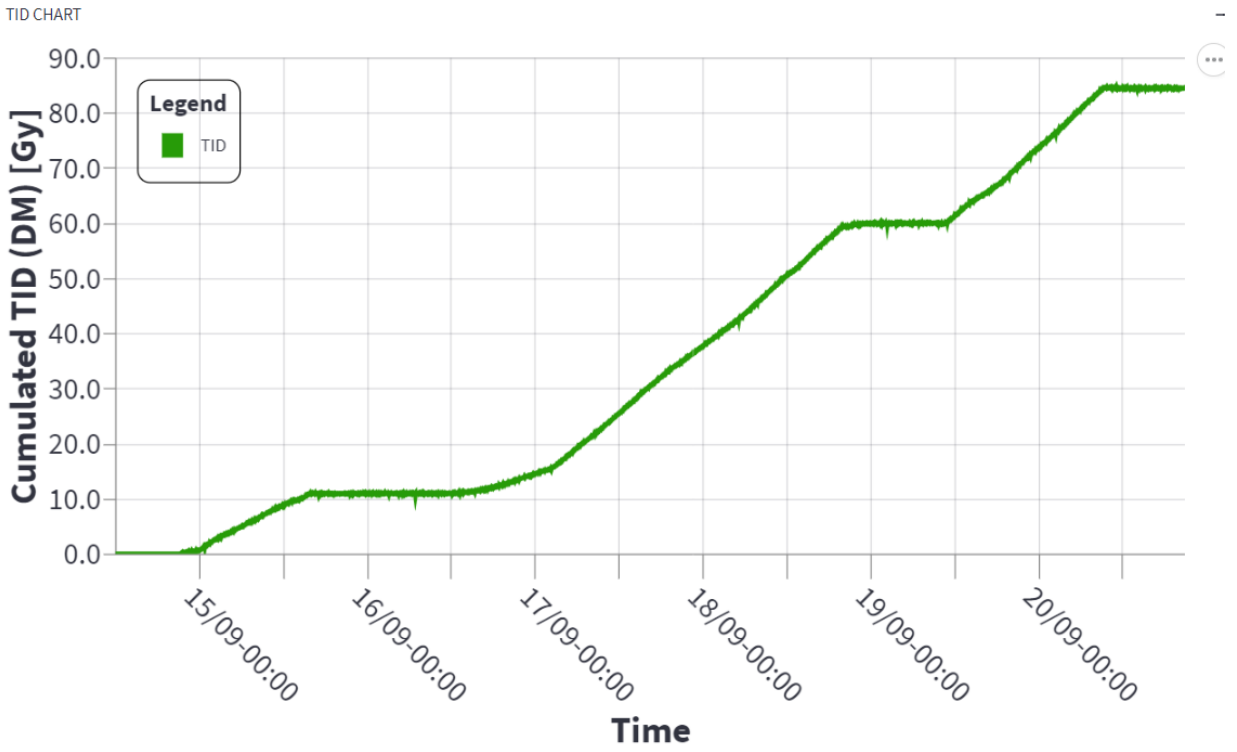
Number of Register	4665 out of 10552	44%
Number of Slices	3271 out of 4700	70%
Number of LUT4s	5698 out of 9400	61%

	Total	Target	
TID [Gy]	84.5	330	25,6%
HeH [cm^-2]	1.99 e11	6.7e+11	29,7%
N1MeV [cm^-2]	1.11 e12	2.7e+12	41,1%

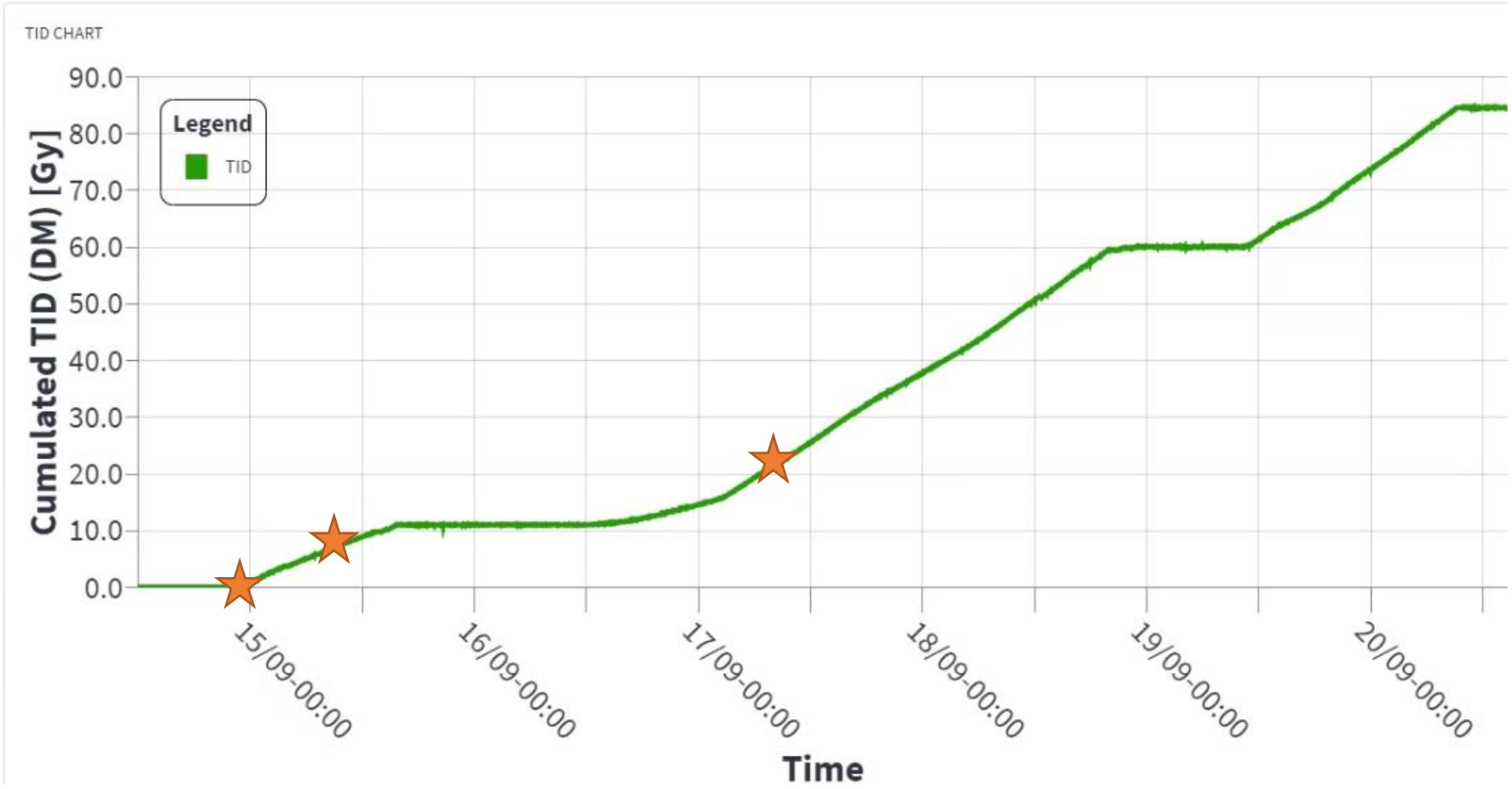


Radiation Dose Mezzanine

	Total	Target	
TID [Gy]	192.5	330	58,33%
HeH [cm^-2]	4,57 e11	6.7e+11	68,2%
N1MeV [cm^-2]	2,85 e12	2.7e+12	105,5%



Relevant events



14/9 21:00 beam start and CPLD start given first comparation errors, not in TMR
Ex: #0,FD00,FD00,FF00,DB00*

15/9 16:00 CPLD start to send corrupted message, eg: <@ …

17/9 19:00 Mezzanine work with less current than the nominal, 1.1 [A] waveforms appears like if not signal is inyected. CMB keep shutdown

Preliminary conclusions

- Mezzanine ADC still working after 192.5 Gy. Digital signals received dont show the signal injected of 5 MHz sinewave of 1 V p-p.
- CPLD is susceptible to radiation, in presence of beam the data from comparators of the benchmark were not equals. After reset the CPLD Works fine again

Future work

- Complete dose on CPLD and Mezzanine on October.
- Analyzed the data
- When the PCB transport is approved, the CPLD memory will be analyzed and the Mezzanine will be tested.