RADIATION ISODOSE MEASUREMENTS INSIDE INTERACTION CHAMBER DURING THE COMMISSIONING EXPERIMENTS OF THE CETAL FACILITY. GAS TARGET CASE.

<u>E. STANCU</u>, C. DIPLASU, G. GIUBEGA, M. SERBANESCU, A. MARCU, R. UNGUREANU, G. COJOCARU, M. ZAMFIRESCU

National Institute for Laser, Plasma and Radiation Physics (INFLPR), Magurele, Romania

Nowadays there are more than 50 high power laser systems in use or in development throughout the world [1]. A part of them is able to accelerate particle beams in relativistic regime and generate high energy ion beam. Two of these high-power lasers are developed in Romania: first developed is from INFLPR, CETAL, and second one ELI-NP [2]. INFLPR during the commission of the CETAL-PW laser demonstrated the ability to accelerate ion beam to considerable high energies. One of the type of experiments performed during the commissioning activities were interaction of ultra-intense laser with gas target in order to accelerate high energy electron beam. For these experiments the laser wake field acceleration (LWFA) mechanism was considered [3]. The interaction take place in interaction chamber in vacuum. The laser pulses generated by the CETAL-PW laser system focused on a gaseous target can produce accelerated electron beams. To achieve this, a valve was used to properly synchronize the gas jet with the laser beam. He (99%) + N (1%) gas targets were used in these experiments. For each experiment inside interaction chamber the radiation isodose measurements were performed using EBT3 gafchromic films. Figure 1 shows the distribution of detectors in order to measure radiation isodoses.

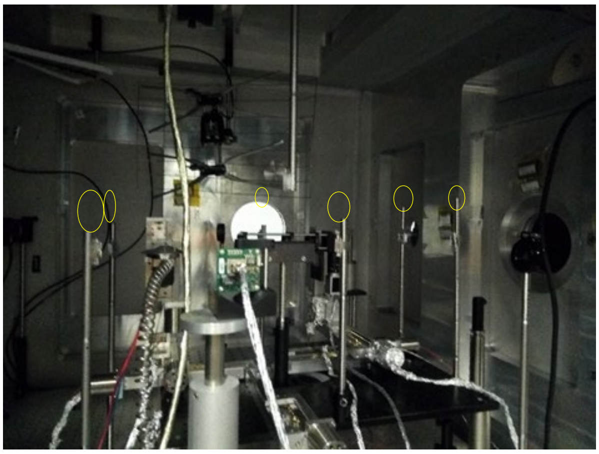

FIG. 1. Position of EBT3 detectors inside the interaction chamber for radiation isodose measurements

During the experiments, the gafchromic films were screened at optical radiation with Al foil. Due to the experimental conditions, which involve vacuuming and unwinding the interaction chamber, it is not possible to perform isodose measurements for each laser pulse. The detectors were read after the accumulation of a noticeable degree of blackening of exposure to ionizing radiation following the laser-target interaction. The radiation isodose measurements were normalized at a distance of 30 cm from the target. Table 1 shows the maximum measured values of radiation dose measurements, normed at a distance of 30 cm from the target. The high energy accelerated electrons on forward the laser beam were measured outside interaction chamber. Radiation doses measured in high energy electron beam axis are not included presented.

TABLE 1. MEASURED VALUES FOR RADIATION ISODOSE MEASUREMENTS, GY, INSIDE THE INTERACTION CHAMBER FOR DIFFERENT EXPERIMENT PERIOD

Measurement point	27.08-17.10.2019	28.10.2019	29.10-10.12.2019	11.02-19.04.2021	19.04-03.06.2021	03.06-02.09.2021
1 (340°)	12	13,4	5,1	0,18	0,20	0,07
2 (51°)	5,7	4,5	8,9	1,30	3,66	0,13
3 (78°)	2,4	1,7	2,5	0,75	14,52	0,38
4 (102°)	1,3	1,3	2,3	0,89	1,20	0,42
5 (135°)	7,2	4,4	1,5	0,78	5,79	0,16
6 (226°)	13,8	13,9	3,1	0,31	0,29	0,10

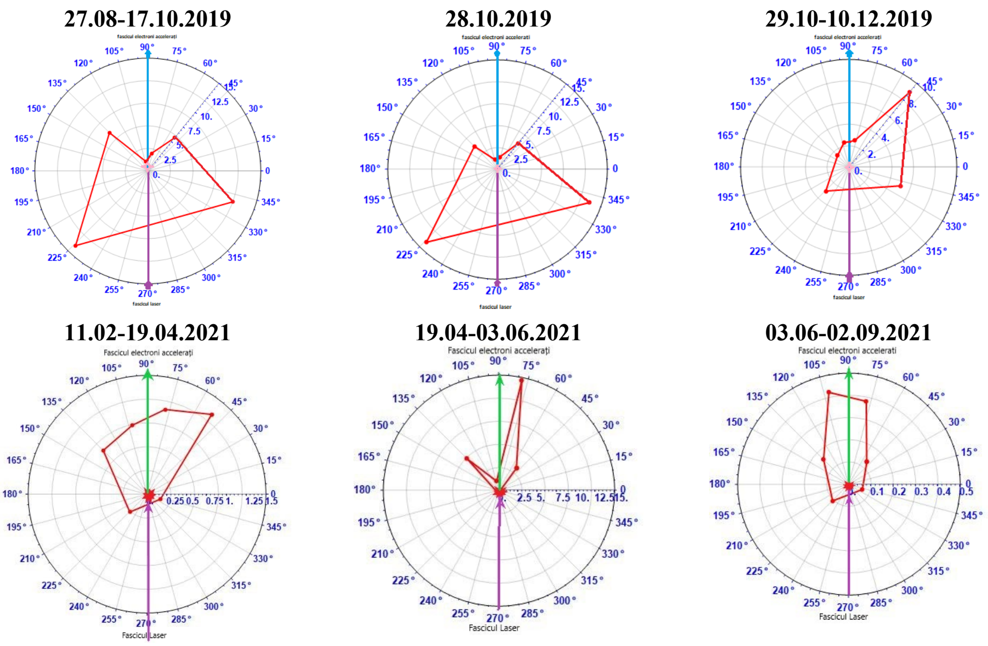

FIG. 2. Radiation isodose measurements during high power laser target interaction.

In this paper there are presented measured values for radiation isodoses obtained during the high-power laser gas target interaction. The measured values suggest the necessity to be considered for experimental data assessment and radiation protection purposes.

REFERENCES

[1] ICUIL website: https://www.icuil.org/pdf/icuil-world-map-2020.pdf, Accessed on 21.09.2021.

[2] http://cetal.inflpr.ro/newsite/pw_facility

[3] DIPLASU, C., GIUBEGA, G., UNGUREANU, R., COJOCARU, G., SERBANESCU, M., MARCU, A., STANCU, E., ACHIM, A., ZAMFIRESCU, M., "Commissioning experiment on laser-plasma electron acceleration in supersonic gas jet at CETAL-PW laser facility", Rom. Rep. Phys. 73, 401 (2021).