



Contribution ID: 20

Type: **Poster (participant)**

X-Ray Sources for Fast 3D Tomography Using Laser-Plasma Acceleration

Tuesday, 15 April 2025 17:10 (1h 30m)

The MULTISCAN3D project aims to provide a technical solution to create 3D tomography systems capable of detecting threats invisible with current 2D technology. Laser-plasma acceleration appears to be a promising method to achieve this goal. Indeed, the laser allows generating multiple X-ray sources at low cost in order to perform 3D cargo scanning. Furthermore, laser-plasma acceleration can produce highly charged, low-energy, and highly divergent electron beams, generating X-rays of interest for cargo screening.

For such X-ray sources to be implemented in industrial systems, several challenges need to be overcome. One major issue is the high divergence of the electron beams. While it is an advantage to illuminate large objects, it can also become a drawback when it is too large, as it tends to increase the X-ray source size and reduce image resolution. To address this, we propose using a train of laser pulses instead of a single pulse. Each laser pulse will accelerate electrons in its wake, producing a train of electron bunches that achieve the same overall charge with smaller divergence. We present here the principle of this technique as well as the first results obtained within the framework of the MULTISCAN3D project.

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Session Classification: Poster Session

Track Classification: Applications