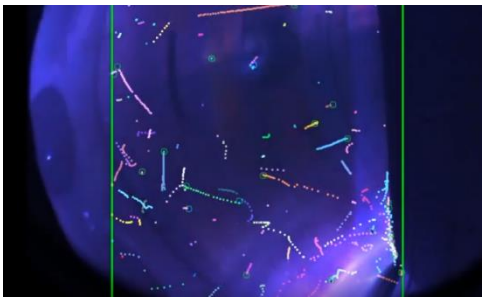
Toolbox for fast detection and tracking of dust particles in tokamaks

Monitoring the dust within a tokamak is quite challenging: dust particles in the transitory state measure only few microns and despite their high thermal radiation are quite challenging to be characterized in term of speed, acceleration and change of direction. For years the plasma physicists of Institut Jean Lamour and then the spin-off APREX Solutions developed measurements tools to carry out truly statistical multi-physics investigations based on the analysis of thousands of tokamak discharges in all kinds of conditions. This solution able to track and analyze images and videos simultaneously and in real is suitable for many non-fusion usecases.

Description of the technology

Researchers of the Jean Lamour institute (Lorraine University, France), have developed measurements tools to carry out truly statistical multi-physics investigations based on the analysis of thousands of tokamak discharges in all kinds of conditions.. They decided to found their company to focus on the development of algorithms and software for process monitoring, optimization and securitization .Based on the video tracking software developed to study fusion plasmas (TRACE algorithm), APREX Solutions developed the Track software, that tracks and analyzes images and videos.



Example of dust monitoring within a tokamak (This video, recorded at 10 000 frames/s, shows dust particles produced by plasma wall interaction

Innovation and advantages of the offer

The main benefit of this toolbox is that it can detect and track many objects with very different motion characteristics (difference of velocities, direction changes, sudden accelerations). The ergonomic and intuitive interface allows to analyze any video (Black & White, colored, HD, UHD, from fast imaging camera, infrared camera, microscope, telescope; with any encoding format) and adapt the tool to any situation

Non-fusion Applications

Analyzing multiple objects with very different motion characteristics is a strong painpoint in many industries and research laboratories. In general, all markets and applications requiring a high-performance, reliable vision system (capture, analysis) for parameters tracking, quality control and process understanding could use this technology. It could be for example metal working, automotive, electronics, agrifood, pharmaceuticals, chemicals and fluidics.

EUROfusion Heritage

Monitoring the dust within a tokamak is quite challenging: dust particles in the transitory state measure only few microns and despite their high thermal radiation are quite challenging to be characterized in term of speed, acceleration and change of direction. But the algorithm allowed the monitoring of them. Developed by the plasma physicists of Institut Jean Lamour (which is also EUROfusion Linked Third Party), these plasma monitoring techniques have been successfully used to investigate the generation and transport of dust particles in the ASDEX Upgrade and TEXTOR tokamaks (reference of contracts: EFDA WP12-IPH-A03-2-11/PS-01/CEA & EFDA WP13-IPH-A03-P2-01/CEA/PS), to investigate the dust dynamics in the Pilot-PSI facility (EURATOM-CfP-WP14-ER-01/VR-01 and EURATOM-CfP-WP15-IPH-WPPFC) and finally the properties of plasma filaments in the edge of the COMPASS tokamak (contract EURATOM WP17-ER-CEA-08).