Researches on the Dust Component in FTU Plasmas:

Diagnostics and Modelling

Carmine Castaldo ENEA - Frascati

3th RCM of the CRP on "Characterization of Size, Composition and Origins of Dust in Fusion Devices", Wien, 30 Nov - 2 Dec 2011

Researches on the Dust Component in FTU Plasmas

Collaborations

KTH S. Ratynskaia, ...

CNR-IFP M. De Angeli, G. Grosso, E. Lazzaro, ...

ENEA E. Giovannozzi, G. Maddaluno, ...

University of Naples U. De Angelis, ...

University of Molise C. Marmolino, ...

C. Castaldo ENEA - Frascati

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Outline

Hypervelocity dust particles

Electro-Optical probe

Aerogel collectors

Modelling of dust dynamics

C. Castaldo ENEA - Frascati

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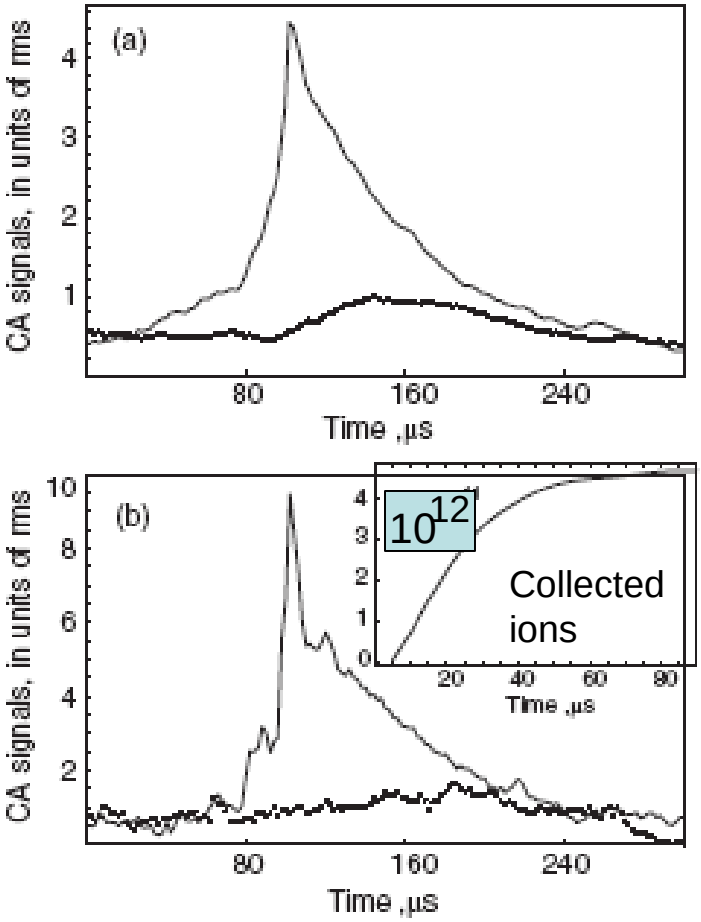
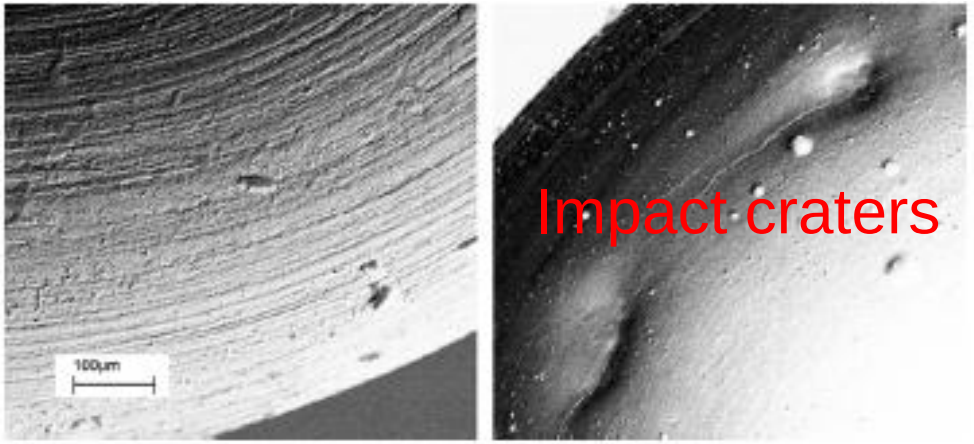
Hypervelocity dust in FTU tokamak

C Castaldo et al NF **47** (2007) L5 ; S. Ratynskaia et al NF **48** (2008) 015006





- The largest spikes in the ion saturation current seen by adjacent (6 mm apart poloidally) e.s. probes are uncorrelated
- The number of these events matches the number of the impact craters found on the probe tips

Hypervelocity dust in FTU tokamak

Currents are < 50 mA

No unipolar arcs

QuickTime™ e un
decompressore
sono necessari per visualizzare quest'immagine.

10^{12}

Collected
ions

QuickTime™ e un

< 4rms spikes
are correlated

> 5 rms spikes
are uncorrelated

→ *No blobs*

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Hypervelocity dust in FTU tokamak

- The rough rims from ejected molten metal (typical for unipolar spots) are missing

- The arc hops from one spot to another causing several mm scratches - not observed

A. Anders Lawrence Berkeley National Laboratory
I. Beilis Tel Aviv University

The energy required to produce the largest craters is ~ 6 mJ
The energy of the largest spikes is < 0.3 mJ

Conclusions

Evidence of hypervelocity impacts in FTU motivated development of specific diagnostics (strong erosion effects)

Electro-Optical Tungsten probe can identify hypervelocity impacts by simultaneous occurrence of W line emission at 409 nm and spikes in the ion saturation current.
Tested in LIBS. First use in FTU demonstrate its compaatibility with vacuum and plasma operations.

Aerogel exposure in FTU (bottom position) in standard discharges (500 kA, 0.8 10^20 m^-3, 6T) . No craters were observed.

Numerical code developed for FTU suggests that dust particles are confined in a SOL region with poloidal angles +/- 7o with respect to the equatorial plane. Hypervelocity regimes could be reached, mainly in low density discharge (350 kA, 0.5 10^20 m^-3, 7 T)