

Four-dimensional (4D) tracking of high-temperature microparticles

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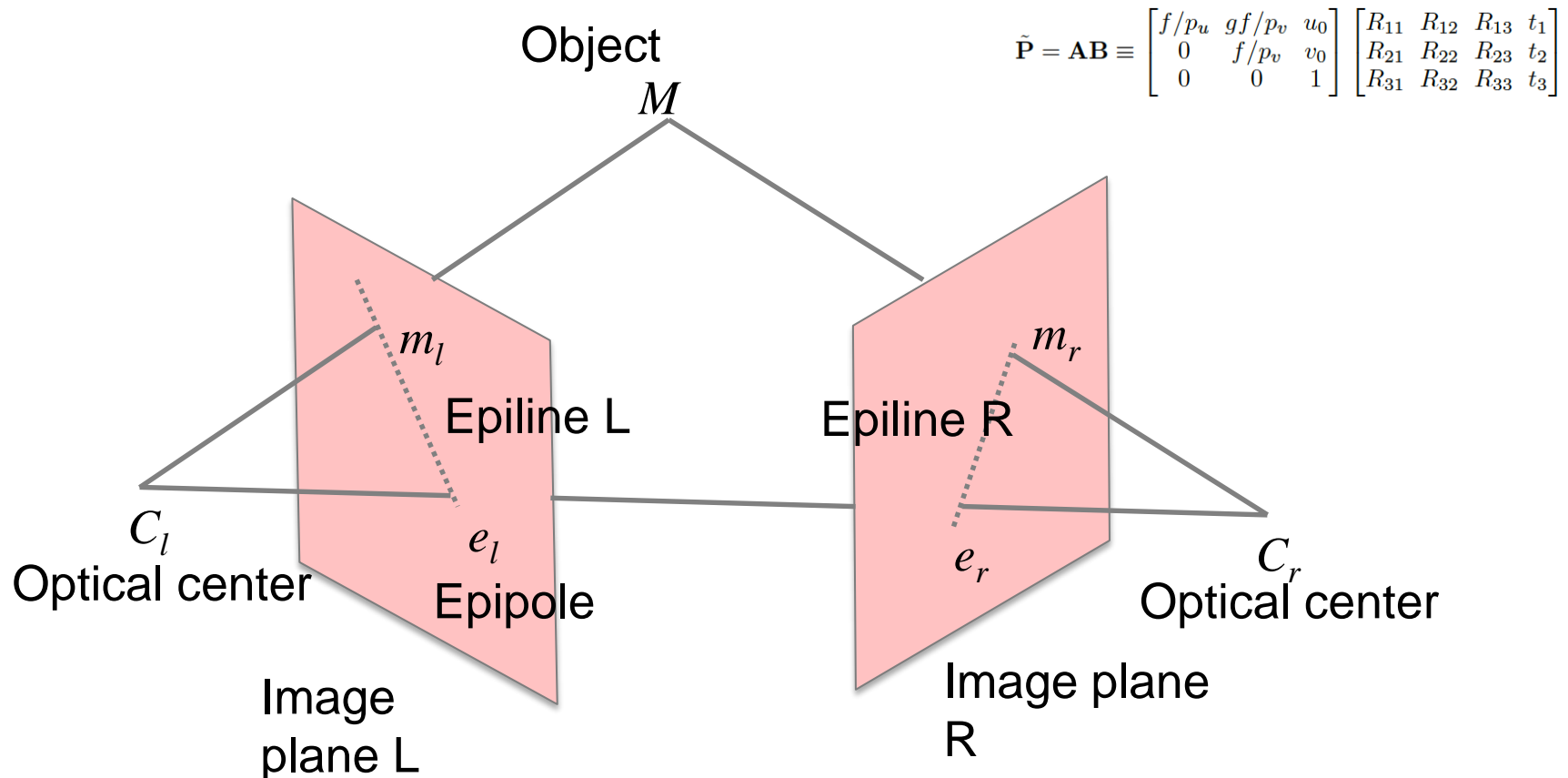
NSTX-U hosts: Rajesh Maingi, Robert Lunsford

(PPPL, Sept 21, 2016)

Motions

- **High-temperature microparticles can be generated/introduced in a number of ways**
 - PMI in the main plasma chamber
 - Divertor region
 - Pellet injection, Granule Injection, Laser ablation, ELM/Disruption controls, Dust,...
- **Hardware & software developed for Time-resolved 3D (4D) microparticle tracking**
- **Results highlight**

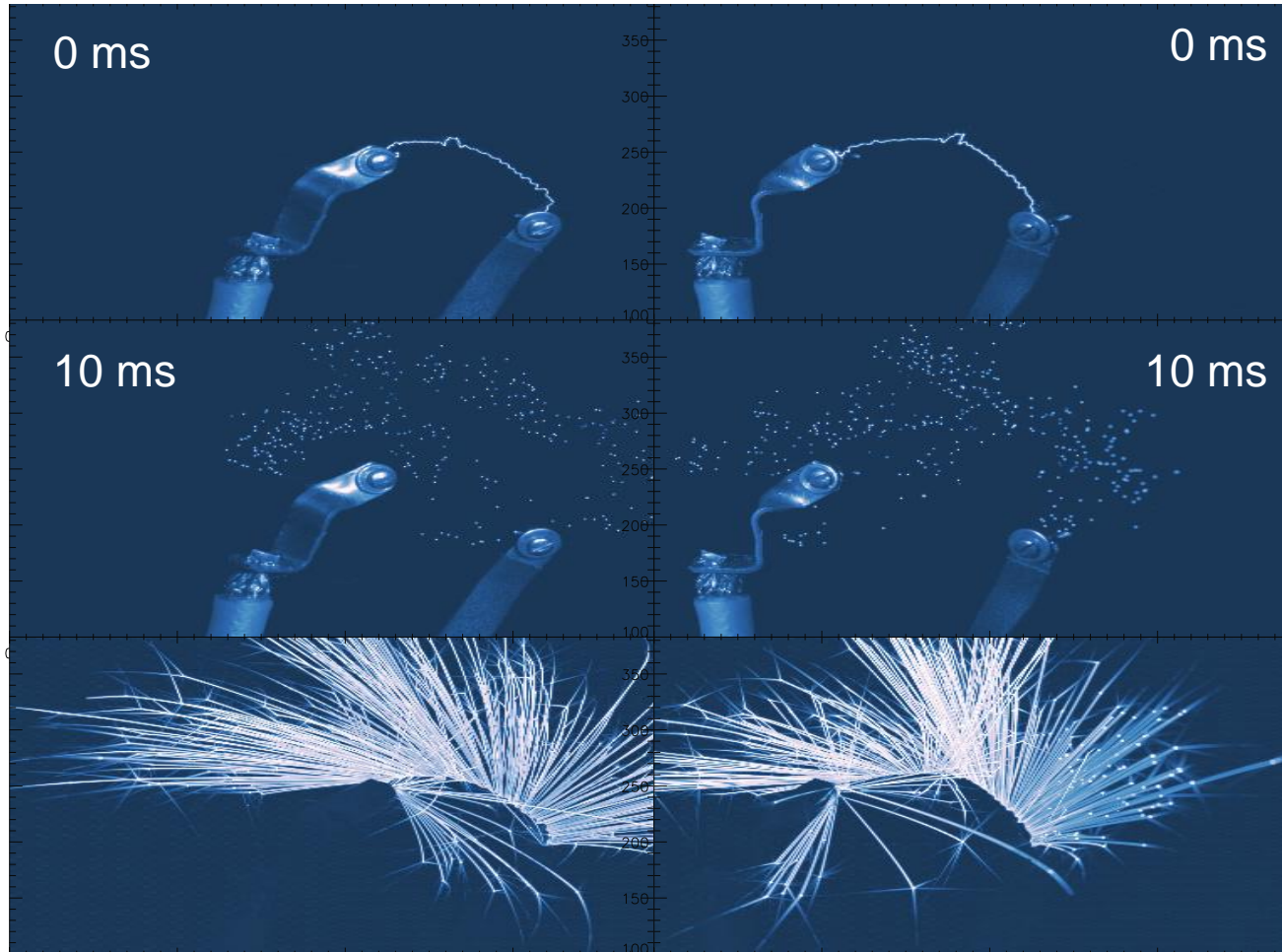
Tracking principle



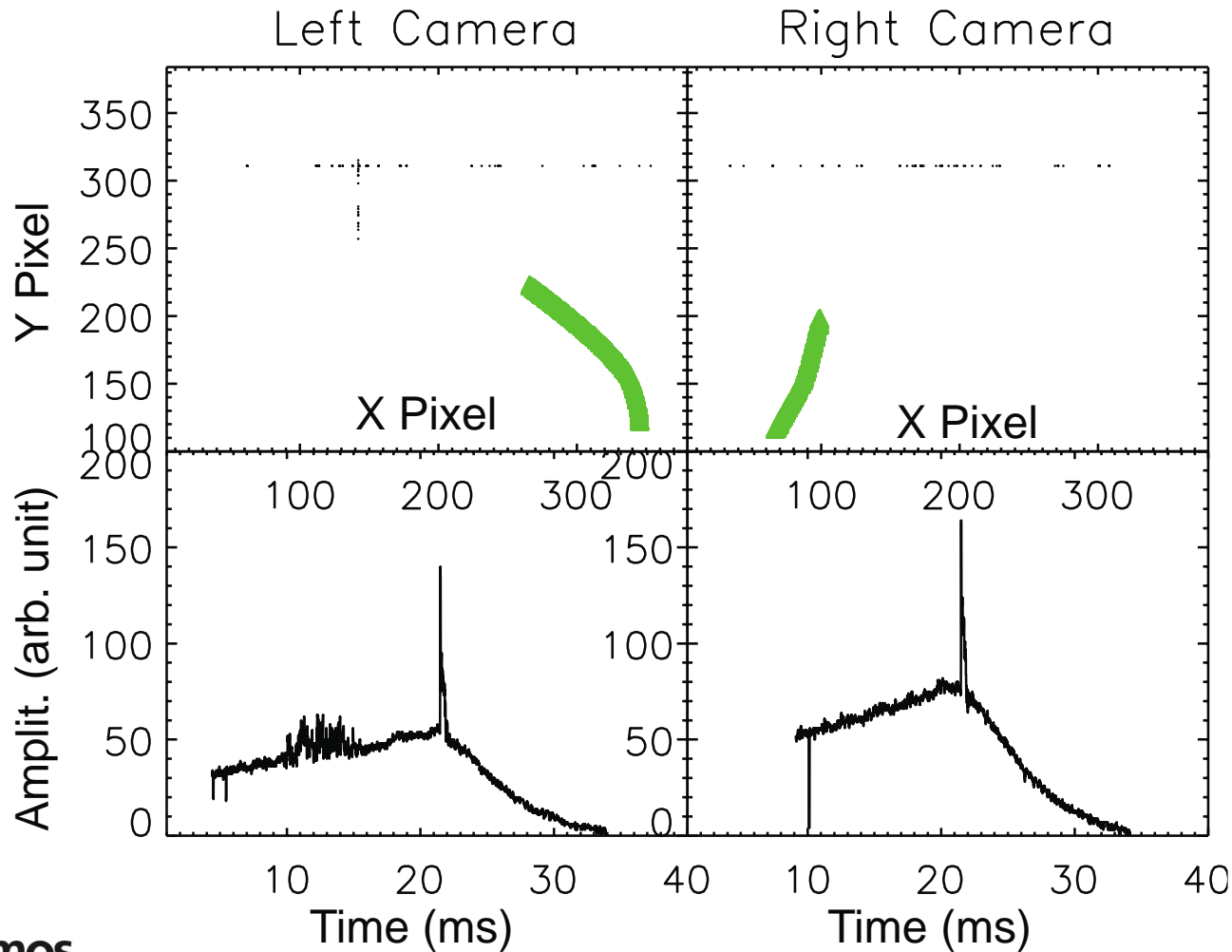
Static calibration



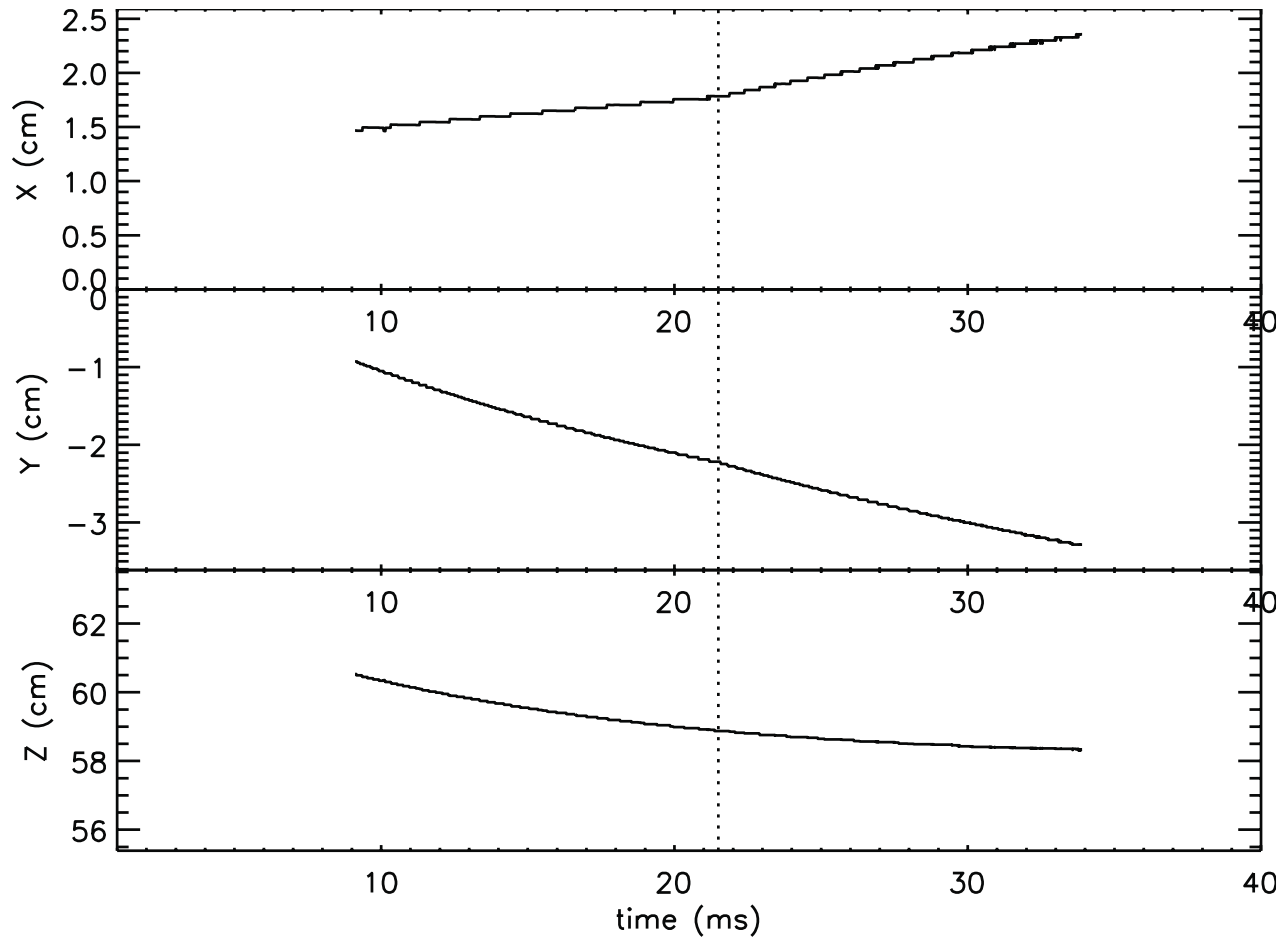
Wire-explosion movie



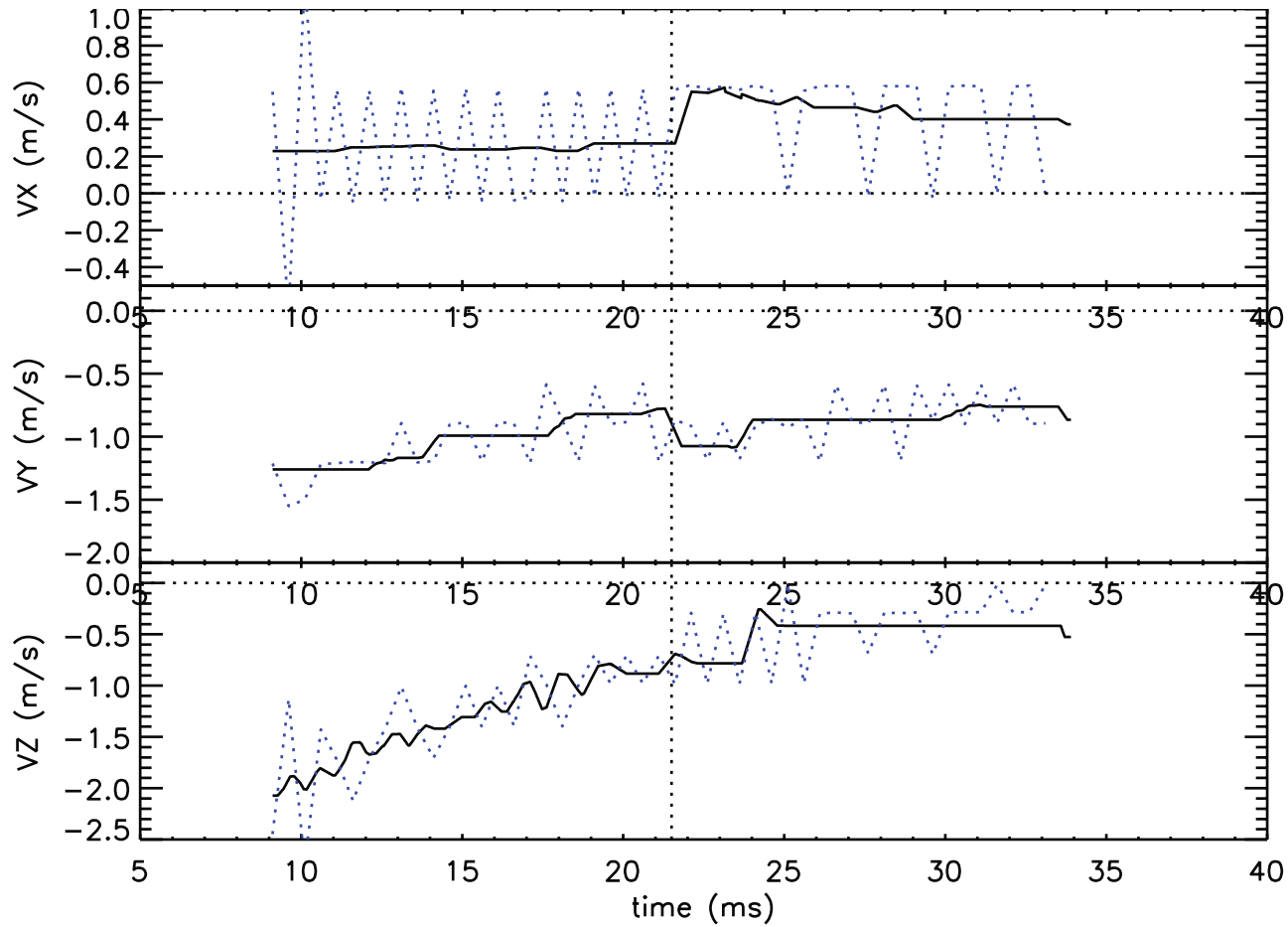
Intensity correlation in time



Triangulation for 3D tracking reconstruction



Velocity calculation



Summary

- **High-temperature microparticles can be useful in many ways to burning plasmas**
- **Hardware & software development for 4D microparticle tracking**
 - Latest fast camera technology
 - Computer vision theoretical framework
 - Algorithms developed for computer vision used.
- **Results highlight**
 - Intensity correlation can be used to tracking pairing
 - Auto-calibration possible
 - Velocity resolution ~ 0.1 m/s

Details: Wang, Liu, Waganaar, Fontanese, James, Munsat, *Rev Sci Instrum* **87**, 11D601 (2016)

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- ...

