

## §2. Self-organized Rotating Filament Structures in LHD Plasmas after Tracer Encapsulated Solid Pellet Injection

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A new diagnostic method with Tracer Encapsulated Solid PELlet (TESPEL) has been developed for impurity transport study by local deposition of the tracer in the plasmas.<sup>1)</sup> The most advantageous feature of TESPEL is production of a localized impurity source as tracers in plasmas. Encapsulated impurity is locally ablated at the position where the normalized minor radius  $\rho$  is about 0.8.<sup>2)</sup> The transport of the ablated impurity is observed with a tangential viewing visible fast-framing camera.

Figure 1 shows sequential images of the tangential view of a LHD plasma observed with the fast-framing camera after the pellet injection. The images were taken in a typical magnetic configuration ( $R_{ax}=3.60m$ ). The pellet was injected at  $t=0s$  in this discharge. The frame rate was set to

20,000 frames per second. Figure 1 (a) shows visible radiation only in the peripheral plasma before the appearance of the effect of the pellet injection. At about 0.582 seconds after the injection, a bright band appeared in the plasma center (b). The band expanded and changed to a uniform bubble-like structure (c). It expanded to a magnetic surface around the core plasma (d). In this time period, the spectroscopic diagnostics detected transport of tungsten ions into the plasma center, and Thomson scattering system shows that the region with low electron temperature radially expanded. After a while, a self-organized bright filament structure appeared on a bubble like structure (e). It began to rotate in the poloidal/toroidal directions (f,g,h,i). The images show that the filament is formed along the magnetic field lines on the bubble. The rotating filament was stably sustained for about 0.22s. After this, the filament and the bubble began to vanish with the rise of the central electron temperature and the decrease of the impurity radiation.

- 1) Sudo, S. et al.: Rev. Sci. Instrum. **83** (2012) 023503.
- 2) Sudo, S. et al.: Nucl. Fusion **52** (2012) 053012.

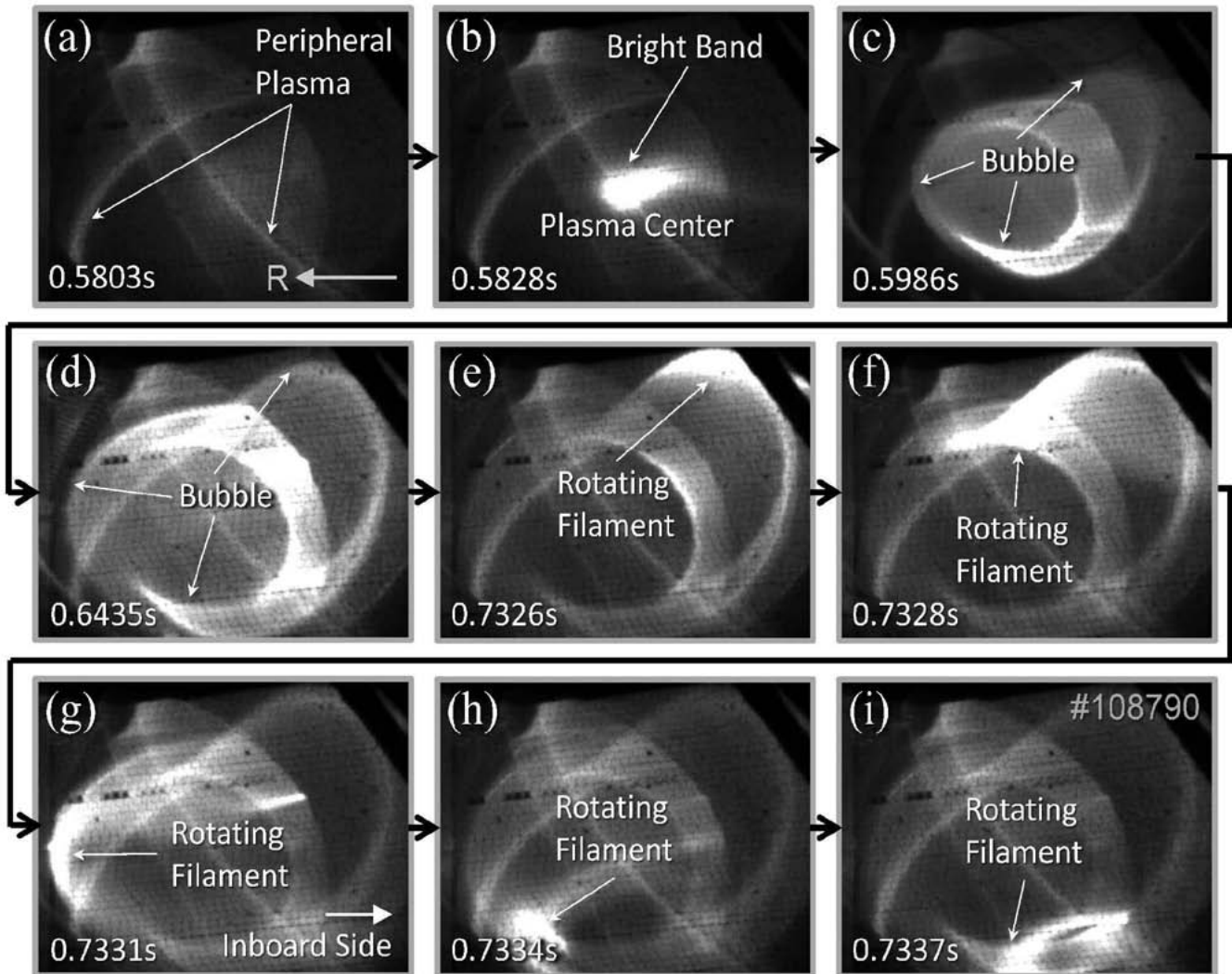


Fig. 1. Sequential images of a tangential view of an LHD plasma observed with a visible fast-framing camera after tungsten encapsulated pellet injection.