

New Detection Principles on the GEMINI SUPRA FE-SEM

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The GEMINI principle^{1,2} of electron detection is unique, because it uses a boosted detection Lens, which projects the information from the only crossover - the focus- to the In-lens detector. The beam booster accelerates the electrons backwards while the optical principle of the GEMINI lens separates the different electron energies and brings them to different trajectories with different focal points. Due to this effect we get an angle filtered information on different detectors at the beam axis. The true surface SE information is acquired on the In-lens detector, while the subsurface high angle and high resolution BSE information is projected to the PSF detector. Due to the fact, that the GEMINI lens separates the different electron energies (BSE, SE) by its imaging principle, we have an energy filtered detection on different detectors. The principle is a separation of the Phase Space. This gives the name to **Phase Space Filtered Detection** – PSFD.

We use the advantage, that radial symmetry to the beam axis allows easiest control of alignment and Detector selection. Both can be used in simultaneous parallel detection. Signals between both can be mixed in any ratio and superimposed, or displayed separately. So true surface information can be mixed with material information in any ratio^{3,4}. Absolutely no alignment is necessary when the different detectors are used. Since the boosted column is accelerating backwards all electrons coming from the spot, the SE and the BSE information is amplified and so enhanced, that one can image almost noise free even at lowest landing energies. Typical scanning time for a picture is less than a second.

- [1] Heiner Jaksch, Field emission SEM for true surface imaging and Analysis, Materials World, Oct. 1996
- [2] Weimer et al, Ultra High resolution SEM—a new approach, Microscopy and Analysis, March 1994, p19

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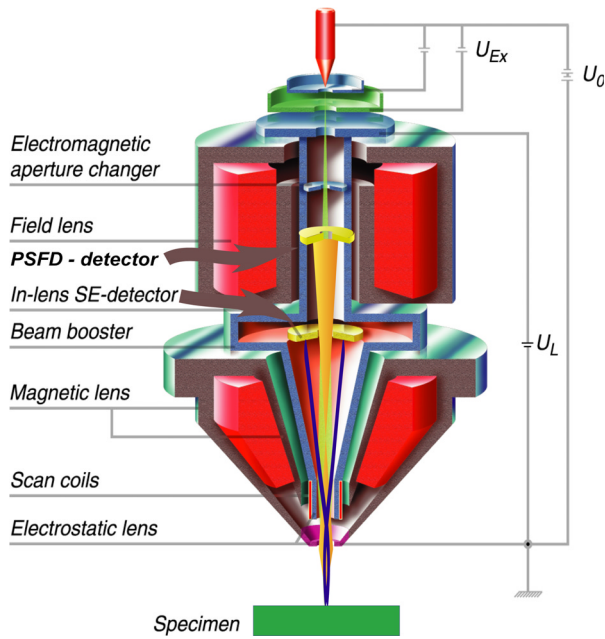


Image 1: The GEMINI Column with PSF Detector

Phase Space Filtered Detection

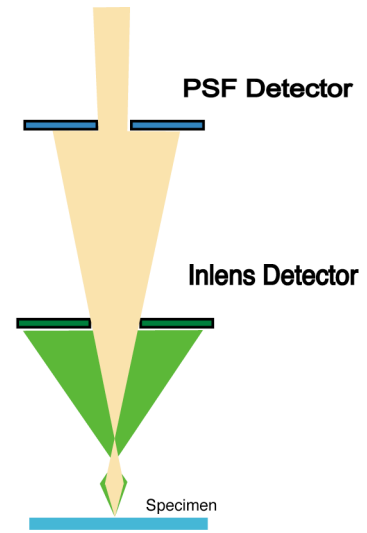


Image 2: PSF Detection principle

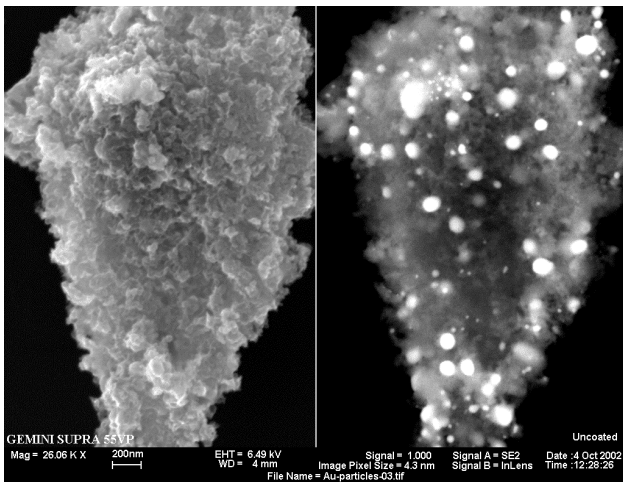


Image 3: Comparison between true surface INLENS detector and the new PSF detector with high resolution subsurface Au particles.

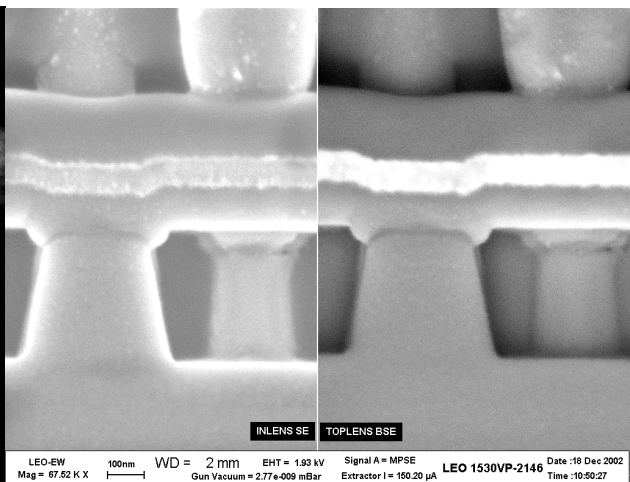


Image 4: Simultaneous imaging of INLENS SE and PSF – BSE information