Electronic Supplementary Information (ESI)

Geometric Super-resolution on Push-broom Hyperspectral Imaging for Plasma Optical Emission Spectroscopy

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This material include supplemental information to the primary manuscript.

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Supplementary Information

Section 1. Relationship between the frequency of periodic error and the scan step

To identify the source of the periodic error, different scan steps are used in the plasma profile model. The single-sided power spectrum after the Fourier-transform of 3 µm scan step is shown in Fig. S1 (left), the error frequency is located at 0.33 Hz, which corresponds to the inverse of the number of sub-pixel steps (0.33=1/3). Similarly, the result of 8 µm scan step (Fig. S1, right) indicates the error frequencies locate at 0.125, 0.25, 0.325 Hz, which is one, two and three times of 0.125 (1/8). It is evident that the periodic error has an inverse relationship with the scan step.

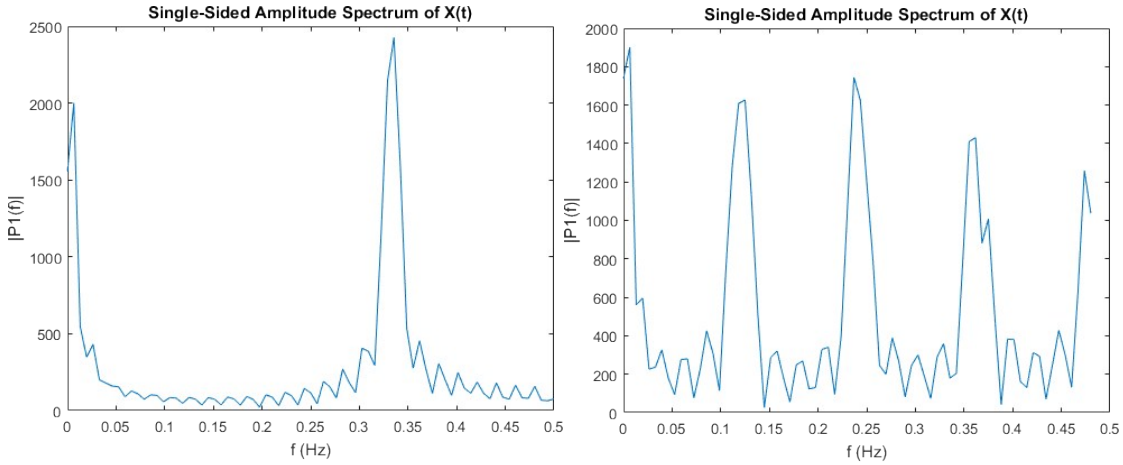

Fig. S1 FT Power spectrums of the model SPS plasma intensity profile with added noise, 10 µm pixel width, and 3 µm scan step (left) or 8 µm scan step (right).

Section 2. Optimization of noise filter frequency thresholds

The rubric for assessing the optimization of the frequency thresholds for periodic noise filtering is based on the RMS of the relative residuals after the filter is applied to the representative noisy/deconvoluted model plasma intensity profile. In principle, a smaller RMS indicates that the filtered data is closer to the true value of the original noise-free model data. Fig. S2a shows the RMS as the low pass filter frequency threshold is varied from 0.19 Hz to 0.1 Hz. The RMS decreases from 0.19 Hz to 0.15 Hz, as more periodic noise is rejected around 0.2 Hz, and it

remains practically at the same level from 0.15 Hz to 0.1 Hz. As a result, the frequency threshold for the lowpass filter was set to 0.15 Hz. A similar protocol was followed for the notch filter optimization. In this case, the bandwidth of the rejected frequency region, centered at 0.2 Hz, is varied. The observed trend shows that a bandwidth of 0.1 Hz is optimum.

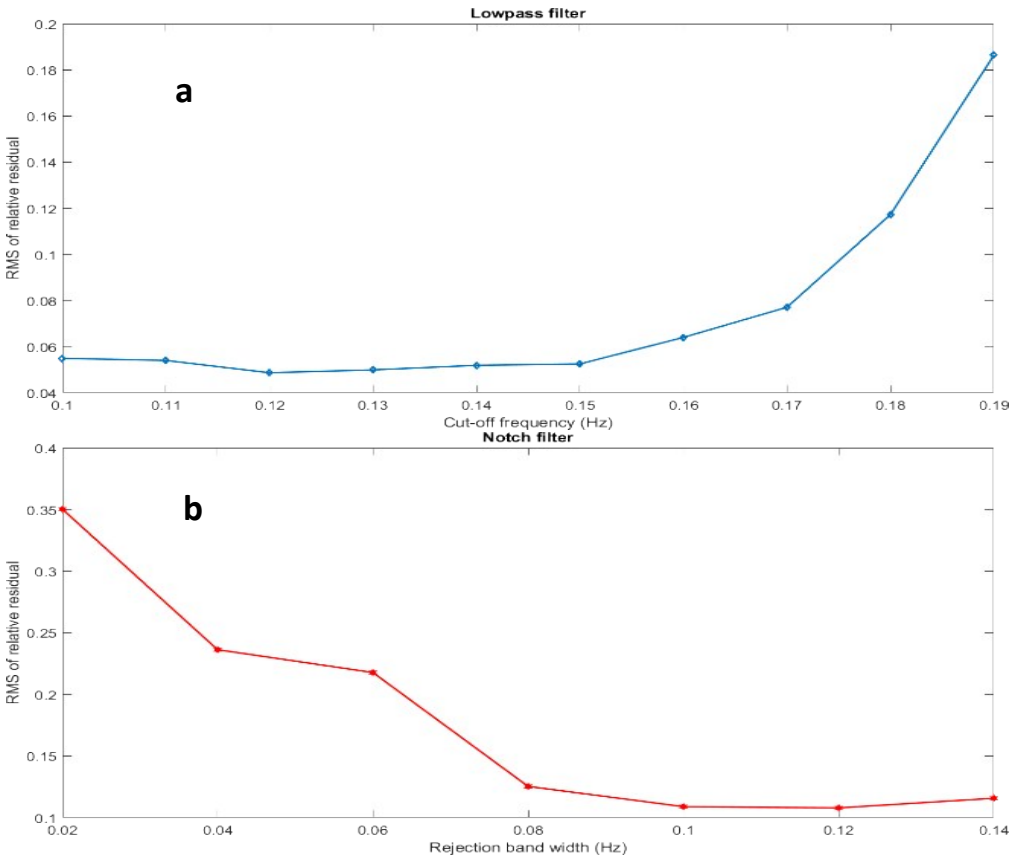

Fig. S2 RMS of the relative residual with varying frequency threshoulds of a) lowpass filter and b) notch filter.