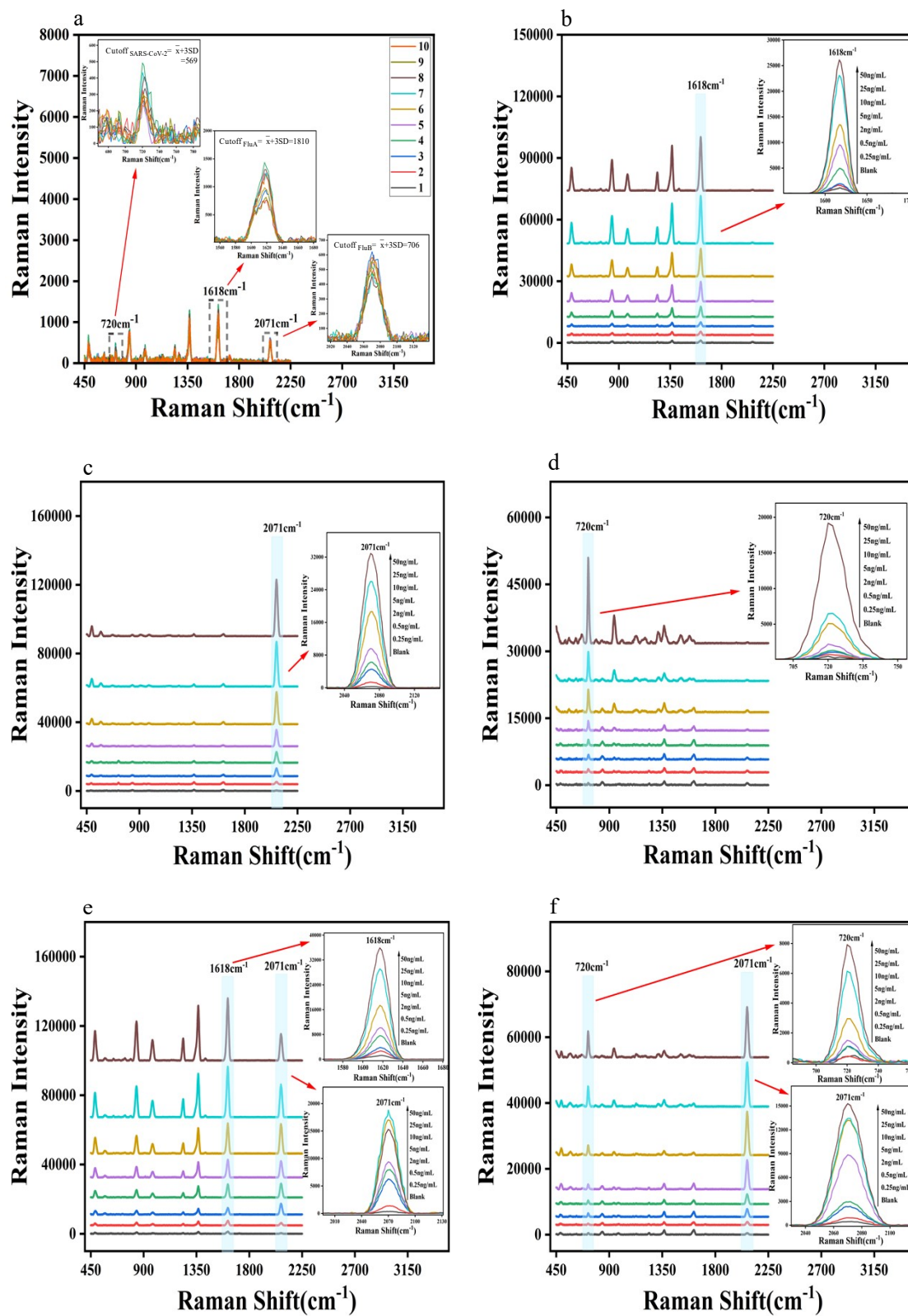


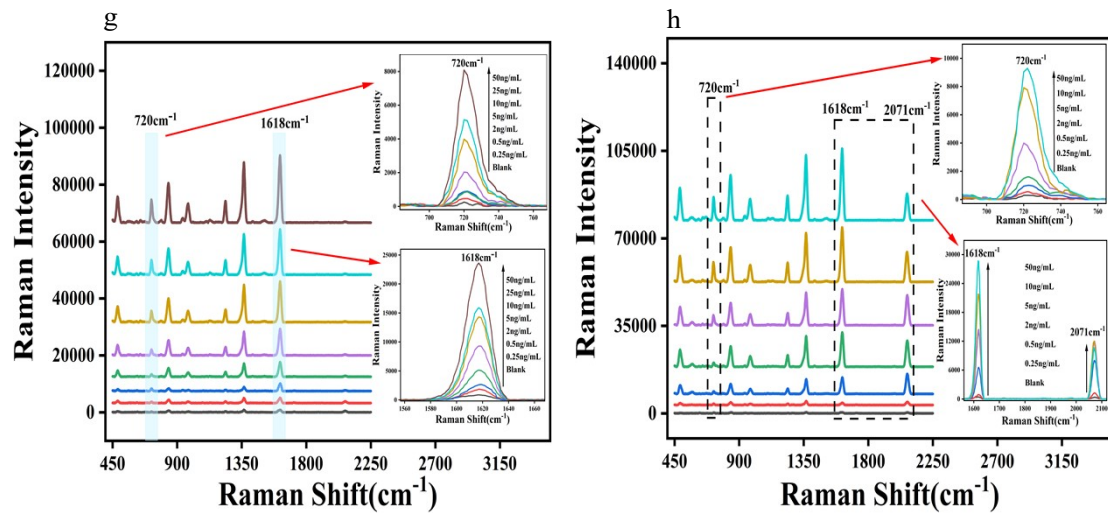
## Supporting Information

### **S1. Raman spectroscopy software processor**

The logic of the software's baseline removal algorithm is as follows: with the laser switched off, a number of spectra are taken under the same test conditions, and these spectra are averaged to give the background spectrum. This spectral signal does not carry the Raman and fluorescence signals of the sample, the spectral signal is the baseline of the device and the stray light signal from the environment. This background spectrum is subtracted in each subsequent test. The logic of the software's fluorescence signal elimination algorithm is as follows: use the wavelet transform to decompose the spectrum into components at different scales, distinguish the fluorescence background (low-frequency portion) and the Raman signal (high-frequency portion), select the appropriate threshold, to consider the low-frequency component as the background, and then reconfigure the spectrum after the low-frequency component is removed.

## S2. Sensitivity testing





**Fig. S2** Results of the sensitivity test of the triple test immunochromatographic test strips: Raman spectra of the T lines at  $1618\text{ cm}^{-1}$ ,  $2071\text{ cm}^{-1}$  and  $720\text{ cm}^{-1}$  on the test paper used to determine the thresholds of the combined FluA, FluB and SARS-CoV-2 detection systems (a); Raman spectra of series concentration FluA at  $1618\text{ cm}^{-1}$  displacement (b); Raman spectra of series concentration FluB at  $2071\text{ cm}^{-1}$  displacement (c); Raman spectra of series concentration SARS-CoV-2 at  $720\text{ cm}^{-1}$  displacement (d); Raman spectra of a series of mixed concentrations of FluA and FluB at  $1618$  and  $2071\text{ cm}^{-1}$  displacements (e); Raman spectra of a series of mixed concentrations of FluB and SARS-CoV-2 at  $2071$  and  $720\text{ cm}^{-1}$  displacements (f); Raman spectra of a series of mixed concentrations of FluA and SARS-CoV-2 at  $1618$  and  $720\text{ cm}^{-1}$  displacements (g); Raman spectra of the T-line at  $1618$ ,  $2071$  and  $720\text{ cm}^{-1}$  for test strips with mixed FluA, FluB and SARS-CoV-2 concentrations (h).