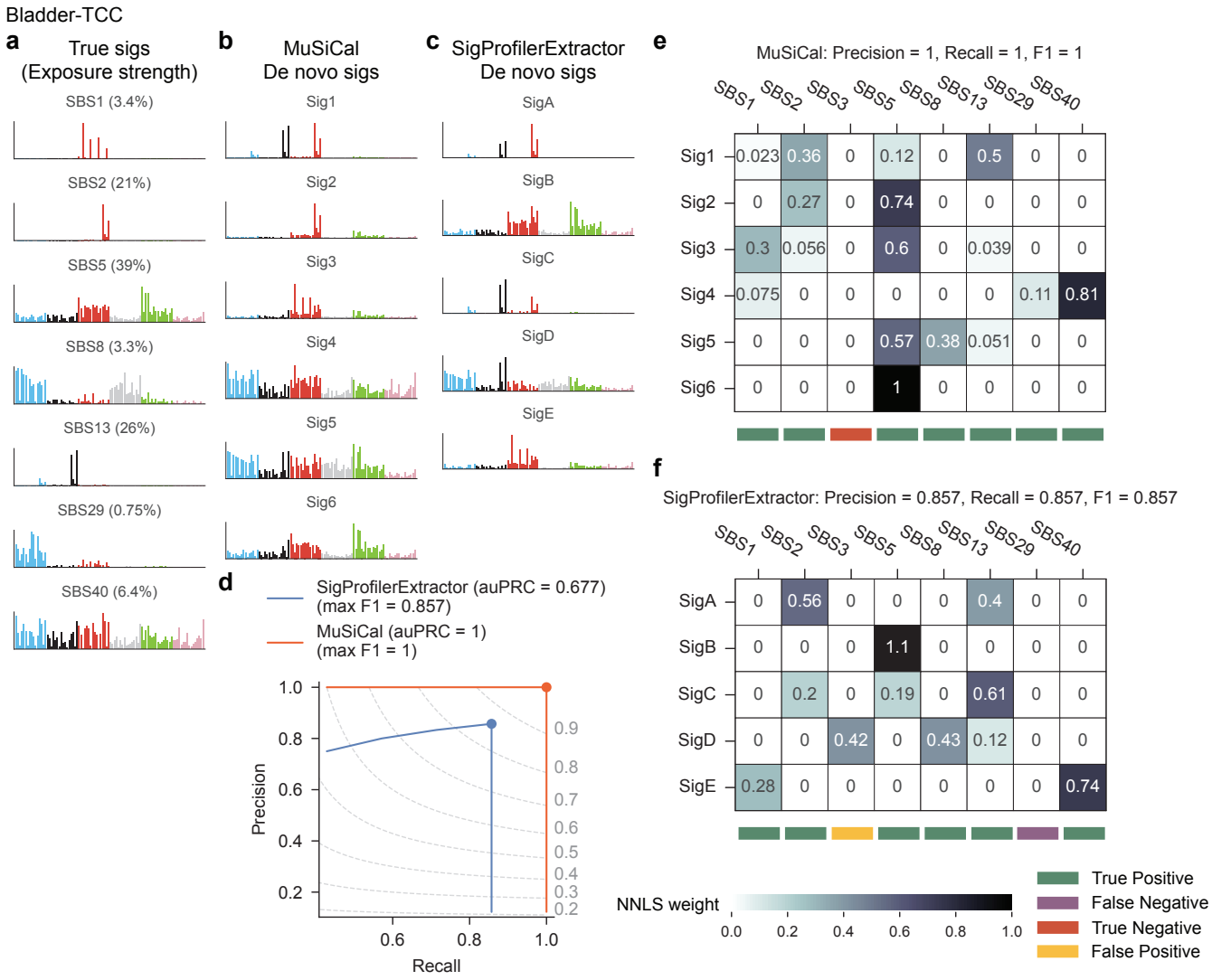
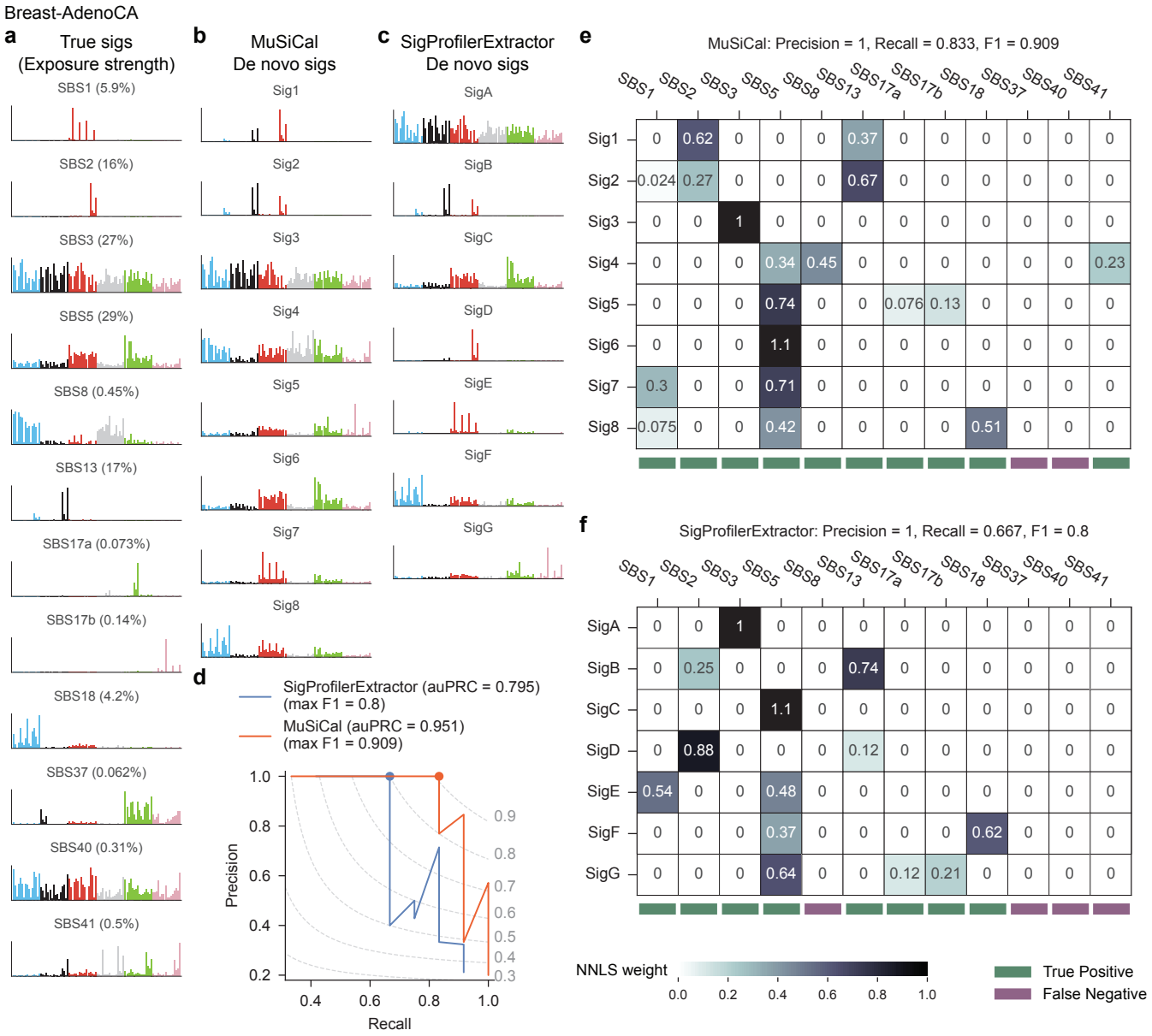
# Supplementary Data

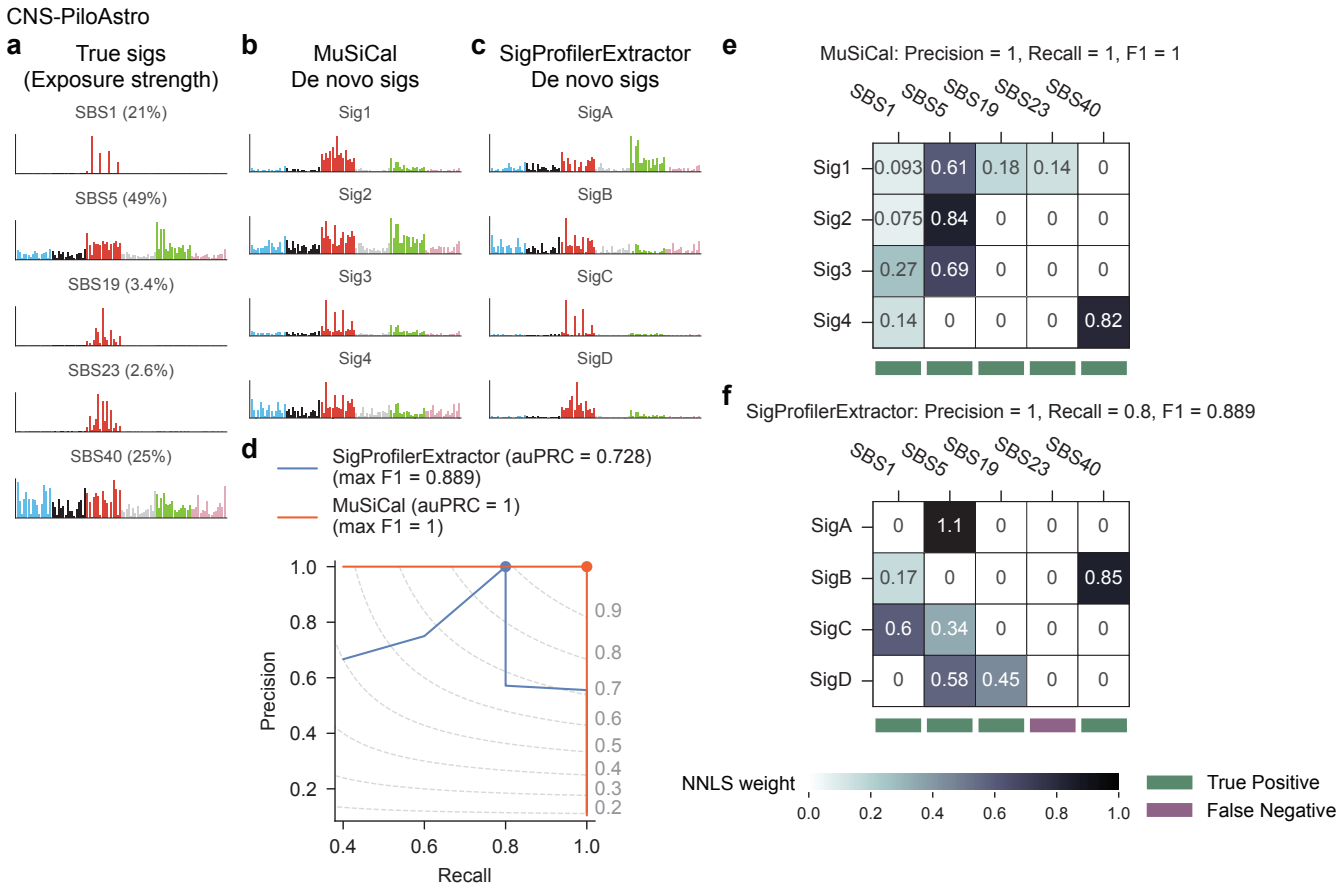
In the Supplementary Data below, we show simulated examples as in Fig. 3a, but for the other 24 tumor types. Specifically, the true signatures were plotted in panel (a), where the percentages below signature names denote exposure strengths of corresponding signatures. *De novo* signatures extracted by MuSiCal were plotted in panel (b). *De novo* signatures extracted by SigProfilerExtractor were plotted in panel (c). The precision-recall curves (PRCs) for both methods were plotted in panel (d), with area under PRC (auPRC) annotated. The matching result corresponding to the largest achieved F1 score was shown in panels (e) and (f) for MuSiCal and SigProfilerExtractor, respectively. Tumor types were ordered as in Fig. 3b.



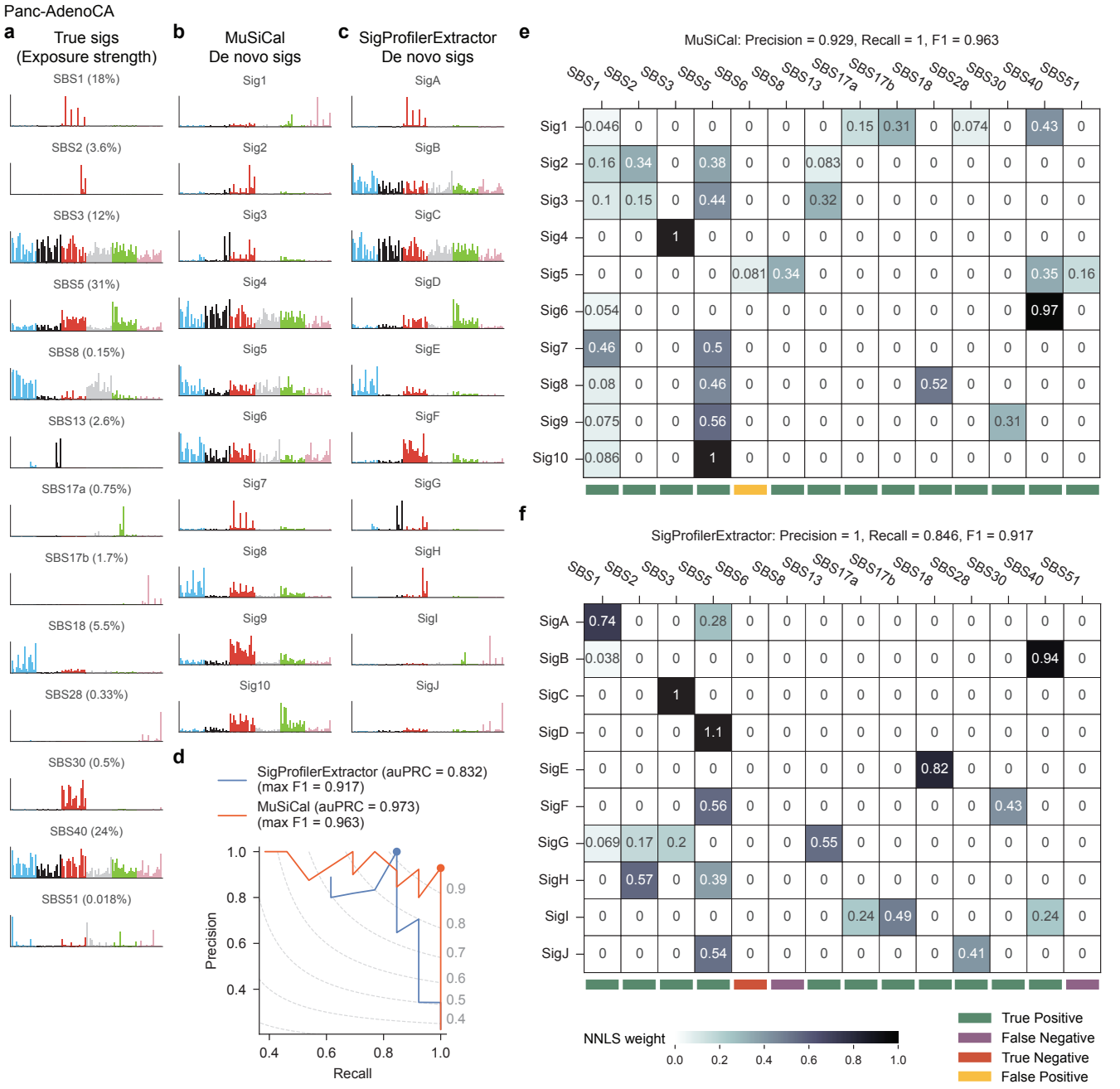

**Supplementary Data Fig. 1** Same as Fig. 3a, but for Bladder-TCC.



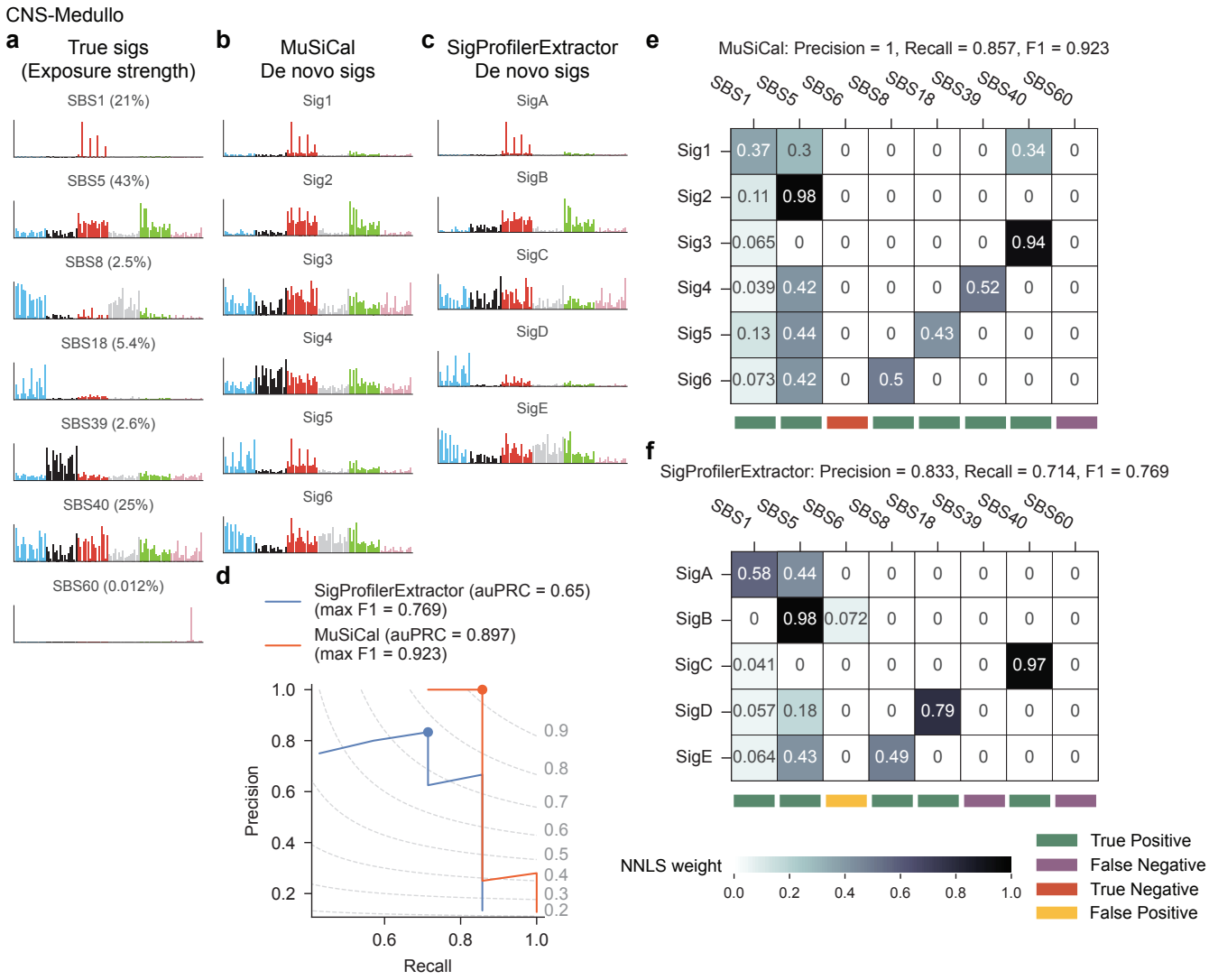

**Supplementary Data Fig. 2** Same as Fig. 3a, but for Breast-AdenoCA.



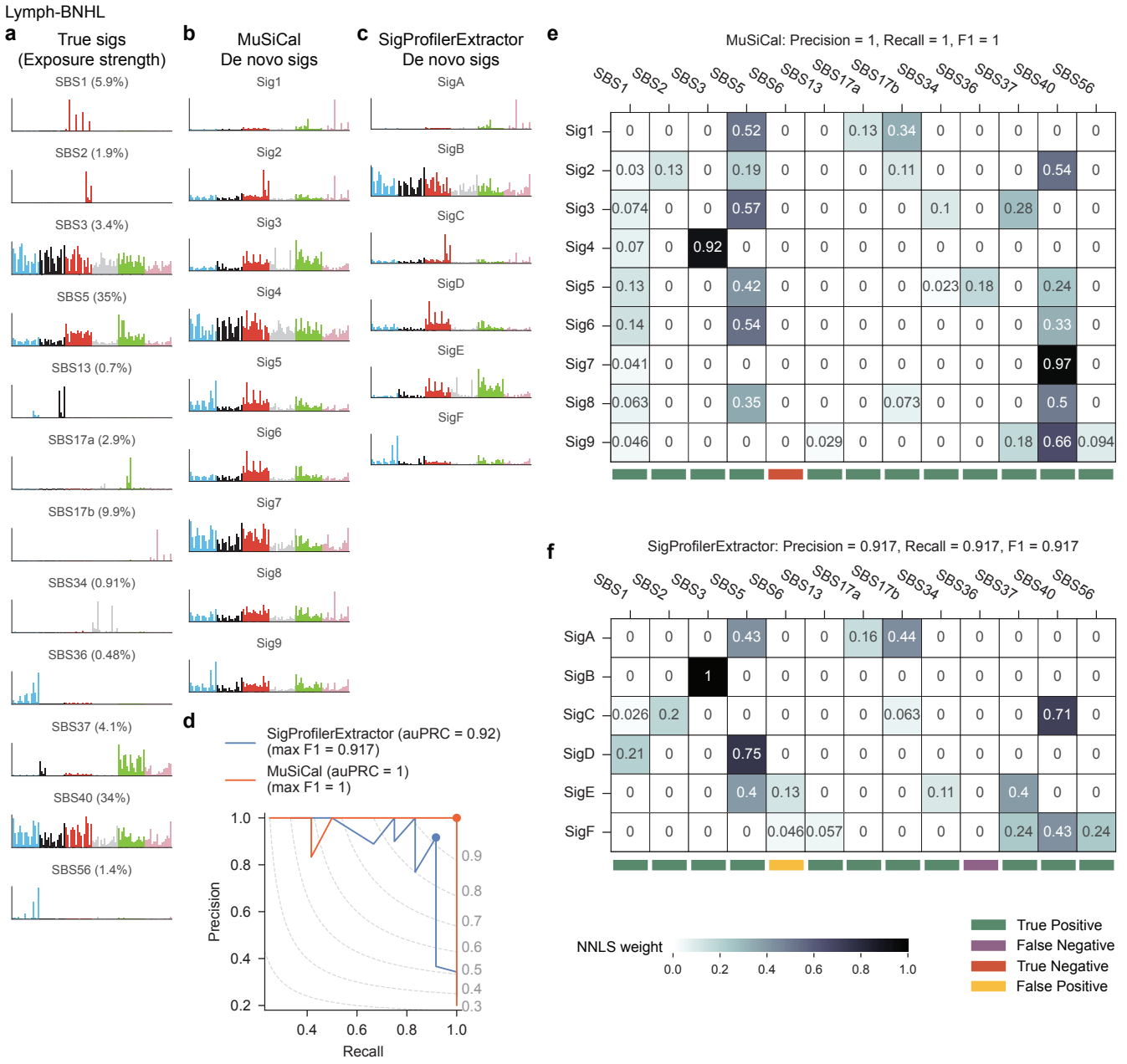

**Supplementary Data Fig. 3** Same as Fig. 3a, but for CNS-PiloAstro.



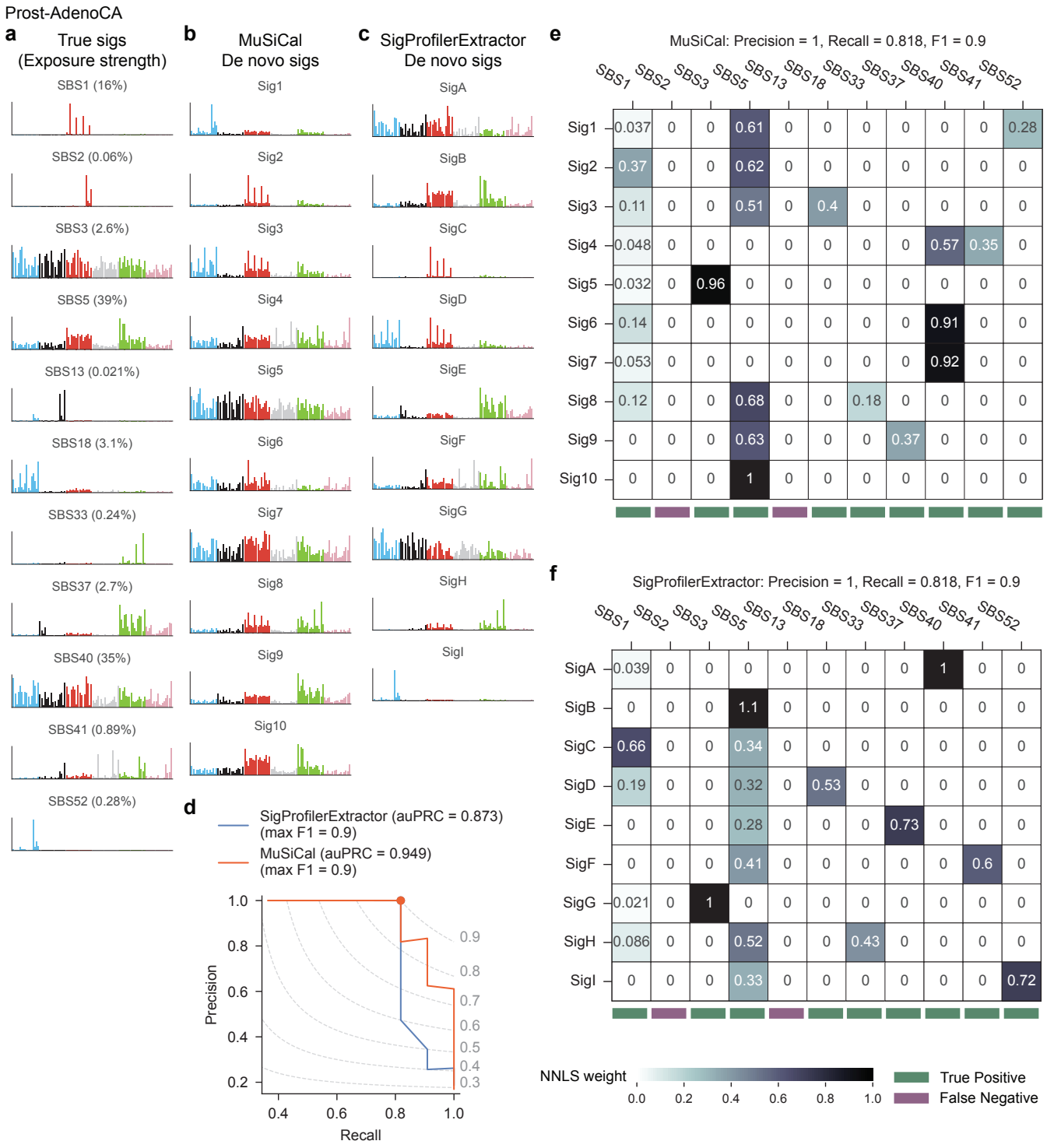

**Supplementary Data Fig. 4** Same as Fig. 3a, but for Panc-AdenoCA.



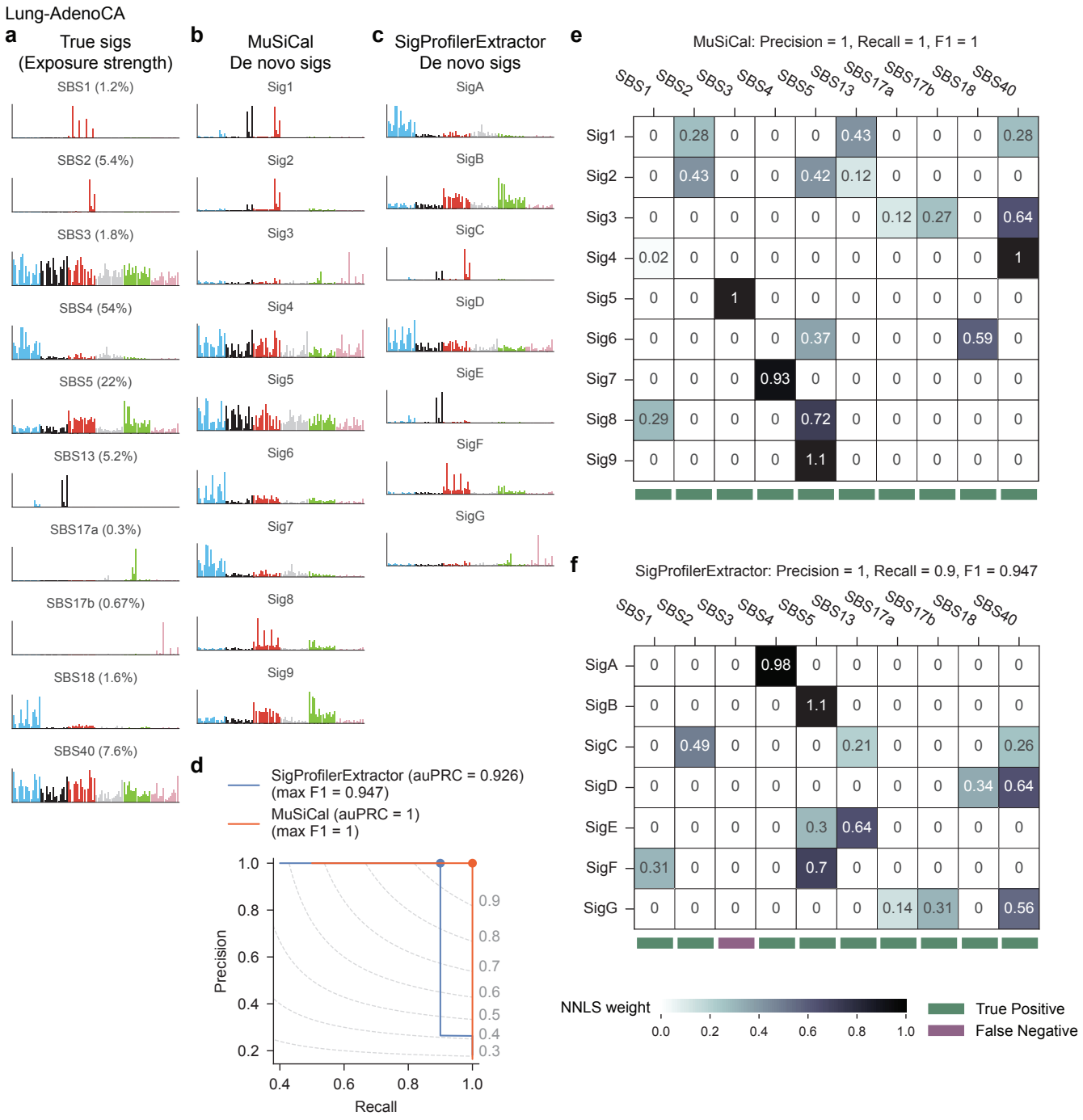

**Supplementary Data Fig. 5** Same as Fig. 3a, but for CNS-Medullo.



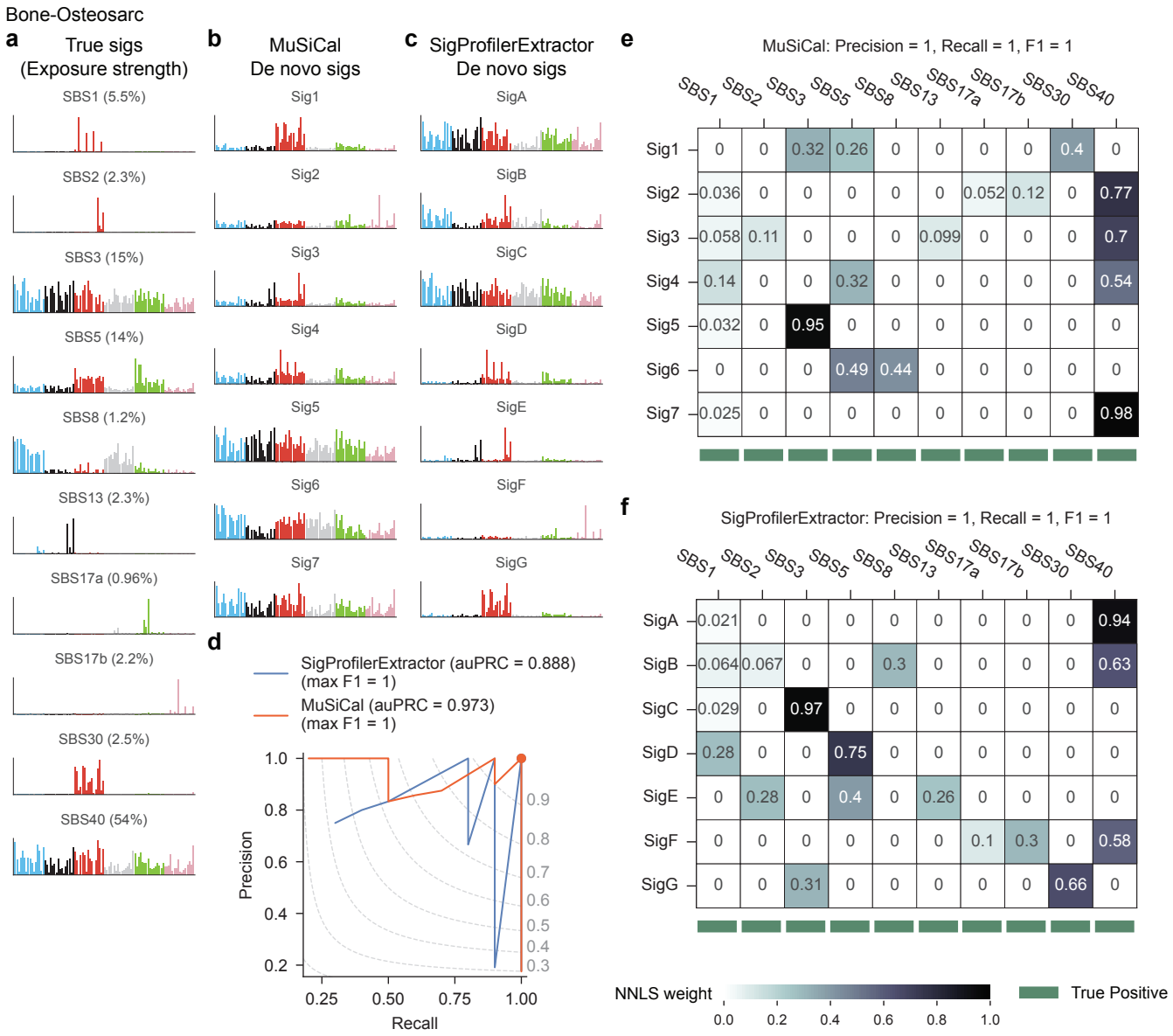

**Supplementary Data Fig. 6** Same as Fig. 3a, but for Lymph-BNHL.



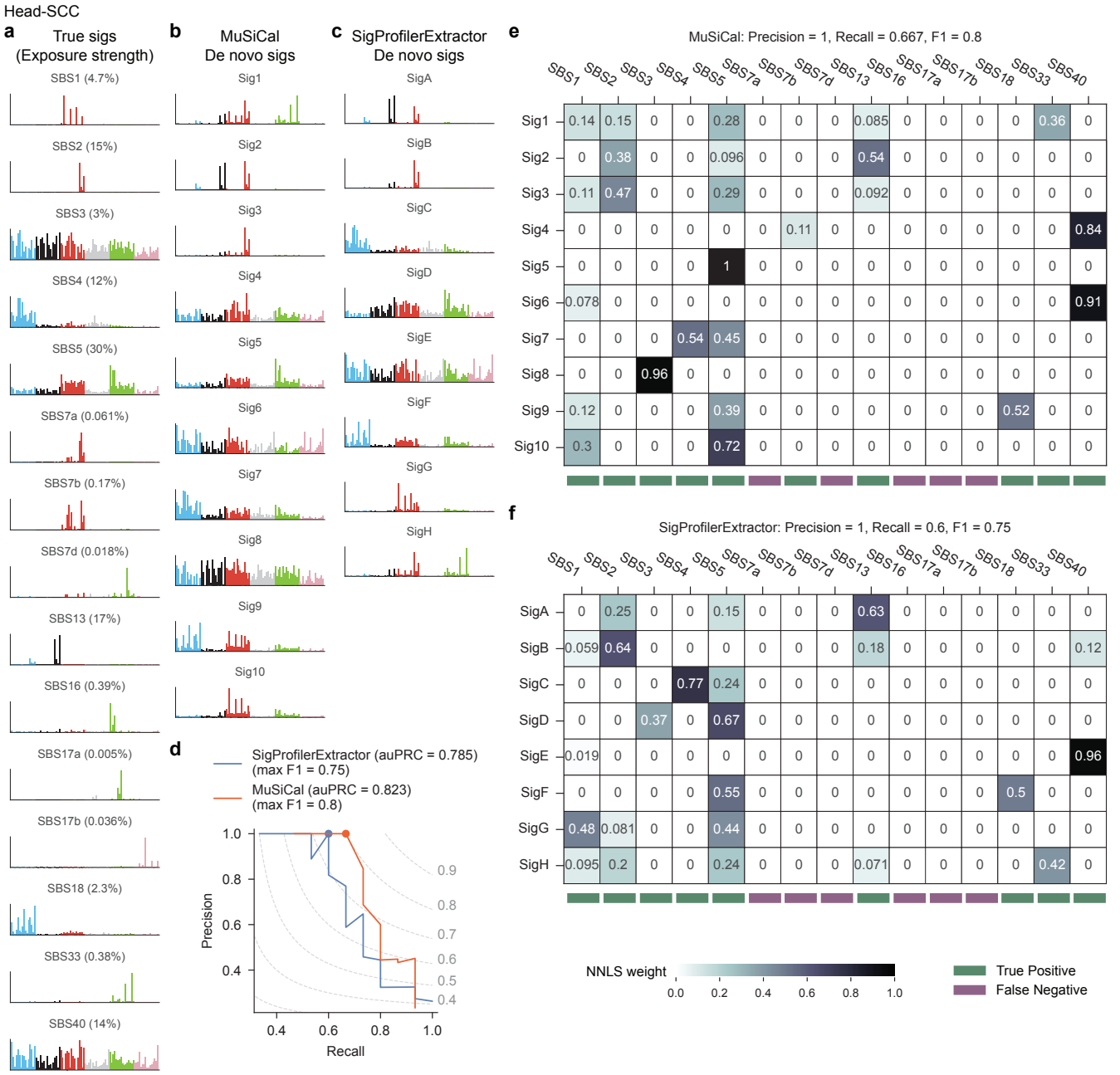

**Supplementary Data Fig. 7** Same as Fig. 3a, but for Prost-AdenoCA.



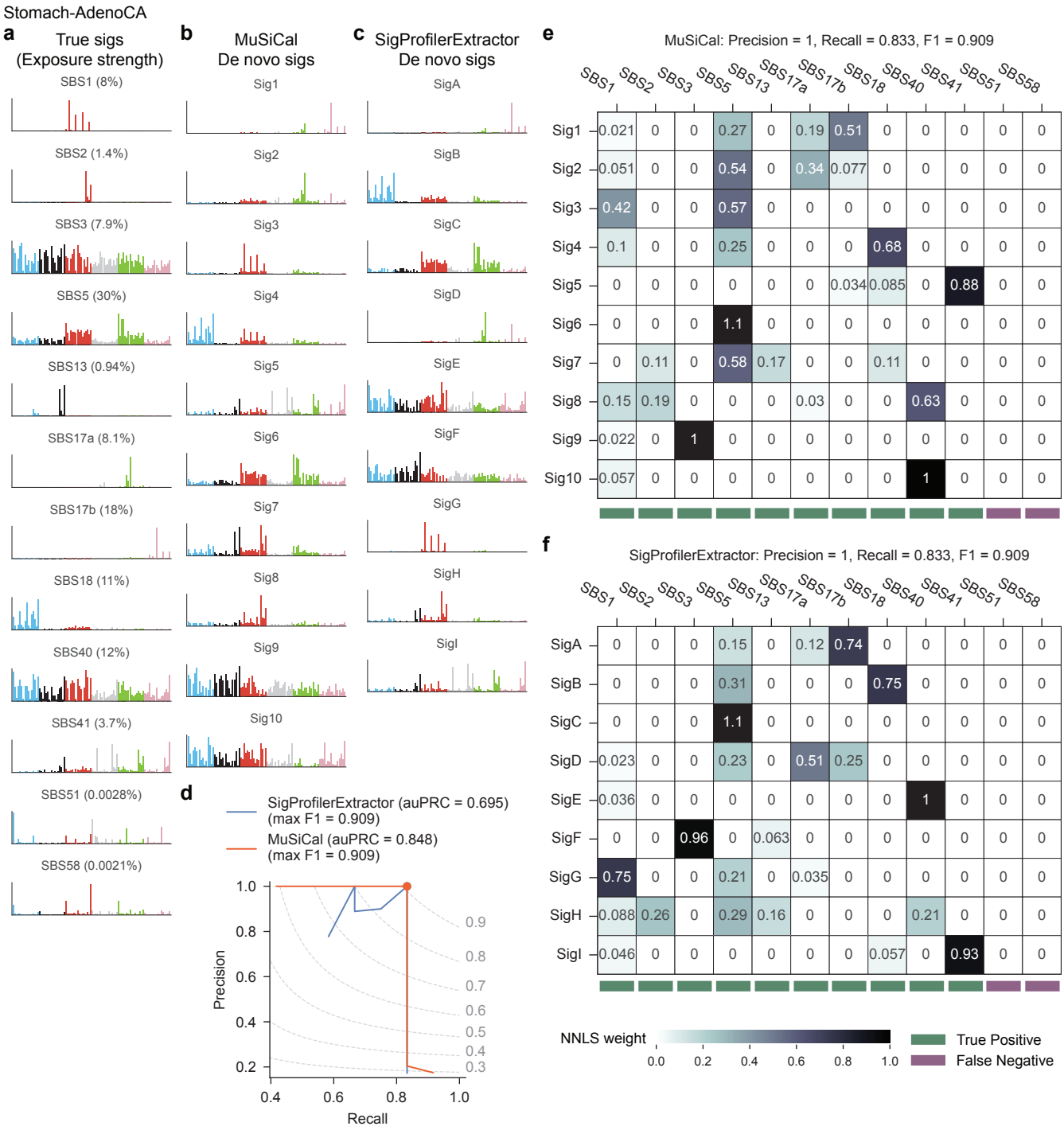

**Supplementary Data Fig. 8** Same as Fig. 3a, but for Lung-AdenoCA.



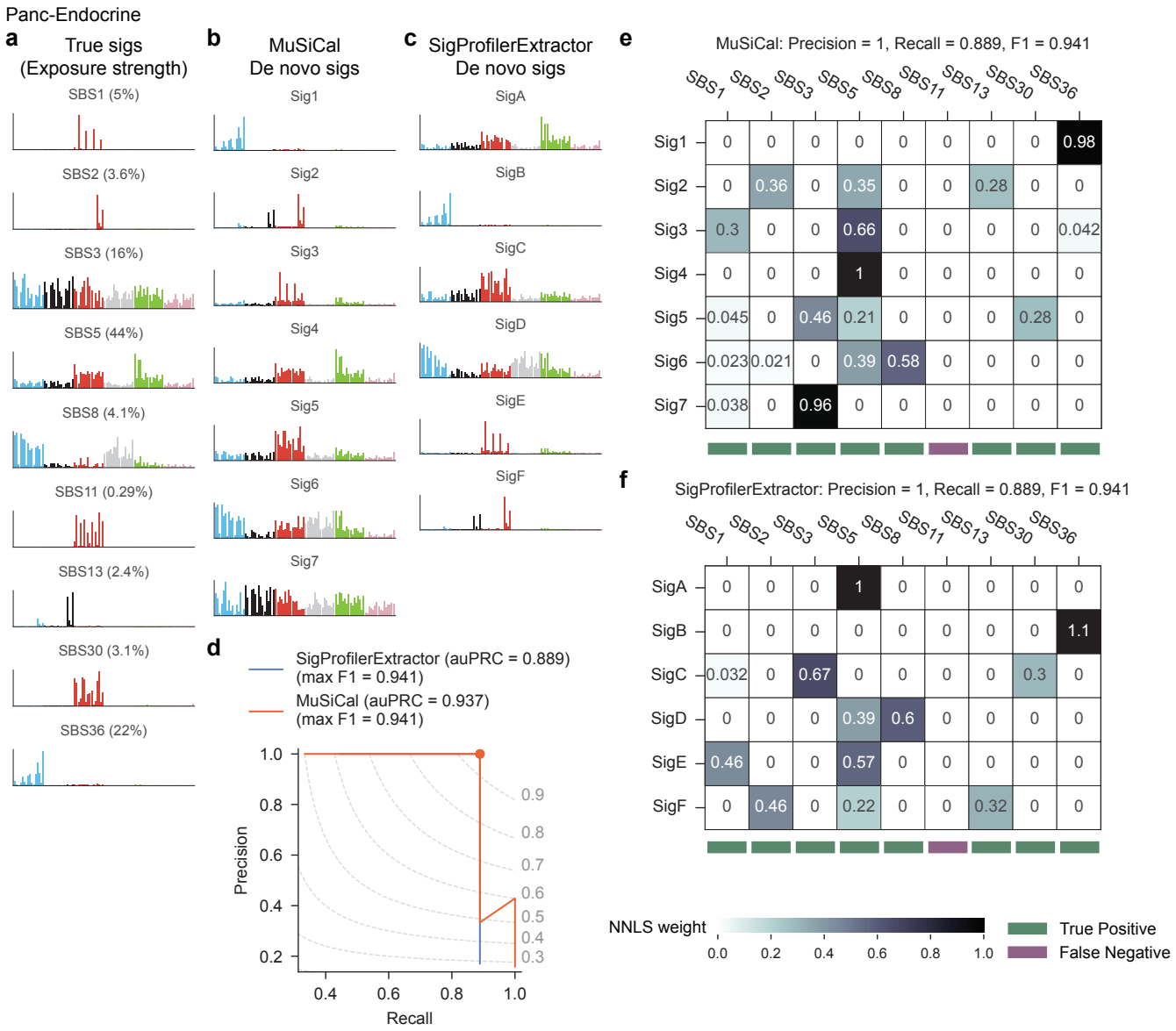

**Supplementary Data Fig. 9** Same as Fig. 3a, but for Bone-Osteosarc.



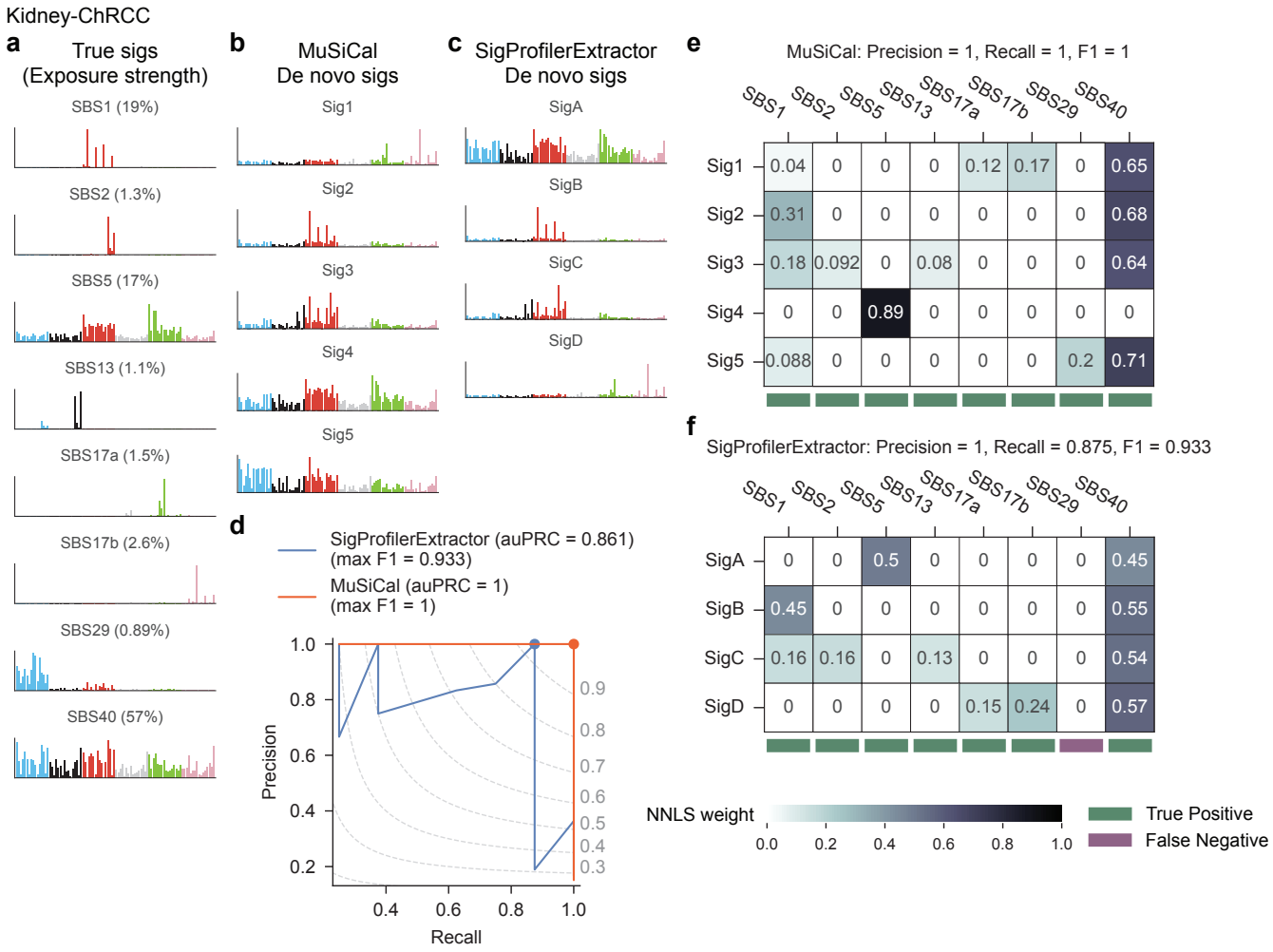

**Supplementary Data Fig. 10** Same as Fig. 3a, but for Head-SCC.



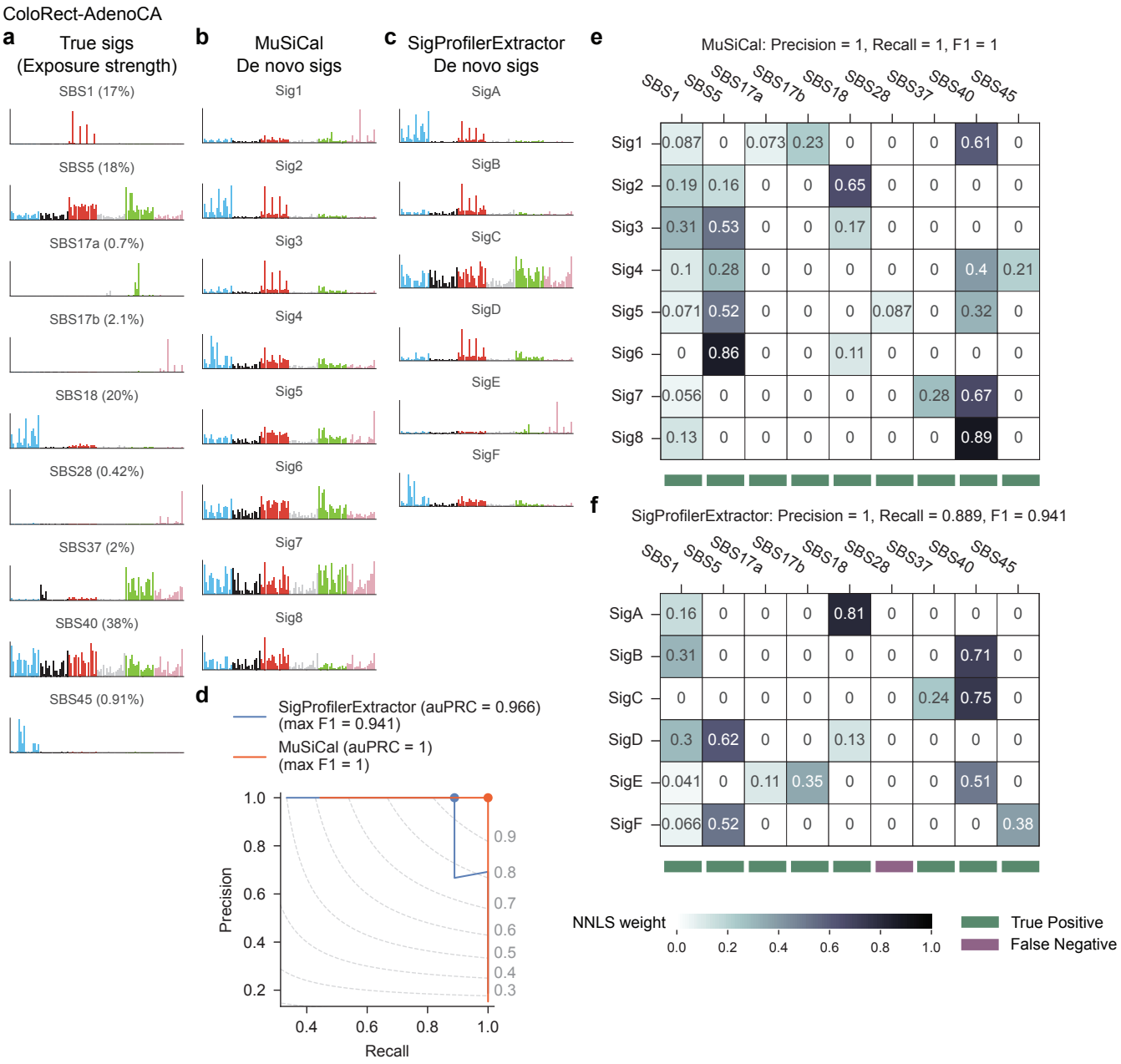

**Supplementary Data Fig. 11** Same as Fig. 3a, but for Stomach-AdenoCA.



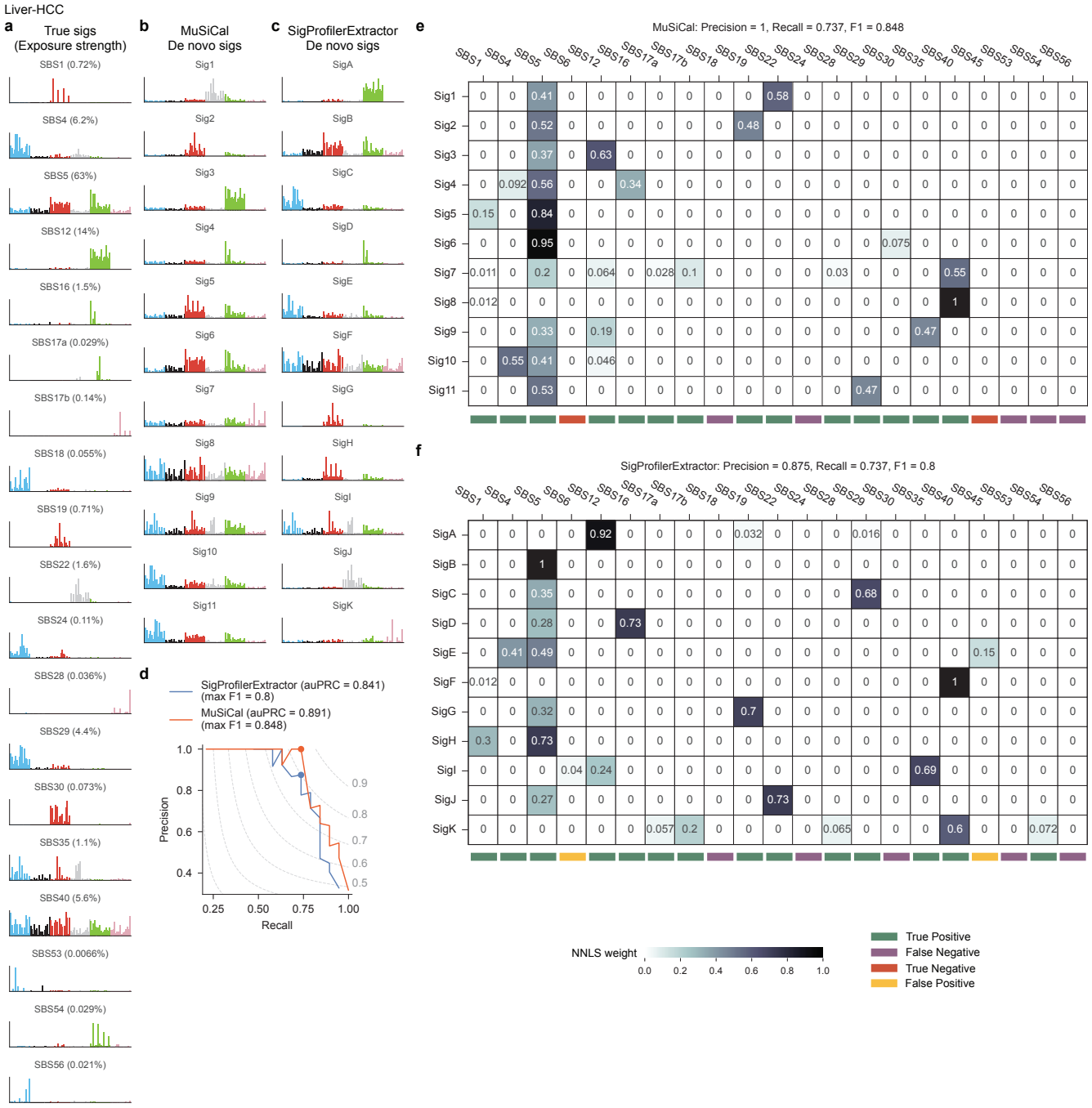

**Supplementary Data Fig. 12** Same as Fig. 3a, but for Panc-Endocrine.



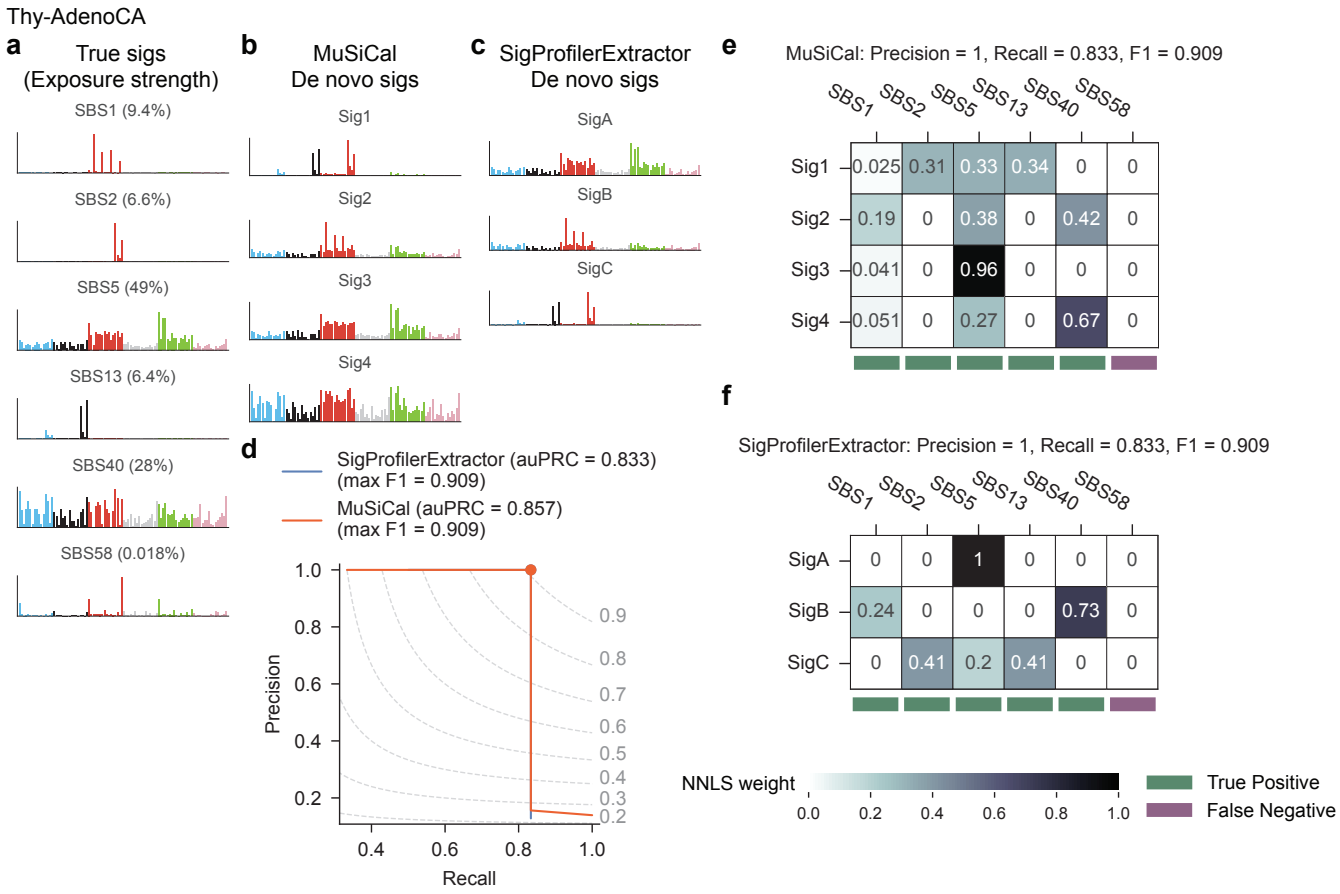

**Supplementary Data Fig. 13** Same as Fig. 3a, but for Kidney-ChRCC.



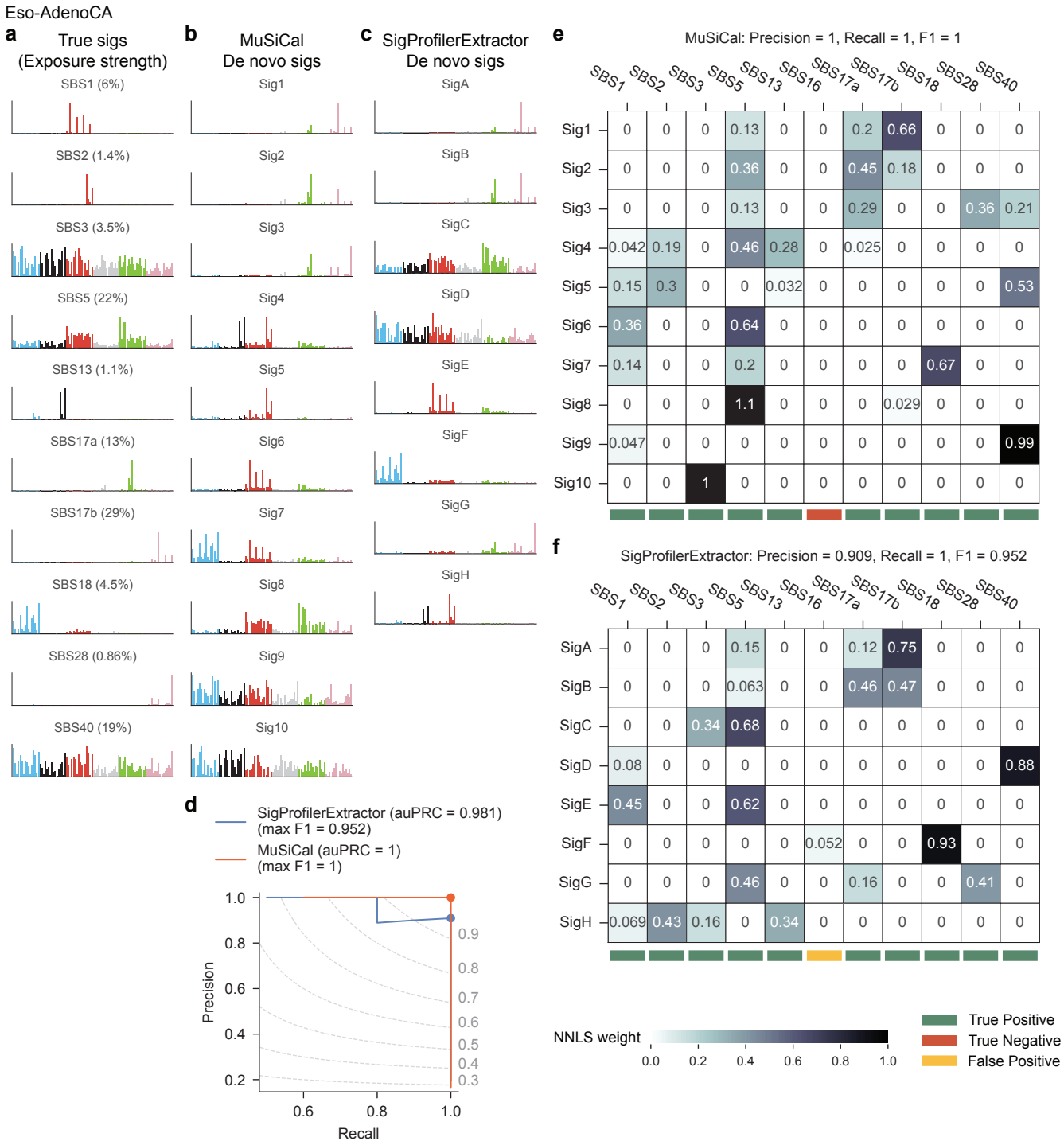

**Supplementary Data Fig. 14** Same as Fig. 3a, but for ColoRect-AdenoCA.



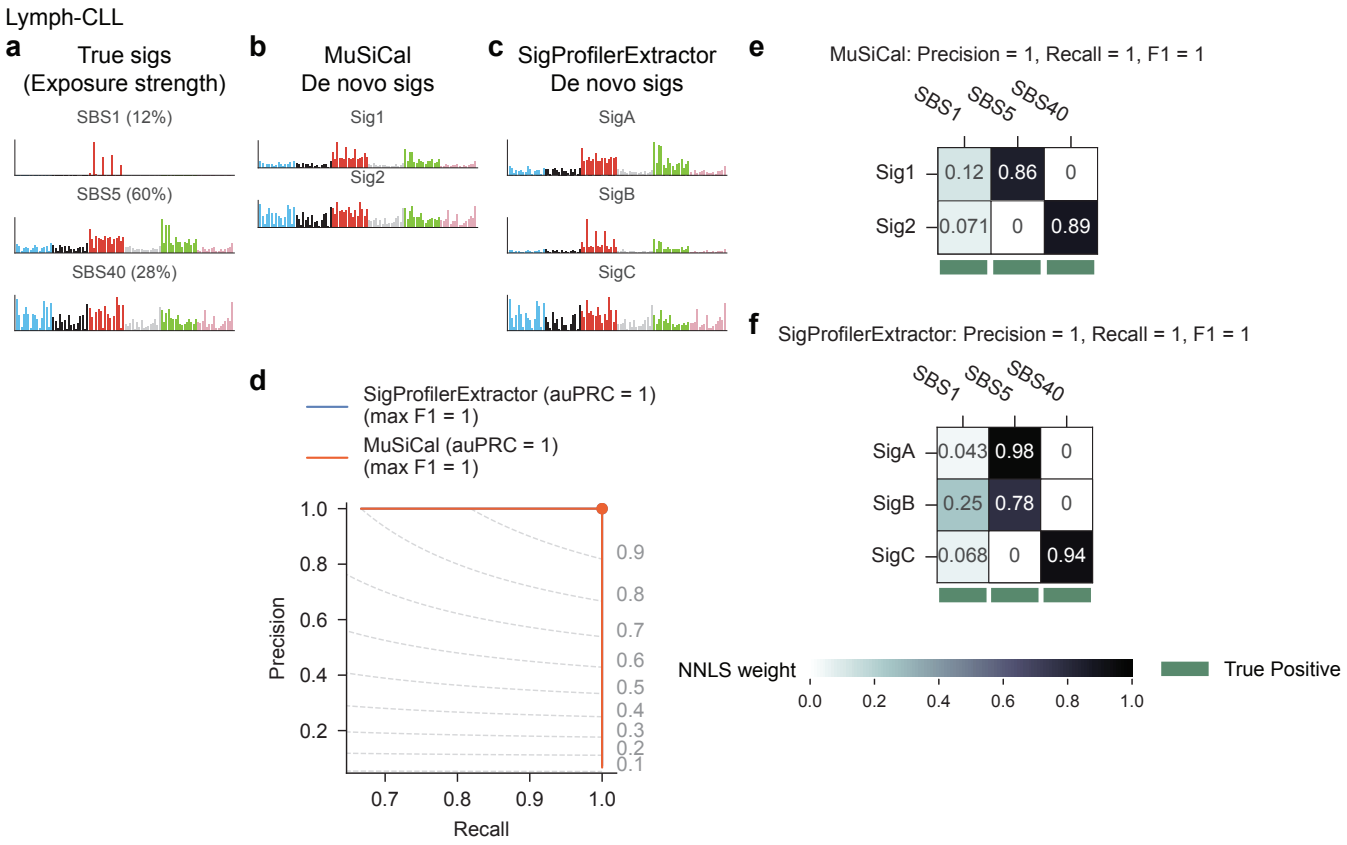

**Supplementary Data Fig. 15** Same as Fig. 3a, but for Liver-HCC.



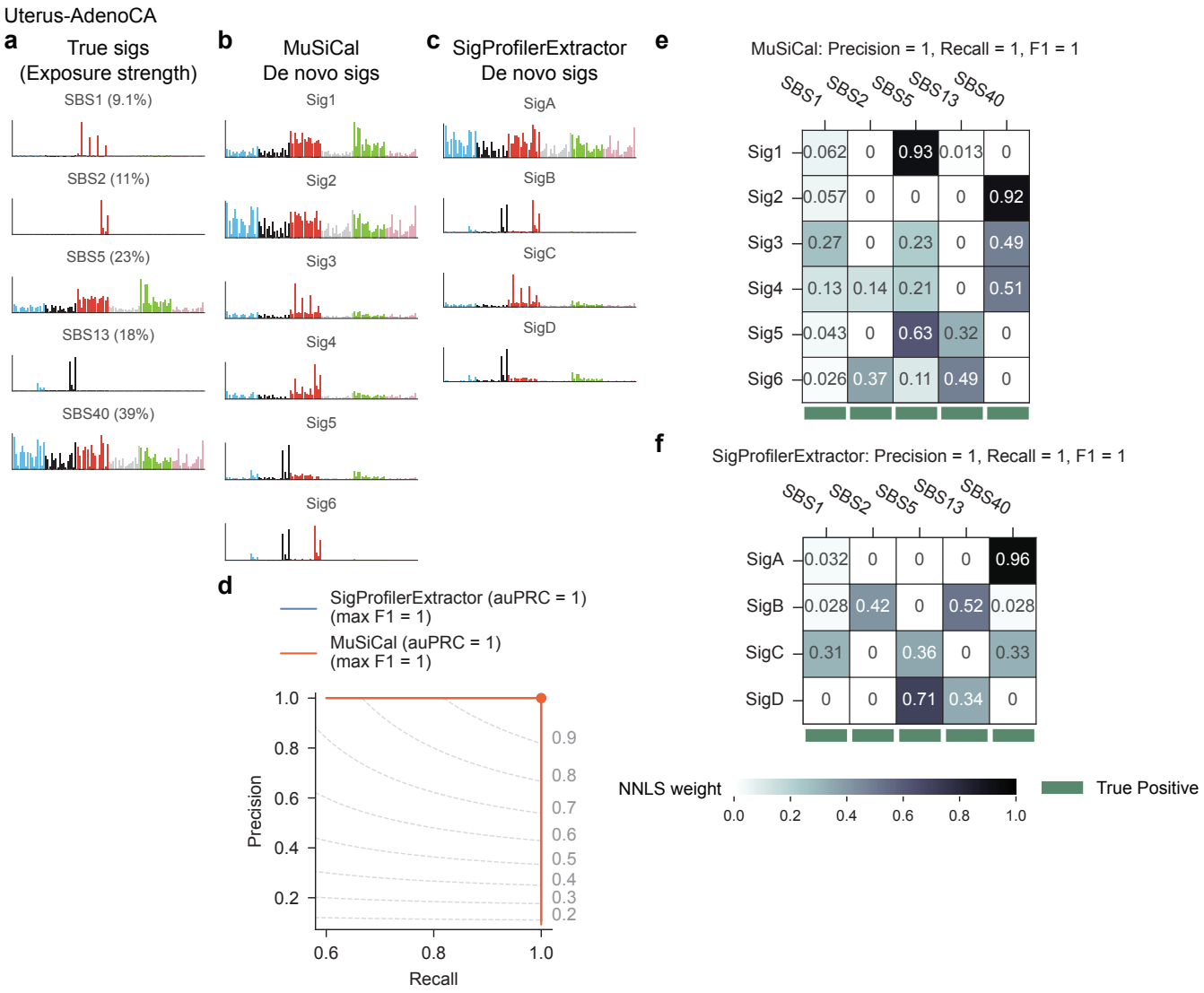

**Supplementary Data Fig. 16** Same as Fig. 3a, but for Thy-AdenoCA.



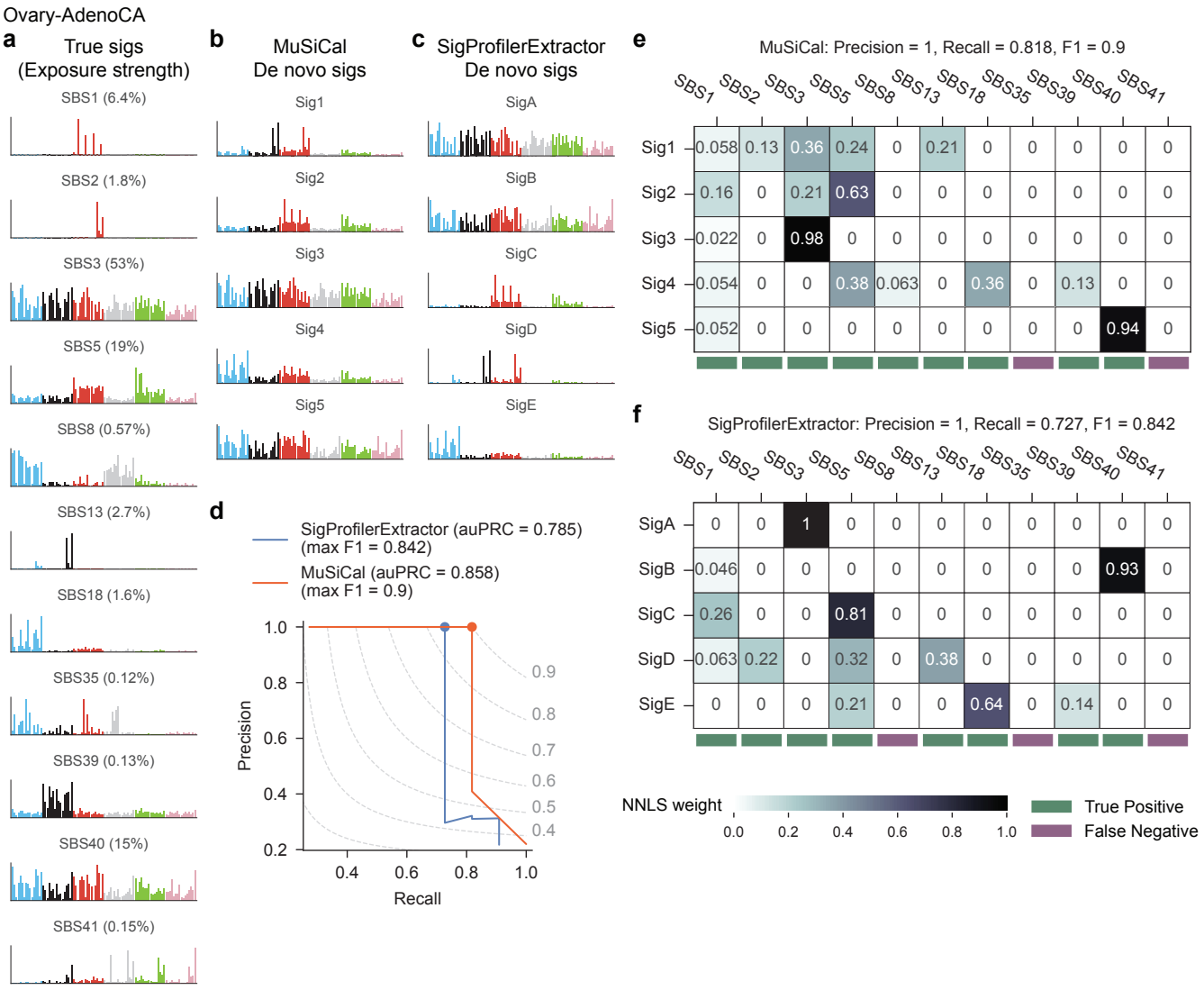

**Supplementary Data Fig. 17** Same as Fig. 3a, but for Eso-AdenoCA.



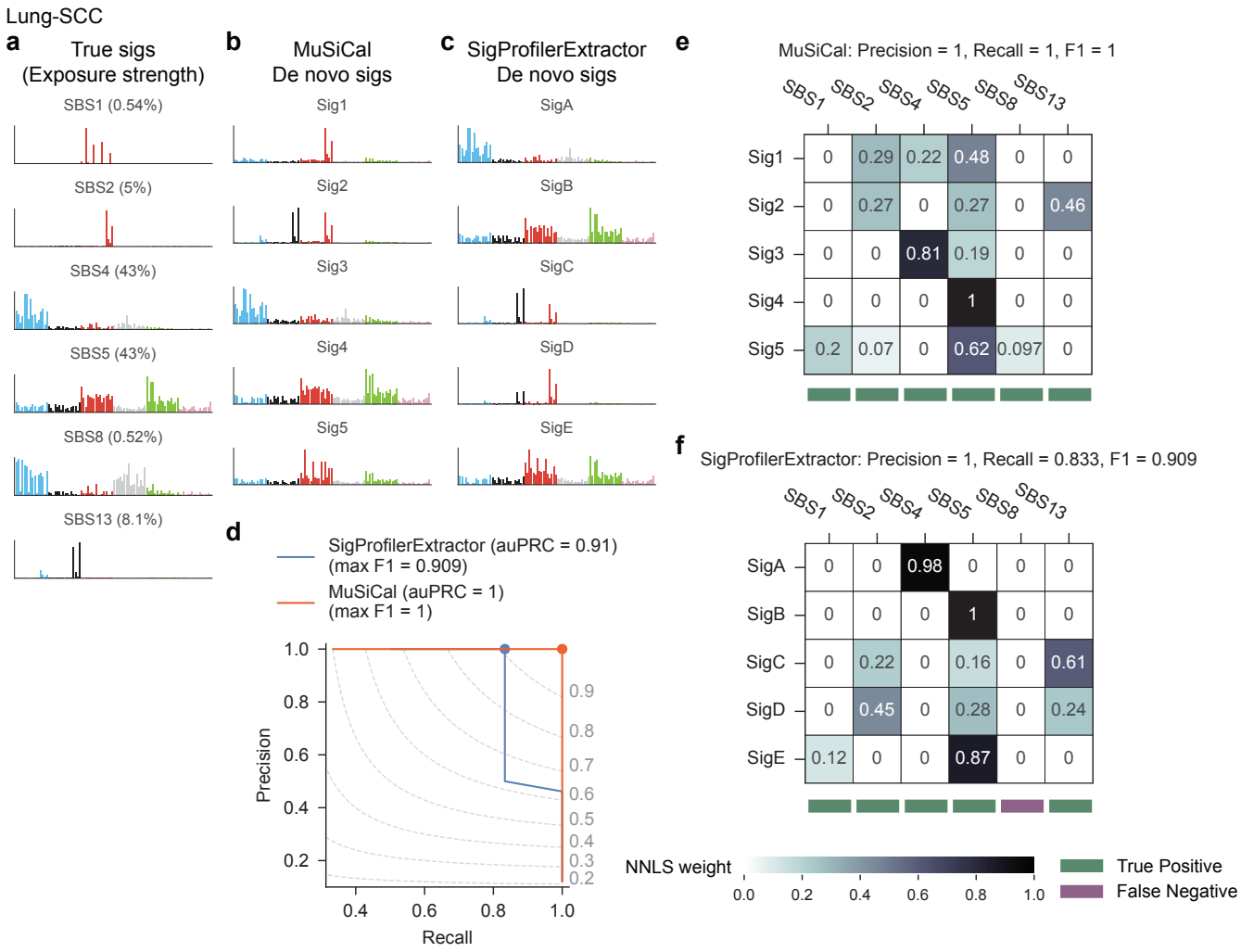

**Supplementary Data Fig. 18** Same as Fig. 3a, but for Lymph-CLL.



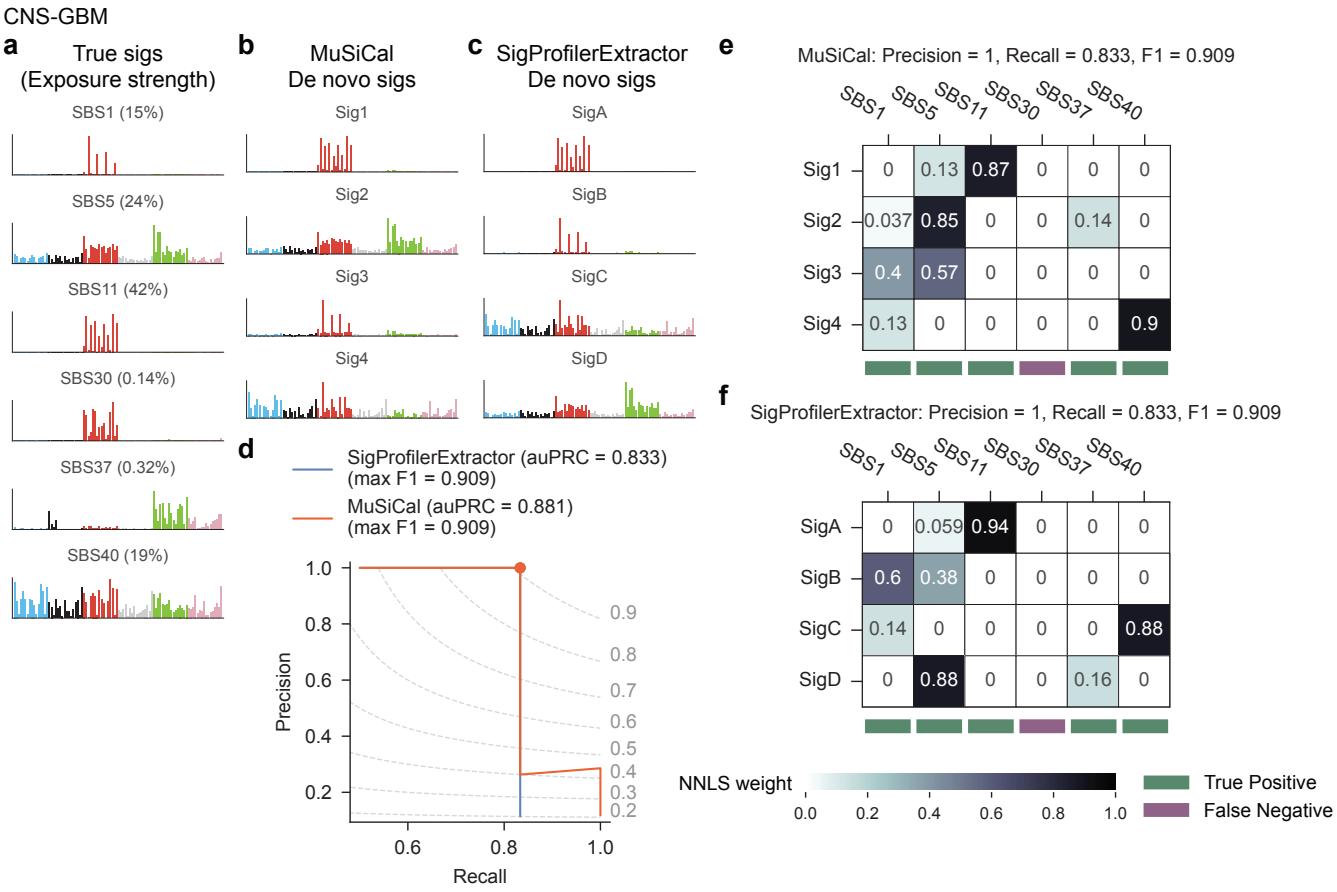

**Supplementary Data Fig. 19** Same as Fig. 3a, but for Uterus-AdenoCA.



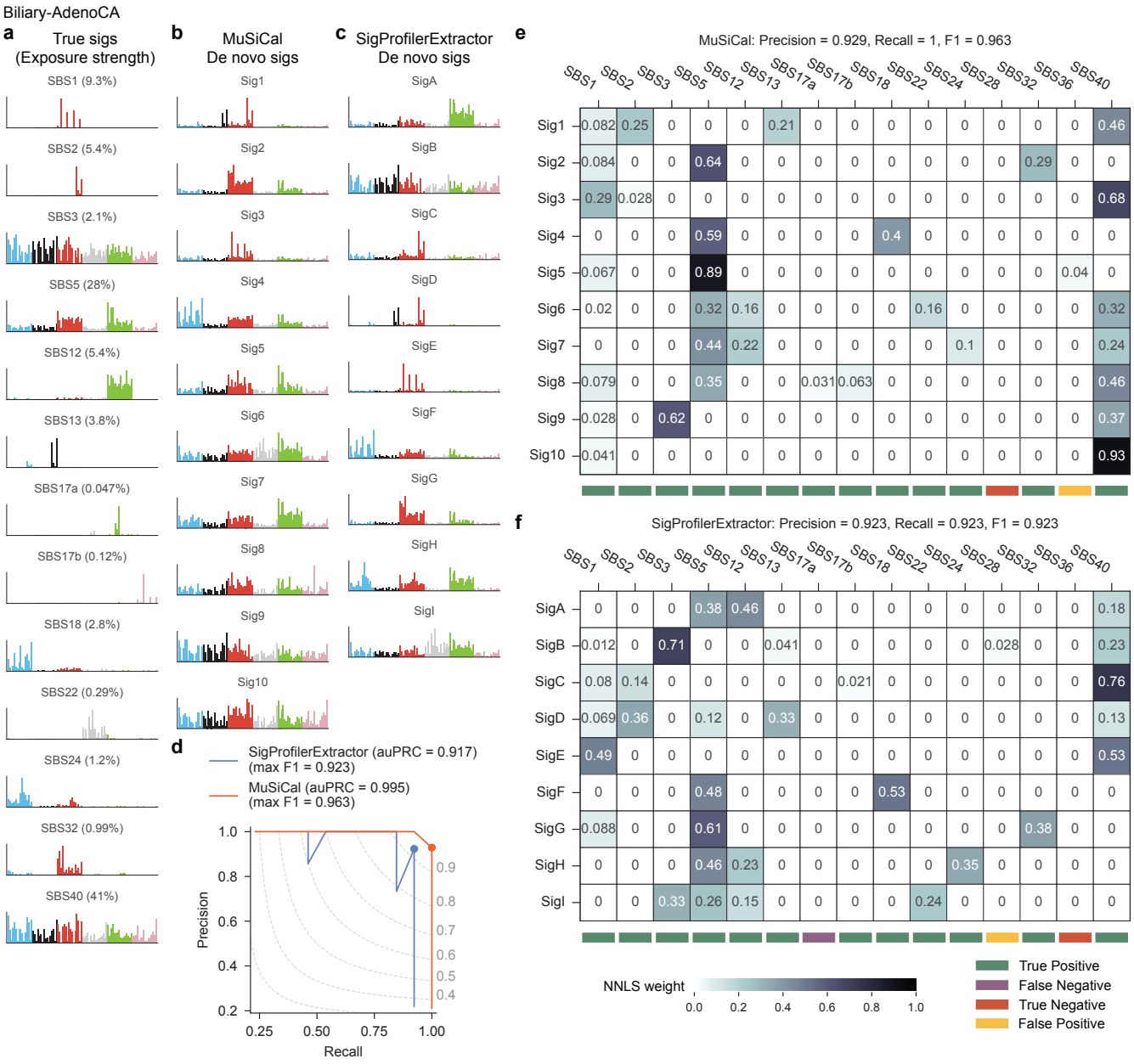

**Supplementary Data Fig. 20** Same as Fig. 3a, but for Ovary-AdenoCA.



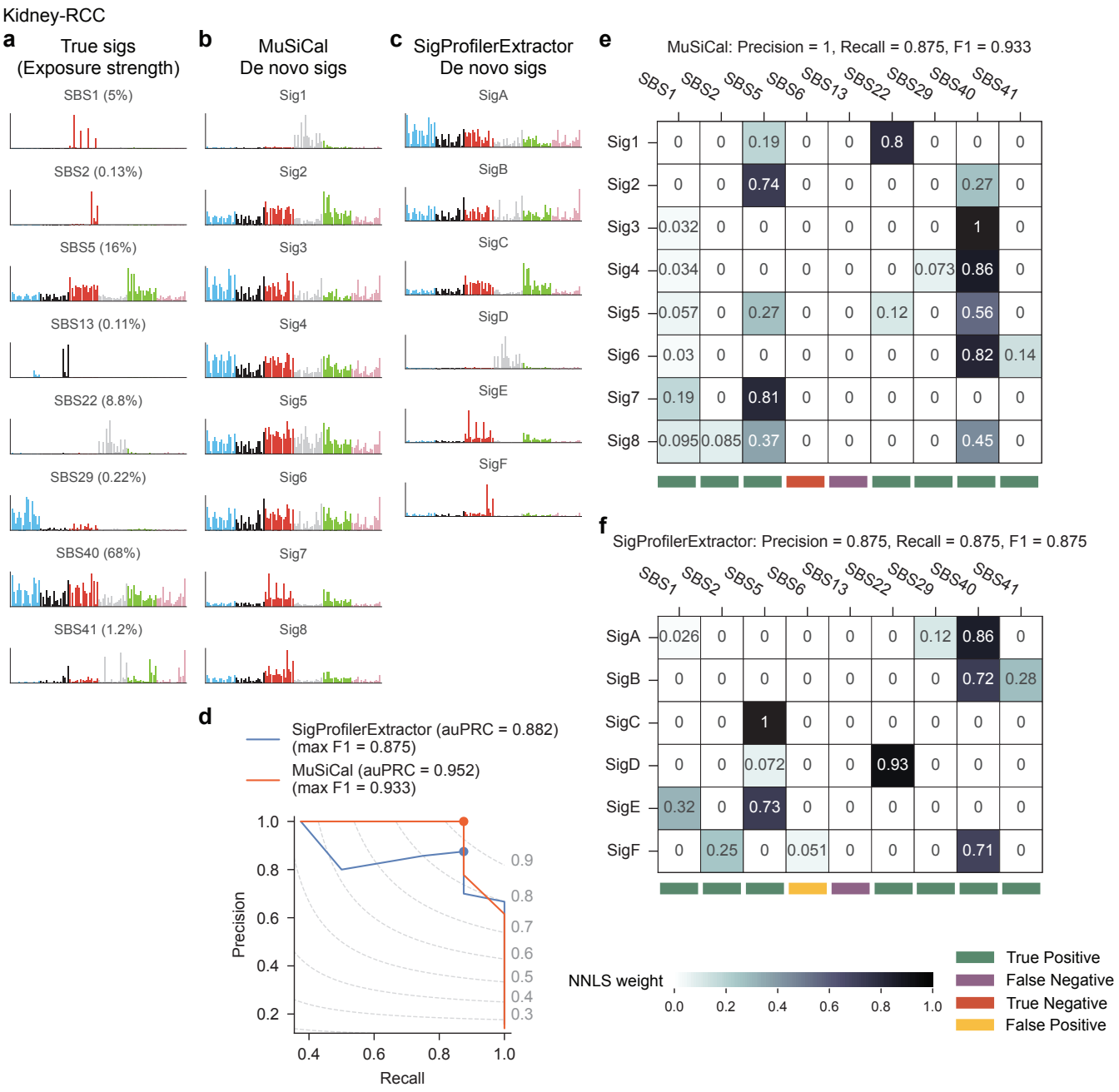

**Supplementary Data Fig. 21** Same as Fig. 3a, but for Lung-SCC.




**Supplementary Data Fig. 22** Same as Fig. 3a, but for CNS-GBM.




**Supplementary Data Fig. 23** Same as Fig. 3a, but for Biliary-AdenoCA.




**Supplementary Data Fig. 24** Same as Fig. 3a, but for Kidney-RCC.