Supp. Figures

Supplementary Figure 1

1. The formula of Pearson Correlation Coefficient (PCC):

$$PCC = \frac{\sum(X_t - \bar{X})(Y_t - \bar{Y})}{\sqrt{\sum(X_t - \bar{X})^2 \sum(Y_t - \bar{Y})^2}}$$

2. When r = 1 :

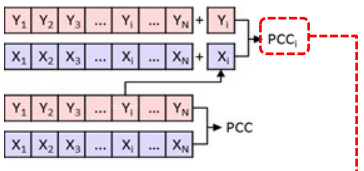
$$\Delta X_t = X_t - r \cdot \sum_{j=1}^{N} X_j \Big/ N \qquad \Delta Y_t = Y_t - r \cdot \sum_{j=1}^{N} Y_j \Big/ N$$

$$PCC = \frac{\sum(X_t - \bar{X})(Y_t - \bar{Y})}{\sqrt{\sum(X_t - \bar{X})^2 \sum(Y_t - \bar{Y})^2}}$$

$$A = \sum_{t=1}^{N} \Delta X_t \cdot \Delta Y_t \qquad B = \sum_{t=1}^{N} {\Delta X_t}^2 \qquad C = \sum_{t=1}^{N} {\Delta Y_t}^2$$

$$PCC = \frac{\sum(X_t - \bar{X})(Y_t - \bar{Y})}{\sqrt{\sum(X_t - \bar{X})^2 \sum(Y_t - \bar{Y})^2}} \rightarrow D_0 = \frac{A}{\sqrt{B \cdot C}}$$

3. When adding Xi and Yi to X list and Y list, respectively :



$$(PCC_i)$$

$$PCC_{new} = \frac{[\sum(X_t - \overline{X_{new}})(Y_t - \overline{Y_{new}})] + (X_i - \overline{X_{new}})(Y_i - \overline{Y_{new}})}{\sqrt{[\sum(X_t - \overline{X_{new}})^2 + (X_i - \overline{X_{new}})^2][\sum(Y_t - \overline{Y_{new}})^2 + (Y_i - \overline{Y_{new}})^2]}}$$

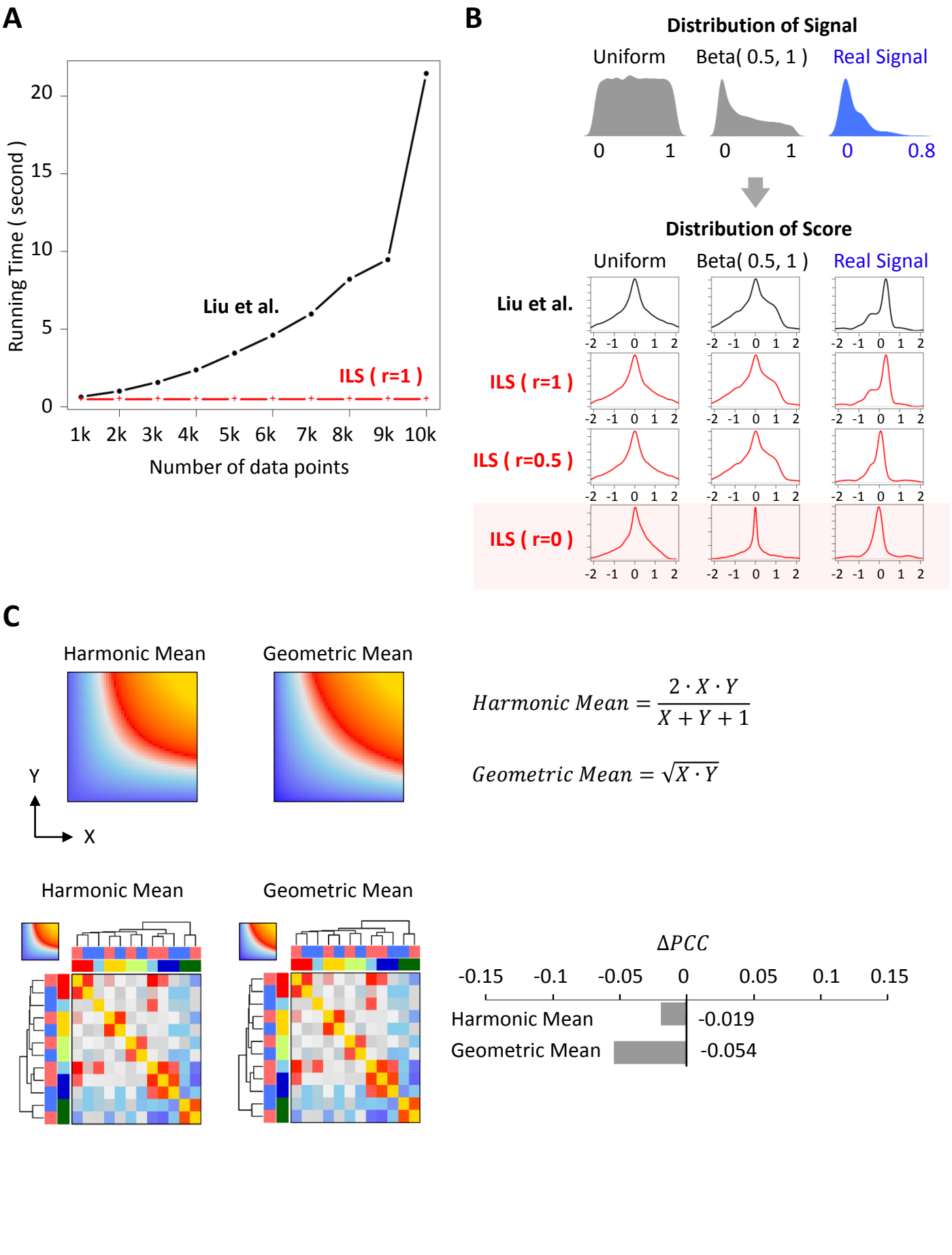
4. Because $\overline{X_{new}} \sim \bar{X}$ and $\overline{Y_{new}} \sim \bar{Y}$:

$$PCC_{new} \sim D_i = \frac{A + \Delta X_i \cdot \Delta Y_i}{\sqrt{(B + {\Delta X_i}^2) \cdot (C + {\Delta Y_i}^2)}}$$

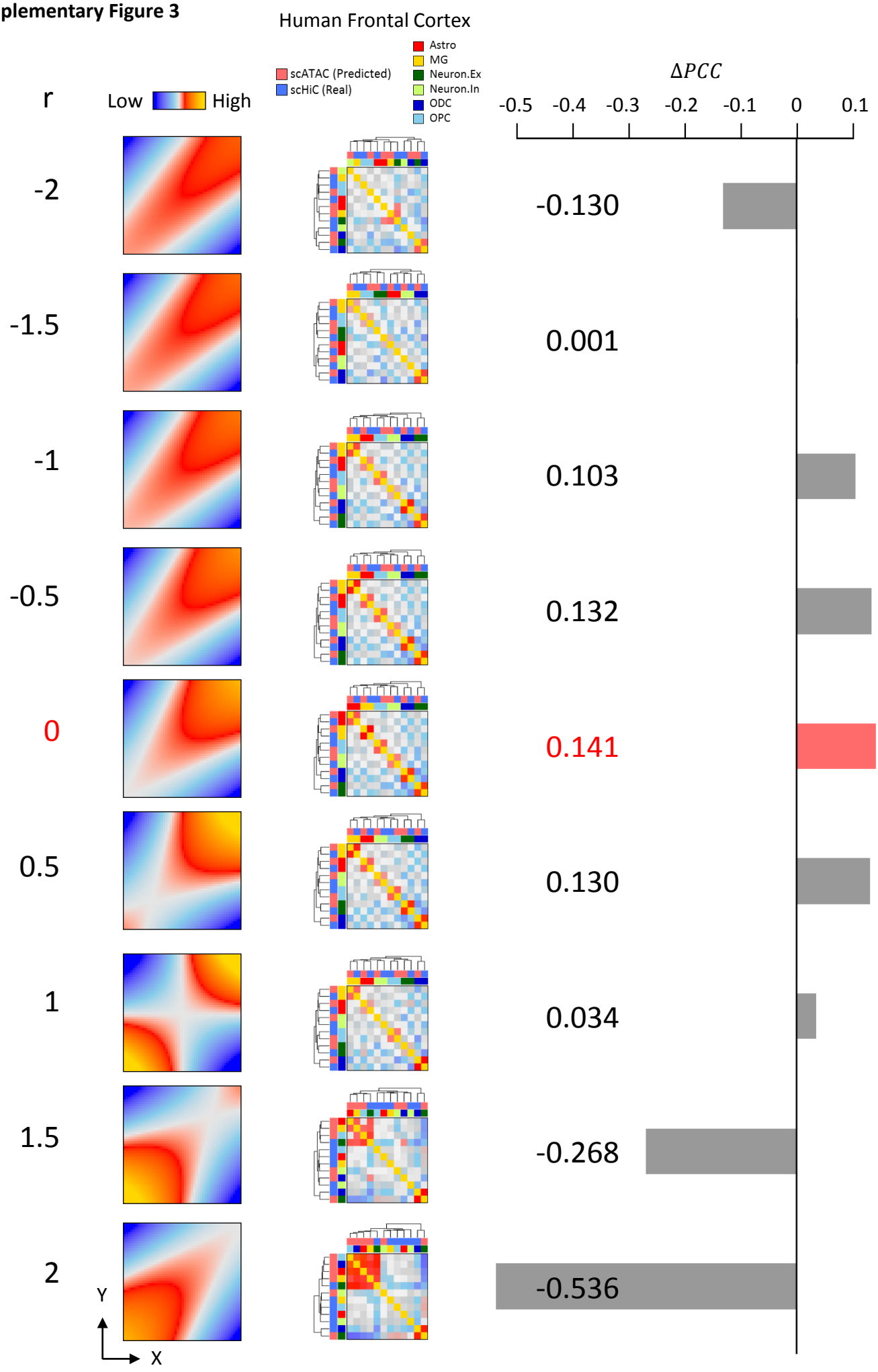
5. Calculation of ILS (r=1):

$$ILS_i = Score_i = \frac{D_i - D_0}{(1 - {D_0}^2)/(N-1)} \sim Score_i \; of \; Liu \; et \; al. = \frac{PCC_i - PCC_0}{(1 - {PCC_0}^2)/(N-1)}$$

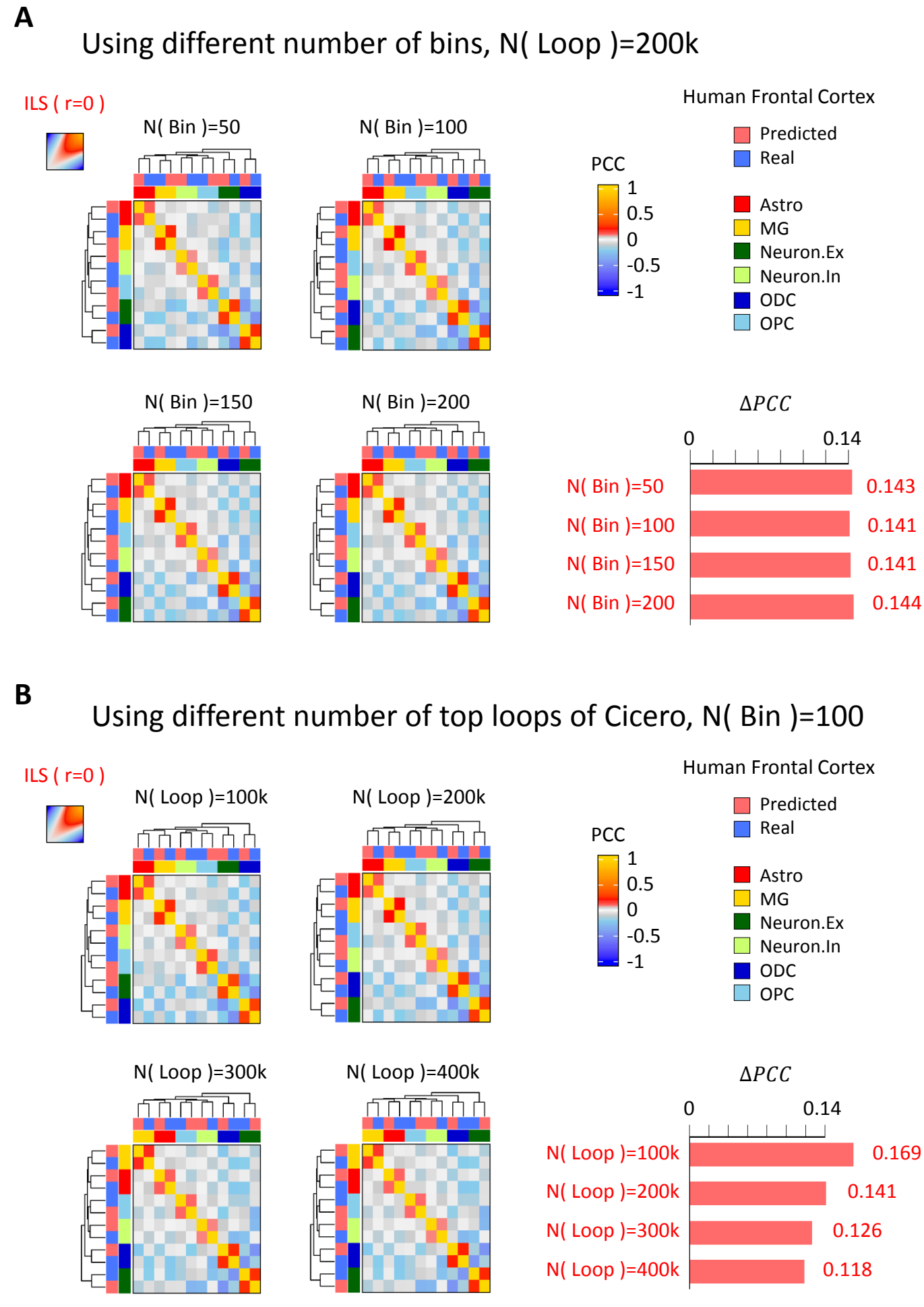
Supplementary Figure 2



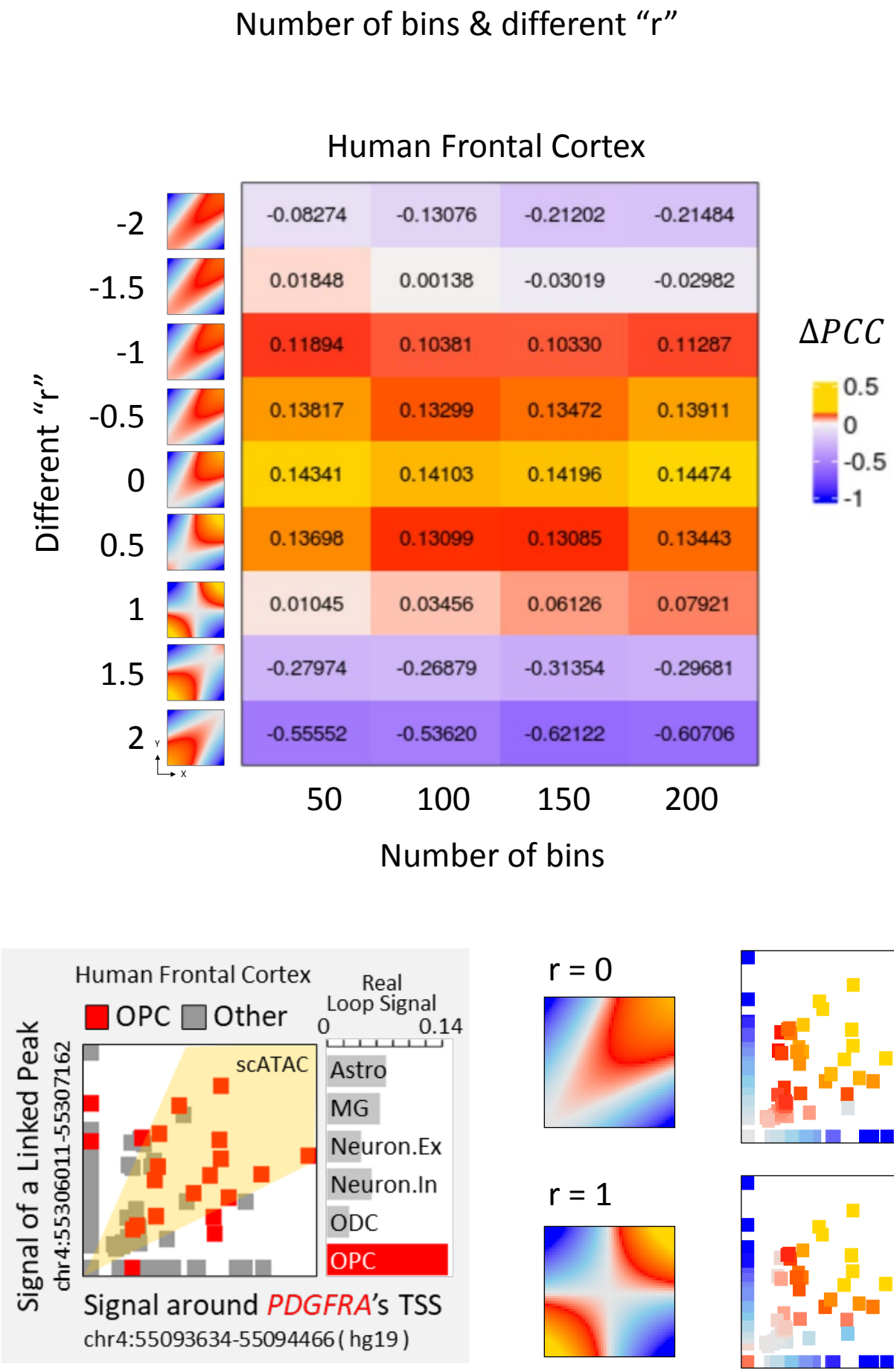
Supplementary Figure 3



Supplementary Figure 4



Supplementary Figure 5

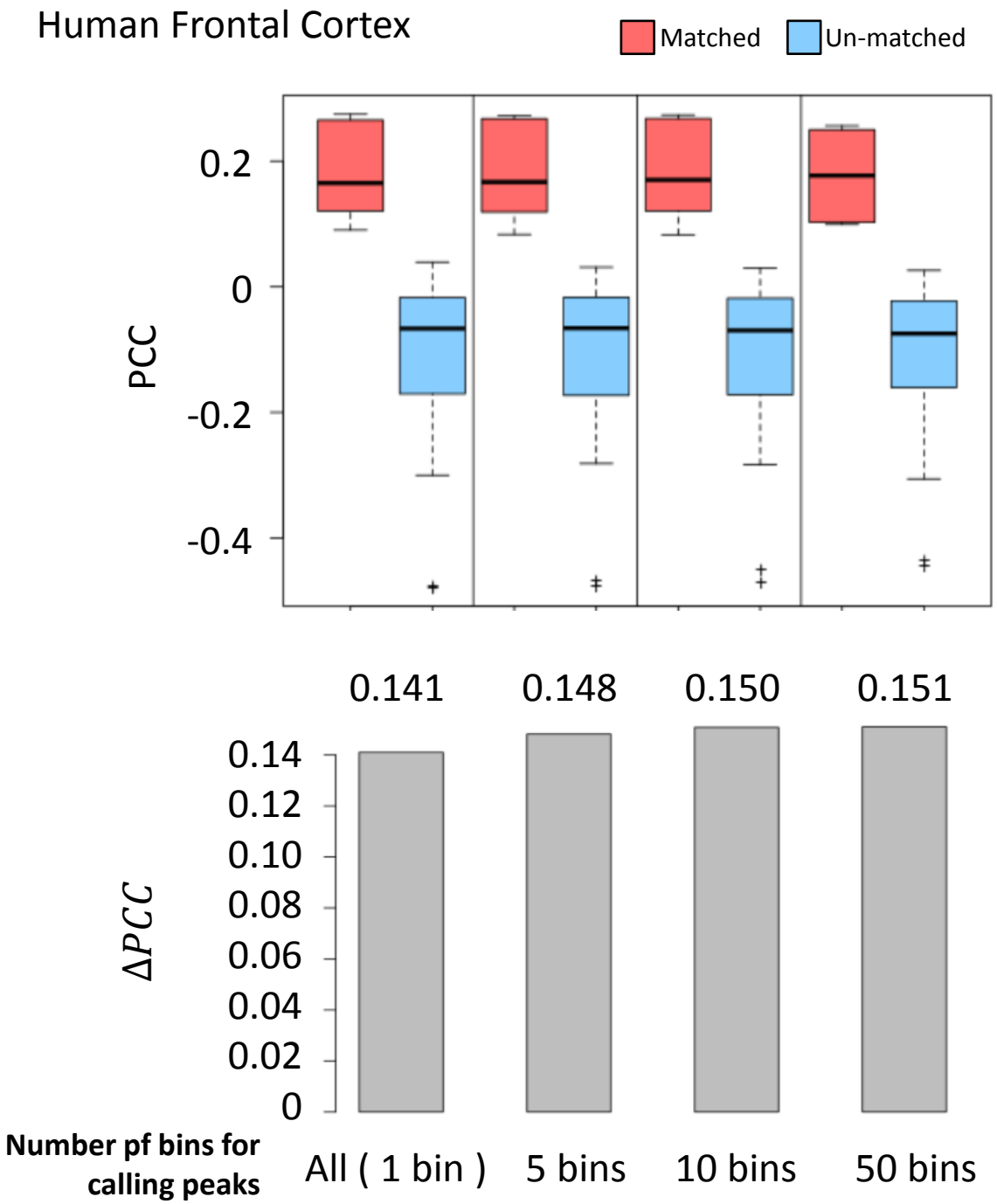


Supplementary Figure 6

Number of bins & peak calling

Peaks are called independently on each bin of cells and then combined:

CallPeaks(…, group.by="bin", …) in Signac

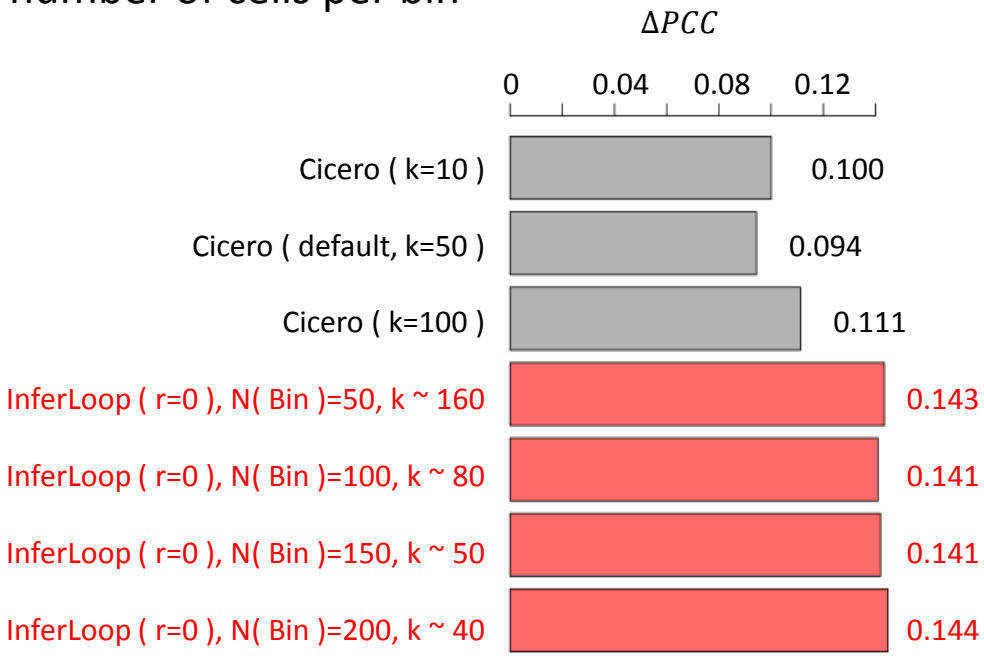


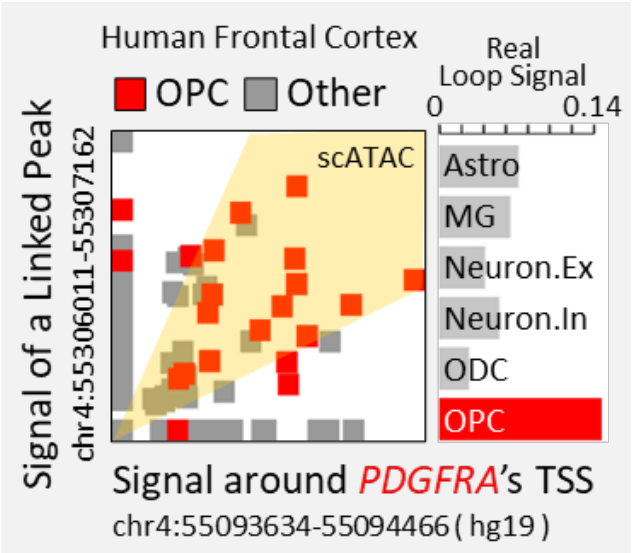
Supplementary Figure 7

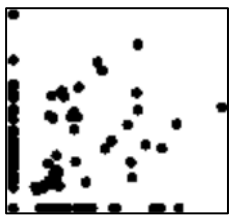
Using different k to run Cicero

Human Frontal Cortex: ~8000 cells

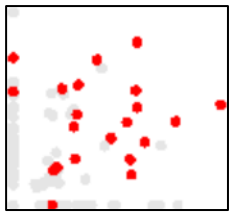
k: number of cells per bin





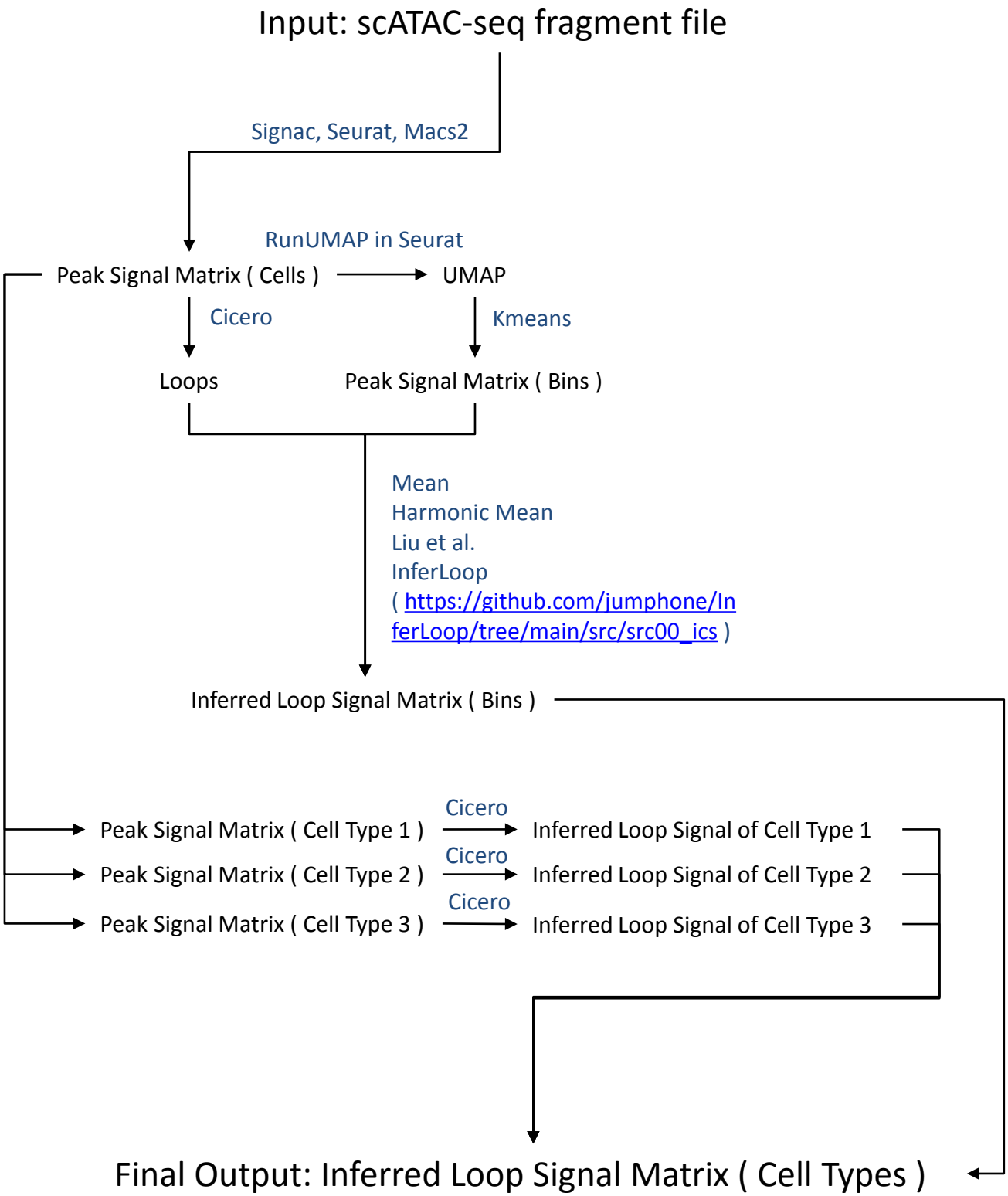


PCC (all bins)
= 0.27

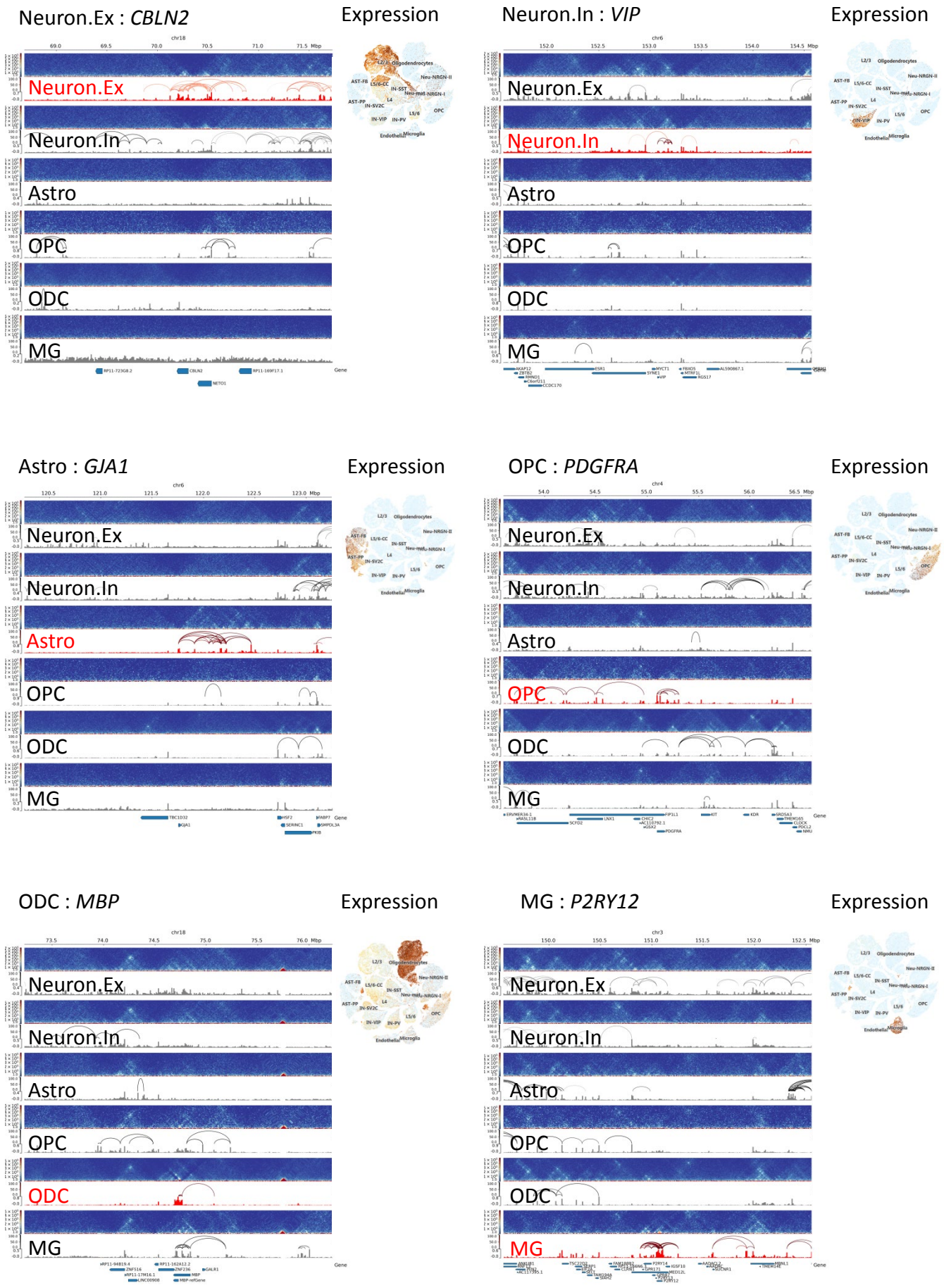


PCC (bins of OPC)
= 0.03

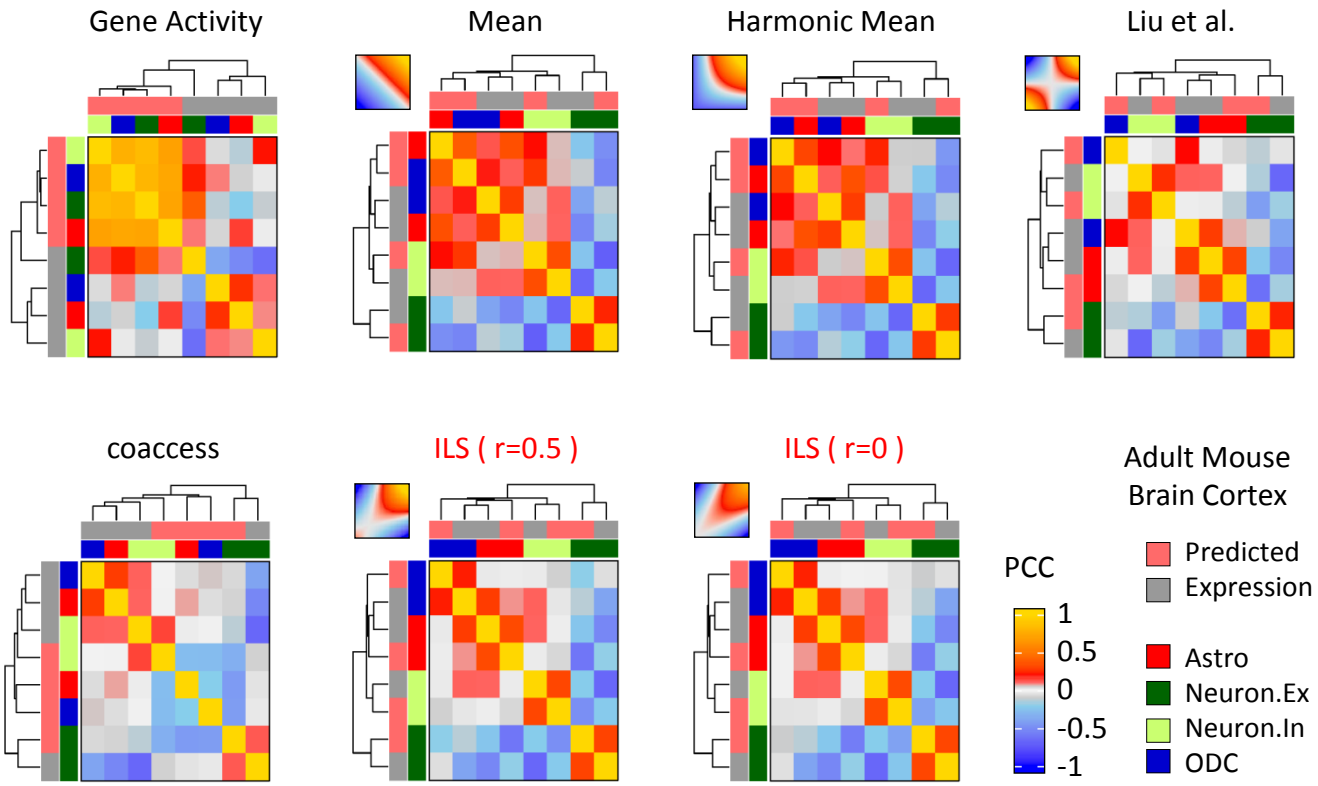
Supplementary Figure 8

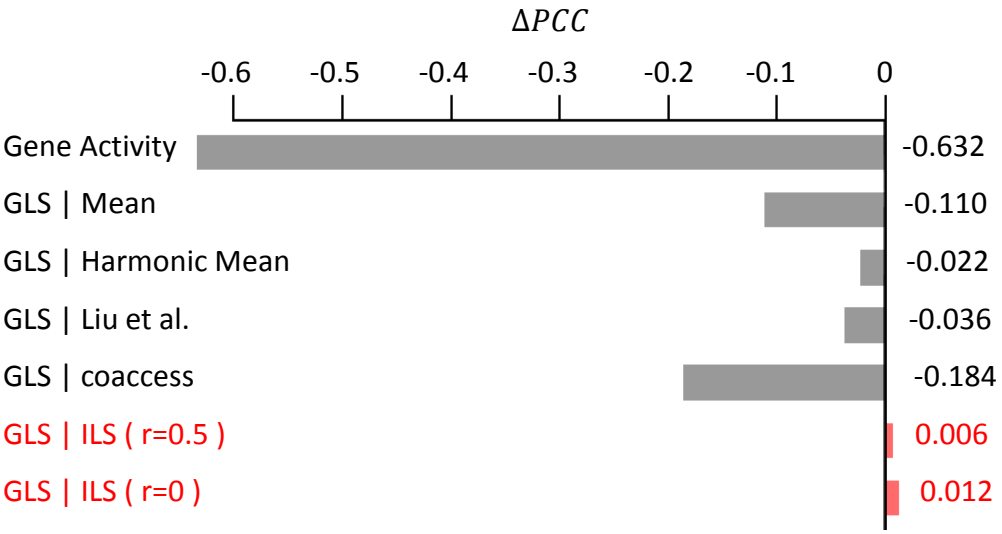


Supplementary Figure 9

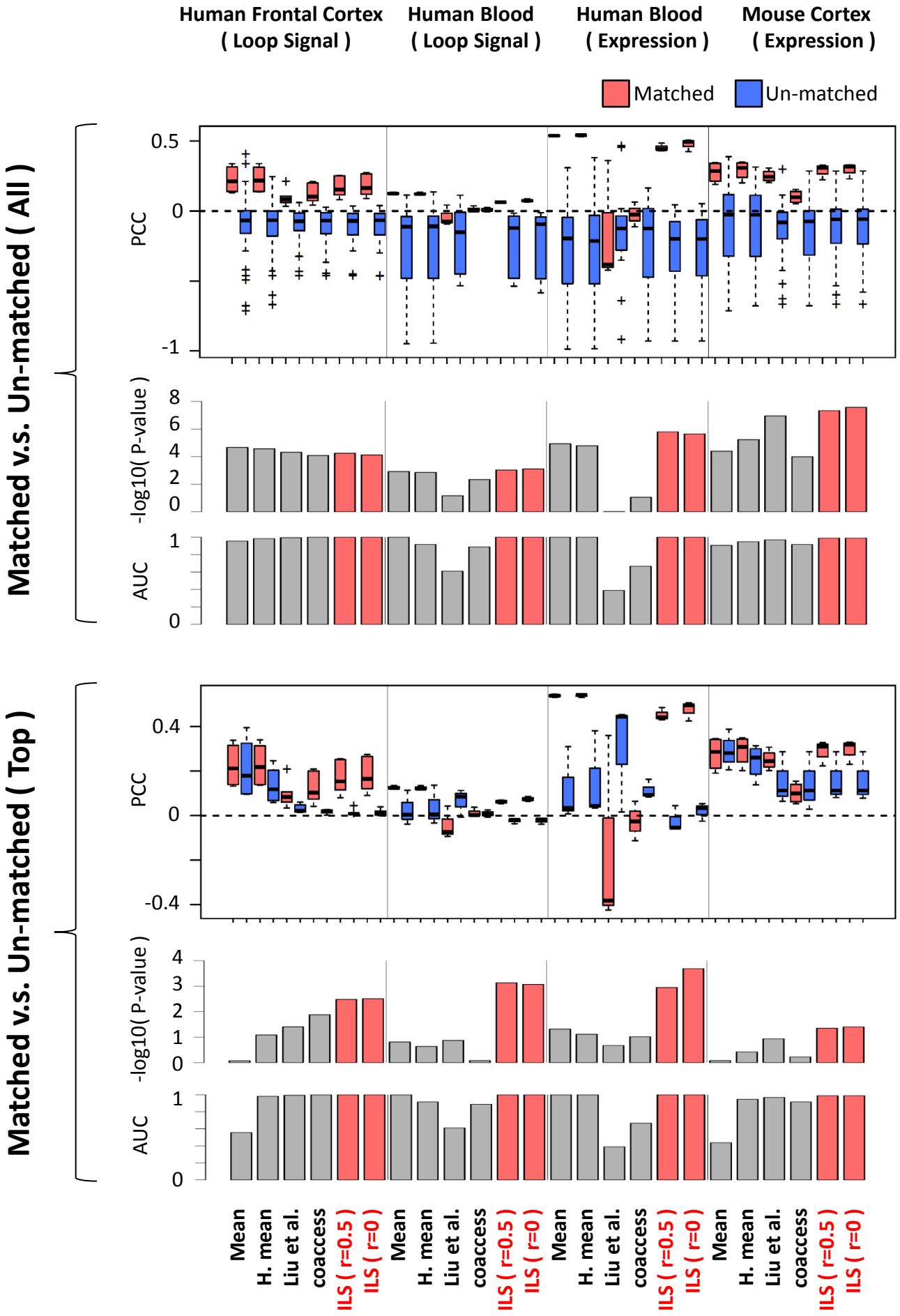


Supplementary Figure 10

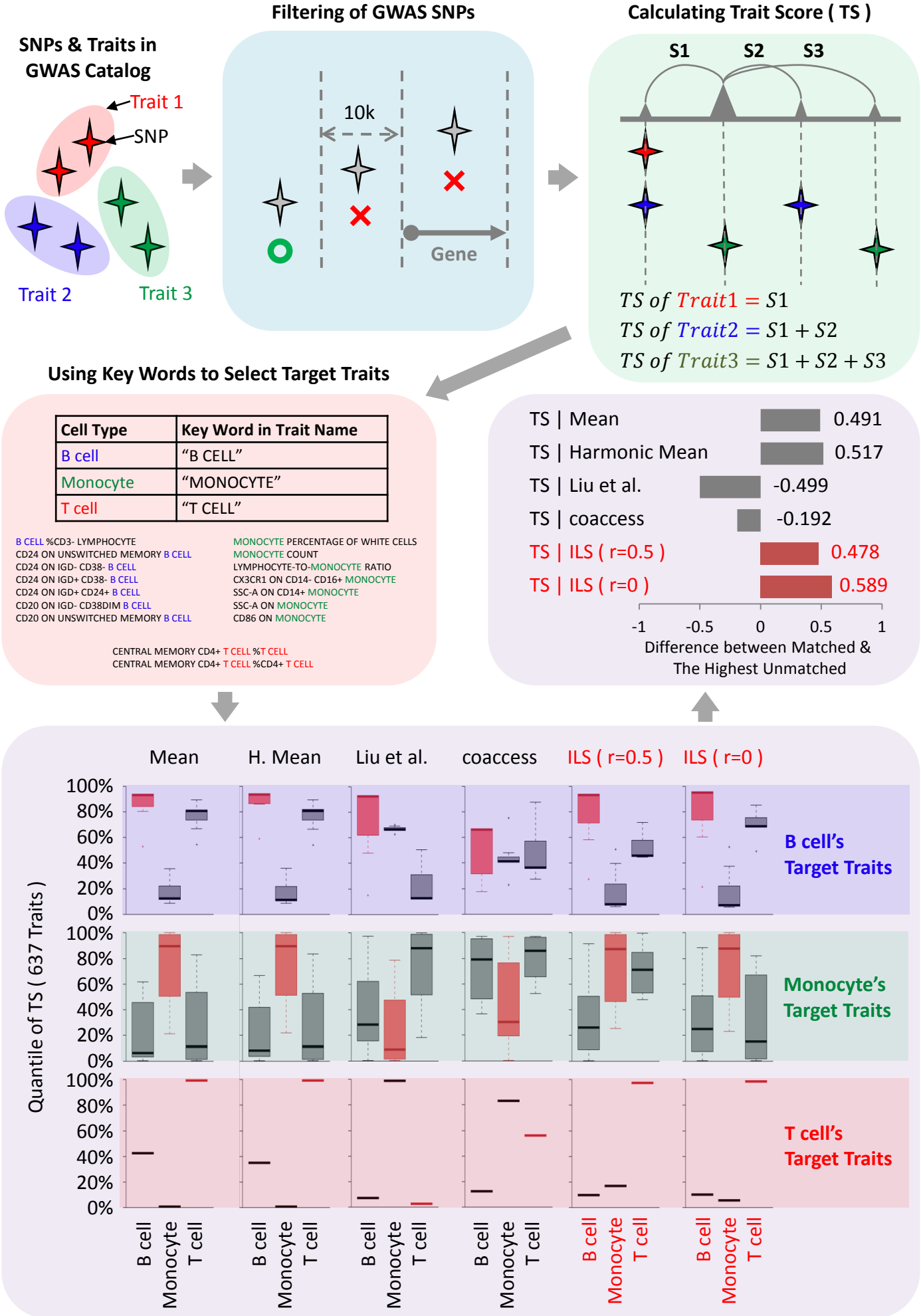




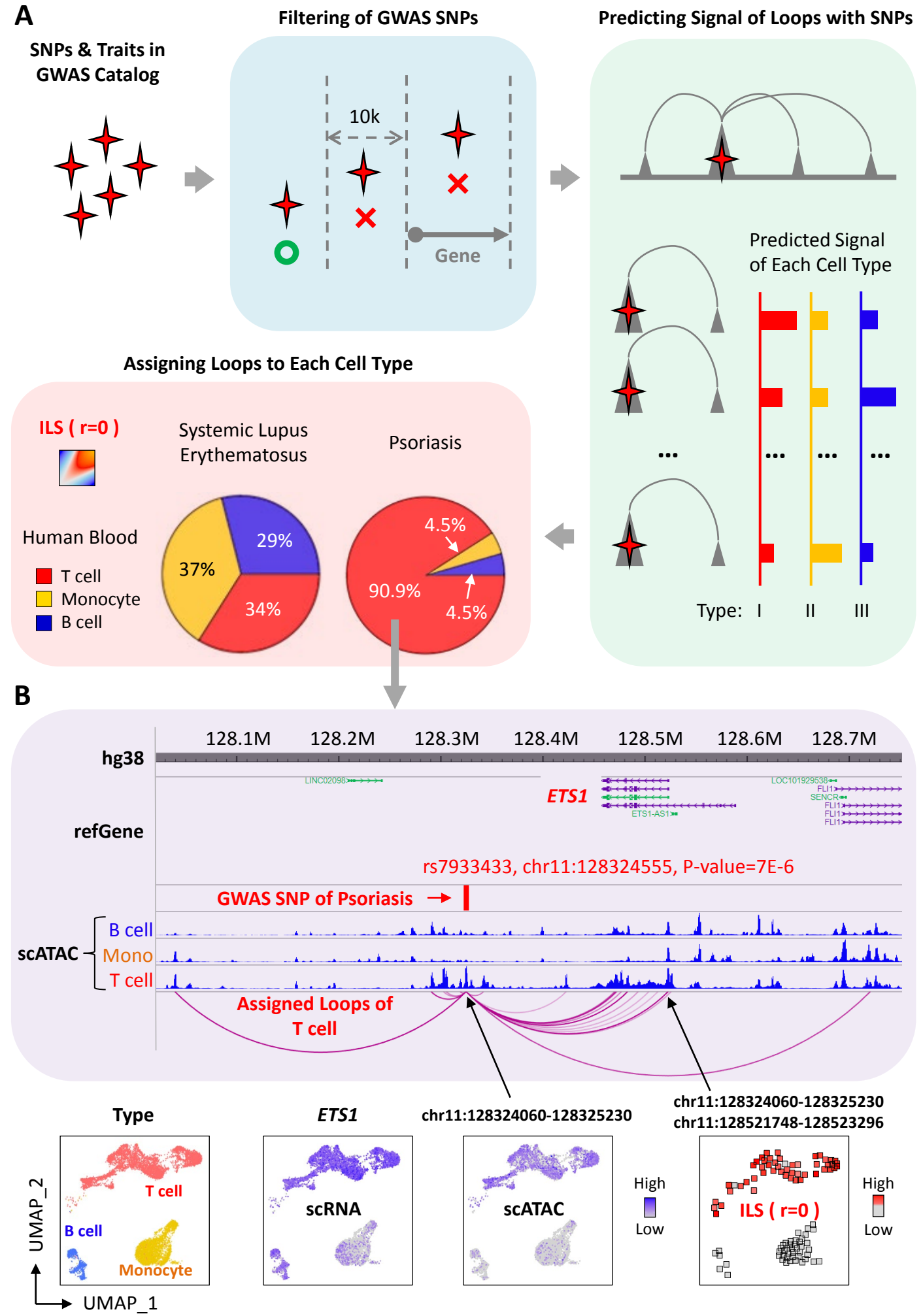
Supplementary Figure 11



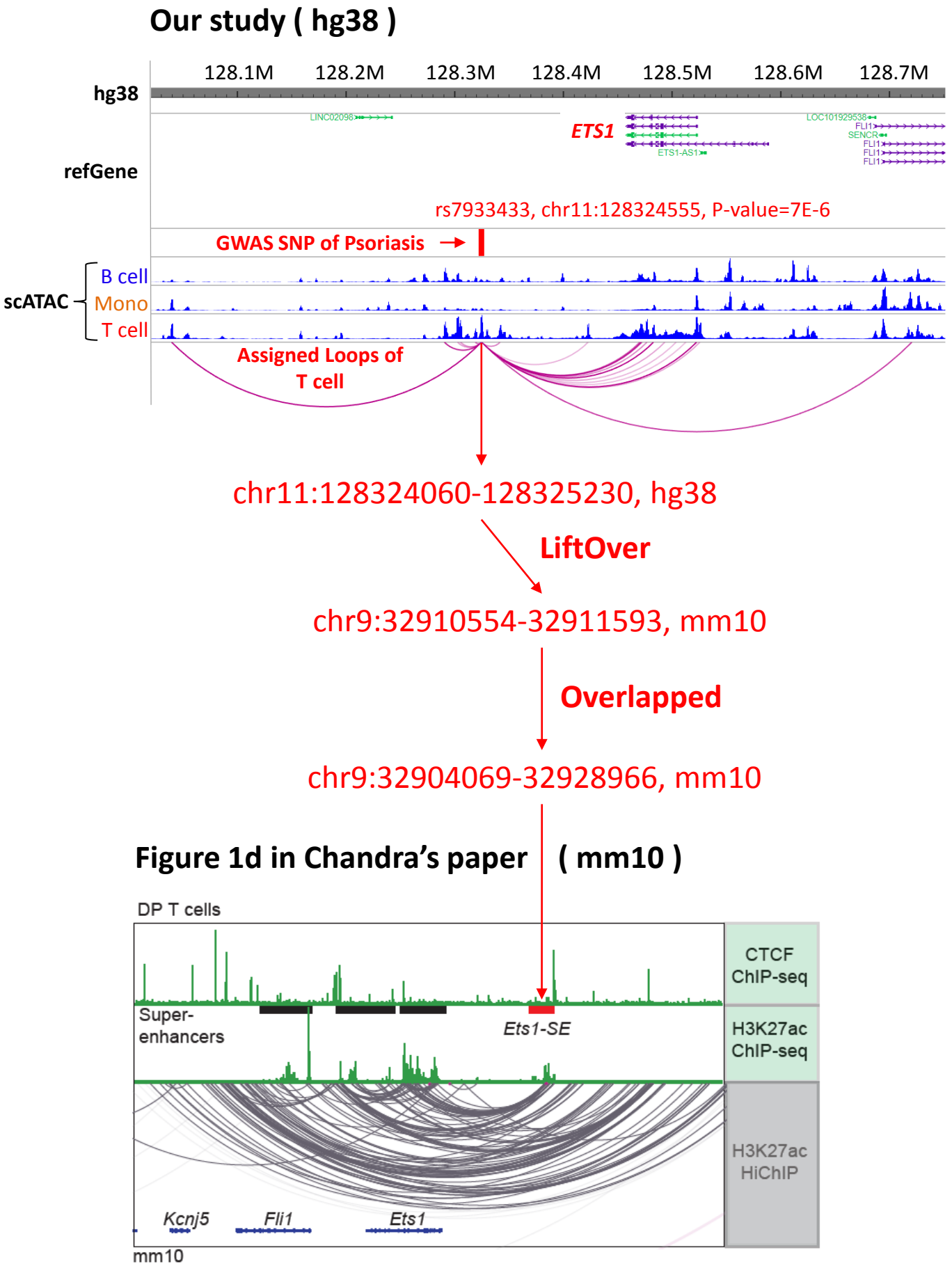
Supplementary Figure 12



Supplementary Figure 13



Supplementary Figure 14



A multi-enhancer hub at the Ets1 locus controls T cell differentiation and allergic inflammation through 3D genome topology, *bioRxiv*, 2022.10.28, https://doi.org/10.1101/2022.10.28.514213