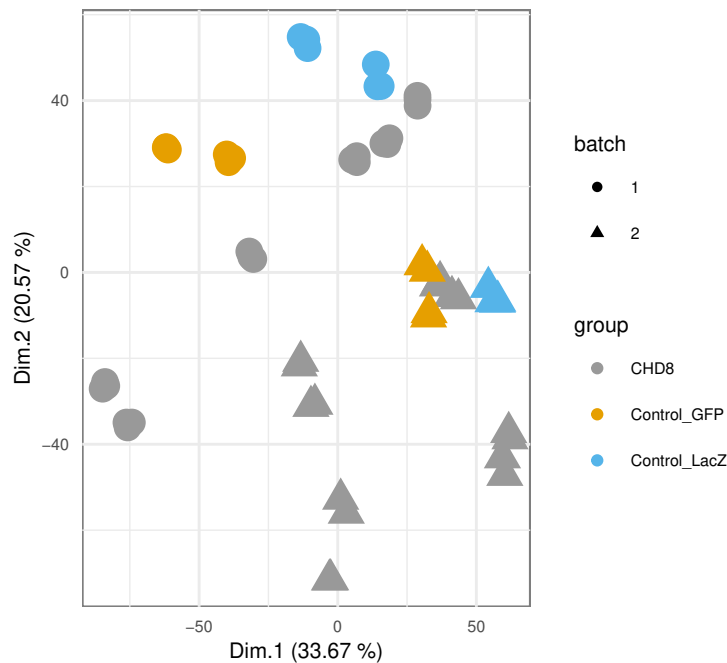**Supplementary material S2**

From top left to bottom right: PCA Abundance, shows the uncorrected PCA of the rlog normalized counts quantified by salmon and imported to a deseq2 object, next to it in the top right panel: The PCA corrected with batch using the acPCA package to return principal components that were computed with the true batch as a confounding factor. The PCA corrected with P_{low} uses the acPCA package likewise, but P_{low} as a confounding factor. To the right of the P_{low} corrected PCA is a corrected PCA on the basis of the data without outliers. We removed outliers of base or corrected PCA, but additionally added a threshold for P_{low} depending on the distribution of P_{low} in the samples (See S1). The last two panels are the PCA corrected by the first surrogate variable of the sva-method and the PCA corrected with all surrogate variables found for this dataset.
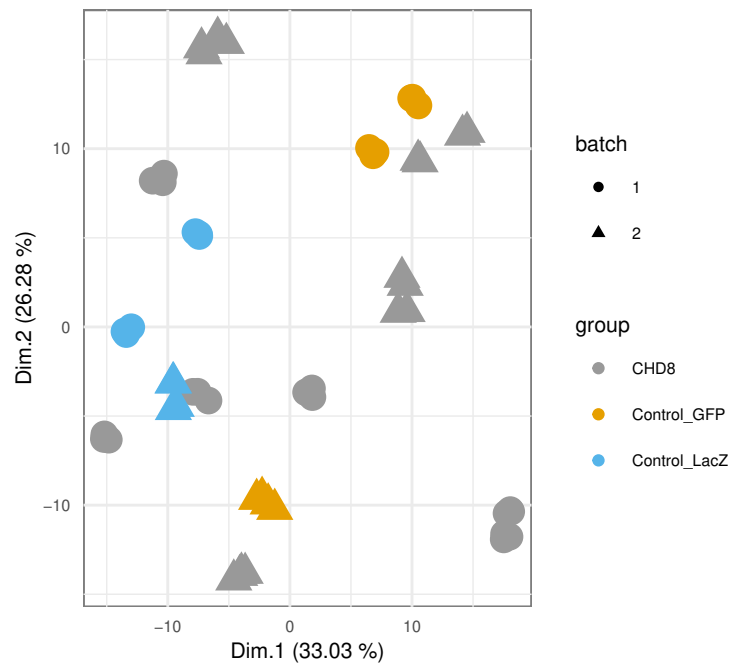
PCA Abundance: GSE61491
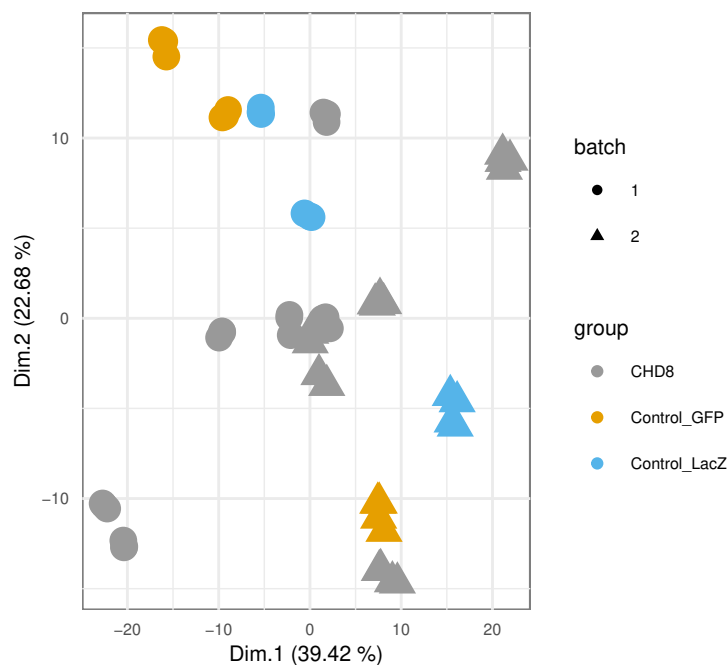DesignBias=0.45, Gamma=0.06, Dunn1=0.03, WbRatio=0.88, DEGs=322

PCA corrected Batch: GSE61491
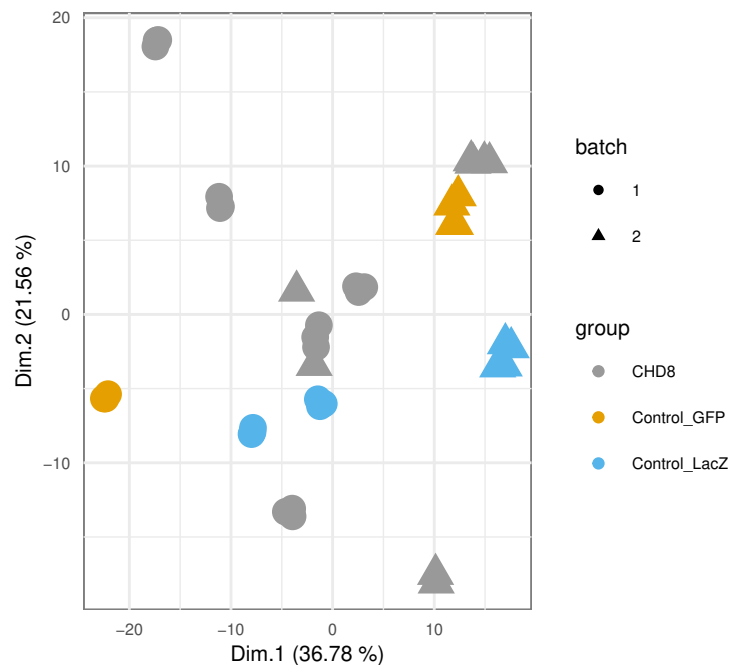DesignBias=0.45, Gamma=−0.01, Dunn1=0.04, WbRatio=0.88

PCA corrected Plow: GSE61491
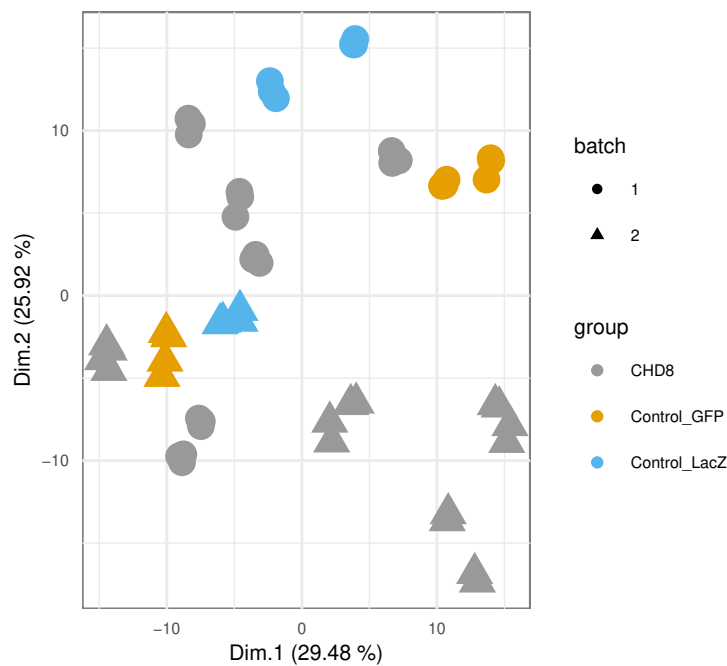DesignBias=0.45, Gamma=0.07, Dunn1=0.04, WbRatio=0.9

PCA corrected Plow and no outliers: GSE61491
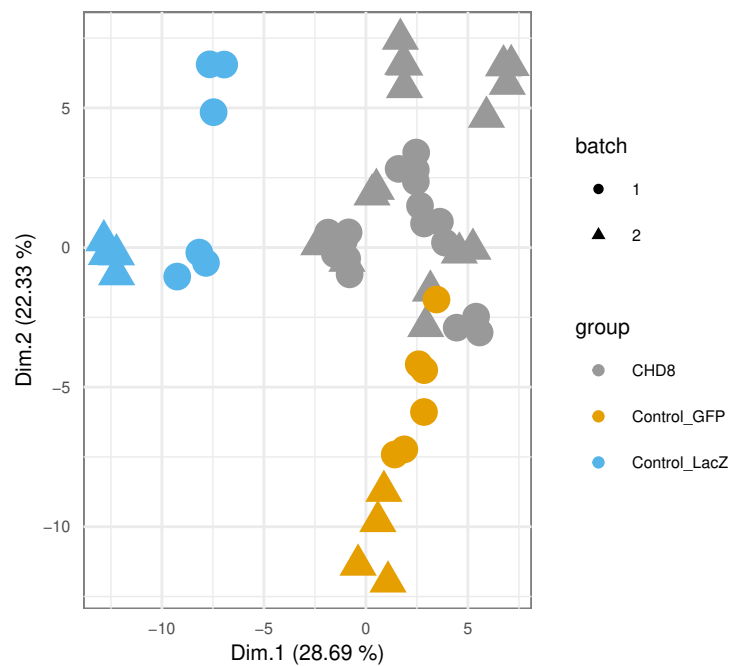DesignBias=0.45, Gamma=0.08, Dunn1=0.05, WbRatio=0.9

PCA corrected SVA V1: GSE61491
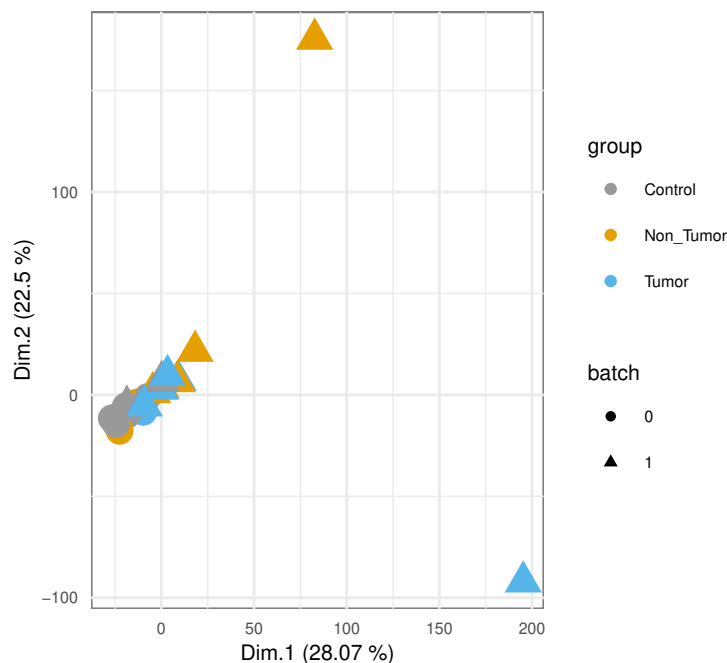DesignBias=0.45, Gamma=0.08, Dunn1=0.09, WbRatio=0.87

PCA corrected SVA all surrogate vars: GSE61491
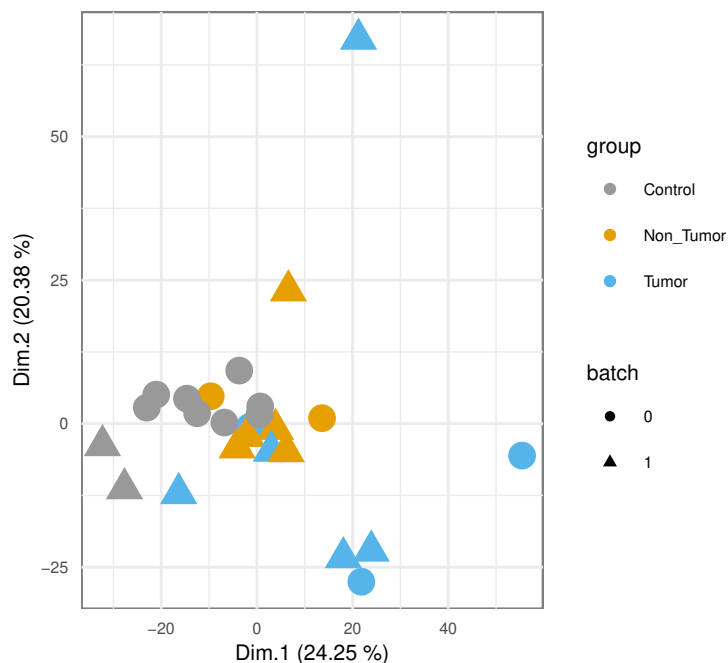DesignBias=0.45, Gamma=0.69, Dunn1=0.04, WbRatio=0.42

PCA Abundance: GSE82177
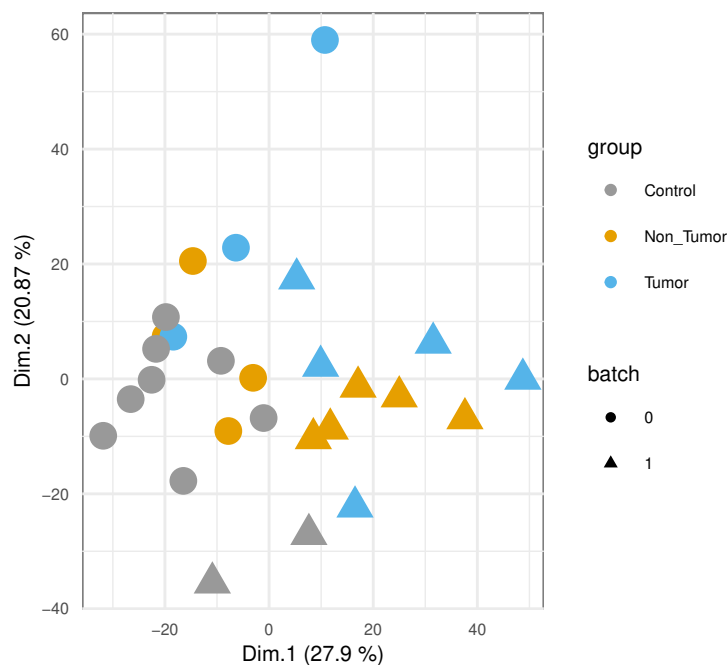DesignBias=0.49, Gamma=0.03, Dunn1=0, WbRatio=0.95, DEGs=5

PCA corrected Batch: GSE82177
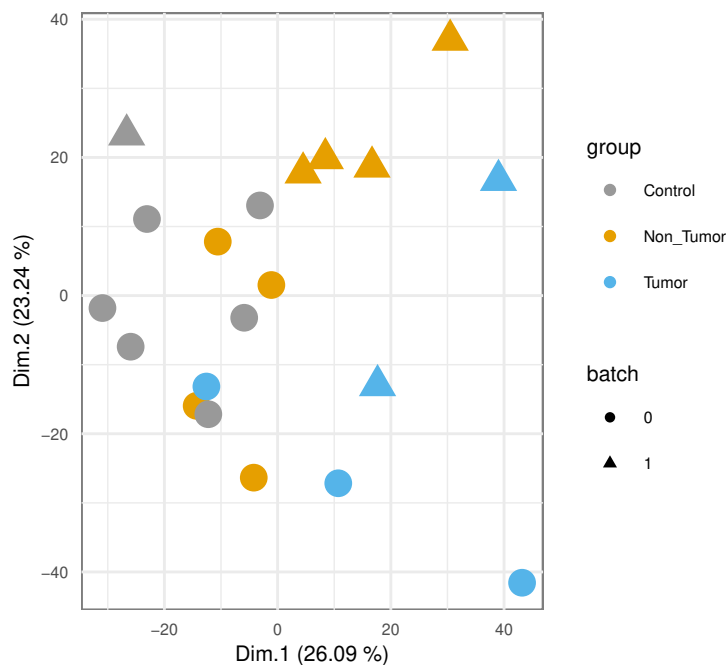DesignBias=0.49, Gamma=0.18, Dunn1=0.01, WbRatio=0.76

PCA corrected Plow: GSE82177
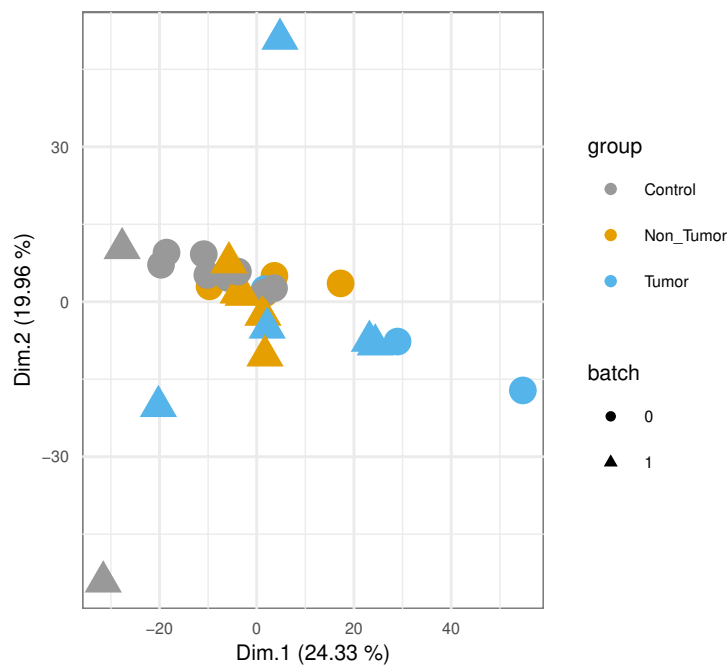DesignBias=0.49, Gamma=0.18, Dunn1=0.02, WbRatio=0.83

PCA corrected Plow and no outliers: GSE82177
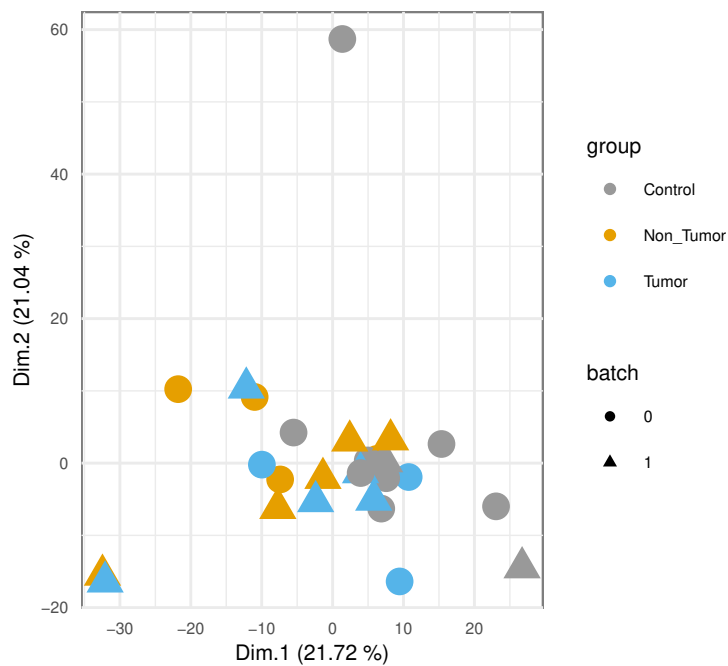DesignBias=0.49, Gamma=0.23, Dunn1=0.03, WbRatio=0.79

PCA corrected SVA V1: GSE82177
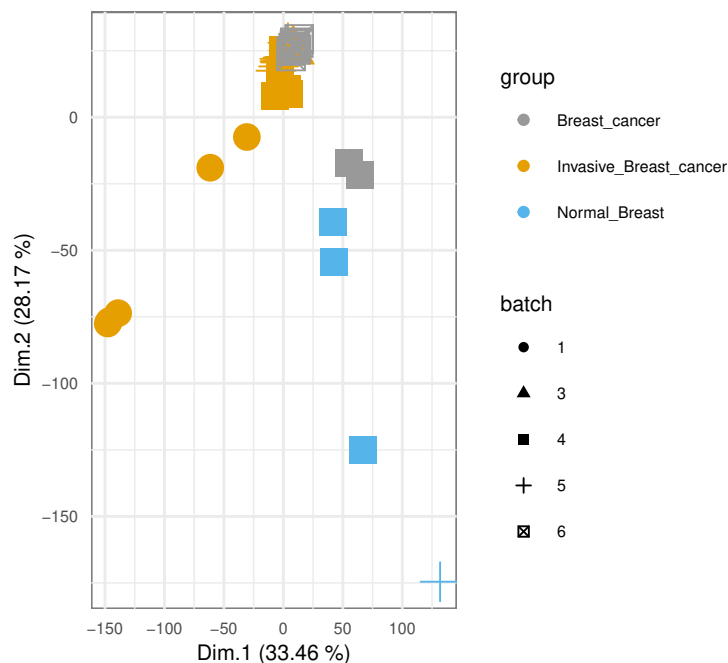DesignBias=0.49, Gamma=0.13, Dunn1=0, WbRatio=0.82

PCA corrected SVA all surrogate vars: GSE82177
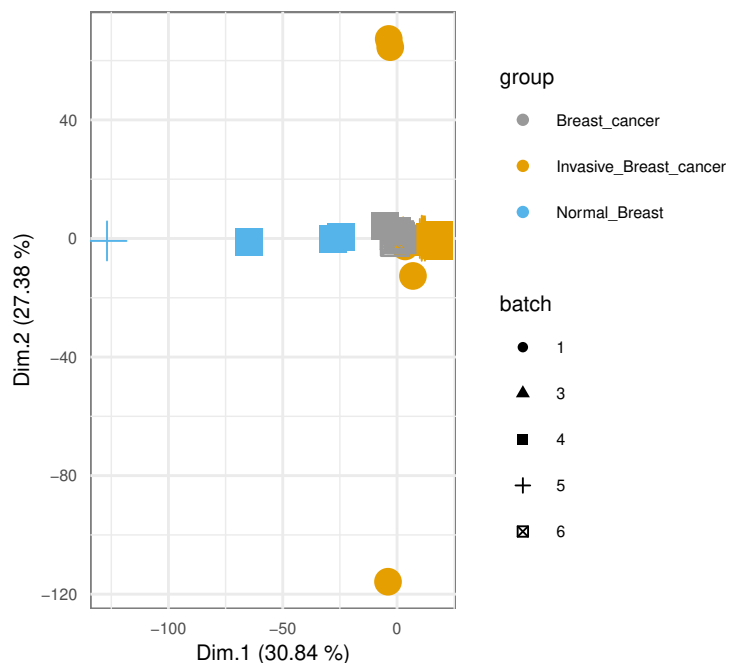DesignBias=0.49, Gamma=0.03, Dunn1=0, WbRatio=0.94

PCA Abundance: GSE117970
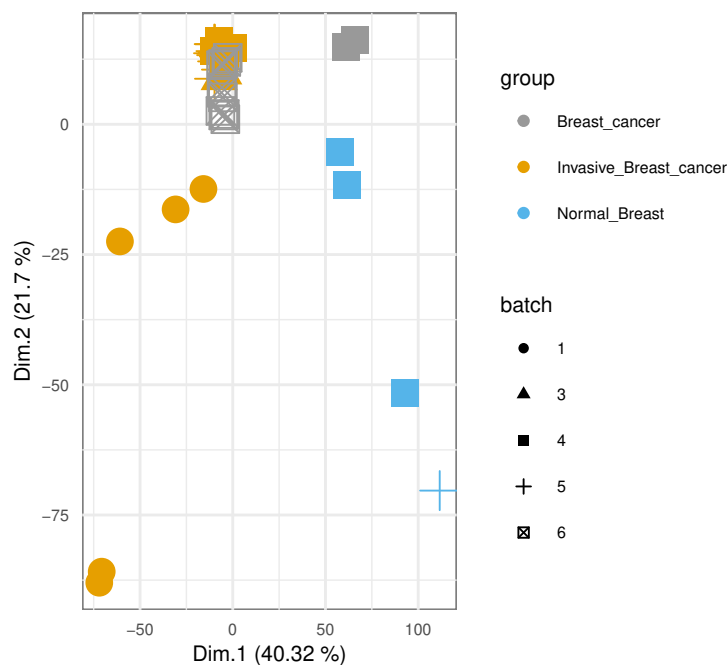DesignBias=0.62, Gamma=0.21, Dunn1=0, WbRatio=0.6, DEGs=1844

PCA corrected Batch: GSE117970
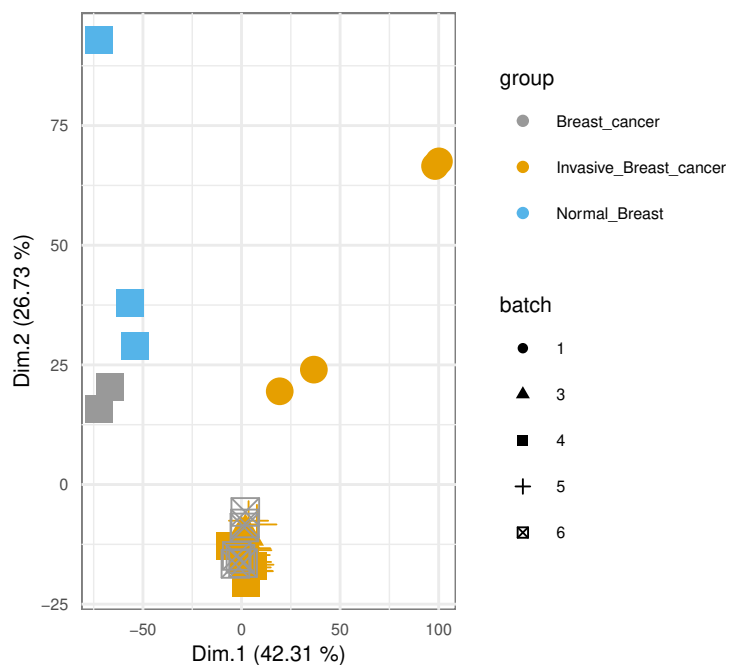DesignBias=0.62, Gamma=0.21, Dunn1=0.01, WbRatio=0.57

PCA corrected Plow: GSE117970
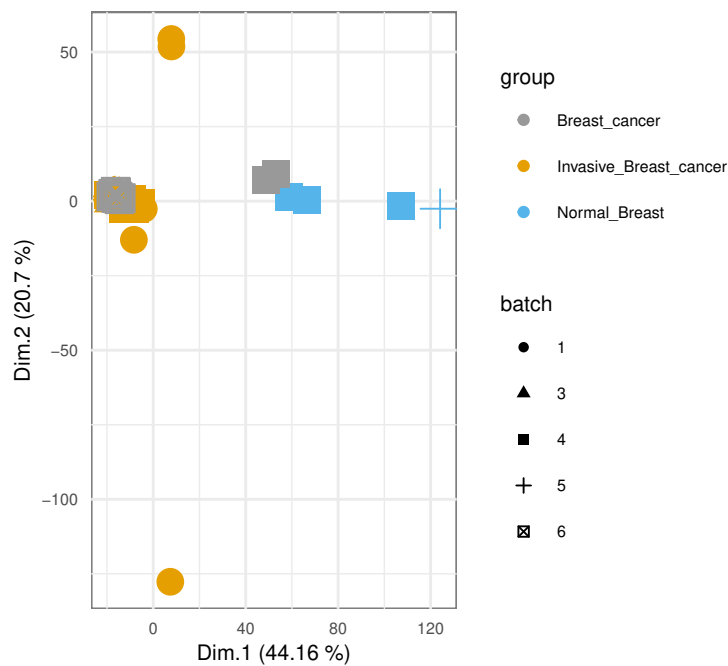DesignBias=0.62, Gamma=0.26, Dunn1=0.01, WbRatio=0.55

PCA corrected Plow and no outliers: GSE117970
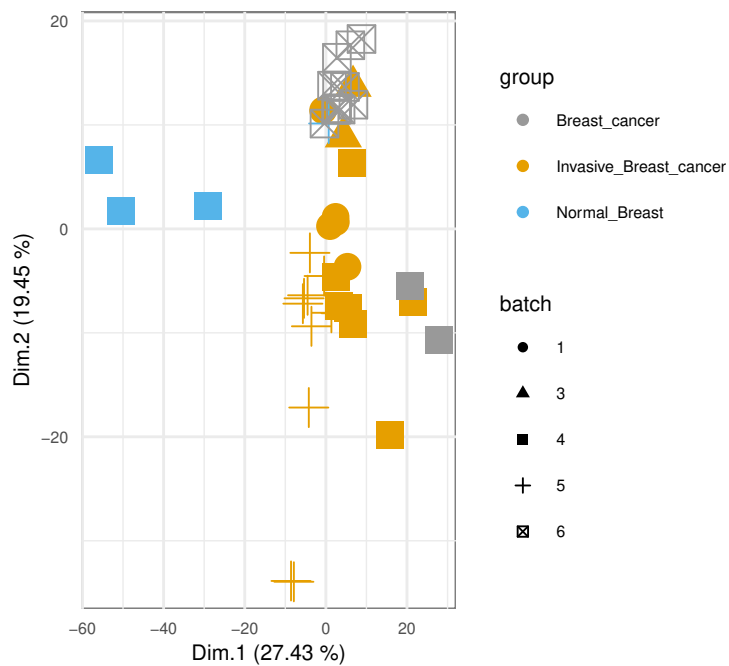DesignBias=0.62, Gamma=0.25, Dunn1=0.01, WbRatio=0.59

PCA corrected SVA V1: GSE117970
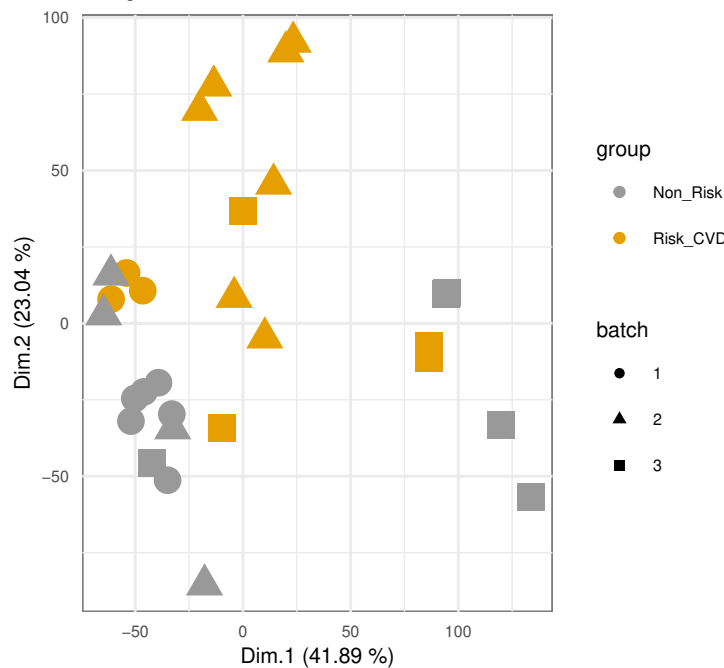DesignBias=0.62, Gamma=0.26, Dunn1=0, WbRatio=0.51

PCA corrected SVA all surrogate vars: GSE117970
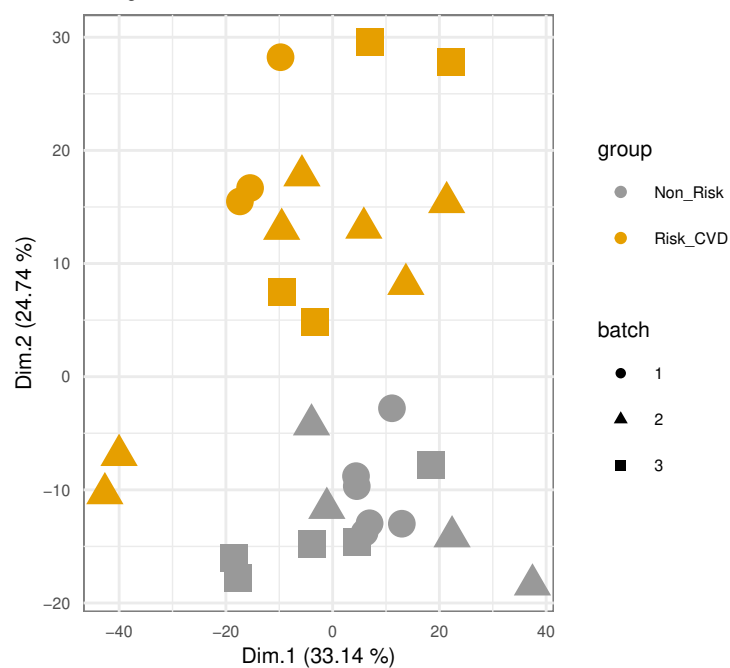DesignBias=0.62, Gamma=0.4, Dunn1=0.02, WbRatio=0.57

PCA Abundance: GSE120099
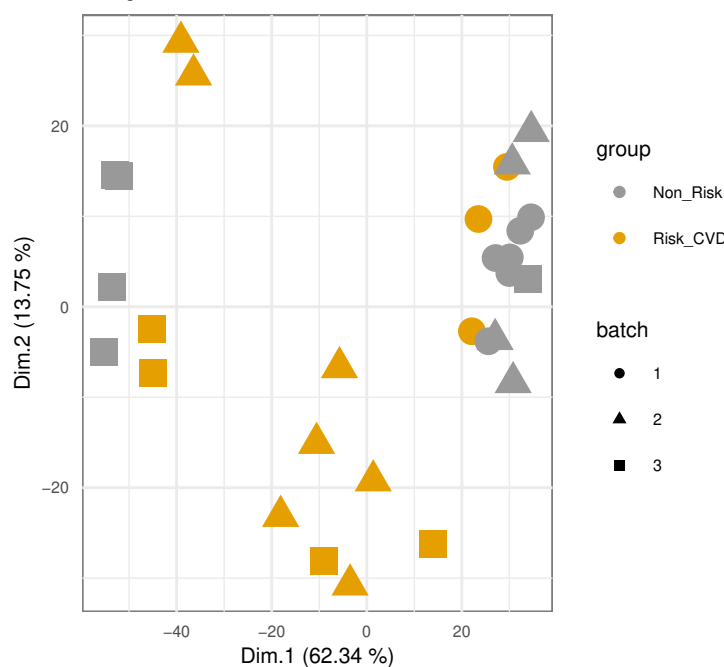DesignBias=0.66, Gamma=0.16, Dunn1=0.03, WbRatio=0.83, DEGs=721

PCA corrected Batch: GSE120099
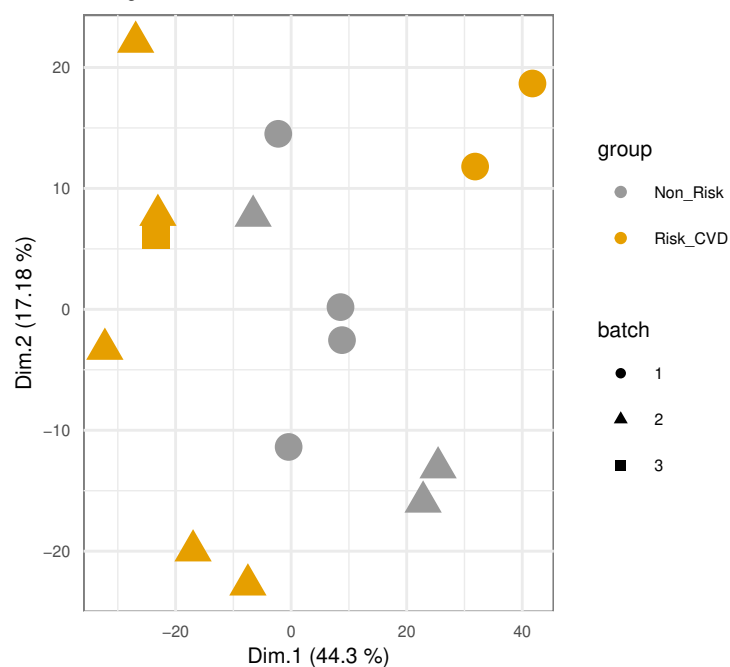DesignBias=0.66, Gamma=0.45, Dunn1=0.12, WbRatio=0.63

PCA corrected Plow: GSE120099
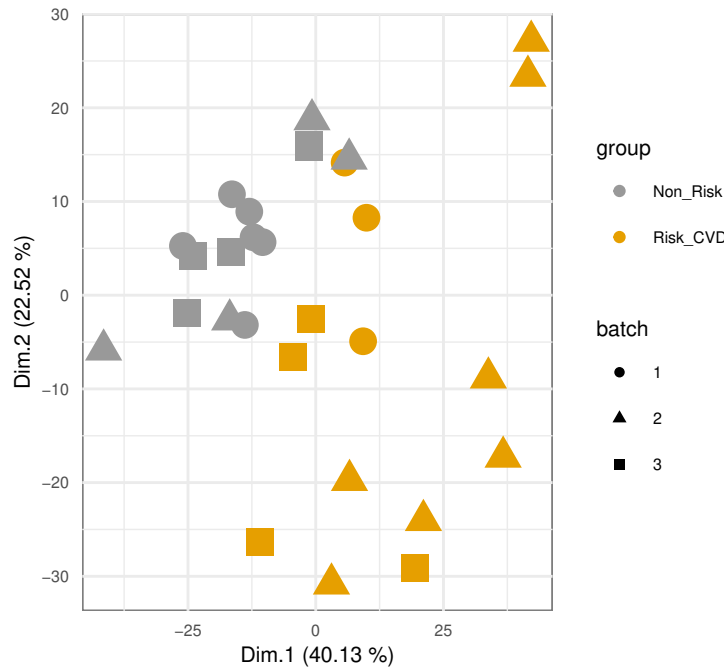DesignBias=0.66, Gamma=0.12, Dunn1=0.01, WbRatio=0.87

PCA corrected Plow and no outliers: GSE120099
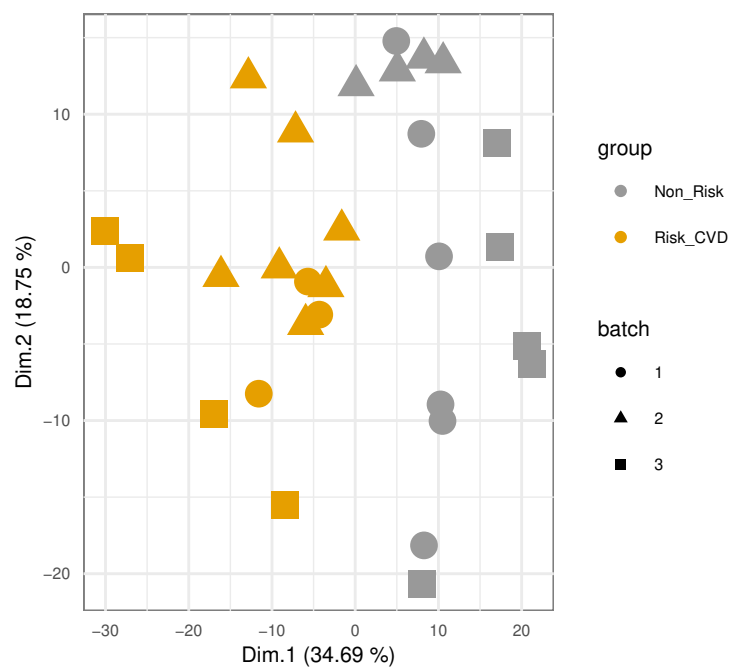DesignBias=0.66, Gamma=0.12, Dunn1=0.17, WbRatio=0.87

PCA corrected SVA V1: GSE120099
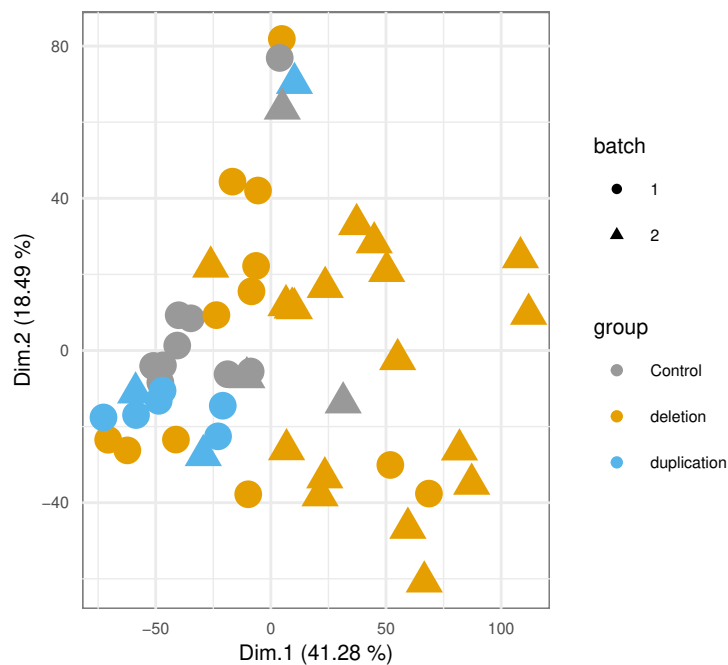DesignBias=0.66, Gamma=0.42, Dunn1=0.01, WbRatio=0.63

PCA corrected SVA all surrogate vars: GSE120099
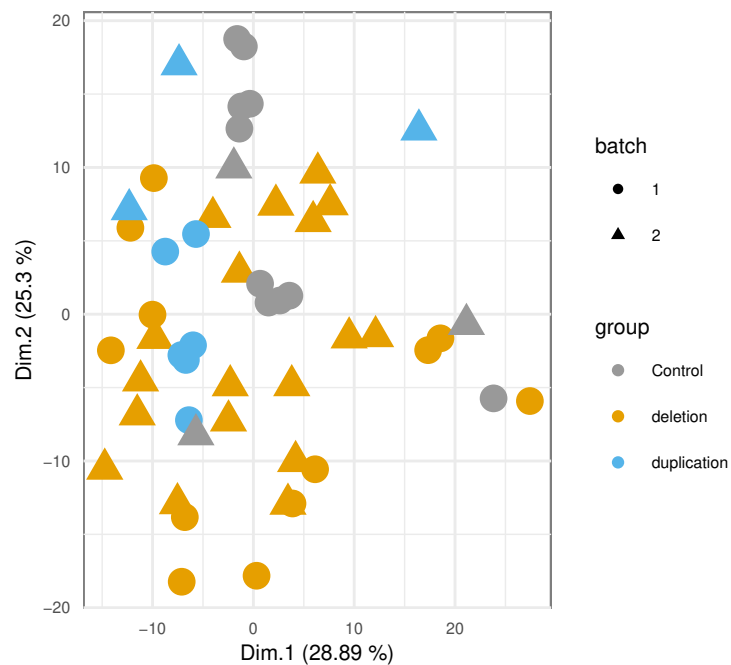DesignBias=0.66, Gamma=0.54, Dunn1=0.22, WbRatio=0.58

PCA Abundance: GSE144736
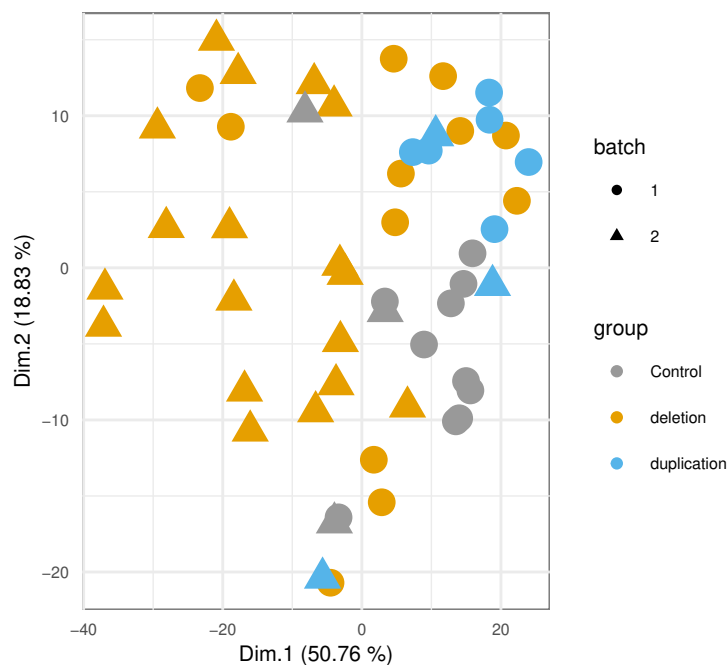DesignBias=0.49, Gamma=0.07, Dunn1=0.01, WbRatio=0.84, DEGs=10

PCA corrected Batch: GSE144736
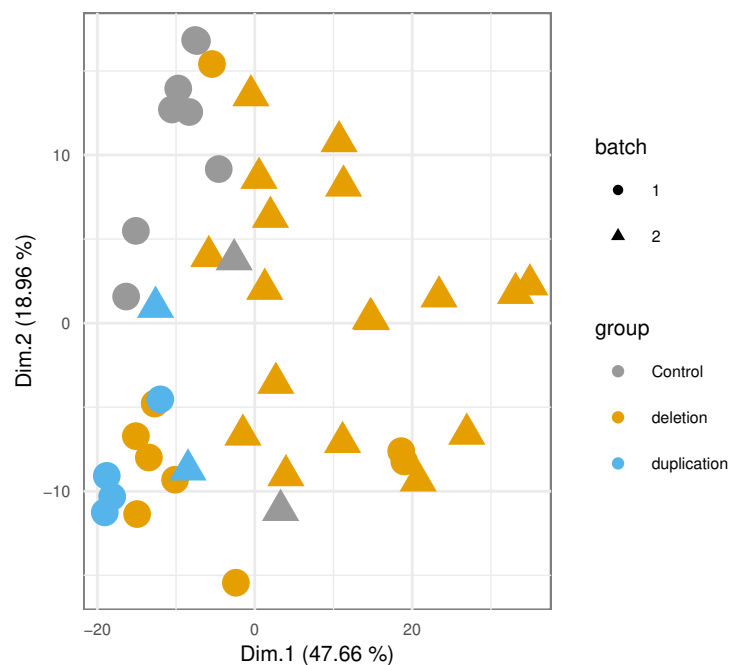DesignBias=0.49, Gamma=0.07, Dunn1=0.03, WbRatio=0.9

PCA corrected Plow: GSE144736
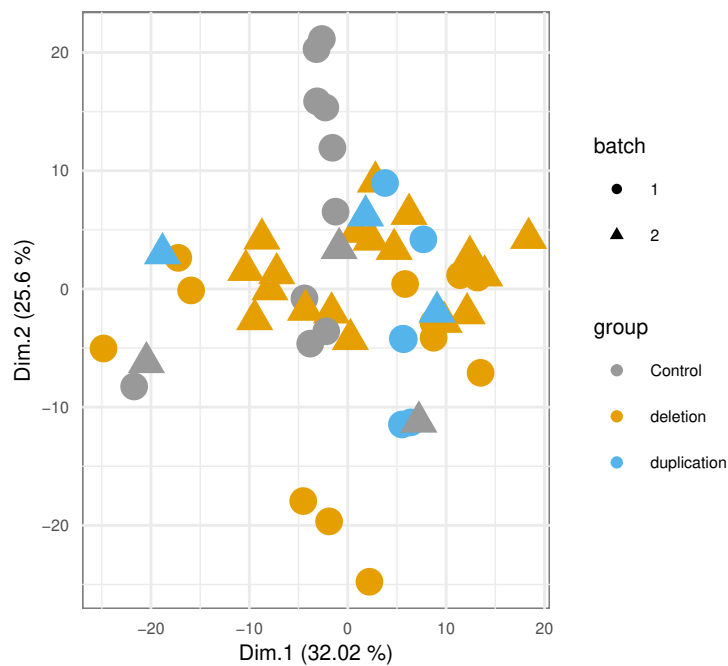DesignBias=0.49, Gamma=0.11, Dunn1=0.02, WbRatio=0.8

PCA corrected Plow and no outliers: GSE144736
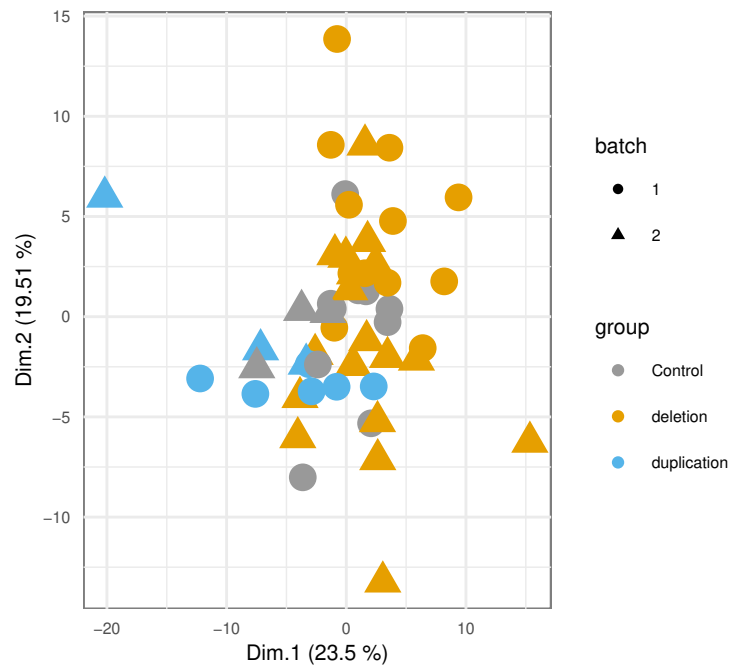DesignBias=0.49, Gamma=0.16, Dunn1=0.01, WbRatio=0.74

PCA corrected SVA V1: GSE144736
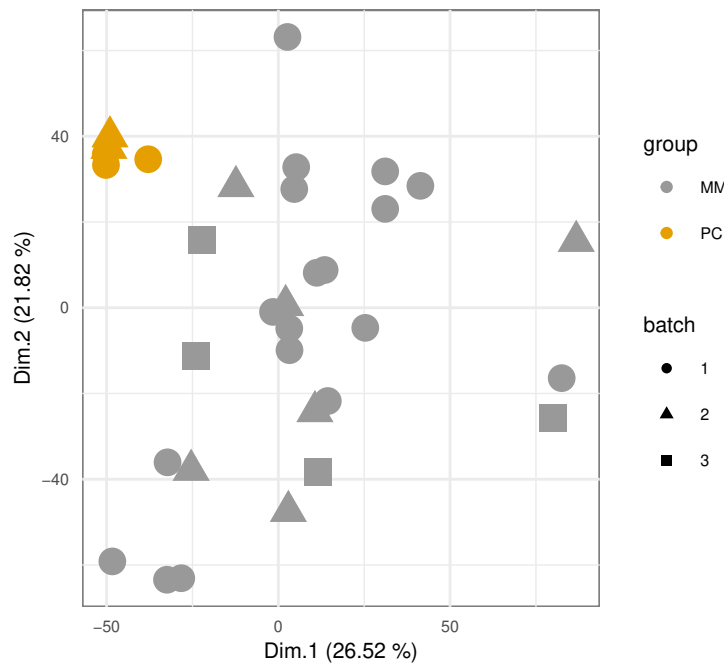DesignBias=0.49, Gamma=0.05, Dunn1=0.02, WbRatio=0.94

PCA corrected SVA all surrogate vars: GSE144736
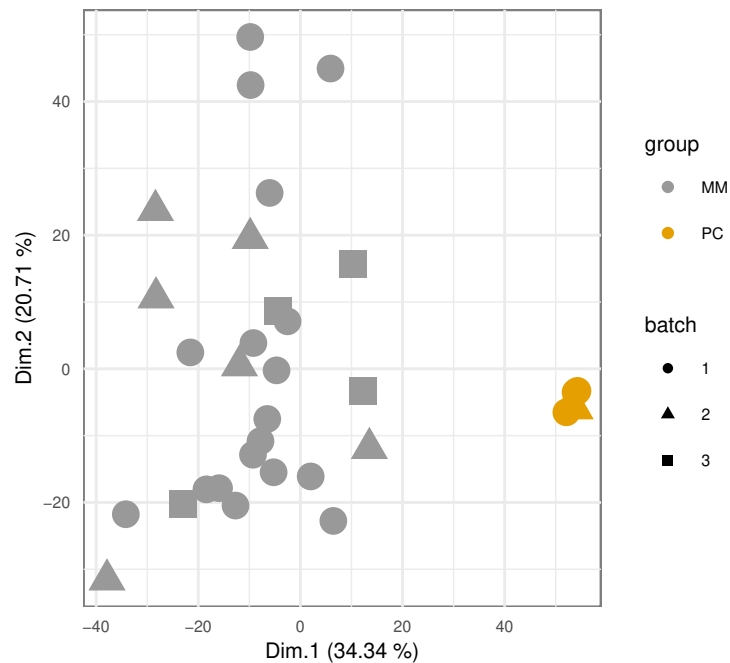DesignBias=0.49, Gamma=0.08, Dunn1=0.02, WbRatio=0.87

PCA Abundance: GSE153380
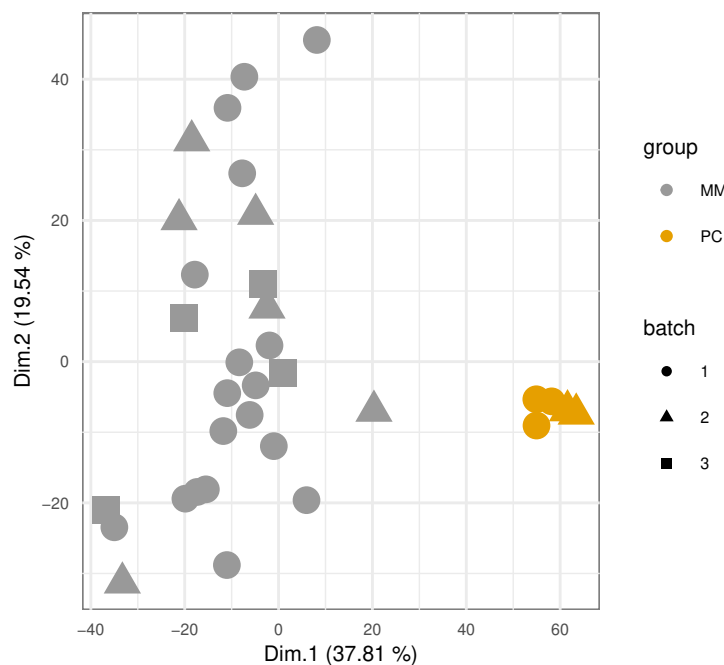DesignBias=0.44, Gamma=0.3, Dunn1=0.16, WbRatio=0.64, DEGs=398

PCA corrected Batch: GSE153380
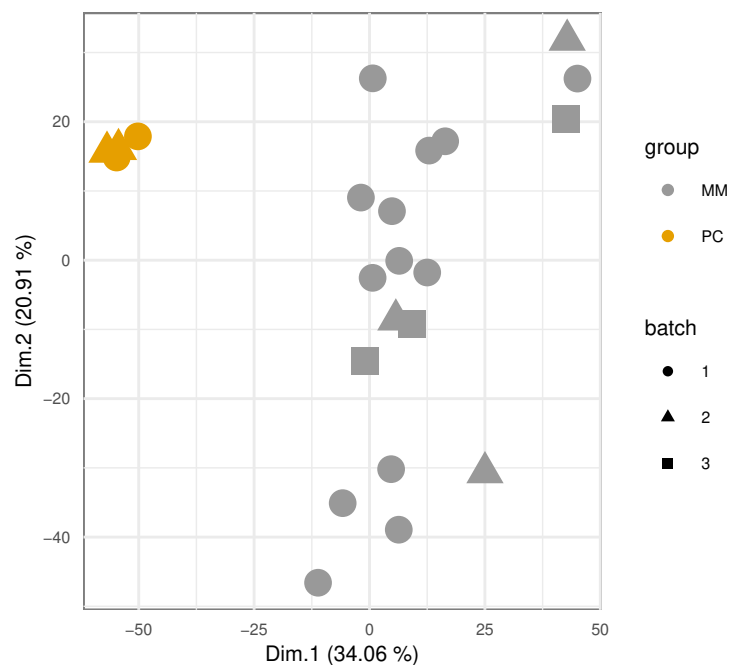DesignBias=0.44, Gamma=0.69, Dunn1=0.44, WbRatio=0.41

PCA corrected Plow: GSE153380
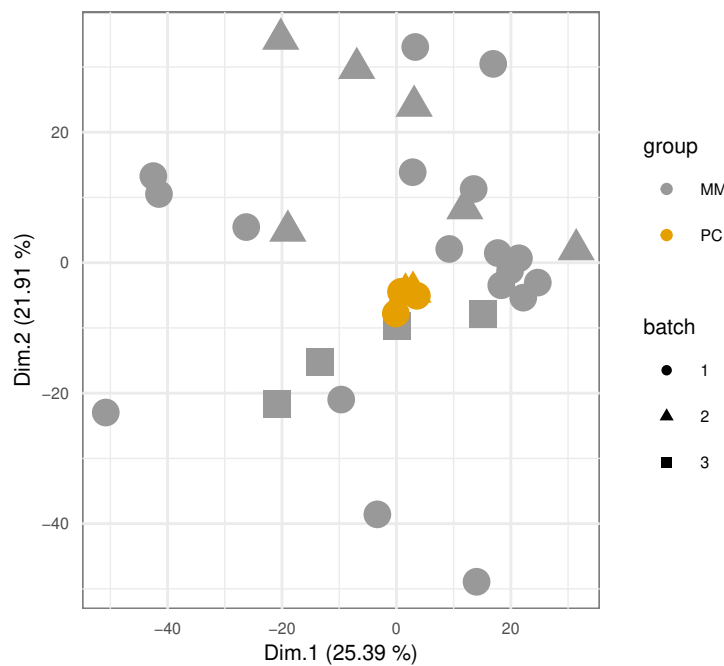DesignBias=0.44, Gamma=0.75, Dunn1=0.4, WbRatio=0.37

PCA corrected Plow and no outliers: GSE153380
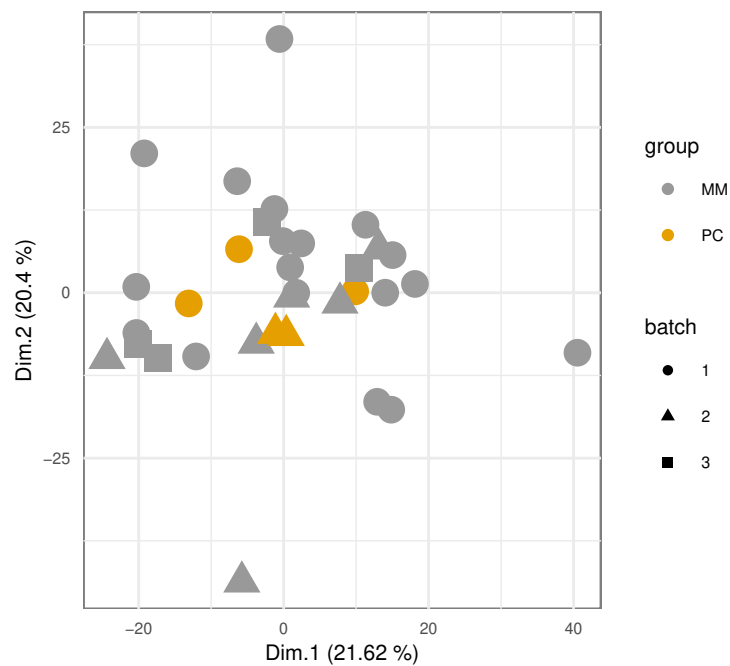DesignBias=0.44, Gamma=0.67, Dunn1=0.52, WbRatio=0.42

PCA corrected SVA V1: GSE153380
DesignBias=0.44, Gamma=−0.22, Dunn1=0.02, WbRatio=1.18
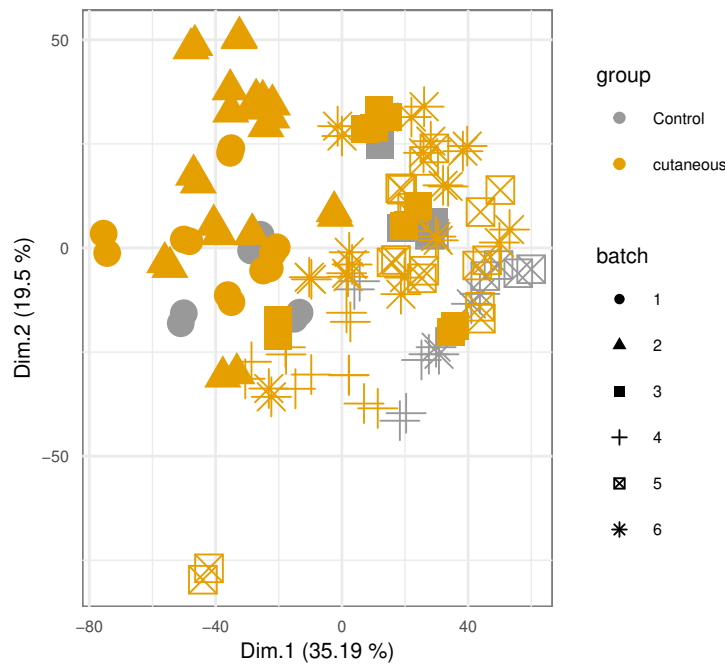
PCA corrected SVA all surrogate vars: GSE153380
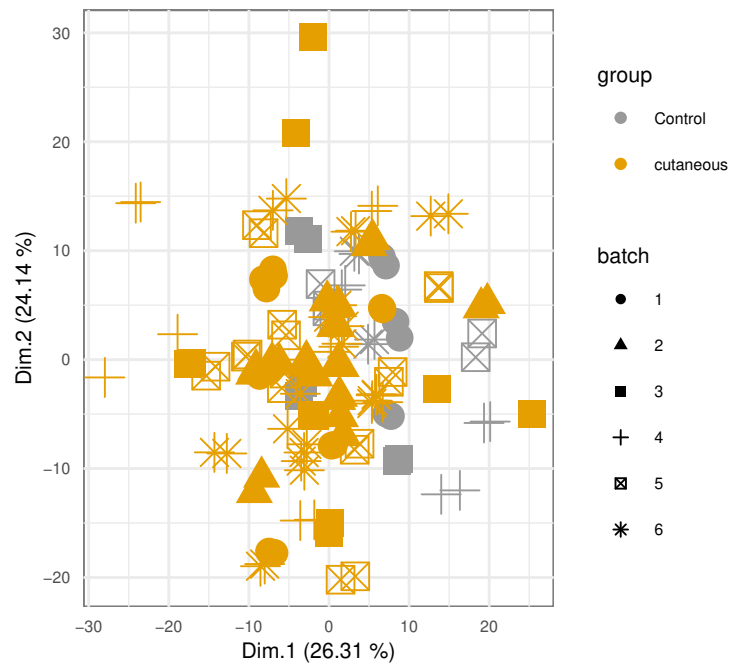DesignBias=0.44, Gamma=−0.18, Dunn1=0.03, WbRatio=1.2

PCA Abundance: GSE162760

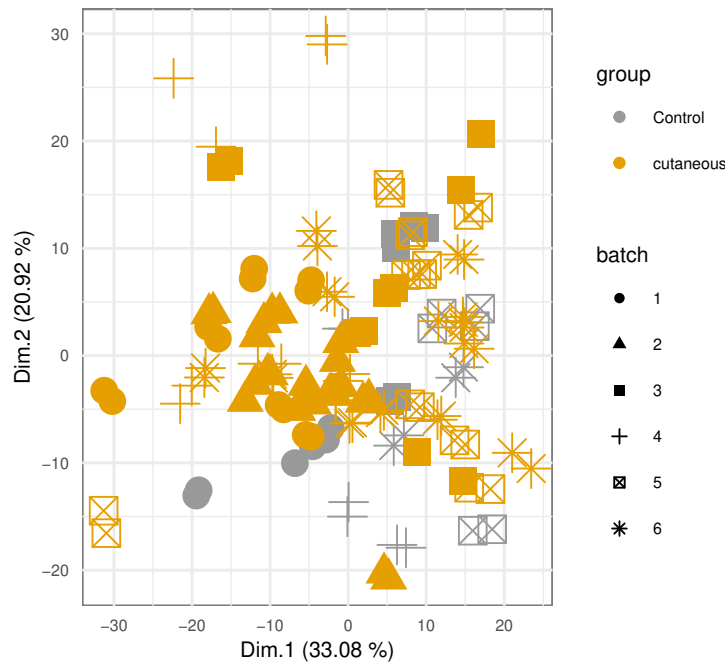DesignBias=0.5, Gamma=0.01, Dunn1=0.01, WbRatio=0.97, DEGs=223

PCA corrected Batch: GSE162760

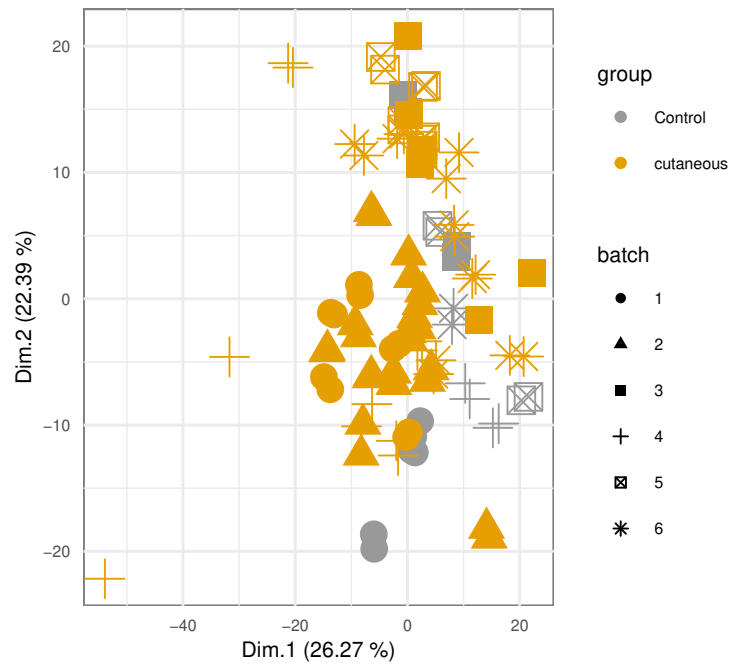DesignBias=0.5, Gamma=0.02, Dunn1=0, WbRatio=0.94

PCA corrected Plow: GSE162760

DesignBias=0.5, Gamma=0.01, Dunn1=0.01, WbRatio=0.97
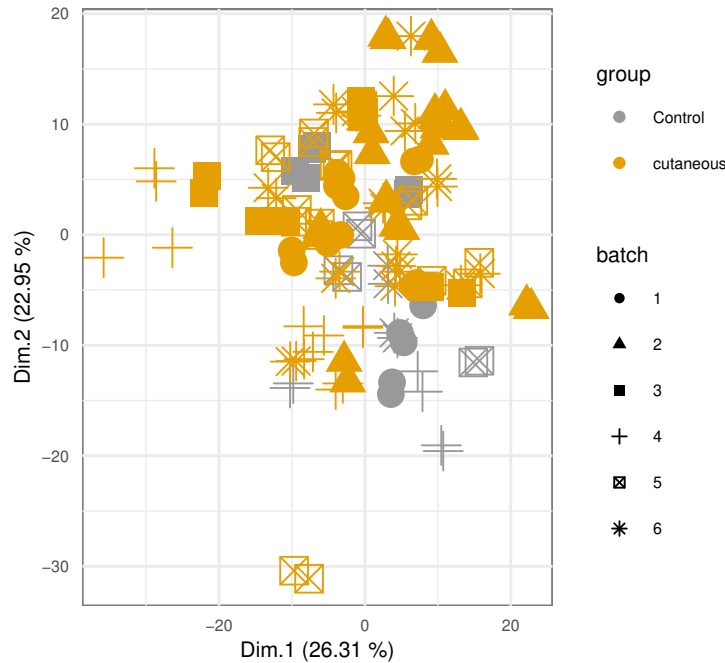
PCA corrected Plow and no outliers: GSE162760

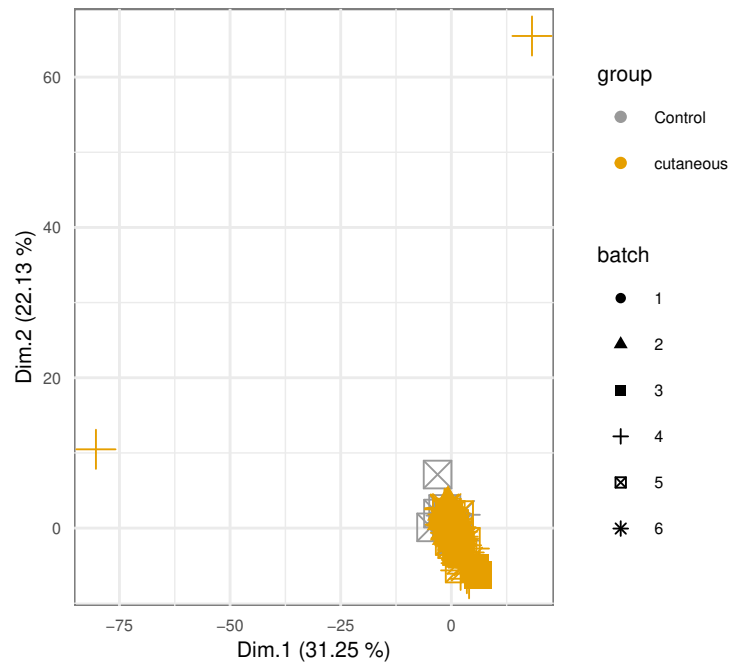DesignBias=0.5, Gamma=0.05, Dunn1=0, WbRatio=0.92

PCA corrected SVA V1: GSE162760
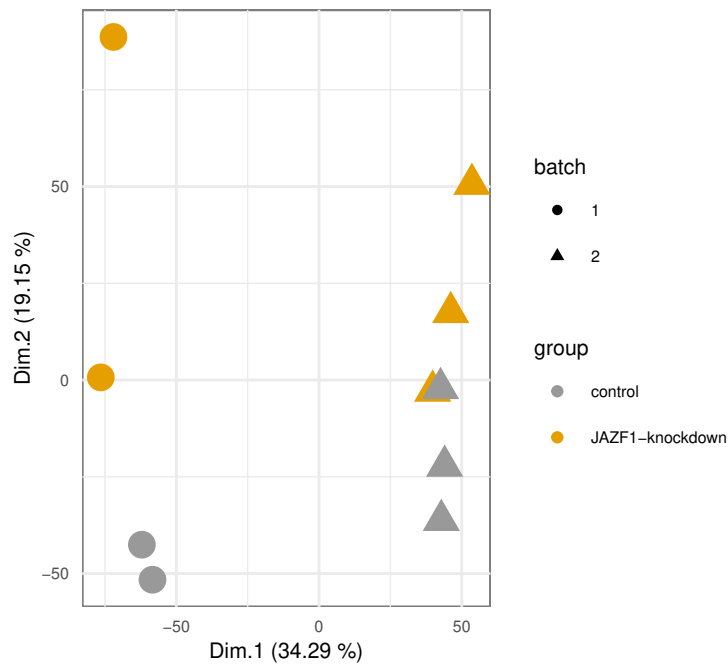
DesignBias=0.5, Gamma=0.02, Dunn1=0, WbRatio=0.94

PCA corrected SVA all surrogate vars: GSE162760

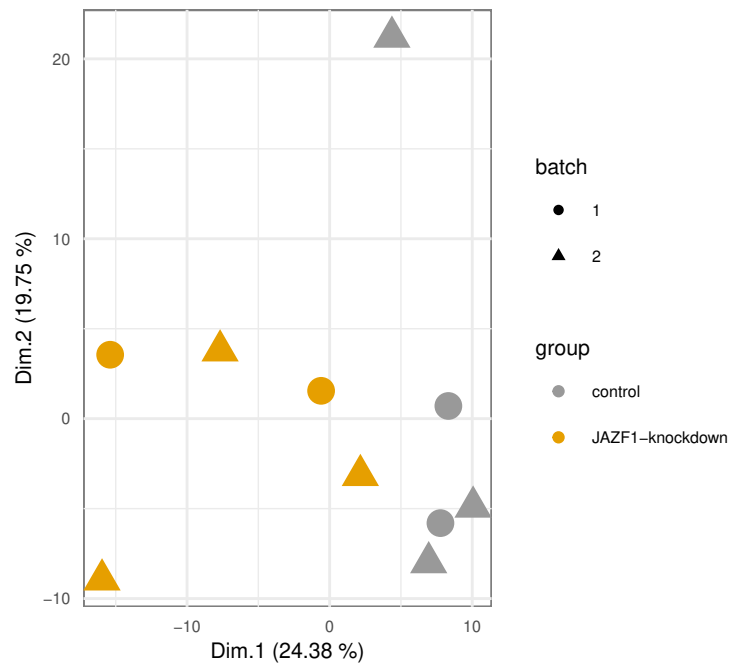DesignBias=0.5, Gamma=−0.03, Dunn1=0, WbRatio=1.09

PCA Abundance: GSE163214
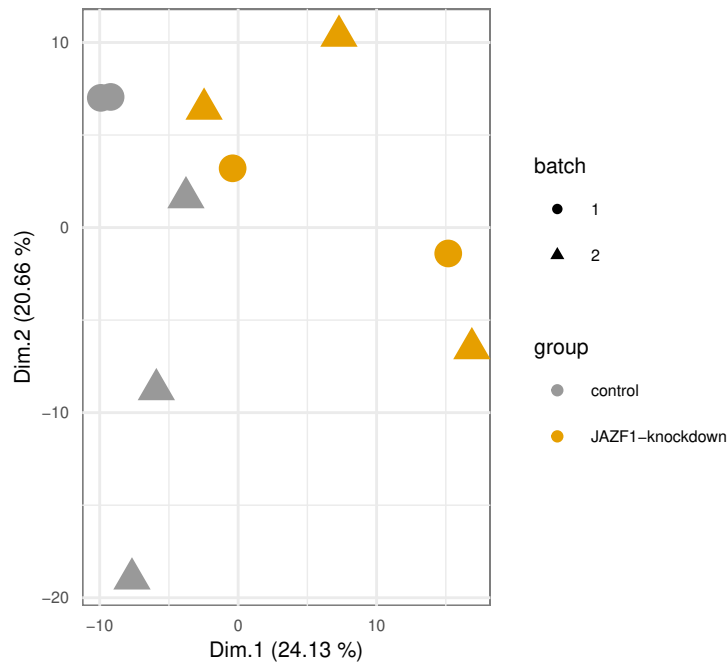DesignBias=0.46, Gamma=0.09, Dunn1=0.02, WbRatio=0.91, DEGs=3

PCA corrected Batch: GSE163214
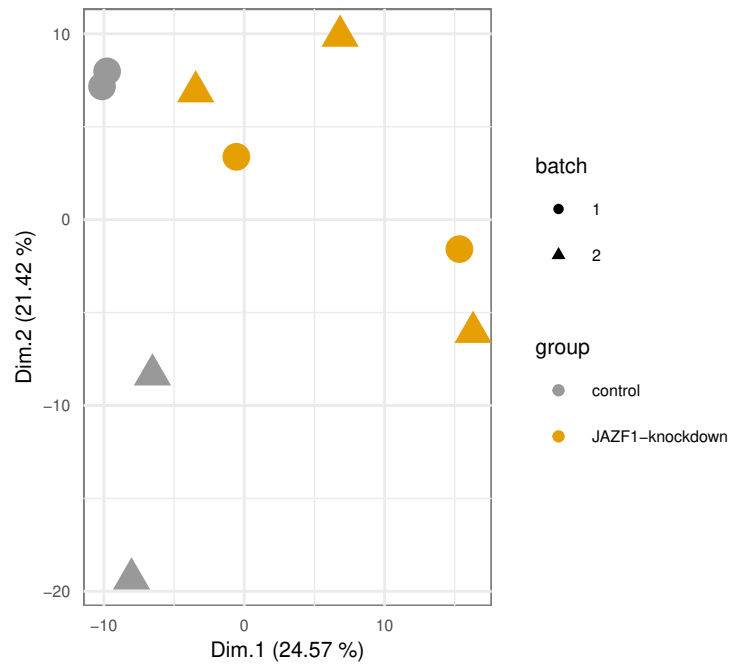DesignBias=0.46, Gamma=0.33, Dunn1=0.21, WbRatio=0.7

PCA corrected Plow: GSE163214
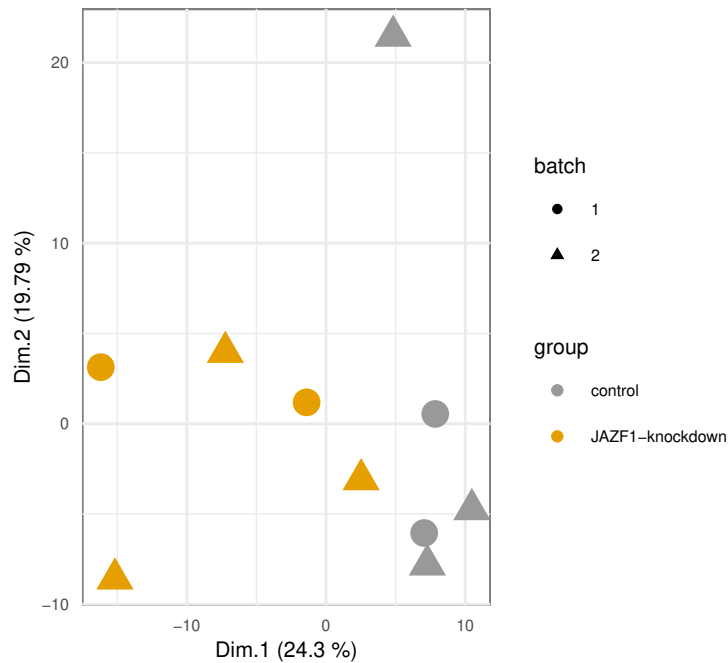DesignBias=0.46, Gamma=0.3, Dunn1=0.14, WbRatio=0.74

PCA corrected Plow and no outliers: GSE163214
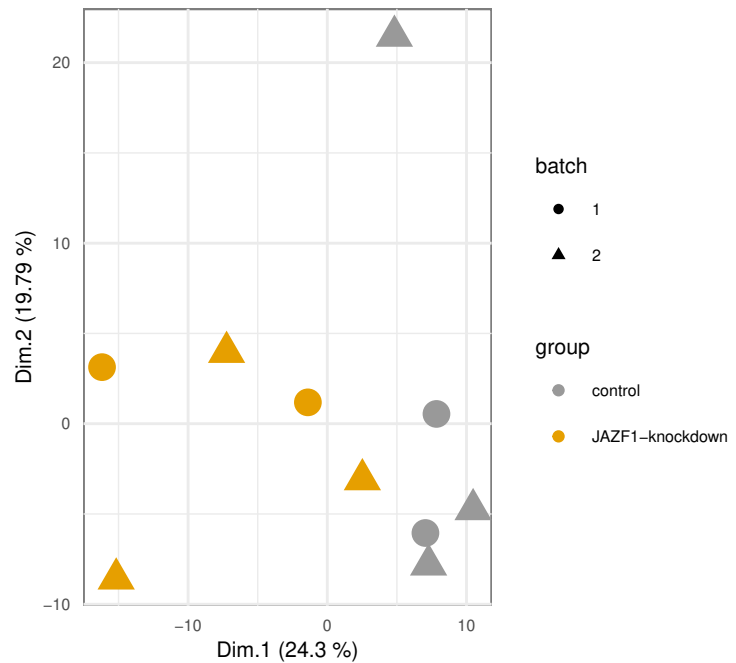DesignBias=0.46, Gamma=0.35, Dunn1=0.23, WbRatio=0.73

PCA corrected SVA V1: GSE163214
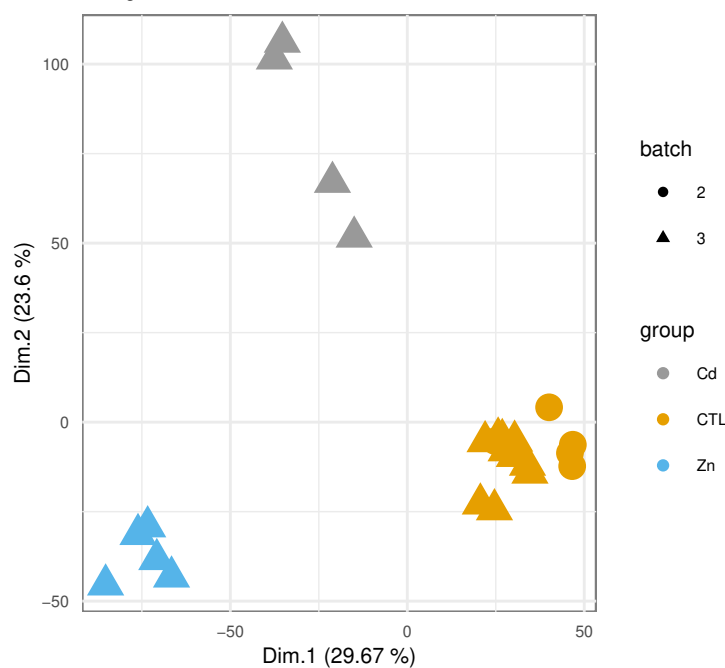DesignBias=0.46, Gamma=0.33, Dunn1=0.18, WbRatio=0.7

PCA corrected SVA all surrogate vars: GSE163214
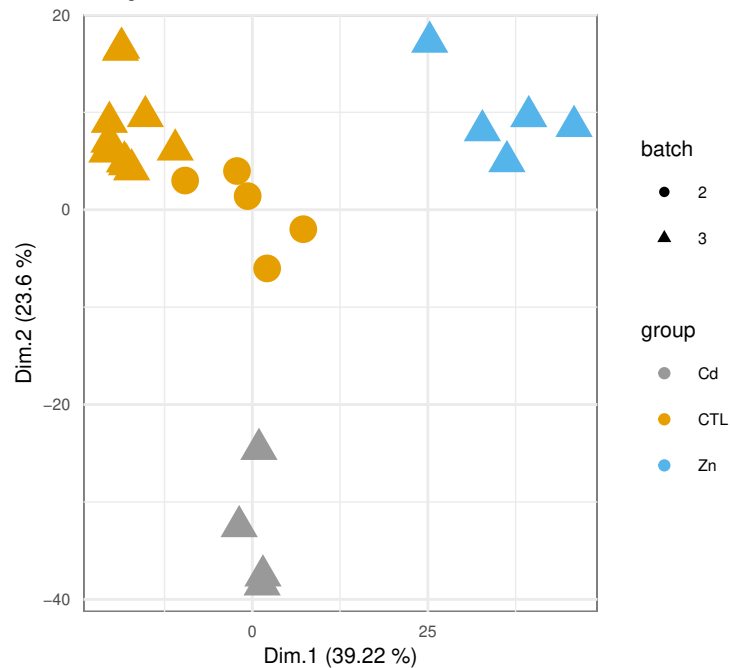DesignBias=0.46, Gamma=0.33, Dunn1=0.18, WbRatio=0.7

PCA Abundance: GSE163857
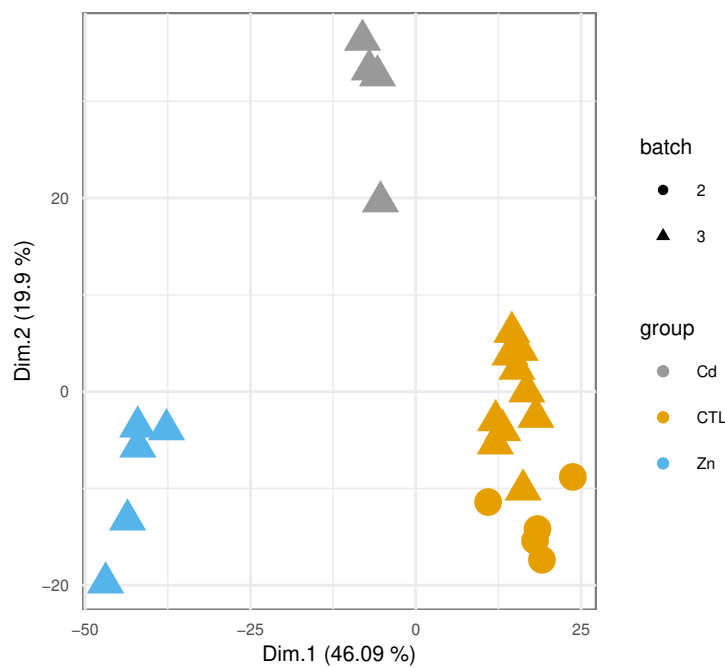DesignBias=0.52, Gamma=0.95, Dunn1=1.17, WbRatio=0.16, DEGs=1726

PCA corrected Batch: GSE163857
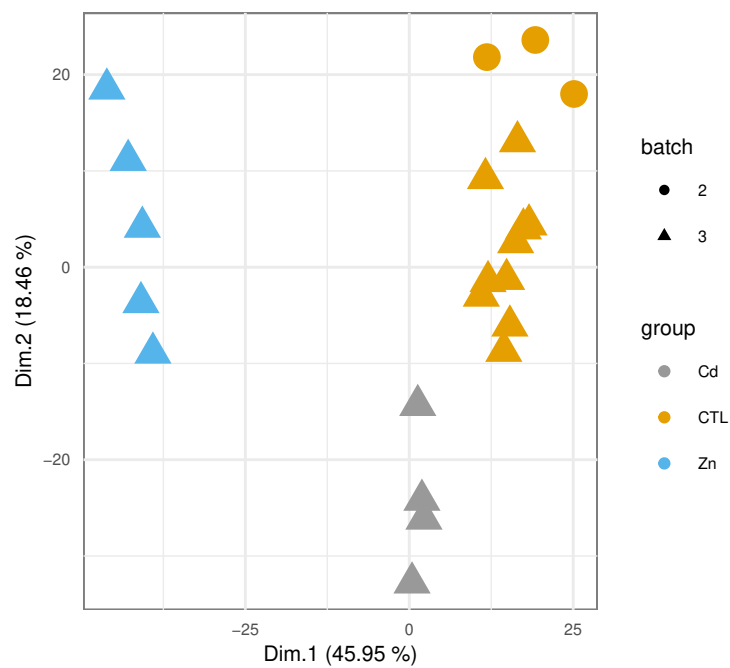DesignBias=0.52, Gamma=0.87, Dunn1=0.58, WbRatio=0.25

PCA corrected Plow: GSE163857
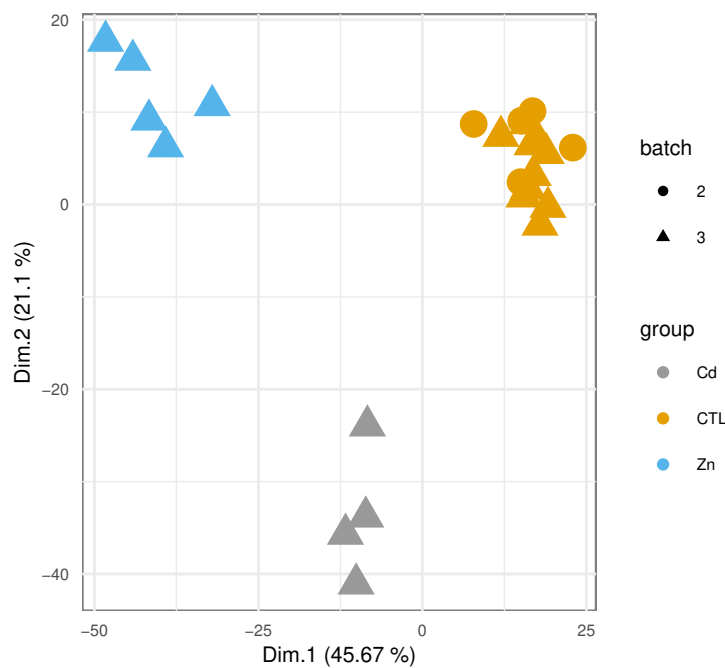DesignBias=0.52, Gamma=0.92, Dunn1=1, WbRatio=0.19

PCA corrected Plow and no outliers: GSE163857
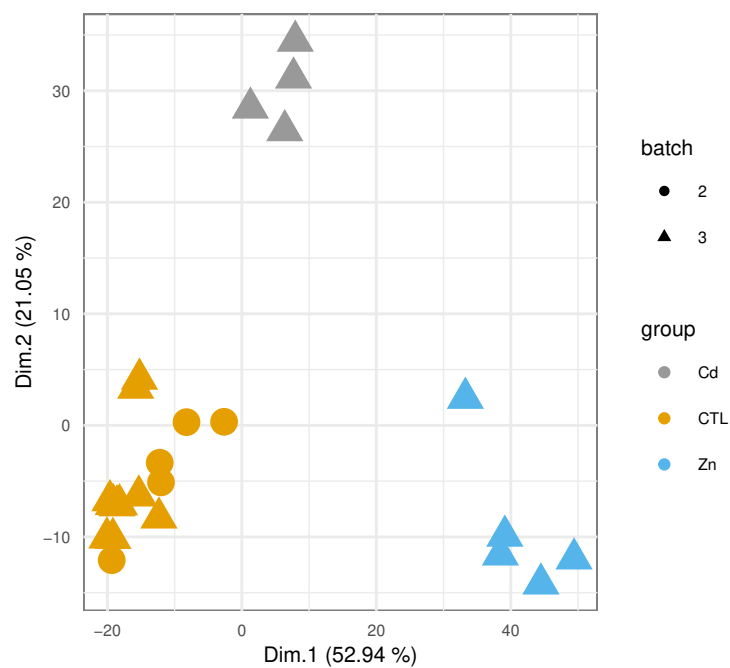DesignBias=0.52, Gamma=0.82, Dunn1=0.44, WbRatio=0.27

PCA corrected SVA V1: GSE163857
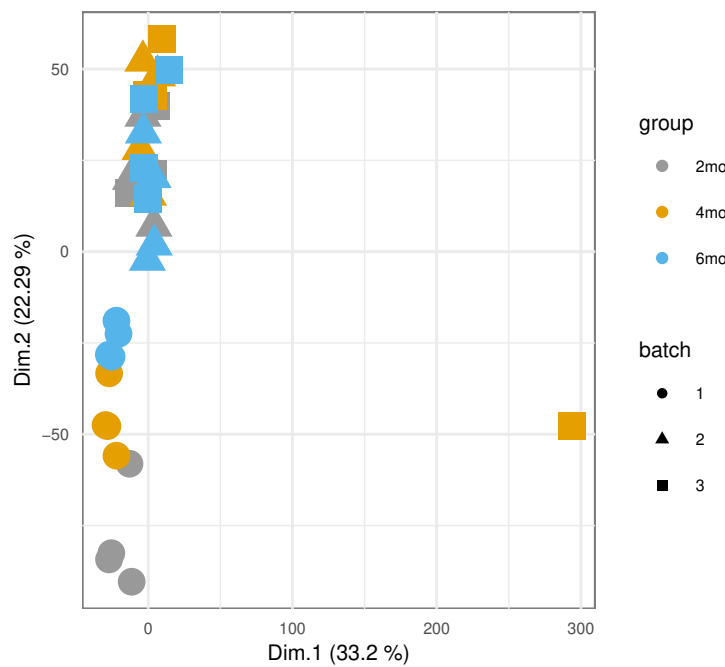DesignBias=0.52, Gamma=0.96, Dunn1=1.93, WbRatio=0.14

PCA corrected SVA all surrogate vars: GSE163857
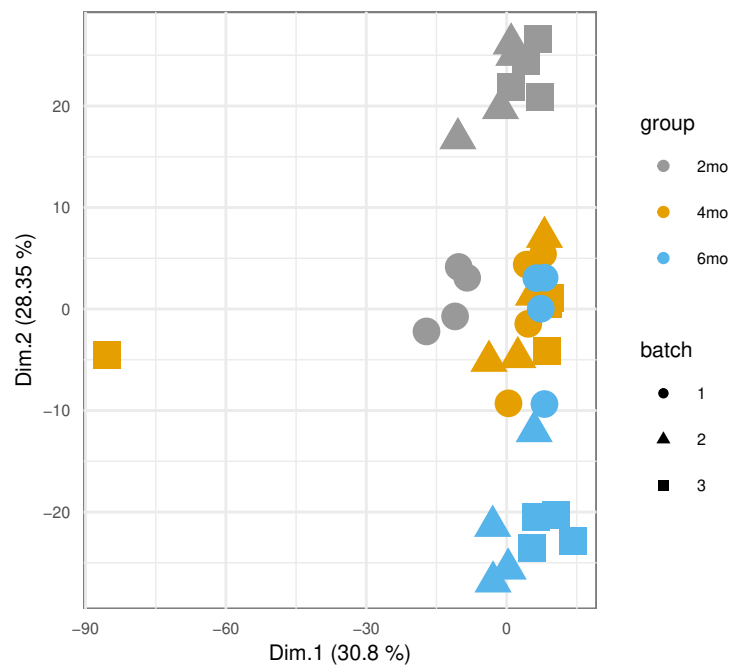DesignBias=0.52, Gamma=0.93, Dunn1=1.28, WbRatio=0.17

PCA Abundance: GSE171343
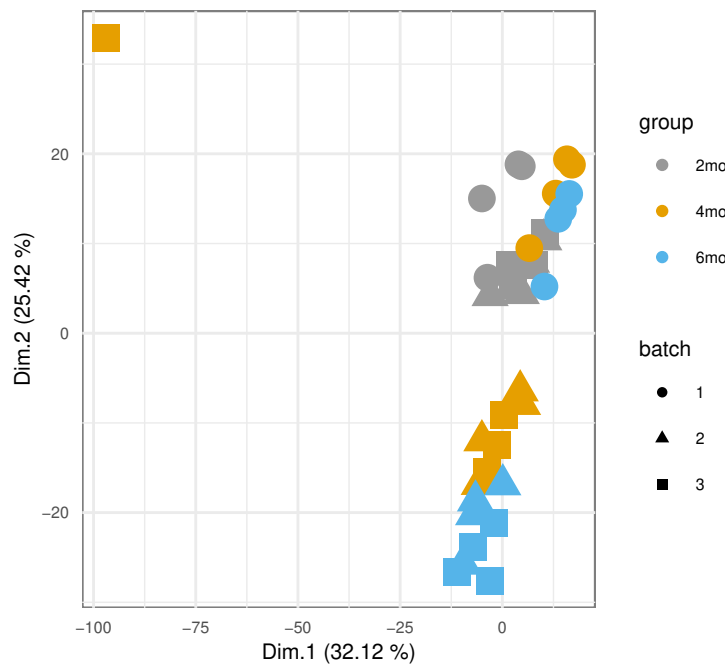DesignBias=0.49, Gamma=0.01, Dunn1=0, WbRatio=0.99, DEGs=1111

PCA corrected Batch: GSE171343
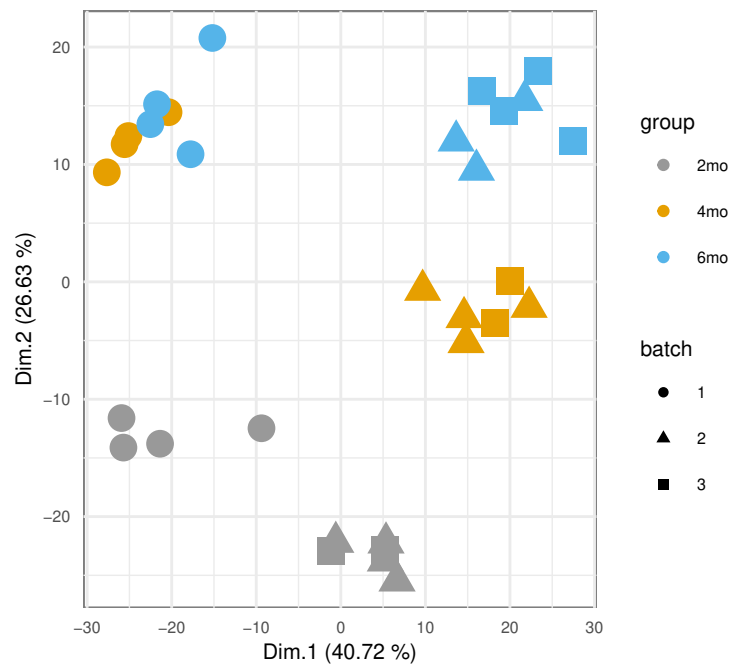DesignBias=0.49, Gamma=0.25, Dunn1=0.02, WbRatio=0.63

PCA corrected Plow: GSE171343
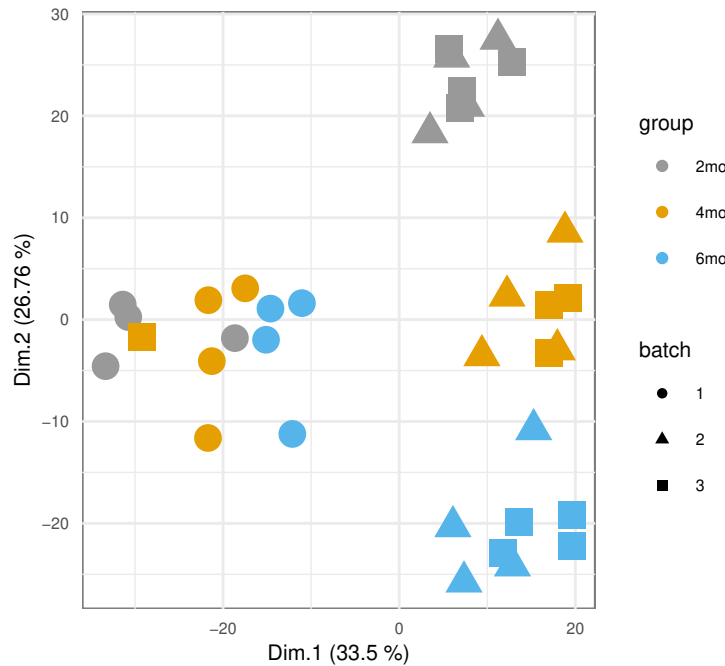DesignBias=0.49, Gamma=0.11, Dunn1=0.01, WbRatio=0.8

PCA corrected Plow and no outliers: GSE171343
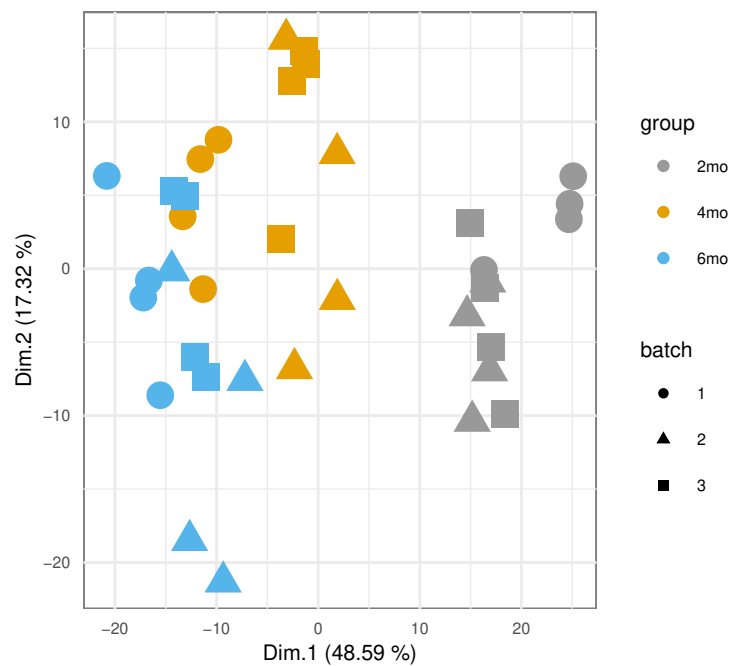DesignBias=0.49, Gamma=0.37, Dunn1=0.03, WbRatio=0.64

PCA corrected SVA V1: GSE171343
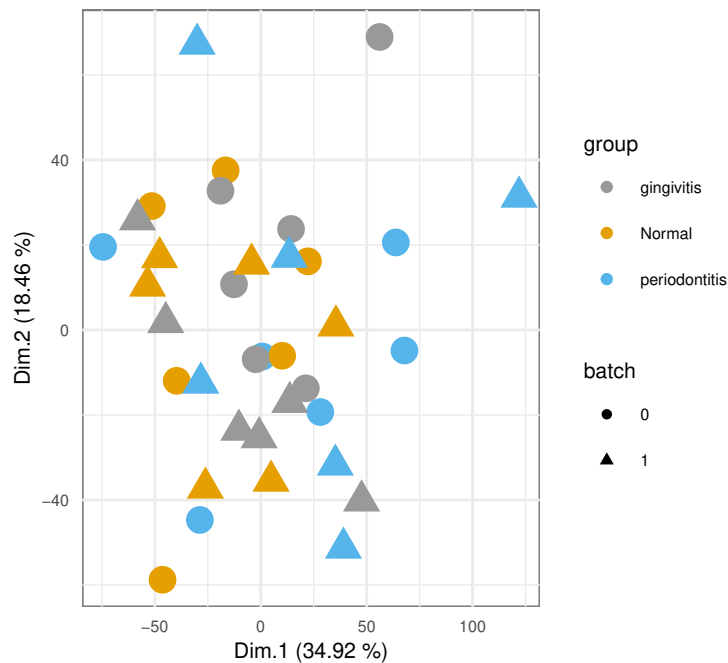DesignBias=0.49, Gamma=0.3, Dunn1=0.05, WbRatio=0.71

PCA corrected SVA all surrogate vars: GSE171343
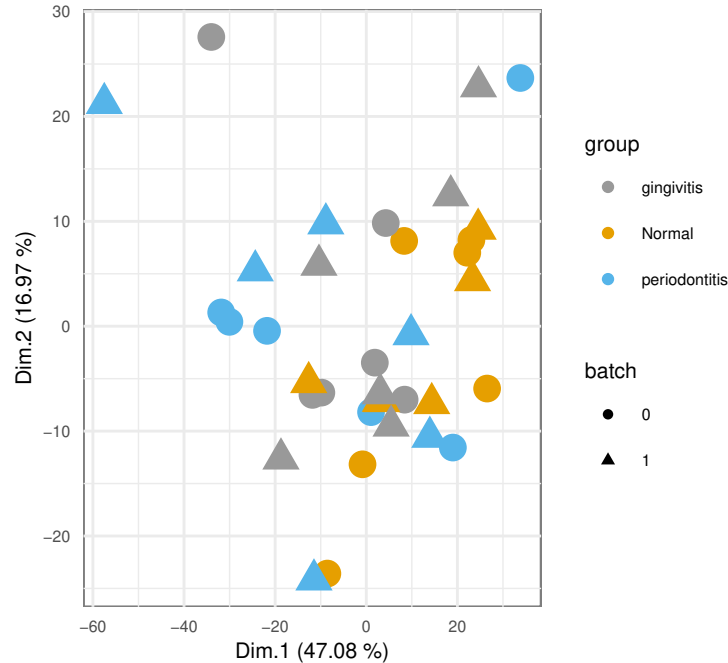DesignBias=0.49, Gamma=0.64, Dunn1=0.05, WbRatio=0.41

PCA Abundance: GSE173078
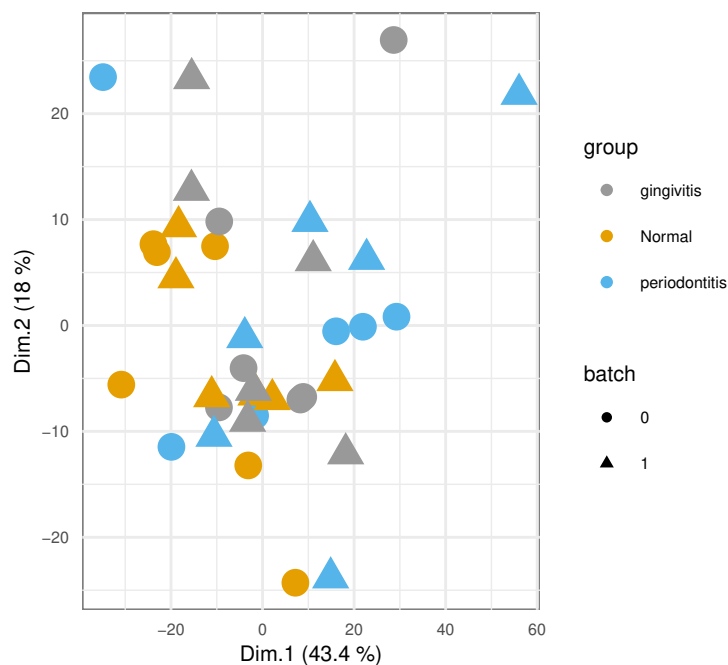DesignBias=0.48, Gamma=0.01, Dunn1=0.02, WbRatio=0.99, DEGs=100

PCA corrected Batch: GSE173078
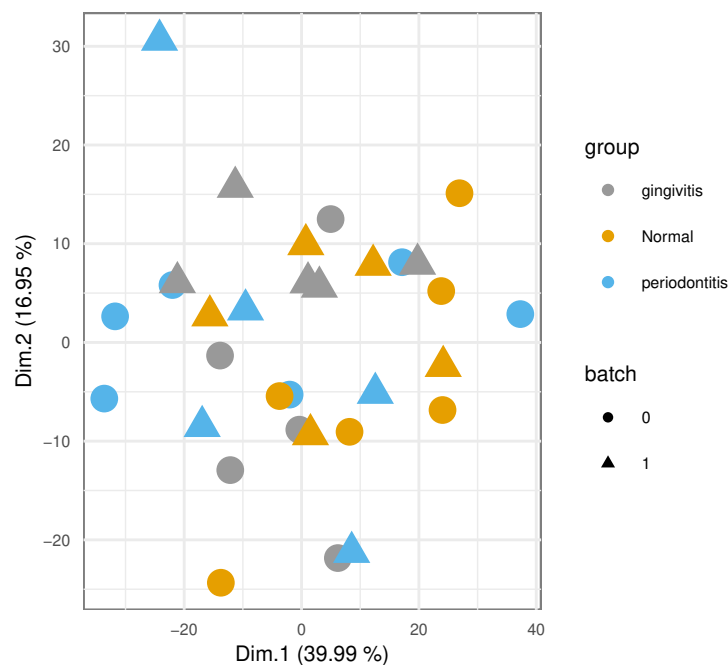DesignBias=0.48, Gamma=0.05, Dunn1=0.01, WbRatio=0.94

PCA corrected Plow: GSE173078
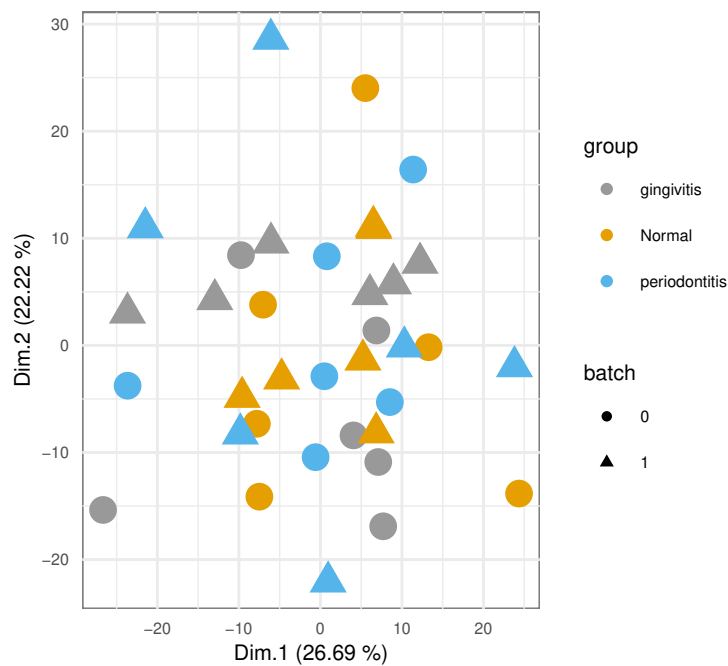DesignBias=0.48, Gamma=0.04, Dunn1=0.01, WbRatio=0.95

PCA corrected Plow and no outliers: GSE173078
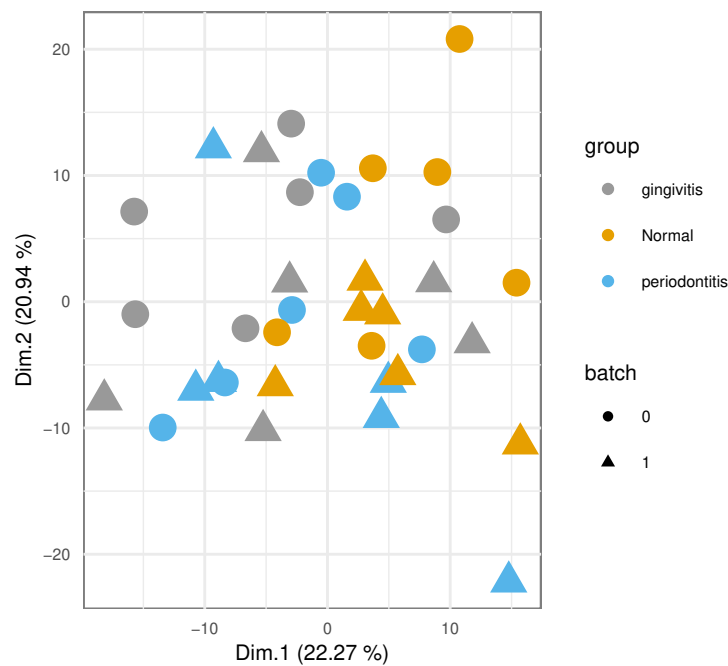DesignBias=0.48, Gamma=0.01, Dunn1=0.01, WbRatio=0.99

PCA corrected SVA V1: GSE173078
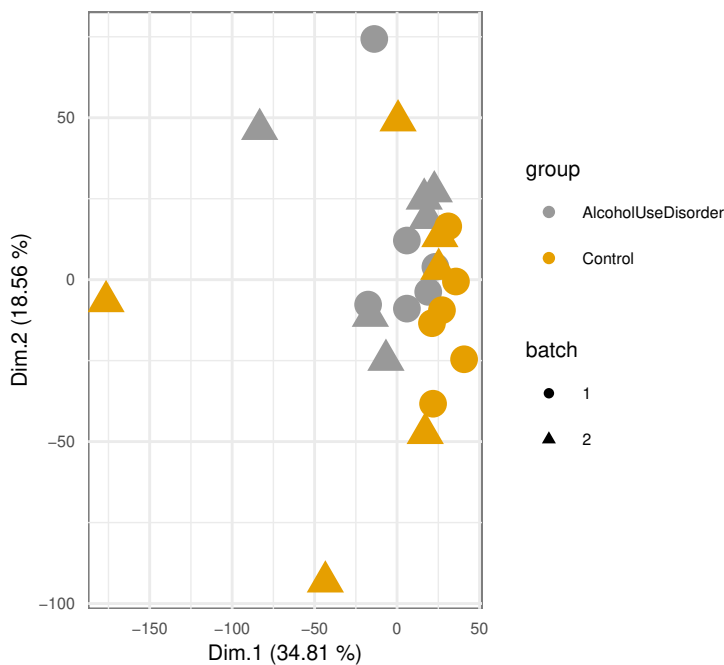DesignBias=0.48, Gamma=−0.04, Dunn1=0.04, WbRatio=1.04

PCA corrected SVA all surrogate vars: GSE173078
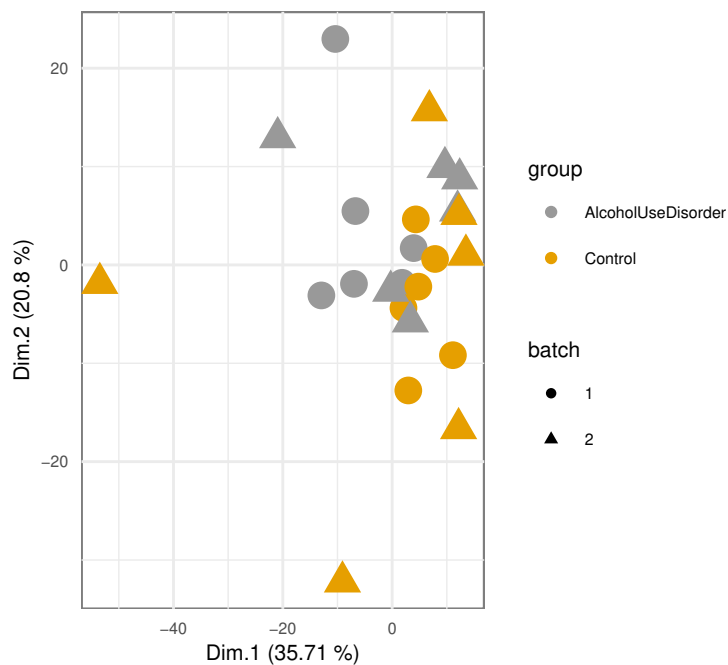DesignBias=0.48, Gamma=0.05, Dunn1=0.02, WbRatio=0.94

PCA Abundance: GSE182440
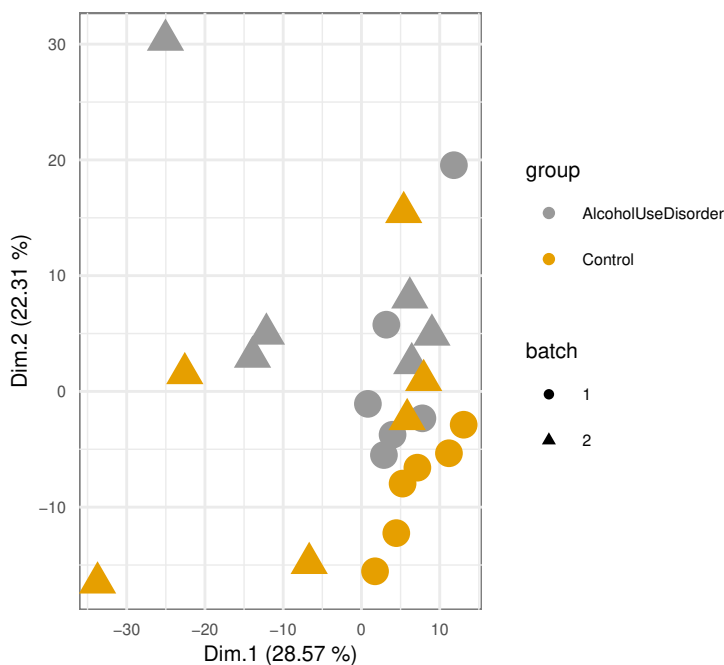DesignBias=0.49, Gamma=0.03, Dunn1=0.01, WbRatio=0.95, DEGs=3

PCA corrected Batch: GSE182440
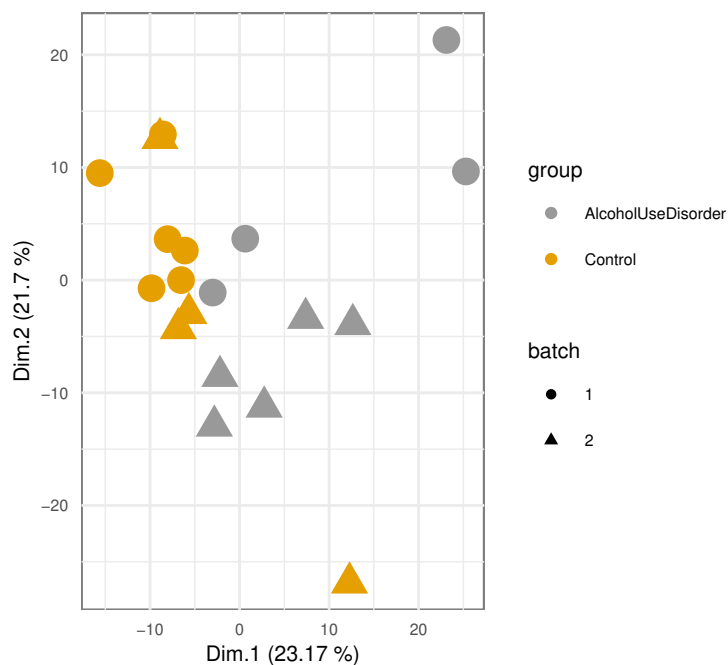DesignBias=0.49, Gamma=0.03, Dunn1=0.01, WbRatio=0.95

PCA corrected Plow: GSE182440
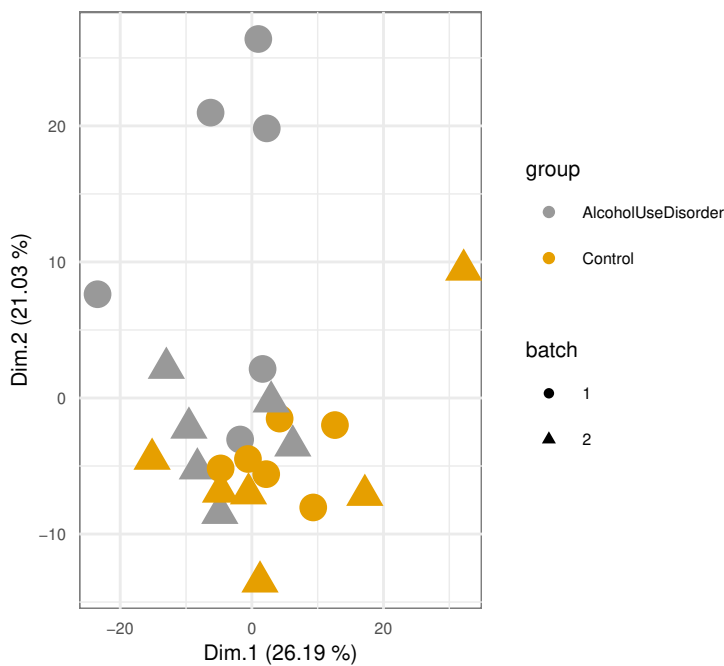DesignBias=0.49, Gamma=0.06, Dunn1=0.04, WbRatio=0.92

PCA corrected Plow and no outliers: GSE182440
DesignBias=0.49, Gamma=0.2, Dunn1=0.07, WbRatio=0.78

PCA corrected SVA V1: GSE182440
DesignBias=0.49, Gamma=0.12, Dunn1=0.03, WbRatio=0.86

PCA corrected SVA all surrogate vars: GSE182440
DesignBias=0.49, Gamma=0.04, Dunn1=0.02, WbRatio=0.96