threshhold_cluster_mean_classifier_full_pairwise

November 12, 2023

[ ]:
```
import numpy as np
import pandas as pd
import data_lib
import plot_lib
import transform_lib
import decision_lib
from sklearn import cluster

np.random.seed(200)
```

[ ]:
```
# print available data summary
_ = data_lib.explore_datasets(datafolder="../../Data",verbose=True)
print(data_lib.LABELS_LIST)
```

```
--------------------------------------------------------------------------------
--------------
-- The following 4 groups were found
-- They contain 40 datasets
-- The first printed entity is the key to the returned dictionary
-----------------------------------
Group: ../../Data/6P-positive-dilution-series-2-labelled/droplet-level-
data/RawData
po-di-se-2-A4, files: 13                po-di-se-2-C4, files: 13
po-di-se-2-A1, files: 13
po-di-se-2-B1, files: 13                po-di-se-2-D1, files: 13
po-di-se-2-B4, files: 13
po-di-se-2-C1, files: 13                po-di-se-2-D4, files: 13
-----------------------------------
Group: ../../Data/6P-positive-dilution-series-1-labelled/droplet-level-
data/RawData
po-di-se-1-D4, files: 13                po-di-se-1-A4, files: 13
po-di-se-1-A1, files: 13
po-di-se-1-D1, files: 13                po-di-se-1-B1, files: 13
po-di-se-1-C1, files: 13
po-di-se-1-B4, files: 13                po-di-se-1-C4, files: 13
-----------------------------------
Group: ../../Data/6P-positive-dilution-series-labelled/droplet-level-
data/RawData
```

```
po-di-se-B8, files: 13                  po-di-se-A8, files: 13
po-di-se-C8, files: 13
po-di-se-D8, files: 13
-----------------------------------
Group: ../../Data/6P-wastewater-samples-labelled/droplet-level-data/RawData
wa-sa-A2, files: 13                     wa-sa-B4, files: 13
wa-sa-C5, files: 13
wa-sa-C4, files: 13                     wa-sa-B3, files: 13
wa-sa-B2, files: 13
wa-sa-A5, files: 13                     wa-sa-A3, files: 13
wa-sa-C2, files: 13
wa-sa-C3, files: 13                     wa-sa-D3, files: 13
wa-sa-D4, files: 13
wa-sa-B1, files: 13                     wa-sa-A4, files: 13
wa-sa-A1, files: 13
wa-sa-D2, files: 13                     wa-sa-D5, files: 13
wa-sa-C1, files: 13
wa-sa-B5, files: 13                     wa-sa-D1, files: 13
-----------------------------------
['IAV-M_POS', 'IAV-M_NEG', 'IBV-M_POS', 'IBV-M_NEG', 'MHV_POS', 'MHV_NEG', 'RSV-
N_POS', 'RSV-N_NEG', 'SARS-N1_POS', 'SARS-N1_NEG', 'SARS-N2_POS', 'SARS-N2_NEG']
```

0.0.1 Get samples for negative control

[ ]:
```python
# compute transformation on waste water
df_wa = data_lib.load_dataset(None, [
                                    "wa-sa-A2", "wa-sa-B4",
                                    "wa-sa-C4",
                                    "wa-sa-B3",  "wa-sa-B2",
                                    "wa-sa-A5", "wa-sa-A3",
                                    "wa-sa-C2",
                                    "wa-sa-C3", # Pos
                                    "wa-sa-D3", # Zero
                                    "wa-sa-D4",
                                    "wa-sa-B1", "wa-sa-A4",
                                    "wa-sa-A1", "wa-sa-D2",
                                    "wa-sa-C5", # Pos
                                    "wa-sa-D5", # Zero
                                    "wa-sa-C1",
                                    ], datafolder="../../Data")
df_negative_control = data_lib.load_dataset([],[
                                                "wa-sa-D3",
                                                "wa-sa-D5"
                                                ], datafolder="../../Data")
df_positive_control = data_lib.load_dataset([],[
                                                "wa-sa-C3",
                                                "wa-sa-C5"
```

```
                                                ], datafolder="../../Data")
np_negative_control = df_negative_control.to_numpy()
np_positive_control = df_positive_control.to_numpy()
np_wa = df_wa.to_numpy(copy=True)[:,:6]
ZCA_whitener = transform_lib.WhitenTransformer(transform_lib.Whitenings.ZCA_COR)
NONE_whitener = transform_lib.WhitenTransformer(transform_lib.Whitenings.NONE)
```

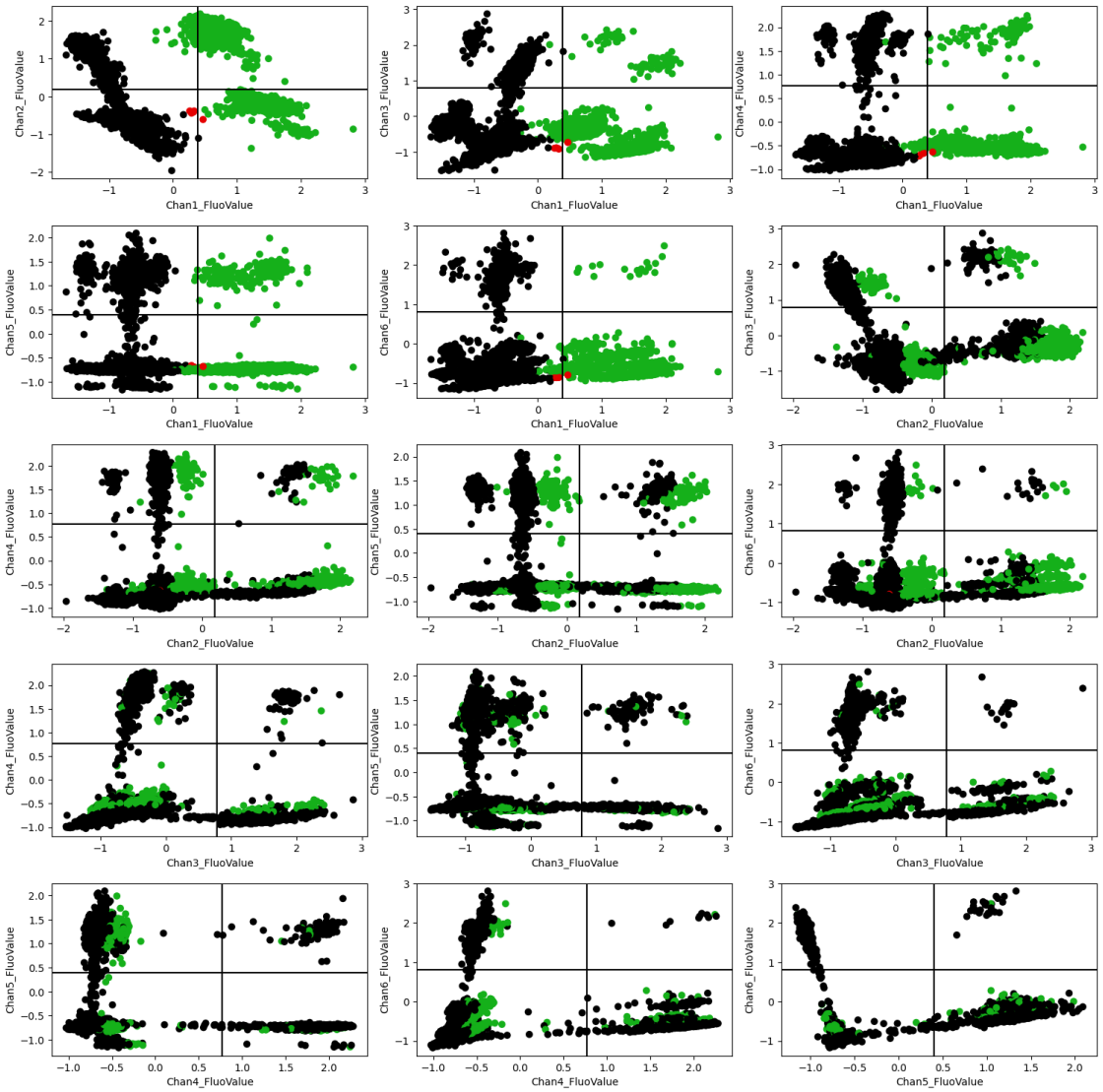
[ ]:
```
# fix clustering algorithm
cluster_engine = cluster.KMeans(n_clusters=64, n_init='auto')
zca_decitions = decision_lib.ThresholdMeanClassifier(
                                    negative_control=np_negative_control,
                                    positive_control=np_positive_control,
                                    cluster_algorithm=cluster_engine,
                                    transform_base="dynamic",
                                    whitening_transformer=ZCA_whitener,
                                    )
zca_decitions.fit(np_wa)
df_zca_preds = zca_decitions.predict(np_wa)
```

0.1 Plot the predictions

- Black = True negative prediction
- Green = True positive prediciton
- Purple = False negative
- Red = False positive

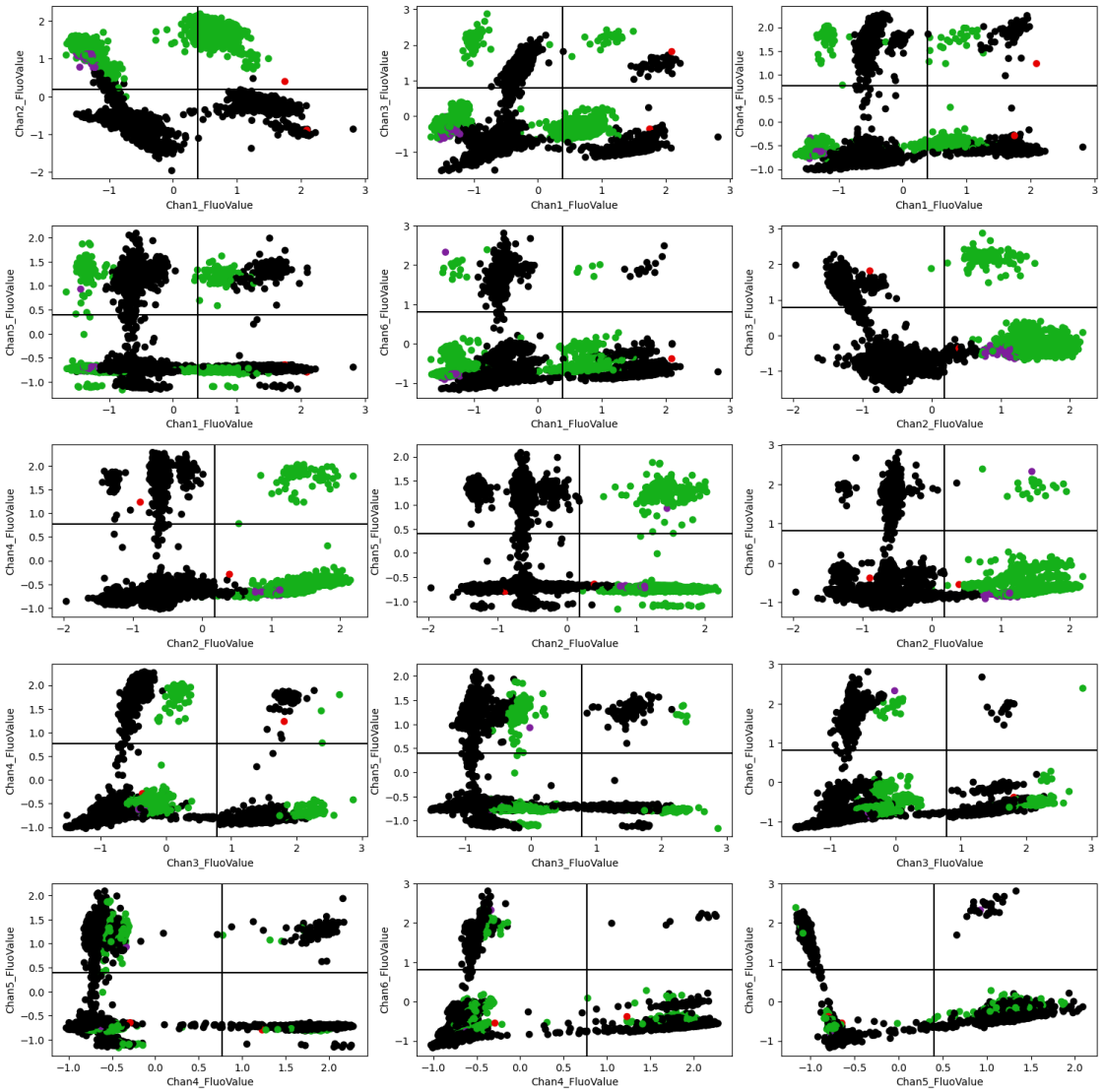
Plot SARS-N2_POS associated with channel 1

[ ]:
```
plot_lib.pairwise_plots_pred_true_thresh(pd.DataFrame(data=zca_decitions.
 ↪X_all_transformed, columns=df_wa.iloc[:,:6].columns),
                                        df_zca_preds.loc[:,"SARS-N2_POS"],
                                        df_wa.loc[:,"SARS-N2_POS"],
                                        axis_thresh=zca_decitions.
 ↪axis_threshholds)
```



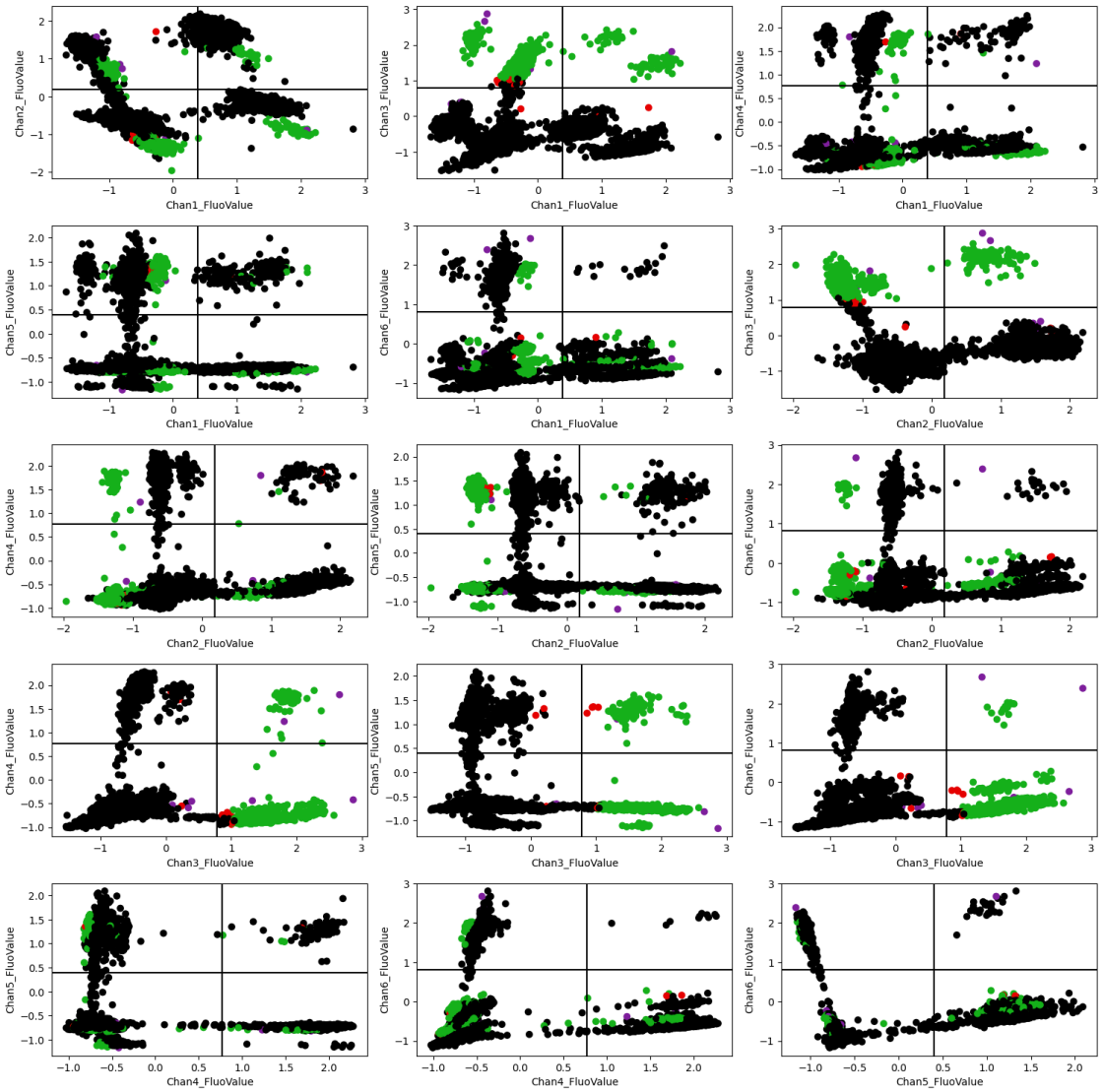
Plot SARS-N1_POS associated with cannel 2

[ ]:
```
plot_lib.pairwise_plots_pred_true_thresh(pd.DataFrame(data=zca_decitions.
↪X_all_transformed, columns=df_wa.iloc[:,:6].columns),
                                         df_zca_preds.loc[:,"SARS-N1_POS"],
                                         df_wa.loc[:,"SARS-N1_POS"],
                                         axis_thresh=zca_decitions.
↪axis_threshholds)
```



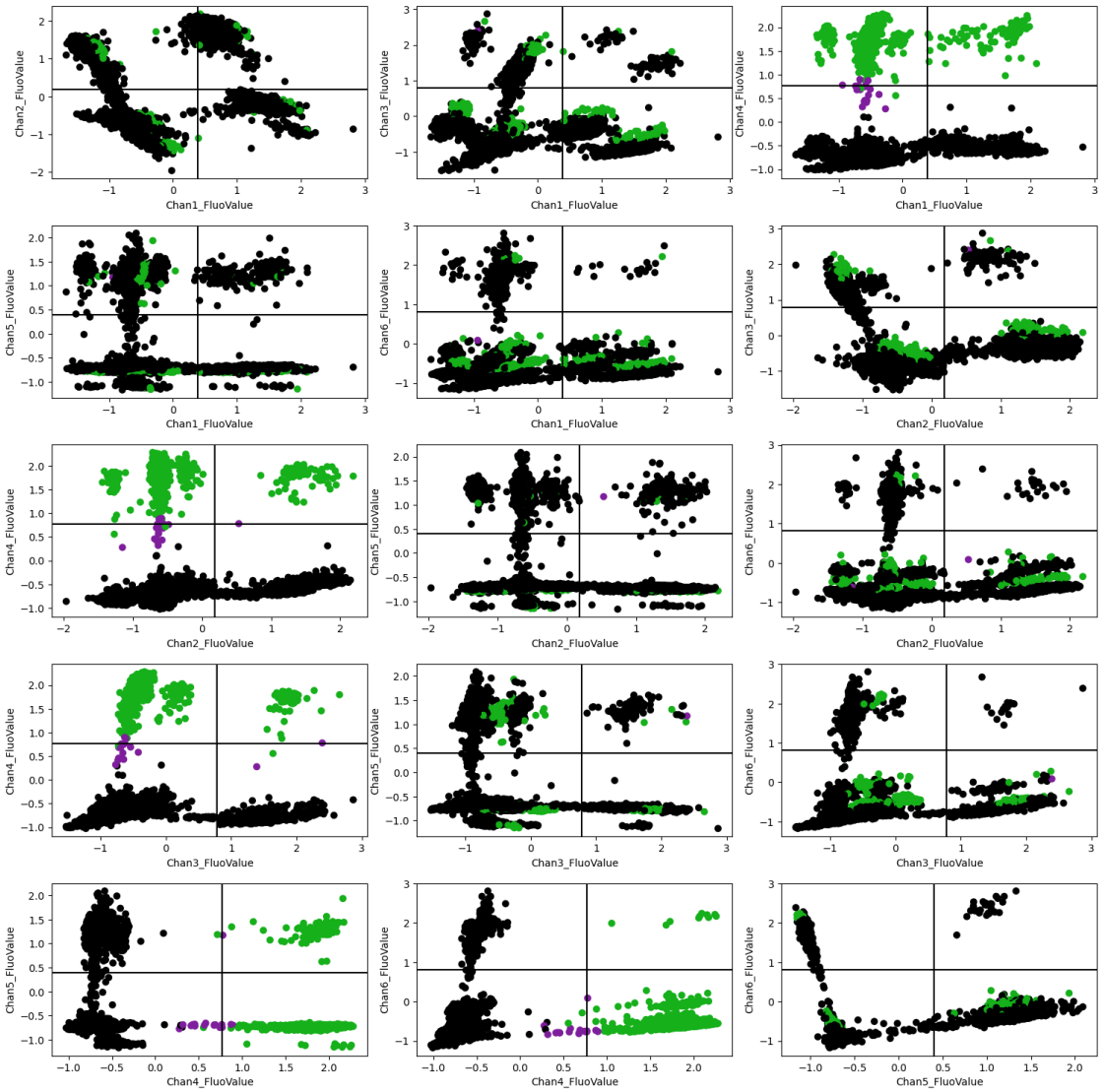
Plot IBV-M_POS associated with channel 3

[ ]:
```
plot_lib.pairwise_plots_pred_true_thresh(pd.DataFrame(data=zca_decitions.
↪X_all_transformed, columns=df_wa.iloc[:,:6].columns),
                                         df_zca_preds.loc[:,"IBV-M_POS"],
                                         df_wa.loc[:,"IBV-M_POS"],
                                         axis_thresh=zca_decitions.
↪axis_threshholds)
```



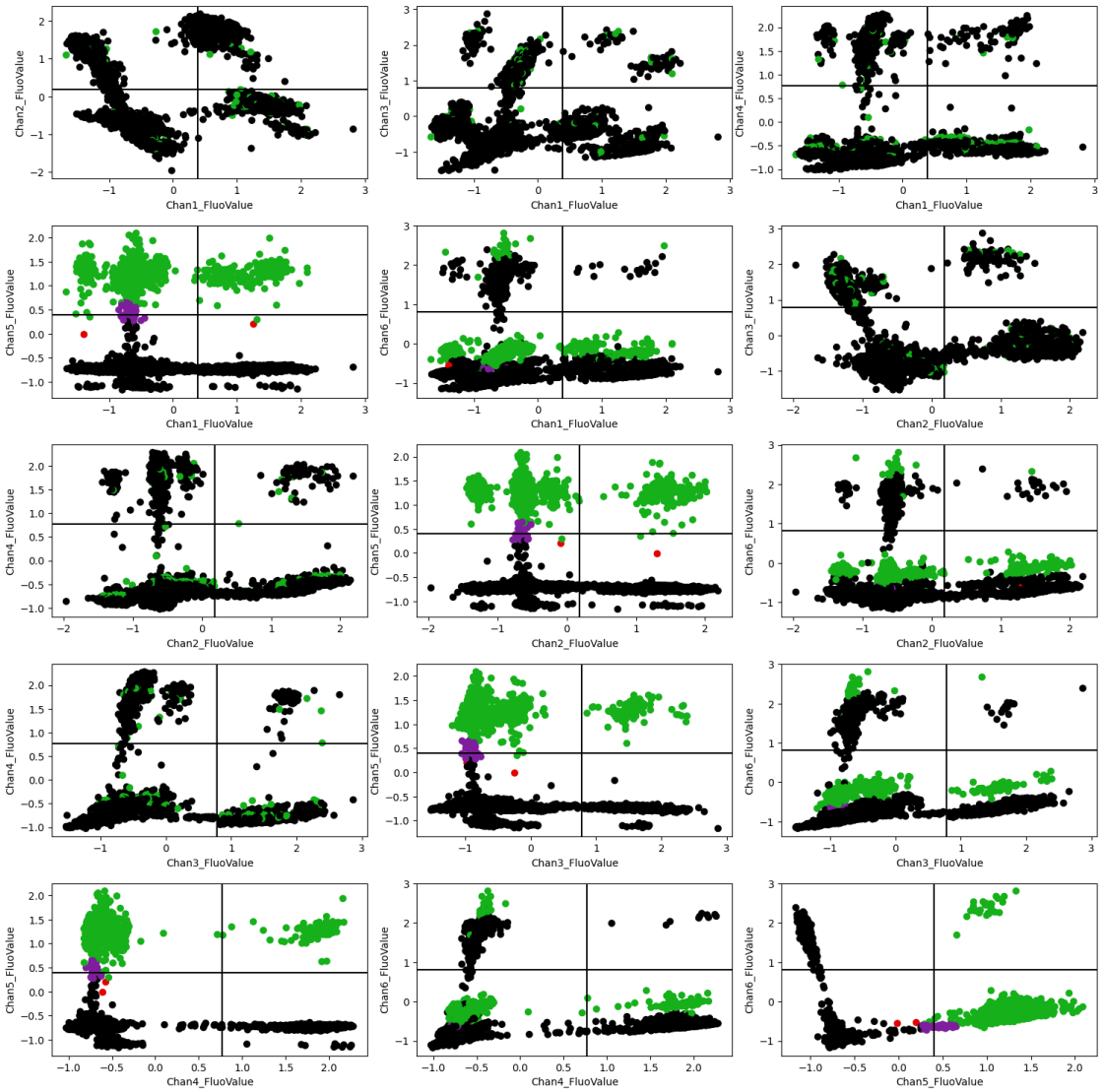
Plot RSV-N_POS associated with cannel 4

[ ]:
```
plot_lib.pairwise_plots_pred_true_thresh(pd.DataFrame(data=zca_decitions.
↪X_all_transformed, columns=df_wa.iloc[:,:6].columns),
                                         df_zca_preds.loc[:,"RSV-N_POS"],
                                         df_wa.loc[:,"RSV-N_POS"],
                                         axis_thresh=zca_decitions.
↪axis_threshholds)
```



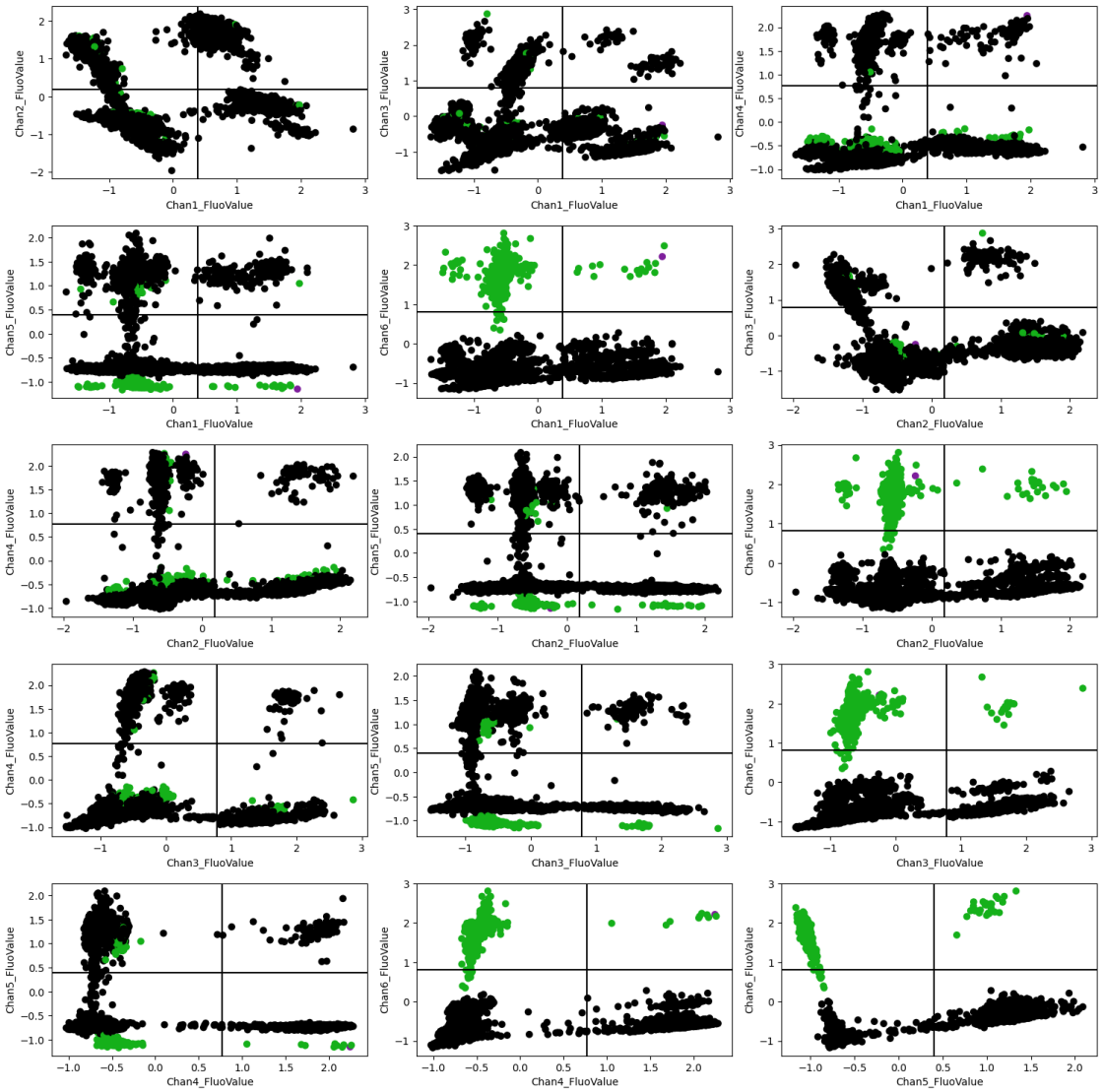
Plot IAV-M_POS associated with cannel 5

[ ]:
```
plot_lib.pairwise_plots_pred_true_thresh(pd.DataFrame(data=zca_decitions.
↪X_all_transformed, columns=df_wa.iloc[:,:6].columns),
                                         df_zca_preds.loc[:,"IAV-M_POS"],
                                         df_wa.loc[:,"IAV-M_POS"],
                                         axis_thresh=zca_decitions.
↪axis_threshholds)
```



Plot MHV_POS associated with cannel 6

[ ]:
```
plot_lib.pairwise_plots_pred_true_thresh(pd.DataFrame(data=zca_decitions.
↪X_all_transformed, columns=df_wa.iloc[:,:6].columns),
                                         df_zca_preds.loc[:,"MHV_POS"],
                                         df_wa.loc[:,"MHV_POS"],
                                         axis_thresh=zca_decitions.
↪axis_threshholds)
```


Chan2_FluoValue
Chan1_FluoValue
Chan3_FluoValue
Chan1_FluoValue
Chan4_FluoValue
Chan1_FluoValue
Chan5_FluoValue
Chan1_FluoValue
Chan6_FluoValue
Chan1_FluoValue
Chan3_FluoValue
Chan2_FluoValue
Chan4_FluoValue
Chan2_FluoValue
Chan5_FluoValue
Chan2_FluoValue
Chan6_FluoValue
Chan2_FluoValue
Chan4_FluoValue
Chan3_FluoValue
Chan5_FluoValue
Chan3_FluoValue
Chan6_FluoValue
Chan3_FluoValue
Chan5_FluoValue
Chan4_FluoValue
Chan6_FluoValue
Chan4_FluoValue
Chan6_FluoValue
Chan5_FluoValue