Sicrit technology

Applications for Novel SICRIT®-MS Analysis of Breath

SICRIT® - Background

Why Breath Analysis?

Non-Invasive, Personalized Breath Profiling, Real-Time Analysis, Early Clinal Detection

Problems

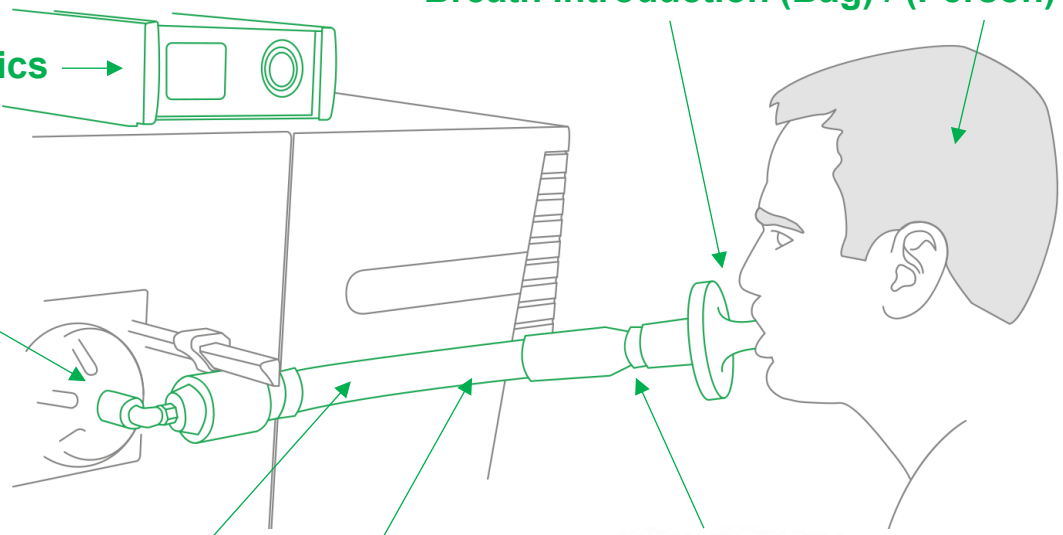
Complex Data, Sensitivity and Specificity, Interference, Reproducibility

How do we exploit the advantages while minimizing the disadvantages?

DBDI(SICRIT®)-LCMSMS
+ Data Analysis Pipeline

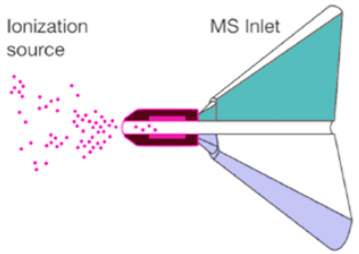
- Handle Complex Data Sets
- Complete Metabolite Ionizability (Sensitive)
- Low Matrix Effect

Breath Introduction (Bag) / (Person)



SICRIT® Ion Source

- DBDI (Dielectric Barrier Discharge)
- Three mechanisms of ionization, allowing broad ionization

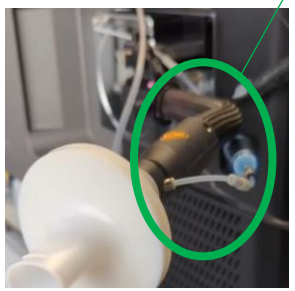


Heated Transfer Line

Prevents condensation

Check Valve

Safety mechanism to avoid contamination and carry over



Charcoal Filter

Prevents additional contamination and suppression effects

Targeted Breath Analysis “Quick Result Summary”

Untargeted Breath Analysis

Application 1	Application 2	Application 3
Targeted Metabolism of Pharmaceutical Degradation (Revlar)	Untargeted Metabolic Profiling with Integrated Statistical Pipeline	Untargeted Clinical Classifying (Covid vs. Non-Covid) Utililizing Automated Machine Learning Pipeline

Breath Applications

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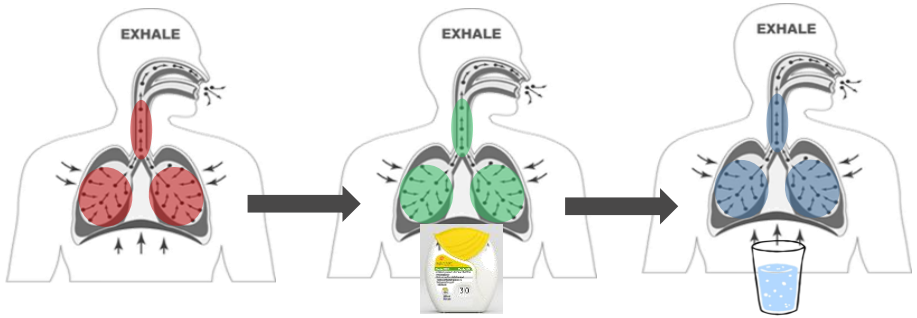
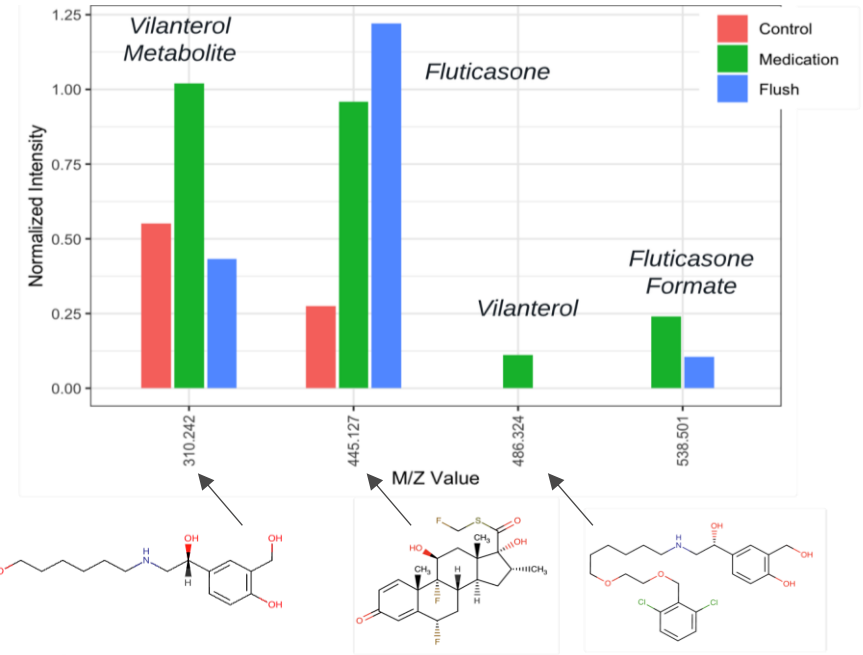
SICRIT®-HRMS for Targeted Exposomic-Metabolomic Research through Direct Respiratory





With breath analysis there is a built-in separation of some metabolites

- Spatial and Temporal separation from mouth to lung
- This allows us to conduct dynamic pharmaceutical studies

A targeted metabolite study was conducted to observe the breath (mouth to lung) metabolism of a medication in real time

- Revlar – COPD and Asthma medication

Here, we are able to track the different active components and associated metabolites

- Control – Measurement before medicine intake
- Medication – Measurement right after medication introduction
- Flush – Measurement after swishing and drinking water

We are able to successfully identify the targeted compounds

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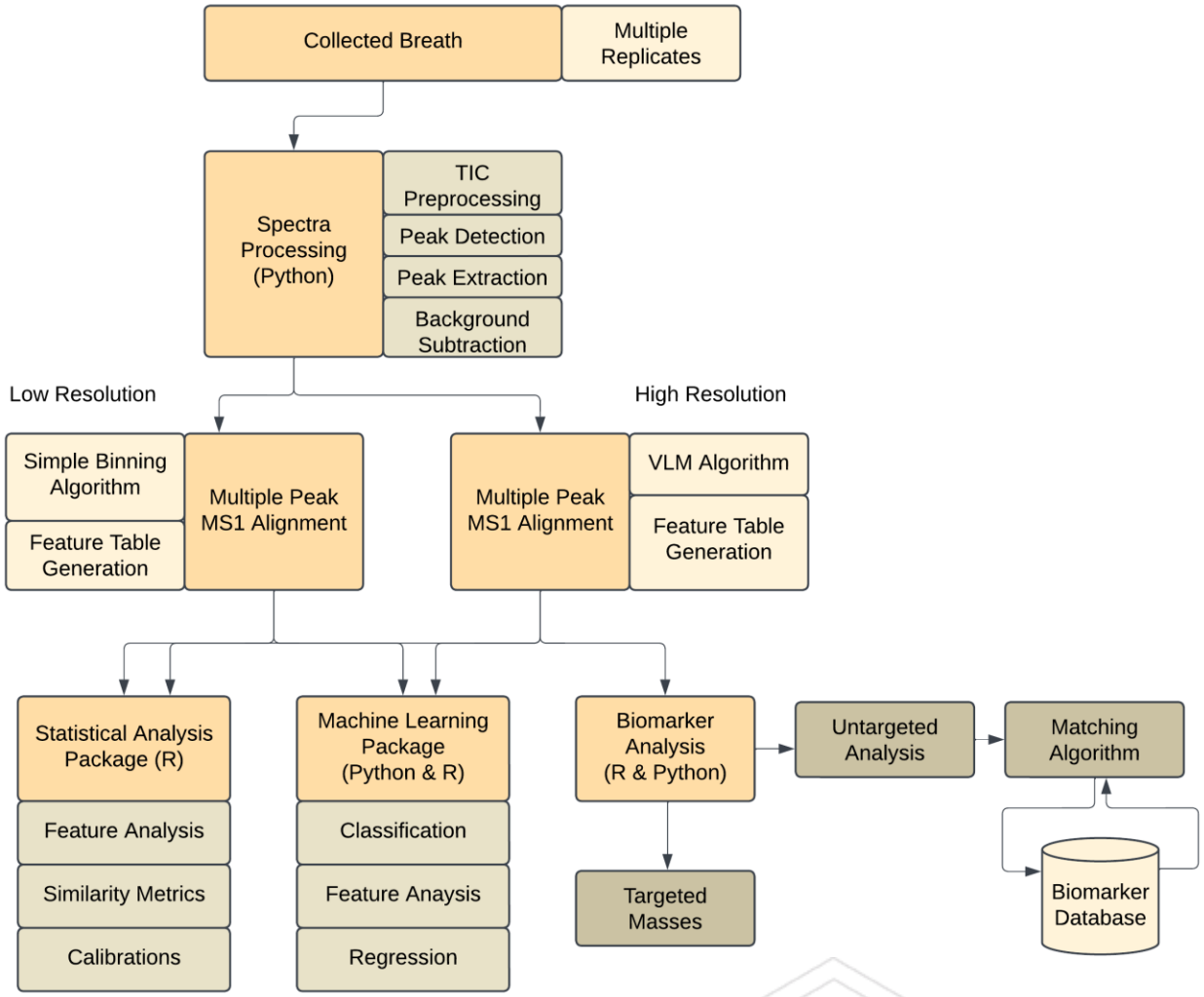

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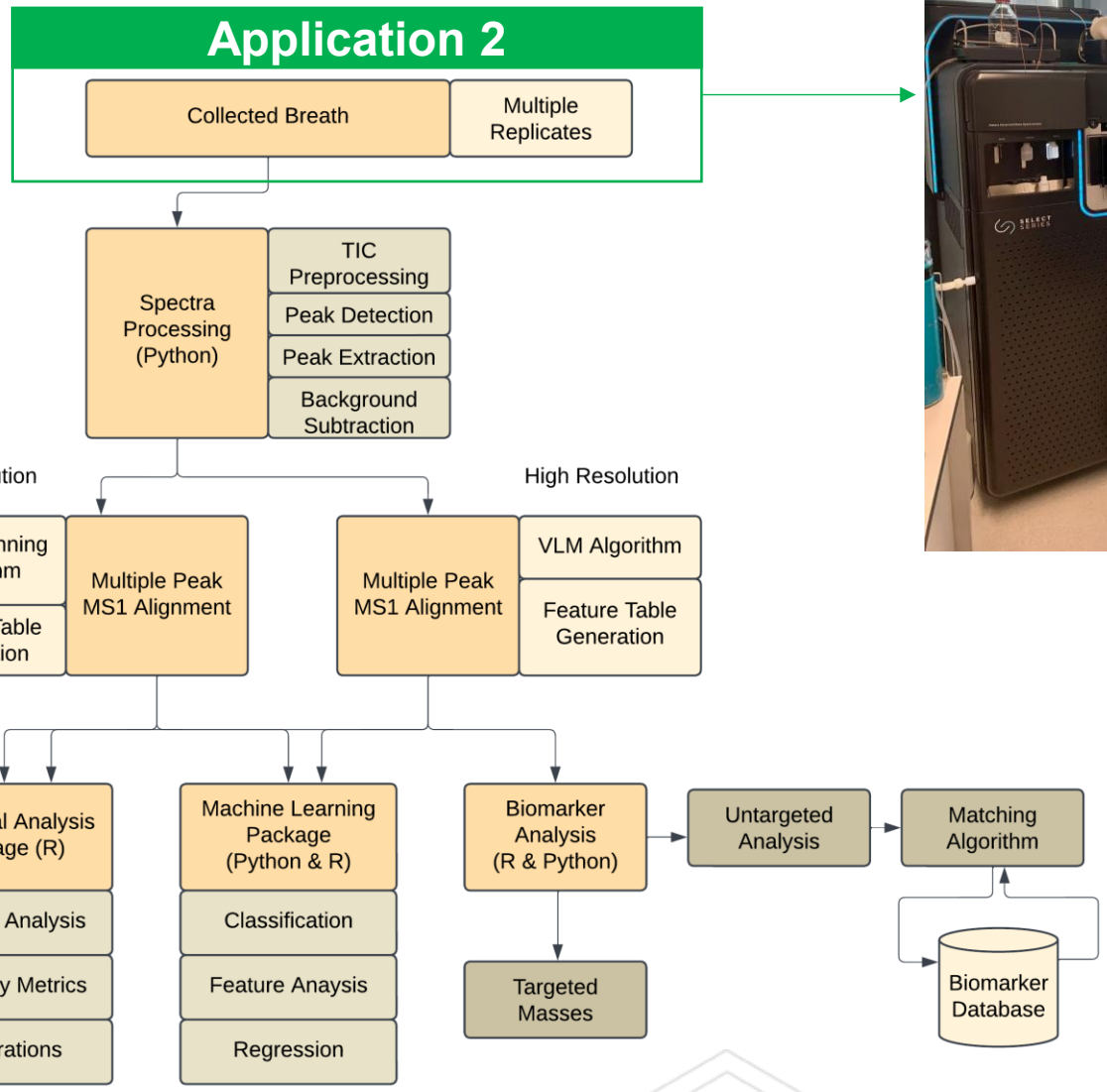

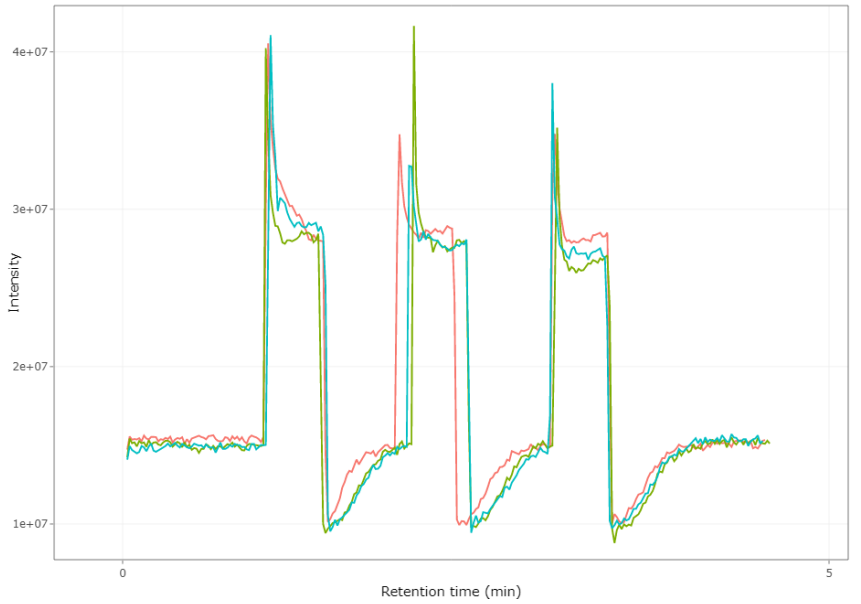

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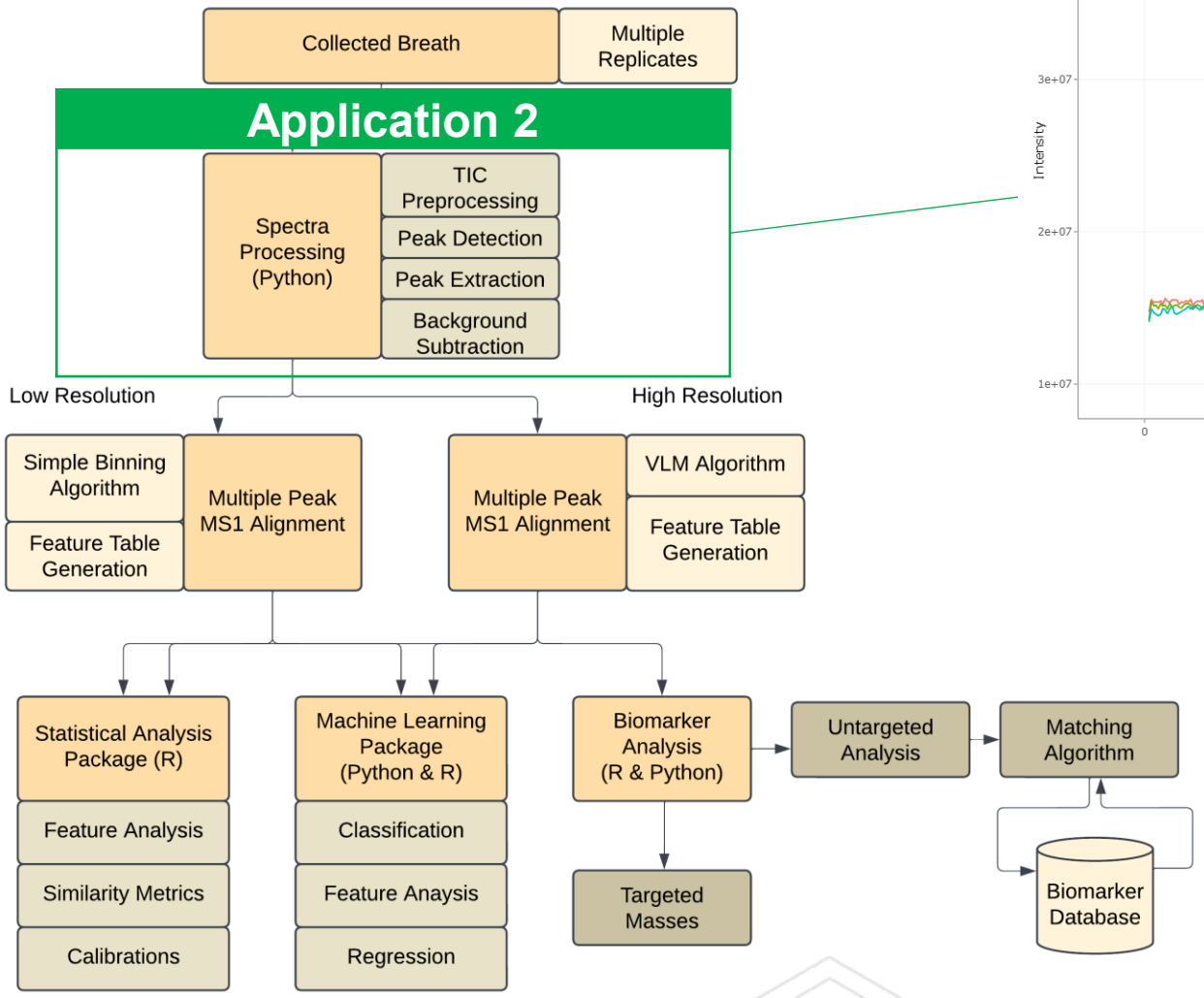

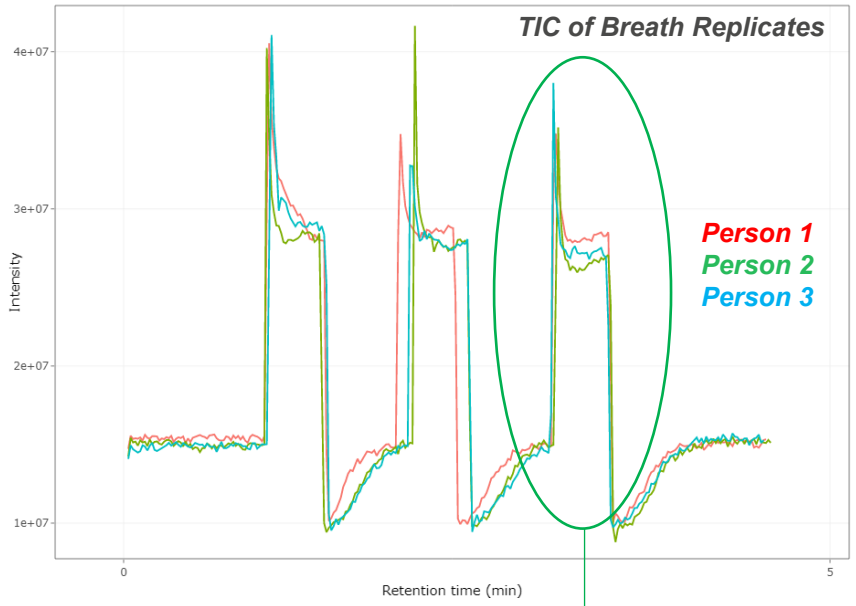

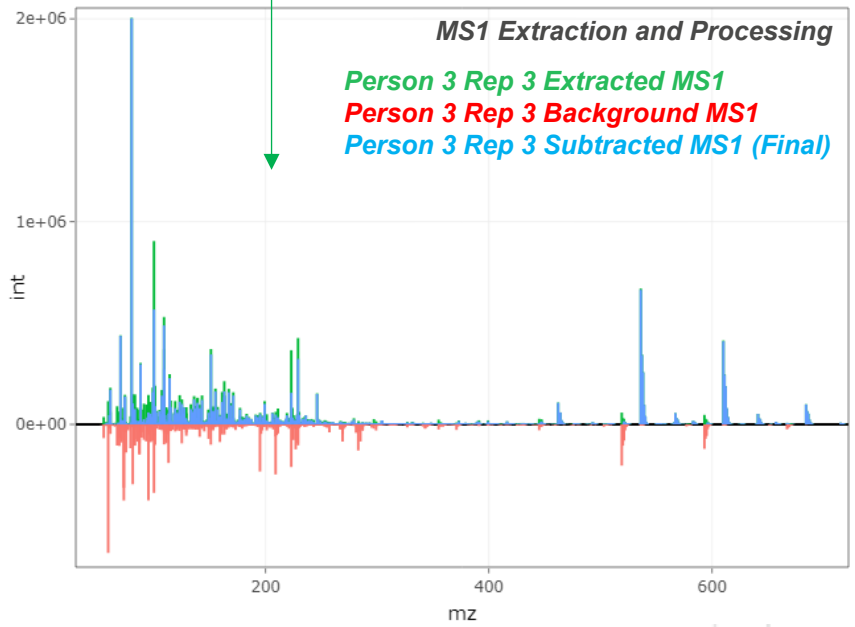

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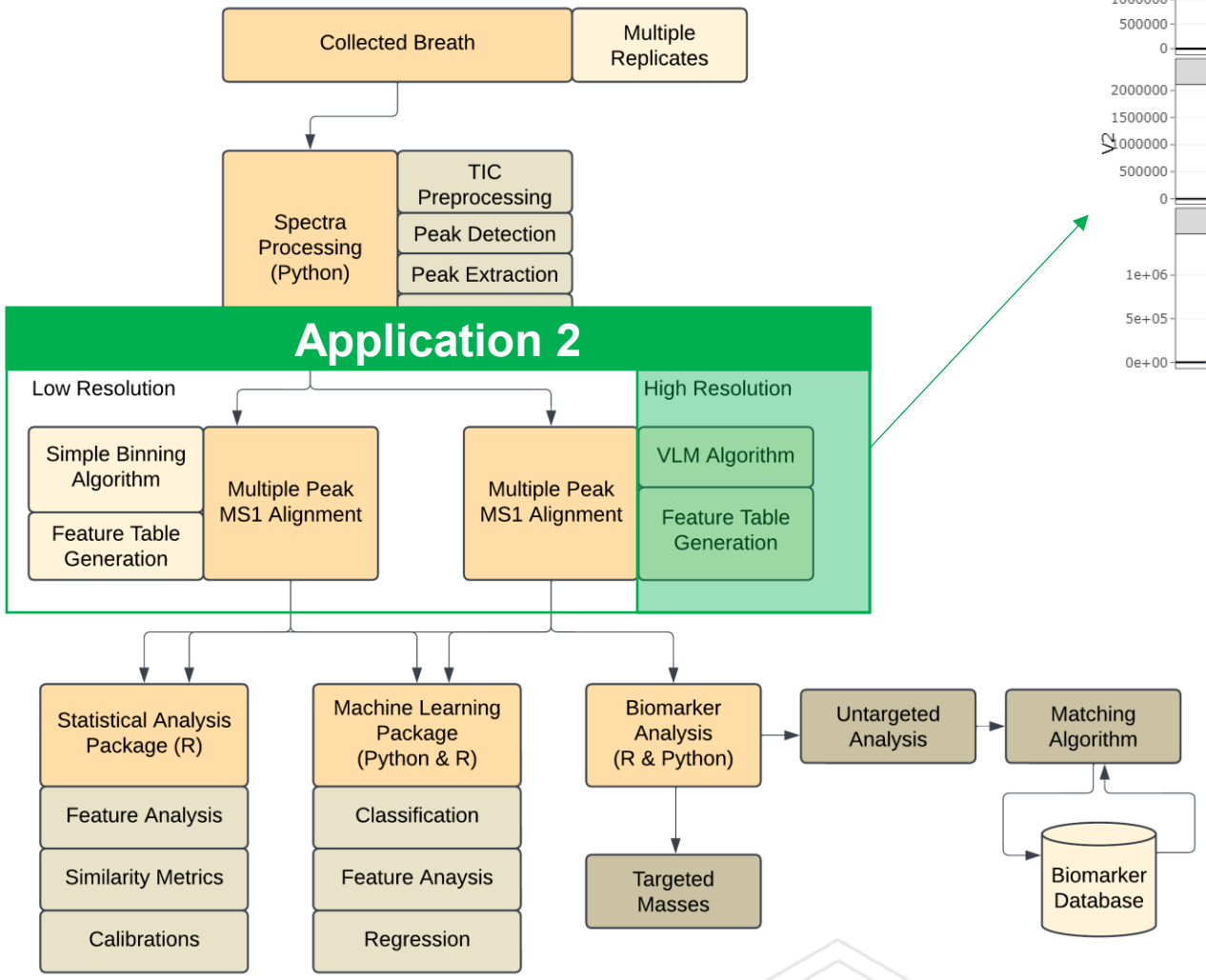
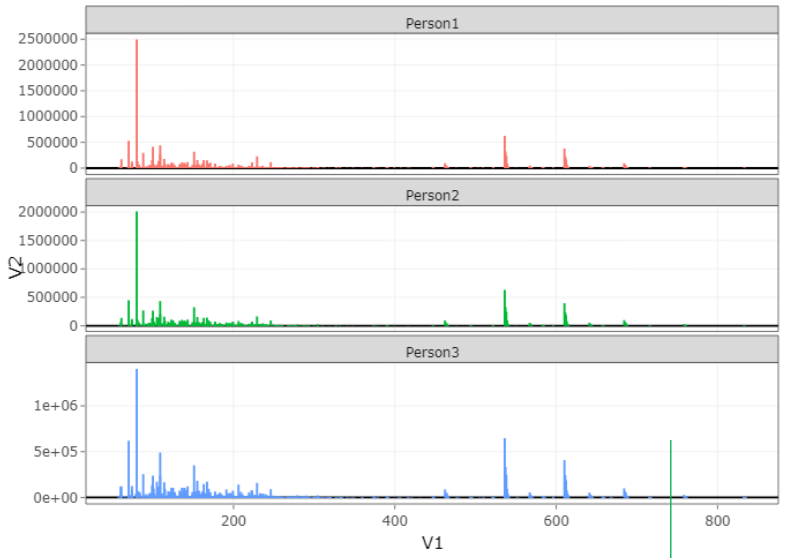
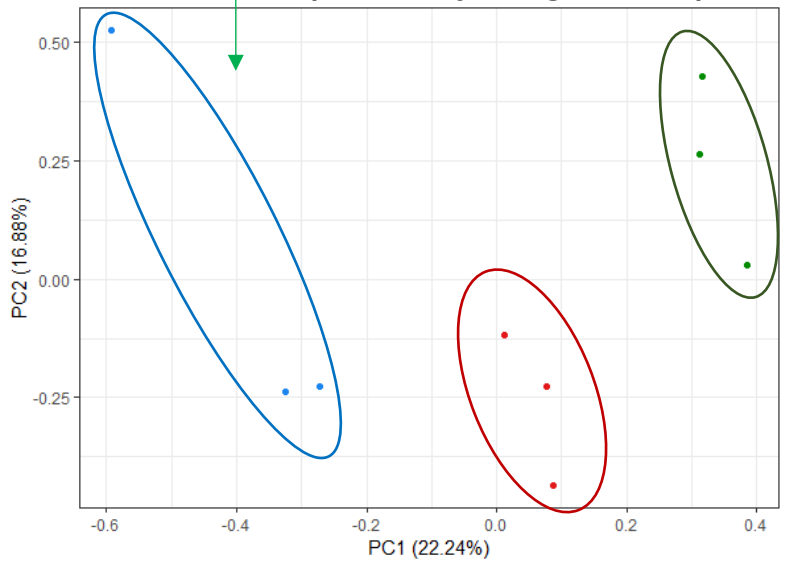


Aligned MS1 Spectra



Reproducibility of Aligned MS1 Spectra



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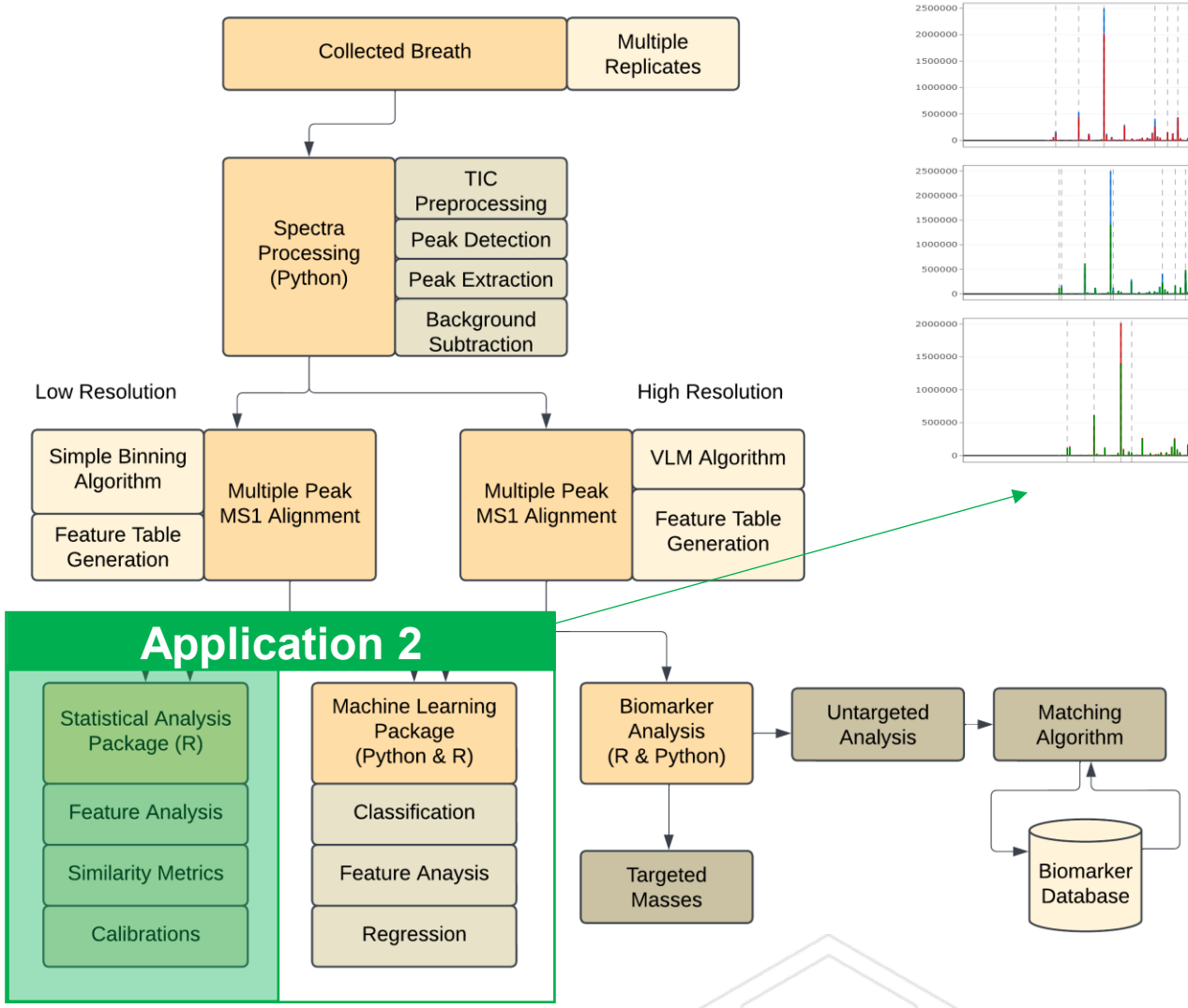
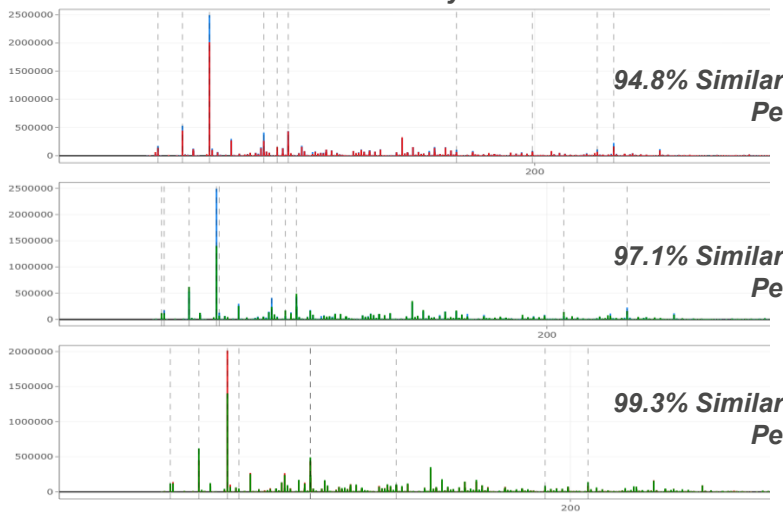


Similarity Metrics Between Individuals

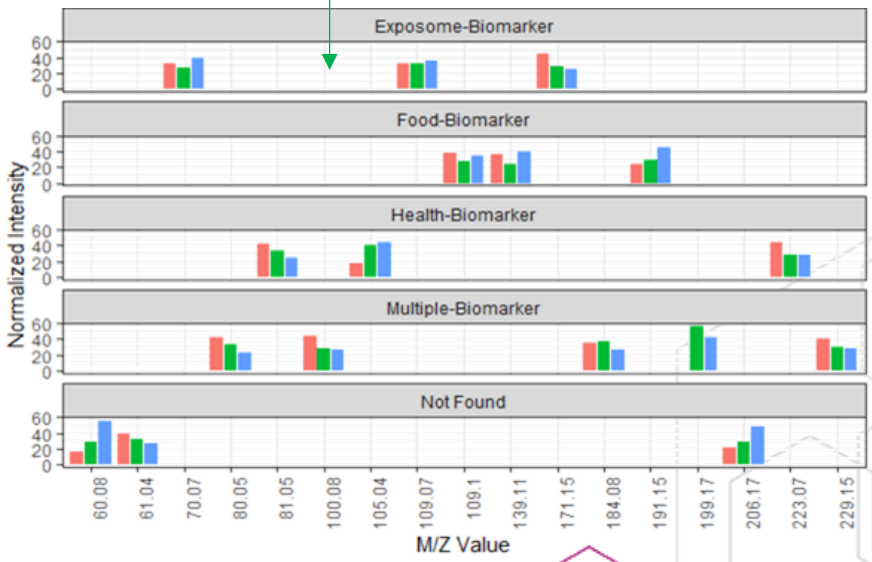


94.8% Similarity – Person 1 vs. Person 3

97.1% Similarity – Person 2 vs. Person 3

99.3% Similarity – Person 1 vs. Person 2

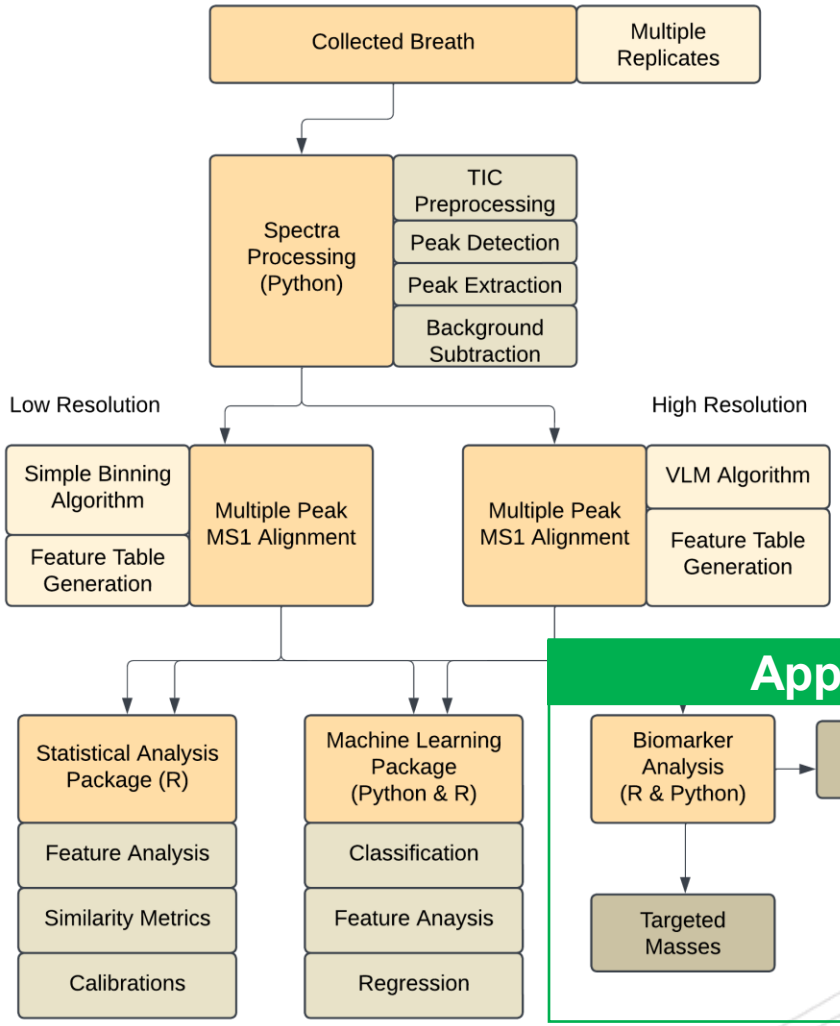
Top Classified Features of Most Significance



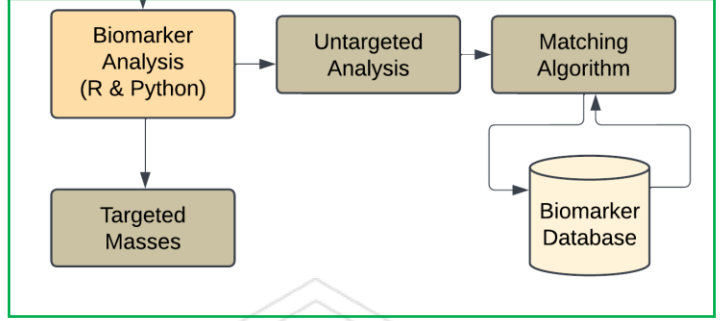
Person 1
Person 2
Person 3

Plasmion
simple smart sensitive

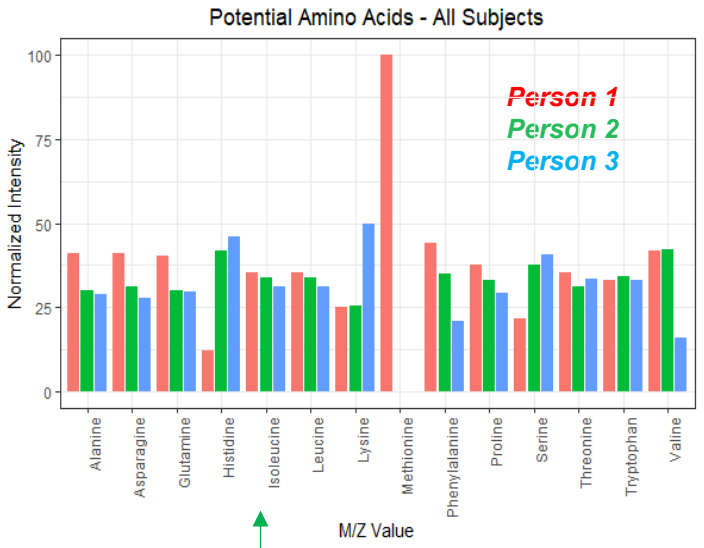
Workflow – General Analysis

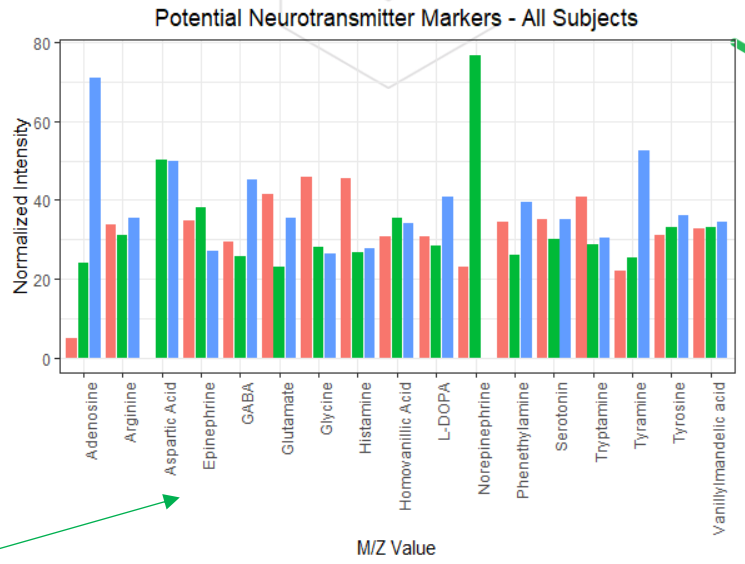


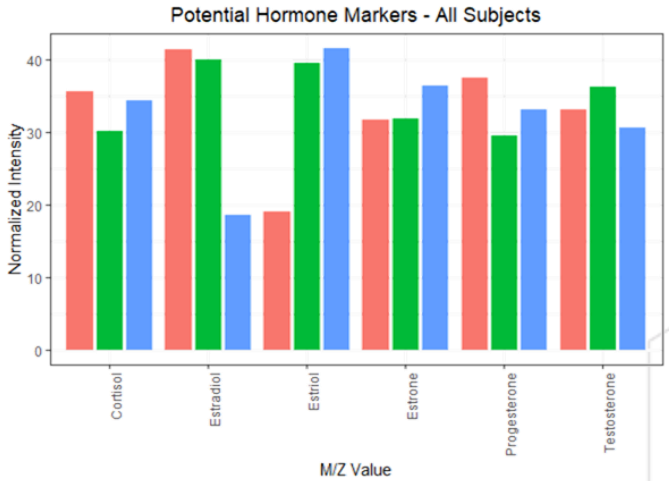
Application 2



Tentative Biomarker Detection







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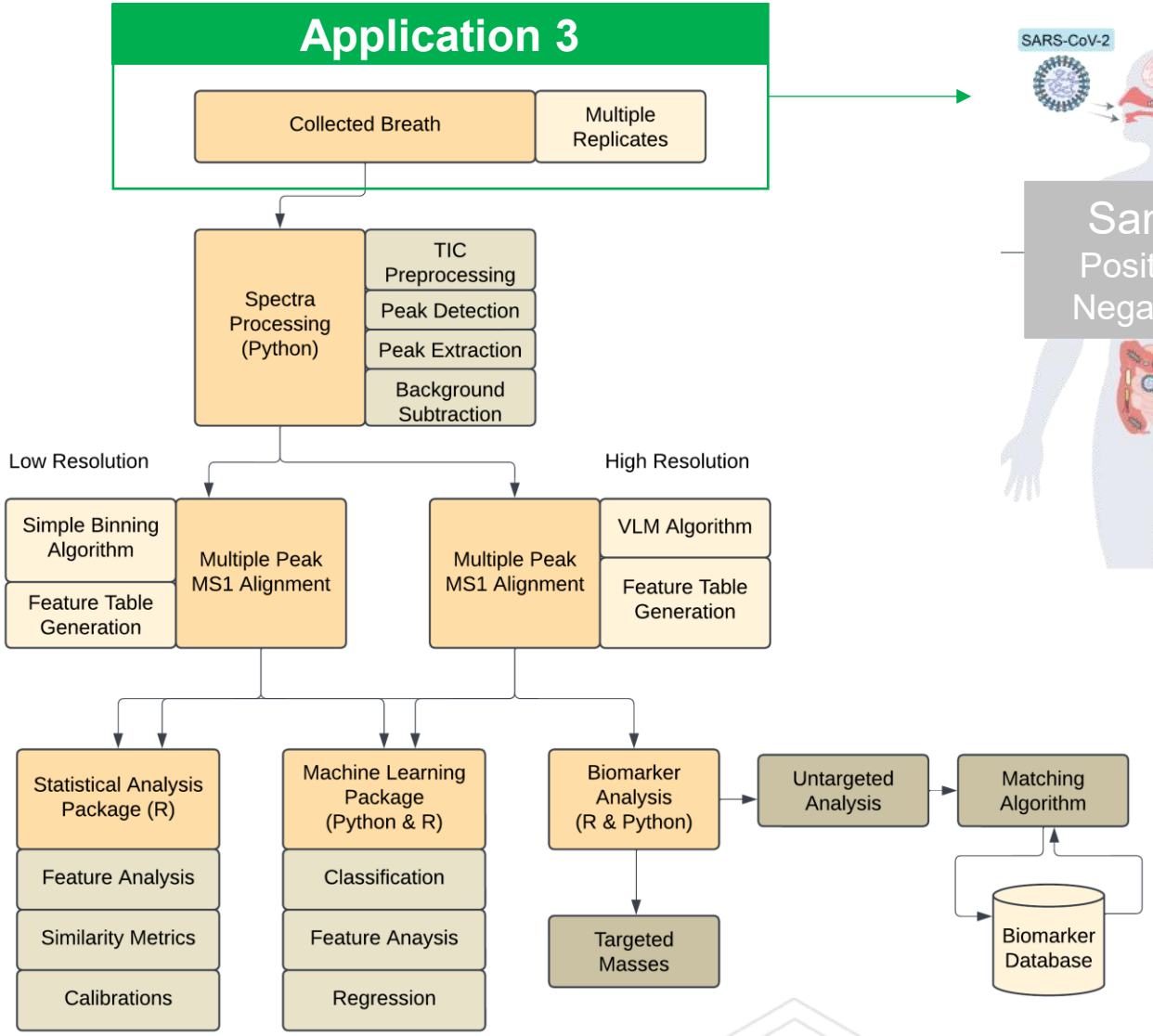
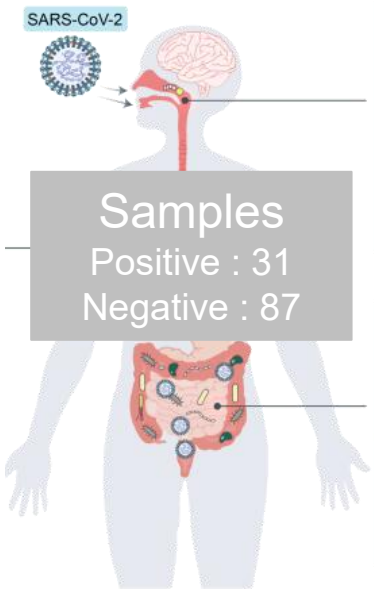




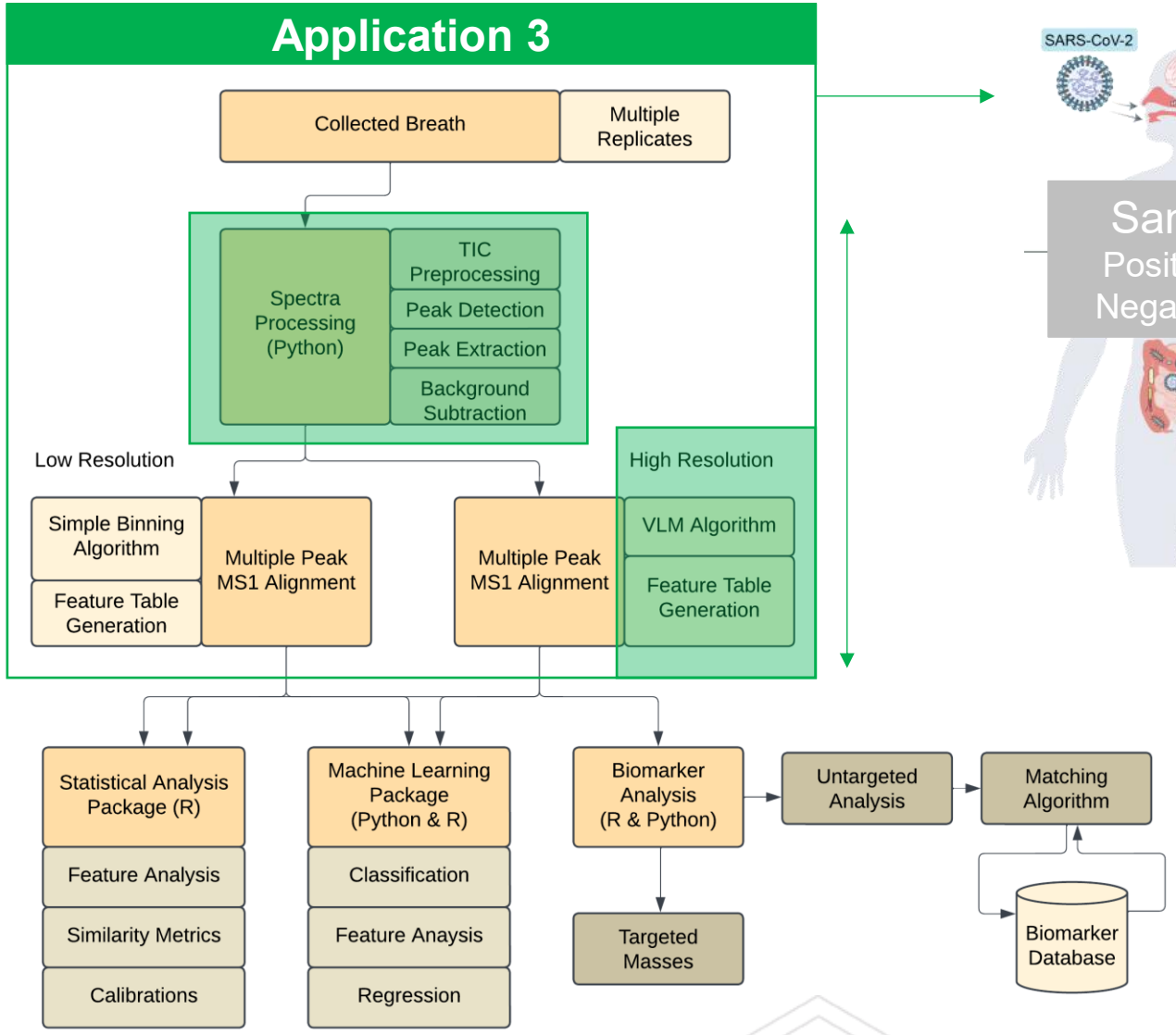
In a collaboration with LMU, breath was collected in plastic bags from two locations (Testing Center & Hospital) of both positive and negative COVID patients (PCR Testing)

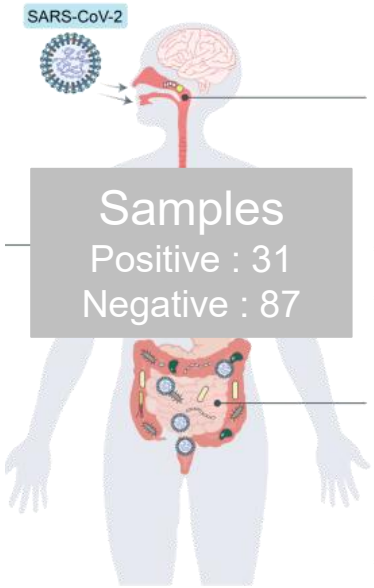
These bags were measured using a SCIEX 4600 to obtain breath profiles for both healthy and ill patients

Study focused on the features that classify positive vs. negative COVID patients

Workflow – General Analysis

Application 3





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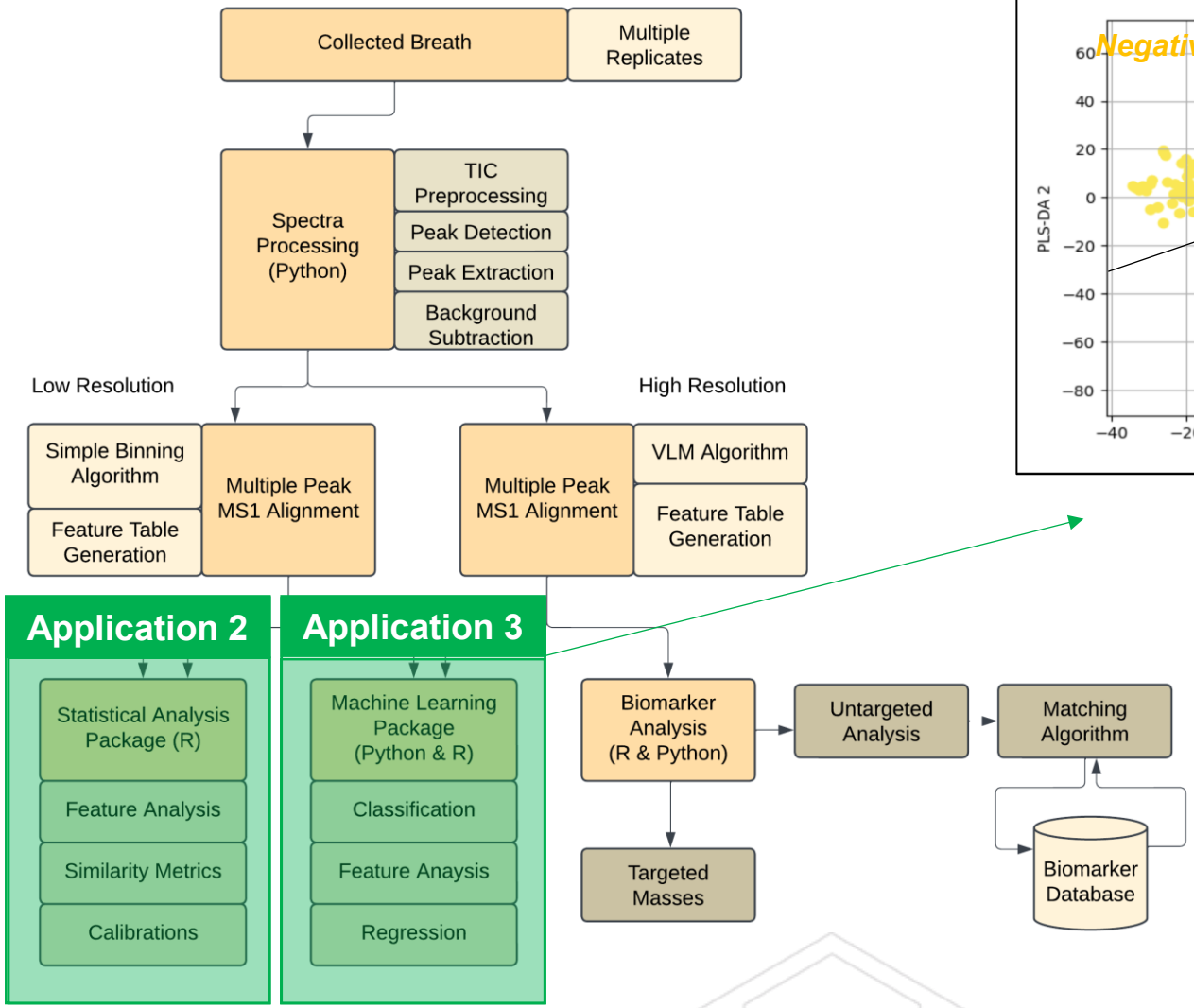
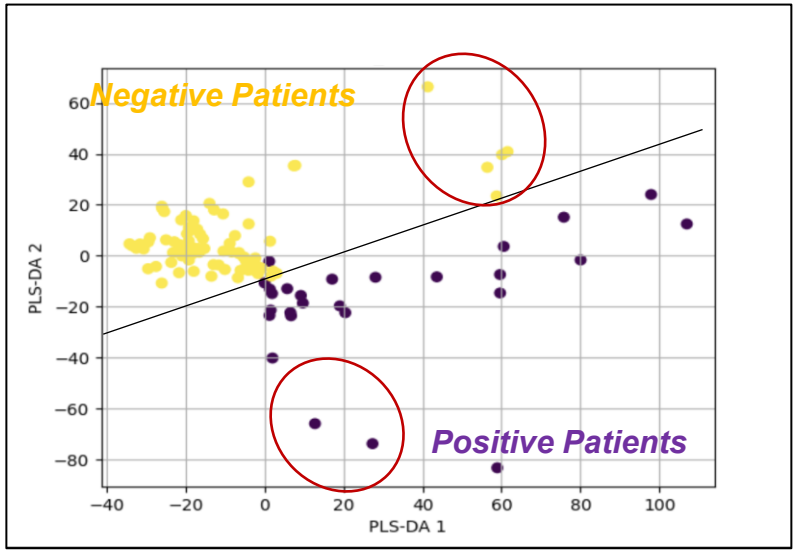


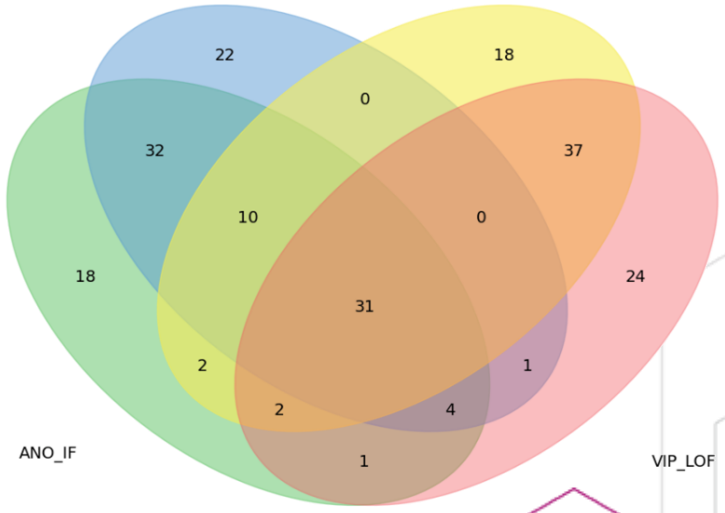
PLSDA of Labelled COVID Patients



Percentage of Correlated Features with Outlier Detection

	All_Samples
Including Outliers	86%
ISO	68%
LOF	71%

Venn Diagram of Common Significant Features



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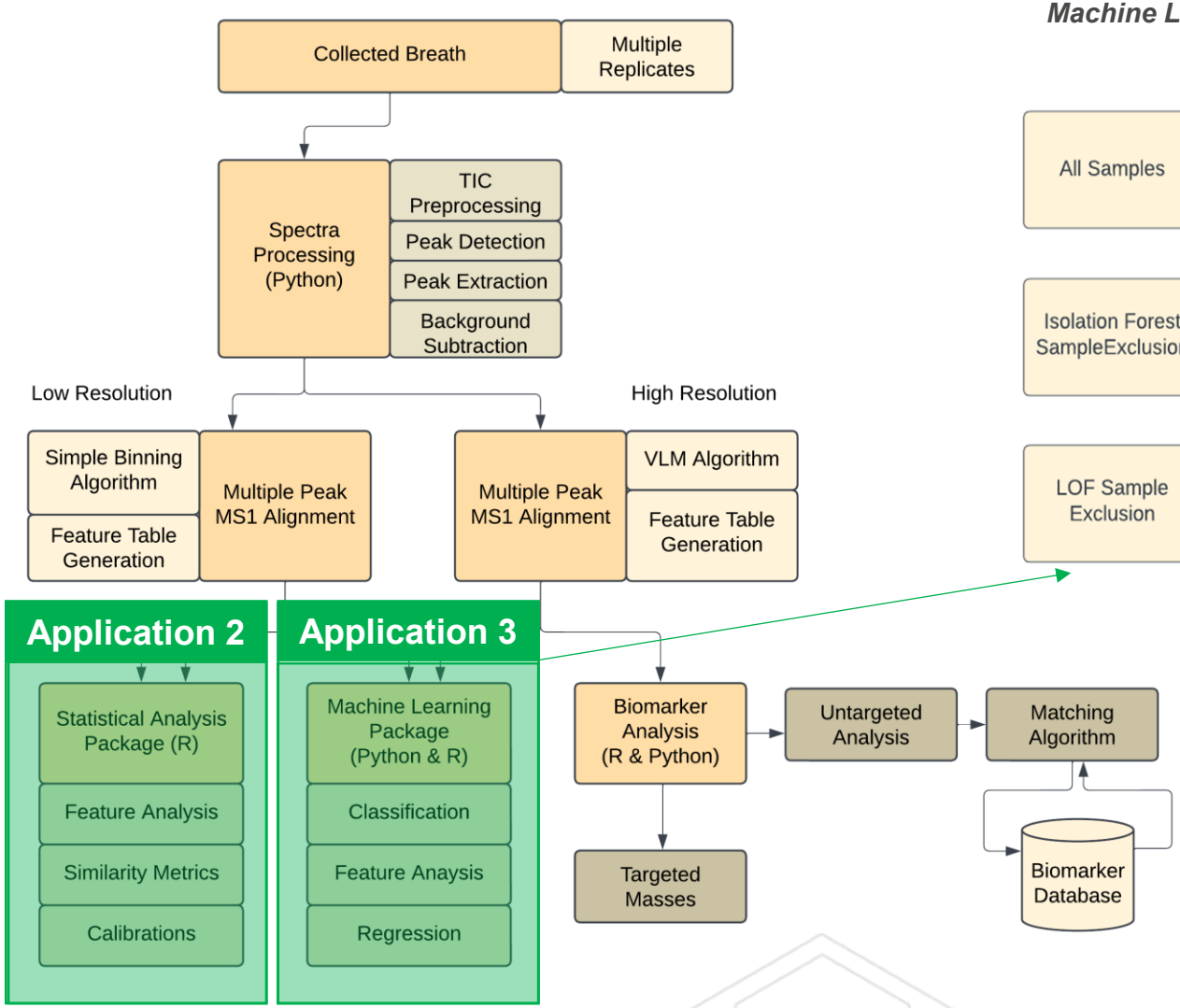

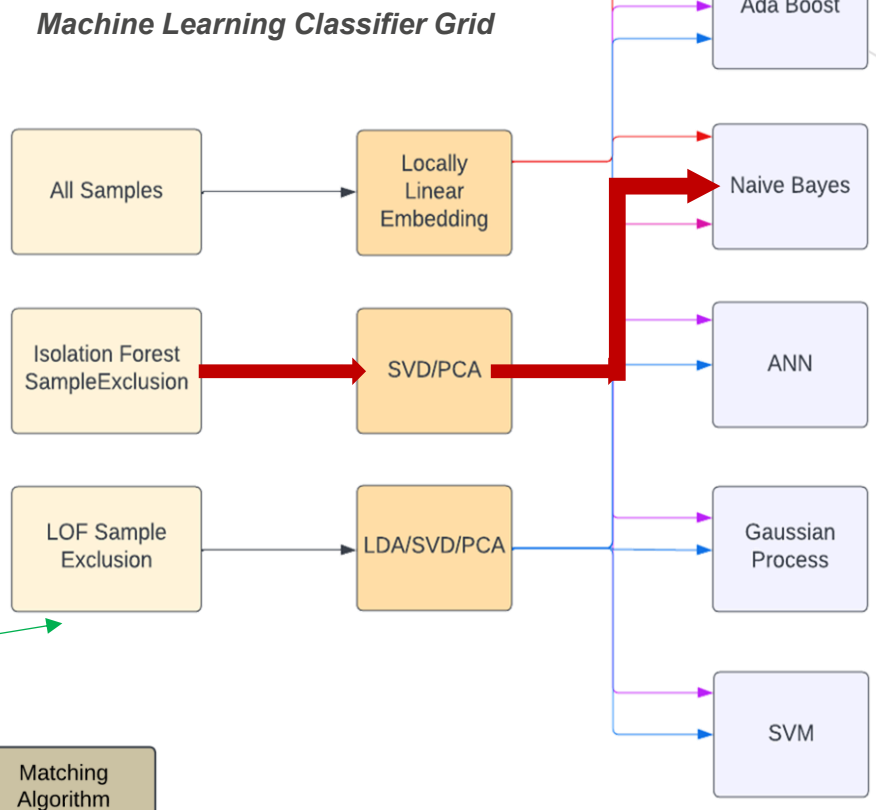

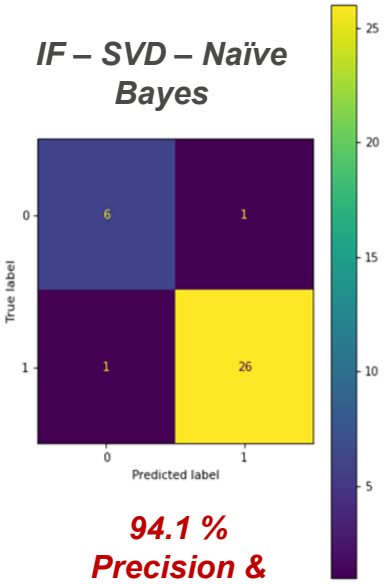

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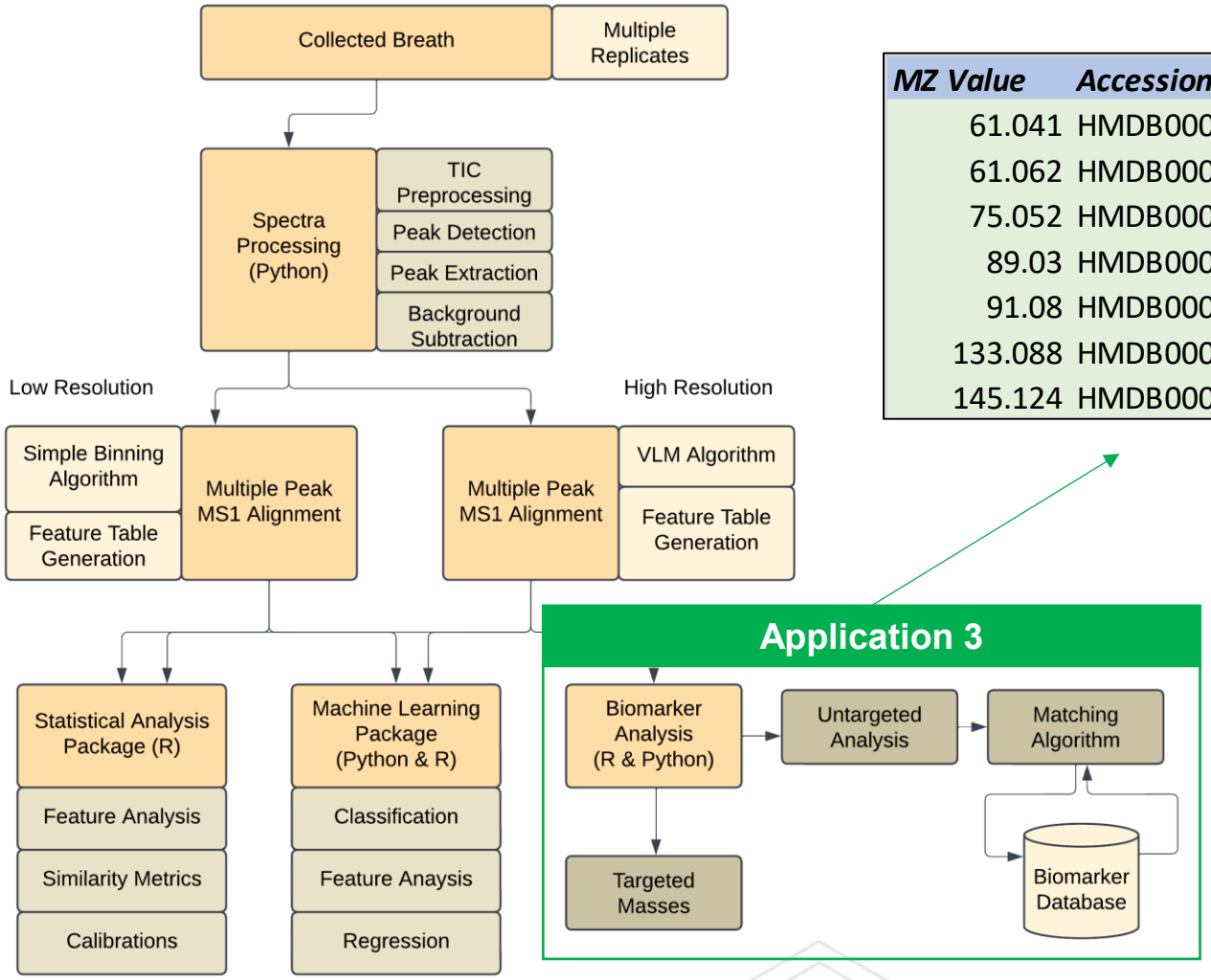


Tentative Biomarker Detection

MZ Value	Accession	Name	MarkerDB	Saliva Biomarker
61.041	HMDB0000294	Urea	Yes	Yes
61.062	HMDB0000863	Isopropyl alcohol/Propyl alcohol	Yes	Yes
75.052	HMDB0000237	Propionic acid	Yes	Yes
89.03	HMDB0000243	Pyruvic acid	Yes	Yes
91.08	HMDB0003156	2,3-Butanediol	Yes	Yes
133.088	HMDB0000746	Hydroxyisocaproic acid	Yes	Yes
145.124	HMDB0000482	Caprylic acid	Yes	Yes

We find from a literature search that these biomarkers, found in the top 31 features, are associated with inflammation and potential infection.

We additionally find that these compounds can be found in MarkerDB and as a Saliva Biomarker in HMDB.

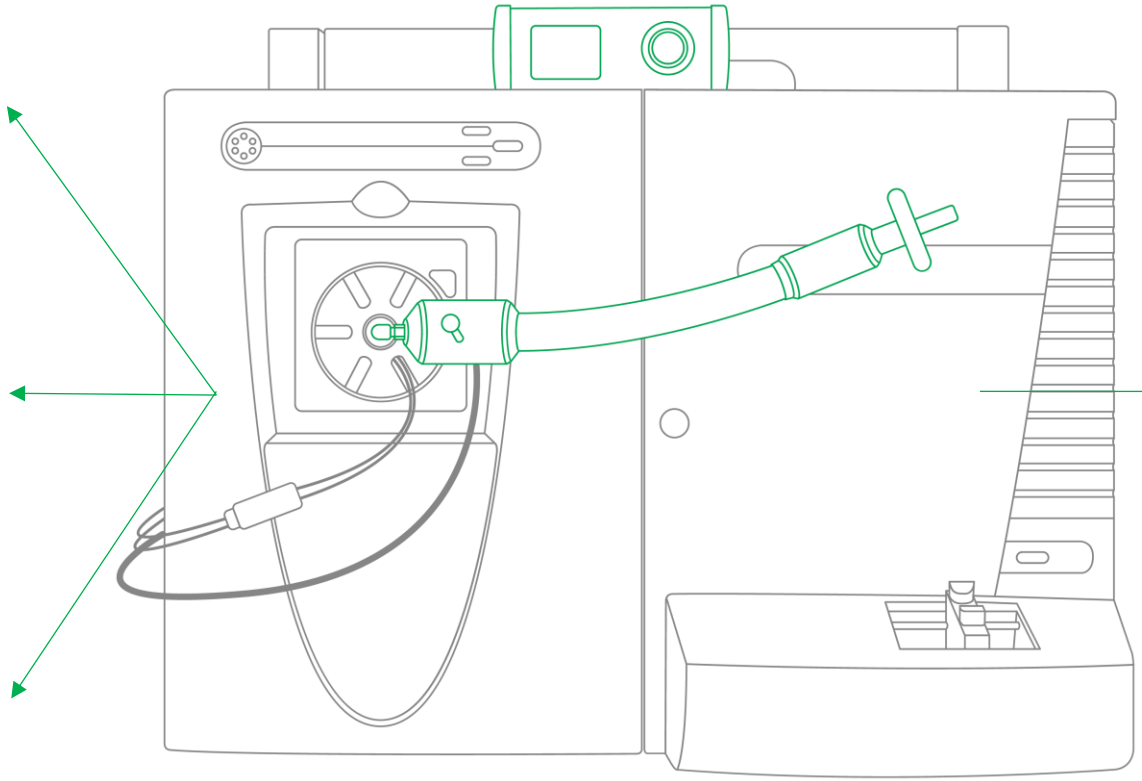
Here, we show successful differentiation between the breath of COVID and Non-COVID Patients with additional tentative biomarker identification that create this difference.

Conclusion

Real-Time Non-Targeted Breath Analysis

Real-Time Targeted Metabolism of Pharmaceuticals Breath Analysis

Differentiation of Infectious and non-Infectious Patients



- Fully Automated Data Processing
- Statistical Analysis Pipeline
- In-depth Machine Learning Pipeline
- Integrated Database Search for Tentative Feature Assignment

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Real-Time Targeted Metabolism of Pharmaceuticals Breath Analysis

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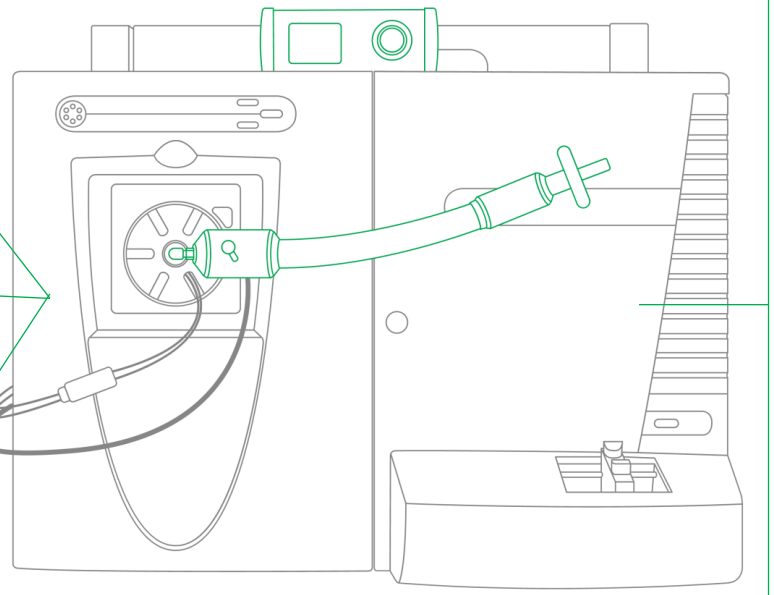

Fully Automated Data Processing

Statistical Analysis Pipeline

In-depth Machine Learning Pipeline

Integrated Database Search for Tentative Feature Assignment

Future Outlook

Expanding the Machine Learning Model Capabilities

Improving the Data Structure for Large Imports and Data Analysis

Expanding into more Clinical Applications

Expanding into Untargeted Exposomic Analysis of Breath

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