

REVOLUTIONIZING FISH EGG QUALITY ASSESSMENT: RAPID FATTY ACID DETECTION WITH RAMAN SPECTROSCOPY AND AI

Raman spectroscopy paired with machine learning enables **on-site assessment of fatty acids (FA) from fish eggs**. Real time measurement of biomolecules using this workflow enable data-driven decisions to improve hatchery management. Current methods to measure biomolecules are expensive and time consuming, limiting their use in hatchery settings.

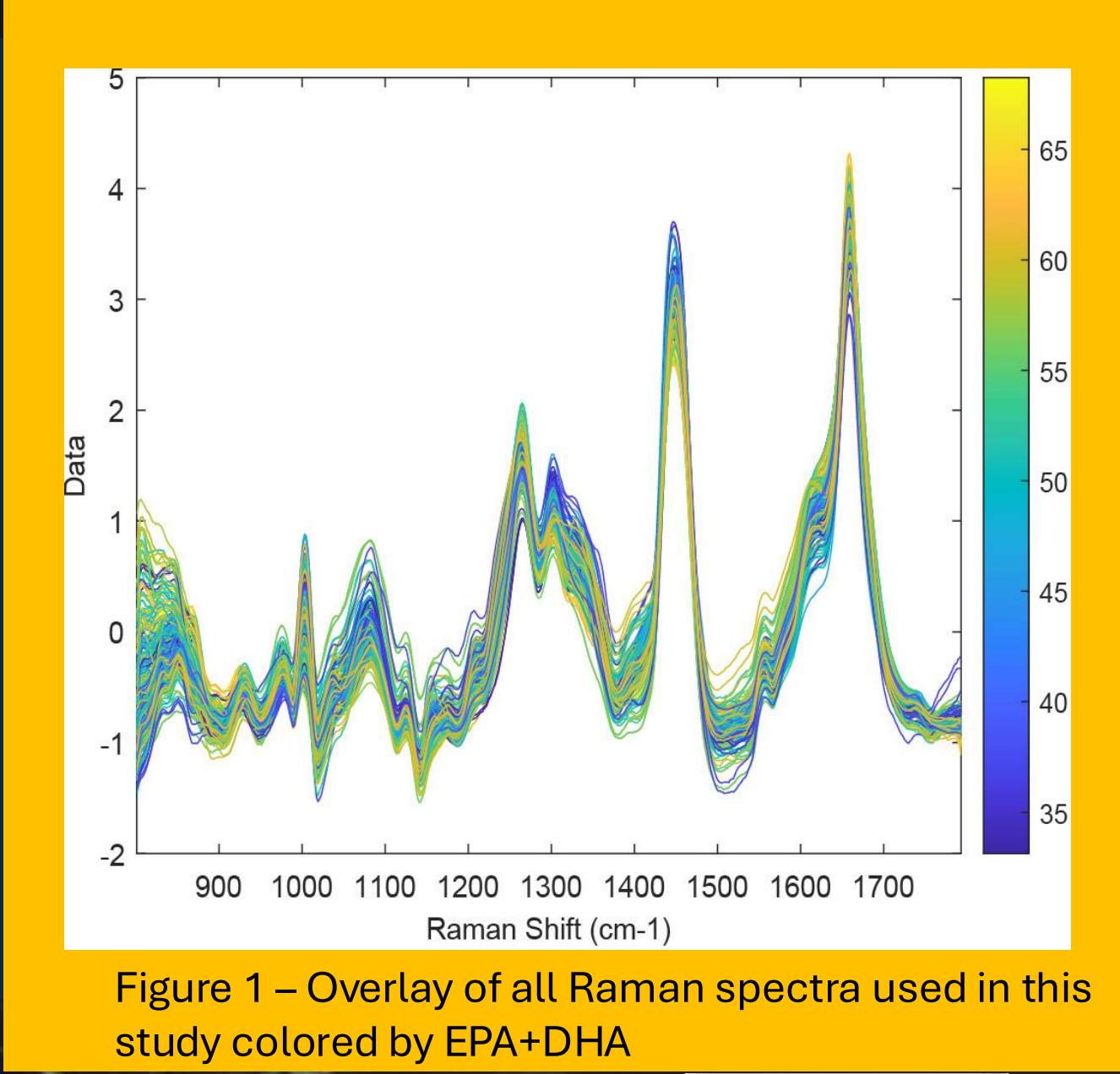
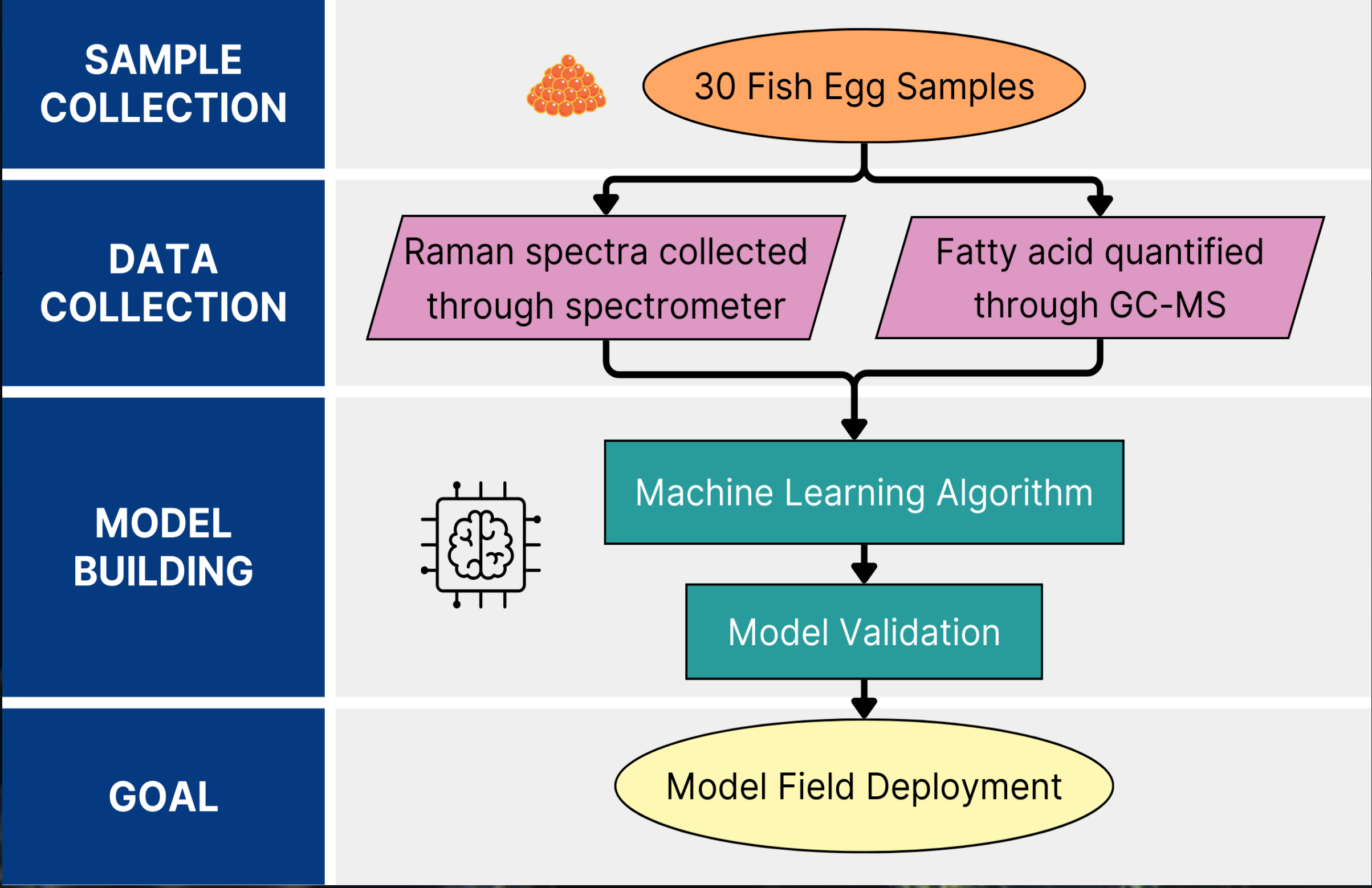


Figure 1 – Overlay of all Raman spectra used in this study colored by EPA+DHA

METHODS:



RESULTS:

- Model validated by spawn season to show on-farm performance
- Omega-3 (EPA+ DHA) model show high accuracy (R^2 : 0.90; RMSE: 2.3%)
- Now, the validated EPA+DHA model can be used to take real time measurements in a hatchery
- An in-house software was developed and validated for streamlining model building and analysis

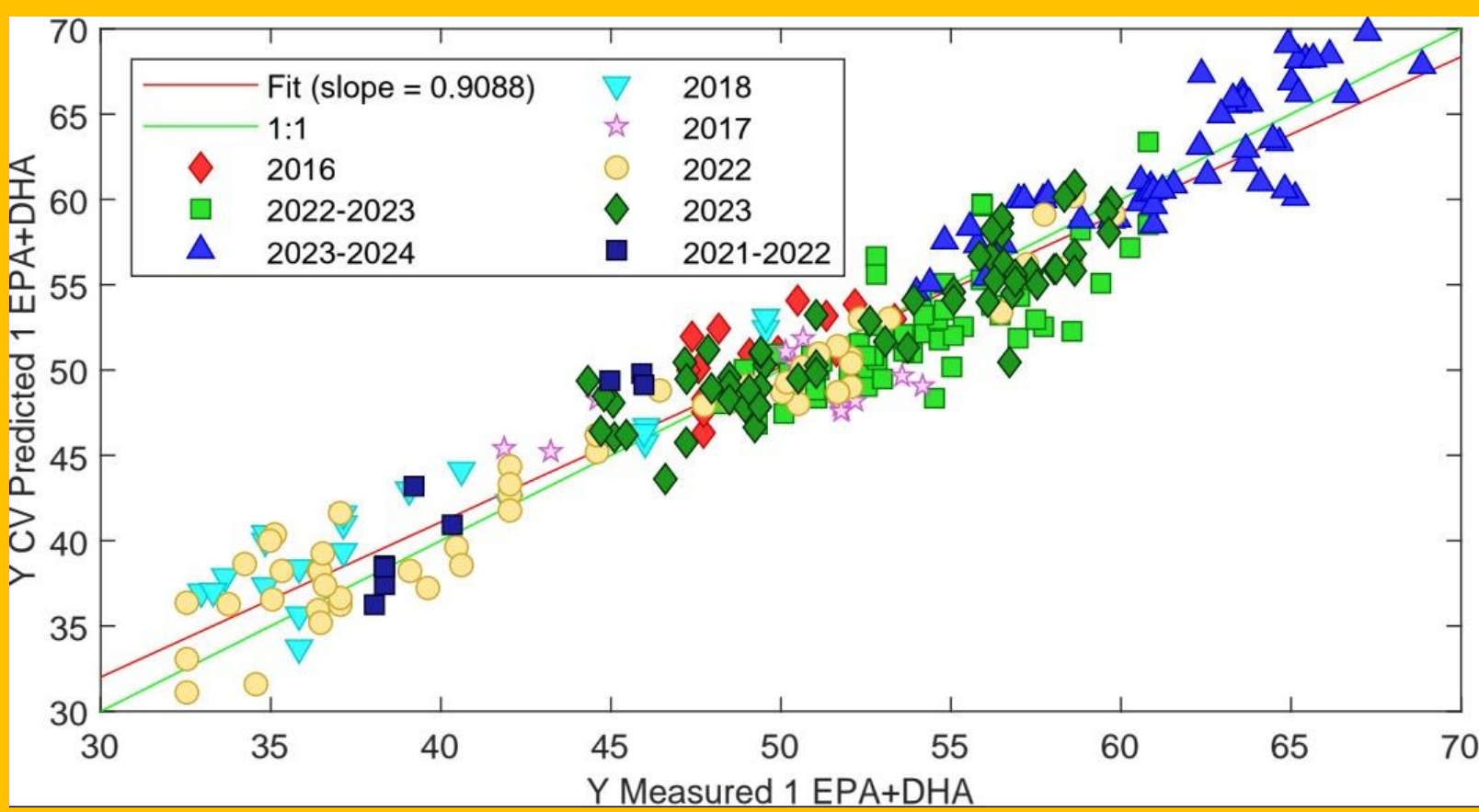


Figure 2 – Cross Validation Performance for EPA+DHA Prediction

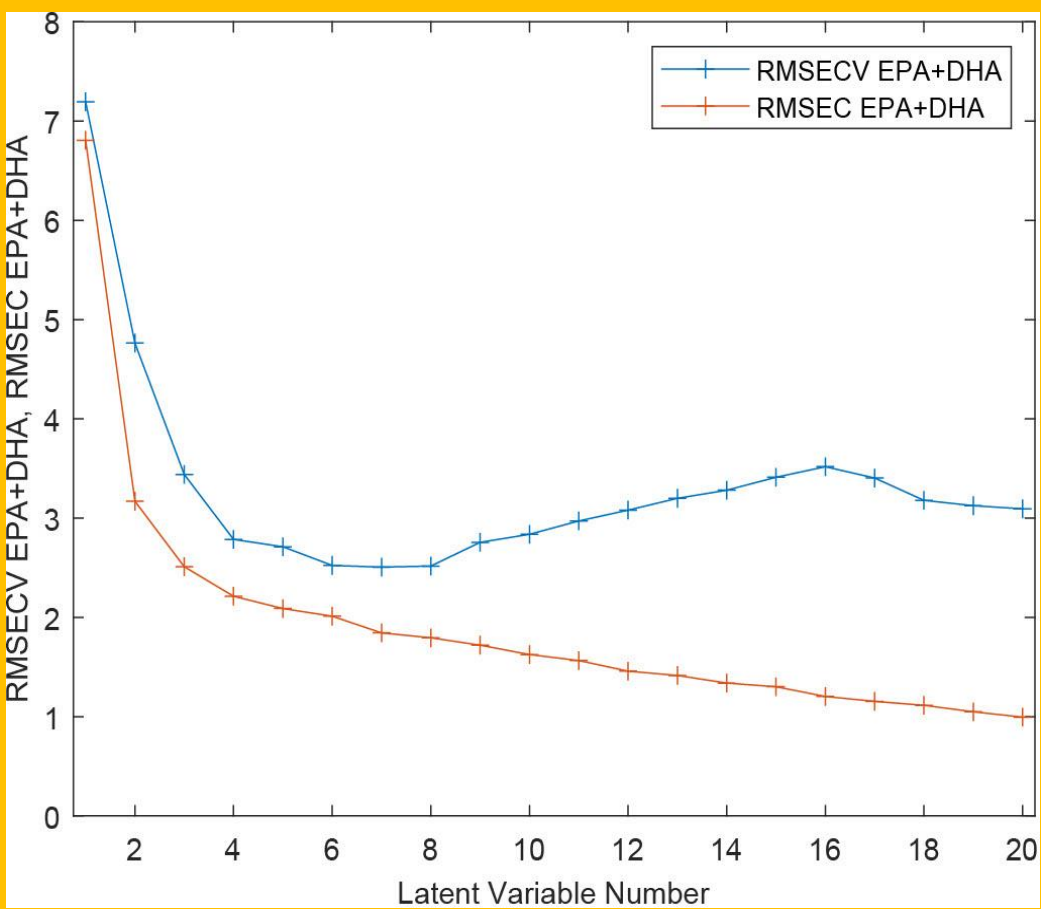


Figure 3 – Model Optimization Results

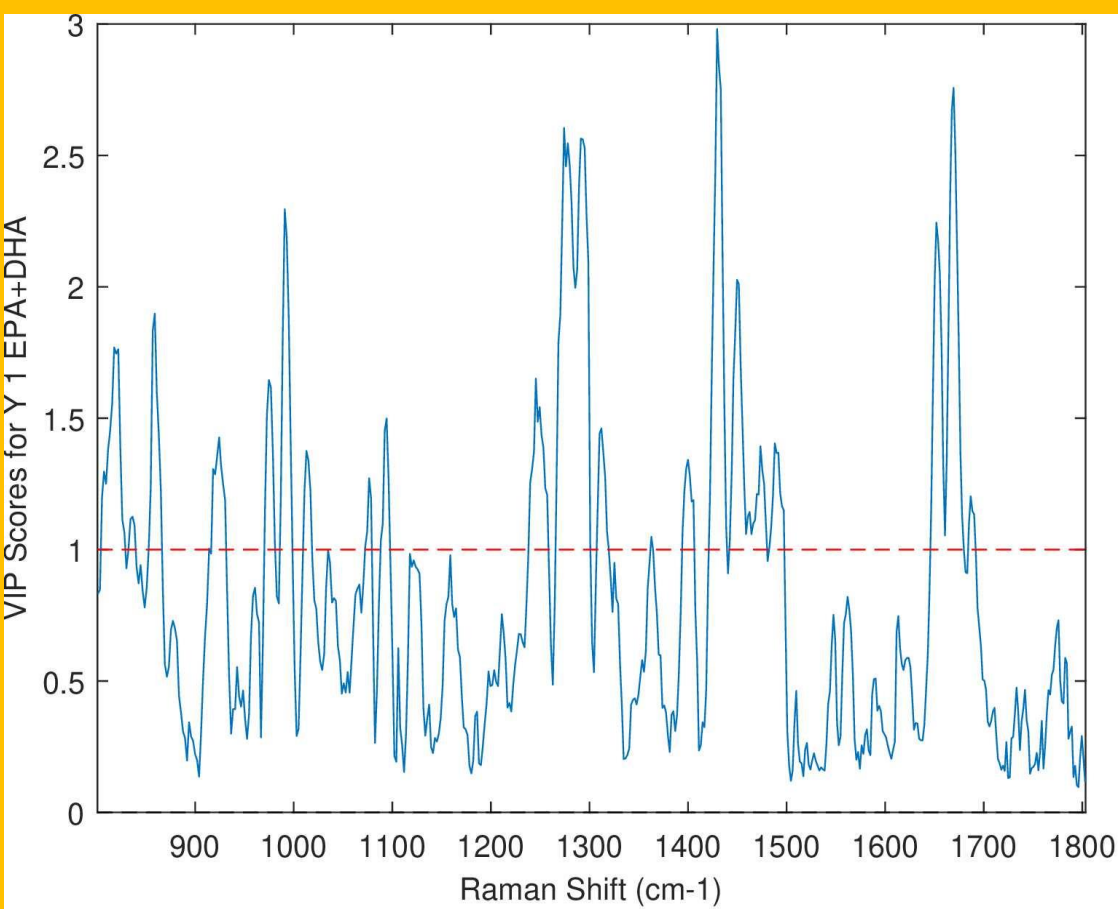


Figure 3 – Variable importance projection (VIP) plot for optimized model

Model Interpretation:

- 6LVs were chosen to minimize overfitting
- VIP plots show model is using fatty acid related Raman bands:
 - C=C stretch (1657)
 - C-H bend (1266)
 - CH₂ scissor deformation (1440)
 - CH₂ twisting deformation (1302)

FUTURE WORK:

- Single multi-species model
- Different sample matrixes
- Other nutrients of interest
 - Amino acids, Carotenoids, etc

