

Work proudly sponsored by CARE and the Calif  
Carpet Stewardship Program



# CARE ID DEVICE ASSESSMENT

RUSS DELOZIER

AUG 31, 2021 – CARE CONFERENCE UPDATE

# AGENDA

● Problem ID/State of Affairs

● Details on the BIG issue

● The Plan

● Company 1 status

● Company 2 status

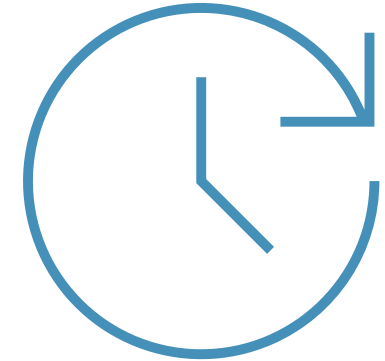
● Next Steps / Conclusion



**Dated Technology**

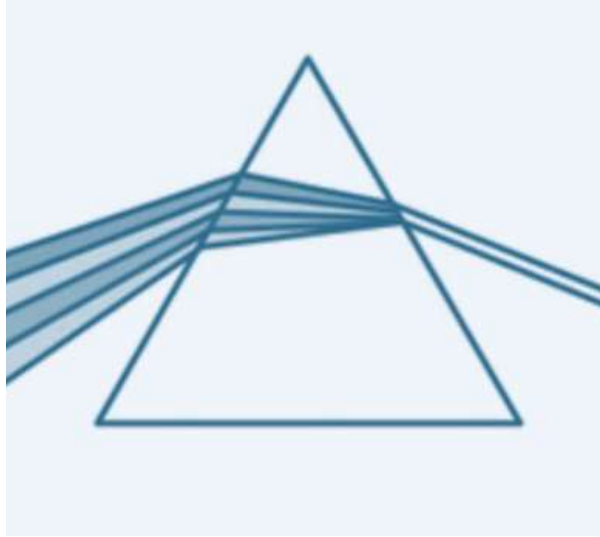


**Difficult Service**

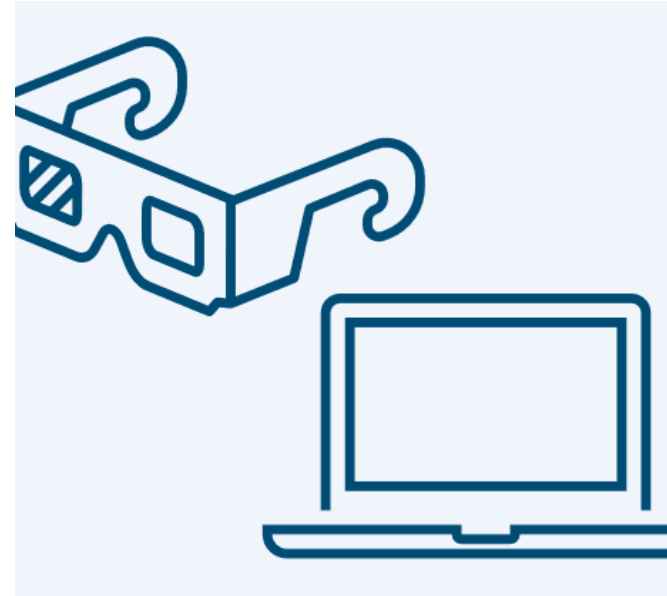


**No Defined Future**

**PROBLEM IDENTIFICATION**



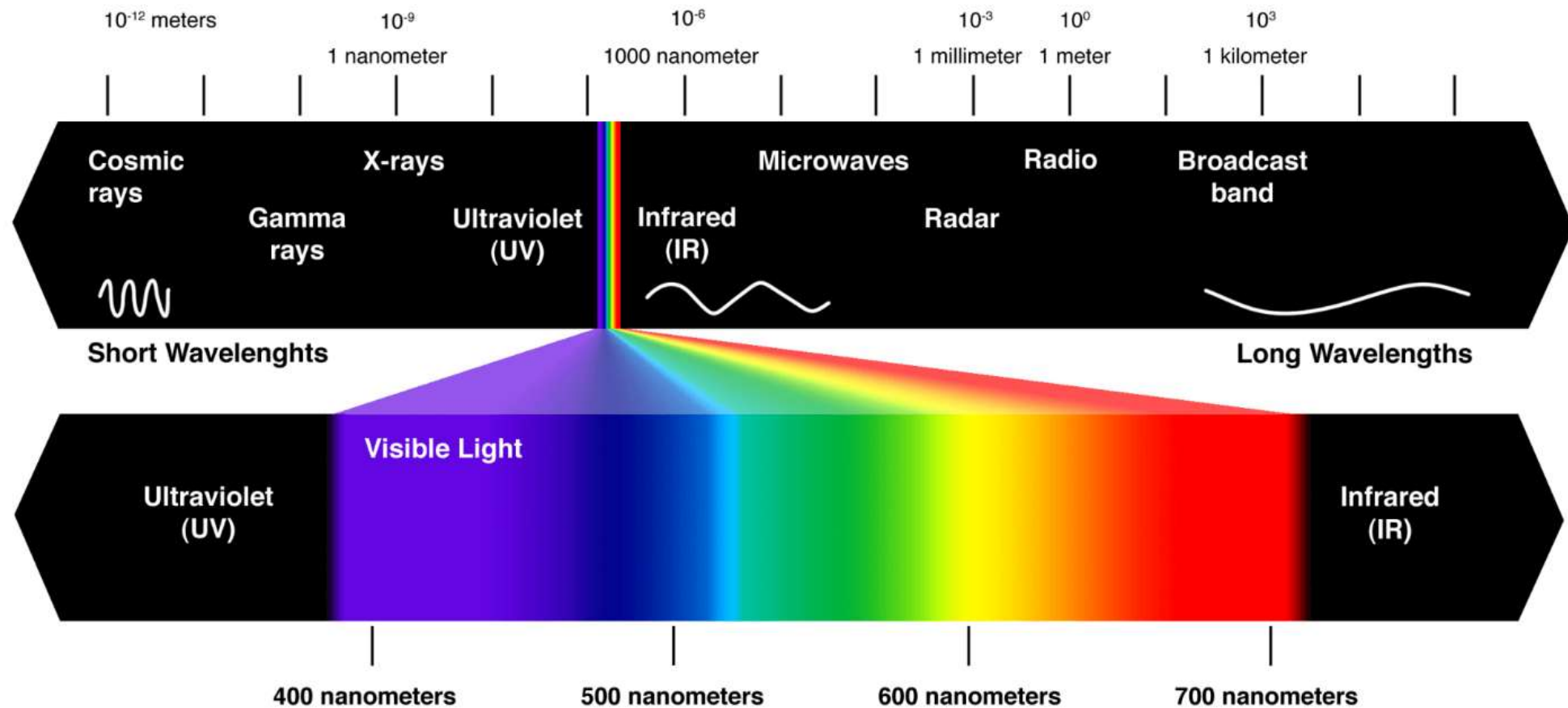
## Spectrometry



## Types of Devices

BASIC TECHNOLOGY

# ELECTRO-MAGNETIC SPECTRUM



# TYPES OF DEVICES FOR CARPET

- Ramon (accurate, available, dark colors, handheld....but very long delay times)
- Filter Photometers (like the old CarPID)
- MEMS (Micro-Electro Mechanics Systems)
  - Tunable Laser (Axsun)
  - Digital Mirrors (micro-Phazir)
  - Interferometer (most historic bench scale and now new handhelds)

# STATE OF AFFAIRS

- Approval of funding by SPC (thank you!)
- The BIG news from Thermo
- Samples, samples and more samples
- Engagement with 2 (or 3) targeted companies
- Size of our market remains an issue. We're just too small to command too much attention
- Will start device trials by mid to late-Sept. 1<sup>st</sup> trials should not take too long beyond Oct
- Refinements taking place in October with new devices available by Nov

# DETAILS OF THE BIG ISSUE

- Message from Thermo-Fisher:
  - *“for the plastics model, we have decided to end of life this product from December 31, 2021, with still a 5-year support for the product. We are going to invest in other NIR platforms [and other instruments]. Sorry for the news!”*
- Been difficult getting with TF since
- The issue is “Plastics” = plastics and carpet was just not a big seller. They are focusing on other, more profitable markets
- Bob Peoples determined to engage TF for commitments
- There exists the option to prebuy in order to hedge bets.
  - Russ feels one or both of the companies will delivery by Nov/Dec)...but they will not be Axsun or Phazir



## THE PLAN

- Engage trinamiX and WOW for updated library (over 70 samples in all colors and fibers and conditions)
- Engage trinamiX and WOW for 2 separate but similar site trials (Baltimore and Los Angeles)
- Obtain feedback from collectors for adjustments to devices and libraries
- Finding speed, accuracy, durability, cost, service, future adjustments/fibers, and overall life are key factors.
- Speed will likely take a hit with new technology. (Carpet is the only application requiring 1.5 seconds or less)

## COMPANY I - TRINAMIX

- Updated sample library developed and loaded. European team on August holiday. Programming limited this month. Library good with limits on Nylons for the immediate time (will require a double trigger pull and must be updated before or after field trials).
- Devices have shipped to CARE for arrival this week.
- Devices will then be shipped, with instructions, to test sites next week and field trials can begin early September.

## COMPANY 2 – WOW ANALYTICS

- Updated sample library developed and loaded using same sample set as other companies have access to.
- Device not yet ‘in hand’. Expect mid September.
- Devices will be shipped with instructions to test sites by mid September and field trails will begin by late September.



BASF Cloud Based System with updated library. Some early issues with Nylon double trigger pull.

WOW prototype, a working and updated carpet library





## **New Business Development – trinamiX Optical Imaging Devices**

# PLASTICS SORTING MADE EASY WITH TRINAMIX NEAR INFRARED (NIR) SPECTROSCOPY SOLUTIONS



- Portable and easy to operate tool for rapid plastics identification
- In-house developed chemometric models cover 6 primary carpet fibers (PP, N6, N66, PET, PTT, Wool)
- Each scan can be labeled, stored, and accessed through online customer portal
- Robust and shock resistant – no moving parts
- IP65 dust and water resistant certified
- Sapphire glass window
- Month-long battery: 6,000 measurements/trigger pulls
- Slightly larger than a smartphone

# CARPET IDENTIFICATION APP

## WITH TRINAMIX NEAR INFRARED (NIR) SPECTROSCOPY SOLUTIONS

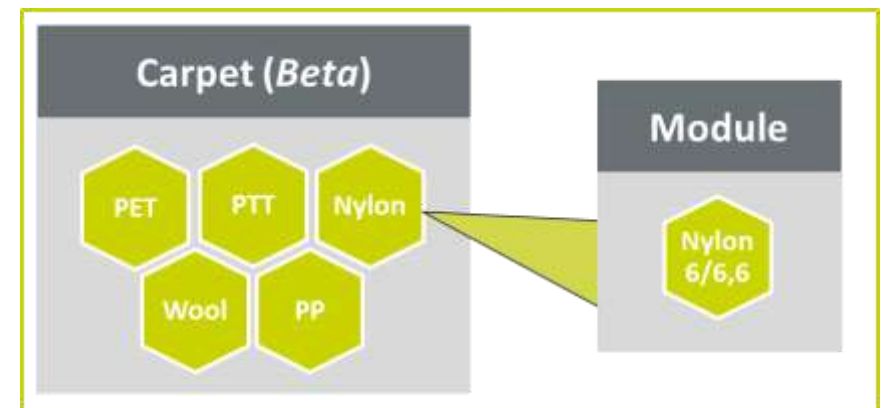
trinamiX

A brand of  
BASF – We create chemistry

- Currently selling into plastics & plastics recycling industry with the materials shown covered and under development



- Working with CARE to create a separate Carpet Identification app to only focus on materials of interest. App reached 100% accuracy with materials sent by CARE. Field trials + validation to begin soon.
- Currently – Nylon 6 vs. 6,6 exists as a separate app that requires multiple scans to average. **Working to integrate into carpet app for a 1-scan solution**



# WOW ANALYTICAL



**APPLYING INNOVATIVE TECHNOLOGY  
FROM AROUND THE GLOBE**

**APPLIED TO REAL WORLD APPLICATION  
... LIKE YOURS**





# Carpet Fiber Identification Tools











CONFIDENTIAL UPDATE ON NEW  
CARPET IDENTIFICATION ANALYZER













## The Next Generation Solution:

- Accurate results
- Ergonomically designed
- Priced Right
- Low cost of operation
  - Low-cost batteries
- Quick Operation --- but getting Faster (around 4 seconds currently)
- Have performed well in drop tests
- Does not yet have an IP-65 rating

# WOW CARPET ID ANALYTICAL CARE VALIDATION

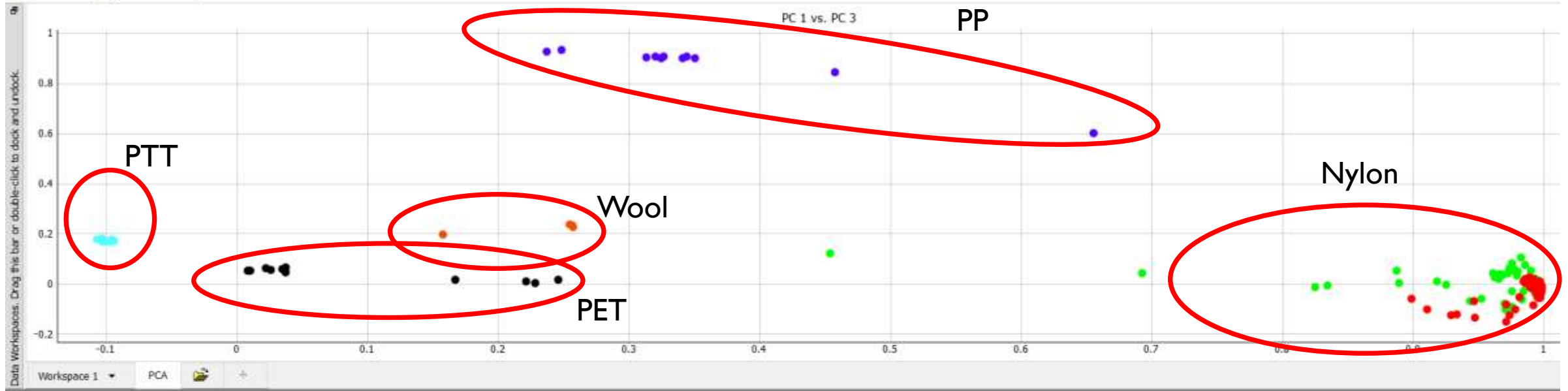
Validation Sample	Results
N66-3-1-L-1	Nylon 6-6 
N66-3-1-L-2	Nylon 6-6 
N66-3-1-L-3	Nylon 6-6 
N66-3-1-L-4	Nylon 6-6 
N66-3-1-M-1	Nylon 6-6 
N66-3-1-M-2	Nylon 6-6 
N66-3-1-M-3	Nylon 6-6 
N66-3-1-D-1	Nylon 6-6 
N66-3-1-D-2	Nylon 6-6 
N66-3-1-D-3	Nylon 6-6 
...	...
16 of 16	100%

Validation Sample	
N6-2-1-L-1	Nylon 6 
N6-2-1-L-2	Nylon 6 
N6-2-1-L-3	Nylon 6 
N6-2-1-L-4	Nylon 6 
N6-2-1-L-5	Nylon 6 
N6-2-1-L-6	Nylon 6 
N6-2-1-L-7	Nylon 6 
N6-2-1-M-1	Nylon 6 
N6-2-1-M-1	Nylon 6 
N6-2-1-M-1	Nylon 6 
...	...
13 of 13	100%

# CARPET ID ANALYTICAL METHOD PCA PLOT-STEP 1

Peak Spectroscopy Software: Extended Trial 4.00.210 from Operant LLC. Licensed to Dan Kievsha 323 days left

File Edit Display Tools Help



- > Data
- > Instruments
- > Manipulations
- > Smoothing & Sharpening
- > Conversions & Corrections
- > Analysis
- > Library Search
- > Quant & Identification
  - QC Compare
  - Conformity Index (CI)
  - Partial Least Squares (PLS)
  - Classical Least Squares (CLS)
  - Principle Components Analysis (PCA)
- > Synthesize / Edit Data
- > Advanced
- > Setup

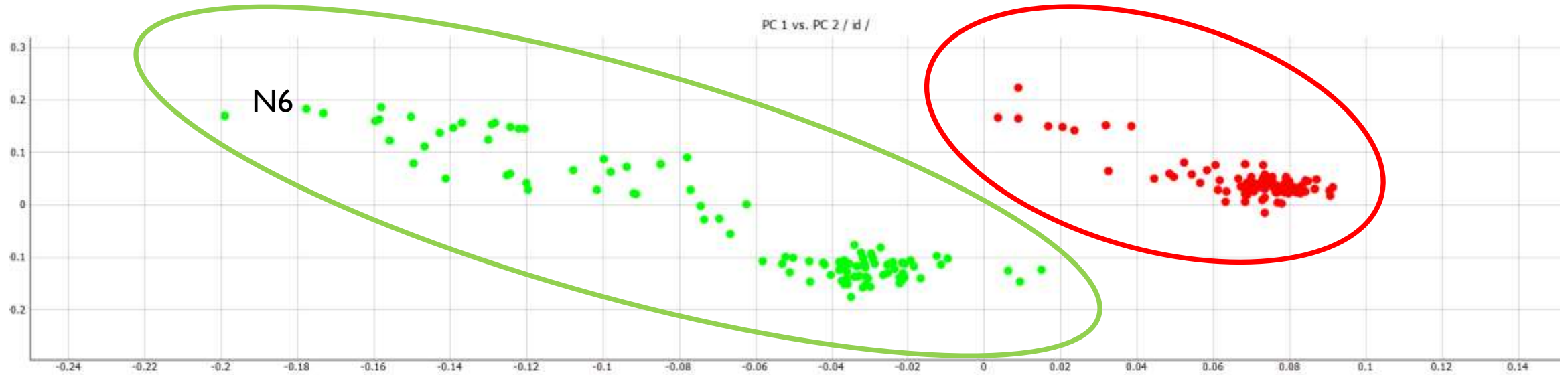
Method Analytes Spectra Explore Validate

- Add Analyte...
- Edit Analyte
- Remove Analyte(s)

Analyte	Status	No. of Factors to use for Prediction	Max Factors for Validation	Mahalanobis Limit (standard deviations)	Color	Plot Symbol	Preprocessing	Regions
1 N6	include	8	13	3.00	Green	circle	Derivative/Vector Normalization	Full Spectrum
2 N66	include	4	16	3.00	Red	circle	Derivative/Vector Normalization	Full Spectrum
3 PET	include	4	10	3.00	Black	circle	Derivative/Vector Normalization	Full Spectrum
4 PP	include	4	10	3.00	Purple	circle	Derivative/Mean Center	Full Spectrum
5 Wool	include	4	10	3.00	Orange	circle	Derivative/Vector Normalization	Full Spectrum
6 PTT	include	4	10	3.00	Cyan	circle	Derivative/Vector Normalization	Full Spectrum

# CARPET ID ANALYTICAL METHOD PLS PLOT-STEP 2

N66



Workspace 1 | PLS

Cross Validation  
Samples to Leave Out:   
 Test Set Validation  
 Full Calibration  
 Second Validation

3	3	N6-1_Abs_3.Spectrum[0]	-0.0184	-0.1184	-0.0075	-0.0064	0.0012	-0.0241	0.0092	-0.0113	-0.0046	0.0013
4	4	n6-2_Abs_1.Spectrum[0]	-0.0296	-0.1560	0.0090	-0.0017	0.0011	0.0178	-0.0030	-0.0098	0.0073	0.0075
5	5	n6-2_Abs_2.Spectrum[0]	-0.0373	-0.1455	0.0060	0.0030	0.0060	0.0092	-0.0045	-0.0047	0.0081	0.0036
6	6	n6-2_Abs_3.Spectrum[0]	-0.0222	-0.1497	0.0114	-0.0004	-0.0004	0.0099	-0.0109	-0.0088	0.0006	0.0046
7	7	n6-4_Abs_1.Spectrum[0]	-0.0291	-0.1030	-0.0108	-0.0100	-0.0121	-0.0182	0.0102	-0.0038	0.0006	-0.0098

# BATTERY TECHNOLOGY

## All Things You Need to Know about 21700 Battery

Tesla, Mass Production of 21700 Battery



**18650**



**21700**

Recently, Tesla Inc together with Panasonic announced a new model of li-ion battery cell-21700, , they also stressed that at present this is the highest energy density and low cost of li-ion battery that goes to mass production, Another lithium ion battery leader, Samsung SDI also announced the same characteristics of the new battery 21700, sooner or later,we can feel the changes.

The 21700 battery can be purchased online between \$13 - \$25 each depending on capacity.

# HISTORY OF NIR ANALYZER SUCCESS IN CARPET RECYCLING

- The technology used in the WOW Carpet Analyzer has been deployed in over 10,000 applications. This MEMS FT-NIR technology is:
  - Proven Reliable and Robustness
  - Highly Accuracy
  - State-of-the-Art Performance
- Dan Klevisha led the development of the Bruker CarpetID System in 2000 and the Polychromix microPHAZIR Carpet ID Tool in 2007. He has lead Bruker, Polychromix, Thermo, and Foss NIR businesses.



Dan Klevisha  
President  
WOW Analytical

## NEXT STEPS / CONCLUSIONS

- Earlier this year, Bob and CARE approved moving forward on this project not a moment too soon
- CARE SPC approval of initial funding has been helpful / key to keep the project moving
- Obtaining a detailed sample set allows CARE to work with any company to obtain a consistent library. Sample set is large enough for years to come. Thanks to LA Fibers and Georgia Carpet Recovery.
- Inform membership of Thermo-Fisher news during CARE Conf and then follow-up update.
- Send units out for field trial and visit with collectors to obtain field feedback.
- Work with suppliers to improve their units based upon what is found in the field trials.
- Obtain approval form CARE Board as to which device (or devices) should be pursued by CARE members going forward.
- Send update to all CARE members defining how to work with selected company(s).



THANK YOU.

ANY QUESTIONS?

[RDELOZIER@WINDSTREAM.NET](mailto:RDELOZIER@WINDSTREAM.NET)