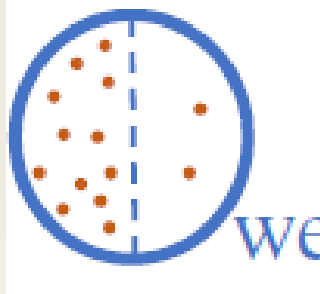


ASHRAE RESEARCH PROJECTS: 1784-RP and 1720-RP

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Bringing ASHRAE Funding home

- Over the years:
 - 674-RP: Evaluation of Test Methods for Determining the Effectiveness and Capacity of Gas-Phase Air Filtration Equipment for Indoor Air Applications: Literature Review. 1991.
 - 671-RP: Validation of Gas-Phase Air-Cleaner Performance Test Method (Standard 145.2) by Laboratory Testing of Commercially Available Filtration Devices. 1993.
 - 760-RP: Investigate and Identify Indoor Allergens and Biological Toxins That Can Be Removed by Filtration. 1994.
 - 792-RP: Evaluation of Test Methods for Determining the Effectiveness and Capacity of Gas-Phase Air Filtration Equipment for Indoor Air Applications: A Laboratory Study to Support the Development of Standard Test Methods. 1996.
 - 909-RP: Determine the Efficacy of Antimicrobial Treatments of Fibrous Air Filters. 1999.
 - 1088-RP: Coordinate and Analyze Interlaboratory Testing of Filters under ASHRAE Standard 52.2 to Determine the Adequacy of the Apparatus Qualification Tests. 2005.
 - 1190-RP: Develop a New Loading Dust and Dust Loading Procedures for the ASHRAE Filter Test Standards 52.1 and 52.2. 2003.
 - 1287-RP: Particle Counter Specifications for use with Filter Performance Test Standard ANSI/ASHRAE Standard 52.2. 2010.
 - 1360-RP: How do Pressure Drop, Efficiency, Weight Gain, and Loaded Dust Composition Change throughout Filter Lifetime. 2013.

Bringing ASHRAE Funding home

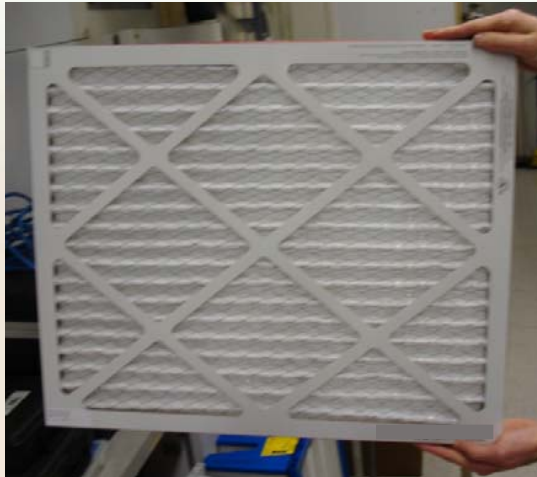
- Now

- 1784-RP: Repeatability and Reproducibility Assessment of ASHRAE Standard 52.2 as Currently Amended (April 2019-August 2020)
- 1720-RP: Validation of gas-phase air-cleaner performance test method (Standard 145.2) by laboratory testing of commercially available filtration devices (Sept. 2018 – August 2020)

Interlaboratory Studies (ILS) aka Round Robins (RR)

1784-RP

- Particle Removal Efficiency
- ASHRAE 52.2 Tests (gives MERV)
- ASHRAE 52.2 Appendix J Tests

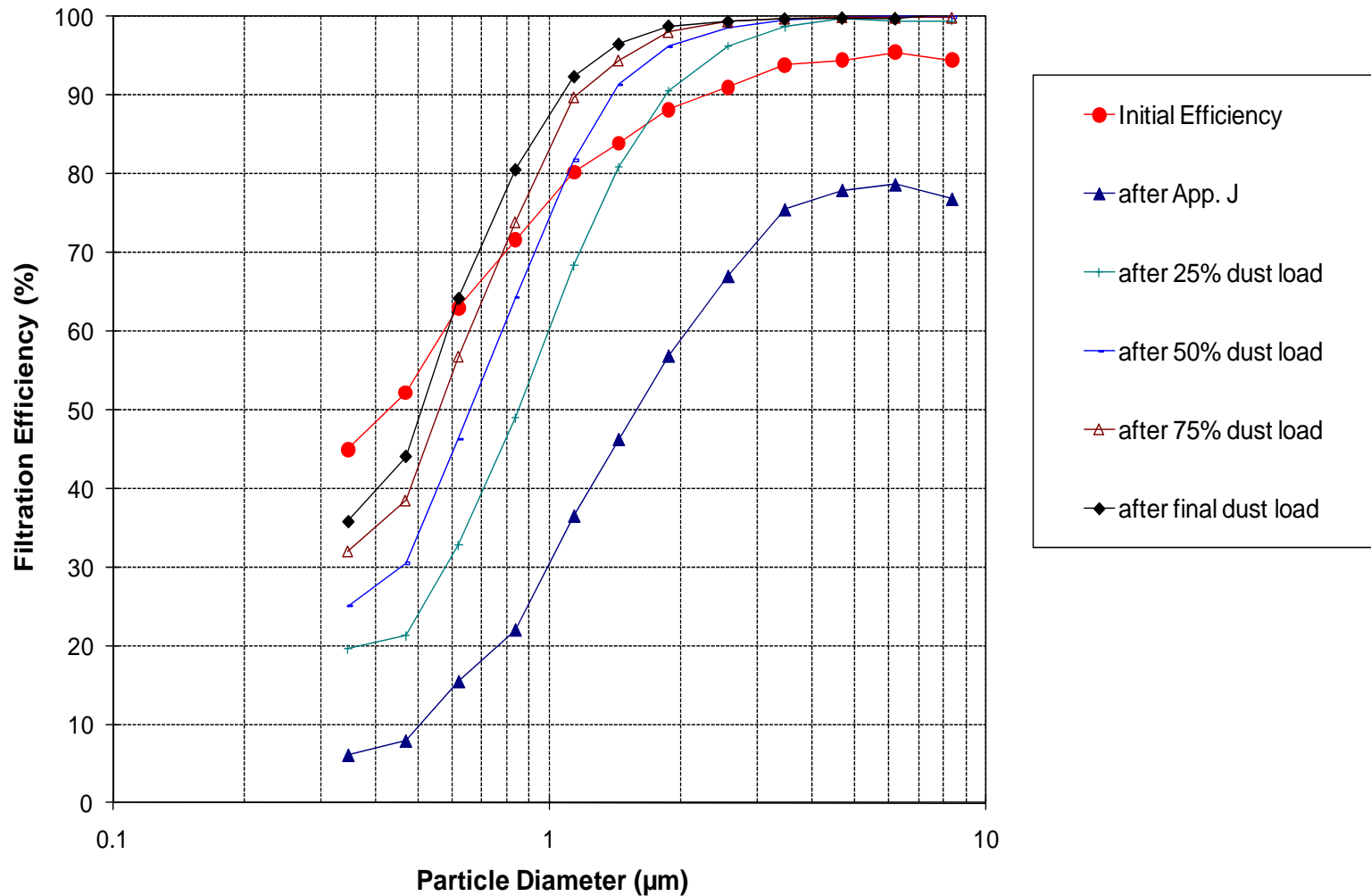


1720-RP

- Gaseous Contaminant Removal
- ASHRAE 145.2 Tests
- Different gases



What Does the ASHRAE 52.2 test test?

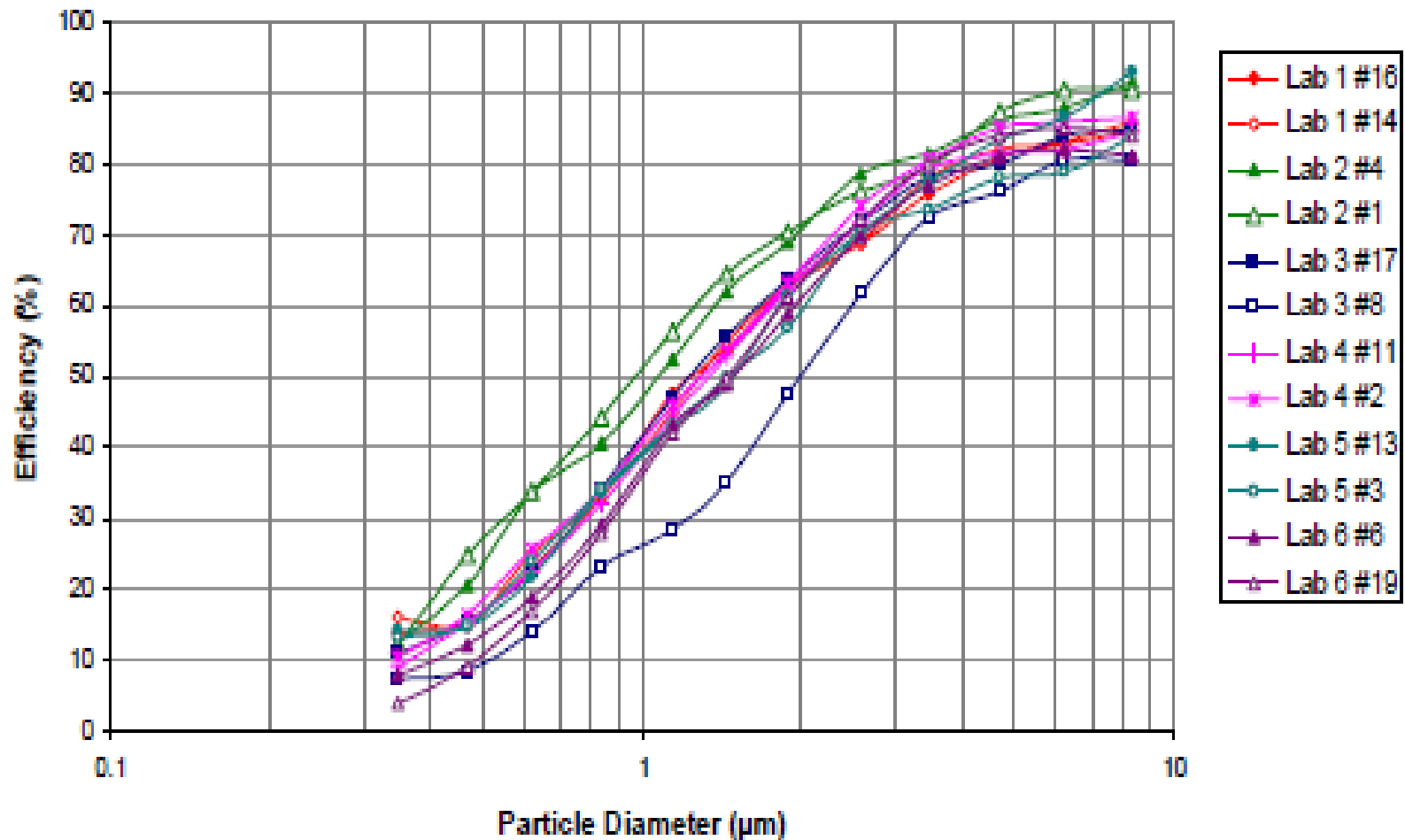


How to get MERV From the Data

- Determine the lowest efficiency value for all 12 particle sizes
- Average the 4 smallest, 4 middle, and 4 largest sizes to get E1, E2, and E3
- Use E1, E2, and E3 to find the right Minimum Efficiency Reporting Value in the MERV table.
- MERV can be from 1-16

ASHRAE 52.2 RR Data from 1088-RP

Type 2 Initial Efficiencies



MERV 8,
10, or 11?

Changes After 1st Round Robin

Addenda to ASHRAE 52.2		
Addendum	Date	Topic
a ⁺	July 2008	Added Appendix J Conditioning
a	2/26/2015	Changes to MERV table
c	8/24/15	OPC (particle counter) specification changes based on 1287-RP
d	2/26/2015	Allowed RH ranged changed from 20% to 65% to 45% \pm 10%
⁺ addendum to 52.2-2007		

Did These Changes Help?

- We've been running with the new rules for several years.
- We think the changes helped.
- We don't have proof.
- Yet!

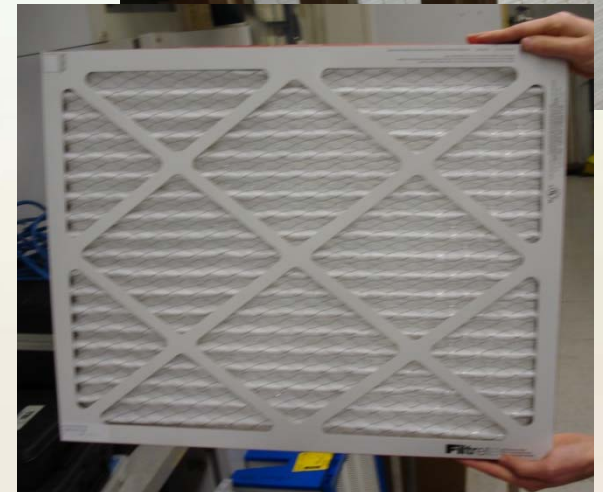
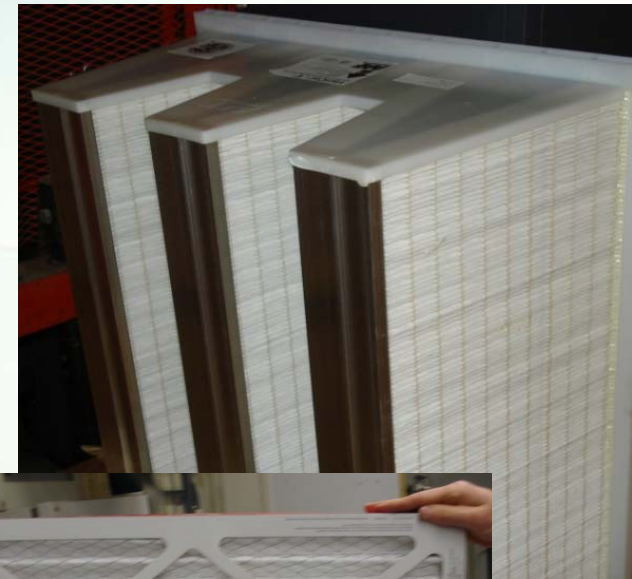
ASTM E691: How to run an ILS

1. Determine that all labs meet the QA requirements*. We want data on correctly run tests.
2. Collect all the test data and data review for completeness and logic.
3. Examine the data for each lab to see where differences occur between tests of the same filter type.
4. Determine if data for different filter types shows the same patterns (does a lab have repeatable MERV 14s but variable MERV 8s).
5. Examine the data at each step to determine if they are logical. For example, do efficiencies go up or down during a test?
6. Determining the ILS statistics for the whole data set.

*If they do not, find out which QA test procedures are hard to follow (and might need to be better written) or if there is a systemic problem that a change in the 52.2 method would help.

This Project

- Find Labs
- Chose Filters
- Decide on Tests
- Collect and analyze lab QA data
- Collect and analyze test data
- Run ILS statistics
- Examine data to look for ways to improve test



Lab Participation

- Find labs to tun the tests
- Send information on the RR testing and get signed agreement to participate
- Prepare and send QA and Equipment questionnaire

Filters and Test Choices

- Choose the filters to be tested (MERV level, brand, size, charged/uncharged, prices)
- Decide on the testing for clean filter efficiency:
 - How many types of filters
 - How many labs
 - How many replicates
- For this project, we are doing two types of tests. So, repeat step 2 for Appendix J conditioning tests
- Make sure the budget covers all the work! (not an ILS requirement)

Possible Test Matrix

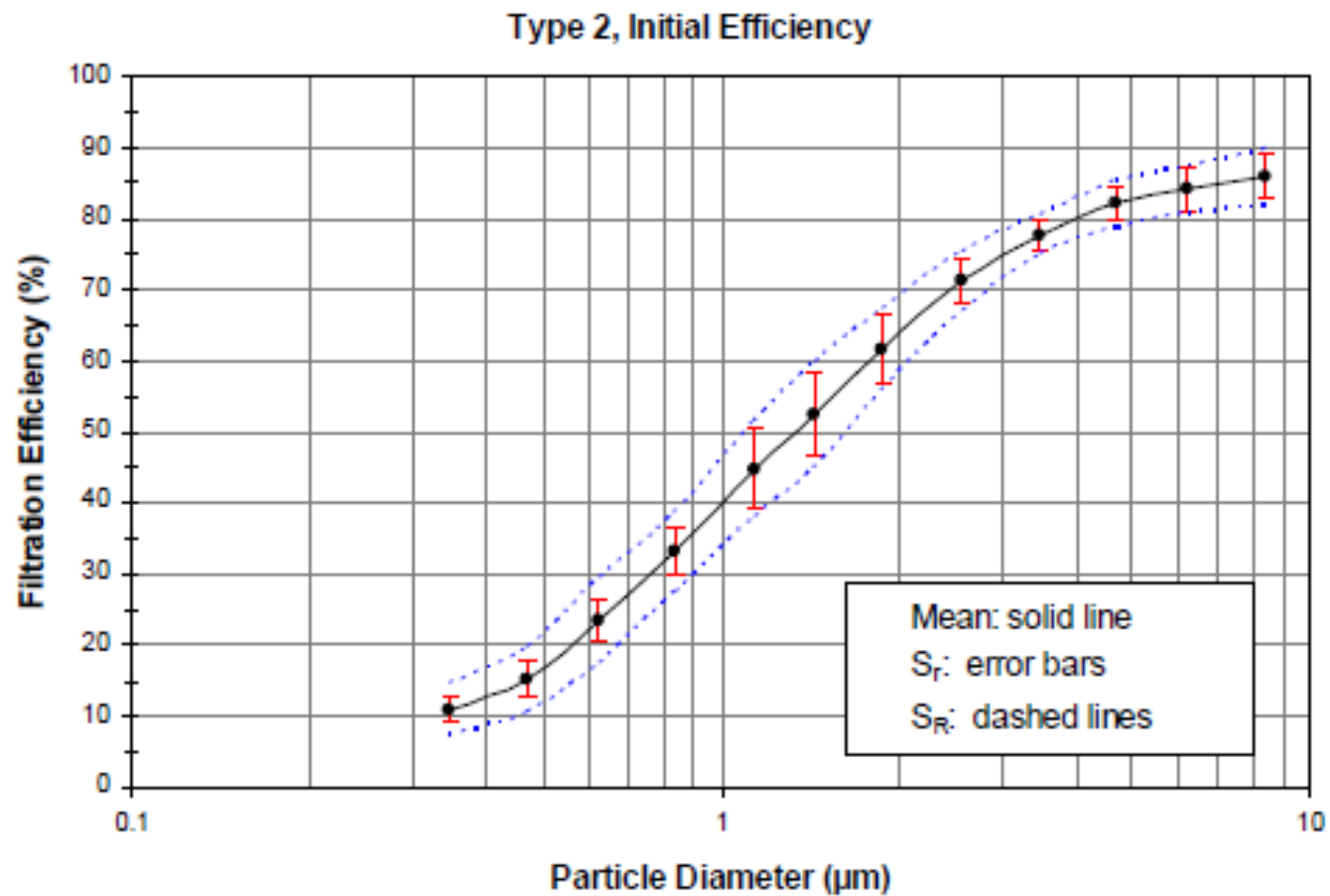
	A Possible Test Matrix					
	Efficiency Tests			Appendix J*		
Filter Types	Number of Test Labs	Replicates Per Lab	Total Efficiency Tests	Number of Test Labs	Replicates Per Lab	Total App J Tests
MERV 8	10	3	30			
MERV 11	10	3	30			
MERV 14	10	3	30			
MERV 14-A	5	3	15	5	3	15
MERV 16	10	3	30			

*Note that Appendix J includes the clean filter efficiency test.

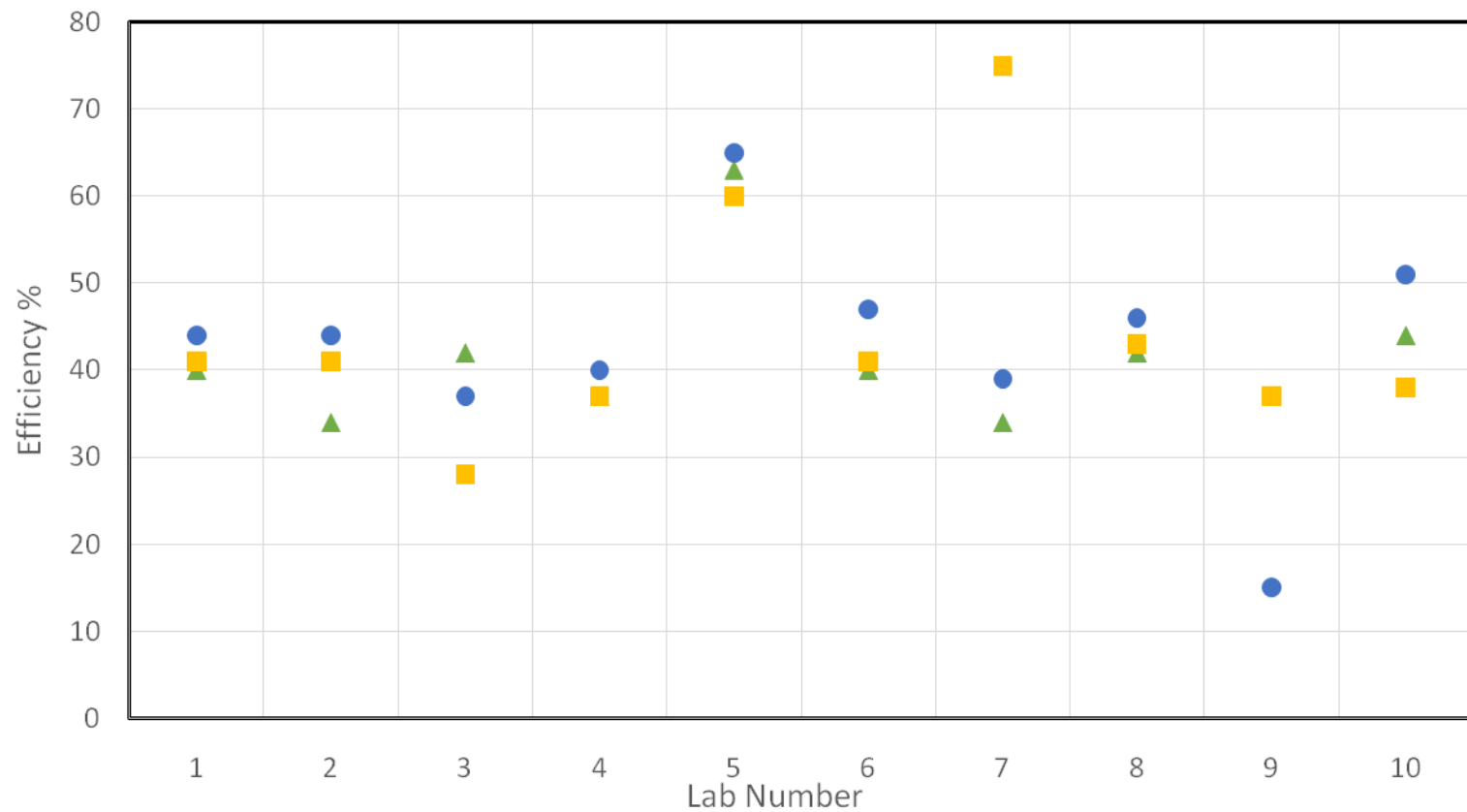
Data Analysis

- Check:
 - Is the data Complete and reasonable?
 - Is the data/are the calculations correct?
- Graph and tabulate
- Use experience with the method to look for oddities
- Run the ILS statistics
- Report repeatability and reproducibility
- If significant differences found, look for reasons!

ILS Statistics: Means and Error bars

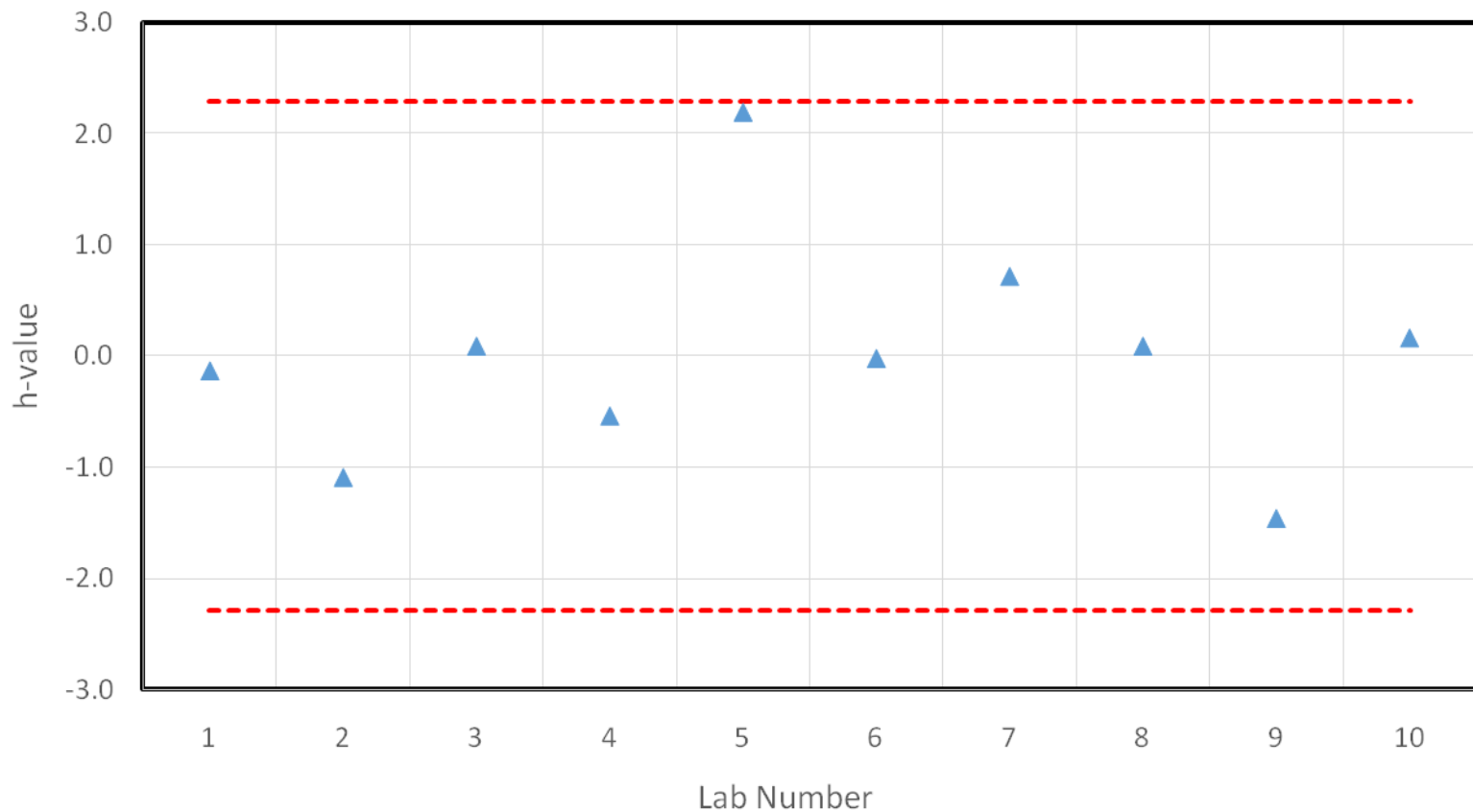


ILS: Determining Outliers using h



h = the between-laboratory consistency statistic

ILS: Determining Outliers using h



h = the between-laboratory consistency statistic

Status of 1784-RP

- 2.5 months old
- 17 labs interested
- Filters chosen?
- QA and equipment information requested
- Coming up – lots of data to process!!!
- If you're in KC in June, come to my PMS presentation.