

Advanced Filtration Platform for Cigarette Smoke

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SMOKE SCIENCE AND PRODUCT TECHNOLOGY

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Outline

- ▶ Background
- ▶ CelFX™ Filtration Platform Physical
- ▶ Pressure Drop Flexibility
- ▶ Carbonyl Reduction
- ▶ Conclusions/Next Steps

CeIFX™ Platform Development

Response to Market Trends

- Regulations
- High Filter Loadings
- Brand Innovation
- Super-Slims

Fresh Look at Filtration

- Focused on preserving experience
- Harnessed filtration capabilities within Celanese
- Discovered unique potential of GUR® material

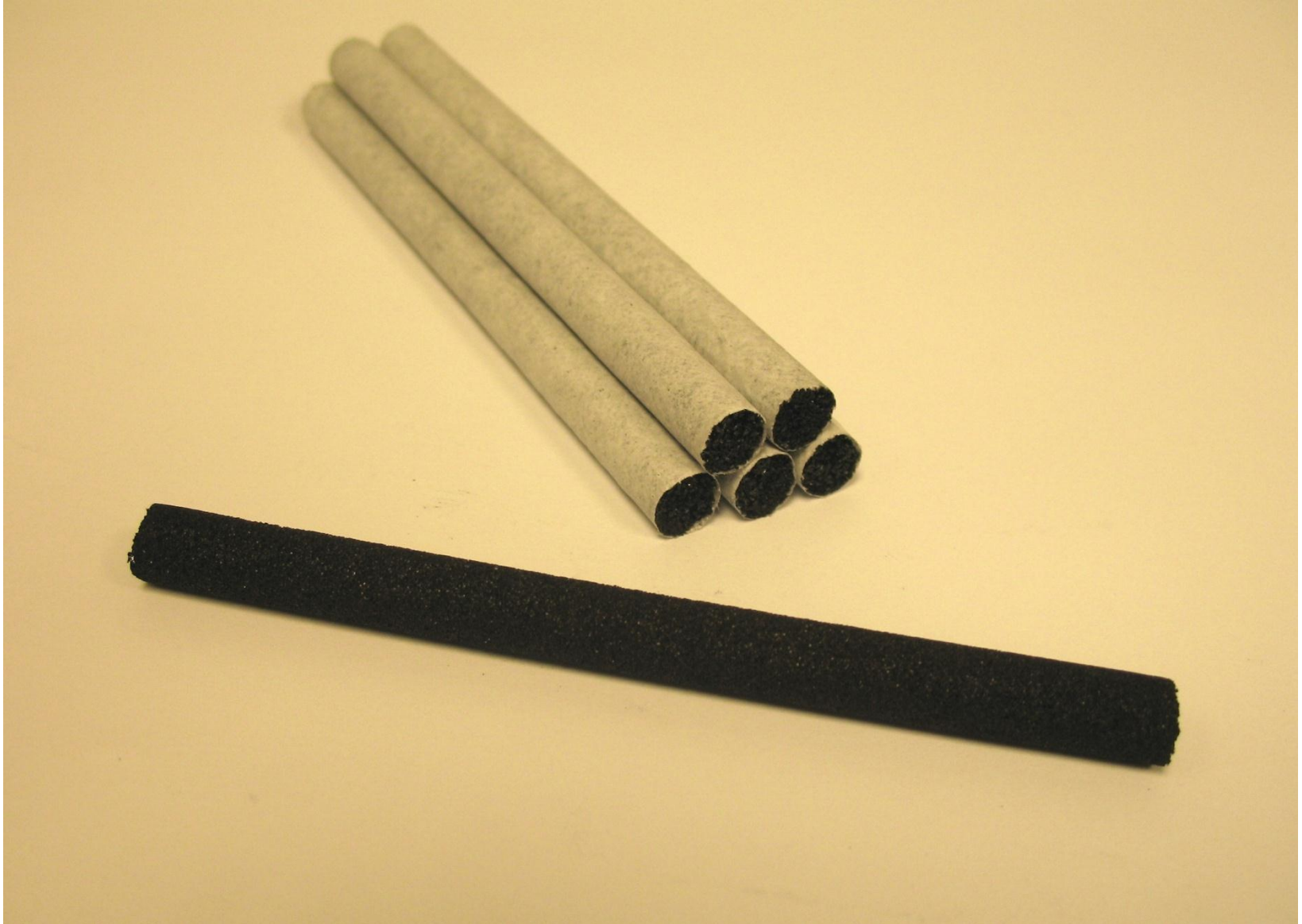
Platform Development

- Conducted internal technical evaluations
- Demonstrated platform potential with multiple materials

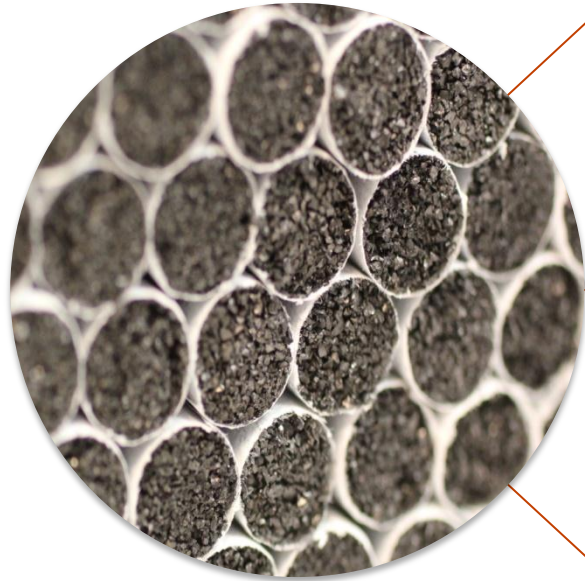
Intellectual Property

- First patent application published in July 2011
- Intellectual Property creation continues

CeIFX™ Carbon



Carbon Loadings



Standard Size

- Pressure drop flexibility down to 0.5 mm/mm
- Carbon loading flexibility up to 20 mg/mm

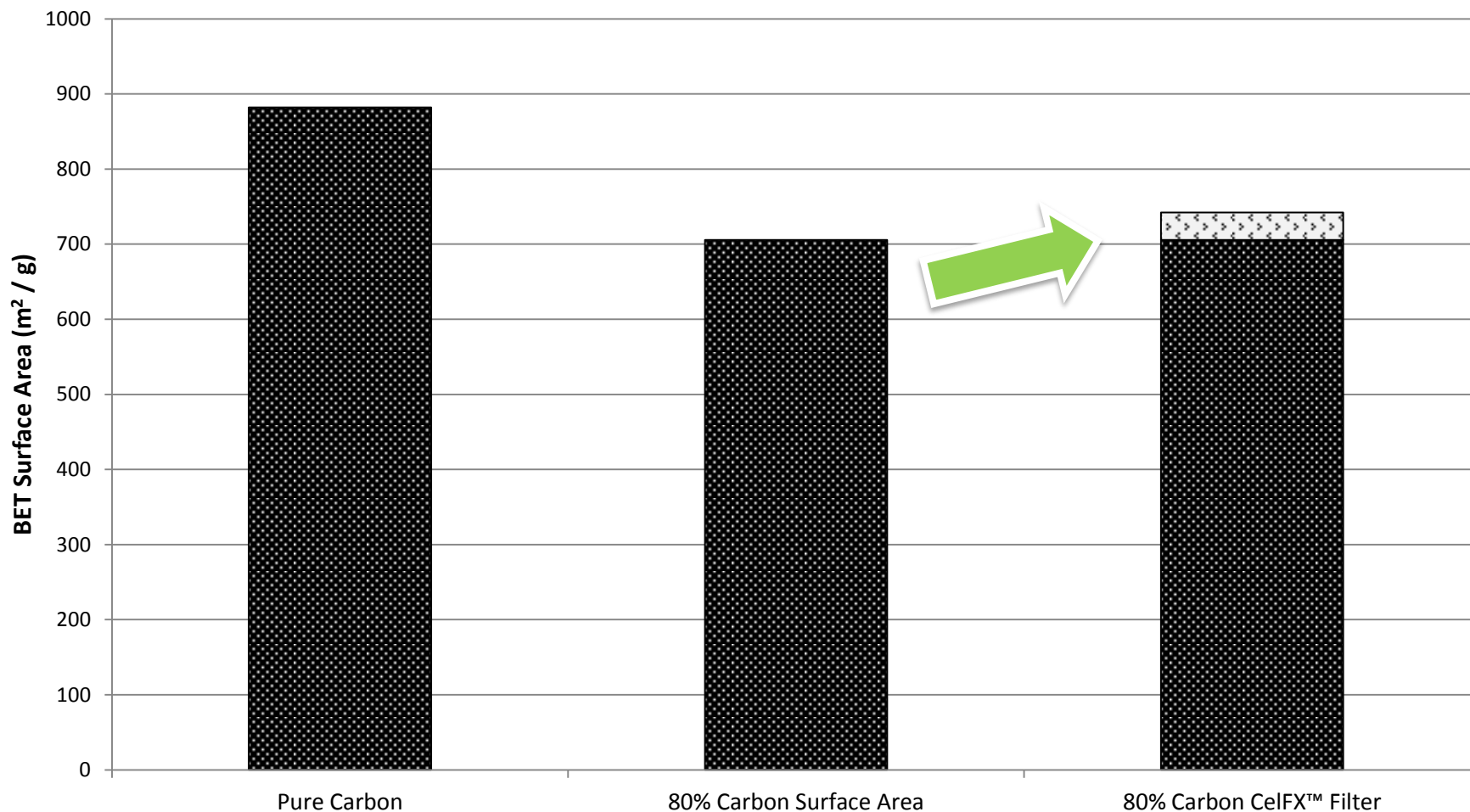
Super-Slim Size

- Pressure drop flexibility down to 3.5 mm/mm
- Carbon loading flexibility up to 8.0 mg/mm

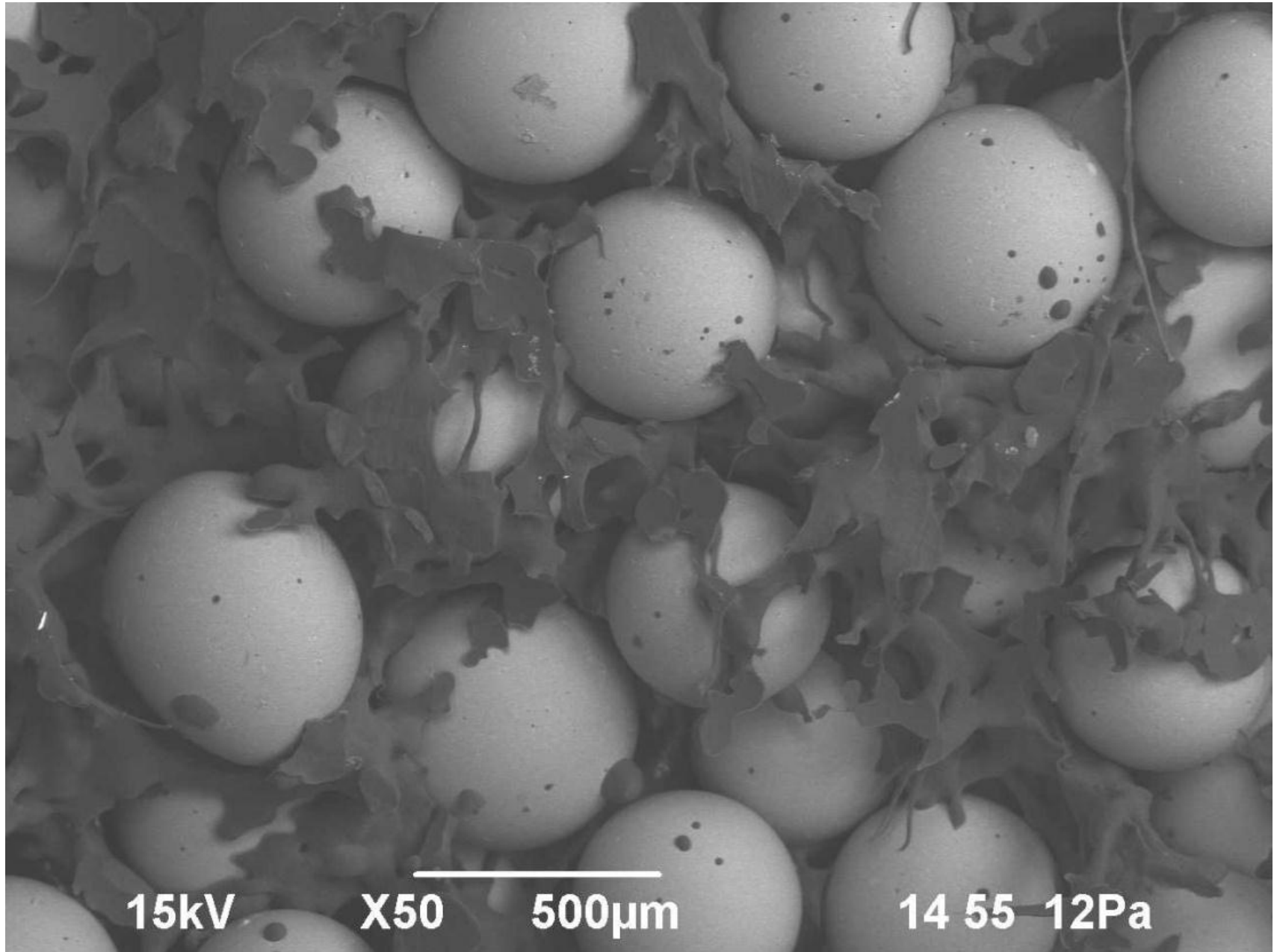
Low Release

- Significantly lower carbon particle release

Increase Effective Surface Area

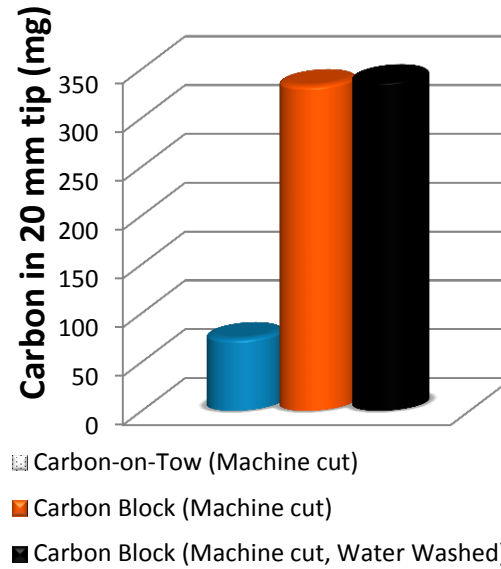


Binder does not de-activate the carbon. It adds surface area!



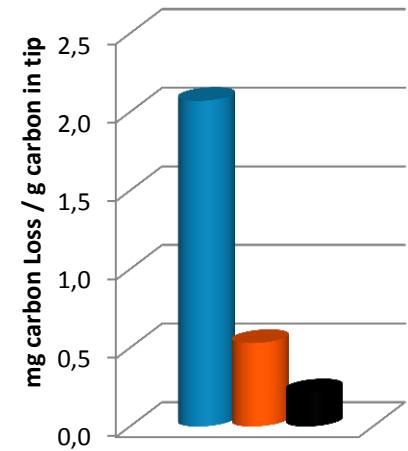
Reduced Particle Release

- ▶ Carbon release test
 - Dry puffed 20 mm tip
 - Released carbon collected in Cambridge pad
- ▶ Released carbon on CelFX™ filter similar to release from carbon on tow filter of same length
- ▶ Options to reduce release further if needed
 - Increase binder
 - Increased processing
 - Optimize carbon
 - Wash CelFX™ filter

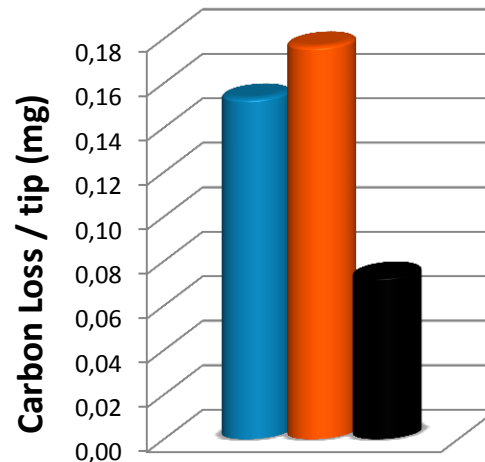


■ Carbon-on-Tow (Machine cut)
■ Carbon Block (Machine cut)
■ Carbon Block (Machine cut, Water Washed)

4.5 times as much carbon in CelFX™ Filter...



...but nearly identical amount released



CelFX™ releases 75% less carbon per gram of carbon in the filter

Rod Structure

- ▶ Structure integrity assessed using internal test
 - 8 x 20 mm segments shaken in a French square glass bottle for 5 minutes
 - Carbon weight loss during shaking converted to % loss
- ▶ < 2% weight loss assumed to be acceptable quality
- ▶ Most filters can be made with % loss < 1.0%



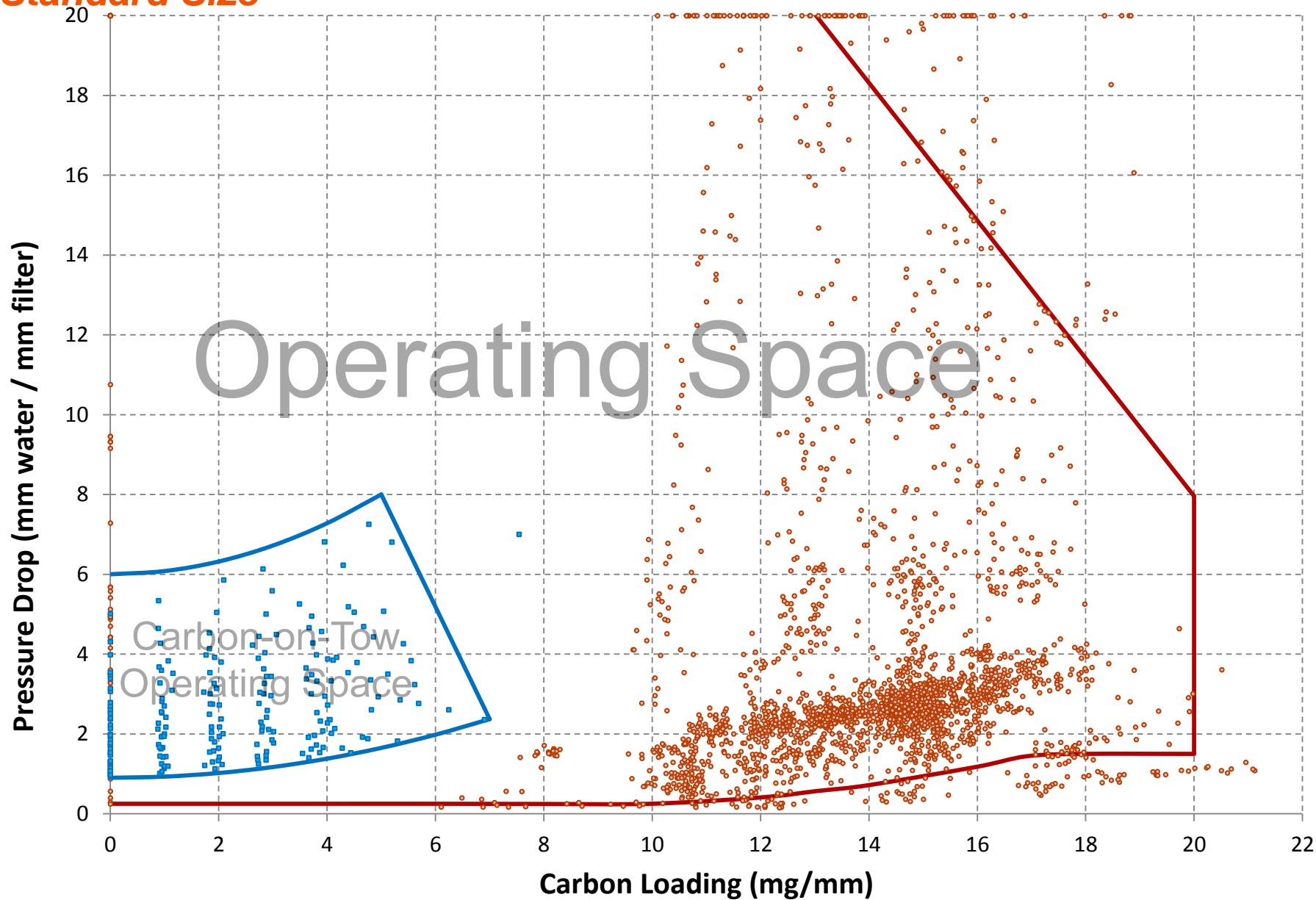
Plasticized carbon-on-tow filter (4.01 mg/mm):
0.98% loss with same test

Filter Structure

	Length mm	Circumference mm	% Volume Occupied	% Void volume	Surface area meter²	Pressure drop/mm of length
Acetate (2.7 DPF)	20	24.45	8	92	0.03	3.3
CeIFX™ (15 mg/mm)	10	24.45	77	23	144	3.2-3.4

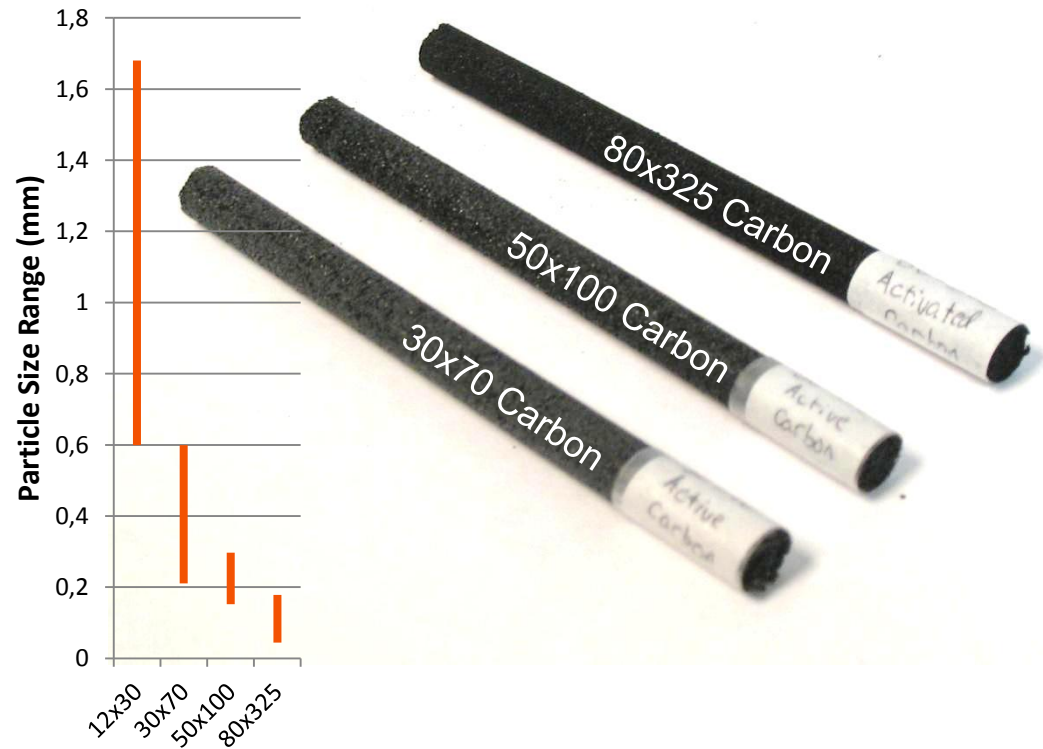
Design Flexibility

Standard Size

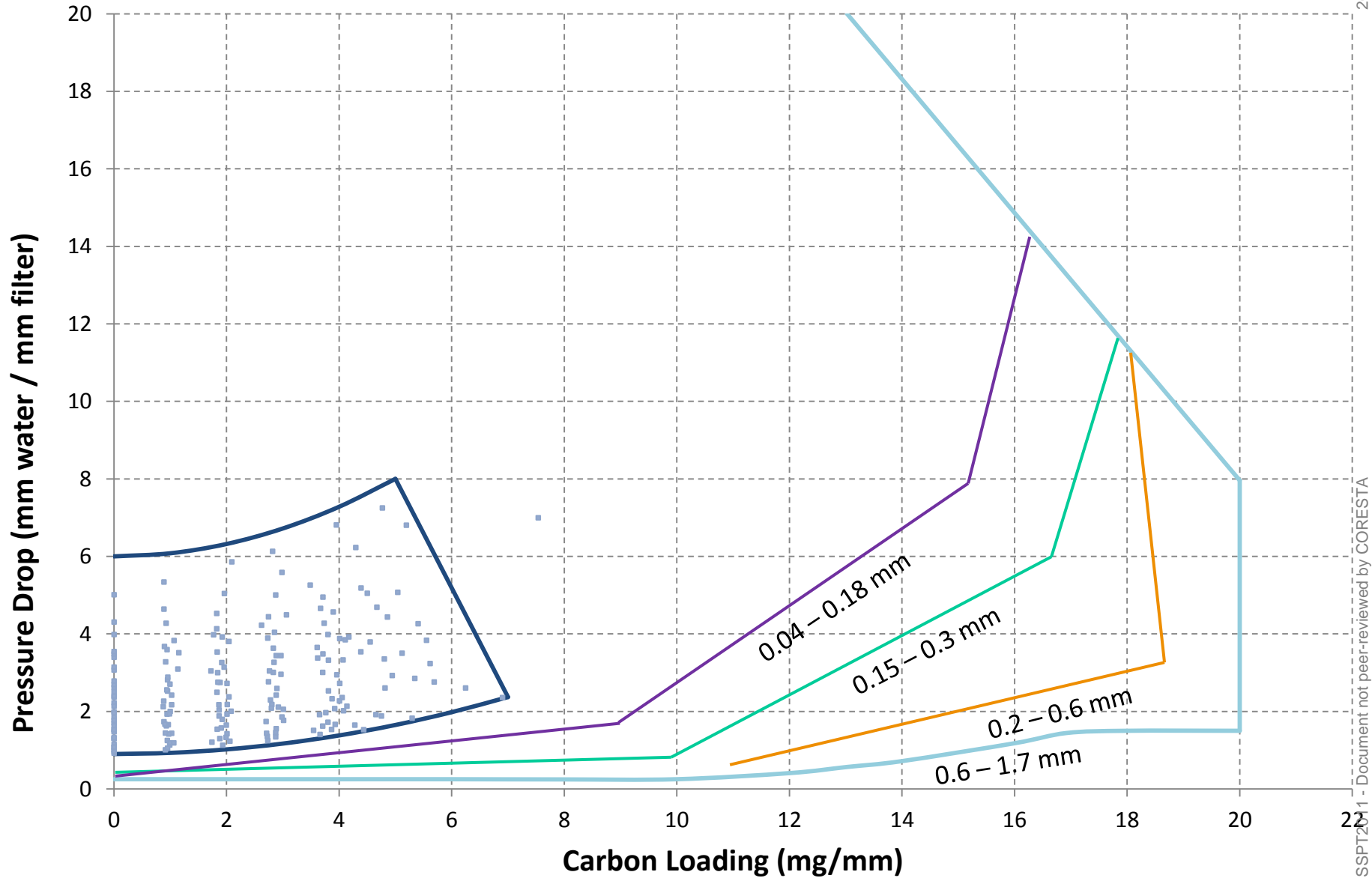


Carbon Types

- ▶ Range of carbon types can be used
 - Different sizes impact EPD range, loading range and structural integrity
 - Carbon activity not impacted
- ▶ More flexibility than with conventional filter platforms

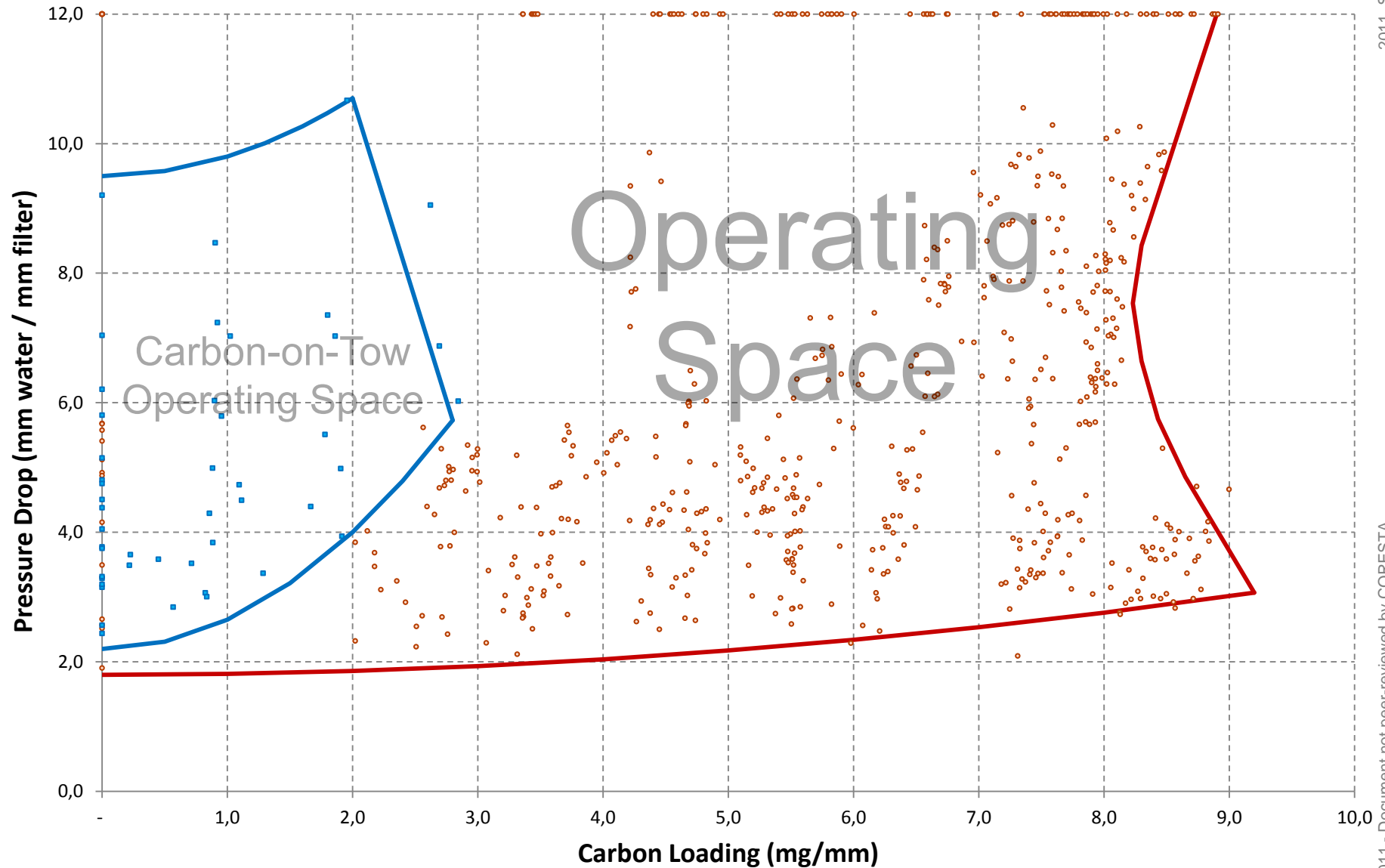


Particle Size Capability



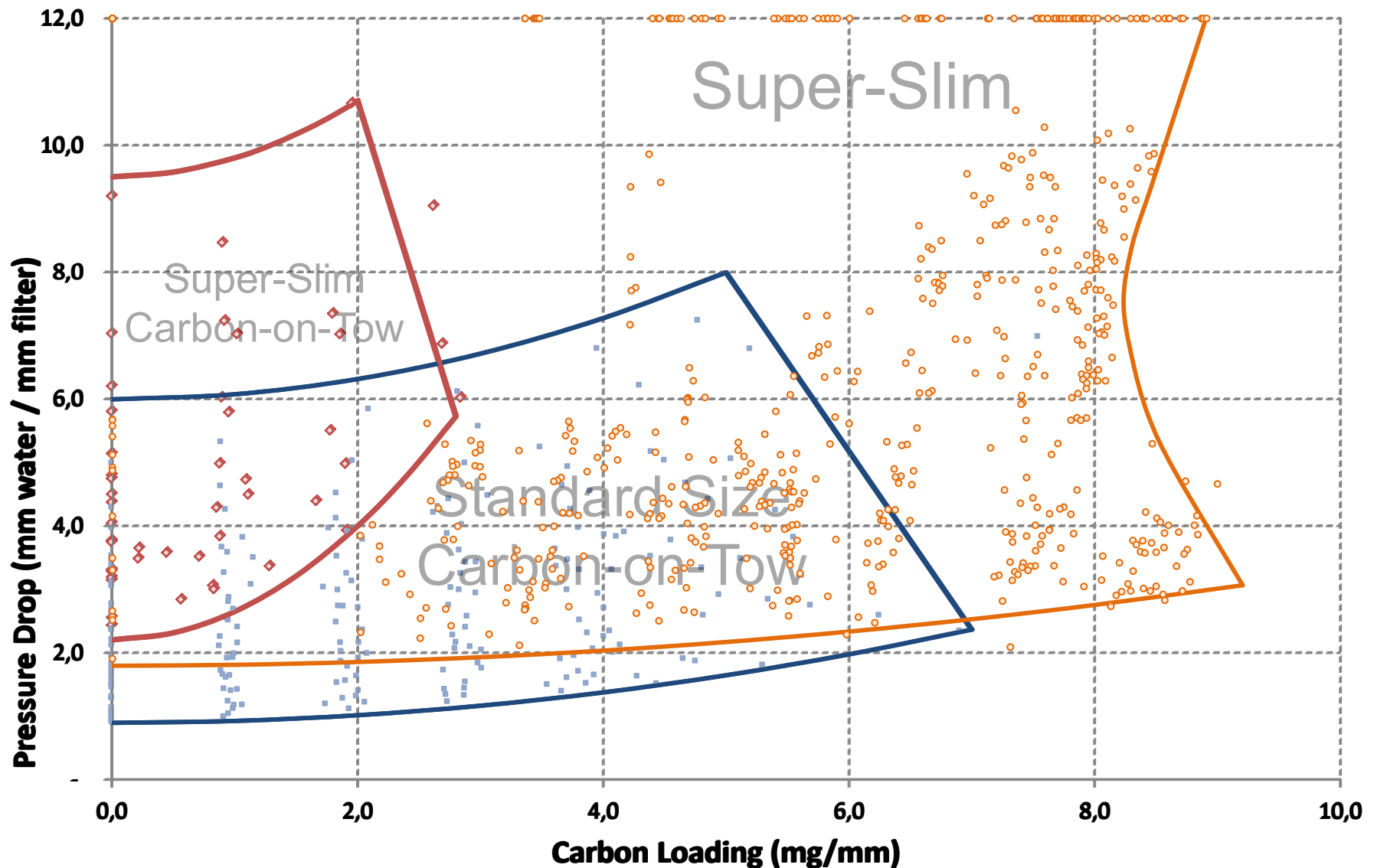
Design Flexibility

Super-Slim Size



Design Flexibility

Standard Filter in a Super-Slim Size



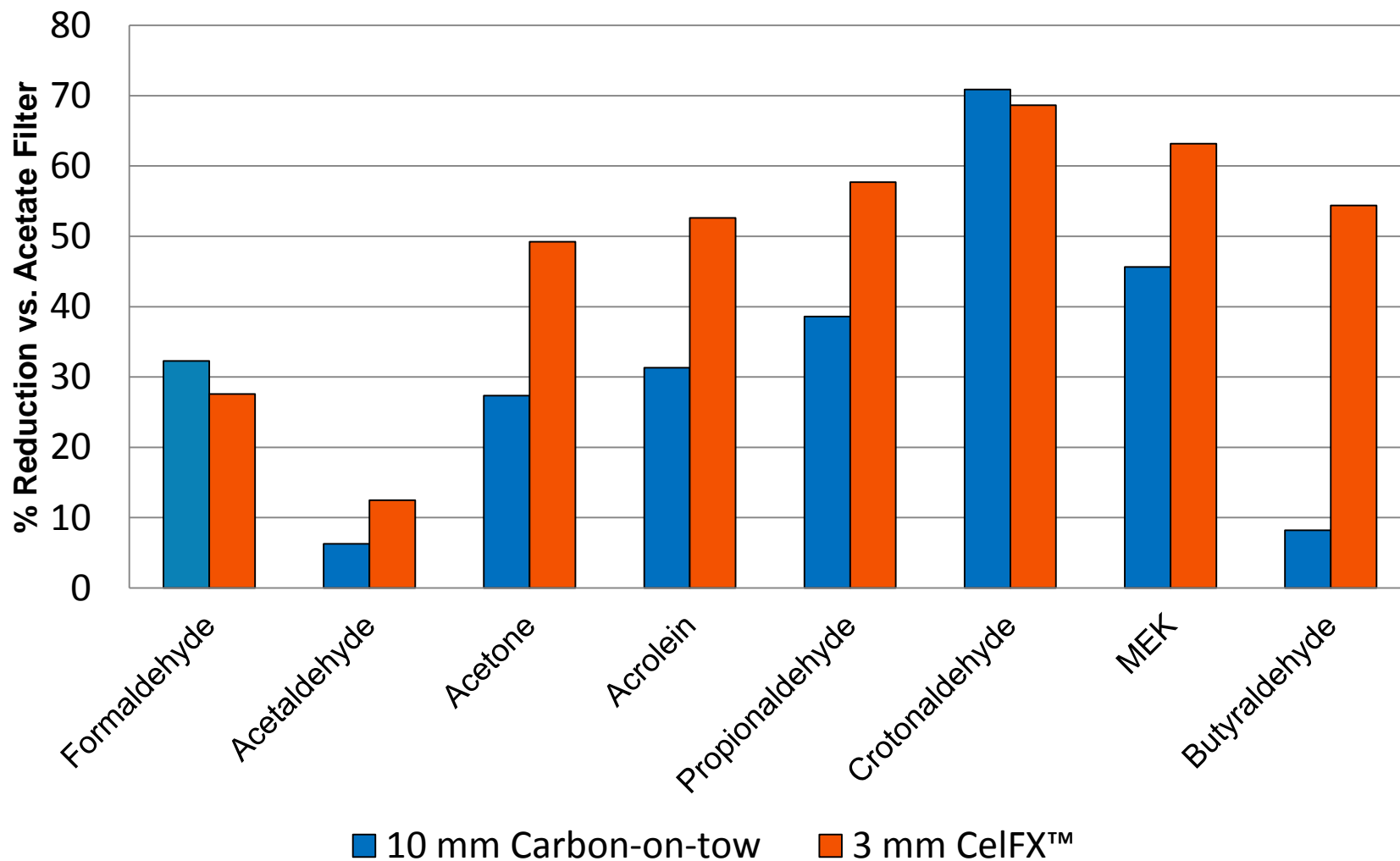
- 16.7 mm Carbon-on-Tow Boundaries
- 24.45 mm Carbon-on-Tow Boundaries
- 16.7 mm CeLFX™ Boundaries
- 16.7 mm CeLFX™ Rods

Carbonyl Reduction: Canadian Intense Filtered Smoke



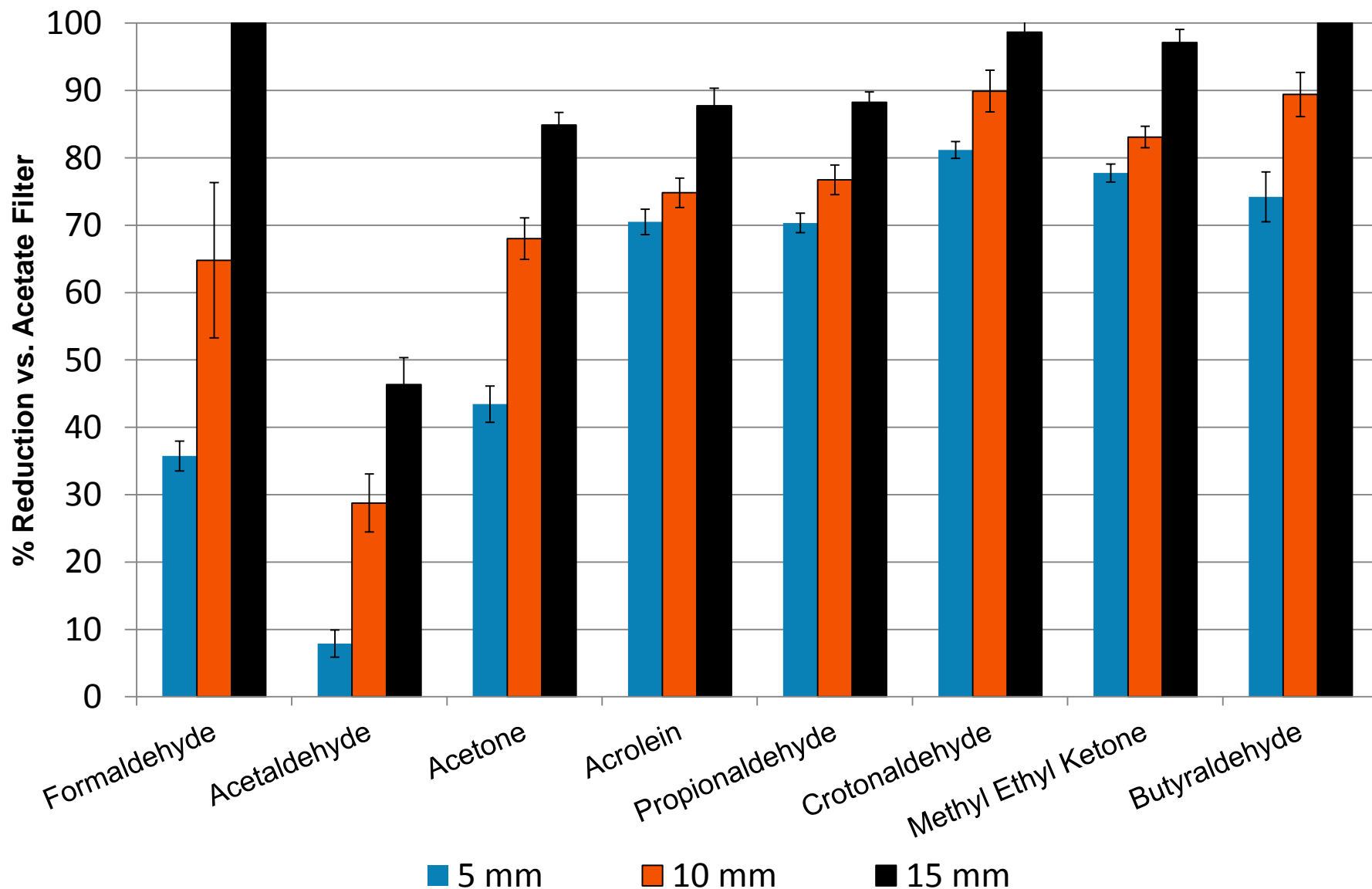
CeIFX™ Carbon vs. Carbon-on-Tow Filter

Matched Loadings Standard Size



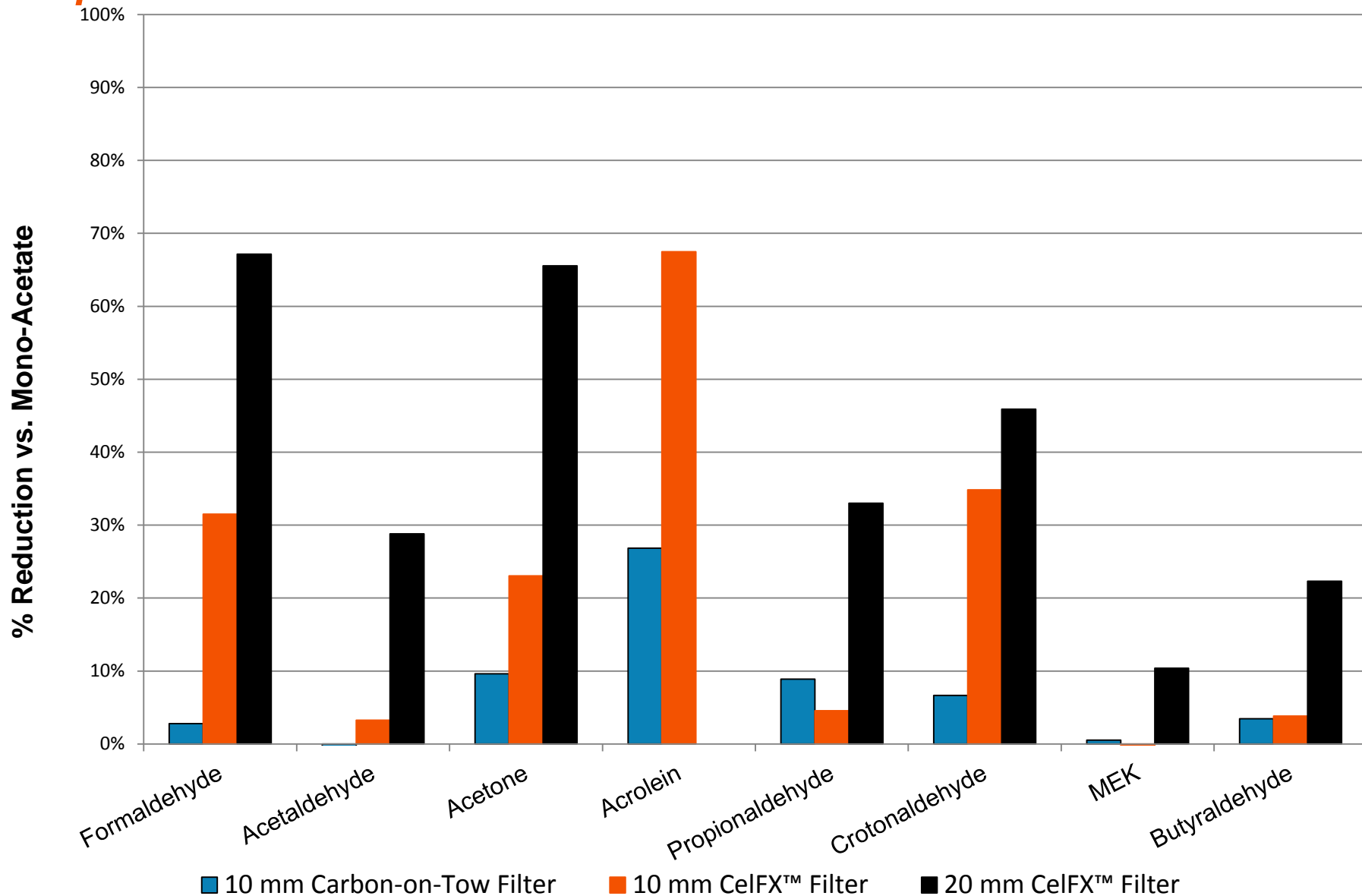
CeIFX™ Carbon Carbonyl Reduction

Standard Size



CeIFX™ Carbon Carbonyl Reduction

Super-Slim Size



Conclusions

- ▶ Flexible, simple platform
- ▶ High loads of active material
 - Standard - 20 mg/mm
 - Super slims - 8 mg/mm
 - Increases filter design opportunity - free up filter length (space)
- ▶ Significant constituent reductions with standard carbons
- ▶ Large pressure drop/loading design space
 - Matches cellulose acetate pressure drop

Next Steps

- ▶ Filter combiner trials
- ▶ Cigarette maker trials
- ▶ Investigate flavors
- ▶ Refine manufacture process
- ▶ Post manufacturing additions

Acknowledgment

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