



GEO-CENTERS, INC.

Further Development of AGENTFATE or Sampling Methodology Development for Laboratory Measurement of the Environmental Fate of HD on Surfaces

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Combinations of Interest

Agents

HD

GB

GD

VX

Thickened

Surfaces

Concrete

Asphalt

Sand/Soil

Vegetation

Distinguishing Features of the ECBC 5cm Wind Tunnels

Balance of chemistry & aerodynamics

Single droplet capability

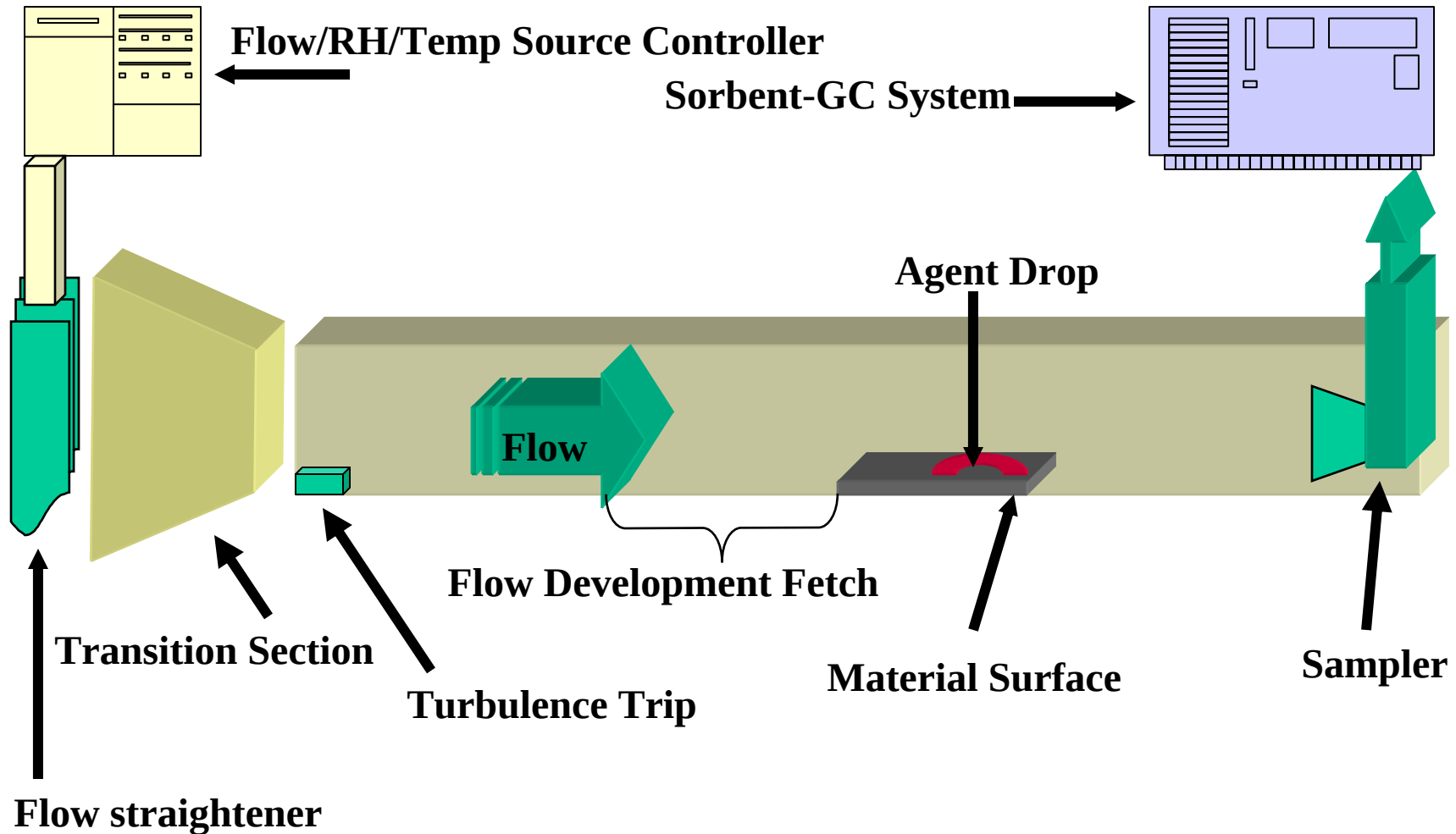
Large dynamic range

Automated - Potential for 24/7 operation

Multiplexed for high throughput

Integrated video system

Diagram of a Laboratory Droplet Vapor Sampling Evaporation Device



“Hapsite” Man Portable GC/MS



Markes Unity Desorber & GC



Both Velocity and Concentration are Critical for Vapor Method

Cross-Sectional Area

Discharge rate

$$Q = (u) (A)$$

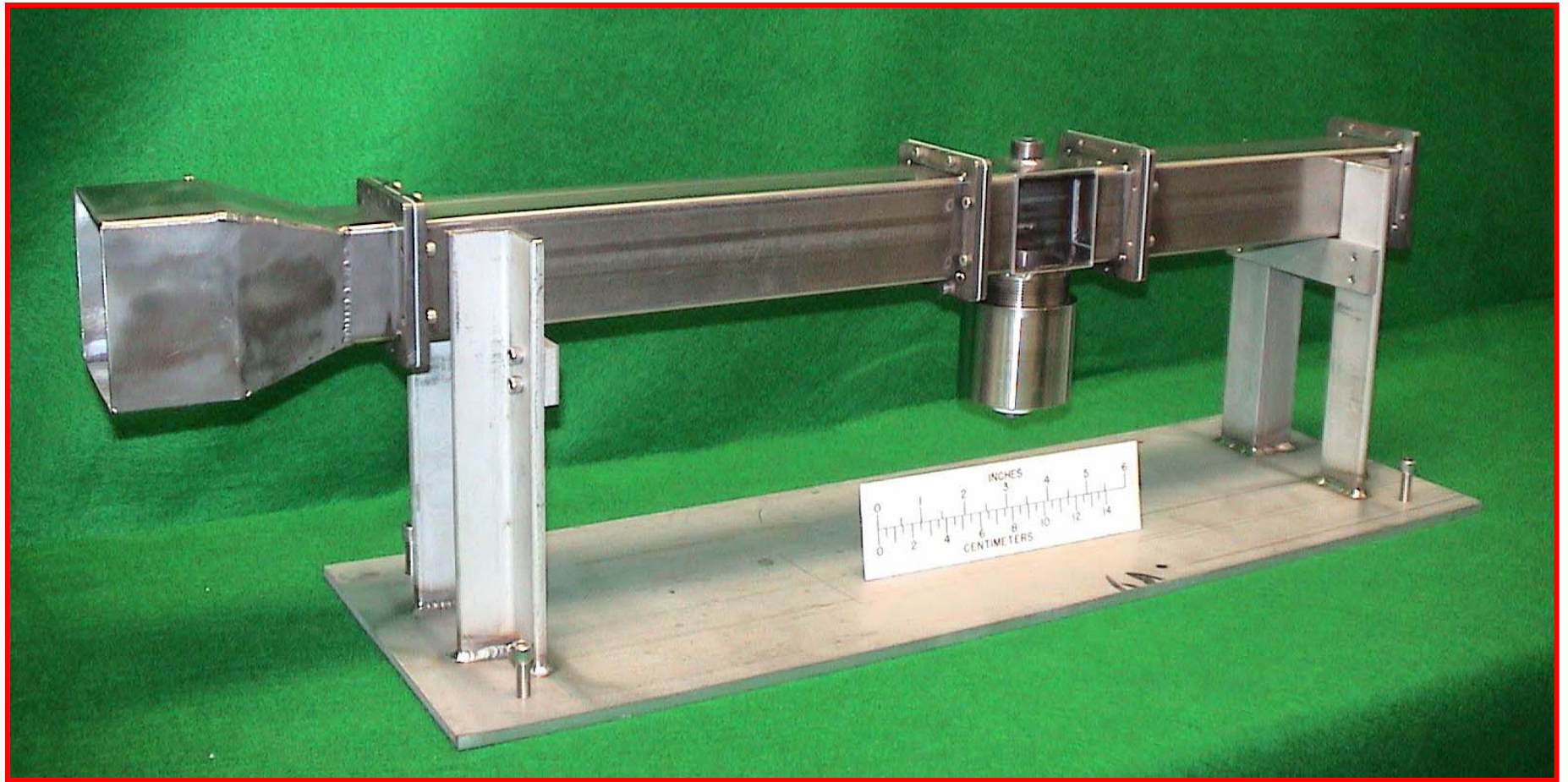
Average Velocity

$$(Q) (t) ([HD]) = \text{Total Mass Agent}$$

5 cm “Wolverine” Tunnel



5 cm “Buckeye” Tunnel



The “Buckeye” Era Begins

“Wolverine” Original Wind Tunnel

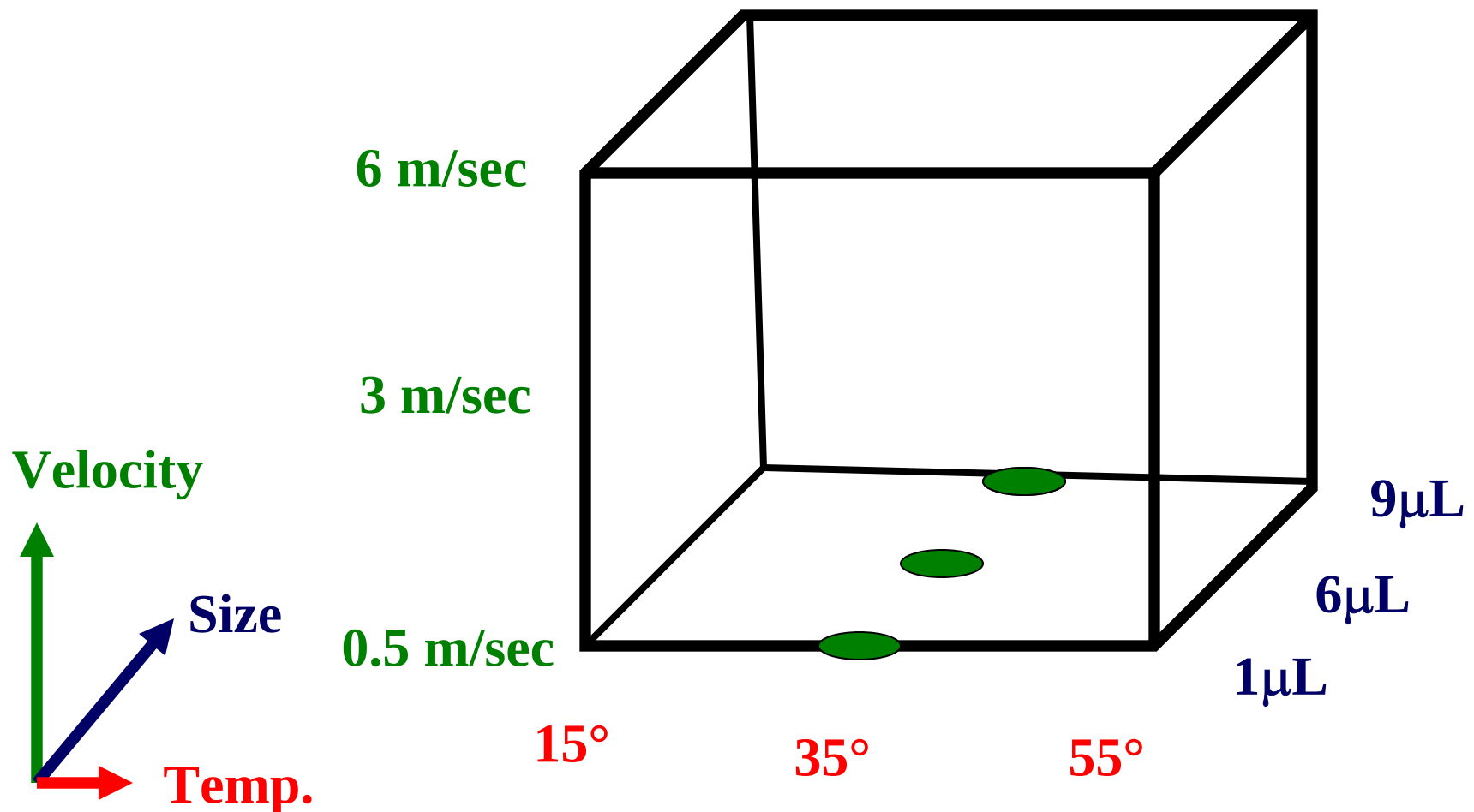
Leaks a constant problem
No wall temperature control
High flow problematic
Inconsistent results

“Buckeye” 2nd Generation Wind Tunnel

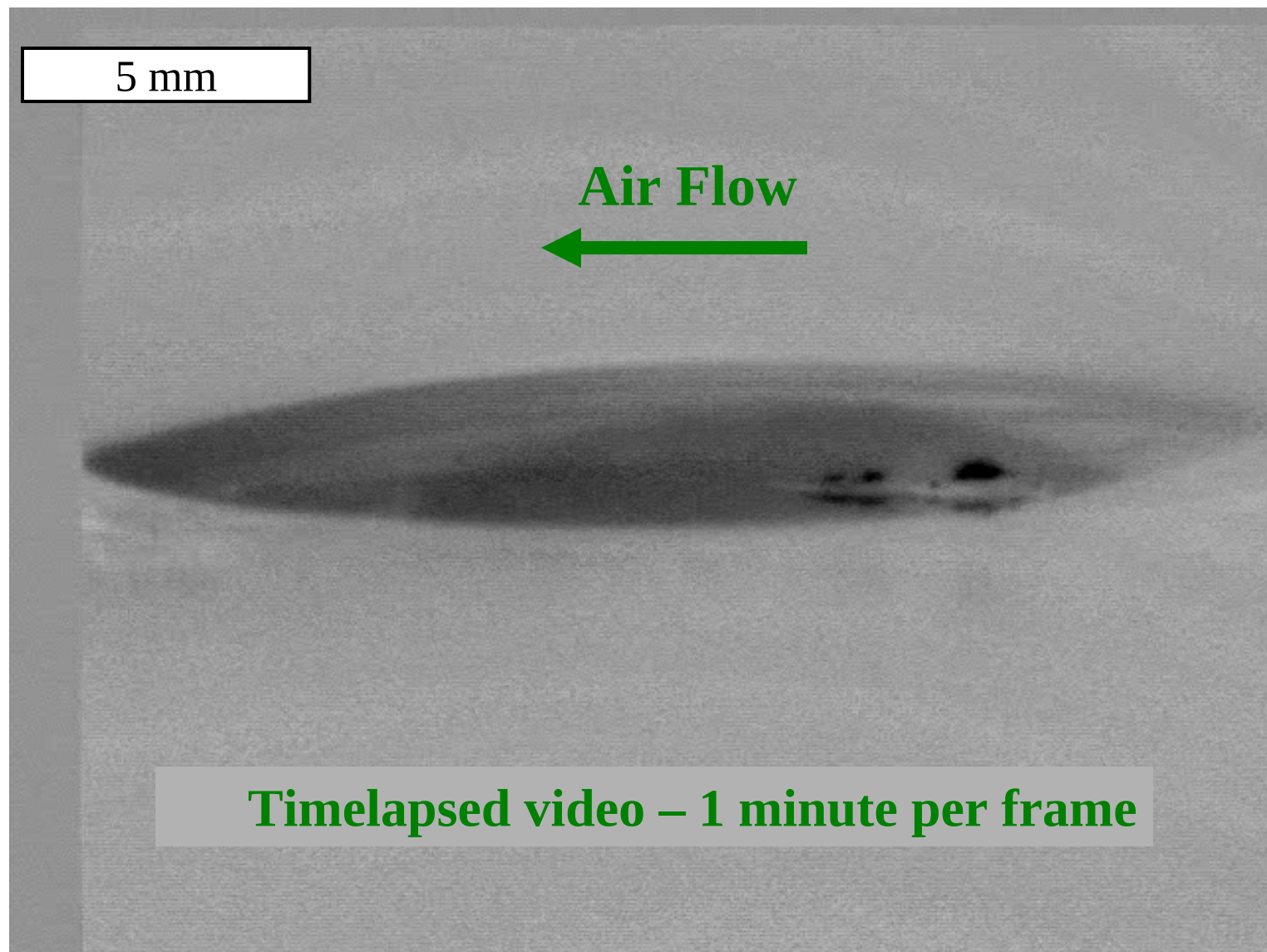
Teflon gasket + flanges to seal
Added two wall temperature controllers
Consistent performance at flows important to the matrix
Integrated digital video system
Expanded flow and temperature ranges

Buckeye design enables measurements encompassing a large part of the matrix

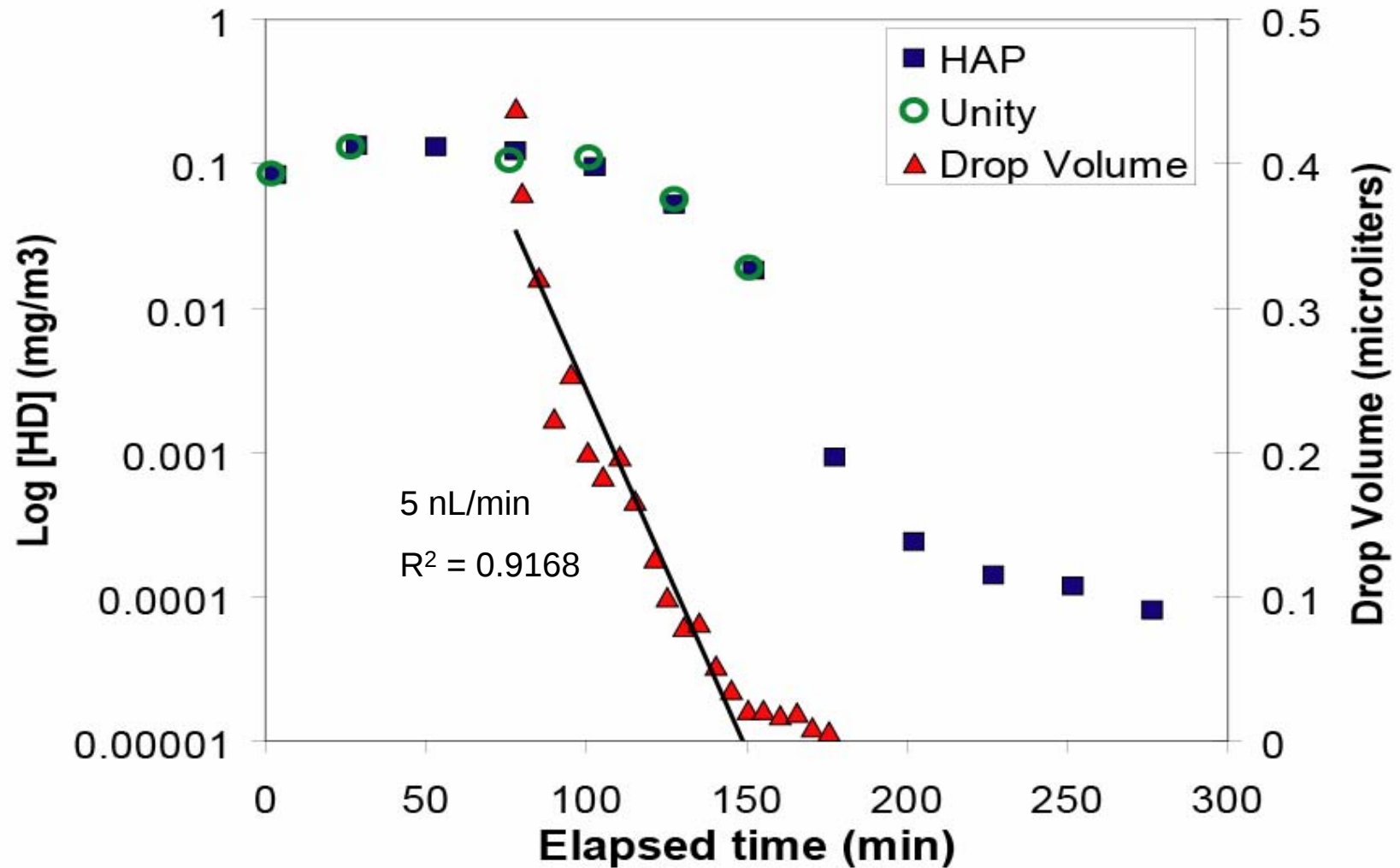
Target: 3 HD Drop Sizes at 35°C, Low Wind Speed on Glass



Real Time Imaging of Evaporation for Volume Measurements



Correlations Between Two Vapor Samplers and Video Information

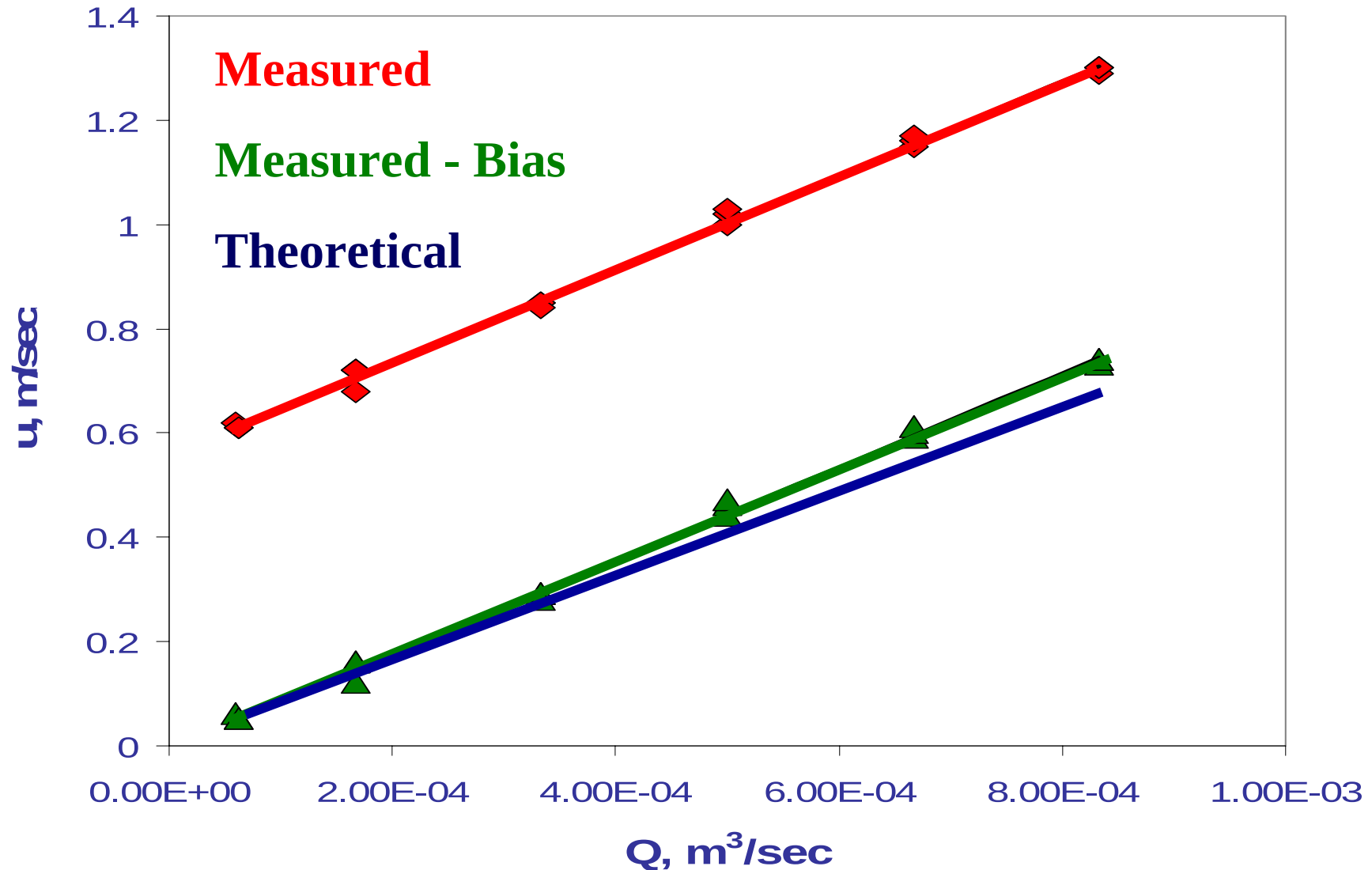


Buckeye Design Yields Consistent Results

Run	Air ° C	Hum. %RH	Flow (Slpm)	Mass (mg)	Vapor Recovery (%)
B05	35.0	< 3%	35.1	1.085	41.2%
B06	34.8	51%	35.7	0.817	41.6%
B07	34.6	50%	35.3	0.927	46.5%
B08	34.7	50%	35.4	0.714	48.3%

Compare “Wolverine” design vapor recovery
0.5 % → 50% at these conditions!

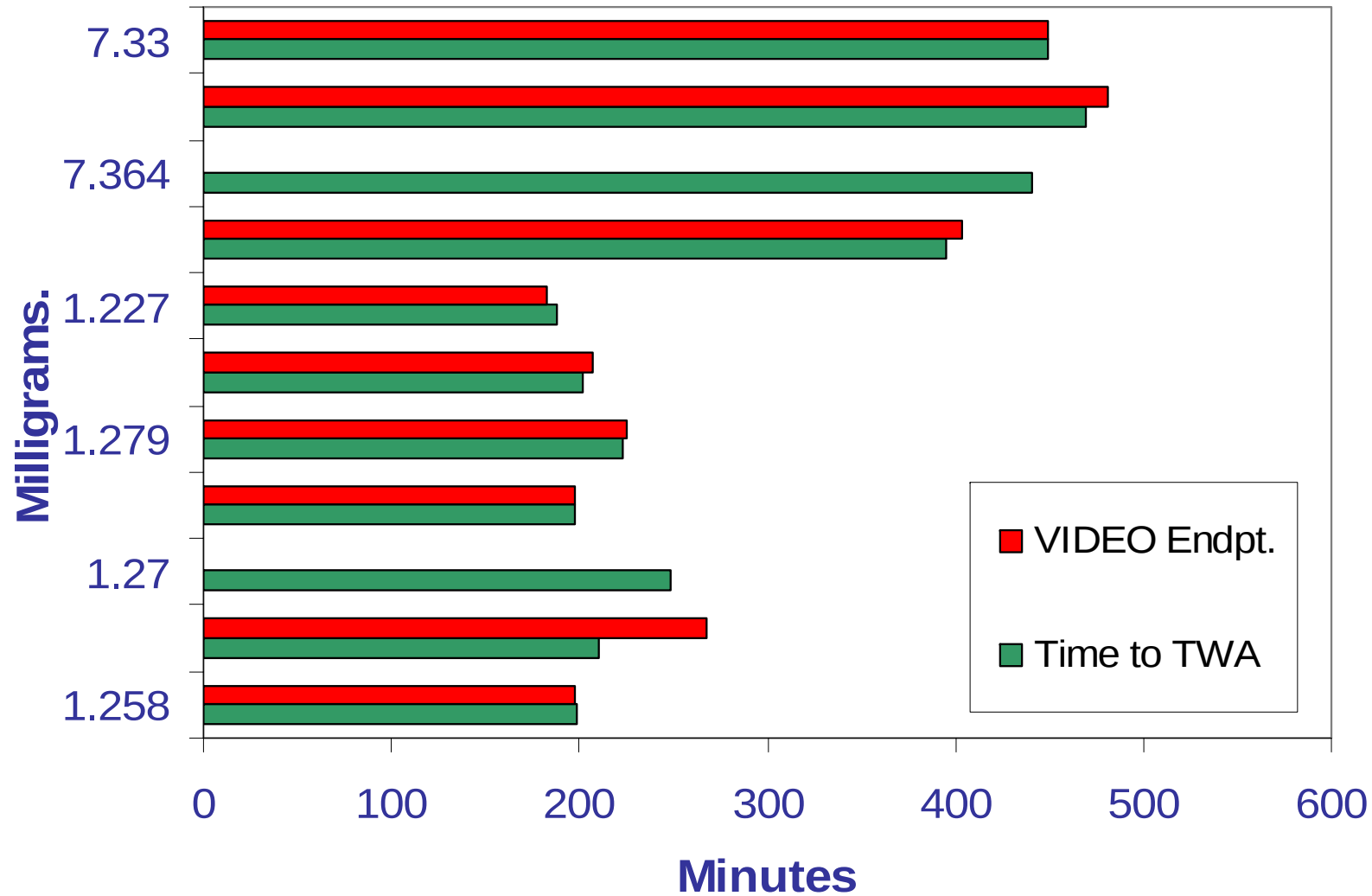
Anemometry Spots a Leak



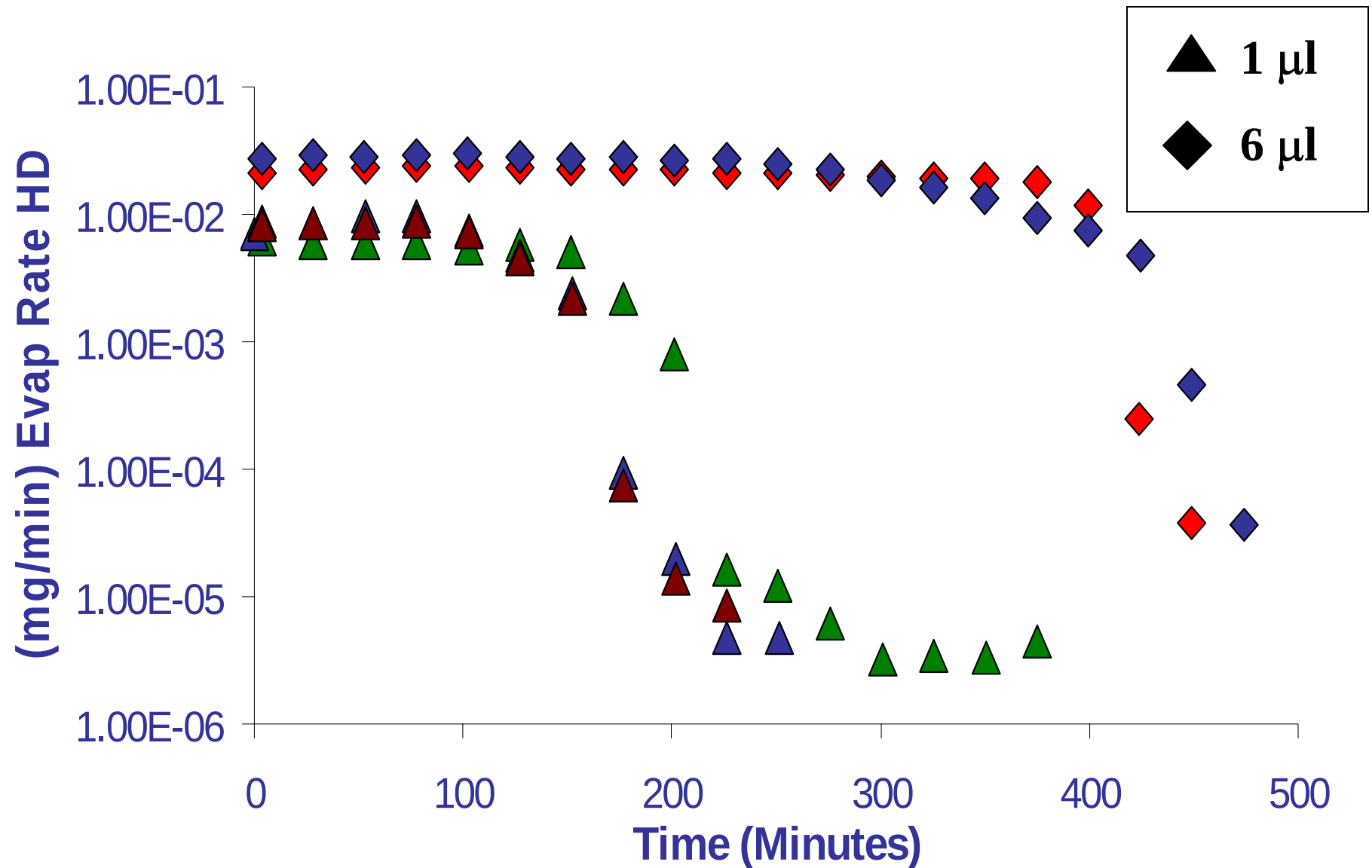
New Blower Design Helps Recovery

Run	Air ° C	Hum. %RH	Flow (Slpm)	Mass (mg)	Vapor Recovery (%)
B18	34.9	< 3%	34.8	1.320	101%
B19	35.0	46%	35.9	1.279	80%
B20	35.0	47%	35.7	1.326	101%
B21	34.9	52%	35.9	1.227	89%

Vapor and Visual Courses Match



Drop Size Effect on Experiment



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Wind Tunnel Design



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Instrumentation & Data Collection



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Video System & Analysis



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