IMPROVE Carbon Analysis

Judith C. Chow (judith.chow@dri.edu)
John G. Watson
Dana L. Trimble

Desert Research Institute, Reno, NV

Presented at

the IMPROVE Steering Committee Meeting

Hot Springs, South Dakota

September 22, 2009

Objectives

- Report progress on IMPROVE carbon analyses
- Present results of carbon analyzer quality control checks
- Enumerate improvements on carbon analyzers

Summary of Carbon Lab Operations

- Acquired three additional Model 2001 carbon analyzers (Sept. 2008, and May 2009)
- Maintained 24 hours per day/7 days per week operation with 2 full-time and 2 part-time technologists, and 4 part-time students
- Recruited a full-time Electro-Mechanical Technician to perform maintenance on the analyzers (Sept. 2009)
- Analyzed over 23,000 IMPROVE samples

IMPROVE Samples for Carbon Analysis using the IMPROVE_A Protocol

(7/08 – 6/09)

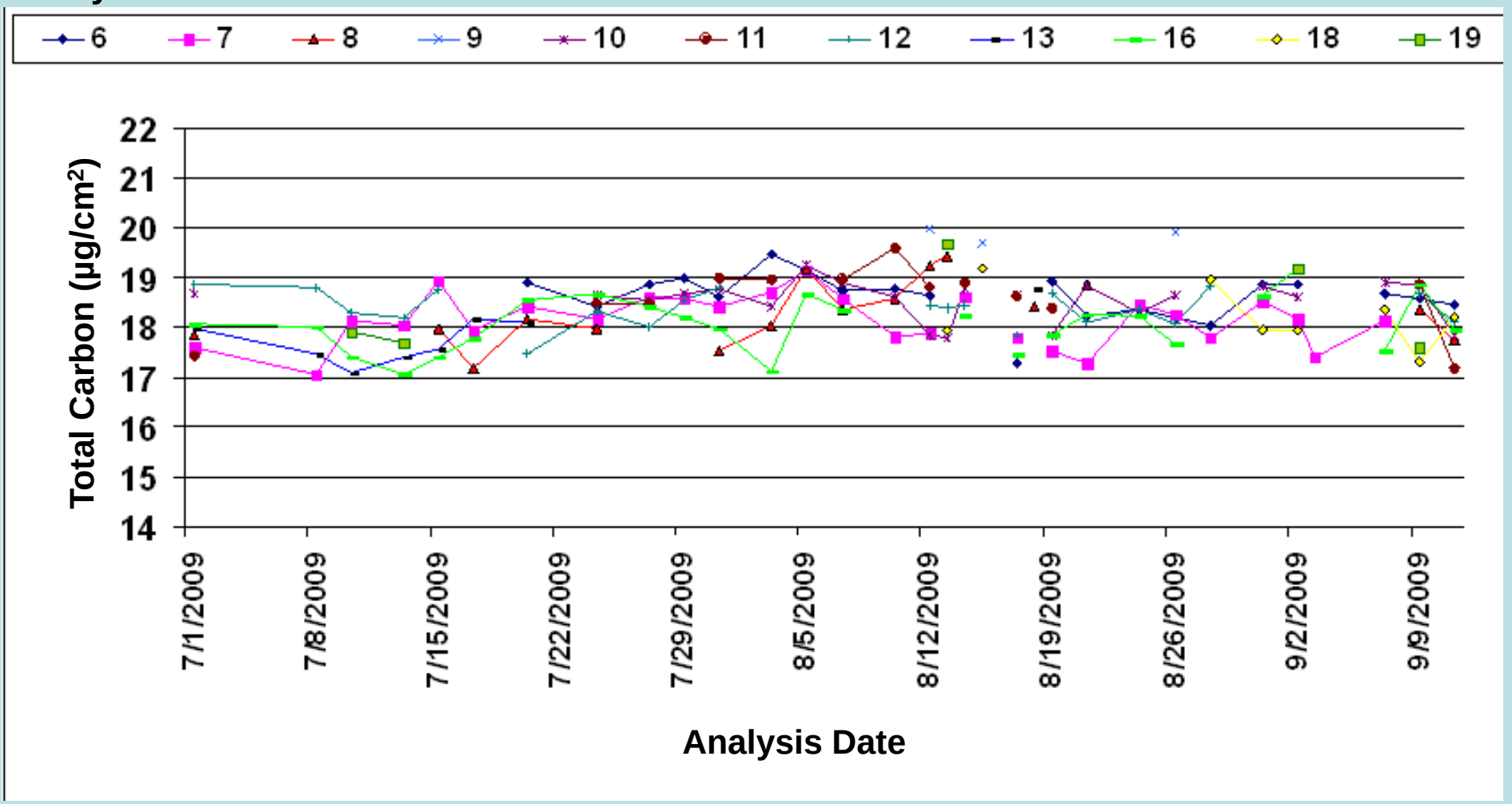
Sampling Period	Samples Received	Analysis Completion Date
7/1/08-12/31/08	11,451	2/12/09
1/1/09-6/30/09	11,933	7/10/09

Weekly Carbon Analyzer Quality Control Checks
(Effective 3/26/09)

	Sunday	Monday	Tuesday	Wed.	Thursday	Friday	Saturday
Morning (as part of startup)	Autocalib	Sucrose Injection*	Autocalib	Sucrose Injection	Autocalib	Sucrose Injection	Autocalib
Evening	CO_2 Injection	Autocalib	CO_2 Injection	Autocalib	CO_2 Injection	Autocalib	CO_2 Injection

* Sucrose injection: 10 µl of a 5% solution
TC ≈ 17.1 – 18.9 µg C/cm^2

Sucrose Calibration
(three times per week)

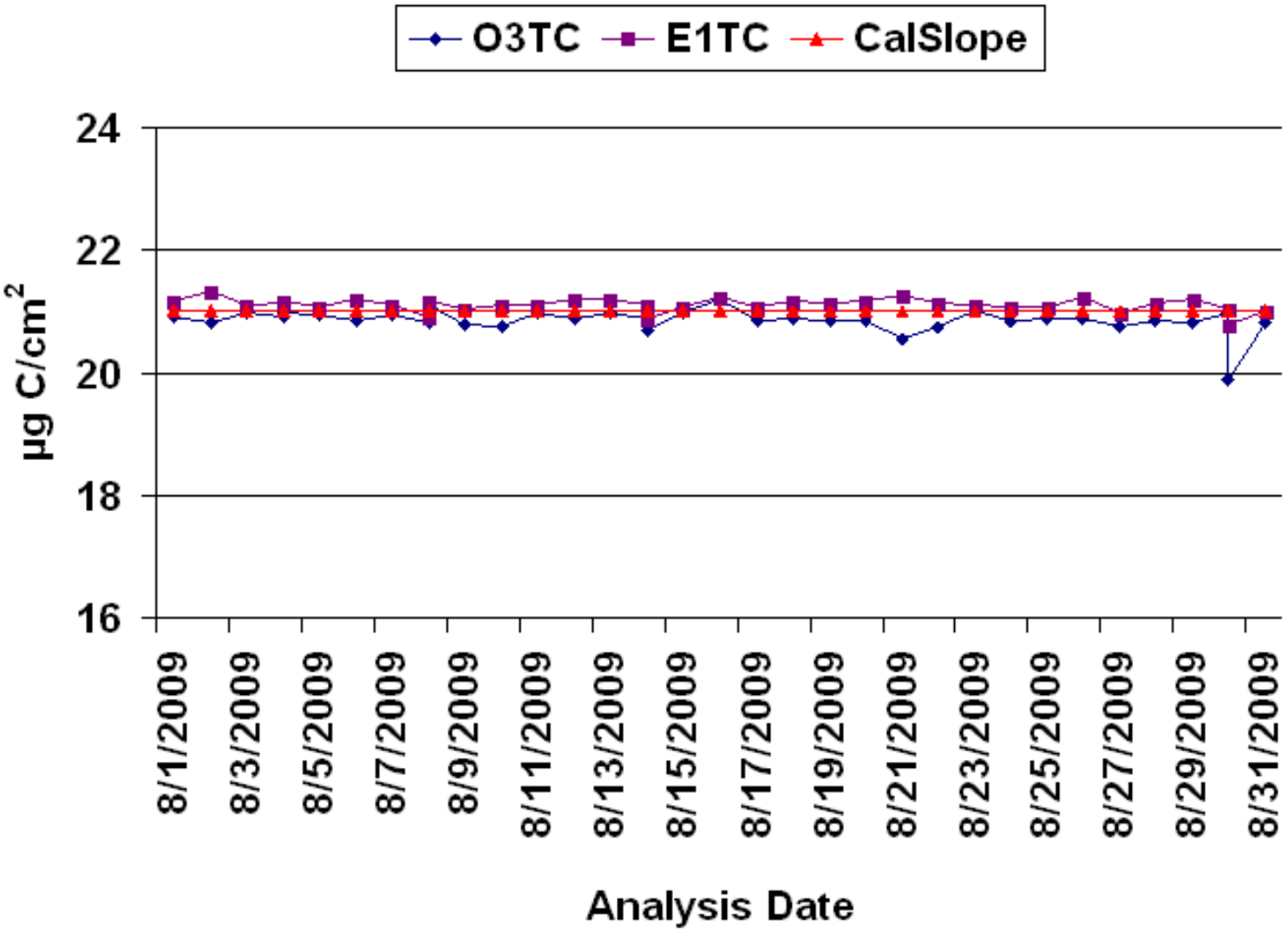


Daily AutoCalibration Procedure

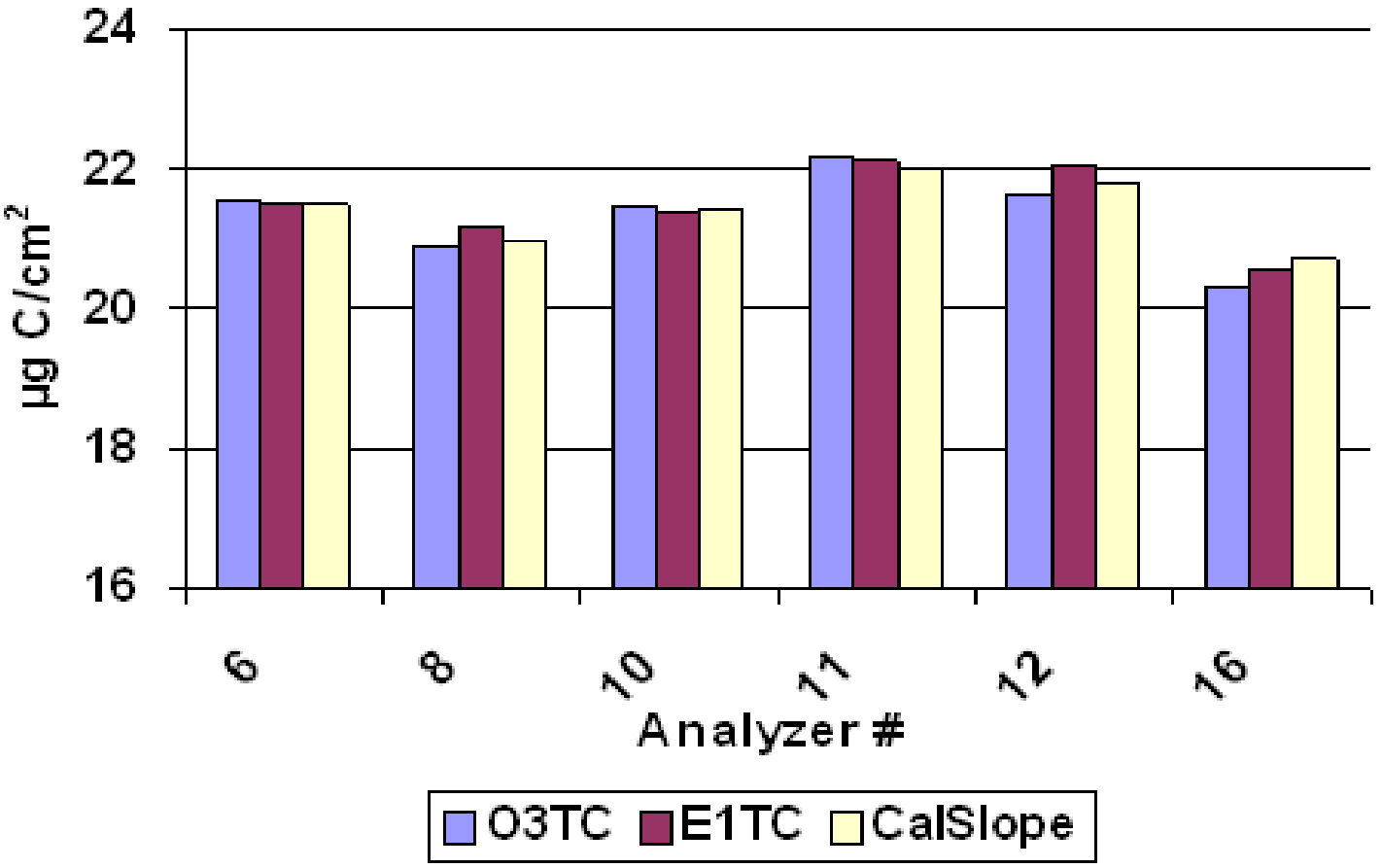
- Inject CH_4 in He-only atmosphere (OC3)
- Inject CH_4 in He/O_2 atmosphere (EC1)
- Inject CH_4 in He/O_2 atmosphere for calibration peak area (CalSlope)

The three peaks should have similar area counts if the catalyst is in good condition and the calibration factor holds

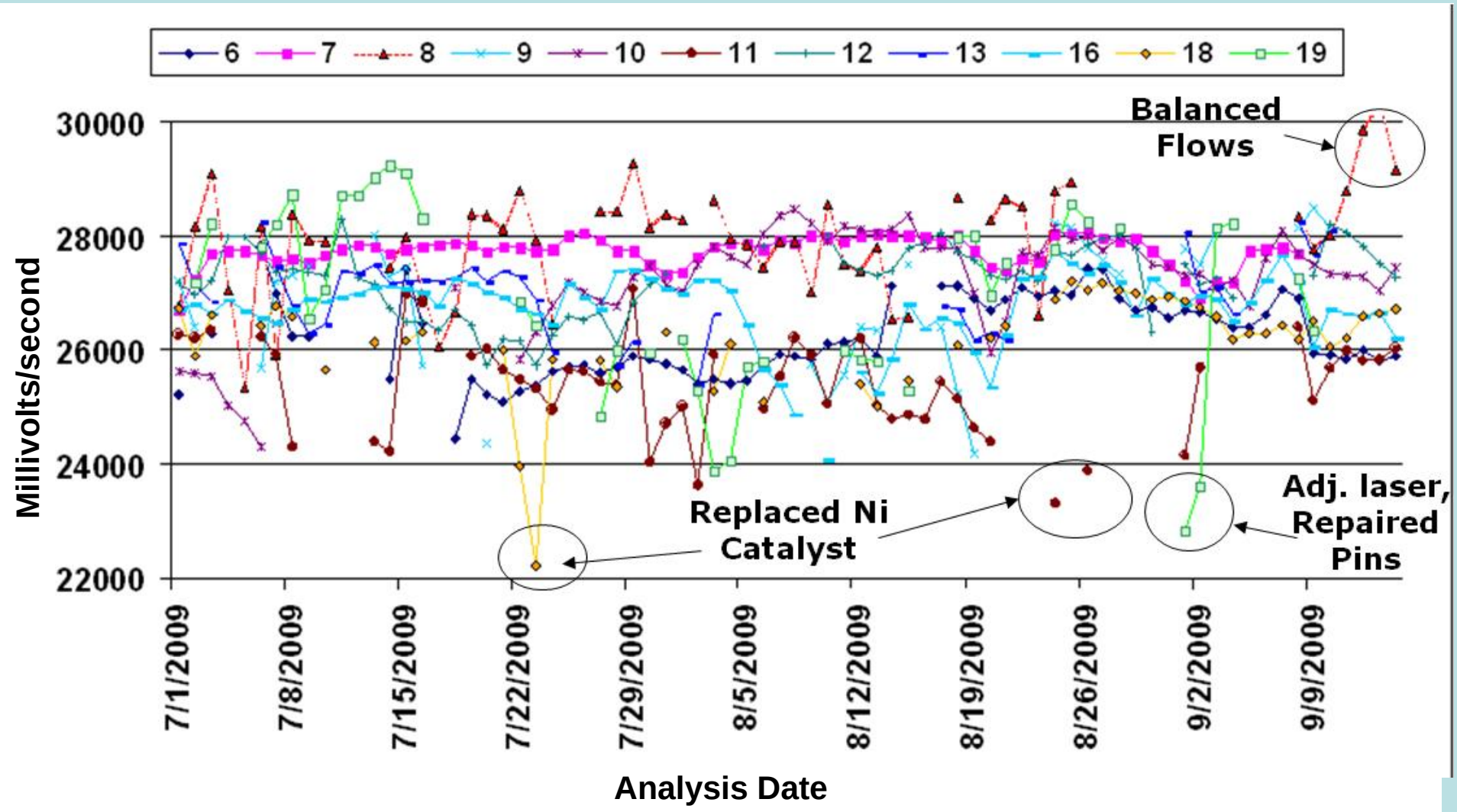
Temporal Variation AutoCalibration Chart for Analyzer #7



Daily AutoCalibration Report (9/15/2009)



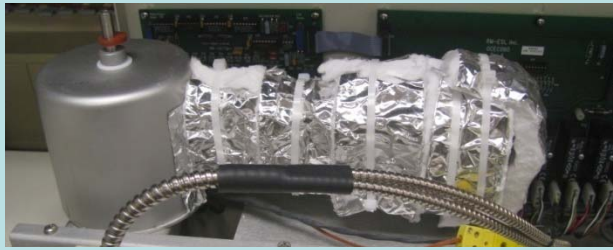
Average CalPeak Area (CH_4) Trend



Carbon Analyzer Improvements

- Installed single stage regulators to ensure consistent (±2 – 3%) flow pressure for He, He/O_2, H_2, and air

- Added aluminum-silica ceramic-fiber insulation around the FID to reduce baseline drift



- Applied NIST reference materials (RM8785, $PM_{2.5}$ fractions of SRM 1649a resuspended urban dust) for comparability between analyzers