Update on IMPROVE Carbon Analysis

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DRI's Environmental Analysis Facility (EAF) continuously operates 10-13 Model 2015 Multiwavelength Carbon Analyzers

(January 2016-November 2025, analyzed ~354,546 samples with ~174,737 for IMPROVE)

EAF Carbon Laboratory (Magee Scientific, Berkeley, CA and Aerosol, d.o.o., Ljubljana, Slovenia)

Carbon Laboratory Operations

- **Received an average of 1,503 IMPROVE samples per month between October 2024 and November 2025 (varied from 800 to 2,000).**
- **Analyzed 18,981 IMPROVE samples from October 2024 and November 2025.**
- **Shipped ~1,600 pre-fired and acceptance tested filters every month to UCD on average.**
- **Operated ~10-20 hours per day. Moved to 7-day per week schedule in October 2025.**
- **Matt Claassen has run the Carbon Lab since June 2021 with assistance from Patrick Hurbain and Mohammadreza Elahifard**

Patrick

Matt

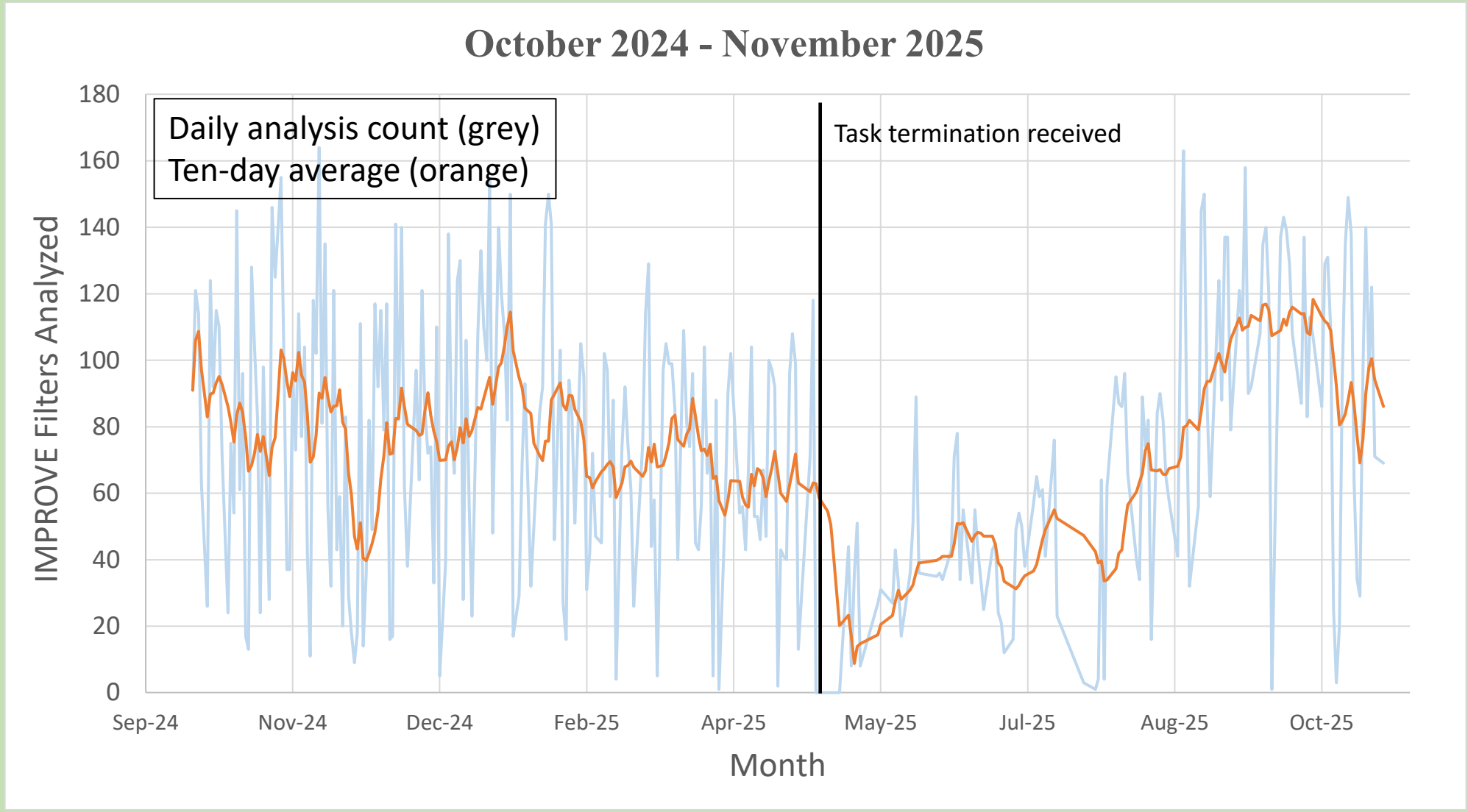
Mohammadreza

Sample Analysis Schedule

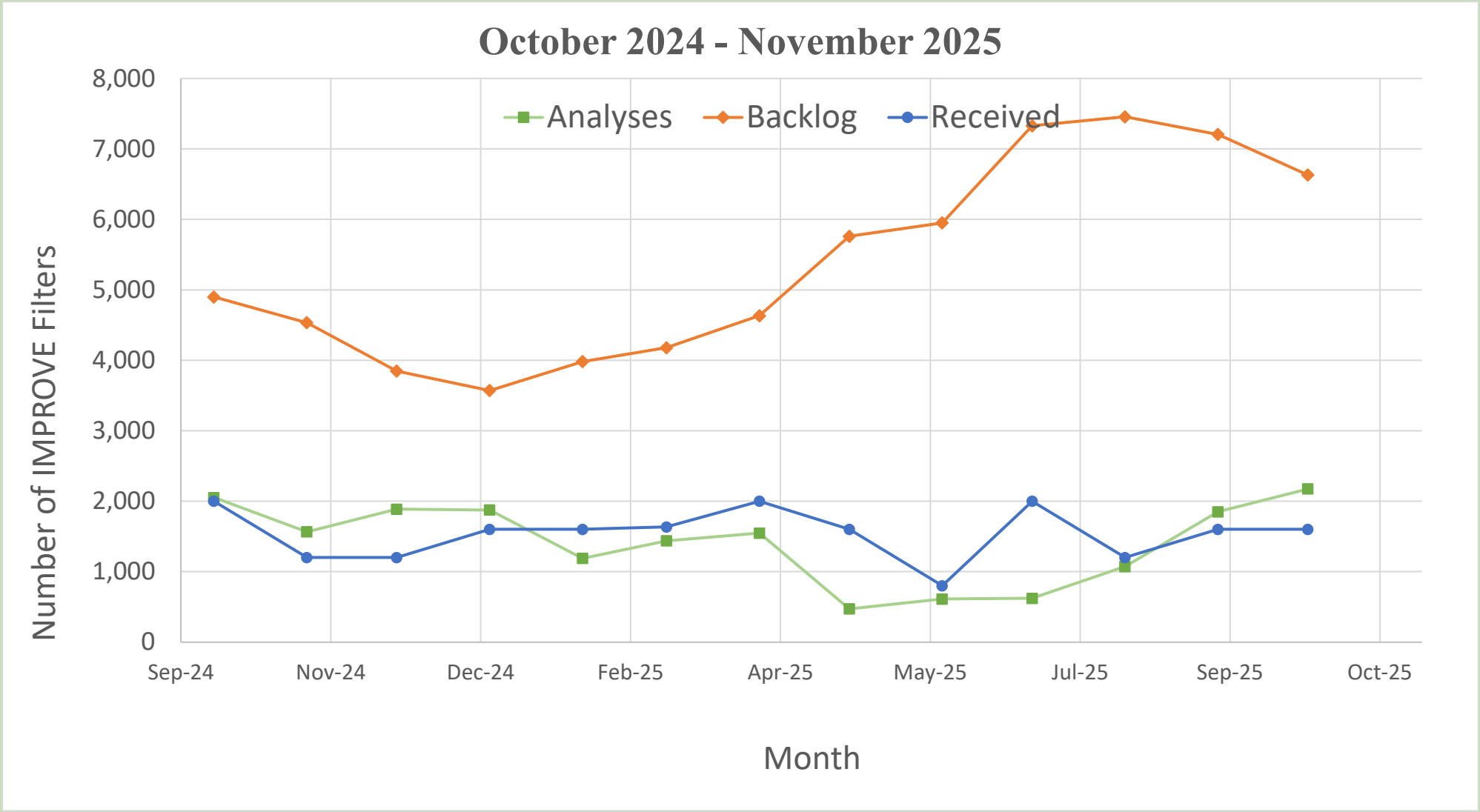
Sampling Period	Samples Received Dates	Number of Samples Received	Expected Analysis Completion Date
1/1/25 – 6/30/25	2/6/25 – 10/16/25	9,155	12/20/2025
7/1/25 – 12/31/25	7/15/25 – Present	5,245*	4/30/2026

*As of 11/10/2025

Carbon throughput averaged 72 samples per day, increasing to 89 per day since August 1st



Carbon backlog has started to decline



Non-dispersive Infrared (NDIR) detectors require replacement

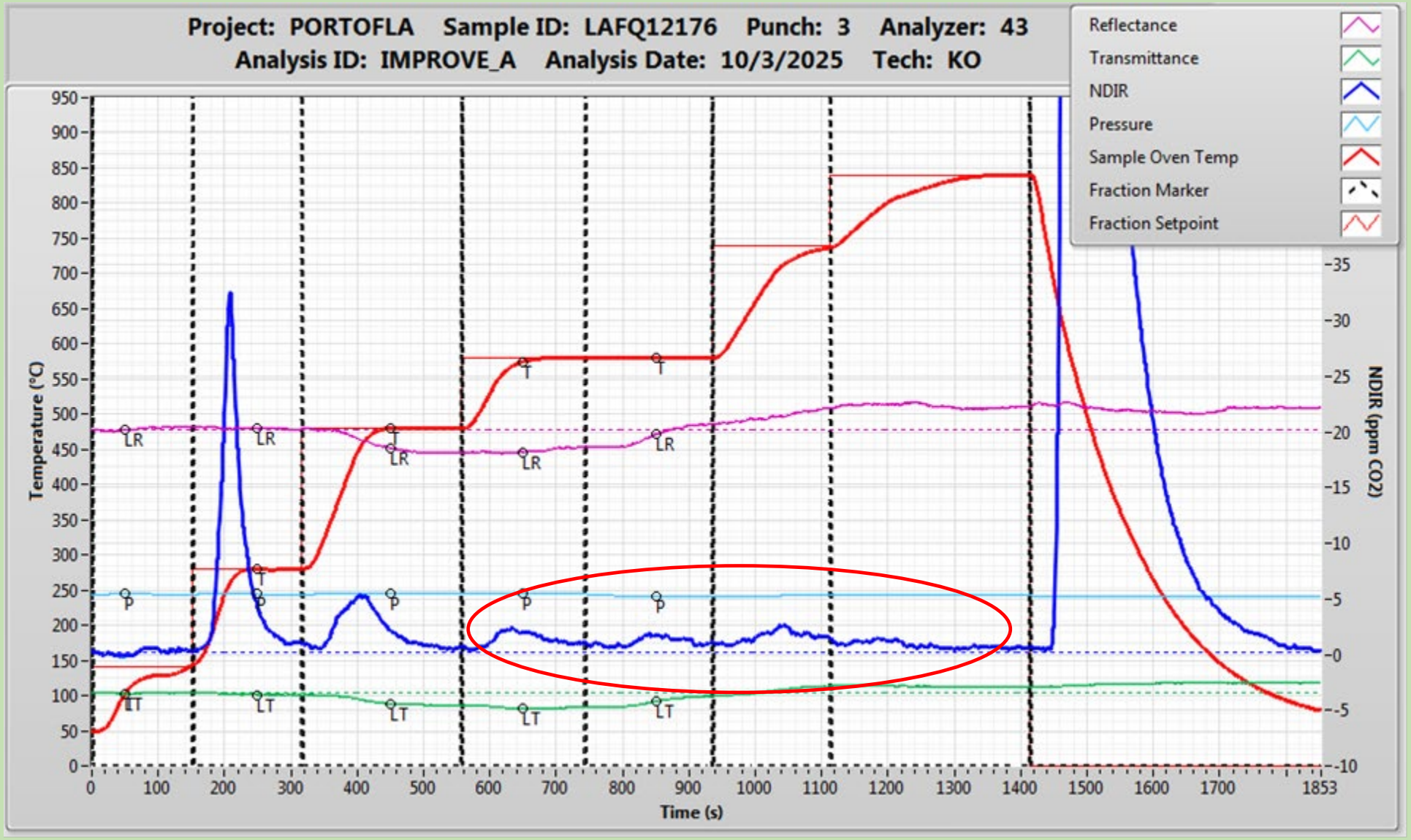
- In the process of replacing current NDIR (SBA-5, PP Systems) to SBA-5+ due to discontinued replacement parts.
- In addition, acquired and tested LI-COR LI-830 and LI-840A

LI-COR LI-830 / LI-840A PP Systems SBA-5+

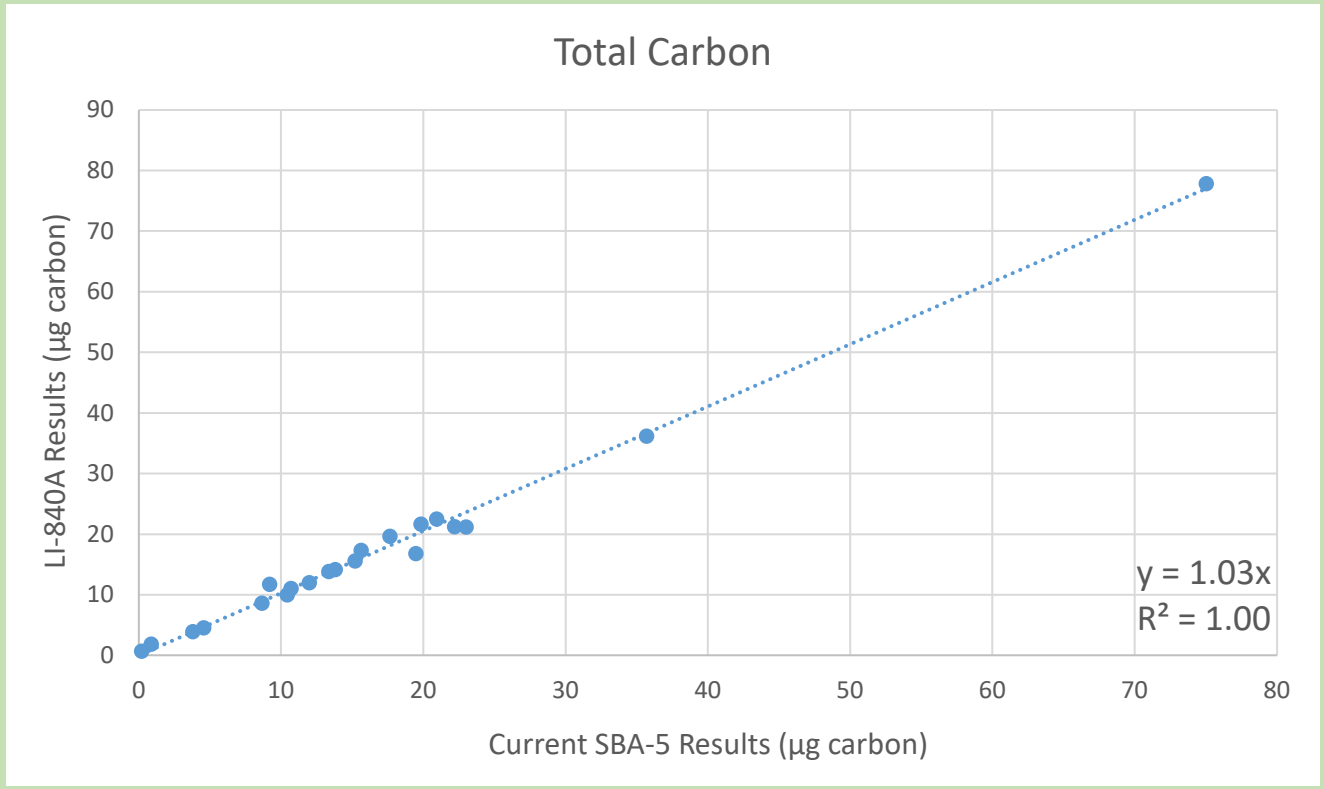
NDIR Replacement Activities

- Testing has been conducted to ensure reproducibility between sample punches and among analyzers
- Refined LabView software to accommodate both LI-COR and PP Systems detectors.
- Continue working with new owner at PP Systems to improve sensitivity.

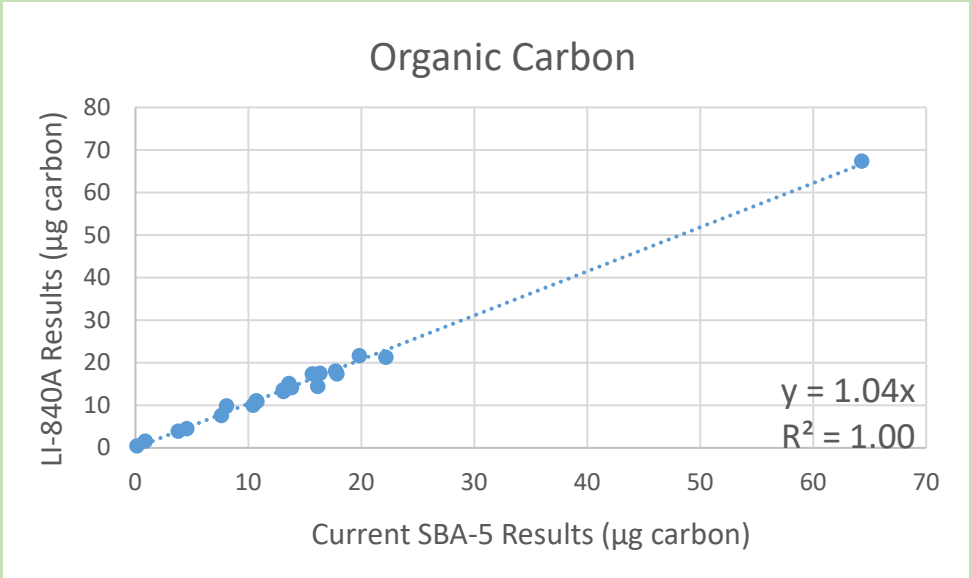
PP Systems SBA-5+ shows some low-PPM noise

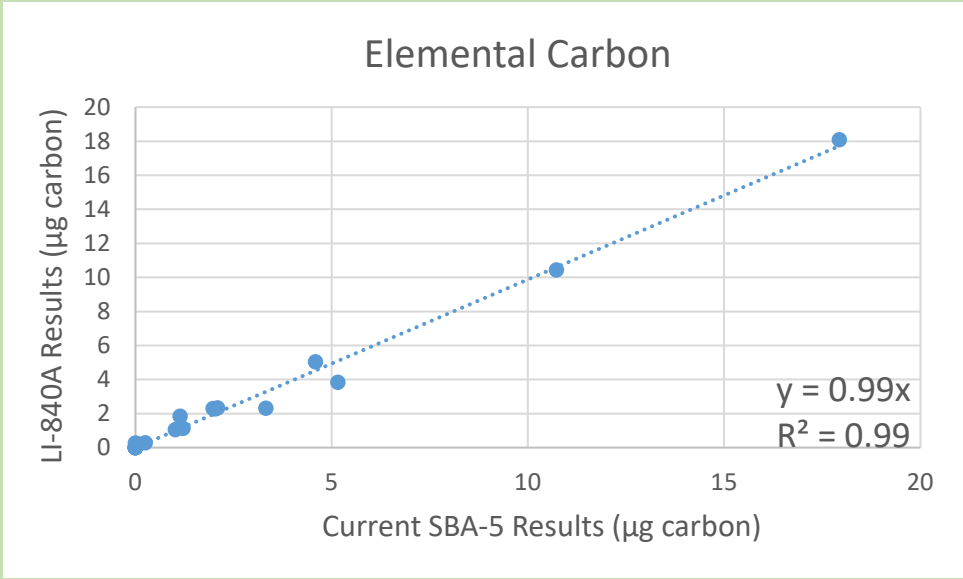


LI-COR LI-840A shows comparable results with the current PP Systems SBA-5

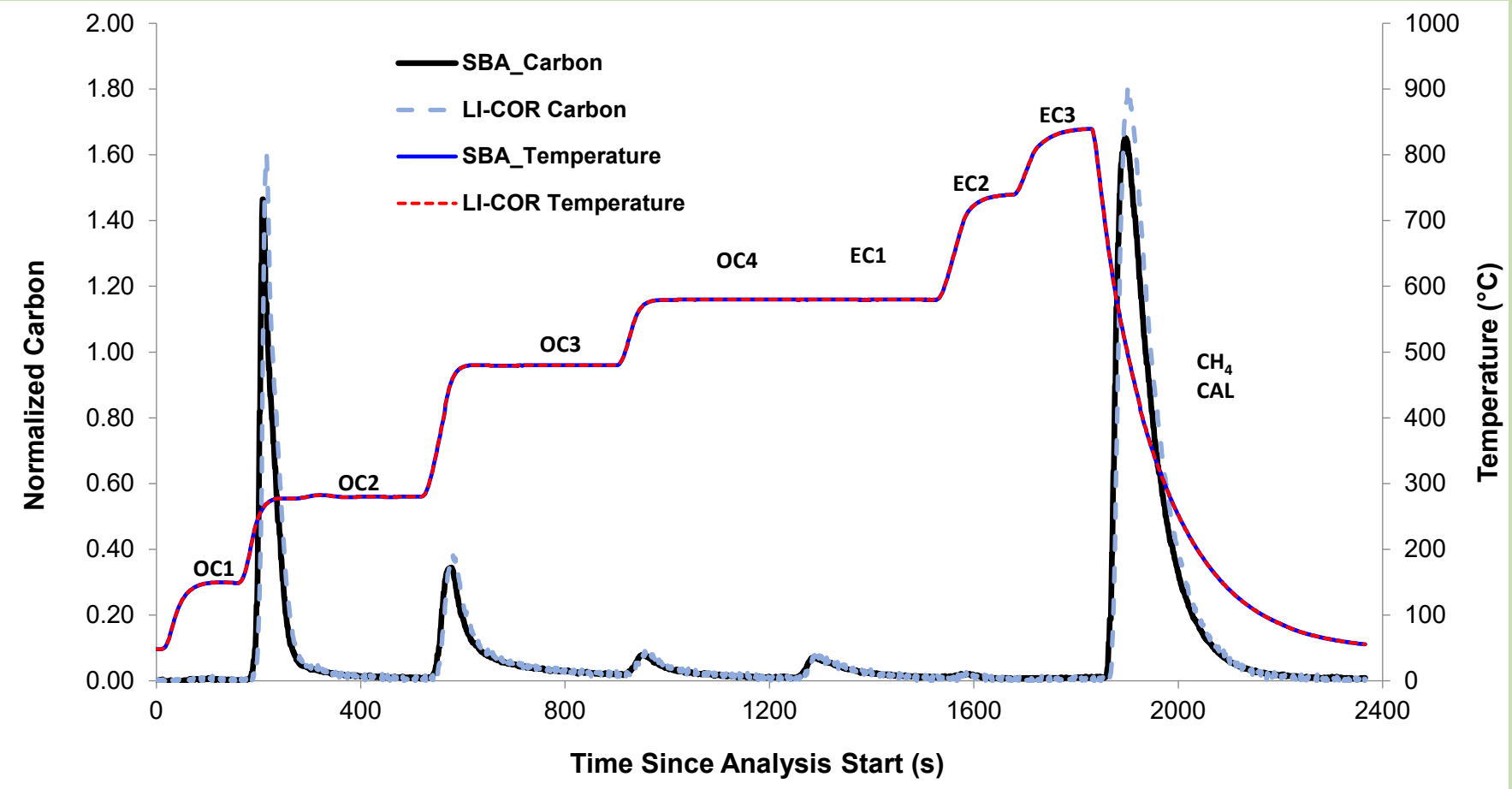


N = 36 analyses





LI-COR LI-840A thermogram closely coincided with PP Systems SBA-5



Recent publications using the IMPROVETOR method

- Ahmad, M., Chen, J., Panyametheekul, S., Yu, Q., Nawab, A., Khan, M.T., Zhang, Y., Ali, S.W., Phairuang, W., (2024). Fine particulate matter from brick kilns site and roadside in Lahore, Pakistan: Insight into chemical composition, oxidative potential, and health risk assessment. Heliyon, 10, 10.1016/j.heliyon.2024.e25884.
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Recent publications using the IMPROVETOR method

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Recent publications using the IMPROVETOR method

- Zhang, X., Min, Y., He, Y., He, X., He, L., Cao, Y., Zheng, X., Zhao, B., Wang, S., Wu, Y., (2025). The significant effects of loading mass on emissions of intermediate and semi-volatile volatility organic compounds from diesel trucks. Atmospheric Environment, 351, 10.1016/j.atmosenv.2025.121187.
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