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PORTABLE EMISSION MEASUREMENT SYSTEMS

Ground breaking new approach to capturing real world, in-use emissions of motor vehicles and engines

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Laboratory Measurement

- Focus on measurement precision & repeatability
  - Controlled conditions
  - Precise driving cycle
  - Professional drivers
- Results tell us what vehicle/engine emits
  - But only under *those* conditions on *that* cycle with *that* driver
  - Expensive and hard to sample randomly
- Difficult to relate those measurements to the real world

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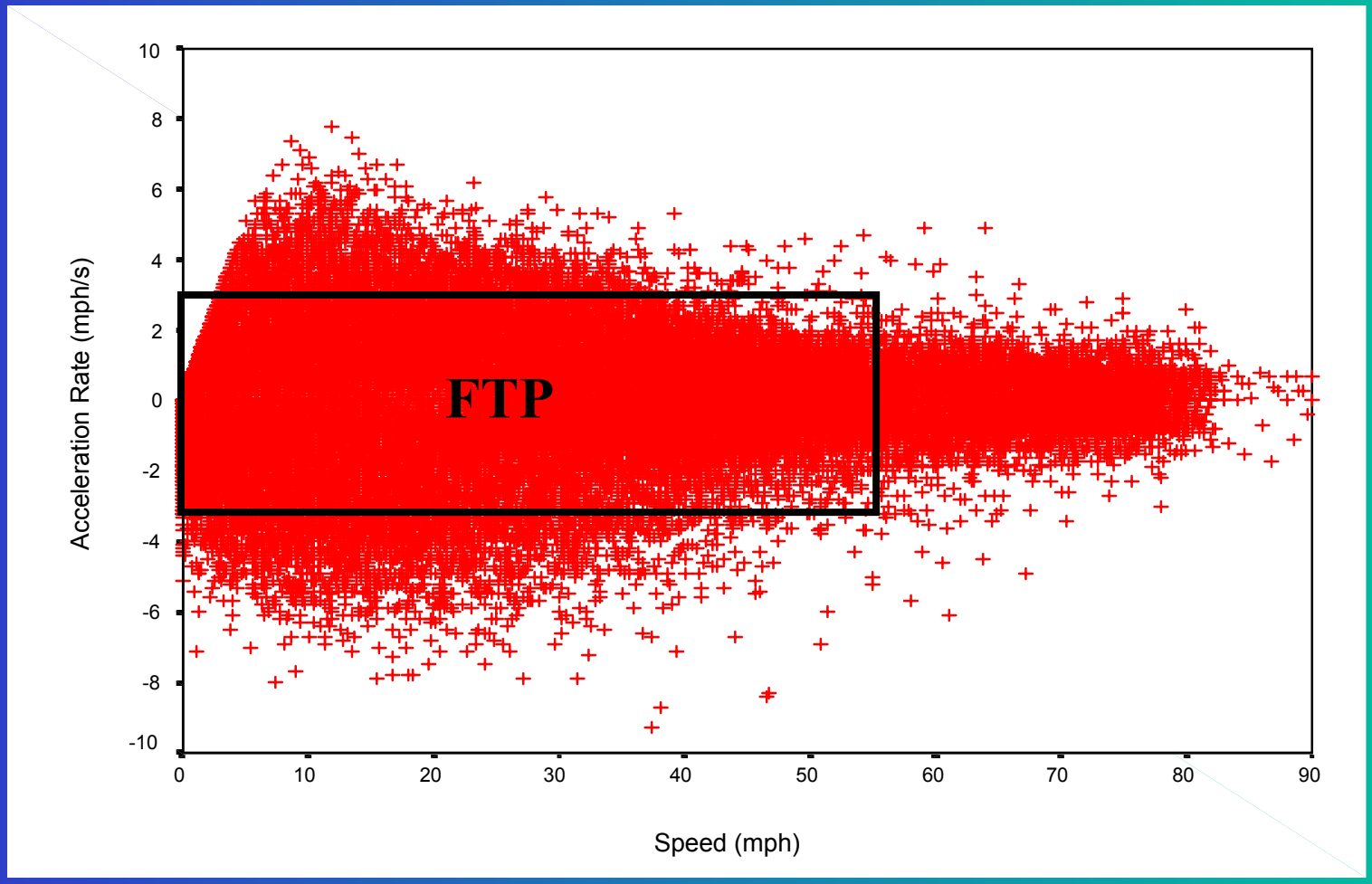
Lab Misses Important Operation



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Why In-Use and On-Road?

- Cheap compared to lab measurements
  - Less expensive to measure in situ
  - Lower instrument and recruitment costs
- Data covers broader ranged of operation
  - Real world testing yields different results
  - Simultaneous data collection:
    - activity, environmental and emission data
- Hard to get sources
  - Heavy duty trucks
  - Nonroad equipment

PEMS Features

- High quality
  - Lab grade emission measurement
    - FID for THC
    - NDIR for CO
    - NDUV for Nox
    - Microbalance for PM (coming soon)
- Full activity/environmental data collection
    - Designed for both electronics-equipped and pre-electronics technology
    - Including GPS, cellular modem, grade sensors, etc.
- Stand-alone flow measurement

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PEMS Advantages

- Real world measurement
  - Owner or regular operator drives vehicle
  - Measurements during normal use
  - No rejections for maintenance, tires, etc.
- Cost-effective
  - Quick to install
  - Unattended operation
  - Cheap to maintain and operate

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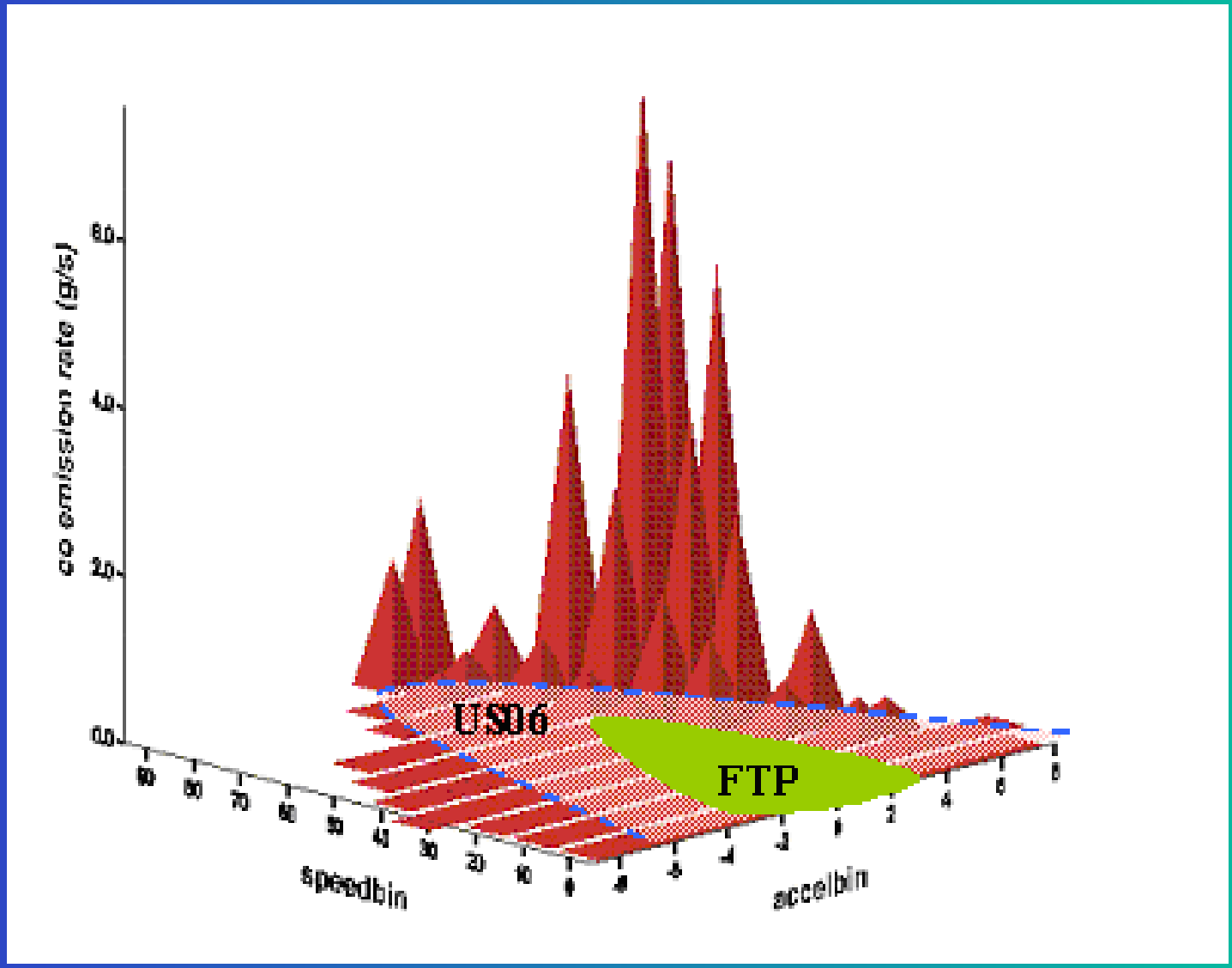
On-Road vs. Driving Cycles



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Advancing the Technology

- Now on 3rd generation
  - ROVER - original PEMS
  - SPOT - developed for nonroad use
  - Commercialization - buy it off-the-shelf
- Multi-part strategy
  - Research & development
  - Licensing patents
  - Purchasing devices
  - Establishing regulatory programs
  - Promoting the concept

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Deployment

- Challenge Bibendum
  - Clean car race sponsored by Michelin
  - Tested all cars participating in the race
  - First opportunity to try out the technology
- Kansas City PM Project
  - Testing 480 LDVs for PM on portable dyno
  - PEMS testing on as many as we can
- Region 7 Nonroad Pilot Project
  - Deploy PEMS and PAMS (activity only)

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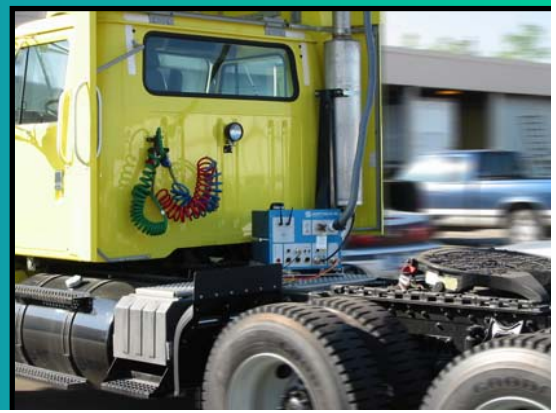
PM - The Big Challenge

- Need to measure PM mass
  - EPA standards are mass based
  - Concluded that inertial microbalances have the best potential for achieving goal
- Move mass measurement into PEMS
  - Micro-balance evaluation complete
  - Proportional sampler developed
- Complete prototype by January



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The Future of PEMS

- Primary way to measure mobile sources
  - Low cost and easy deployment will decentralize emission factor work
  - Push technology to measure low levels
- Lab measurement supplements PEMS work
  - Detect subtle differences, e.g., fuel effects
  - Specialized testing, e.g., toxic emissions
- Integral part of the regulatory framework
  - Facilitates integrating NTE into in-use testing
- Primary basis for future inventory work
  - New generation model - MOVES