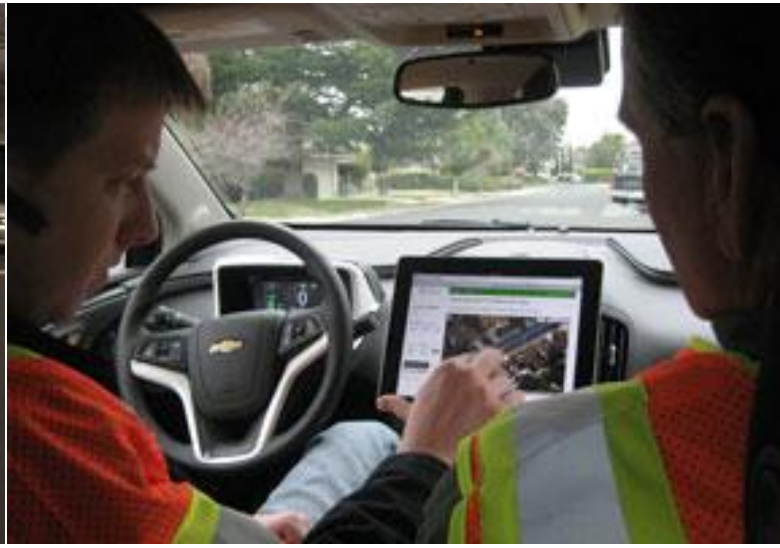
PICARRO Surveyor™

for Natural Gas Leaks



+ PG&E

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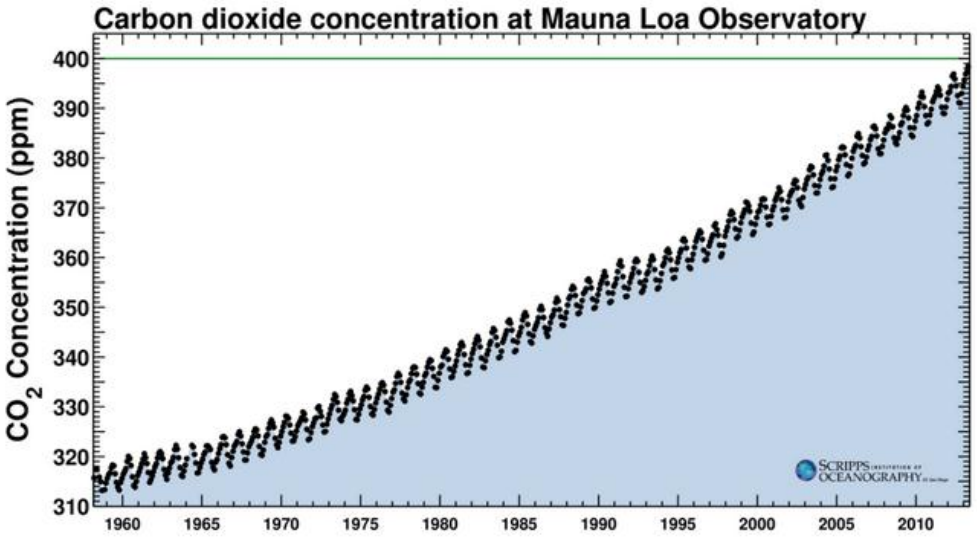

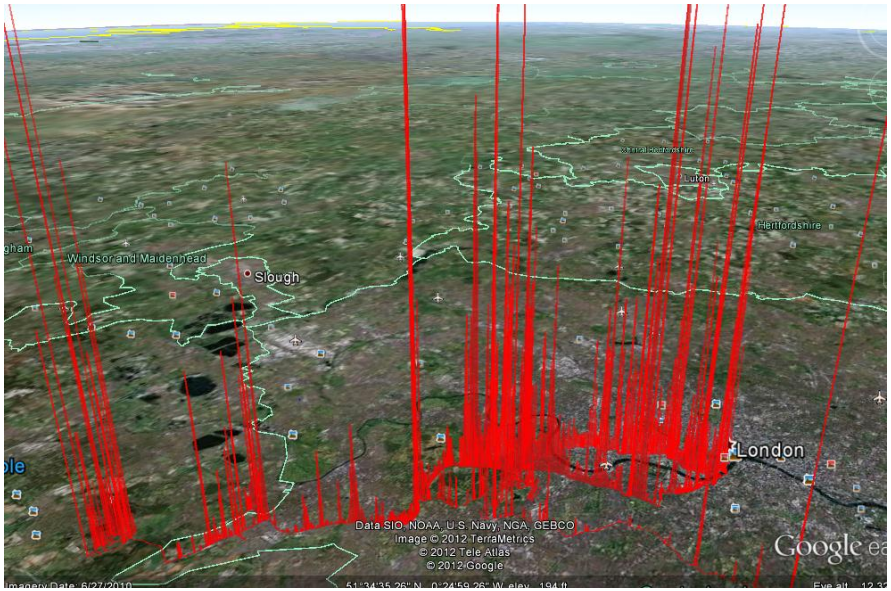

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CNBC DISRUPTOR 50

CNBC DISRUPTORS | DISRUPTOR 50 LIST | INDUSTRIES | VIDEOS | METHODOLOGY | REL

Energy Disruptors Revealed

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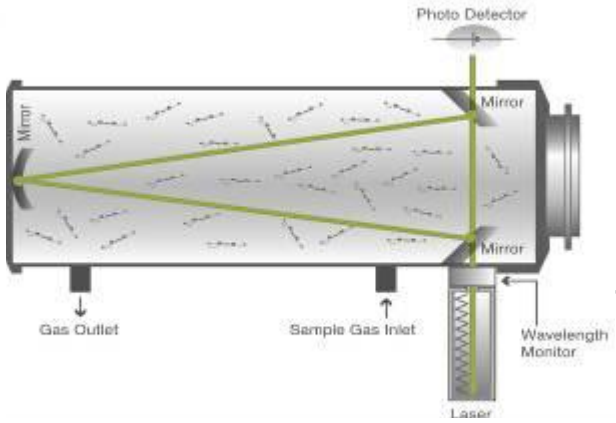
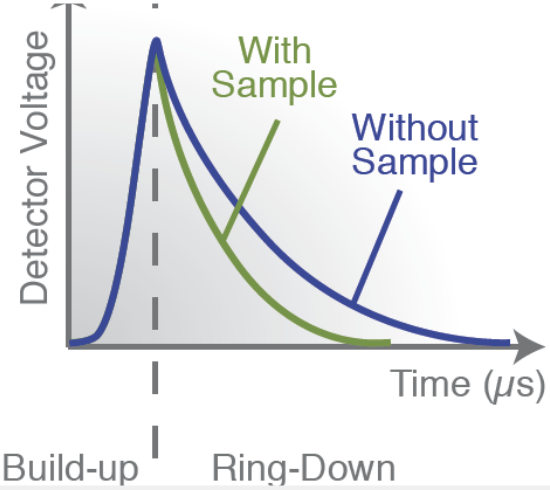
CRDS Technology – *Global Gold Standard*





Consider that…

Carbon Dioxide is only ~390 PPM or 0.039% of air…

Methane is only ~1.9 PPM or 0.00019% of air.

Picarro's precision is:

0.00000005% for Carbon Dioxide, and 0.000000007% for Methane!!

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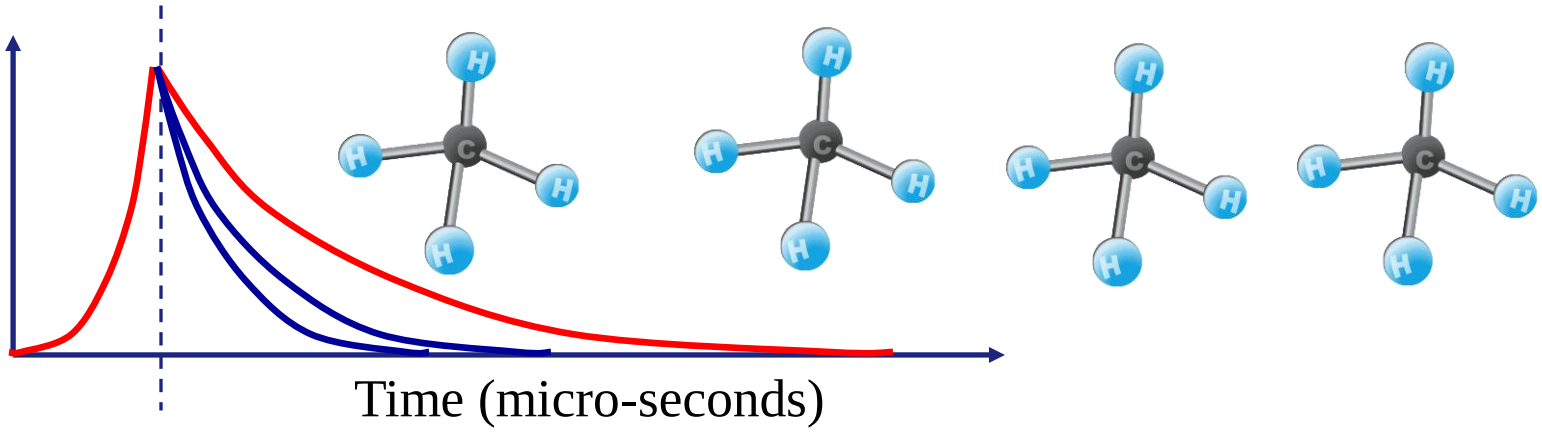
Cavity Ring Down Spectroscopy

Shut off Laser



Passive measurement.

Laser is off during measurement.

Small, 35 cc sample cavity

Effective path length > 12 km.

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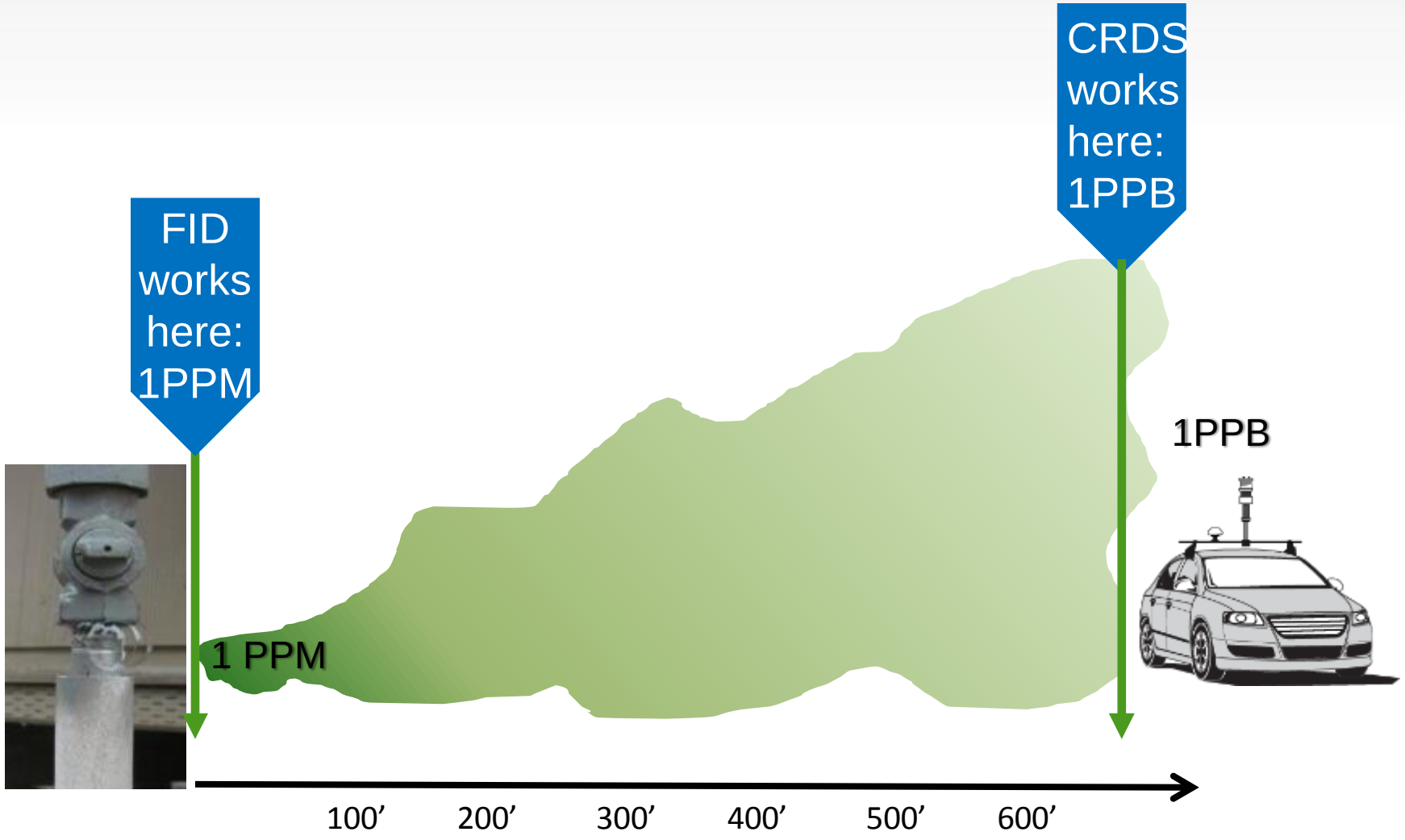
1,000X More Sensitive – Measure at Great Distances



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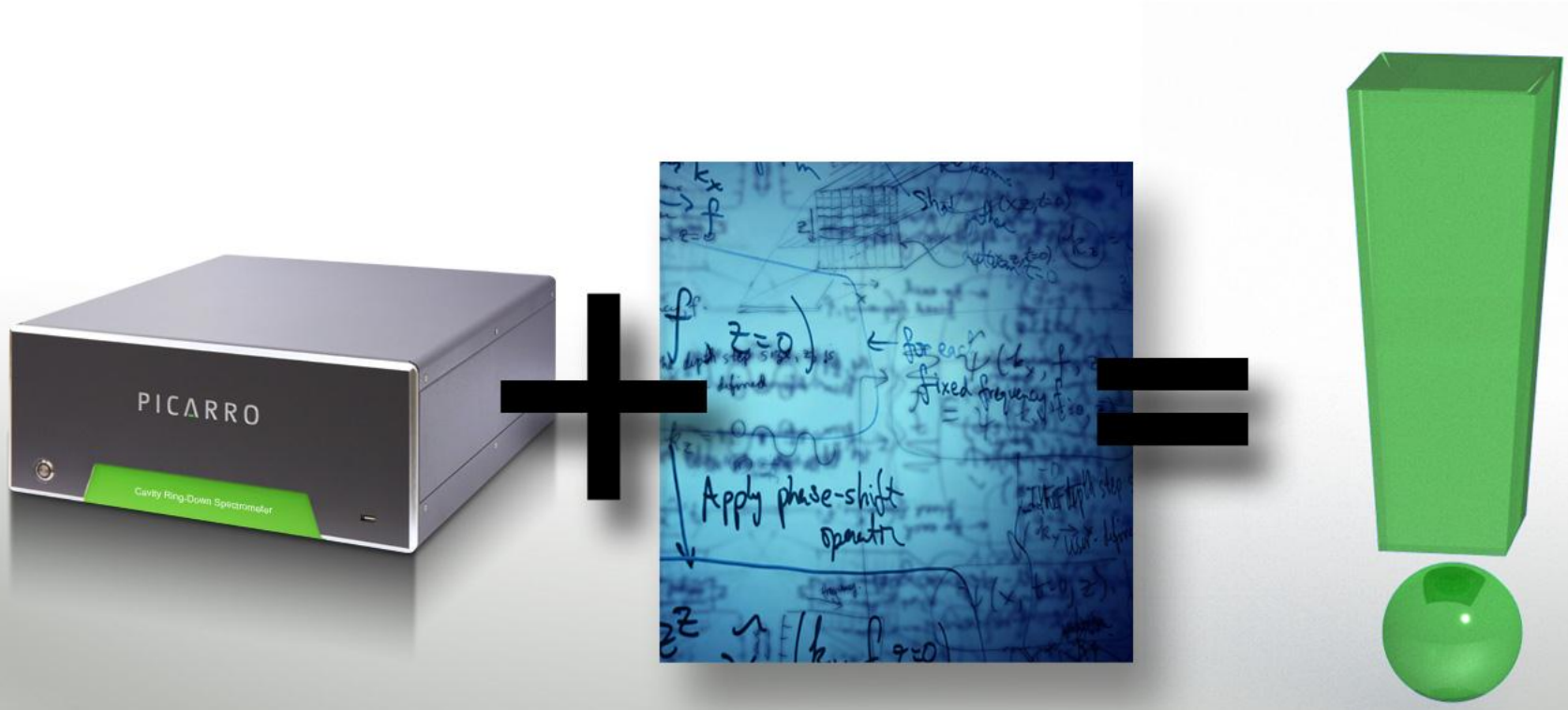

PICARRO + SCIENCE = INFORMATION

With Cloud-Based Speed and Simplicity

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Picarro Surveyor™ and P-Cubed

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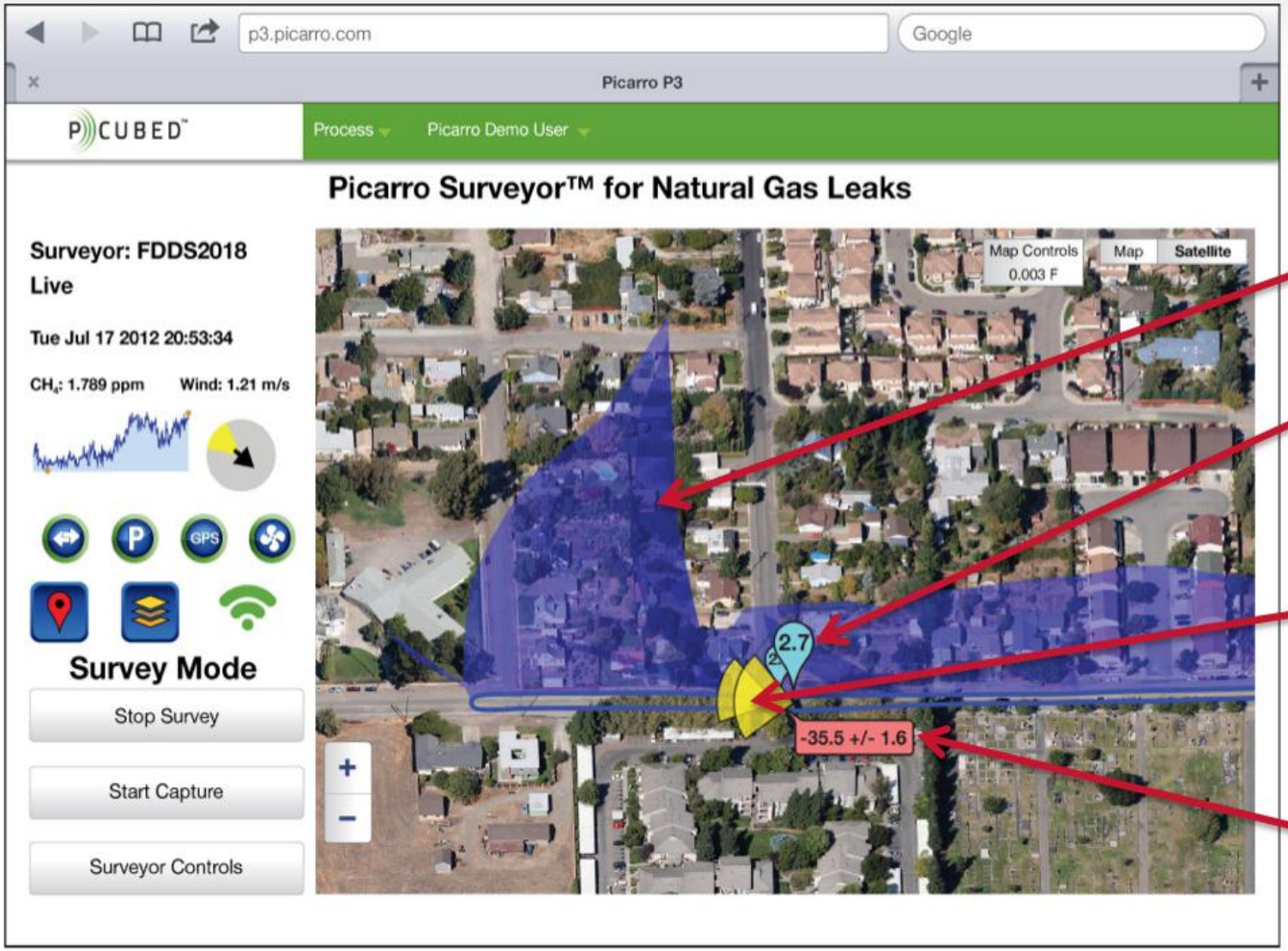
Key Features



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FOV example: 2 passes, 2 different nights

Drive #1, + Drive #2, = Composite FOV

- **Composite has 100% “coverage” i.e. 100% of area covered by at least one FOV swath.**
- **Leak find probability >95% for entire area**

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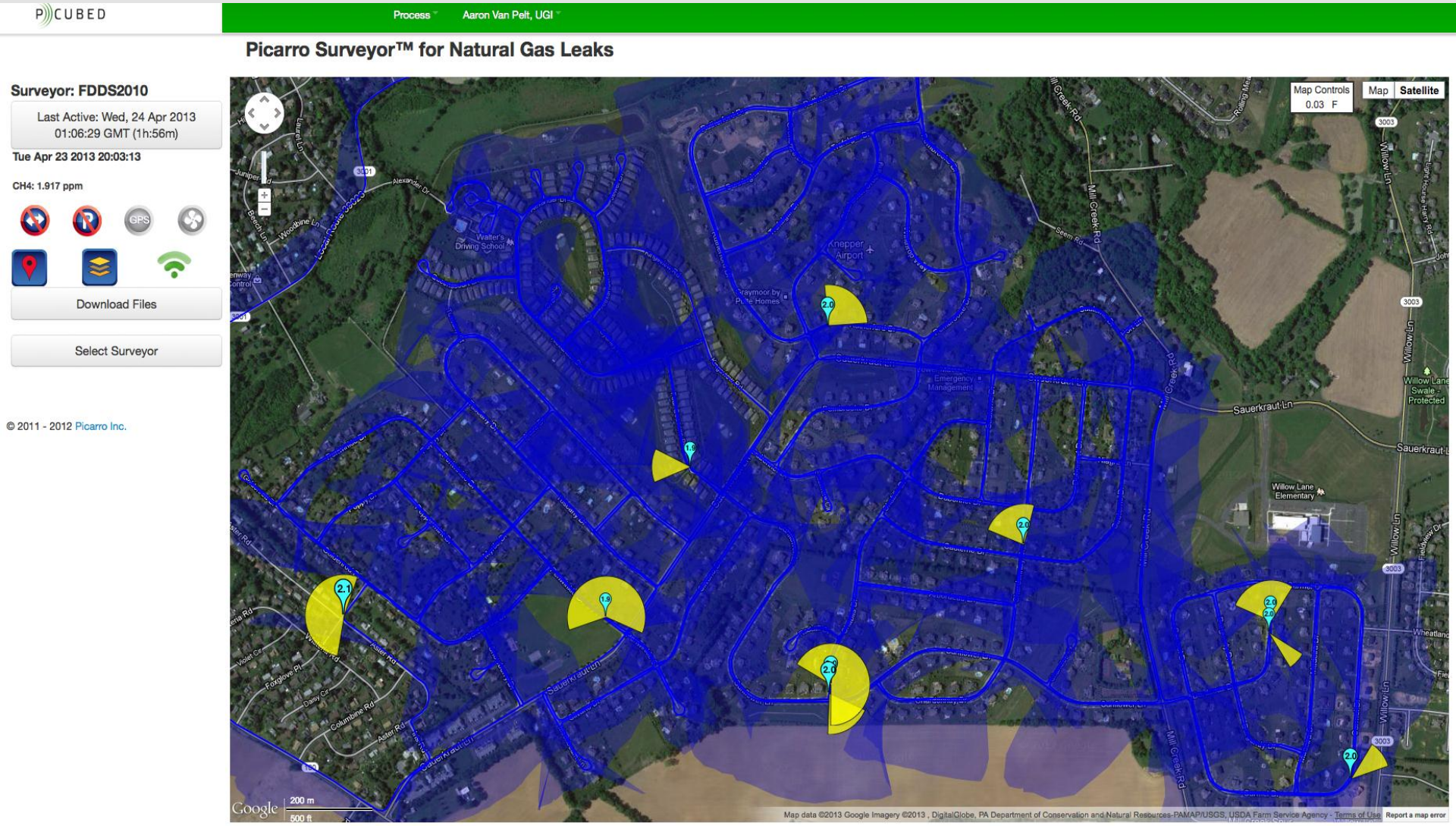
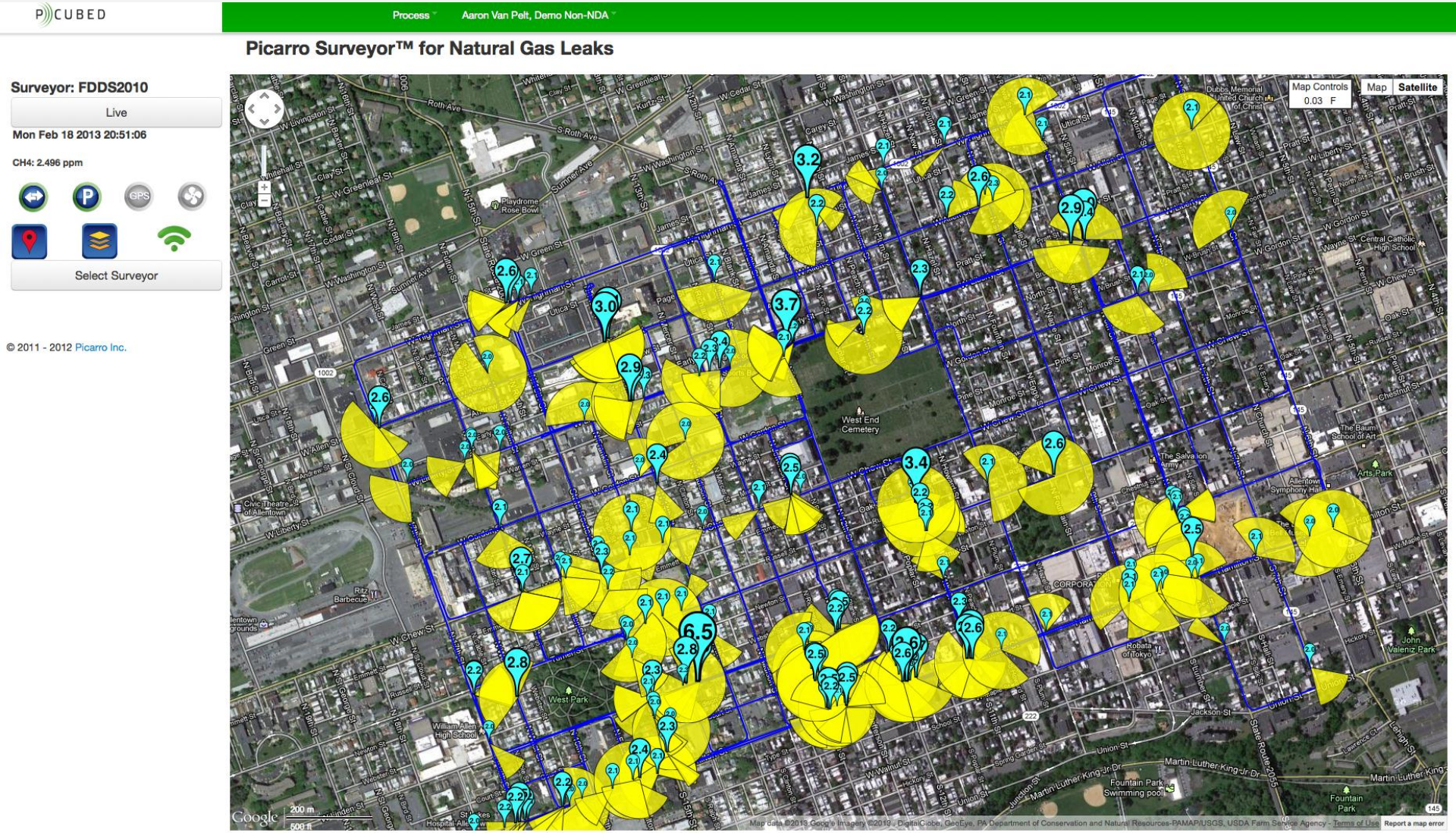
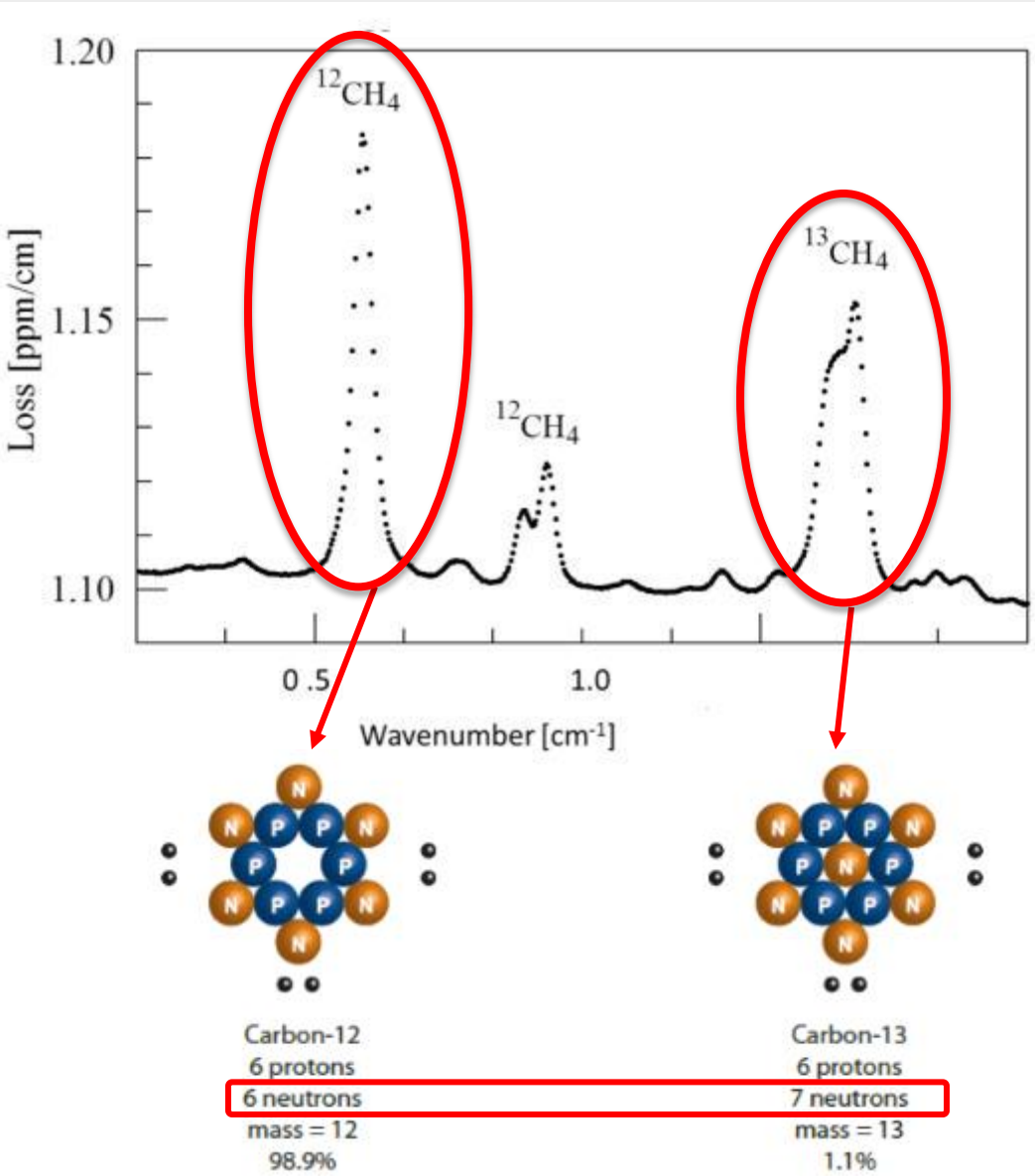
New plastic pipes



Cast Iron


P CUBED
Process
Aaron Van Pelt, Demo Non-NDA
Picarro Surveyor™ for Natural Gas Leaks
Surveyor: FDDS2010
Live
Mon Feb 18 2013 20:51:06
CH4: 2.496 ppm
Select Surveyor
© 2011 - 2012 Picarro Inc.
Map Controls
0.03 F
Map
Satellite
West End Cemetery
Playdrome Rose Bowl
West Park
Fountain Park Swimming pool
Google

Spectroscopic isotope analysis



- Surveyor's stable isotope measurement can distinguish source of methane as **pipeline gas** or from **natural sources** (landfill, sewer gas etc.)

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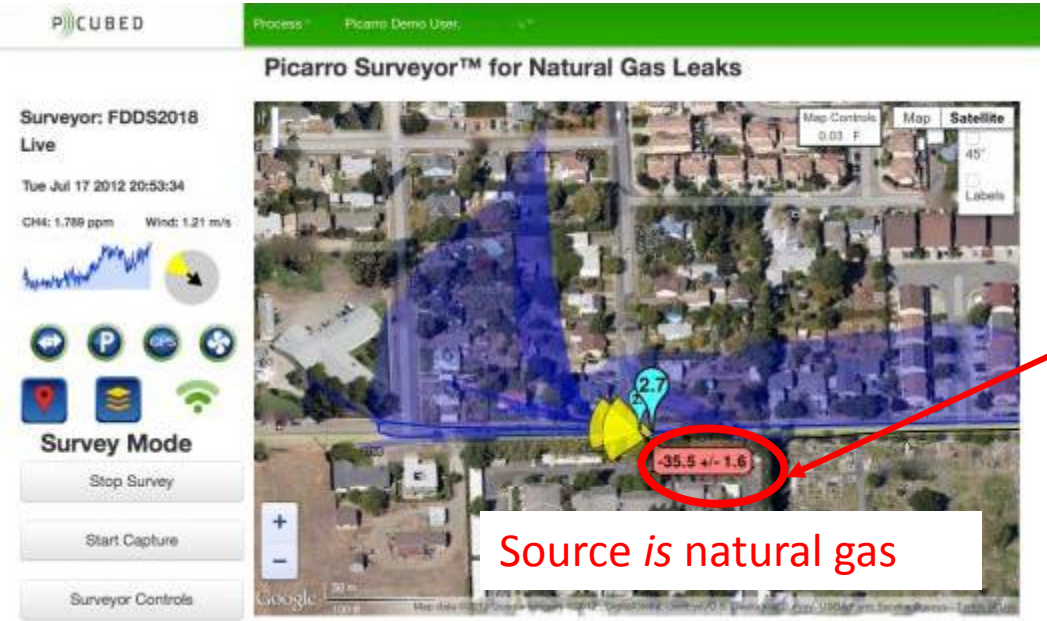
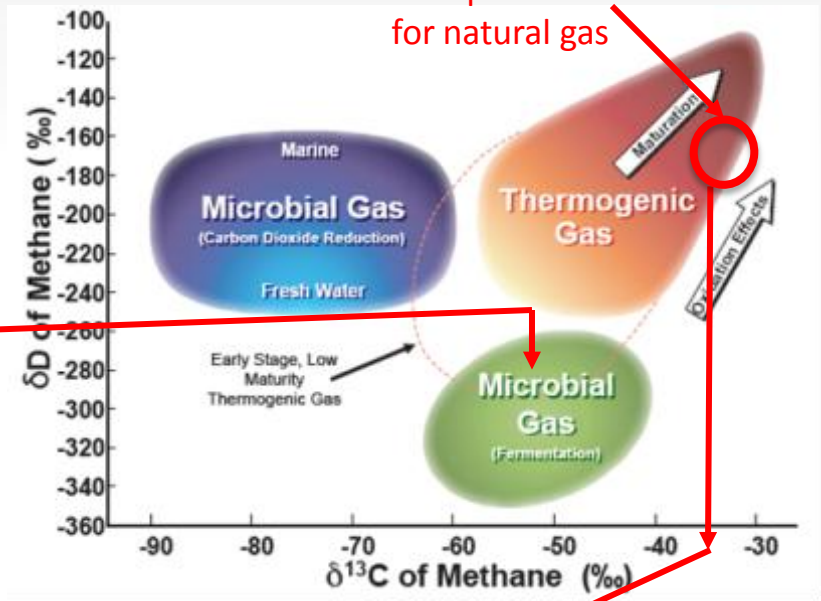
Example: leak source identified as natural gas…or not



Range of stable isotope values for natural gas



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"Known Unknown"

Table A1. Natural Gas Unaccounted for by State, 2005-2009
(Million Cubic Feet)

	2005	2006	2007	2008	2009
Alabama	3,584	-4,288	2,611	3,736	4,071
Alaska	-1,500	4,842	-2,066	R11,001	6,904
Arizona	2,673	3,694	2,247	2,137	2,280
Arkansas	5,787	1,800	4,756	4,585	7,676
California	1,442	38,304	29,877	19,940	48,972
Colorado	3,092	16,070	1,158	6,334	9,213
Connecticut	3,756	6,299	7,989	8,717	29,127
Delaware	620	-596	454	853	594
District of Columbia	701	1,229	659	887	1,581
Florida	6,359	9,575	10,471	13,005	6,558
Georgia	-2,159	-1,866	-4,736	R-1,752	-7,373
Hawaii	-187	-171	-167	-143	-161
Idaho	-2,056	627	183	-2,123	-613
Illinois	34,655	74,476	44,857	4,438	3,425
Indiana	-2,081	-18,406	-1,652	10,301	-339
Iowa	1,342	735	3,930	R1,962	546
Kansas	-4,708	-6,770	-1,259	-2,823	6,885
Kentucky	4,667	1,135	-10,243	4,901	4,308
Louisiana	5,576	-25,916	7,228	-22,729	15,115
Maine	646	411	-289	66	132
Maryland	3,803	4,005	4,001	5,398	5,070
Massachusetts	-5,434	4,316	1,344	R12,336	12,943
Michigan	21,965	-10,851	26,886	14,032	10,010
Minnesota	-1,822	-5,193	4,946	R6,748	3,207
Mississippi	5,149	2,806	-7,274	R-1,405	-2,054

Source: Energy Information Administration (EIA), Form EIA-176, "Annual Report of Natural and Supplemental Gas Supply and Disposition."

Distribution Pipelines: reduce lost & unaccounted gas

Repair the four largest leaks

Repair 4 out of 40 leaks, eliminate 90% of emissions, 0.7% of total usage

Solution for downstream distribution leak detection

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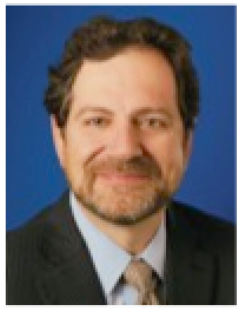
Pipeline Research Council International (PRCI) and Pacific Gas & Electric (PG&E)

"We deployed Picarro Surveyor prototypes nine months ago, and they've proven to be so powerful that we are committing to rolling out this innovative technology across our service area Surveyor will allow us to conduct more frequent and comprehensive surveys"

"We're making every effort to ensure that PG&E is the safest utility in the United States, and Picarro's technology is a cornerstone to making that happen."

- Nick Stavropoulos, Executive Vice President
Gas Operations, PG&E



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THANK YOU!!

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Leak Detection & Correction Process Improvement ~ A Gas Utility Prospective

Steve Redding
Gas M&C Director, PG&E

Gas Utility Prospective

We Owe it to our Customers & Public to have…

- The Safest Gas Operating system possible

To Accomplish this goal, Gas Industry Leaders must:

- Continuously evolve relative to technology, work standards/procedures, and the use of science
- Be Open to Change, and Gain the benefit of everyone's thinking
- Find & Fix leaks as quickly as possible
- Have a comprehensive & completely accurate Integrity Management Program
- Have Verifiable, Traceable & Complete records

Obtaining Safety Goal ~ Leak Detection

Picarro Surveyor™, a very powerful leak detection instrument!

- 1,000 times more sensitive (PPB)
- Fast & Efficient ~ mobile application
- Distinguishes between natural occurring methane to pipeline gas
- Finds more leaks
- Pinpointing “Hard-to-Locate” leaks
- Job Planning efficiency
- Quality control / training
- Leak Cluster analysis
- Special Surveys
- Verifiable, Traceable & Complete records
- Redefining the way we view leak detection & correction protocols

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Integration Challenges / Opportunities

Commitment to finding solutions…

- Technology capabilities & limitations
  - Pinpointing & Grading
  - Field of View
  - False Positives
  - Missed Leaks
- Change Management
- Union Partnership
- Work Procedures / Standards (process engineer)
- Integrated / automated work procedures, mapping & technology
- Bundling
- Operator Qualifications & training
- Dispatching / Job scheduling
- Industry Acceptance
- Financial ~ General Rate Case

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Evolving Forward

- Picarro Surveyor™ utilization now at PG&E
  - Pinpointing difficult to find leaks
  - Analysis of PG&E gas versus natural occurring methane
  - Side-by-side blind testing
  - High Risk pipe (cluster) surveys
  - Special Surveys (up-rates / post event)
  - Job Planning (pinpointing)
  - Quality control / training
  - Fixed wing / Drone

- PG&E PMO~ Leak Detection & Correction Process Improvement team
  - General Rate Case
  - Begin Deployment in 2014

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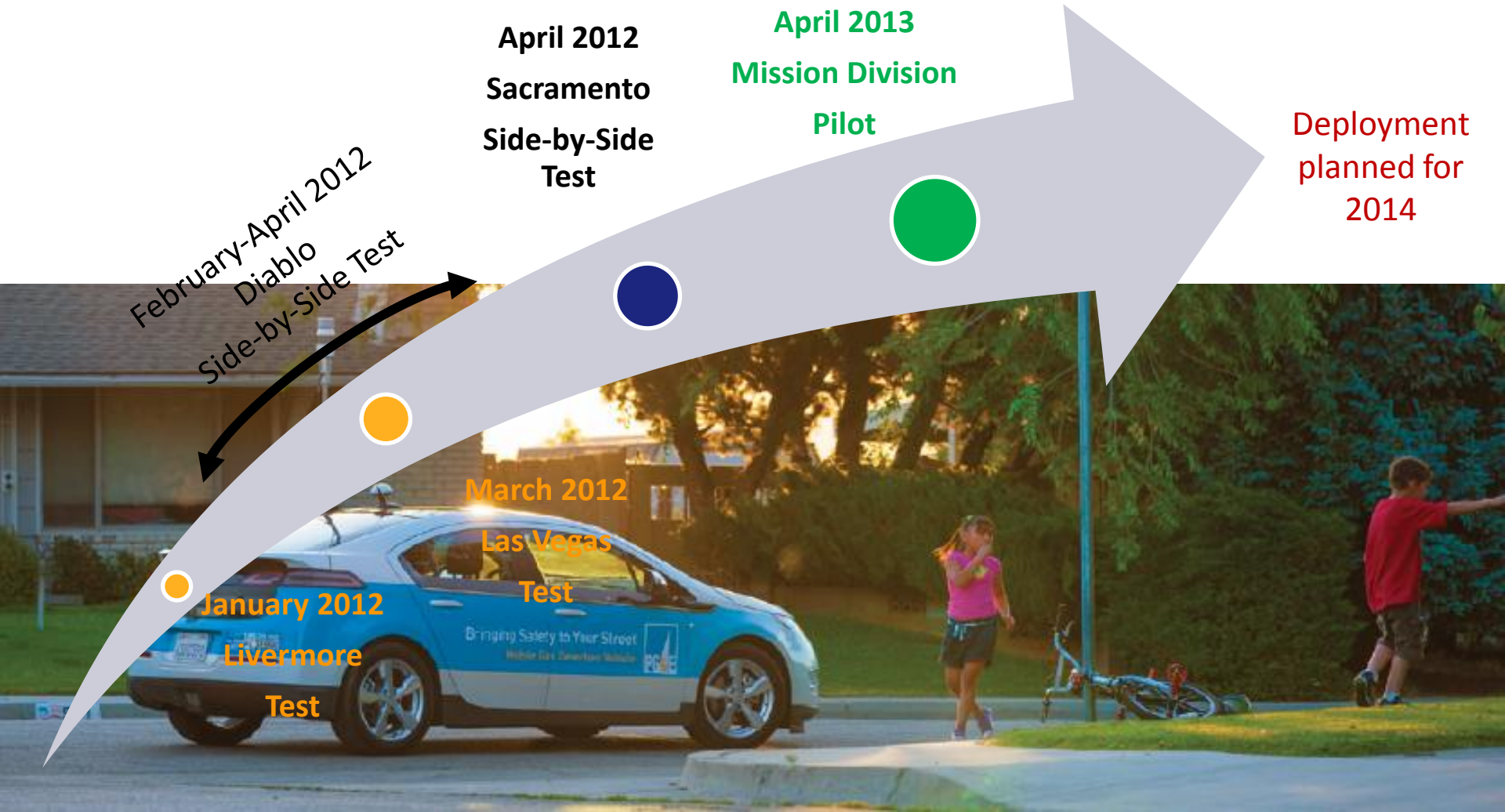
Launching a breakthrough technology



Questions?

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