

LIMS Presentation

From Soil to Solutions

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ALTA Winter Workshop • February 2026



Q:

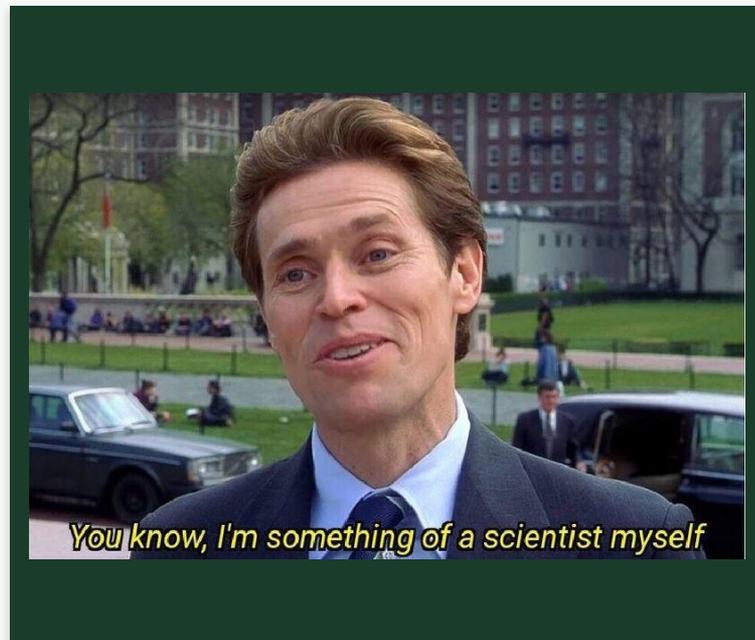
**What kind of scientist has
the audacity to lecture experts
on material they
already know?**

A: A computer scientist.

Hi, I'm Matt Whitehall.

I'm a computer scientist, and I'm here to talk to a room full of people who know infinitely more about soil than I ever will.

So let me show you where our worlds overlap.



Hypothesis → Testing → Validation

How software engineers and soil scientists think the same way



In The Lab

Run QCS — expect a known value
Result is off — something's wrong
Hypothesize: calibration drift? matrix?
Recalibrate, re-run. Passes.
Now check: does it hold across different sample types?
Concentrations?

In Software (TDD)

Write a test for what SHOULD happen
Run it — it fails (that's expected)
Hypothesize which code is wrong
Fix it — test passes.
Now test edge cases: different data, different context, different conditions

Same method. Same rigor. Automated tests in code = quality automations in the lab.

Now Let's Talk About Your World

What we learned when we walked into the lab



THE Book

Thousands

of samples per year

One source of truth:

**A three-ring binder
on a table in the office.**

*Even with all the latest
technology at our
fingertips, we
sometimes
prefer analog.*

**Paper in hand
is still useful.
The question is
scale.**

People-powered Integration

70+

data formats a lab must support
to integrate with partners

"Most labs don't have a team of developers. They have several systems and a technical user who moves data around."

*"Jim was their API.
He was very reliable.
But he wanted to retire."*

The Knowledge Silo

Jim was their API.

Now what?

He moved data between systems,
knew every format, every exception.
None of it was documented.

The check-in person knows
when to insert QC samples.

Is that documented?

*Every lab has critical processes
that live in one person's head.
If they leave, the knowledge
walks out the door.*

The Seasonal Pressure Cooker

70%

of annual volume
in 6 weeks

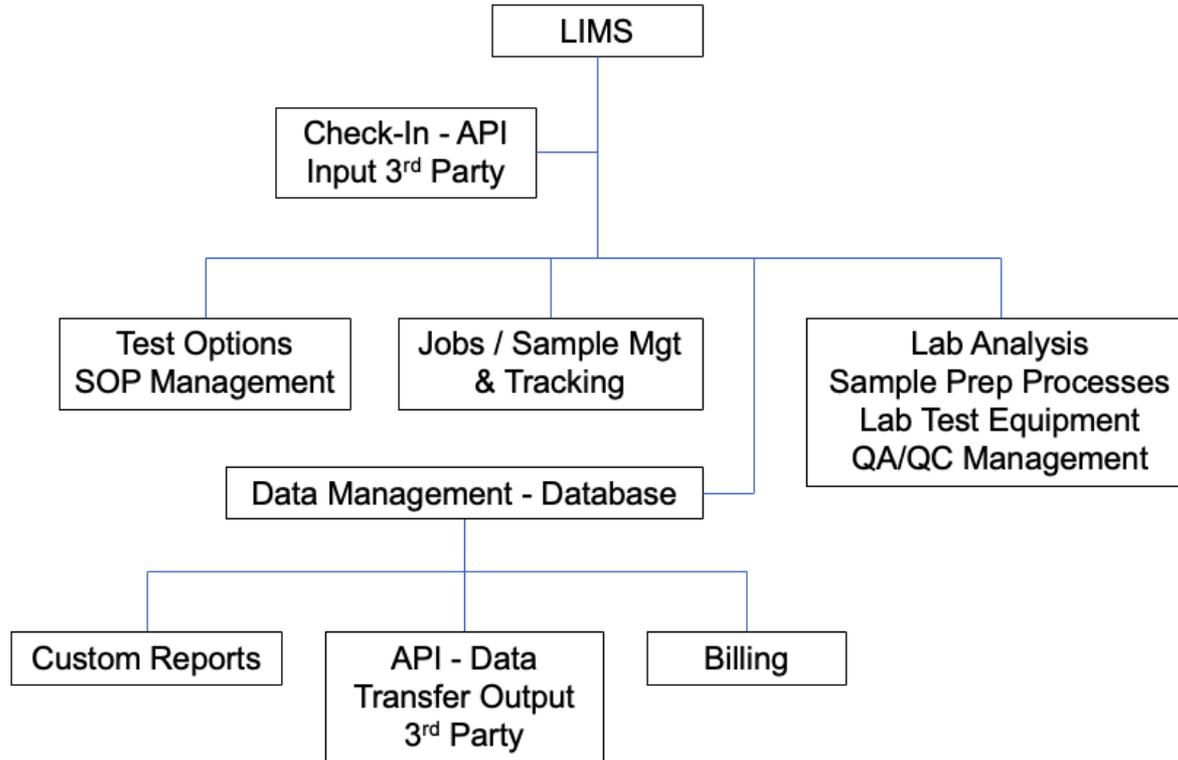
1,000+

samples per day;
several thousand
at peak

What you don't need are systems that are inefficient or unreliable.

ALTA LIMS Framework

The categories ALTA's LIMS Committee identified for what a LIMS should cover



Our Approach

Three principles that guide everything we build



Three Core Principles



Separate the Field from the Lab

Work Orders own field ops. LIMS owns lab ops. Purpose-built for their own jobs.



Connect Once, Share Everywhere

The Integration Hub means every integration is built once. Every lab benefits.



Bridge the Current Equipment and the New LIMS

The testing equipment and process doesn't change, the data is centralized.

How the Pieces Connect

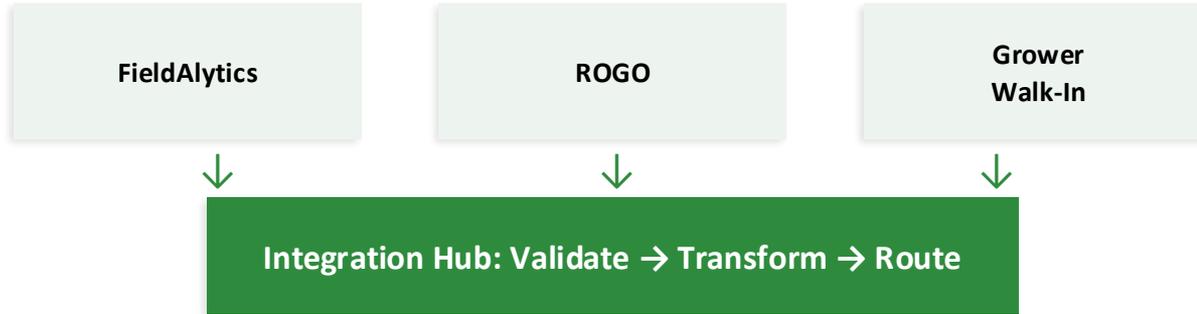


Lab Daemons (on existing PCs)

Watch directory → Parse file → Upload to cloud → Buffer offline → Heartbeat

Works without internet • Retries with backoff • No instrument changes

Check-In & the Integration Hub



New integrations are adapter builds, not system redesigns

Check-In Workflow

1. Scan bag barcode
2. Auto-assign Field #
3. Confirm tray batch
4. Next sample

Designed to be
faster than paper.

Sample Tracking: The Heart of the System



Every transition logged • Can't skip steps • System enforces the workflow

Run Format Automation

- Auto-groups into trays of 50
- Handles partial trays (1–49)
- Injects QCS every 50th sample
- Generates run sheets

QCS Auto-Injection

- Quality control standards every 50 samples
- Partial batches get QCS at threshold
- System counts; humans don't

Deep Dive: The ICP Room

ICP-OES Spectrometer • Primary nutrient testing

Current: "The CSV Round Trip"

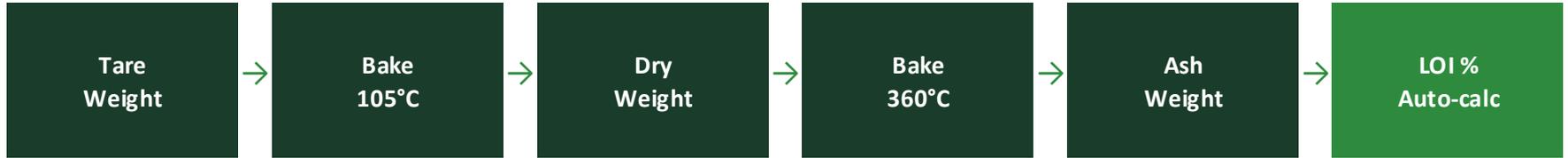
1. Lab software → CSV to shared drive
2. Open instrument software, import CSV
3. Run analysis
4. ICP exports results CSV
5. Copy/paste columns into Excel
6. Manual entry into another system (Jim API)

4 files • 3 pairs of hands

Solution

1. LIMS generates inbound CSV
 2. Daemon places inbound CSV
 3. The chemist runs ICP as normal
 4. Daemon watches for output file
 5. Daemon sends results to cloud
- Zero copy-paste
 - Same instrument
 - Same instrument software

Deep Dive: LOI — Loss on Ignition



Current

Reused Excel spreadsheet
Manual sample ID entry
No saved history • Prints and hands off

Solution

Tare tracking with history
Auto LOI calculation
Permanent storage

"Not everything needs a daemon. Sometimes the best integration is a clean form and a keyboard."

Data Conversion: The Invisible Challenge

The Problem

Raw test readings: instrument units
Labs report: ppm, lb/acre, meq/100g
Agronomists expect: specific units

The math isn't hard —
keeping it consistent and
auditable is.

Our Approach

ConversionService: per-analyte
factors as config, not code

Stores raw + converted values
Raw instrument output in JSONB

Update config, not code
Full audit trail on every conversion

QA/QC: Trust But Verify

Automated Checks

- ✓ Out-of-range value detection
- ✓ QCS failure flagging
- ✓ Inconsistent duplicate detection
- ✓ Control sample validation

Human Review

Flagged results → reviewer

Decision recorded: who, when

Tagged FLAGGED_APPROVED

You can't release results that haven't been through QC.

Every decision logged • Full paper trail • System enforces QC before release

Reports & Data Output



Check-In Report

The digital Book
Accounting + warehouse truth



Lab COA

Certificate of Analysis
Results, methods, QA sign-off



Data Exports

CSV, Modus XML, PDF
Modus-compatible systems
consume directly

Billing: Intentionally delegated. Labs use the billing system they like. Integration hub exports compatible data.

The Customer Portal

Self-service access for growers and retailers

With thousands of samples per day moving through the lab, the lab doesn't have time to answer status calls.

The portal gives customers:

- Work order status tracking
- Direct result downloads
- Self-service instead of phone calls



LIMS Scorecard

Category	Maturity Level	Current State
Check-In / API Input	CORE WORKFLOW OPERATIONAL	Hub inbound pipeline, Modus validation, barcode scanning
Test Options / SOP Mgt	FOUNDATION IMPLEMENTED	Analyte configs built; formal SOP doc mgt on roadmap
Jobs / Sample Tracking	CORE WORKFLOW OPERATIONAL	8-stage lifecycle, tray batching, QCS auto-injection
Lab Analysis	CORE WORKFLOW OPERATIONAL	ICP import, LOI workflow, result entry, calculation engine
Sample Prep	FOUNDATION IMPLEMENTED	Status tracking exists; detailed sub-steps not yet built
Lab Test Equipment	CORE WORKFLOW OPERATIONAL	Go daemon: file watcher, parser, uploader, offline buffer
QA/QC Management	CORE WORKFLOW OPERATIONAL	Auto-flagging, range validation, QCS checks, approval trail
Data Management	COMPLETE	PostgreSQL + JSONB + PostGIS, multi-tenant, audit logs
Custom Reports	CORE WORKFLOW OPERATIONAL	CSV, Modus XML, PDF exports, Check-In Reports, COAs
API Output / 3rd Party	CORE WORKFLOW OPERATIONAL	Outbound delivery, adapter pattern, retry with backoff
Billing	DELEGATED	Managed through Integration Hub

8 of 11 Operational/Complete • 2 Foundation Implemented • 1 Intentionally Delegated

What's Next

Phase 2 and beyond



The Roadmap



Multi-Lab & Integration Economy

Lab #2 gets instant access to every integration lab #1 built. Integrations become shared assets, not cost centers.



Recommendation Engine

Go beyond 'here are the results.' Crop-specific, yield-goal-driven recommendations based on regional agronomy guidelines.



Advanced Automation & Analytics

Deeper instrument integrations, historical trend analysis, and operational dashboards.

If you've got a Book problem,
we want to talk.

If you've got a 70-format problem,
we *definitely* want to talk.

And if you've got a Jim who is
your entire integration layer
and he's thinking about retirement...

we should talk soon!

Questions?



Thank You

Let's keep the conversation going.

Matt Whitehall

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Phil Stokes

Director of Business Development

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