

AI-Assisted Workflows for Characterization Studies

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The Data Mine



Motivation

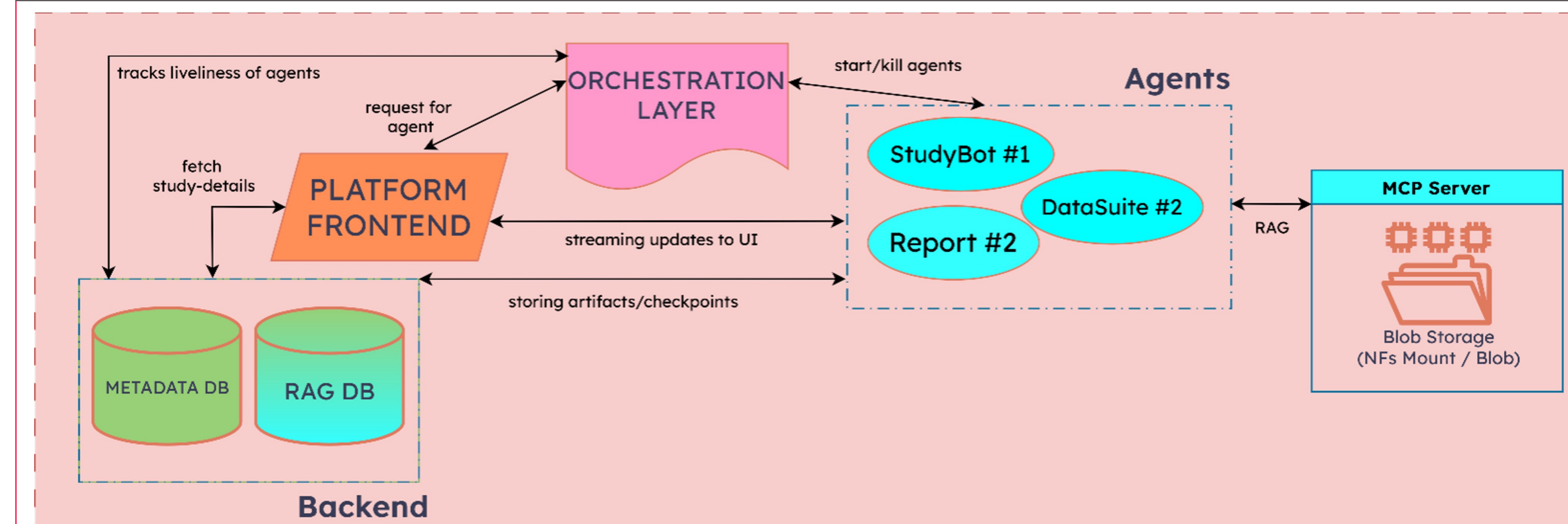
- **Dow Inc.** is a global leader supporting innovation across chemistry & manufacturing through product development.
- Chemical characterization workflows (called “Studies”) need **fast and reliable** access to prior knowledge and experiment results to move forward.
- Today, much of the progress involves
 - ◆ **repetitive** form completion,
 - ◆ **fragmented handoffs** between users/scientists, and
 - ◆ **manual effort** in reviewing data & preparing reports.

Our project, **Beacon**, builds an AI-assisted LIMS to automate and simplify existing flows, containerized to run out-of-box.

Impact

- ⚡ **Faster Study Intake:** Reduces form-filling effort by automating Study creation
- 👥 **Better Scientist-User Coordination:** Creates a clearer handoff between requestors and in-lab scientists through a shared, trackable workflow
- 🗄️ **Quicker Data Analysis:** Agents simplify data extraction and visualization from returned datasets.
- 🔄 **Stronger Knowledge Re-use:** Makes tracking Studies and Projects simpler across the Dow organization.

System Infrastructure



- Shared Tools:**
- Docker
 - FastAPI
 - FastMCP
 - DuckDB
 - Dash
 - Claude API

1 | Study Creation and Approval *

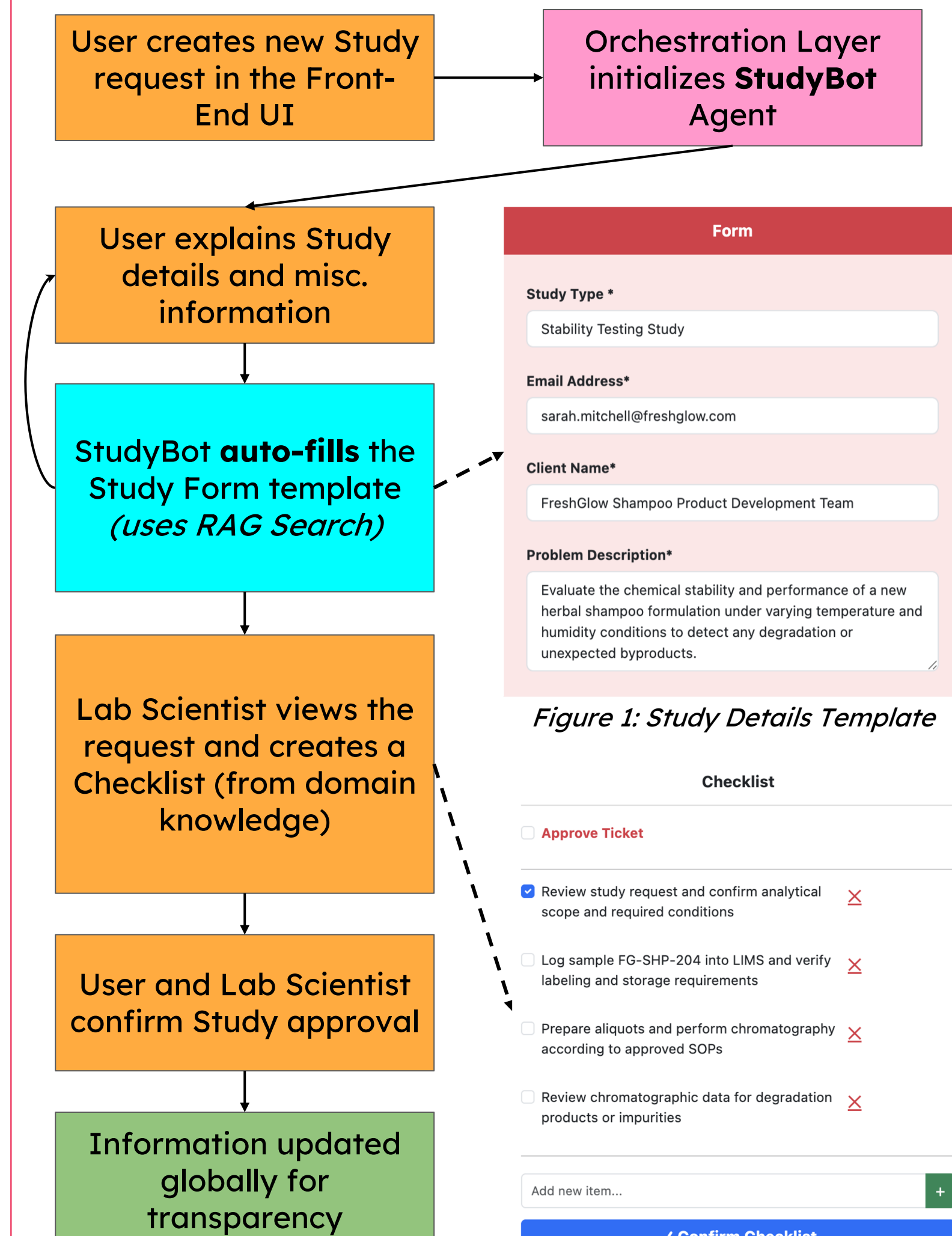


Figure 2: Checklist View

Tech Stack: DSPy, LangGraph (RAG), PyTorch

2 | Data Analysis and Exploration *

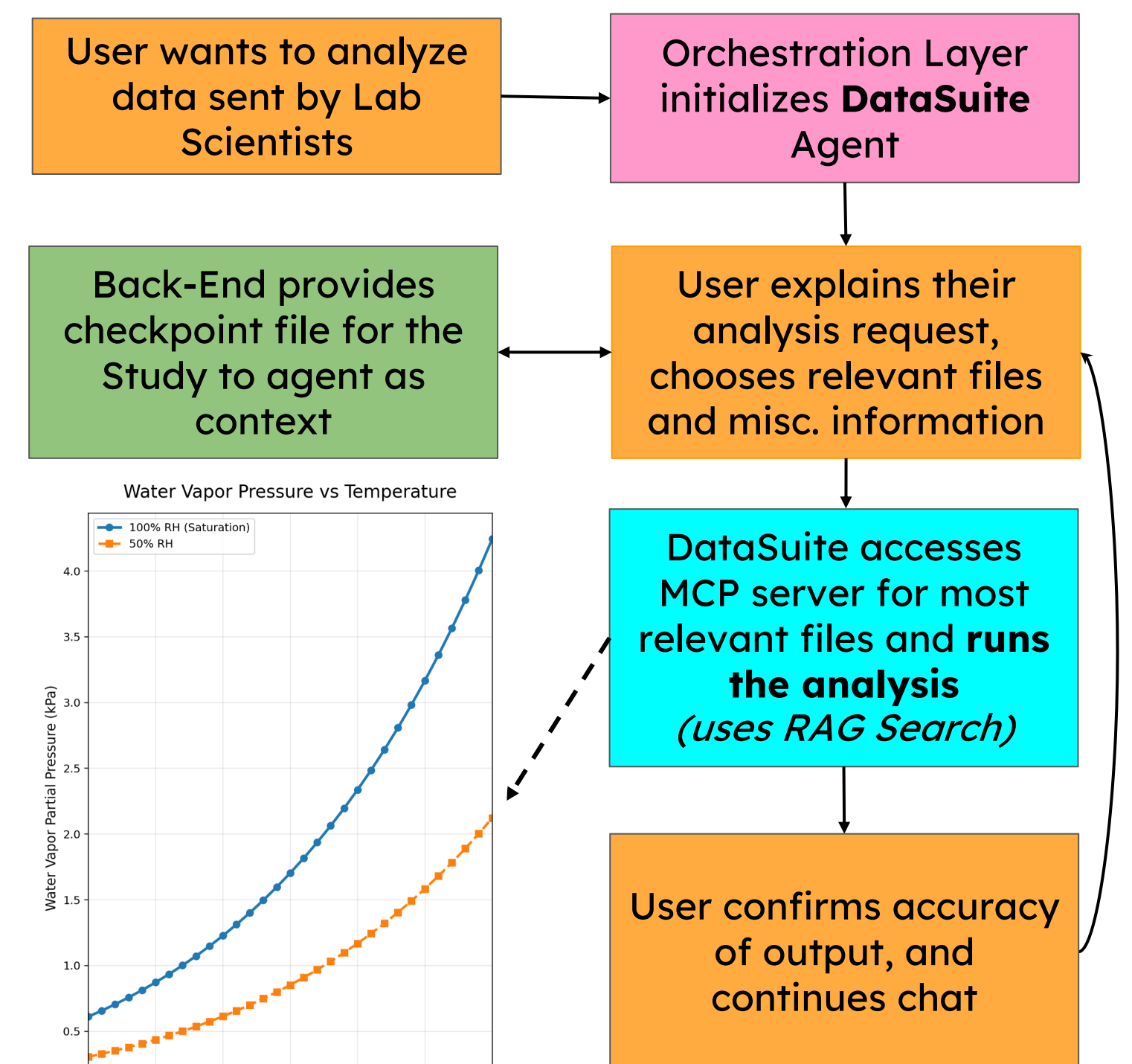


Figure 3: Sample Generated Plot

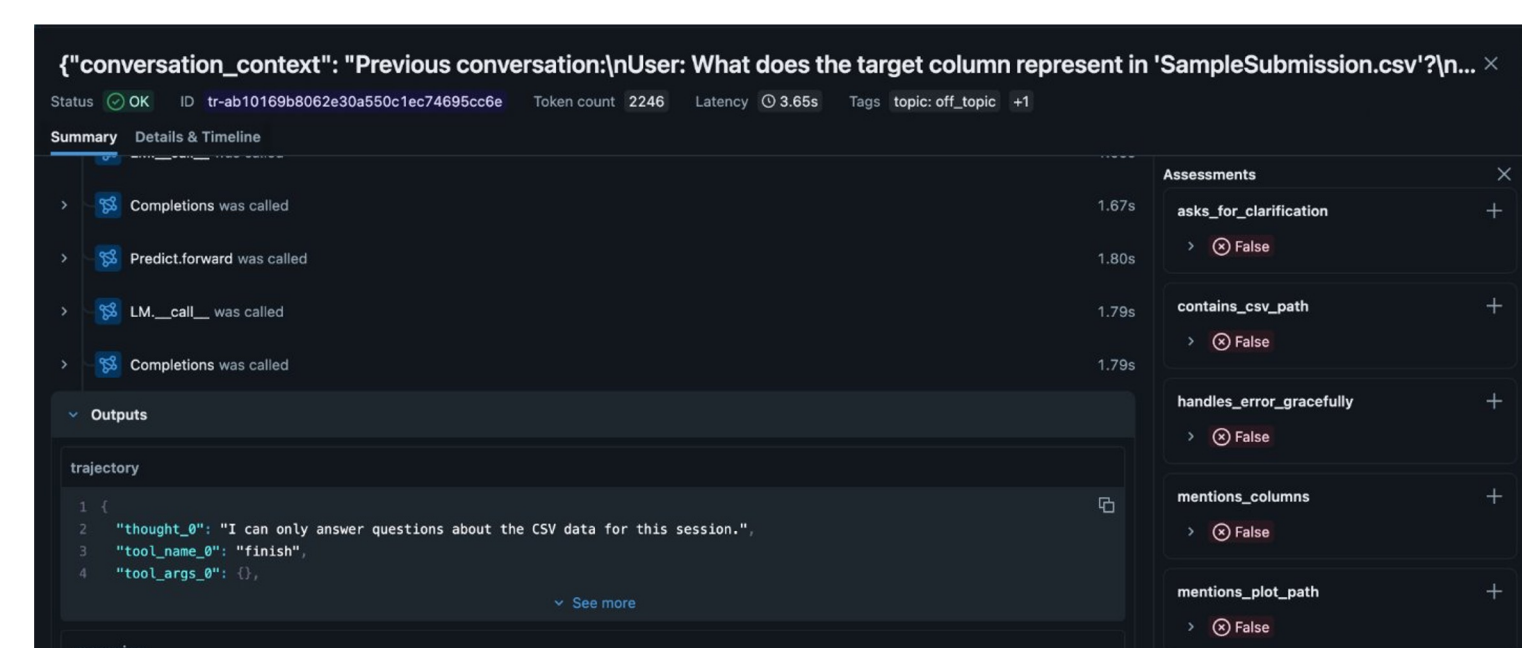


Figure 4: MLflow Testing for a robust system-prompt

Tech Stack: DSPy, MLFlow, SentenceTransformers

3 | Report Generation and Revision *

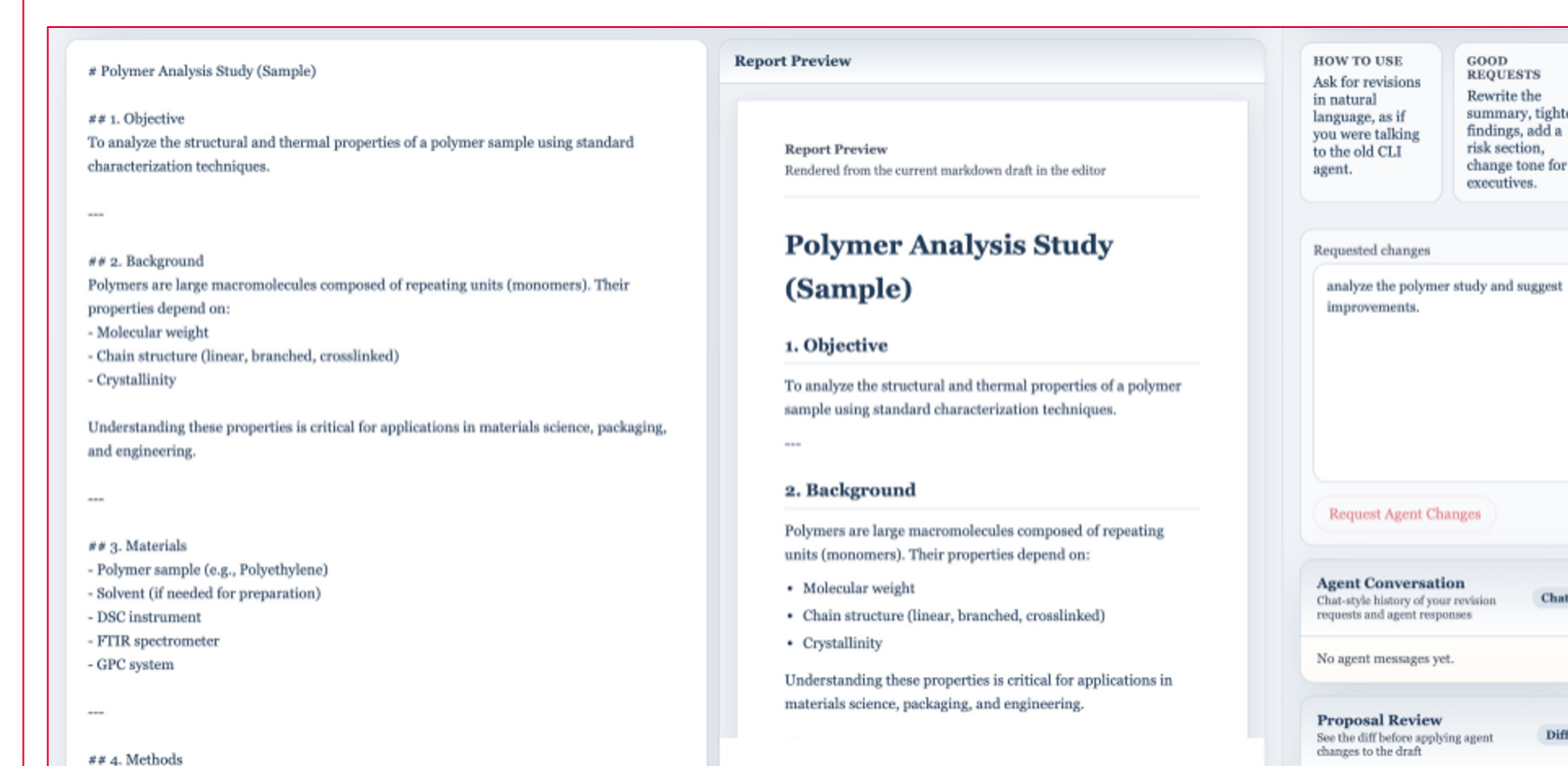
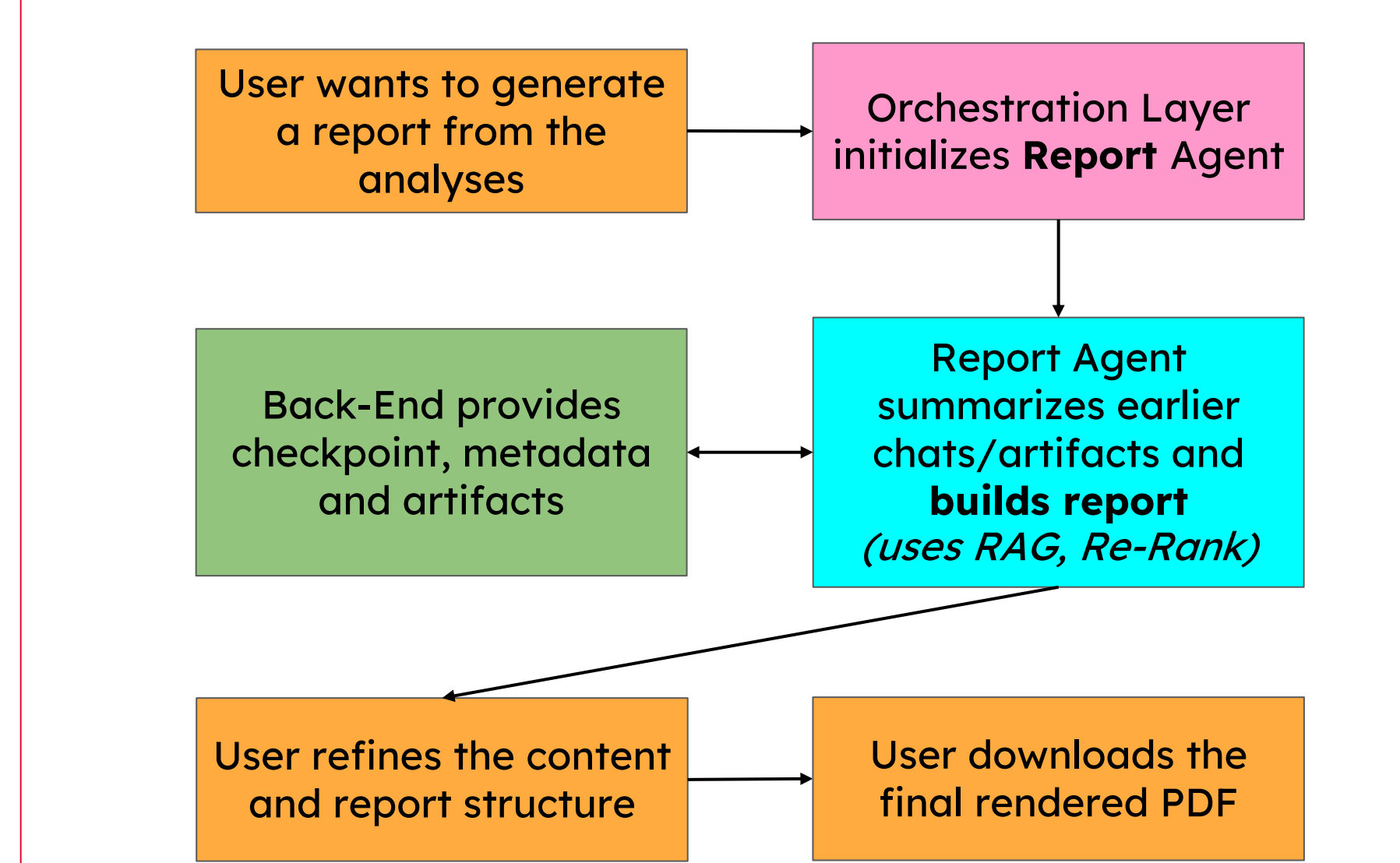


Figure 5: Report Agent Front-End View

Tech Stack: LangGraph, Transformers, Quarto, PyPDF2

Conclusion

Beacon is built as a modular, **containerized prototype** of independent services connected through a shared Back-End and Orchestration Layer. This microservice-oriented design makes the platform well-suited for **future scaling** into a production deployment.

Future Goals

- Deploy Beacon on **Azure or AWS** using managed containers
- Improve observability with centralized logging and health checks
- Setup **MLOps flows** with company LLM APIs.
- Strengthen **enterprise integration** by opening hooks for Microsoft Teams and Azure AD Auth

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* Please refer to “System Infrastructure” section for color-codes

