MadAgents

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AITP
AI and Theoretical Physics

Questions

aim Develop a reliable and efficient agentic interface for the collider simulation MadGraph.

- **Q1**: How can we handle diverse user tasks?
- **Q2**: How can we ensure reliable results?
- **Q3**: How can we minimize latency?

Methods

MadAgents [1,2] is a **multi-agent system** where an orchestrating agent invokes specialized subagents based on the user's task.

Most subagents are **consultants** for specific parts of MadGraph, providing in-depth knowledge grounded in the source code [3,4].

A two-tier llm-wiki [5] **memory** reuses verified knowledge efficiently, reducing latency for similar tasks.

Find us



Daniel



Sascha

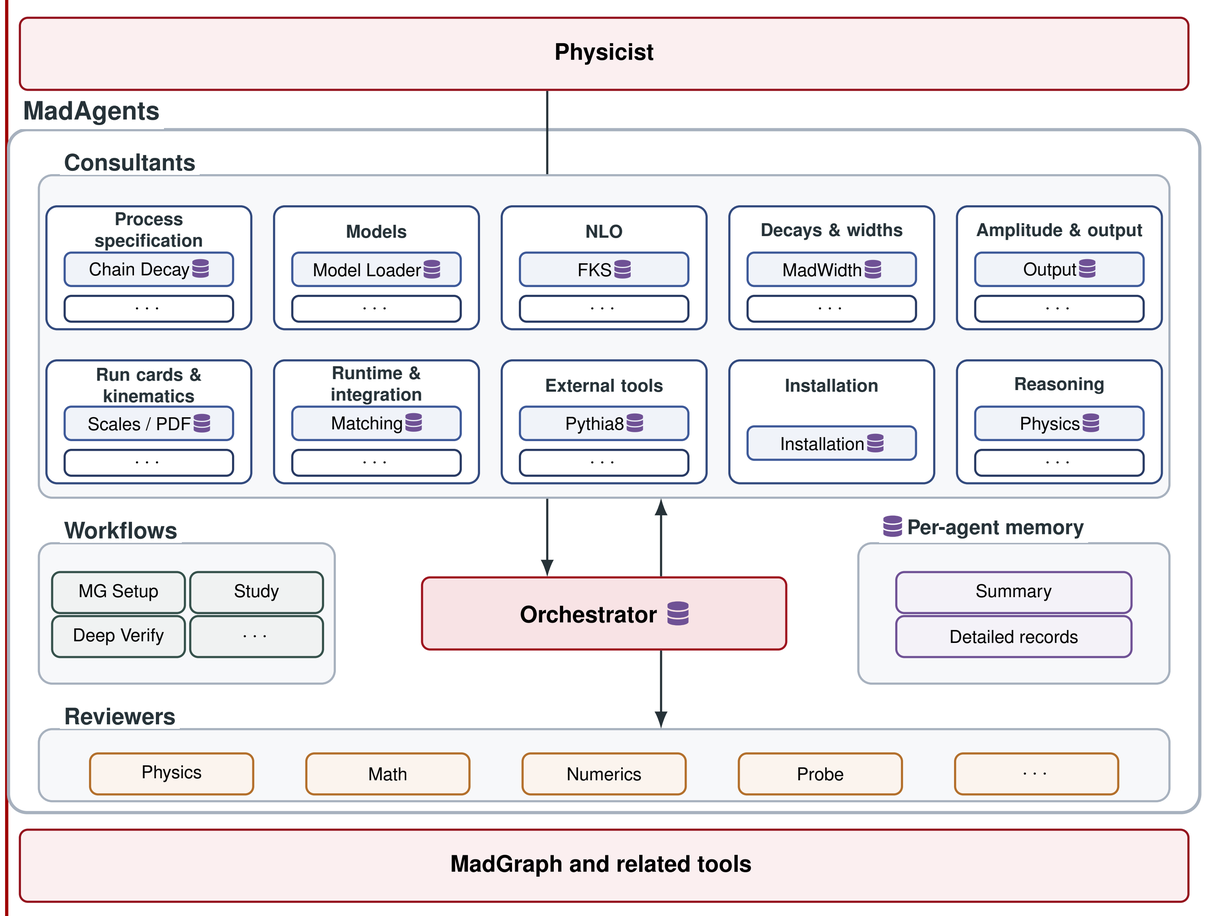


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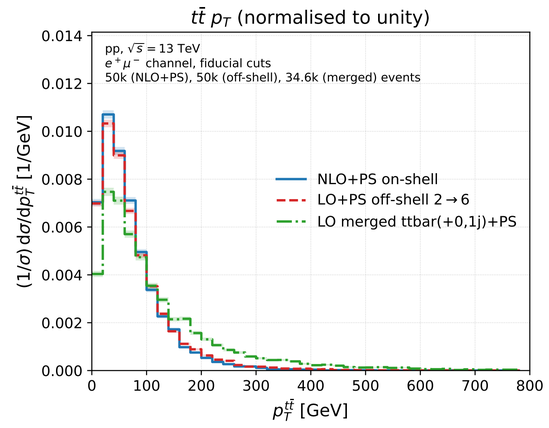
Nikita

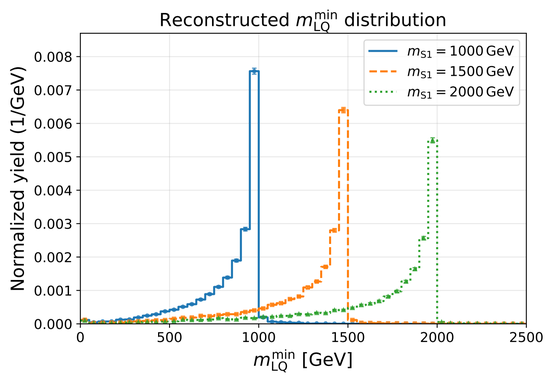
Agent system



MadGraph support in practice

- **Software installation**, including ROOT compilation.
- **Training beginners** through tailored tutorials and coaching, learning by doing, and documenting and reviewing work.
- **Supporting expert users**.
  Illustrated by exploring and implementing higher-precision setups for $pp \to t\bar{t}$ production.
  Blue: NLO $t\bar{t}$ production
  Red: $2 \to 6$ LO off-shell
  Green: LO $t\bar{t}$ production merged with up to one additional jet
- Running **autonomous simulation** campaigns.
  Illustrated with a scalar leptoquark mass scan from high-level PDF instructions, including web search and the download of a suitable MadGraph model.
- **Part of SFitterAgents** [2], recasting measurements for a global SMEFT analysis.





Outlook and impact

- **Accelerating simulation workflows.**
- Making collider simulations **more accessible** to new users and **more efficient** for experienced users.
- Providing an **interactive interface**, keeping physicists in control of key physics decisions.
- Improving the reliability of the agentic system through source-grounded knowledge, validation, and learning from failures.
- Enabling autonomous simulation campaigns from high-level physics instructions and scientific publications.
- Providing a modular MadGraph interface for other agentic systems, as demonstrated with SFitterAgents [2].
- **Next:** Running MadAgents with open-source models.

Check it out

References

[1] Plehn, Schiller, Schmal, "MadAgents" *arXiv:2601.21015*.
[2] Diefenbacher, Plehn, Schiller, Schmal, "Agentic Re-Casting using Agentic Re-Simulations" *arXiv:2607.22813*.
[3] Technical collaboration with Siddarth Mishra-Sharma, Anthropic & Boston University.
[4] Technical workshop with the startup barra (Erik Gerwick, Dario Hügel, et al.).
[5] Karpathy, "LLM Wiki: A Pattern for Building Personal Knowledge Bases Using LLMs", GitHub Gist (2026).

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