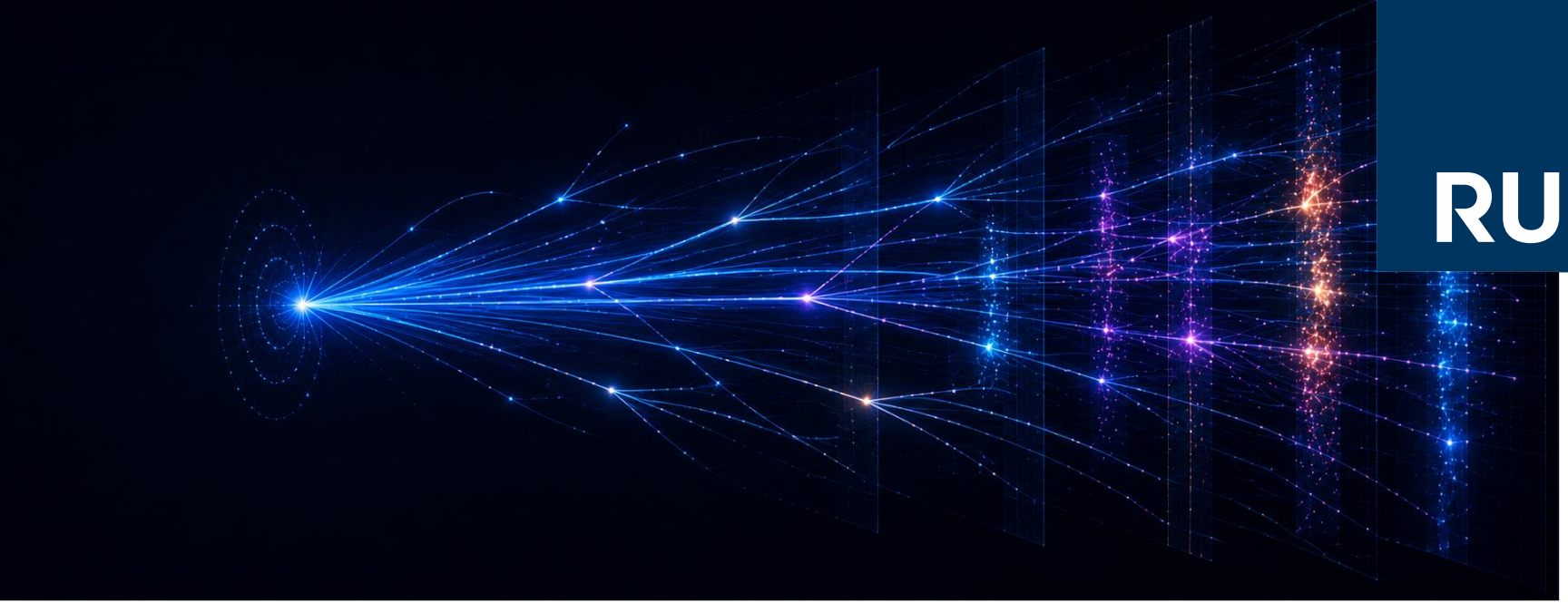

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GENERATED USING CHATGPT

AGENTIC DECIPHERING OF COMPLEX COMPUTATION GRAPHS

AN EFFICIENT PROMPTING METHOD OF ANALYSING COMPUTATIONAL FRAMEWORKS ON THE EXAMPLE OF TF-PWA

Alexander Kazatsky | Mikhail Mikhasenko | Marian Stahl | EuCAIFCon 2026 Heidelberg | 27.08.26

DEMOS
democratizing models

Federal Ministry
of Research, Technology
and Space

DEMOS (**DE**mocratizing **MO**del**S**)

- **Problem:**
  - Lack of accessible, reproducible models across disciplines

    → Slowing down scientific progress
- **Core goals:**
  - Establishing an accessible platform/interface for researchers to share, integrate and build upon models across different fields of physics
  - Foster a new habit of publishing models in a **standardized format**

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Common Issues with Frameworks (here: TF-PWA)

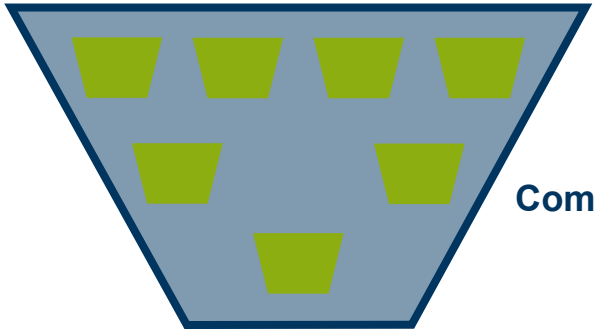
Used in ~35 papers

- Documentation not very thorough
- Computation steps not extractable (non-human-readable objects)
- Source code functions very granular (34.850 lines of code, 2.050 functions, 227 classes)

→ **Using agentic AI for efficient reconstruction**

Workflow-based Tracing

Input 1, input 2, input 3, input 4, input 5, …



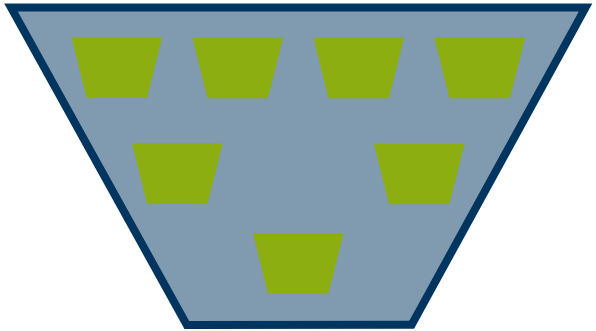
Computation

Output value

- **Fails due to explosion of execution paths**
  (using Gemini-3 Pro and GPT-5.4)
- **Agent takes incorrect paths → wrong output**
  (Codex produced incorrect documentation after ~1h)
- **Agent reaches token limit → no output**
  (Antigravity failed after ~3h with pro subscription)

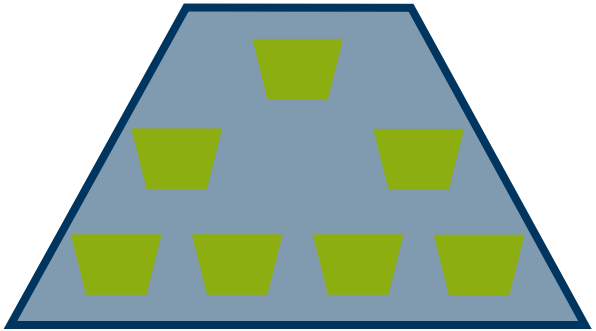
Workflow-based Tracing vs Backward Tracing

Input 1, input 2, input 3, input 4, input 5, …



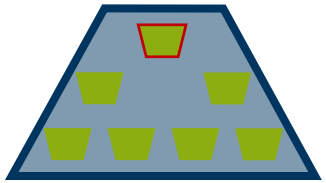
Output value

Output value



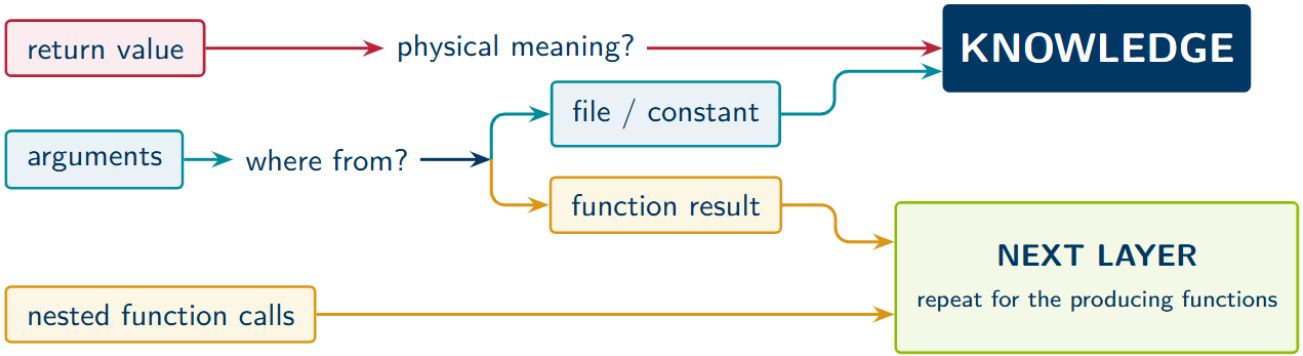
Input 1, input 2, input 3, input 4, input 5, …

Backward Tracing

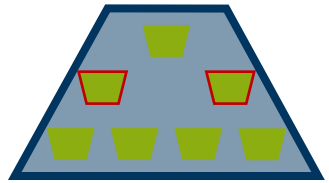


CURRENT LAYER

```
def function(arg1, arg2, arg3):
  a = subfunc1(...)
  b = subfunc2(...)
  c = a + b
  return c
```



Backward Tracing



CURRENT LAYER

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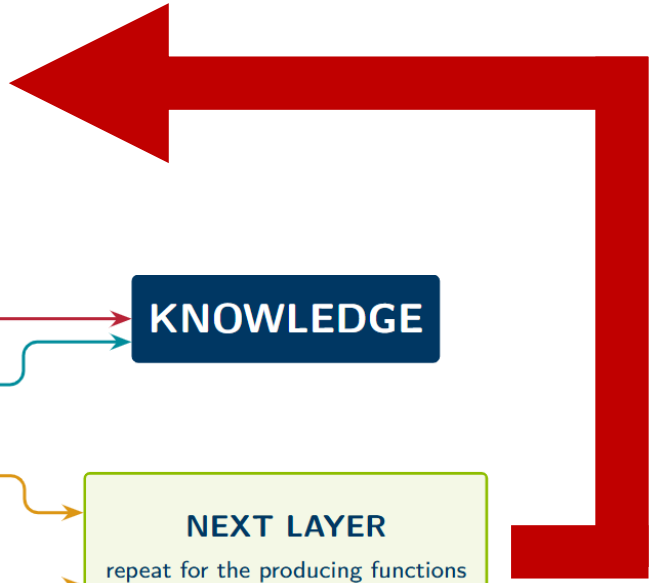


return value → physical meaning? → KNOWLEDGE

arguments → where from? → file / constant → KNOWLEDGE

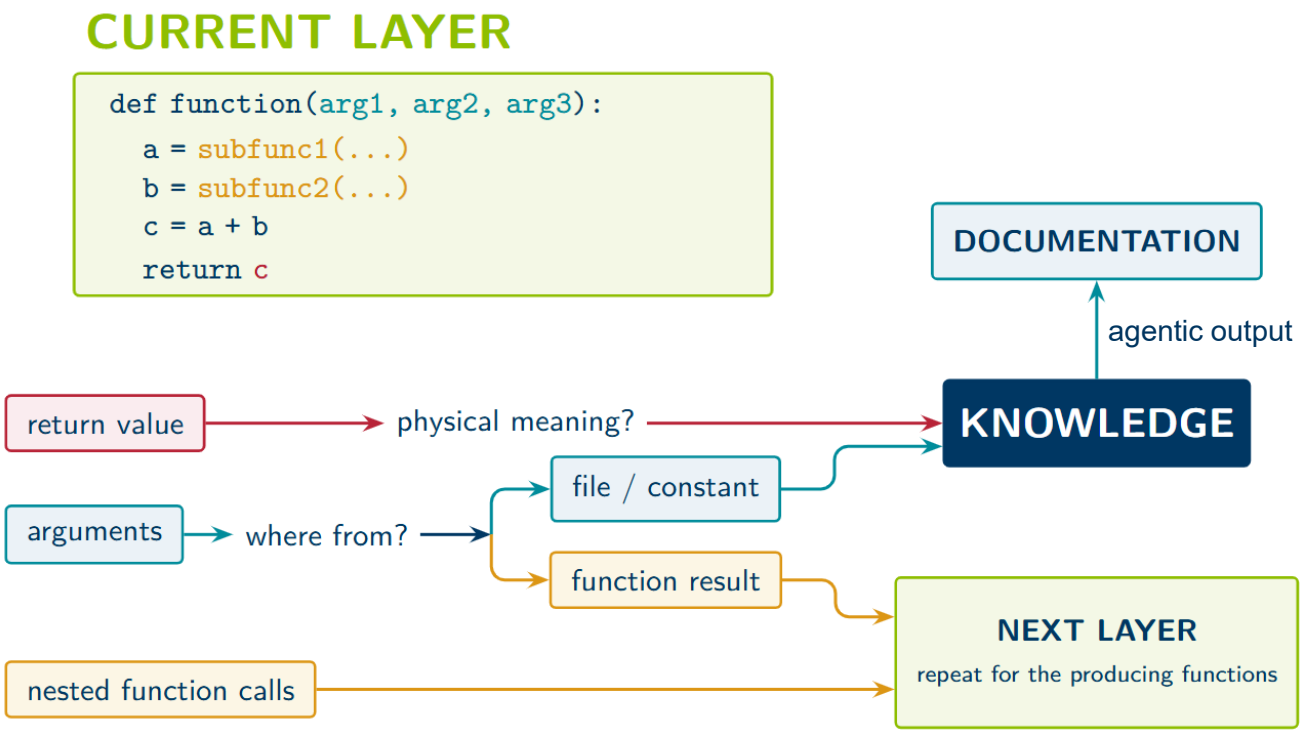
where from? → function result → NEXT LAYER

nested function calls → NEXT LAYER

NEXT LAYER

repeat for the producing functions

Backward Tracing



Test Application

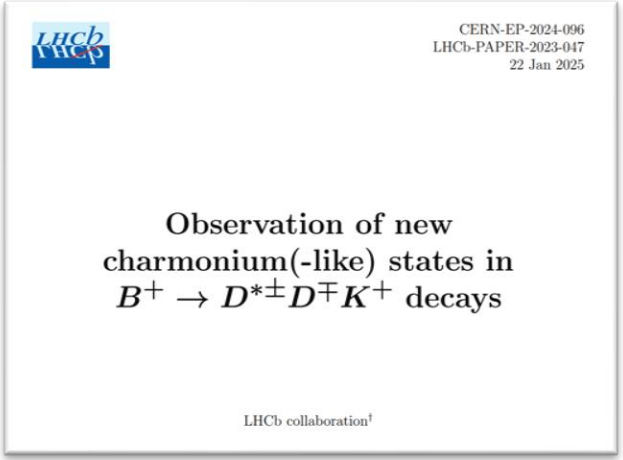
- Original framework:

  TF-PWA (**P**artial **W**ave **A**nalysis using **T**ensor**F**low)

  https://github.com/jiangyi15/tf-pwa

- **Goals:**
  - Isolated amplitude reproduction
  - Mapping to the **CascadeDecays.jl** framework

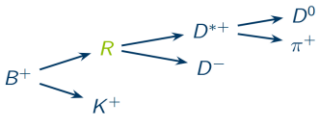
    https://github.com/RUB-EP1/CascadeDecays.jl

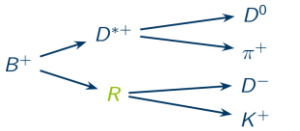

CERN-EP-2024-096
LHCb-PAPER-2023-047
22 Jan 2025

Observation of new charmonium(-like) states in $B^+ \to D^{*\pm}D^{\mp}K^+$ decays

LHCb collaboration[†]

Phys.Rev.Lett. 133 (2024) 13, 131902





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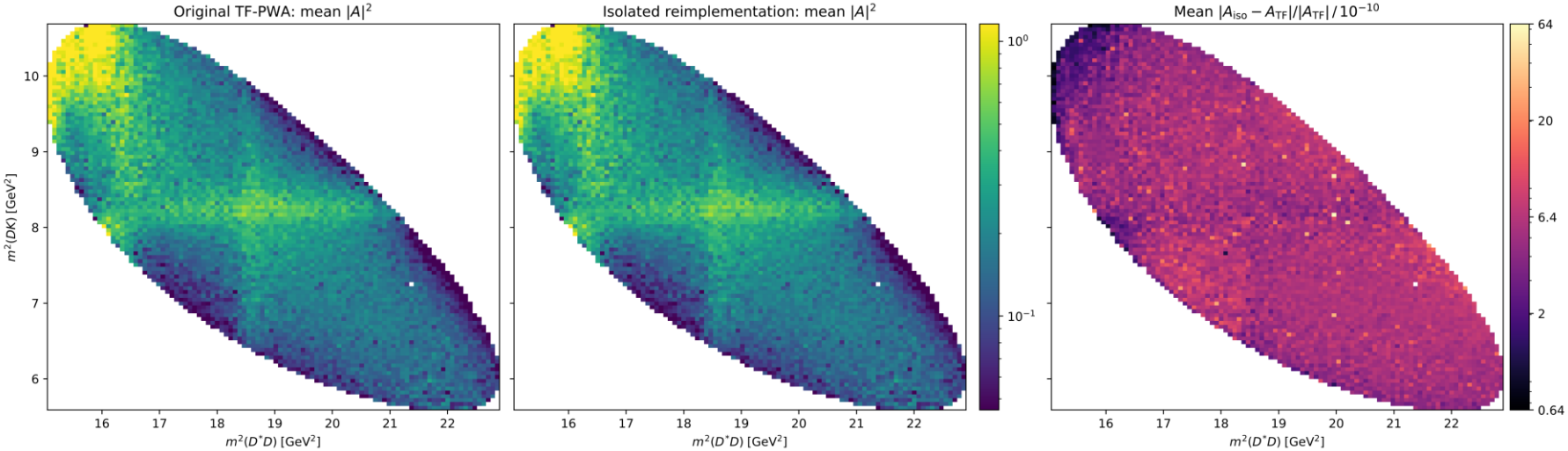
Reproduction Results

Generated documentation



- Relative difference: $6.4 \cdot 10^{-11} - 6.4 \cdot 10^{-9}$ → **consistent within numerical round-off**

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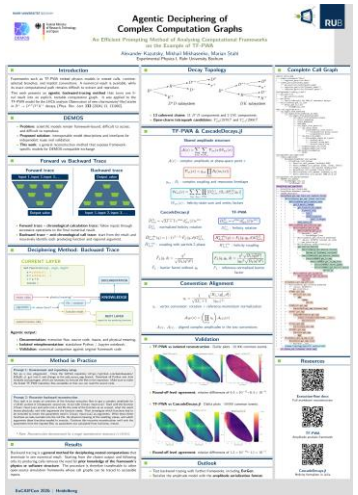
Summary

- **What was found?**
  - A **token-efficient**, **stable**, and **general** deciphering method for frameworks
  - Most relevant for local and small LLMs
- **Boundaries?** Framework has to …
  - have a collapsing structure
  - be open source
- **Poster:** details on prompts, comparison to CascadeDecays.jl convention

Nr. 150



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