

Luke Kreczko - AI in research: what changed in three years?

Three years ago, AI assistants were starting to enter research workflows — mostly for the enthusiastic early adopters, with results that varied a lot. Since then, the capability shift has been significant: models that generated code on request have given way to agents that inspect codebases, run tests, detect dead ends, and revise — autonomously, across many steps. This talk takes stock of what has actually changed, what the current limitations are, and what it means to use these tools responsibly in a scientific context.

The first half covers the components of an AI agent system — context, tools, memory, routing, and guardrails — and a practical framework for deciding what to delegate and what to keep in human hands. The second half works through concrete examples from HEP: simulation code and end-to-end analysis automation. The talk closes with a look at what the broader HEP community is doing in this space and a brief snapshot of where the technology is heading.

Introduction using a 1-year old model (Haiku 4.5)

Luke Kreczko is a Senior Research Associate in Particle Physics at the University of Bristol, where he leads research in particle physics and dark matter following his PhD from the University of Hamburg (2003–2009). A key contributor to the CMS collaboration at CERN, he has authored over 65,000-cited publications on Higgs boson measurements and fundamental physics. Beyond experimental work, Luke spearheads the SWIFT-HEP project, which develops software and AI tools for modern physics research. He's uniquely positioned to discuss how artificial intelligence has transformed particle physics research over the past three years.

Introduction using a 1-month old model (Opus 5.5)

Our speaker today is Dr Luke Kreczko, who did his PhD here at Bristol on the CMS experiment at CERN, analysing top quark data. He's now a Research Fellow in Bristol's Particle Physics group, building the software and computing infrastructure that lets experiments like CMS, LZ and DUNE handle enormous datasets. Today he'll look back at how AI has changed research over the past three years: what has worked, what hasn't, and where things are heading. Please join me in welcoming Luke.