

Building AI Foundation Models for Physics

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Why in News?

Recently, the European Organization for Nuclear Research (CERN) and French artificial intelligence leader Mistral AI signed a landmark statement of intent to establish a long-term strategic partnership.

- **Aim** - To develop advanced AI foundation models specifically tailored for scientific discovery, starting with **high-energy physics**.

Core Objectives

- **Developing the Large Physics Model**
 - The partnership focuses on building a unified **Large Physics Model** trained on billions of simulated proton-proton collisions generated at the **Large Hadron Collider (LHC)**.
 - Instead of relying on isolated, sequential chains of specialized algorithms to interpret detector traces, the model aims to learn across the entire collision reconstruction and particle identification chain simultaneously.
- **Managing Exascale Data Loads**
 - CERN currently houses approximately **one exabyte** (one million terabytes) of experimental collision data.
 - With the upcoming transition to the **High-Luminosity LHC (HL-LHC)** scheduled around 2030, particle collision rates are projected to increase tenfold, creating massive computational bottlenecks that demand next-generation AI processing efficiencies.

Strategic Significance

- Combines CERN's unmatched expertise in fundamental physics and large-scale computing infrastructure with Mistral's proficiency in frontier model training.
- The initiative aims to enhance precision measurements of known physical laws and scale up searches for unknown phenomena under extreme data workloads.



CERN
World's largest
particle physics
research organisation

CERN & MISTRAL AI PHYSICS PARTNERSHIP



SHANKAR
IAS PARLIAMENT
Information is Empowering.



OBJECTIVE
Build a unified **“Large Physics Model”**
for particle physics



PARTNERS

- CERN (Domain Expertise & Exabyte Data)
- Mistral AI (Training & AI Expertise)



MISTRAL AI
Leading European
AI company

THE DATA CHALLENGE

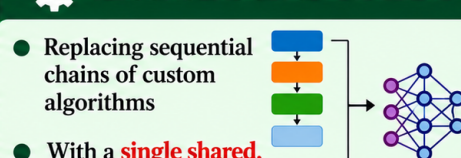
- Managing **~1 exabyte** of LHC experimental data
- Preparing for **10x collision surge** in High-Luminosity LHC





RECONSTRUCTION PIPELINE

- Replacing sequential chains of custom algorithms
- With a **single shared, pretrained** neural architecture



Reference

[The Hindu | AI foundation models for physics](#)