A Magnetised High-Pressure Gaseous Argon TPC for the DUNE Near Detector

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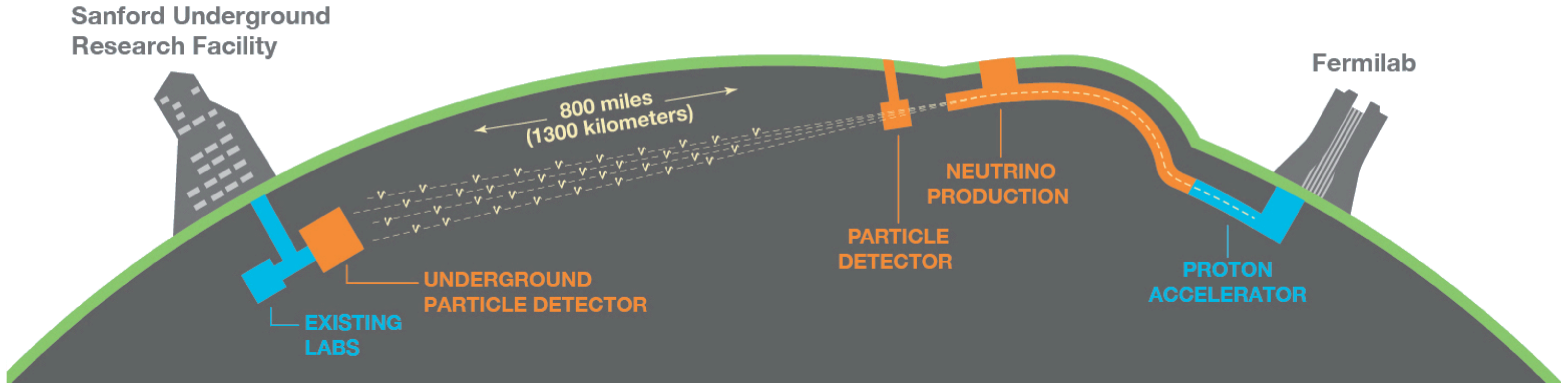
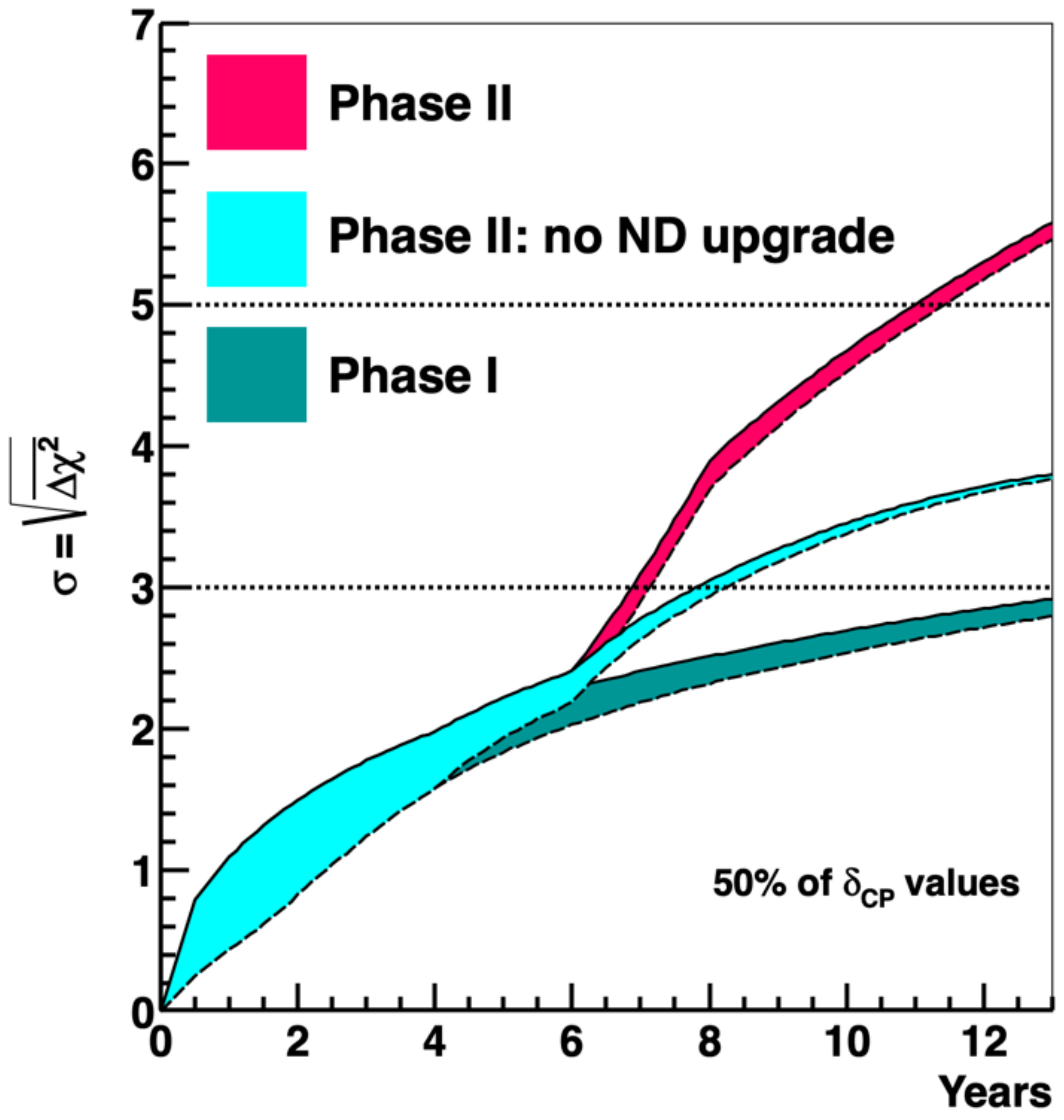
Deep Underground Neutrino Experiment



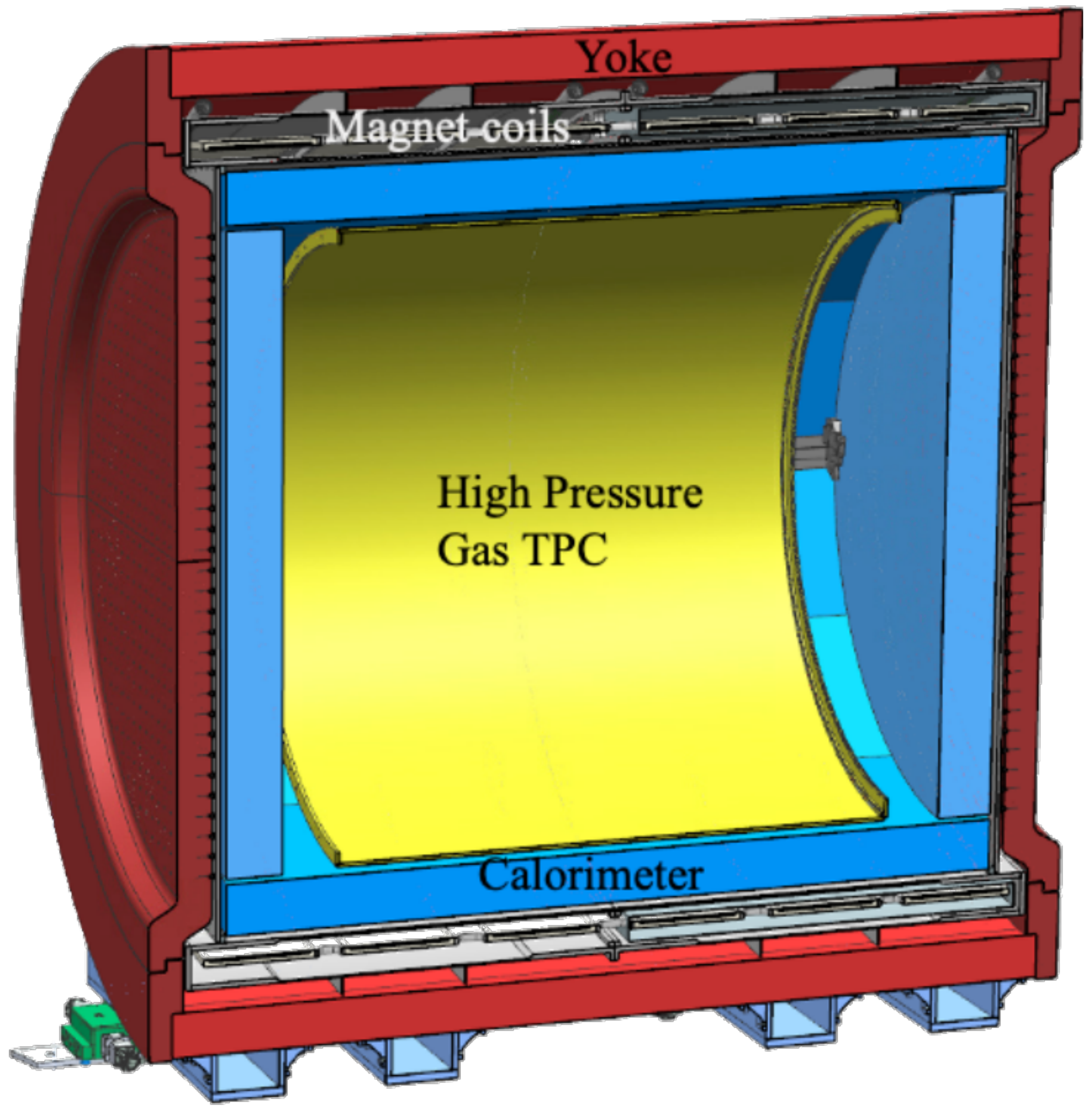
- Determine the **neutrino mass hierarchy**.
- Measure the value of the **leptonic CP violation**.
- Perform **precision measurements** of the three-flavour model.

Parameter	Phase I	Phase II
FD mass	20 kt fiducial	40 kt fiducial
Beam power	up to 1.2 MW	2.4 MW
ND config.	ND-LAr, TMS, SAND	ND-LAr, ND-GAr, SAND



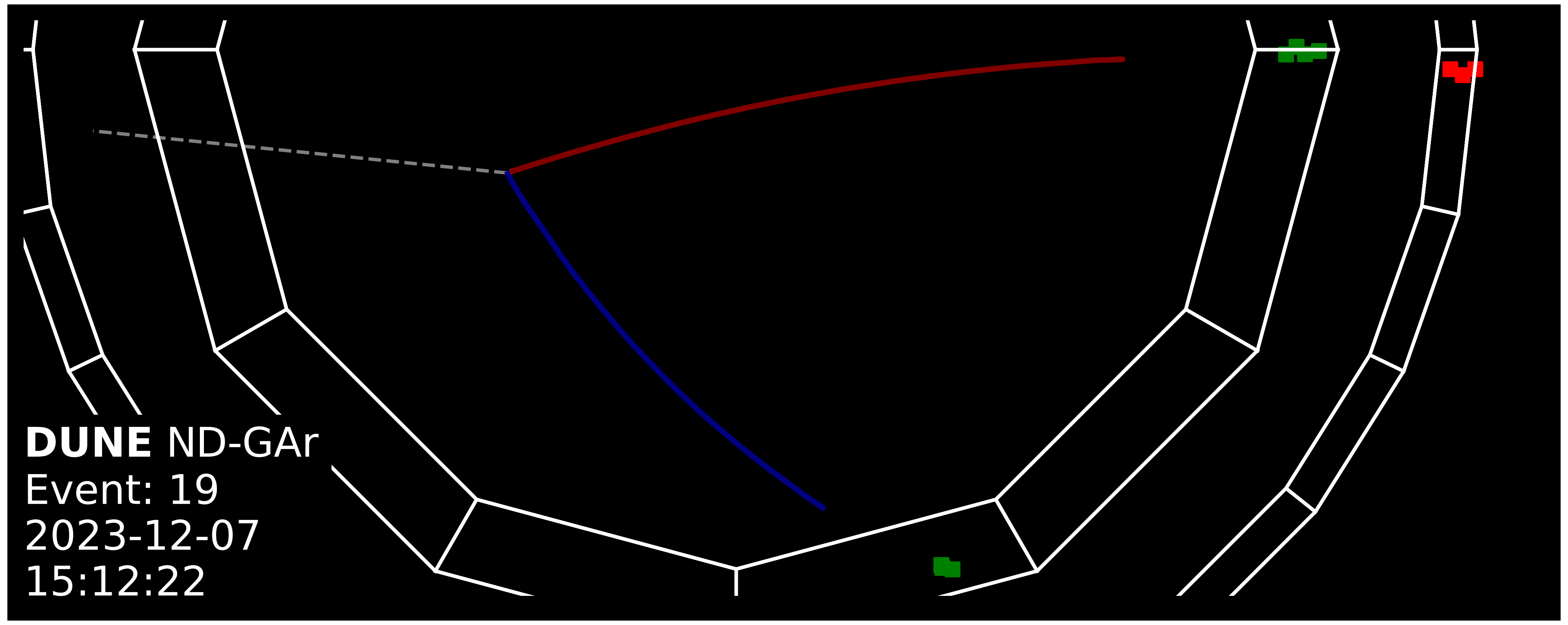
- Phase I is sufficient for early physics goals.
- **Phase II is necessary** to reach the design sensitivity for δ_{CP}.
- A **ND upgrade** is needed in order to reach the design sensitivity!

ND-GAr concept

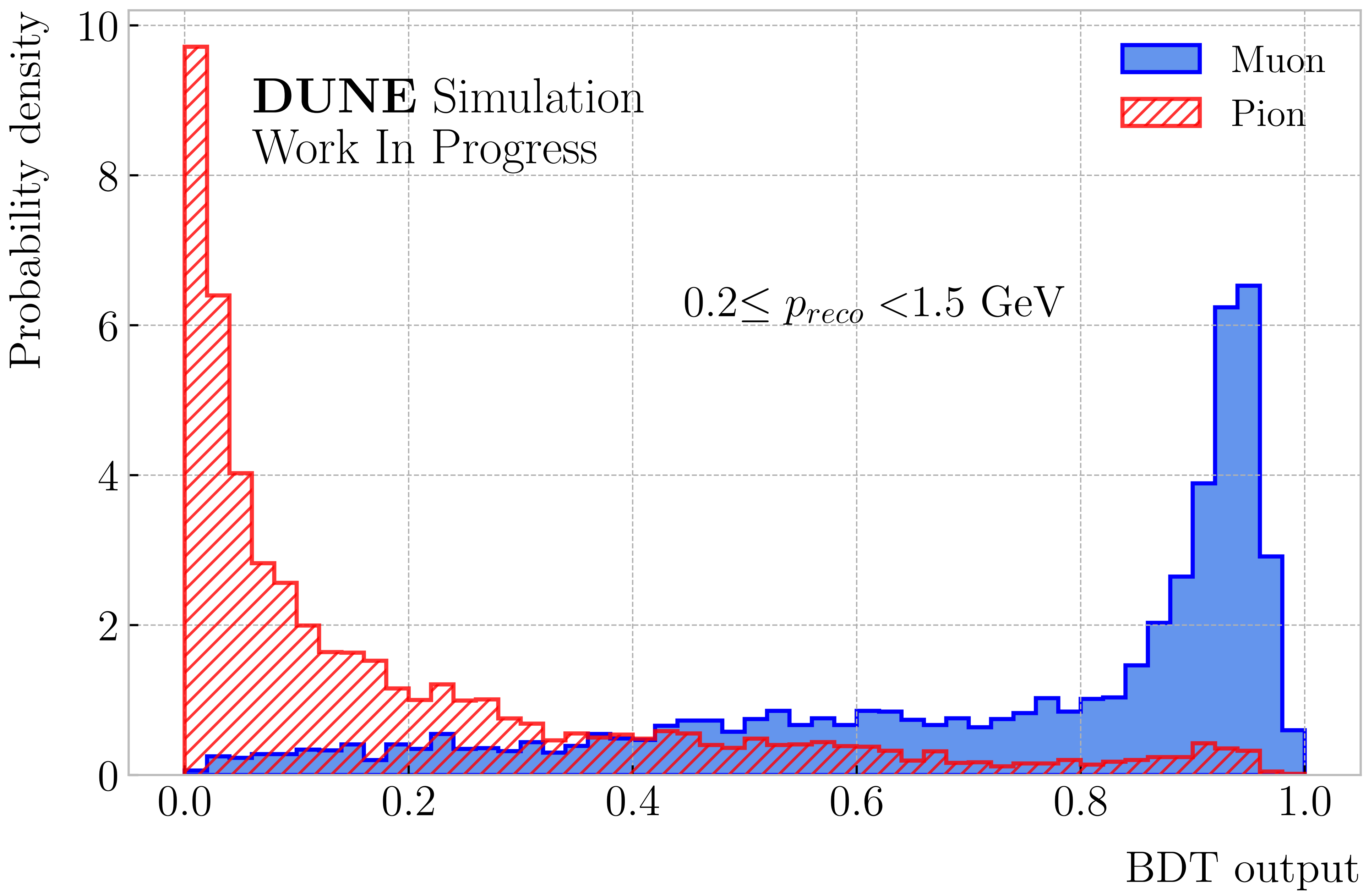


- ND-GAr is a magnetised high-pressure gaseous argon TPC, surrounded by an ECal and a muon tagger.
- The gaseous argon provides **lower tracking thresholds** and larger angular acceptance.
- The B field and the ECal allow for **particle identification** and **momentum and sign reconstruction**.

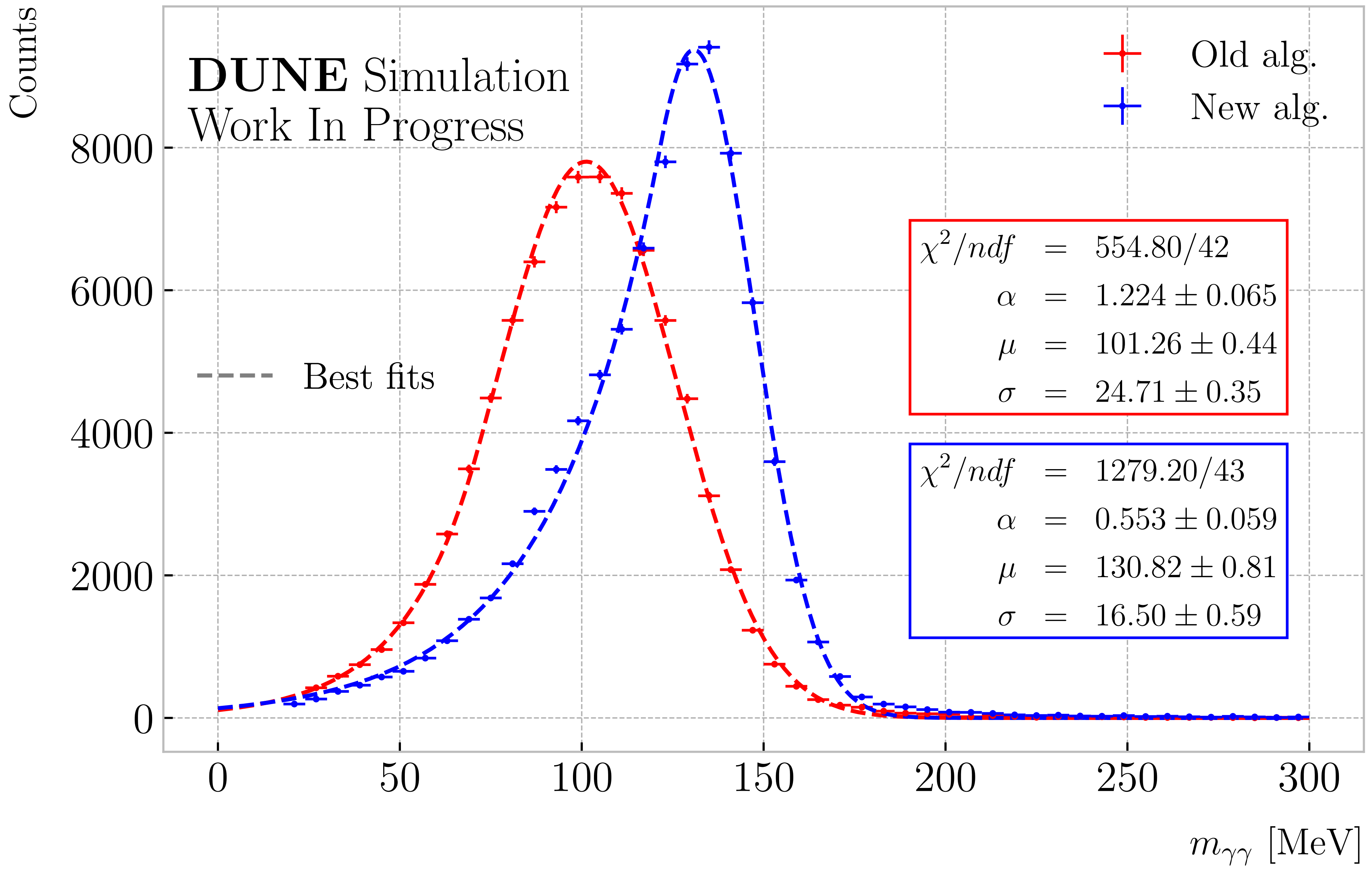
- *GArSoft* is ND-GAr's own **simulation and reconstruction toolkit**.
  - Simulates the readout of the TPC, ECal and muon detector.
  - Reconstructs tracks, vertices and ECal deposits.



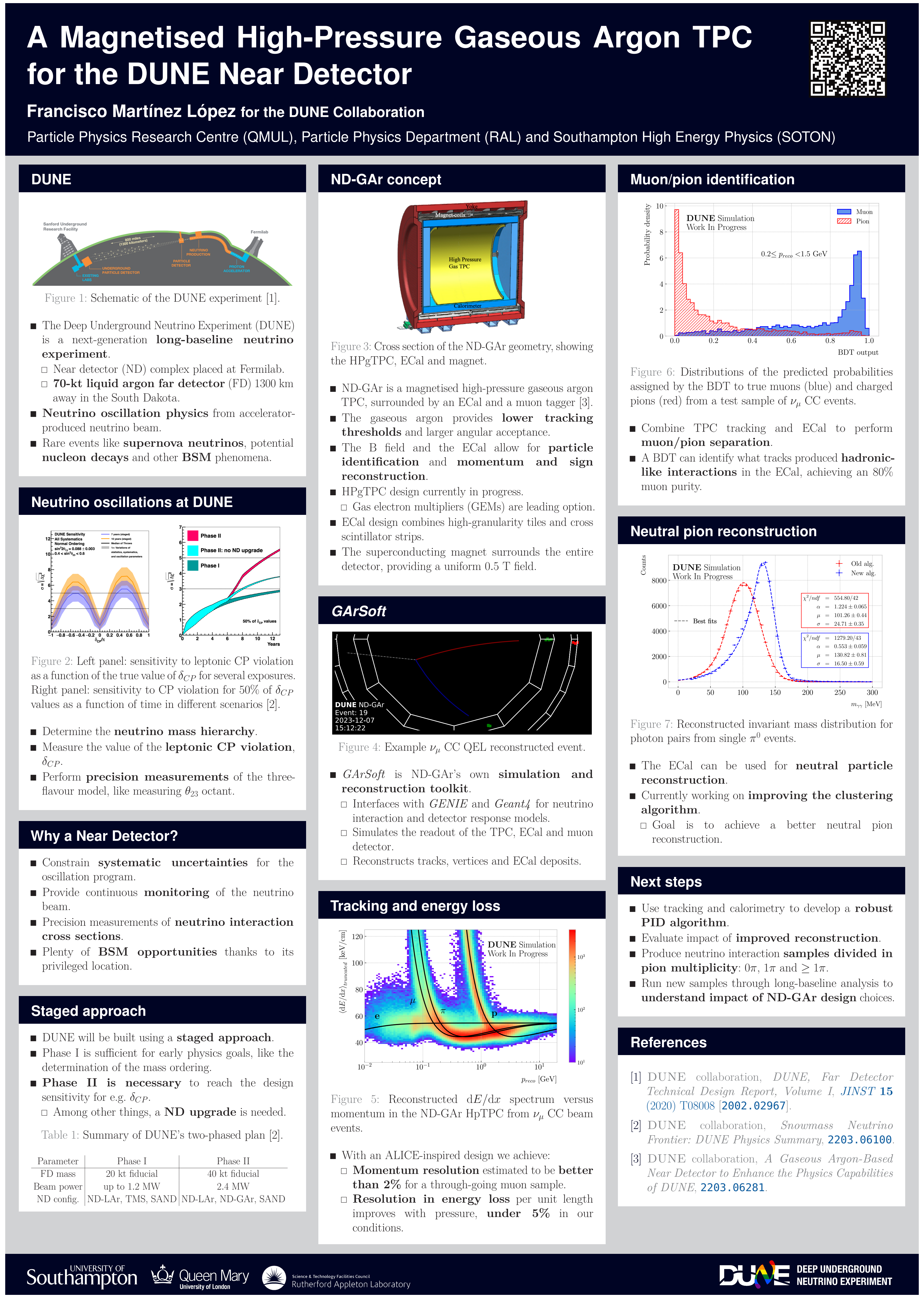
Ongoing sim/reco work



- Recent **reconstruction improvements**:
  - Studies on muon/pion separation using ECal.
  - Improving ECal clustering for neutral pion reconstruction.



- Develop a **robust PID algorithm**.
- Produce **samples divided in pion multiplicity**.
- Run new samples through long-baseline analysis to **understand impact of ND-GAr design** choices.



Come and take a look!

Poster EX-11