

Angular analysis of
 $B \rightarrow K\pi\pi\mu\mu$ at the LHCb,
and SciFi detector
performance studies at
SND@LHC

CHIPP Winter School of Particle Physics 2023

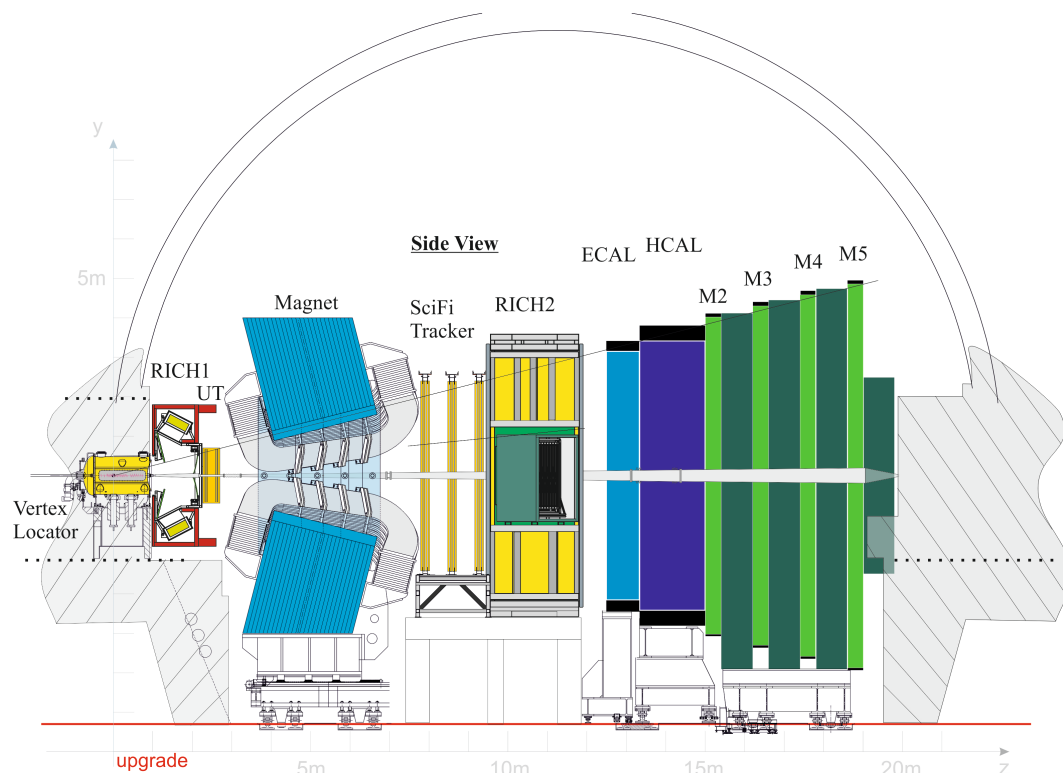
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**Swiss National
Science Foundation**

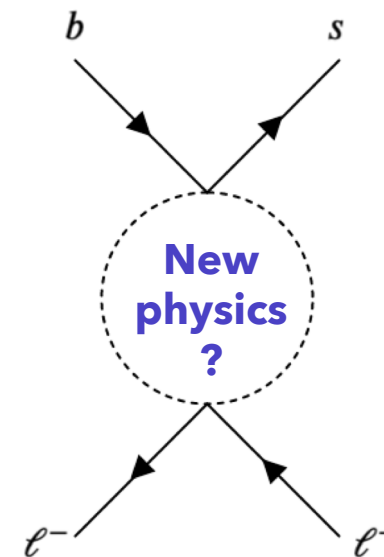
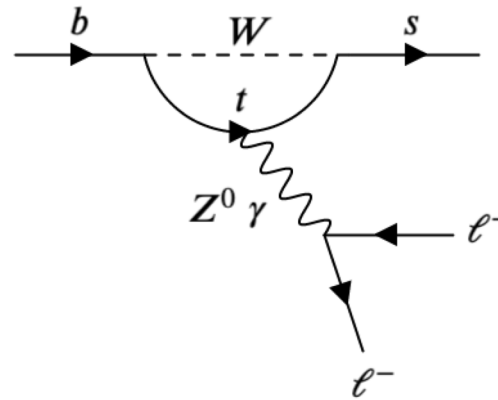
LHCb experiment



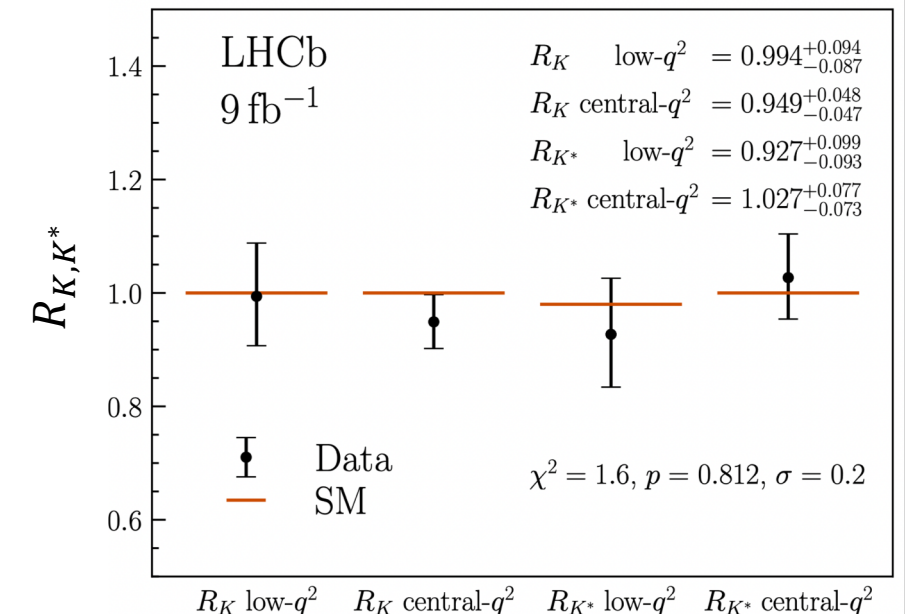
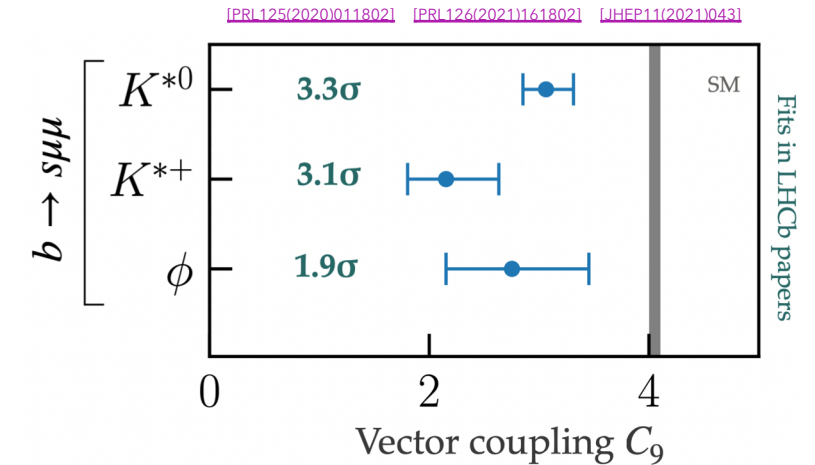
- Built for the study of b-physics and CP-violation
- Single-arm forward spectrometer
- Diverse physics programme including beauty- and charm physics, rare decays, and exotic hadrons
- Recently underwent a major detector upgrade for LHC Run 3

Why study rare decays?

- New physics may appear as indirectly affecting SM processes
- Rare decays offer a good testing ground due to the small SM amplitudes
- Examples: LFU ratios R_K, R_{K^*} (anomalies now gone ☺), branching fractions and angular observables in $b \rightarrow s \mu \mu$ transitions (unexplained tensions with SM predictions remain)

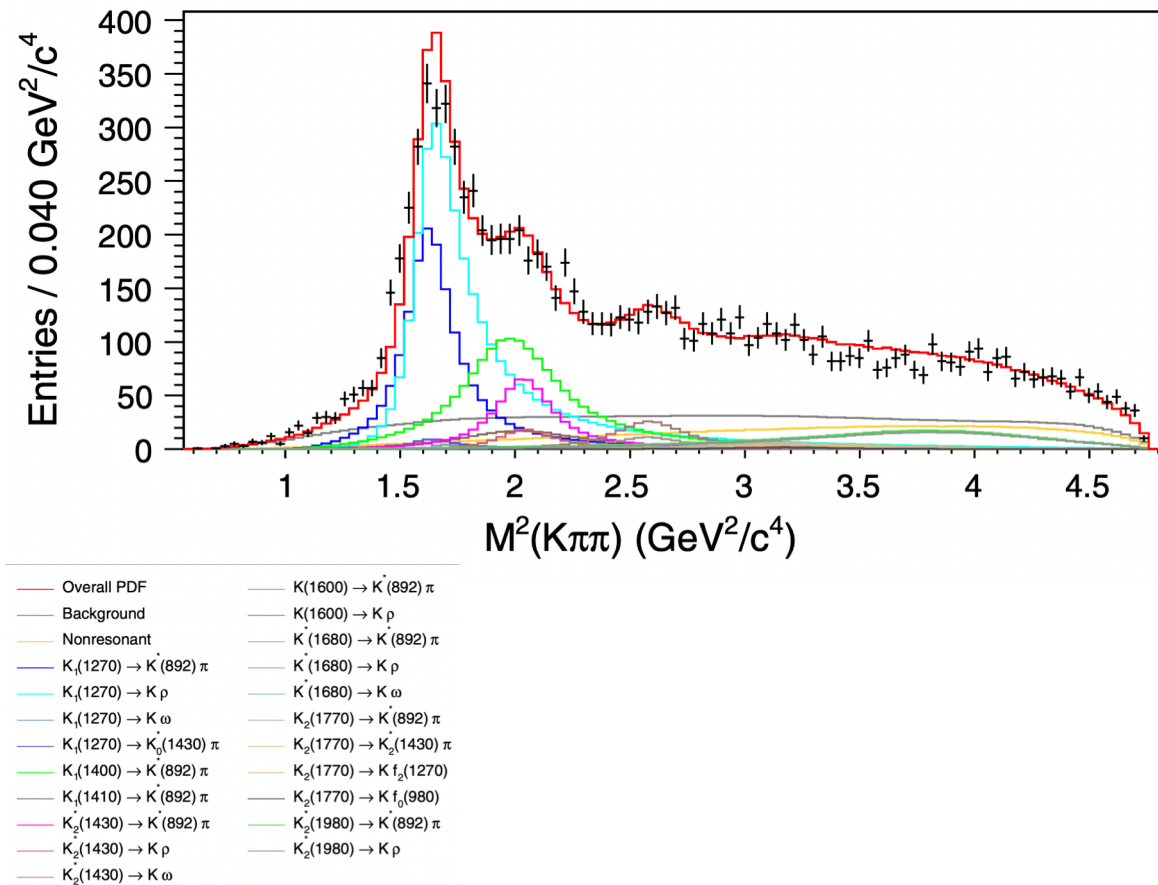


[2212.09153]



Angular analysis of $B \rightarrow K\pi\pi\mu\mu$

[PhysRevD.83.032005]

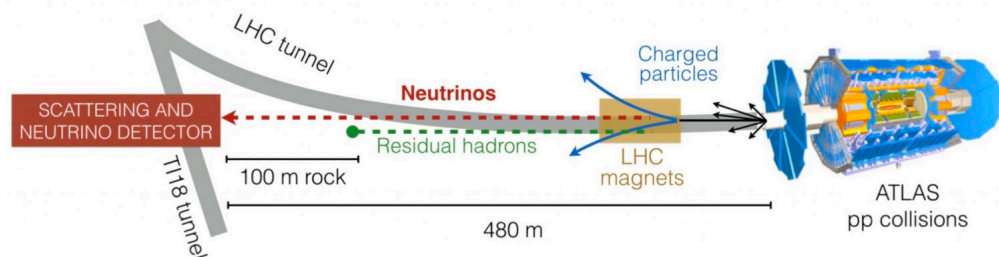


- First angular study of a rare 5-body decay
- No selection applied to the hadronic system - can extract information of different spin structures, complementing results from channels like $B \rightarrow K^* \mu \mu$
- Possibility for a measurement of the differential BR
- The interference between the hadronic resonances present an opportunity to study CP-violation by comparing the B^-/B^+ decays



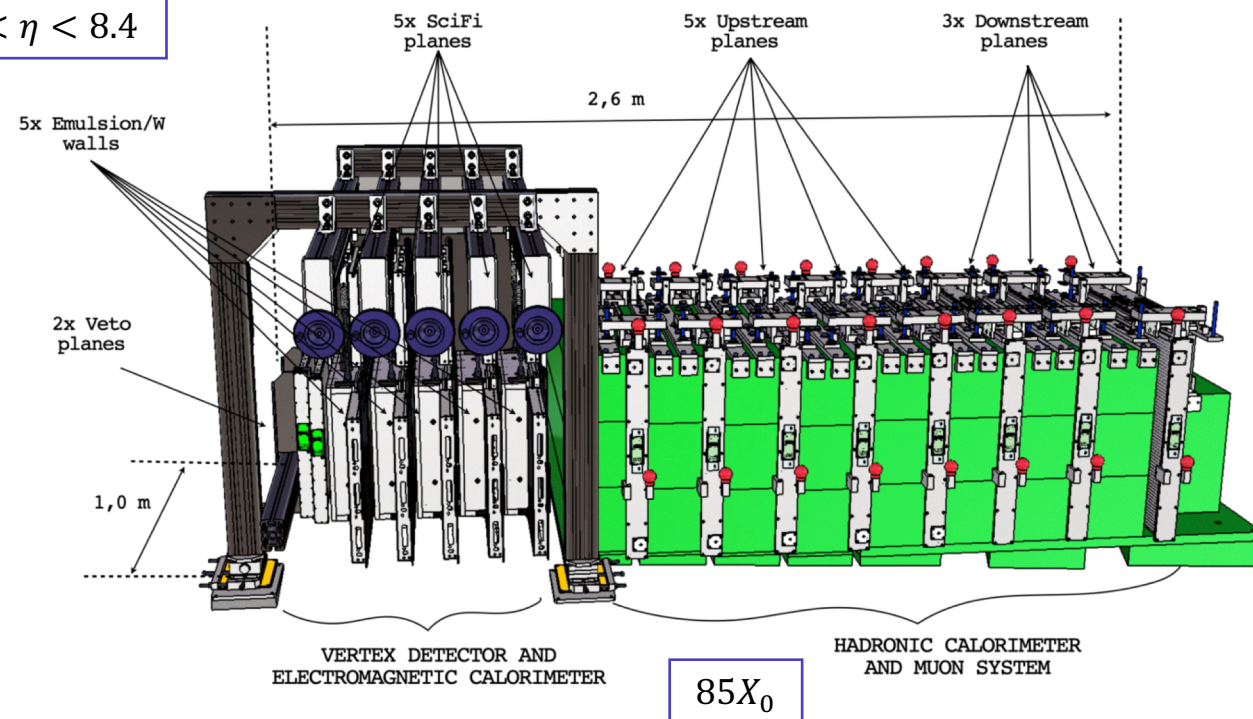
Scattering and Neutrino Detector
at the LHC

SND@LHC experiment



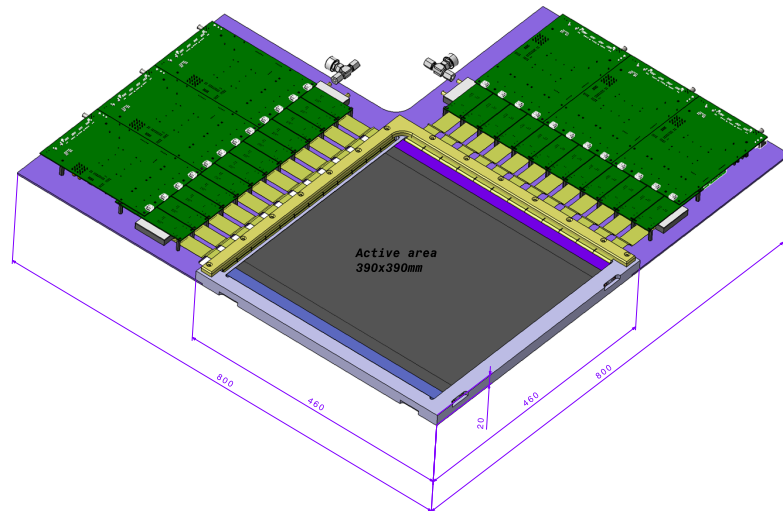
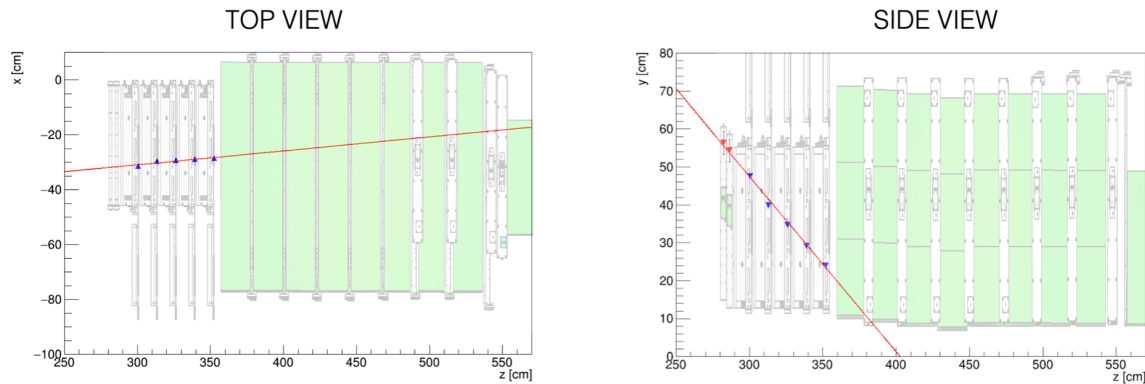
$$7.2 < \eta < 8.4$$

- A newly-built, compact neutrino experiment at the LHC
- Designed to study the neutrinos coming from the ATLAS interaction point, with an emphasis on identifying the three neutrino flavours
- Potential to study various topics, including the measurement of charm production cross-section, LFU tests in neutrino interactions, and the search for feebly-interacting particles



[2210.02784]

SciFi detector performance analysis



- Understanding the performance of the detector is essential for the interpretation of physics data
- My work will involve analysing the performance of the SND@LHC scintillating fibre (SciFi) detector, including the spatial and temporal resolution, tracking efficiency, and geometrical effects

Summary

My PhD work will involve two projects:

- The angular analysis of the decay $B \rightarrow K \pi \pi \mu \mu$ with LHCb
- A study of the SND@LHC SciFi detector performance



*Thank you for
your attention!*