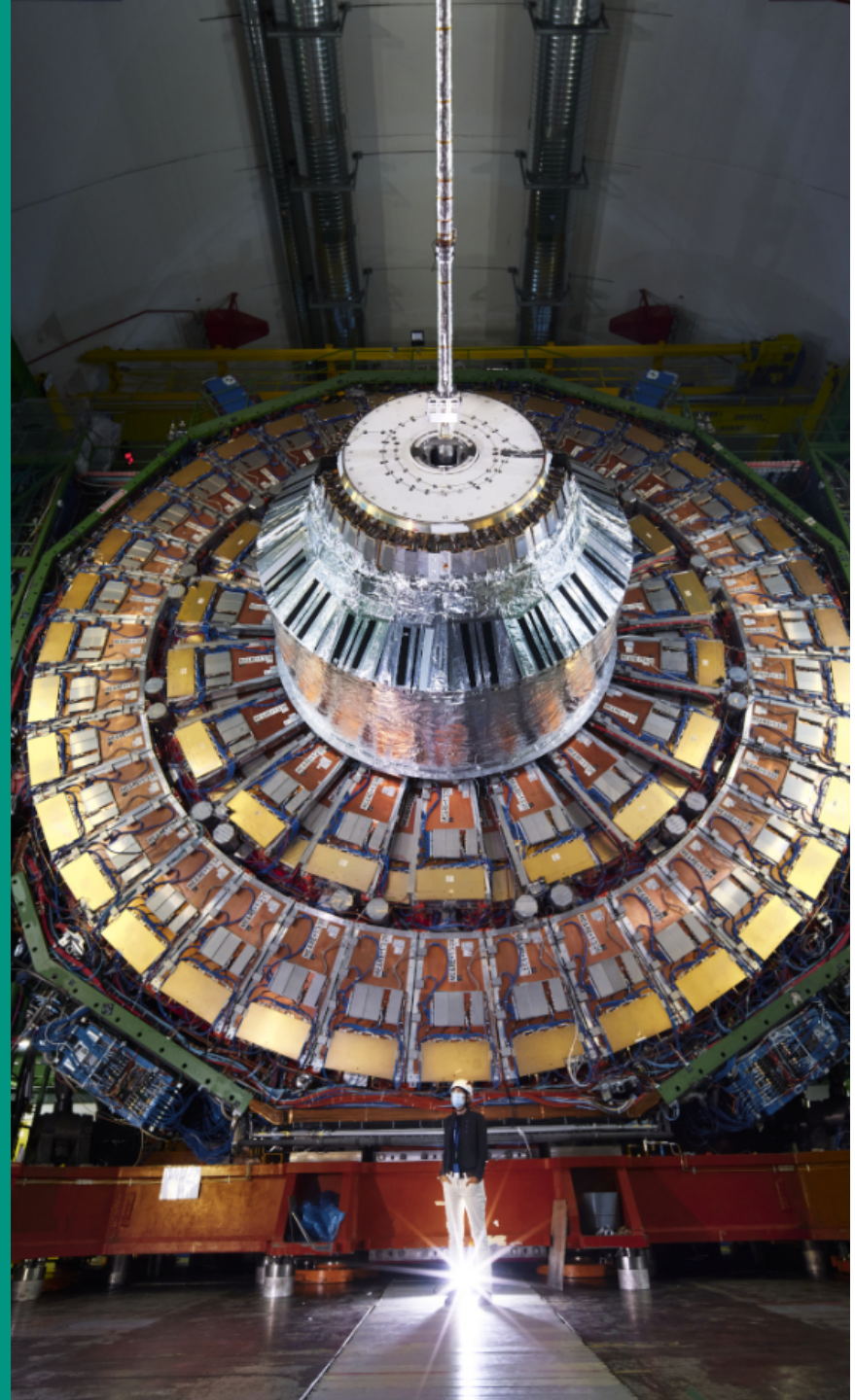
ETP Monday Meeting



Markus Klute
March 03rd, 2025

New Group Members

Please introduce yourself, fill out the “Laufzettel”, and register your thesis

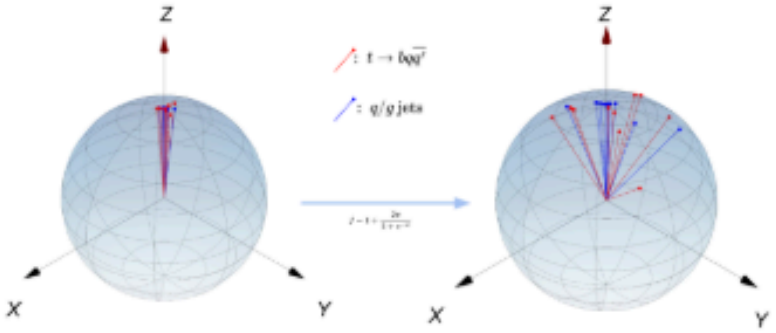
CERN Tour

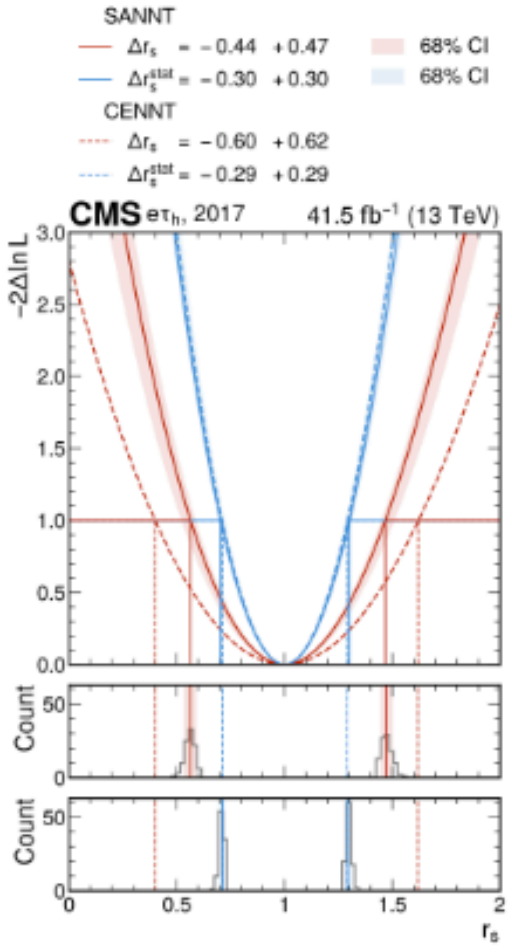
New Paper

Advancing Machine Learning Concepts

- Systematics-aware training on a complex analysis demonstrates 25% improvement
  - Analysis led by KSETA fellow **Lars Sowa** and **Artur Monsch**. Submitted to CSBS (arXiv:2502.13047)
- 1 Particle - 1 Qubit: Particle Physics Data Encoding for machine learning on quantum computers
  - Study led by KSETA fellow **Aritra Bal**. Submitted to PRL (arXiv:2502.17301).

Bloch sphere -
effect of the input scaling



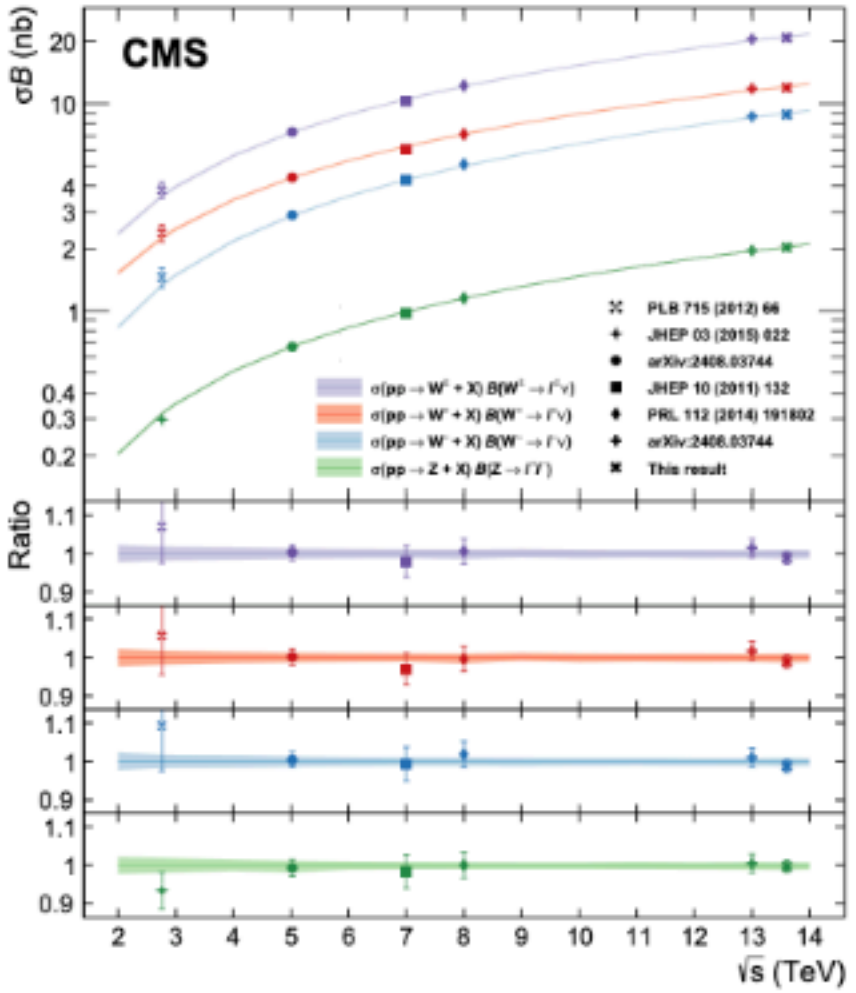


Profile likelihood

New Paper

CMS W/Z Cross Section at 13.6 TeV

- Precision measurements of the W and Z boson inclusive cross section and their ratios
- Analysis led by KSETA fellow **Jost von den Driesch**
- Implemented new and improved muon calibration method
- Results submitted to JHEP



Slide prepared for KSETA Workshop

New Paper

A model-independent parameterization of $B \to \pi\pi\ell\nu$ decays

Florian Herren,[1] Bastian Kubis,[2] and Raynette van Tonder[3]

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[2] *Helmholtz-Institut für Strahlen- und Kernphysik (Theorie) and Bethe Center for Theoretical Physics, Universität Bonn, 53115 Bonn, Germany*
[3] *Institut für Experimentelle Teilchenphysik, Karlsruhe Institute of Technology (KIT), D-76131 Karlsruhe, Germany*

(Dated: March 3, 2025)

We introduce a novel parameterization of $B \to \pi\pi\ell\nu$ form factors relying on partial-wave decompositions and series expansions in suitable variables. We bound the expansion coefficients through unitarity and include left-hand cut contributions using established dispersive methods. The two-hadron lineshapes are treated in a model-independent manner using Omnès functions, thus allowing for a data-driven determination of the expansion parameters. We study the underlying composition of the di-pion system in $B \to \pi\pi\ell\nu$ decays through fits to differential spectra of $B^+ \to \pi^+\pi^-\ell^+\nu$ measured by the Belle experiment. In contrast to previous works, we are able to study the full phase-space and are not limited to certain kinematic regions. As a consequence, we extract branching fractions for the different partial waves of the di-pion system. We find:

$$\mathcal{B}(B^+ \to (\pi^+\pi^-)_S\ell^+\nu) = 2.2^{+1.4}_{-1.0} \times 10^{-5}\,,$$
$$\mathcal{B}(B^+ \to (\pi^+\pi^-)_P\ell^+\nu) = 19.6^{+2.8}_{-2.7} \times 10^{-5}\,,$$
$$\mathcal{B}(B^+ \to (\pi^+\pi^-)_D\ell^+\nu) = 3.5^{+1.3}_{-1.1} \times 10^{-5}\,.$$

In addition, we derive predictions for the thus far unobserved $B^+ \to \pi^0\pi^0\ell^+\nu$ decay and obtain a sizeable branching fraction of $\mathcal{B}(B^+ \to \pi^0\pi^0\ell^+\nu) = 2.9^{+0.9}_{-0.7} \times 10^{-5}$.

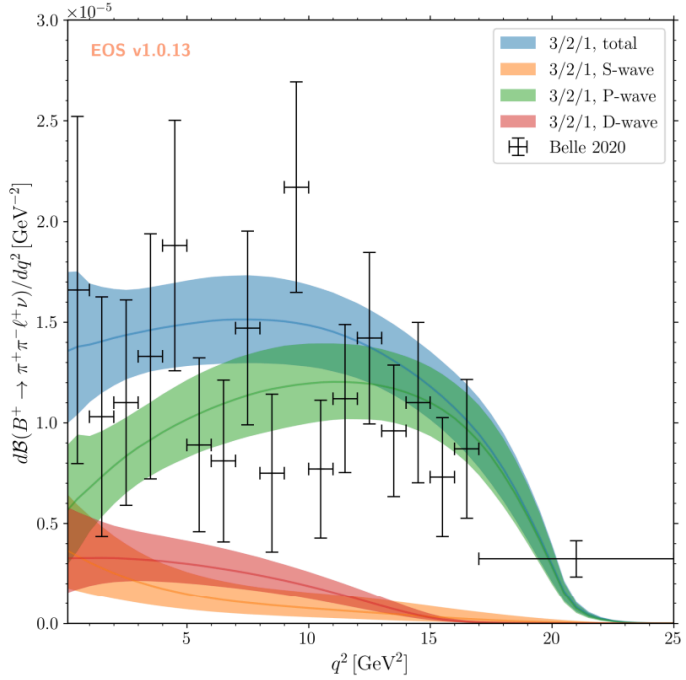

FIG. 3. The $B^+ \to \pi^+\pi^-\ell^+\nu$ q^2 spectrum. The different bands show the contributions of the three partial waves as well as their sum. The data points are from the 1D-measurement of Ref. [20].

Upcoming Events

10.03. - 12.03.2025: KSETA Plenary Workshop in Wildberg
17.03. - 21.03.2025: Terascale Detector Workshop in Bonn
31.03. - 04.04.2025: DPG in Göttingen
07.04. - 11.04.2025: CMS Upgrade Week
17.05.2025: Open Day
10.06. - 13.06.2025: CMS Week
04.07.2025: KIT eats
…TBD……: ETP Summer Party
02.09. - 12.09.2025: HEP Herbstschule in Bad Honnef
17.09. - 19.09.2025: CMS FSP Meeting in Hamburg
25.09.2025: ETP Hike
29.09.-03.10.2025: CMS Week
05.12.2025: ETP Christmass Party
08.12.-12.12.2025: CMS Week in Seoul

Teaching Sommer Semester 2025

MMDA: Alessandro, Jonas, Sofia, Johannes, Jan
PP2 Flavor: Lennard, Giacomo, Pablo
PP2 BSM: Moritz, Juliette, Markus
P3: Marcel, Greta
ModPhEdu: Cedric, Klaus
CGDA: Thorsten, Ulrich
ModPhy3: Nils, Torben
P2: Hans-Jürgen, Roger
…

Master and BSC students are invited to join

Housing Crisis