Some Ideas for the Full Event Interpretation

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Meeting Bonn & Hamburg Belle 2 Groups

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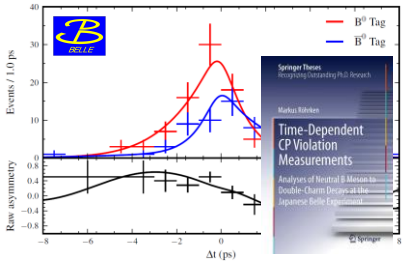
Brief Overview of Past Activities

- Physics studies at University of Hamburg and DESY
- Ph.D at Karlsruhe Institute of Technology (KIT)

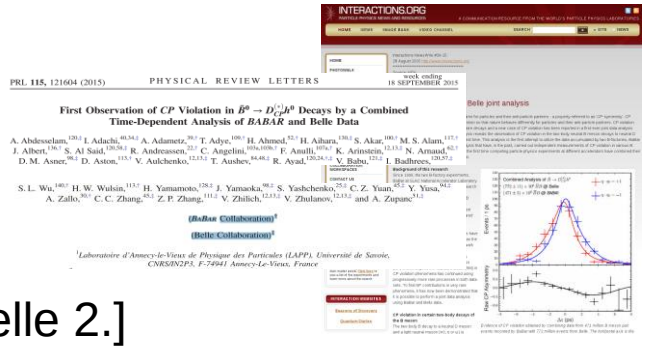
  Belle + Belle II: +



[At this time the NeuroBayes EKP full reconstruction has been developed at KIT.]

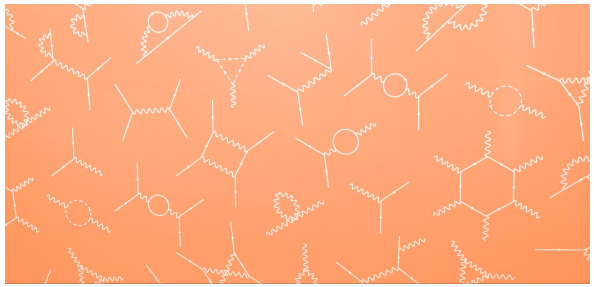
- Postdoc at California Institute of Technology

  Combined *BABAR* +Belle measurements: +

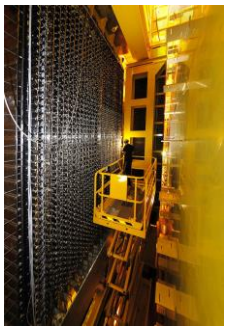


[Crude approach to get more data before the start of Belle 2.]

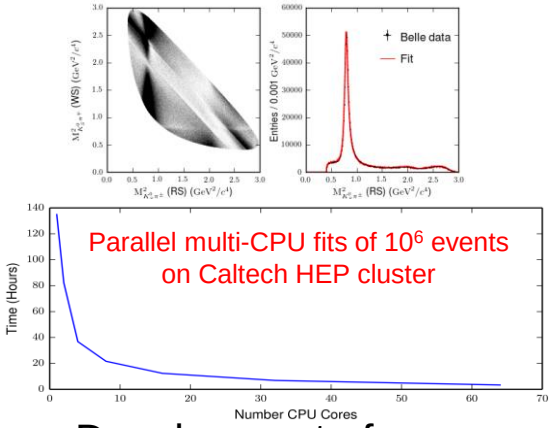
- CERN Research Fellow at LHCb (until summer this year):



Study of pure quantum-loop processes (time-dependent CPV and Dalitz analyses)

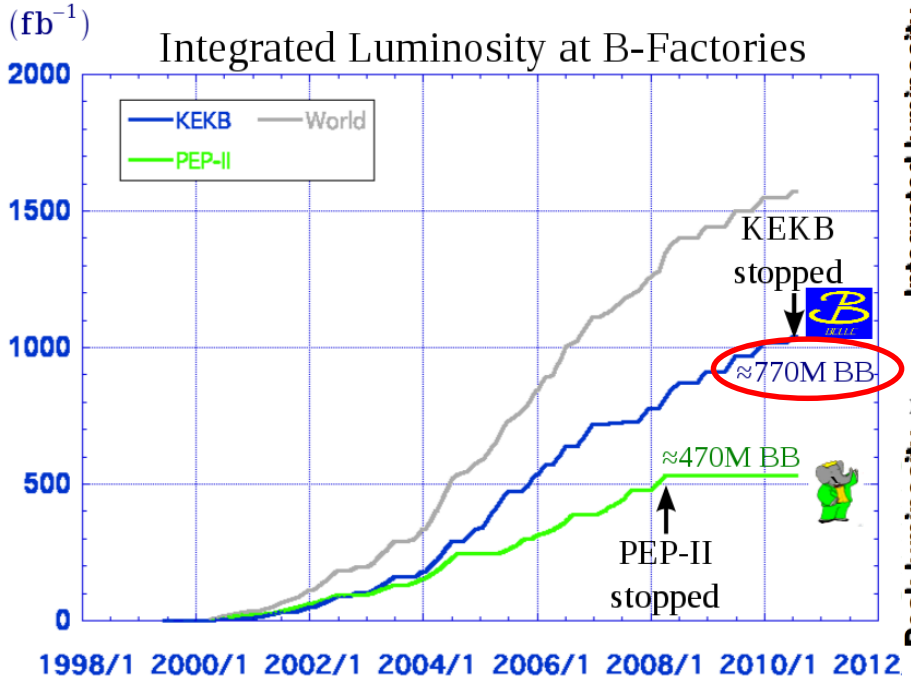


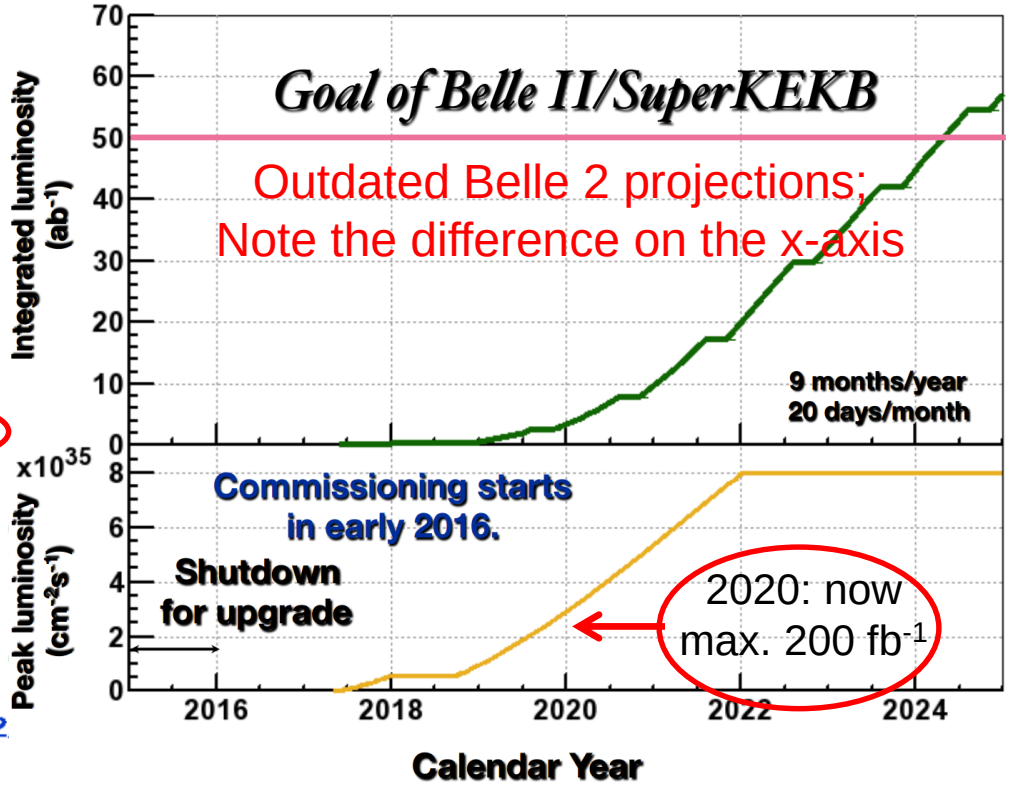
Simulation studies for the ECAL upgrade



Development of new analysis techniques

Data at the *B* Factory Experiments





- Belle 1 collected $772 \times 10^6\ \mathrm{B\bar{B}}$ pairs which still provides the largest single experiment dataset.
- Belle 2 likely will need another ≥2 years to reach the integrated luminosity of Belle 1.
- Belle 1 data has been integrated in the Belle 2 software framework. This allows to test the new Belle 2 tools on real data.

Tools such as the Full Event Interpretation (FEI) algorithms could already today be validated and refined for future Belle 2 analyses using the existing Belle 1 dataset.

Some Ideas for the Full Event Interpretation

The Belle 2 software framework and the new Full Event Interpretation provide many technical improvements compared to Belle 1 and the NeuroBayes-based EKP-Fullrecon.

A few examples:

- Historically, hadronic and semileptonic (SL) tag analyses have been performed separately at the $BABAR$ and Belle experiments. One reason was the different approach in the reconstruction. The FEI unifies the hadronic and SL tag on the reconstruction level, thus enabling for transparent combination of both tags in single analyses.

- Previous hadronic tag techniques such as the NeuroBayes-based EKP full reconstruction used multivariate classifiers trained on generic B decay samples independently of the signal side. The FEI allows for a retraining of the BDTs for specific signal signatures. This could allow for further efficiencies&background rejection gains.

  → In certain modes, this gain could be sizable. [Low multiplicity final states such as $B \to K\nu\bar{\nu}$ are currently being studied in Sasha Glazov's group.]

Summary

- The operation of SuperKEKB and the data collection of Belle 2 have started.
- The FEI unifies SL and hadronic tagging techniques and enables many measurements of B meson decay-modes that are not accessible at other experiments such as LHCb (e.g. invisible final state particles and inclusive analyses).
- Still the FEI needs to be refined, validated and calibrated for use with real data.
- Continuing Belle 1 measurements within the Belle 2 framework would enable to test the FEI on real data and to continue performing competitive analyses until Belle 2 collected its first attobarn of data (i.e. within the next 2 years).
- The speaker is looking forward to the FEI tutorials.