

UNTAGGED MEASUREMENT OF $B \rightarrow \pi l \nu$ AT BELLE II

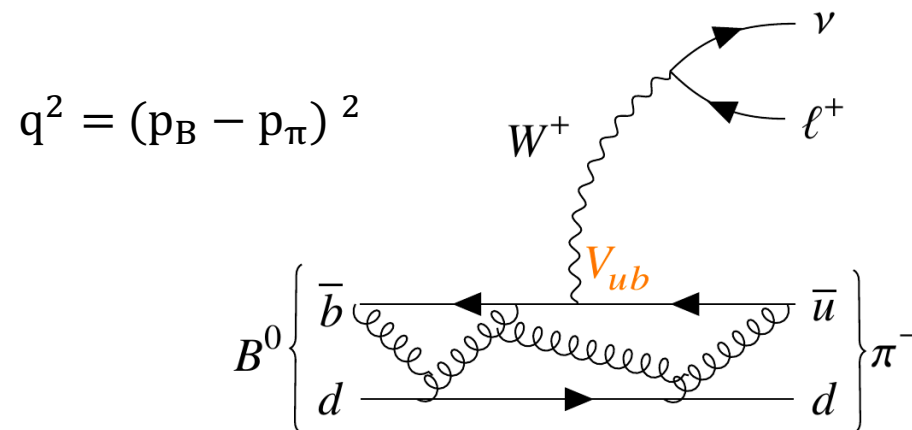
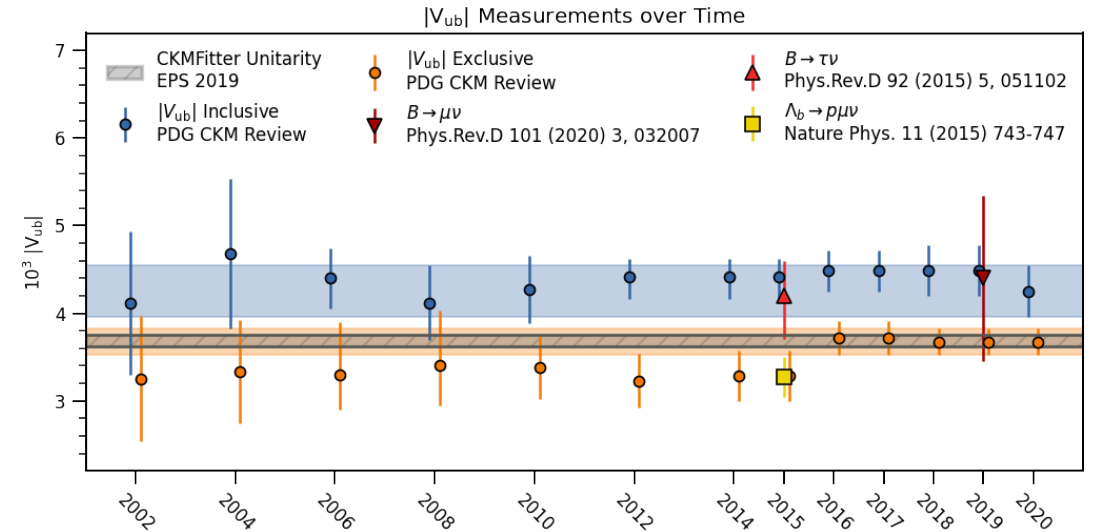
Florian Bernlochner, Jochen Dingfelder,
Svenja Granderath, Peter Lewis

ICHEP 2020, 29.07.20



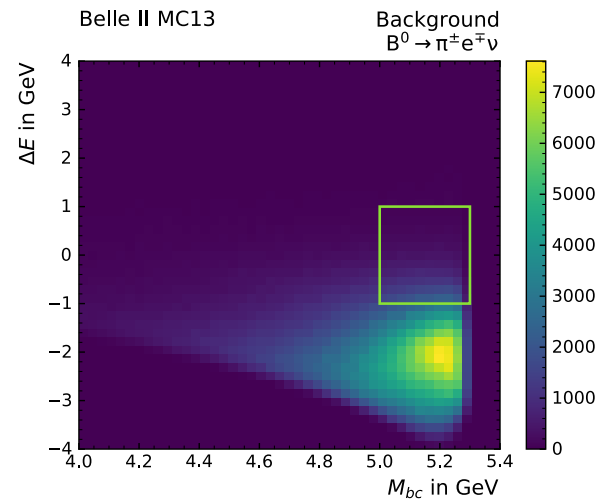
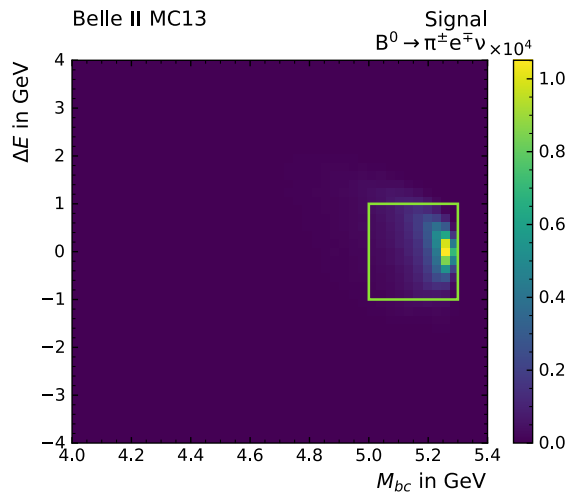
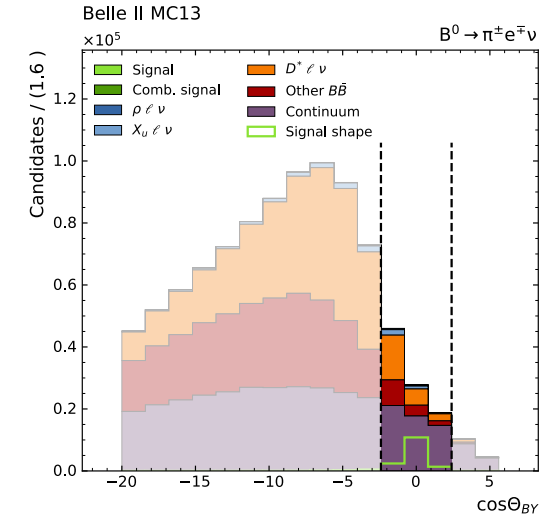
INTRODUCTION AND METHOD

- Belle II is e^+e^- collider producing $B\bar{B}$ pairs
- The B mesons can decay semileptonically
- Allows measurement of $|V_{ub}|$, where tension between $|V_{ub}|$ measured exclusively and inclusively persists
- $B \rightarrow \pi l \nu$ most accessible channel
- $BF \propto |V_{ub}|^2 f(q^2)$
- Determine ΔBF in five q^2 bins
- Form factor fit to the ΔBF spectrum



SIGNAL SELECTION + BACKGROUND SUPPRESSION

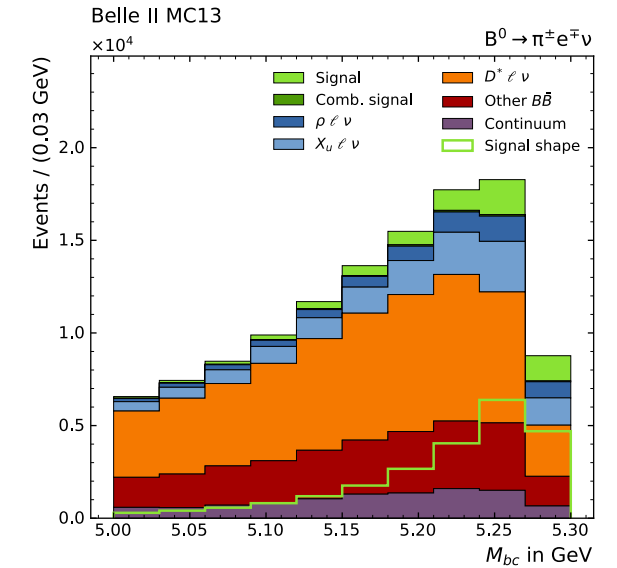
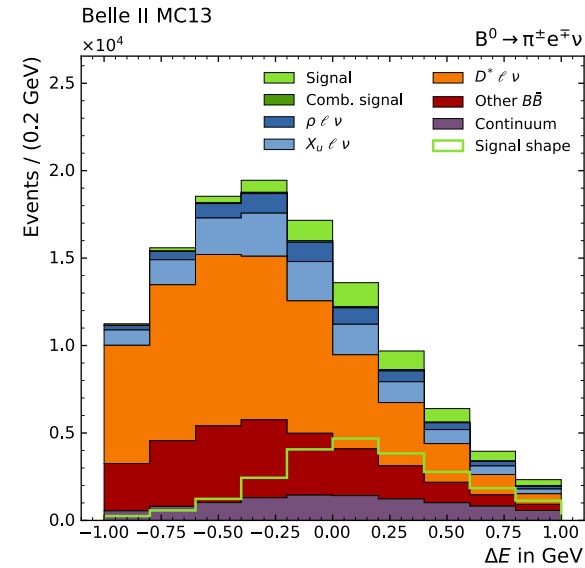
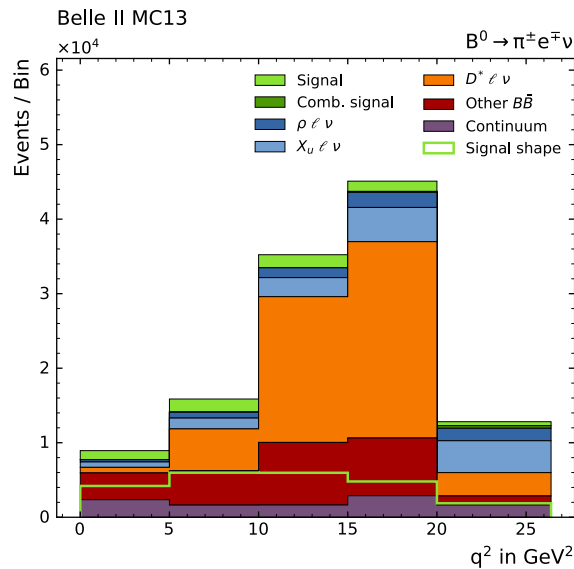
- Call combination of lepton and pion candidate a Y candidate
- Select on cosine of the angle between B and Y candidate: $\cos\theta_{BY}$
- Define: $\Delta E = E_B - E_{\text{beam}}$ $M_{bc} = \sqrt{E_{\text{beam}}^2 - |\vec{p}_B|^2}$
- Select 2D region:



- Event shape for continuum and $B\bar{B}$ events different
- Use ten training variables to train a continuum suppression BDT in each q^2 bin

SIGNAL EXTRACTION

- Simultaneous extended binned maximum likelihood fit of the 2D distributions of ΔE and M_{bc}
- Signal to background ratio in the q^2 bins:



Calculate partial BF from:

$$BF = \frac{N}{2\epsilon_{rec} f \times N_{BB}}$$

