Prospects of Tau CLFV at BelleII

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Tau CLFV Coffee Hour
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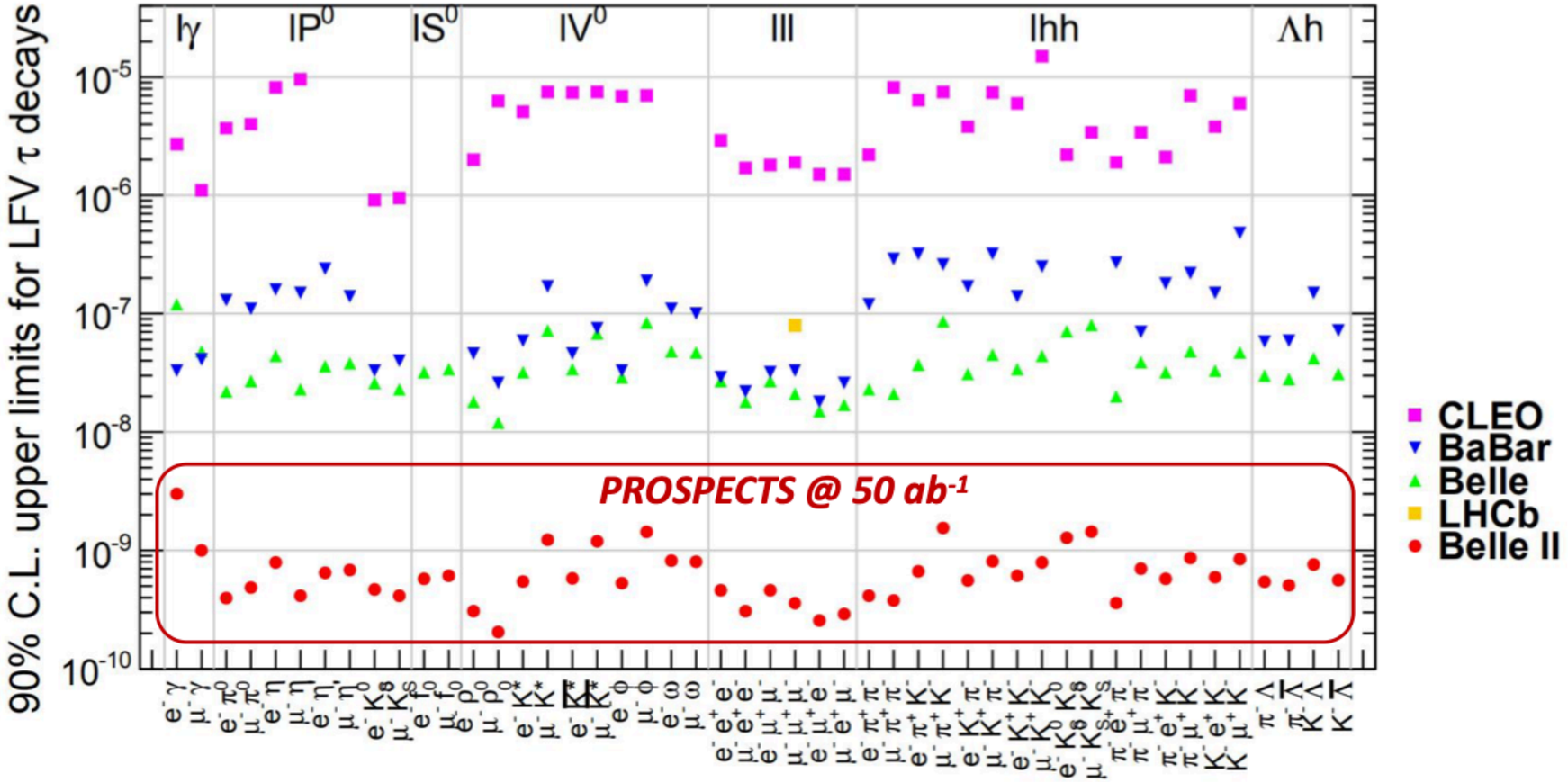
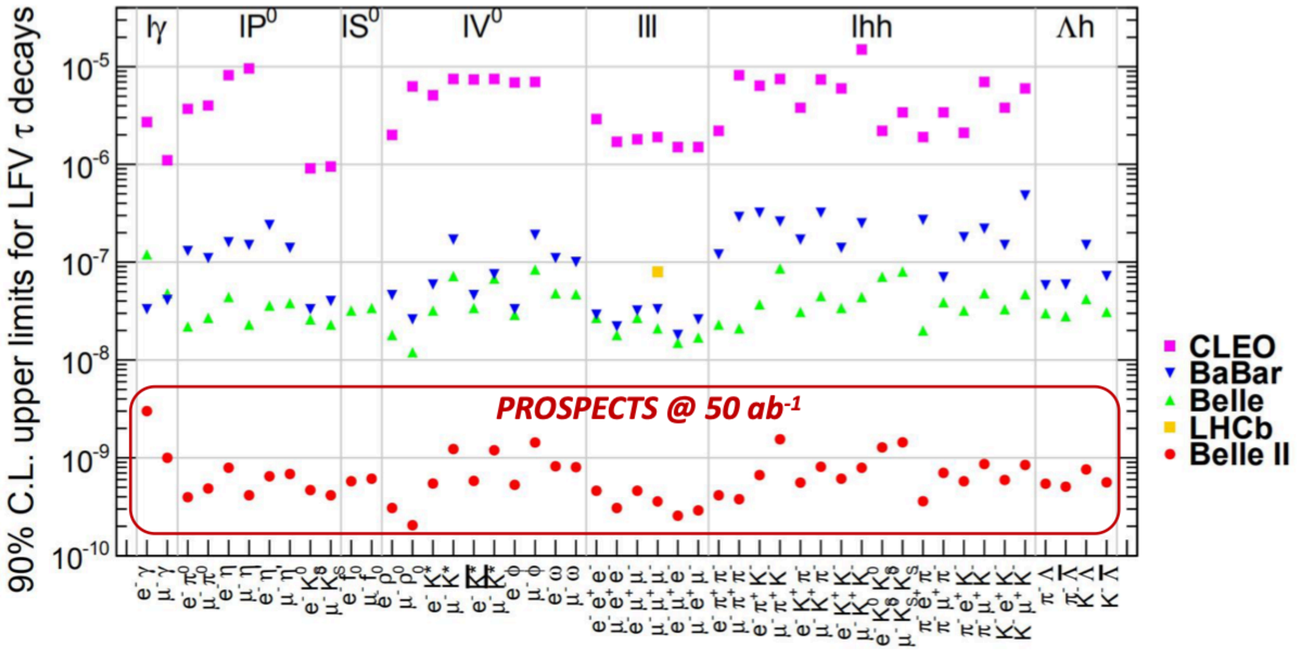
Golden modes for discovery

Improvement of 2 orders of magnitude expected for Belle II!



The Belle II Physics Book, Prog. Theor. Exp. Phys. (2019), 123C01

Golden modes for discovery



Test the SM in a variety of ways

- radiative ($\tau \to \ell\gamma$)
- leptonic decays ($\tau \to \ell\ell\ell$)
- a large variety of LFV and LNV semi-leptonic decays
- $\tau \to \mu$ and $\tau \to e$: test of the lepton flavour structure

- One of the factors pushing up the sensitivity of probes is the increase of the luminosity
- Equally important is the increase of the signal detection efficiency
  - high trigger efficiencies; improvements in the vertex reconstruction, charged track and neutral-meson reconstructions, particle identification, refinements in the analysis techniques…

$\tau \to \mu\mu\mu$

Signal-background discrimination using kinematics of the event

μID - the most powerful discriminating variable

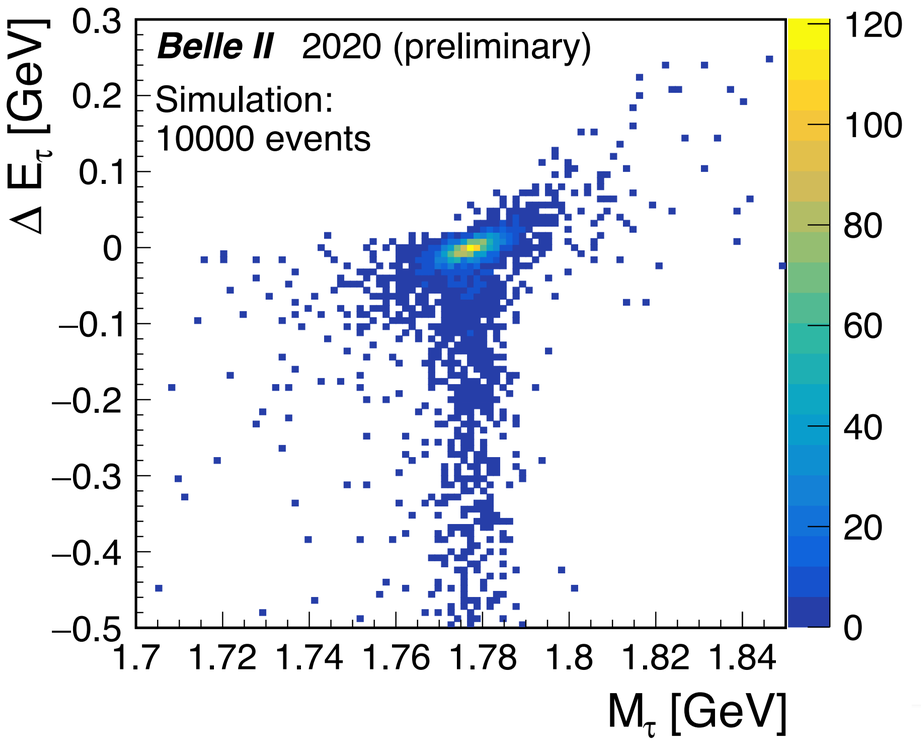
Momentum dependent optimisation of the muID requirement

- $P_\mu < 0.7$ GeV
  - μ do not reach the μ detector (KLM)
- $0.7 < P_\mu < 1$ GeV
  - μ reach KLM but not many layers are crossed
- $P_\mu > 1$ GeV
  - μ reach KLM and many layers are crossed

Other requirement used @Belle but not @Belle II:

- μ veto on tag track
- $P_\mu > 0.6$ GeV

Higher efficiency is foreseen @Belle II than @Belle or @BaBar



Two independent variables:

$$M_\tau = \sqrt{E^2_{\mu\mu\mu} - P^2_{\mu\mu\mu}}$$

$$\Delta E = E^{CMS}_{\mu\mu\mu} - E^{CMS}_{\text{beam}}$$

- For signal → ΔE close to 0 and $M_{\mu\gamma}$ close to τ mass