LFV discussion session

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LFV session @ WIFAI 2023

Three main topics:

- LFV and LFU at colliders
- cLFV with muons

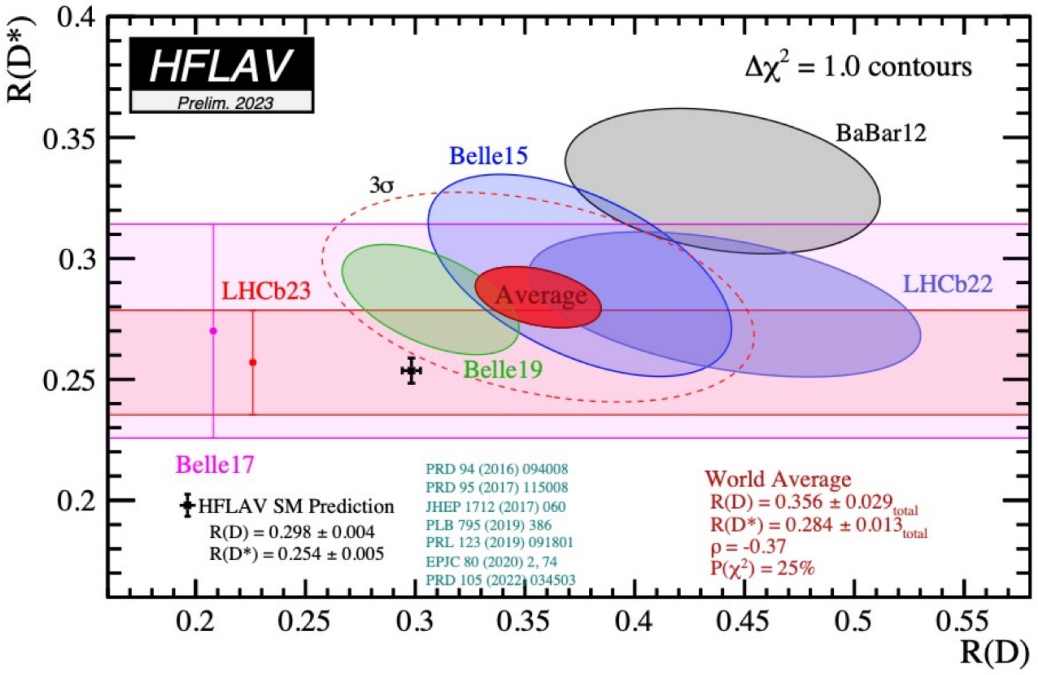
LFV @ colliders

Results from ATLAS / CMS / LHCb / BELLE-II

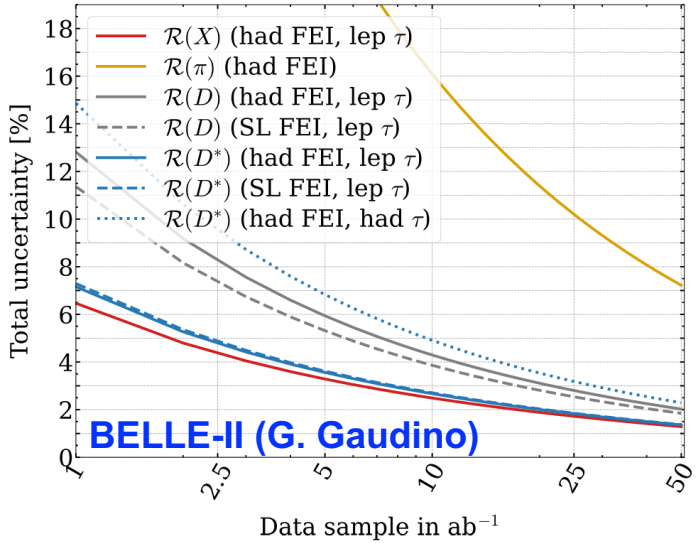
- Almost all current results statistically limited
- All running experiments, a significant increase in integrated luminosity expected for all of them → main ingredient to push down limits or improve measurements
- Are there other strategy that can be put in place to provide further improvements?
  - targeted trigger selections?
  - improved analysis techniques?

Lepton Flavour Universality

- Tension on LFU in B decays washed out in $R(K^{(*)})$ but still present @ 3σ level for $R(D^{(*)})$
- Complementary measurements in D sector by BESIII in several leptonic and semileptonic channels: deviations below 2σ's



Also in this case, measurements are statistically limited



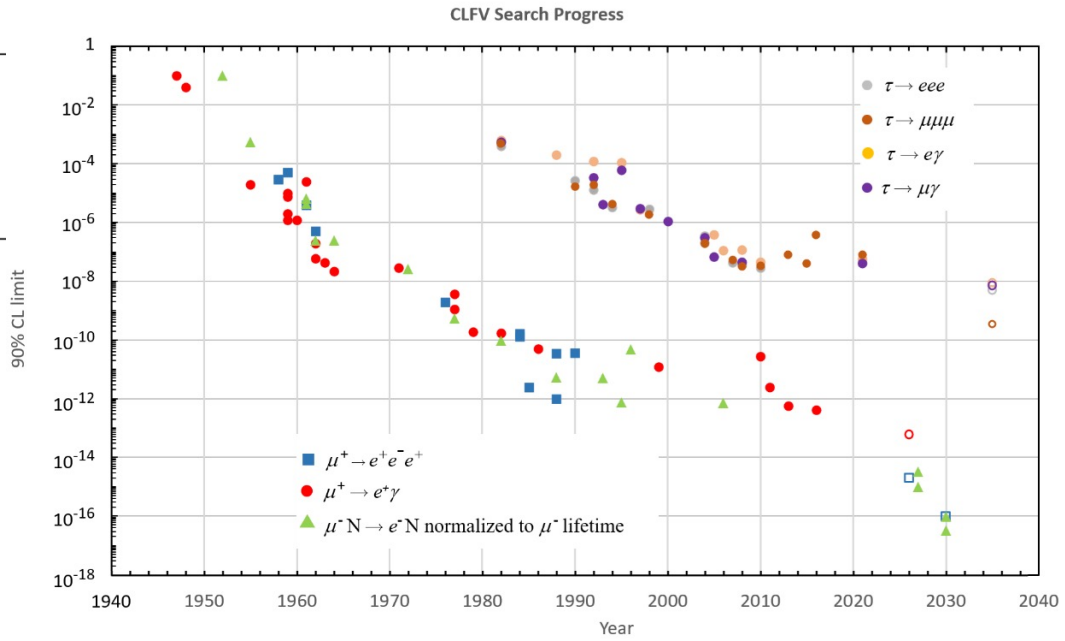
- Synergies between BELLE-II and LHCb?

cLFV overview

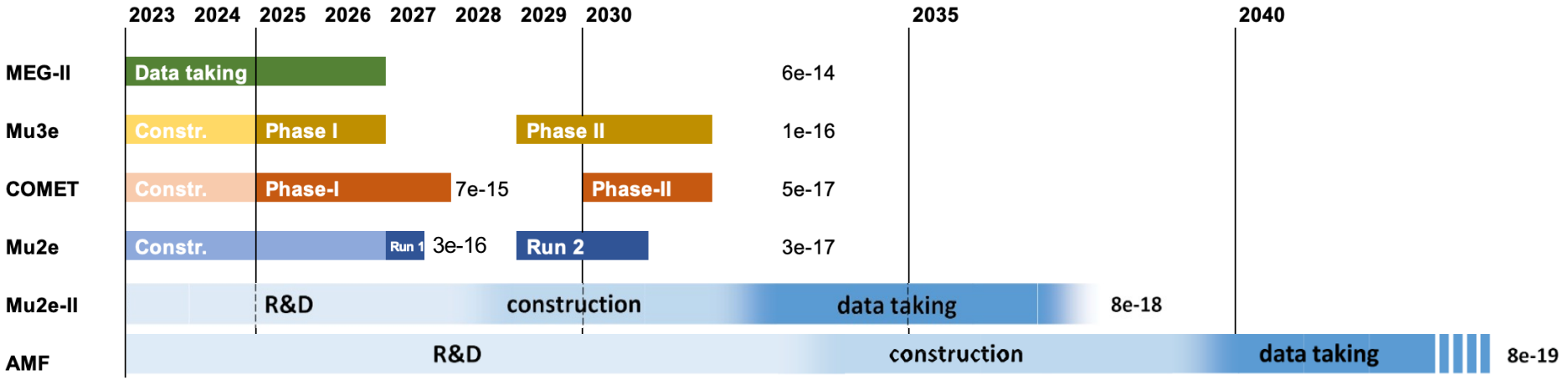
Process	Current bound on BR	Future Sensitivity
$\mu \to e\gamma$	$< 4.2 \times 10^{-13}$ MEG	10^{-14} MEGII
$\mu \to \bar{e}ee$	$< 1.0 \times 10^{-12}$ SINDRUM	10^{-16} Mu3e
$\mu A \to eA$	$< 7 \times 10^{-13}$ SINDRUMII	$10^{-16} \to 10^{-18}$ COMET, Mu2e
$\tau \to l\gamma$	$< 3.3 \times 10^{-8}$	$3 \times 10^{-9}(e), 10^{-9}(\mu)$
$\tau \to e\bar{e}e$	$< 2.7 \times 10^{-8}$	5×10^{-9}
$\tau \to \mu\bar{\mu}\mu$	$< 2.1 \times 10^{-8}$	4×10^{-9}
$\tau \to \mu\bar{e}e, e\bar{\mu}\mu$	$< 1.8, 2.7 \times 10^{-8}$ Belle	$3,5 \times 10^{-9}$ BelleII
...	...	...
$\tau \to l\pi^0$	$< 8.0 \times 10^{-8}$	4×10^{-9}
$\tau \to l\eta$	$< 6.5 \times 10^{-8}$	7×10^{-9}
$\tau \to l\rho$	$< 1.2 \times 10^{-8}$ Belle	10^{-9} BelleII
$K^0 \to \mu^{\pm}e^{\mp}$	$< 4.7 \times 10^{-12}$	
$B_d^0 \to \tau^{\pm}\mu^{\mp}$	$< 1.2 \times 10^{-5}$ LHCb	$\sim 10^{-6}$?
...	...	...
$h \to e^{\pm}\mu^{\mp}$	$< 6.1 \times 10^{-5}$ Atlas	2.1×10^{-5}
$h \to e^{\pm}\tau^{\mp}$	$< 2.2 \times 10^{-3}$ CMS	2.4×10^{-4}
$h \to \tau^{\pm}\mu^{\mp}$	$< 1.5 \times 10^{-3}$ CMS	2.3×10^{-4} ILC
$Z \to e^{\pm}\mu^{\mp}$	$< 7.5 \times 10^{-7}$ Atlas	
$Z \to l^{\pm}\tau^{\mp}$	$< 10^{-7}$ Atlas	

M. Ardu @ CLFV 2023

- $\mu \to e$ decays: best sensitivities
- $\tau \to l$ decays: can help distinguish models



cLFV from muon decays



R&D synergies among cLFV experiments and beyond:

- detectors (muon conversion and decays)
- high radiation environment (LHC)
- handling of high rates: DAQ and trigger (LHCb?)
- production target and magnets (muon collider)

AMF is a completely new paradigm, where conversion and decay experiments could coexist, pushing forward synergies among research groups