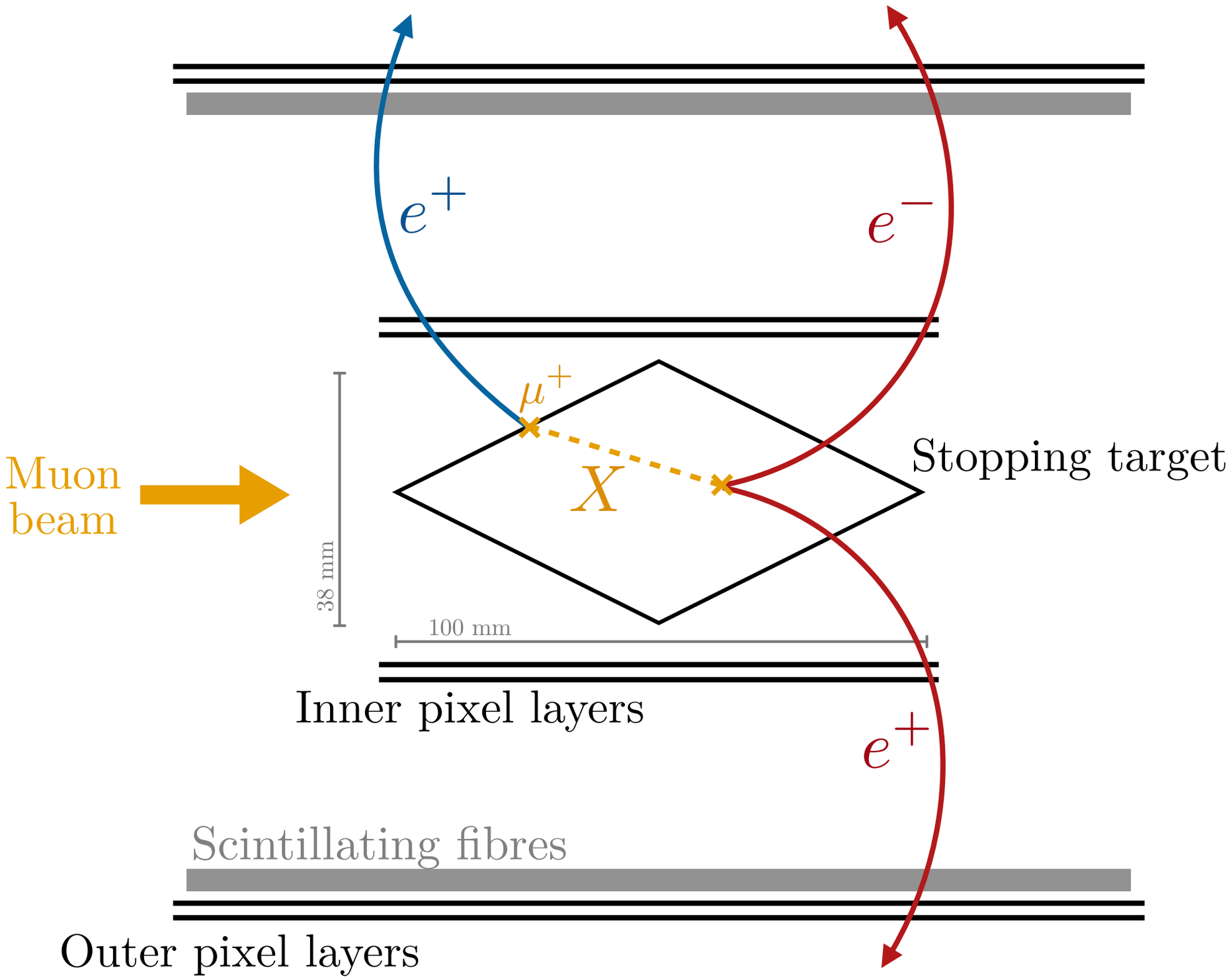
Multi-Lepton signatures

D. Redigolo, M. Tammaro

Istituto Nazionale di Fisica Nucleare
SEZIONE DI FIRENZE

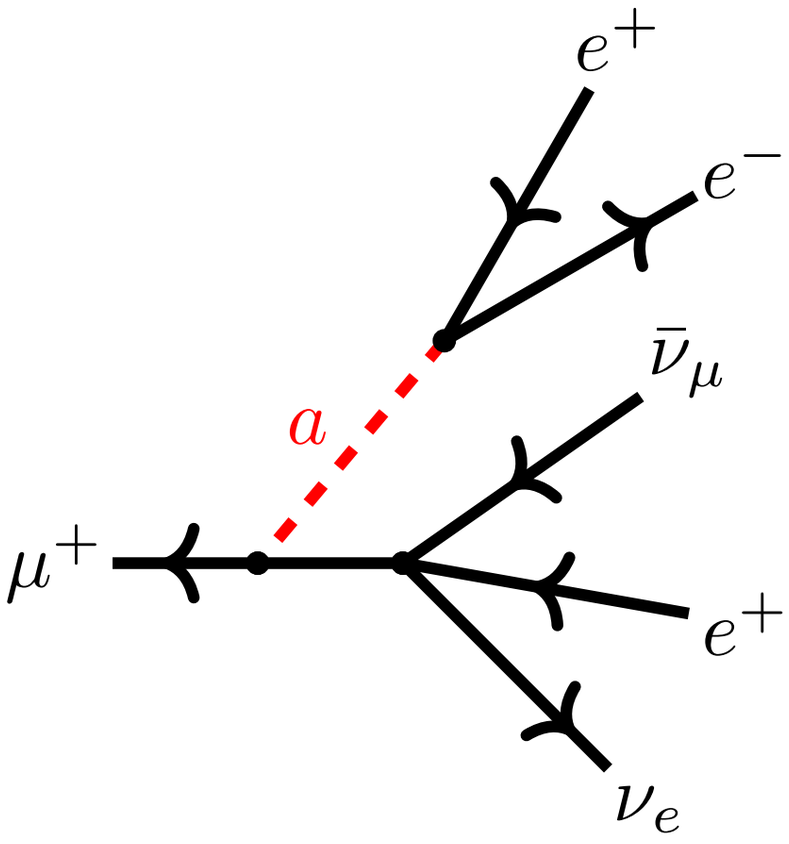
Displaced vertices from muon decays

Opferkuch, Knapen, Redigolo, Tammaro:
2410.13941



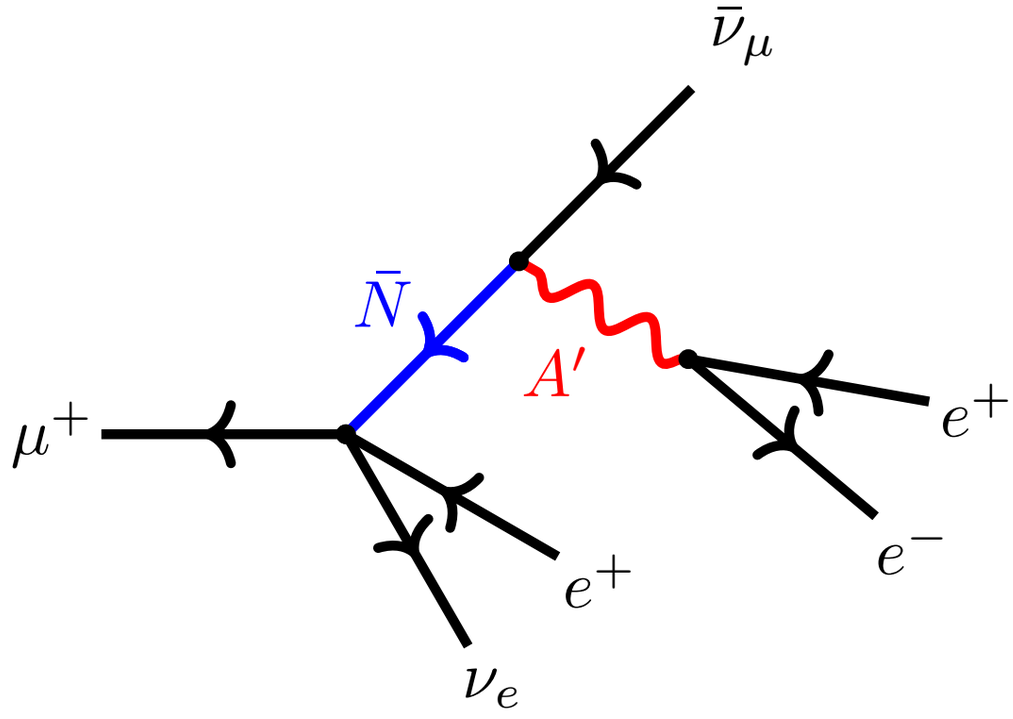
ALP

Opferkuch, Knapen, Redigolo, Tammaro: 2410.13941



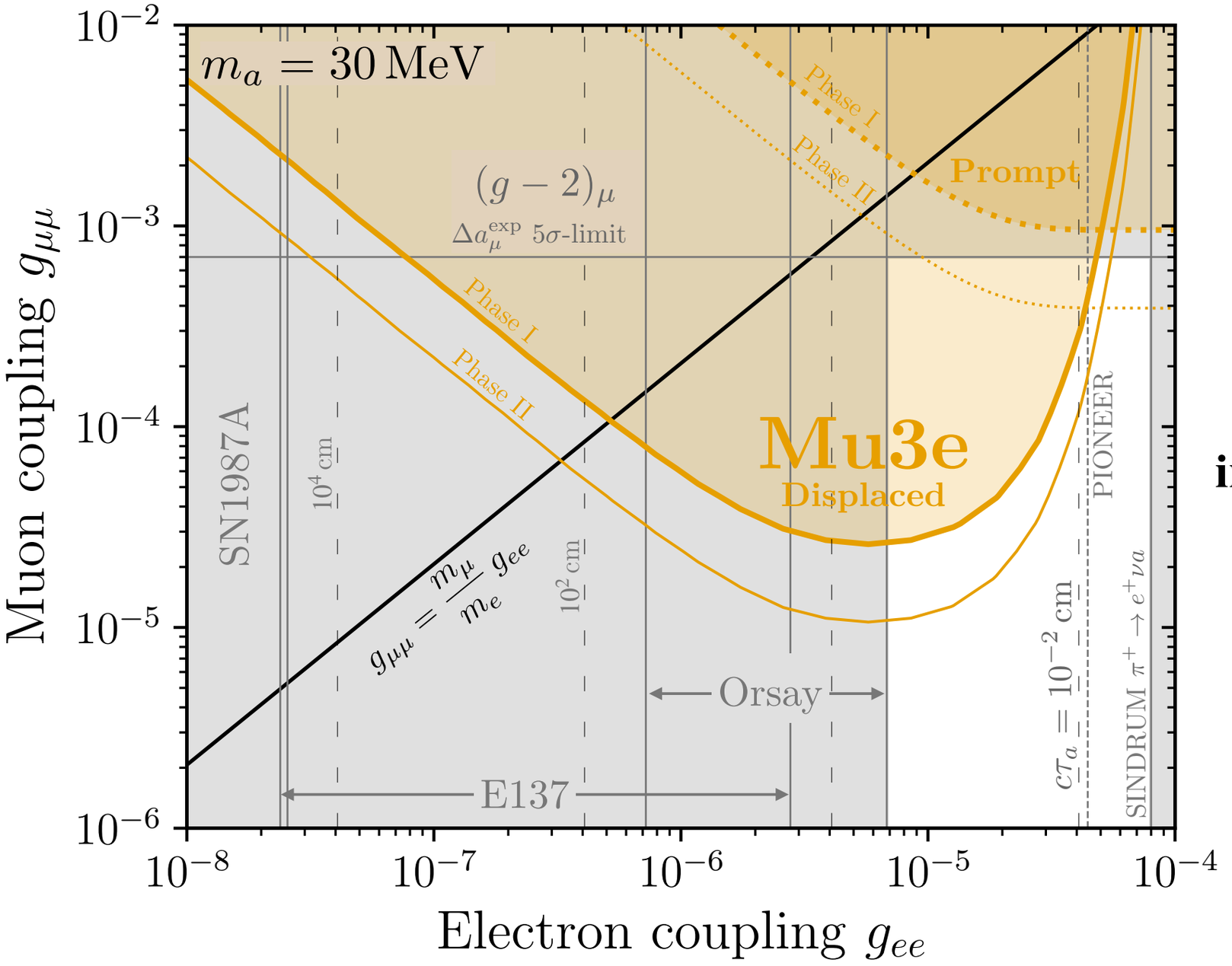
HNL + Dark Photon

Ballett, Hostert, Pascoli: 1903.07589



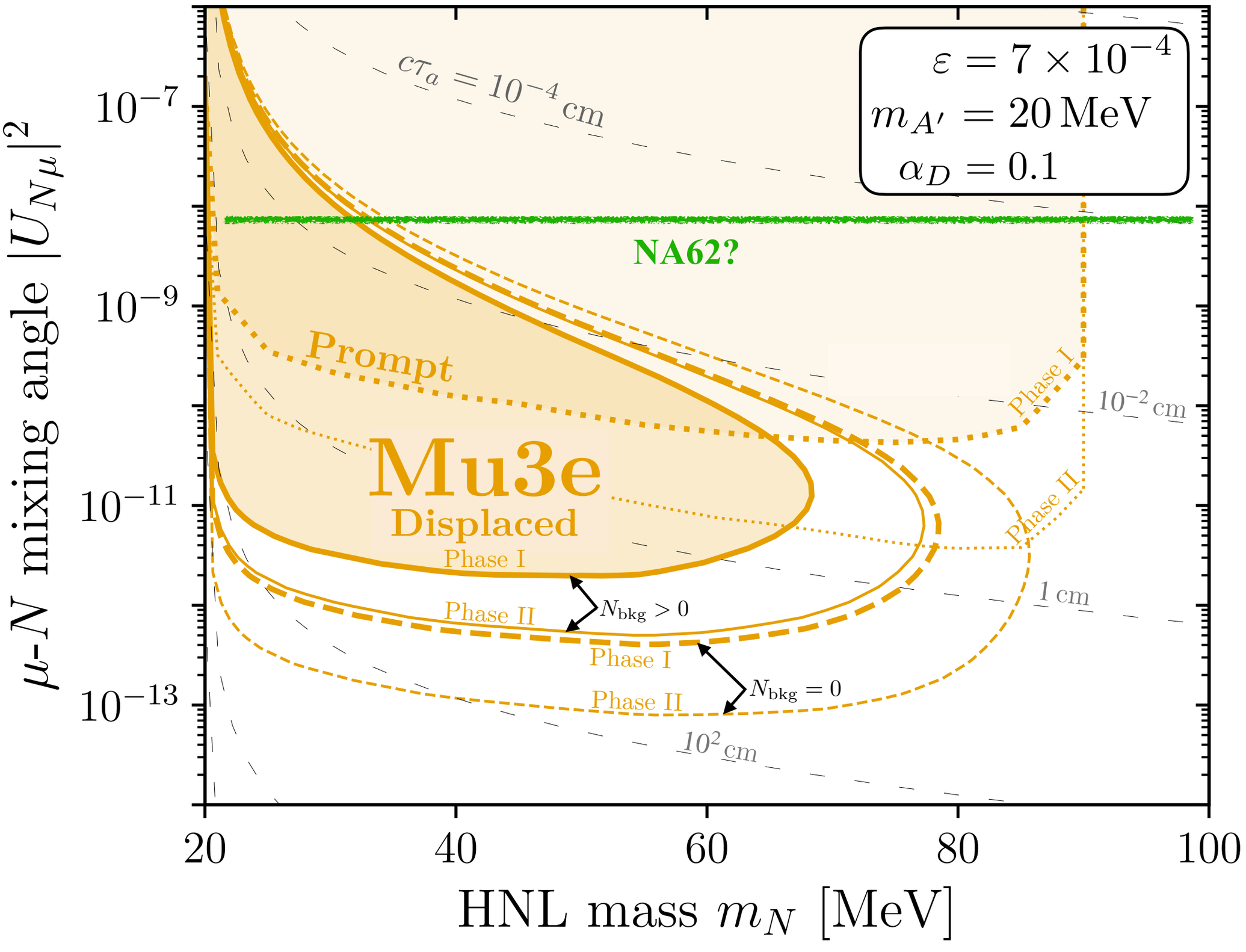
$$m_{ee} = m_X < m_\mu$$

Displaced vertices in SM particles decay



Big gain
w.r.t beam dump experiments
in the short displacement regime

What about Kaons?



Bijnens, Ecker: hep-ph/9209261

Table 5: Theoretical values for the branching ratios for the decay $K^+ \to \mu^+\nu_\mu e^+e^-$ for various cuts.

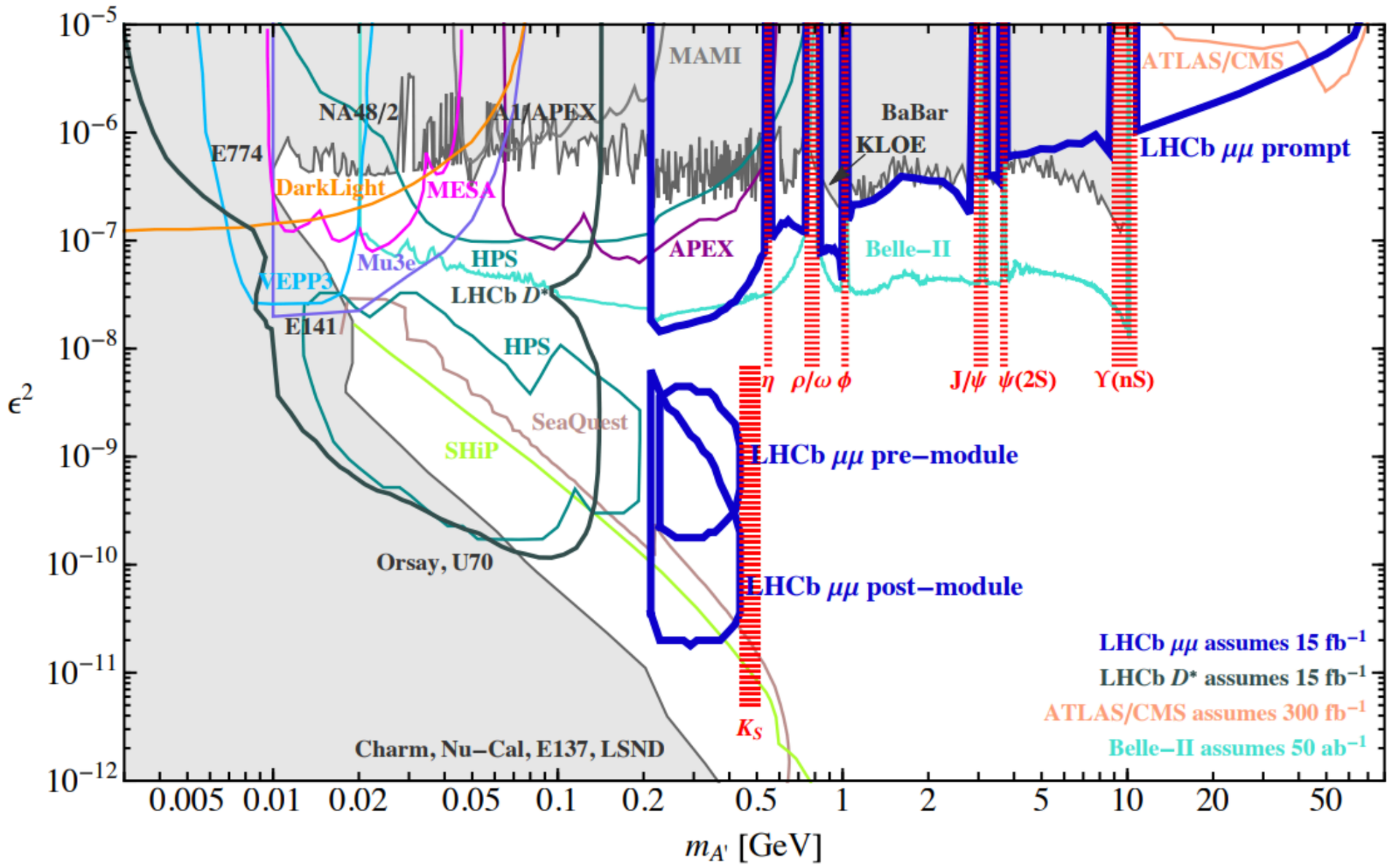
	tree level	form factors as given by CHPT
full phase space	$2.49 \cdot 10^{-5}$	$2.49 \cdot 10^{-5}$
$z \leq 10^{-3}$	$2.07 \cdot 10^{-5}$	$2.07 \cdot 10^{-5}$
$z \geq 10^{-3}$	$4.12 \cdot 10^{-6}$	$4.20 \cdot 10^{-6}$
$z \geq (20\ MeV/M_K)^2$	$3.15 \cdot 10^{-6}$	$3.23 \cdot 10^{-6}$
$z \geq (140\ MeV/M_K)^2$	$4.98 \cdot 10^{-8}$	$8.51 \cdot 10^{-8}$
$x \geq 40\ MeV/M_K$	$1.58 \cdot 10^{-5}$	$1.58 \cdot 10^{-5}$

E865: hep-ex/0204006

Experiment 865 at the Brookhaven AGS obtained 410 $K^+ \to e^+\nu e^+e^-$ and 2679 $K^+ \to \mu^+\nu e^+e^-$ events including 10% and 19% background. The branching ratios were measured to be $(2.48 \pm 0.14(stat.) \pm 0.14(syst.)) \times 10^{-8}$ ($m_{ee} > 150$ MeV) and $(7.06 \pm 0.16 \pm 0.26) \times 10^{-8}$ ($m_{ee} > 145$ MeV), respectively. Results for the decay form factors are presented.

Cuts on the invariant e^+e^- mass > 145 MeV ($K_{\mu 2ee}$) and > 150 MeV (K_{e2ee}) removed backgrounds associated with large branching ratio processes including a low mass e^+e^--pair, *e.g.* $K \to \pi\pi^0_D$.

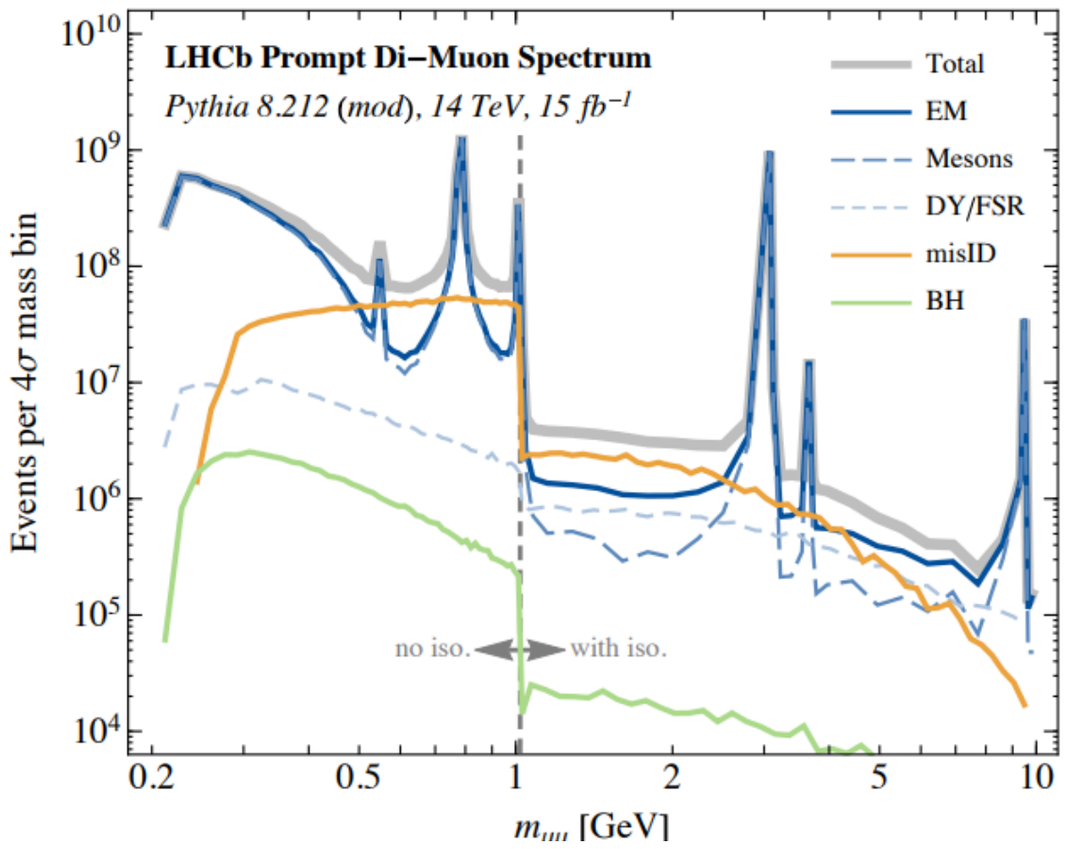
Inclusive searches at LHCb



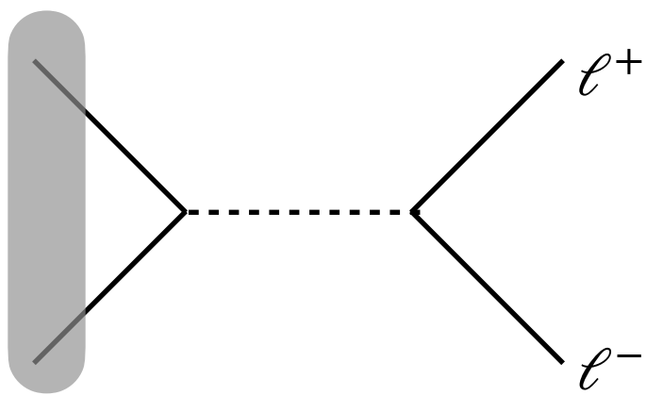
Di-muon resonances @ LHCb

Inclusive searches at LHCb

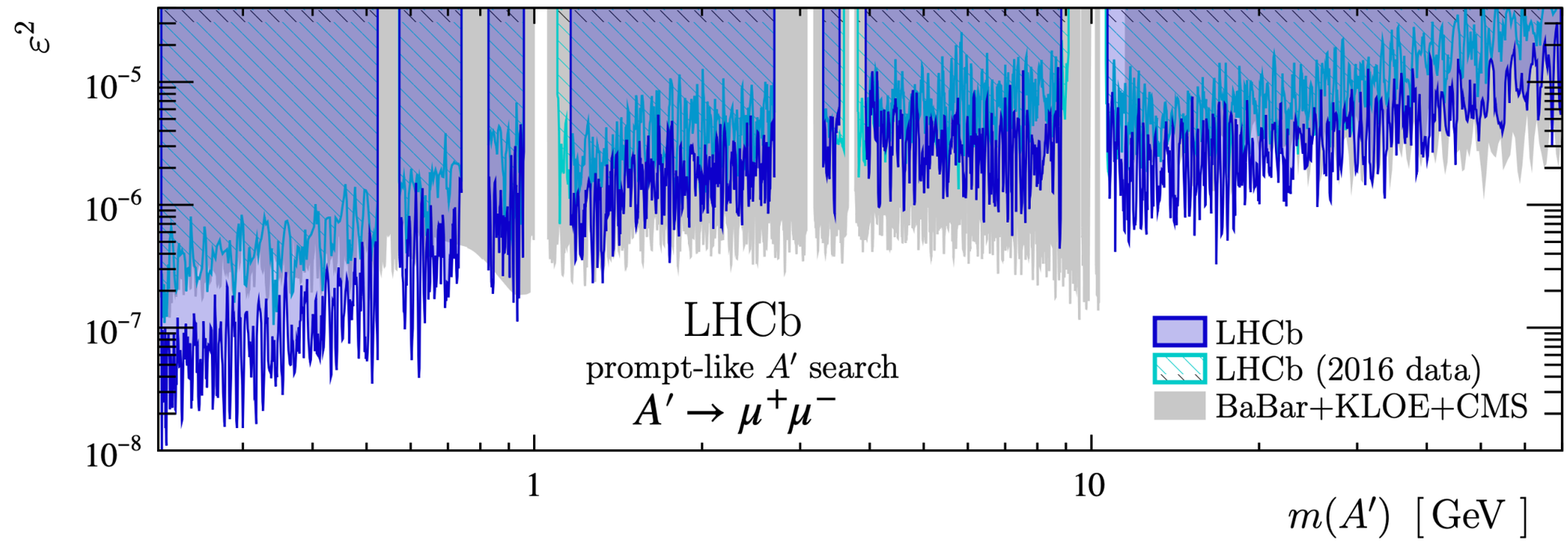
Philip Ilten,[1,*] Yotam Soreq,[2,†] Jesse Thaler,[2,‡] Mike Williams,[1,§] and Wei Xue[2,¶]



Di-muon resonances @ LHCb

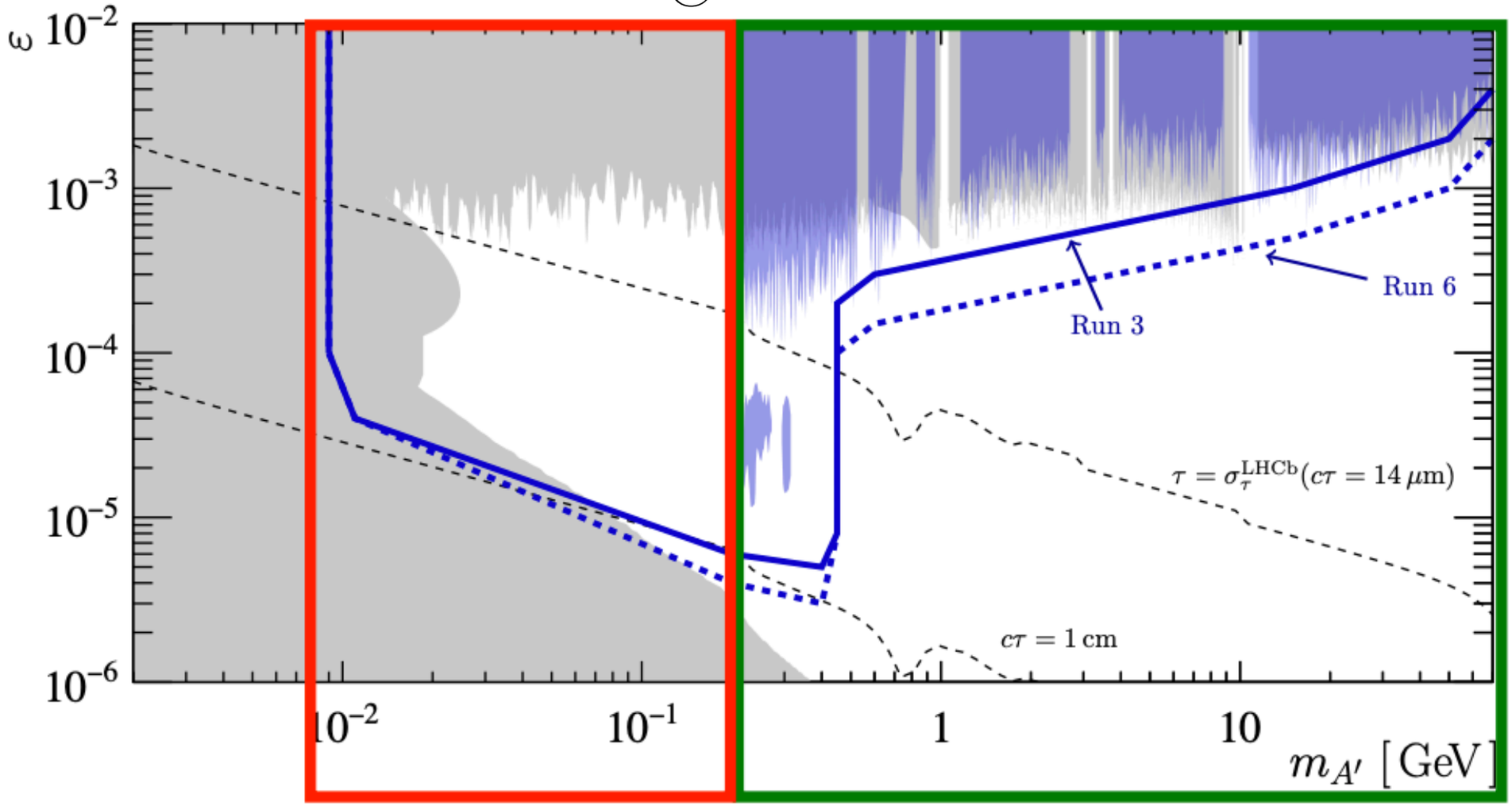


Strongest limits below 1 GeV!



Inclusive triggers for electrons @ Run3

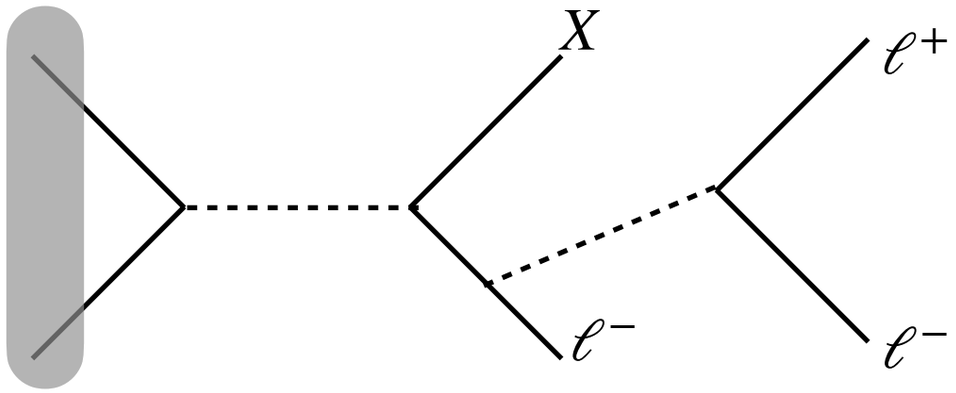
Slide from L. Merli's talk @ WIFAI



Inclusive triggers for di-electron resonances

100x yield thanks to software trigger

A new inclusive trigger line?



3 leptons + 2 resonant:

Options: **1 muon + 2 resonant electrons**

1 muon + 2 resonant muons

1 electron + 2 resonant muons

1 electron + 2 resonant electrons

Backgrounds ⟶ Estimate of the sensitivity