

Exotica Searches at LHCb

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on behalf of the LHCb Collaboration



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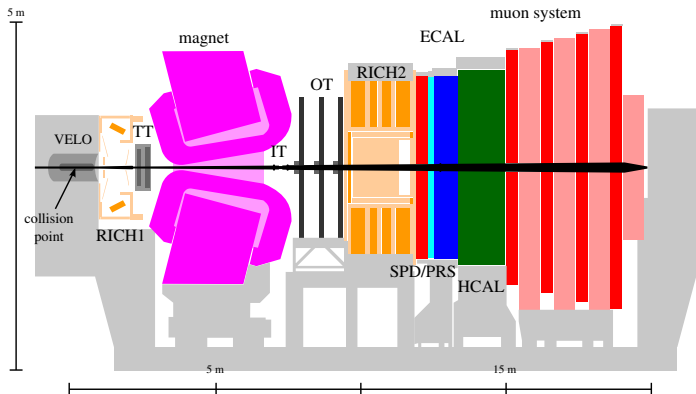


August 2, 2017

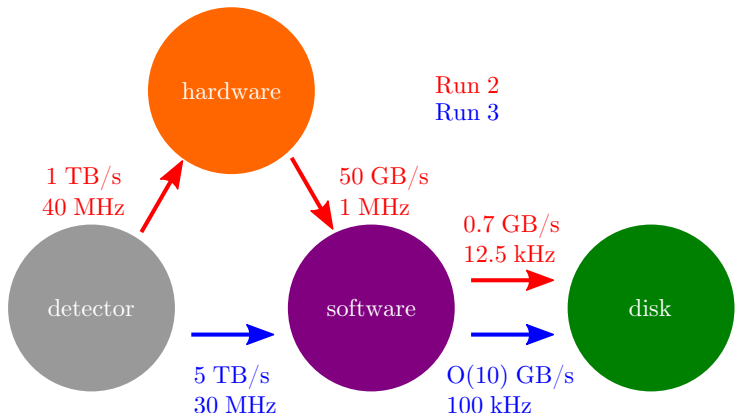


Detector

LHCb, IJMPA 30 (2015)



- fully instrumented between $2 < \eta < 5$
- momentum resolution between 0.5% at 5 GeV to 1% at 200 GeV
- impact parameter resolution of 13 – 20 μm for tracks
- secondary vertex precision of 0.01 – 0.05(0.1 – 0.3) mm in $xy(z)$



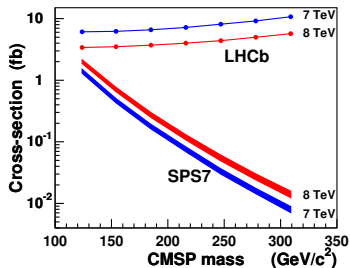
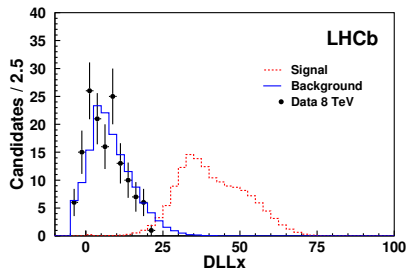
- real-time calibration and full event reconstruction in Run 2
- inclusive dimuon from threshold and jet triggers in Run 2
- full detector readout in Run 3

Long Lived Particles

Massive Charged Particle

LHCb, EPJC 75 (2015)

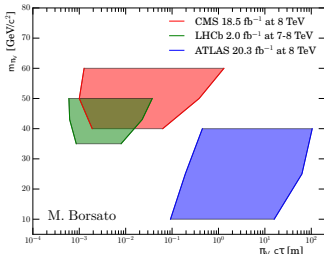
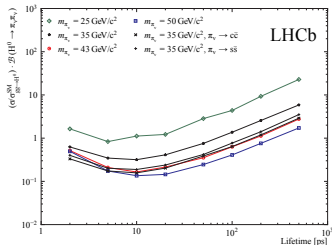
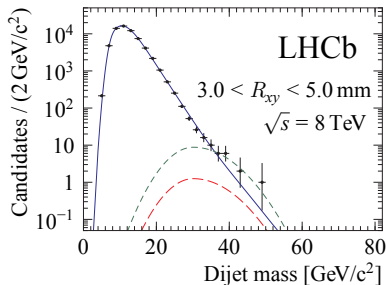
- search for heavy, charged, very long lived particles, *e.g.* $\tilde{\tau}$
- utilize absence of light in RICH in addition to minimal energy loss
- assume Drell-Yan production and compare to SPS7 benchmark scenario



Single Displaced Particle

LHCb, arXiv:1705.07332

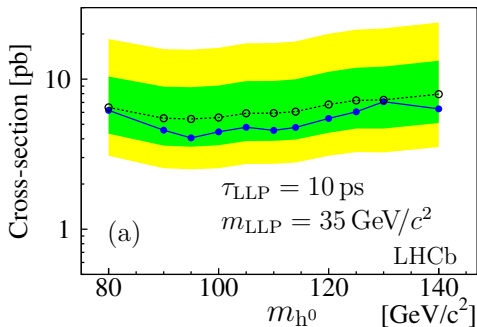
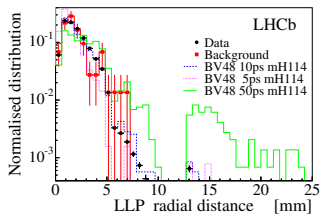
- search for single long lived particle decaying into jet pair, *e.g.* π_V
- production from SM-like Higgs decay



Two Displaced Particles

LHCb, EPJC 76 (2016)

- search for two long lived particles, *e.g.* χ_1^0
- production from SM-like Higgs decay with baryon number violation
- masses from 20 – 60 GeV and lifetimes from 5 – 100 ps

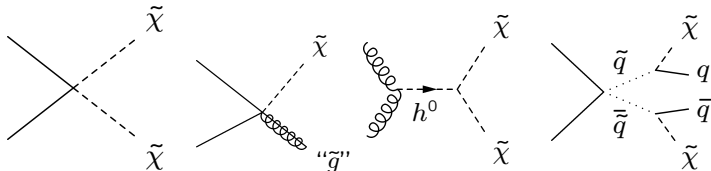
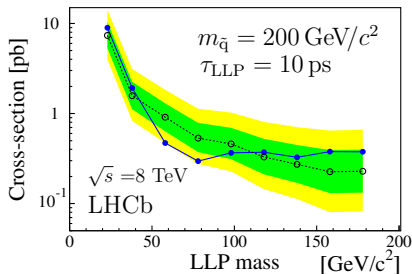


Associated Leptons

Displaced with Muon

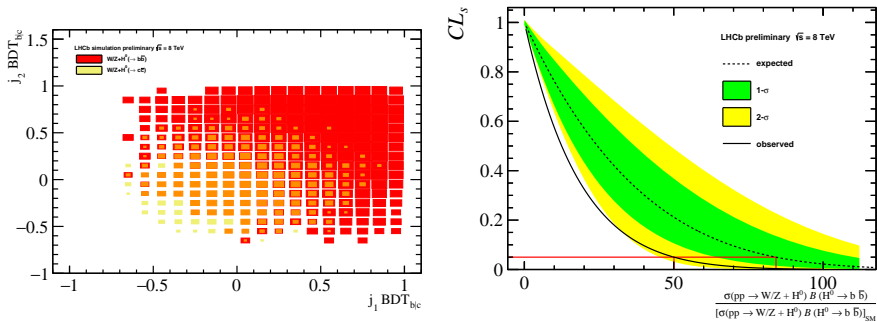
LHCb, EPJC 77 (2017)

- search for long lived particle decaying into di-quark and muon
- consider full PYTHIA model and four simplified models
- utilizes excellent secondary vertex reconstruction



Higgs Decay into $Q\bar{Q}$

LHCb, LHCb-CONF-2016-006

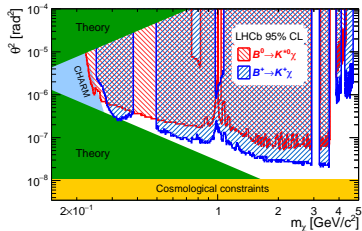
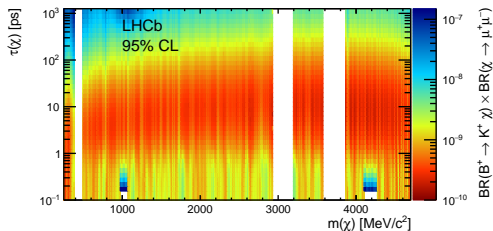


- search in association with W/Z
- utilize excellent heavy flavor tagging and b/c separation
- limits not competitive with SM, but important proof-of-concept

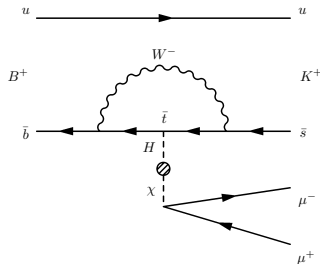
Light Dark Sector

Resonances in B Decays

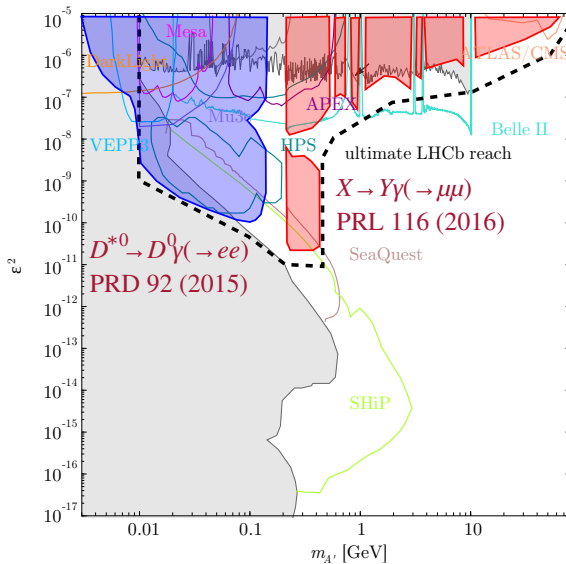
LHCb, PRD 95 (2017)



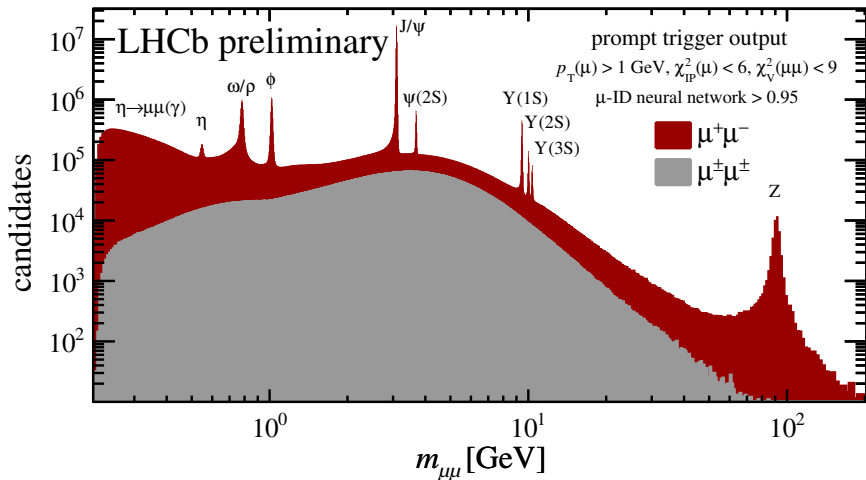
- $B^0 \rightarrow K^{*0} \mu \mu$ and $B^+ \rightarrow K^+ \mu \mu$
- perform both prompt and displaced search simultaneously
- model independent limits provided for re-casting



Dark Photons



Dimuon Spectrum



Outlook

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- exotica search program reaching maturity at LHCb
- important to utilize strengths of detector, provide complementarity
 - flexible trigger with very low p_T and mass requirements
 - full particle identification including RICH
 - excellent secondary vertex and lifetime resolution
- variety of searches using new inclusive dimuon dataset underway

Thank you!