Search for new long-lived particles at $\sqrt{s} = 13\,\text{TeV}$

—Supplemental Material—

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Table 1: Signal efficiencies (in %) for $c\tau_0$ = 30 mm and various values of mass with modified branching ratios relative to the Jet-Jet and B-Lepton models. Selection requirements are cumulative from the first row to the last.

Light-Light

m_{χ^0} [GeV]	50	100	300	1000	1500
≥2 tags	2.84 ± 0.12	15.56 ± 0.29	54.87 ± 0.92	80.52 ± 1.11	82.19 ± 1.14
Trigger	0.53 ± 0.05	5.70 ± 0.17	47.14 ± 0.85	74.85 ± 1.07	77.07 ± 1.10
Selection	0.33 ± 0.04	3.90 ± 0.14	45.68 ± 0.84	74.80 ± 1.07	76.96 ± 1.10
≥3 tags	0.05 ± 0.02	1.11 ± 0.08	21.77 ± 0.58	50.04 ± 0.88	55.36 ± 0.93
≥4 tags	—	0.23 ± 0.04	7.38 ± 0.34	25.80 ± 0.63	32.47 ± 0.71

B-Electron

$m_{\tilde{\chi}}$ [GeV]	300	600	800	1000
≥2 tags	39.01 ± 0.65	53.70 ± 0.75	59.62 ± 0.78	62.42 ± 1.11
Trigger	22.95 ± 0.50	38.07 ± 0.63	43.06 ± 0.66	45.21 ± 0.95
Selection	21.59 ± 0.48	37.02 ± 0.62	39.47 ± 0.64	42.20 ± 0.92
≥3 tags	7.86 ± 0.29	14.28 ± 0.38	17.37 ± 0.42	20.39 ± 0.64
≥4 tags	1.37 ± 0.12	3.32 ± 0.19	4.34 ± 0.21	4.69 ± 0.31

B-Tau

$m_{\tilde{\chi}}$ [GeV]	300	600	800	1000
≥ 2 tags	34.98 ± 0.61	51.42 ± 0.73	57.20 ± 0.76	59.43 ± 1.07
Trigger	20.20 ± 0.46	39.78 ± 0.64	45.46 ± 0.68	47.62 ± 0.96
Selection	17.17 ± 0.43	37.47 ± 0.62	43.64 ± 0.67	44.26 ± 0.92
≥3 tags	5.21 ± 0.24	13.29 ± 0.37	16.15 ± 0.40	19.13 ± 0.61
≥4 tags	0.86 ± 0.10	3.09 ± 0.18	3.68 ± 0.19	4.48 ± 0.29

B-Muon

$m_{\tilde{\chi}}$ [GeV]	300	600	800	1000
≥ 2 tags	20.09 ± 0.46	35.46 ± 0.60	41.18 ± 0.64	43.13 ± 0.93
Trigger	6.63 ± 0.26	24.73 ± 0.50	31.85 ± 0.56	34.10 ± 0.82
Selection	5.25 ± 0.24	21.40 ± 0.47	27.42 ± 0.52	31.18 ± 0.79
≥ 3 tags	0.34 ± 0.06	3.03 ± 0.18	5.28 ± 0.23	6.08 ± 0.35
≥ 4 tags	—	0.12 ± 0.04	0.68 ± 0.08	0.68 ± 0.12

Table 2: Signal efficiencies (in %) for $m_{X^0} = m_{\tilde{\tau}} = 300\,\text{GeV}$ and for various values of $c\tau_0$ with modified branching ratios relative to the Jet-Jet and B-Lepton models. Selection requirements are cumulative from the first row to the last.

Light-Light

$c\tau_0$ [mm]	1	10	100	1000
≥2 tags	2.20 ± 0.19	40.49 ± 0.80	54.92 ± 0.93	14.55 ± 0.47
Trigger	2.04 ± 0.18	39.16 ± 0.78	39.63 ± 0.79	8.20 ± 0.36
Selection	2.03 ± 0.18	38.41 ± 0.77	36.99 ± 0.76	6.89 ± 0.33
≥3 tags	0.19 ± 0.05	14.77 ± 0.48	16.70 ± 0.51	1.48 ± 0.15
≥4 tags	—	5.11 ± 0.28	4.73 ± 0.27	0.22 ± 0.06

B-Electron

$c\tau_0$ [mm]	1	10	100	1000
≥2 tags	0.81 ± 0.10	20.51 ± 0.47	39.01 ± 0.65	11.46 ± 0.35
Trigger	0.40 ± 0.07	14.68 ± 0.40	22.95 ± 0.50	5.15 ± 0.23
Selection	0.40 ± 0.07	13.92 ± 0.39	20.34 ± 0.47	3.58 ± 0.19
≥3 tags	0.04 ± 0.02	4.22 ± 0.21	7.21 ± 0.28	0.82 ± 0.09
≥4 tags	—	0.73 ± 0.09	1.19 ± 0.11	0.05 ± 0.02

B-Tau

$c\tau_0$ [mm]	1	10	100	1000
≥2 tags	0.48 ± 0.07	18.40 ± 0.45	34.98 ± 0.61	9.31 ± 0.32
Trigger	0.44 ± 0.07	14.63 ± 0.40	20.20 ± 0.46	3.81 ± 0.20
Selection	0.41 ± 0.07	12.45 ± 0.37	15.50 ± 0.41	2.37 ± 0.16
≥3 tags	0.02 ± 0.02	3.23 ± 0.19	4.62 ± 0.22	0.44 ± 0.07
≥4 tags	—	0.53 ± 0.08	0.66 ± 0.09	0.02 ± 0.02

B-Muon

$c\tau_0$ [mm]	1	10	100	1000
≥2 tags	0.13 ± 0.04	8.02 ± 0.29	20.09 ± 0.46	4.03 ± 0.21
Trigger	0.05 ± 0.02	3.97 ± 0.21	6.63 ± 0.26	0.88 ± 0.10
Selection	0.04 ± 0.02	2.92 ± 0.18	4.21 ± 0.21	0.49 ± 0.07
≥3 tags	—	0.23 ± 0.05	0.31 ± 0.06	0.03 ± 0.02
≥4 tags	—	0.01 ± 0.01	—	—

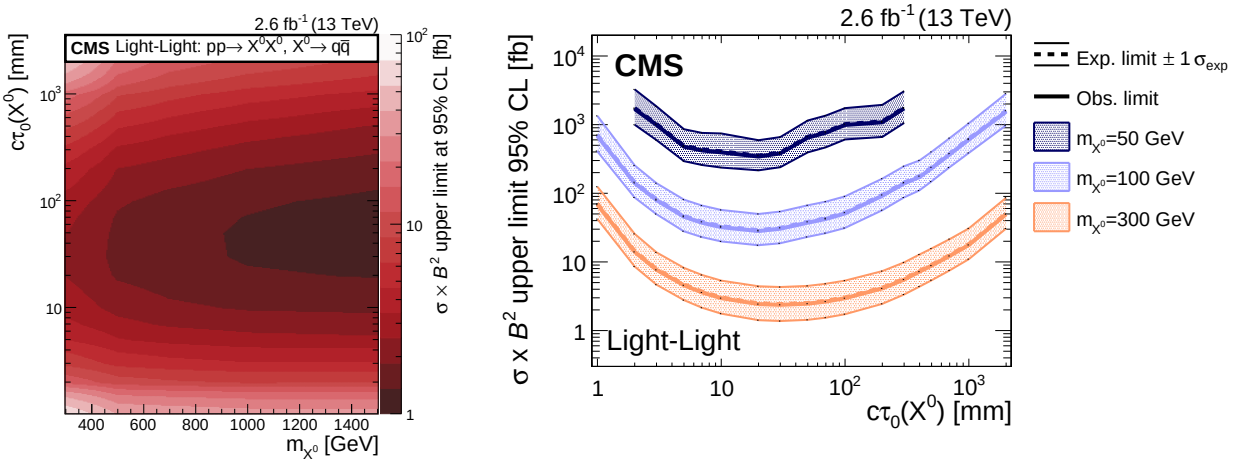

Figure 1: The excluded cross section at 95% CL for the Light-Light model as a function of the mass and proper decay length of the parent particle X^0 (left) and as a function of the proper decay length for three illustrative smaller values of the mass (right). The shaded bands in the right plot represent the one standard deviation uncertainties in the expected limits.

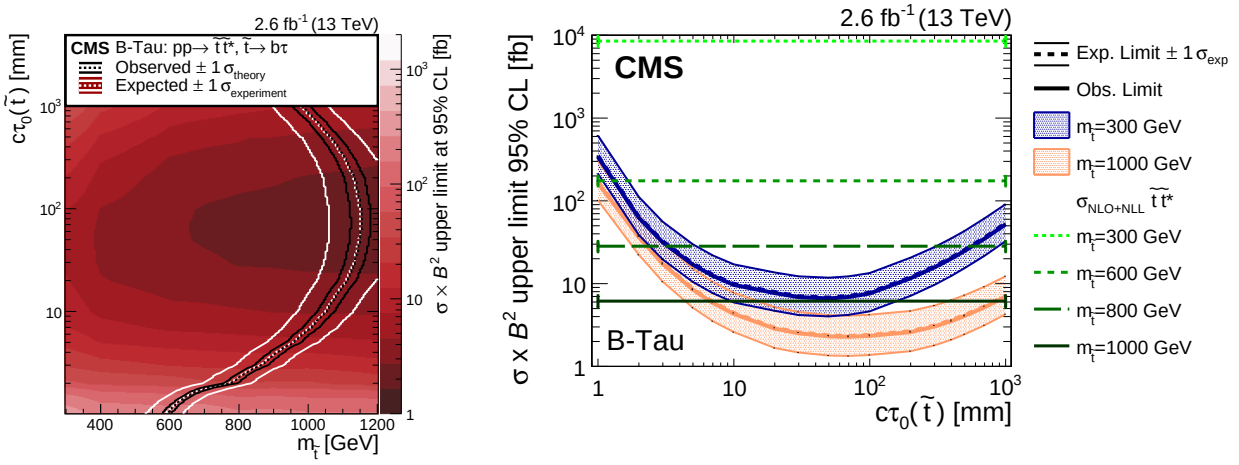

Figure 2: The excluded cross section at 95% CL for the B-Tau model as a function of the mass and proper decay length of the parent particle $\tilde{t}$ (left) and as a function of the proper decay length for two values of the mass (right). The left plot also shows the expected (observed) exclusion region with one standard deviation experimental (theoretical) uncertainties, utilizing a NLO+NLL calculation of the top squark production cross section. The right plot also shows the expected left limits with one standard deviation uncertainties as bands. The NLO+NLL calculation of the top squark production cross section is drawn horizontally in green for four mass values.

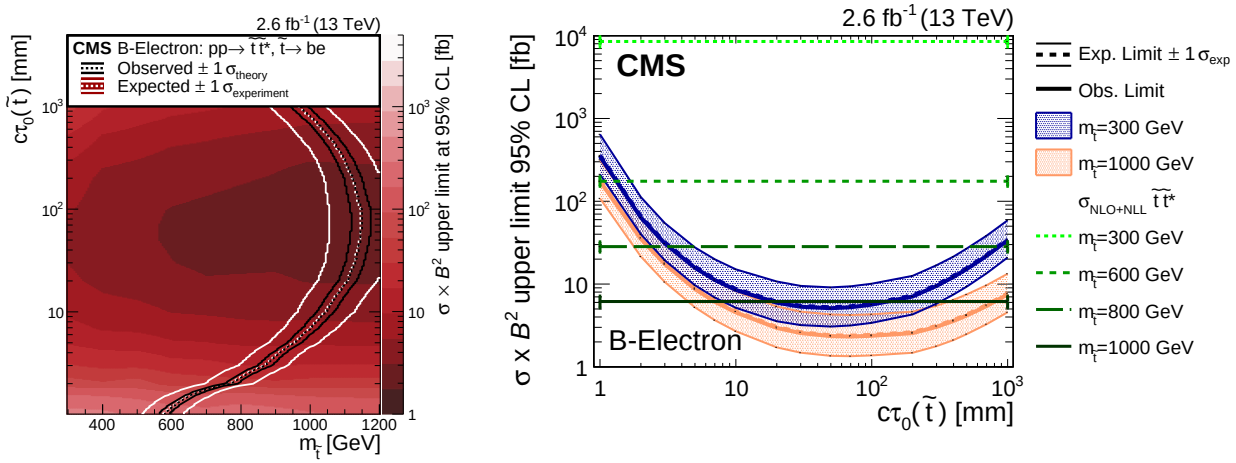

Figure 3: The excluded cross section at 95% CL for the B-Electron model as a function of the mass and proper decay length of the parent particle $\tilde{t}$ (left) and as a function of the proper decay length for two values of the mass (right). The left plot also shows the expected (observed) exclusion region with one standard deviation experimental (theoretical) uncertainties, utilizing a NLO+NLL calculation of the top squark production cross section. The right plot also shows the expected left limits with one standard deviation uncertainties as bands. The NLO+NLL calculation of the top squark production cross section is drawn horizontally in green for four mass values.

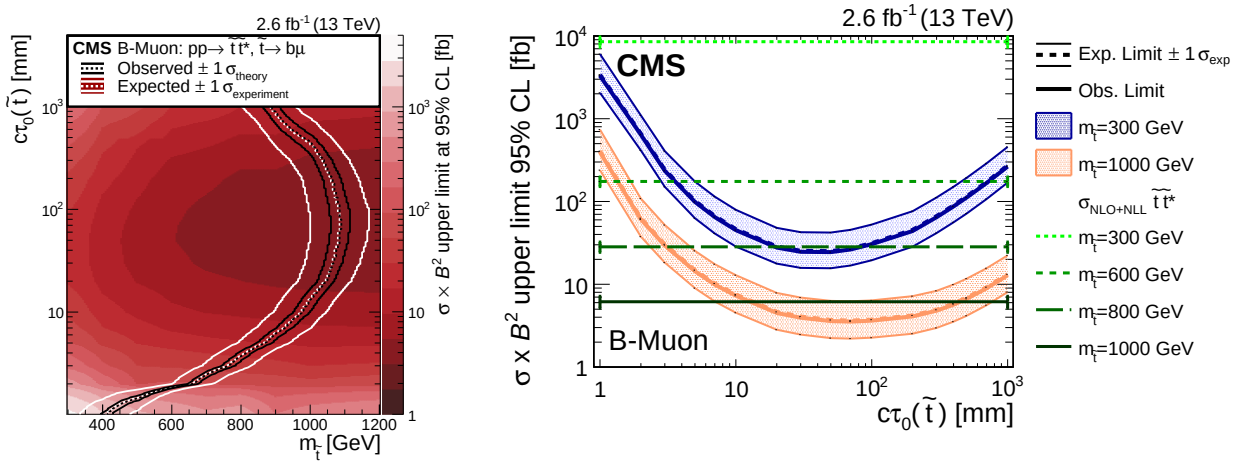

Figure 4: The excluded cross section at 95% CL for the B-Muon model as a function of the mass and proper decay length of the parent particle $\tilde{t}$ (left) and as a function of the proper decay length for two values of the mass (right). The left plot also shows the expected (observed) exclusion region with one standard deviation experimental (theoretical) uncertainties, utilizing a NLO+NLL calculation of the top squark production cross section. The right plot also shows the expected left limits with one standard deviation uncertainties as bands. The NLO+NLL calculation of the top squark production cross section is drawn horizontally in green for four mass values.