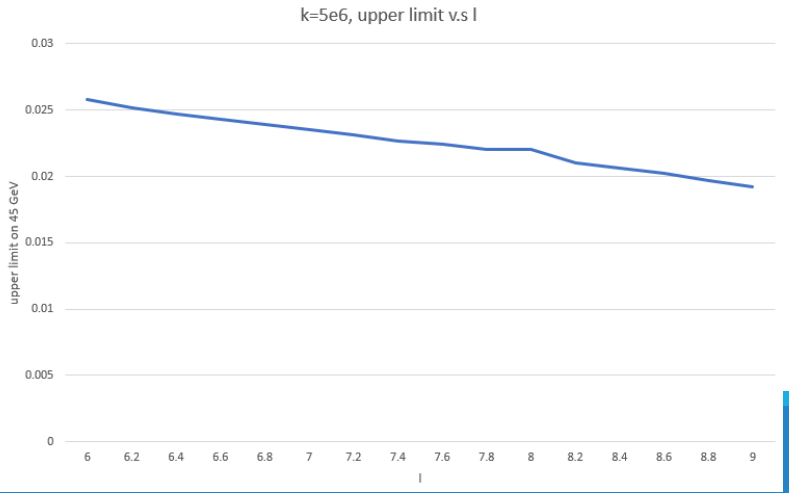
Zprime bkg modelling optimize

- Extend the fit range to (30-80).
- Optimize the GP function for bkg modelling
- SS test and signal injection test.
- Upper limit.

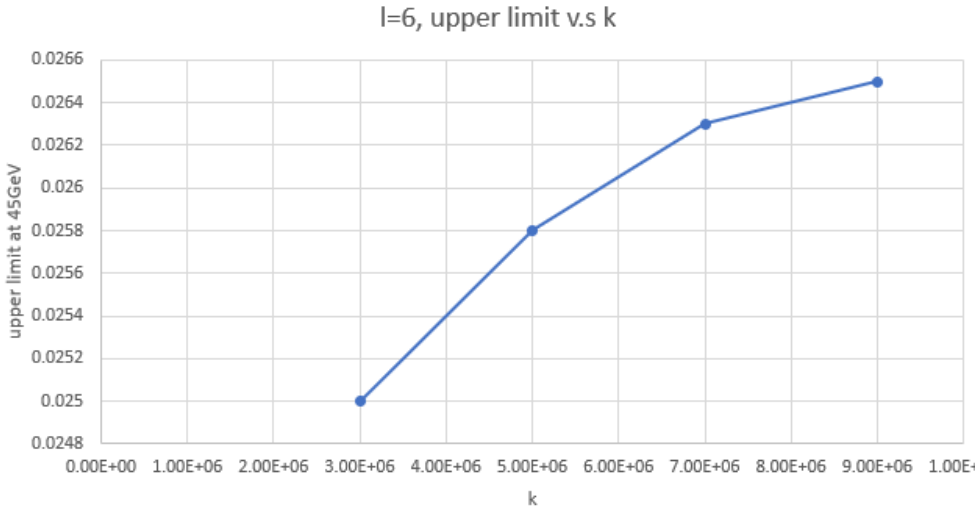
- The best results until now:
  - Based on Bern order 9 as mean function.

	Stat unc.	Spurious signal unc.	Upper limit(without ss sys)	Upper limit (sys)
l ↑	↓	worse ↑	Better (linear rel.) ↓	
K ↓	↓	worse ↑	Better (linear rel.) ↓	

- Example: keep k = 5e6, and change l



- Example: keep l = 6, and change k

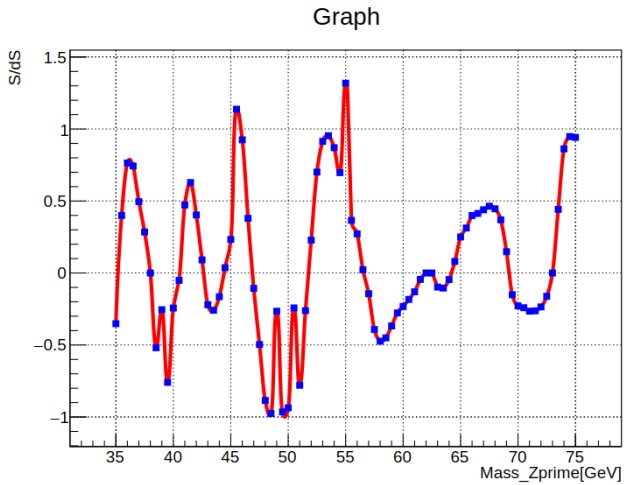


Zprime bkg modelling optimize

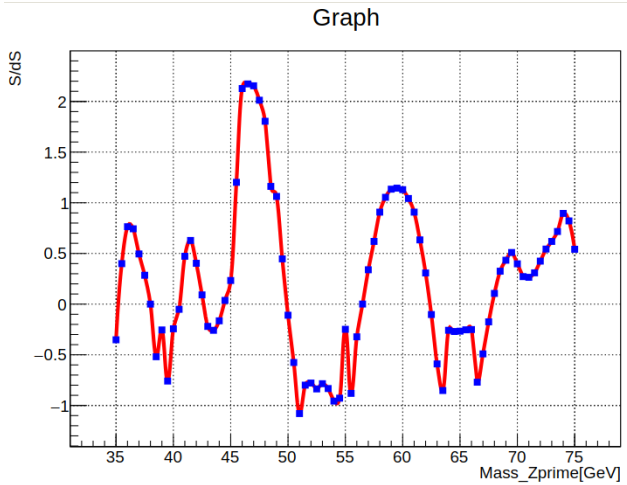
- Based on Bern order 9 as mean function.

	Stat unc.	Spurious signal unc.	Upper limit(without ss sys)	Upper limit (sys)
l ↗	↘	Worse (overall, not all points)	better ↘	
K ↘	↘	Worse (overall, not all points)	better ↘	

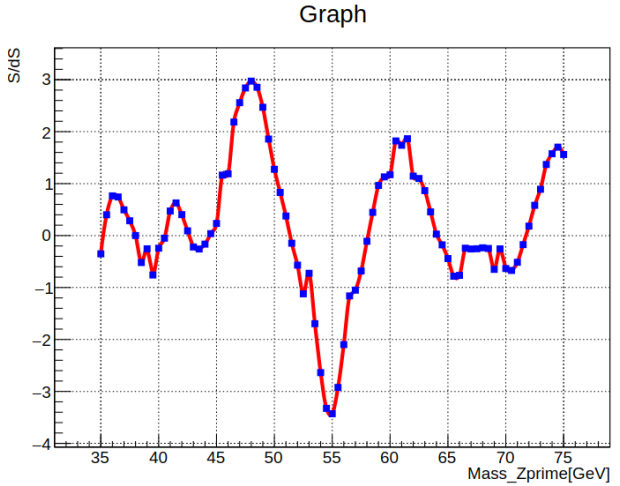
- k = 5e6, l = 6.8



- K = 5e6, l = 8.8



- K = 5e6, l = 10

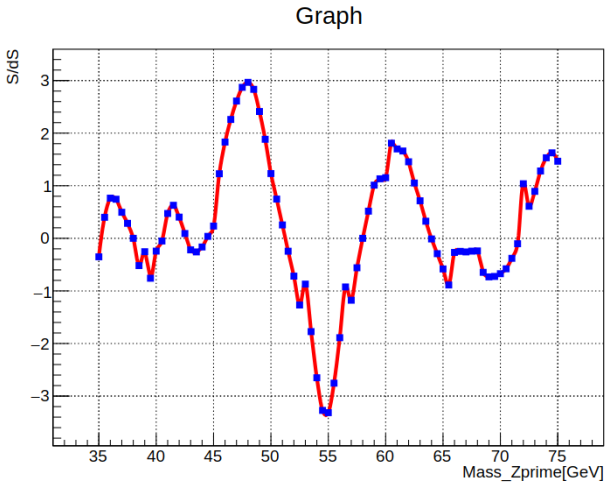


Zprime bkg modelling optimize

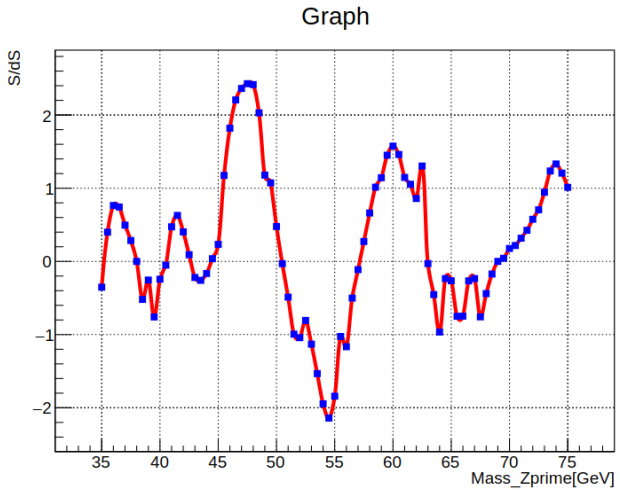
- Based on Bern order 9 as mean function.

	Stat unc.	Spurious signal unc.	Upper limit(without ss sys)	Upper limit (sys)
l ↗	↘	Worse (overall, not all points)	better ↘	
K ↘	↘	Worse (overall, not all points)	better ↘	

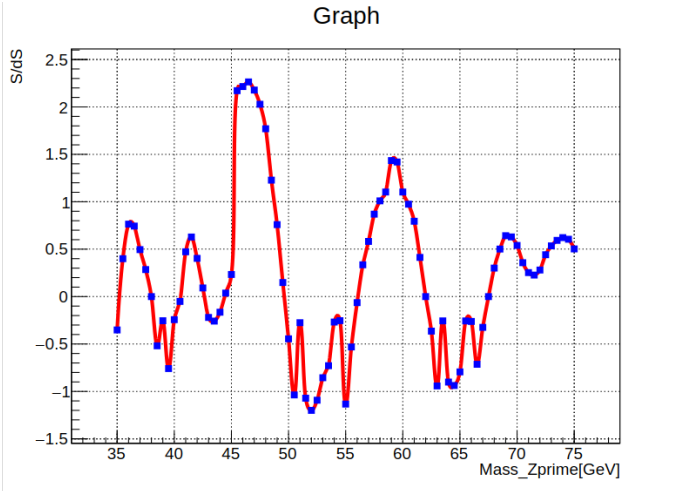
- k = 3e6, l = 9.6



- K = 9e6, l = 9.6



- K = 3e7, l = 9.6



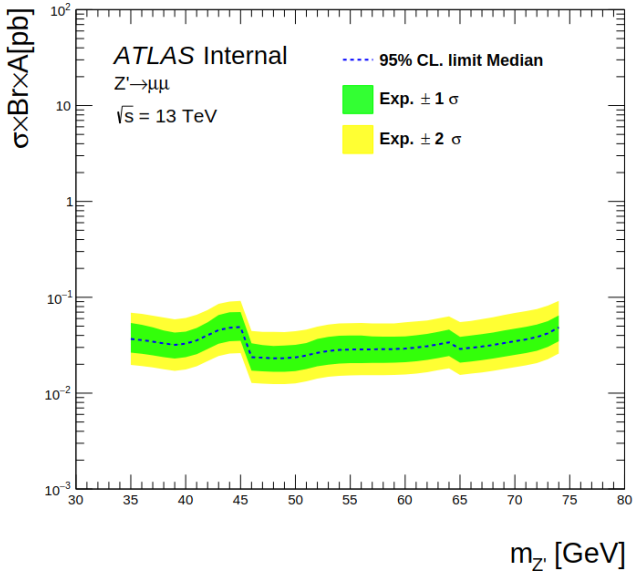
Zprime bkg modelling optimize

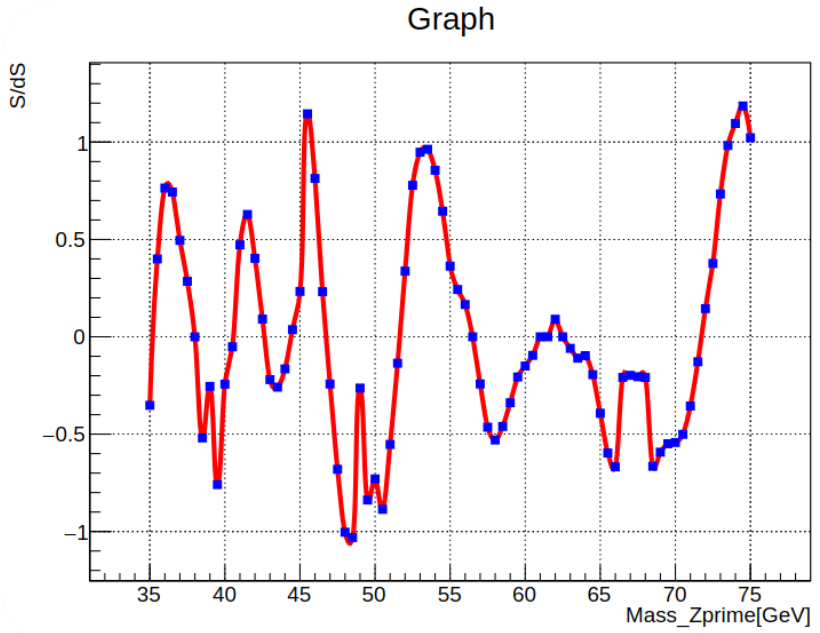
- Based on Bern order 9 as mean function.

	Stat unc.	Spurious signal unc.	Upper limit(without ss sys)	Upper limit (sys)
l ↗	↘	Worse (overall, not all points)	better ↘	
K ↘	↘	Worse (overall, not all points)	better ↘	

- Considering these table and find a good result:
  - 35-45: k = 1e9, l = 4
  - 45-64: k = 5e6, l = 6.7
  - 64-75: k = 5e6, l = 8.4

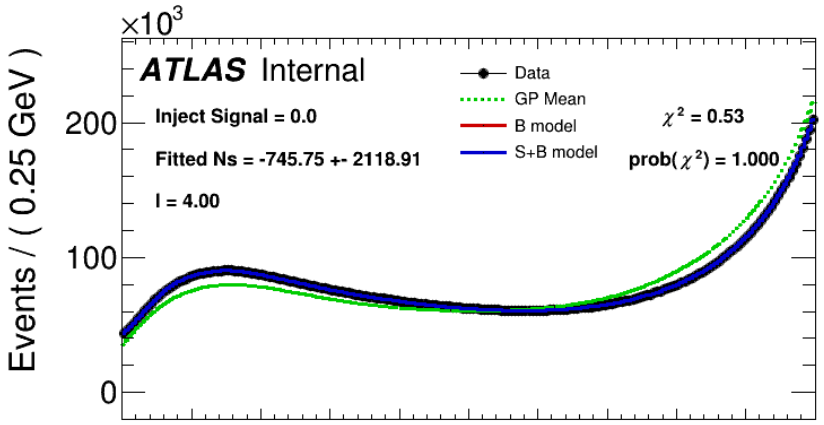
- Final upper limit: (need to *2000/140000)
  - 35-45: 2.573 – 3.418
  - 45-64: 1.665 – 2.371
  - 64-74: 2.024 – 3.386

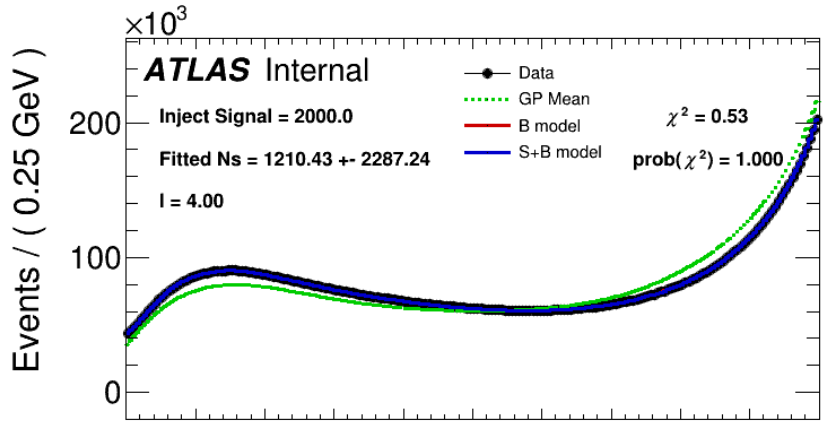


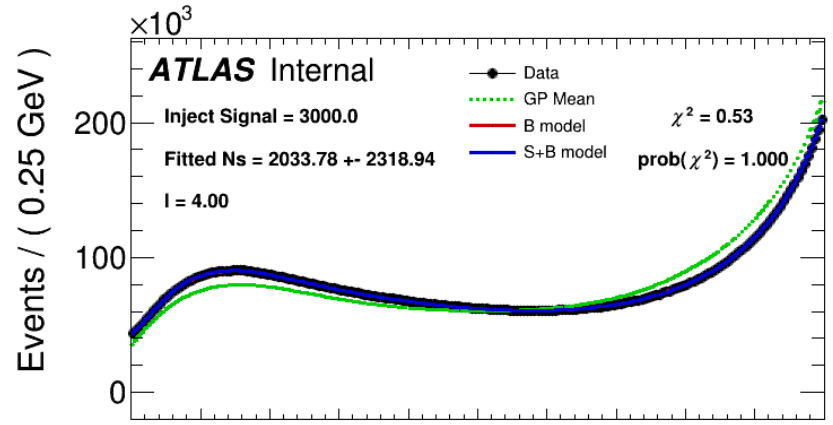


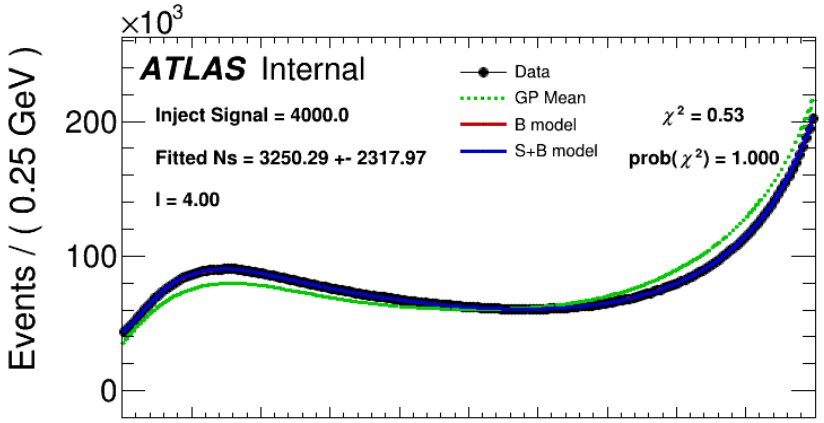
Signal injection test

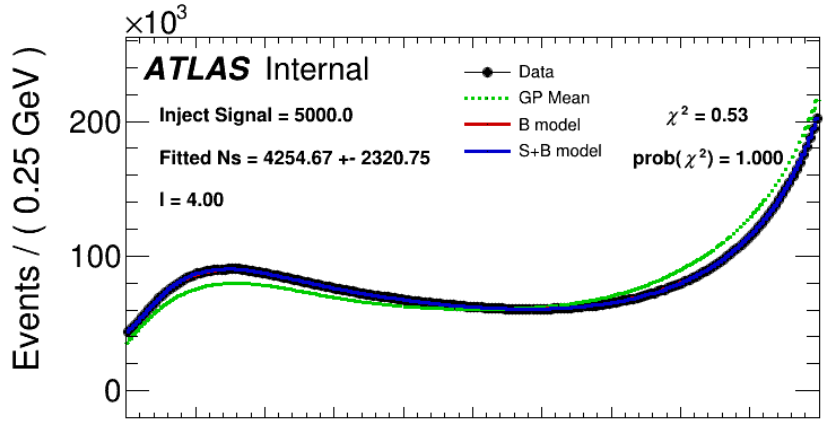
- 35: (stat unc. 2000-3000)

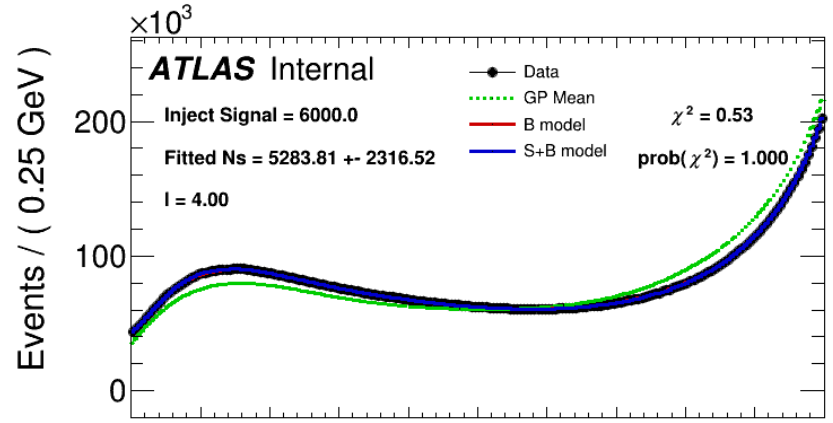






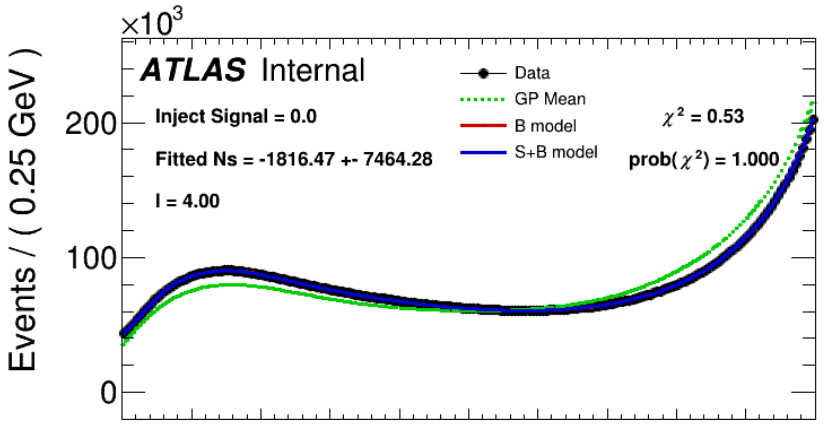


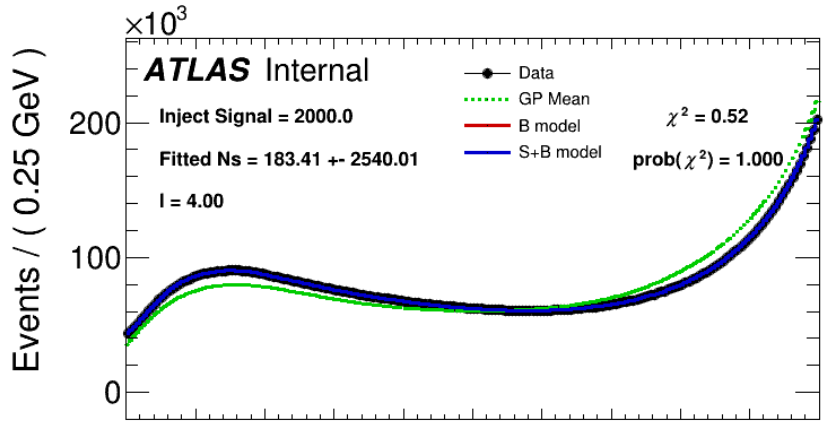


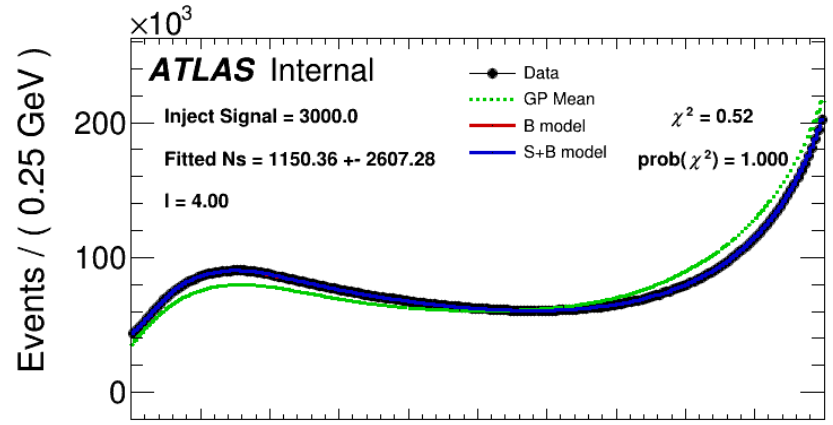


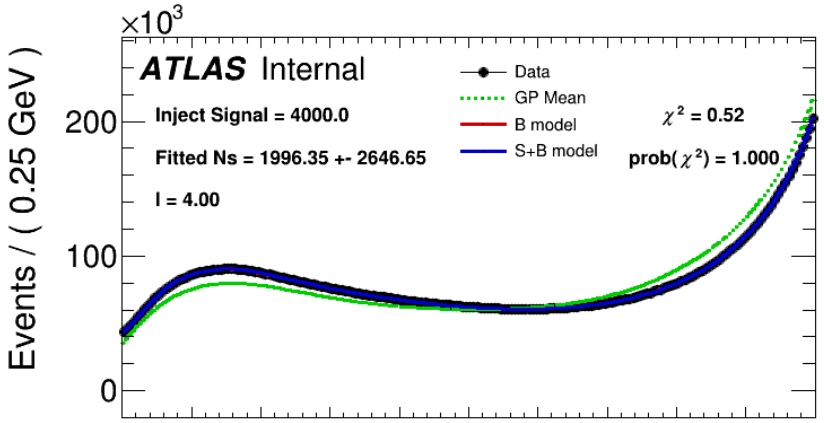
Signal injection test

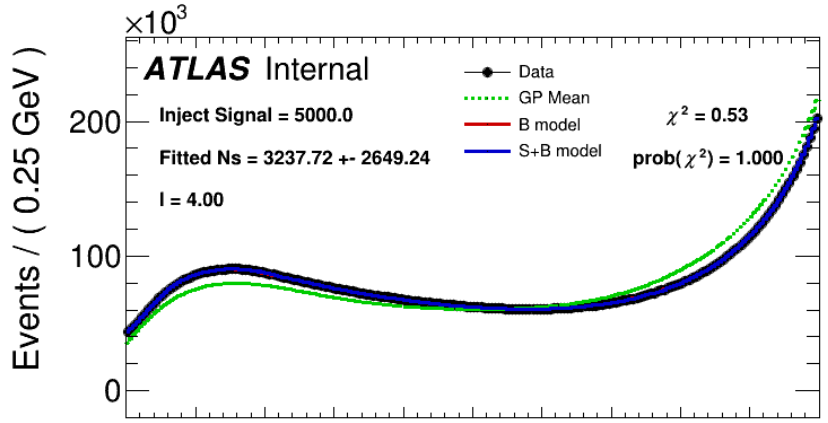
- 40：

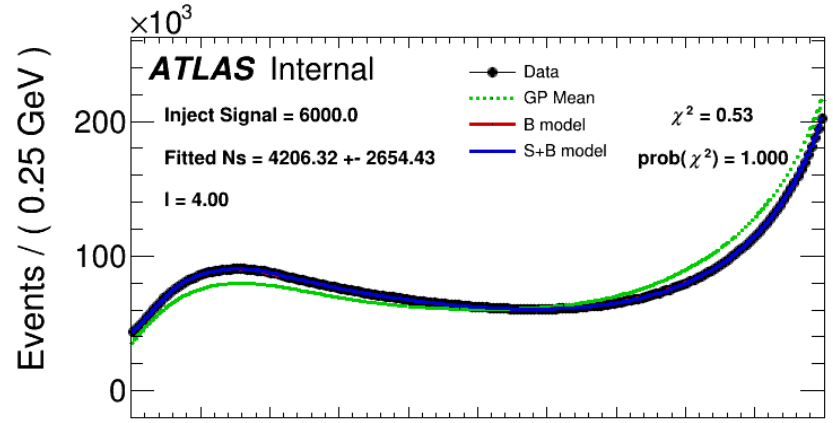






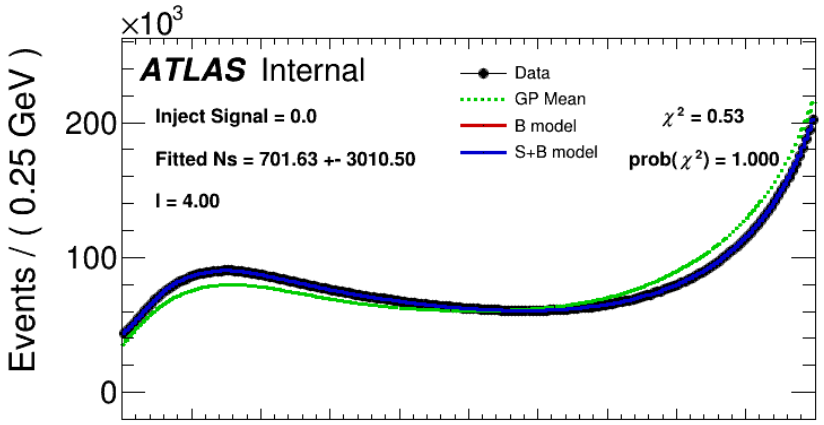


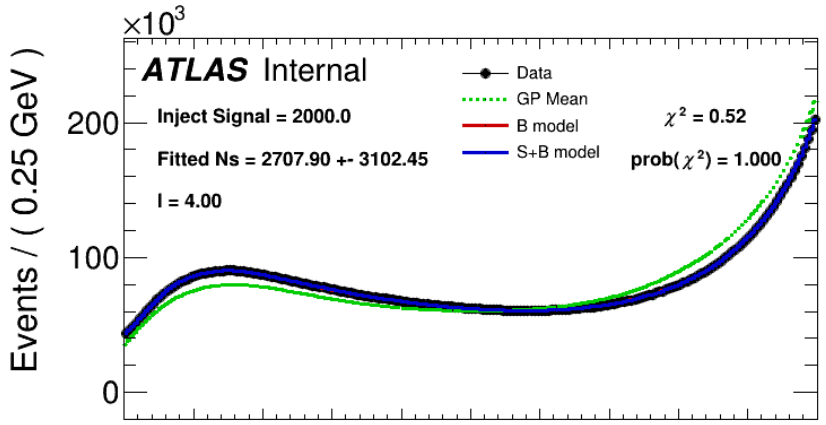


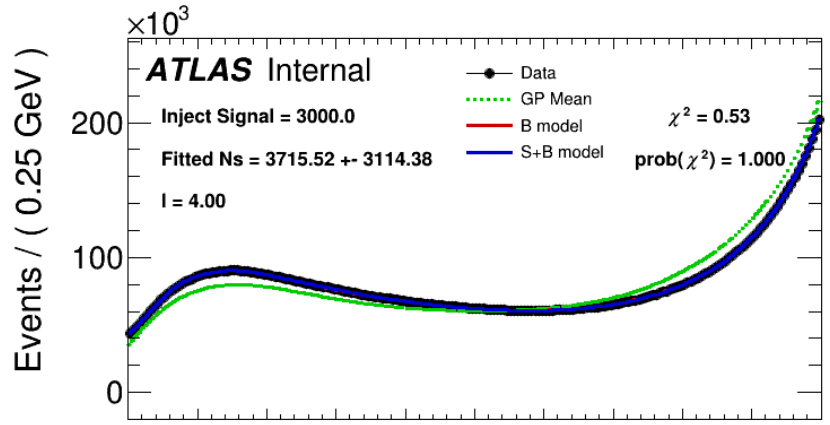


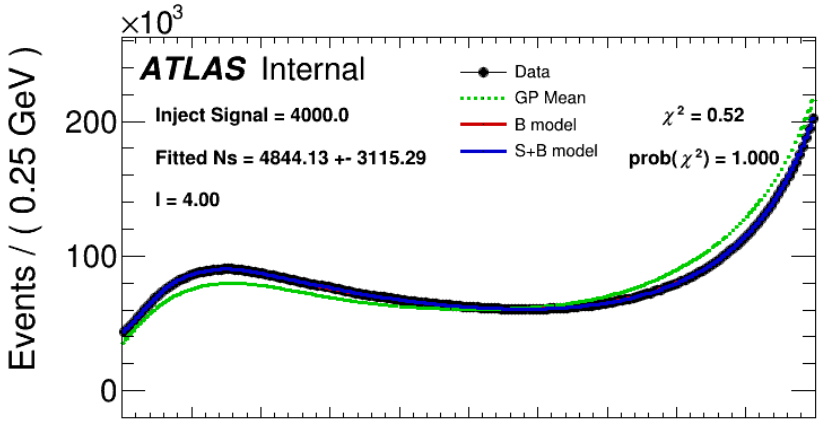
Signal injection test

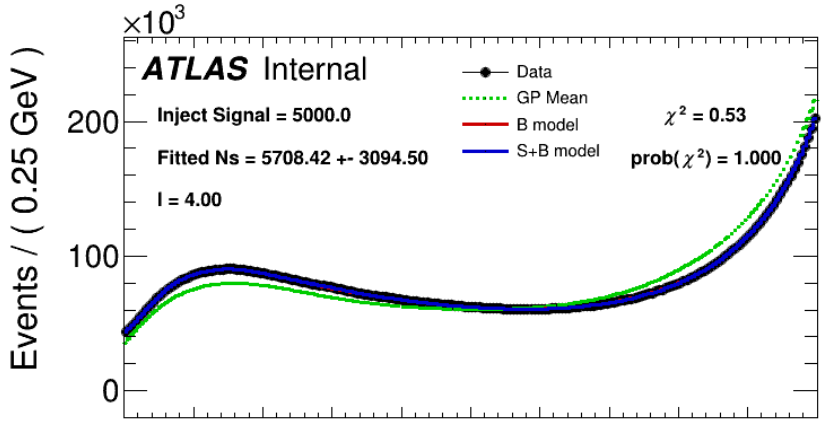
- 45：

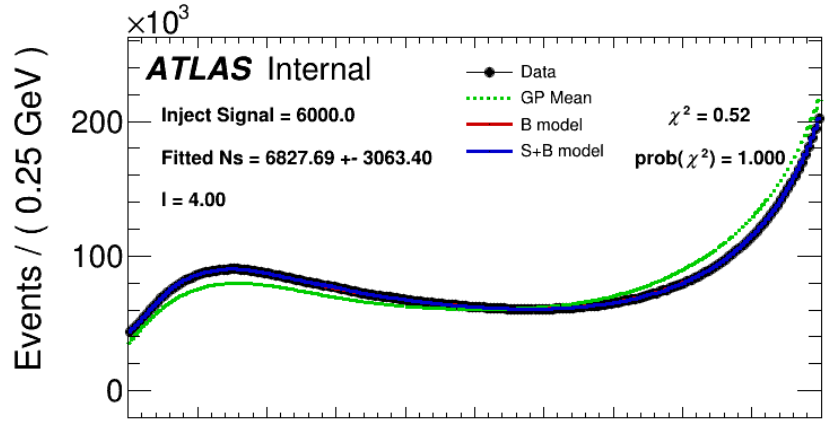






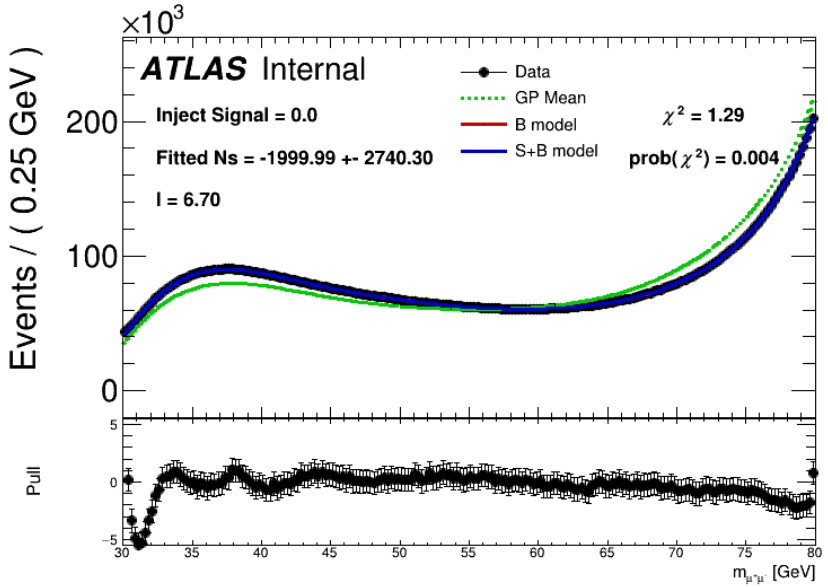


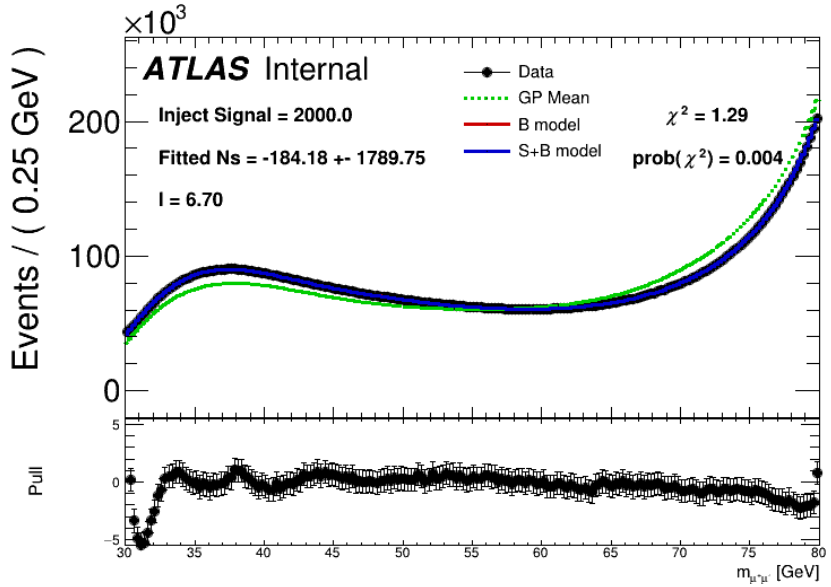


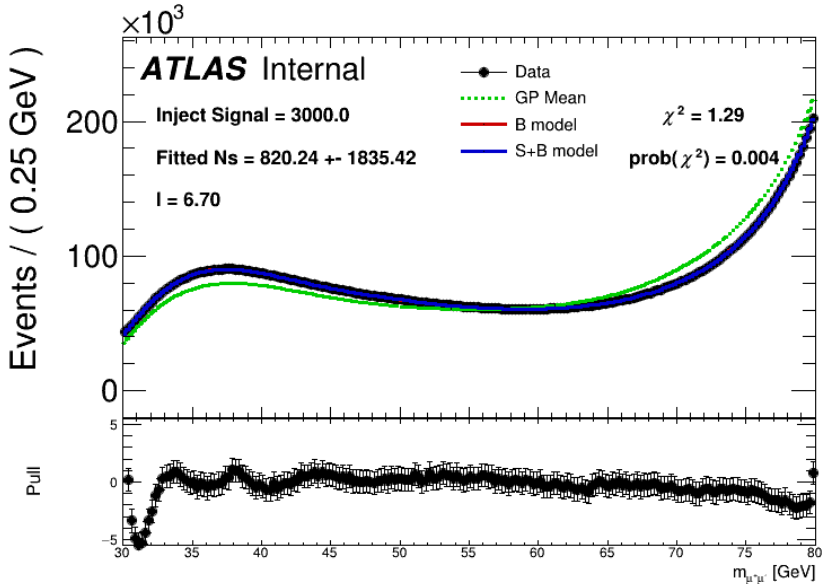


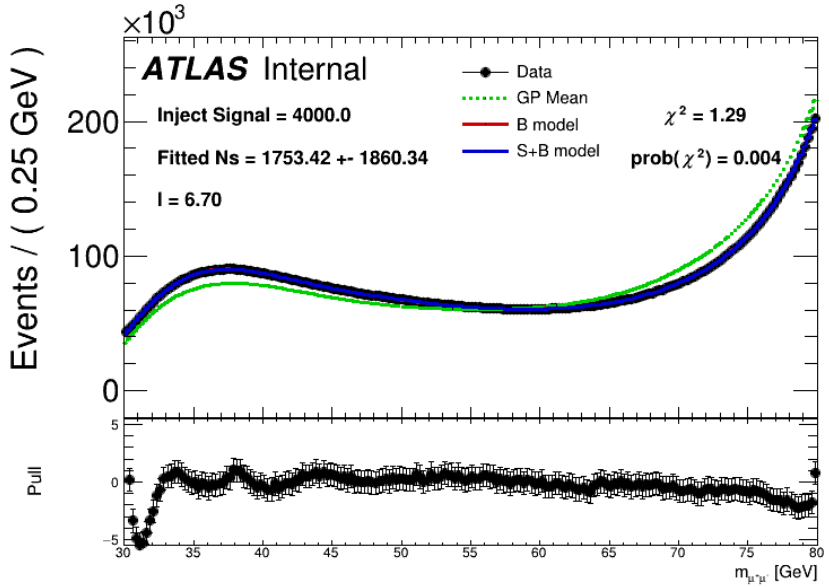
Signal injection test

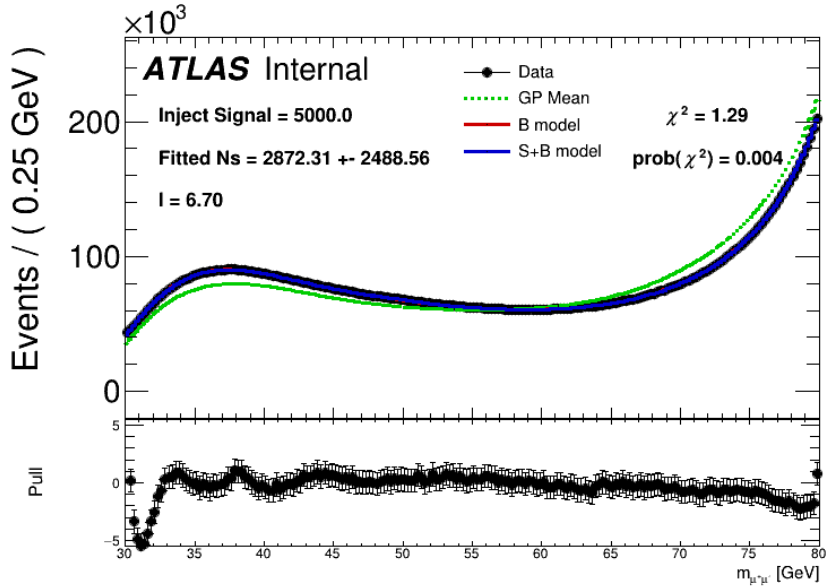
- 50：

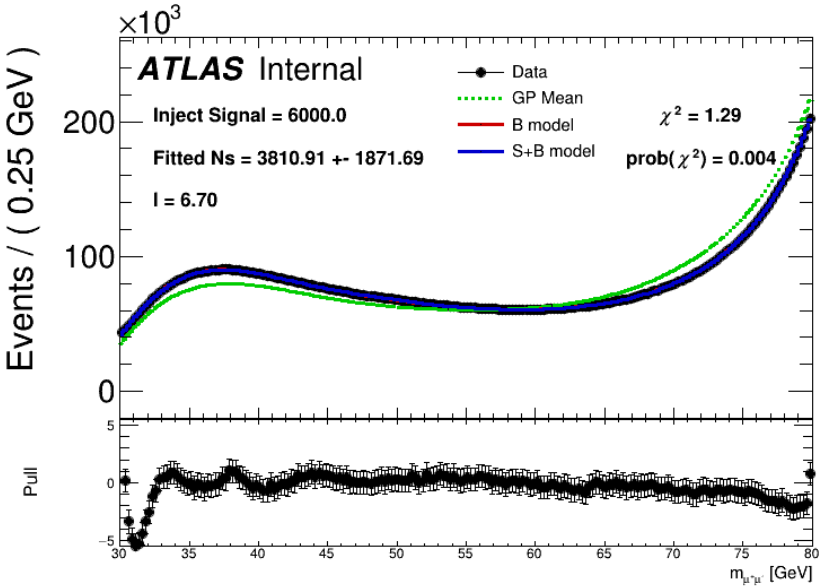






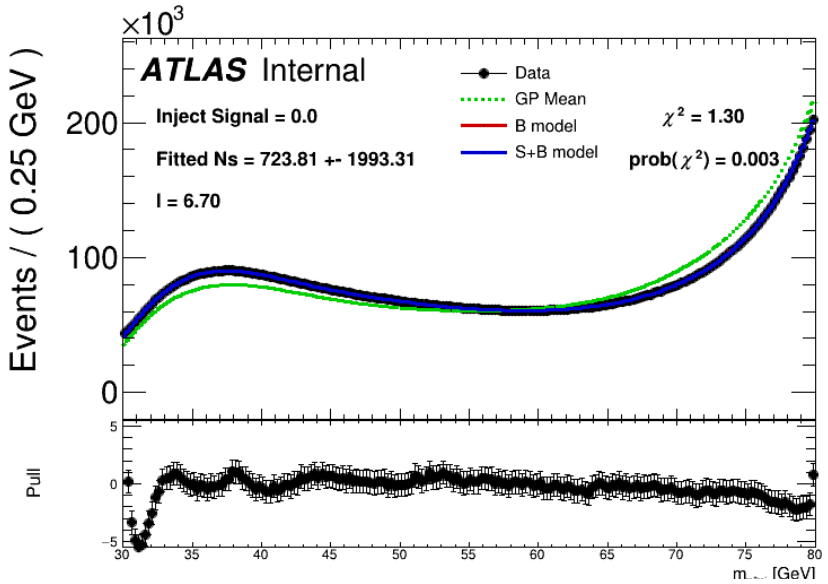


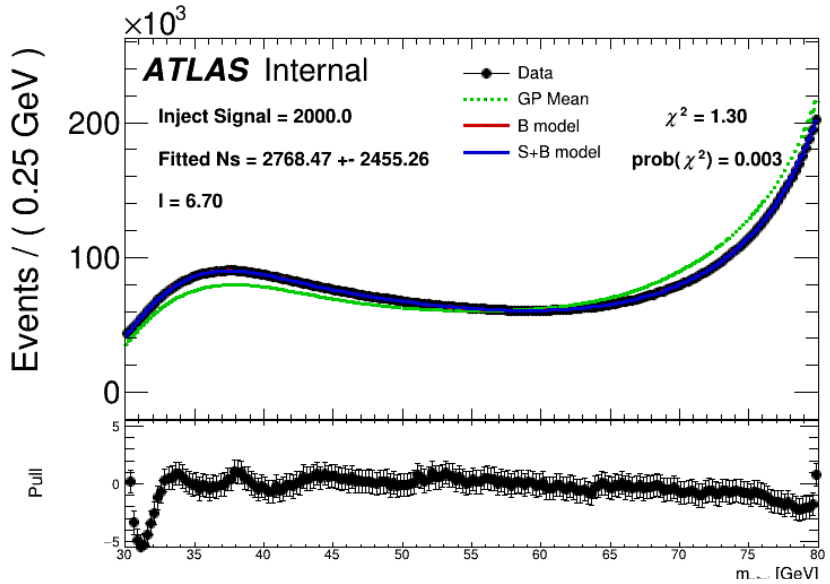


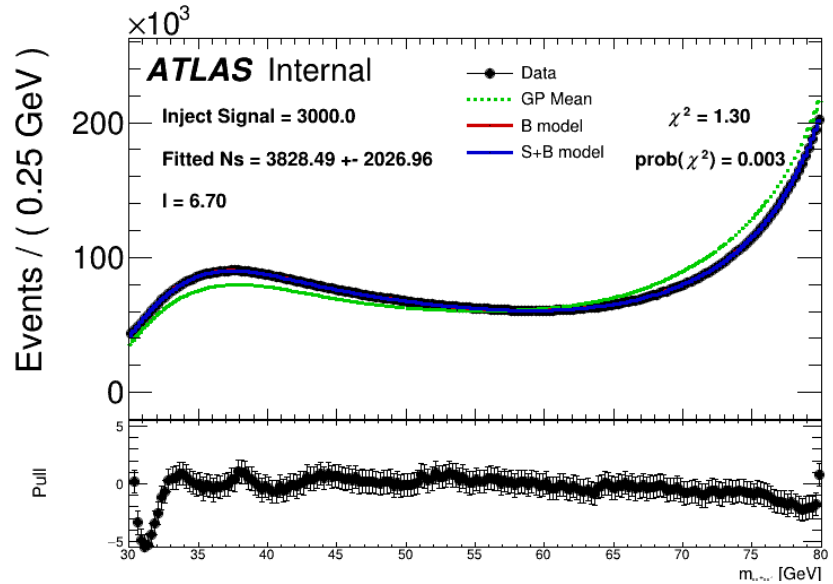


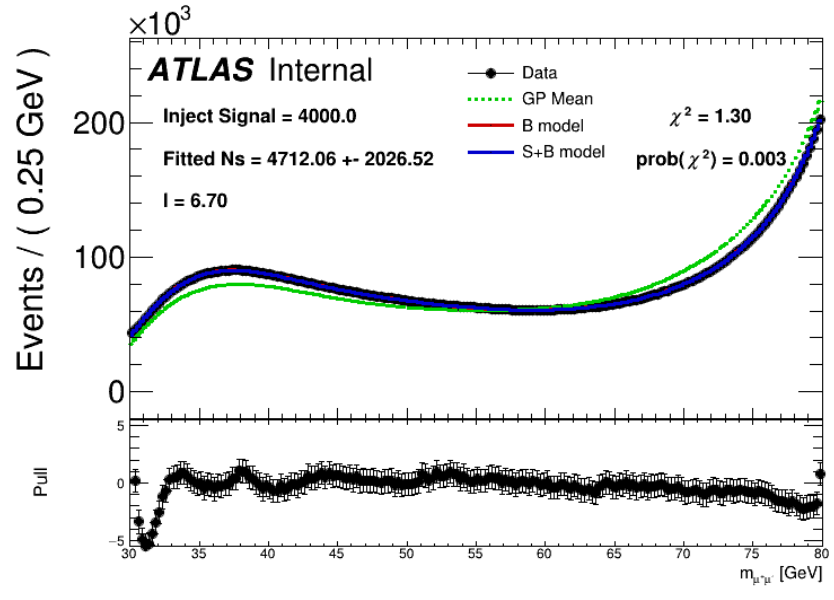
Signal injection test

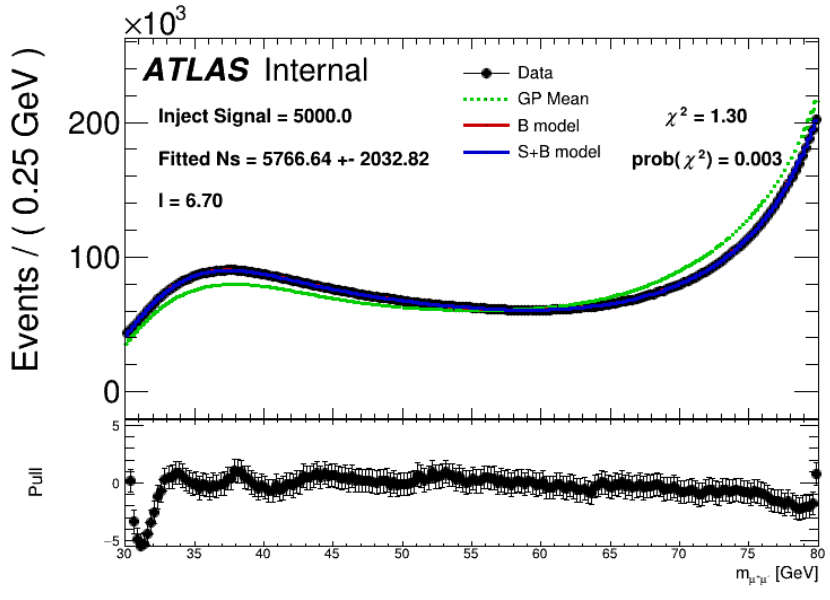
- 55：

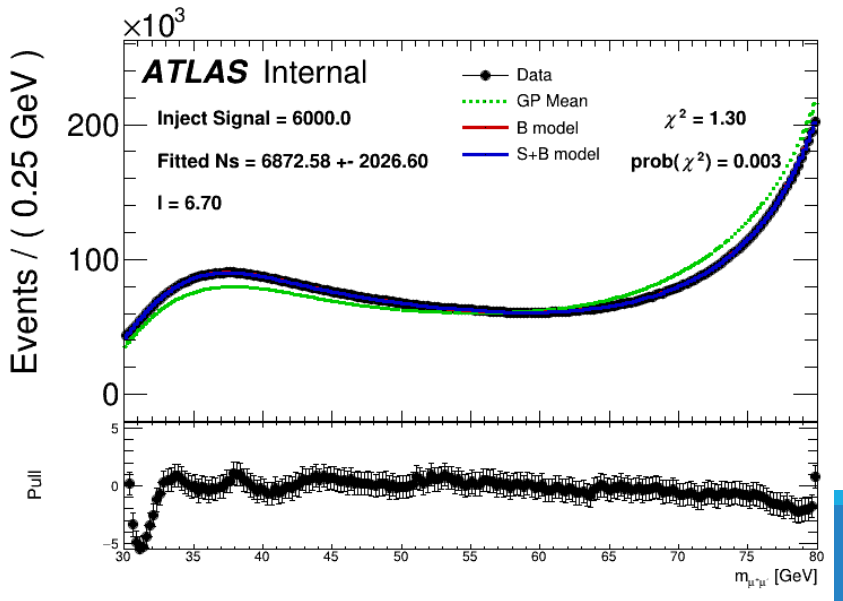






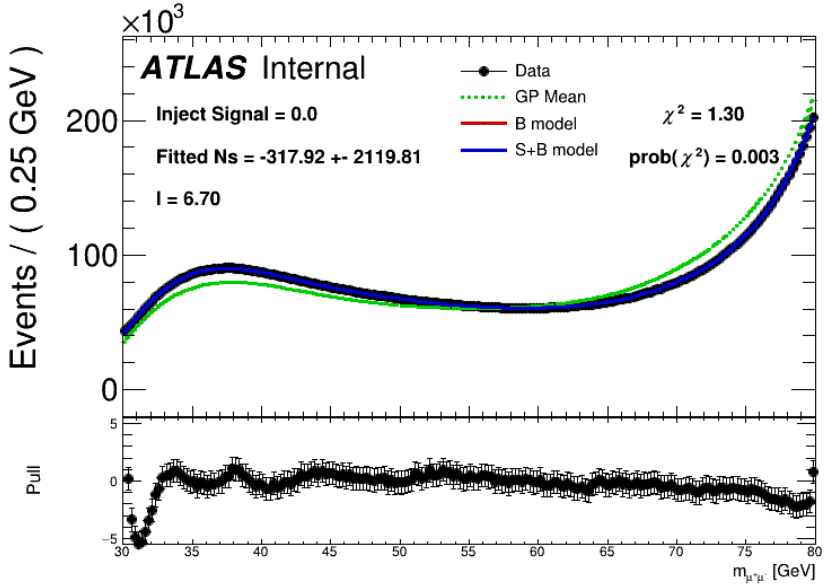


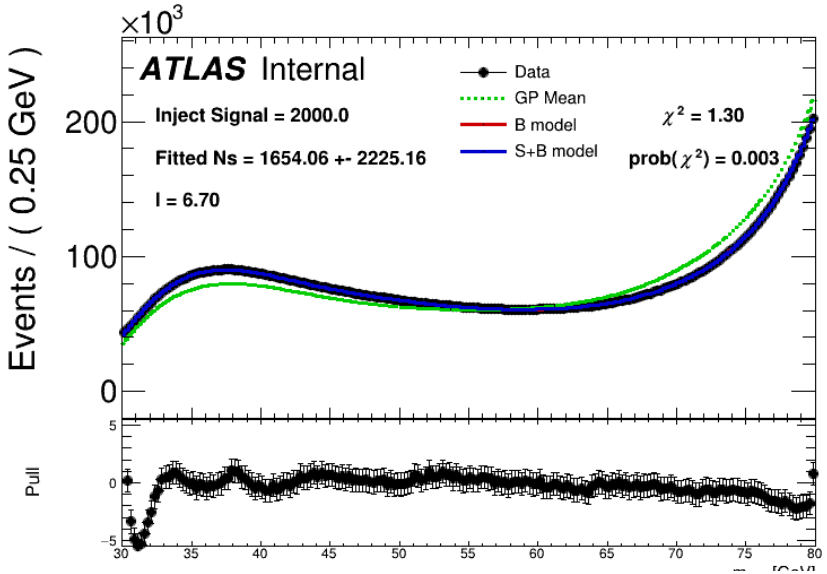


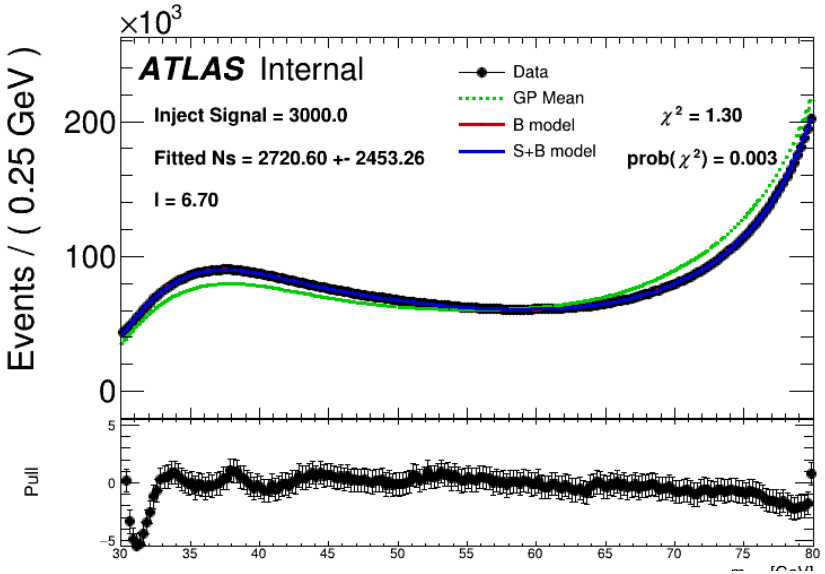


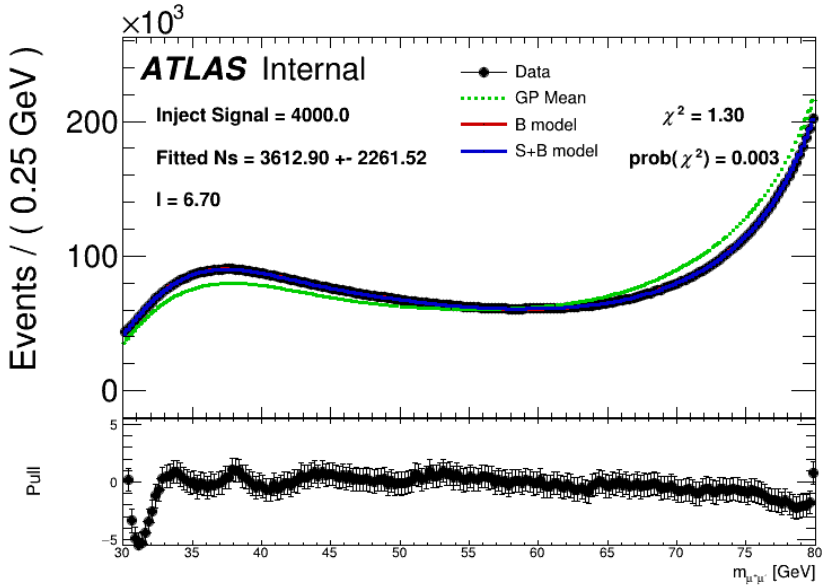
Signal injection test

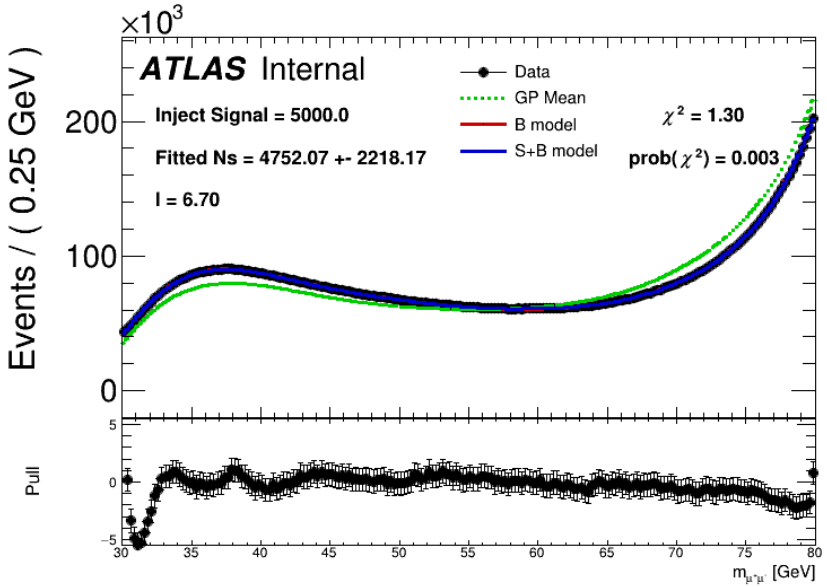
- 60：

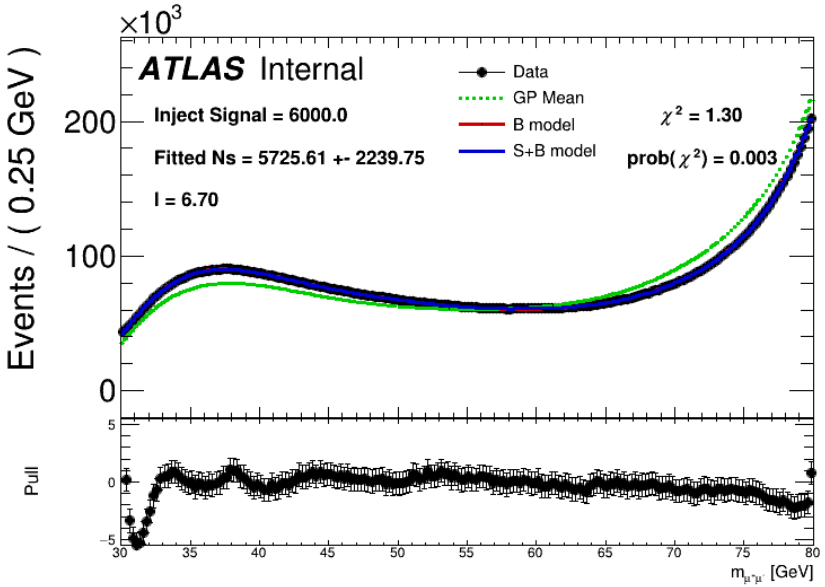






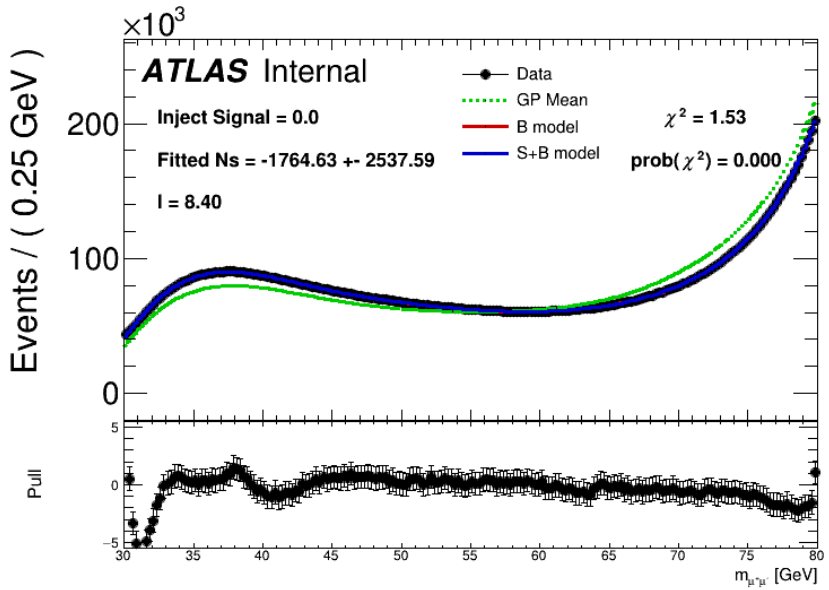


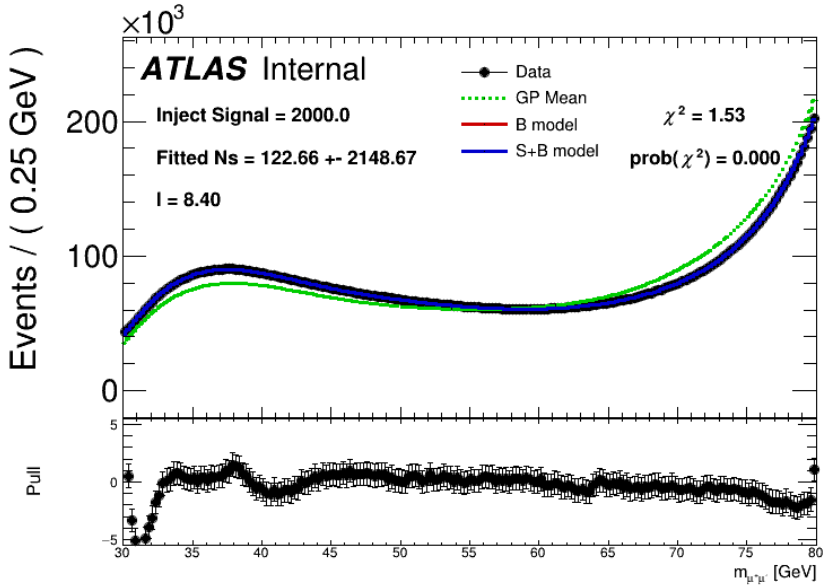


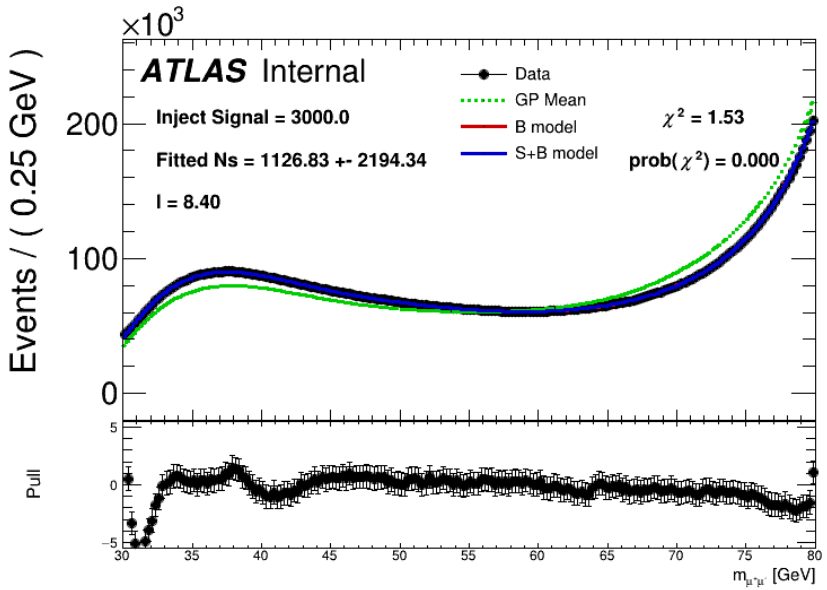


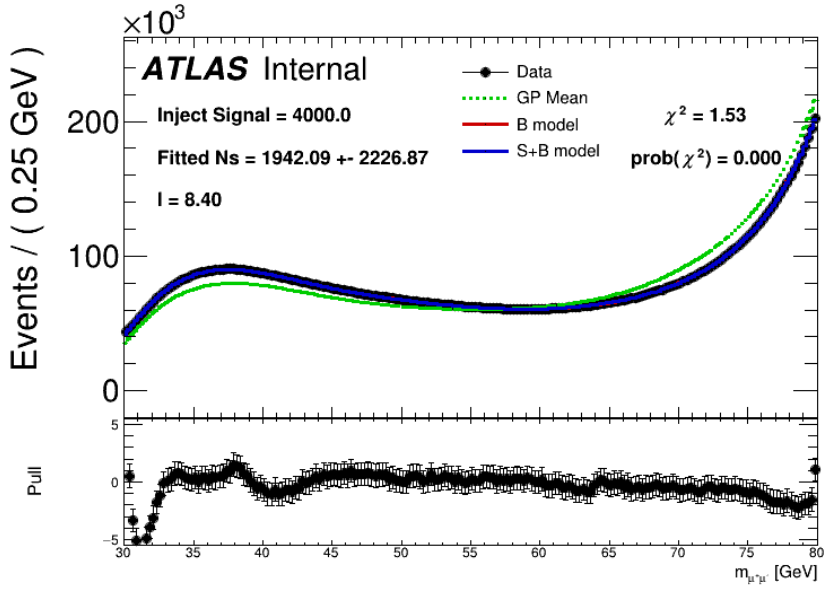
Signal injection test

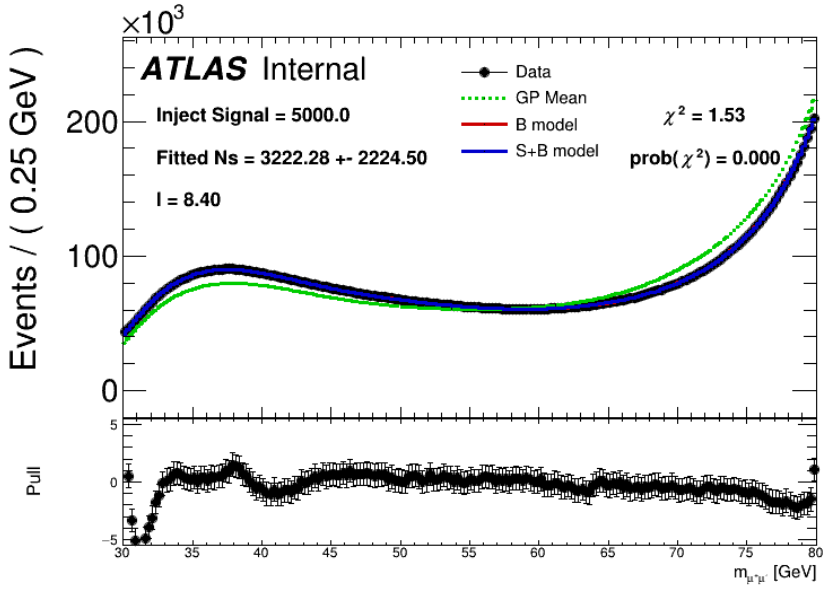
- 65：

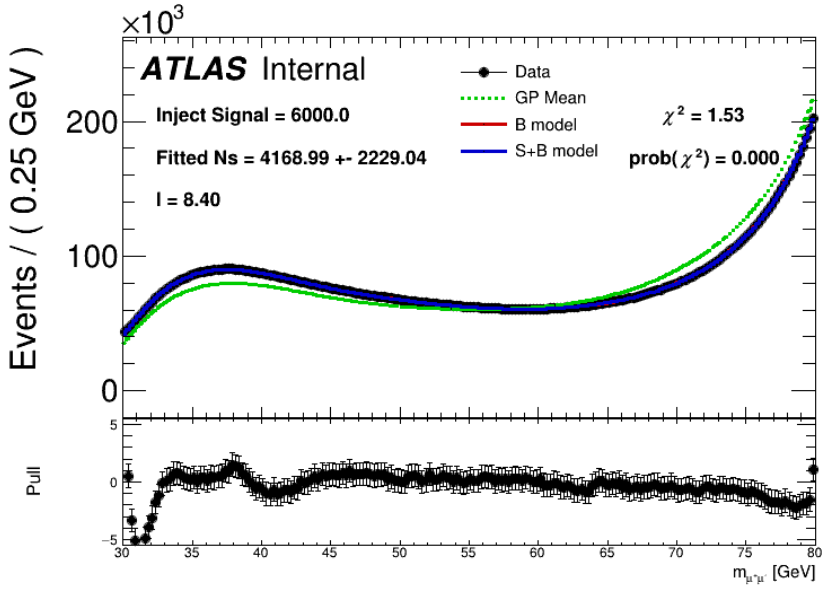






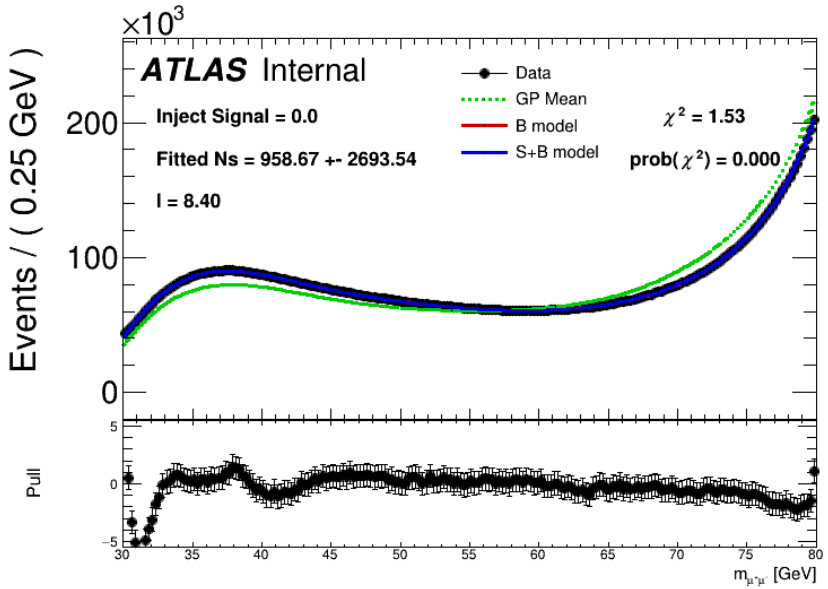


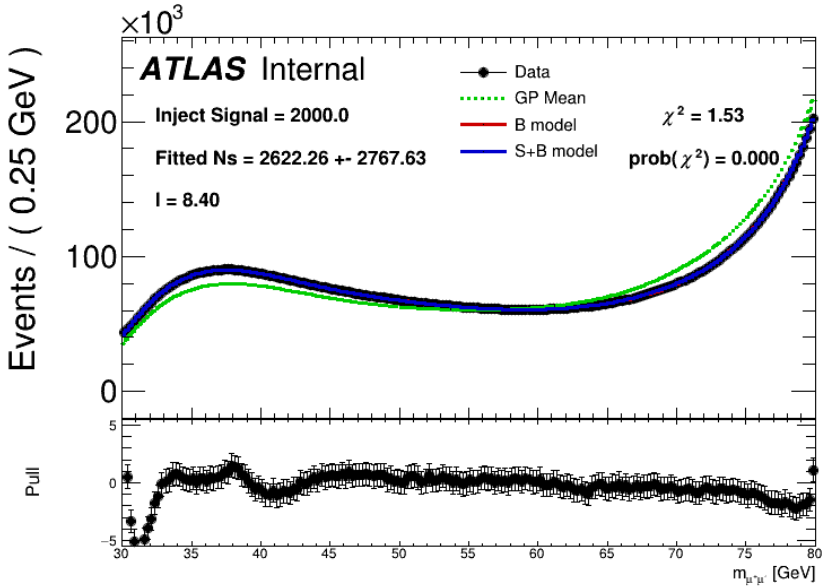


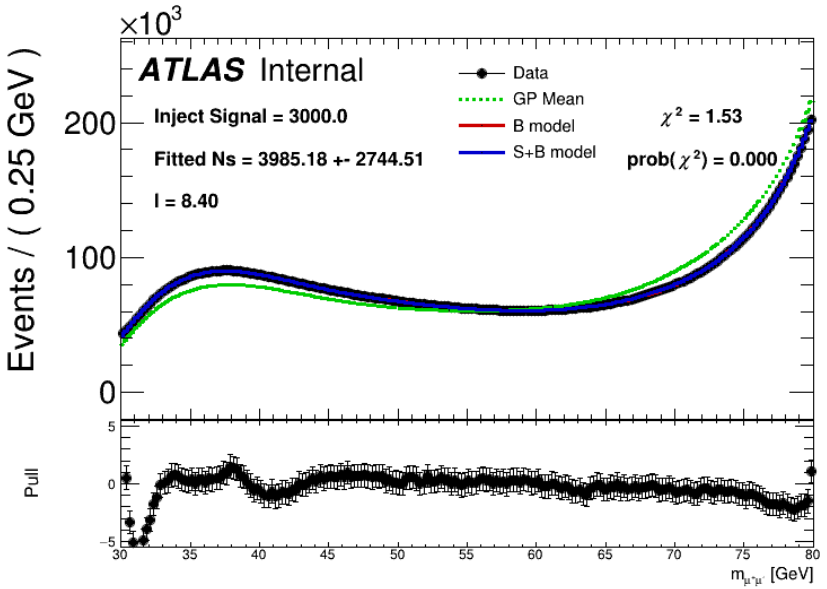


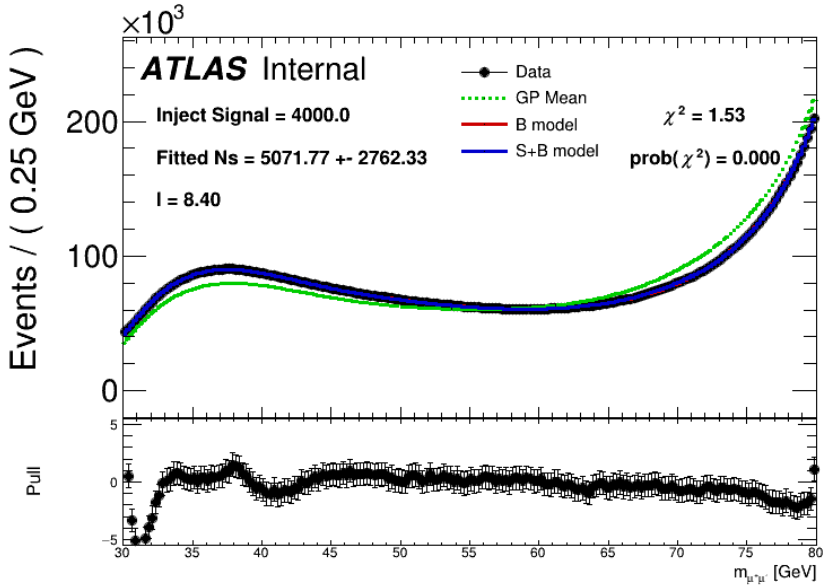
Signal injection test

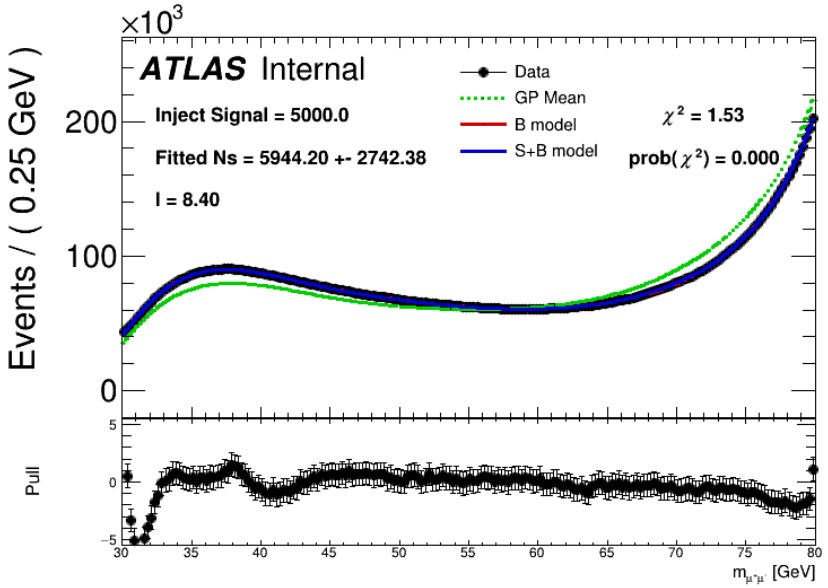
- 70：

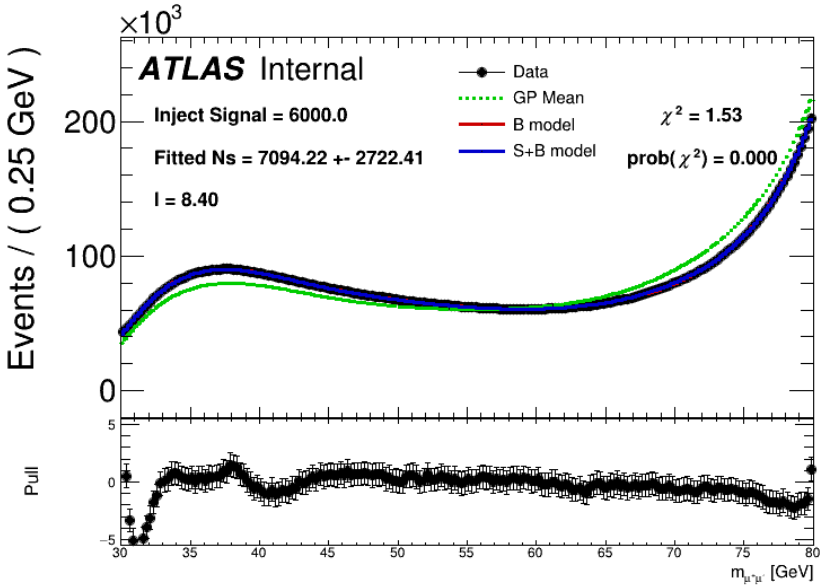






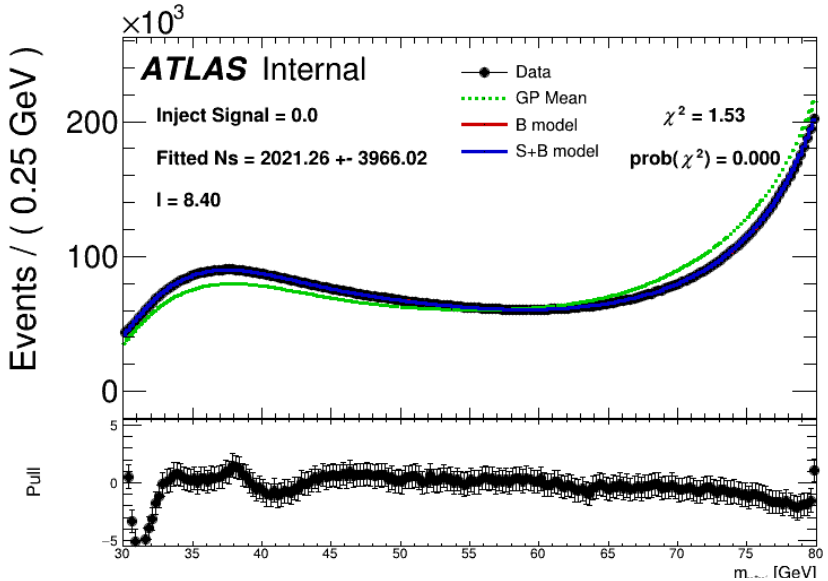


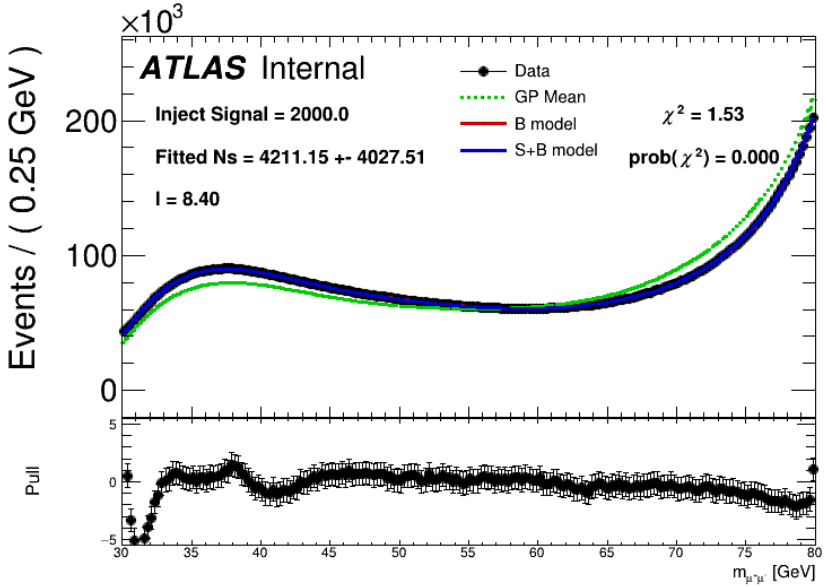


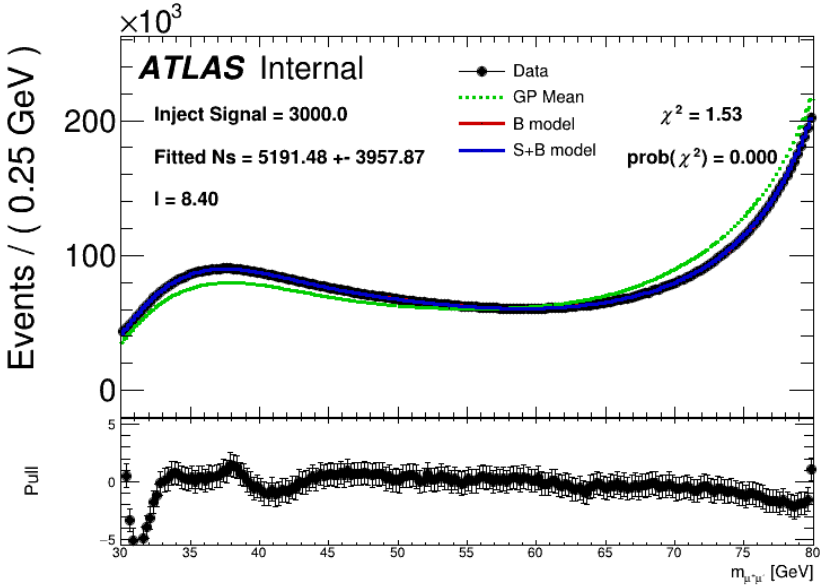


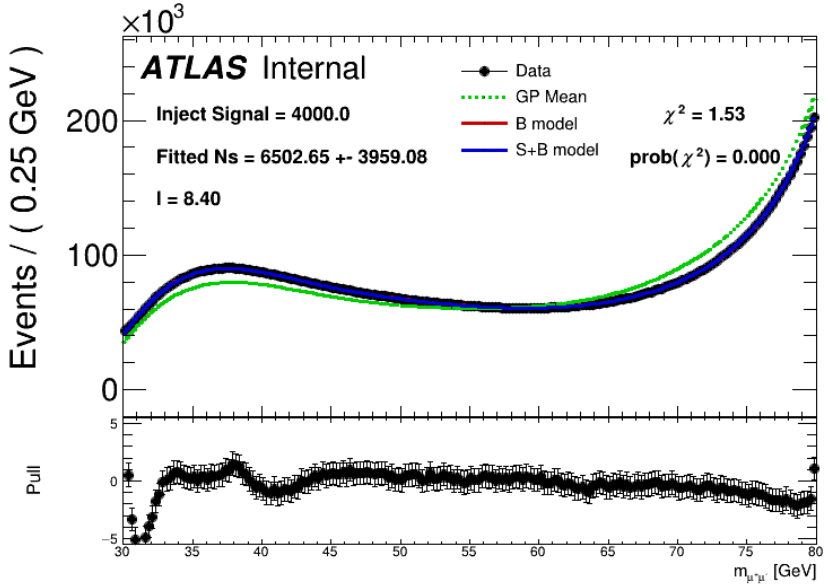
Signal injection test

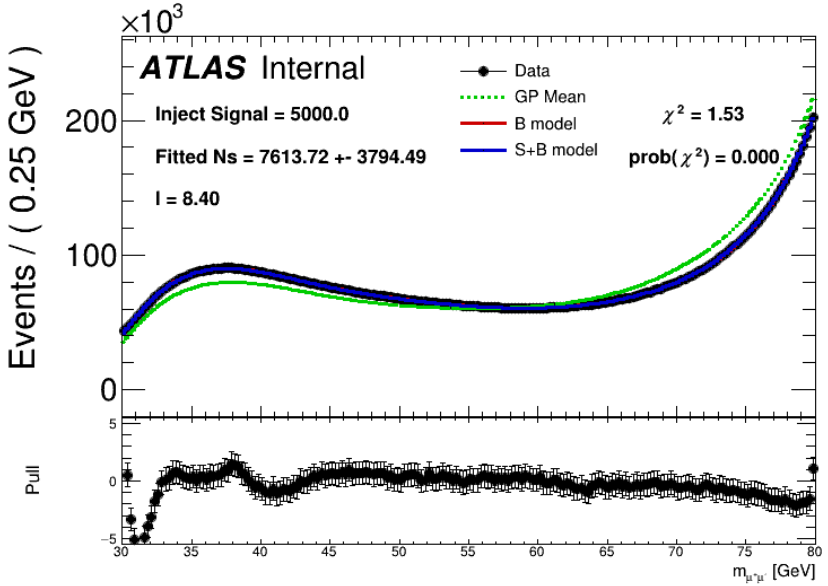
- 75：

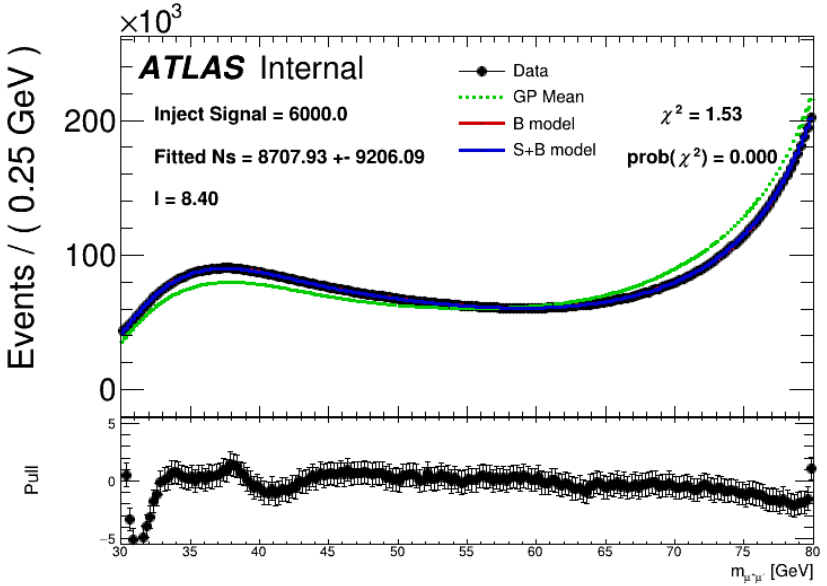










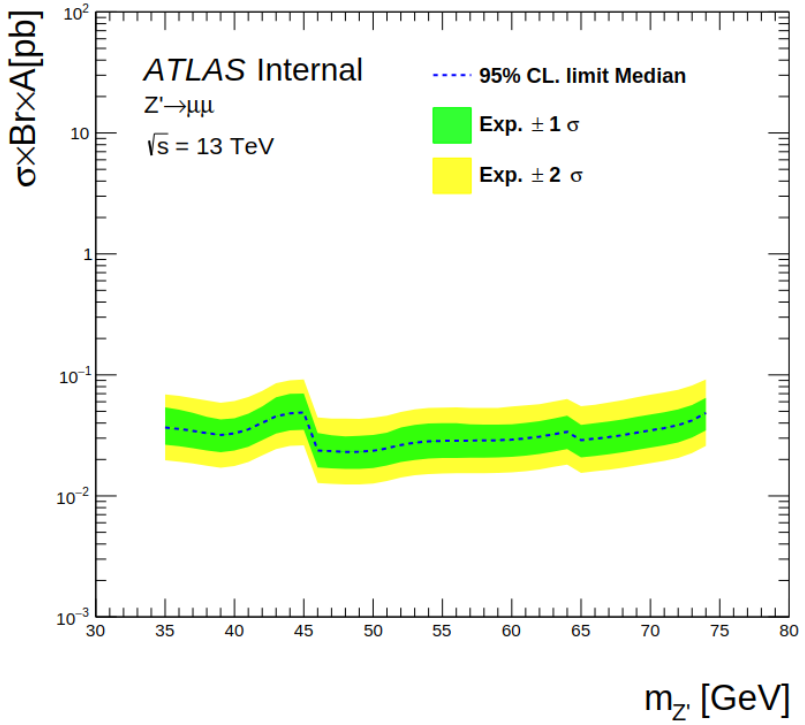


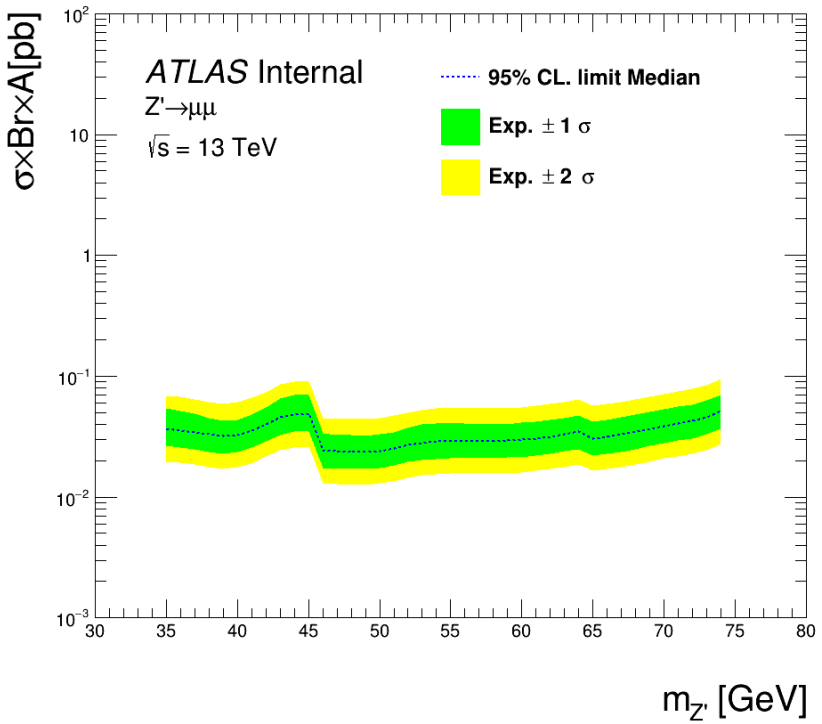
After apply ss sys.

- Final upper limit: (need to *2000/140000)
  - 35-45: 2.573 – 3.418
  - 45-64: 1.665 – 2.371
  - 64-74: 2.024 – 3.386

- Final upper limit: (need to *2000/140000)
  - 35-45: 2.576 – 3.418 (0.037 – 0.049)
  - 45-64: 1.700 – 2.426 (0.024 – 0.035)
  - 64-74: 2.150 – 3.586 (0.031 – 0.051)

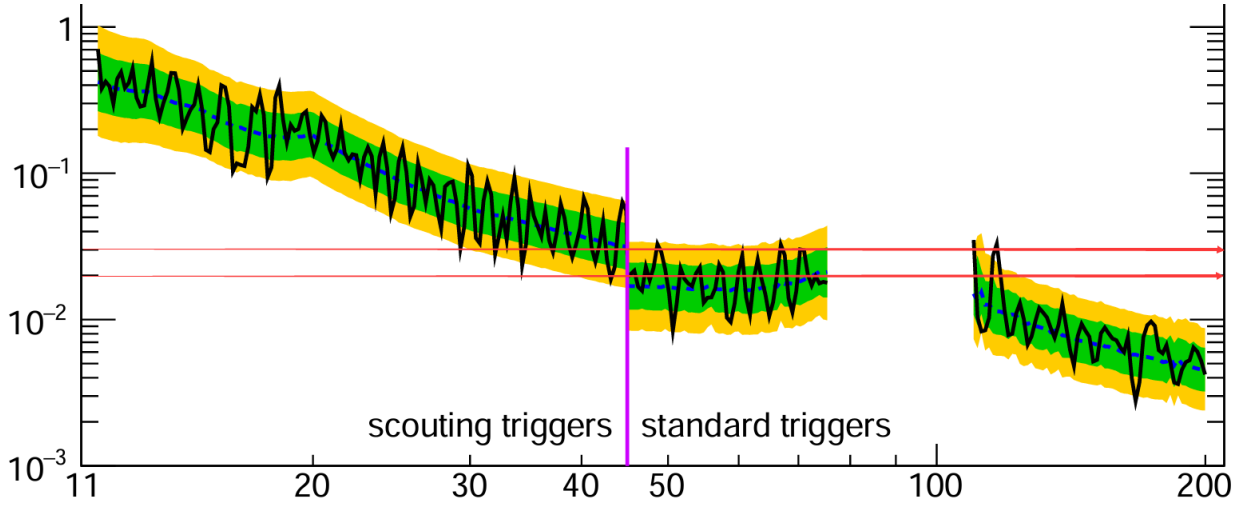
- The impact of ss sys equivalent to reducing l by 1 when keep K.

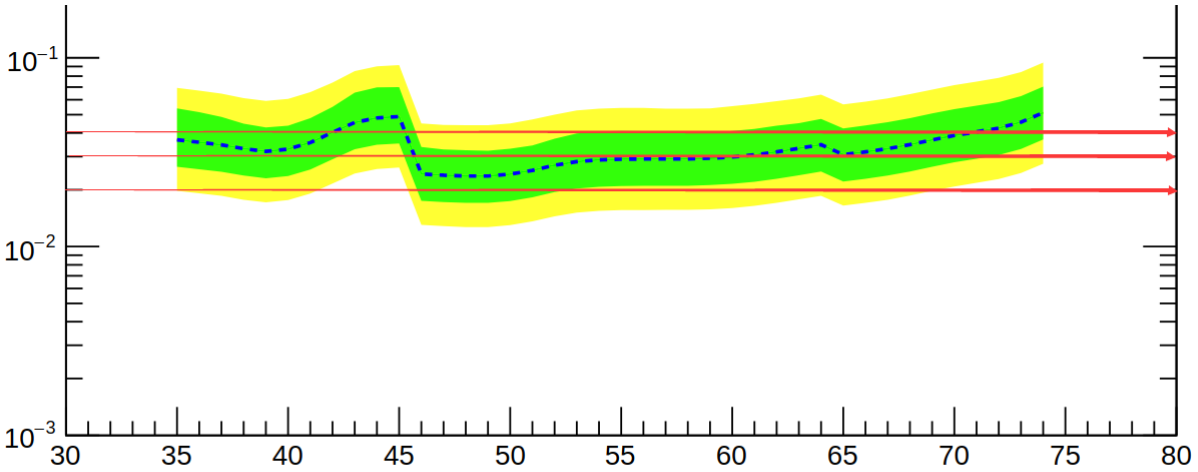




Compare with CMS.

- 0.01~0.03 (pb) worse than CMS





$m_{Z'}$ [GeV]

Resonanc	Observed limit [pb]		Resonanc	Observed
35	0.072		55.37	0.014
35.35	0.051		55.92	0.014
35.71	0.044		56.48	0.016
36.07	0.037		57.05	0.024
36.43	0.055		57.62	0.021
36.79	0.035		58.2	0.01
37.16	0.029		58.78	0.01
37.53	0.04		59.36	0.013
37.9	0.062		59.96	0.021
38.28	0.049		60.56	0.028
38.67	0.033		61.16	0.014
39.05	0.027		61.78	0.011
39.44	0.033		62.39	0.019
39.84	0.042		63.02	0.026
40.24	0.068		63.65	0.019
40.64	0.057		64.28	0.015
41.05	0.031		64.93	0.011
41.46	0.025		65.58	0.013
41.87	0.032		66.23	0.02
42.29	0.047		66.89	0.032
42.71	0.026		67.56	0.028
43.14	0.019		68.24	0.014
43.57	0.023		68.92	0.011
44.01	0.046		69.61	0.016
44.45	0.063		70.31	0.03
44.89	0.056		71.01	0.03
44.99	0.028		71.72	0.02
45	0.019		72.44	0.017
45.83	0.022		73.16	0.02
46.29	0.017		73.89	0.018
46.75	0.016		74.63	0.018
47.22	0.023		75	0.018

35	0.036798		55	0.029039
36	0.035693		56	0.02911
37	0.034582		57	0.029131
38	0.033012		58	0.029167
39	0.031935		59	0.029393
40	0.032832		60	0.029841
41	0.035553		61	0.030624
42	0.040262		62	0.031742
43	0.045463		63	0.033158
44	0.048051		64	0.034663
45	0.04882		65	0.030708
46	0.024261		66	0.031754
47	0.023882		67	0.032999
48	0.023662		68	0.03469
49	0.023653		69	0.036748
50	0.0242		70	0.038787
51	0.025339		71	0.040532
52	0.02698		72	0.042429
53	0.028173		73	0.045669
54	0.028798		74	0.051227

Compare with CMS.

Resonanc	Observed	Resonanc	Observed
35	0.072	55.37	0.014
35.35	0.051	55.92	0.014
35.71	0.044	56.48	0.016
36.07	0.037	57.05	0.024
36.43	0.055	57.62	0.021
36.79	0.035	58.2	0.01
37.16	0.029	58.78	0.01
37.53	0.04	59.36	0.013
37.9	0.062	59.96	0.021
38.28	0.049	60.56	0.028
38.67	0.033	61.16	0.014
39.05	0.027	61.78	0.011
39.44	0.033	62.39	0.019
39.84	0.042	63.02	0.026
40.24	0.068	63.65	0.019
40.64	0.057	64.28	0.015
41.05	0.031	64.93	0.011
41.46	0.025	65.58	0.013
41.87	0.032	66.23	0.02
42.29	0.047	66.89	0.032
42.71	0.026	67.56	0.028
43.14	0.019	68.24	0.014
43.57	0.023	68.92	0.011
44.01	0.046	69.61	0.016
44.45	0.063	70.31	0.03
44.89	0.056	71.01	0.03
44.99	0.028	71.72	0.02
45	0.019	72.44	0.017
45.83	0.022	73.16	0.02
46.29	0.017	73.89	0.018
46.75	0.016	74.63	0.018
47.22	0.023	75	0.018