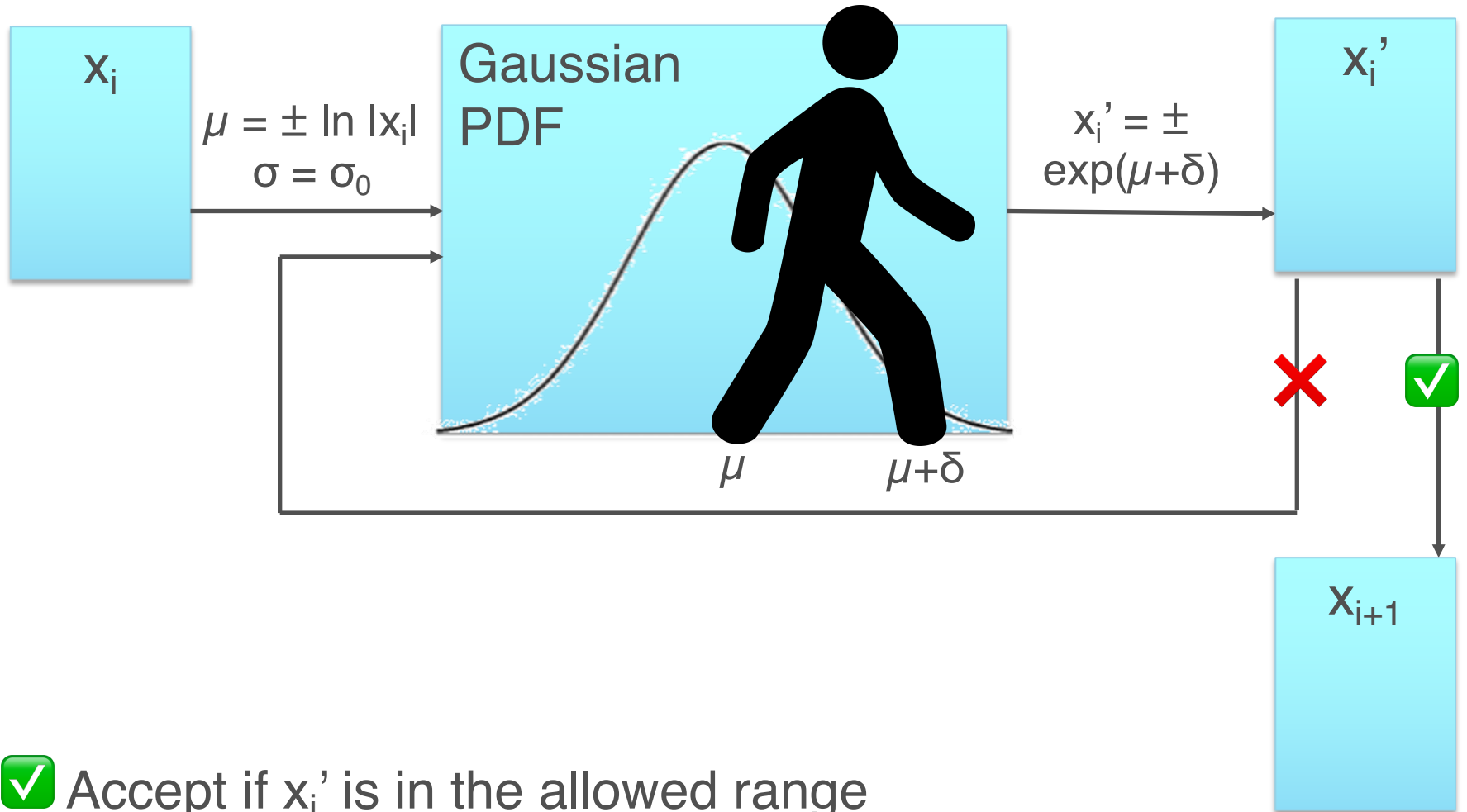# A first look at pMSSM scan dependence on step size

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Log stepping, fixed width gaussian


x_i

$\mu = \pm \ln |x_i|$
$\sigma = \sigma_0$

Gaussian
PDF

μ $\mu+\delta$

$x_i' = \pm$
$\exp(\mu+\delta)$

x_i'

❌   ✅

x_{i+1}

✅ Accept if x_i' is in the allowed range
and $L(x_i')$ satisfies criteria

🐝 **Fermilab**

Varying width of Gaussian

- Width of Gaussian used for stepping = σ_0 = width_coefficient * (param_max - param_min)
- ~5000 points run for width coefficient = 0.01, 0.05, 0.10
- Look at mean and std of each pMSSM parameter
  - Should see std ~increase with width coefficient
  - Ignore accepted/rejected classification for now

🎇 Fermilab

Varying width of Gaussian

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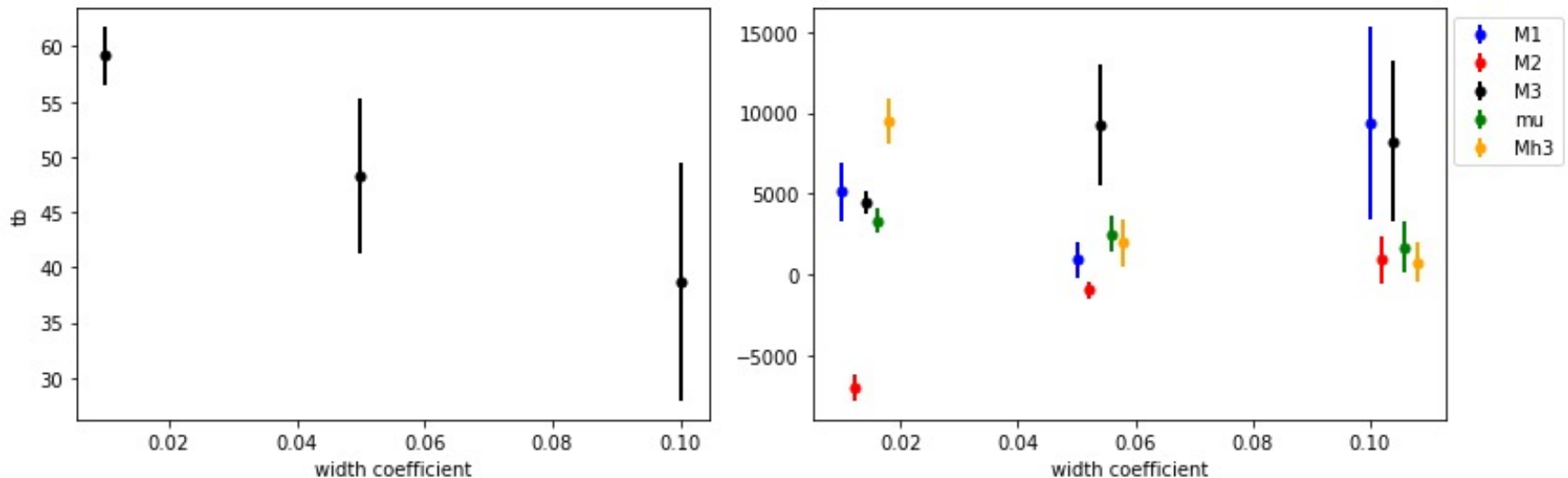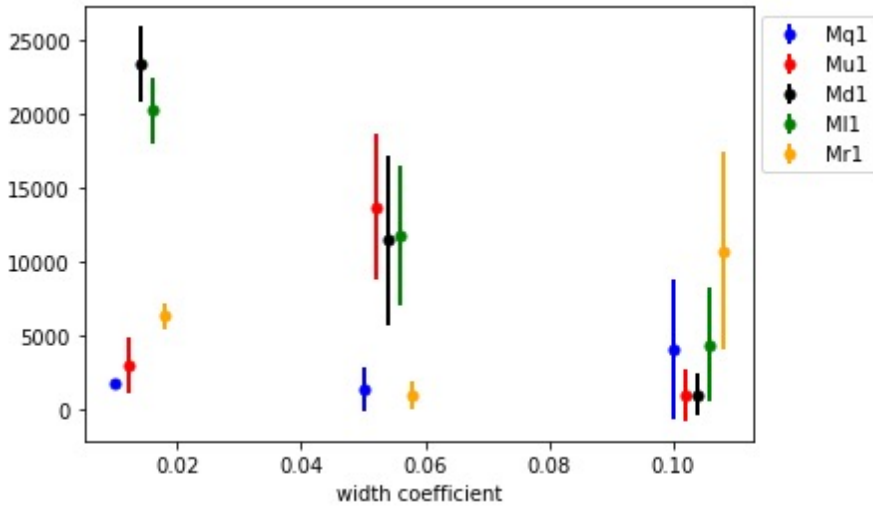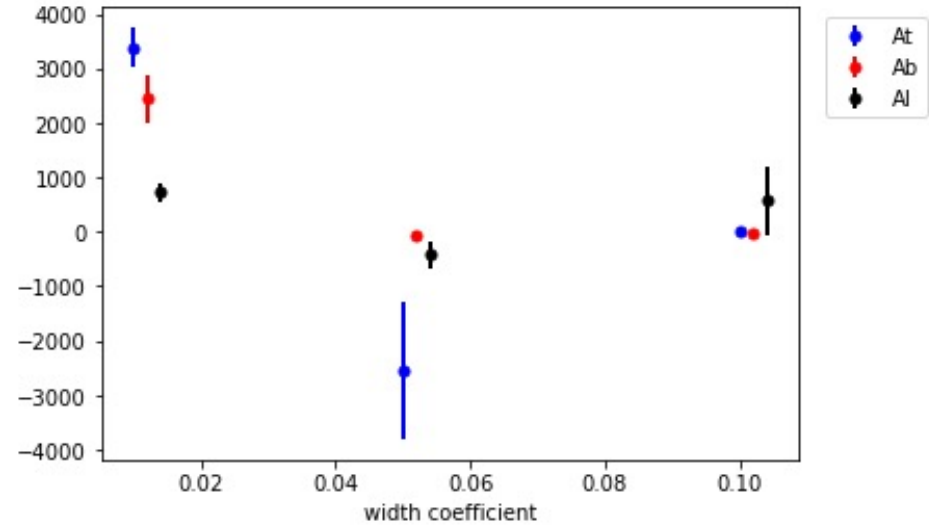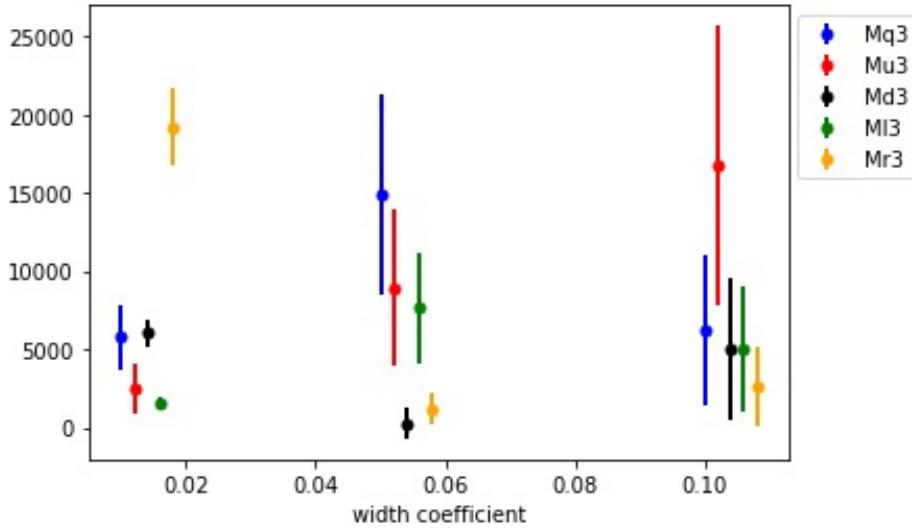
Varying width of Gaussian

- Width of Gaussian used for stepping =
  width_coefficient * (param_max - param_min)

width_coefficient	0.01 (last time)	0.05	0.1
Npoints total	5000	5002	5001
Npoints accepted	160	44	16
None accepted after	193	87	70
Reason	Not sure yet	Too high likelihood	Too high likelihood

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Last accepted points, width coefficient = 0.01

Higgs signals χ² → χ^2

Higgs mass

Total likelihood

rejected
accepted
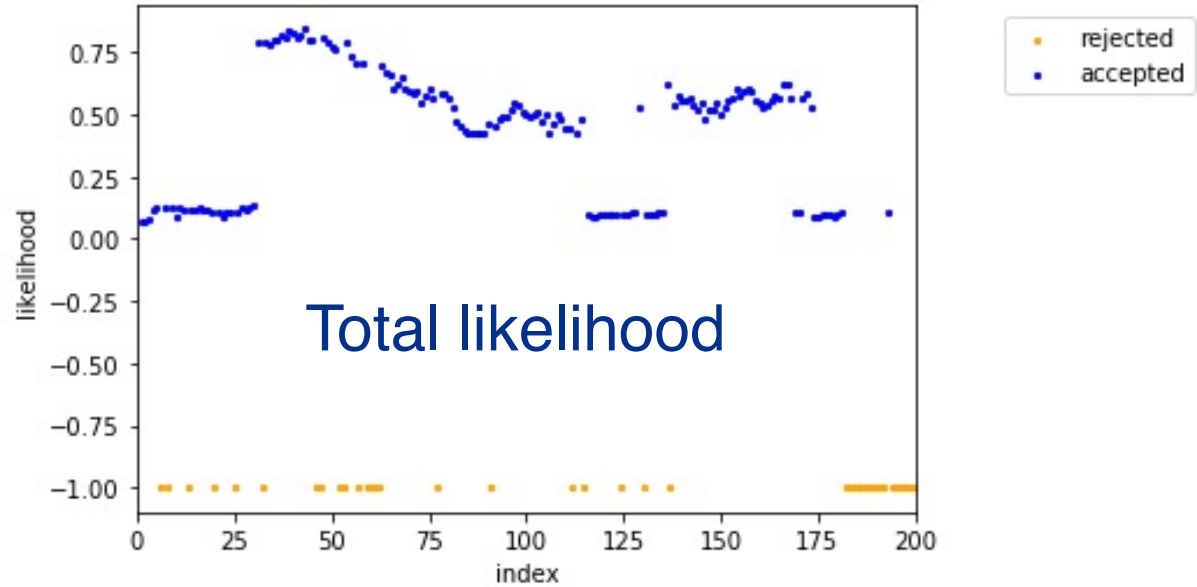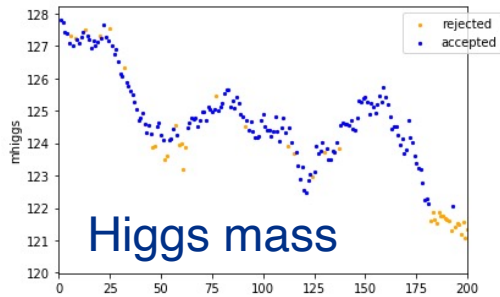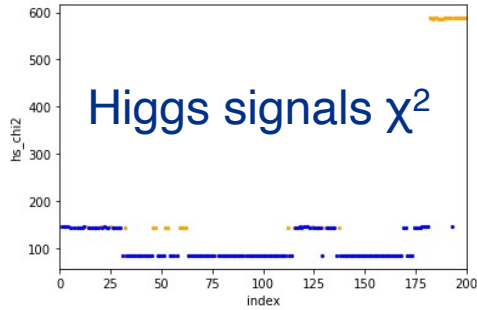
```
In [71]: accepted_df.iloc[[-3,-2,-1]][['tb', 'M1', 'M2', 'M3', 'Mh3', 'mu', 'Al', 'Ab', 'At']]
```
Out[71]:

	tb	M1	M2	M3	Mh3	mu	Al	Ab	At
179	60.379249	3957.3707	-6699.0735	5330.2195	9962.2022	3433.5933	661.37624	2363.4177	4351.6448
180	60.812939	4367.8915	-6520.5688	4468.7668	10093.2320	3653.4172	600.47465	2334.6066	4243.7747
192	60.341764	4831.1584	-6868.7579	4565.5147	9386.2126	3188.5204	697.39597	2367.1262	3962.3857

```
In [72]: accepted_df.iloc[[-3,-2,-1]][['Mr1', 'Mr3', 'Ml1', 'Ml3', 'Mq1', 'Mq3', 'Md1', 'Md3', 'Mu1', 'Mu3']]
```
Out[72]:

	Mr1	Mr3	Ml1	Ml3	Mq1	Mq3	Md1	Md3	Mu1	Mu3
179	5714.4504	21252.052	21158.239	1528.9510	1700.3579	8507.5208	25741.766	7639.8529	2362.1890	2186.6423
180	5638.3162	19374.838	21859.682	1399.9314	1816.5188	7498.2089	27256.122	6744.9382	2219.1616	2095.9028
192	6360.6332	20124.114	20809.727	1482.8048	1805.8753	5417.4048	22650.457	5984.7586	2780.4072	2204.8603

Last accepted points, width coefficient = 0.05

Total likelihood
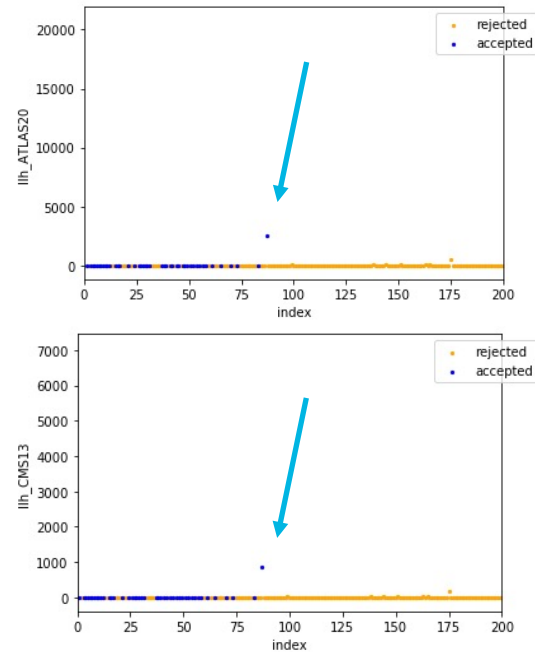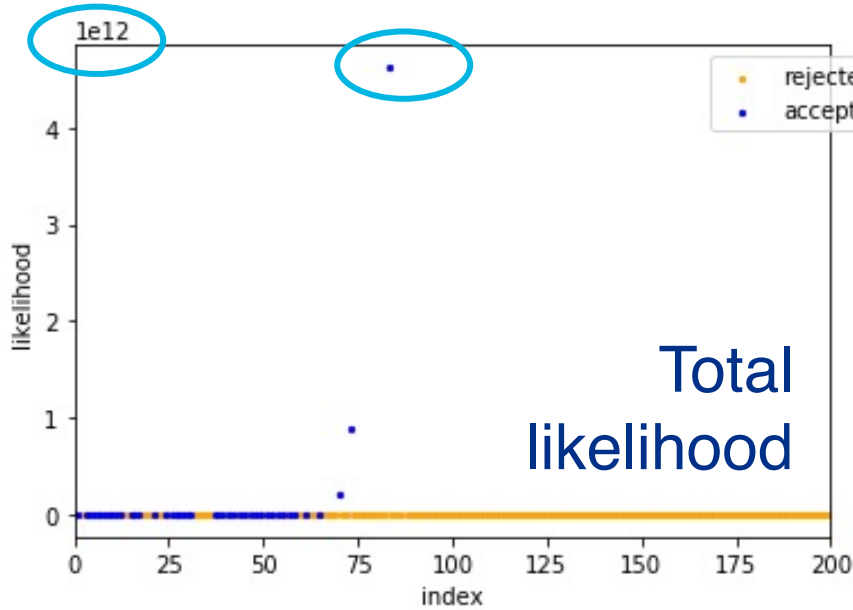
ATLAS and CMS Heavy H(ττ) from Higgs Bounds

```
In [154]:  accepted_df.iloc[[-3,-2,-1]][['tb', 'M1', 'M2', 'M3', 'Mh3', 'mu', 'Al', 'Ab', 'At']]
```

Out[154]:

	tb	M1	M2	M3	Mh3	mu	Al	Ab	At
72	40.019208	759.52749	-158.36469	5071.4745	1180.8504	4105.2731	-308.05460	-33.014392	-1384.0803
82	51.065733	446.91349	-716.43896	7569.5460	1304.6598	1555.9444	-298.77571	-39.319519	-2886.1270
86	50.796781	730.79761	-828.95832	8432.2355	1367.5129	2039.5229	-375.61081	-51.708700	-2273.0393

```
In [155]:  accepted_df.iloc[[-3,-2,-1]][['Mr1', 'Mr3', 'Ml1', 'Ml3', 'Mq1', 'Mq3', 'Md1', 'Md3', 'Mu1', 'Mu3']]
```

Out[155]:

	Mr1	Mr3	Ml1	Ml3	Mq1	Mq3	Md1	Md3	Mu1	Mu3
72	805.61330	2545.25250	10658.664	8476.5047	3098.2308	9496.0507	10205.7240	159.05512	12290.506	3149.0763
82	1224.61270	1528.51180	14079.773	6813.6875	3259.8789	7892.8211	9261.4583	167.49087	17542.906	10554.5040
86	753.78145	906.86596	11518.179	7352.5376	1136.4460	15138.7400	11205.3730	137.59123	15769.794	7941.8770

Last accepted points, width coefficient = 0.1

Total likelihood

CMS 8 and 13 TeV Heavy H(ττ) from Higgs Bounds

```
In [30]: accepted_df.iloc[[-3,-2,-1]][['tb', 'M1', 'M2', 'M3', 'Mh3', 'mu', 'Al', 'Ab', 'At']]
```
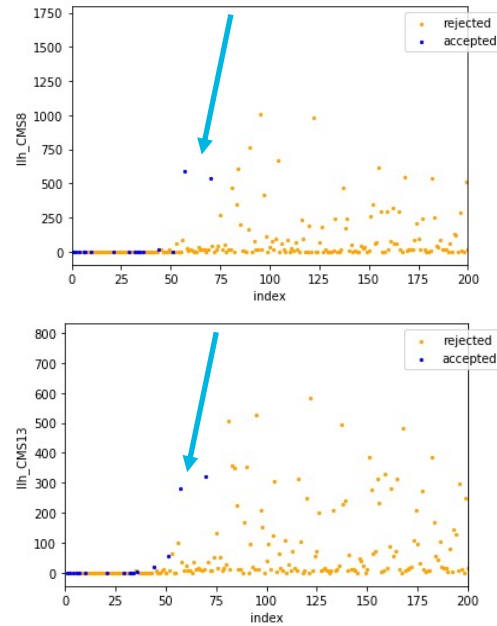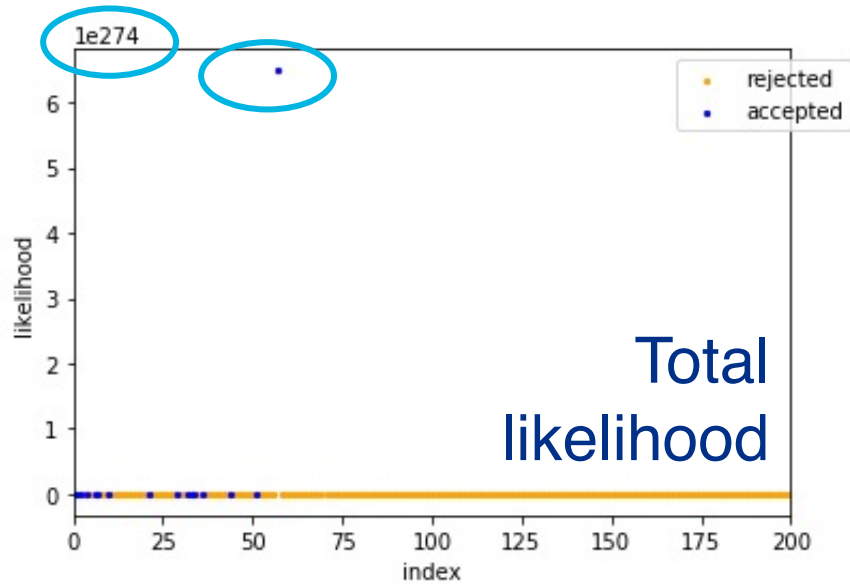
Out[30]:

	tb	M1	M2	M3	Mh3	mu	Al	Ab	At
50	53.688493	5857.1555	447.10167	10945.8080	1377.37870	2035.2003	1052.67660	-7.638251	16.584306
56	36.290925	13386.5200	293.35292	7464.3345	146.50785	2469.6134	262.04399	-2.907024	13.436153
69	38.303189	8805.7576	515.18824	16443.1170	169.57514	1629.9494	361.78540	-17.376888	18.094071

```
In [31]: accepted_df.iloc[[-3,-2,-1]][['Mr1', 'Mr3', 'Ml1', 'Ml3', 'Mq1', 'Mq3', 'Md1', 'Md3', 'Mu1', 'Mu3']]
```

Out[31]:

	Mr1	Mr3	Ml1	Ml3	Mq1	Mq3	Md1	Md3	Mu1	Mu3
50	4931.3442	1145.12990	2313.5778	1901.1590	12421.3270	8027.7561	353.30923	6536.1474	1374.63190	10444.235
56	1014.6962	393.06278	15298.9440	4163.9496	1764.5717	5819.8671	224.37123	7489.3005	1320.56360	22421.602
69	11340.1700	1150.65600	2437.5253	3512.8848	2448.4602	8346.9616	435.51009	3649.7836	318.58228	30175.147

8

Backup

Observables in likelihood

Superiso	SPheno	FeynHiggs	Higgs Signals	Higgs Bounds
$\Delta_0(B\to K\gamma)$	$BR(B^+ \to \tau\nu)$*	m_W	LHC Higgs meas. (includes m_H)	LHC Higgs Heavy $H(\tau\tau)$
$BR(b\to s\gamma)$	$BR(D_s\to \tau\nu)$*			
$BR(B_s\to\mu\mu)$	$BR(D_s\to\mu\nu)$*			
$BR(B_d\to\mu\mu)$	$\Delta(\rho)$ *			
$BR(b\to s\mu\mu)$	m_{top}			
$BR(b\to see)$	α_S			
$BR(B0\to K^{*0}\gamma)$	m_{bottom}			

* Missing for v1.3

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Parameter ranges

Parameter	Minimum	Maximum	Stepping
tan β	1	60	Log
M_A	100 GeV	25 TeV	Log
$|\mu|$	80 GeV	25 TeV	Log
$|M_1|$	1 GeV	25 TeV	Log
$|M_2|$	70 GeV	25 TeV	Log
M_3	200 GeV	50 TeV	Log
$m_L 123\sim$, $m_e 123\sim$	90 GeV	25 TeV	Log
$m_Q 12\sim$, $m_u 12\sim$, $m_d 12\sim$	200 GeV	50 TeV	Log
$m_Q 3\sim$, $m_u 3\sim$, $m_d 3\sim$	100 GeV	50 TeV	Log
$|A_b|$, $|A_\tau|$	1 GeV	7 TeV	Log
$|A_t|$	1 GeV	$3\sqrt{(m_Q 3\sim m_u 3\sim)}$	Log

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