pMSSM scan update

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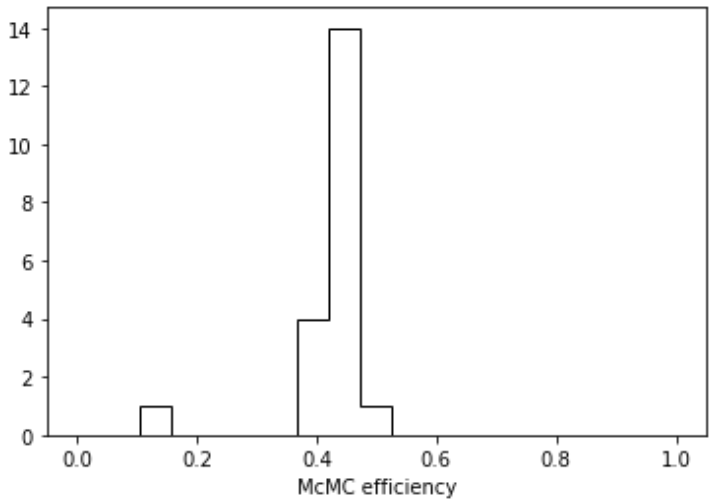
September 29, 2021

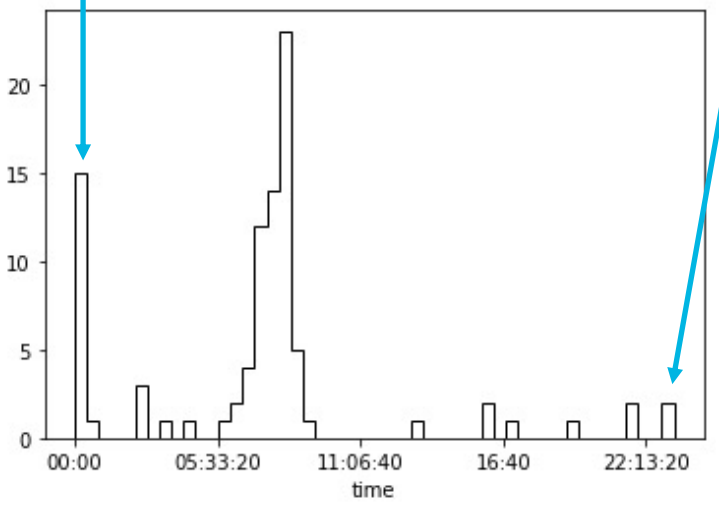
A big test scan

- Launched 100 parallel scans x 20,000 points
  - Signs chosen at random
- McMC acceptance efficiency 43%

Failed due to bug in batch submission (now fixed)

lxplus queue allows up to 1 week!





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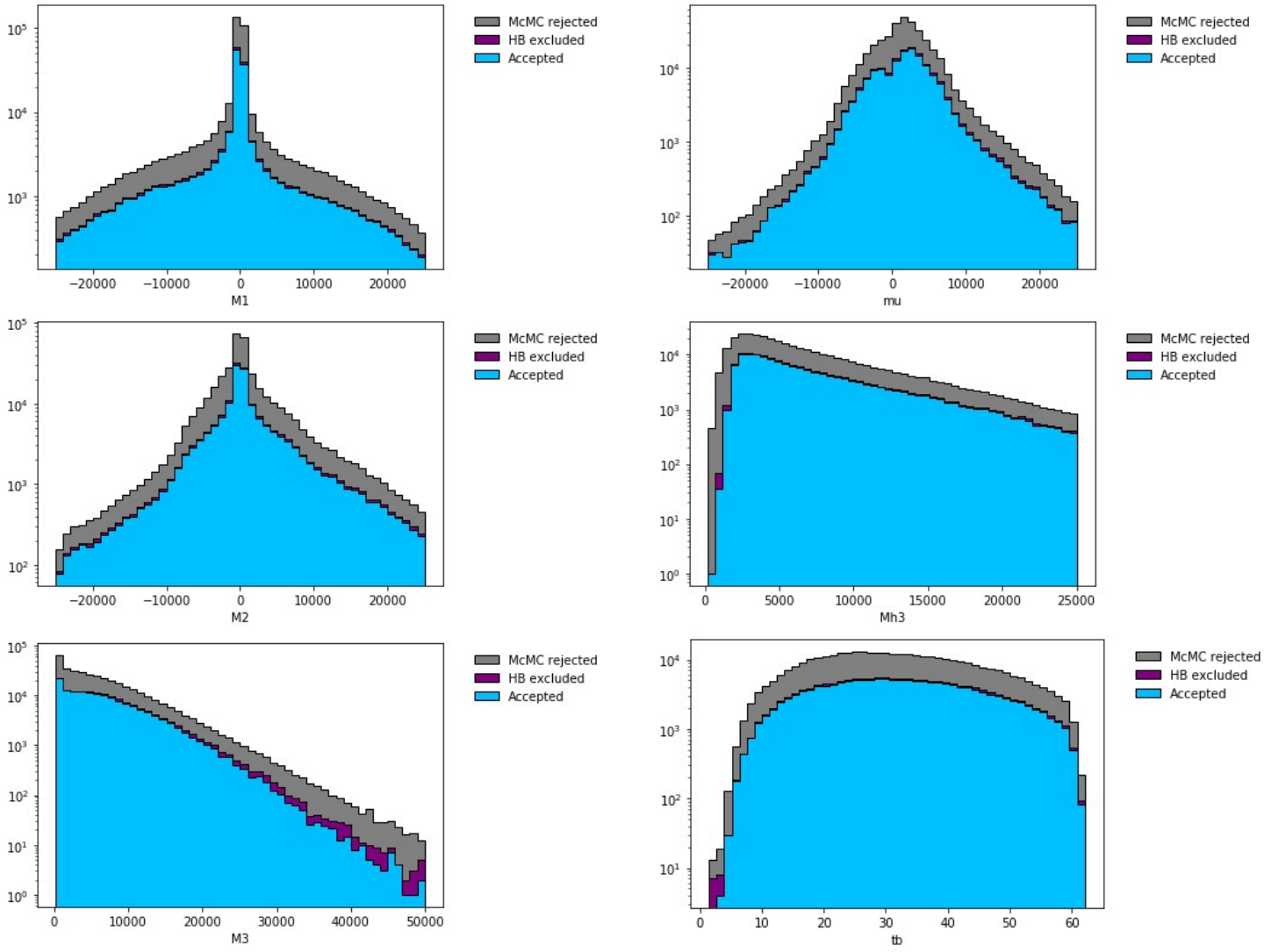
McMC likelihood

- Contributions from **SPheno** and **FeynHiggs**: Gaussian with mean/width = experimental value/uncertainty
- Contributions from **Superiso**, **HiggsSignals**, and **HiggsBounds**: χ^2 is calculated directly by the program

Superiso 4.0	**SPheno 4.0.4**	**FeynHiggs 2.18.0**	**Higgs Signals 2.6.0**	**Higgs Bounds 5.9.1**
$\Delta_0(B\to K\gamma)$	$BR(B^+ \to \tau\nu)$	m_H, H properties →	LHC Higgs meas. →	LHC Heavy H($\tau\tau$)
$BR(b\to s\gamma)$	$BR(D_s\to \tau\nu)$			
$BR(B_s\to\mu\mu)$	$BR(D_s\to\mu\nu)$			
$BR(B_d\to\mu\mu)$	α_S			
$BR(b\to s\mu\mu)$	m_{top}			
$BR(b\to see)$	m_{bottom}			
$BR(B0\to K^{*0}\gamma)$				

pMSSM params (1)

✅ Log stepping works
✅ Sign choice works



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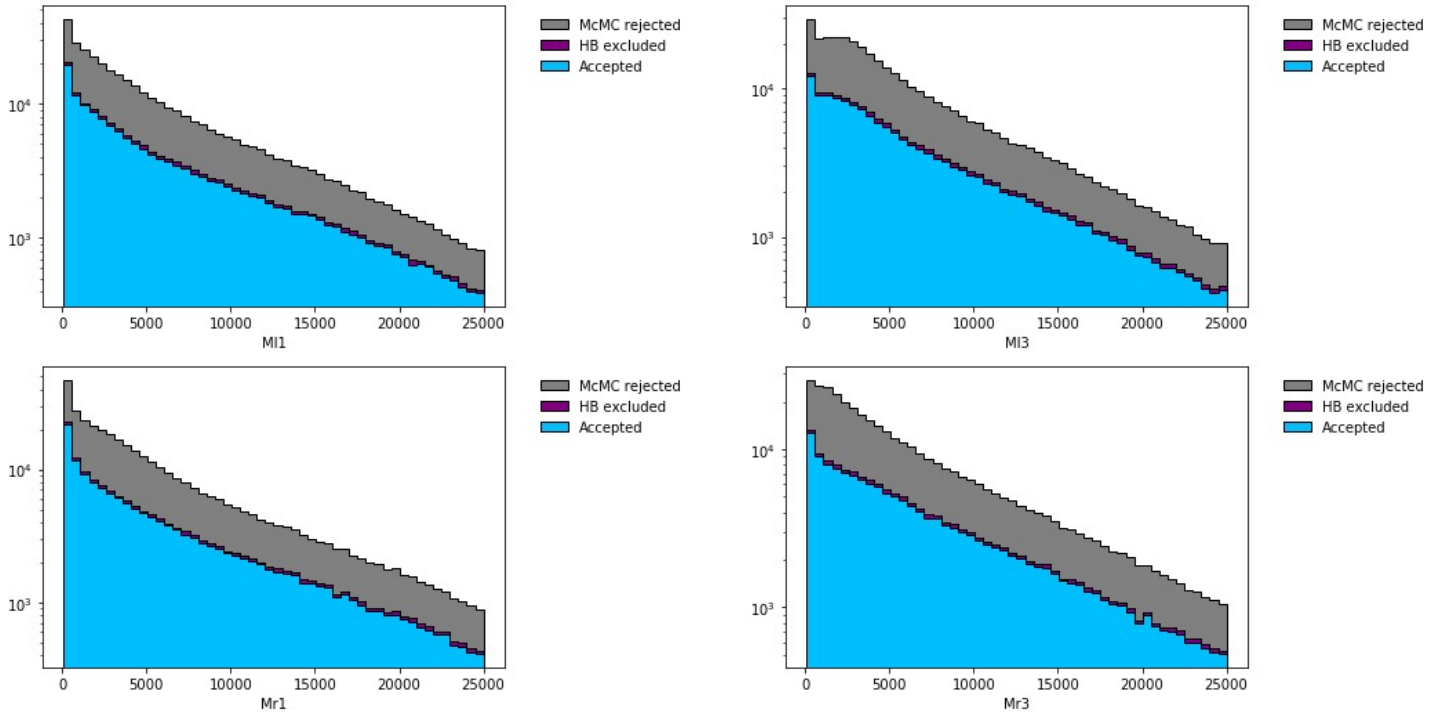
pMSSM params (2)

✅ Log stepping works
✅ Sign choice works



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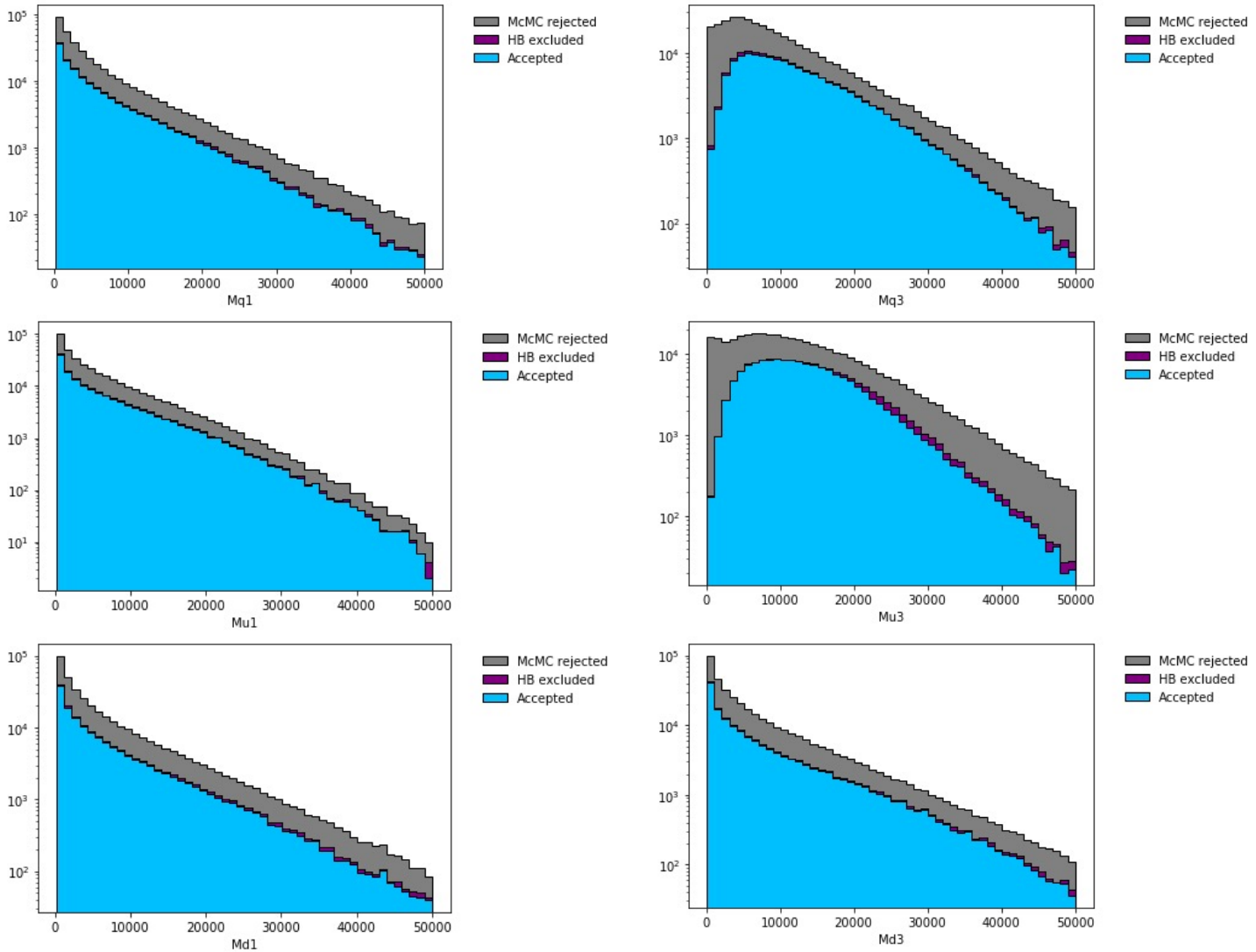
pMSSM params (3)

✅ Log stepping works
✅ Sign choice works



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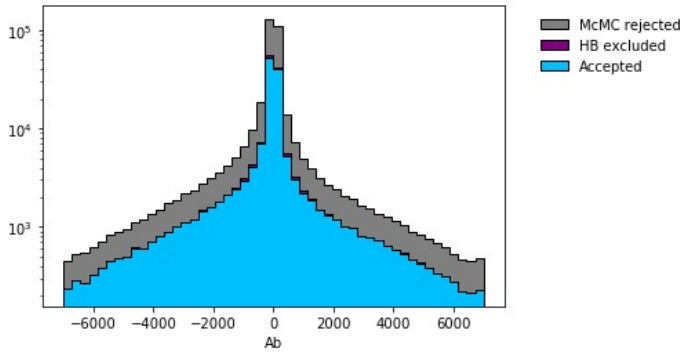
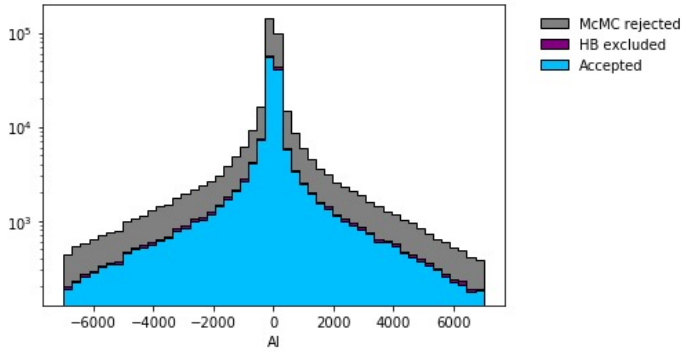
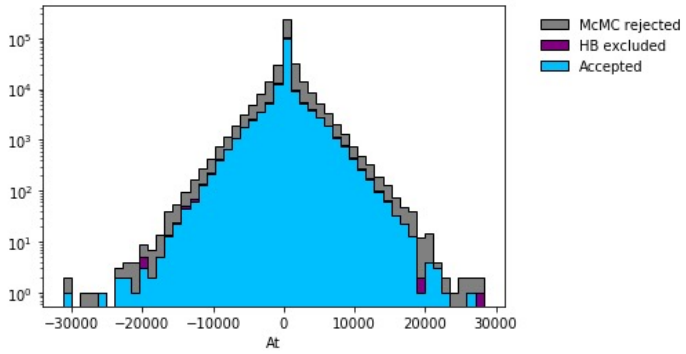
pMSSM params (4)

✅ Log stepping works
✅ Sign choice works







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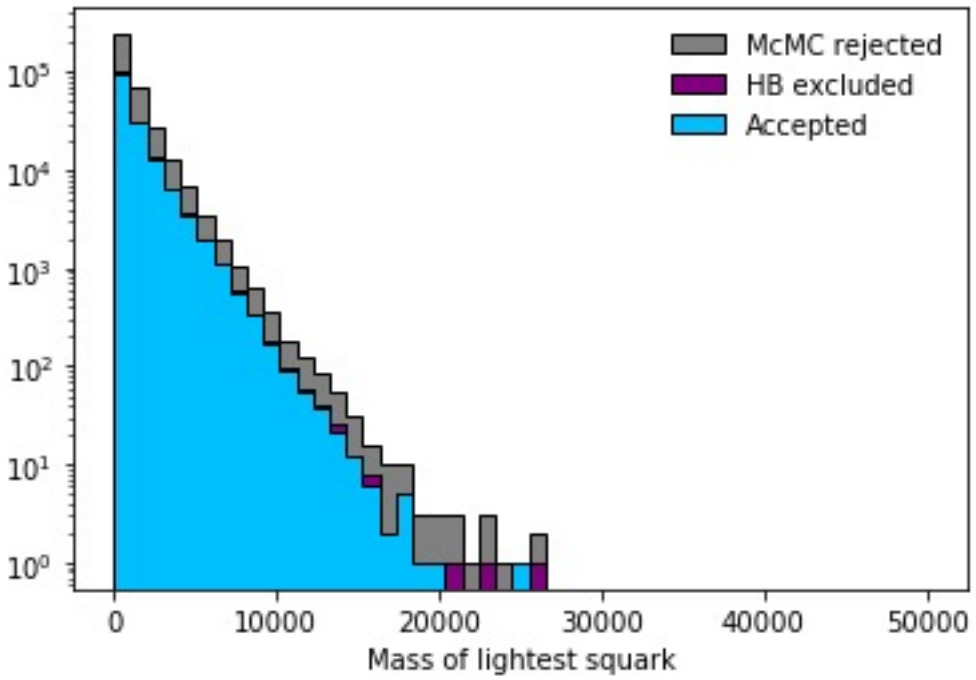
Mass of lightest squark

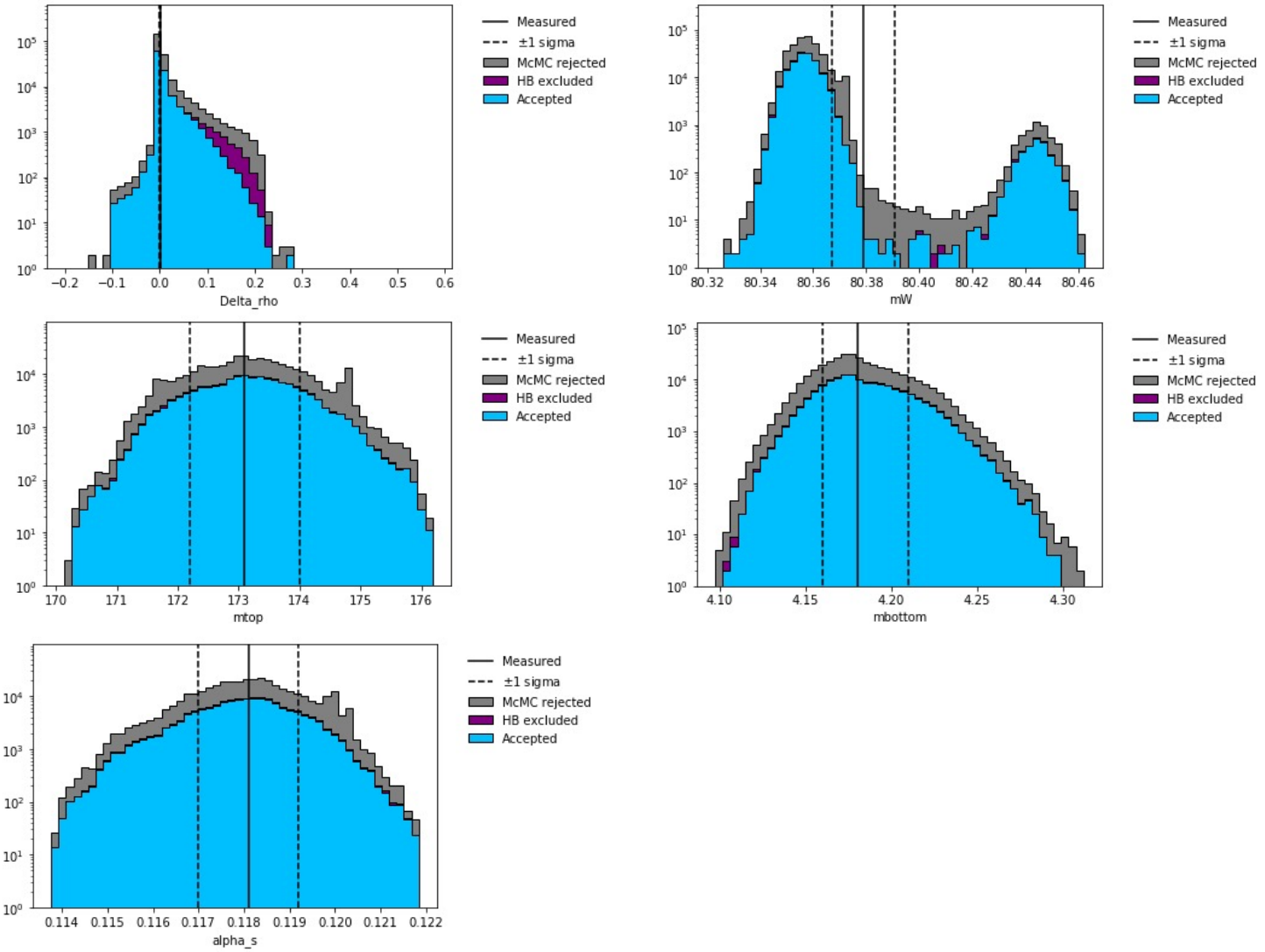
- Gaussian step width = 5% of parameter range
  - 0.17% of accepted points > 10 TeV



Will run some tests with 10%, 20% width

Don't think we should go lower …

Physics observables



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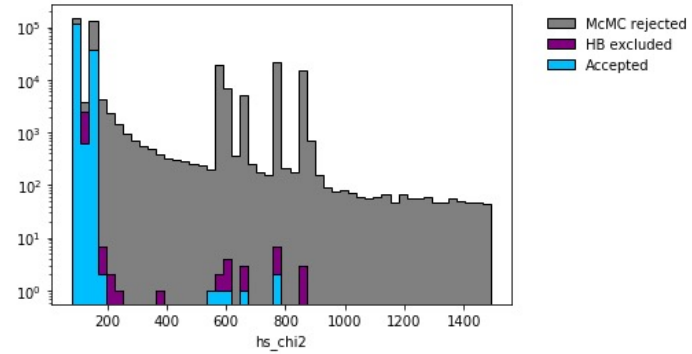
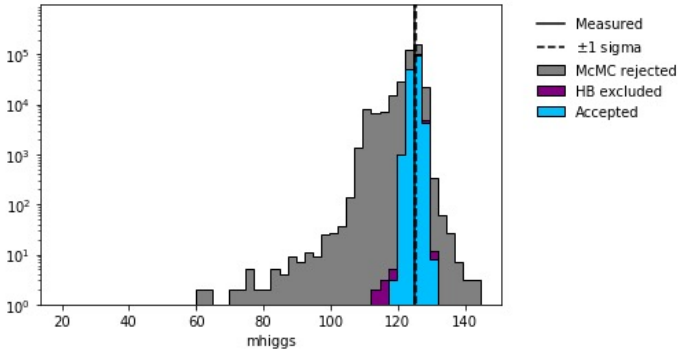
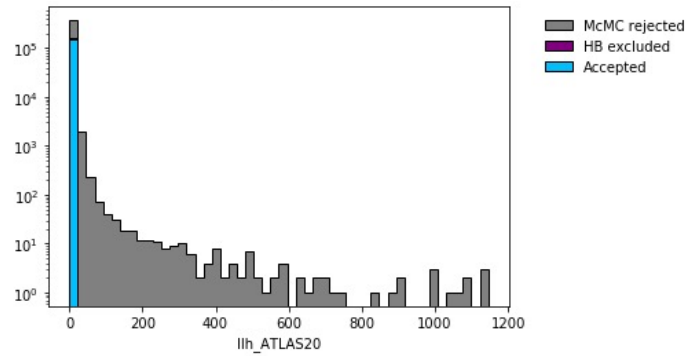
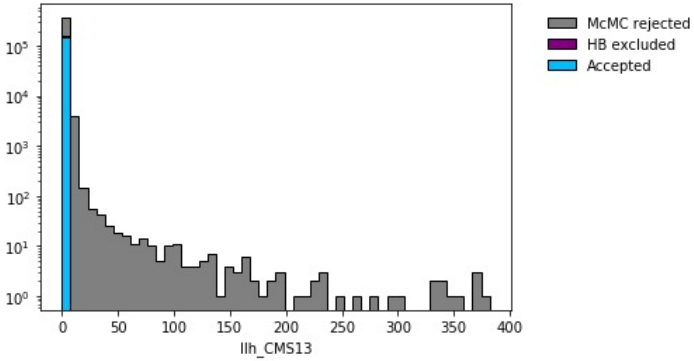
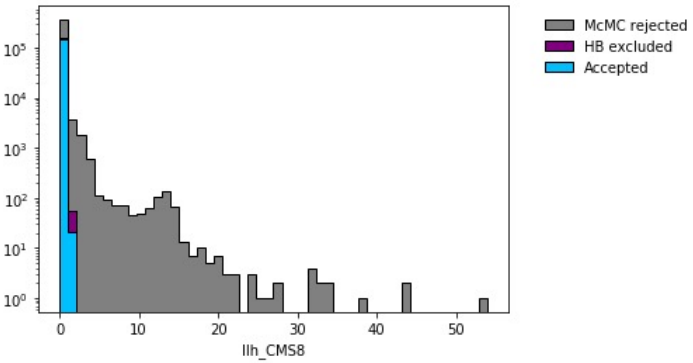
Likelihood contributions

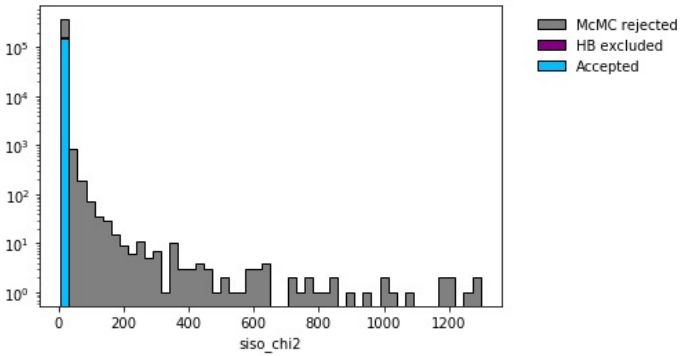












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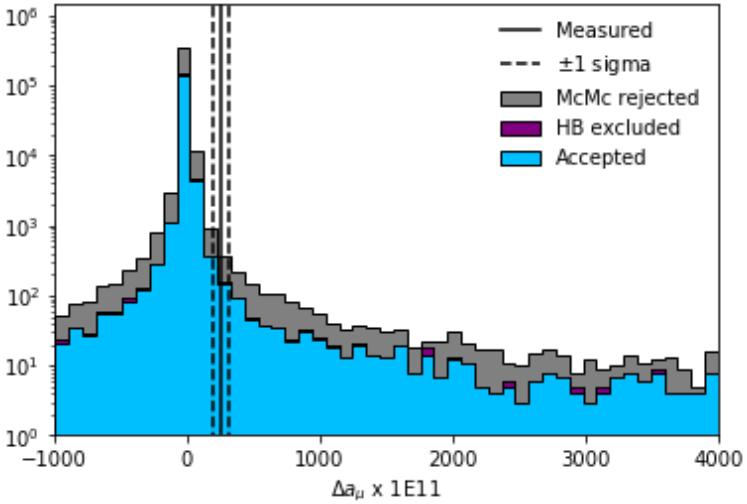
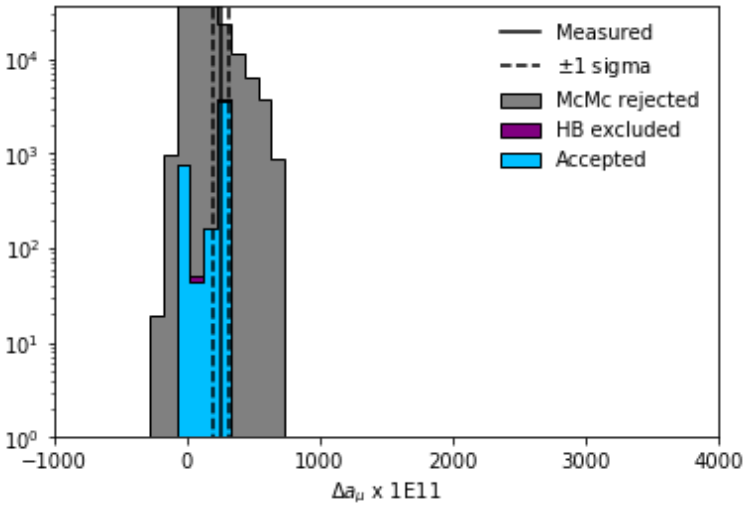
Adding Δa_μ to the likelihood

- Launched 100 parallel scans x 20,000 points
  - Many failed due to bug in batch submission
- McMC acceptance efficiency 1.7%
- Negligible impact on job time

No Δa_μ in likelihood
0.05% within 1σ of measurement



Yes Δa_μ in likelihood
1.3% within 1σ of measurement



Remaining open items

- Pending update to SPheno
- Gaussian stepping width
- Micromegas in scan or in post-processing?
  - Some trouble running this in batch mode… work in progress
- Want to add SModelS to post-processing
  - Volunteers to help with this?
- Want to start sharing output. Where is the best place?