ALPhA Summer Week 4 Presentation

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Summary

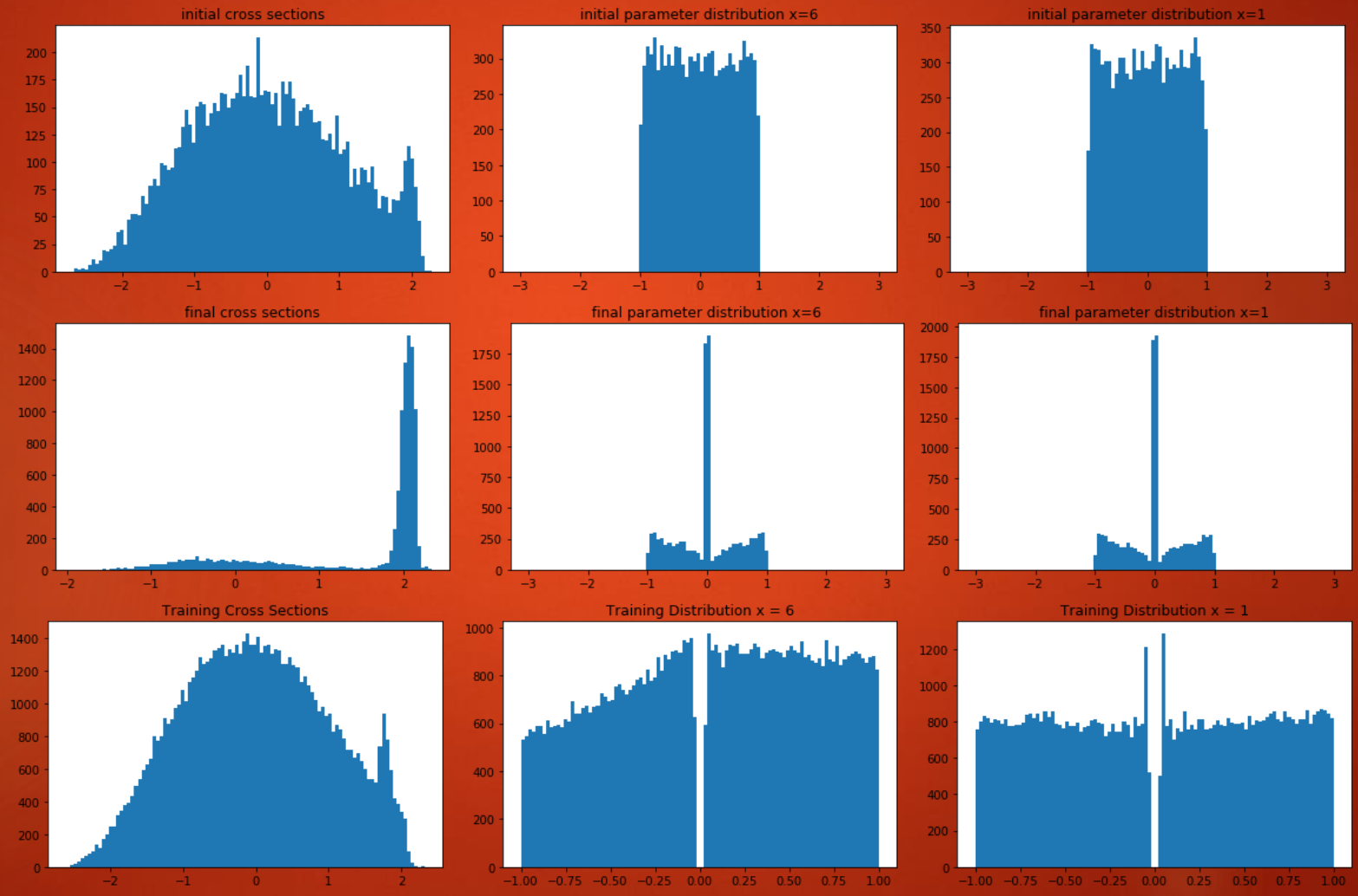
- Ran gradient ascent over all input parameters
- Froze higgsino and wino mass parameters and ran gradient ascent
  - This didn't really work, so I ran a more global optimization method
- Found approximate top calculation speed
  - 112, 000 points a second on GPU using batches of 5 million points
  - 112,000 points would take around 7.7 days on the cluster running SUSY-HIT and Prospino
- Measured impact of changes in an individual parameter by incrementing it and using a collection of random values for the other parameters
  - Higgsino and wino set to 1.0 when not be varied to dilute their impact
- Added a feature to the BNN code which trains a normal neural network first and then extracts its weights
  - Best performance came from using Nadam or AMSgrad with several training cycles with decreasing learning rate

Maximization

Cross Section Distribution

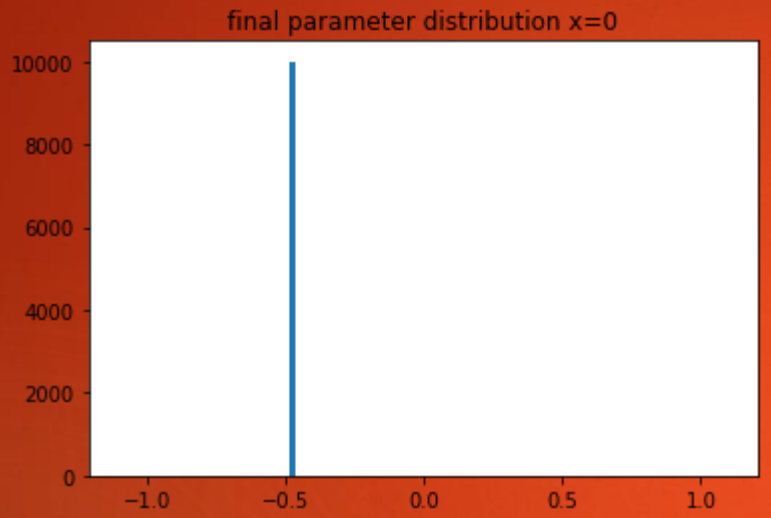
Higgsino Mass parameter

Wino Mass parameter

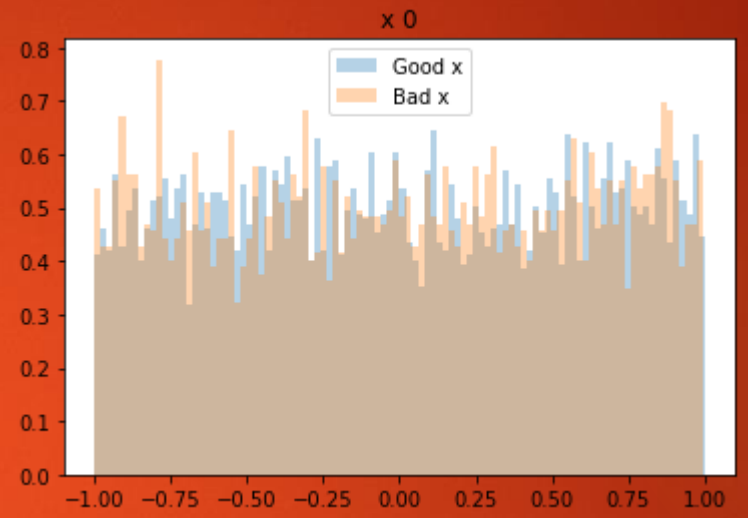


Bino mass parameter

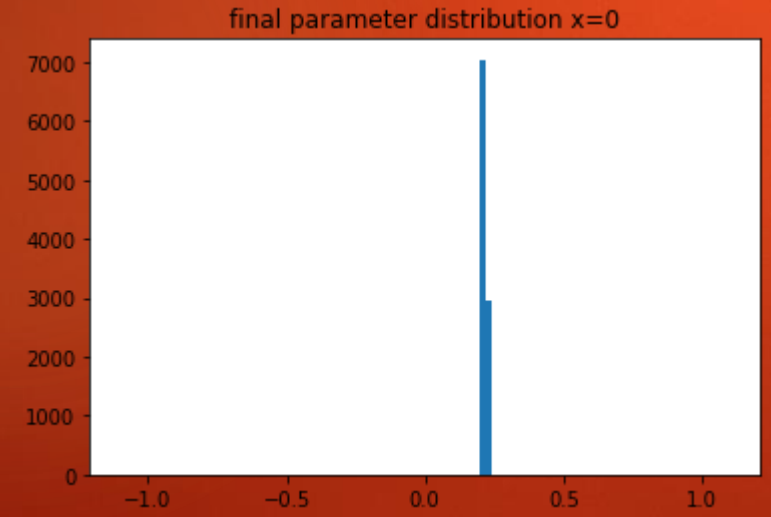
Maximum cross sections



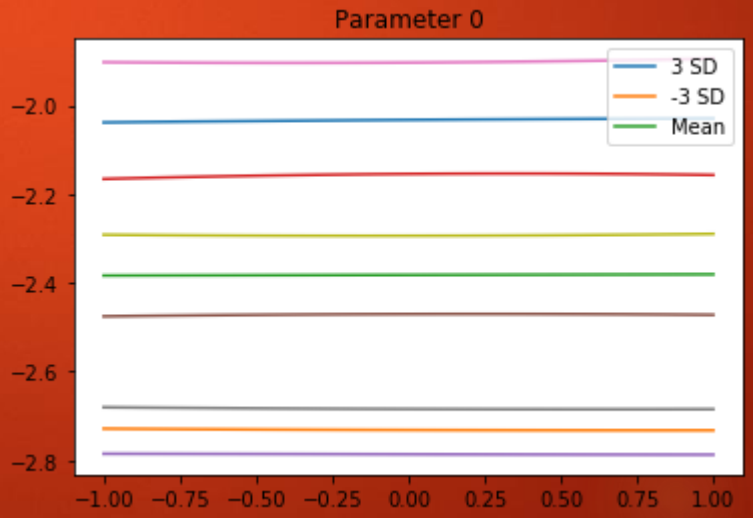
Network Error



Minimum cross sections

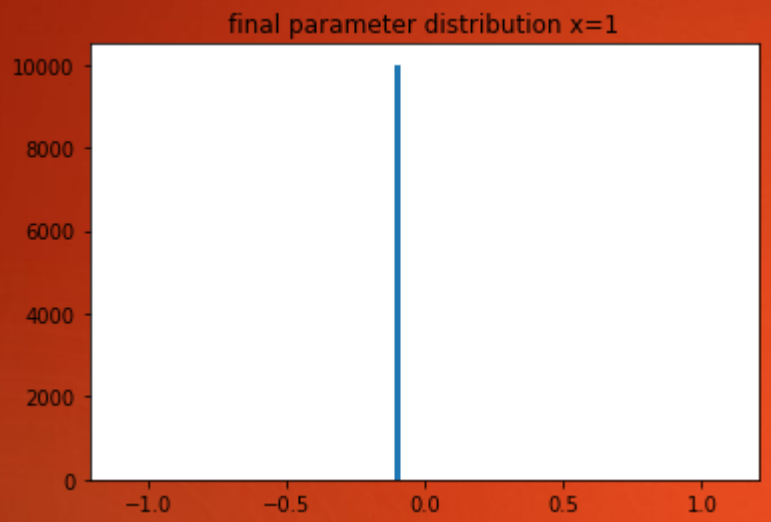


Cross section spread



Wino mass parameter

Maximum cross sections



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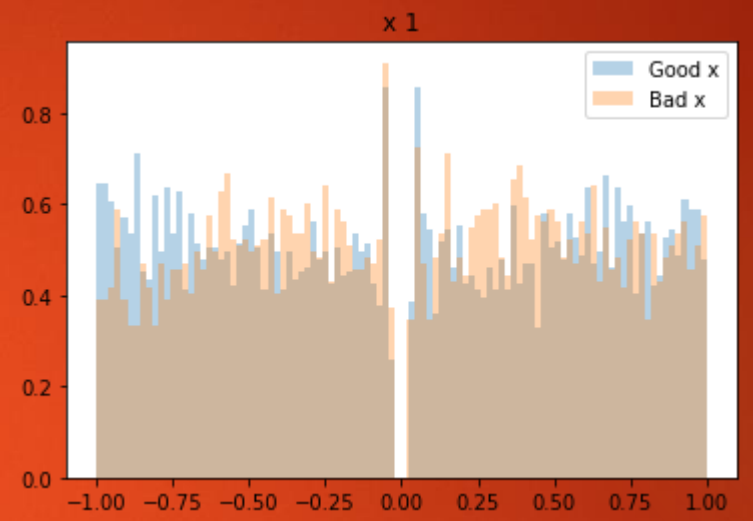
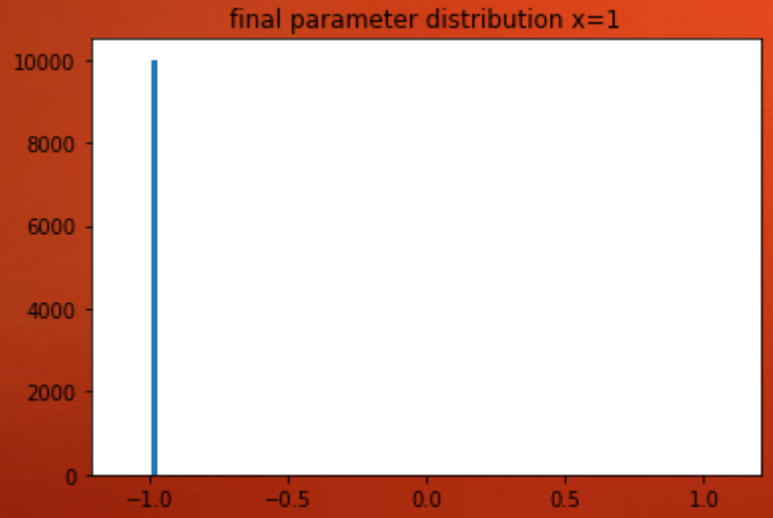
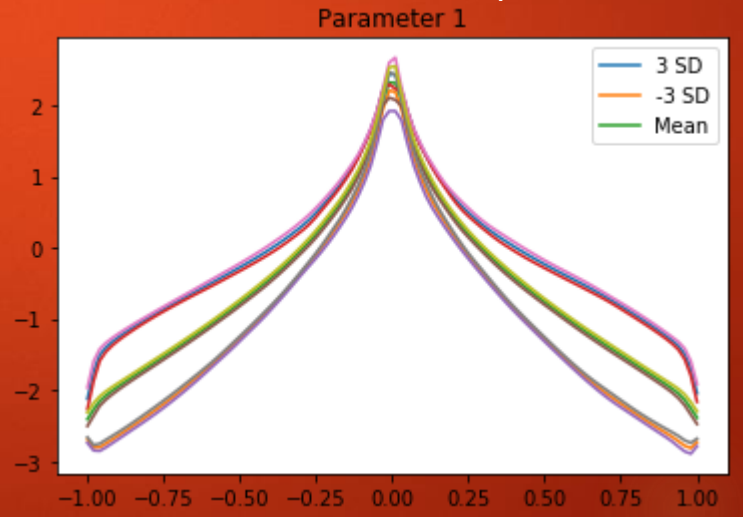


Minimum cross sections

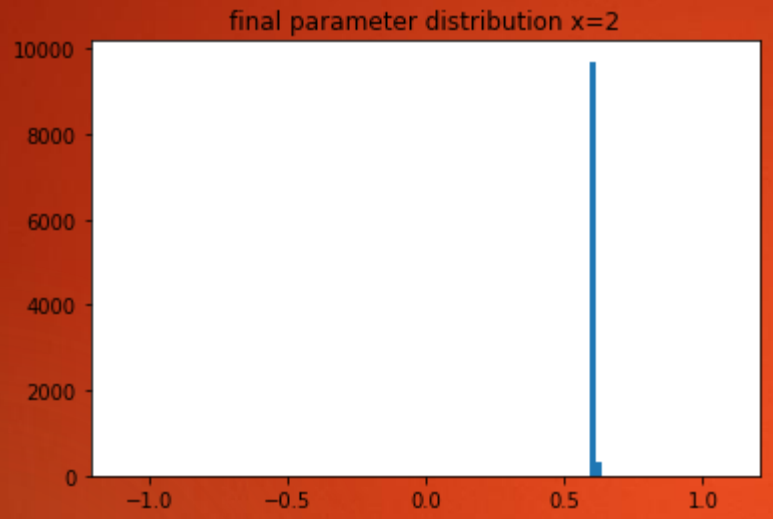


Cross section spread

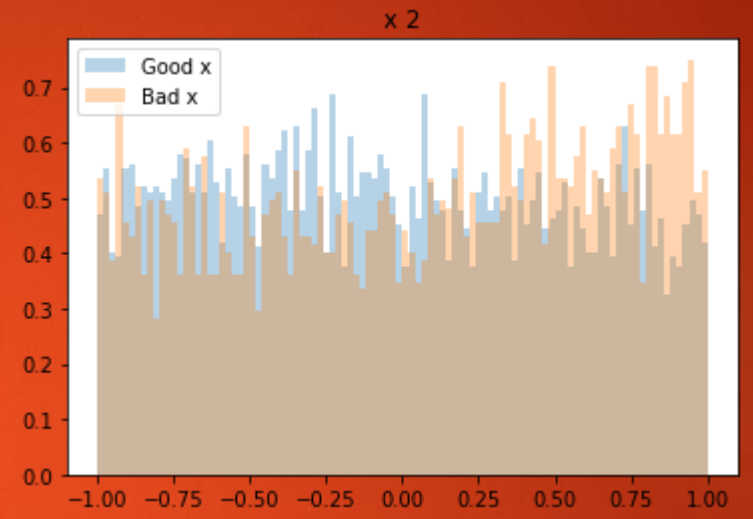


Gluino mass parameter

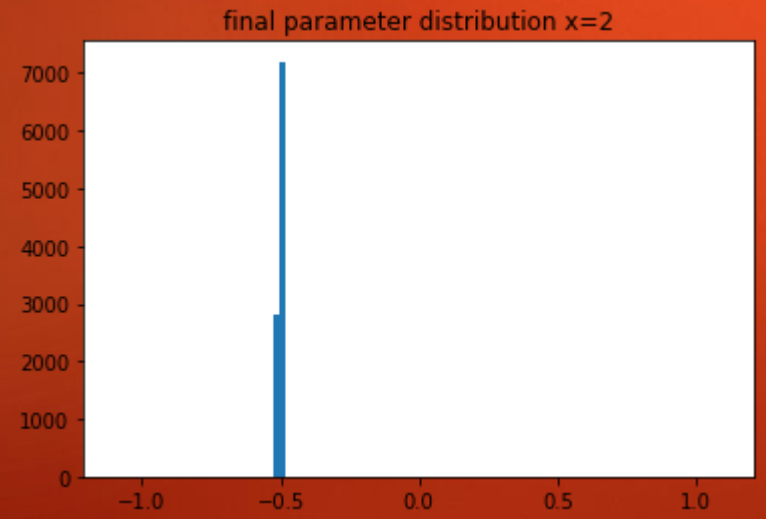
Maximum cross sections



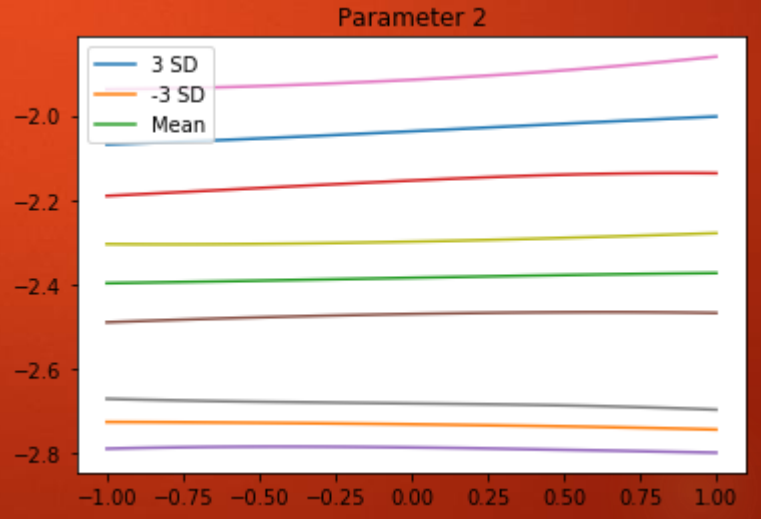
Network Error



Minimum cross sections

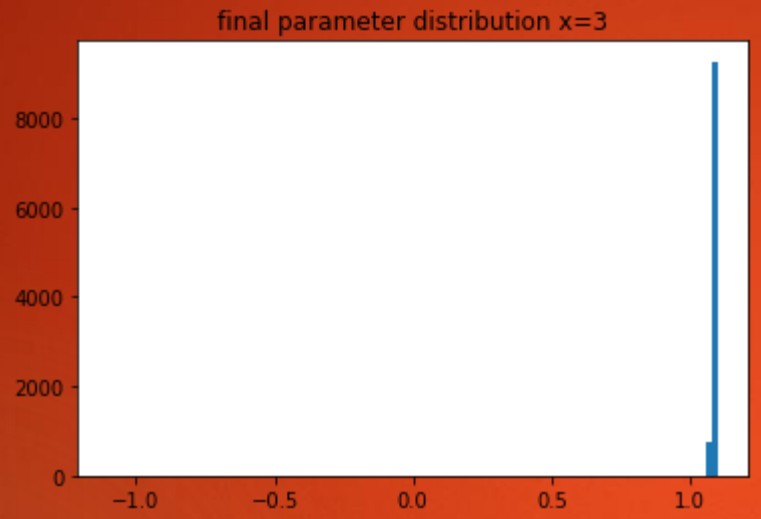


Cross section spread

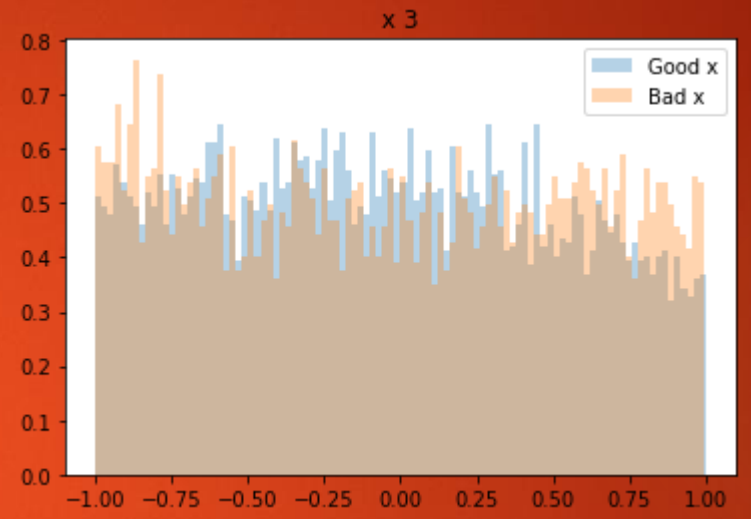


A_{top} trilinear coupling

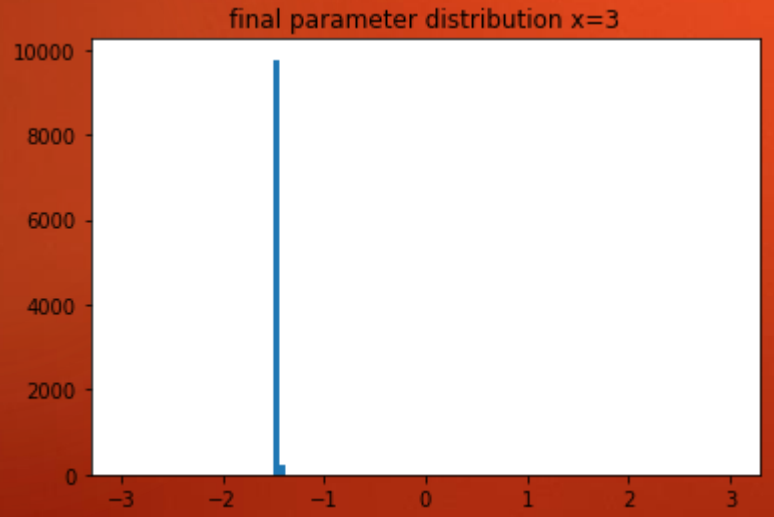
Maximum cross sections



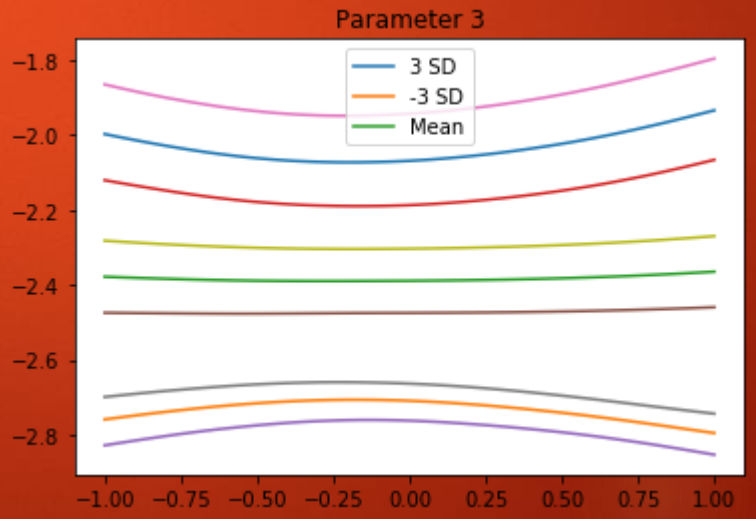
Network Error



Minimum cross sections

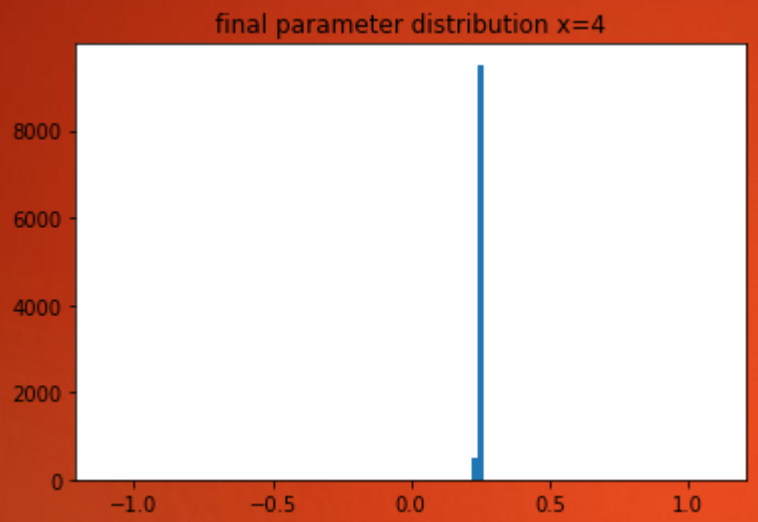


Cross section spread



A_{bottom} trilinear coupling

Maximum cross sections



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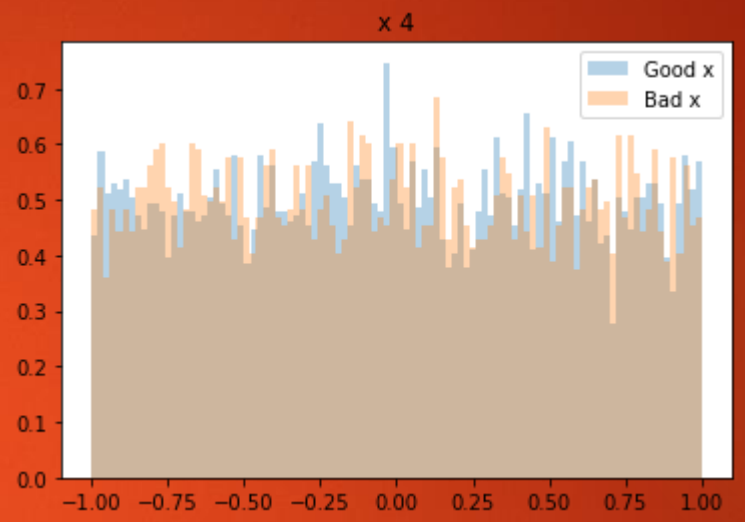
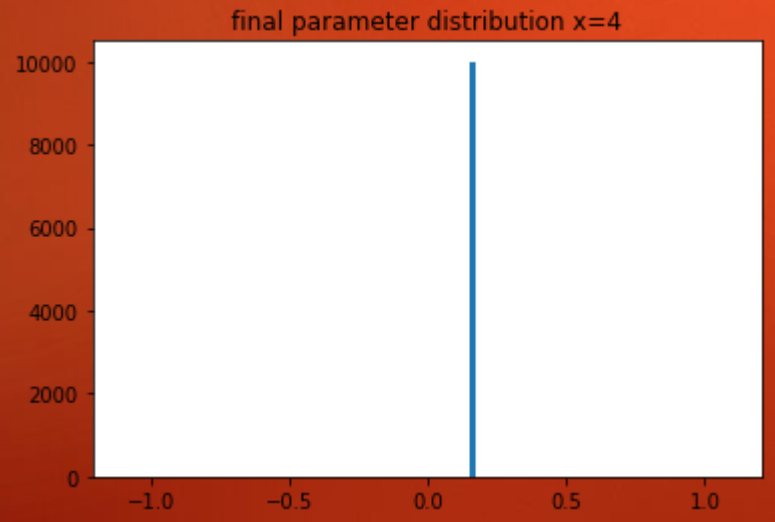
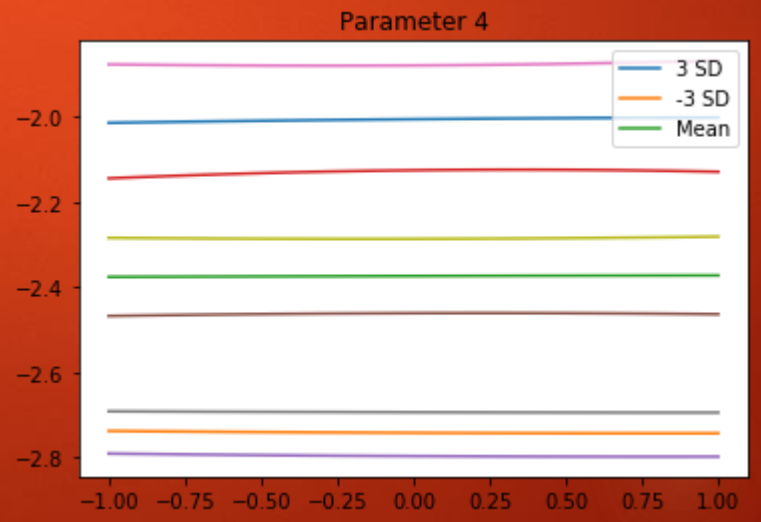


Minimum cross sections

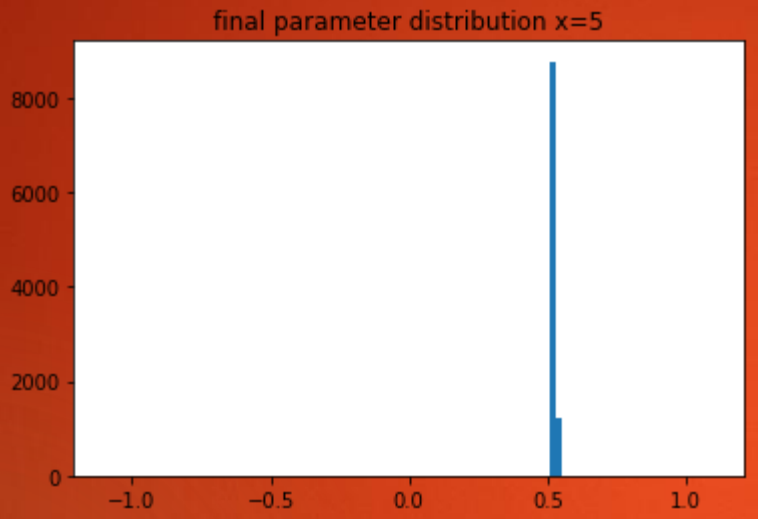


Cross section spread



A_{tau} trilinear coupling

Maximum cross sections



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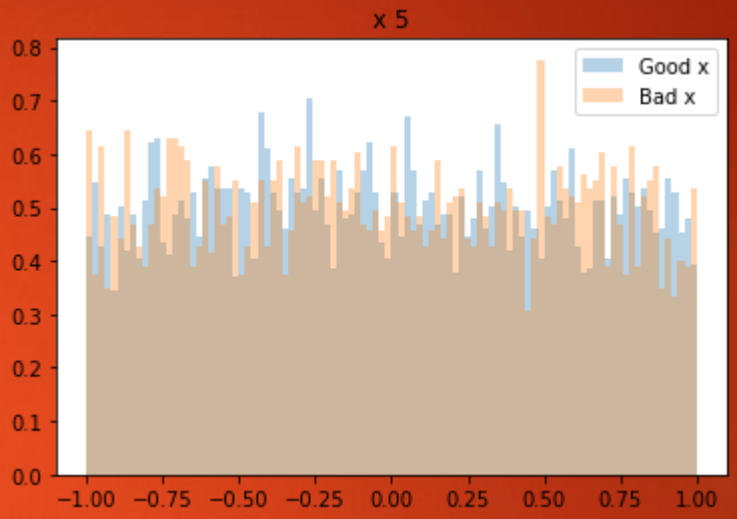
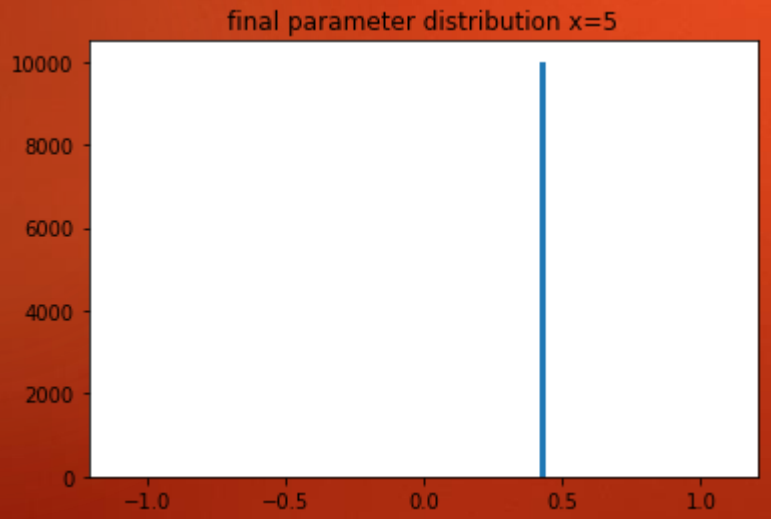
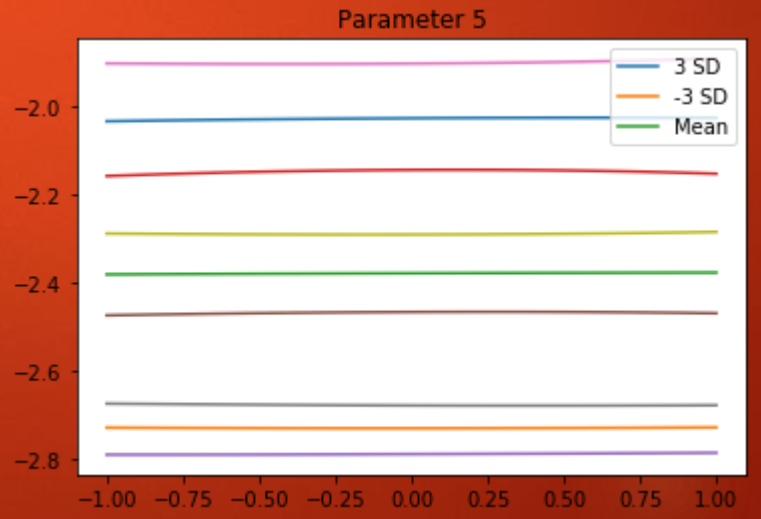


Minimum cross sections

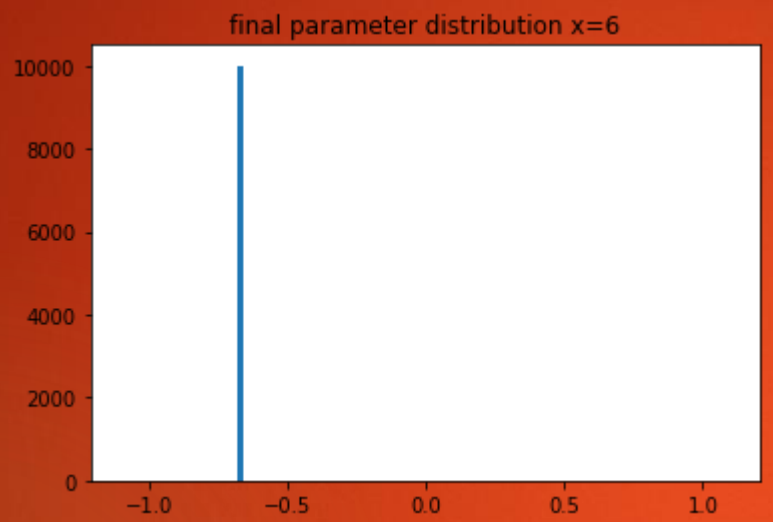


Cross section spread

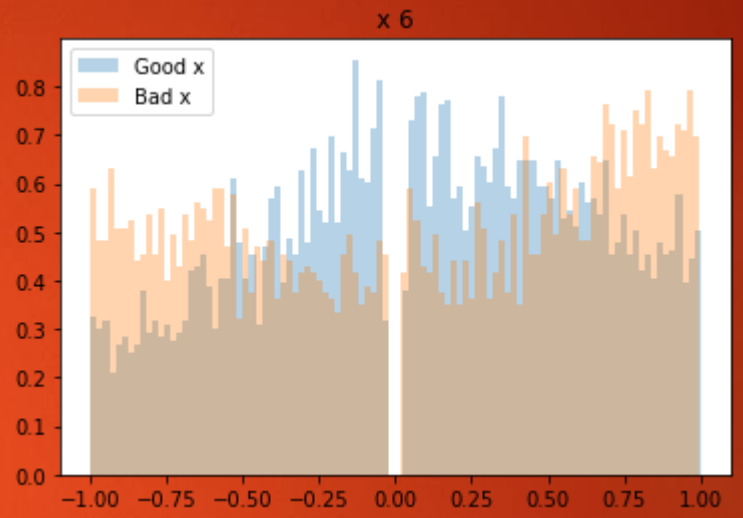


Higgsino mass parameter

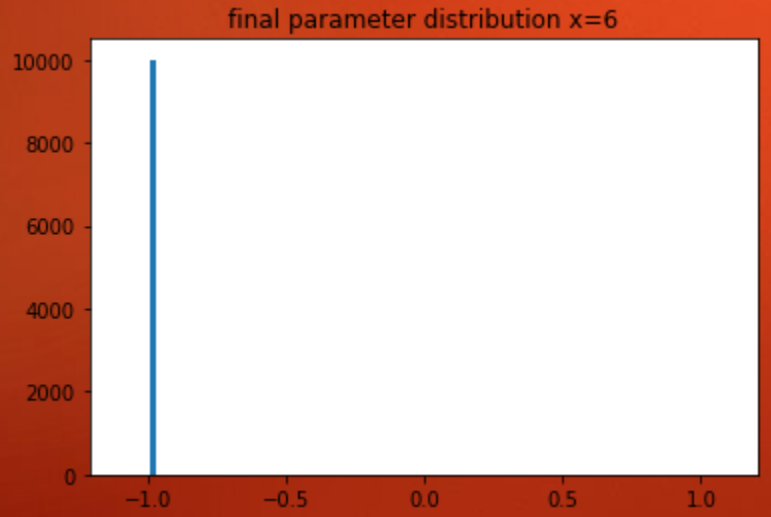
Maximum cross sections



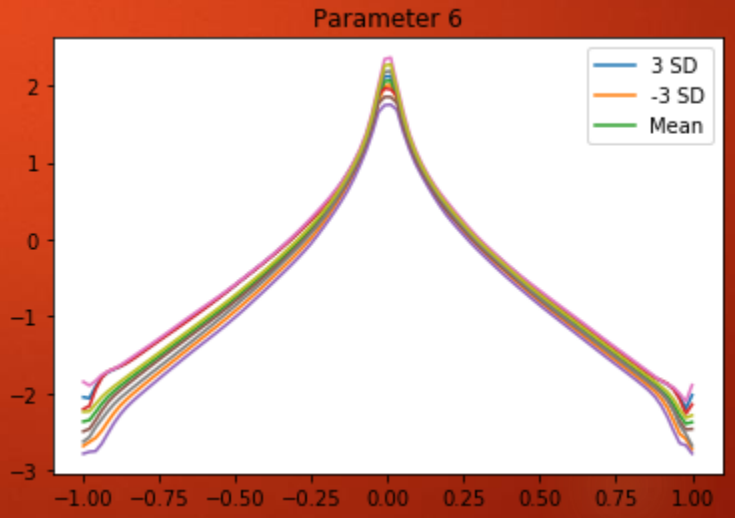
Network Error



Minimum cross sections

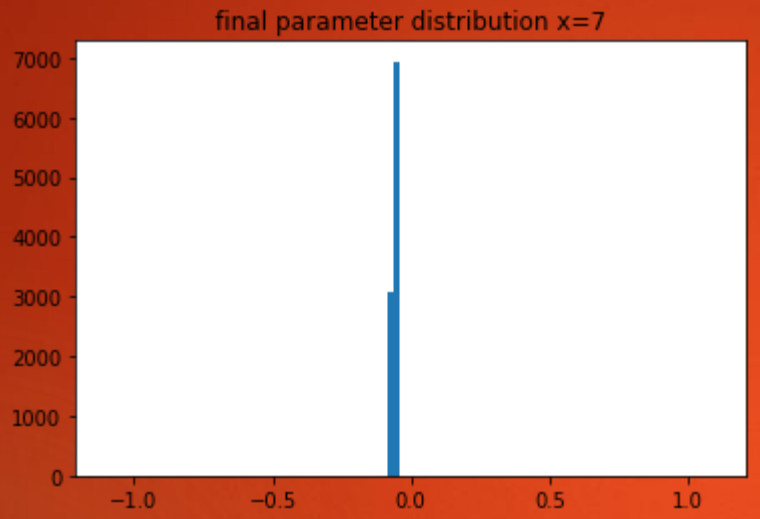


Cross section spread

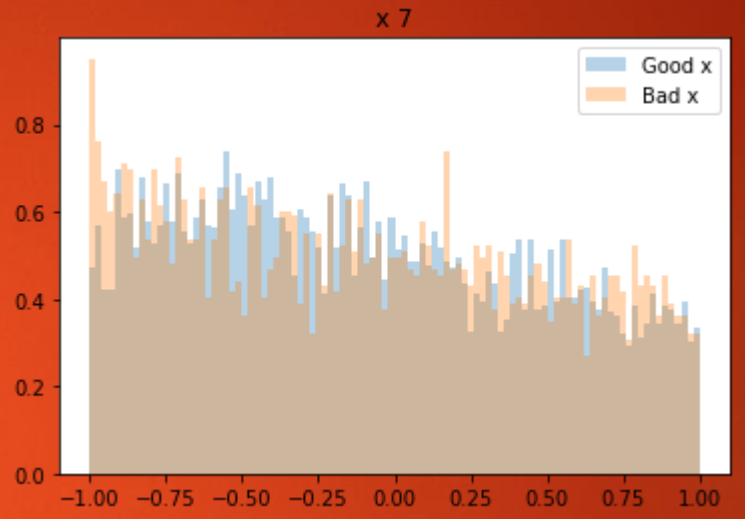


Tan beta

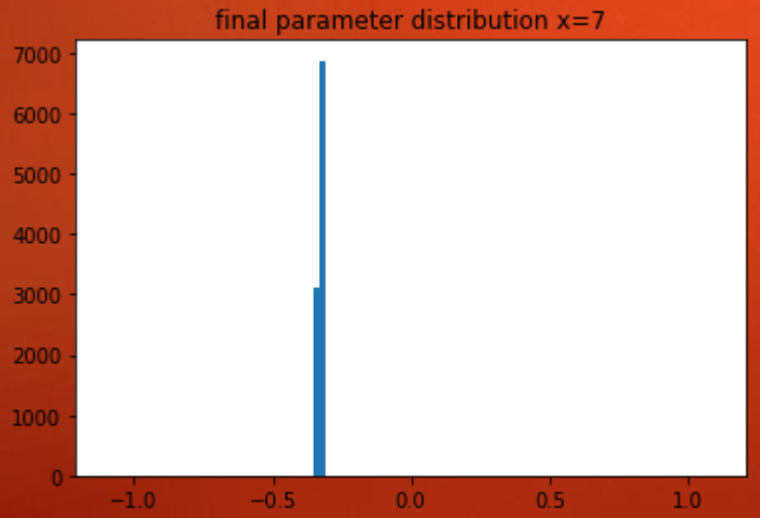
Maximum cross sections



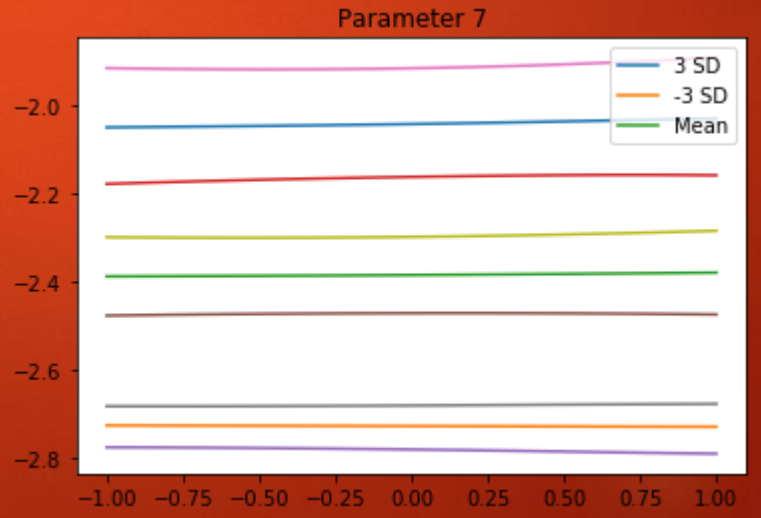
Network Error



Minimum cross sections

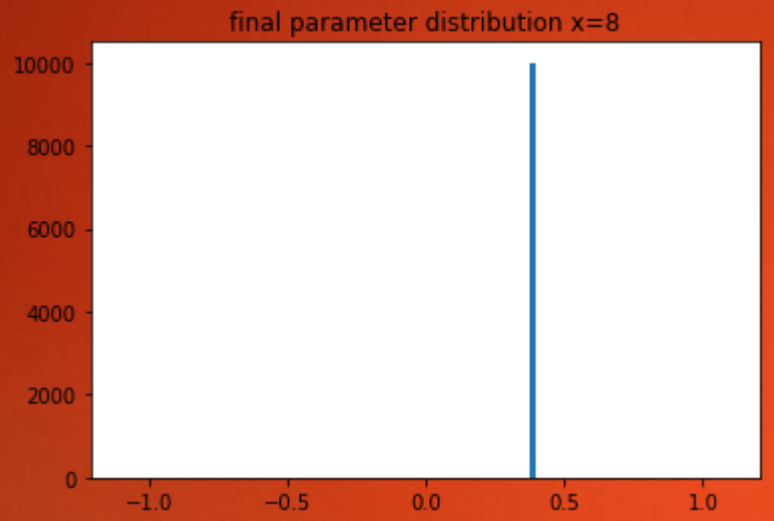


Cross section spread

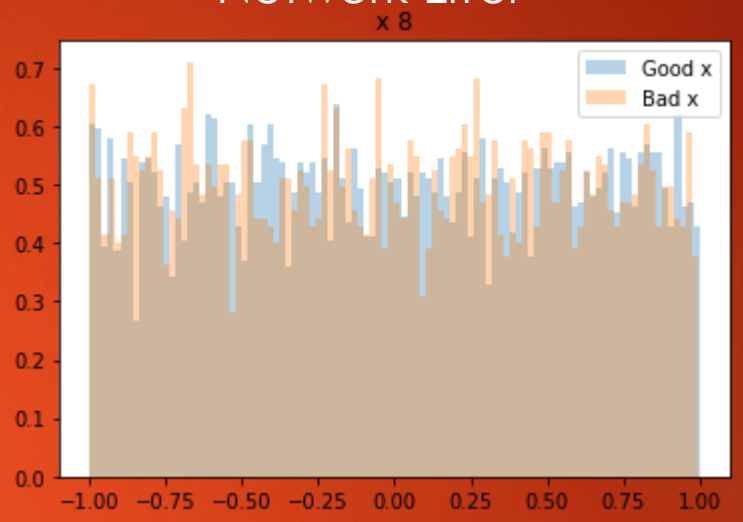


Pseudoscalar Higgs boson mass

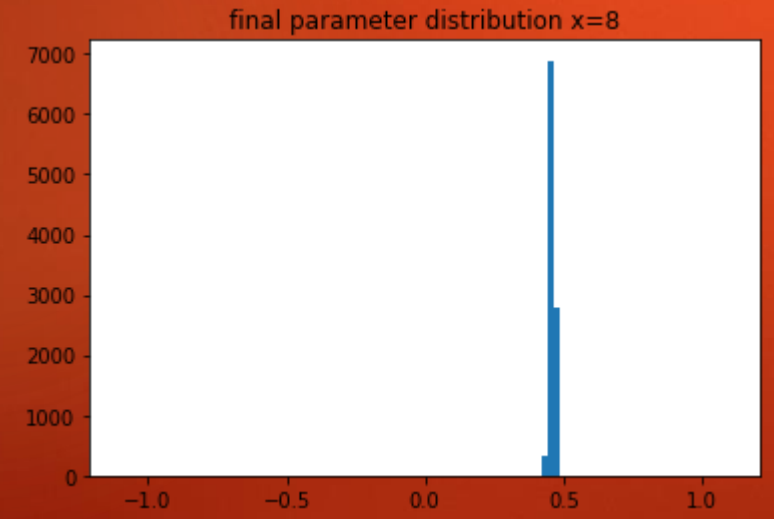
Maximum cross sections



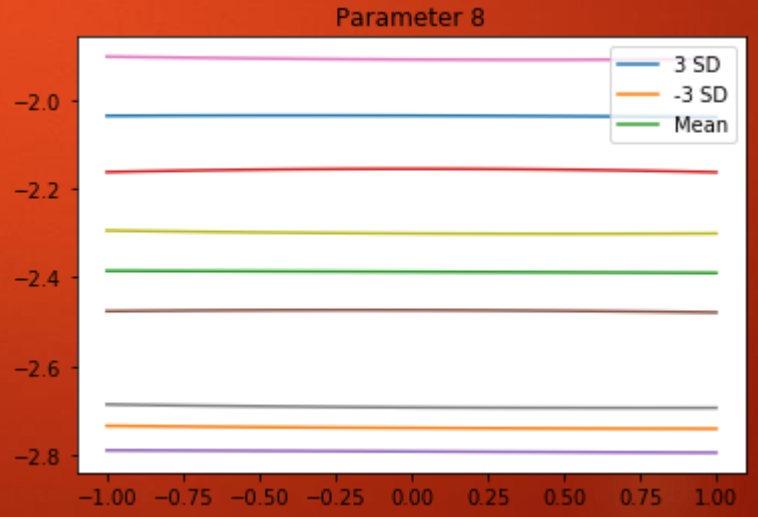
Network Error



Minimum cross sections

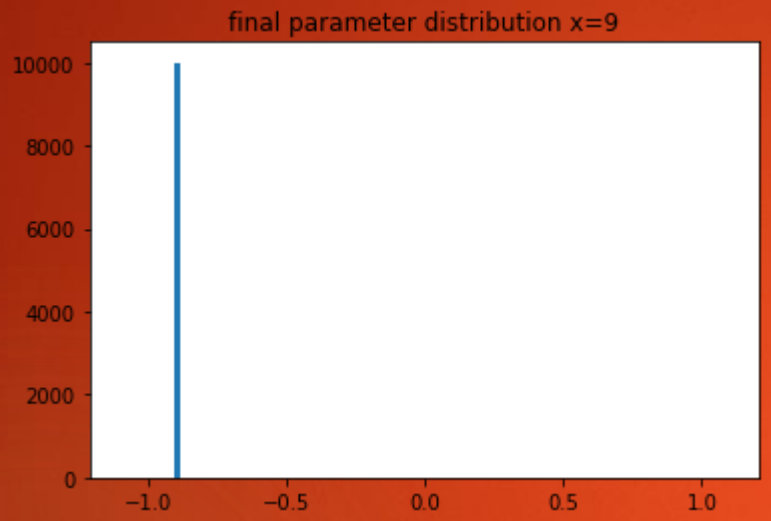


Cross section spread

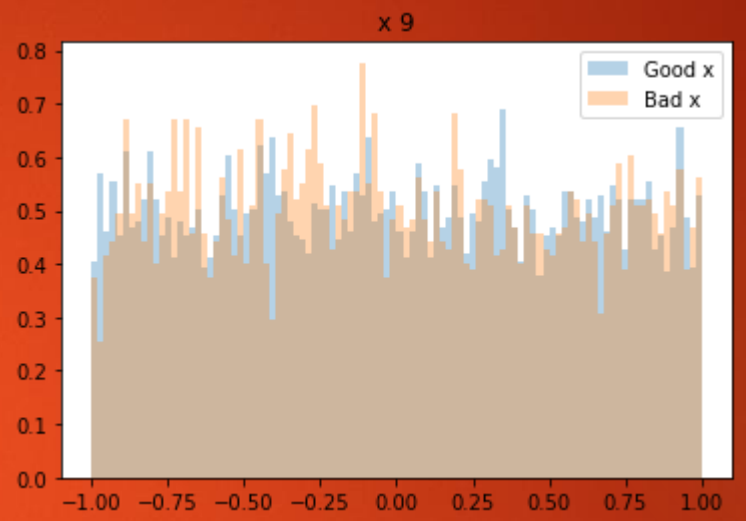


M_el

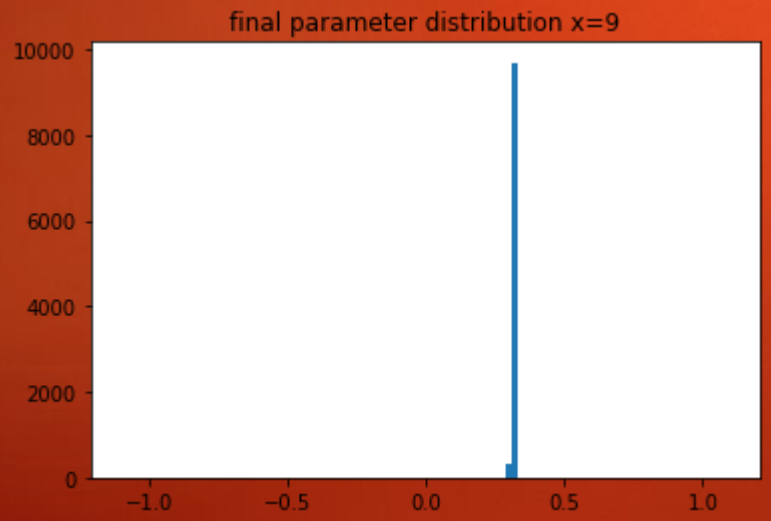
Maximum cross sections



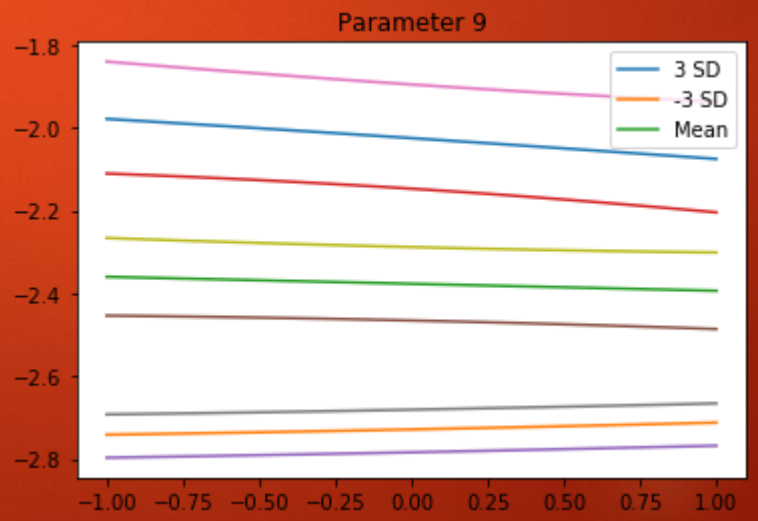
Network Error



Minimum cross sections

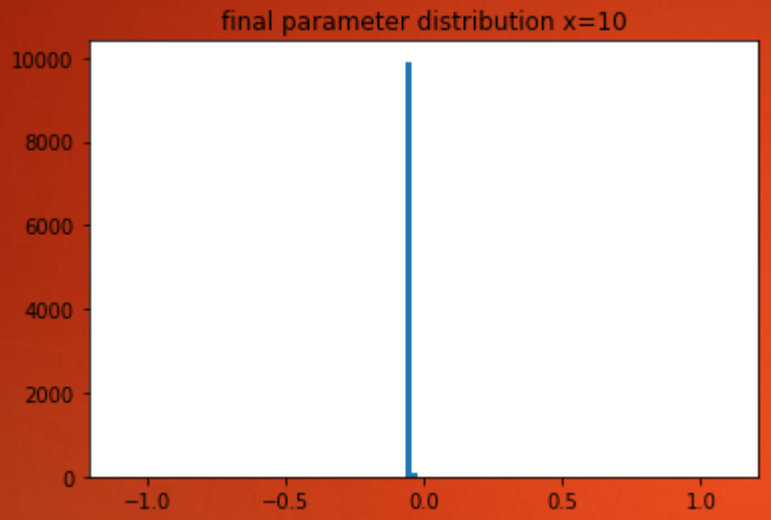


Cross section spread

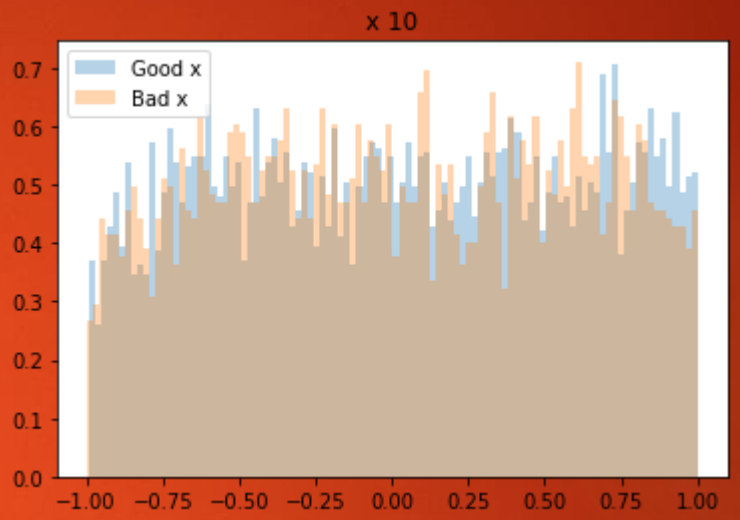


M_tauL

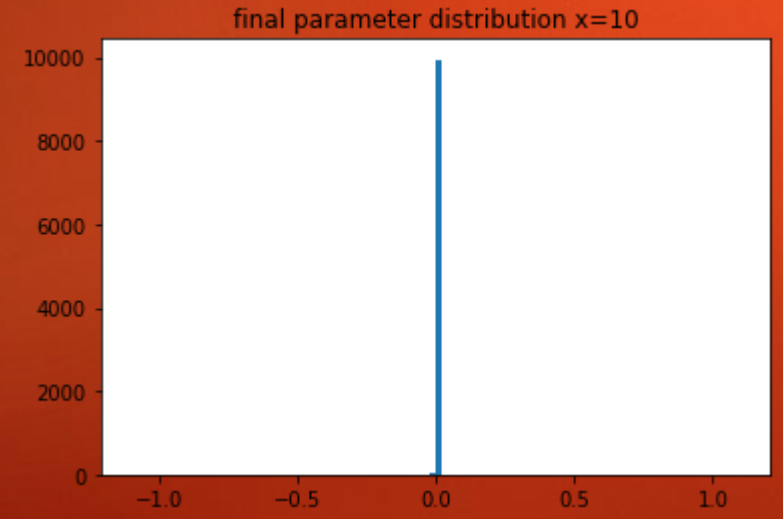
Maximum cross sections



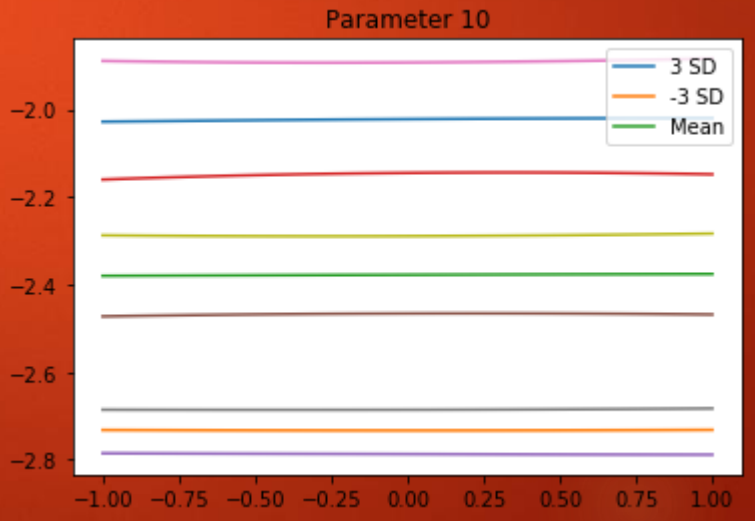
Network Error



Minimum cross sections

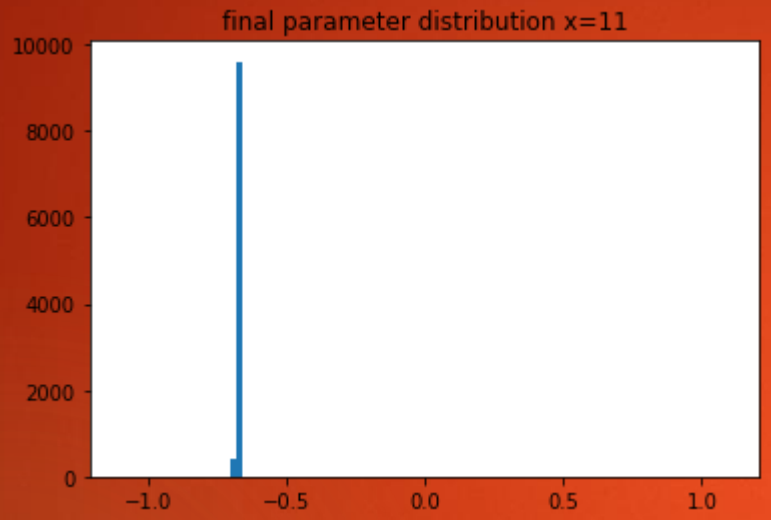


Cross section spread

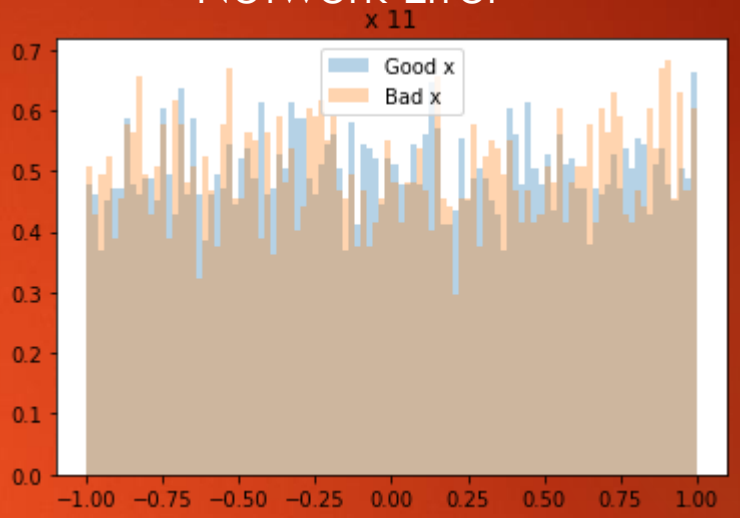


M_eR

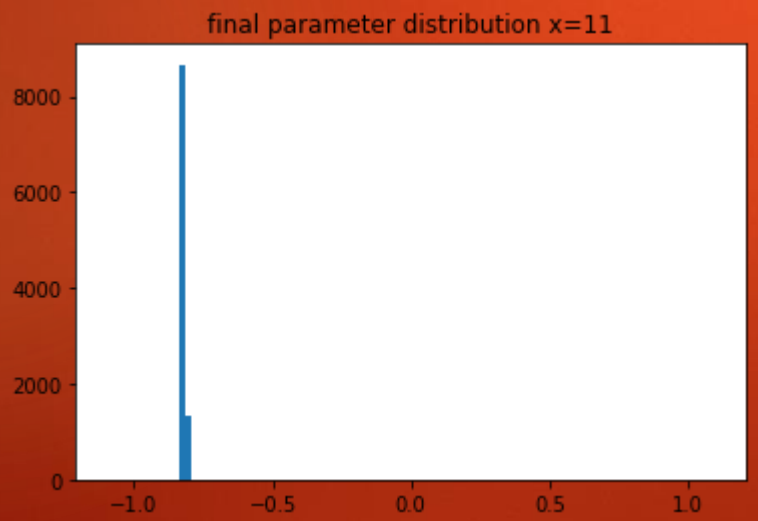
Maximum cross sections



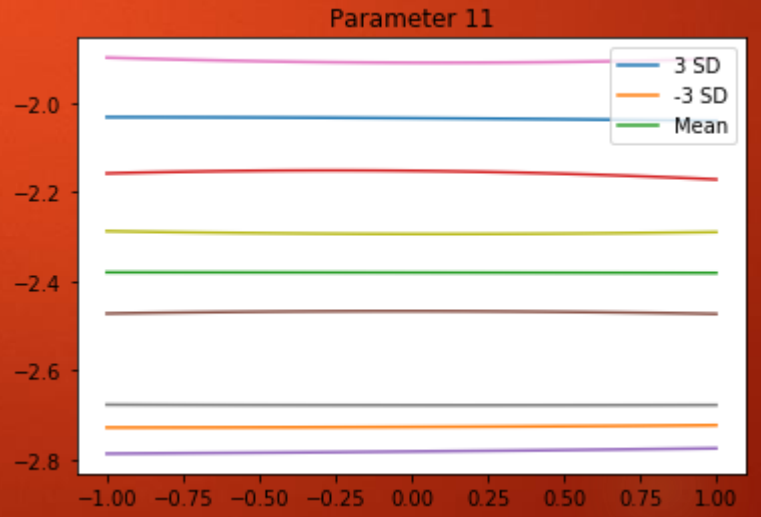
Network Error



Minimum cross sections

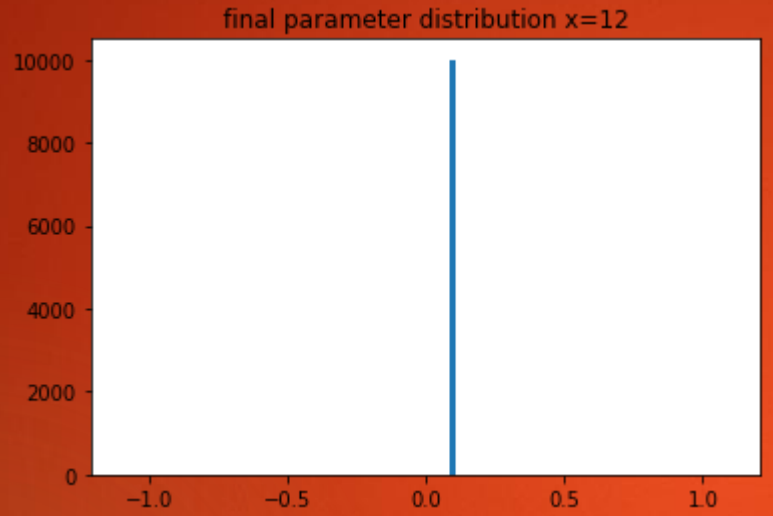


Cross section spread

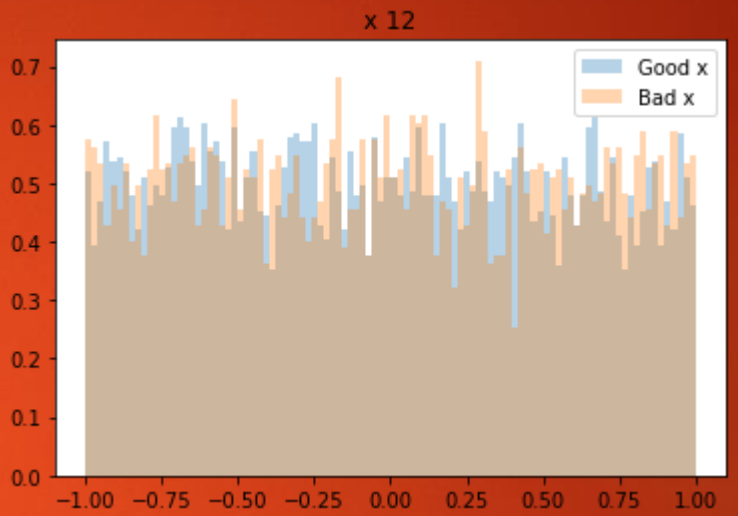


M_tauR

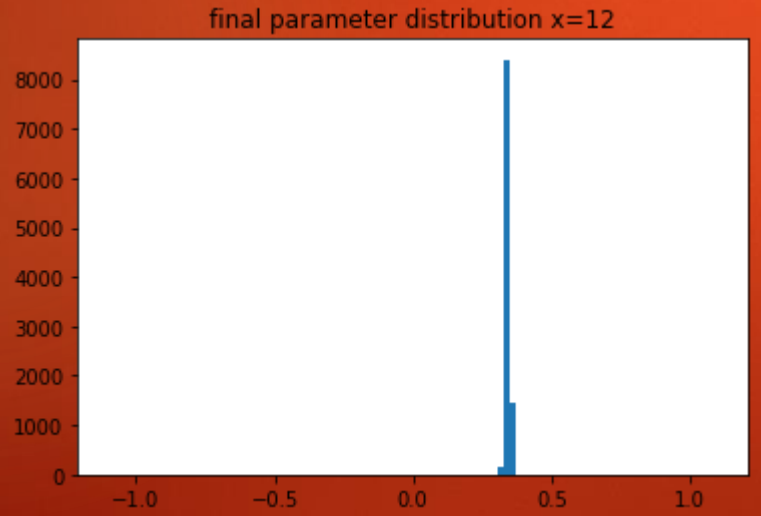
Maximum cross sections



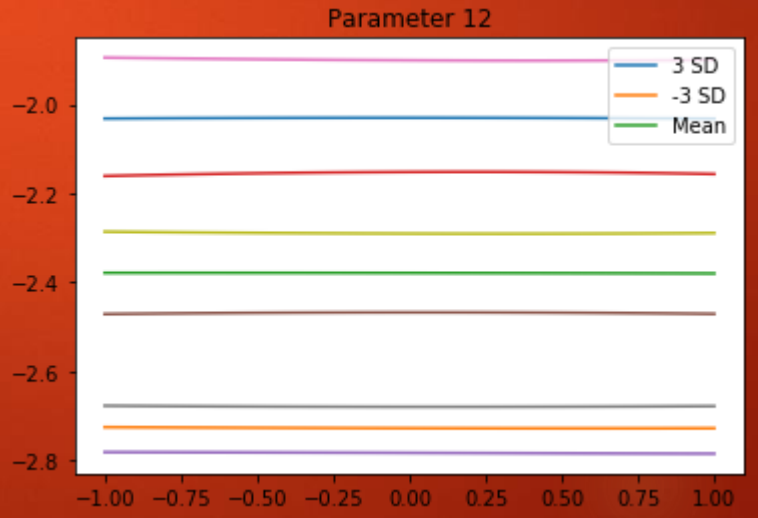
Network Error



Minimum cross sections

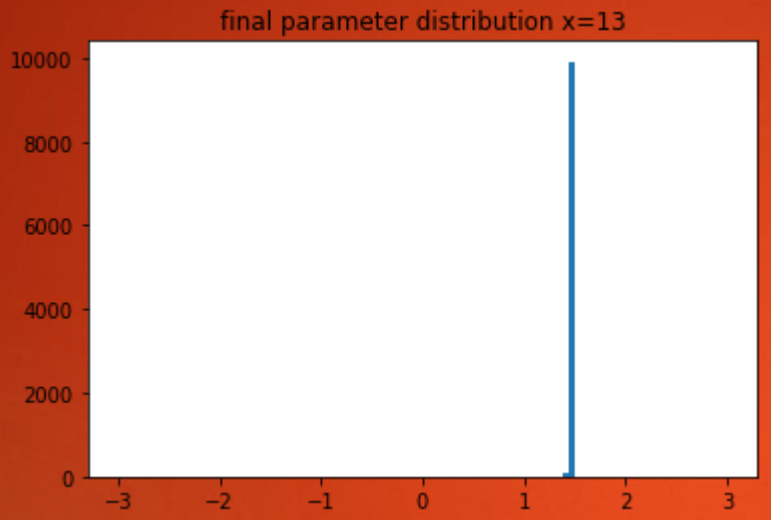


Cross section spread

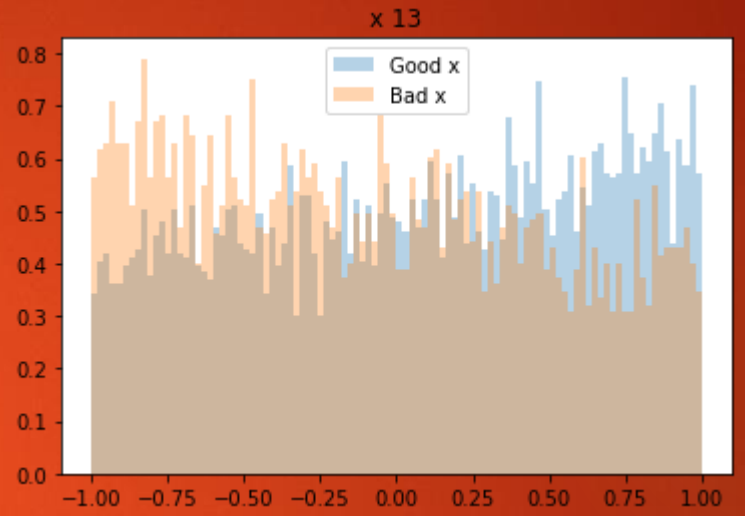


M_q1L

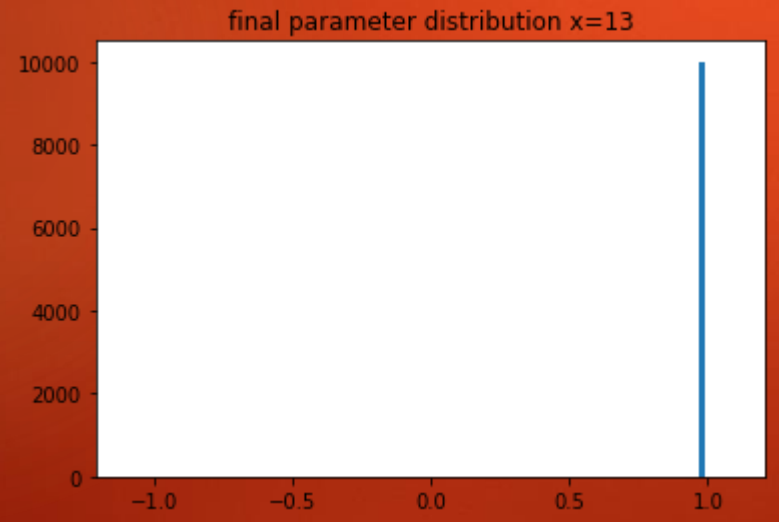
Maximum cross sections



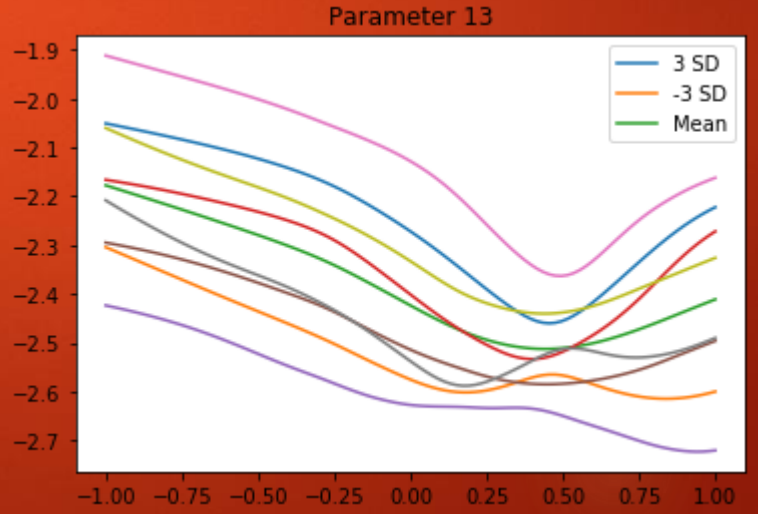
Network Error



Minimum cross sections

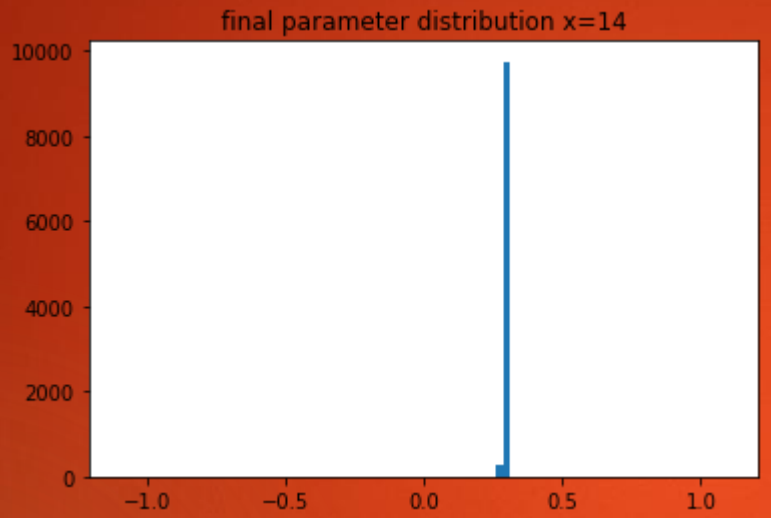


Cross section spread

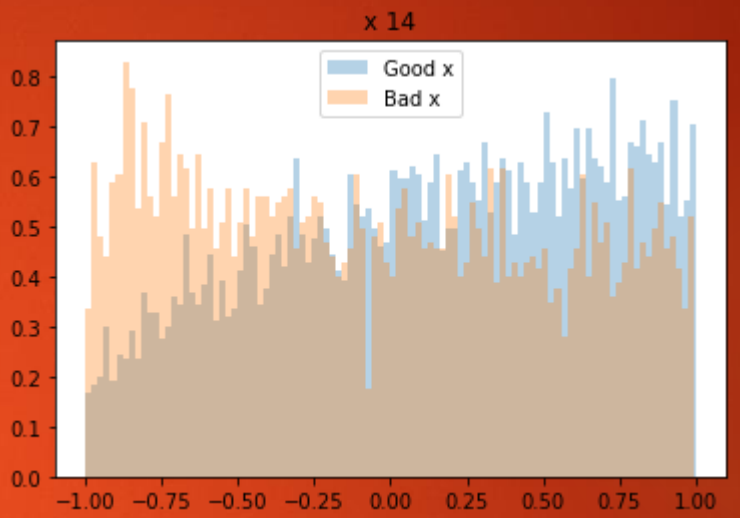


M_q3L

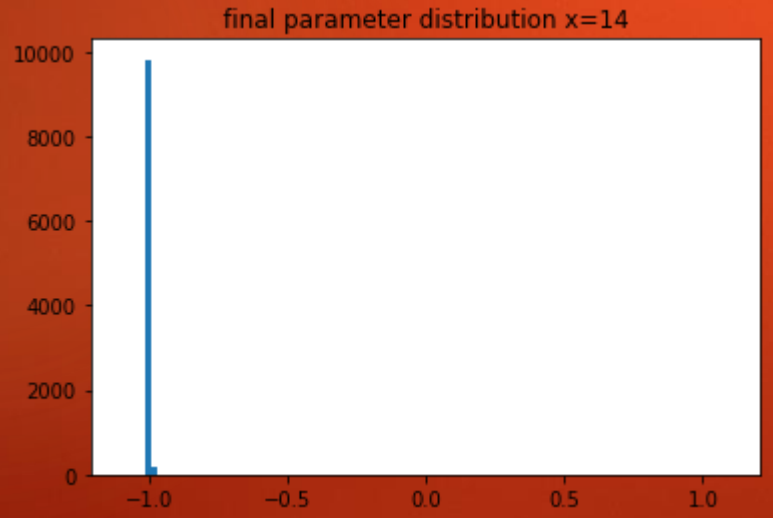
Maximum cross sections



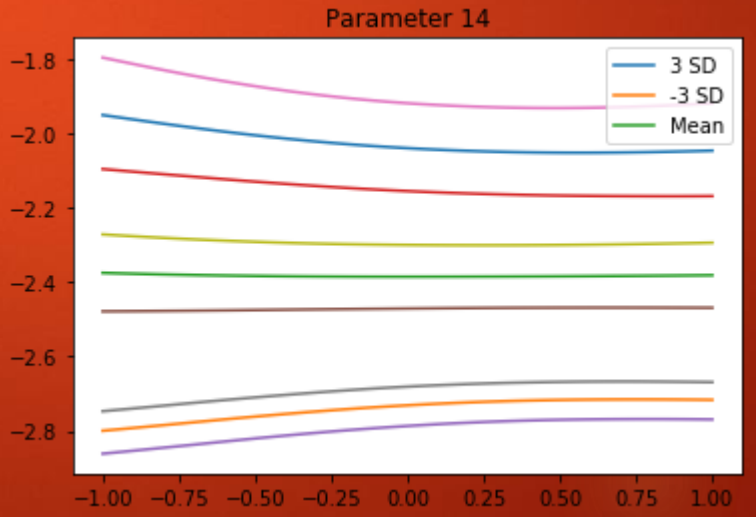
Network Error



Minimum cross sections

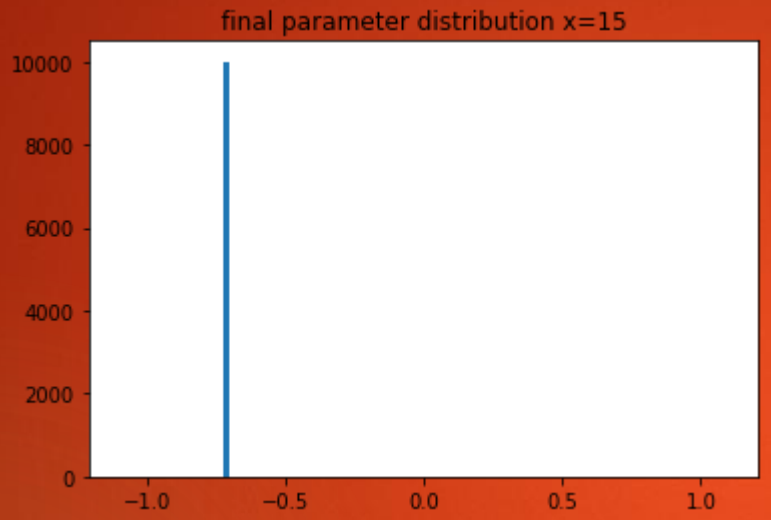


Cross section spread

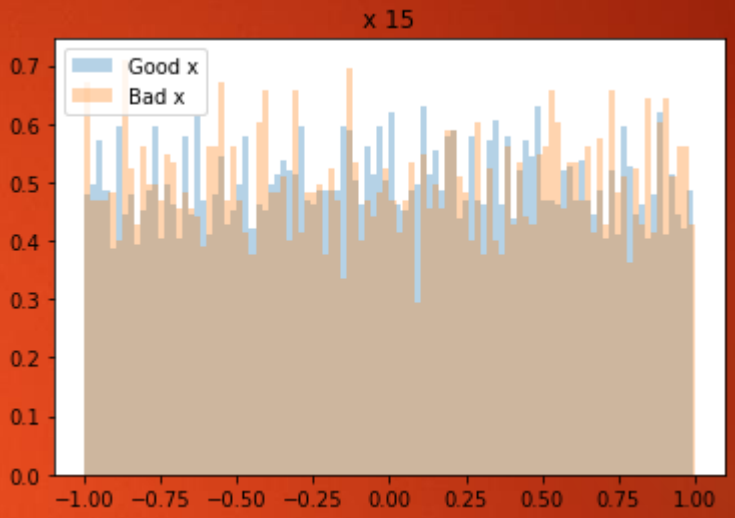


M_uR

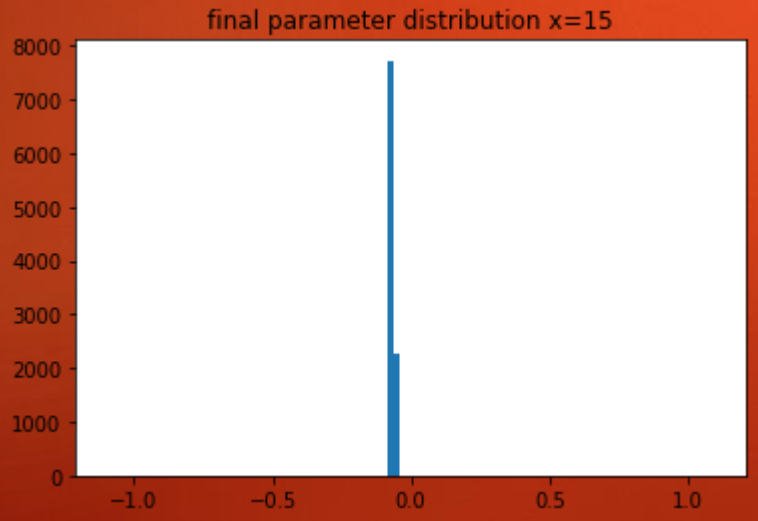
Maximum cross sections



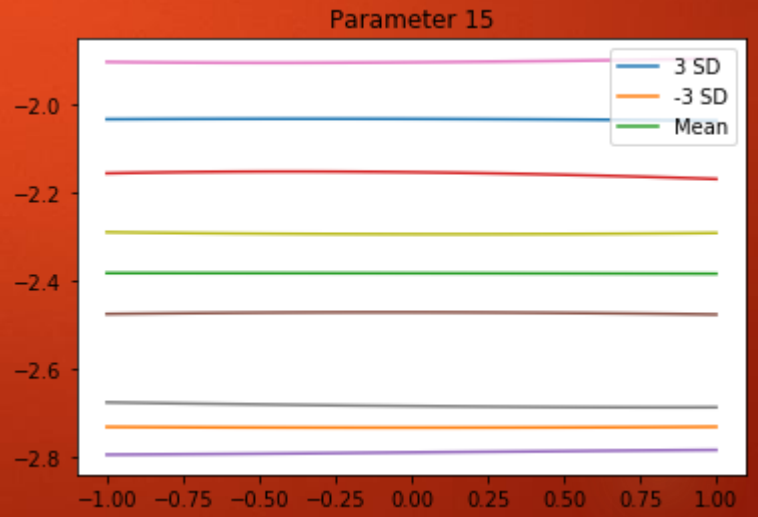
Network Error



Minimum cross sections

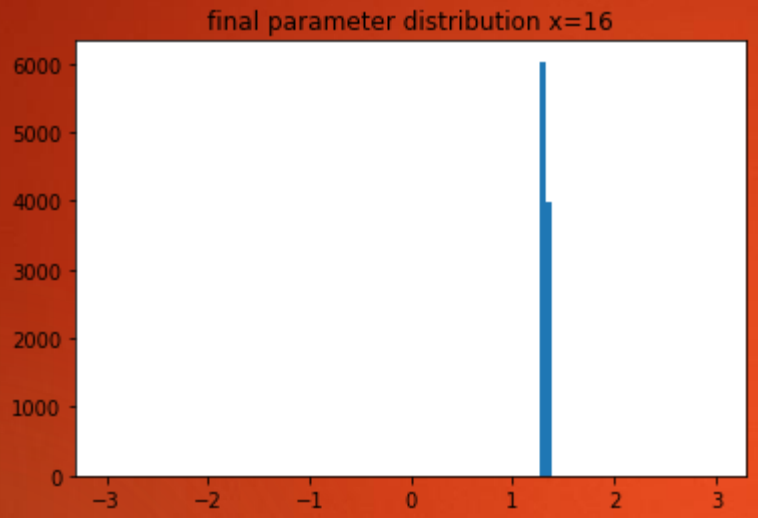


Cross section spread

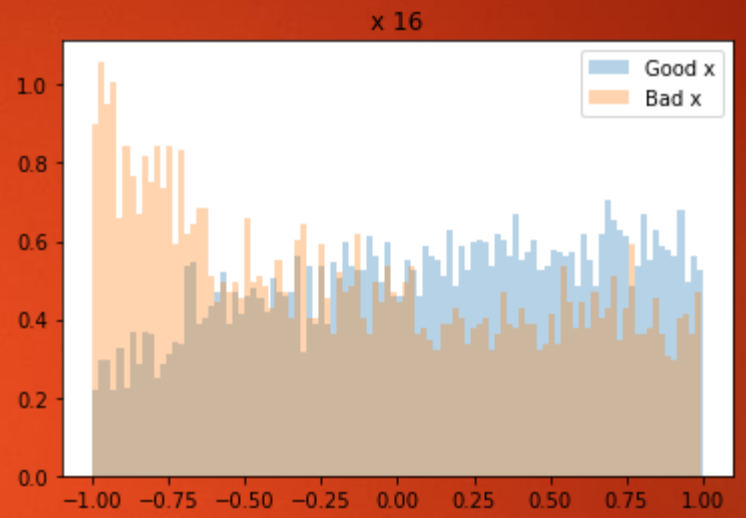


M_tR

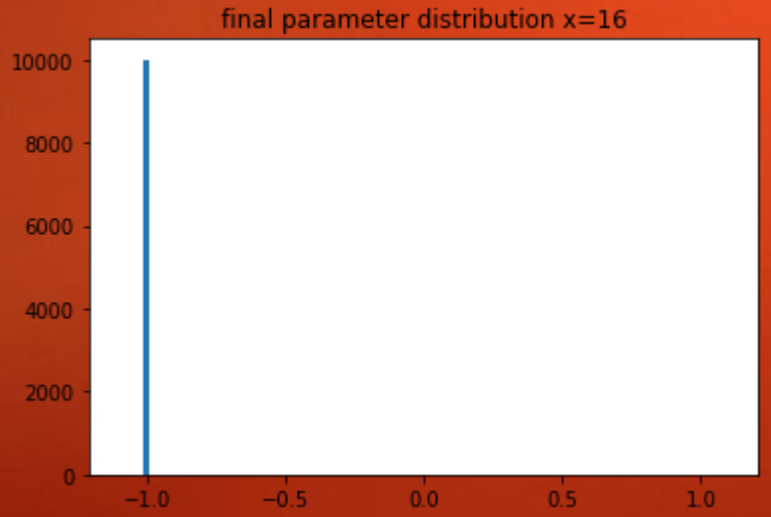
Maximum cross sections



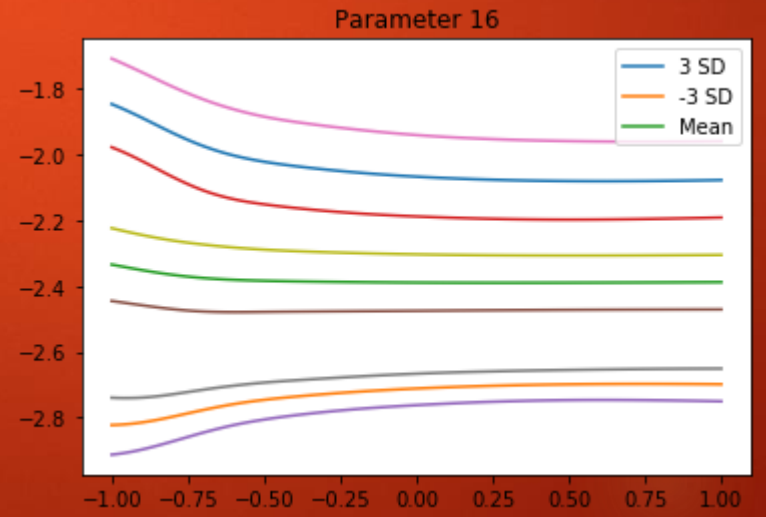
Network Error



Minimum cross sections

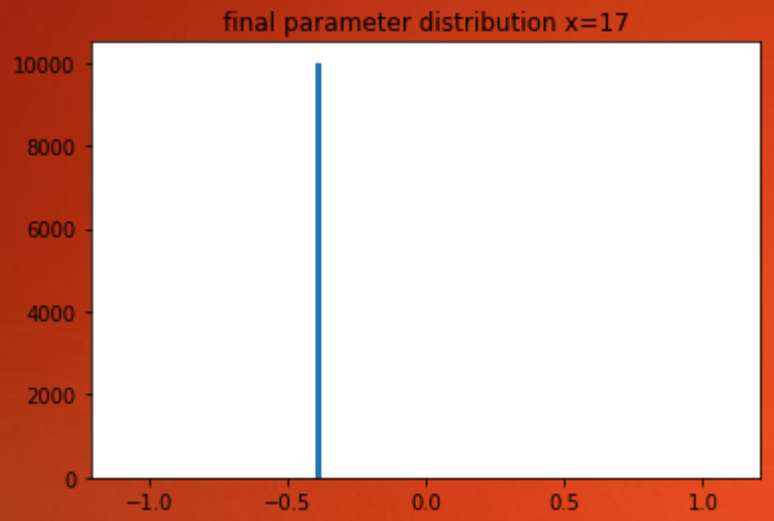


Cross section spread

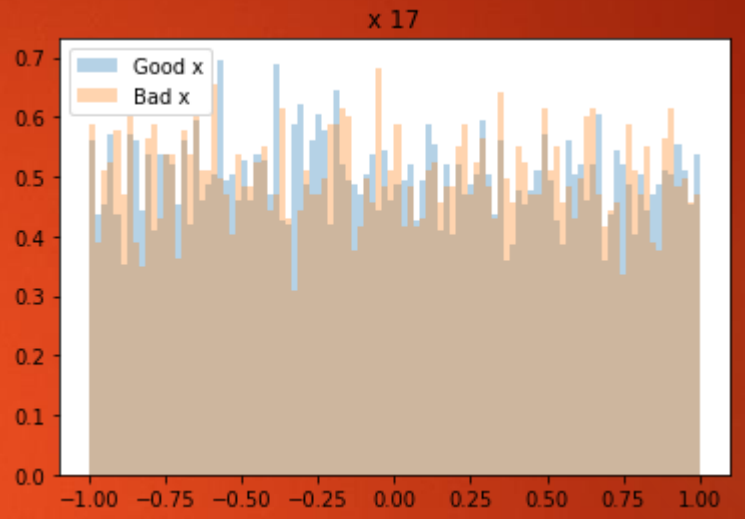


M_dR

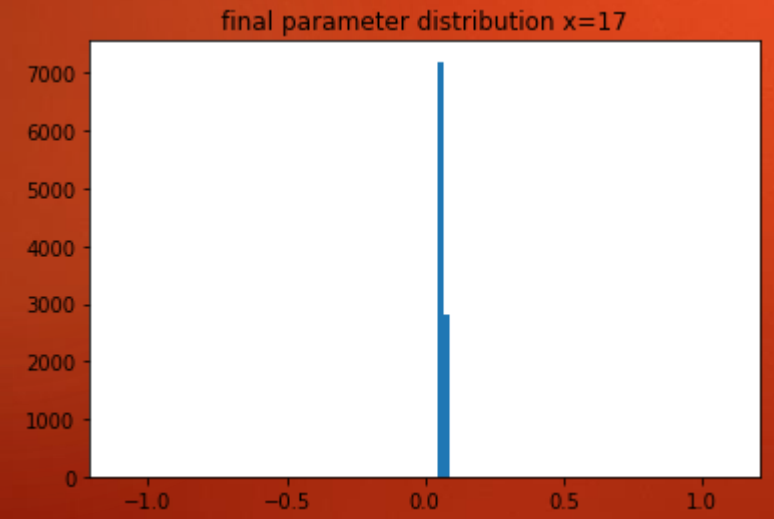
Maximum cross sections



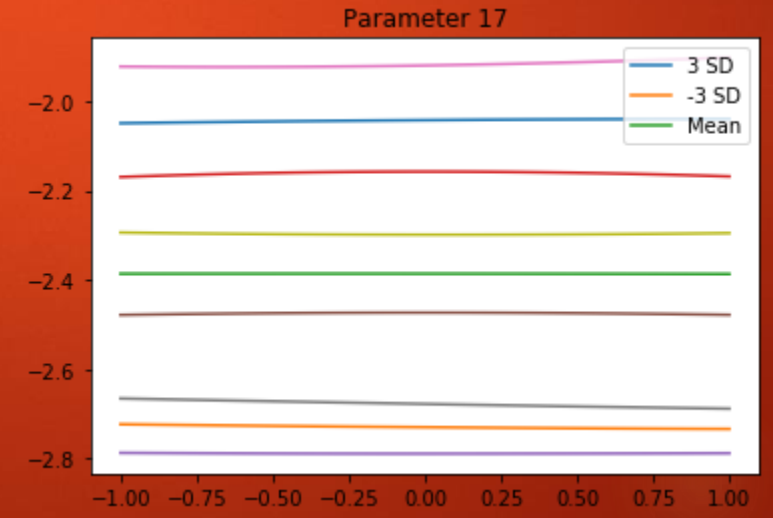
Network Error



Minimum cross sections

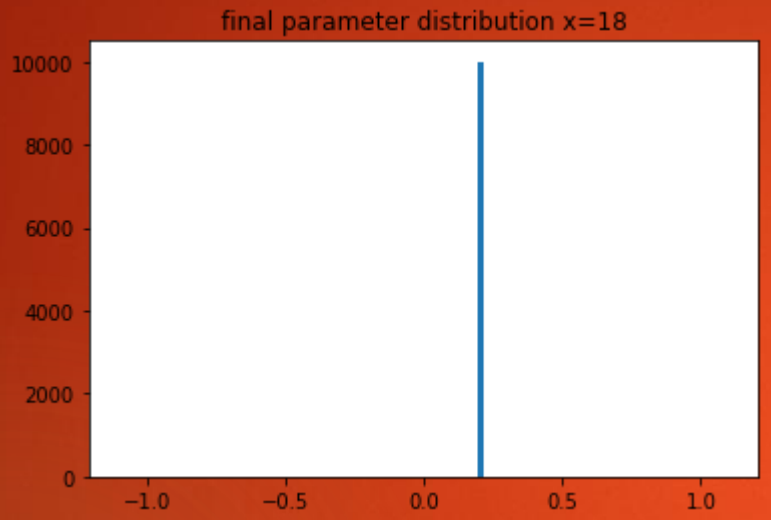


Cross section spread

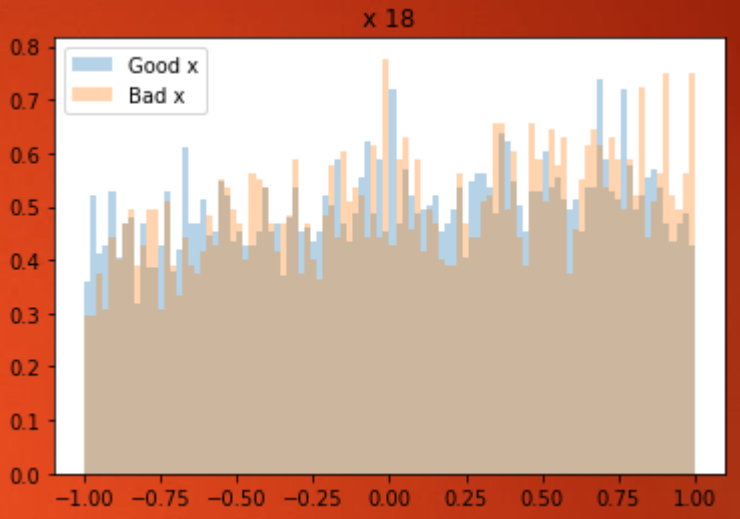


M_bR

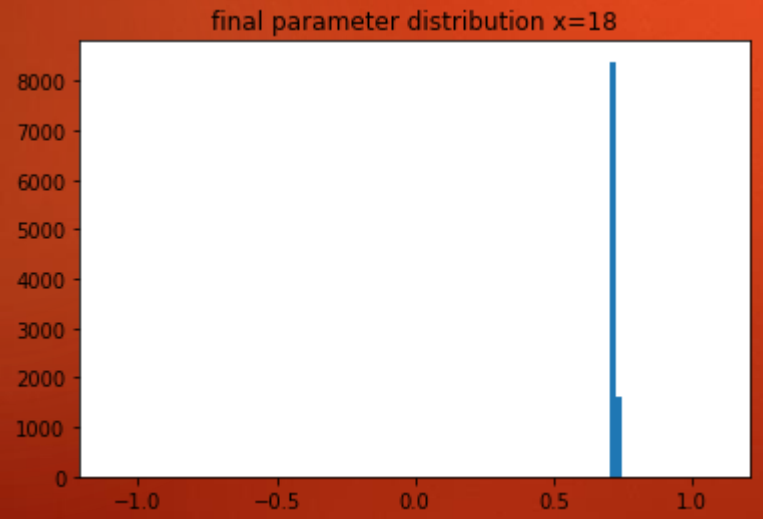
Maximum cross sections



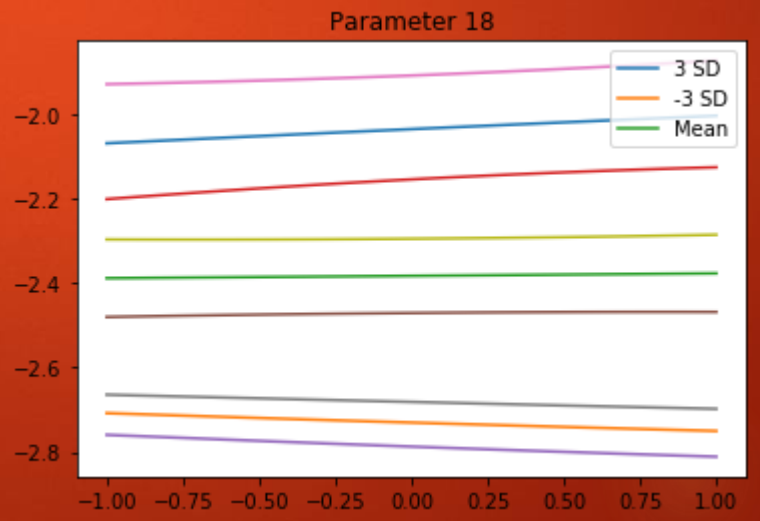
Network Error



Minimum cross sections



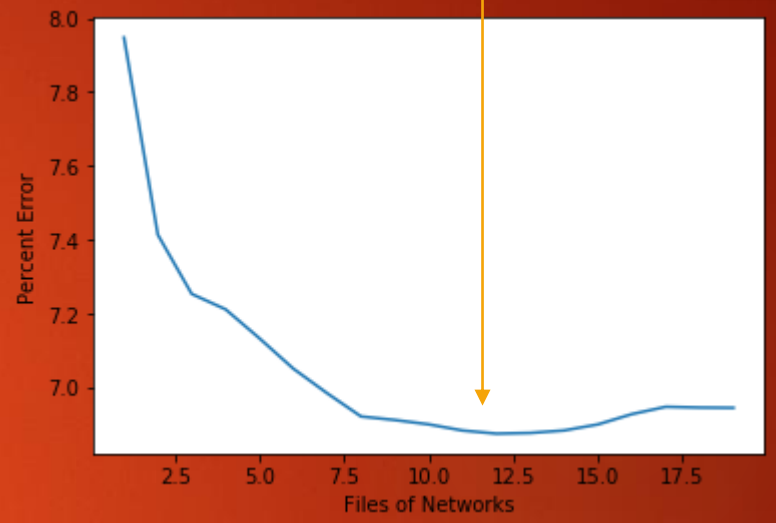
Cross section spread

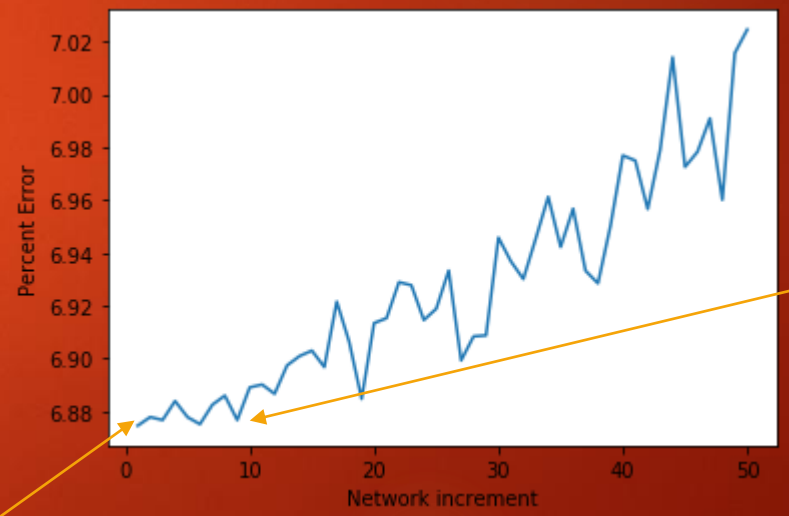


Network

5 Deep 50 Wide, pretrained with Nadam optimizer with lr=1e-2, 1e-3, 1e-4, 1e-5, and 1e-6 1e-7	
Train % Error	6.73%
Validation % Error	6.88%
Test % Error	7.38%
Train % inside 3 SD	95.7%
Validation% inside 3 SD	95.4%
Test % inside 3 SD	95.6%

Min at 12





Just slightly higher at 9, gives 66 networks

Min at increment of 1, giving 600 networks

Goals for next week

- Figure out how to generate actual masses of particles given parameters using SUSPECT
- Research known parameter constraints
- Make graphs of one parameter against another
- Look at paper which goes the other direction