

# EFT Update

2018-10-11

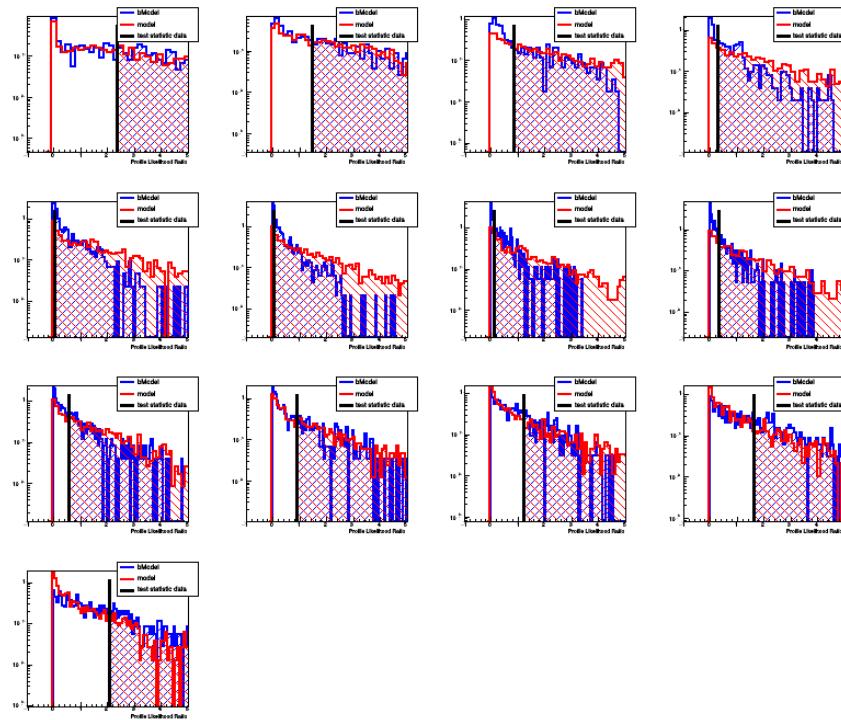
# New Stuff

# Updated PLR in Several Ways:

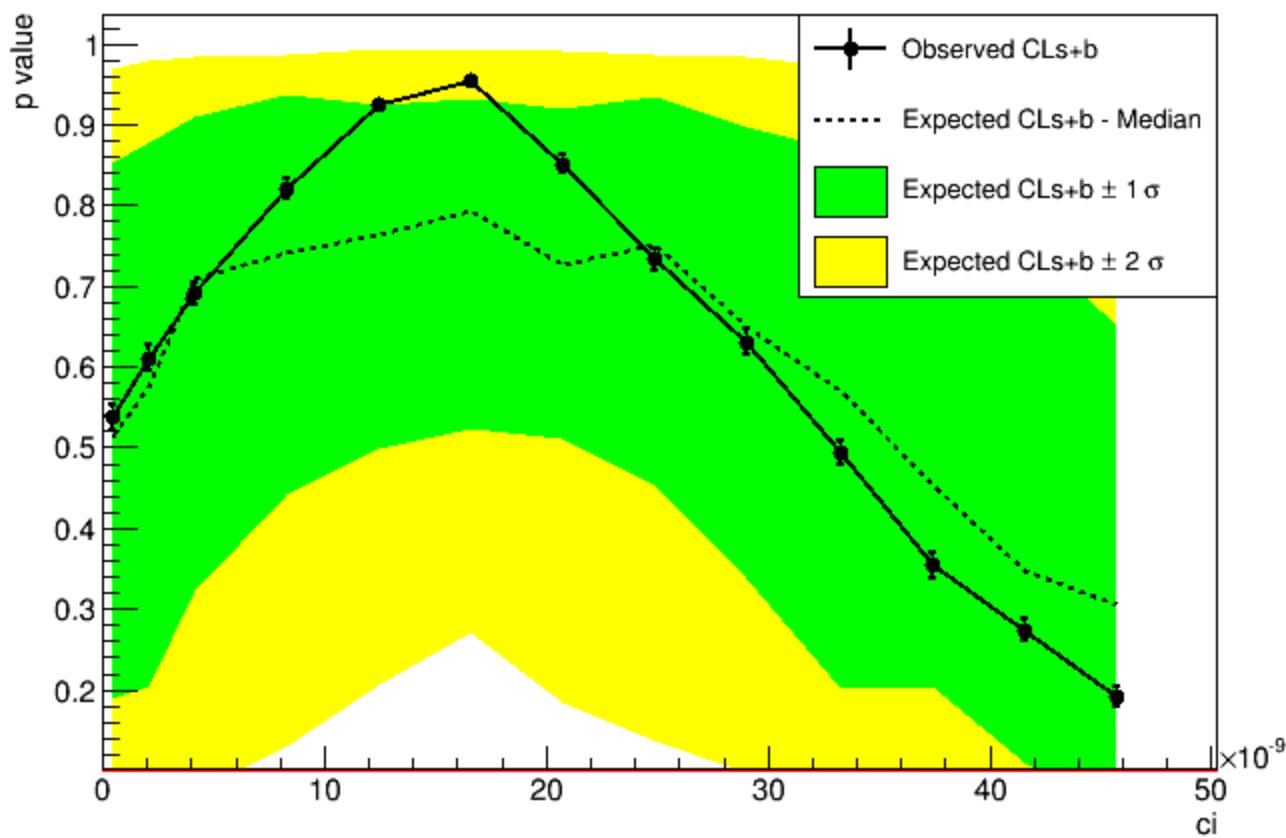
- Reverted back to using classes instead of loads of confusing vectors (breaks root5 compatibility)
- Correctly take into account effect of cutting down our S1 and S2 range to a restricted ROI (different for each operator-nucleon-mass-timeBin-zSlice)
- Implemented a toggle that automatically uses the kr85 background if the recoil spectrum includes energy above a set threshold, and doesn't include this background (allowing larger exposure time) otherwise

# Updated PLR to test only specific POI values

- Then created a script to combine the results into one.
  - This gets around the previously mentioned “too many datasets to track” problem
  - Allows more parallelization



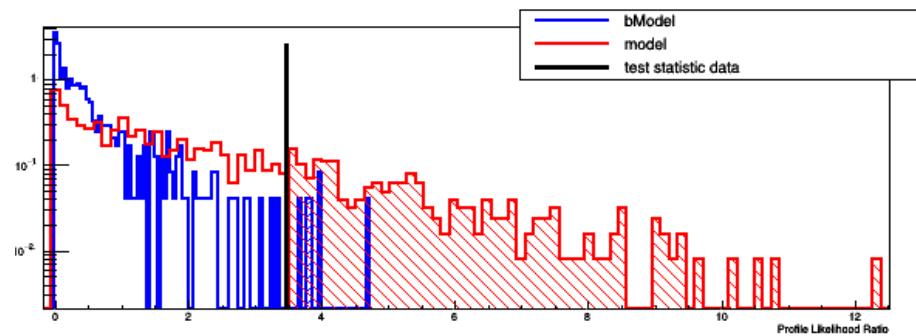
## HypoTestInverter Result For ci



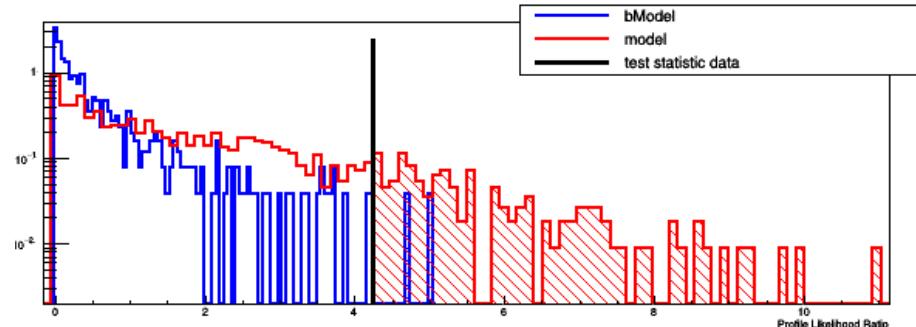
# Updated PLR to use background as data

- For the purpose of testing different cuts, etc on our sensitivity, draws a “data” set directly from the background model
- Tried to use, but problem....

6 signal events expected



7 signal events expected



# Another problem...

- PLR maximization to..... data? Always the same background numbers no matter what data I feed in...

Data:  
background  
model

```
----- VARIABLE IS AT ITS LOWER ALLOWED LIMIT.
MIGRAD MINIMIZATION HAS CONVERGED.
FCN=1262.03 FROM MIGRAD   STATUS=CONVERGED   180 CALLS   181 TOTAL
                           EDM=4.26491e-05  STRATEGY= 0  NO ERROR MATRIX
EXT PARAMETER      CURRENT GUESS      STEP      FIRST
NO.   NAME      VALUE      ERROR      SIZE      DERIVATIVE
  1  ci      6.69500e-15  3.11574e-09  1.93976e-02** at limit **
  2  nExpBkg_Accidental  8.81452e-02  8.72627e-02  1.35884e-04  1.21466e-03
  3  nExpBkg_Ar37    7.90959e+00  7.82446e+00  -2.78031e-03  5.53305e-02
  4  nExpBkg_ComptonBottom  8.29229e+00  8.20437e+00  -2.46293e-03  4.37056e-01
  5  nExpBkg_ComptonRest  1.11312e+02  1.10148e+02  -2.15489e-03  3.35140e-01
  6  nExpBkg_RnKr     3.83458e+01  3.79494e+01  -1.85563e-03  2.47052e-02
  7  nExpBkg_Wall    1.36323e+01  2.00000e+00  3.03503e-03  8.20180e-04
                           ERR DEF= 0.5
StandardHypoTestInvDemo - Best Fit value : ci = 6.695e-15 +/- 3.11574e-09
Time for fitting : Real time 0:00:00, CP time 0.210
```

Data:  
background  
model x 100

```
MIGRAD MINIMIZATION HAS CONVERGED.
FCN=106935 FROM MIGRAD   STATUS=CONVERGED   173 CALLS   174 TOTAL
                           EDM=4.44989e-05  STRATEGY= 0  NO ERROR MATRIX
EXT PARAMETER      CURRENT GUESS      STEP      FIRST
NO.   NAME      VALUE      ERROR      SIZE      DERIVATIVE
  1  ci      8.30865e-08  3.11574e-09  -3.82123e-02** at limit **
  2  nExpBkg_Accidental  8.80958e-02  8.72627e-02  -1.19052e-03  -2.90511e-03
  3  nExpBkg_Ar37    7.89914e+00  7.82446e+00  -1.24280e-03  -3.14154e-03
  4  nExpBkg_ComptonBottom  8.28267e+00  8.20437e+00  -1.24433e-03  -3.14860e-03
  5  nExpBkg_ComptonRest  1.11199e+02  1.10148e+02  -1.24584e-03  -3.15552e-03
  6  nExpBkg_RnKr     3.83116e+01  3.79494e+01  -1.00648e-03  -2.92321e-03
  7  nExpBkg_Wall    1.36040e+01  2.00000e+00  -4.27708e-02  -5.10538e-03
                           ERR DEF= 0.5
StandardHypoTestInvDemo - Best Fit value : ci = 8.30865e-08 +/- 3.11574e-09
```

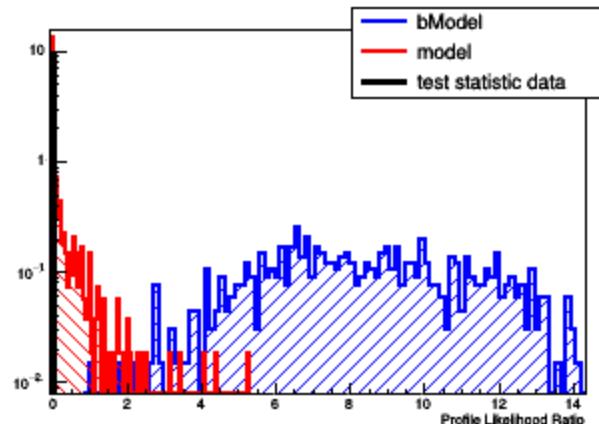
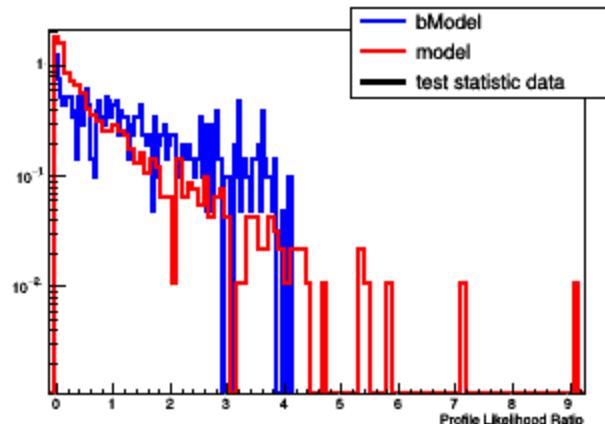
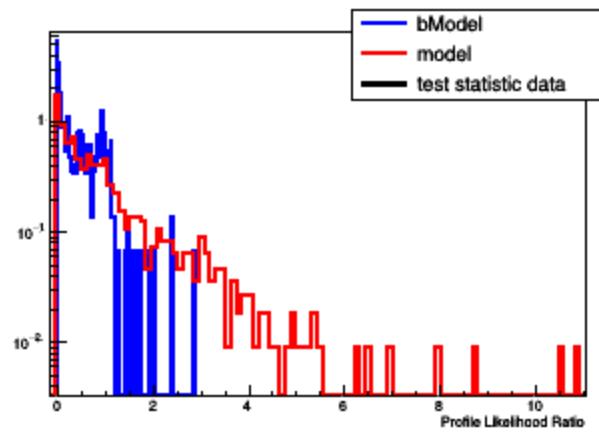
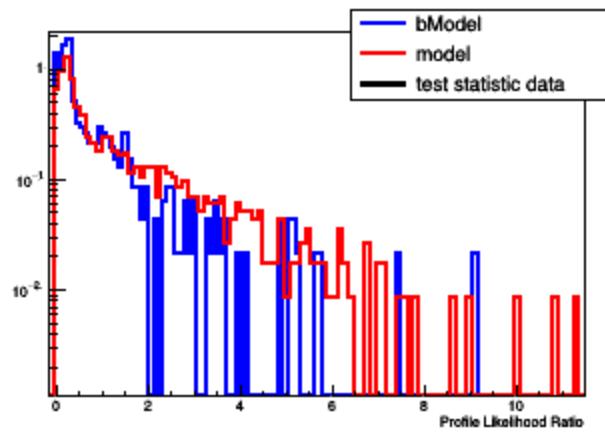
# Try Operator 1 Isoscalar

# Result!

Red is null hypothesis (WIMP exists with given POI)

Blue is alternative hypothesis (WIMPs do not exist)

Black is the test statistic obtained from our run.

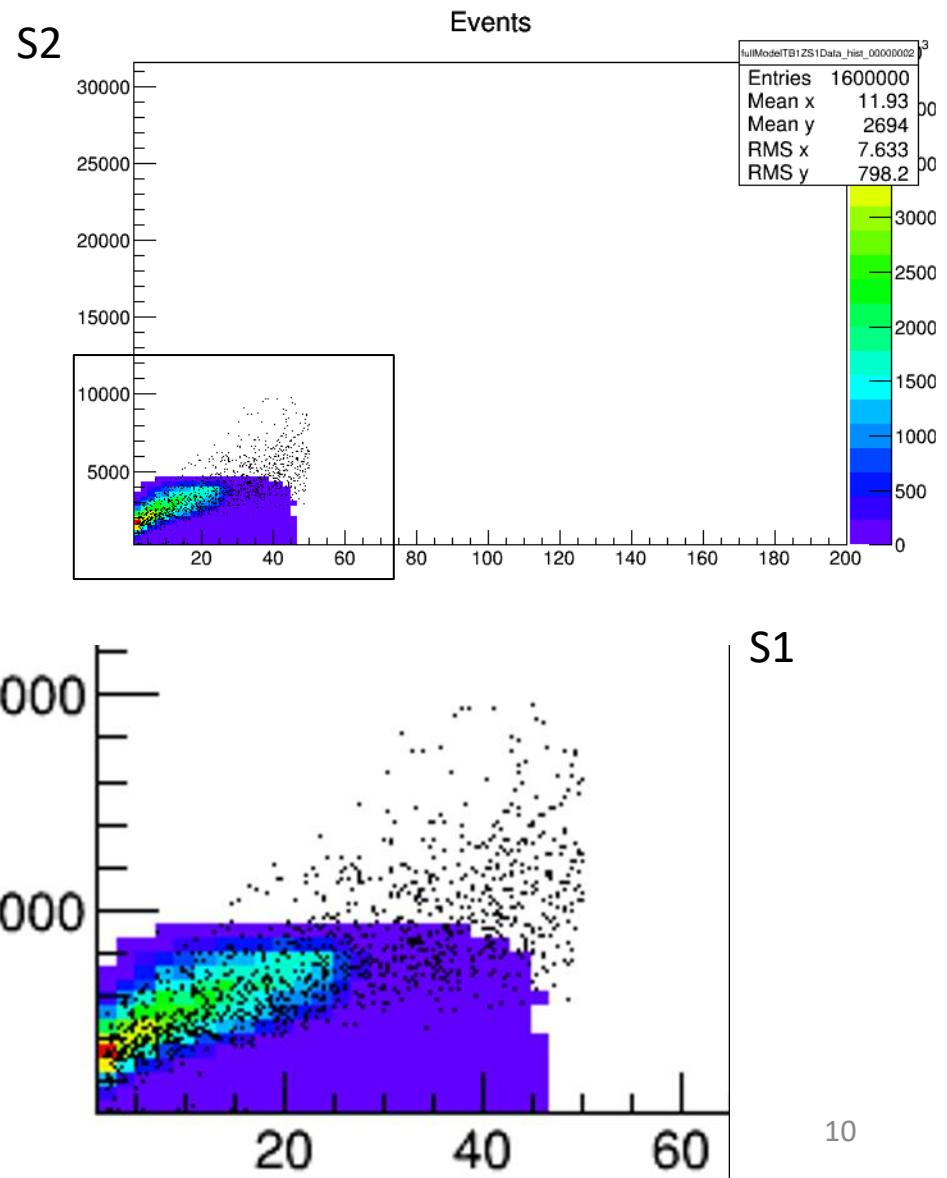
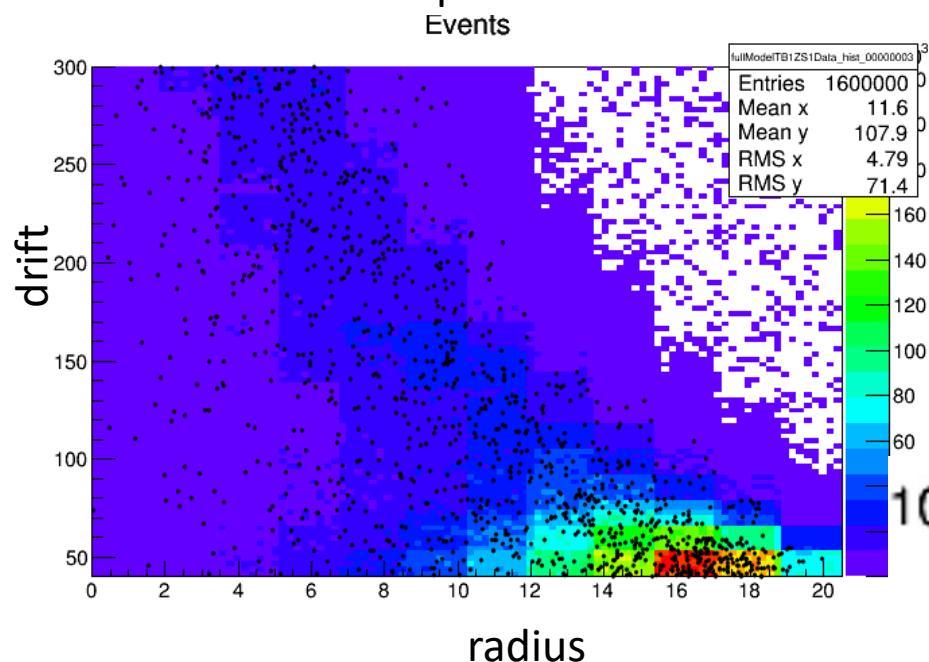


Something's wrong...

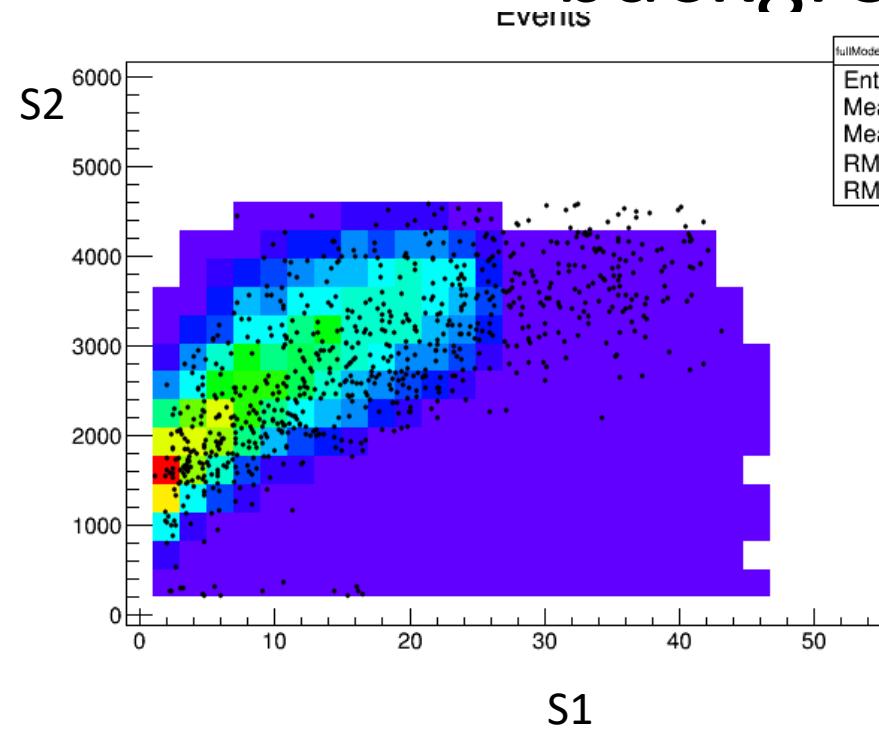
Data-model  
likelihood always 0!

# Model vs Data

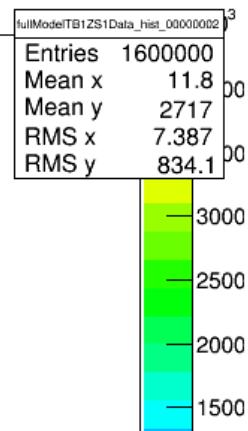
Histogram is model,  
Black points are data



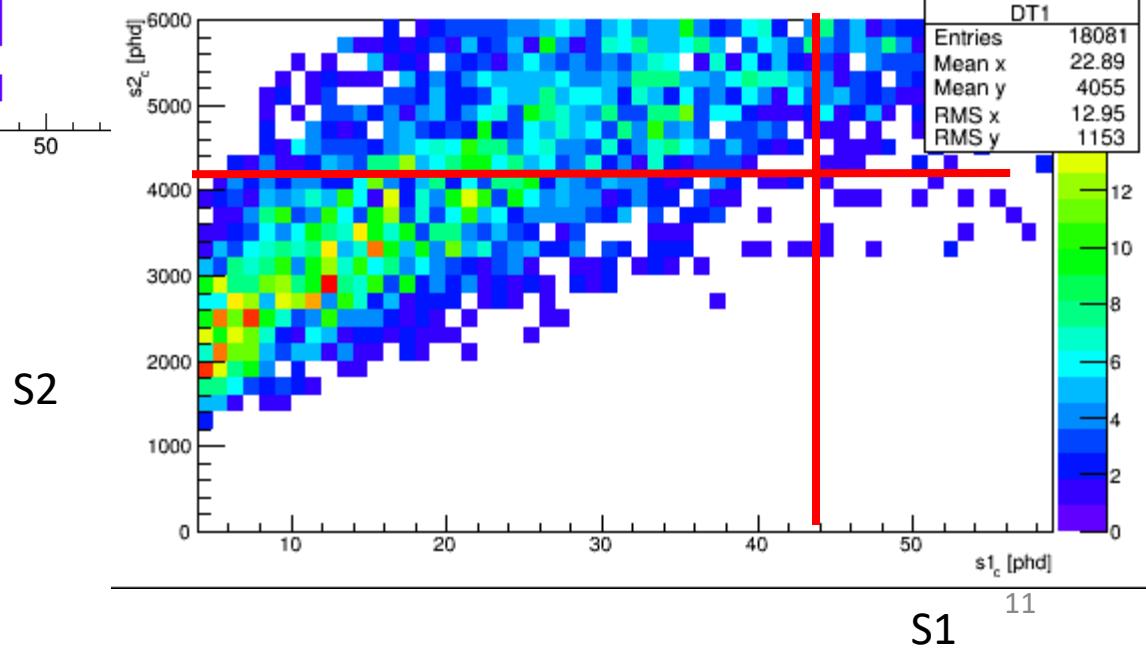
# Cut data to same thresholds as background model



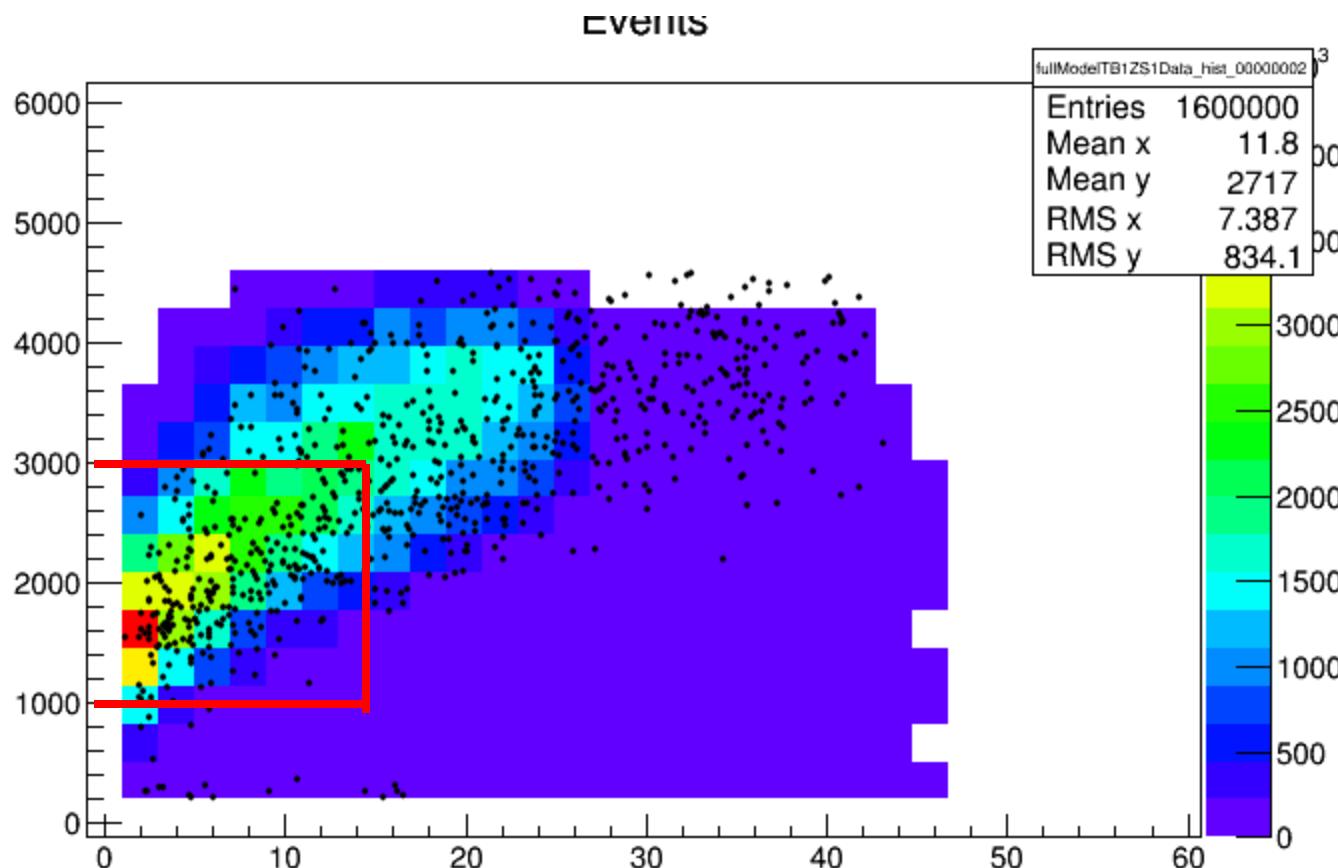
Stand-in dummy wall model  
is included, not real wall  
model



Most dominant component



# Cut data to only a small region compatible with the model



# Non-zero likelihoods!

