Update on Kinematic Fits in the Leptonic Channel

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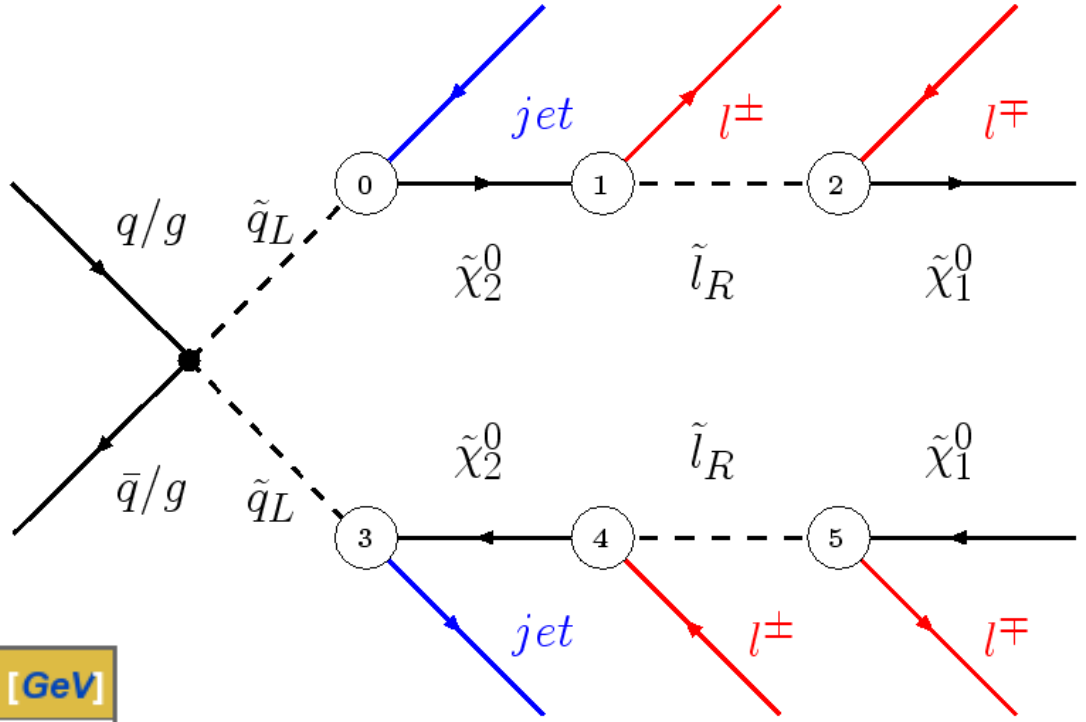
Benchmarkpoint & Cascade

mSUGRA Parameters

	SPS1a
m_0	100 *GeV*
$m_{1/2}$	250 *GeV*
A_0	-100 *GeV*
$\tan(\beta)$	10
μ	>0

Particle	Mass [*GeV*]	ΔM to next [*GeV*]
$\tilde{g}$	606	39 / 44
$\tilde{q}_L$	567 (ud) / 562 (cs)	387 / 382
$\tilde{\chi}_2^0$	180	37
$\tilde{l}_R^{\pm}$	143	46
$\tilde{\chi}_1^0$	97	

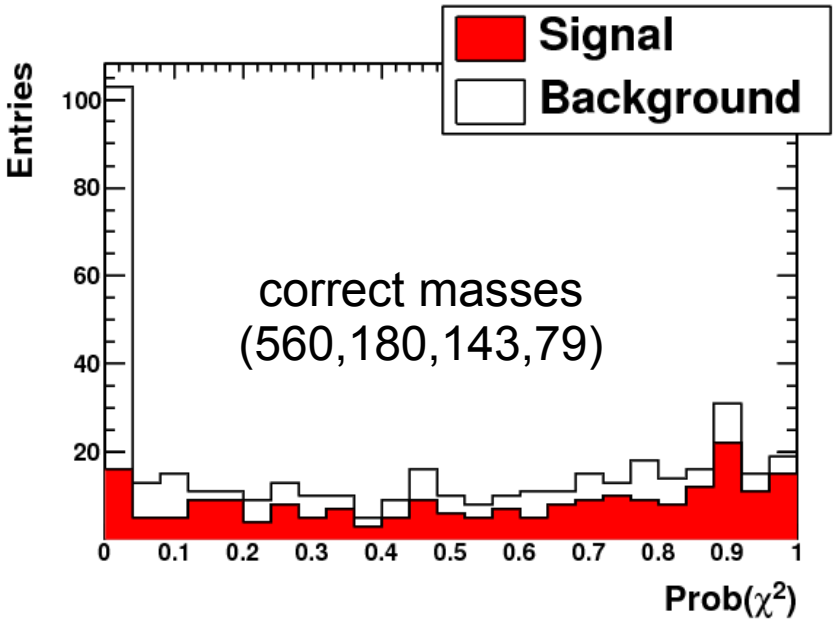
X-section: ~36 pb @ 14 TeV

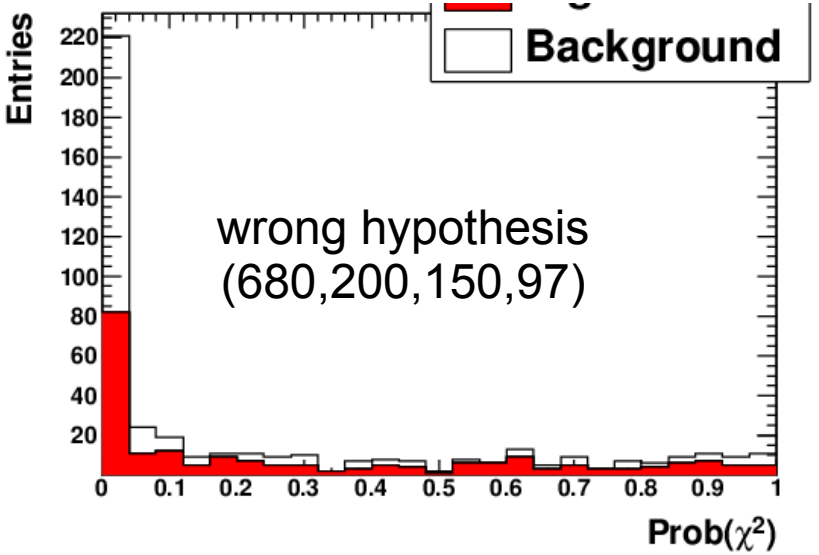


Leptonic Cascade

- 2 jets + 2x2 OSSF leptons
- 16/32 possible combinations
- BR = $1.7*10^{-3}$

Likelihood Definition





- Hypotheses close to true masses fit on average better
- Use events' combined fit probability to quantify how good the assumed masses fit.

$$\log \mathcal{P} = \sum_{i}^{N} \log P(\chi_i^2)$$

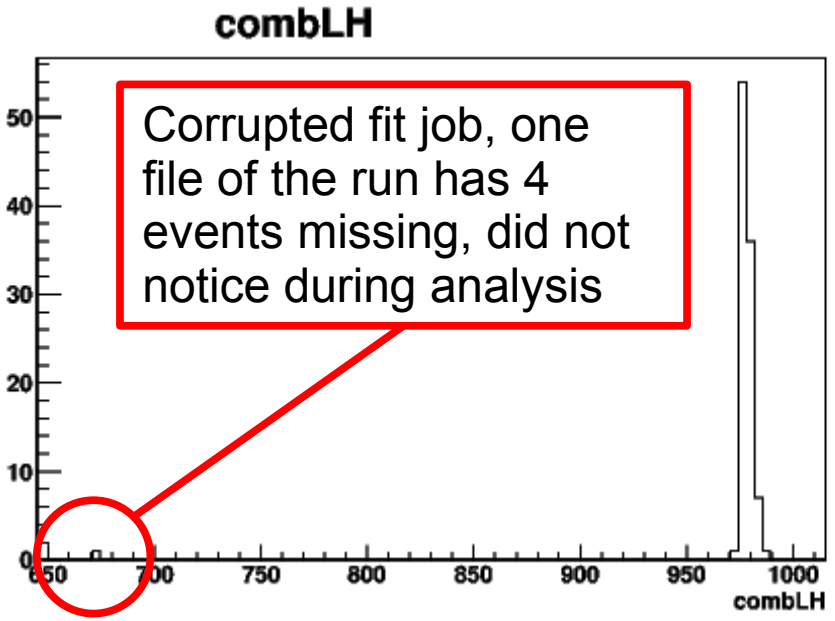
$$P_i = P_{\mathrm{cut}} \ \mathrm{for} P_i < P_{\mathrm{cut}}$$

  - Cut-off to avoid numerical fluctutations
  - P_{cut}=0.01

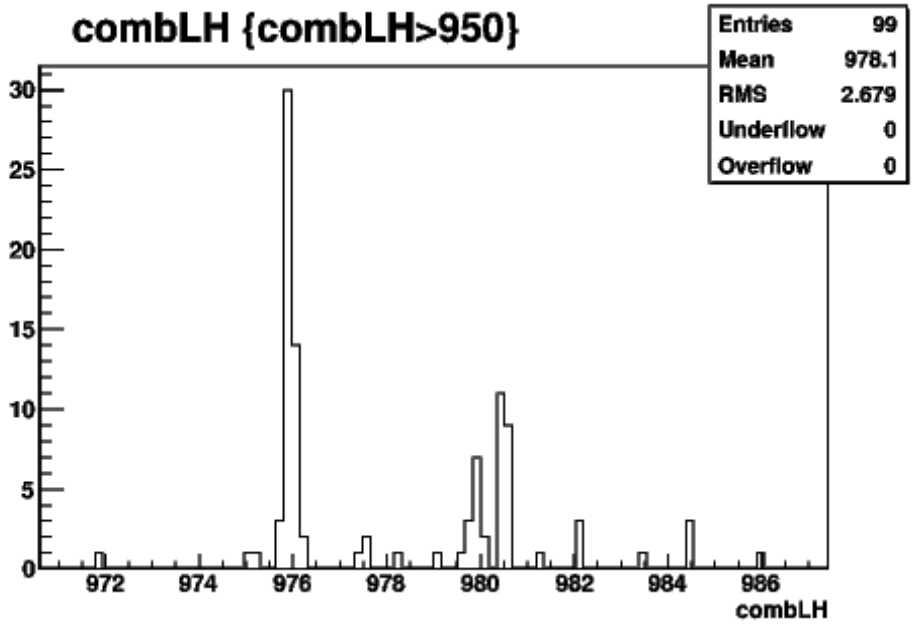
Spread after repeated Fit

Last week:

- Fit each event 498 times (for true masses here)
  - Calculate likelihood from best probability of each event
- Repeat this 100 times
- Some Likelihood P:



Zoom:

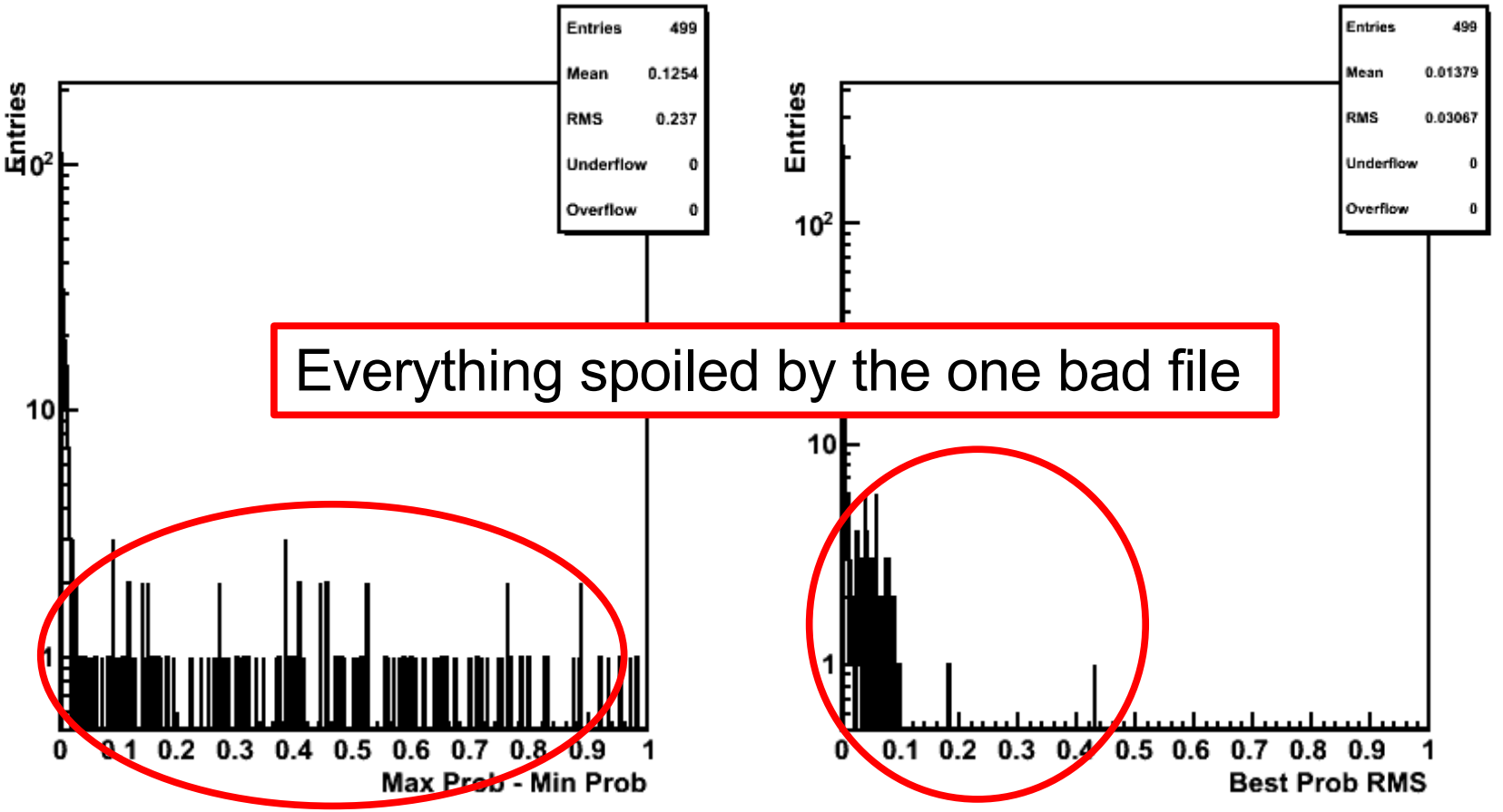


- Large Spread
  - Expected one peak...
  - Outlier: bug?

Event-wise Spread

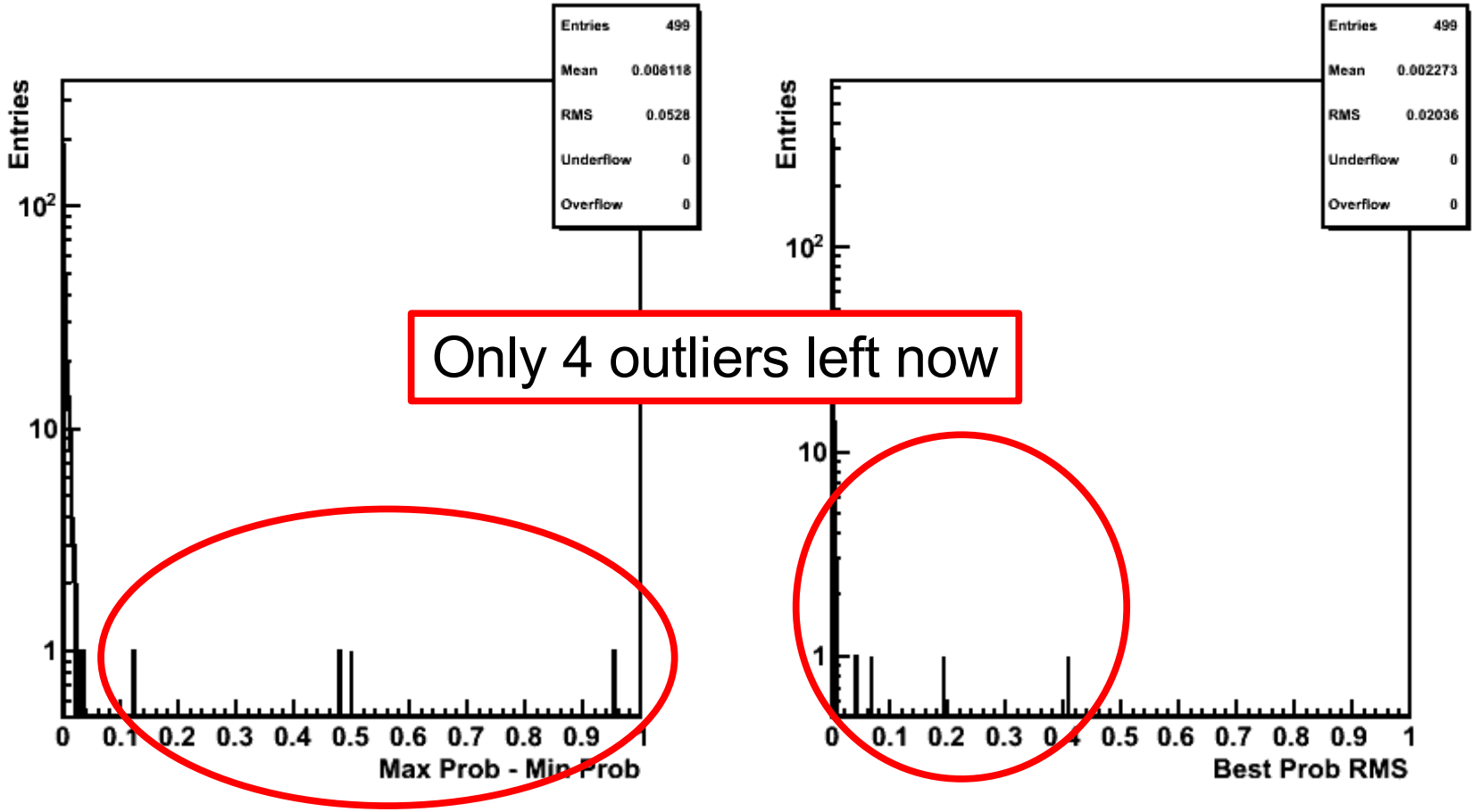
Last week:

- From 498x100 Fits of all events:
  - Max. difference: find some event with really large values
  - RMS of distribution
    - rather small values
    - study 2 outliers



New Event Grouping

- Now 505x99 Fits of all 499 events:
  - Max. difference of fit probabilities for one event: P_{max}-P_{min}
  - RMS of probability distribution
    - rather small values
    - study 2 outliers

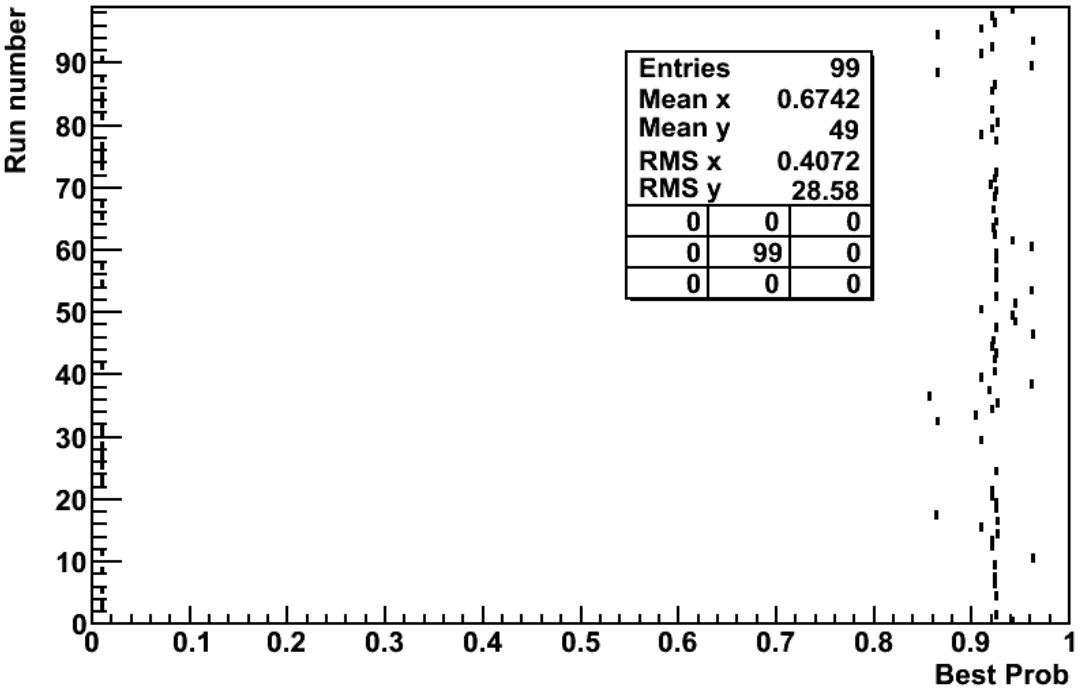


Outlier Events

Event No.	Type	RMS	Max.-Min.	Converged Runs*
113	Signal	0.407	0.953	72/99
64	Signal	0.191	0.499	81/99
323	Signal	0.066	0.478	2/99
210	Signal	0.04	0.121	86/99

(*) Converged here means any Prob>P_{cut} in this run

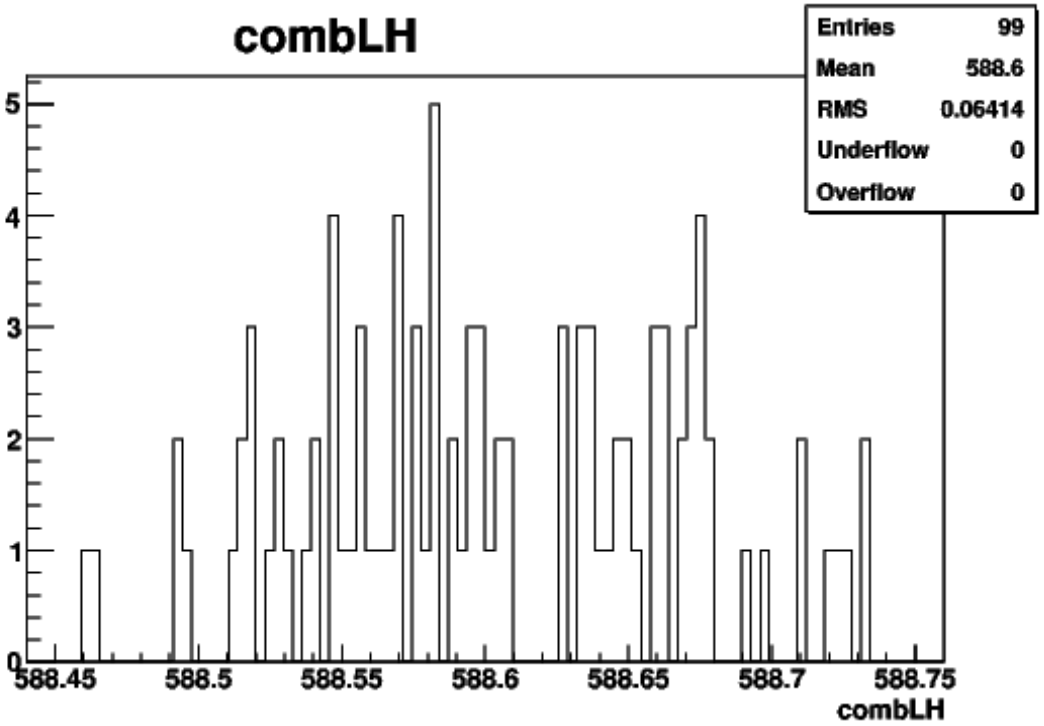
- Problematic Feature:
  - Distribution of best Prob has two 'populations'
  - Some runs with no Prob>P_{cut}
  - Causes large differences in total likelihood



- For now just excluded them from the total likelihood

Likelihood w/o Outliers

- Total likelihood distribution from 99 runs:



  - Very small spread now
  - Looks almost gaussian

Next: study problematic events

- Why does it happen?
  - Particular event topology?
  - Mass hypothesis dependency?
- How to deal with them?
  - Exclusion: How to classify as good/bad event
  - ...?