PRELIMINARY

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More on the 2015 IMD

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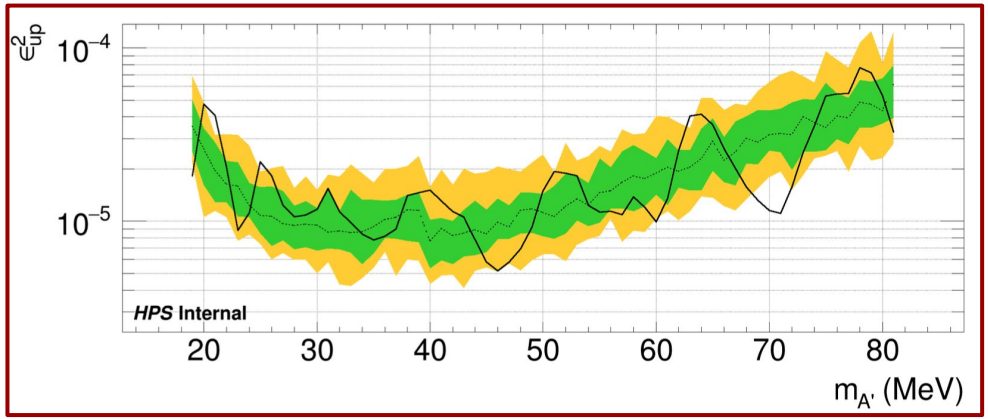
Global BKG Fitting of 2015 IMD (Re-Re-Analysis)

Summer student TJ Britt has been assisting in implementing global fitting techniques to 2015 IMD.

Objectives

- Improve physics result!
- Standardize procedure across datasets.
- Combine 2015/2016 upper limits to create 2019, 2021 template.

2015 ε^2 Upper Limit Result (re-analysis)

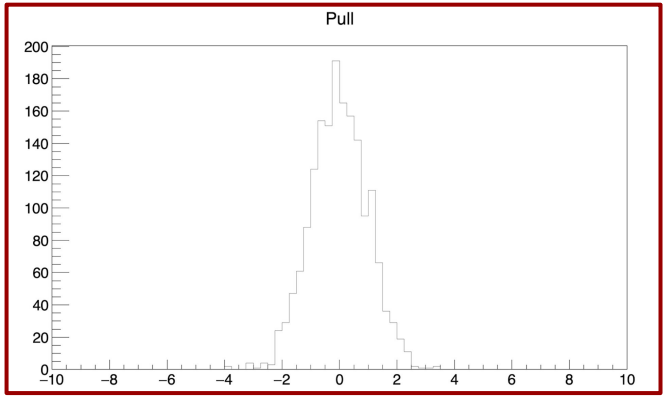


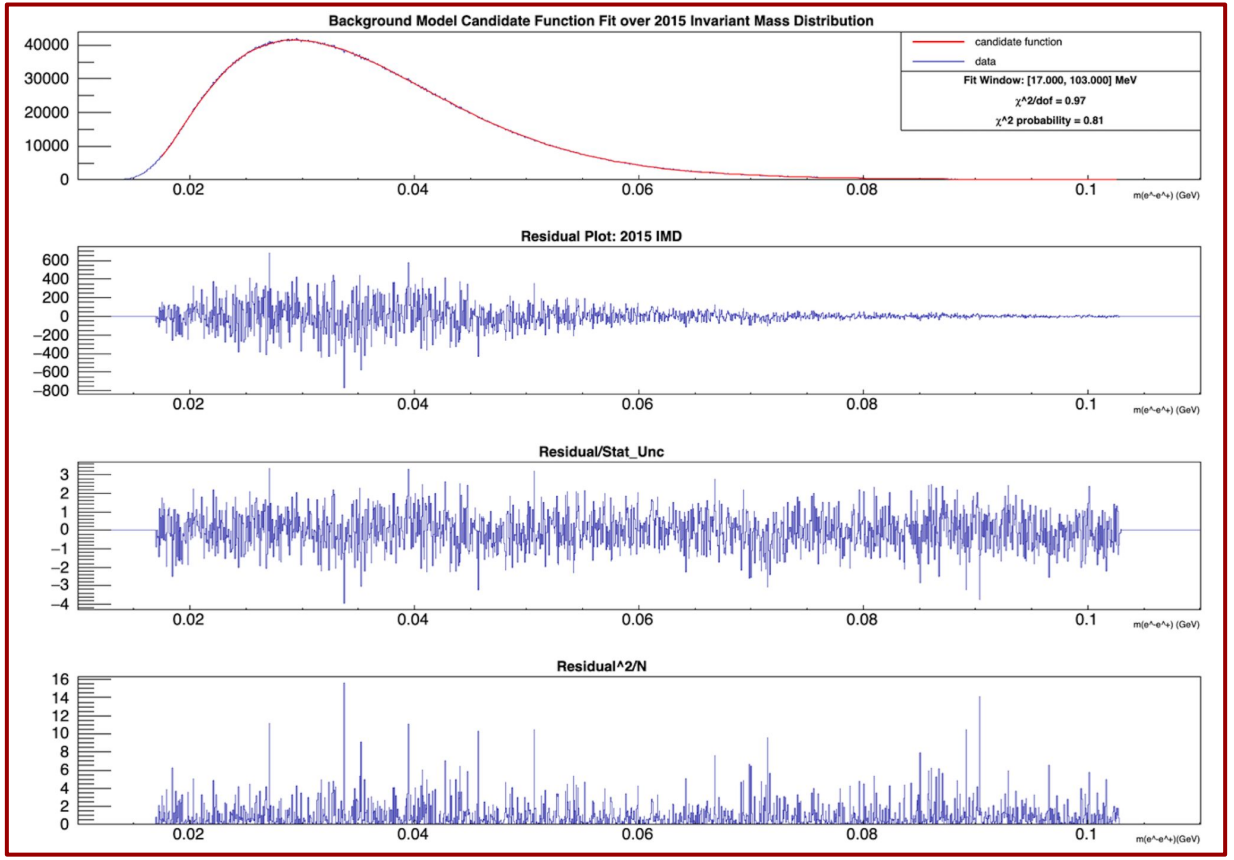
2015 Engineering Run: 1.2 pb^{-1}, 1.06 GeV

Good background only fit

From TJ's fits / tools

- parameters stored for use in bkg+signal model
- **chi2 probability = 0.81**
- **chi2/dof = 0.97**





Bumphunter Procedure

SLAC

For each mass hypothesis

I. Background Only Fitting
   A. Used parameters from TJ's testing
   B. Floated Global Normalization Constant

II. Background + Signal Fitting
   A. Signal yield + GNC floating

Was able to get convergence at each mass hypothesis!

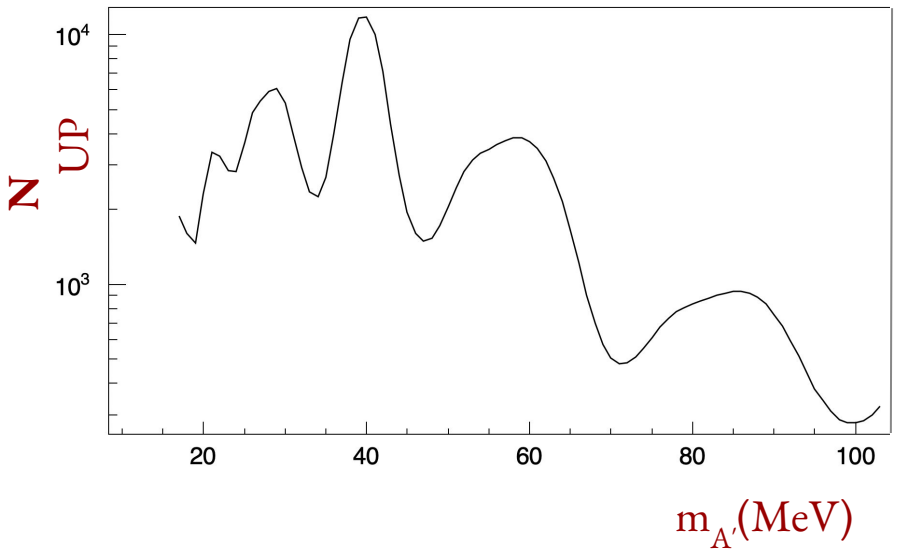
Candidate Background Model Functional Form

$$\mathcal{C} \cdot \left[\mathrm{Er}_1 \cdot (1-x)^{p[1]} \cdot e^{p[2] \cdot \log(x)} + \mathrm{Er}_2 \cdot q[1] \cdot (1-x)^{q[2]} \cdot (1+x)^{q[3] \cdot x} \right]$$

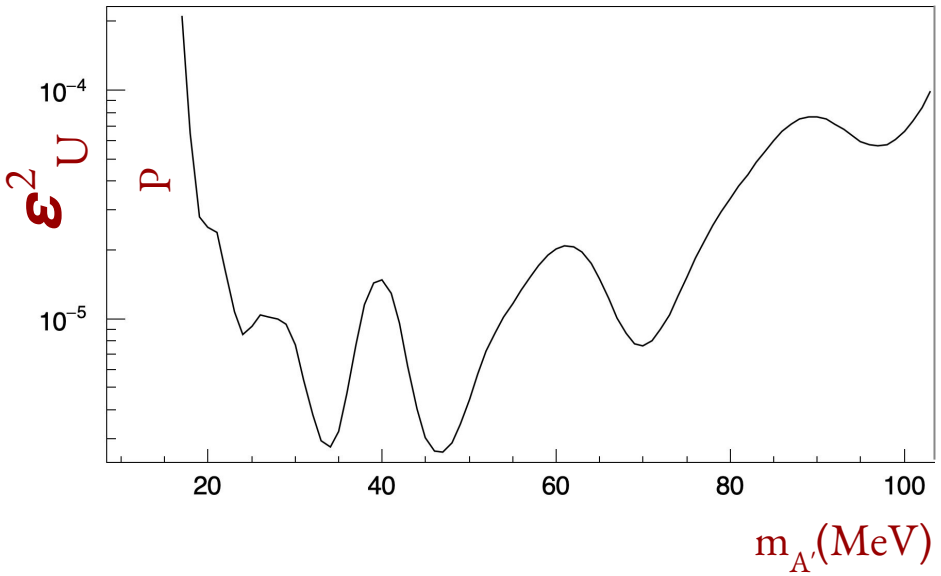
```
//using TJ 2015 parameters, p2 left floating
bkg->FixParameter(0, 0.014644197894772693);
bkg->FixParameter(1, 0.04221614030484323);
bkg->SetParameter(2, 0.12652265782128902);
bkg->FixParameter(3, 41.307773476701016);
bkg->FixParameter(4, -4.650919568835351);
bkg->FixParameter(5, 0.006096010217600811);
bkg->FixParameter(6, 0.01338393672261954);
bkg->FixParameter(7, -2378756.1401456497 / 0.12652265782128902);
bkg->FixParameter(8, 204.9533977916774);
bkg->FixParameter(9, 908.6264962251225);
```

Preliminary Upper Limits

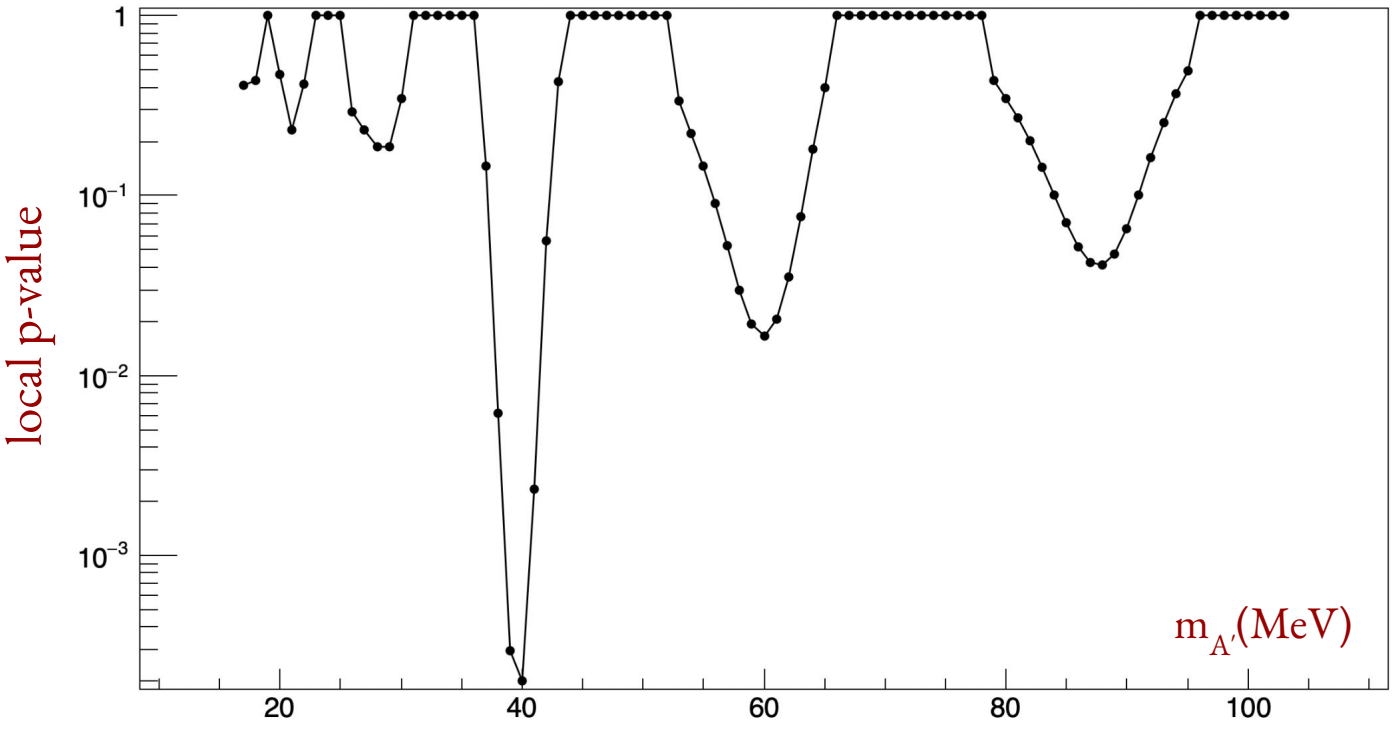
Signal Yield Upper Limit



ε^2 Upper Limit



Preliminary PValue



Next steps

- Analyze the 6.5% 2016 IMD to compare candidate function performance across similarly sized but distinct samples

- Start a 2015 re-re-analysis section of my overleaf note
  - Work with TJ to compile necessary displays, rebinned fits, and calculate optimistic statistical only limits
  - plot old limits, improvement on the limit, and optimistic limit together