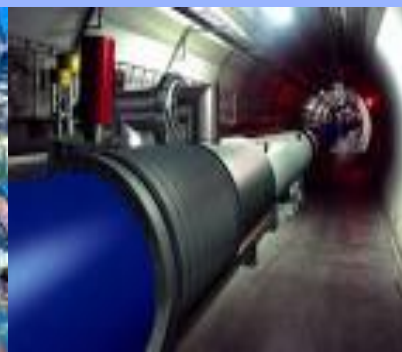




# $G \rightarrow e^+e^-$ Intentions & Early Progress

17/11/09



By Daniel Hayden, Royal Holloway University of London, Supervisor: Dr. Tracey Berry.



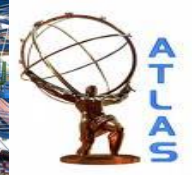
## Contents:

- Introduction
- Analysis Intentions
- Graviton MC Data Samples
- RooFit / RooStats
- Early Progress
- Summary & Aims



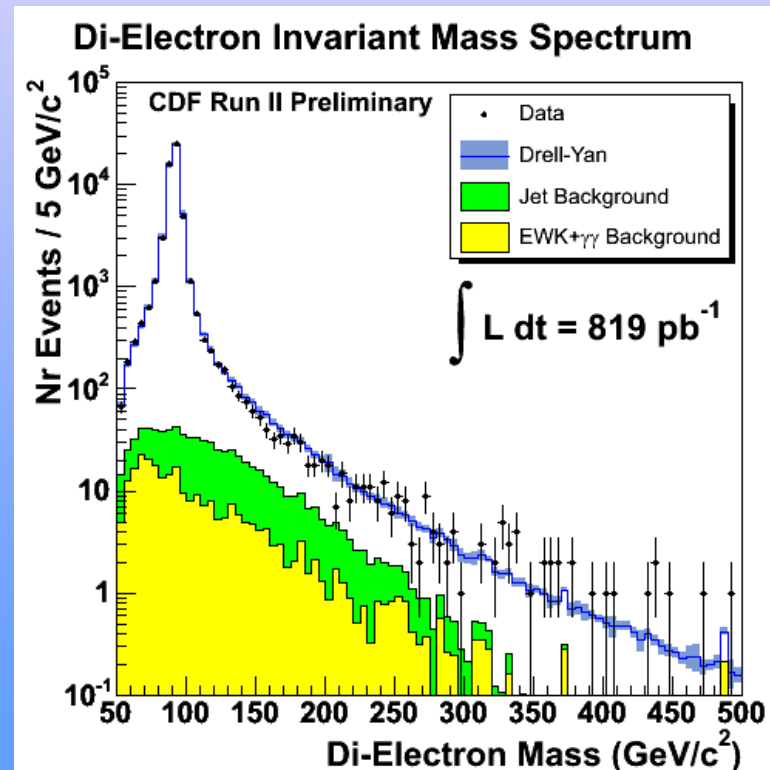
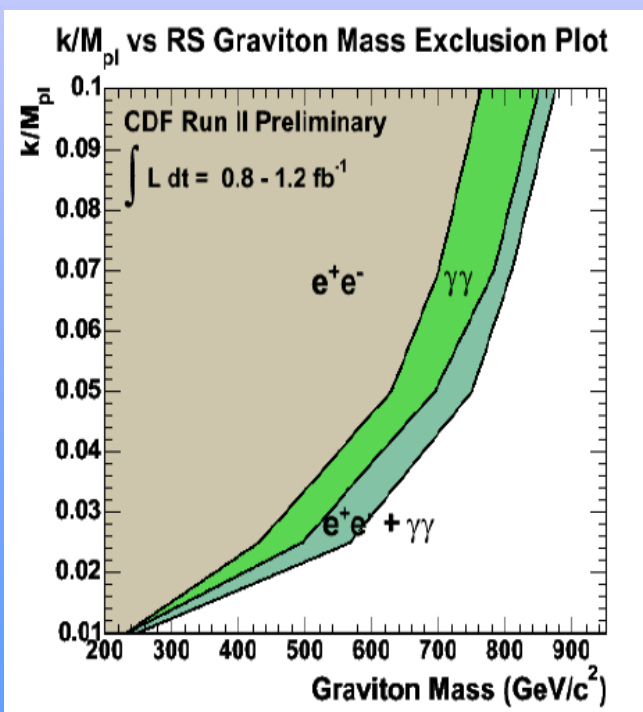
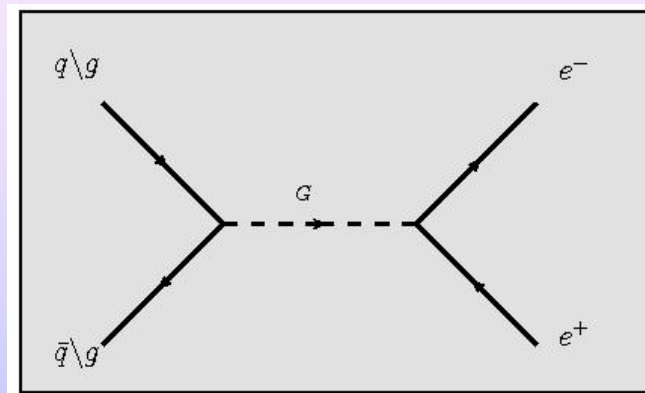
## Introduction

- Now at the beginning of the 2<sup>nd</sup> year of my PhD.
- Started by looking at Electron Triggering, Identification & Resolution with the ATLAS Detector.
- Now concentrating on  $G \rightarrow e^+e^-$  analysis, leading to statistical combination of channels in the future using RooStats.
- Service Work is looking at Triggering of Very High  $P_t$  Electrons, how can we look for best candidate? Forms part of early commissioning with Data.



# Introduction

- Present RS Graviton constraints are from CDF, who also combined channels to present better limits.
- Theoretical Constraints disfavour  $k/M_{pl} > 0.1$  as bulk curvature becomes too large.

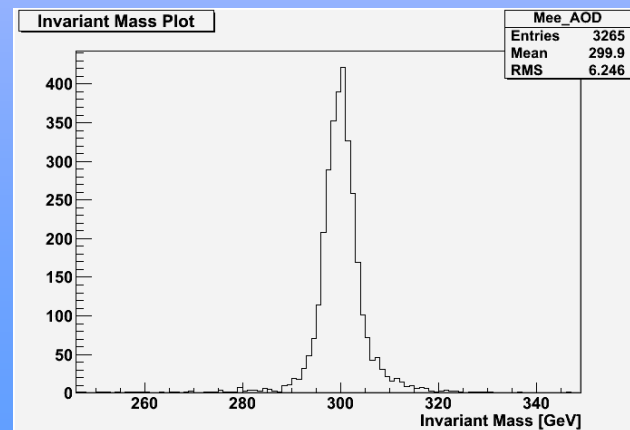
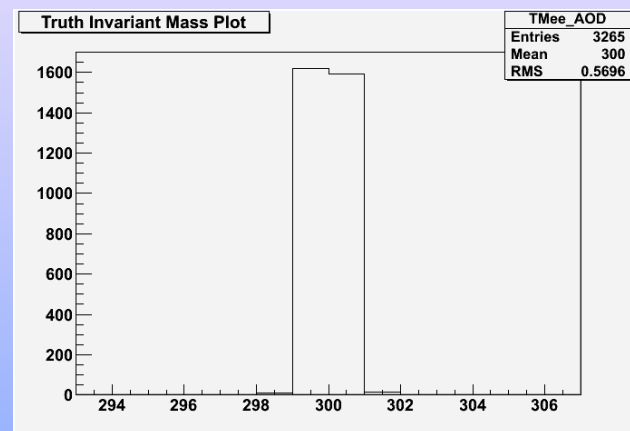
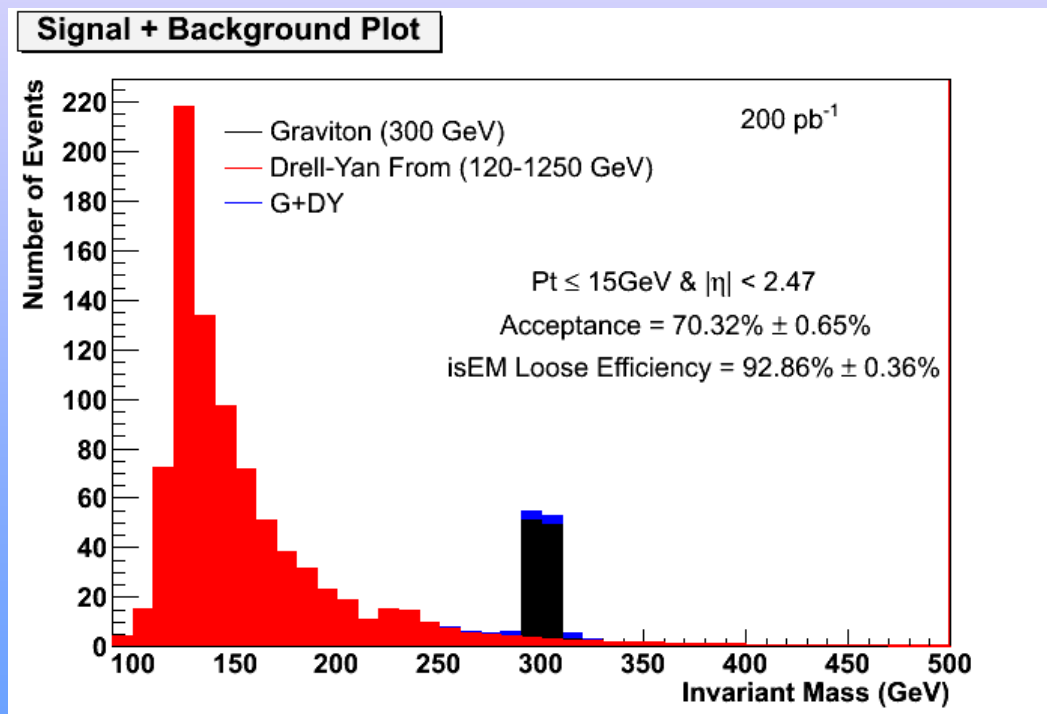






# Analysis Intentions

- Aim to create robust search technique for  $G \rightarrow e^+e^-$  in ATLAS
- Look at how Graviton Width changes with Mass &  $k/M_{Pl}$ ?
- What does this mean with ATLAS' Resolution?





## Graviton MC Data Samples

Currently only one official  $G \rightarrow ee$  sample:

mc08.105616.Pythia\_Gee\_300.recon.AOD.e355\_s462\_r541

Process	Mass	k/Mpl	Xsec	Events	Release	Pythia
$G \rightarrow ee$	300 GeV	0.01	0.834pb	10000	14	6.415

Have just completed the MC Validation and Request for:

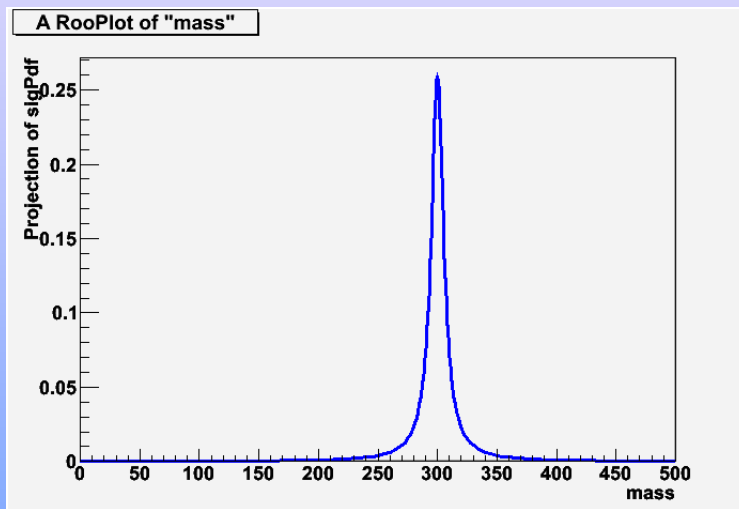
Process	Mass	k/Mpl	Xsec	Events	Release	Pythia
$G \rightarrow ee$	500 GeV	0.01	79.5fb	10000	15	6.42
$G \rightarrow ee$	1000 GeV	0.01	2.17fb	10000	15	6.42
$G \rightarrow ee$	1000 GeV	0.1	214.2fb	10000	15	6.42

Production should be finished in the coming weeks....

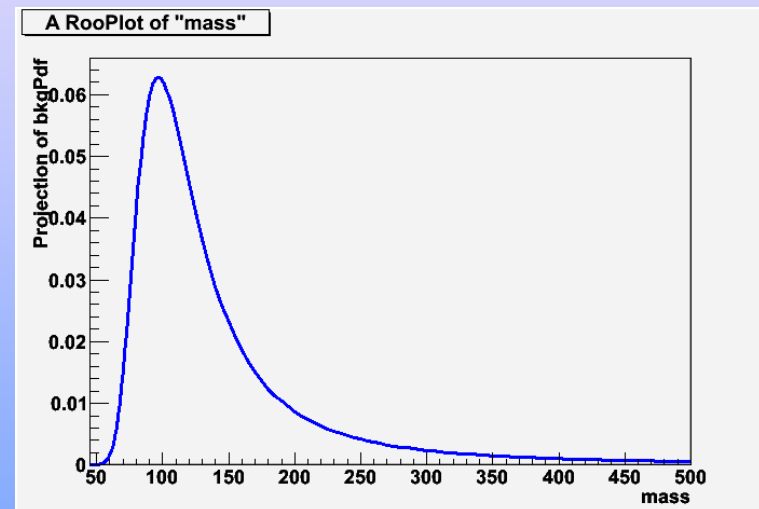


## Roofit / RooStats

- See Ferrag's talk on 01/10/09 for more on RooFit/RooStats
- I will use these tools to do a Statistical Search for  $G \rightarrow e^+e^-$ .
- Assume you know Signal & Background Shapes.



+



Graviton Signal shape (Assumed BreitWigner)

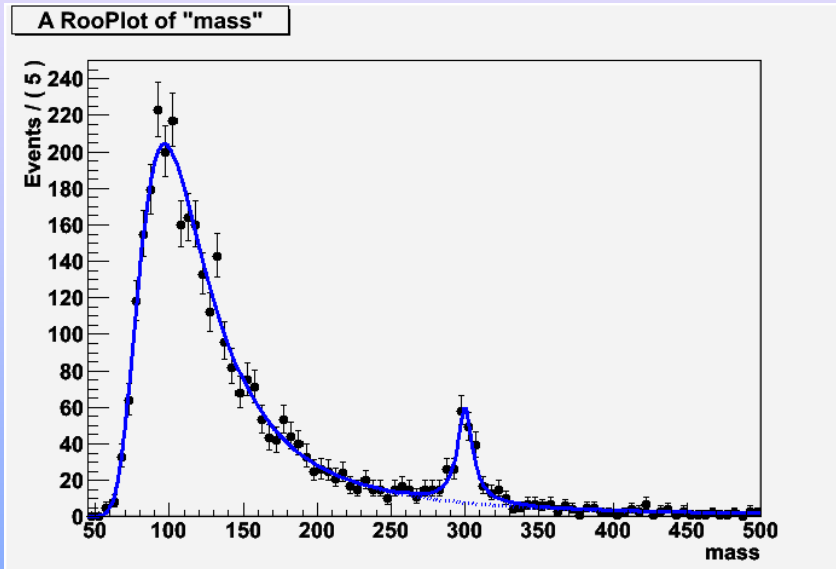
Crude DY Bkg shape (Assumed ChebyChev)

- Can Create a Work Space containing your Model and Data (At first Generated MC around model, but eventually real).

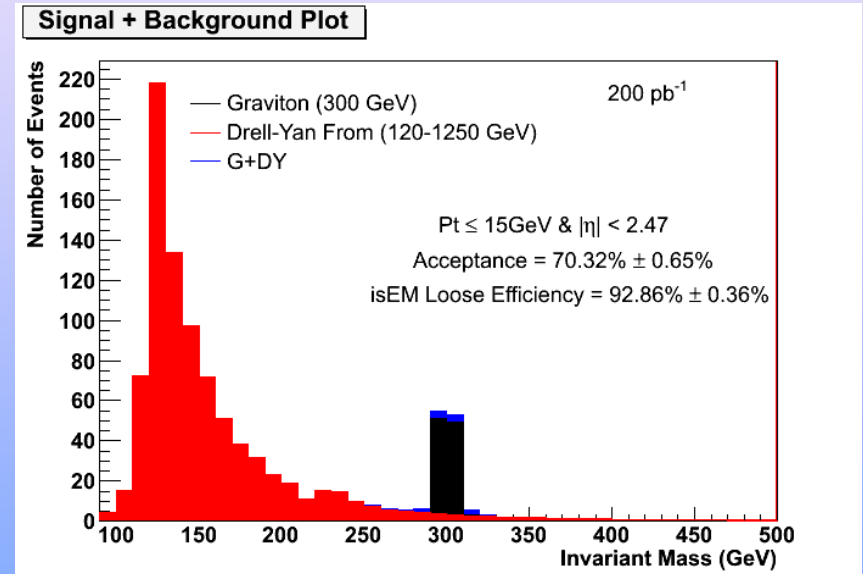


# RooFit / RooStats

- This model can then be subjected to various statistical tests
- Flexibility of this system allows you to vary most parameters



Combined Model



Monte Carlo Data (Official 300 GeV Sample)

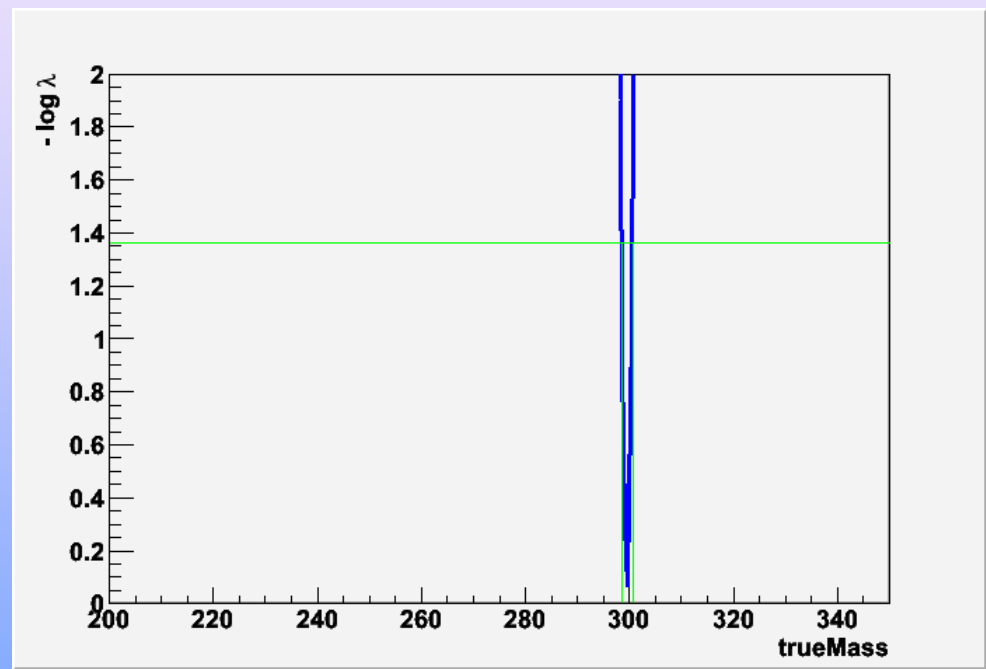
- I am producing a robust model allowing variation of True Mass, Signal Width, A Coupling Strength Constant (0-1), and later, Background Scaling.



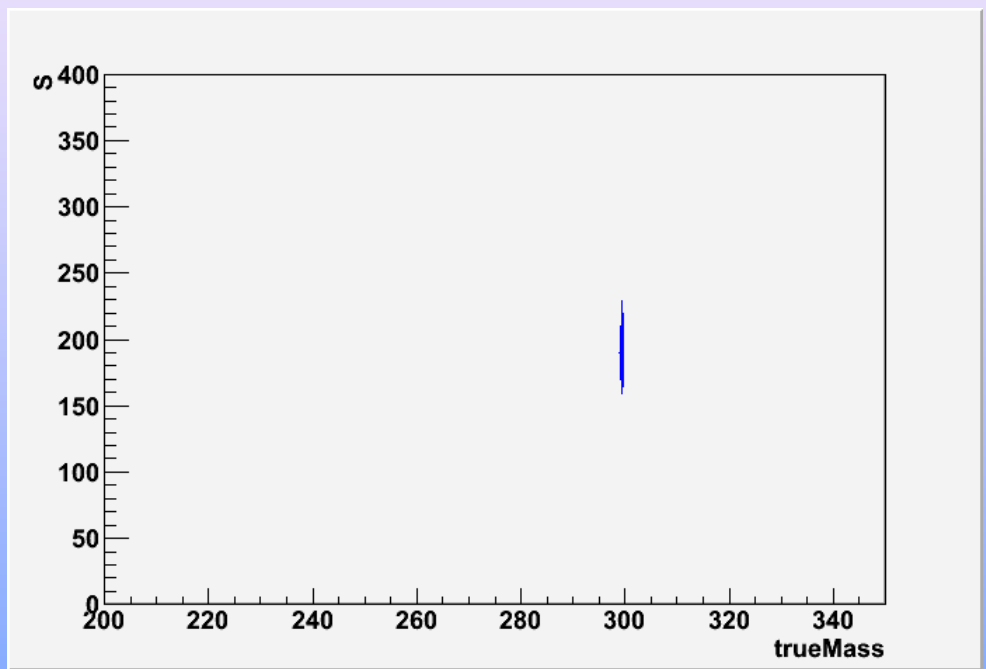


## Early Progress

- Attended the First RooFit/Roostats Tutorial (15<sup>th</sup>-16<sup>th</sup> Oct)
- Have got some Stats tests working for simple model already.



Profile Likelihood Calculator  
(Based on MINUIT/MINOS)



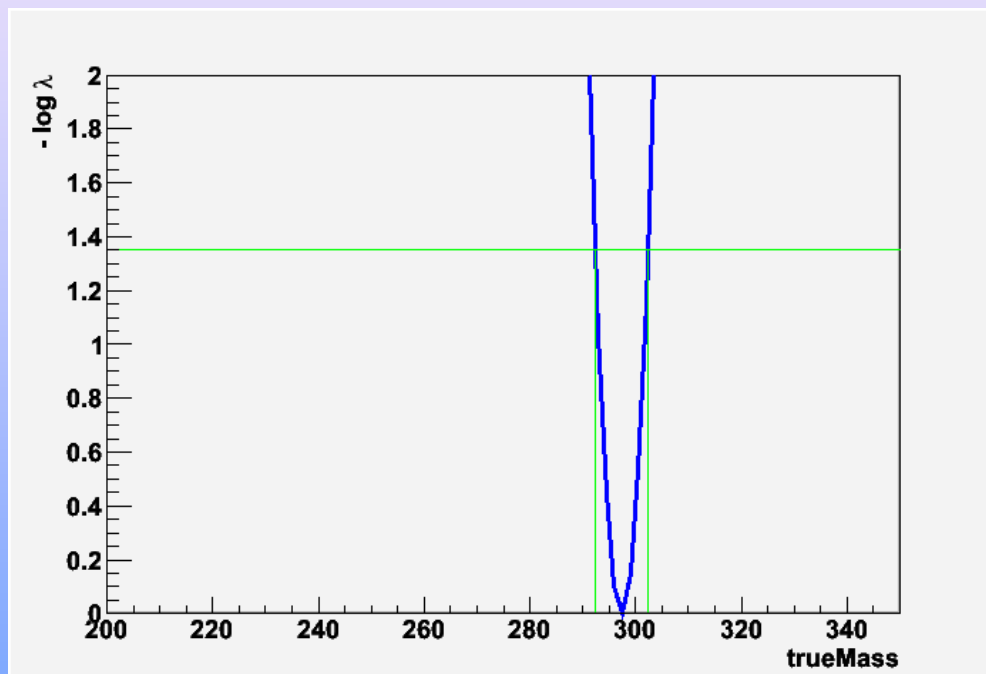
\*PLC\* / FeldmanCousins / MCMC Test  
(Various Highly Attractive Stats Methods)

- Here you see the two-sided upper limit 90% CL Interval, using the 300 GeV Official MC sample, and my initial model.

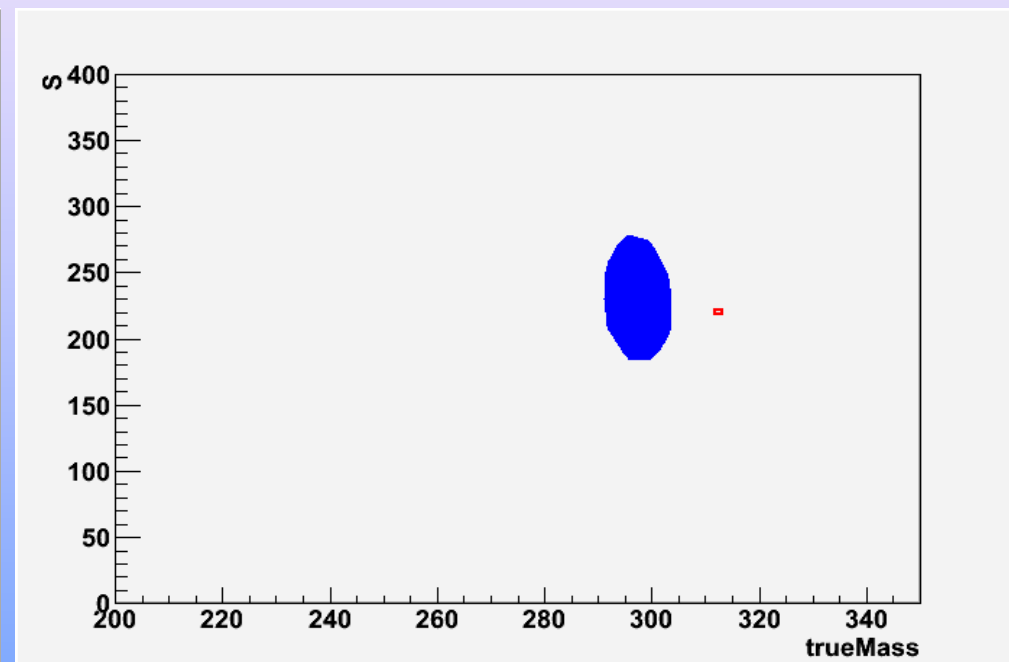


## Early Progress

- Note the plots before were rather restrictive, giving the model more freedom you can make things more realistic.



Profile Likelihood Calculator



\*PLC\* / FeldmanCousins / \*MCMC\* Test

- Here, the Width of the Signal Peak was allowed to vary more.
- Important when thinking about Resolution of Detector



## Summary

- Many interesting aspects to look at with RS Graviton.
- I will do  $G \rightarrow e^+e^-$  search with view to combination of channels.
- New Graviton MC data samples arrive soon.
- RooStats is a new powerful tool I will use.

## Aims

- Build a robust statistical search technique for  $G \rightarrow e^+e^-$
- Create Workspace with Backgrounds that can be used across multiple analysis'. (Future ATLAS & CMS collaboration?)
- Be able to make meaningful Significance, and Exclusion Plots for Graviton using RooStats.



## Side Note: Very High Pt Electron Triggers

- Earlier in the Year started a small project after attending various e/g meetings and talking to Monika Wielers.
- Aim to look at Efficiency of L1\_EM100, L2\_e105, etc. These were assumed to be fine, but never fully checked.
- Was working with the New TrigDec Tool, ran in to problems, which meant I wasn't able to do complete this task to my satisfaction.
- Why? Can't easily find the specific electron that did the Triggering! (Only Event / TrigElectronContainer.) This is what I will be working on solving now.





# Any Questions

# ?

# Thank you