

Back to Basics

Simple Principle

$$e^{-3} \sim 5\%$$

If you observe 0 events you can exclude a total yield of 3 @ 95% CL

What is so special about this statement?

If you observe 0 you know that you have observed 0 signal events

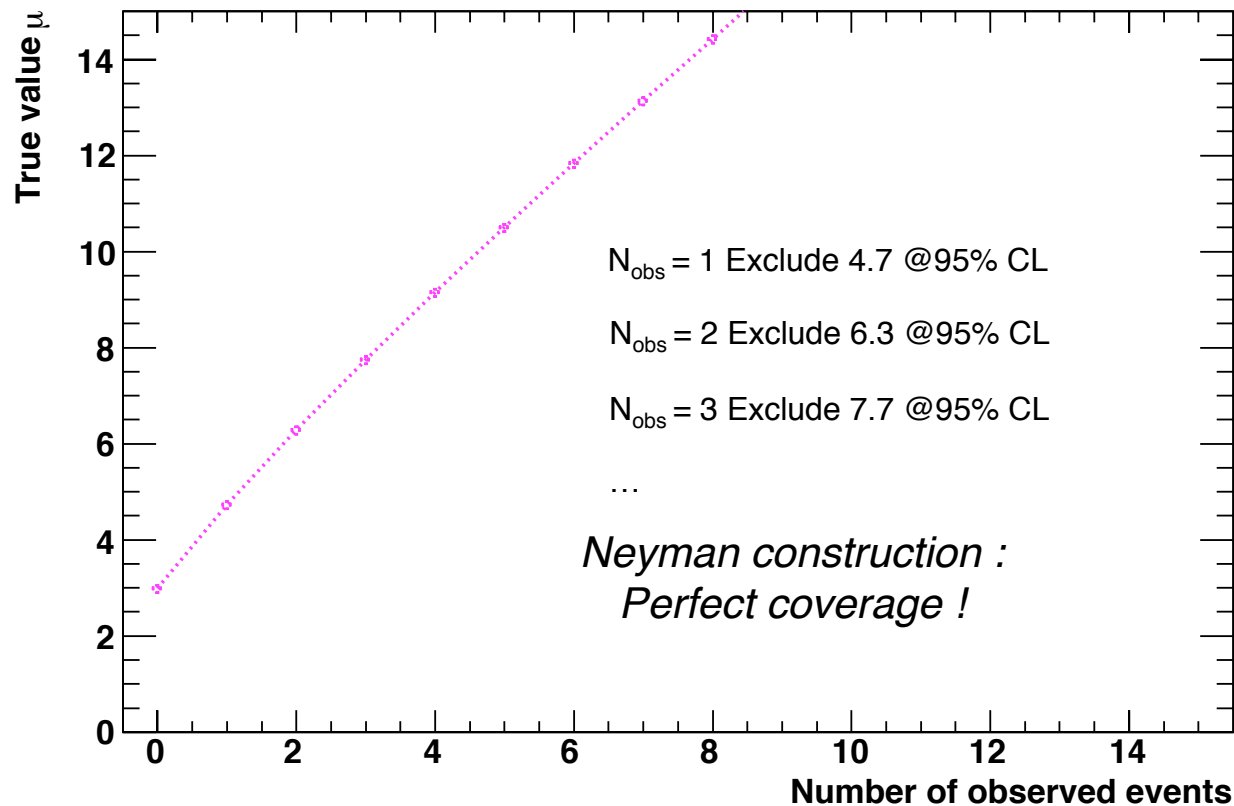
Firm statement about your signal, whatever the background, or the auxiliary measurements

What happens when you observe N_{obs} events ?

You can still make a purely frequentist statement about your expected yield

This is a conservative limit on a signal whatever the background is.

Assuming : $b = 0$ means assume all observed events are signal.



Conservative, but only possible assumption if you don't know your background

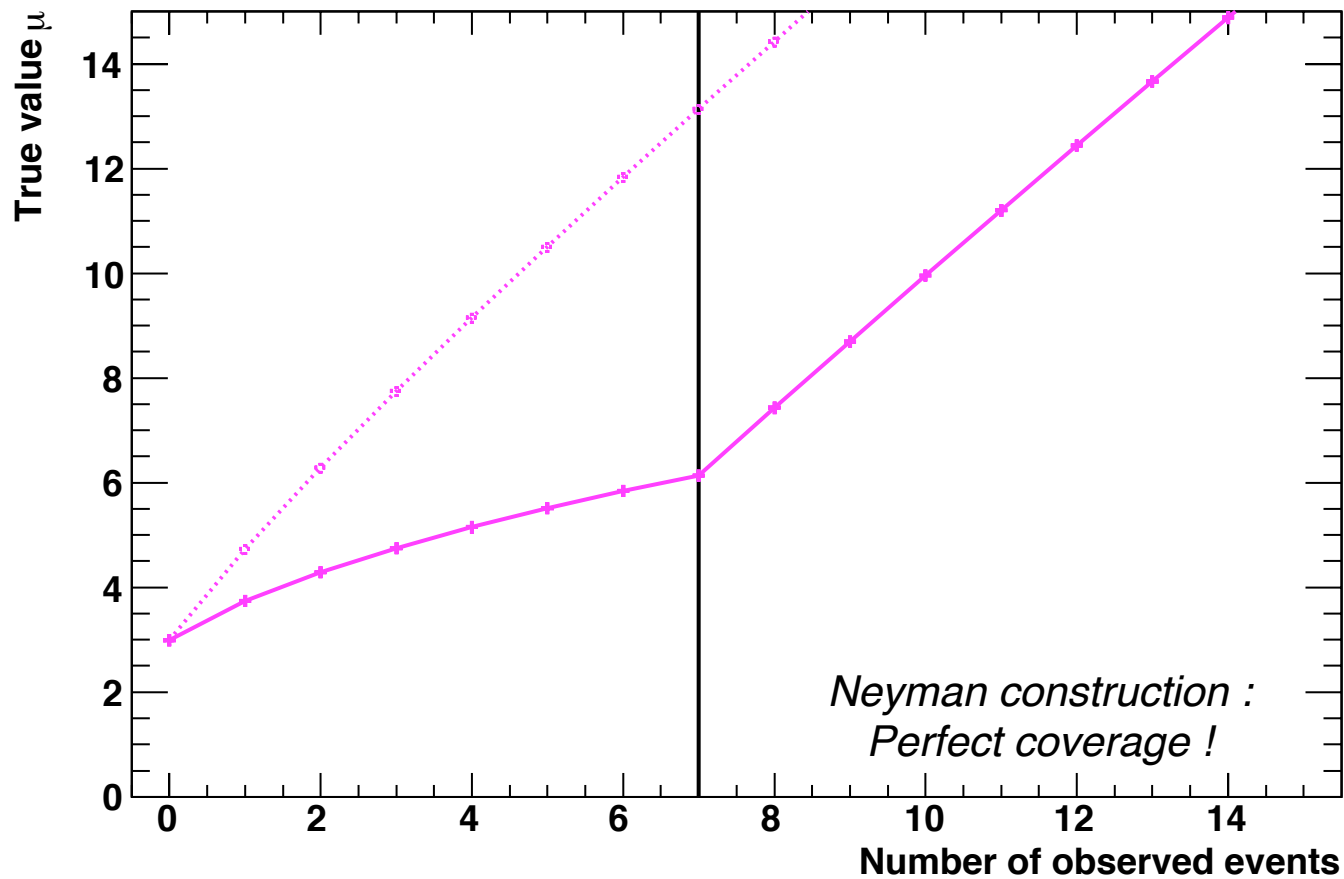
What if we know what to *expect* for the background ?

$$b = 7$$

SPP

Simple Pragmatic Prescription (Mandelkern)

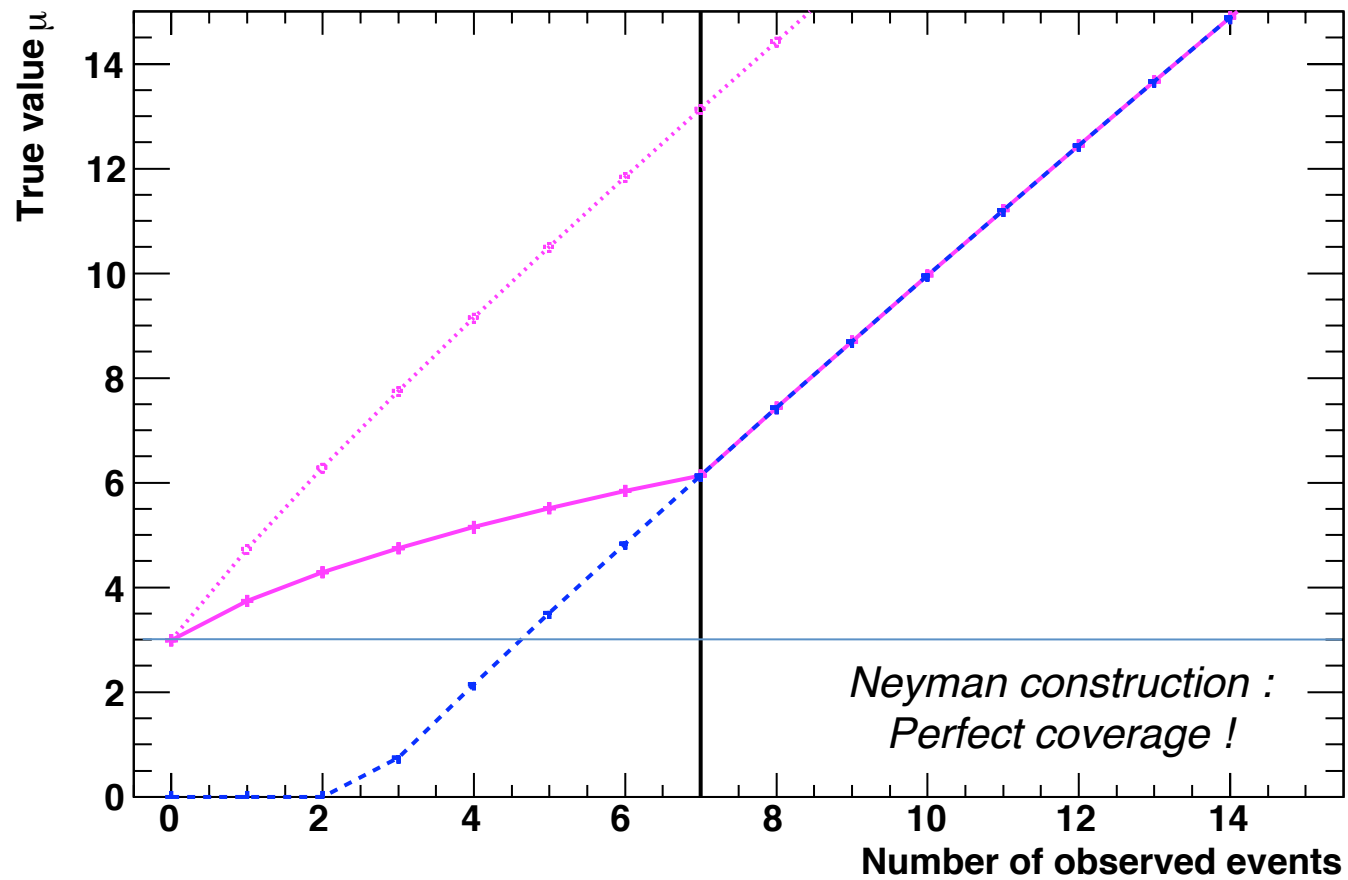
Still don't know if what we observe is background or signal, but let's assume that until we reach b , it's background!



Don't allow yourself to subtract more than what you have

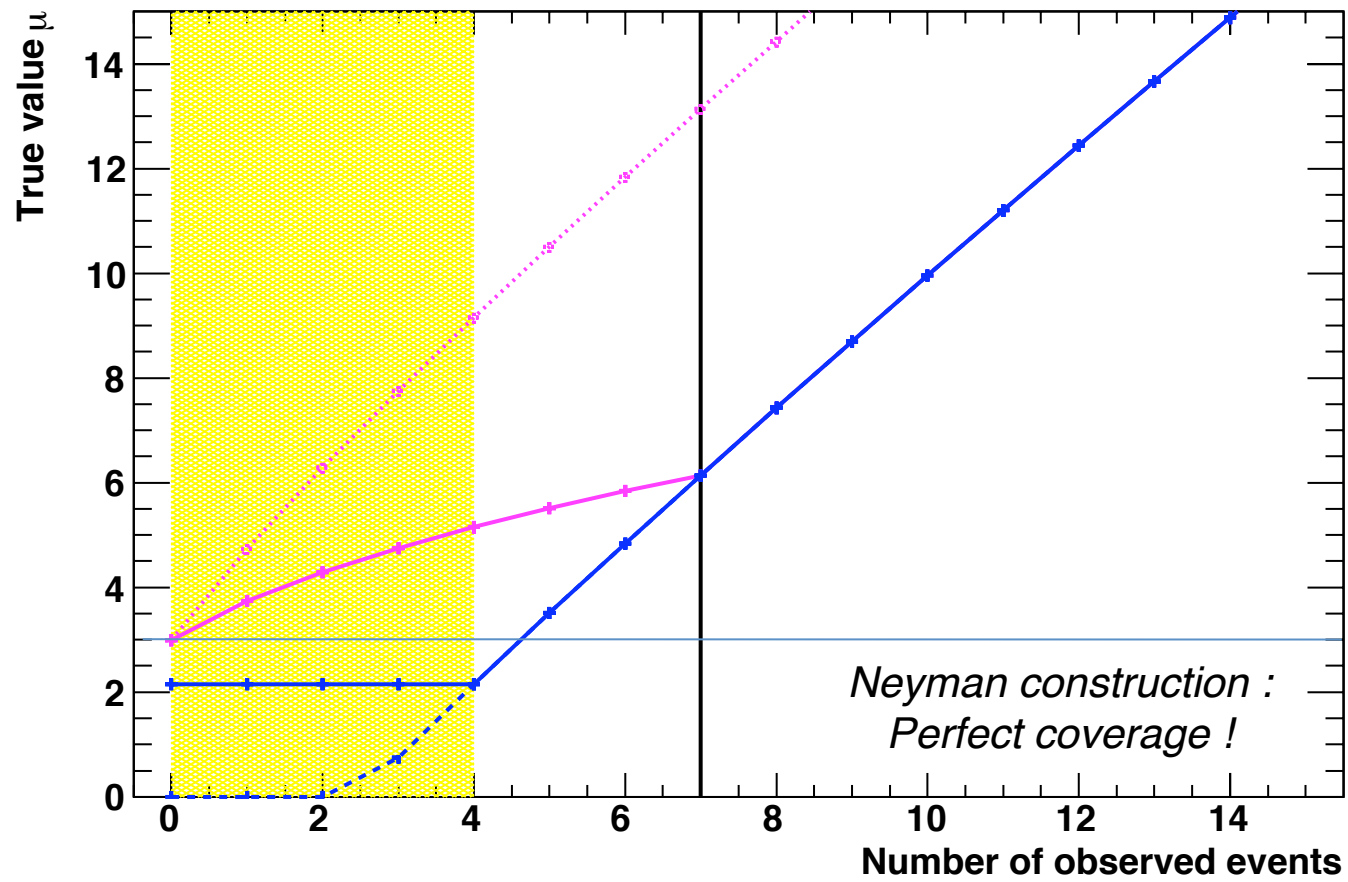
$$CL_{s+b}$$

The so-called diagonal line is simply the subtraction of b .



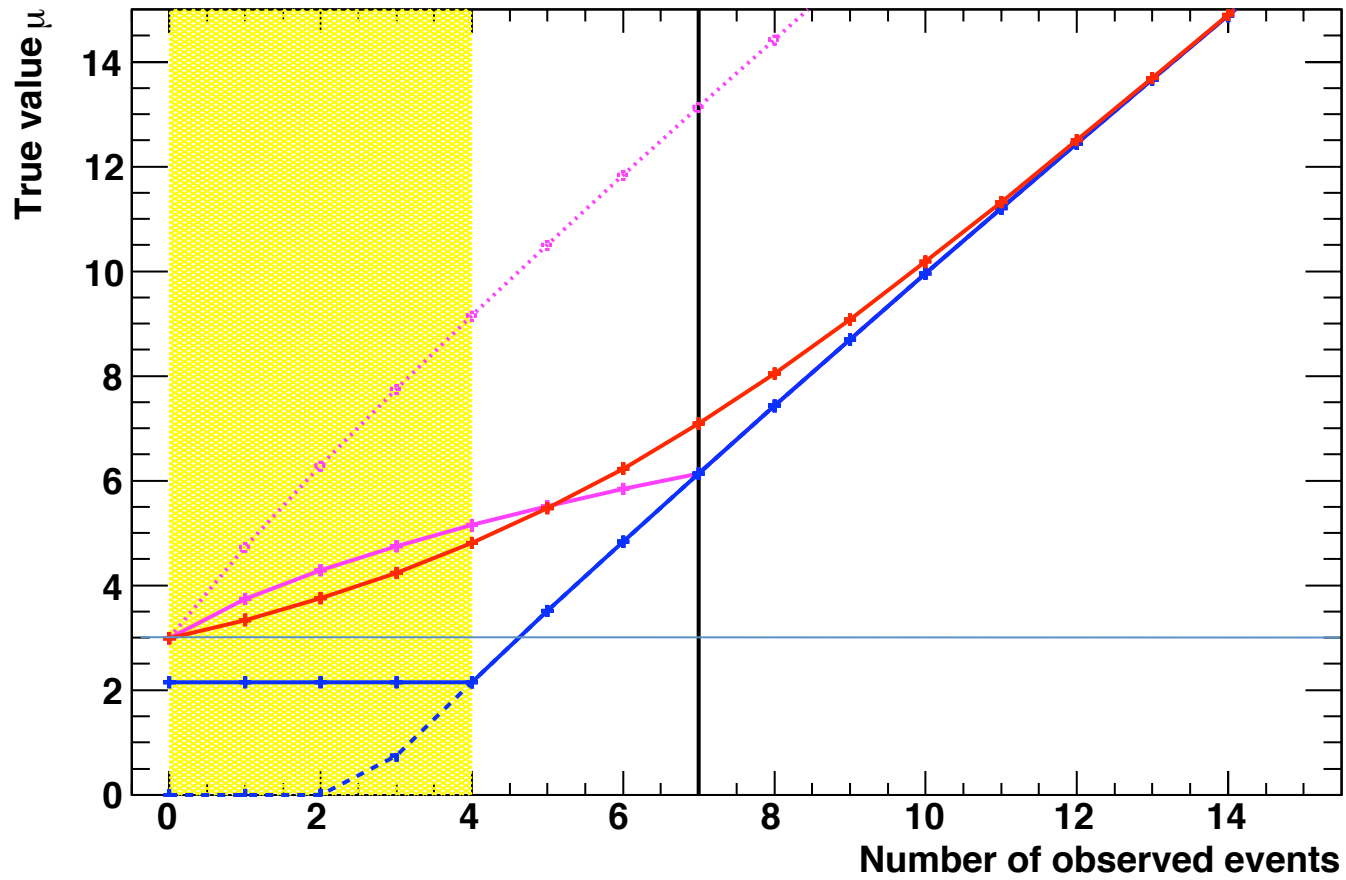
PCL

Cowan, Cranmer, Gross, Vitells



CL_s Read

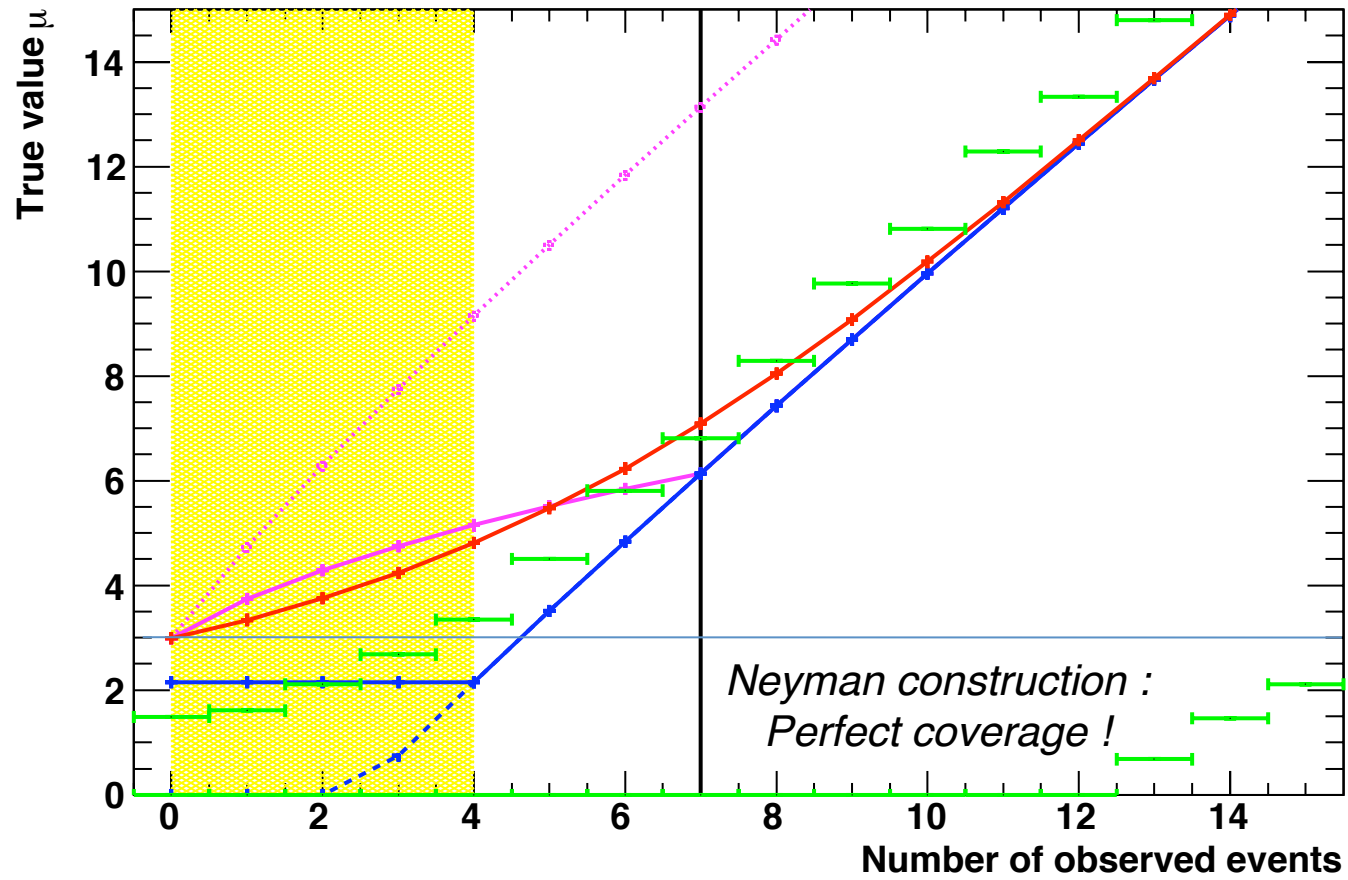
Neyman construction with modified frequencies



FC

Feldman and Cousins

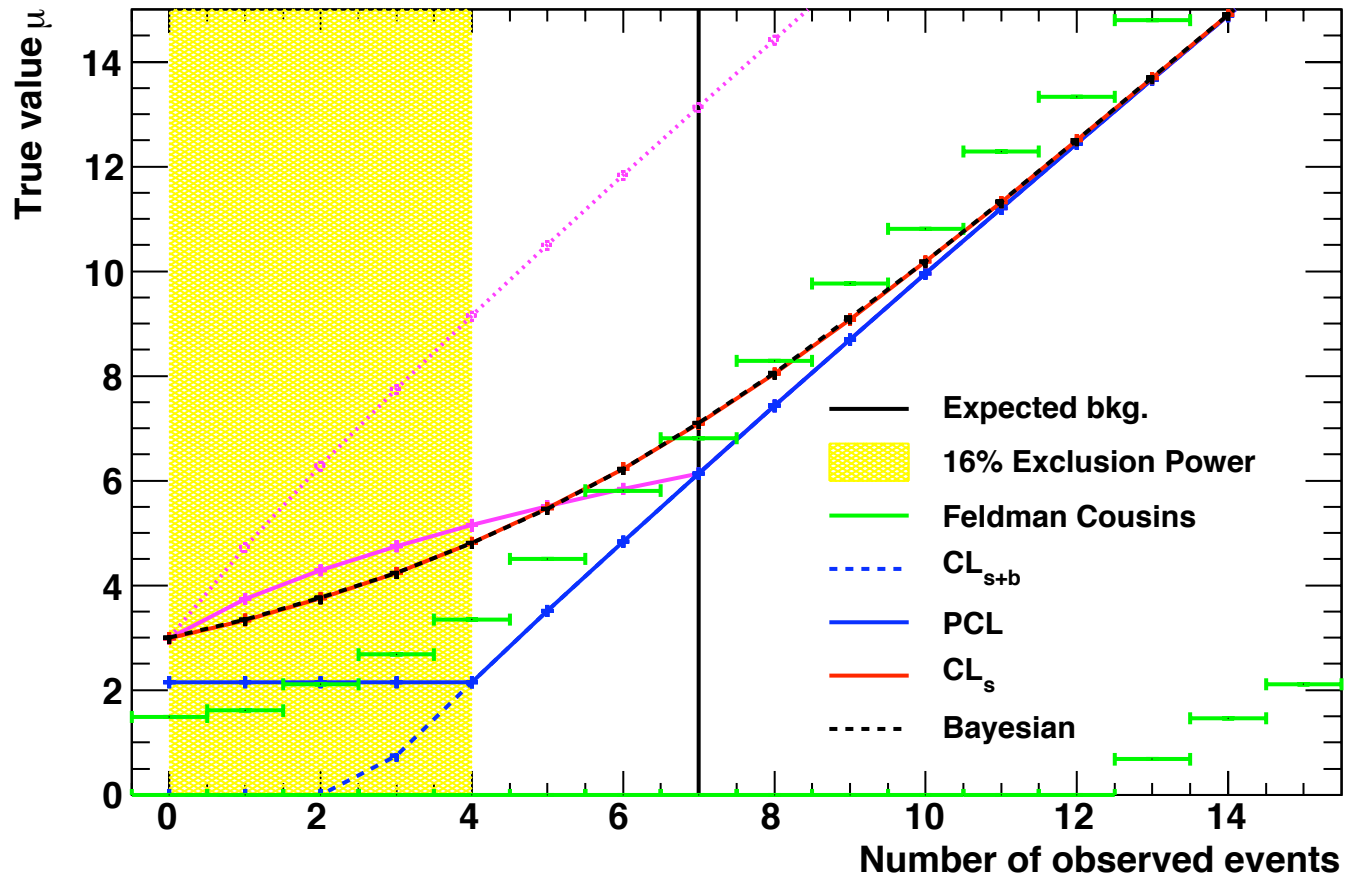
Neyman construction with modified test statistic



Bayesian

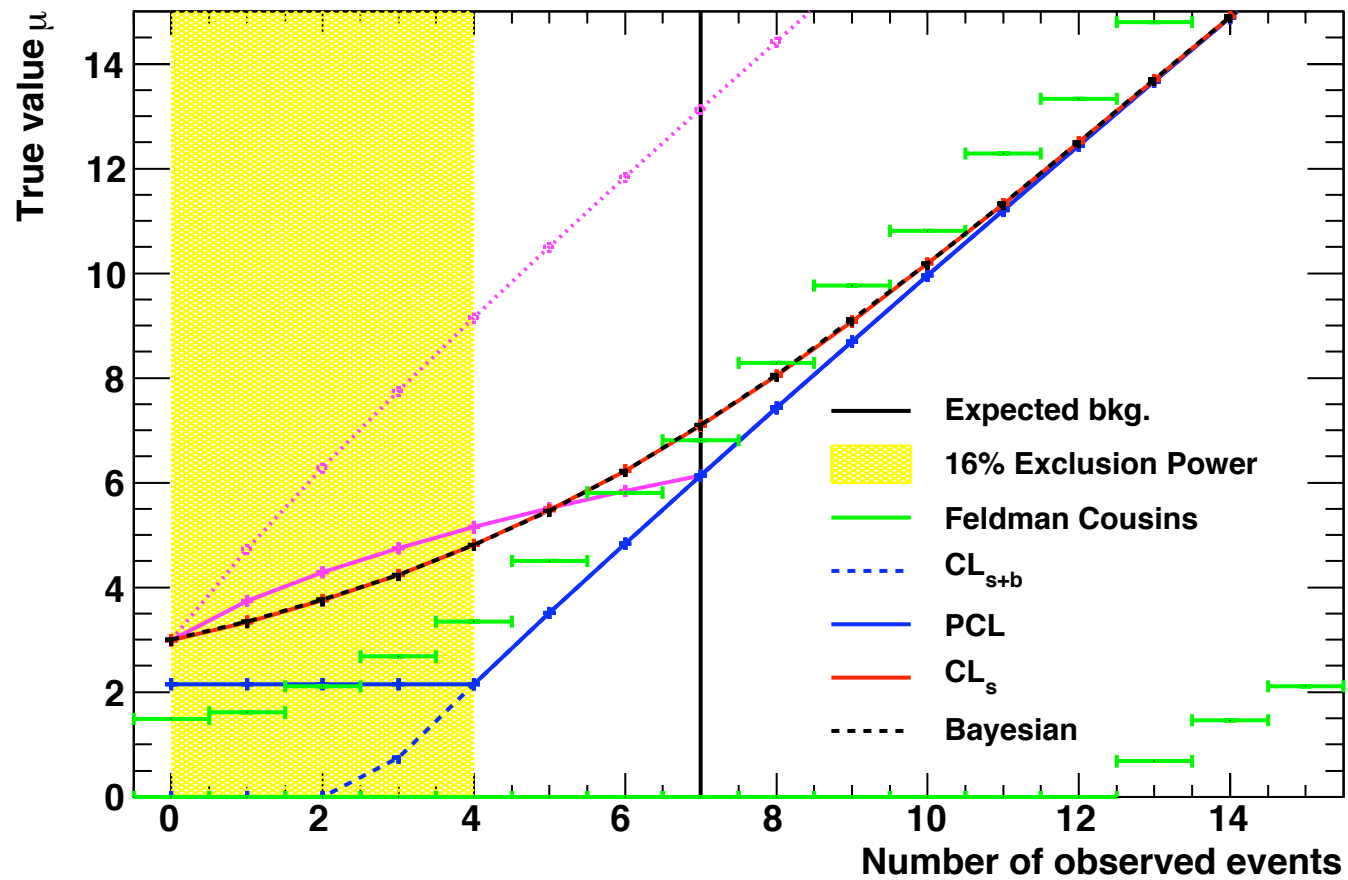
O' Helene

Not a Neyman construction... Bayesian integral with flat prior !

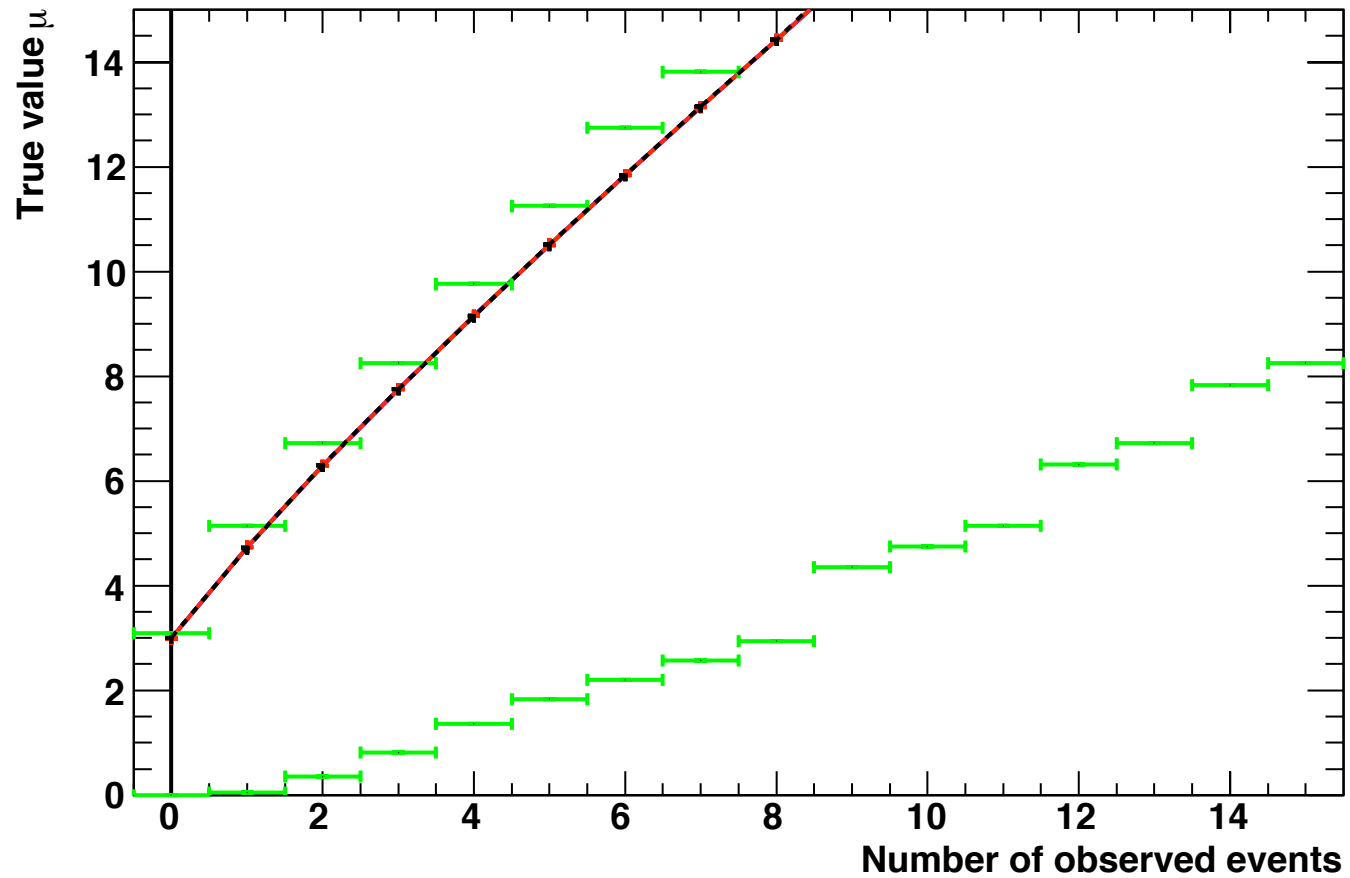


Summary

Adding 50% PCL constraint.

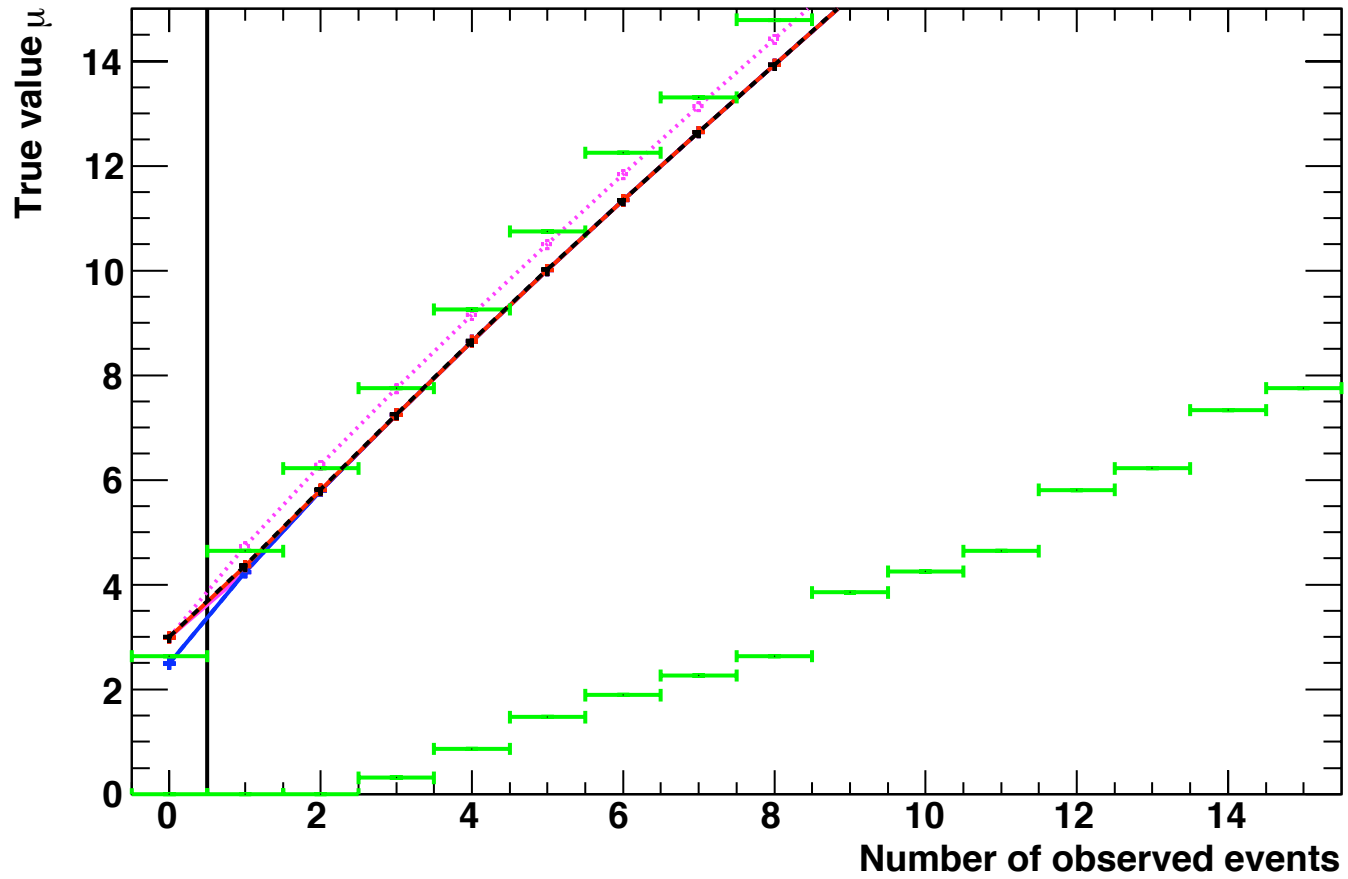


Varying background hypotheses



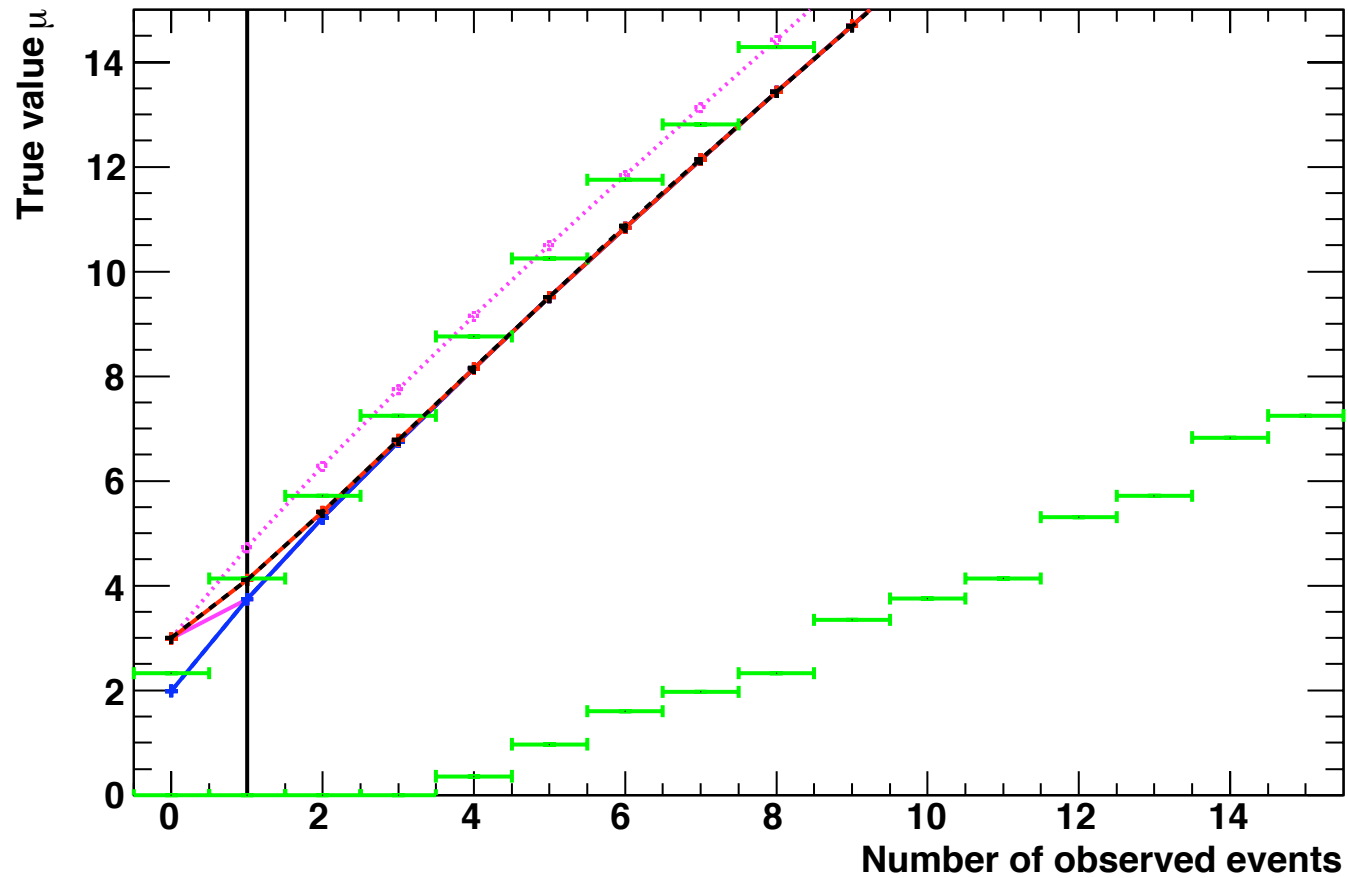
$$b = 0$$

Varying background hypotheses



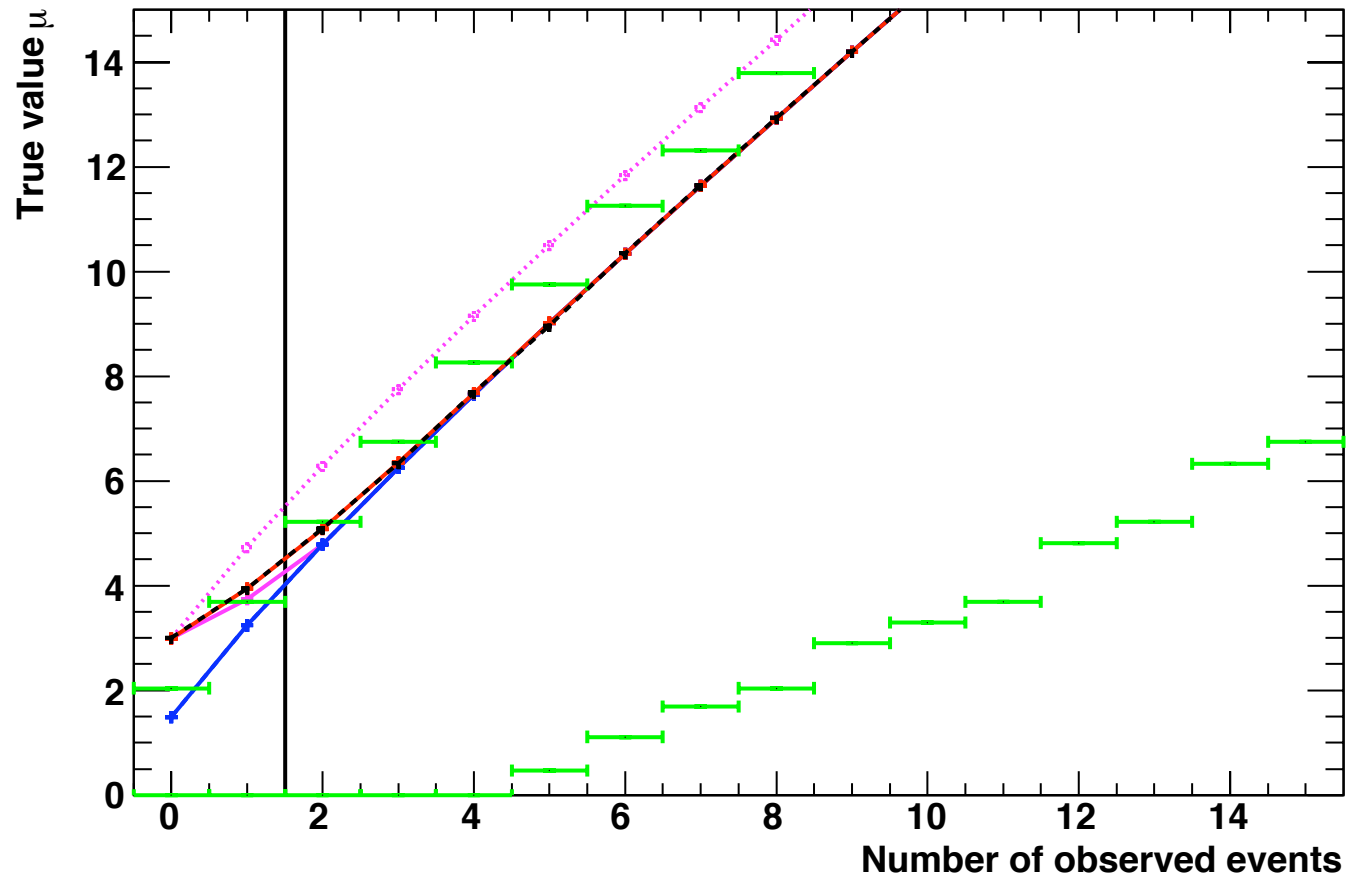
$$b = 0.5$$

Varying background hypotheses



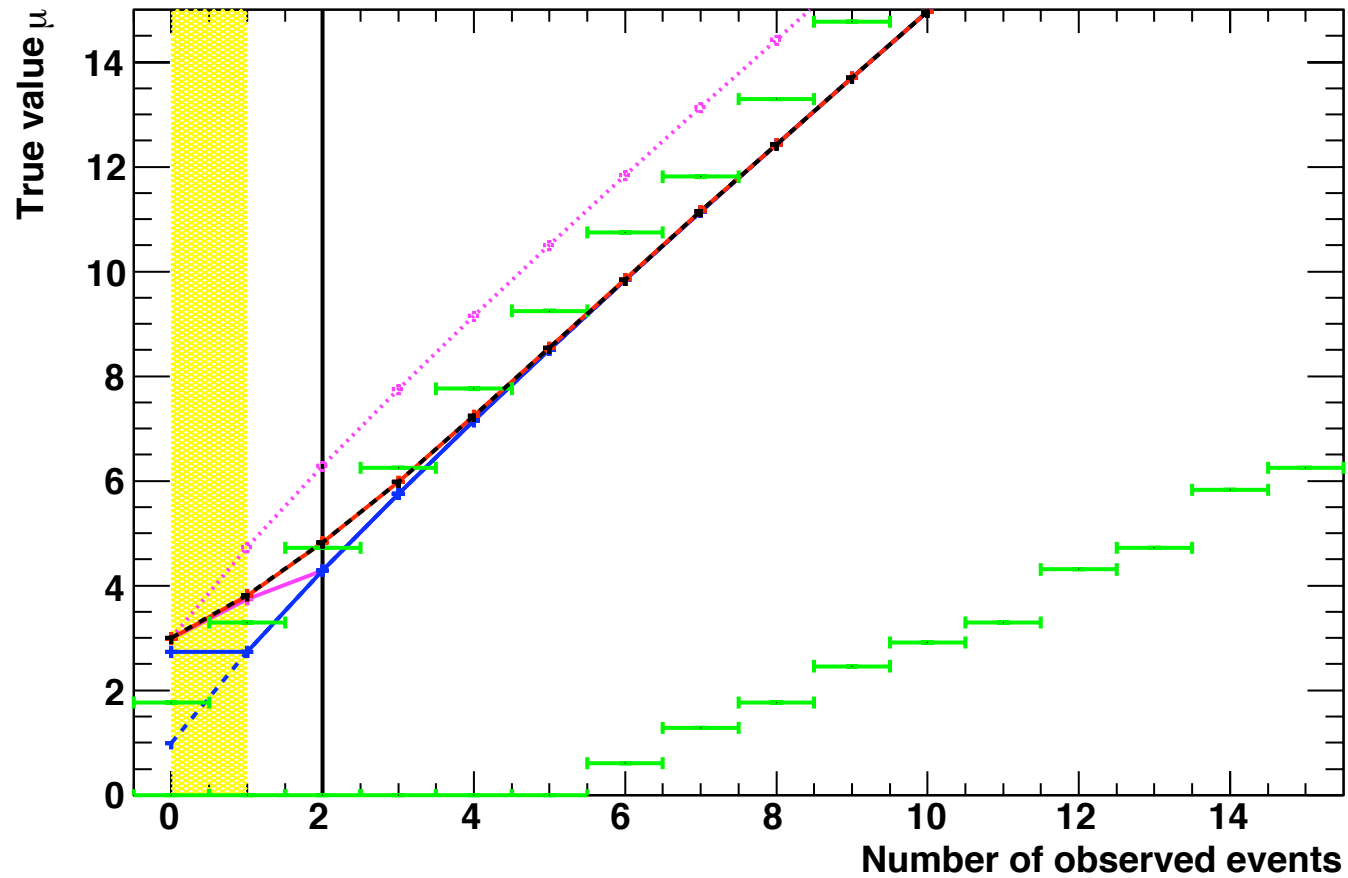
$$b = 1.0$$

Varying background hypotheses



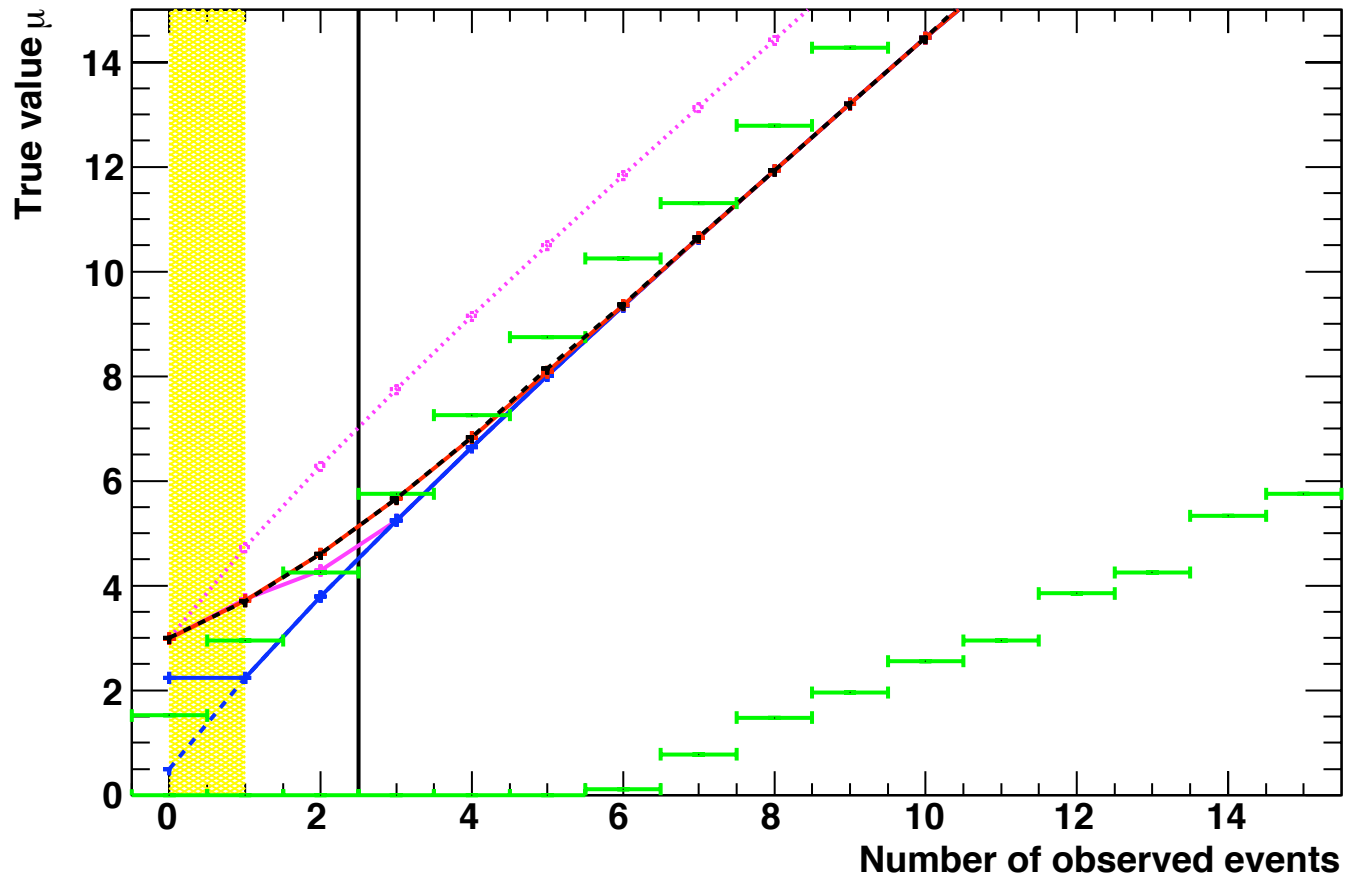
$$b = 1.5$$

Varying background hypotheses



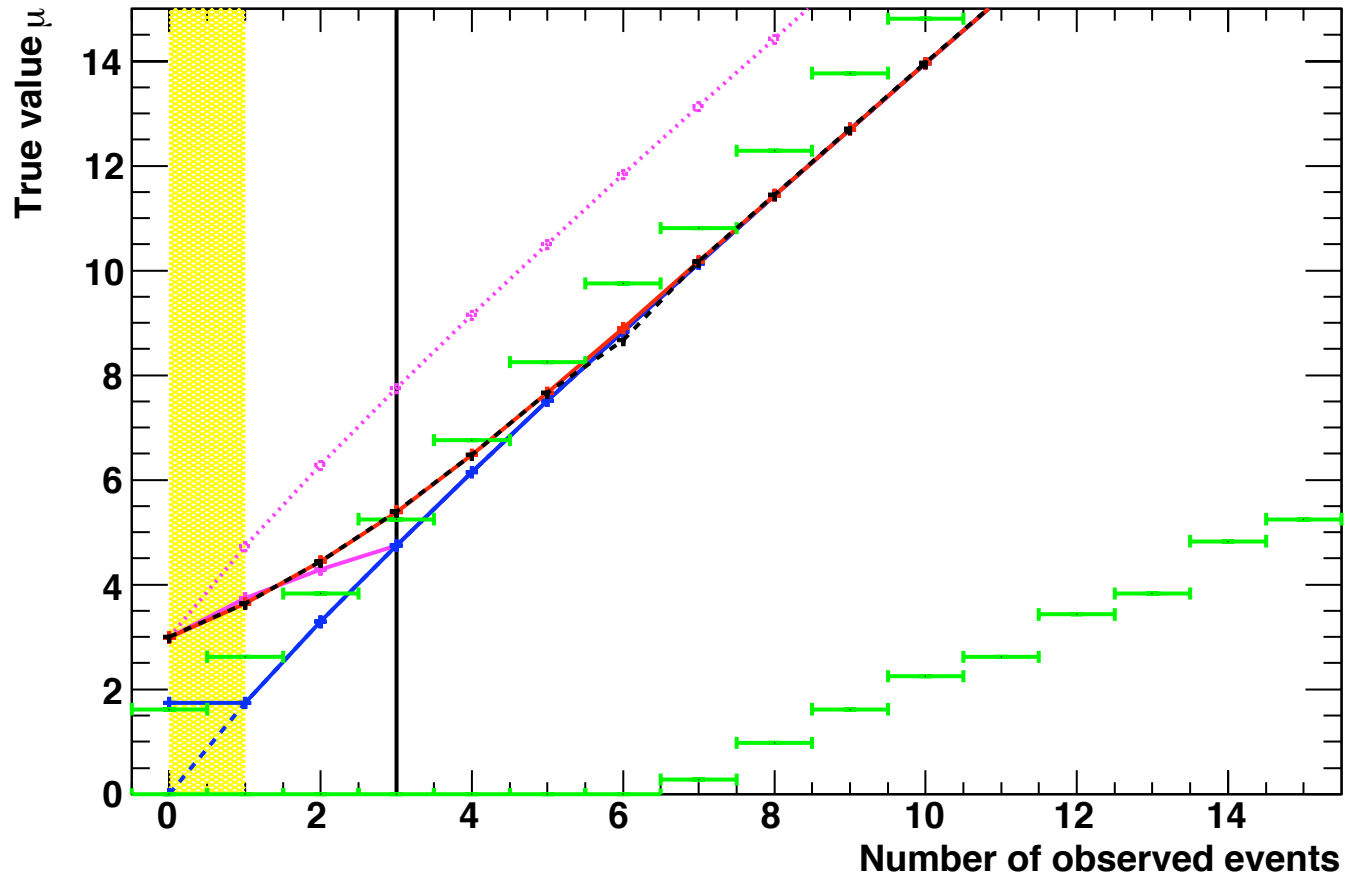
$$b = 2.0$$

Varying background hypotheses



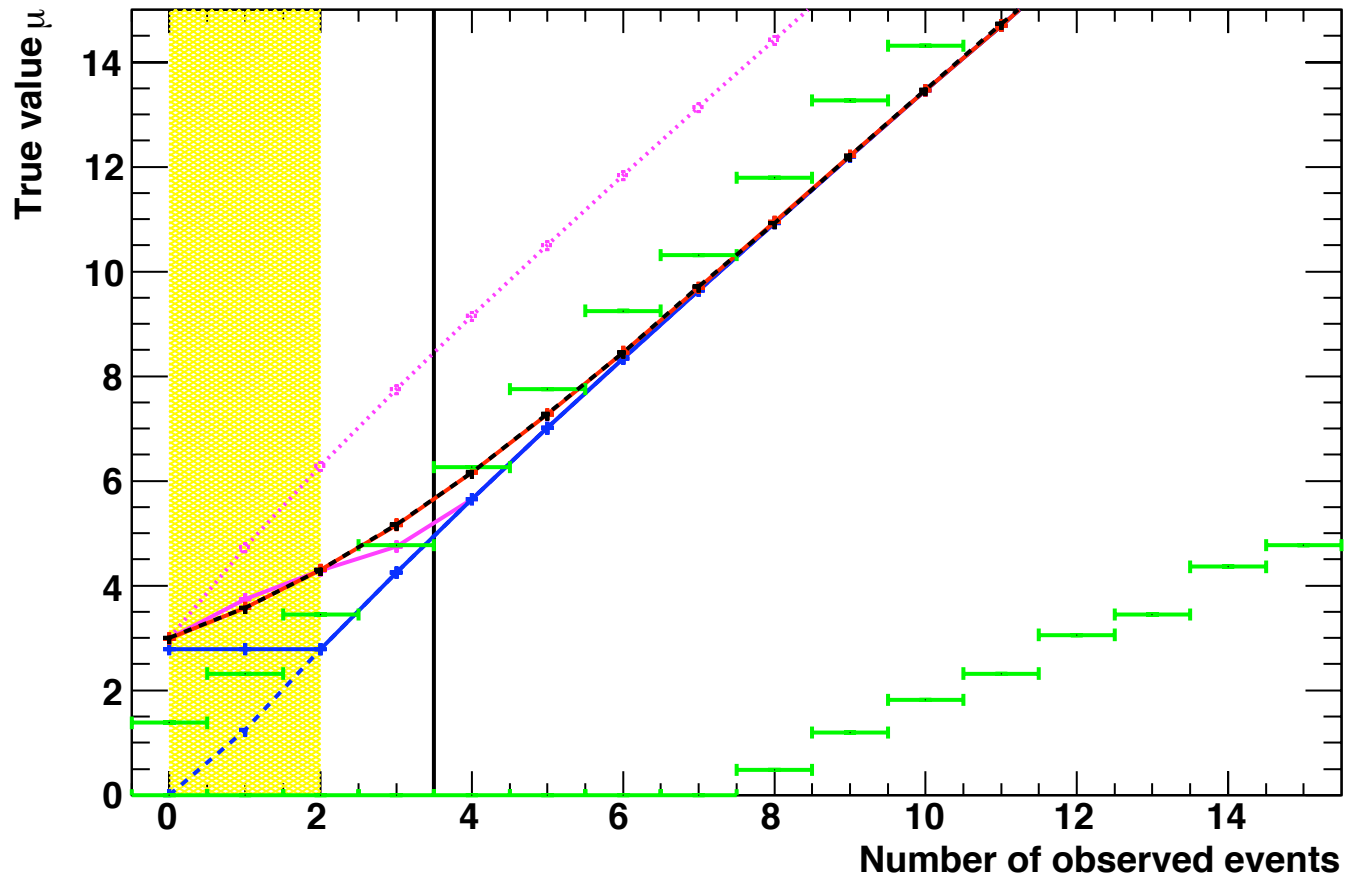
$$b = 2.5$$

Varying background hypotheses



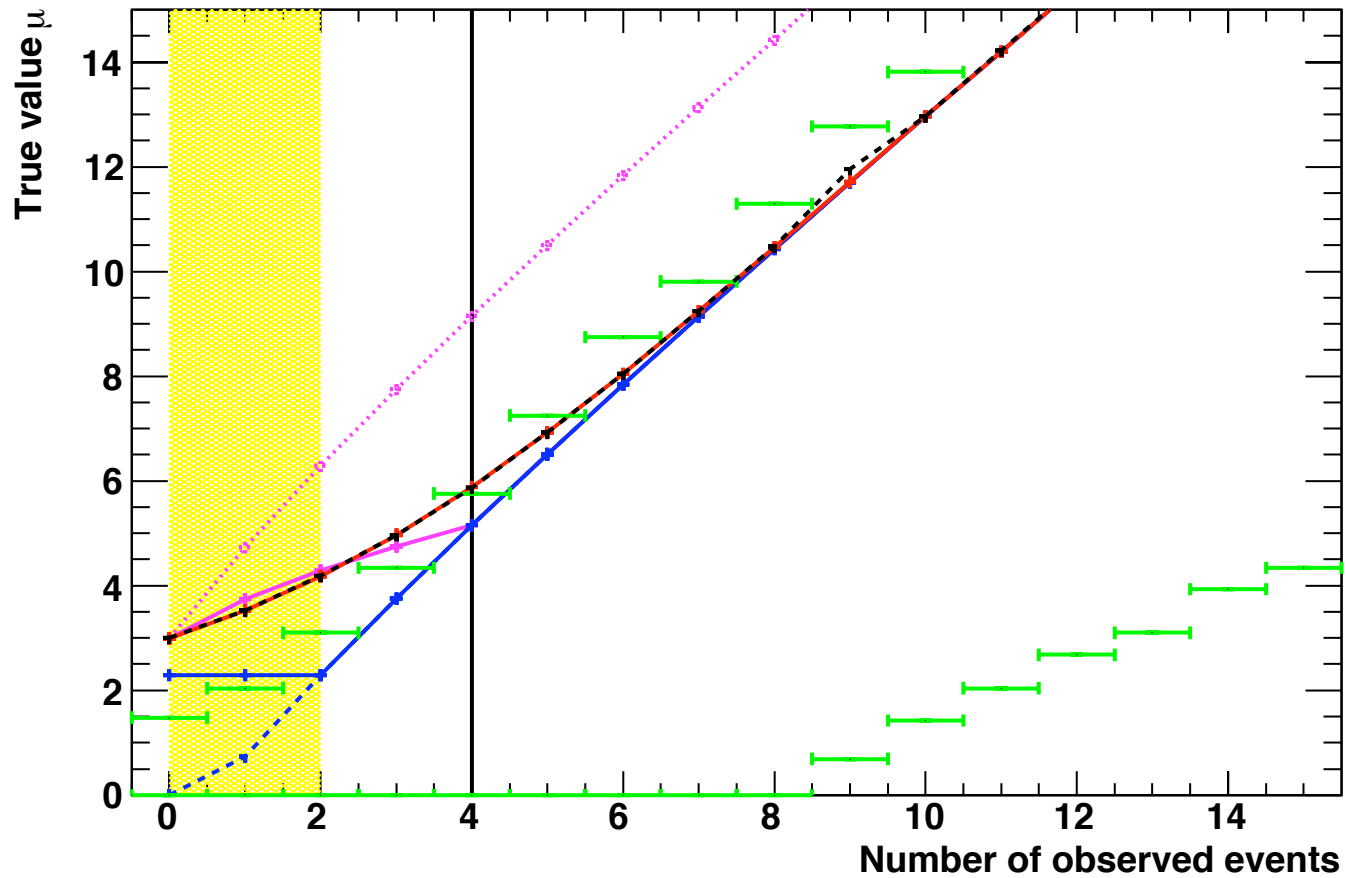
$$b = 3.0$$

Varying background hypotheses



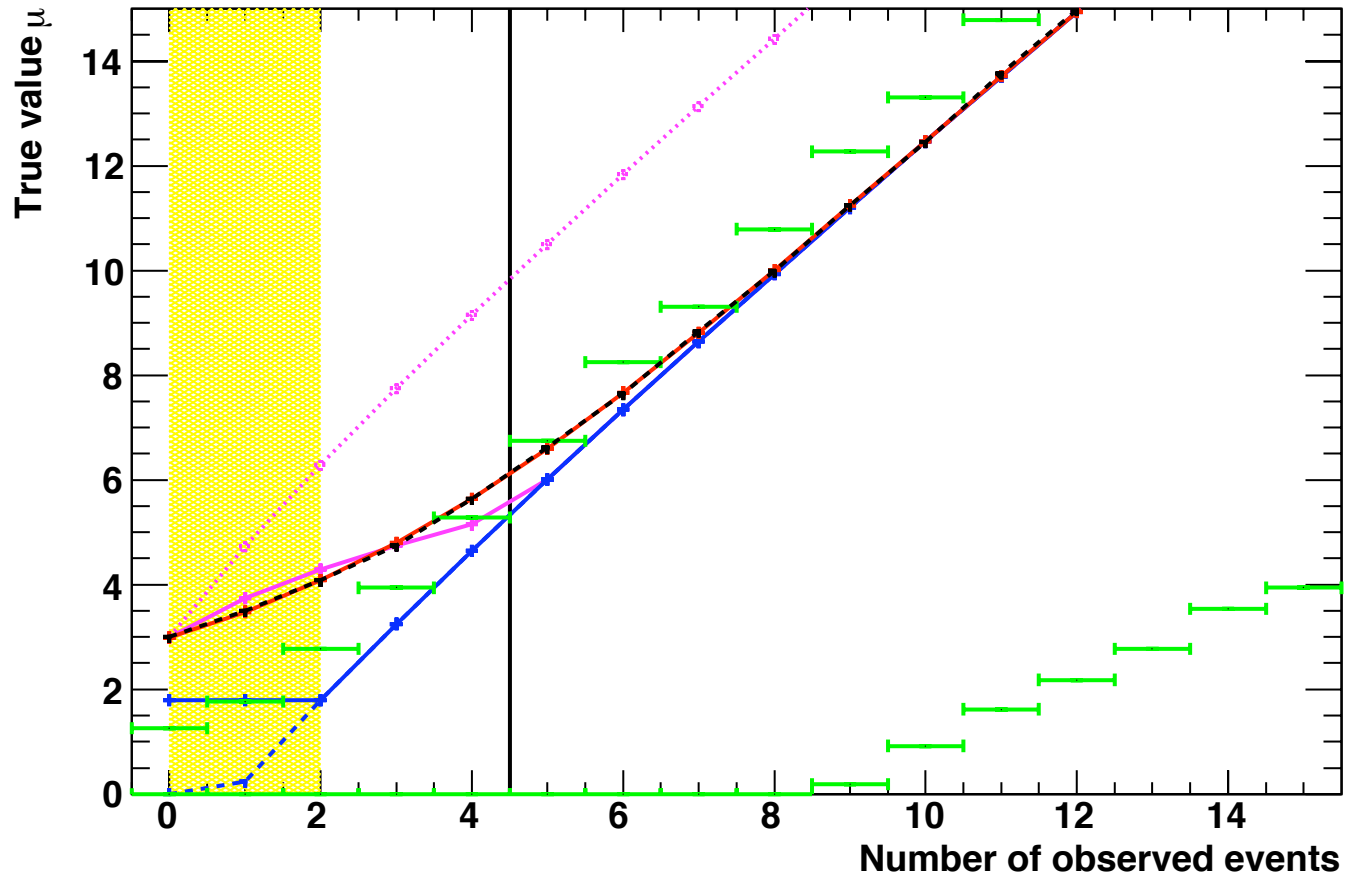
$$b = 3.5$$

Varying background hypotheses



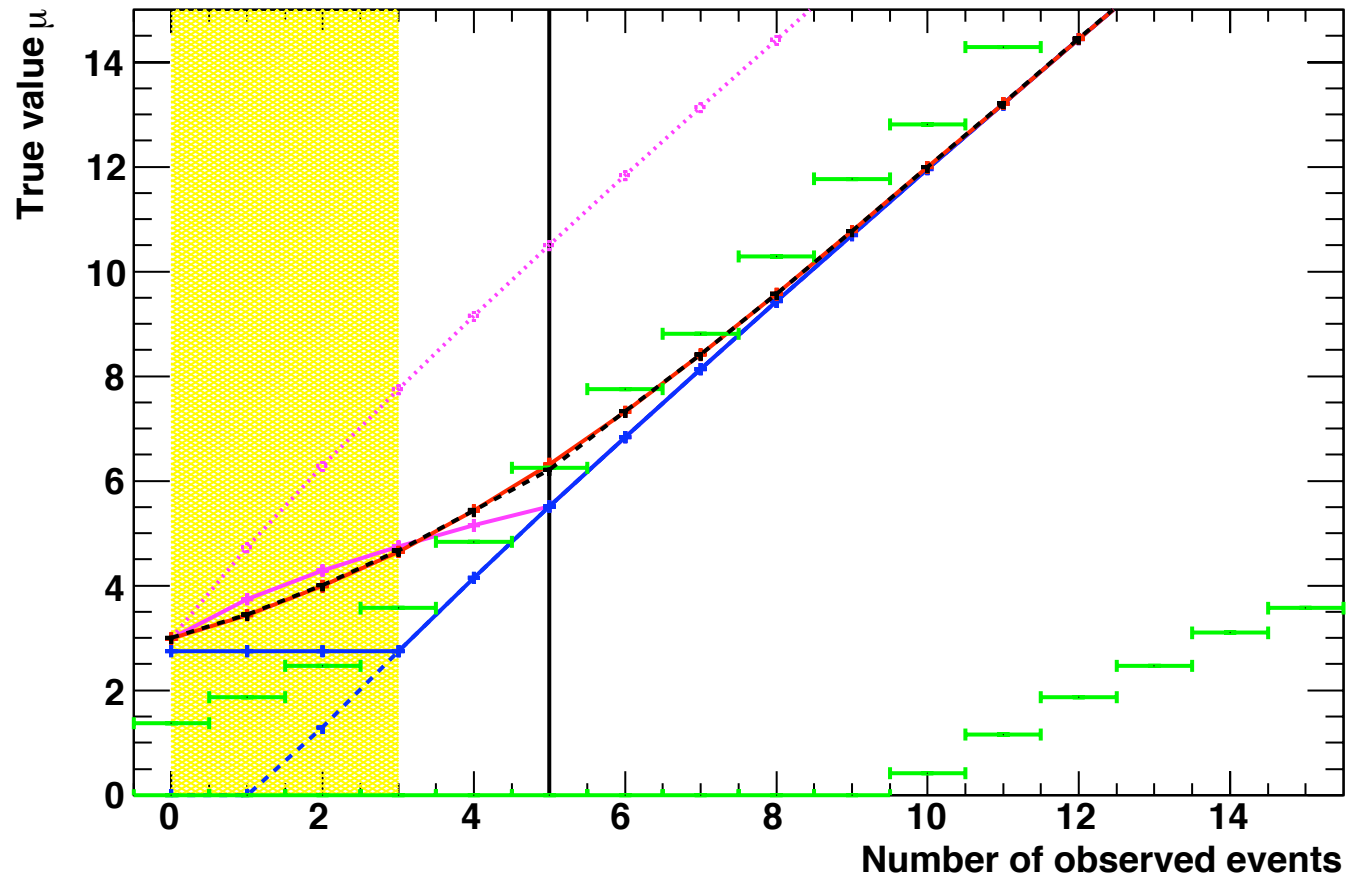
$$b = 4.0$$

Varying background hypotheses



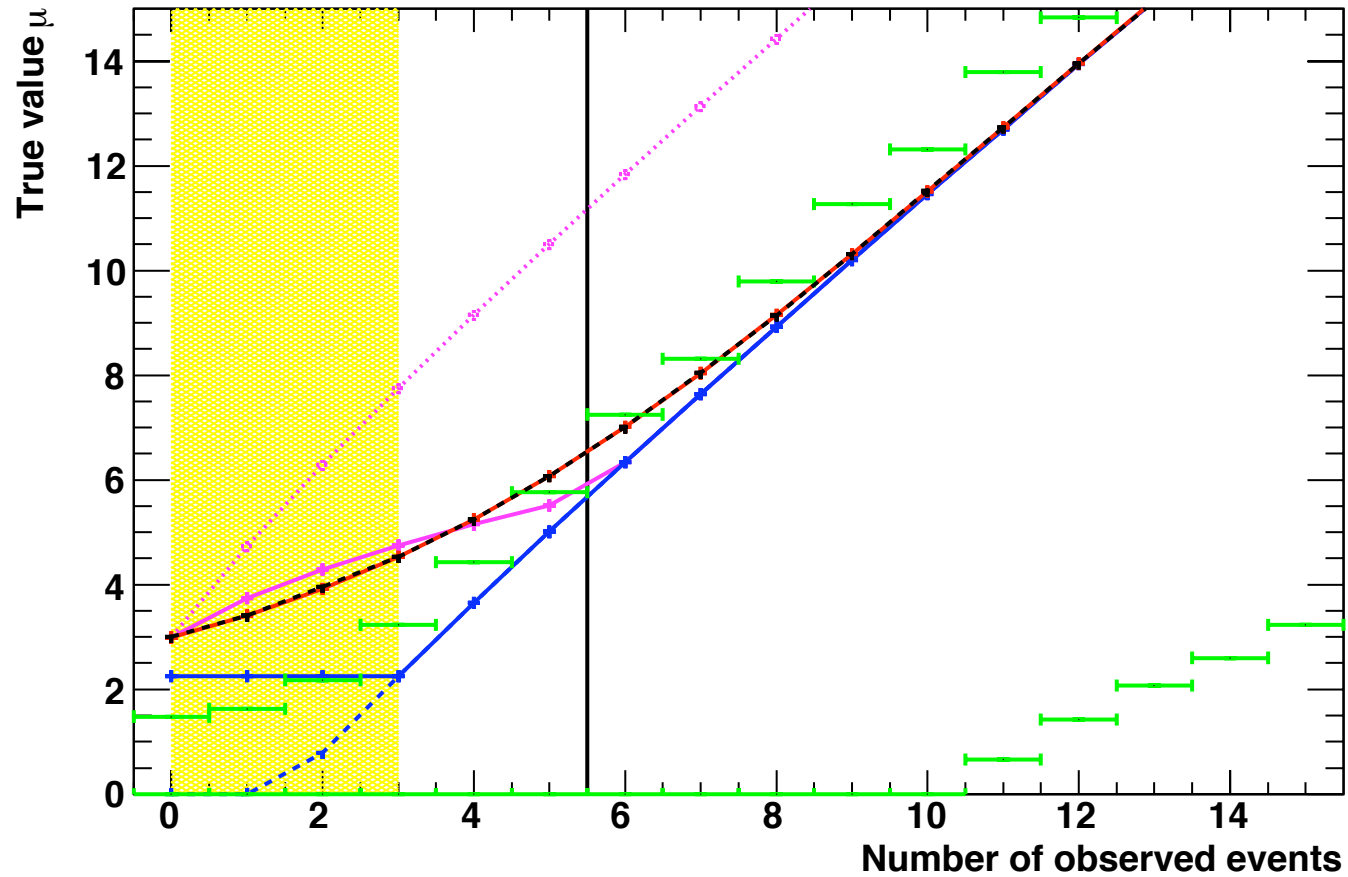
$$b = 4.5$$

Varying background hypotheses



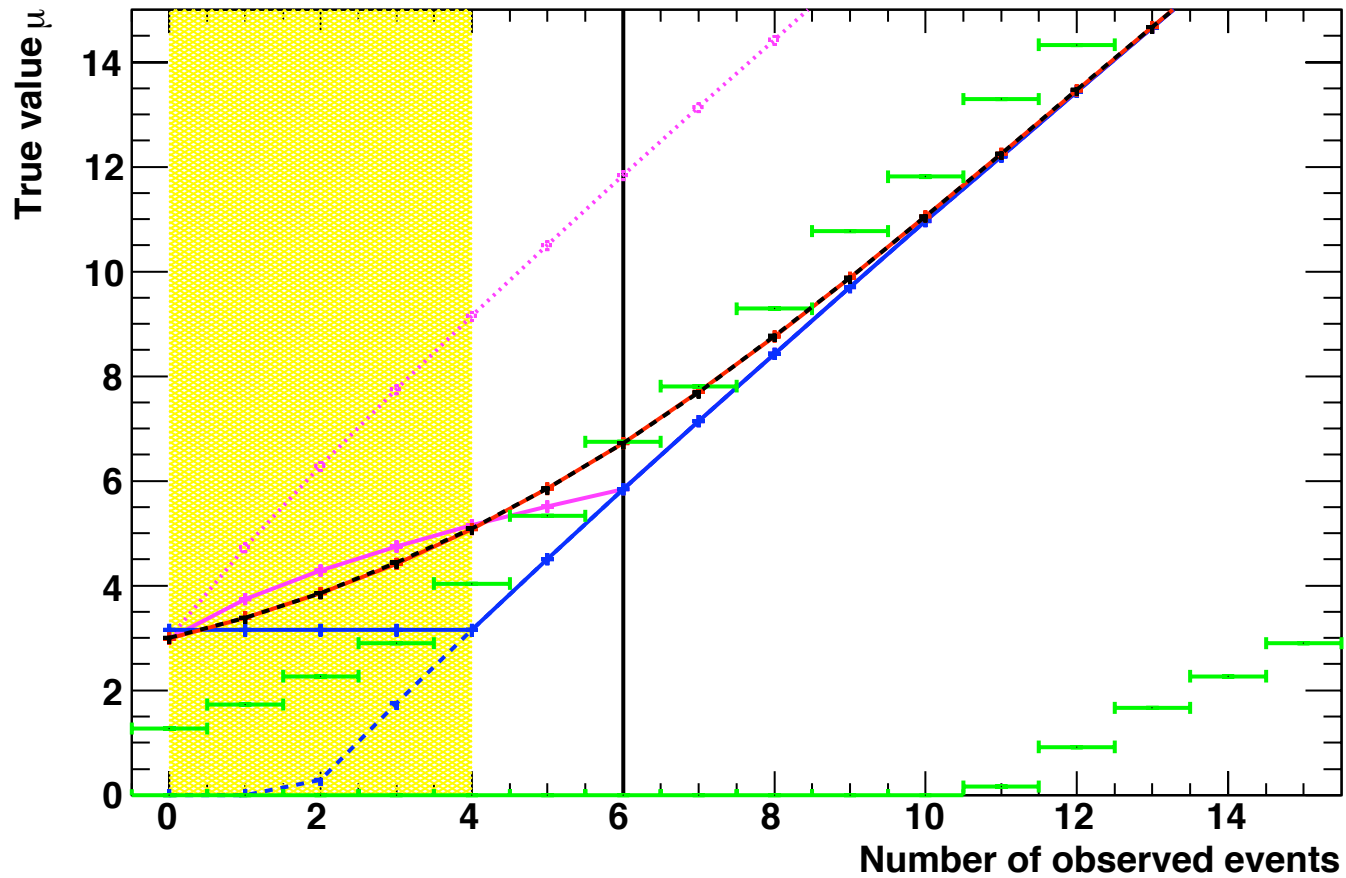
$$b = 5.0$$

Varying background hypotheses



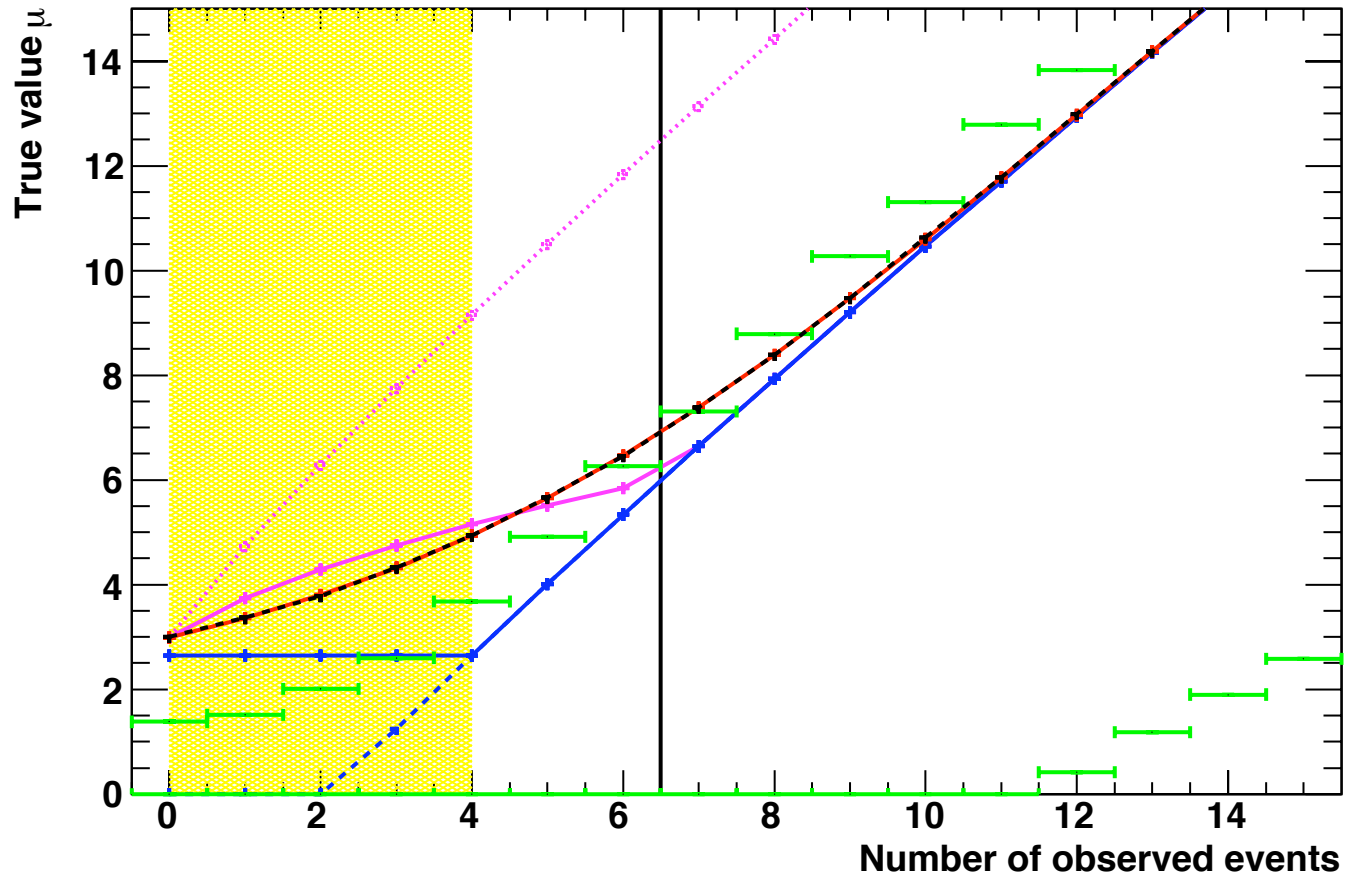
$$b = 5.5$$

Varying background hypotheses



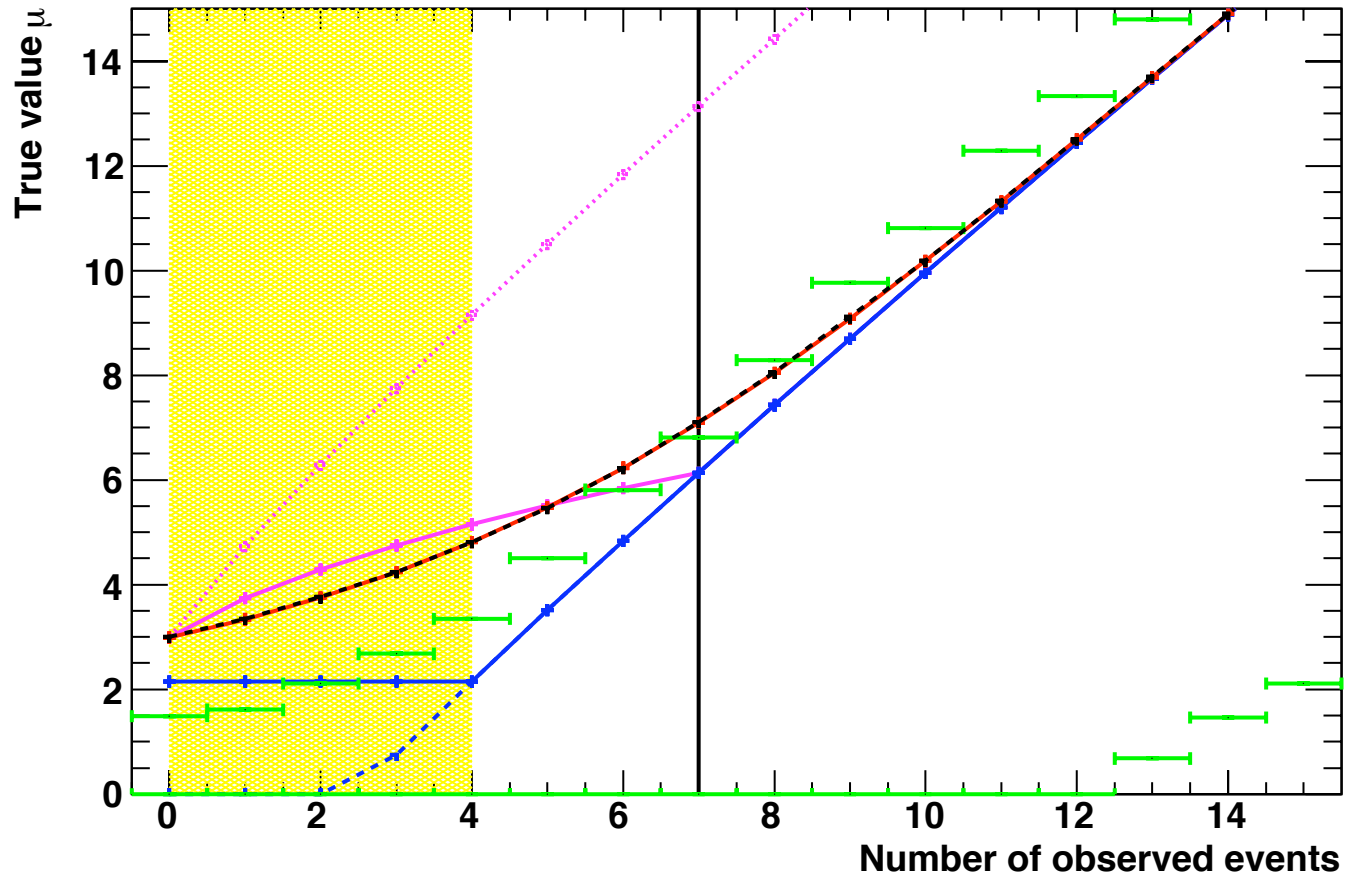
$$b = 6.0$$

Varying background hypotheses



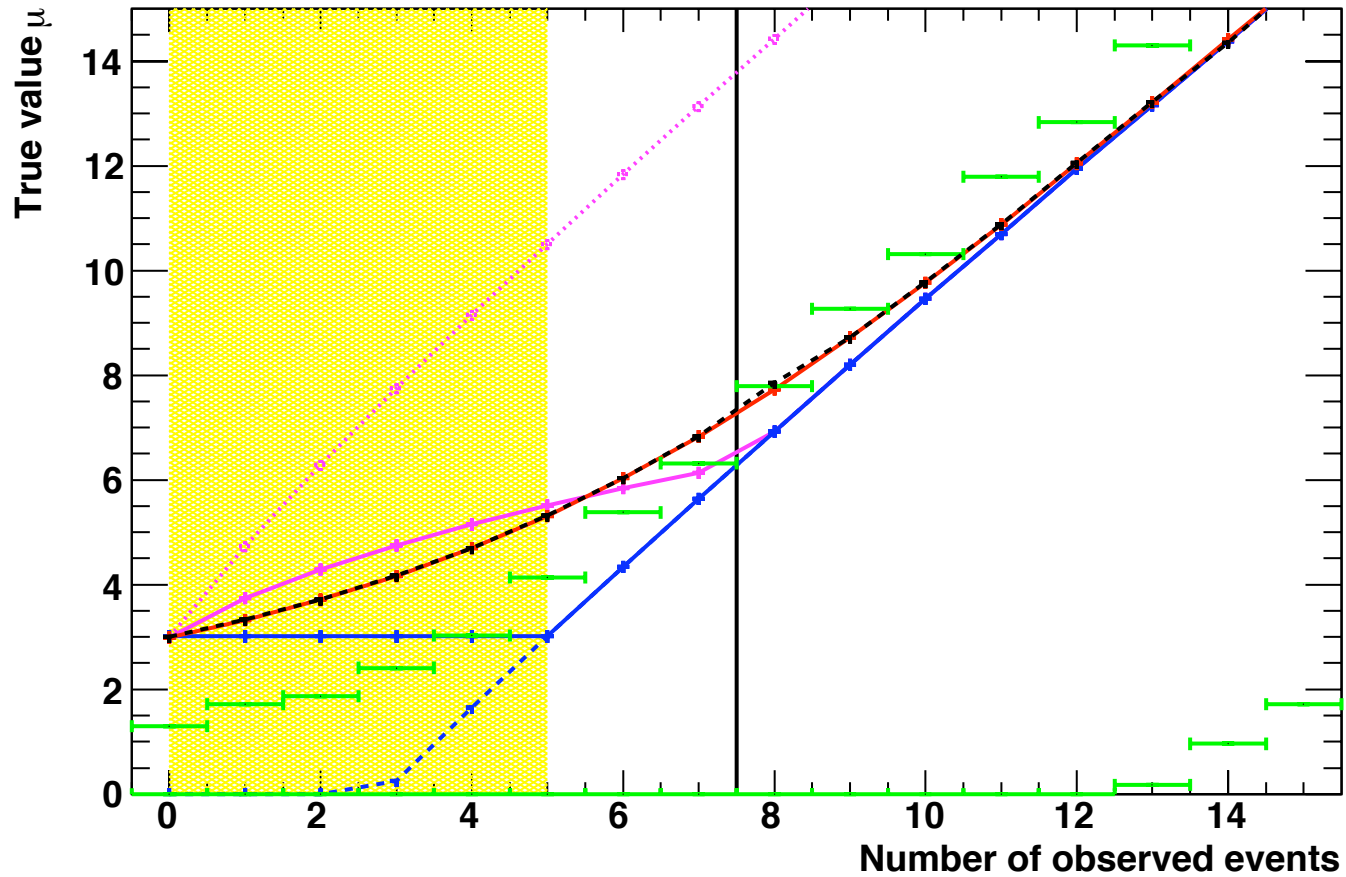
$$b = 6.5$$

Varying background hypotheses



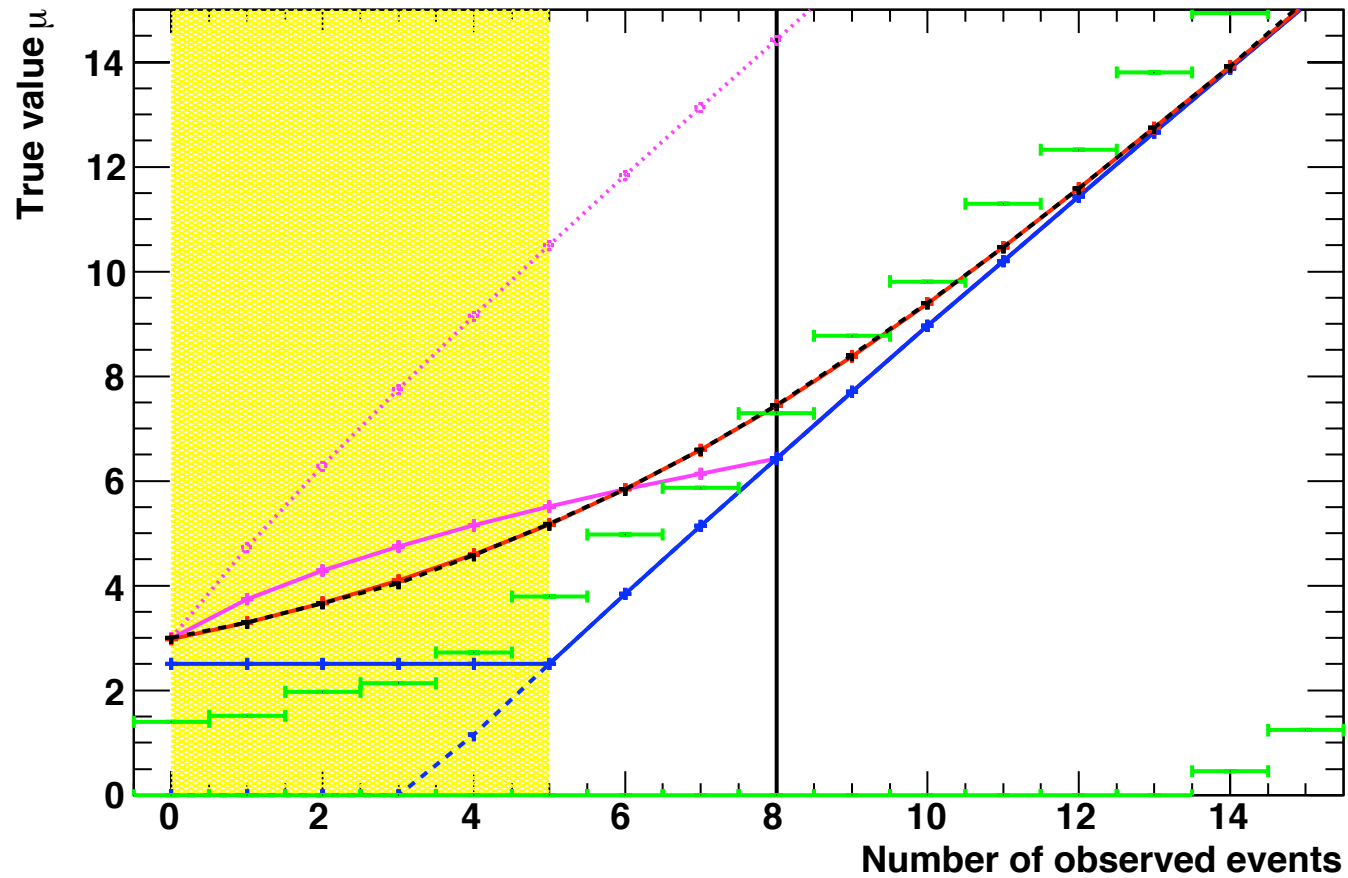
$$b = 7.0$$

Varying background hypotheses



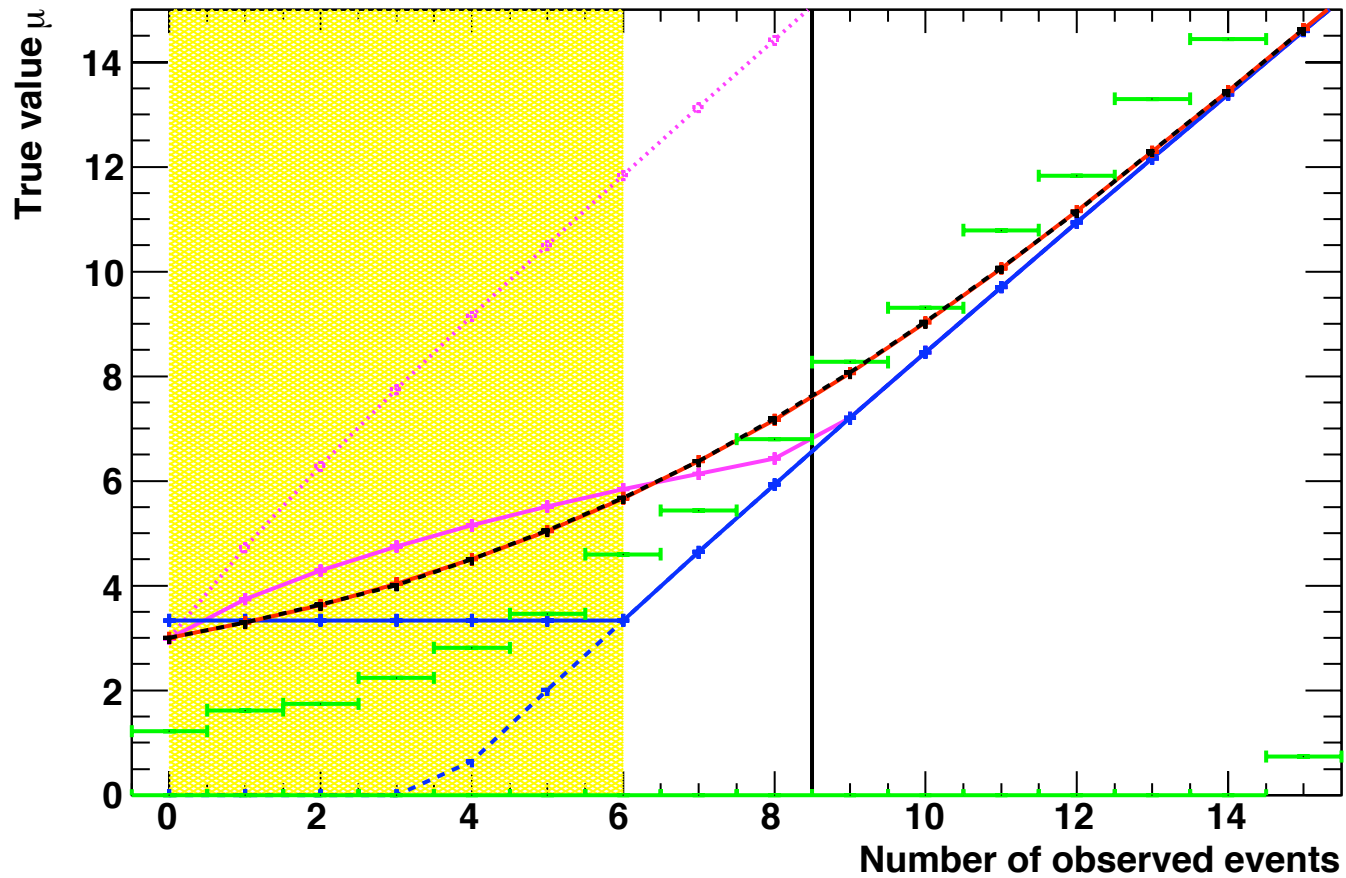
$$b = 7.5$$

Varying background hypotheses



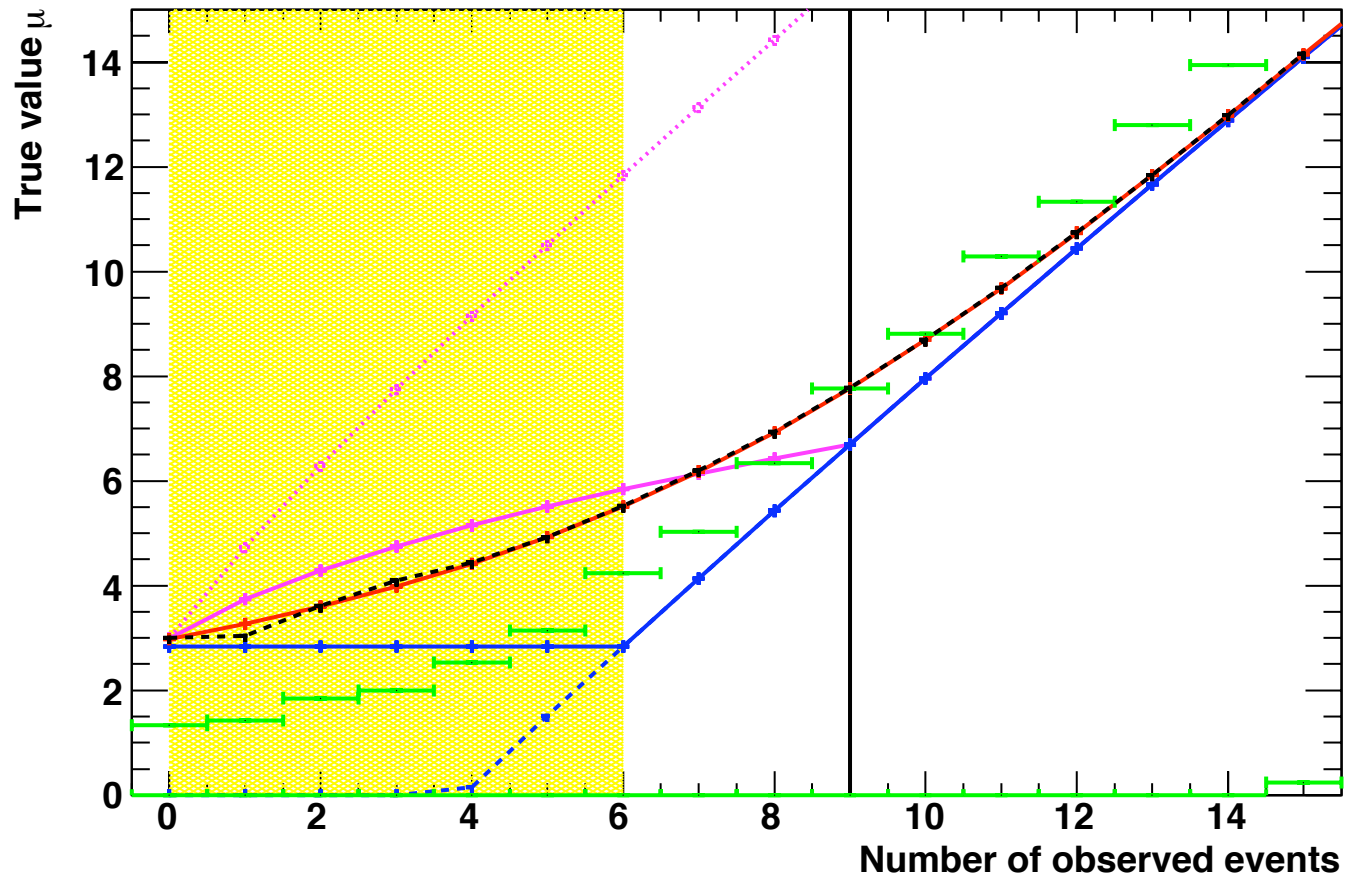
$$b = 8.0$$

Varying background hypotheses



$$b = 8.5$$

Varying background hypotheses



$$b = 9.0$$