

Early work
on

$$\Lambda_b \rightarrow \mu^+ \mu^- \Lambda^0$$

Duran Osuna M. Cecilia

Eduard de la Cruz Burelo.

Mazatlan, Sin, Mexico.
CINVESTAV, Physics Department

OUTLINE:

- **MOTIVATION**
- **OBJECTIVES**
- **RESULTS**
- **CONCLUSIONS**

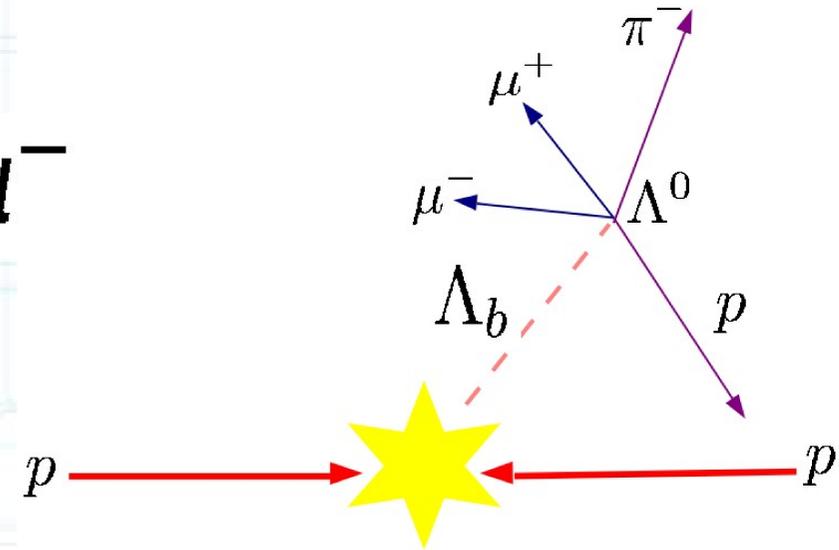


MOTIVATION

The decay

$$b \rightarrow s \mu^+ \mu^-$$

$$\Lambda_b \rightarrow \mu^+ \mu^- \Lambda^0$$



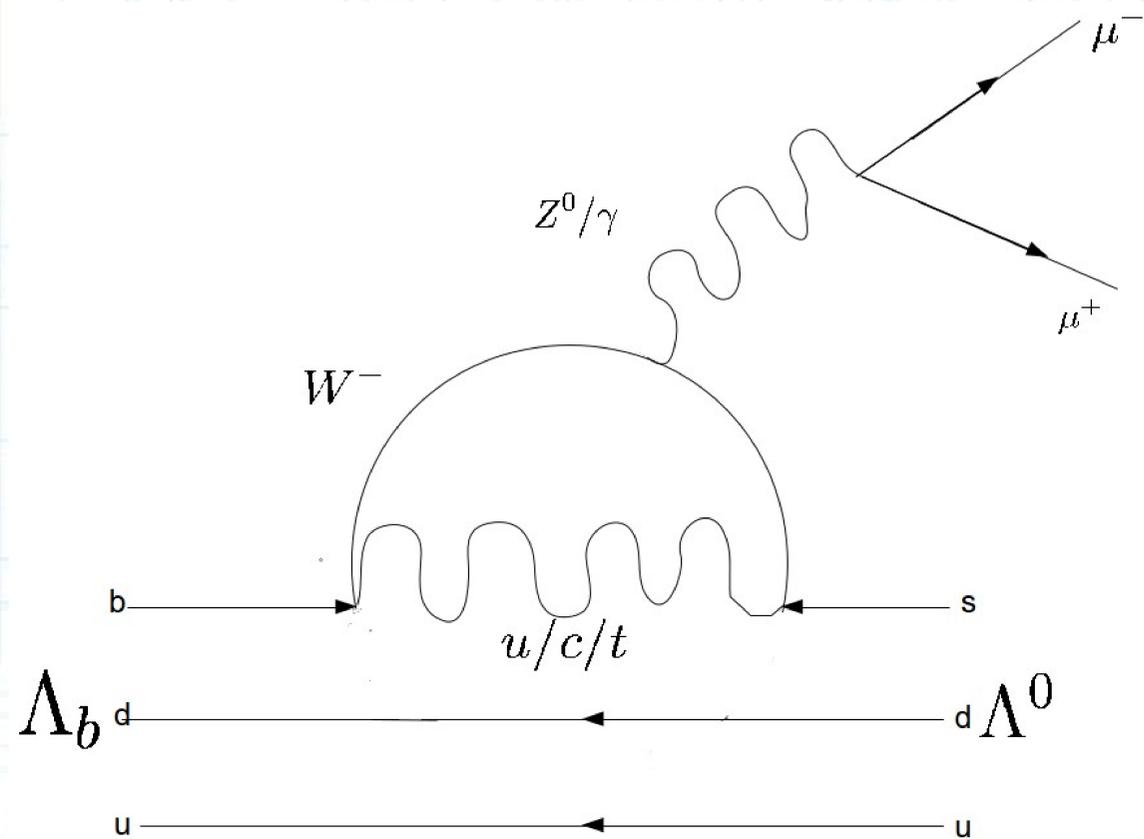
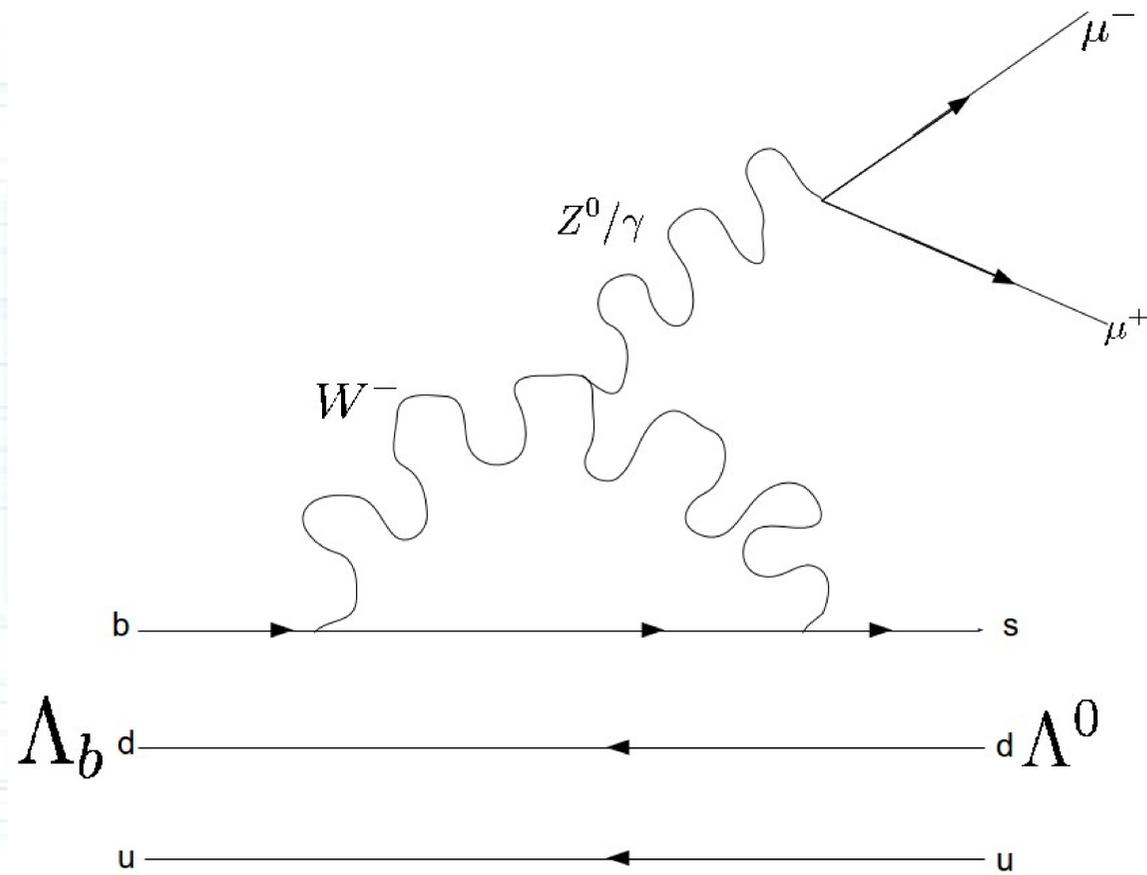
→ Is a rare flavor changing neutral current process (FCNC).

FCNC are suppressed at tree level in the SM.

→ And must occur at higher level.

Standar Model Feynman Diagramas for the decay

$$\Lambda_b \rightarrow \mu^+ \mu^- \Lambda^0$$



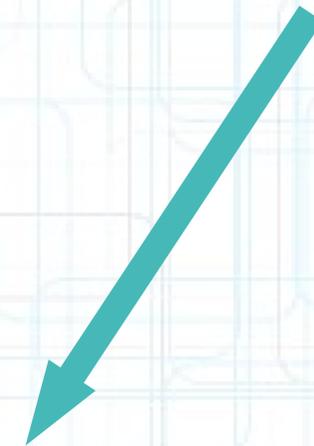
They can only proceed
via loop processes
involving electroweak
penguin or box
diagrams

Motivation

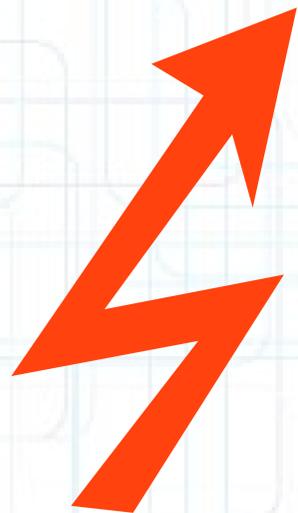
Their suppressed nature along with reliable theoretical predictions for their rates make them excellent search channels for new physics.



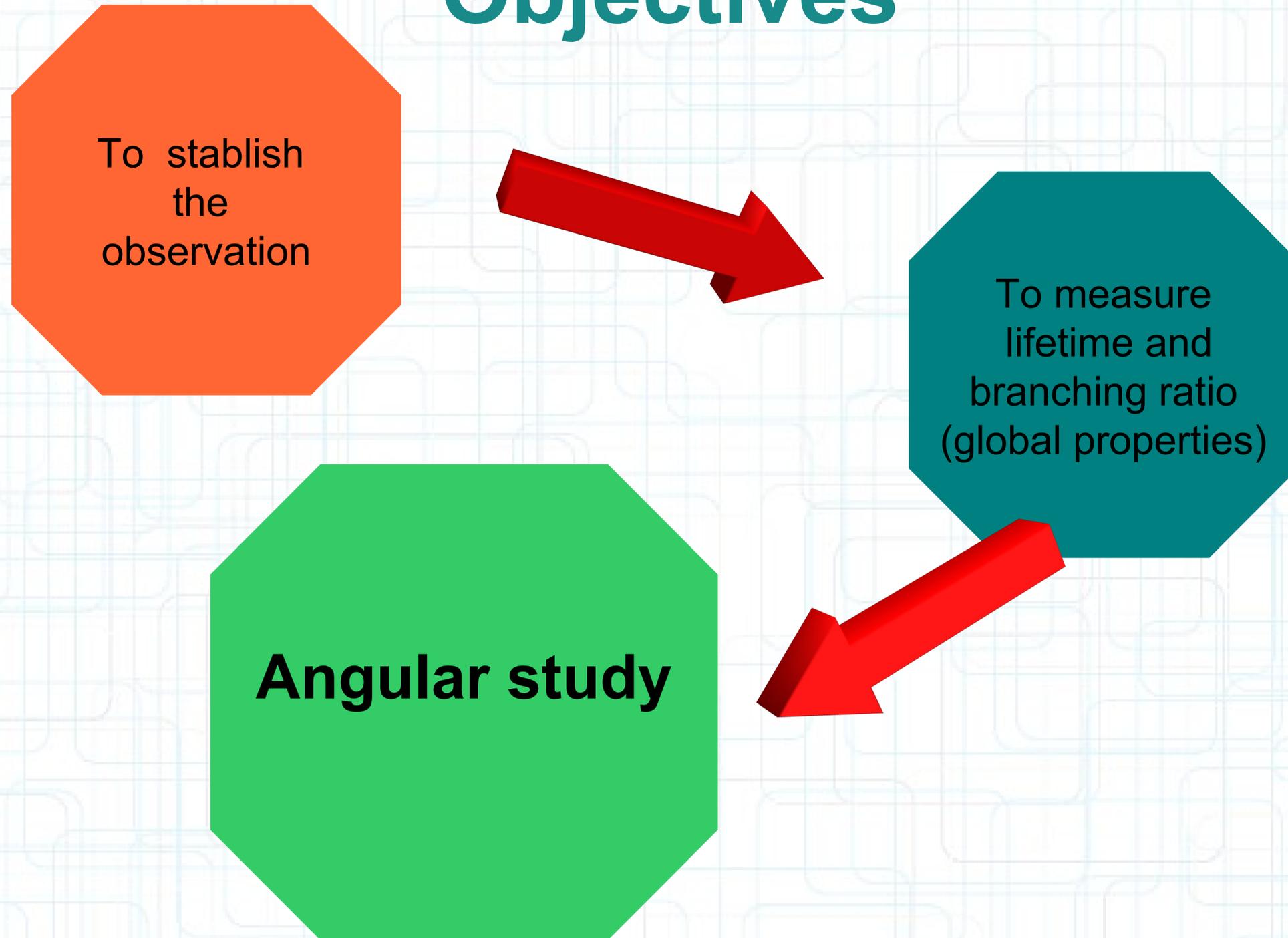
The baryonic FCNC decays are sensitive to the helicity structure of effective hamiltonian.



The measurement of the total and differential branching ratio can help to the improvement of the theoretical treatment



Objectives



Today I will show you just a preliminary result of the study of the 2012 Data.

CMS Detector

31 Nations, 150 Institutions, 1870 Scientists

TRIGGER & DATA ACQUISITION

Austria, CERN, Finland, France, Greece, Hungary, Italy, Korea, Poland, Portugal, Switzerland, UK, USA

TRACKER

Austria, Belgium, CERN, Finland, France, Germany, Italy, Japan*, Switzerland, UK, USA

CRYSTAL ECAL

Belarus, CERN, China, Croatia, Cyprus, France, Italy, Japan*, Portugal, Russia, Switzerland, UK, USA

PRESHOWER

Armenia, Belarus, CERN, Greece, India, Russia, Taiwan (PC), Uzbekistan

RETURN YOKE

Barrel: Czech Rep., Estonia, Germany, Greece, Russia
Endcap: Japan*, USA

SUPERCONDUCTING MAGNET

All countries in CMS contribute to Magnet financing in particular:
Finland, France, Italy, Japan*, Korea, Switzerland, USA

FEET

Pakistan
China

FORWARD CALORIMETER

Hungary, Iran, Russia, Turkey, USA

HCAL

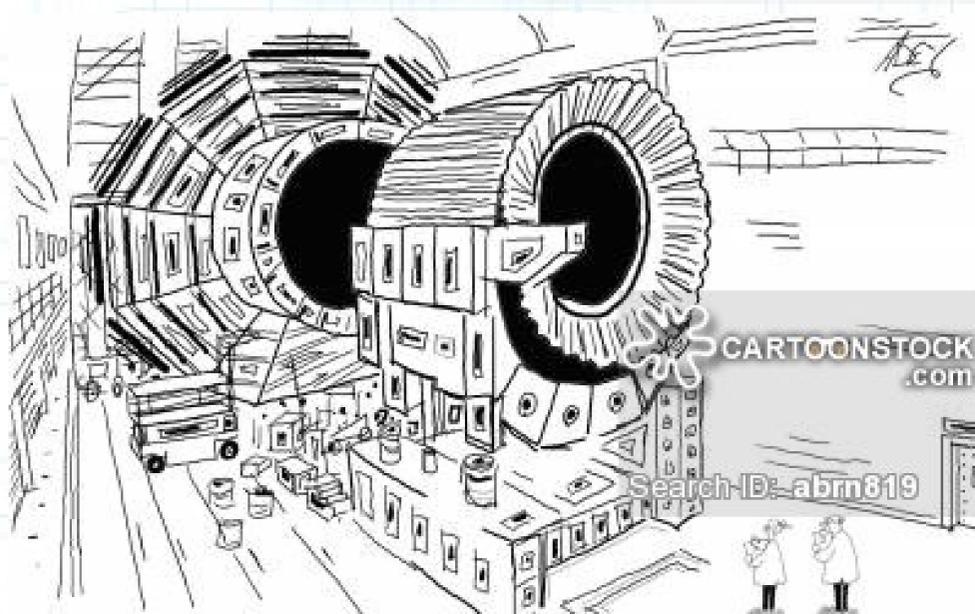
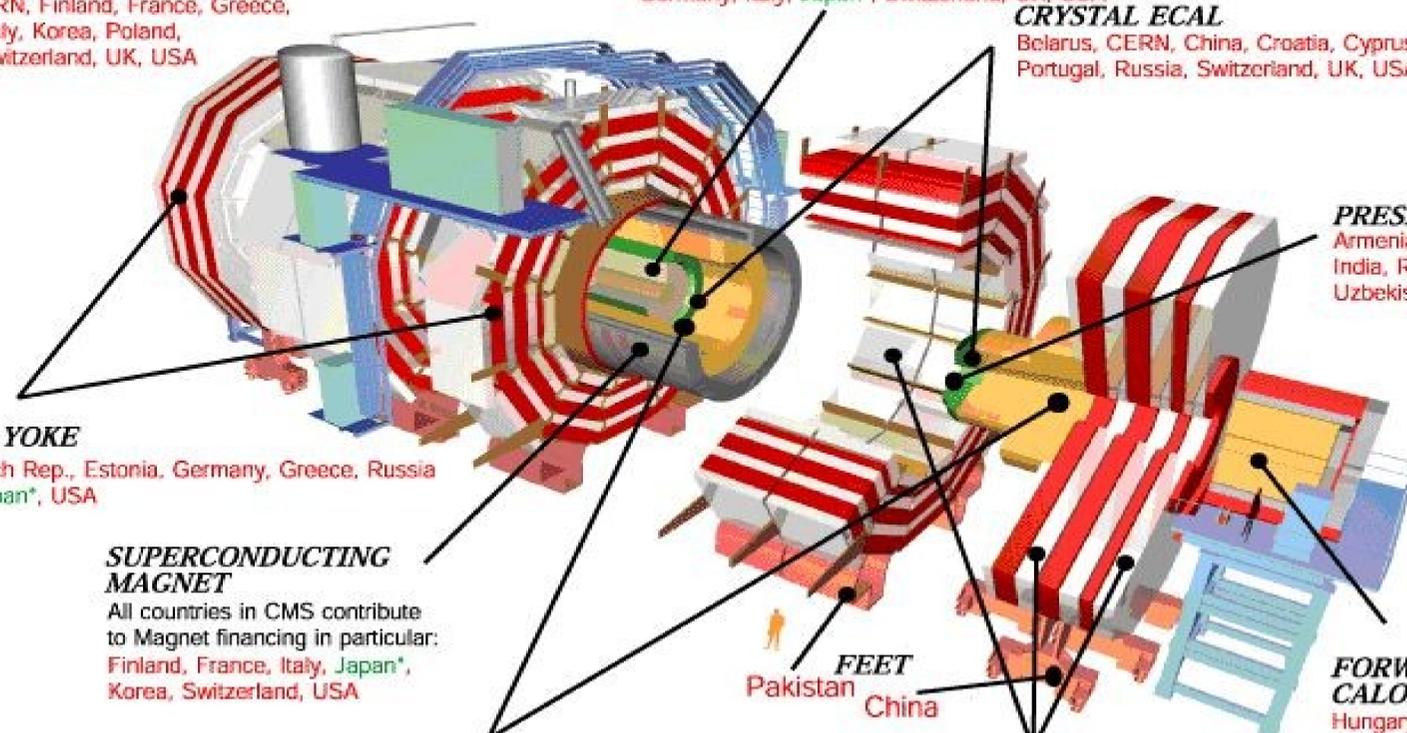
Barrel: Bulgaria, India, Spain*, USA
Endcap: Belarus, Bulgaria, Russia, Ukraine
HO: India

MUON CHAMBERS

Barrel: Austria, Bulgaria, CERN, China, Germany, Hungary, Italy, Spain
Endcap: Belarus, Bulgaria, China, Korea, Pakistan, Russia, USA

Total weight : 12500 T
Overall diameter : 15.0 m
Overall length : 21.5 m
Magnetic field : 4 Tesla

* Only through industrial contracts



"If all else fails - it makes a great frothy latte."

Data sample and trigger

Sample	Luminosity fb^{-1}
• /DoubleMuParked/Run2012A-22Jan2013-v1/AOD	0.923
• /MuOniaParked/Run2012B-22Jan2013-v1/AOD	4.811
• /MuOniaParked/Run2012C-22Jan2013-v1/AOD	7.102
• /MuOniaParked/Run2012D-22Jan2013-v1/AOD	7.631
Total	20.467

Trigger: **HLT_DoubleMu3p5_LowMass_Displaced**.

Trigger Cuts

$$P_T(\mu) > 3.5$$

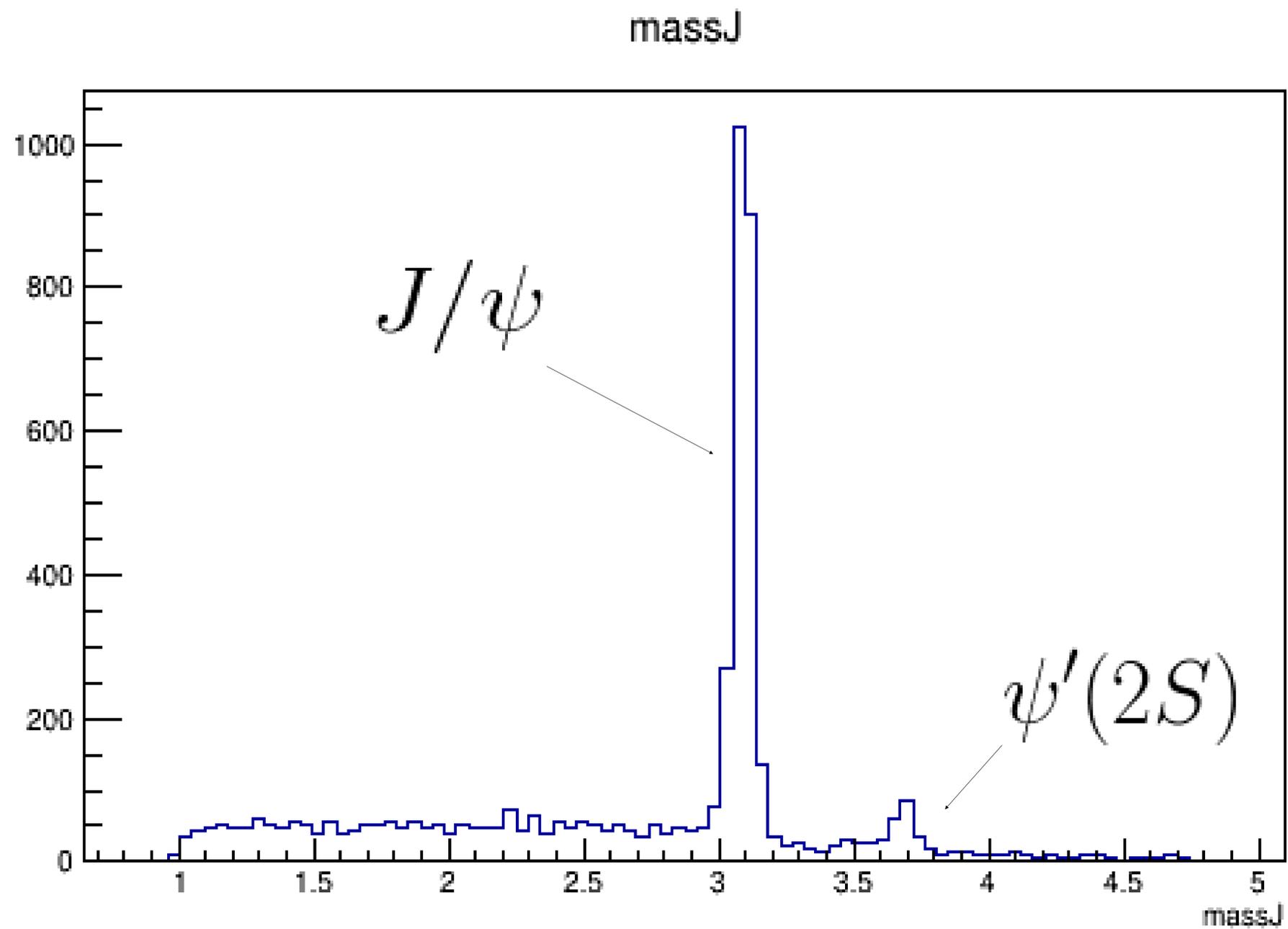
$$|\eta(\mu)| > 2.2$$

$$P_T(\mu\mu) > 6.9$$

$$L_{xy}/\sigma_{L_{xy}} > 3$$

$$1 < M(\mu\mu) < 4.8 \text{ GeV}$$

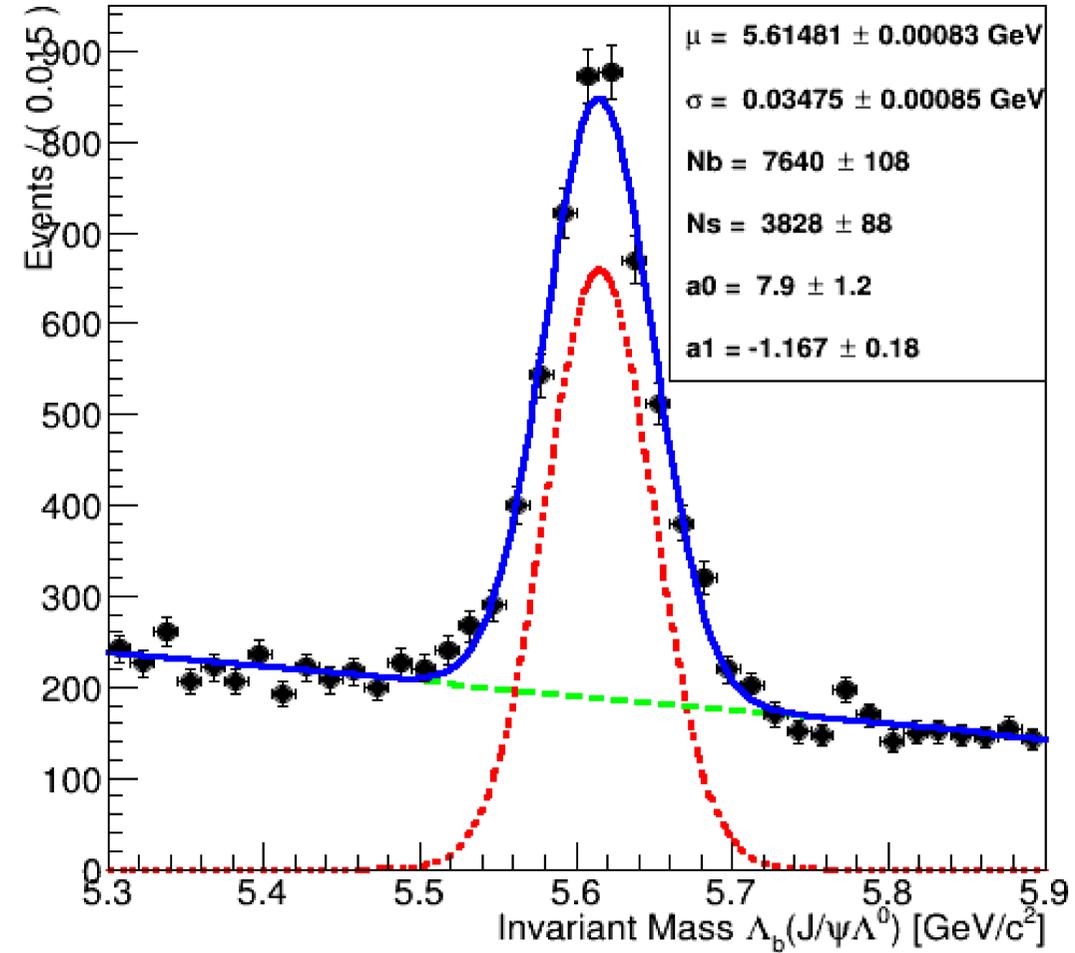
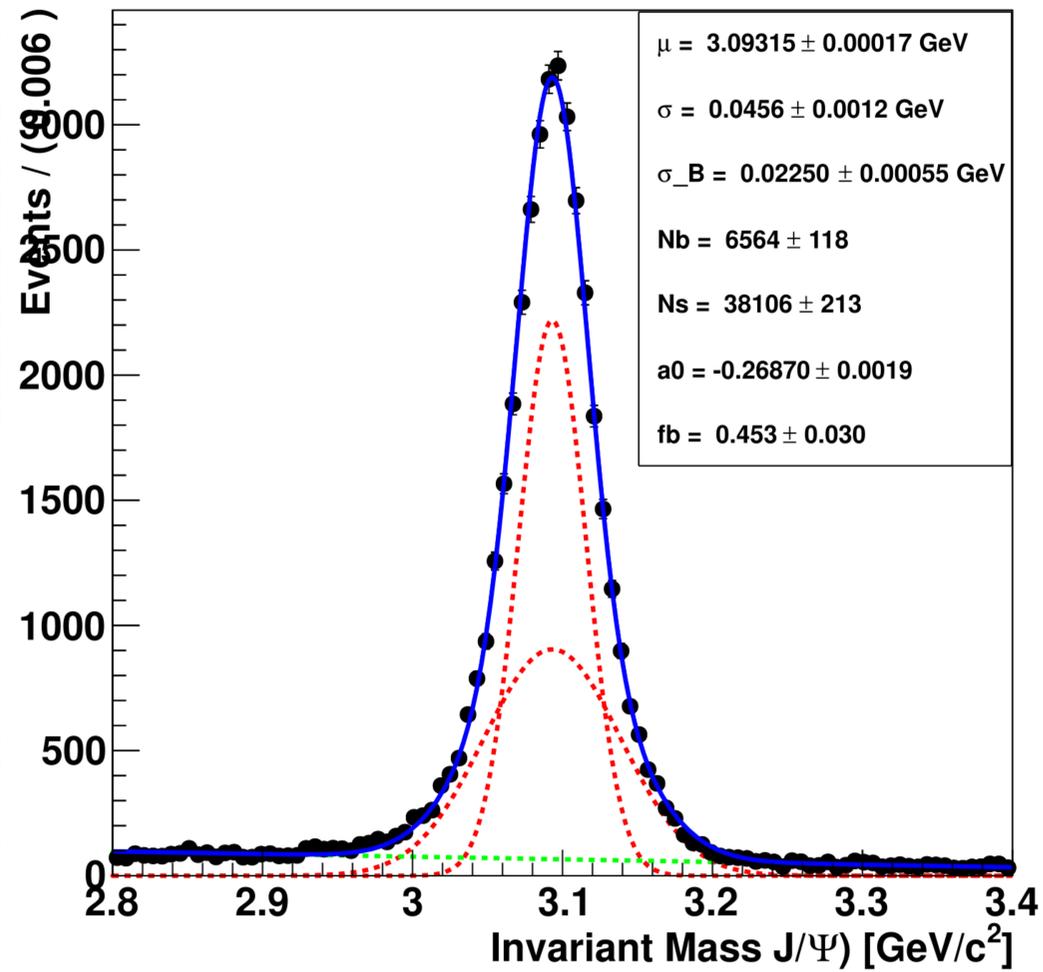
Muons mass distribution



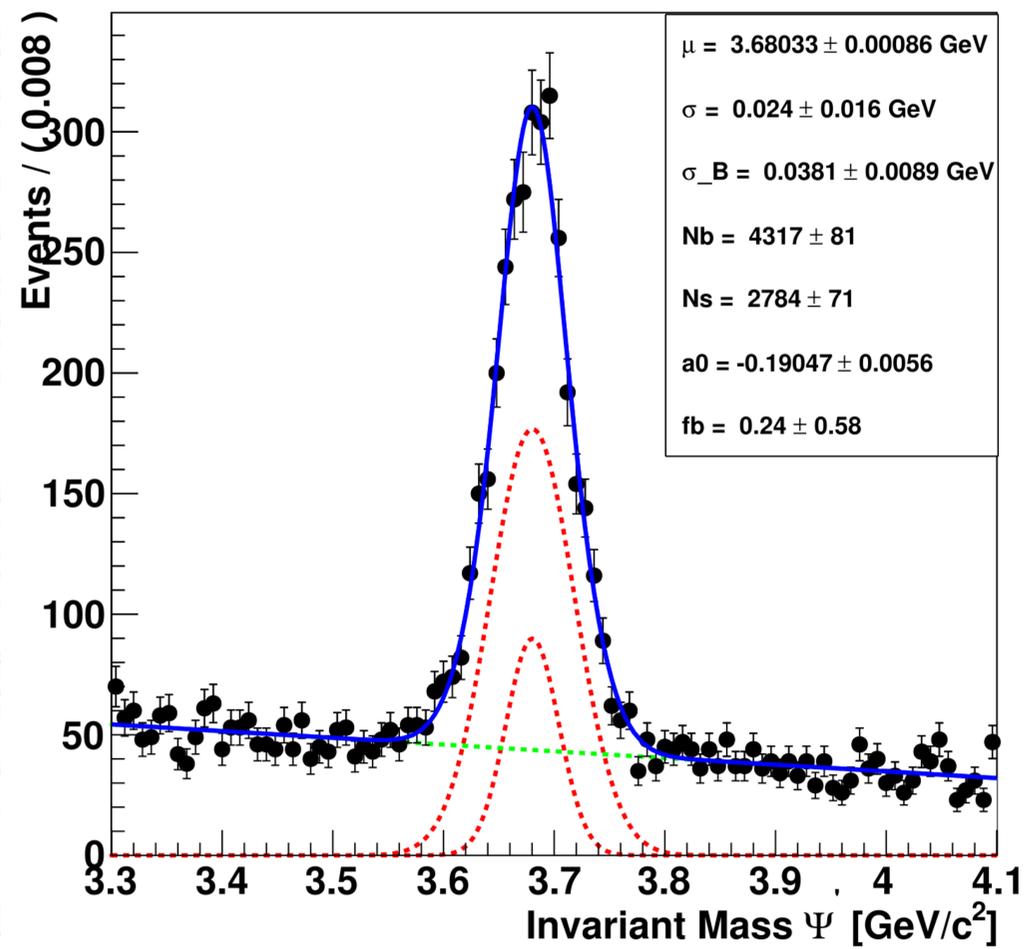
Resonances

J/ψ

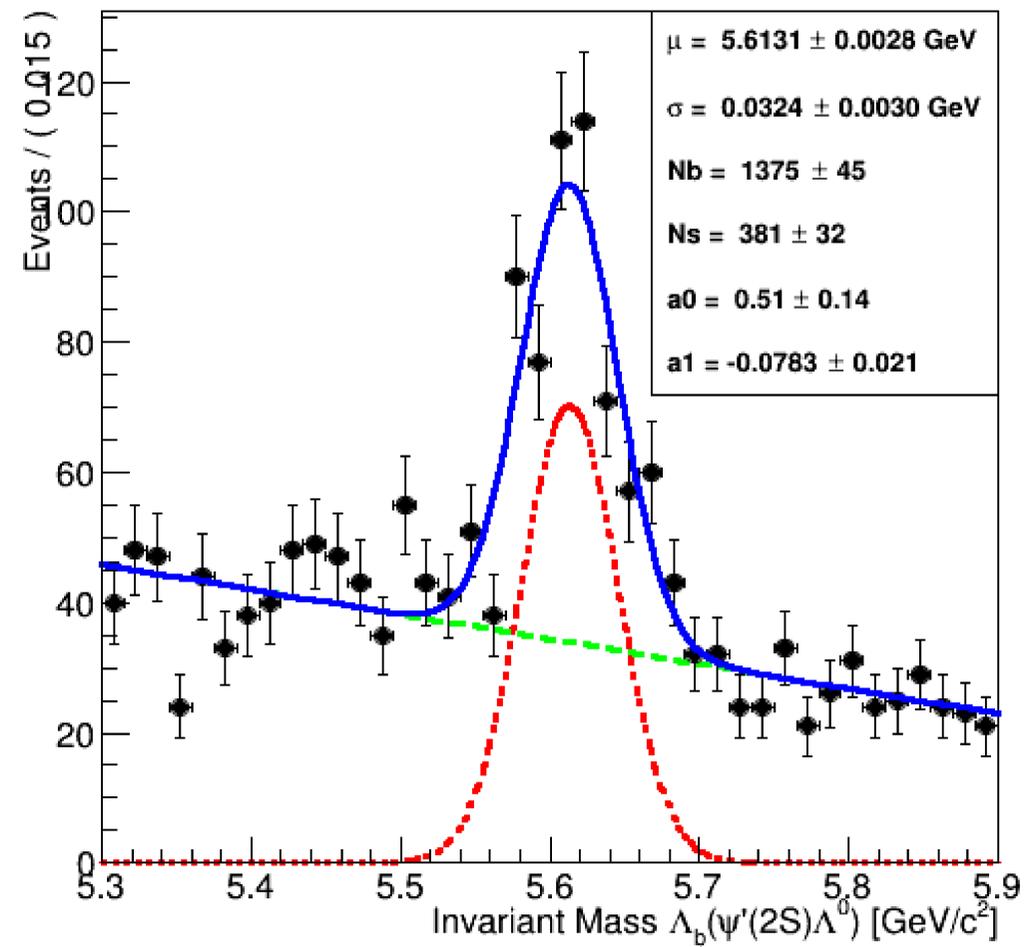
$\Lambda_b \rightarrow J/\psi \Lambda^0$



$\psi'(2S)$

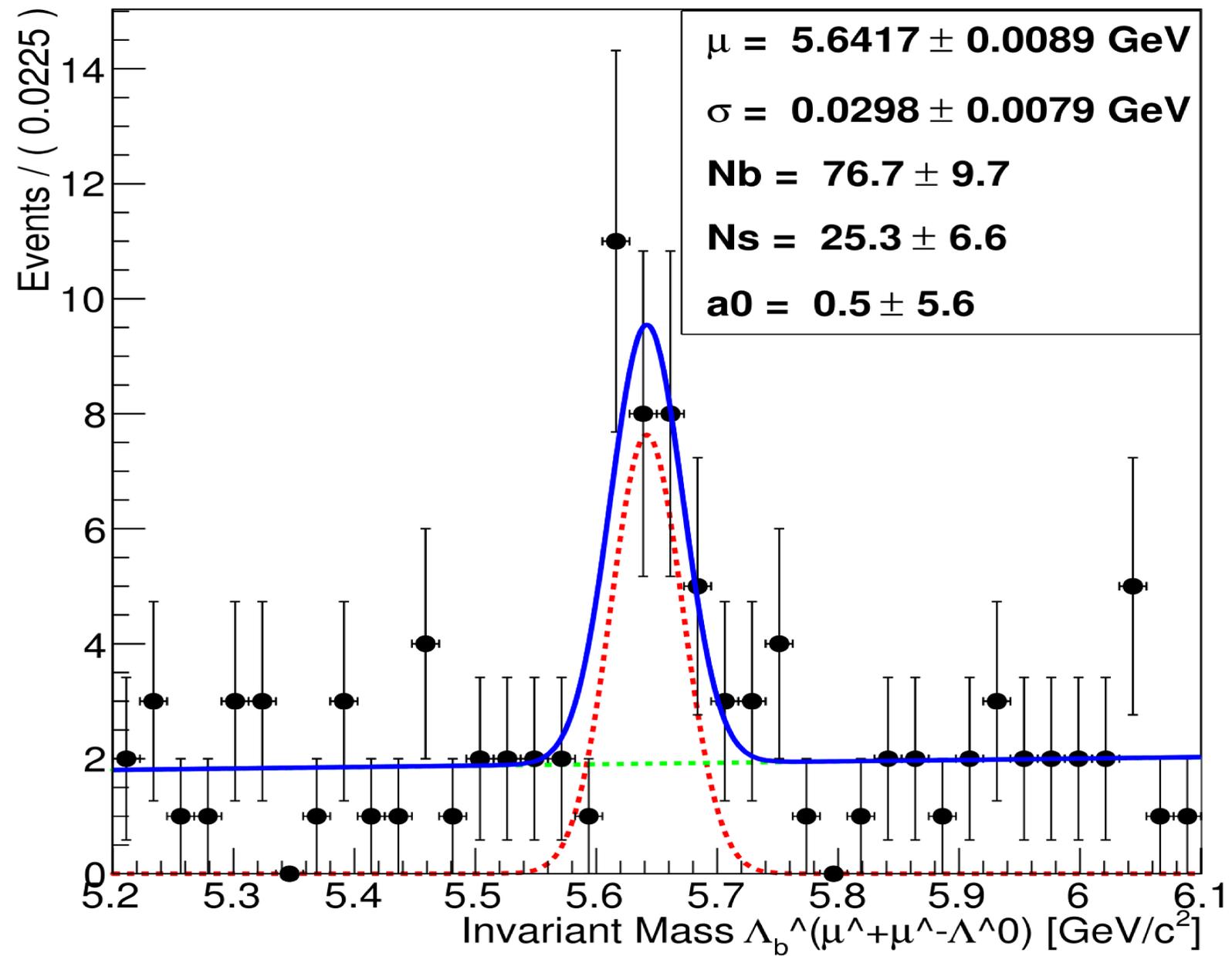


$\Lambda_b \rightarrow \psi'(2S)\Lambda^0$



Resonances vetos

- $m(\mu\mu) < m_{J/\psi PDG} - 3\sigma_{m(\mu\mu)}$
- $m_{J/\psi PDG} + 3\sigma_{m(\mu\mu)} < m(\mu\mu) < m_{\psi' PDG} - 3\sigma_{m(\mu\mu)}$
- $m(\mu\mu) > m_{\psi' PDG} + 3\sigma_{m(\mu\mu)}$



Invariant mass for $\Lambda_b \rightarrow \mu^+ \mu^- \Lambda^0$ candidates in the 2012 sample.

Conclusions/Plans

- ✓ We have proved that we can reconstruct this rare decay in the 2012 data.
- ✓ The next step is to establish the signal in the new data, once we get 5 times more statistics
- ✓ After the observation we will be ready to measure properties and go on with the angular analysis.

We are also working on the decay

channel $\Lambda_b \rightarrow \mu^+ \mu^- \Lambda^*$