



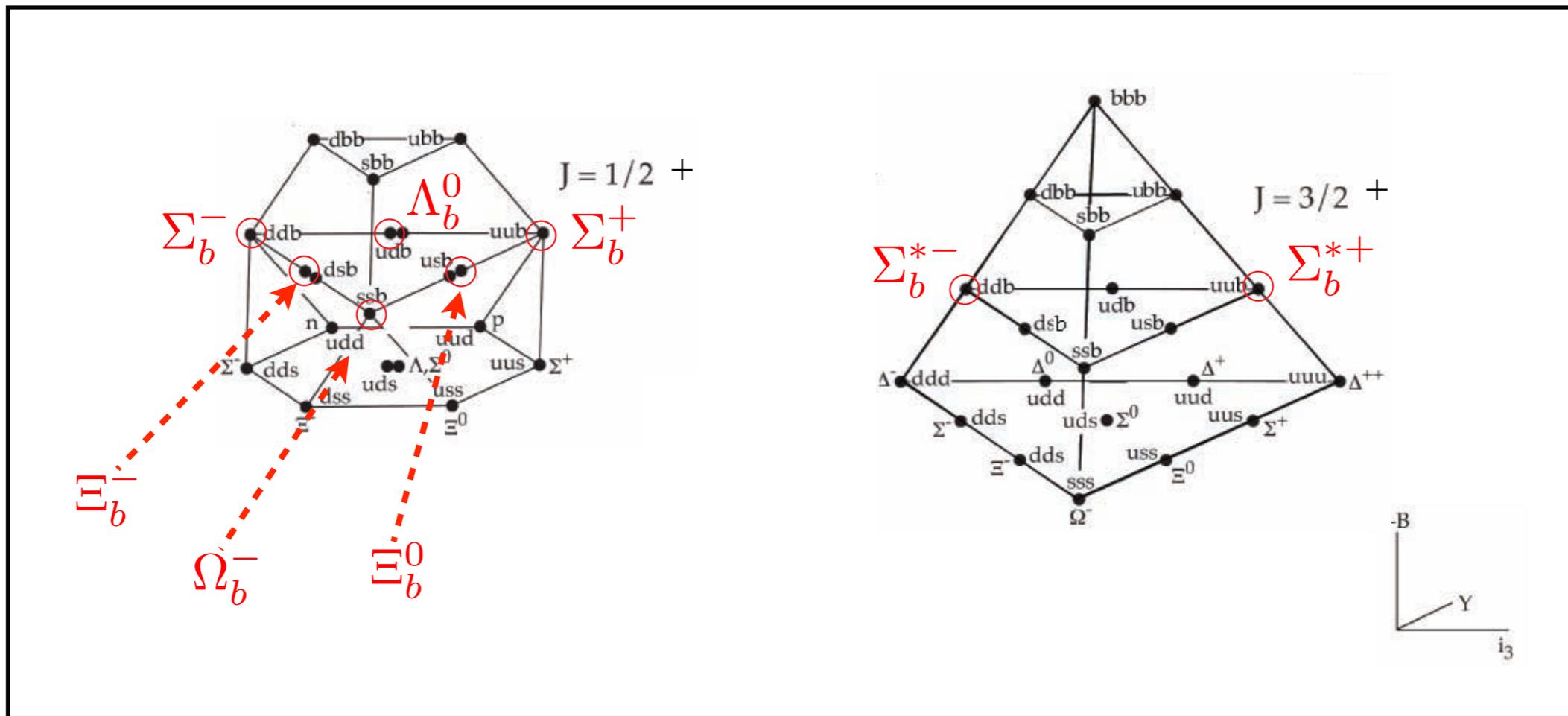
b-baryon searches at the CMS experiment

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Why b -baryons?

- Only 8 baryons with b -quarks have been observed:



- Evidence often rests on a small number of events
- Most of the predicted ground states are still to be discovered

In this talk:

I) $\Lambda_b(u d b)$

II) $\Sigma_b^{(*)+}(u u b)$, $\Sigma_b^{(*)-}(d d b)$

$\Lambda_b \rightarrow J/\psi(\mu\mu)\Lambda(p\pi)$ decay angular analysis

Motivation

from theoretical point of view:

- does polarization depend on quark mass?
- how are polarized b-quarks produced?
- how to model hadronization process?
- test of heavy quark polarization models and PQCD

from experimental point of view:

- four charged particles and two displaced vertices in final state
- two muons to trigger on

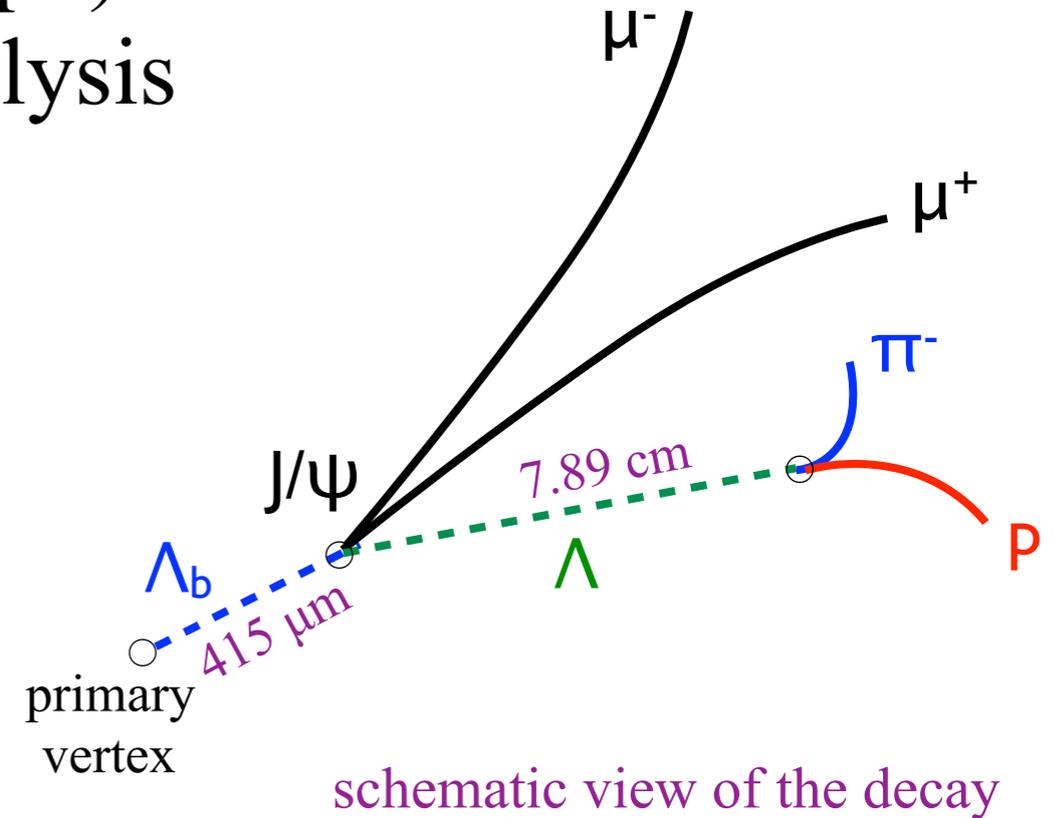
From PDG:

$$M_{PDG}(\Lambda_b) = 5620.2(1.6) \text{ MeV}/c^2$$

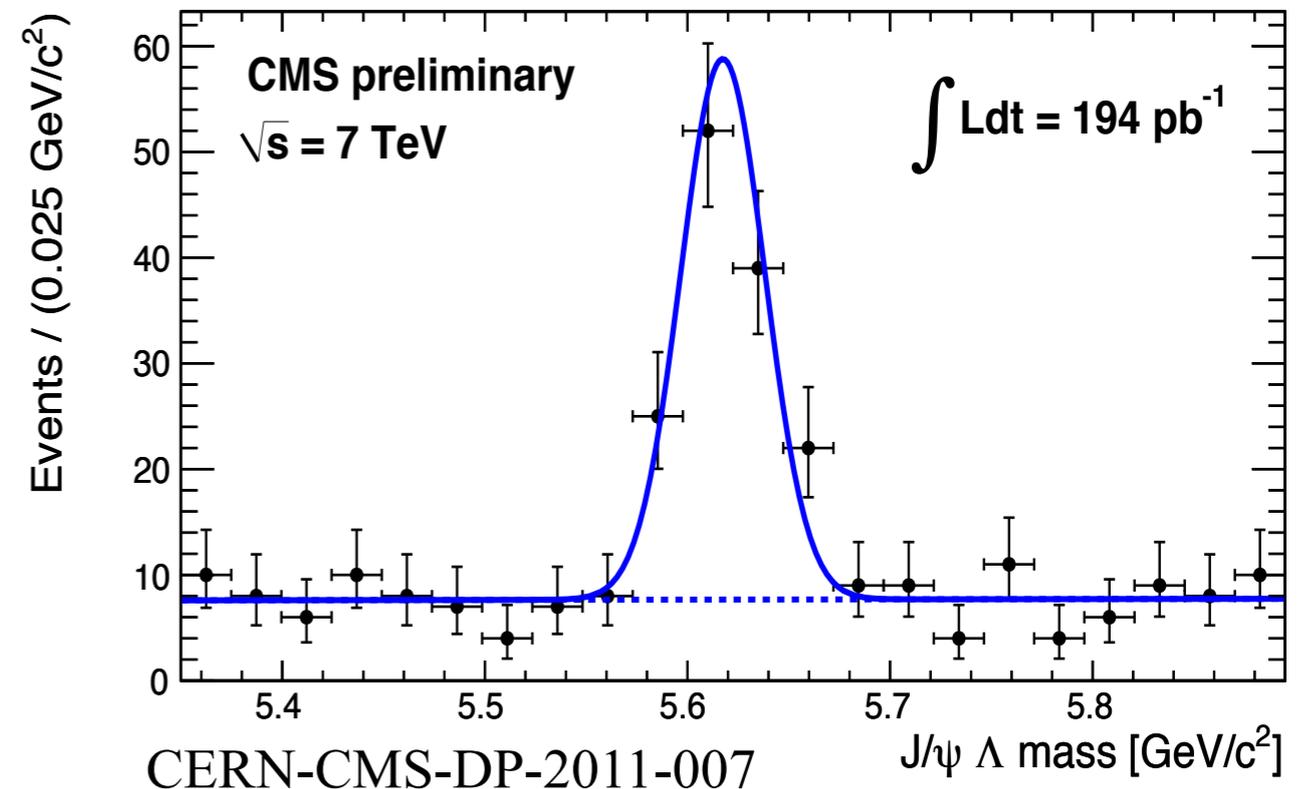
$$c\tau(\Lambda_b) = 415 \mu\text{m}$$

Step 1:

- Use of 2011 data
- Clear Λ_b signal reconstructed
- Low background achieved



example distribution of reconstructed Λ_b signal:



$\Lambda_b \rightarrow J/\psi(\mu\mu)\Lambda(p\pi)$ decay angular analysis

Step 2:

Decay angular distributions

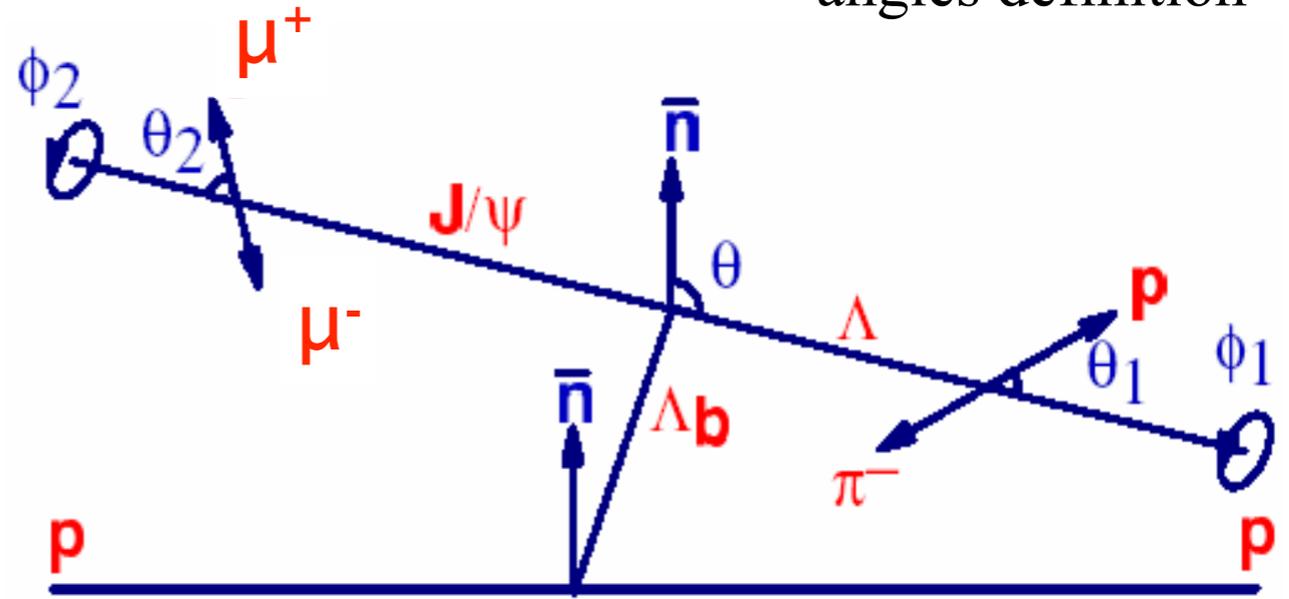
$$\frac{dN}{\cos\theta} \sim 1 + \alpha_{AS} P_{\Lambda_b} \cos\theta$$

determined
simultaneously

P_{Λ_b} - Λ_b polarization

α_{AS} - asymmetry parameter out of
4 complex helicity amplitudes

angles definition



Observables:

5 angles:

$\theta, \theta_1, \theta_2, \phi_1, \phi_2$

9 unknown parameters:

P_{Λ_b}

$$\alpha_{AS} = |a_+|^2 - |a_-|^2 + |b_+|^2 - |b_-|^2$$

measure from daughters' decay angles

Work in progress

Search for $\Sigma_b^{(*)\pm} \rightarrow \Lambda_b \pi^\pm$

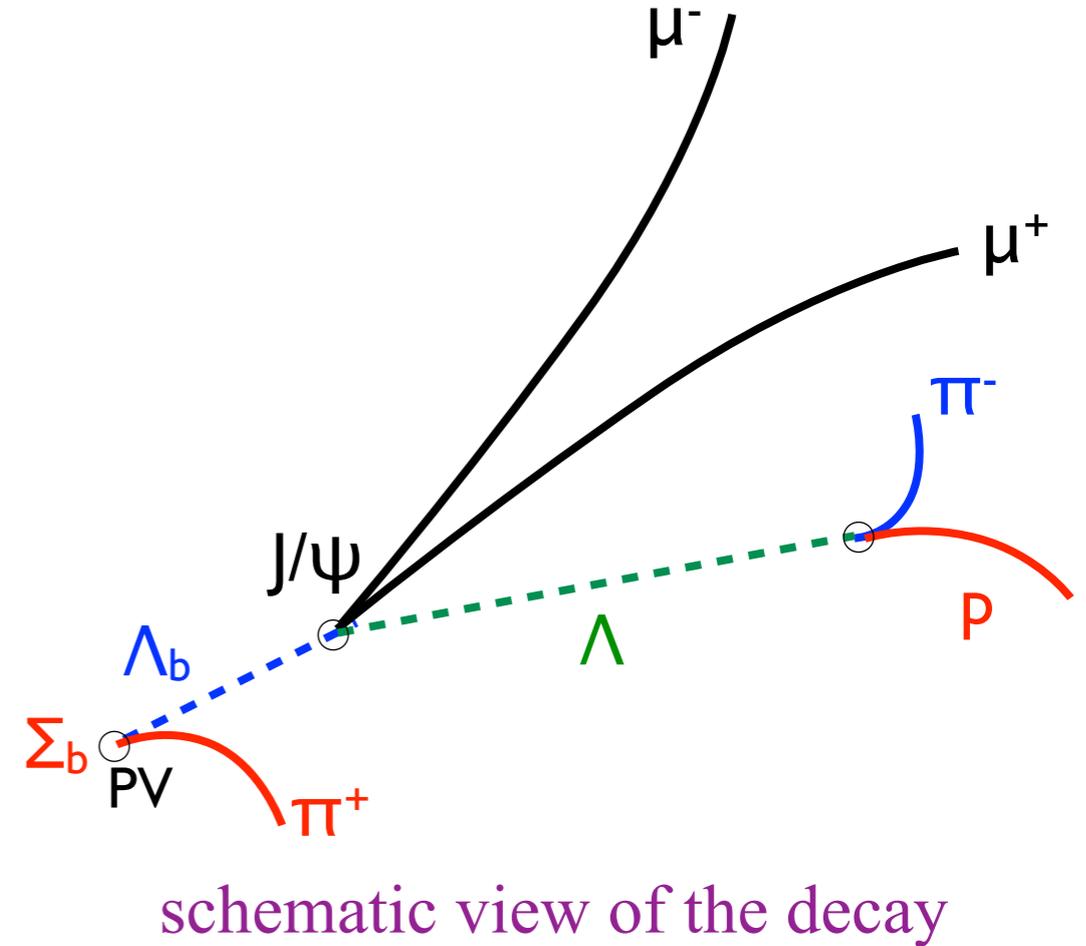
Four charged states observed so far (by CDF):

$$\Sigma_b^{(*)+} (uub) \rightarrow \Lambda_b^0 \pi^+$$

$$\Sigma_b^{(*)-} (ddb) \rightarrow \Lambda_b^0 \pi^-$$

Theoretical expectations:

| Σ_b property | Expected value (MeV/c ²) |
|--|--------------------------------------|
| $m(\Sigma_b) - m(\Lambda_b^0)$ | 180 - 210 |
| $m(\Sigma_b^*) - m(\Sigma_b)$ | 10 - 40 |
| $m(\Sigma_b^-) - m(\Sigma_b^+)$ | 5 - 7 |
| $\Gamma(\Sigma_b), \Gamma(\Sigma_b^*)$ | $\sim 8, \sim 15$ |



Challenges at CMS:

- soft (low energy) pion coming from PV
- huge combinatorial background
- tight muon triggers

Many requirements to assure that:

- selected pion is from same PV as Λ_b

Plan to measure
 Σ_b cross-section relative to Λ_b

Work in progress