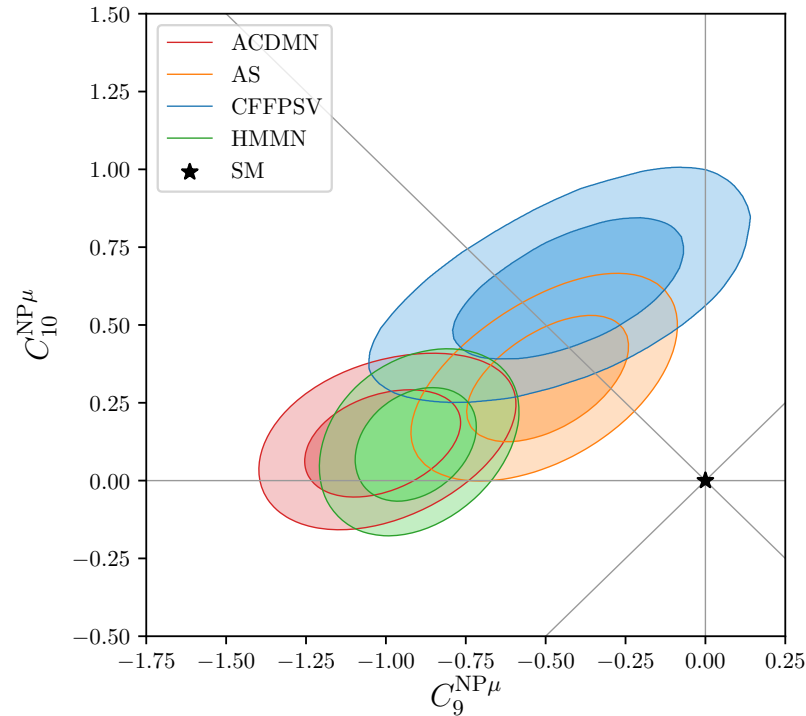# It is not a mass peak. Now what?

~6σ being said. What would convince us as a community?
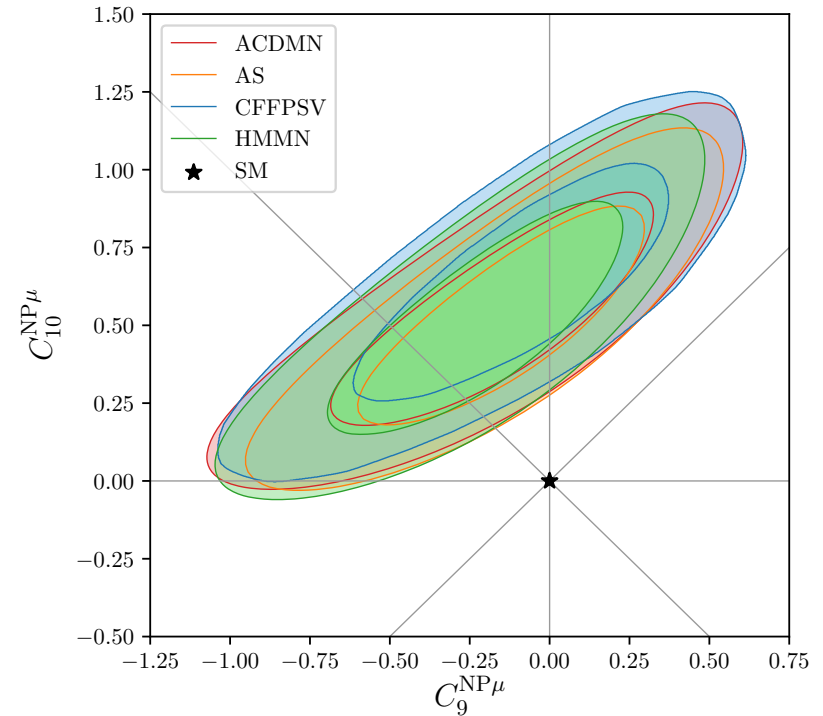
* Provocative questions to launch the discussion

# "Consensus talk" : important outcome yesterday

- Extremely interesting collaborative work:



global fit



fit to LFU observables + $B_s \rightarrow \mu\mu$

- Comparison when using same input?

# b→sll Discussion: Building Consensus

How can we – HEP Community - convince ourselves (& the world..) ?

1) how conservative does one need to be?

2) how to quantify the significance?

3) how to proceed from here?

# 1) How conservative does one need to be?

– LHCb wants to be conservative about any claim

– Does the theory community have recommendations for LHCb ?

# 2) Quantifying significance ?

- ## How to treat theory uncertainties?

    a) Use all observables with best knowledge?      ($\rightarrow$ and quantify $C_i$ ?)

    b) Only use clean observables?      ($\rightarrow$ only quantify significance ?)
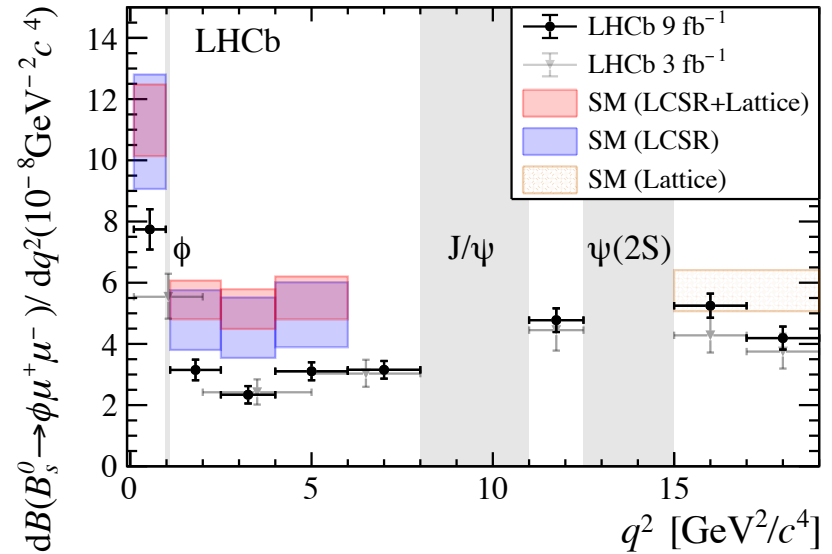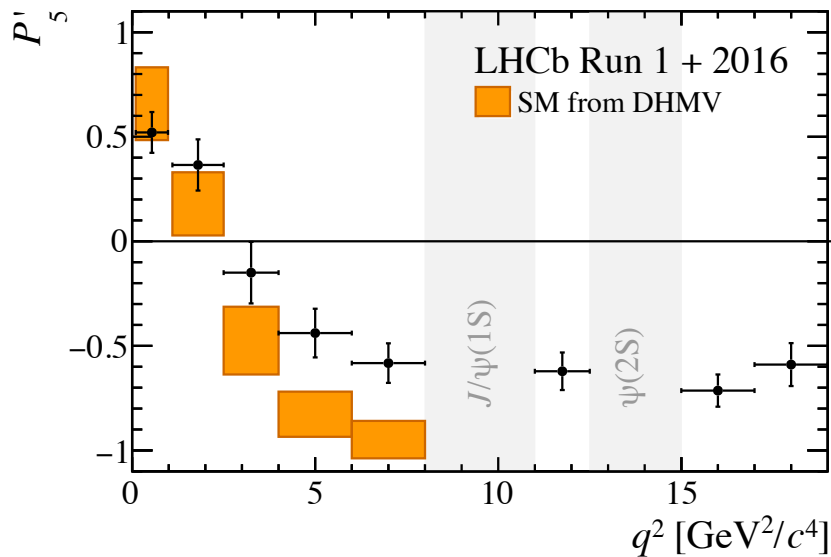


- ## "Look-elsewhere-effect" in Wilson Coef. space?

# 2) Quantifying significance ?



fit to LFU observables + $B_s \to \mu\mu$

- ## How to treat theory uncertainties?

    a) Use all observables with best knowledge?

    b) Only use clean observables? Which ones?

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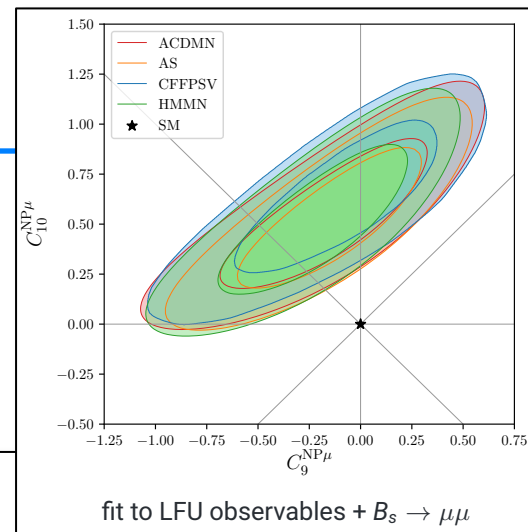
### *p*-value SM fit

For the frequentist fits, the *p*-value of goodness-of-fit can be computed from Wilks' theorem

$$p - value_{SM} = 1 - F(\chi^2_{SM}; n_{obs})$$

with $F(\chi^2; n_{obs})$ the $\chi^2$ CDF and $n_{obs}$ the number of independent observables in the fit (measurements of a given observable by different experiments are counted as different observables).

▶ **ACDMN**

$$Global\ fit:\ n_{\mathrm{dof}} = 246 \quad \Rightarrow \quad p - value = 1.1\%$$
$$LFU\ fit^*:\ n_{\mathrm{dof}} = 22 \quad \Rightarrow \quad p - value = 1.4\%$$

▶ **AS**

$$Global\ fit:\ n_{\mathrm{dof}} = 191 \quad \Rightarrow \quad p - value = 1.2\%$$
$$LFU\ fit^*:\ n_{\mathrm{dof}} = 21 \quad \Rightarrow \quad p - value = 0.5\%$$

▶ **HMMN**

$$Global\ fit:\ n_{\mathrm{dof}} = 173 \quad \Rightarrow \quad p - value = 0.4\%$$
$$LFU\ fit^*:\ n_{\mathrm{dof}} = 7 \quad \Rightarrow \quad p - value = 0.02\%$$

*LFU fit: all the measured LFU observables + $\mathcal{B}(B_s \to \mu^+\mu^-)$ (all groups)
   + effective $B_s \to \mu\mu$ lifetime + radiative decays + $\mathcal{B}(B_s \to X_s\mu^+\mu^-)$ (depending on the group)

# 3) How to proceed from here?

How can we – HEP Community - convince ourselves (& the world..) ?

- ## How should we proceed?
    - (g-2) example: theory and experiment synchronized?
    - Another joint workshop?

\* Of course a lot will depend on future experimental input!

# b→sll Discussion: Building Consensus

How can we – HEP Community - convince ourselves (& the world..) ?

1) how conservative does one need to be?

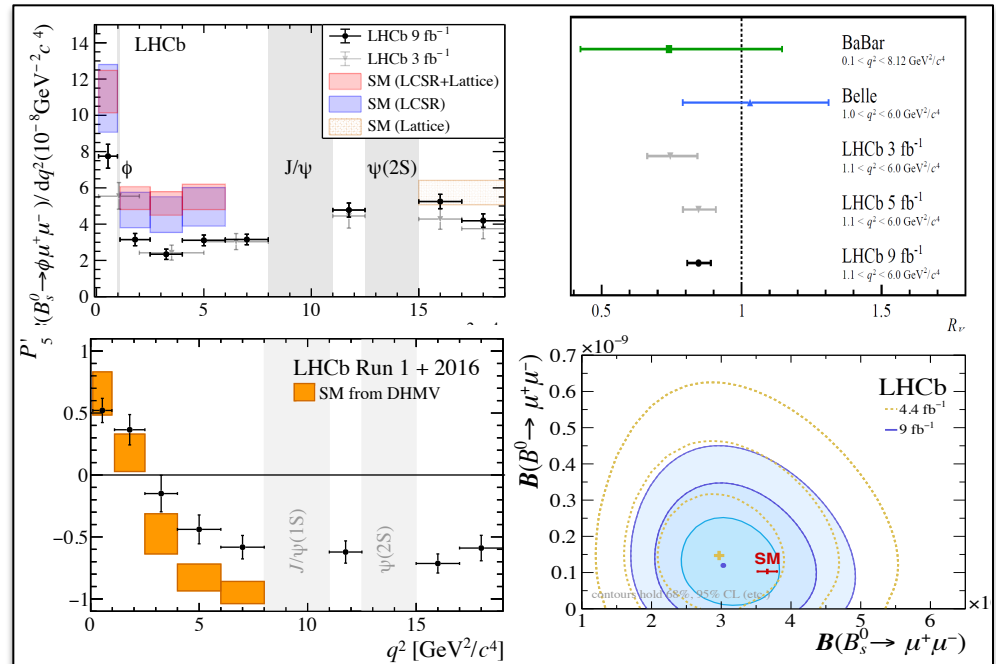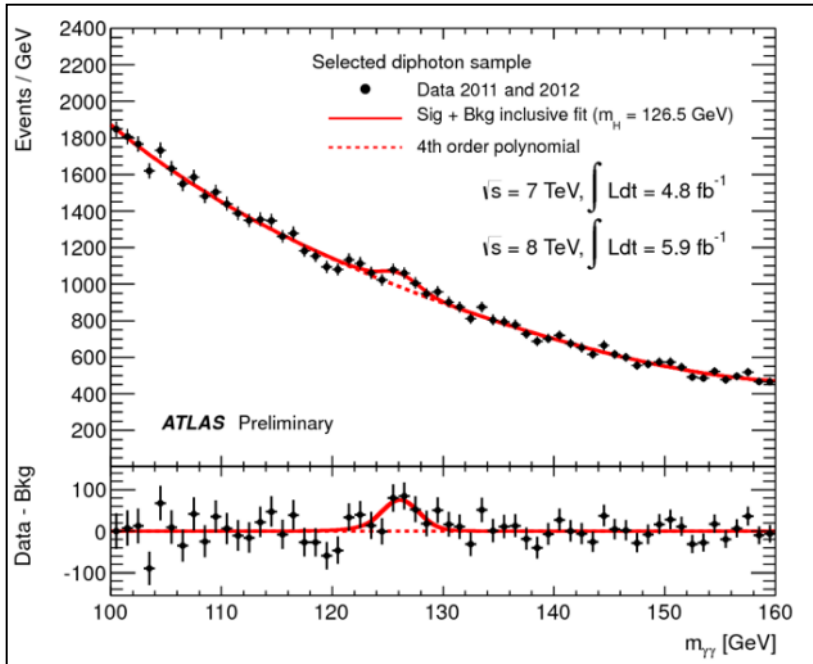2) how to quantify the significance?

3) how to proceed from here?

# Backup

# 2) Quantifying significance ?

Higgs          vs          $b \to s l^+ l^-$



p-value of SM hypothesis?

$\Delta\chi^2$ wrt discovery hypothesis *(coherent pattern)* ?

Look-elsewhere effect ?