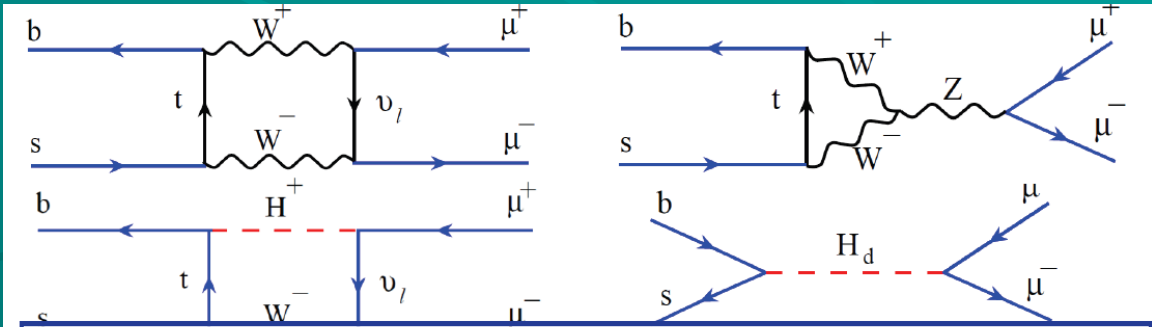


$B_s(d) \rightarrow \mu\mu$

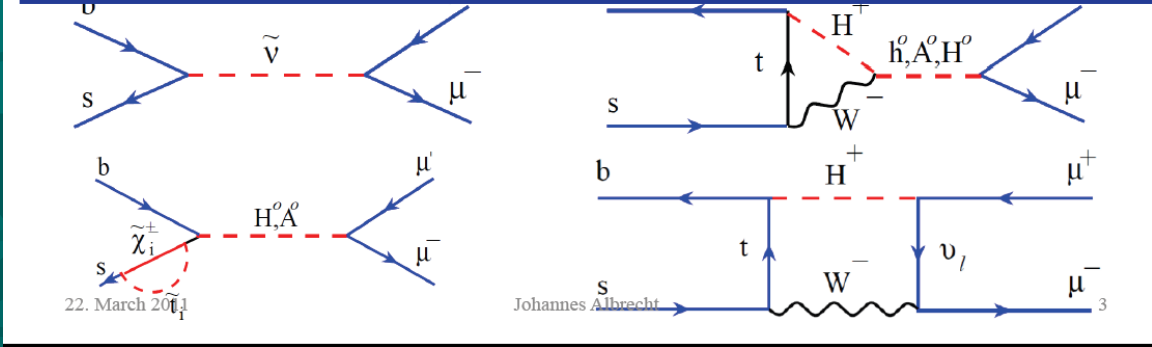
New results from LHCb

The proponents:

C. Adrover, J. Albrecht, F. Archilli, M.O.Bettler, X. Cid Vidal,
F. Dettori, C. Elsasser, J.A.Hernando Morata, G. Lanfranchi, G. Mancinelli,
D. Martinez Santos, S. Oggero, M. Palutan, A. Pellegrino, M. Perrin-Terrin,
N. Sagidova, A. Sarti, J. Serrano, B. Sciascia, Y. Shcheglov, F. Soomro,
O. Steinkamp, S. Tolk



Introduction: $B_{s,d} \rightarrow \mu^+ \mu^-$ as probe for New Physics



22. March 2011

Johannes Albrecht

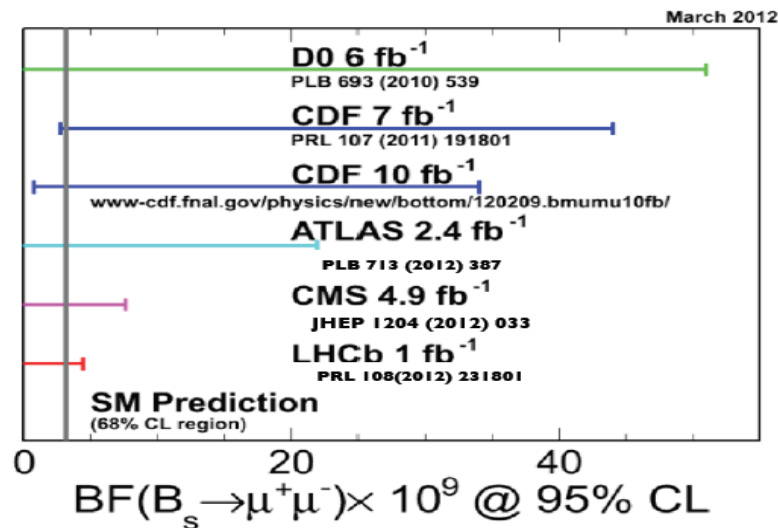
3

Стандартная модель

$$\begin{aligned}
 \mathcal{B}(B_s^0 \rightarrow \mu^+ \mu^-)^{CP} &= (3.23 \pm 0.27) \cdot 10^{-9} & \rightarrow &= (3.54 \pm 0.30) 10^{-9} \\
 \mathcal{B}(B^0 \rightarrow \mu^+ \mu^-)^{CP} &= (1.07 \pm 0.10) \cdot 10^{-10}
 \end{aligned}$$

Предыдущие данные

Status of $B^0_s \rightarrow \mu^+ \mu^-$ search



March 2012

LHCb and CMS getting very close to get sensitivity for observing a SM rate...

LHC combination (June 2012): $BR(B^0_s \rightarrow \mu^+ \mu^-) < 4.2 \times 10^{-9}$ at 95% CL

LHCb-CONF-2012-017

CMS-PAS-BPH-12-009

ATLAS-CONF-2012-061

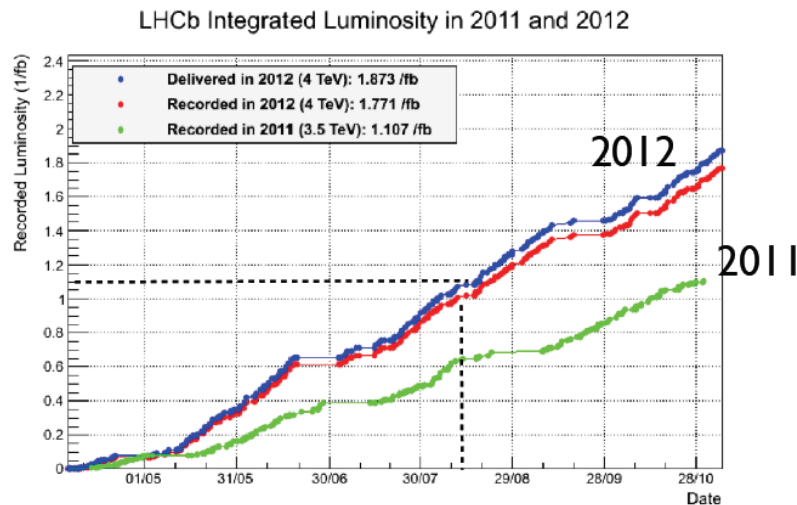
$B^0_s \rightarrow \mu^+ \mu^-$ at LHCb



Today we'll present the update on $B^0_{(s)} \rightarrow \mu^+ \mu^-$ search with

1.0 fb⁻¹ at 7 TeV (2011) + 1.1 fb⁻¹ at 8 TeV (2012)

2012: another great year of data taking thanks to the performances of LHC!



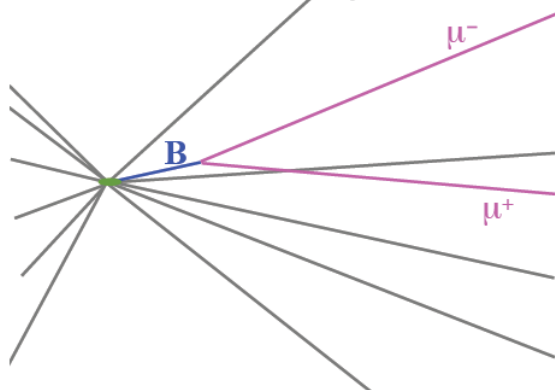
7 TeV data already published in PRL 108 (2012) 231801:

it has been reanalyzed as part of the measurement presented here; the result supersedes the previous publication

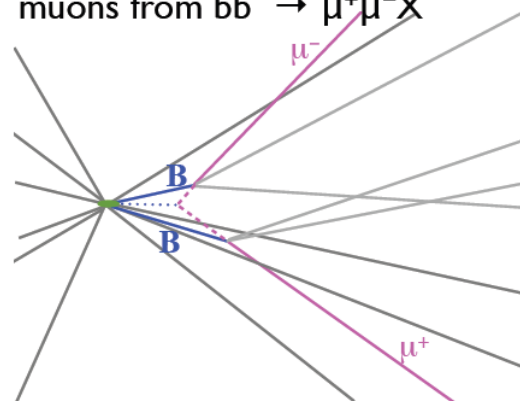
Signal discrimination: BDT



signal: 2 muons from a single well reconstructed secondary vertex



dominant background: two real muons from $b\bar{b} \rightarrow \mu^+\mu^-X$



Discrimination is achieved by a BDT with 9 input variables

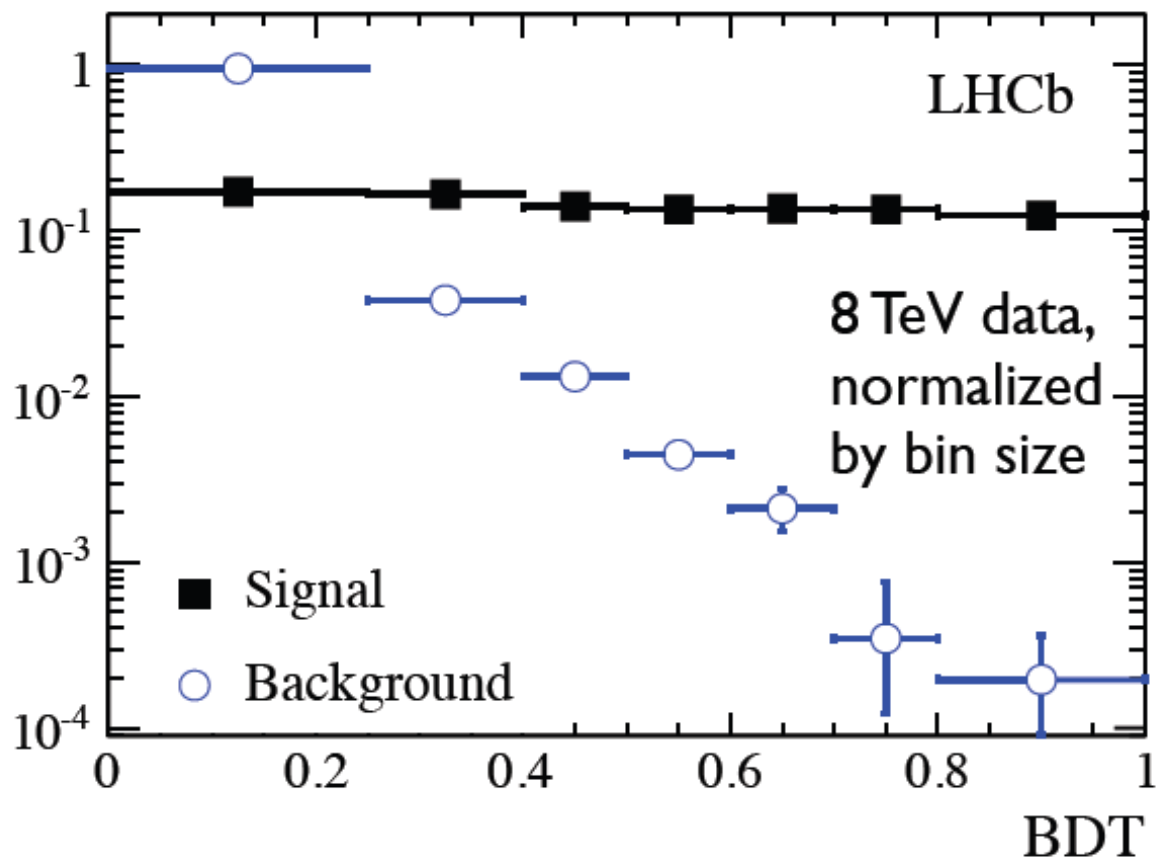
B candidate:

- proper time
- impact parameter
- transverse momentum
- B isolation

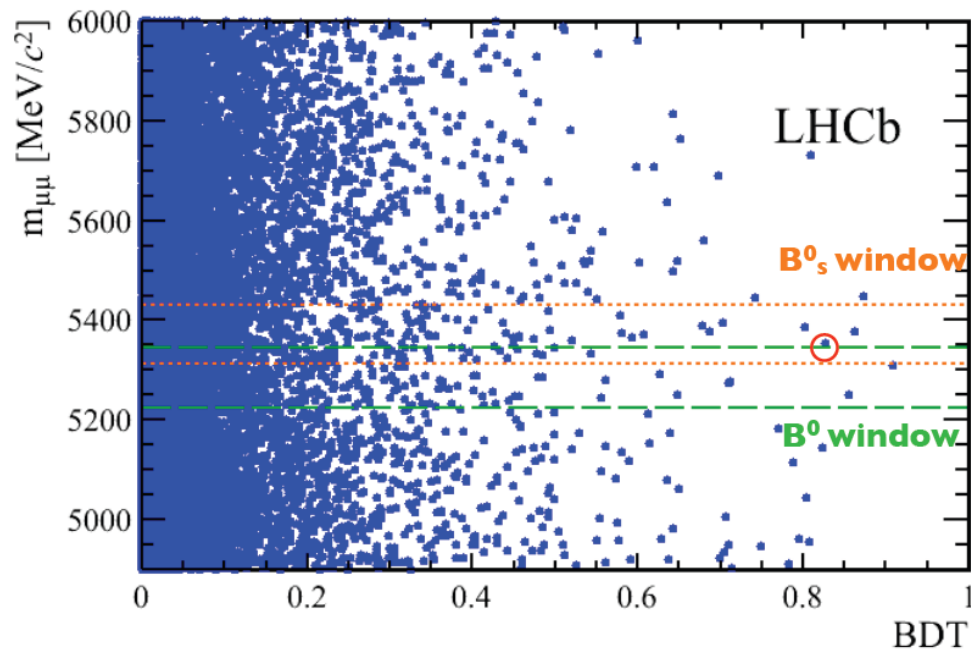
muons:

- min p_T
- min IP significance
- distance of closest approach
- muon isolation,
- polarization angle

this choice of variables avoids correlation with invariant mass

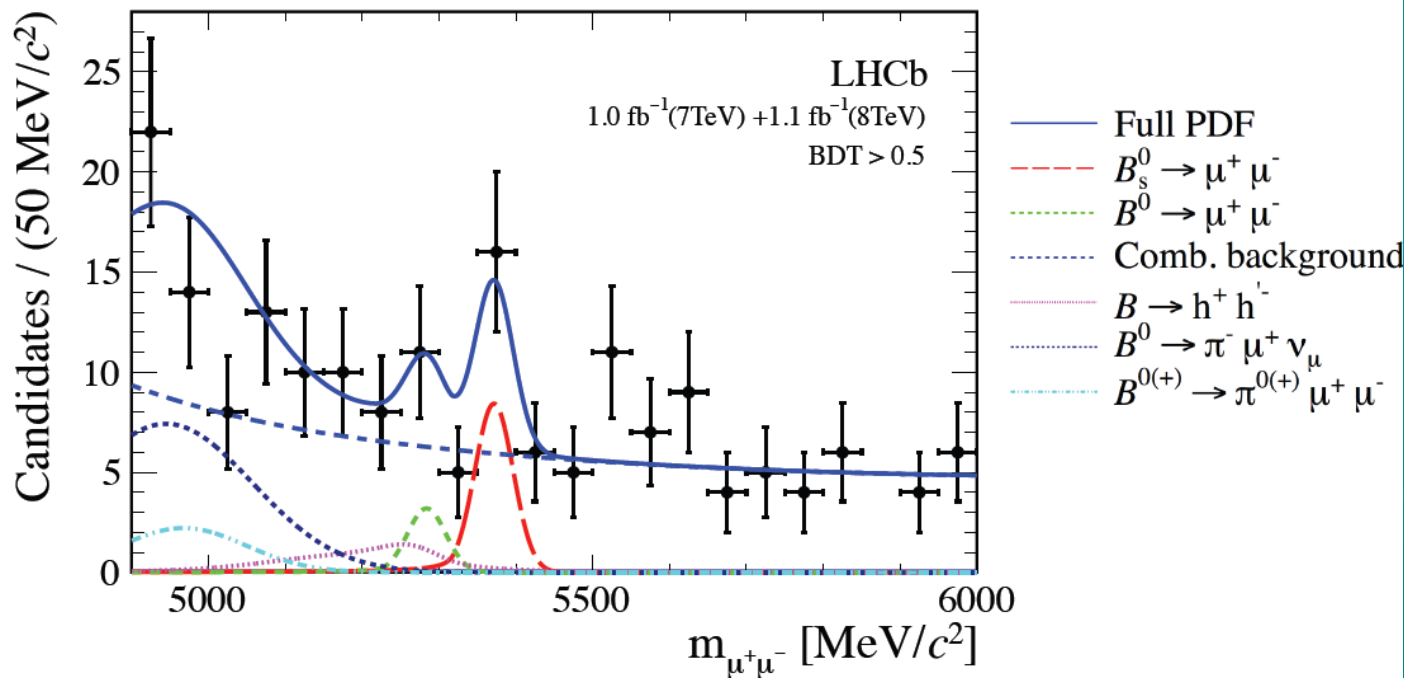


Mass-BDT plane

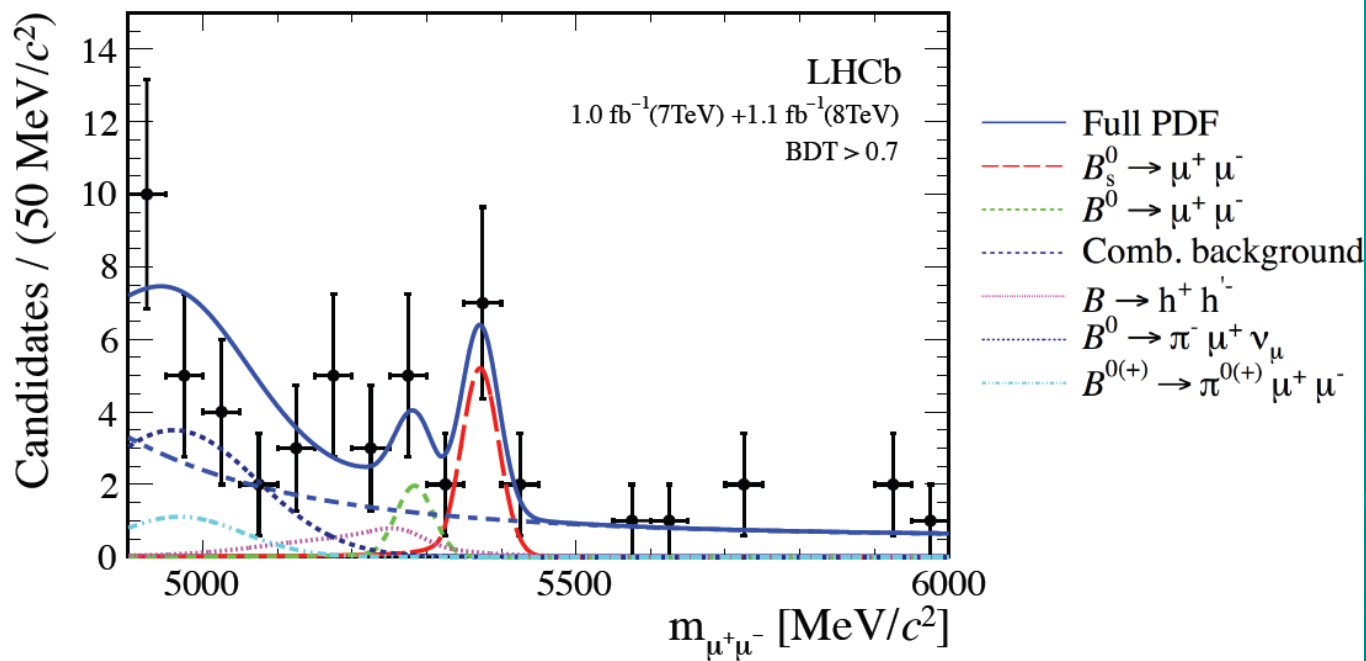


8 TeV
data

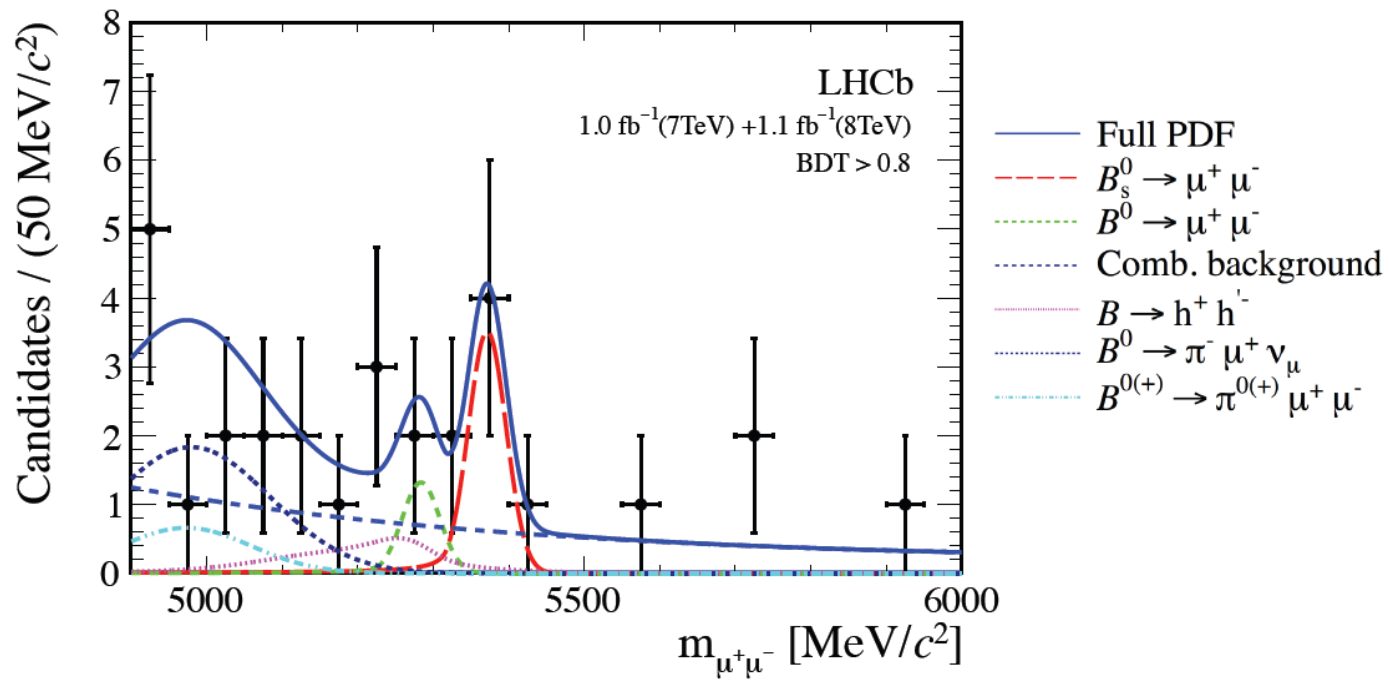
Combined dataset: BDT>0.5



Combined dataset: BDT>0.7

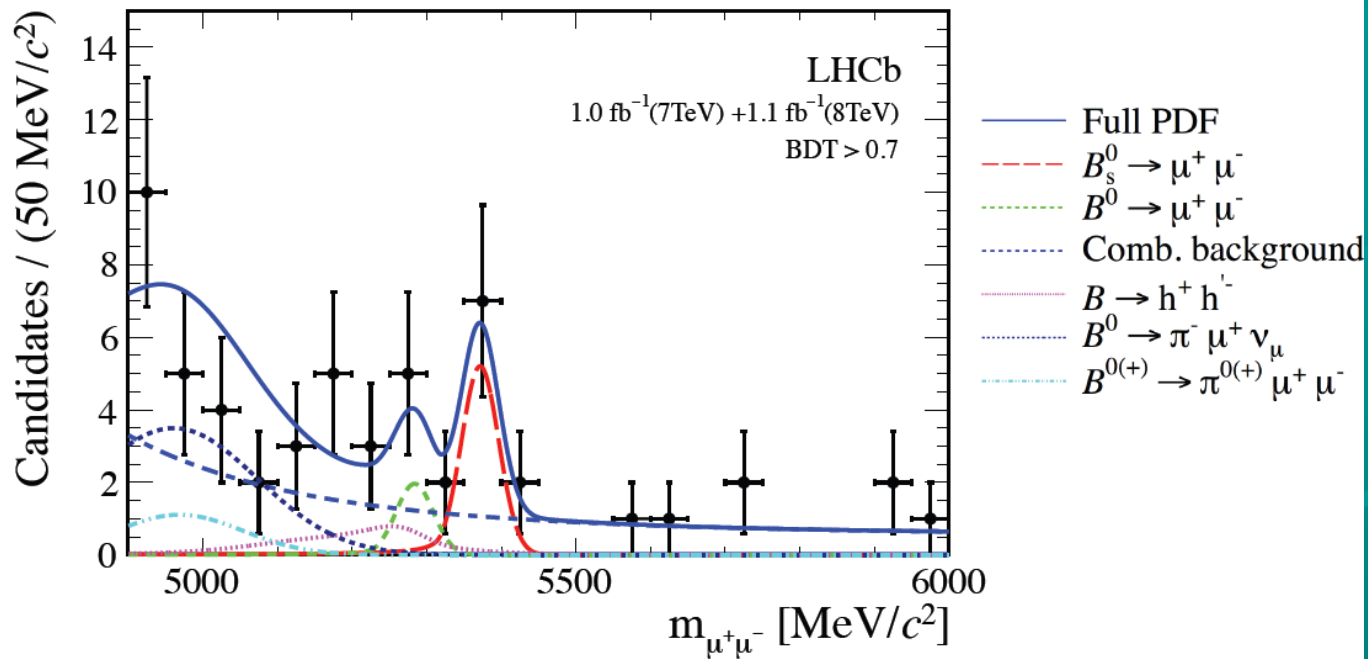


Combined dataset: BDT > 0.8



First evidence for the decay $B_s \rightarrow \mu\mu$

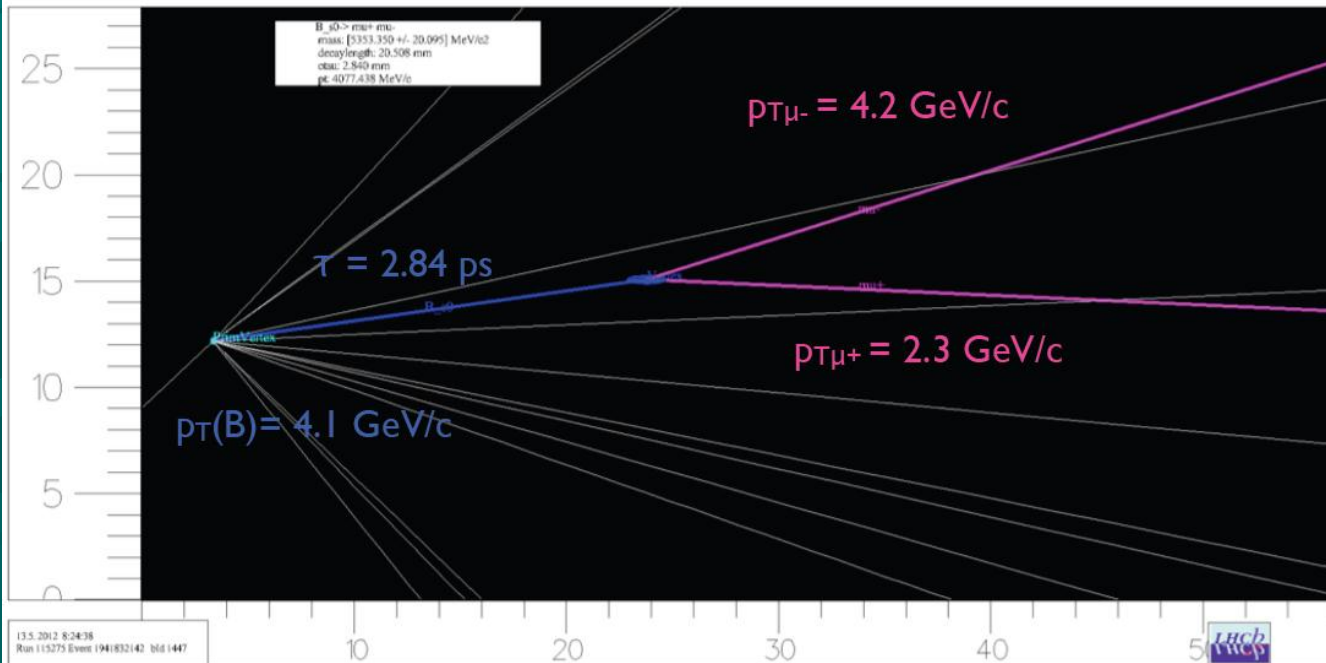
Combined dataset: BDT > 0.7



$B^0_s \rightarrow \mu^+ \mu^-$ candidate



8 TeV data



Conclusions



We presented today an updated search for $B^0_{(s)} \rightarrow \mu^+\mu^-$ combining 7 TeV (1.0 fb^{-1}) and 8 TeV (1.1 fb^{-1}) data

We observe an excess of $B^0_s \rightarrow \mu^+\mu^-$ signal above background expectation with a p-value of 5.3×10^{-4} , corresponding to 3.5σ

A maximum likelihood fit to data yields

$$\mathcal{B}(B^0_s \rightarrow \mu^+\mu^-) = (3.2^{+1.5}_{-1.2}) \times 10^{-9}$$

in agreement with SM expectation

On the same dataset, we set the most stringent limit on $B^0 \rightarrow \mu^+\mu^-$ decay:

$$\mathcal{B}(B^0 \rightarrow \mu^+\mu^-) < 9.4 \times 10^{-10} \text{ at 95\% CL}$$