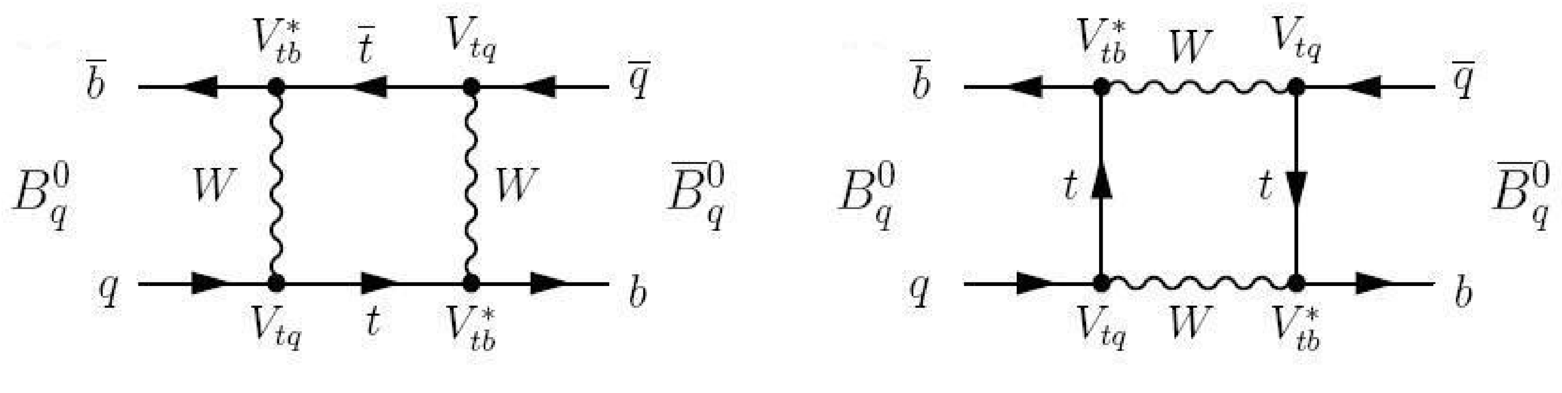
$B\overline{B}$ Time integrated mixing probability ($\overline{\chi}$) measurement with the CMS detector at LHC

Mixing Probability

Flavor changing neutral currents induce the flavor (F) **transformation** $\Delta F = 2$ **of a neutral B-meson into its antiparticle** and viceversa. In the standard model this phenomenon is described by box diagrams involving the exchange of two up-like quarks (mostly top) and two W bosons.



Feynman box diagrams for B mixing.

The **time integrated mixing probability** is defined as:

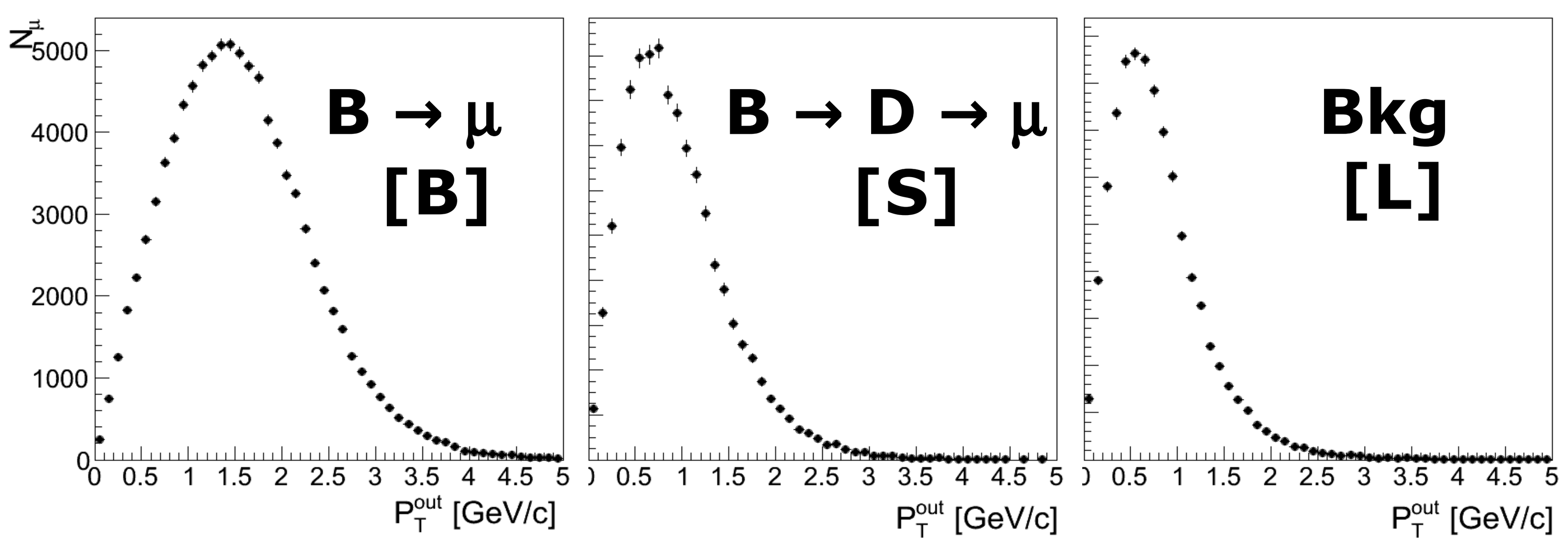
$$\overline{\chi} = \Gamma(b \to B \to \overline{B})/\Gamma(b \to B) = f_d\chi_d + f_s\chi_s$$

where f_d and f_s are the fractions of B^0 and B_s mesons contained in an unbiased B sample.

Uncertainties on the b-sample composition are among the largest sources of systematic errors in the measurements of b-hadrons branching fractions at LHC.

χ_d and χ_s have been already measured in b-factories and at the Tevatron collider by the CDF collaboration.

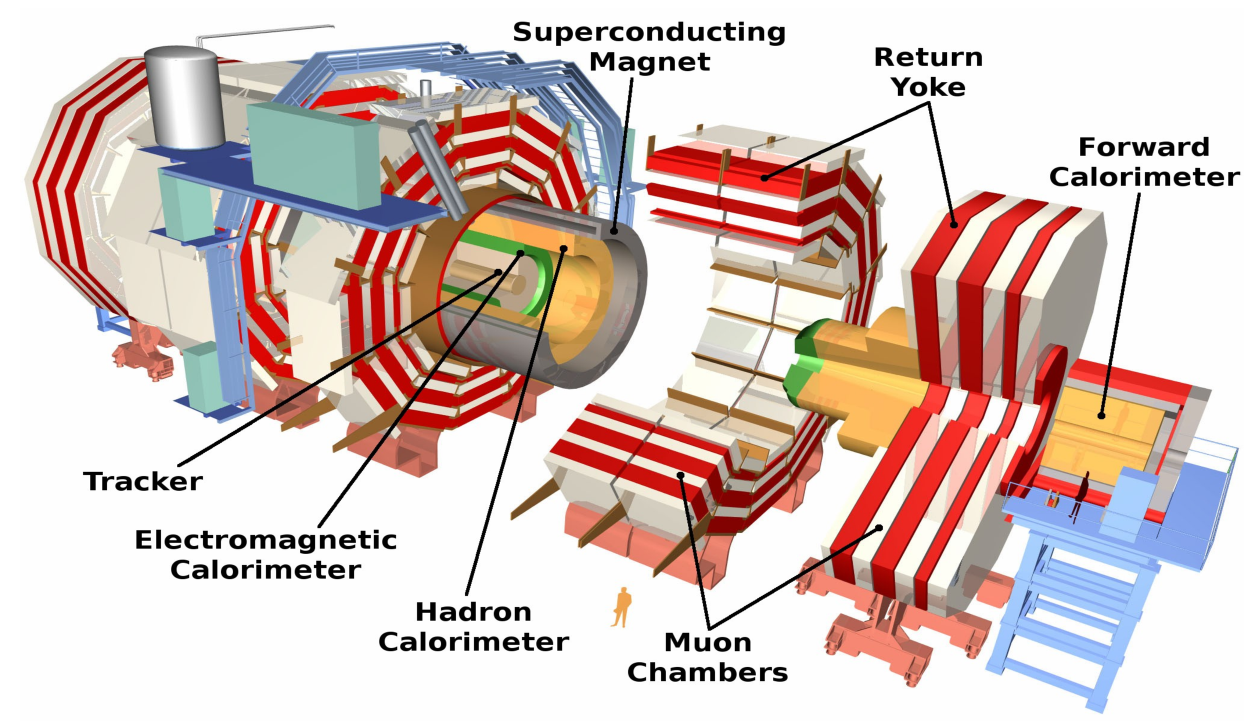
The measurement of $\overline{\chi}$ will provide therefore a **constraint on** the values of $\mathbf{f_d}$ and $\mathbf{f_s}$.



The CMS experiment

The main features of the CMS detector are:

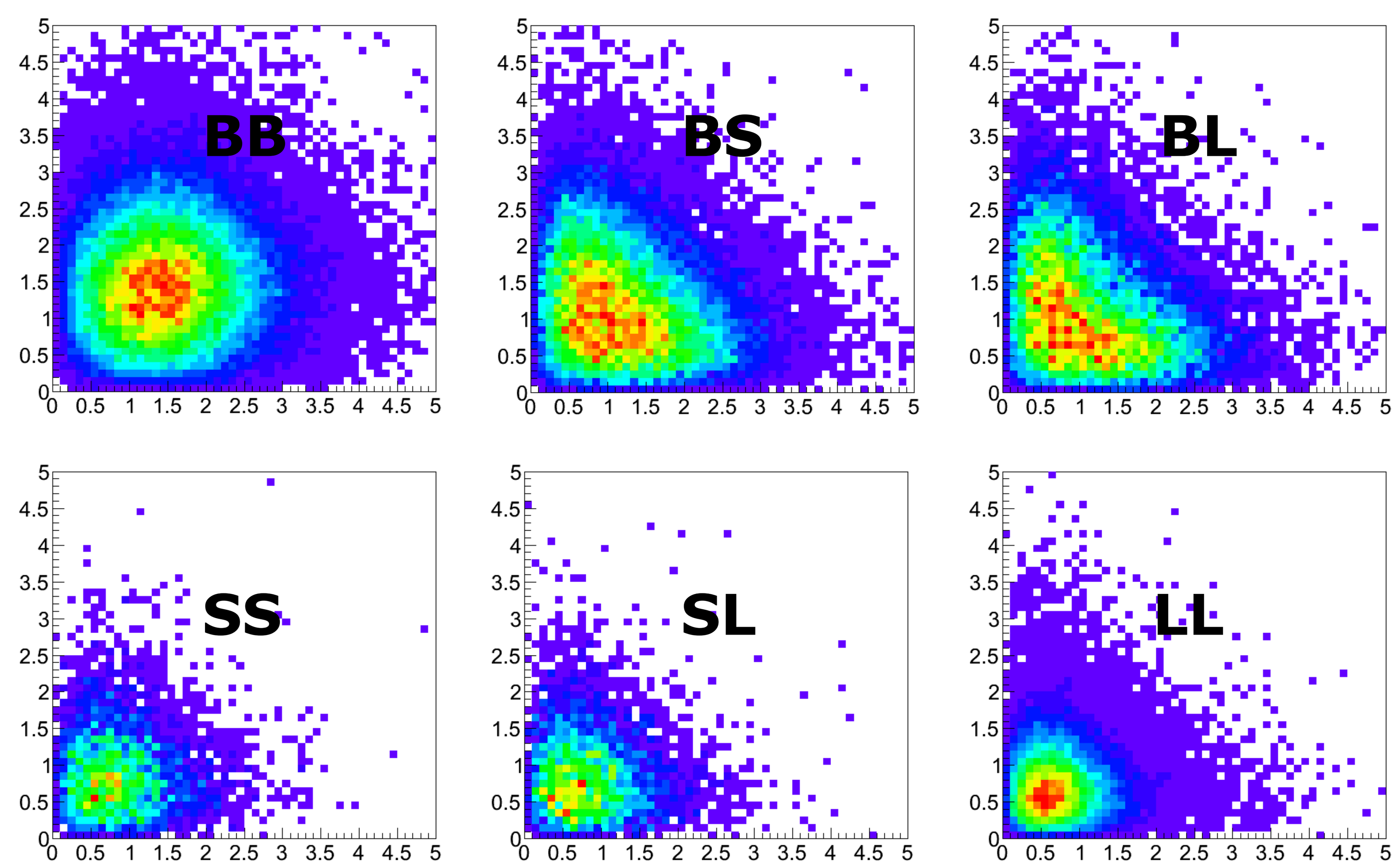
- 200 m^2 silicon tracker (≲ 20 μm spatial resolution)
- 3.8 T superconducting solenoid
- gaseous detectors based muon spectrometer [DT-CSC-RPC]: (≲ 1% p_T resolution up to 100 GeV/c)



Event selection

Events containing at least two muon, each with $p_T > 4$ GeV and $|\eta| < 2.1$, are selected.

Each muon must belong to a jet reconstructed with a particle flow algorithm.

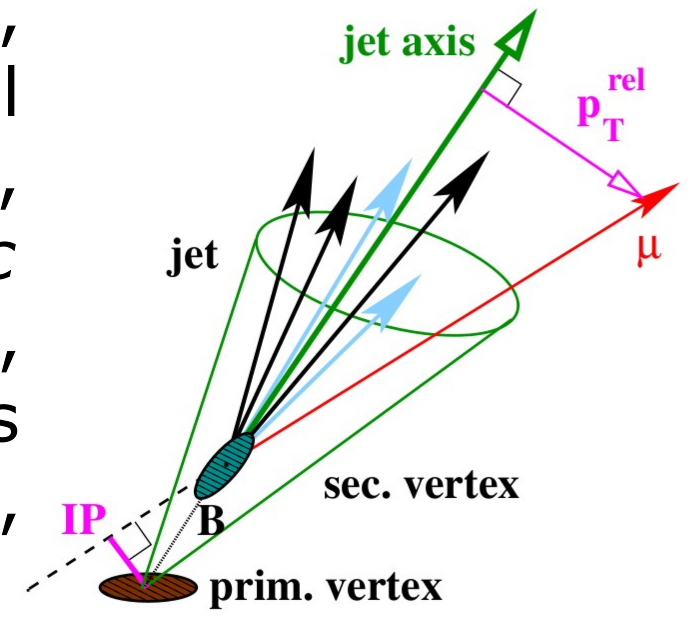


Analysis strategy

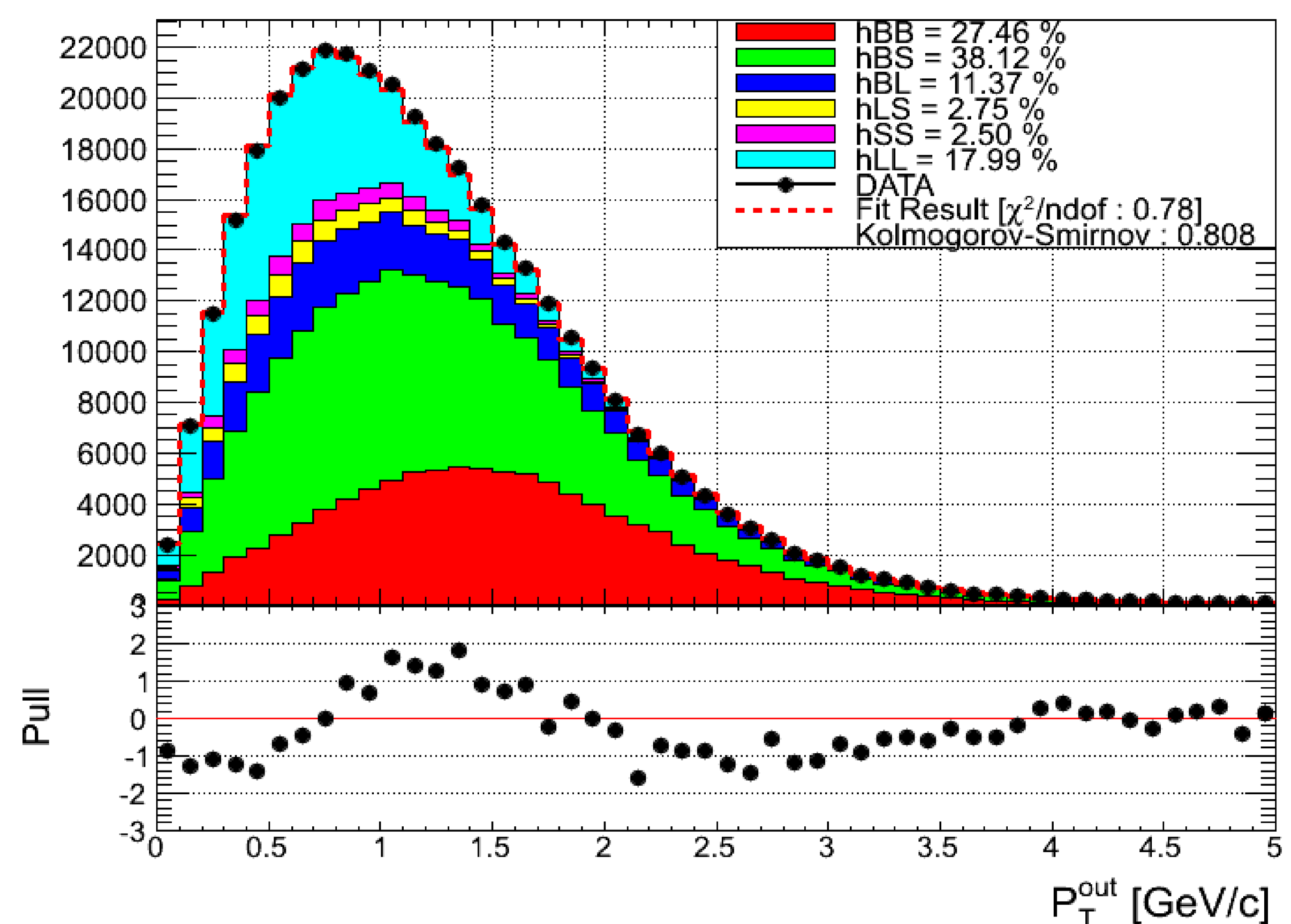
$\overline{\chi}$ is measured by comparing the rates of events with two equal or opposite charge muons from the semileptonic decay $B \to \mu^+\nu X$. *Same-charge* events occur when one, and one only, of the two B-hadrons produced undergoes mixing. *Opposite-charge* events are observed when either none or both the mesons have oscillated.

$$N_B(\mu^\pm\mu^\pm)/[N_B(\mu^\pm\mu^\pm) + N_B(\mu^\pm\mu^\mp)] = 2\overline{\chi}(1-\overline{\chi})$$

The momentum of the muon in the direction ortogonal to the jet axis, p_T^{rel}, is used to discriminate signal events from the background, which includes muons from *c and light hadrons* decays, punch through and muons from *sequential B decays*, like the cascade process $B \to DX \to \mu^-\nu X$.



The signal fractions in the same-charge and opposite-charge samples are determined with a two-dimensional fit to the muons p_T^{rel}.



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SUSSP69 – Scottish Universities Summer School in Physics 2012