



B-tag validation on data and HLT DQM online

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Plan

- Introduction
 - HLT DQM
 - B-tag
 - Validation
- Motivations
- B-tagging basics
- Results

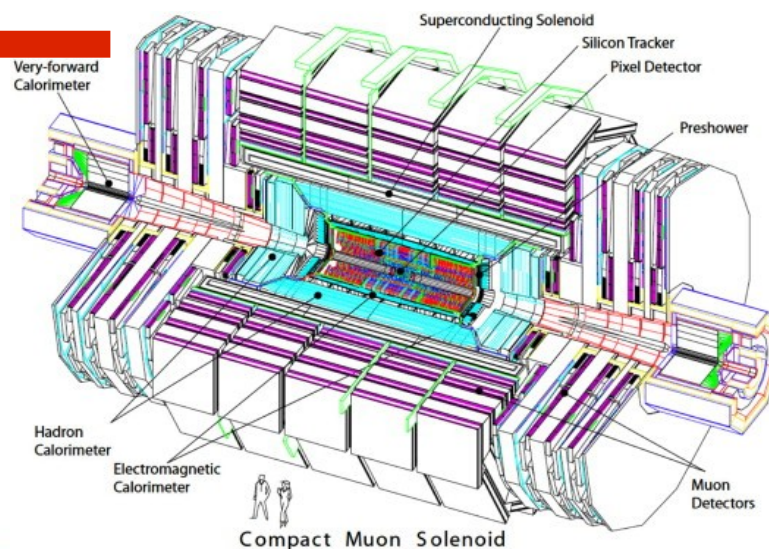
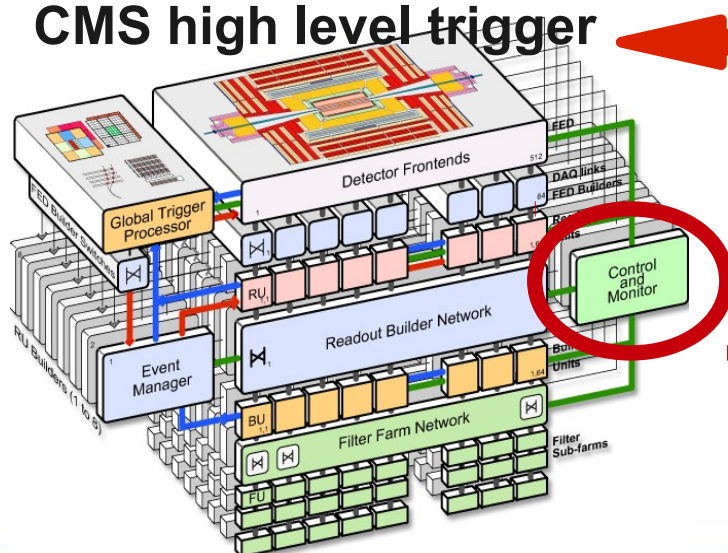
Introduction: HLT DQM

LHC
CMS

HLT (high-level trigger)
DQM (data quality monitor)



CMS high level trigger



Introduction: B-tagging

- B-tagging
 - Jets originate from partons
 - Tagging – assigning color to a jet
 - B-jets – originate from b-quarks
 - B-jets – originate from b-hadrons
- HLT reconstructs and tags jets
 - Details further

Introduction: Validation

- HLT reconstructs and tags jets
 - CMS software is used
 - CMS software is under constant development
 - This should not affect physics
- Validation
 - Software versions comparison

Name of the report explanation

B-tag validation on data
and HLT DQM online

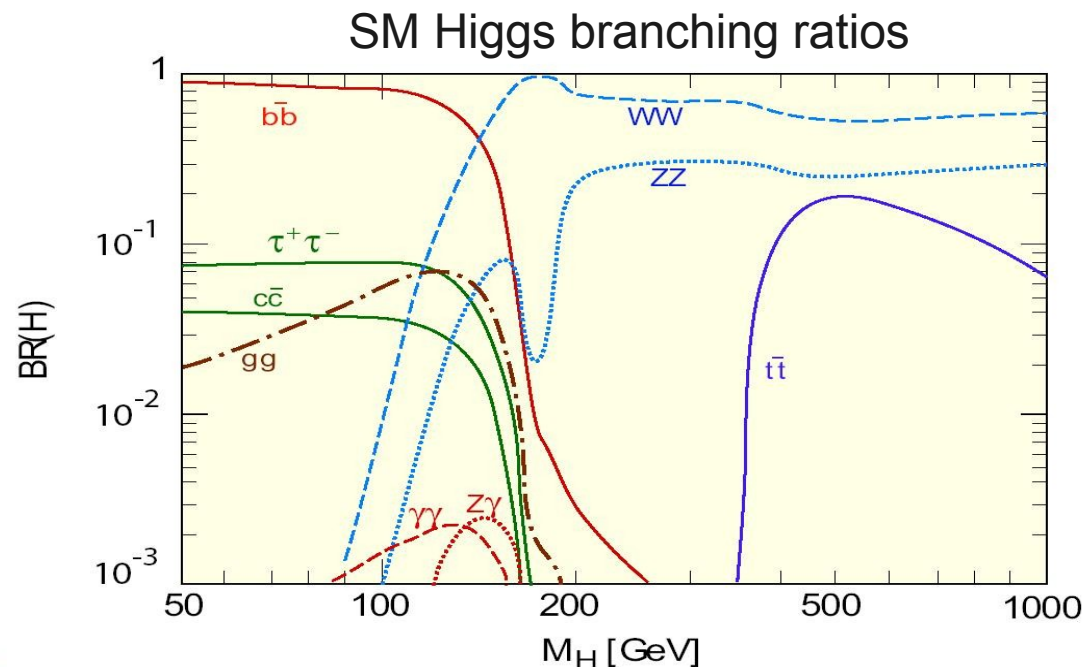
Motivation

Motivation

- B-tagging is important
 - Heavy flavour physics
 - Higgs investigation, models beyond SM
- Nice B-tag HLT performance control
 - Can improve signal/background ratio
 - Allows to monitor beam condition

Relation to Higgs boson

- A new boson with mass around 125 GeV is discovered
 - Is it a SM Higgs?
 - Needs further investigation
- If SM Higgs boson has mass 125 GeV, it mostly decays into $b\bar{b}$
- And produces b-jets
- MSSM check



Current state of affairs

- Offline validation on MC
- **No** validation on data
- **No** online monitoring of B-tag HLT stability

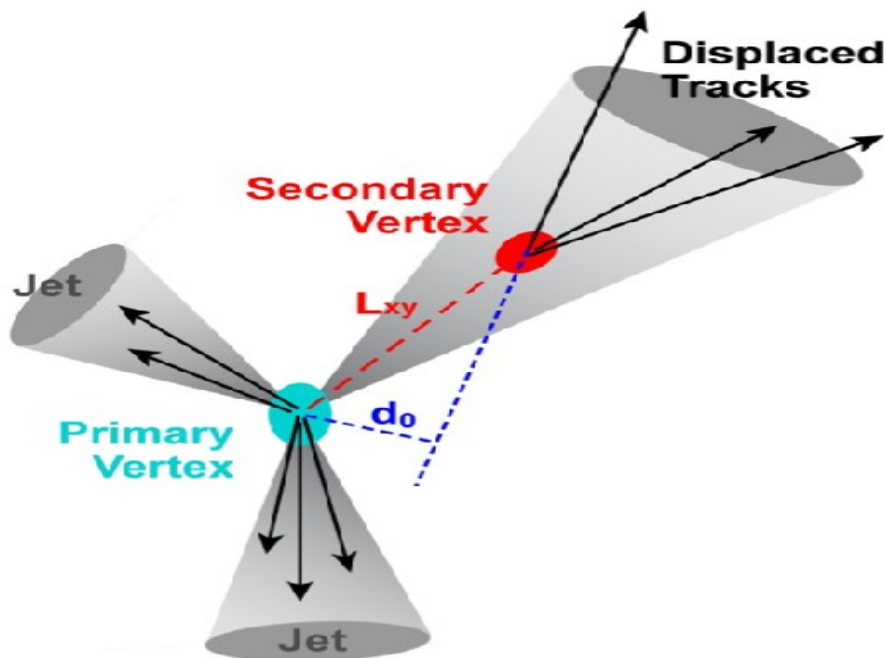
We have code suitable for all these purposes

- Mostly based on existing code

B-tagging basics

B-tagging

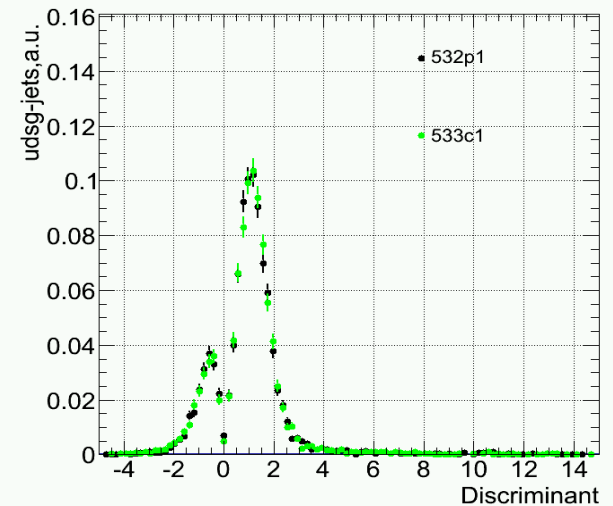
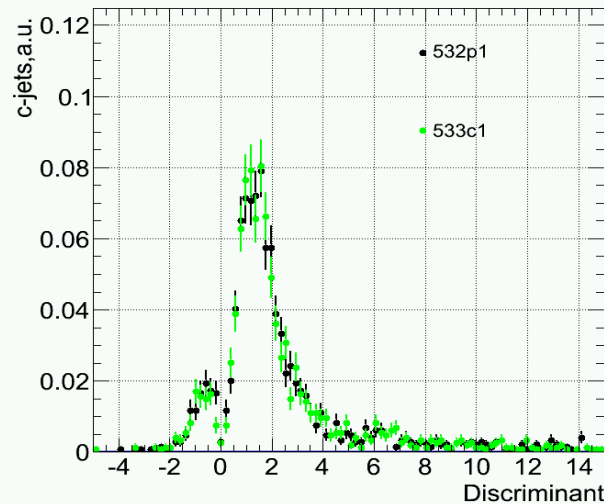
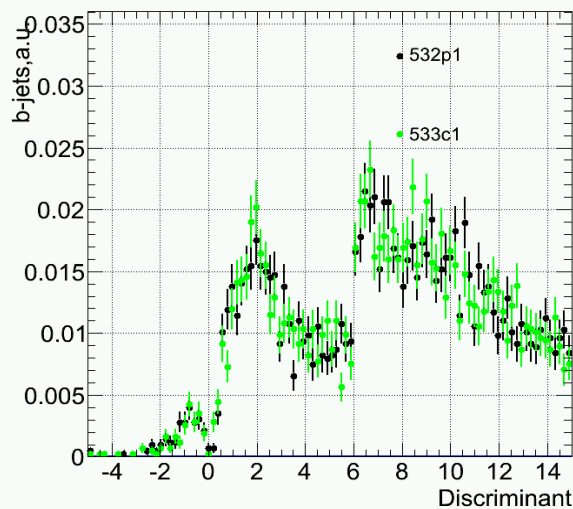
- B-hadrons fly around 2mm before decay
- Displaced secondary vertex



d_0/σ is called
“track significance”

B-tagging

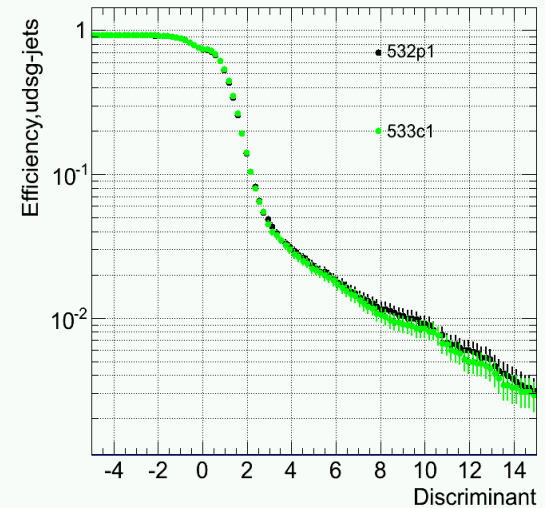
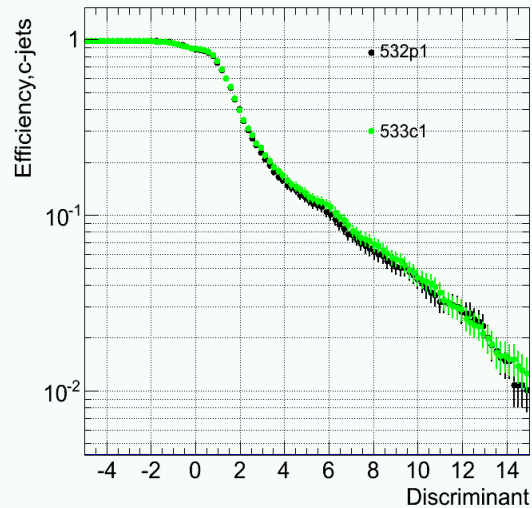
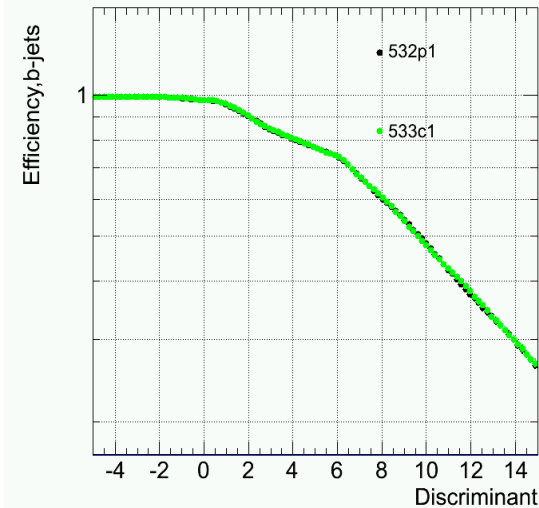
- Discriminator
 - If $>$ given value – jet is b-tagged
 - Is built from track significances



- Efficiency = $\frac{\text{\#tagged jets of flavour N}}{\text{\# all jets of flavour N}}$

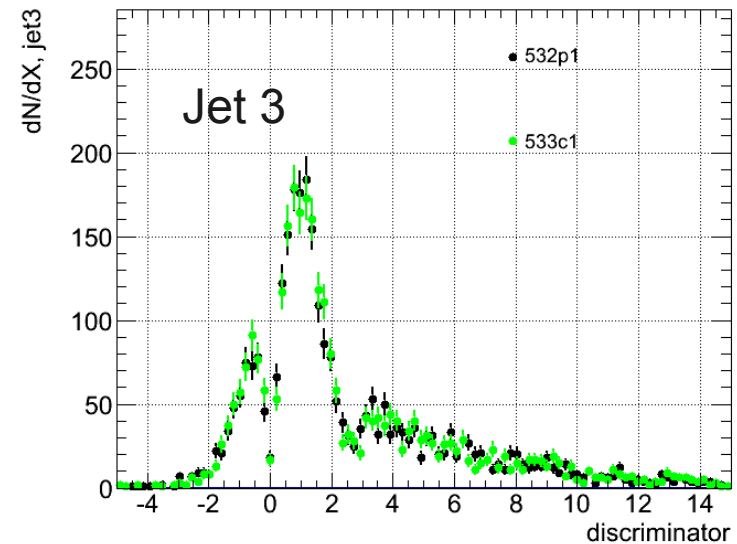
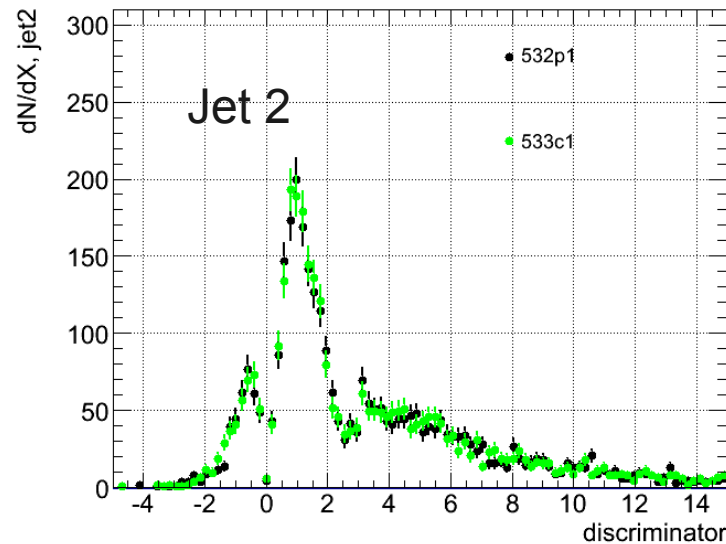
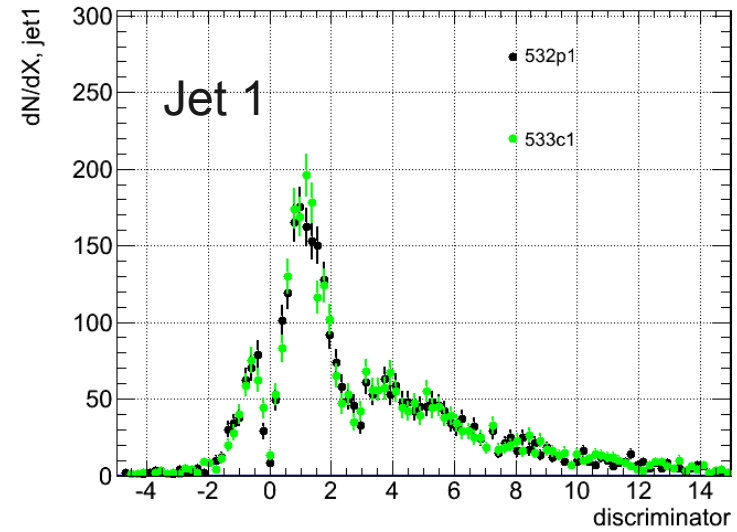
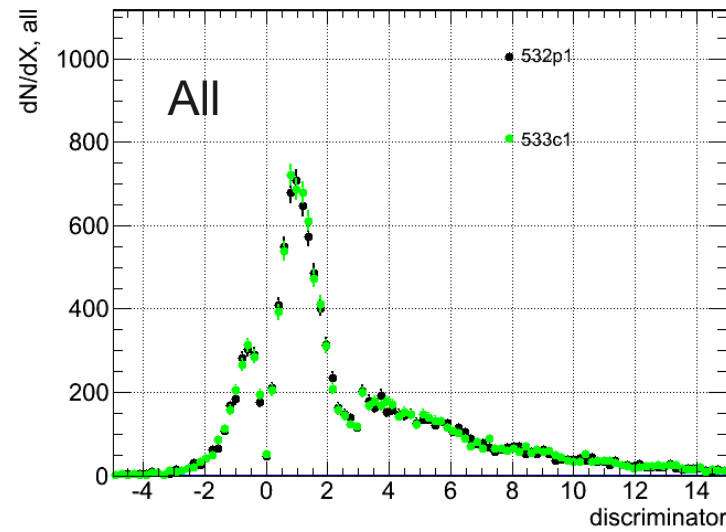
Results

Results: validation plots on MC



- Efficiency vs. discriminator cut
- B-jets, c-jets, other jets
- **Can be applied for MC only**

Plots applicable both on data and MC



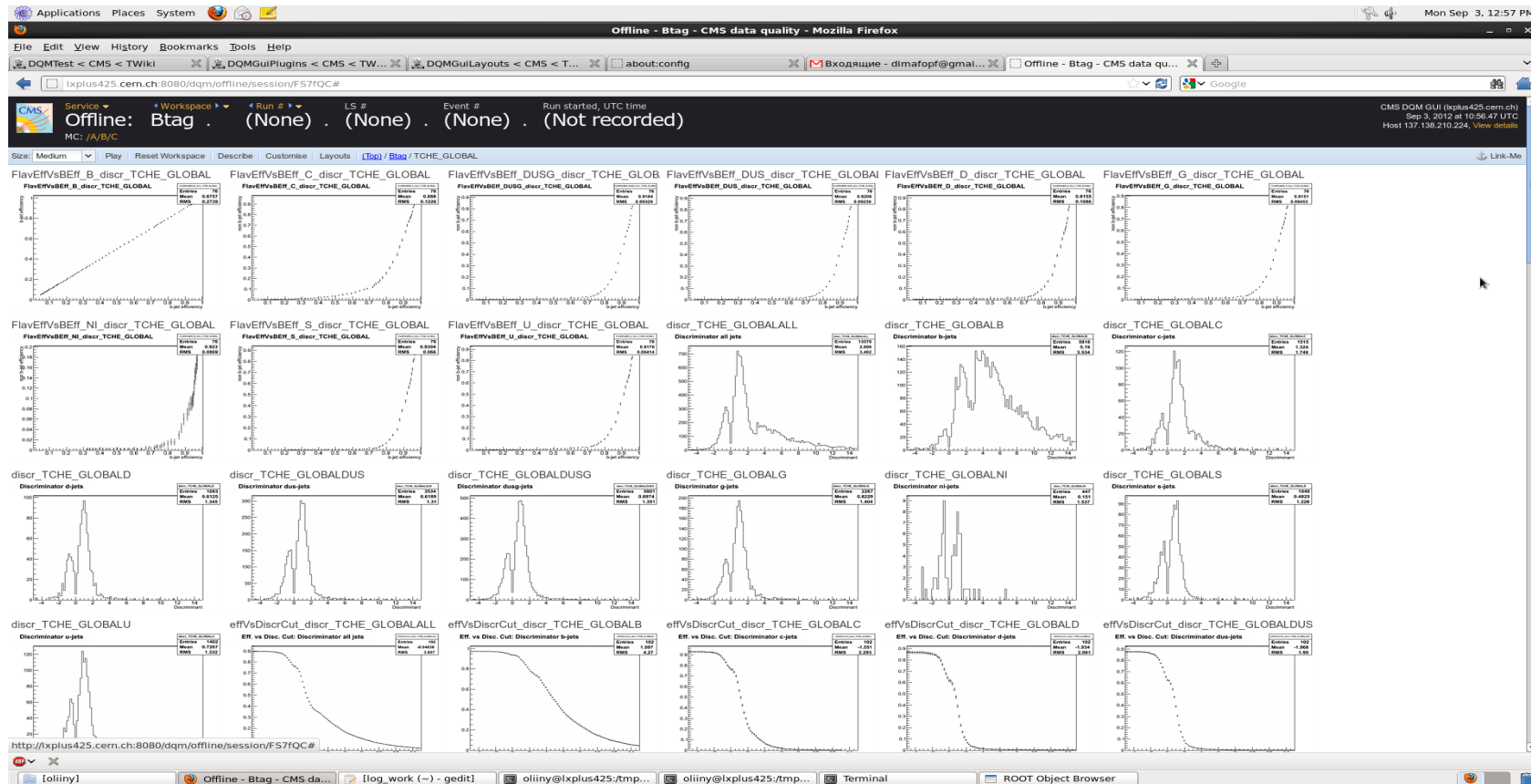
Explanation to plots

- X axis – jet discriminator
- Y axis – dN/dX
- 4 histograms

1. Histogram for ALL jets in event	2. Histogram for jets with maximal Pt (transverse momentum) in event “jet 1”
3. Histogram for jets with second Pt by value in event “jet 2”	4. Histogram for jets with third Pt by value in event “jet 3”

- Compare different CMSSW versions 532p1 vs 533c1, collection L25

Results: plots on DQM GUI server



DQM GUI is used by shifters in control room

Conclusions

- We have done
 - Validation on data
 - B-tag HLT monitoring online
 - Code already works but needs to be inserted to DQM system
- Further plans
 - Monitoring of different B-tagging object: vertices, etc
 - Beam spot and primary vertex control via B-tag monitoring

Thank you for your attention

B-tagging: MSSM check

Higgs sector of MSSM

- 2 doublets: H_u, H_d
- different vacuum expectations:
 $v_2 = \langle H_u \rangle, v_1 = \langle H_d \rangle$
- physical states:
 h, H (SM Higgs-like, CP even),
 A (heavier, CP odd),
 $H_{\pm}$ (charged)
- 2 free parameters:
 - A mass: M_A
 - $\tan\beta = v_1/v_2$
- b to H coupling is $\tan\beta$ times enhanced

