# WH→lνbb

Sebastien Greder, IPHC / CNRS, Strasbourg
*on behalf of the WH group*
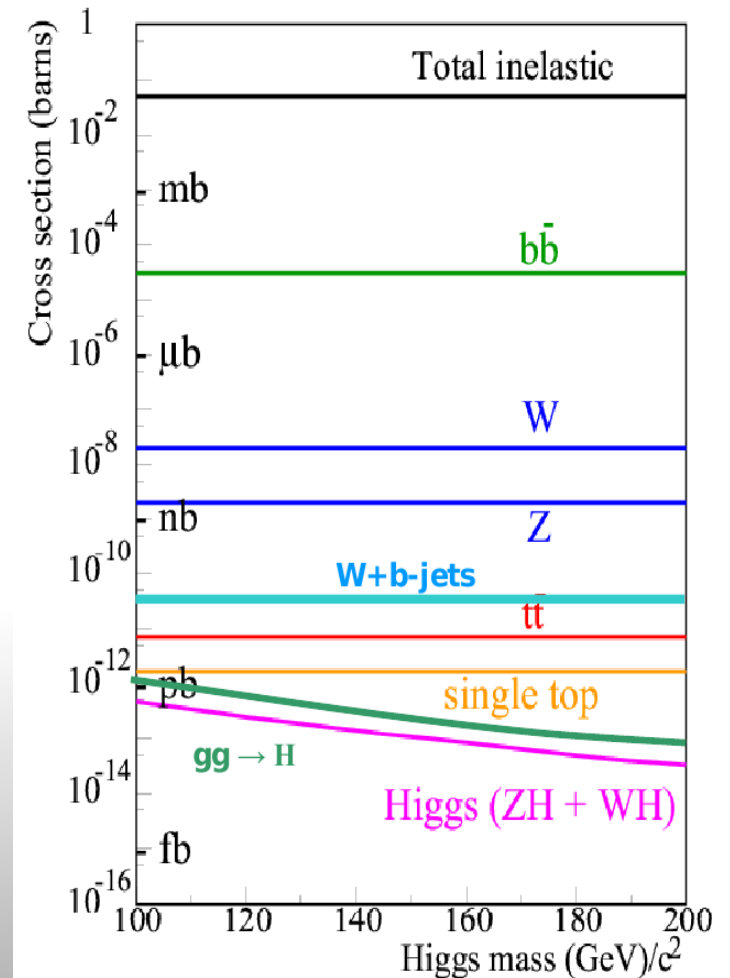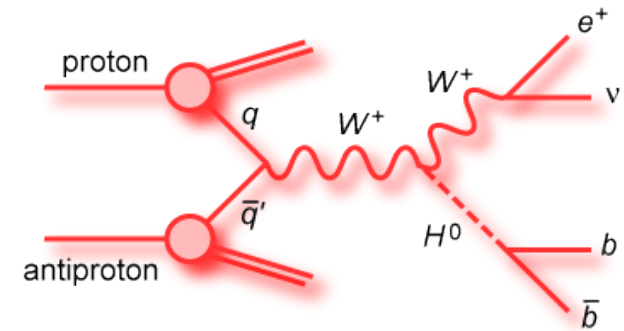
# Introduction



## "Golden-mode" for low-mass Higgs

- Associated production
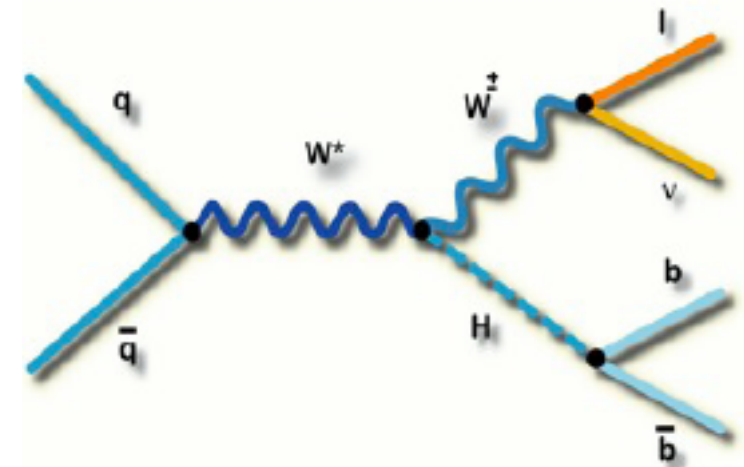- $m_H$ < 135 GeV/c$^2$

## Datasets

- Run 2b 123 *( +4 not yet included )*
  - *~6.3fb$^{-1}$*
- Run 2a from publication

# Preselection



## W→eν

- "SuperOR" trigger
- $p_T$ > 15 GeV, Point 1-2 for $|\eta|$ < 1.1 - 1.5 < $|\eta|$ < 2.5
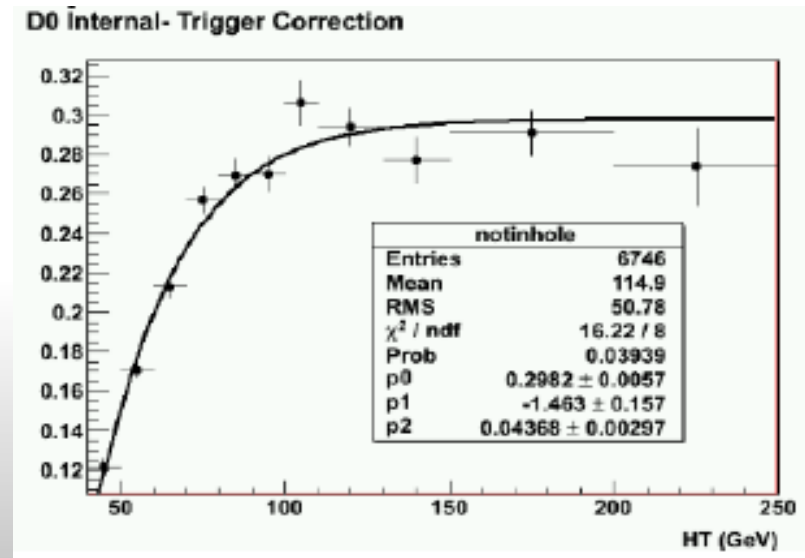- $ME_T$ > 15 GeV

## W→μν

- Single-muon → inclusive trigger
- $p_T$ > 15 GeV, "Medium-MedTrk-TrkTightScaled", $|\eta|$ < 1.6 *( working on || < 2. )*
- $ME_T$ > 20 GeV

## Di-jet system

- 2 or 3 JCCB, vertex confirmed jets
- $p_T$ > 20 GeV

## Other

- $|PV_Z|$ < 60 cm
- delta Z( PV,lepton ) < 2 cm *( muon )*
- **Vetoes:** ZH →llbb, H →WW →lνlν



D0 Internal- Trigger Correction

| notinhole | |
|---|---|
| Entries | 6746 |
| Mean | 114.9 |
| RMS | 50.78 |
| $\chi^2$ / ndf | 16.22 / 8 |
| Prob | 0.03939 |
| p0 | 0.2982 ± 0.0057 |
| p1 | -1.463 ± 0.157 |
| p2 | 0.04368 ± 0.00297 |

HT (GeV)

# Multijet background (I)

## 2-steps method

### 1) Template shape

- unbinned matrix method
- fake rate parameterization: lepton $p_T$, detector eta, $\Delta\varphi^{min}$(jet,lepton), $\Delta\varphi$(lepton,ME$_T$)
- determined in 5 < MET < 15 data sample with same preselection cuts
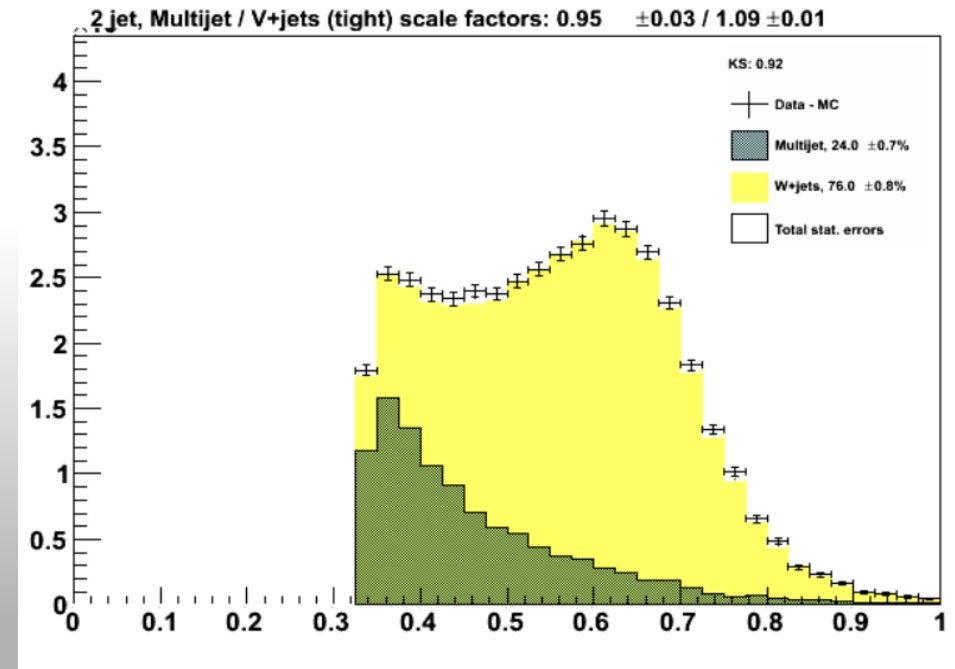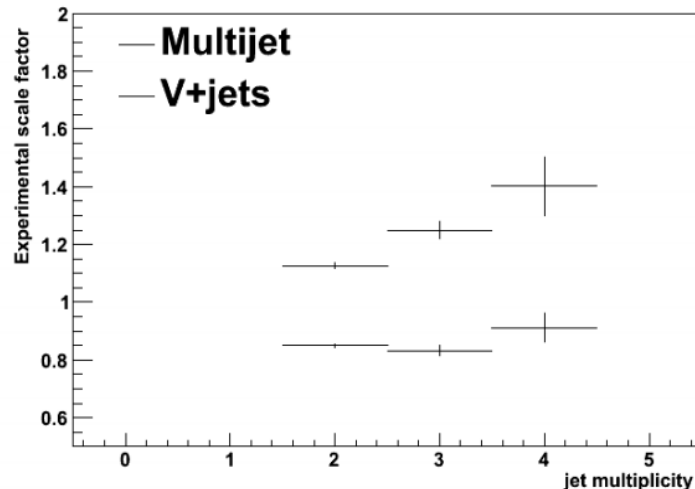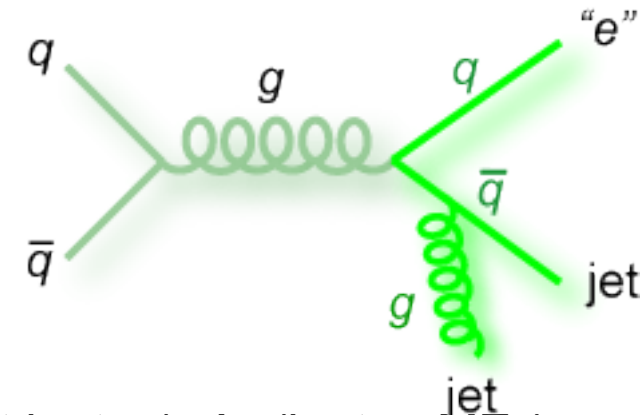- *x-check in muon channel:* "Anti-isolation" method ( *i.e a la H→WW→lnujj* )

### 2) Normalization

multijet and V+jets fit to data-SM ( *tt,single-top,VV)* **W m$_T$**

- Constrain absolute normalization to data

**V+jets SF ~ 1.1** *( 2-jet )*

*( x-checked in electron / muon, run2b1, run2b23 )*



2 jet, Multijet / V+jets (tight) scale factors: 0.95 ±0.03 / 1.09 ±0.01

KS: 0.92

Data - MC
Multijet, 24.0 ±0.7%
W+jets, 76.0 ±0.8%
Total stat. errors

# Multijet background (II)

## Multijet reduction

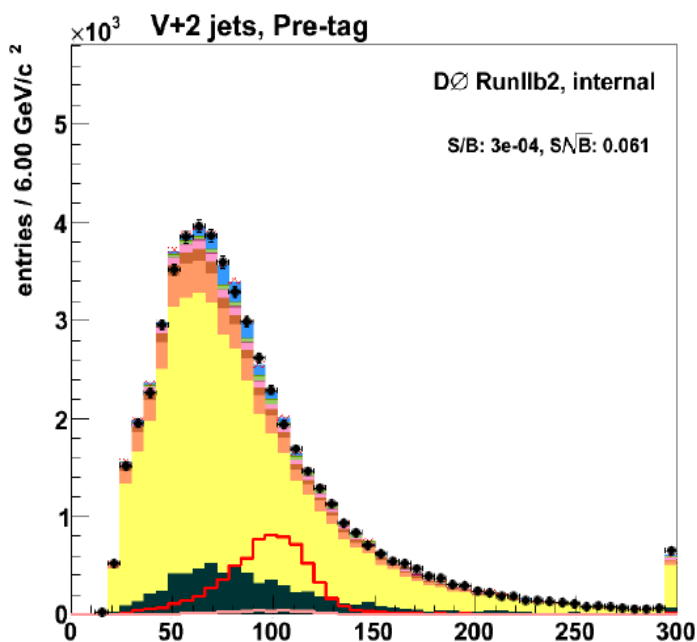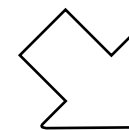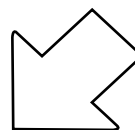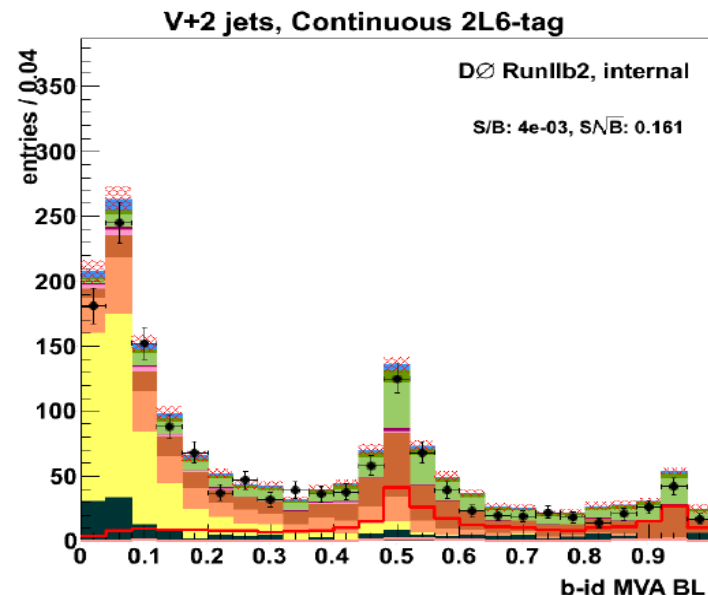- **Muon:** "triangular-cut", i.e $W\ m_T > 40 - 0.5*ME_T$
- **Electron:** multivariate technique *( Decision Tree )*
  - *train loose-not-tight vs VH*
  - **+15% signal** *gain w.r.t traingular-cut @ same multijet rate*
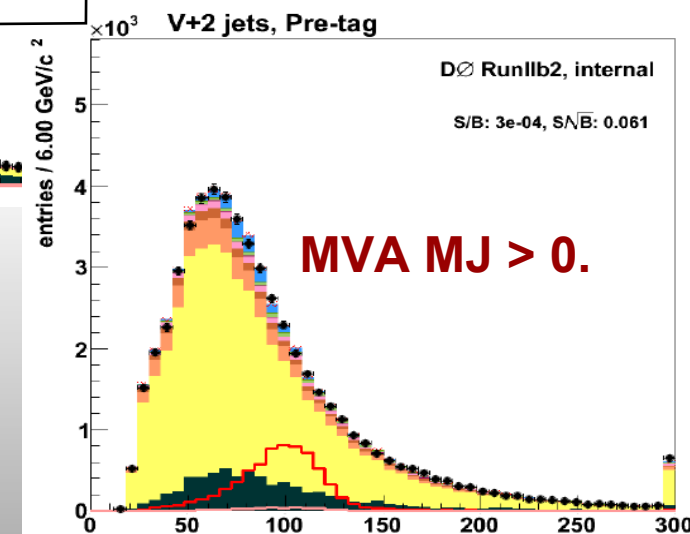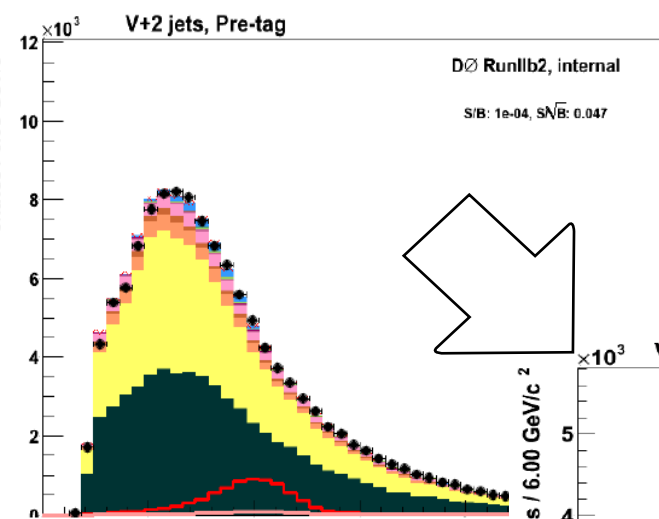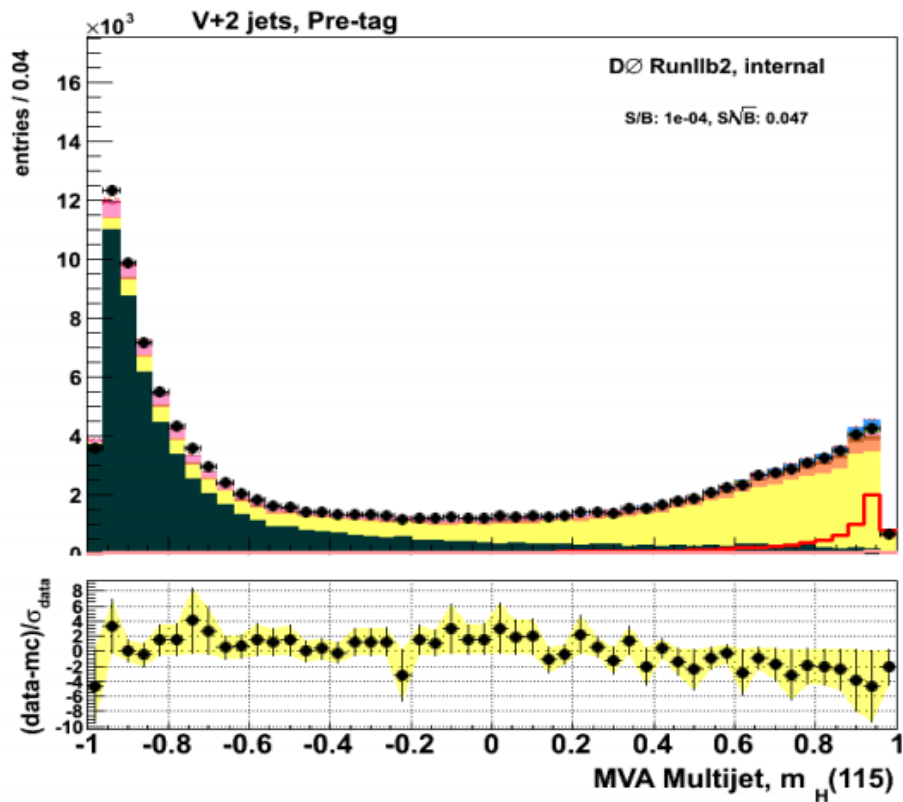
# B-tagging

## Setup

- >= 1 taggable jet
- MVA BL tagger
- 1 L6 or 2 L6 jets
- *pseudo-continuous* scale factors
  - allows to use b-id output as an                    in
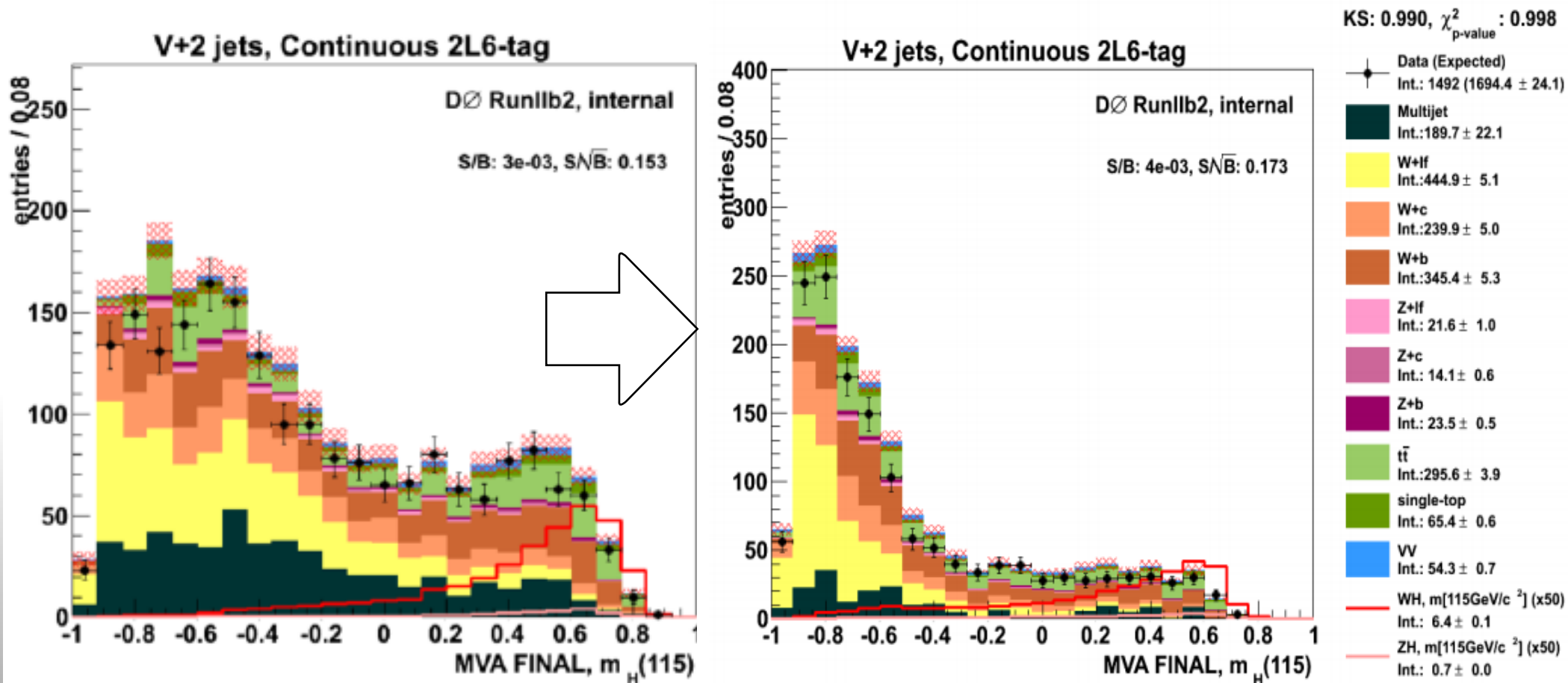    to final MVA
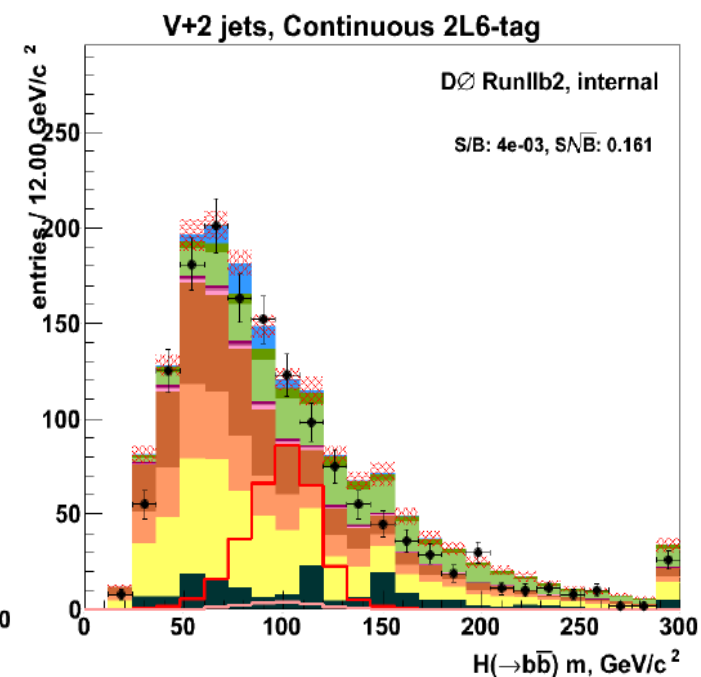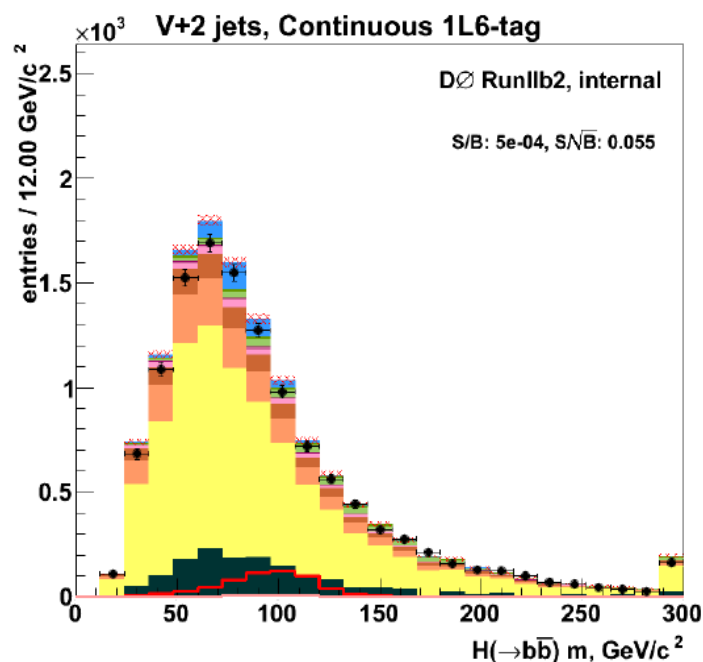
# FINAL MVA (I)

## Optimization strategy

- in 2-tag channel ( ~90% of our sensitivity ), the biggest background to fight: **tt and wbb**
- Developed MVA *tt vs. VH* and *Wbb/cc vs. VH*, shown here with MVA MJ > 0.: )
- *Final MVA trained against all backgrounds with*
  - MVA $tt > 0.$ && MVA $W_{HF} > 0.$
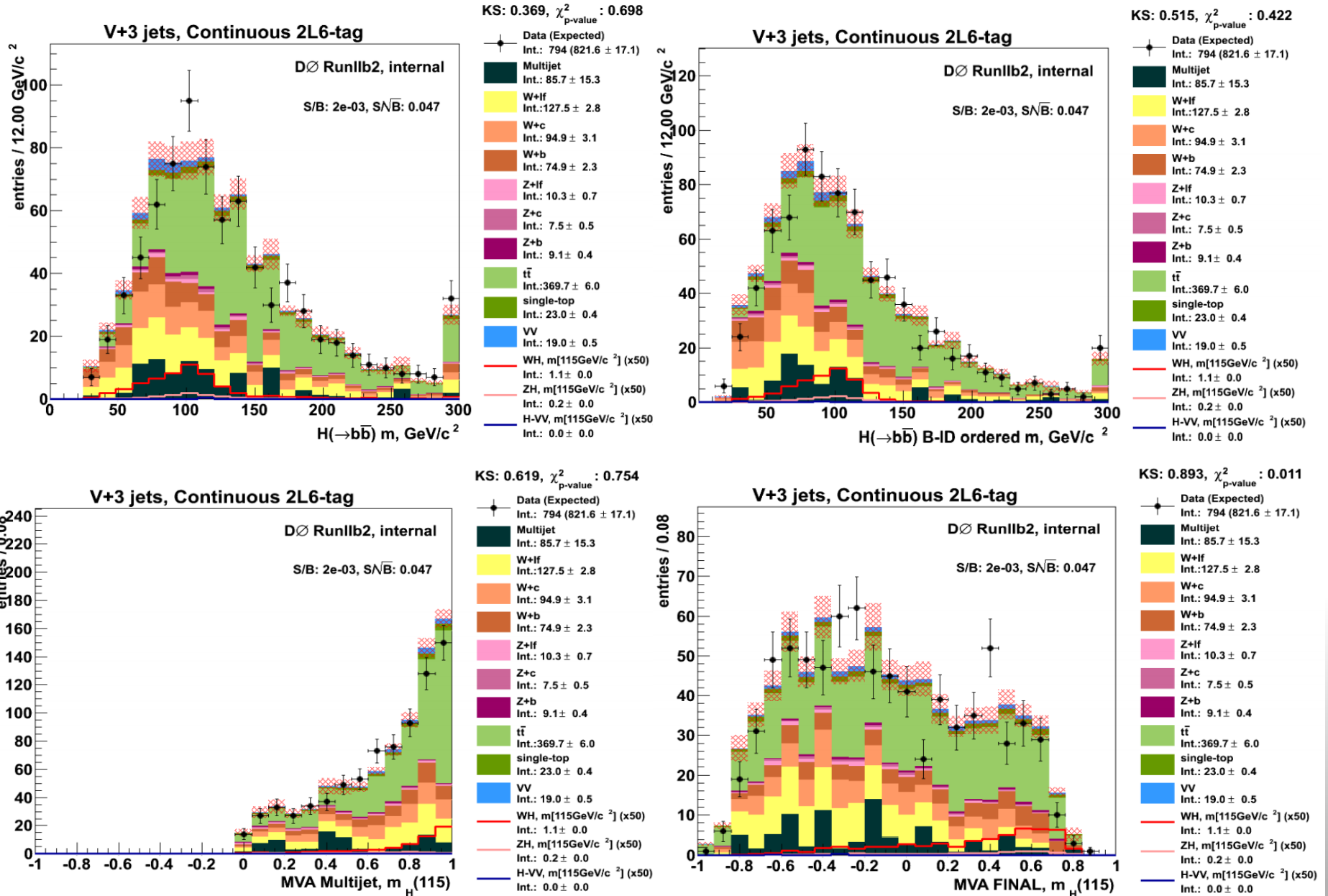  
    ( but applied all events ! )
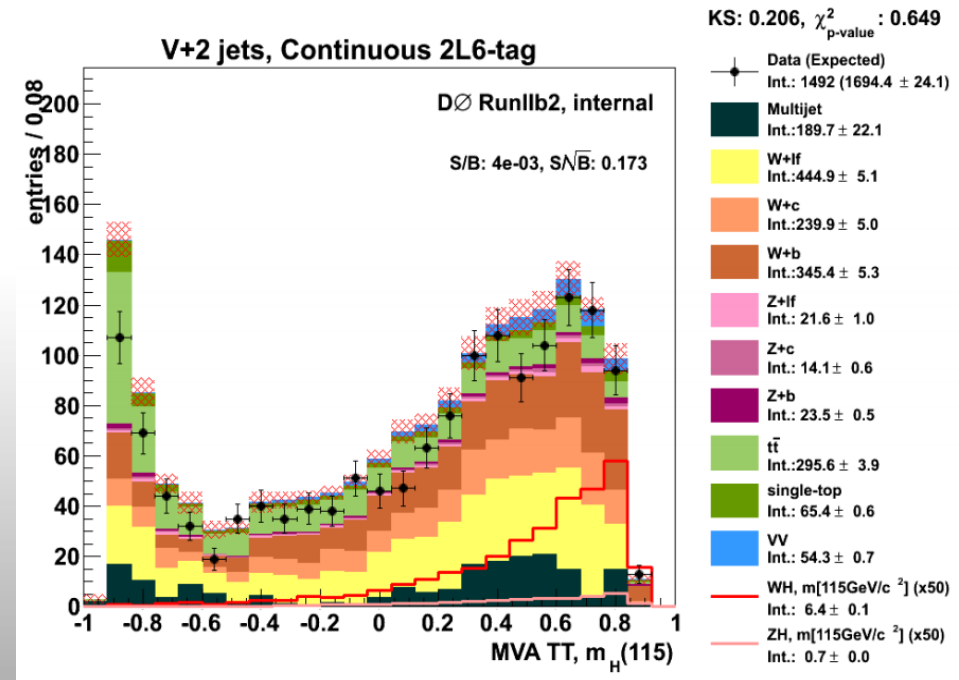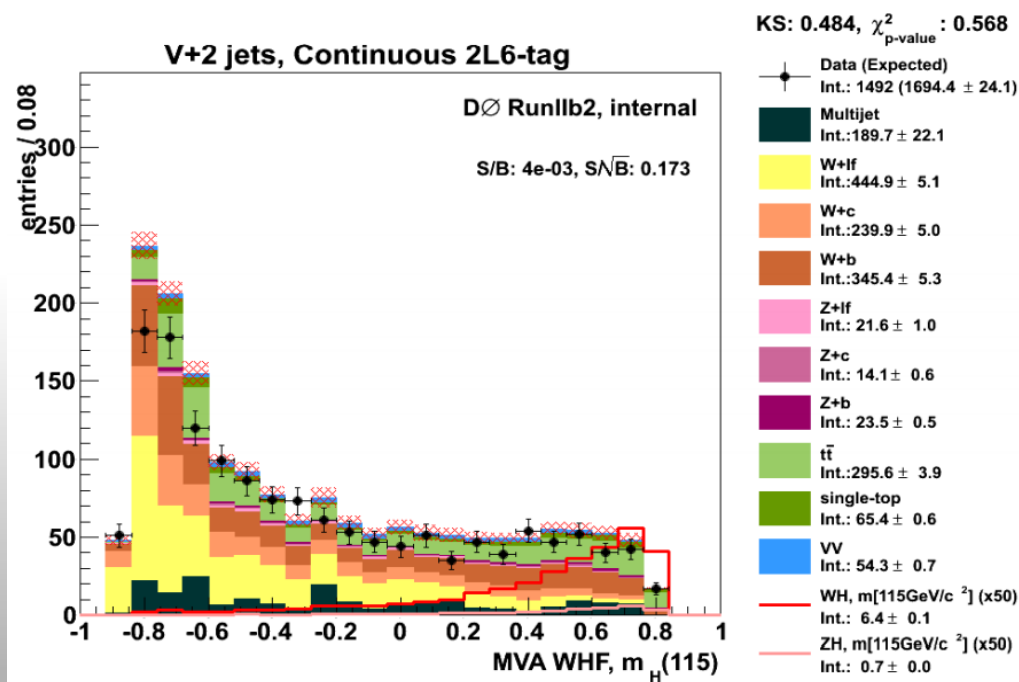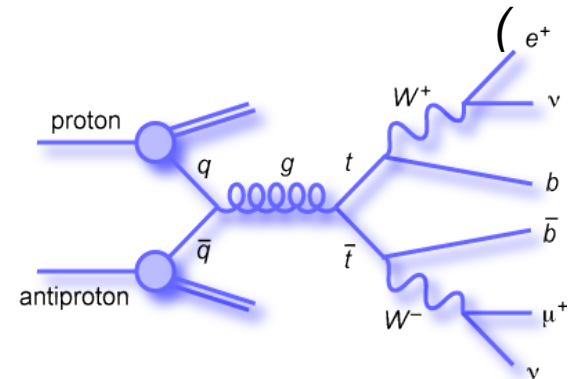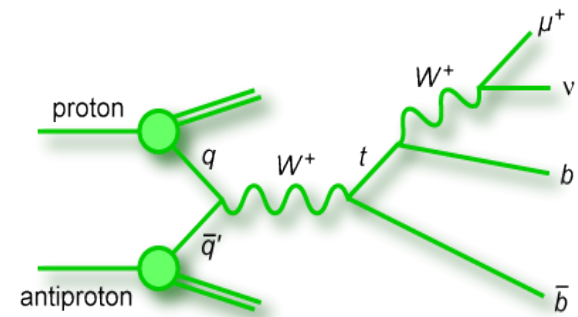
# FINAL MVA (II)

## Expected limits

- doing all combination at th moment ( e/mu, run2b1 / 234, single / double-tag )
- **Ex.:** electron, run 2b23, 1+2-tag: exp. 5.4 *( initial 6.1 ) x SM*
- *expect to reach ~3.5x SM*

# FINAL MVA, 3-jet

## !! Being optimized at the moment *( see e.g Florian's talk )*

# Conclusions / Plans

**Entering reviewing steps** *( group today ! )*

- Final optimization / combination undergoing
- Scrutinizing systematics *( expect ~20-25% degradation on limit )*

Many improvements w.r.t publication *(5.3fb$^{-1}$)*

  - *MVA multijet*
  - *improved / refined b-tagging techniques*
  - *new observables*
  - *improved MVa techniques*
  - *...*

Plans

- *Be part of EPS 2011 TeVatron combination !*