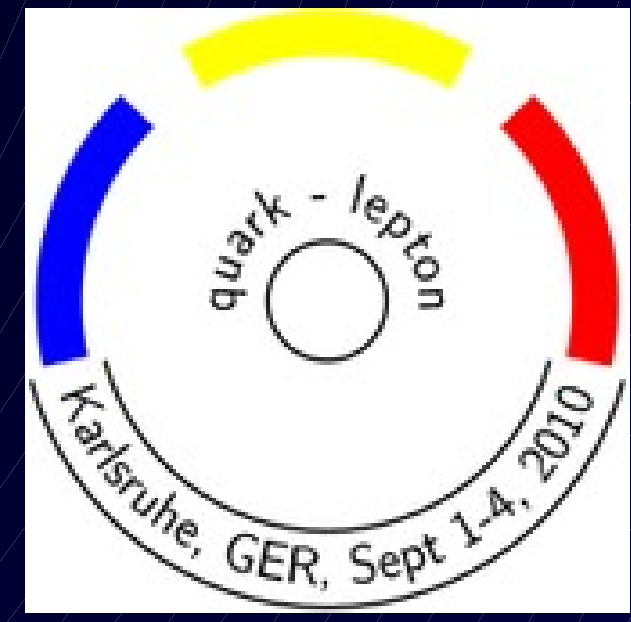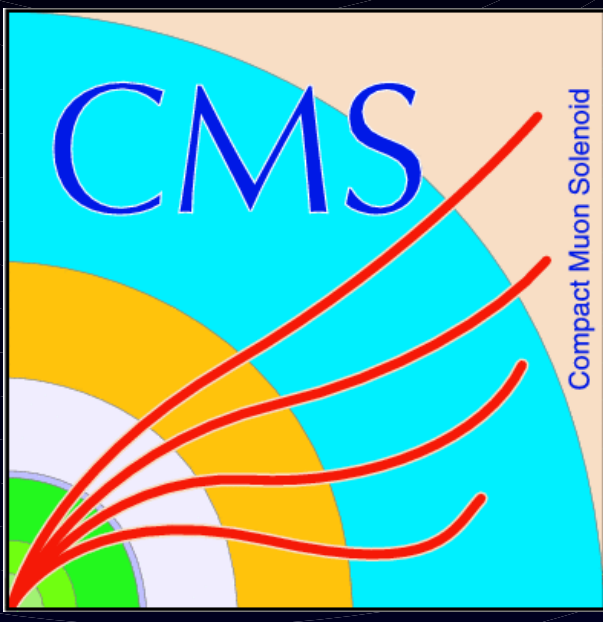# Selection of Top-Like Events in the Lepton+Jets Channel in Early 7 TeV LHC-Data with CMS

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on behalf of the CMS collaboration

CMS — KIT — Karlsruhe Institute of Technology — quark - lepton, Karlsruhe, GER, Sept 1-4, 2010

Predicted top pair production cross section at 7 TeV: **158 ± 23 pb** [from MCFM]

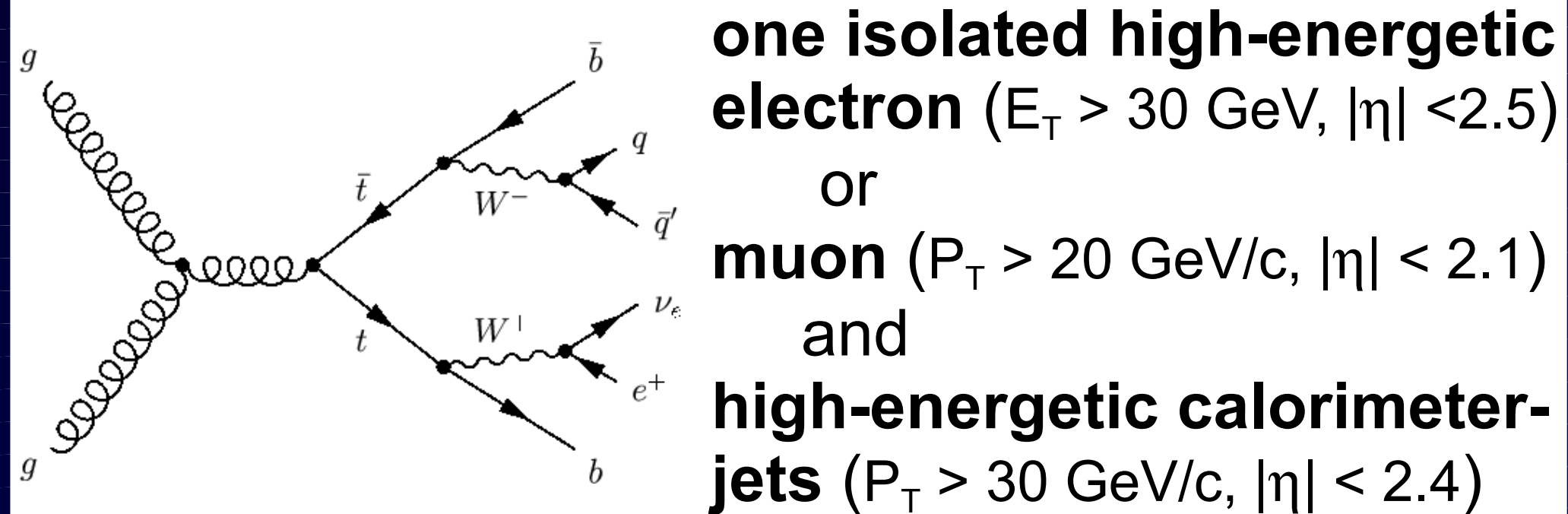Data set used for the presented studies: **L$_{int}$ = 0.84/pb**

→ **More than 100 top quark pairs should have already been produced!**

This poster gives an overview of the status of the selection of top-like events in the available data and the comparison with MC predictions as well as a brief description of methods for the estimation of the QCD multijet background directly from data.
Everything looks so far very promising - The next step is to really measure the cross section with more data available!

Event Selection in the Lepton+Jets Channel

One top quark decays hadronically (t → bjj) and the other semileptonically (t → lνb). We require:

one isolated high-energetic electron (E$_T$ > 30 GeV, |η| <2.5)
or
muon (P$_T$ > 20 GeV/c, |η| < 2.1)
and
high-energetic calorimeter-jets (P$_T$ > 30 GeV/c, |η| < 2.4)

Event Yield for L$_{int}$ = 0.84/pb

Electron+Jets Channel:

Jets	ttbar	single top	W+Jets	Z+Jets	QCD	Sum MC	Data
≥ 1	12 ± 2	3.1 ± 0.4	419 ± 77	92 ± 11	436 ± 62	962 ± 99	1022
≥ 2	11 ± 2	1.9 ± 0.3	74 ± 18	19 ± 5	85 ± 22	191 ± 29	183
≥ 3	8.9 ± 1.8	0.70 ± 0.14	13 ± 4	3.3 ± 1.0	14 ± 5	40 ± 7	43
≥ 4	4.8 ± 1.2	0.21 ± 0.06	2.6 ± 1.1	0.60 ± 0.23	2.3 ± 1.1	11 ± 2	13

Muon+Jets Channel:

Jets	ttbar	single top	W+Jets	Z+Jets	QCD	Sum MC	Data
≥ 1	13 ± 3	3.9 ± 0.4	552 ± 106	42 ± 12	79 ± 17	690 ± 108	789
≥ 2	13 ± 2	2.3 ± 0.3	92 ± 24	7.1 ± 4.4	10 ± 3	124 ± 25	153
≥ 3	10 ± 2	0.82 ± 0.15	16 ± 5	1.3 ± 0.9	1.3 ± 0.5	29 ± 5	40
≥ 4	5.6 ± 1.4	0.24 ± 0.06	3.1 ± 1.2	0.25 ± 0.18	0.15 ± 0.07	9.3 ± 1.9	11

Jet Multiplicity Distributions: with b-tagging*

### Electron+Jets and Muon+Jets combined
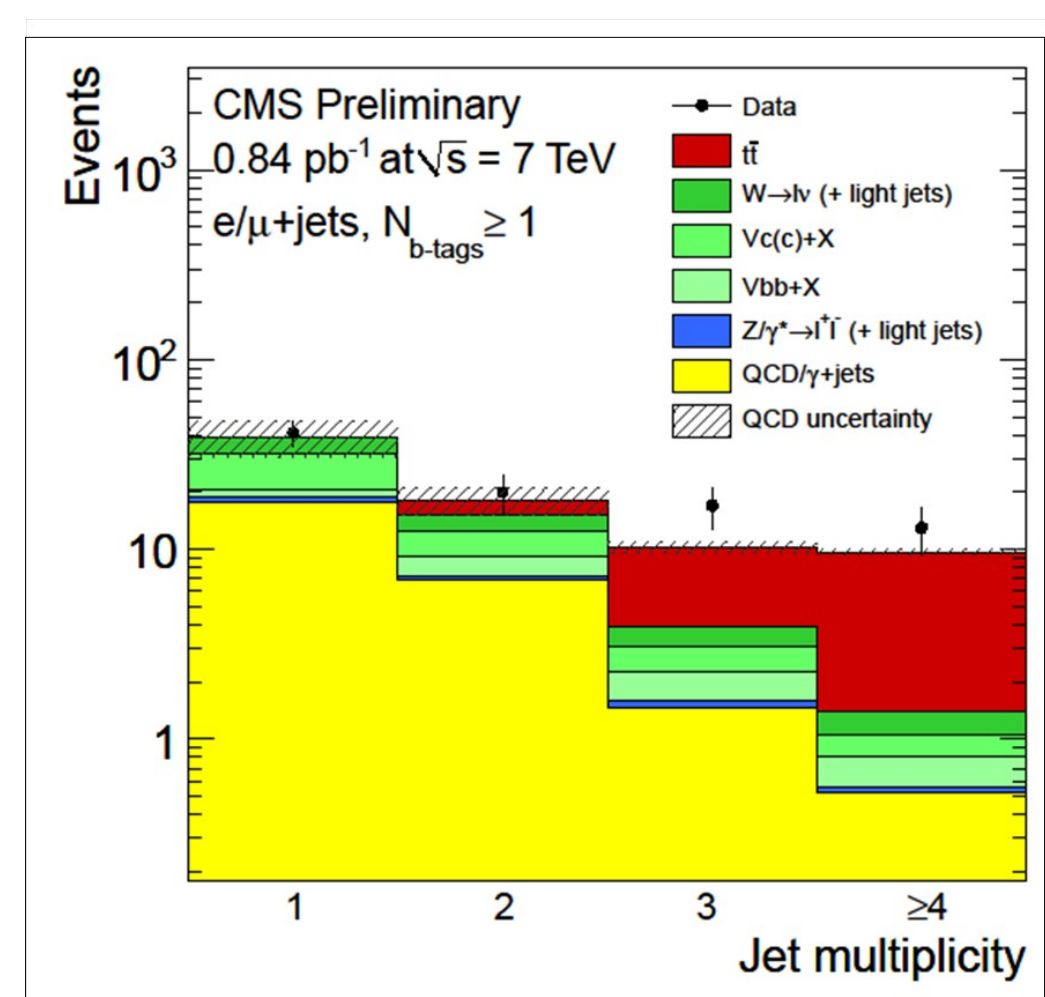
The requirement of at least one jet to be b-tagged enlarges the signal fraction significantly.

Looking at N$_{jets}$ ≥ 3:
Observed events: **30**
Background expectation: **5.3**
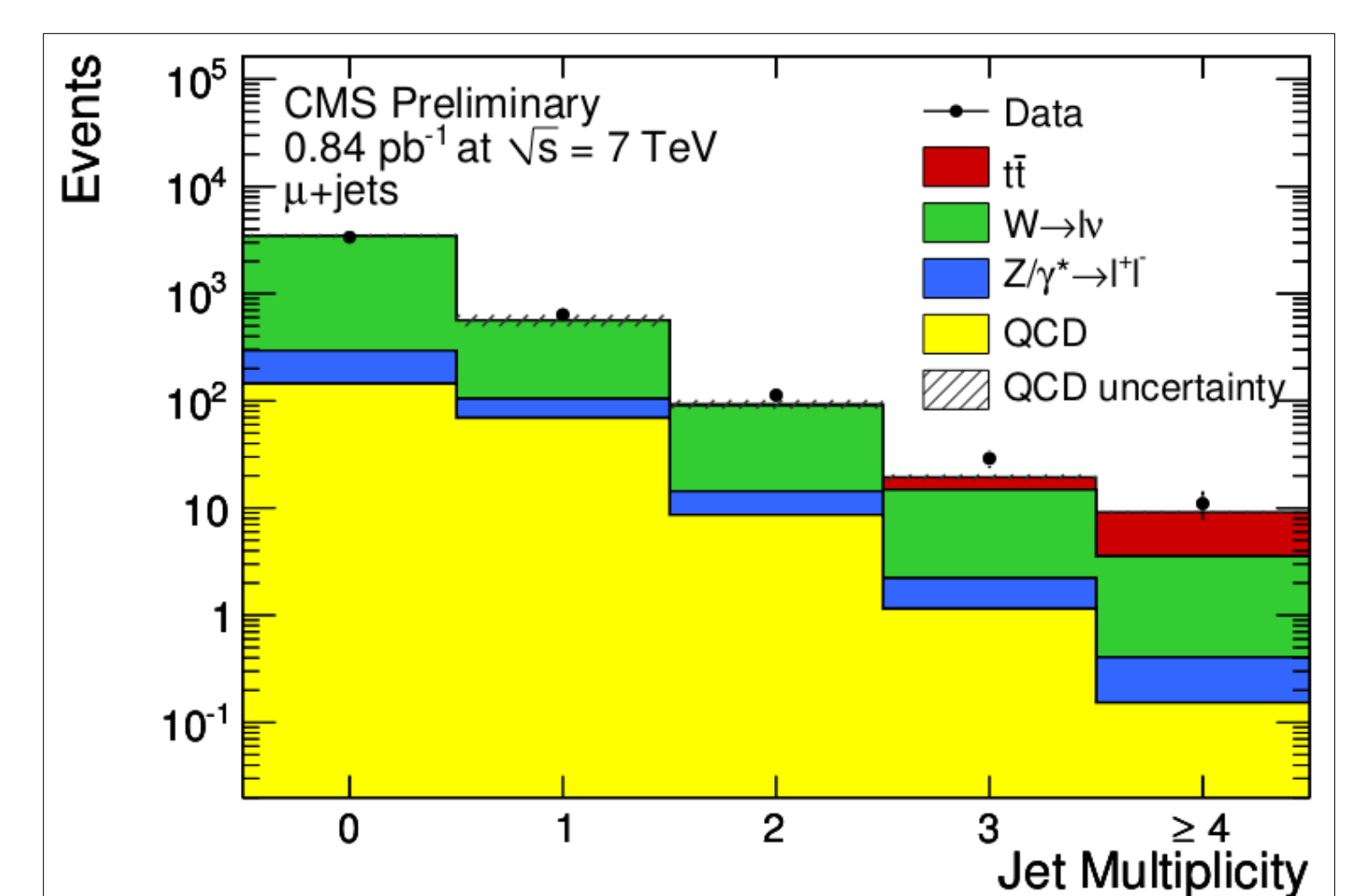The excess is within the uncertainties compatible with the SM expectation for signal of **15** events

*Secondary Vertex Tagger

Jet Multiplicity Distributions: without b-tagging

Electron+Jets
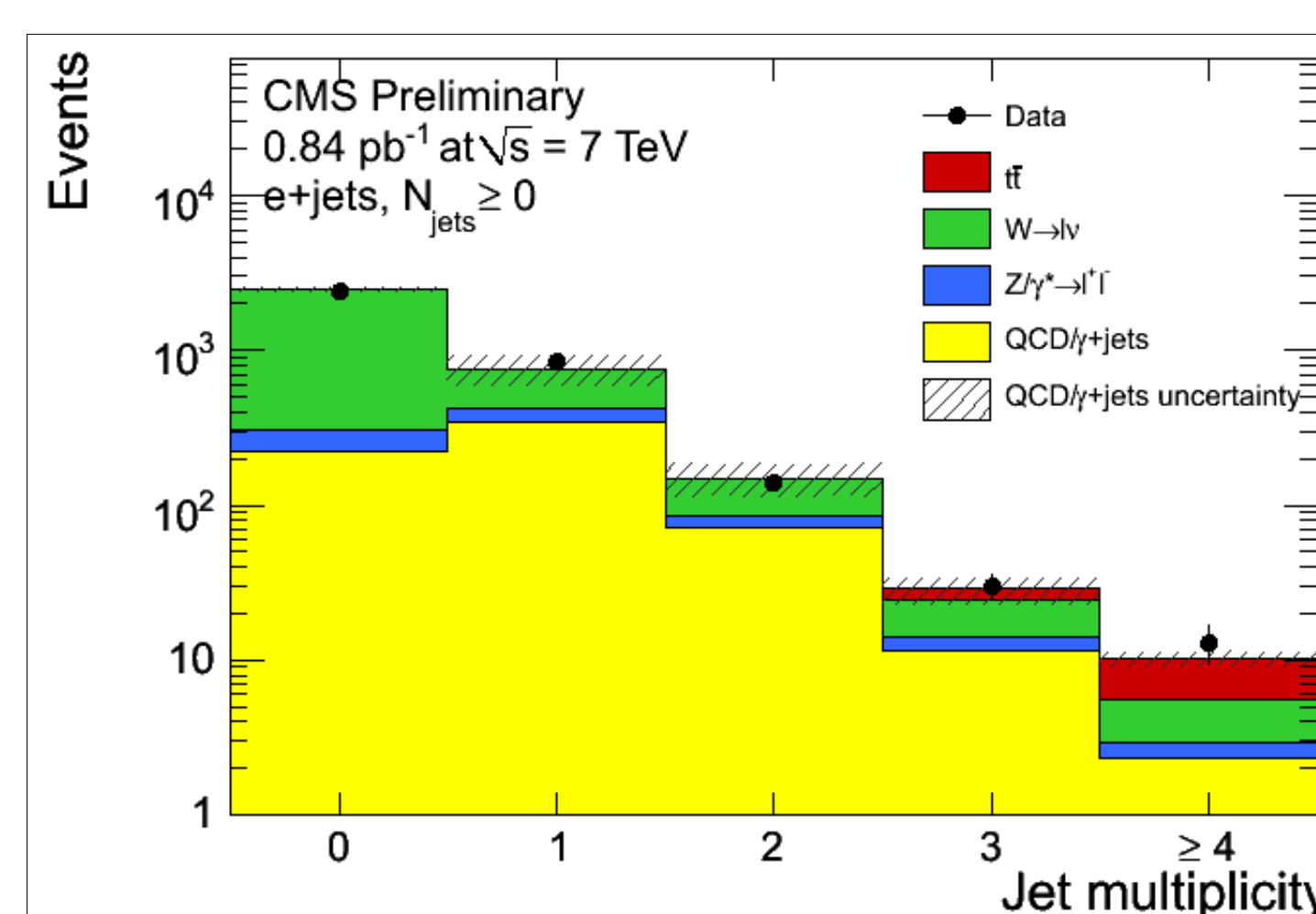

Muon+Jets

Data-driven Estimation of the...

In order to not rely on MC prediction of the QCD contamination, several methods to estimate this contribution directly from data have been developed.


Method 1: RelIso-Fit
We fit the distribution of an isolation variable in a QCD dominated sideband region with a function and extrapolate into the signal region (Relative Isolation < 0.1).
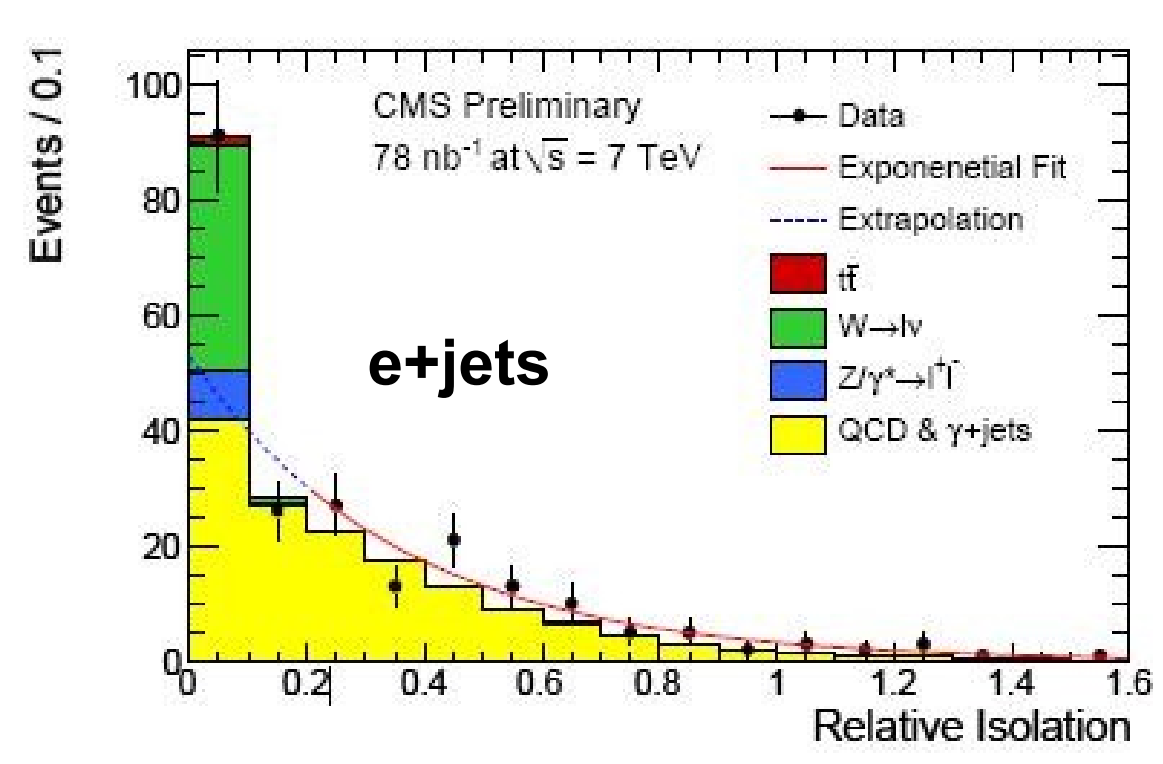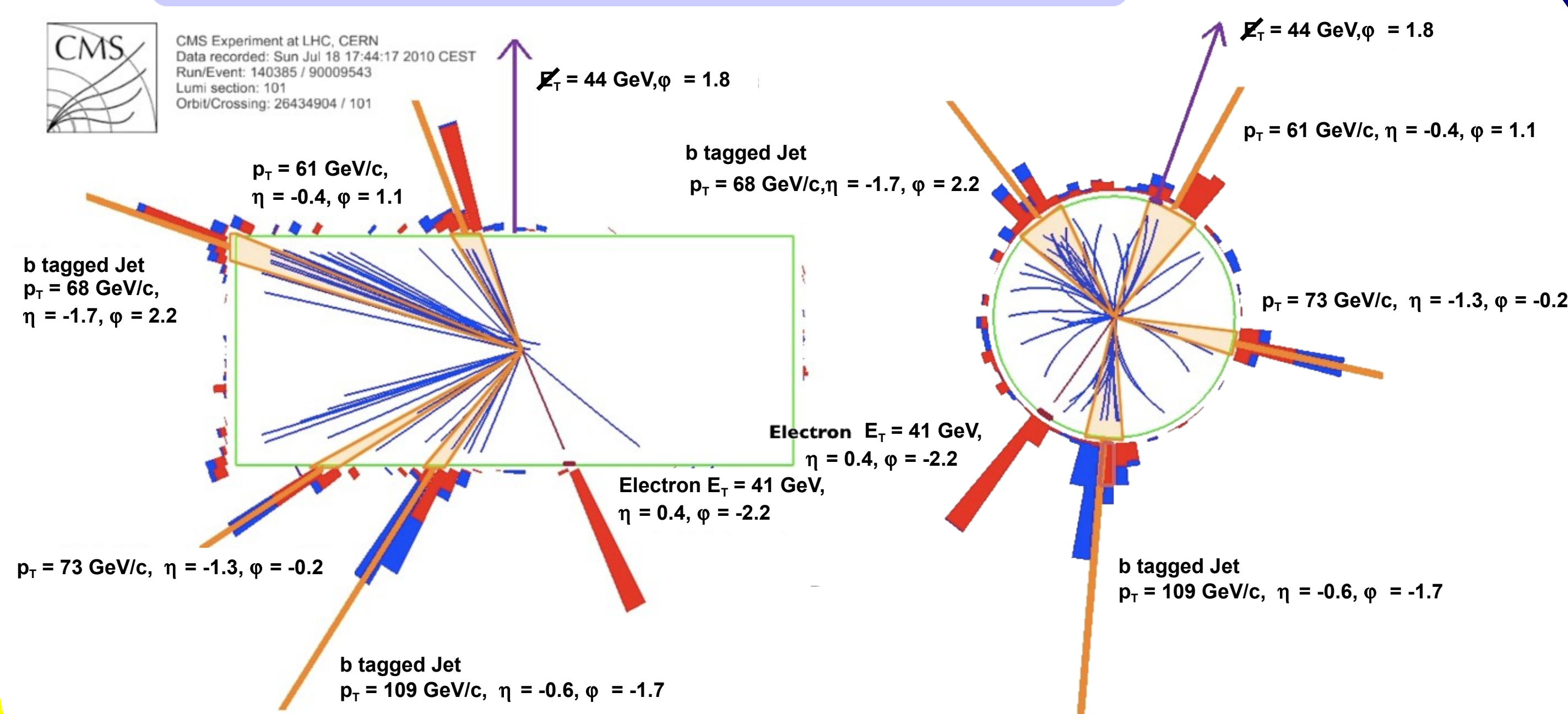
... QCD Multijet Background

Method 2: Template Fit to H$_{T,lep}$
H$_{T,lep}$ (MET + E$_T$ of the electron) can be used to distinguish between QCD and other processes. We fit the H$_{T,lep}$ distribution in a sideband region (small H$_{T,lep}$ values) and extrapolate into the signall region (above H$_{T,lep}$ cut value).
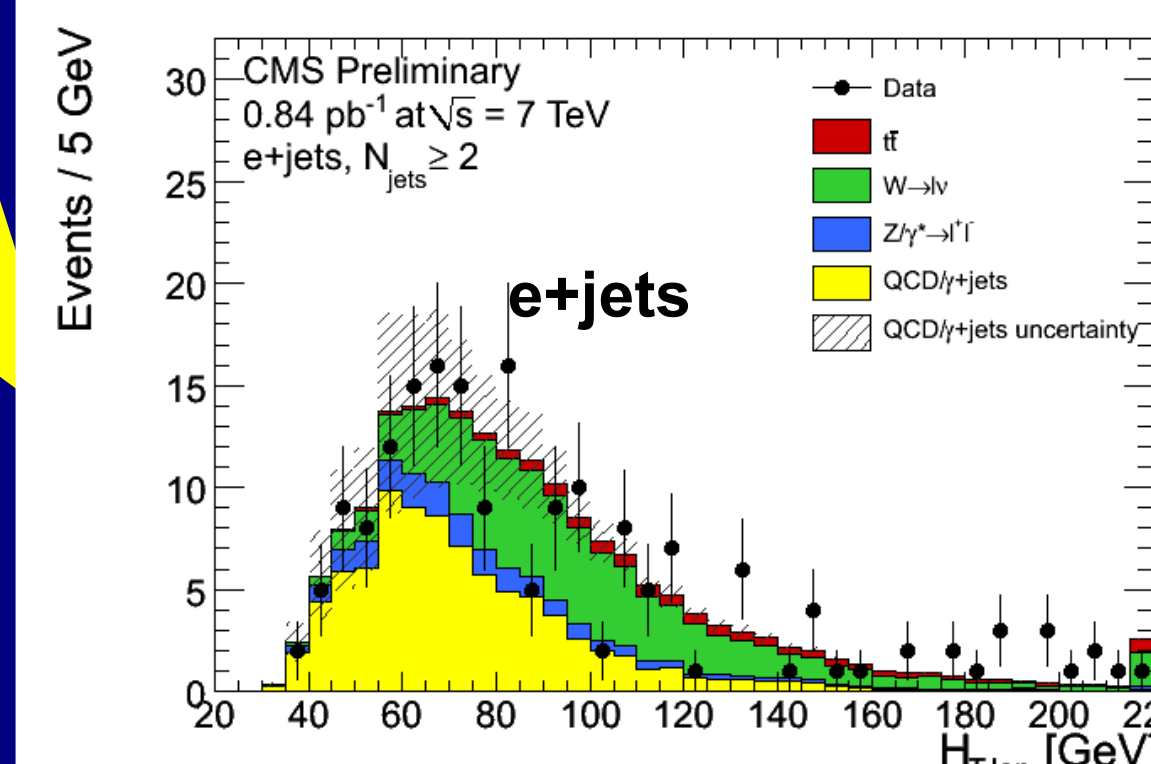
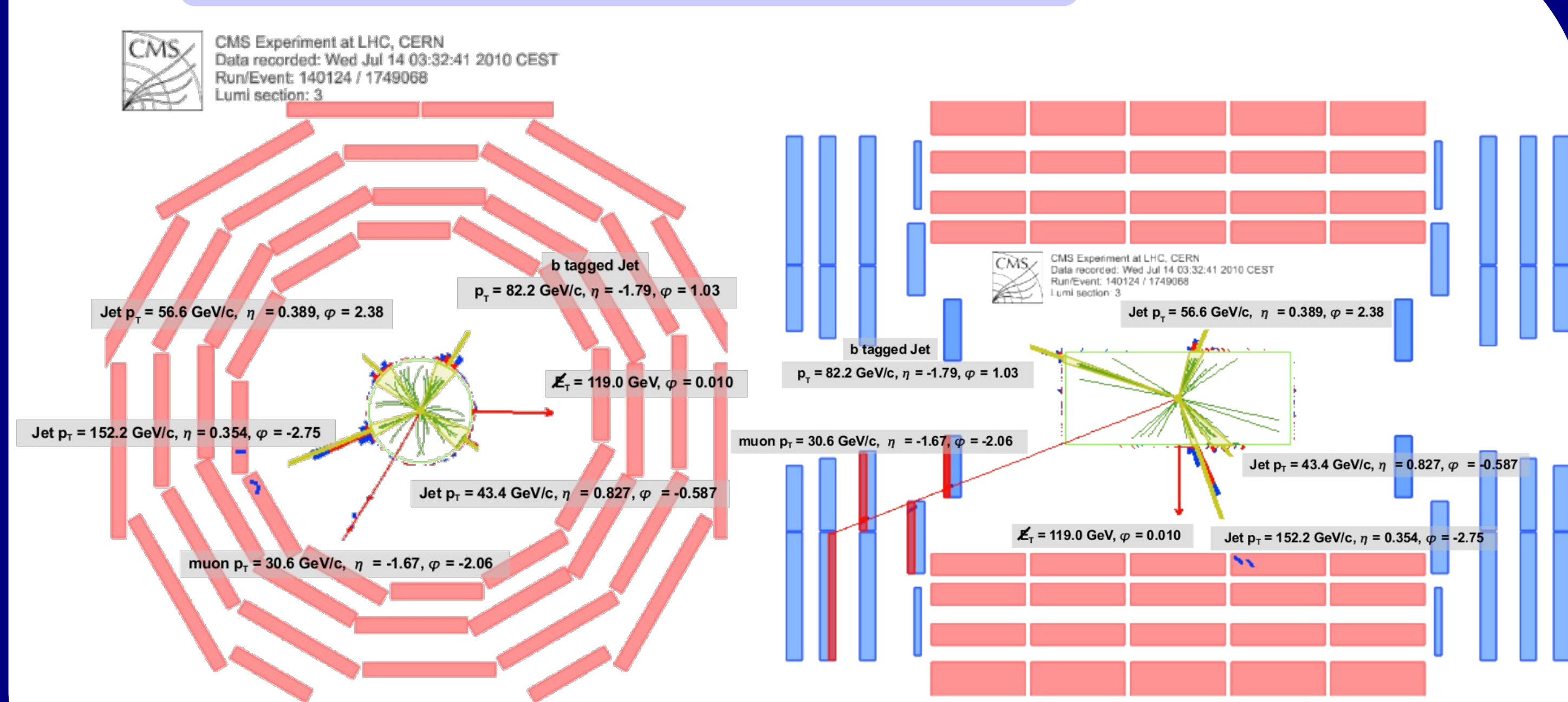→ For the mu+jets channel similar methods exist.

Electron+Jets Candidate Event

Electron+4Jets (two with a b-tag) candidate event with...
MET = 44 GeV, M$_T$(W) = 77 GeV/c², M3 = 232 GeV/c²

The first nice candidates for top quark pairs ...

Muon+Jets Candidate Event

Muon+4Jets (one with a b-tag) candidate event with ...
MET = 119 GeV, M$_T$(W) = 104 GeV/c², M3 = 210 GeV/c²

... are showing up !!!