V+jets dark matter background study (experimental intro)

ETH zürich

Les Houches
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Why care for this ratio ?

- Searching for dark matter & supersymmetry is one of the main goals of the LHC; Jets + MET final state is sensitive to this type of new physics
- Main (irreducible) background is **Z(->vv) + jets**
- p_T(Z->inv) ~= MET; can't rely solely to theory to predict the background in the tail of the MET distribution

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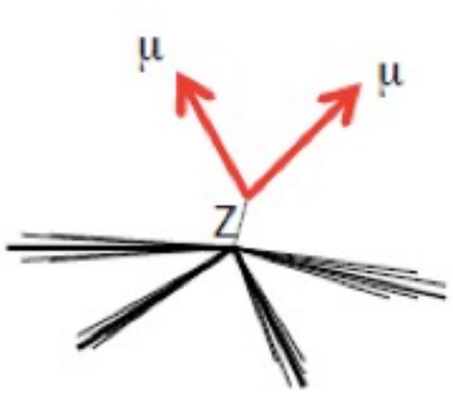
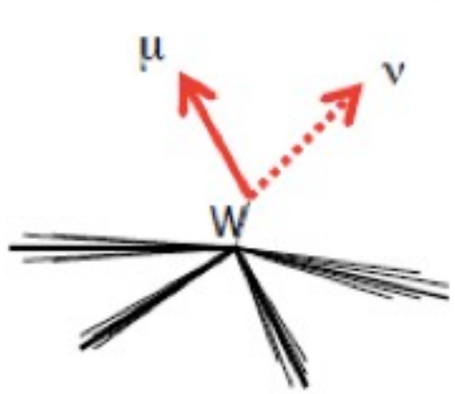
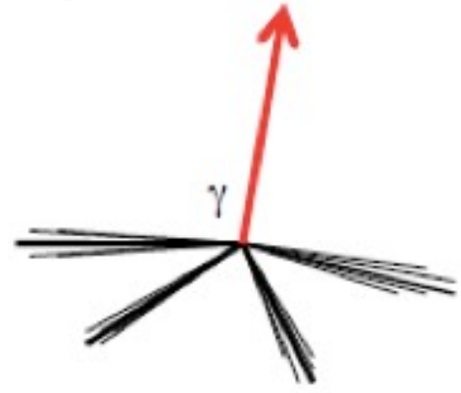
data control samples for the experimental analysis?







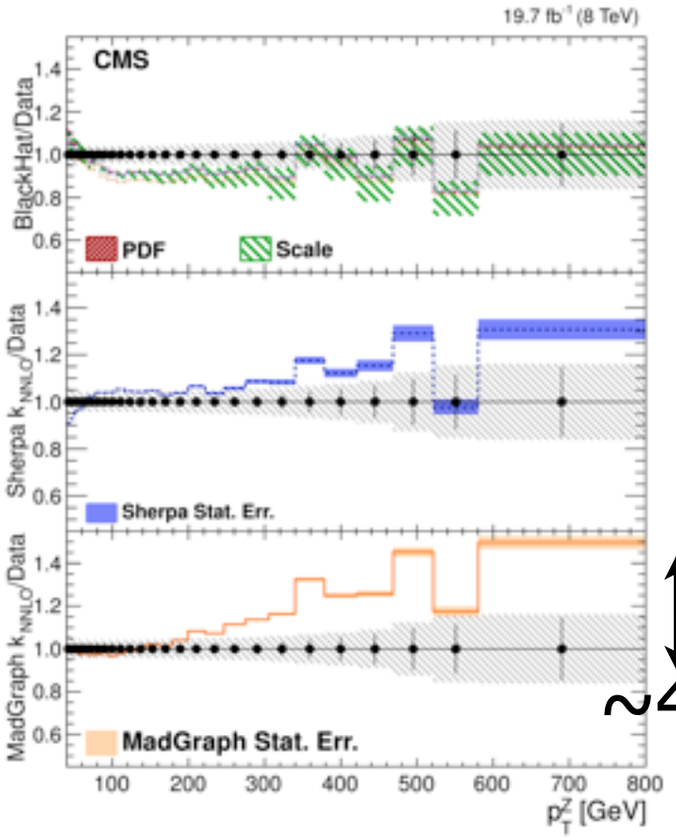
Z→μμ + jets
MET' = p_T(μμ)
best but not enough

W→μν + jets
MET' = p_T(μ)+ MET
not so clean

gamma + jets
MET' = p_T(γ)
R(Z/γ) ?

e.g, N^{pred}(Z->νν) = R^{theory}(Z/γ) * N^{data}(γ+jets)

The R(Z/γ) ratio



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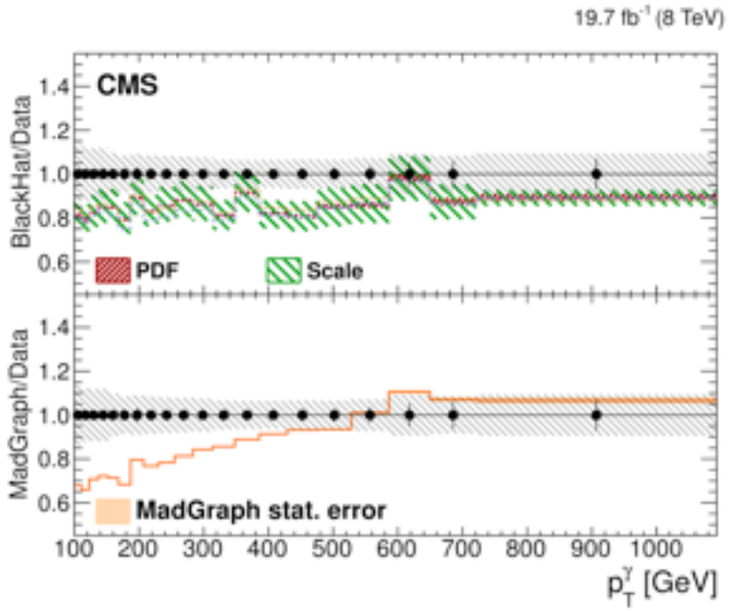

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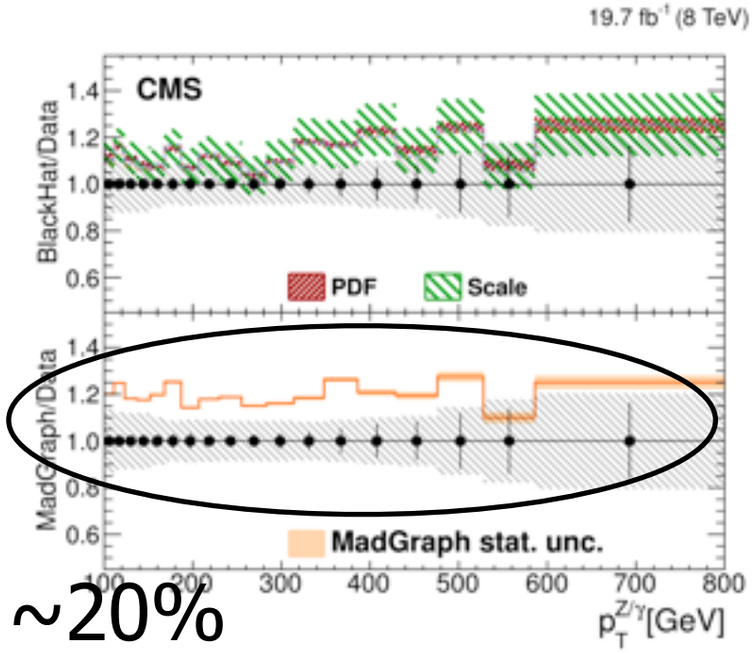


~40%

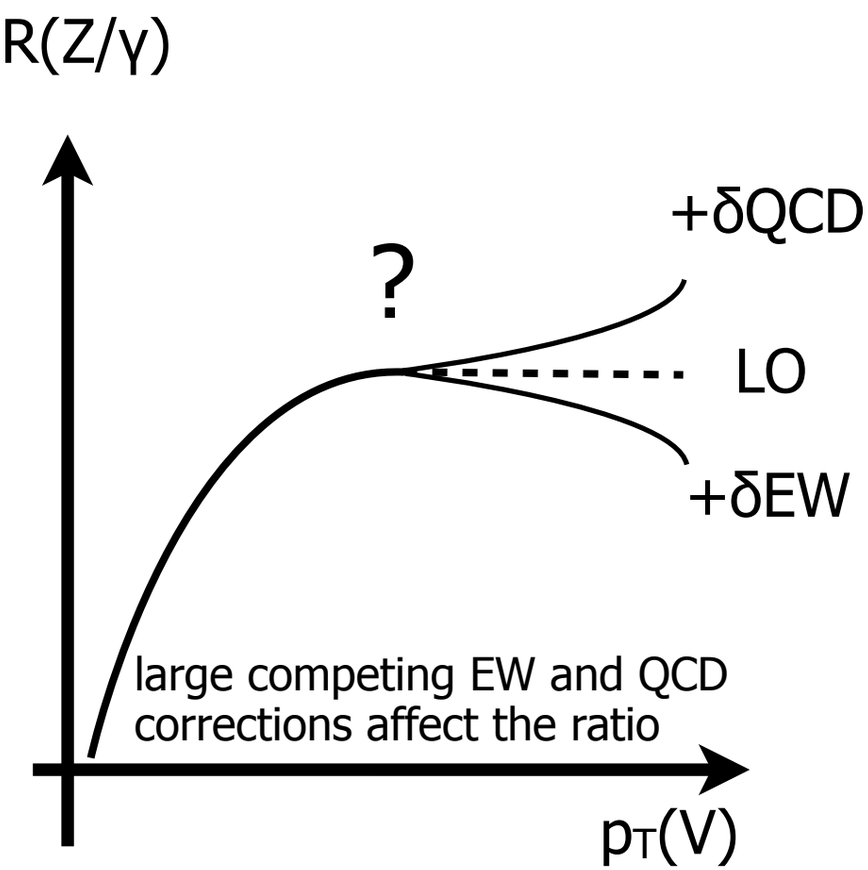
~20%

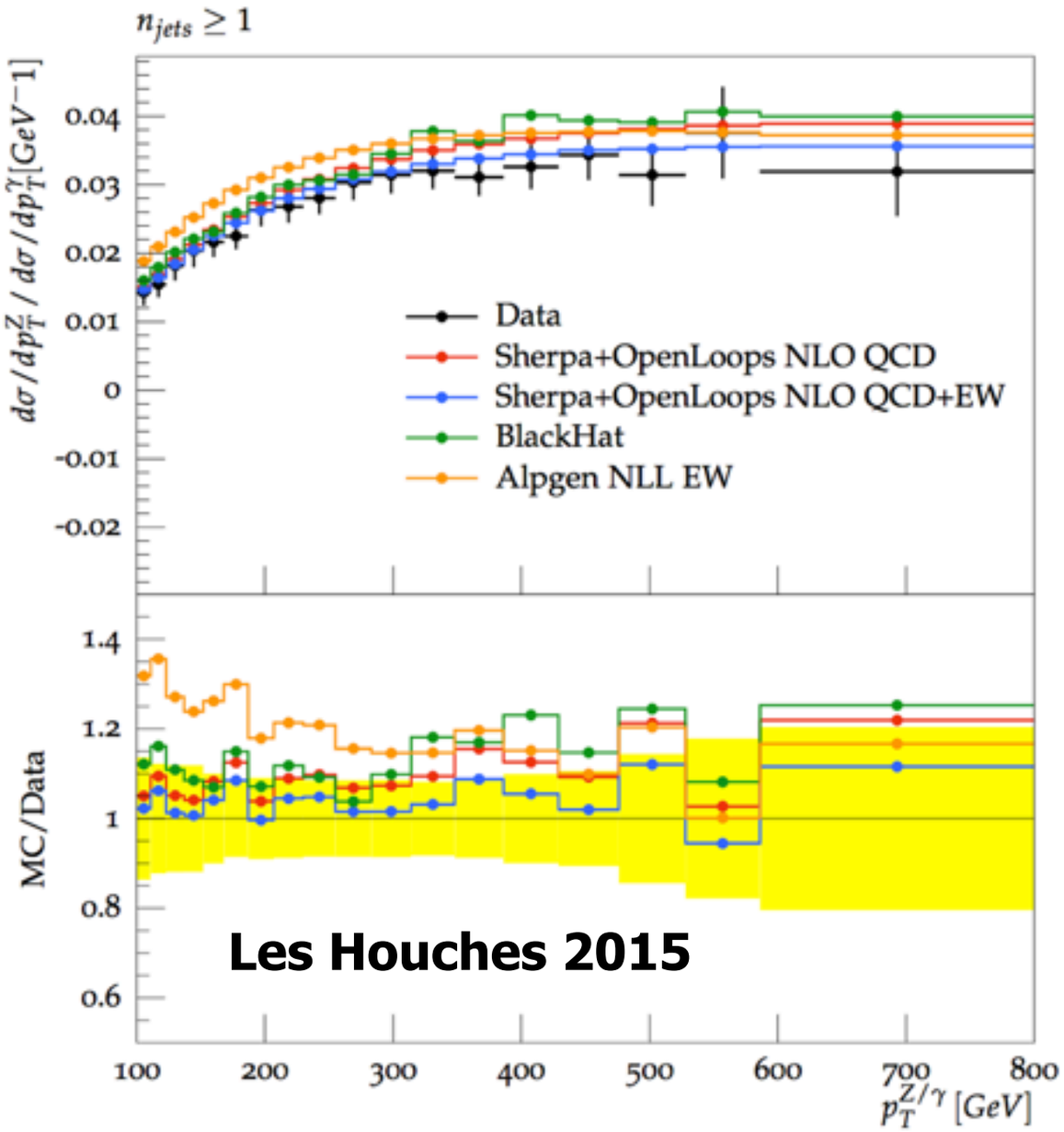
σ(Z+jets) / σ(γ+jet) = R(Z/γ)

First measurement of its kind by CMS [JHEP 10 (2015) 128], comparing data with NLO and framing LO+PS uncertainties with high P_T vector boson data

Measurement was binned in Nj, H_T, an important aspect => understand stability of R(Z/γ) from inclusive to more exclusive/extreme phase spaces

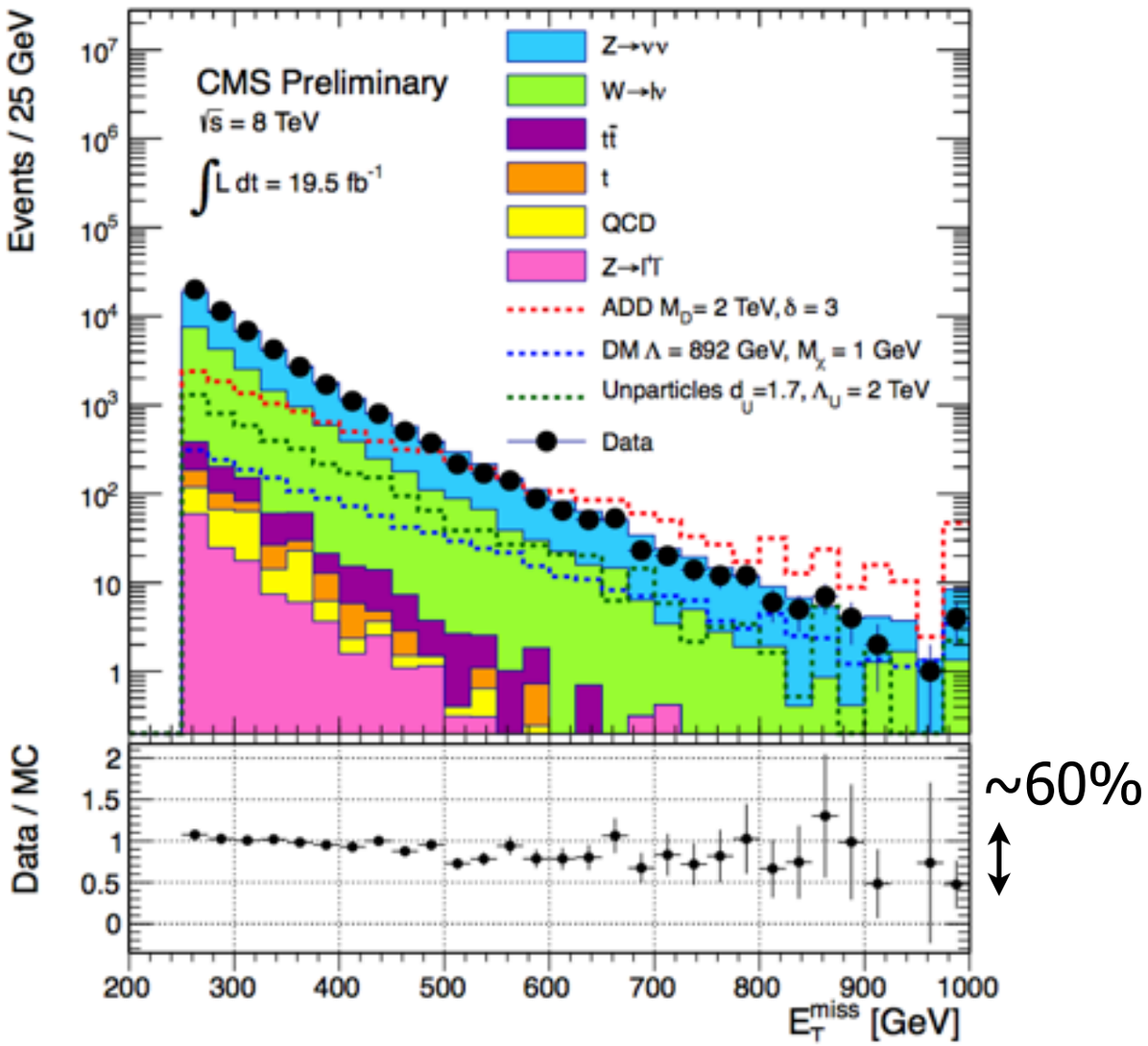
Les Houches 2015 studies



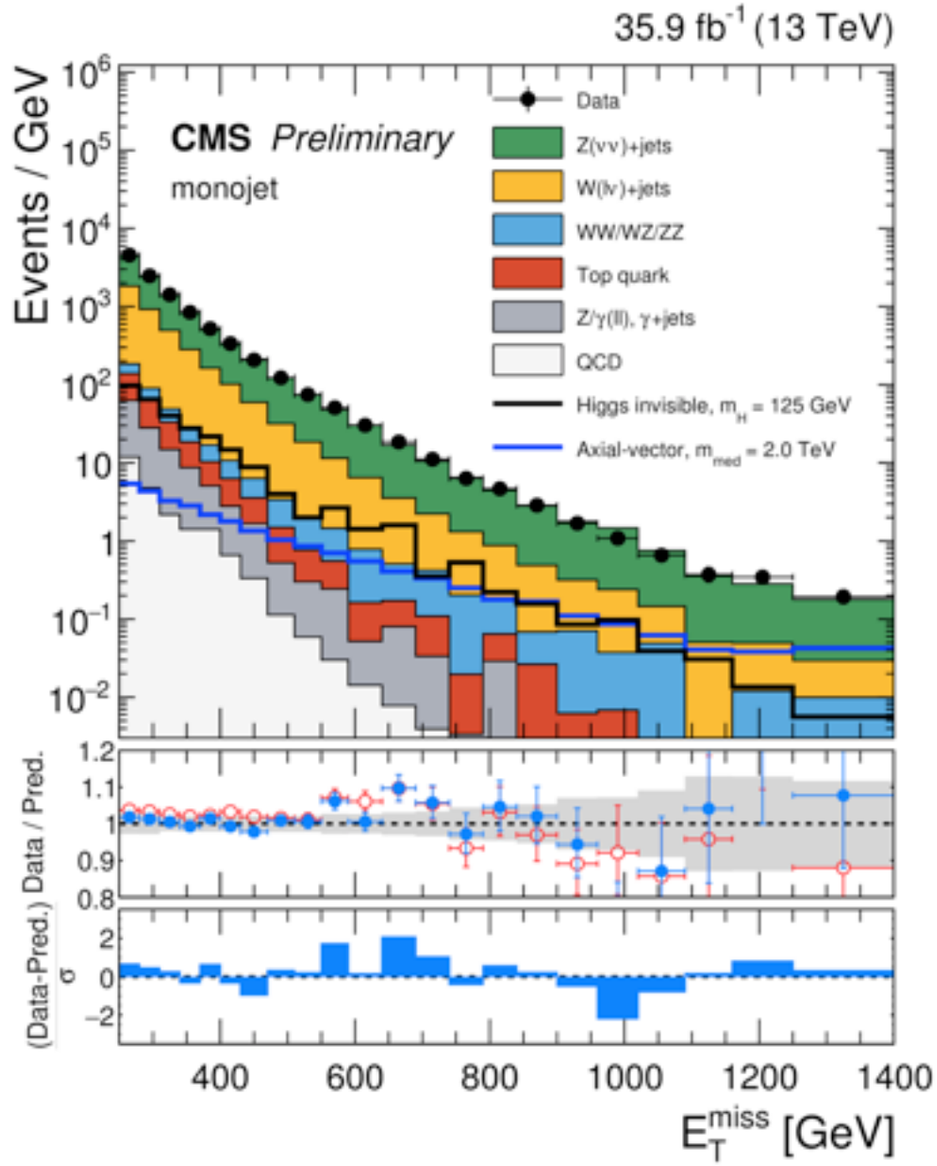


CMS measurement of R(Z/γ) -- JHEP 10 (2015) 128 -- was one of the **Les Houches 2015 studies**, finding that NLO QCD+EW Sherpa predictions match within uncertainties the CMS data

R(Z/γ) in dark matter searches



(old) Run I, dark matter search, P_T(Z->νν) = MET



(latest) Run II, dark matter search, featuring **R(Z/γ)** and ho QCD+ EW corrections

Before passing the mic to Stefan …

- A new theory study for the ratio has been made available last month theory uncertainty on the ratio is brought at the few percent level up to the TeV range
  - What can be further studied in Les Houches 2017 ?
- What type of auxiliary measurements could be interesting for the experiments to pursuit ?

CERN-TH-2017-102
CERN-LPCC-2017-02
FERMILAB-PUB-17-152-T
IPPP/17/38
ZU–TH 12/17

Precise predictions for V+jets dark matter backgrounds

J. M. Lindert[1], S. Pozzorini[2], R. Boughezal[3], J. M. Campbell[4], A. Denner[5], S. Dittmaier[6], A. Gehrmann-De Ridder[2,7], T. Gehrmann[2], N. Glover[1], A. Huss[7], S. Kallweit[8], P. Maierhöfer[6], M. L. Mangano[8], T.A. Morgan[1], A. Mück[9], F. Petriello[3,10], G. P. Salam*[8], M. Schönherr[2], and C. Williams[11]

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