

# Understanding the structure of the proton: from HERA and Tevatron to LHC



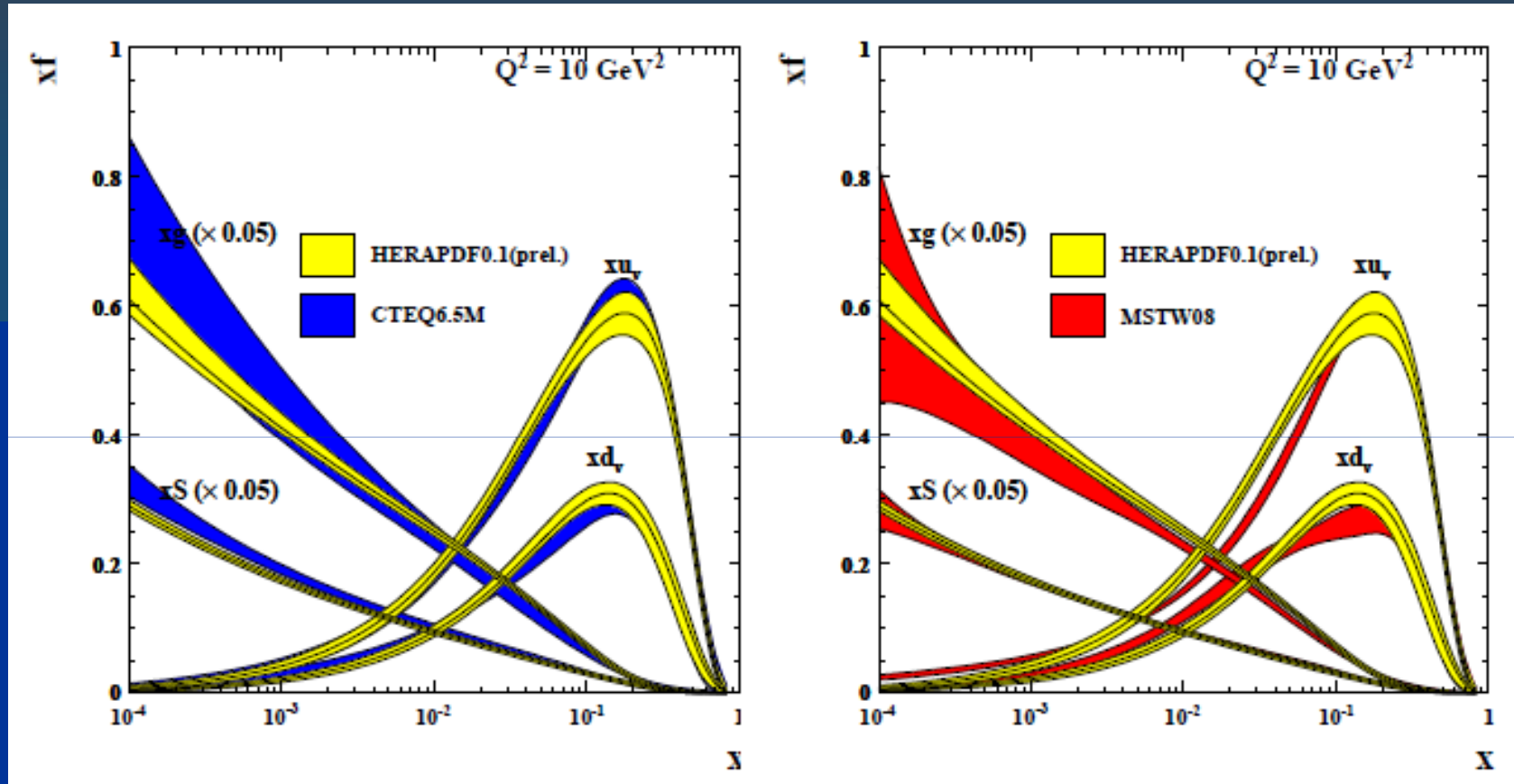
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Work done in collaboration with

M. Boonekamp, F. Chevallier, C. Royon

*arXiv:0902.1678 Akta Phys. Pol.*

# Today landscape for proton PDFs



Note: PDFs uncertainties does not reflect the hypothesis done when running the global fits  
*(in particular in the anti-quark sector)*

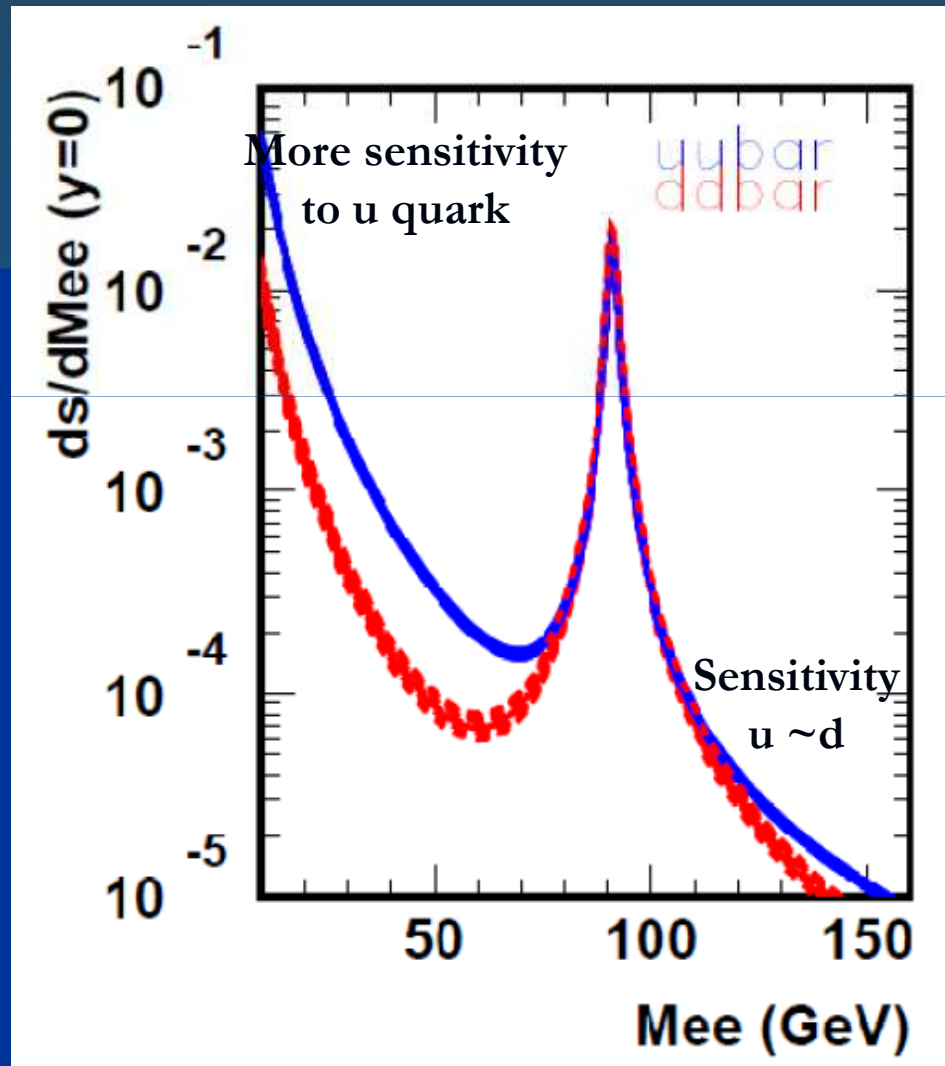
We discuss possible improvements  
possible at LHC in EW physics...

& The role of PDFs error  
versus

The observation of new phenomena

# Possible improvements

## Drell-Yan at LHC: prospects



Idea:  
Differentiate between  
up & down quarks

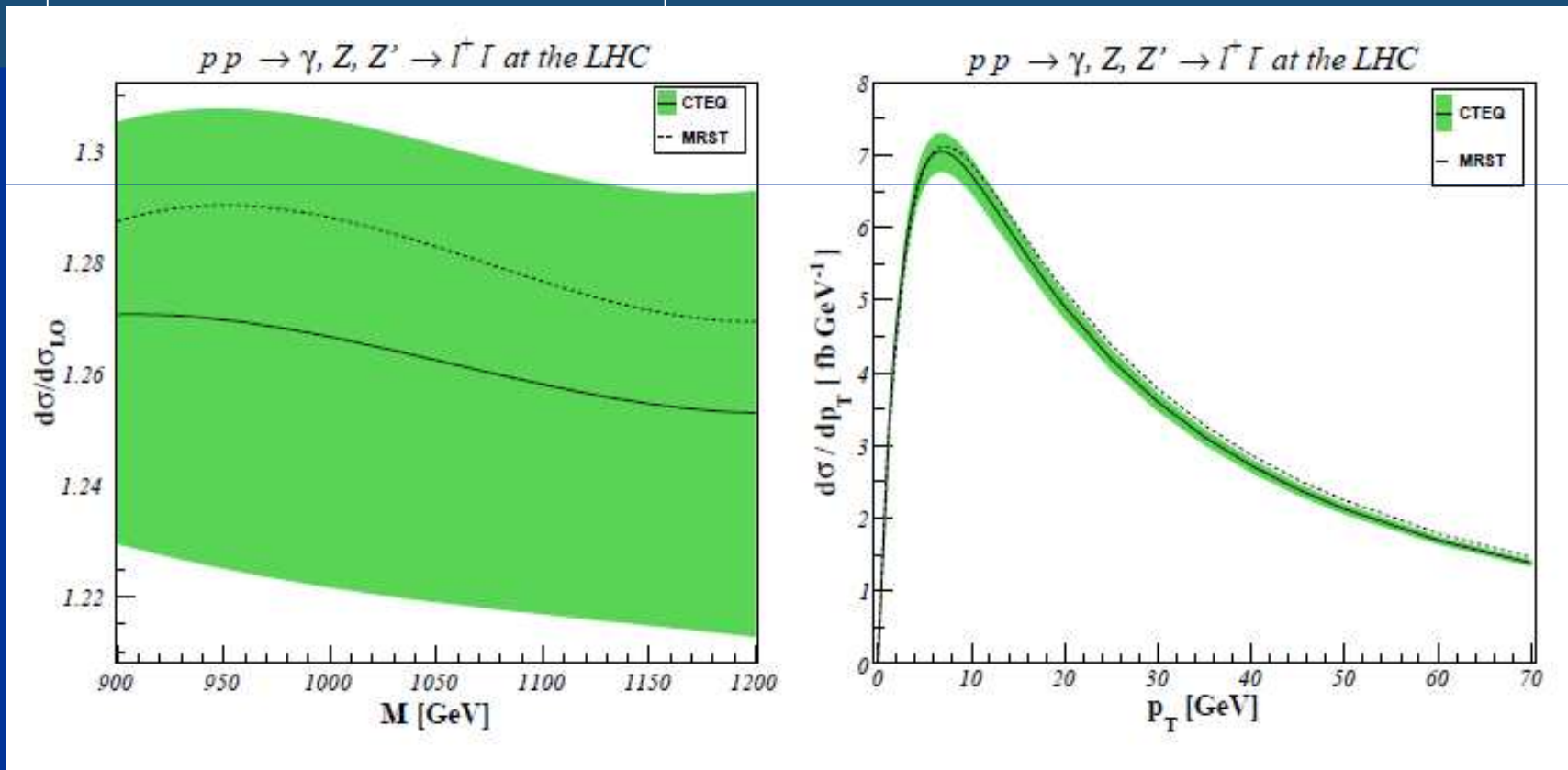
Compare DY at large  
& low mass  
 $\Rightarrow$  Reduce the error  
on  $d(x)$

# Drell-Yan (high mass) at LHC

## Expectations and error

~6% uncertainty

$p_T$  distribution for these events

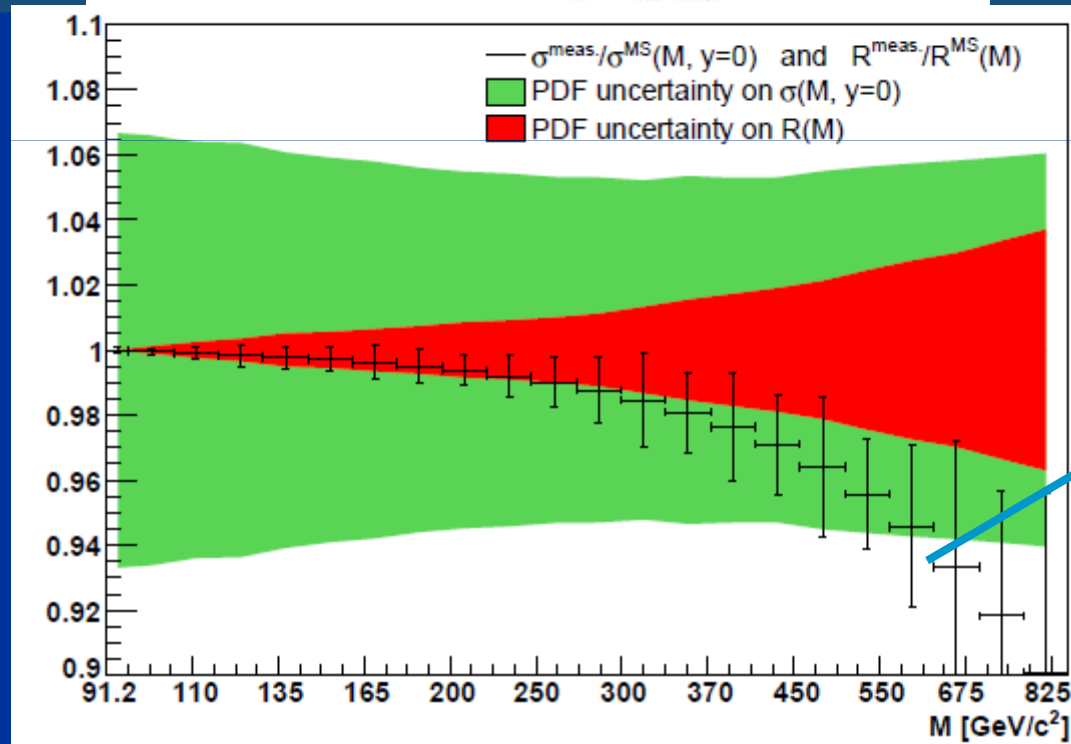


# Drell-Yan

## Observation of new phenomena

$$m = M_Z \exp(-|y|) \quad \& \quad M = M_Z \exp(+|y|)$$

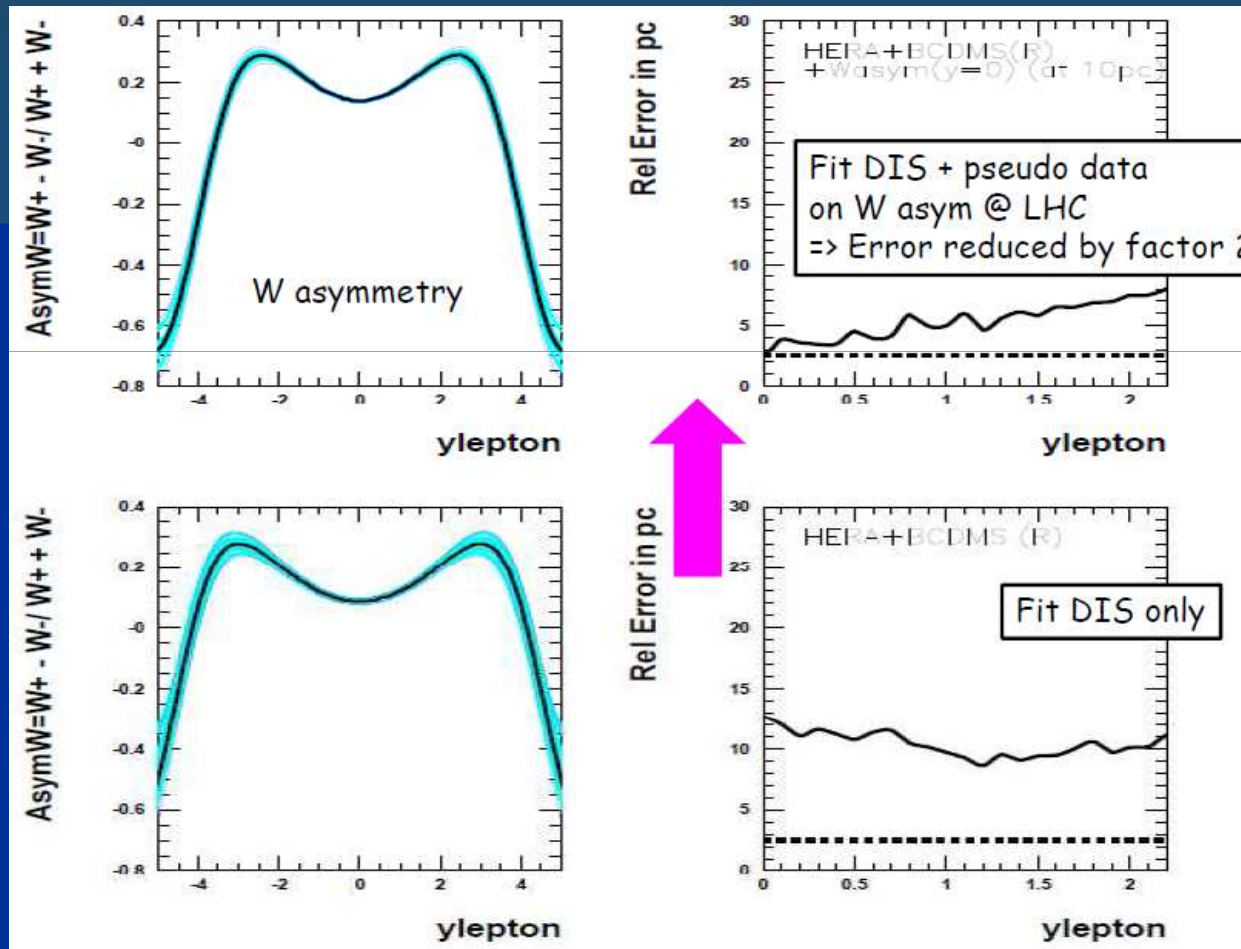
$$R(M) = \frac{\sigma(m, y = 0) \cdot \sigma(M, y = 0)}{\sigma^2(M_Z, y)}$$



Interest for xs ratio  
to reduce the effect  
of PDFs  
uncertainties

Simulation with  
SM + 2TeV Z'  
Sensitivity  
>650 GeV for  $\sigma$  &  
~300 GeV for R

# Another example of xs ratio @ LHC: W asymmetry



Same fit with  
Wasym LHC  
Pseudo-data

Fit DIS data without  
The assumption  
 $\bar{u} = \bar{d}$  at low x  
Rel error  $\sim 10\%$

## Main message

With Z and W measurements at LHC, there will be a strong input in the PDF landscape...

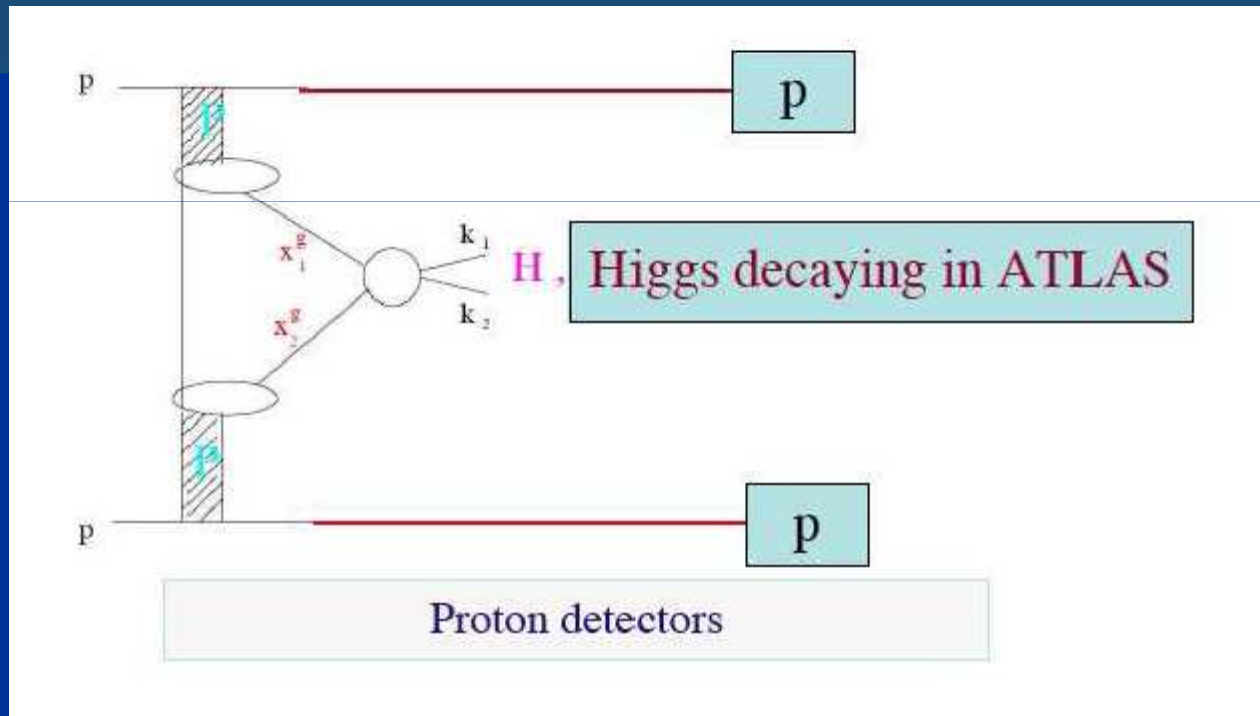
*& subsequently on the possibility to observe new phenomena as deviations in standard spectra*



# Diffraction at the LHC and more...

(towards a unified understanding of processes)

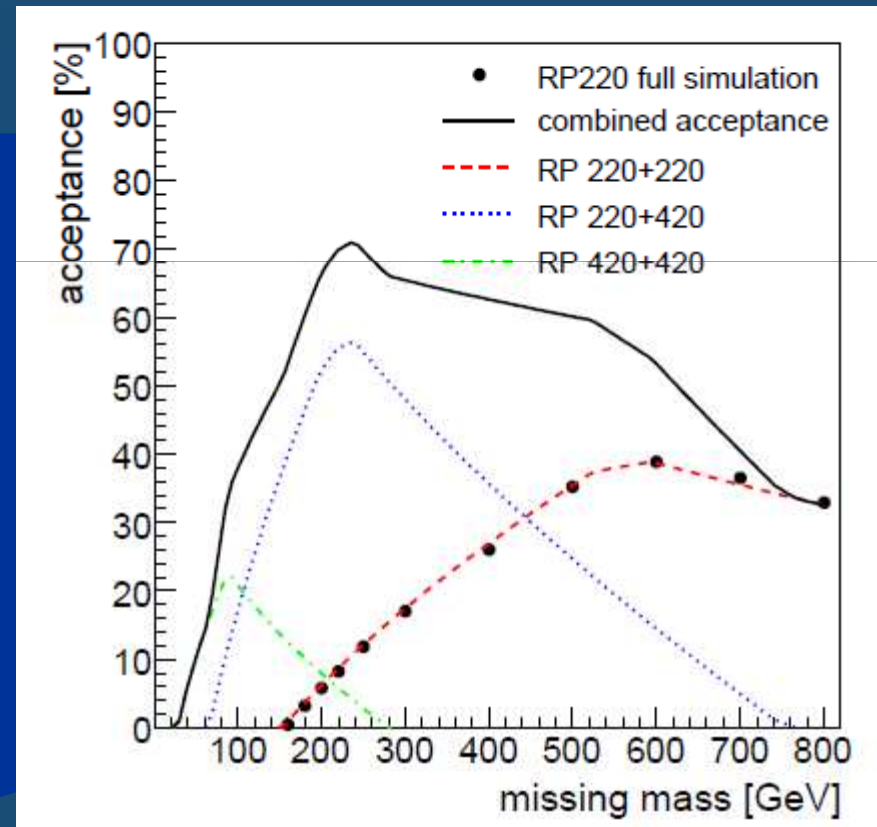
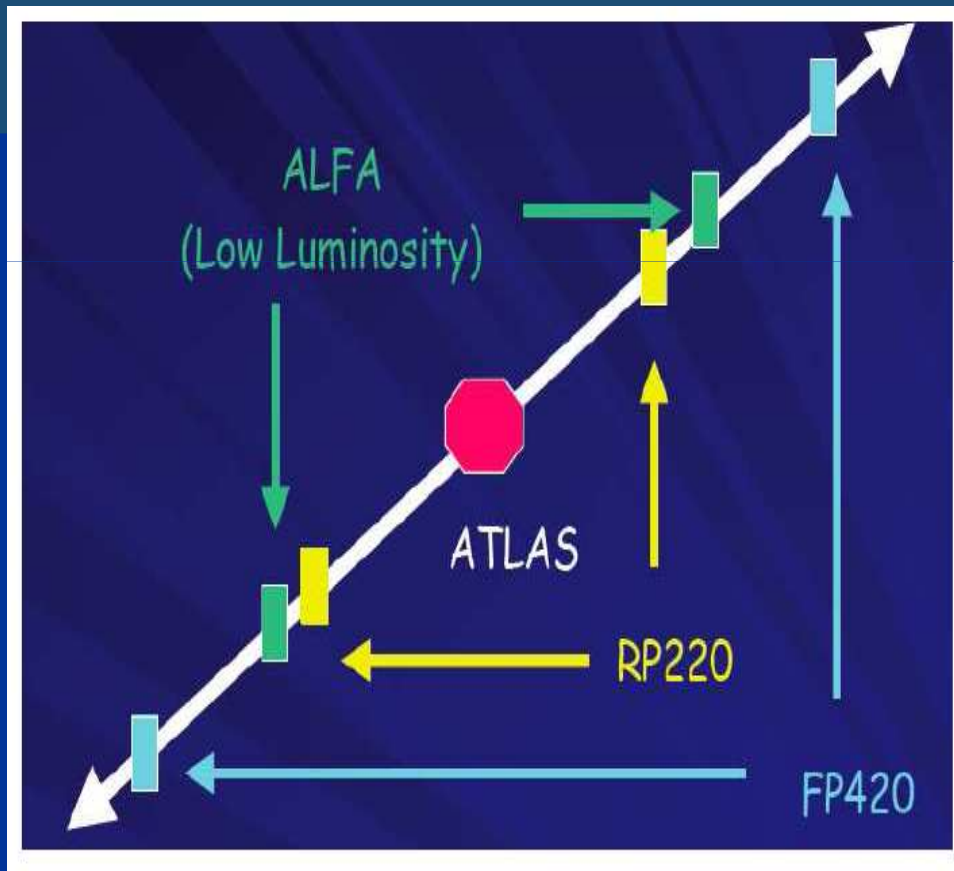
## Double Pomeron Exchange and Higgs



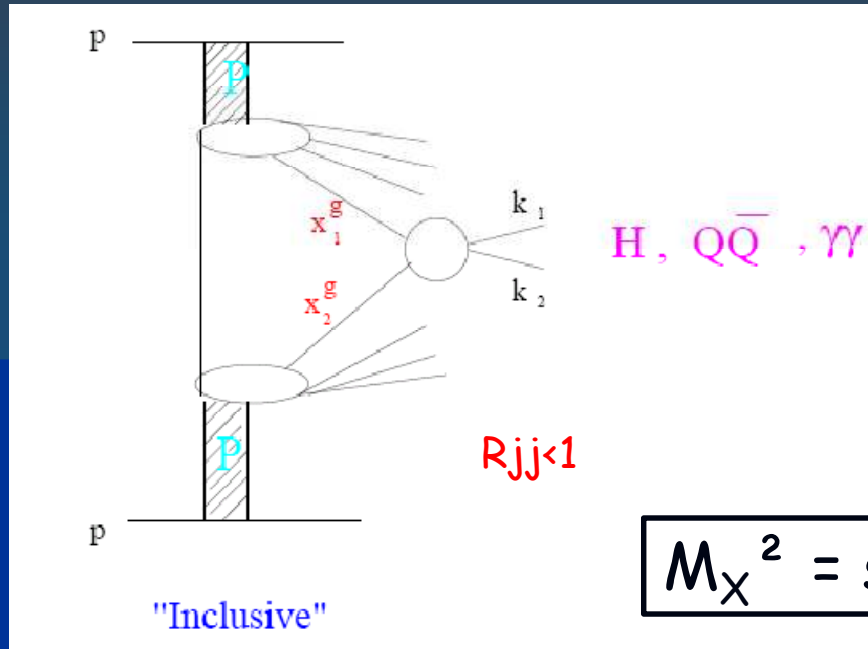
*See dedicated talks in this conference*

# Detectors at LHC for diffraction

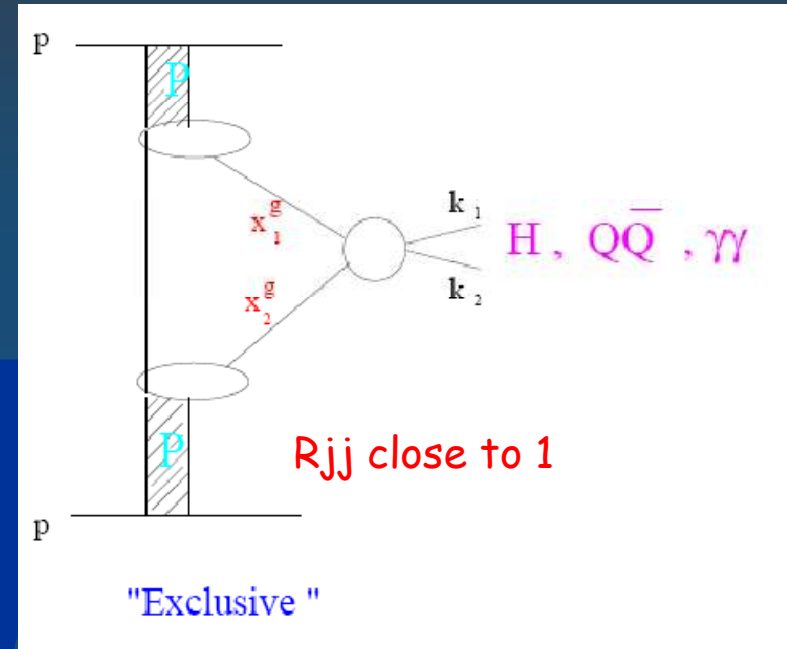
## Proton tagging in Roman Pots



# What has been done @ Tevatron



$$M_X^2 = s \xi_1 \xi_2$$



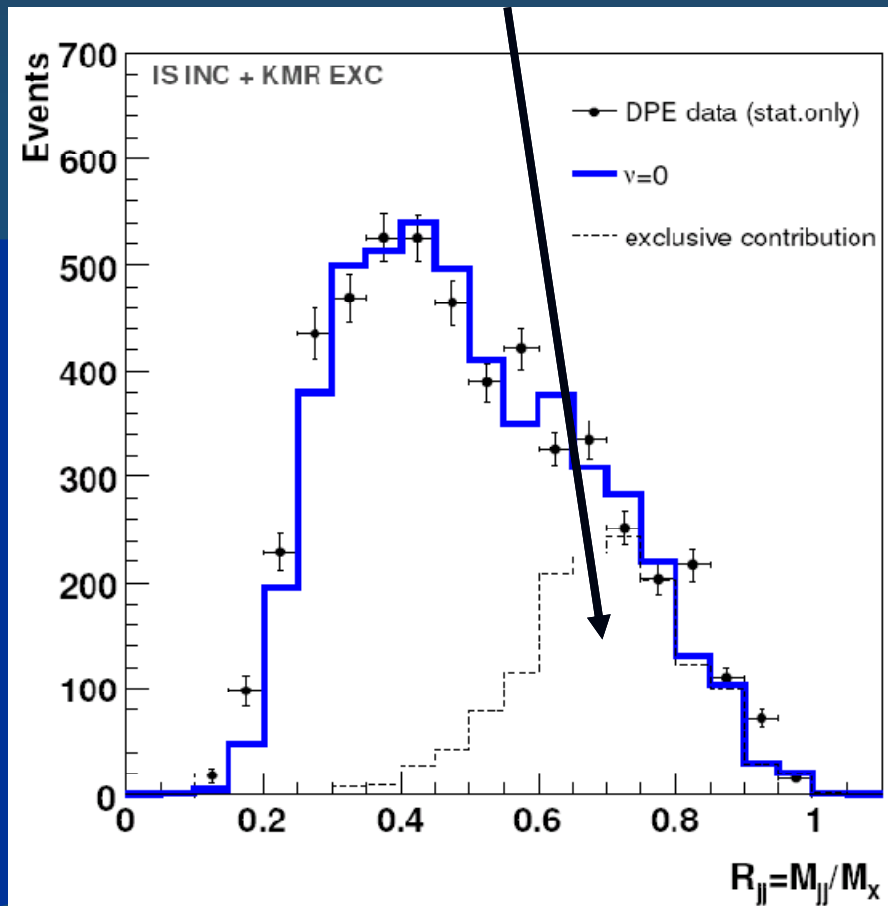
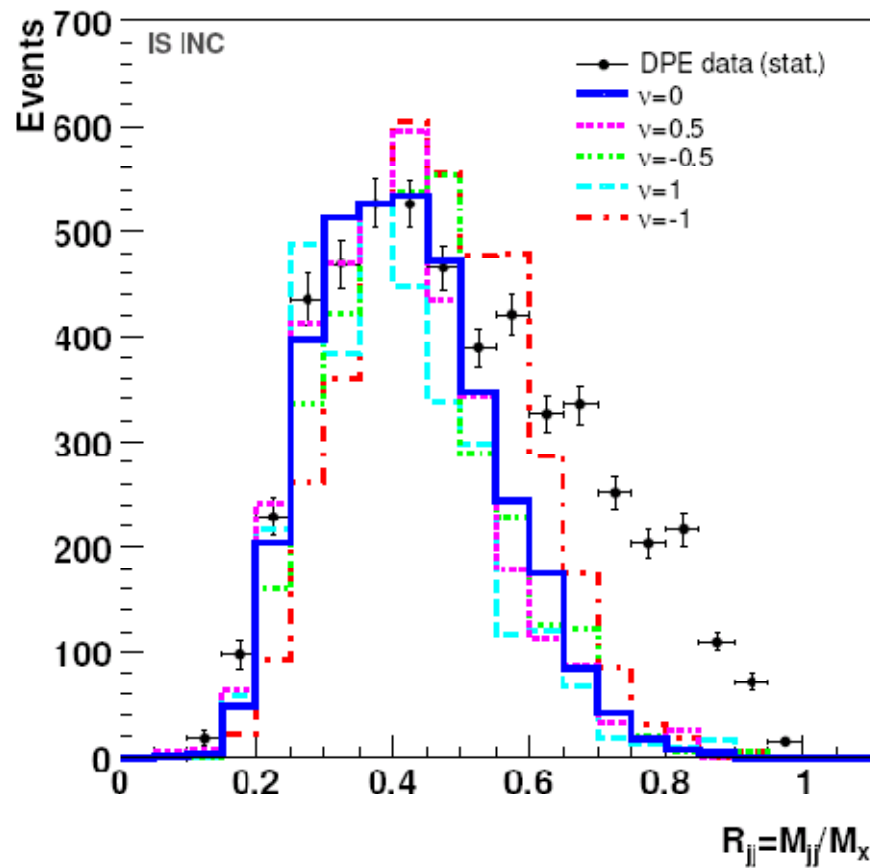
Measurement of the Dijet Mass Fraction @ TeV

$$R_{jj} = \frac{M_{jj}}{M_X}$$

Can we observe exclusive events? ( $R_{jj} \sim 1$ )

# Diffraction at Tevatron & DPE

predictions  
with exclusive DPE production



# Summary

Only few items selected from:

arXiv:0902.1678 Akta Phys. Pol.

**General idea:**

**LHC data (even @ 8 TeV) would help to bring constraints on SM physics (continuation of HERA+TeV)**

\*\* Example with QED and WW coupling (see C.R. talk)

\*\* Examples with PDFs and DY + W asymmetry

\*\* Exclusive processes @ LHC open also a potential for diffraction and DPE...

\*\* **Important note:** HERA data at large  $x/Q^2$  will have a strong impact on the PDFs landscape (work on going)