Diffractive Higgs Production at Tevatron and LHC

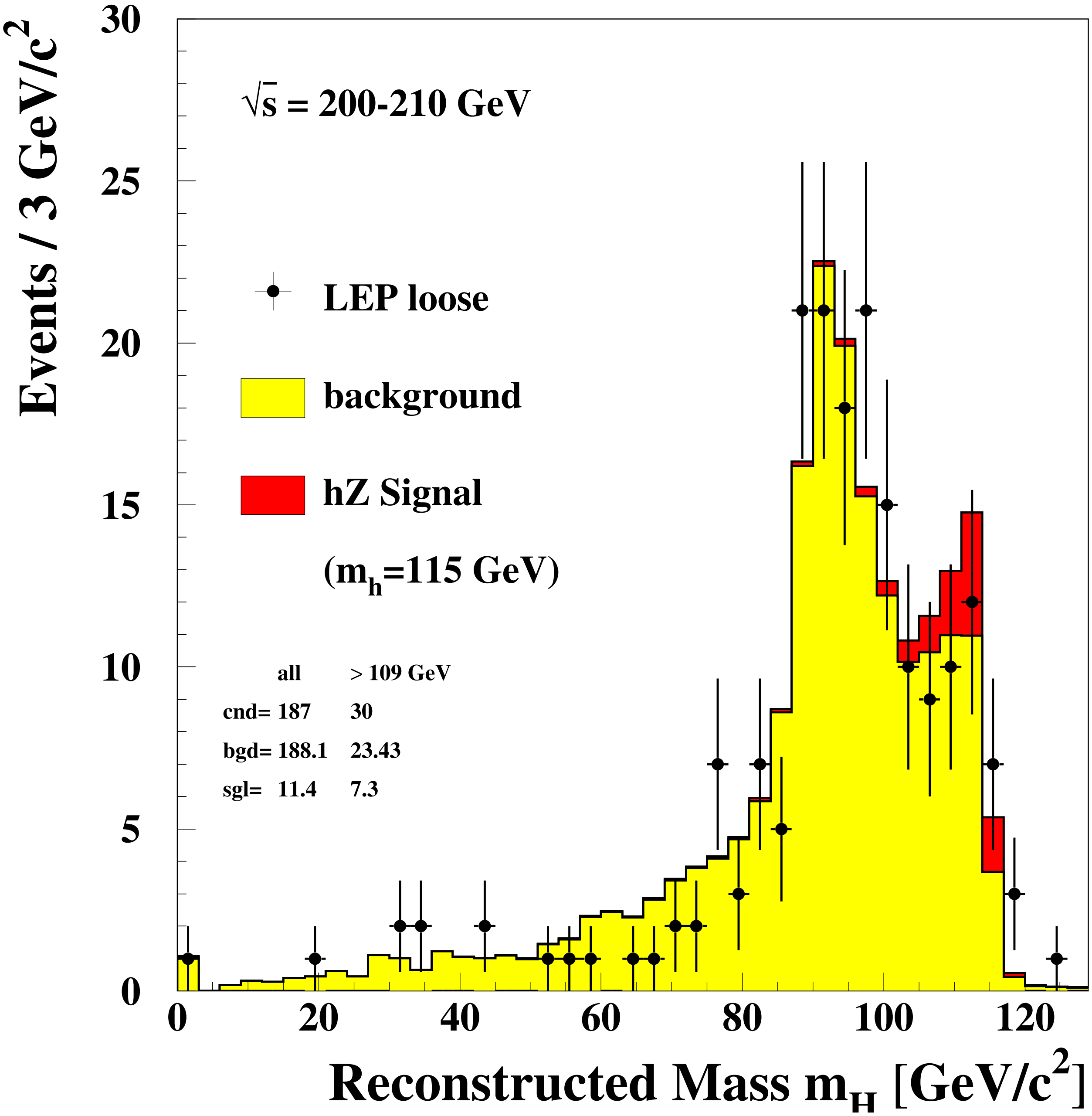
Christophe Royon
DAPNIA-SPP, CEA Saclay

CERN EP seminar, April 15

Contents

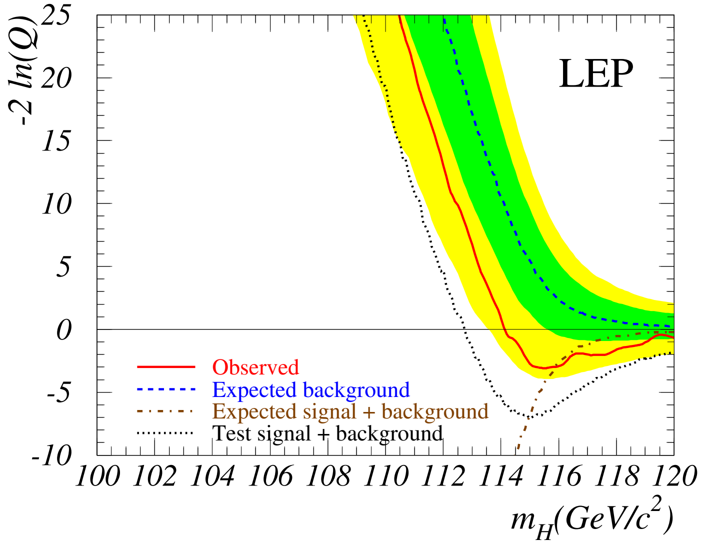
- Introduction and motivation, standard Higgs production
- Proton and pomeron (factorizable and non-factorizable models) induced models
- Comparison between models, and reason of differences
- Dijet and $\gamma\gamma$ diffractive production to "calibrate" the diffractive Higgs production cross section
- Advantage of diffractive events to reconstruct the Higgs mass at LHC
- Soft colour interaction models

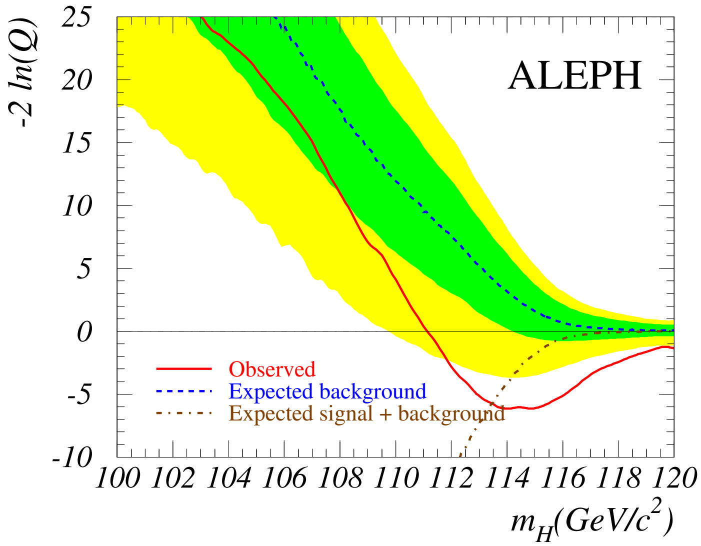
Higgs candidates from LEP



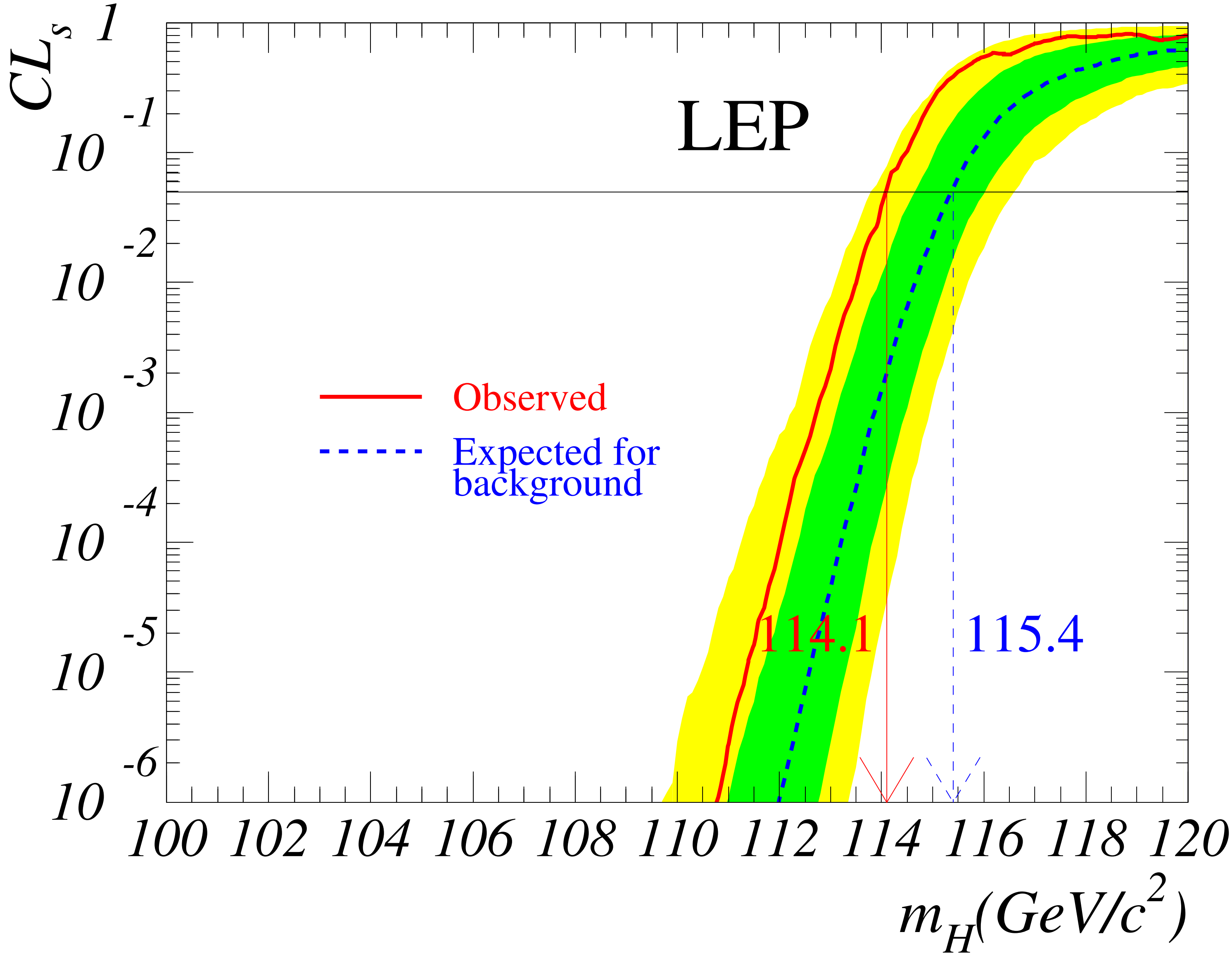
Higgs candidates from LEP

Q: ratio of the probability to observe what has been seen if it is a Higgs signal by the probability to observe the same if it is only background





LEP limits on Higgs mass

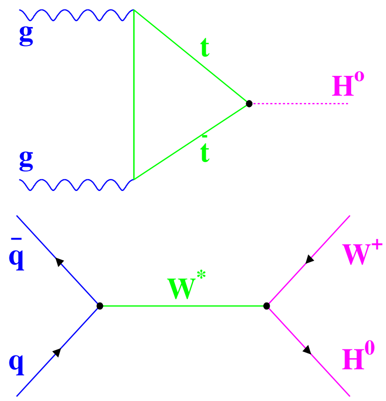


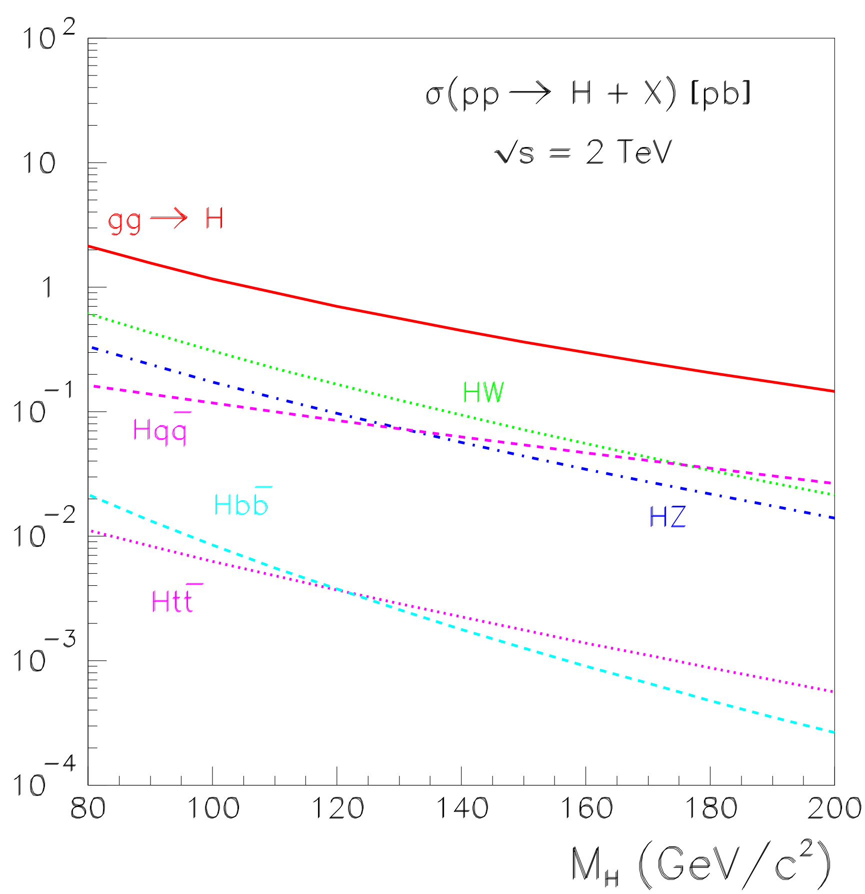
Introduction and motivation

- Motivation for Tevatron: Quite obvious from the LEP candidates, very important to look for Higgses in the 115-120 GeV region, and we also need to have different ways to see the Higgs at Tevatron since this search will be hard...

- LHC: Clearly, the golden accelerator the see the Higgs, but more difficult in the low mass region ($\gamma\gamma$ region). The mass measurement using diffractive events may be very important using the resolution coming from roman pot detectors.

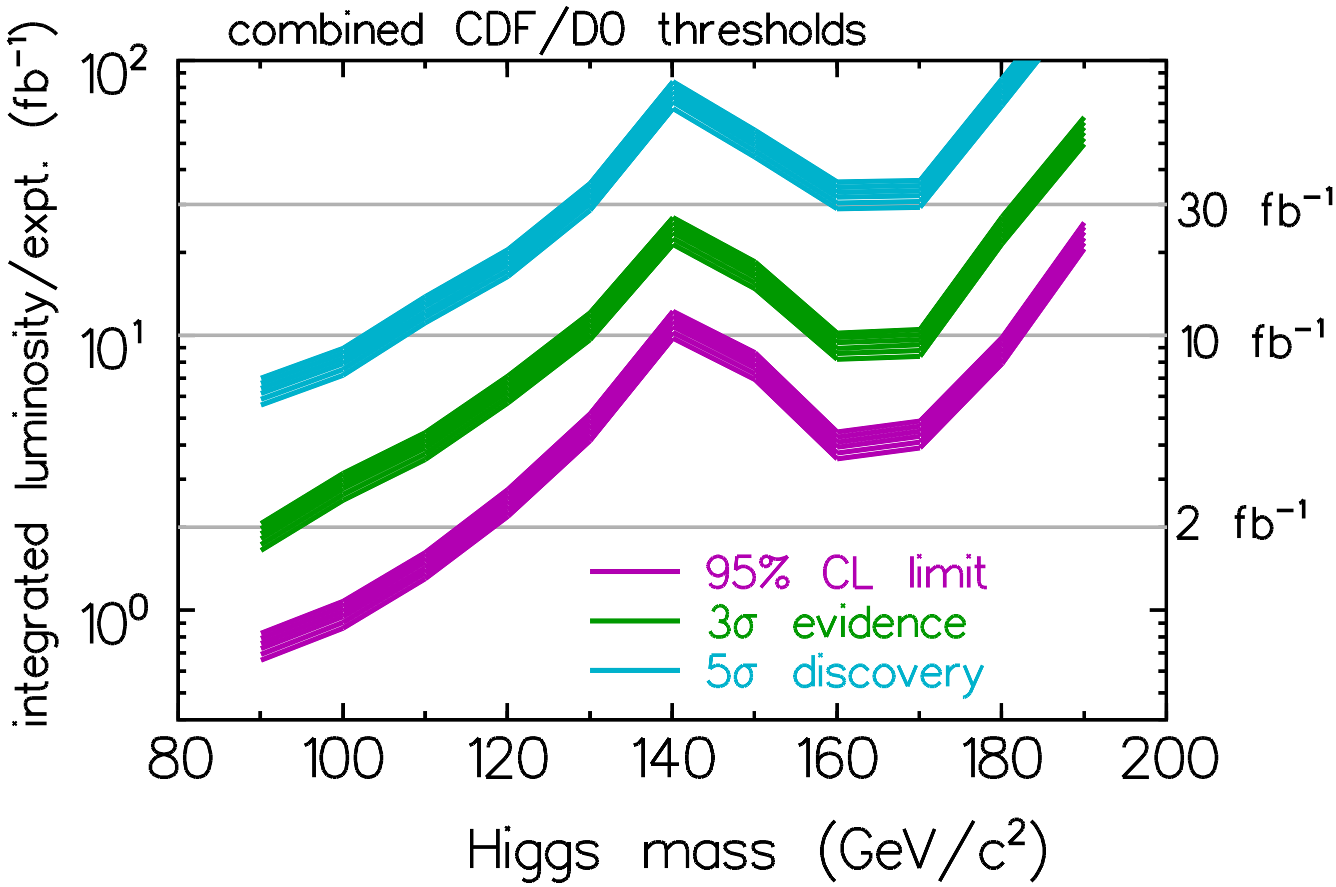
SM Higgs cross section at Tevatron





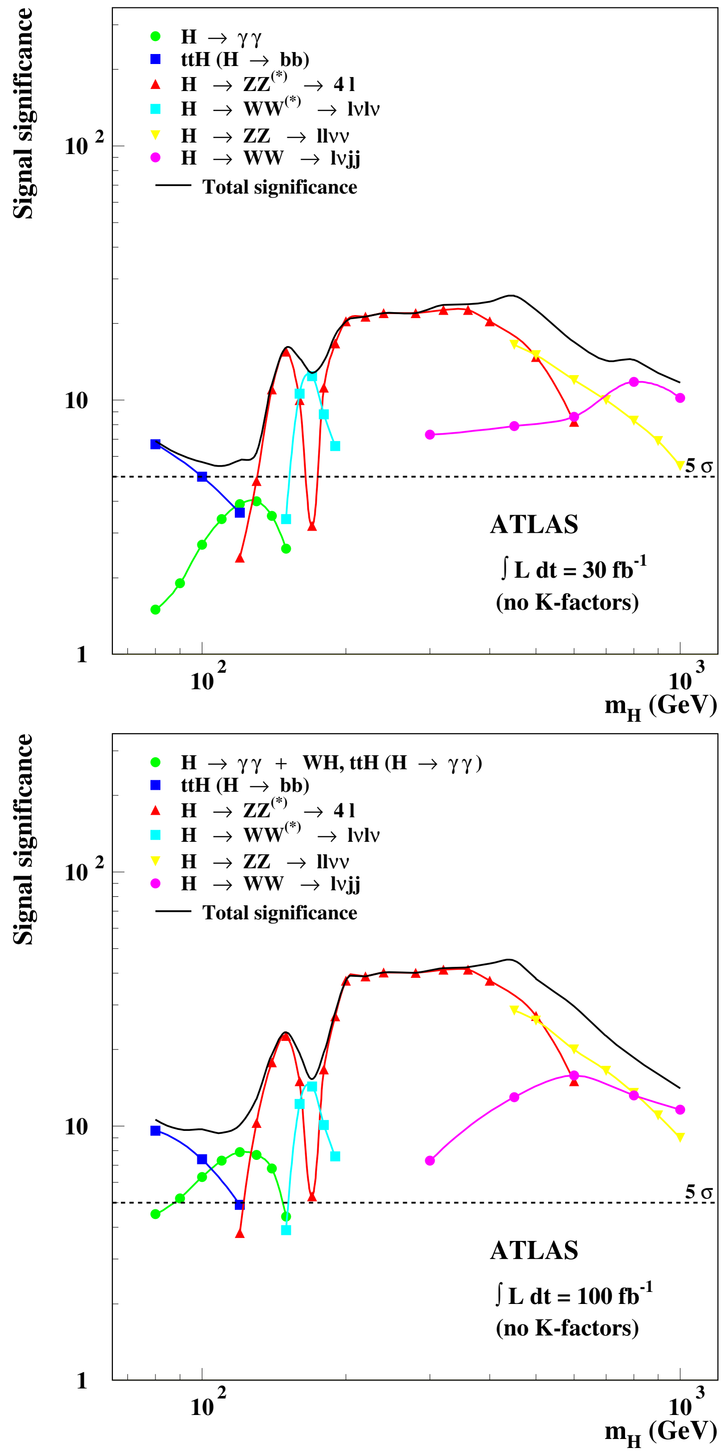
Expectation at Tevatron

Tevatron: Expected luminosity of 2 fb^{-1} before 2004, and 15 fb^{-1} per experiment before the start of LHC

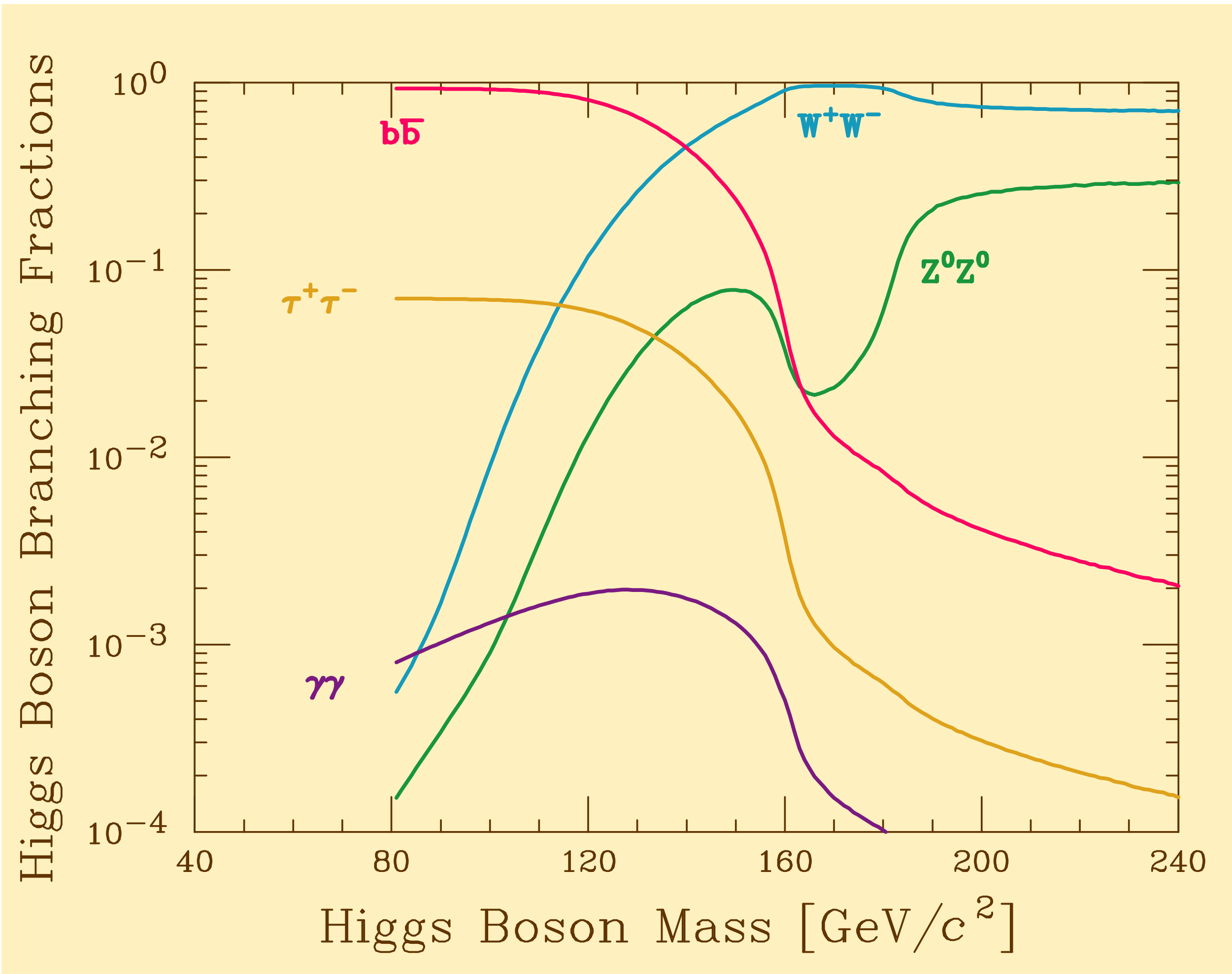


(Assumes 10% $m_{b\bar{b}}$ resolution, neural network analysis for $H \to b\bar{b}$ channel, conservative treatment of QCD background)

Expectation at LHC



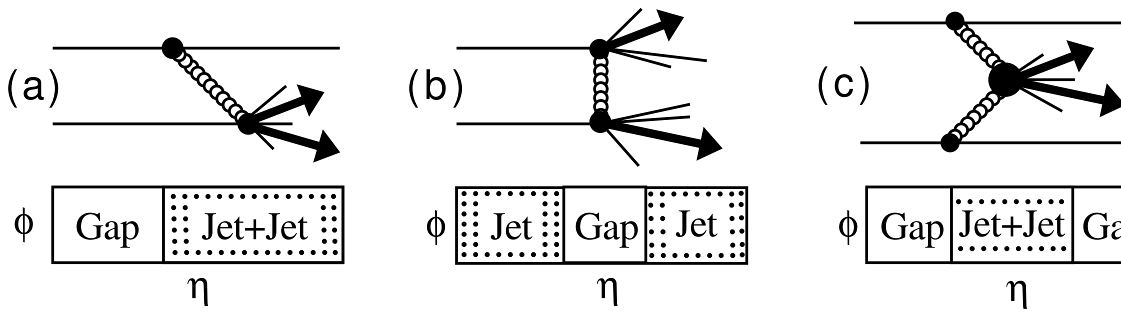
SM Higgs decay



Low masses: $b\bar{b}$ and $\tau\tau$ dominate

High masses: WW dominates

Diffraction at Tevatron/LHC

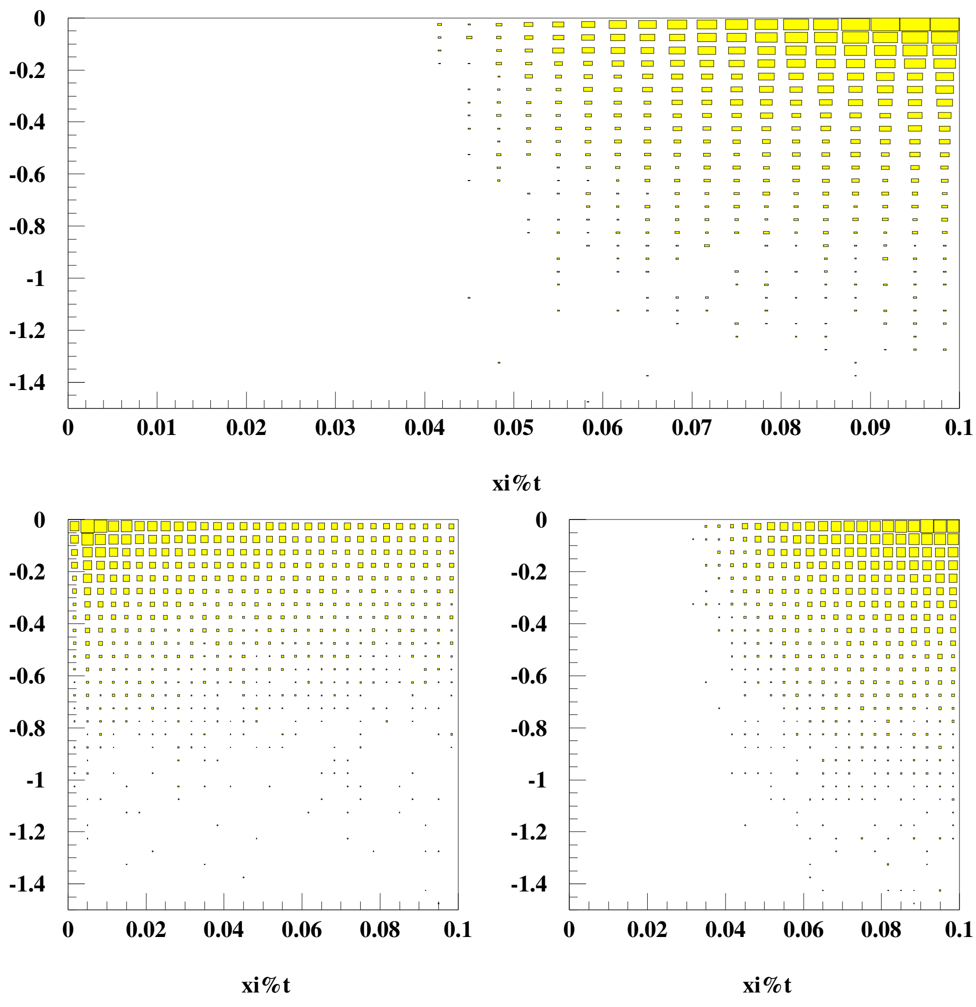


Kinematic variables

- t: 4-momentum transfer squared
- ξ: proton fractional momentum loss (momentum fraction of the proton carried by the pomeron)
- $\beta = x_{Bj}/\xi$: Bjorken-x of parton inside the pomeron
- $M^2 = s\xi$: diffractive mass produced
- $\Delta y \sim \Delta\eta \sim \log 1/\xi$: rapidity gap

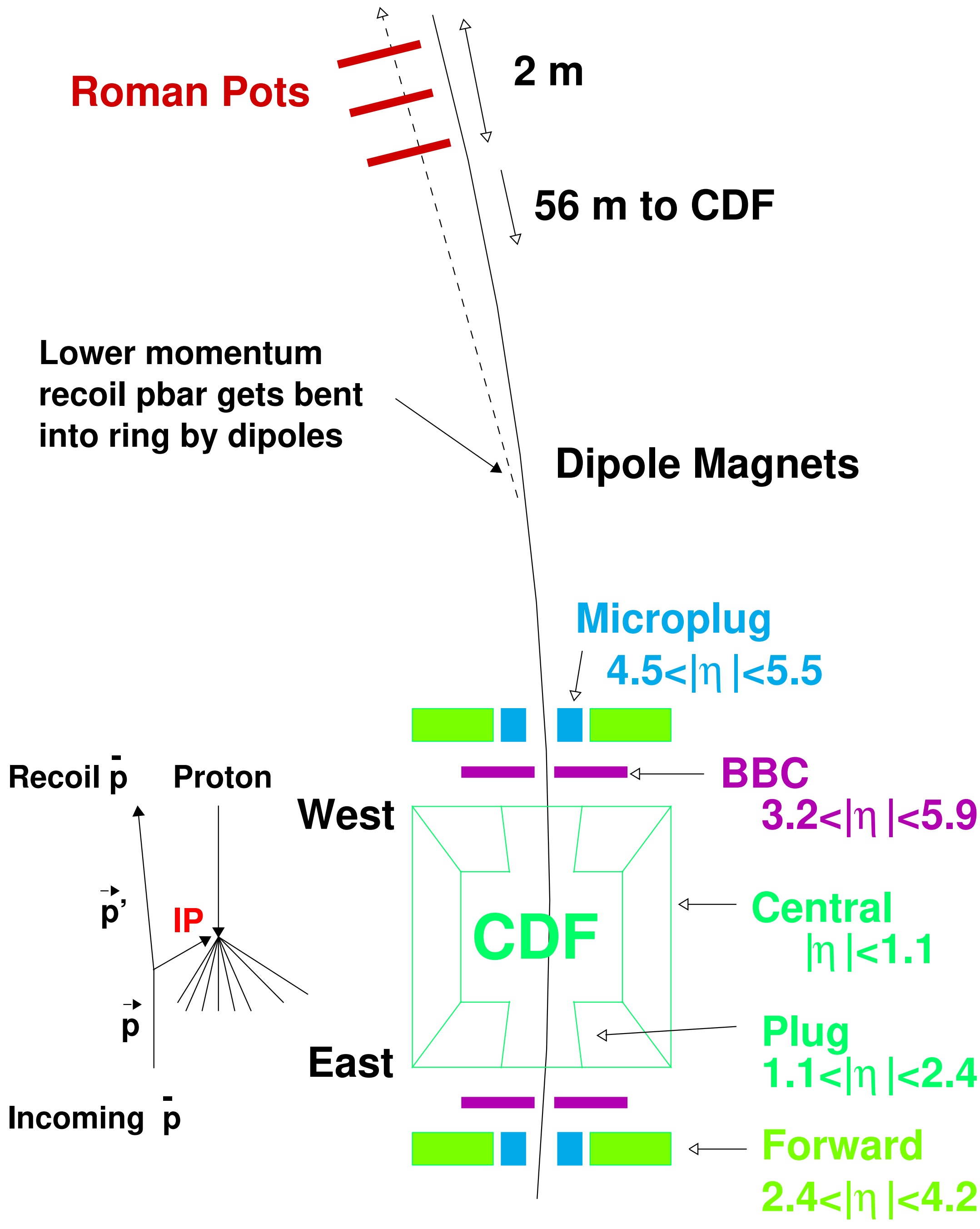
Kinematics

ξ vs t for Tevatron ($M_H = 120$ GeV) and LHC ($M_H = 120, 800$ GeV)

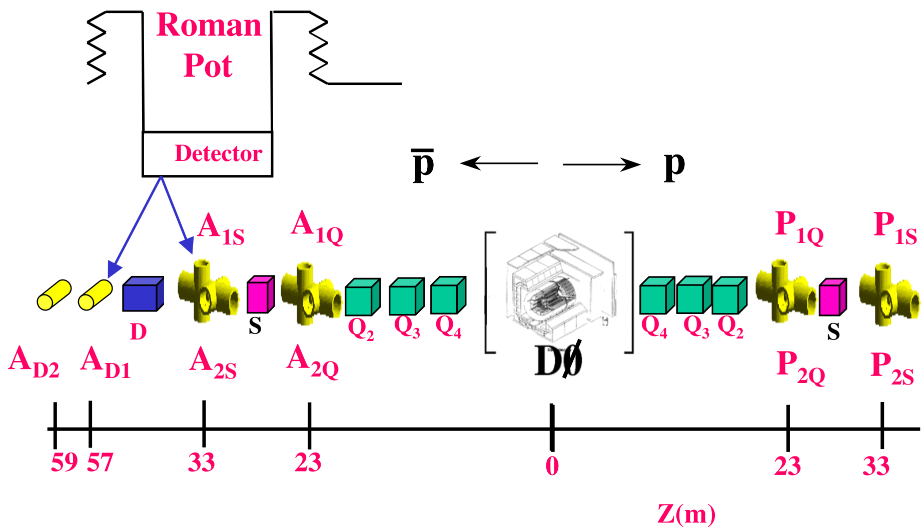


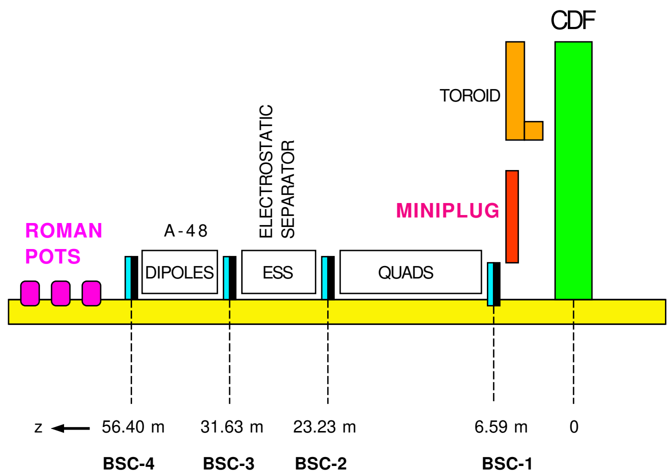
Conclusion: needs acceptance at low t, and high ξ (Tev.) and both low and high ξ (LHC)

Measurement of leading proton



Roman pot detectors from D0 and CDF



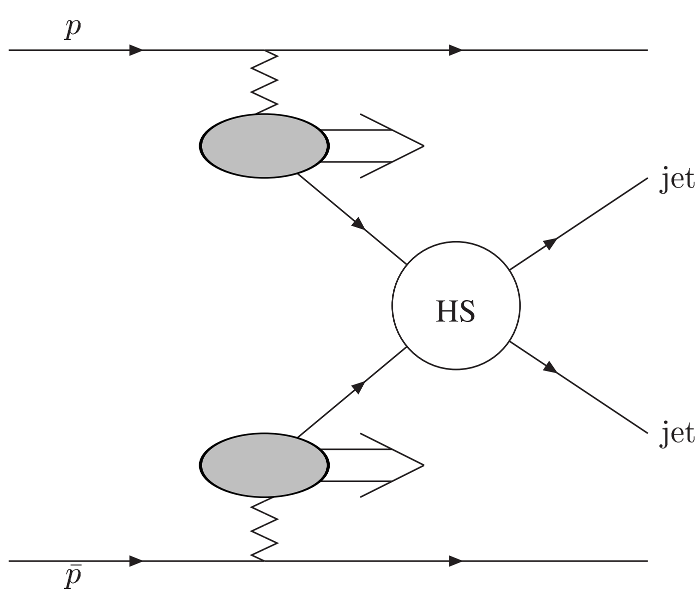


Conclusion: "Dipole" pots needed on both side if one wants a good acceptance at low t (CDF and D0 have them on one side only now)

Proton or pomeron induced models?

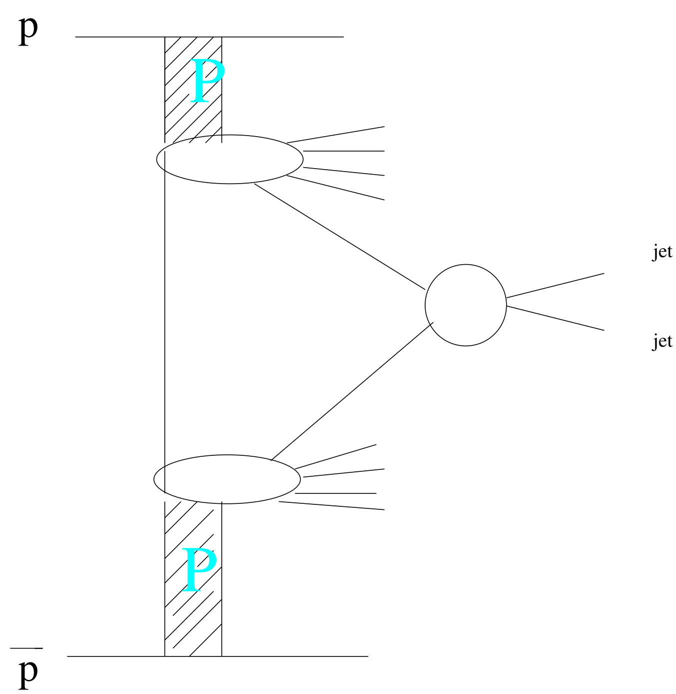
Diffractive dijet, photon, Higgs... production:

- Pomeron induced models: use of the gluon density in the pomeron convoluted with the hard subprocess (dijets, Higgs...) cross section. We distinguish in the following:
  - Factorizable models: Take the parameters from the HERA measurement, and apply them to the Higgs search at Tevatron



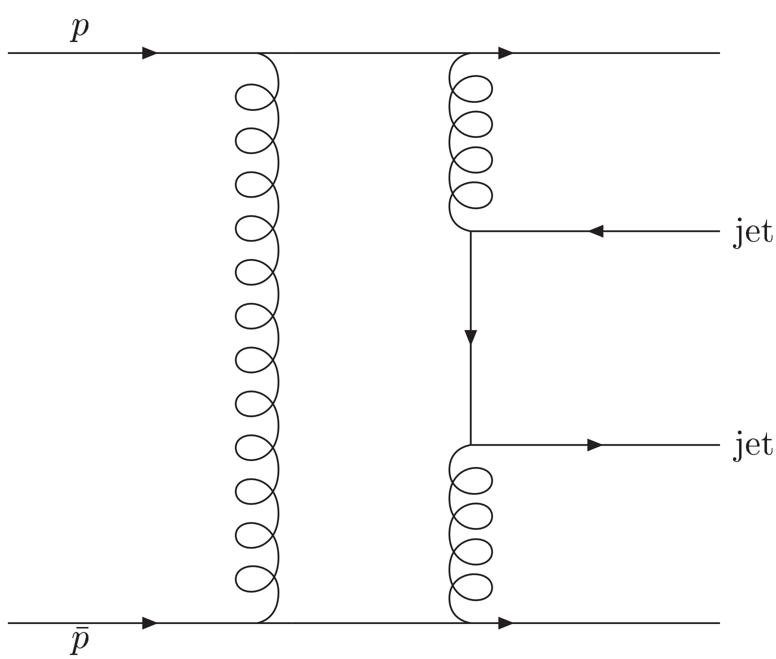
Proton or pomeron induced models?

– Non-factorizable models: Take the hadron-hadron "usual" cross section convoluted with the parton distributions in the pomeron



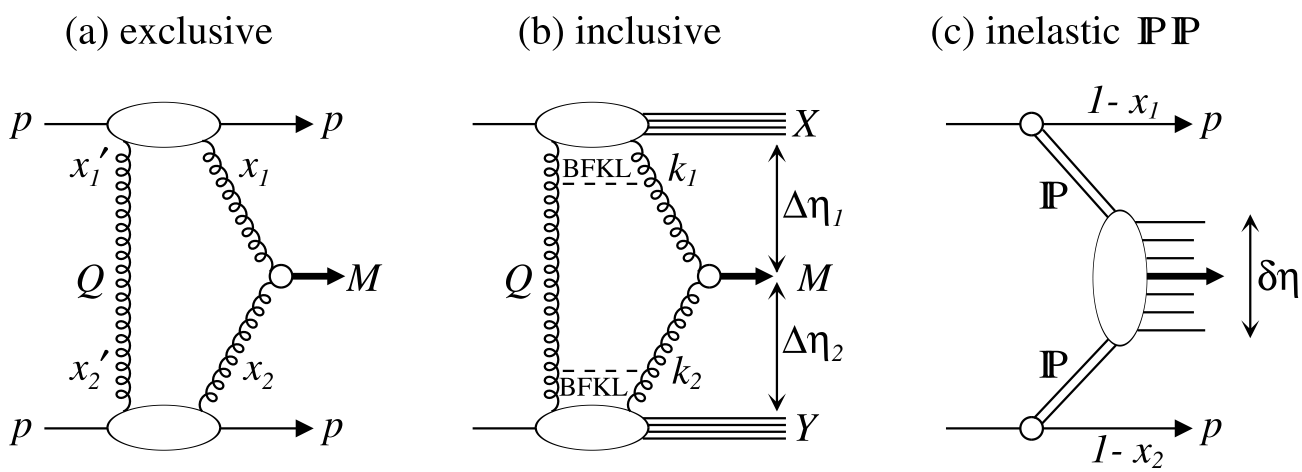
Proton or pomeron induced models?

- Proton induced models: perturbative calculation of the process using the gluon density in the proton



Proton induced models

V.Khoze, A.Martin, M.Ryskin, hep-ph/0002072, hep-ph/0111078, hep-ph/0104230



Two kinds of signal to be considered:

- "Exclusive signal": $p\bar{p} \to p\ gap\ H\ gap\ \bar{p}$
- "Inclusive signal": $p\bar{p} \to X\ gap\ H\ gap\ Y$

Exclusive and inclusive signals

- Production amplitude for the "exclusive" process:

  $$M \sim \int \frac{dQ_T^2}{Q_T^4} e^{-S(Q_T^2, M_H^2)} f(x_1, Q_T^2) f(x_2, Q_T^2)$$

  where f is the unintegrated gluon density in the proton, and S the Sudakov form factor which is the probability *not* to emit bremsstrahlung gluons in the interval $Q_T \leq p_T \leq M_H/2$ (a rapidity gap is required between the Higgs and the proton).

- "Inclusive" Higgs production: The initial protons may break up, the transverse momentum of the Higgs is no longer limited by the proton form factor and the Sudakov suppression is weaker.

- Hard process: This amplitude must be convoluted with the hard process (Higgs, dijet... production)

Higgs production at Tevatron

Exclusive and inclusive Higgs production cross section (in fb) for rapidity gap $\Delta\eta = 2$ or $\Delta\eta = 3$.

M_H	σ_{excl}	σ_{incl} $\Delta\eta = 2$	σ_{incl} $\Delta\eta = 3$
100	0.07	1.1	0.09
120	0.03	0.62	0.05
140	0.02	0.28	0.03
160	0.008	0.25	0.02

Conclusion: Almost impossible for Tevatron...
A gap survival probability of 0.1 is assumed (to take into account soft gluon emission which kills the gap after the hard diffractive interaction).

Higgs production at LHC

Exclusive and inclusive Higgs production cross section (in fb) for rapidity gap $\Delta\eta = 2$ or $\Delta\eta = 3$. A gap survival probability of 0.1 is assumed.

M_H	σ_{excl}	σ_{incl} $\Delta\eta = 2$	σ_{incl} $\Delta\eta = 3$
100	2.4	49	5.5
120	1.4	36	3.9
140	0.9	28	2.9
160	0.55	21	2.3

Conclusion: Feasible at LHC provided the gap survival probability is not much smaller

Remarks on proton induced models

- "Exclusive" cross sections: Unfortunately, this is an ideal case with a very low cross section. We cannot suppress totally QCD radiation and this is why it will be hard to search for these events (it is as if one is looking for partonic events without QCD).

- Rapidity gaps: Required both for inclusive and exclusive final states. The price to pay is an exponential Sudakov form factor to suppress QCD radiation and so a low cross section.

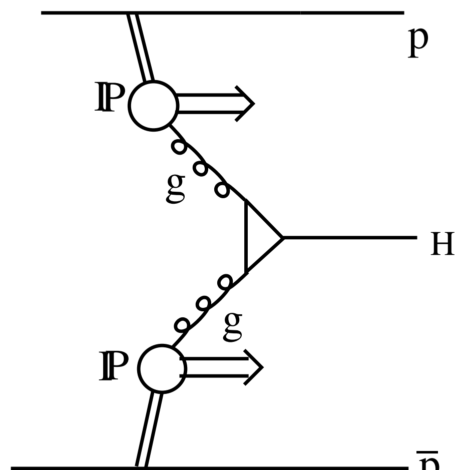
- Gluon density: The gluon density from the proton is used, assumes a similarity between diffraction and standard QCD events (no QCD substructure such as a "pomeron").

Remarks on proton induced models

- Rapidity gap: Two effects will "pollute" the rapidity gaps at Tevatron (and further more at LHC): hadronisation effects, and pile-up events which fill in gaps. The rapidity gap requirement will work only at low luminosity (one interaction per bunch crossing).

- Generator and full simulation needed: Up to now, there is no generator associated with this model, and there is no way to compare with the CDF diffractive dijet measurement performed at Run I. It would be quite nice to include it in one of the generators used in D0/CDF and later on at LHC.

Pomeron induced models - The factorizable case



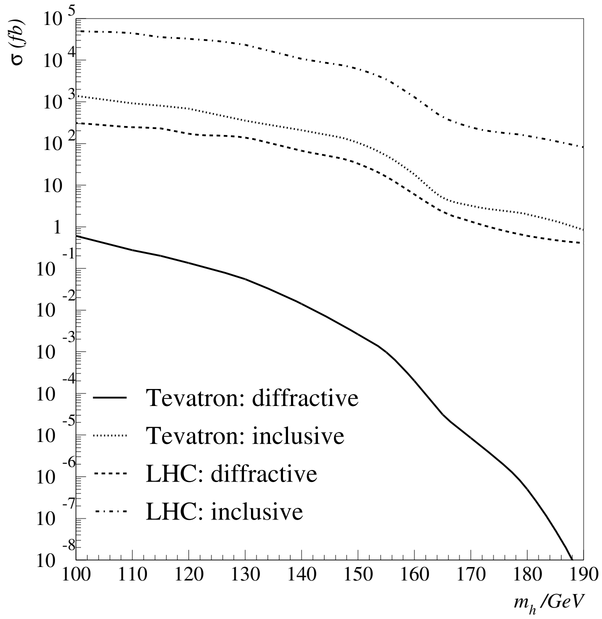
- Cross section to produce Higgs boson where the incoming hadrons lose a fraction of their momenta less than ξ_{max}

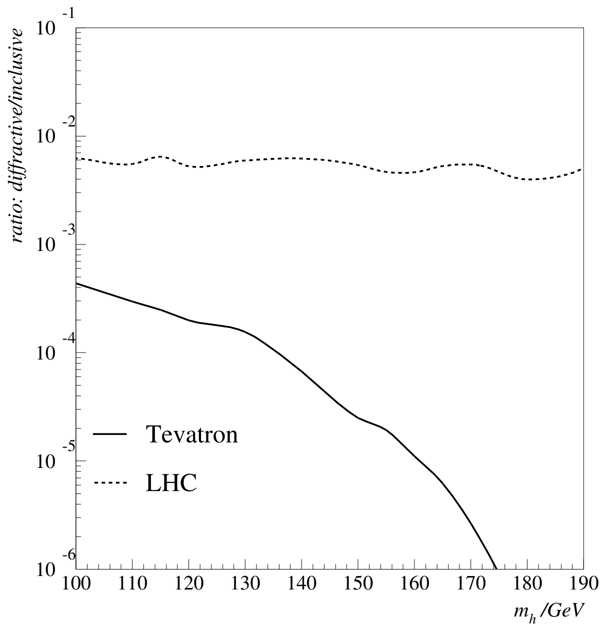
$$\sigma \sim \int_{\tau}^{1} \frac{dx}{x} g_1(x, m_h^2) g_2(x, m_h^2)$$

$$g_i(x, Q^2) = \int_{x}^{\xi_{max}} d\xi_i f_P(\xi_i) g_P(x/\xi_i, Q^2)$$

- Gluon density taken from H1 F_2^D fits
- Ref: B.Cox, J.Forshaw, B.Heinemann, hep-ph/0110173
  R.Appleby, J.Forshaw, hep-ph/0111077

Cross section results for Tevatron and LHC





Cross section results for Tevatron and LHC

- Predictions for Tevatron

  The gap survival probability (GSP) is here taken to be 0.1.

Process	(1)	(2)	(3)	(4)
$H \to b\bar{b}$	726.5	0.19	0.21	0.02
$H \to WW$	260	0.003	0.003	0.0003

$H \to b\bar{b}$: 115 GeV

$H \to WW$: 160 GeV

(1): σ incl (fb)

(2): σ Pom. (fb)

(3): σ Pom.+Reg. (fb)

(4): σ * GSP (fb)

- Predictions for LHC

	(1)	(2)	(3)
$H \to b\bar{b}$	37660	176	276
$H \to WW$	19050	97	133

$H \to b\bar{b}$: 115 GeV

$H \to WW$: 160 GeV

(1): σ incl (fb)

(2): σ Pom. (fb)

(3): σ Pom.+Reg. (fb)

NB: Gap survival probability not applied, unknown for LHC

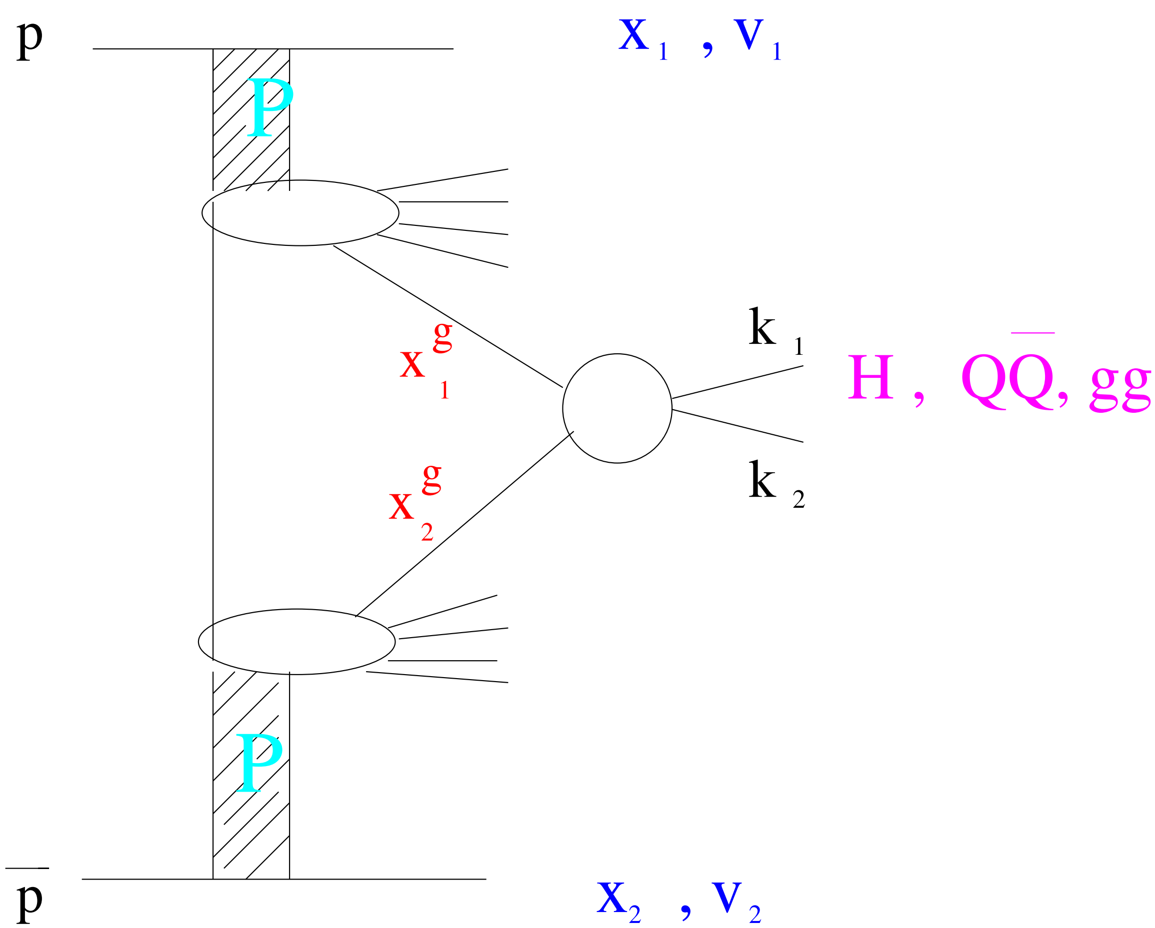
- Conclusion: Interesting process for LHC, hopeless for Tevatron...

Remarks on factorizable models

- Breaking of factorization: It is known theoretically that factorization is broken (Collins). Experimentally, it is also known that factorization is broken (CDF, D0) (at HERA, one gets about 10% of diffractive events and at Tevatron about 1% with rapidity gaps).
- How does this model take this into account? Using the gap survival probability which kills the gaps (0.1-0.15)
- Question? Can we still use the HERA parameter (the pomeron intercept for instance at 0.2) saying that the hard interaction is of the same kind, or do we need more a usual hadron-hadron approach with a low value of the intercept (0.08)?

Pomeron induced model - Non-factorizable case

M.Boonekamp, R.Peschanski, C.Royon,
hep-ph/0107113, Phys.Rev.Lett. 87 (2001) 251806



The idea of the model: Take the usual hadron-hadron cross section to produce the hard scattering (Higgs, dijets, $\gamma\gamma$) and convolute it with the parton densities inside the pomeron

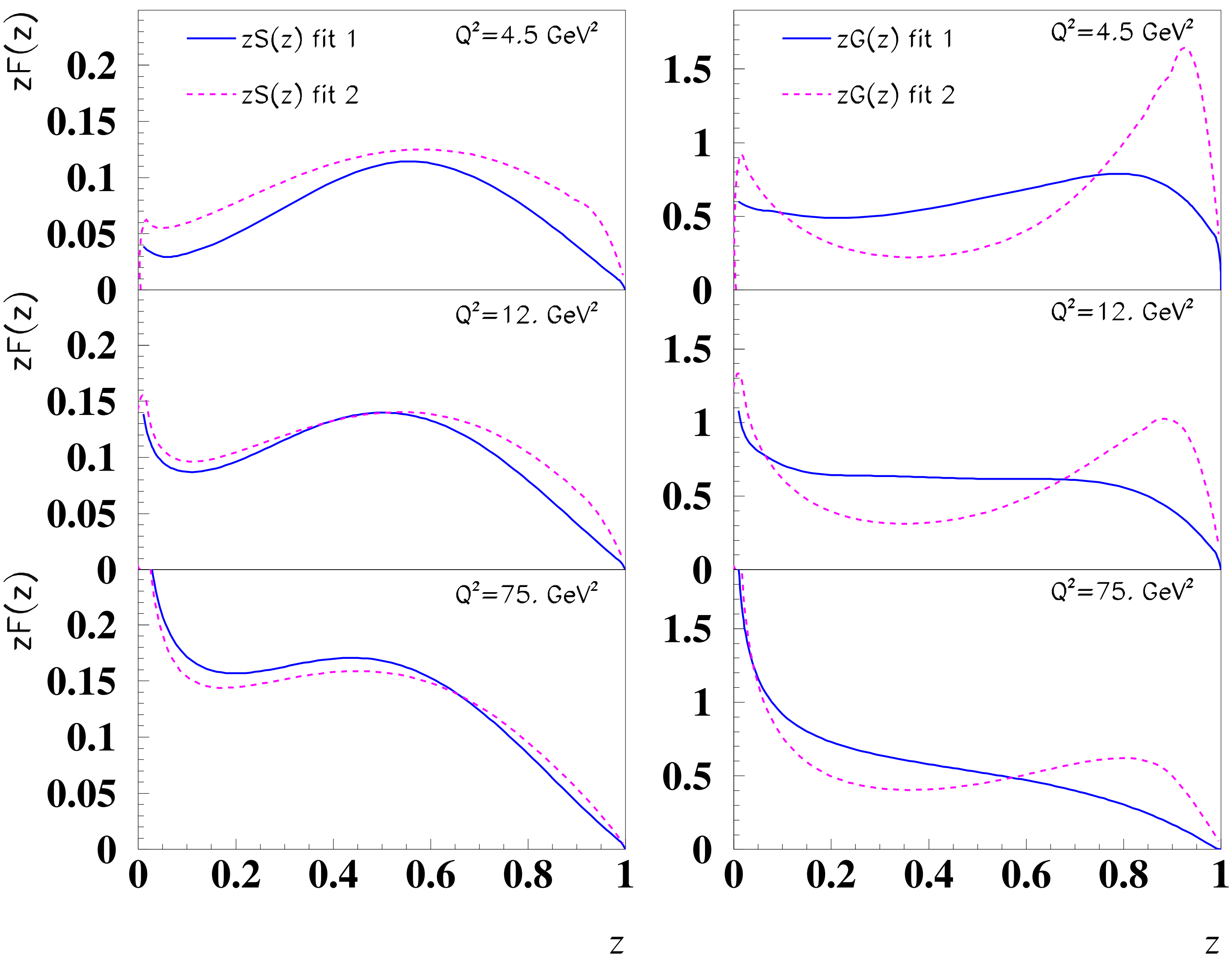
Inclusive cross section- The hadron-hadron part

- Starting point: double pomeron exchange: Bialas-Landshoff for Higgs cross section, and Bialas-Szeremeta-Janik for dijet production: $p\bar{p} \to p\bar{p}H$ and $p\bar{p} \to p\bar{p}q\bar{q}$
- Higgs:

$$\sigma_H \sim \left(\frac{s}{M_H^2}\right)^{2\epsilon} \frac{1}{x_1}\frac{1}{x_2}\,\delta\left((1-x_1)(1-x_2)-\frac{M^2}{s}\right)$$
$$(1-x_1)^{2\alpha' v_1^2}(1-x_2)^{2\alpha' v_2^2}\exp\left(-2\lambda(v_1^2+v_2^2)\right)$$

where:
$\alpha(t)=1.08+0.25t$ (α'=0.25) NB: This implies a factorisation breaking since we do not take the HERA parameters ($\alpha(t)=1.2+0.25t$)
x_i is the momentum fraction of the proton
v_i their transverse momentum
k_i the outgoing jet momentum
$\lambda \sim 2$ GeV^2, the slope of the pomeron-proton coupling, compatible with the proton form factor in the Landshoff model

Gluon density in the pomeron



Detector simulation and acceptance

- Fast simulation (shw) of the CDF and D0 central detector
- Dijet CDF measurements
  - CDF Run I cuts: $\bar{p}$ tagged, $0.035 \leq \xi_{\bar{P}} \leq 0.095$, $|t| < 1$ GeV^2, $0.01 \leq \xi_p \leq 0.03$
  - CDF run I measurement: Total CDF cross section: $\sigma \sim 43.6$ nb,
  - Pomeron induced model: $\sigma \sim 11.5$ nb - (Gluon shape determined in H1, not the absolute normalization)
  - Conclusion: Numbers of the pomeron induced models rescaled to the CDF measurement (factor 3.8) (Estimation of a factor 2 uncertainty due to precision on cuts, fast MC used)

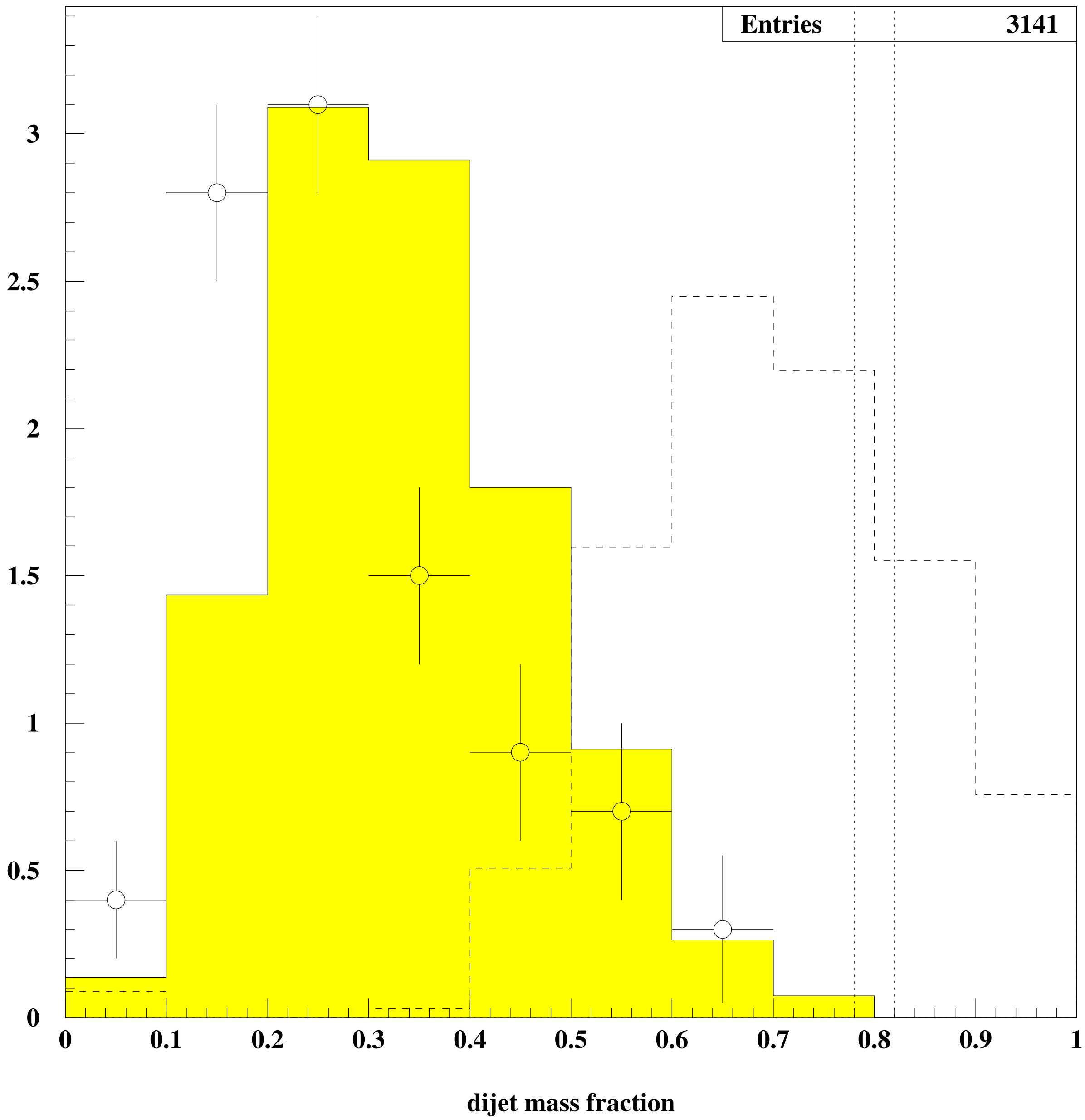
Detector simulation and acceptance

- Resolution and acceptance for Higgs predictions (assumes double tagged events in dipole roman pot detectors):
  ξ resolution: 0.2 %
  t resolution: $0.1\sqrt{t}$
  ξ acceptance: 100% if $\xi > 0.04$, 0% if $\xi < 0.01$, linear between 0 and 100% if $0.01 < \xi < 0.04$
  t acceptance: $|t| \leq 0.5$ GeV^2

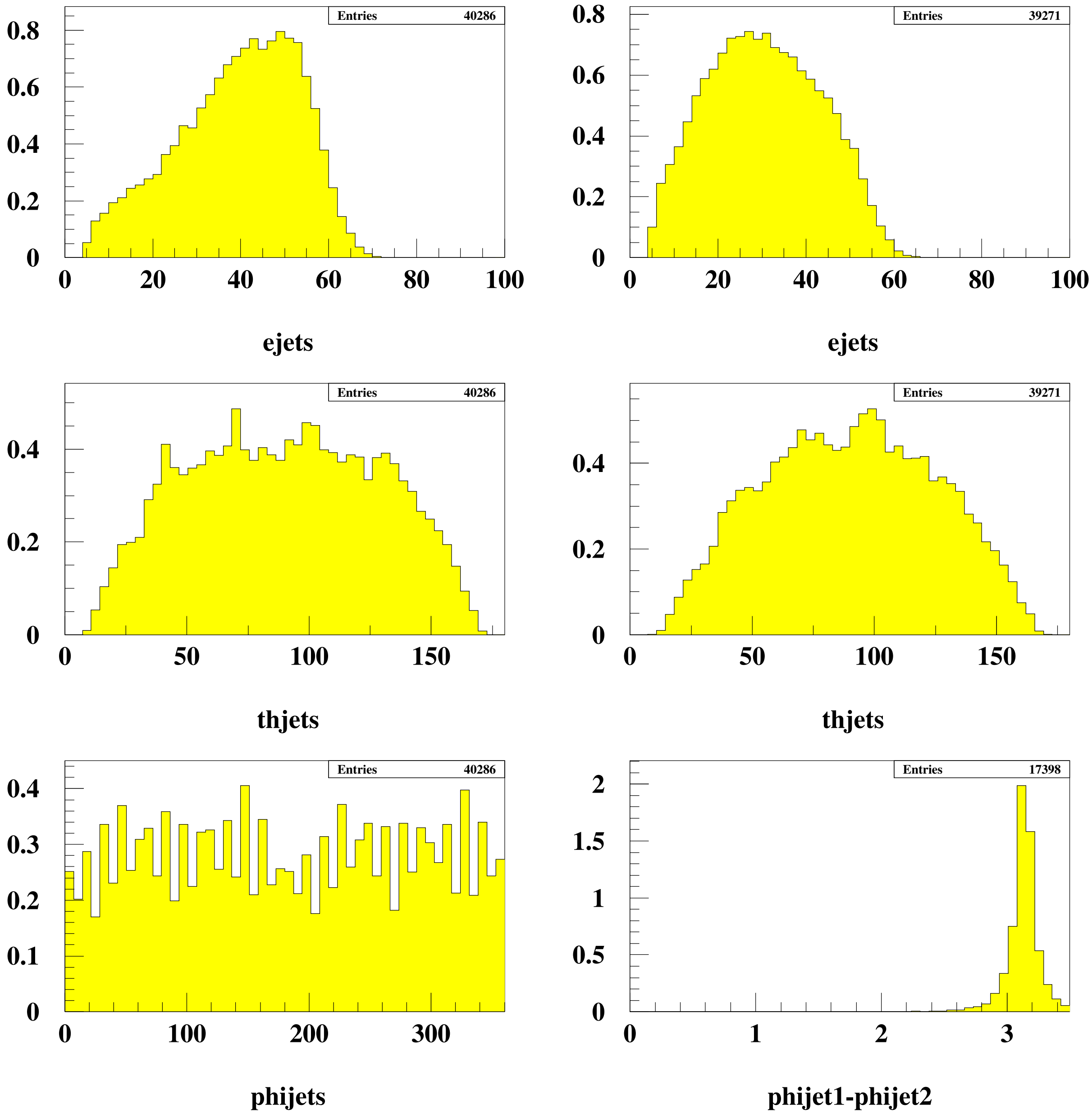
CDF dijet mass fraction

- Yellow: xG + diquarks with radiation (fully simulated)
- Dashed line: xG + diquarks without pomeron structure function (bare hadron-hadron cross section) (fully simulated)
- Dotted line: xG + diquarks without pomeron structure function (bare hadron-hadron cross section) (generator level)
- Conclusion: The QCD radiation and the parton densities in the pomeron are needed as expected..., good description of CDF data. The dijet mass fraction is sensitive to the gluon distribution inside the pomeron.

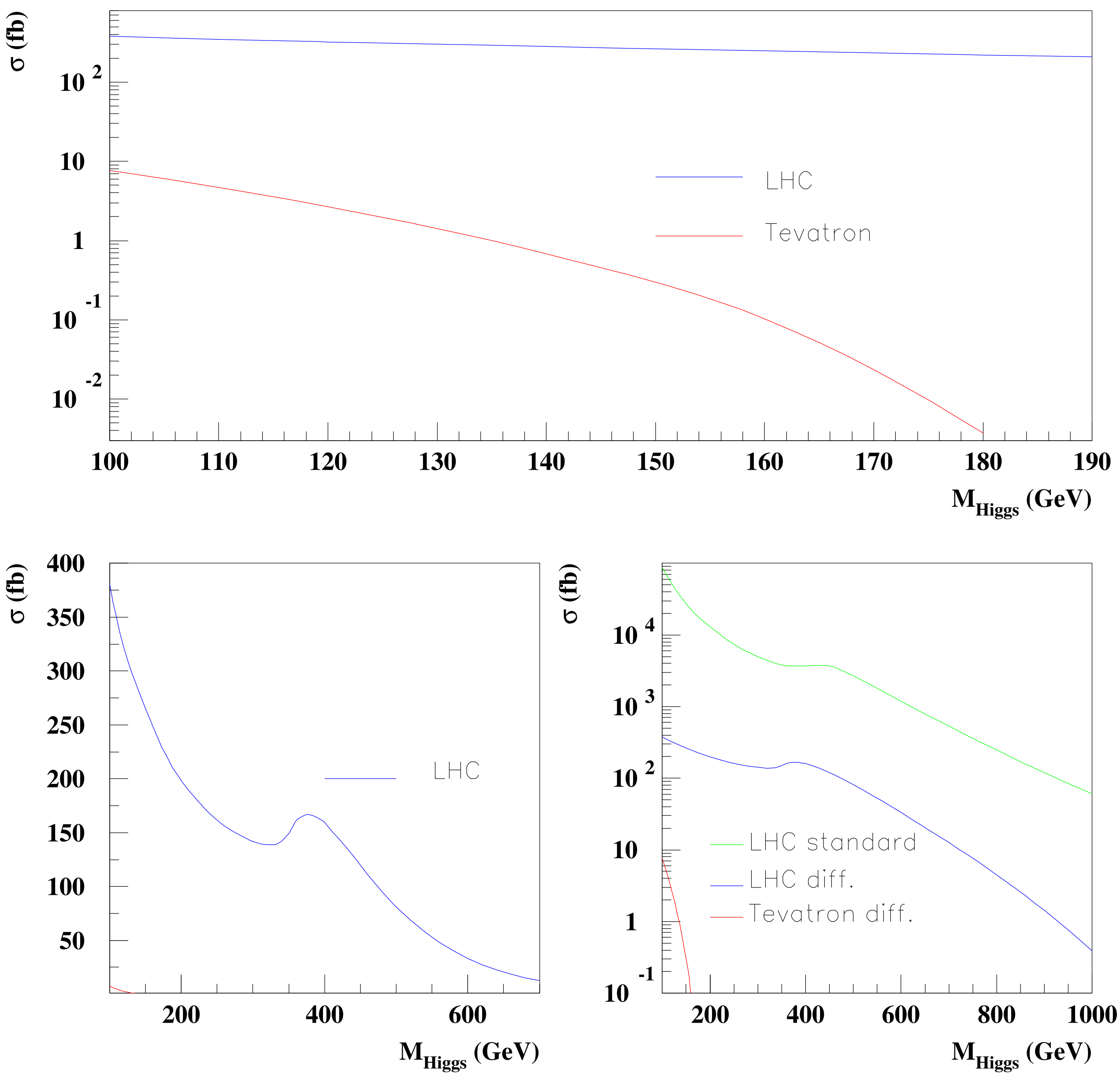
CDF dijet mass fraction



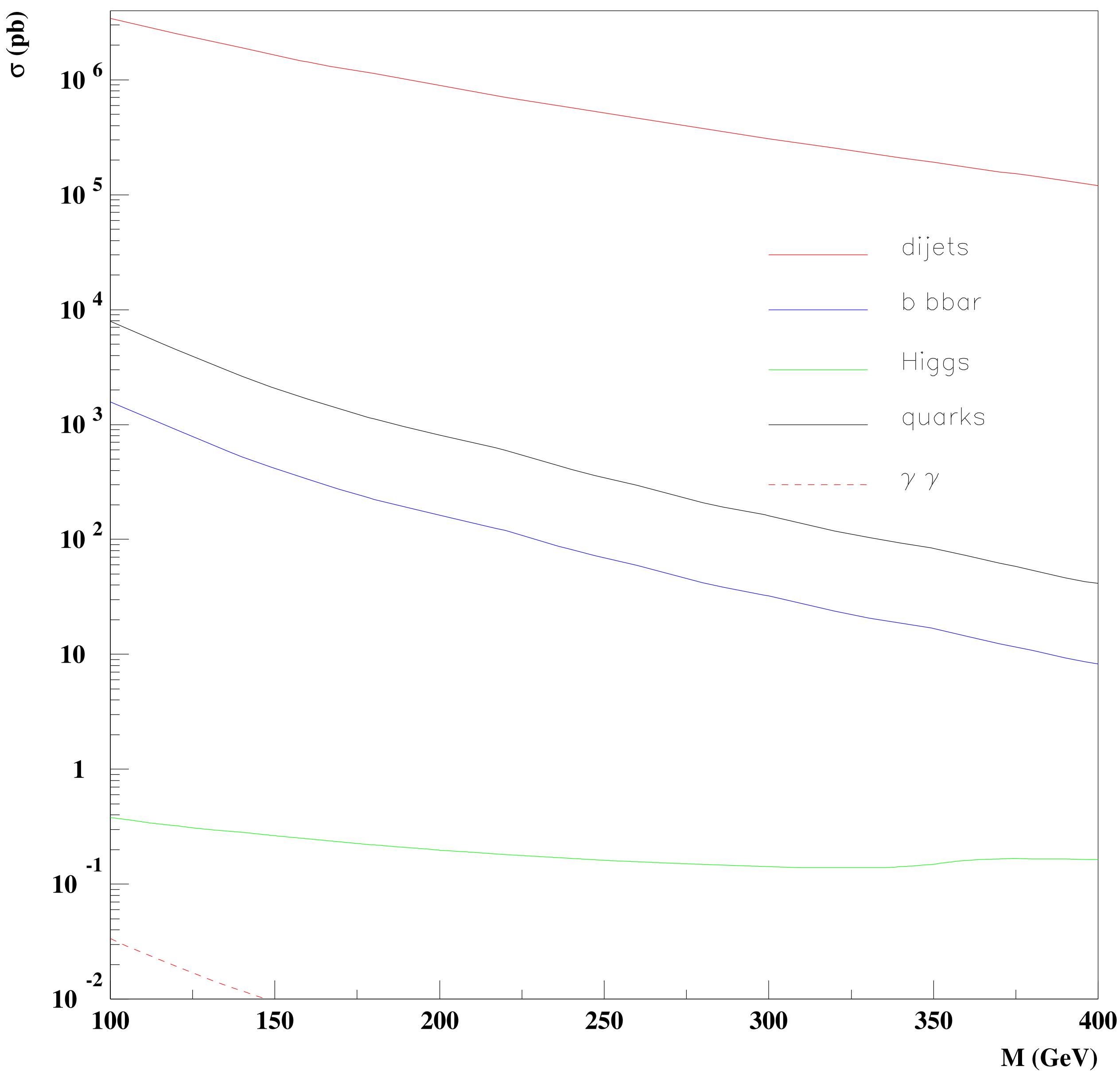
Energy and angle distributions for Higgs



Tevatron and LHC cross sections



LHC cross sections



Number of Higgs events for $1 fb^{-1}$ after shw (Tev.)

M_{Higgs}	(1)	(2)	(3)	(4)	(5)
100	7.7	5.2	1.6	0.5	0.0
110	4.7	2.9	1.3	0.3	0.1
120	2.7	1.5	0.8	0.1	0.3
130	1.4	0.6	0.4	0.0	0.4
140	0.6	0.1	0.1	0.0	0.3

- (1): generator level
- (2): detected in roman pots ($b\bar{b}$ channel)
- (3): + at least two jets of 30 GeV p_T
- (4): τ channel
- (5): W^+W^- channel
- $H \rightarrow \tau^+\tau^-$ and $H \rightarrow W^+W^-$ at high mass with almost no background
- Conclusion: difficult at Tevatron, but large uncertainties

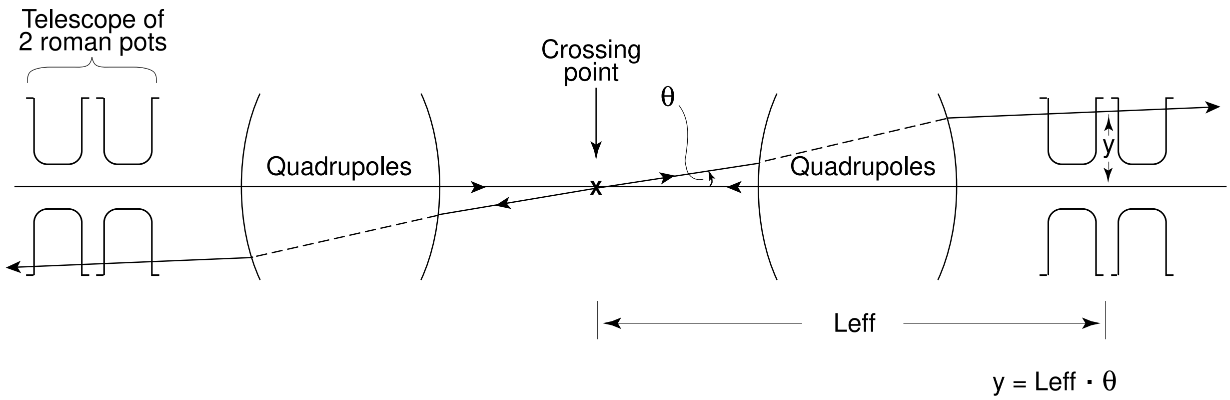
LHC: Case of CMS collaboration

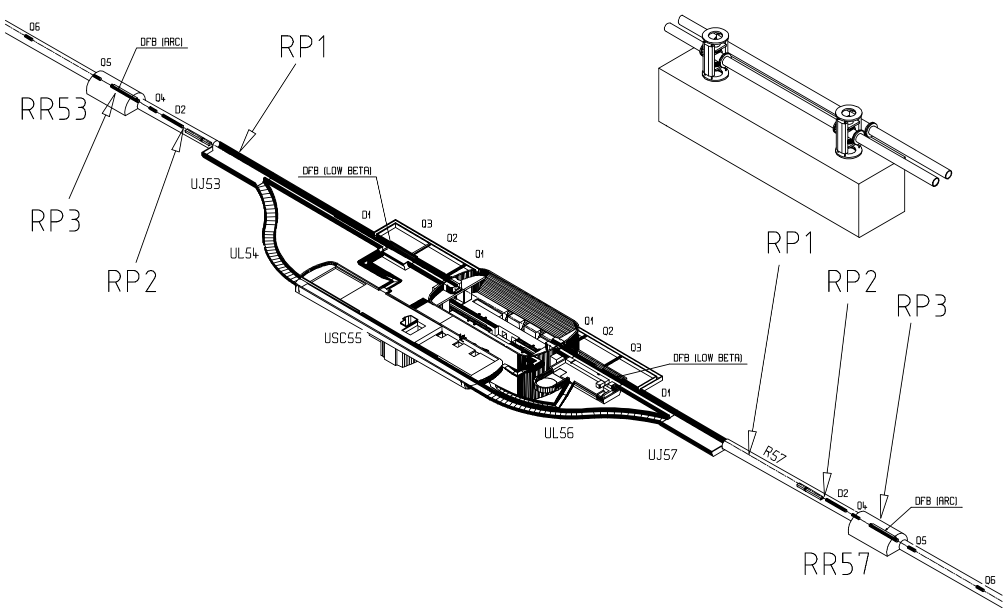
CMS: 3 different options to implement roman pot detectors

- (1) 140-180 meter pots (standard TOTEM) $|t| < 1.5$ GeV^2, $\xi > 0.02$
- (2) 240 meter pots (addition in warm section), and TOTEM $|t| < 2$ GeV^2, $\xi > 0.01$
- (3) 425 meter pots (cold section) $|t| < 2$ GeV^2, $0.002 < \xi < 0.02$
- (4) All pots $|t| < 2$ GeV^2, $\xi > 0.002$

LHC/CMS: Totem

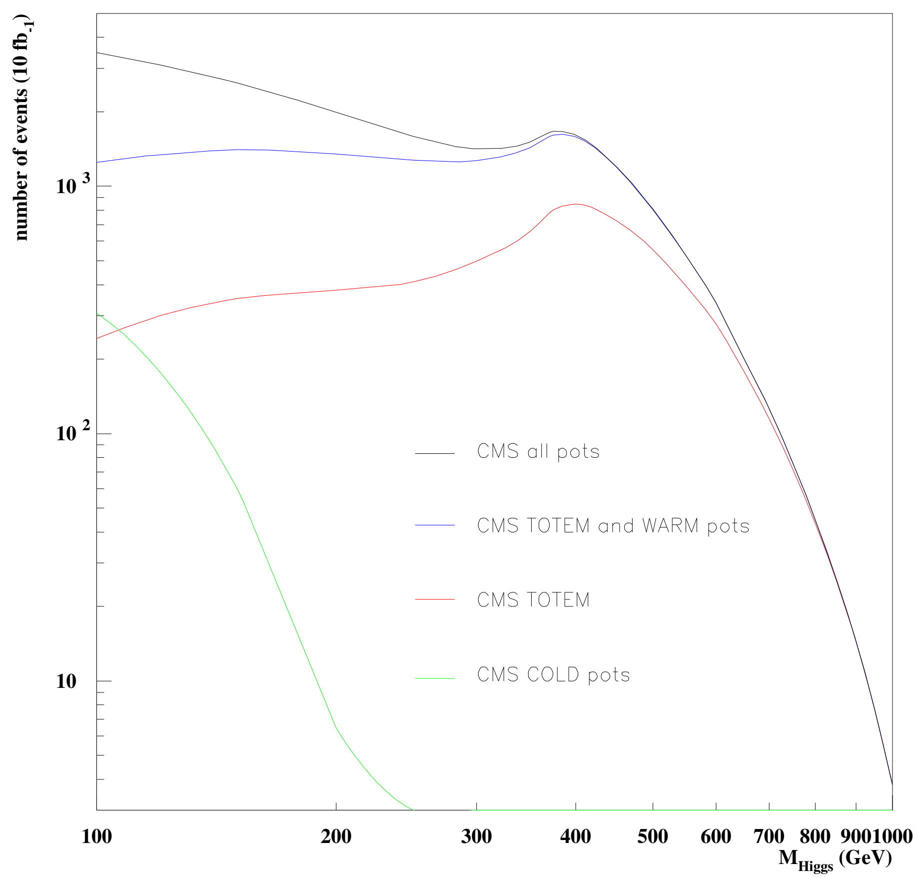
Proton spectrometers close to the CMS detector





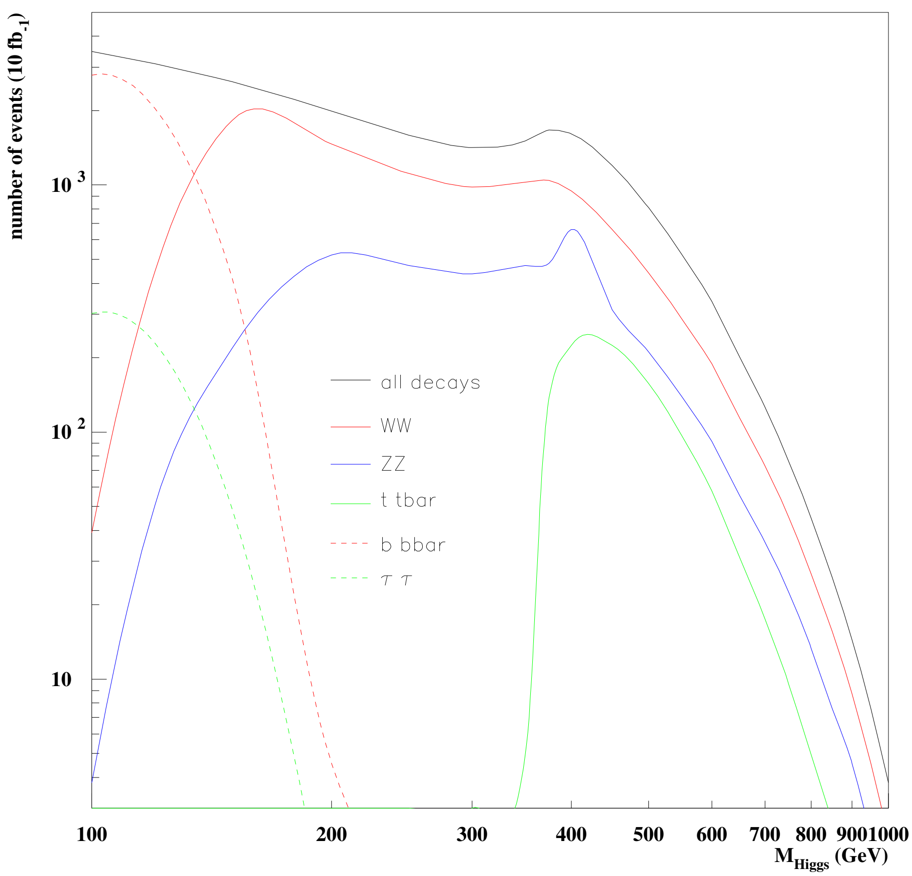
LHC: cross sections

Number of double tagged events in the CMS roman pot acceptance (Lumi 10 fb^{-1})



LHC cross sections

Number of double tagged events in the CMS roman pot acceptance, and product decays of the Higgs boson



Number of Higgs events for $10 fb^{-1}$ (LHC)

M_{Higgs}	(1)	(2)	(3)	(4)	(5)	(6)
120	1073	681	76	149	16	0
150	879	139	16	609	74	0
200	665	1	0	490	174	0
300	473	0	0	328	146	0
375	558	0	0	349	161	46
500	271	0	0	147	71	52
700	42	0	0	24	11	6
1000	1.3	0	0	0.8	0.4	0.1

- (1): generator level
- (2): $b\bar{b}$ channel (detected in roman pot)
- (3): τ channel (detected in roman pot)
- (4): W^+W^- channel (detected in roman pot)
- (5): ZZ channel (detected in roman pot)
- (6): $t\bar{t}$ channel (detected in roman pot)

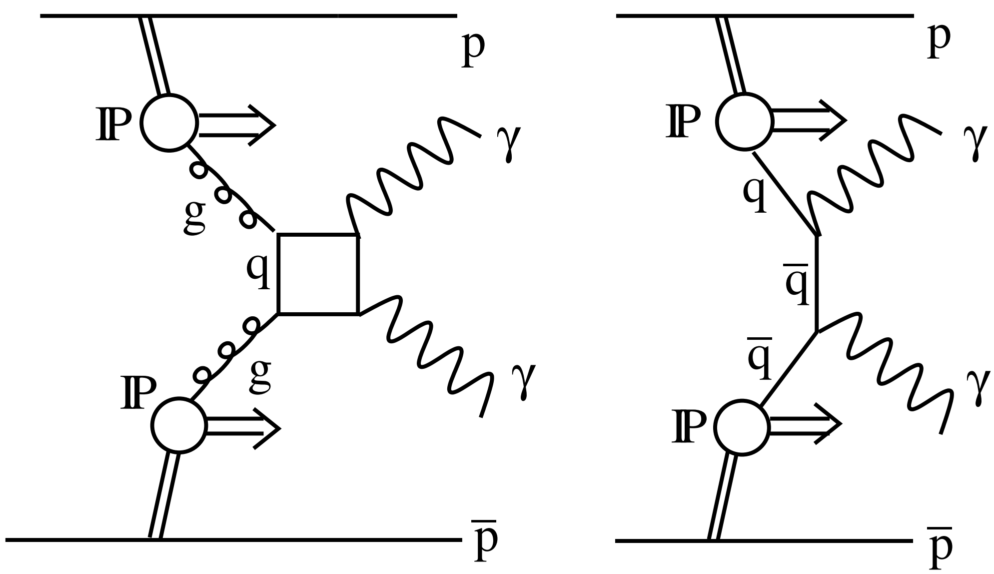
Remarks on the non-factorized model

- New generator: Ready to get diffractive events in double pomeron exchange, interfaced with pythia for hadronization
- Dijet cross section: scaled to the CDF Run I measurement
- Higgs prediction: Higgs decaying centrally in the main detector, low number of Higgs events at Tevatron, high number at LHC.
- Big uncertainty on the results: Results very sensitive on cuts (diffractive cuts, jet energy scale), and depends a lot on survival gap probability.
- Assumption: Take the usual hadron-hadron cross section, and in particular the low value of the pomeron intercept (0.08), this needs to be tested with data

How to distinguish between the different models?

First idea: measure the $\gamma\gamma$ cross section:

All models predict values for the $\gamma\gamma$ cross section which will be a test of the models.



How to distinguish between the different models?

Prediction for the factorisable - non factorisable models:

Process	(1)	(2)	(3)	(4)
$\gamma\gamma$ $E_t > 12$ $\eta < 2$	72477	266 289	1275	128
$\gamma\gamma$ $E_t > 7$ CDF cuts		684 690	1251	125
2 jets, $E_t > 7$ CDF cuts		$2.4\ 10^8$	$3.3\ 10^8$	$3.3\ 10^6$

1: σ incl (fb)

2: σ Pom. (fb)

3: σ Pom.+Reg. (fb)

4: σ * GSP (fb)

How to distinguish between the different models?

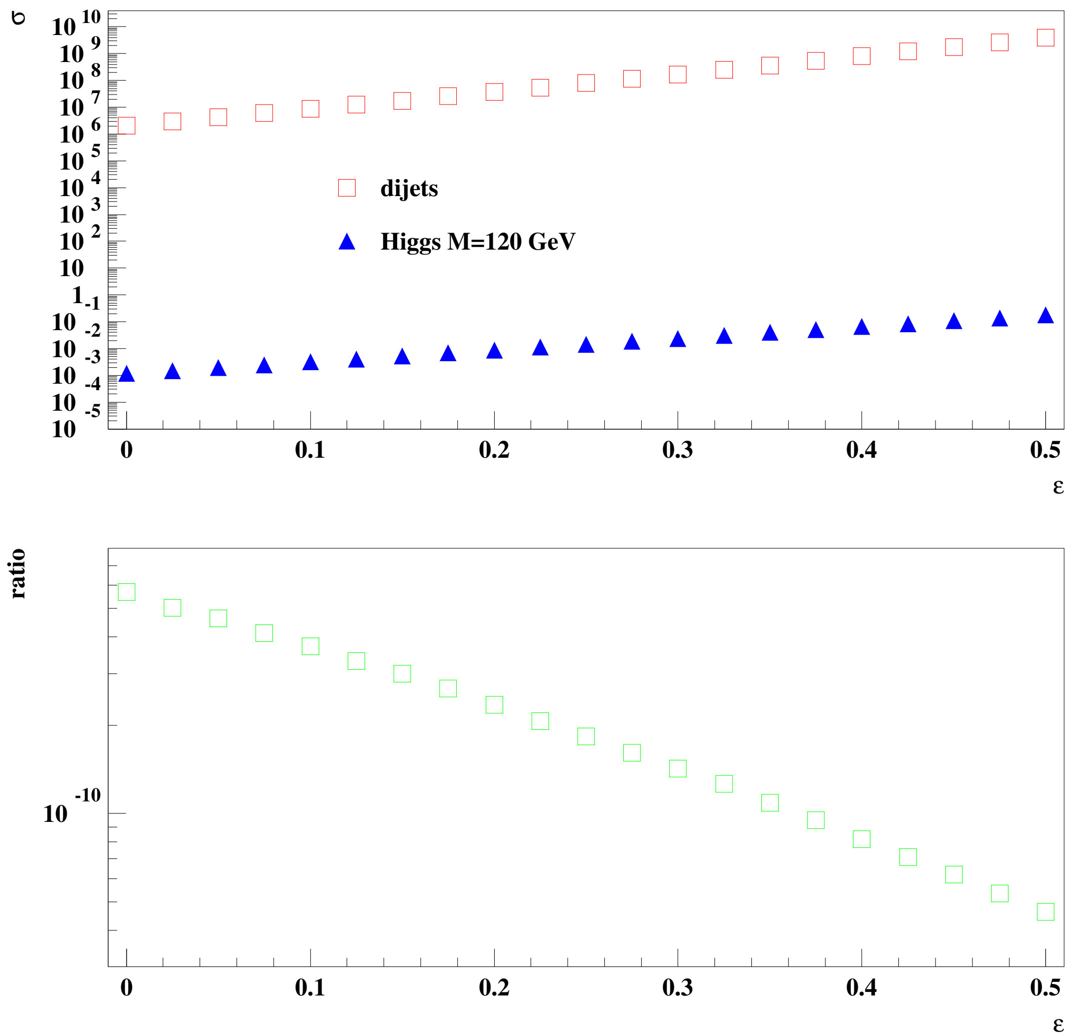
Predictions for the proton induced models:

- Tevatron: $\sigma = 0.5$ fb for $m_{\gamma\gamma} \sim 50$ GeV, $\sigma = 0.008$ fb for $m_{\gamma\gamma} \sim 120$ GeV, too small to be observed at Tevatron... (pomeron models: resp. 11 fb, 0.05 fb)
- LHC: $\sigma = 0.12$ fb for $m_{\gamma\gamma} \sim 120$ GeV at LHC, observable at LHC (pomeron models: 19 fb)
- NB: These numbers take only into account the gluon content of the proton and not the quark contribution (which is the dominating one in factorisable models)
- Measurement allowing to distinguish between the proton or the pomeron induced models

How to test the pomeron induced models?

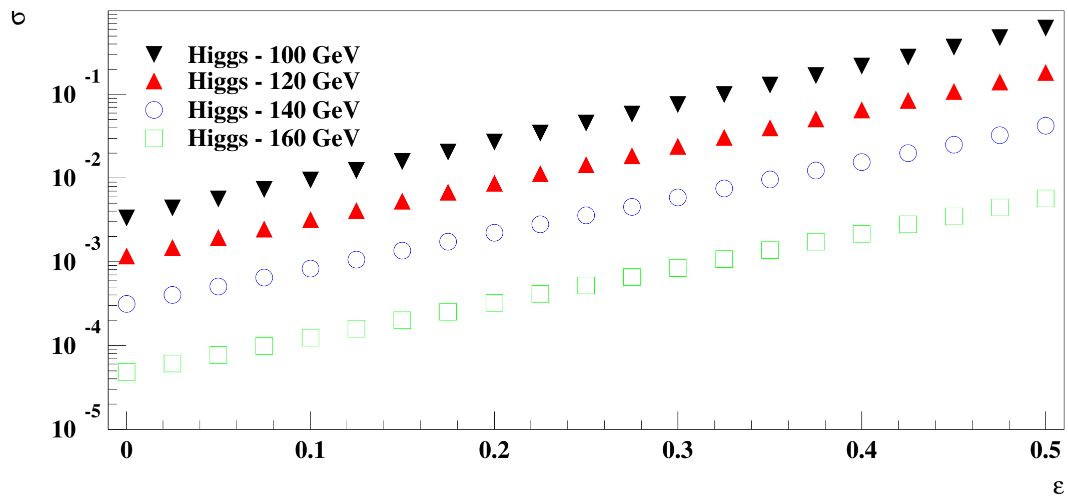
- Why do we get different results? Dependence on the pomeron intercept: $\alpha(t) = \epsilon + \alpha_0 t$.
  - For the pomeron based model in the non factorizable case, ϵ=0.08
  - For the pomeron based model in the factorizable case, ϵ=0.2
  - Leads to different dijet cross sections which are rescaled to the CDF measurement, and so to different Higgs predictions...
- Why such a different dependence on Higgs mass? Different gluon densities used, in peculiar at high β

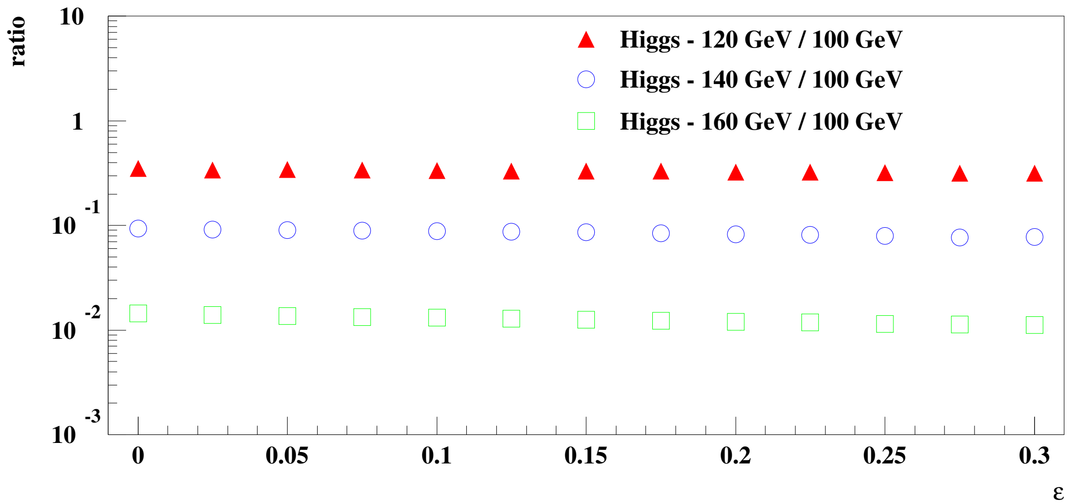
How to test the models?



Variation of the dijet cross section (generator level) as a function of the pomeron intercept and less strong variation of the Higgs one.

How to test the models?





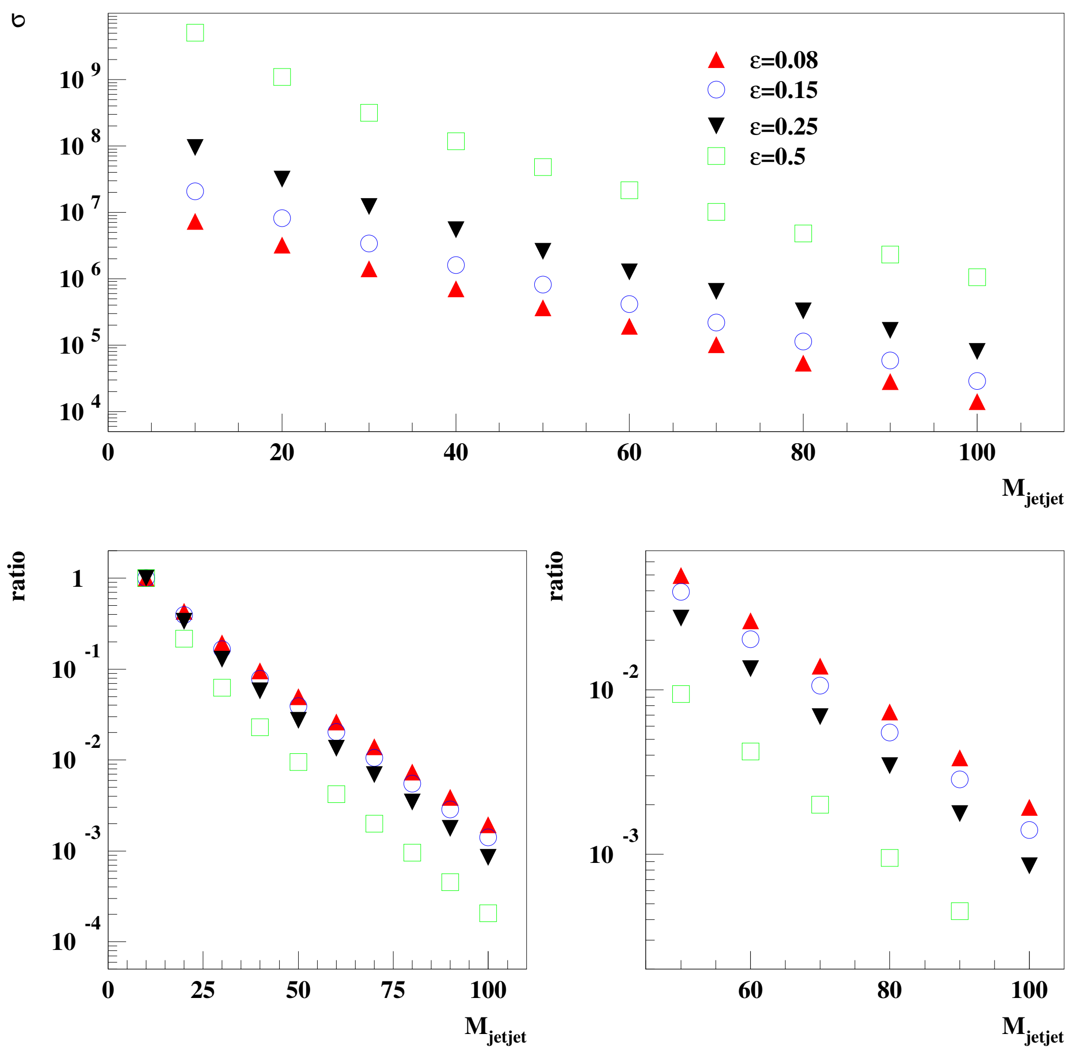
The Higgs cross section for different Higgs masses vary in the same way for different pomeron intercepts

The role of ϵ

- Dependence of the diffractive dijet cross section: High dependence on ϵ, and this is used to scale to the CDF cross section! The cross section varies by one order of magnitude on the full range in ϵ
- Dependence of the diffractive Higgs cross section: Not very high dependence of the Higgs cross section on ϵ and not high dependence on the Higgs mass
- Conclusion: Very important to measure ϵ in the beginning of run II to get precise predictions!

How to measure ϵ?

Study the dependence on the dijet mass



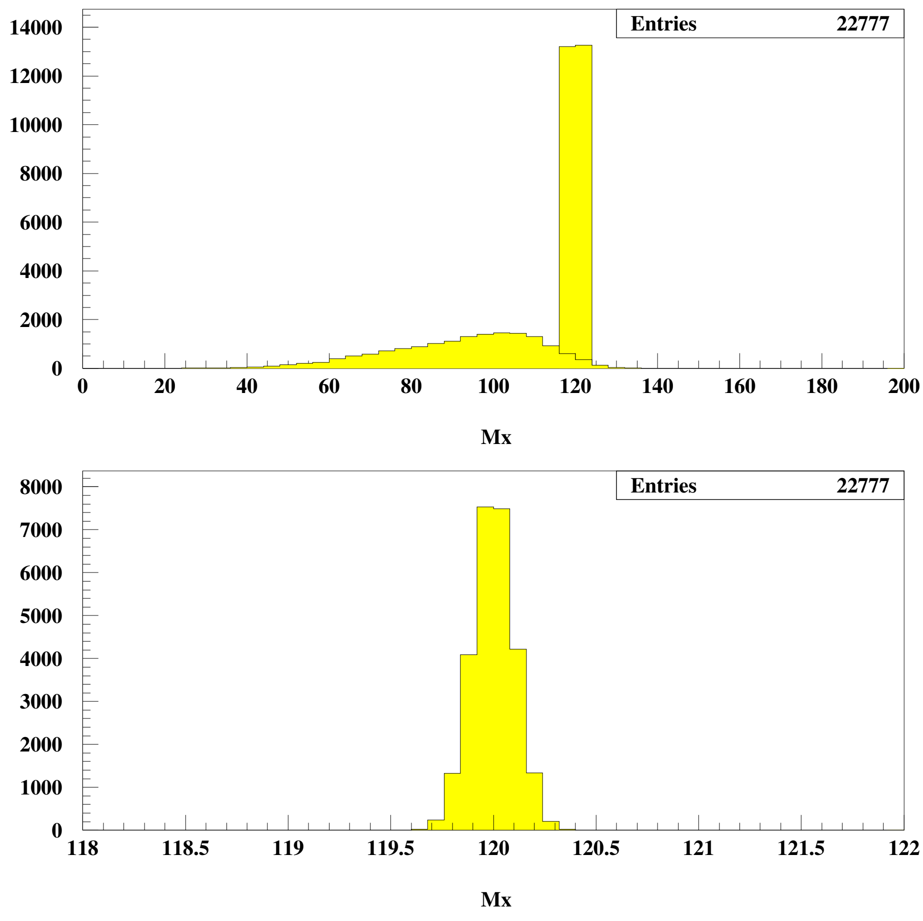
Advantage of the diffractive events?

H mass reconstruction (missing mass method)

(M.Albrow, A.Rostovtsev, hep-ph/0009336)

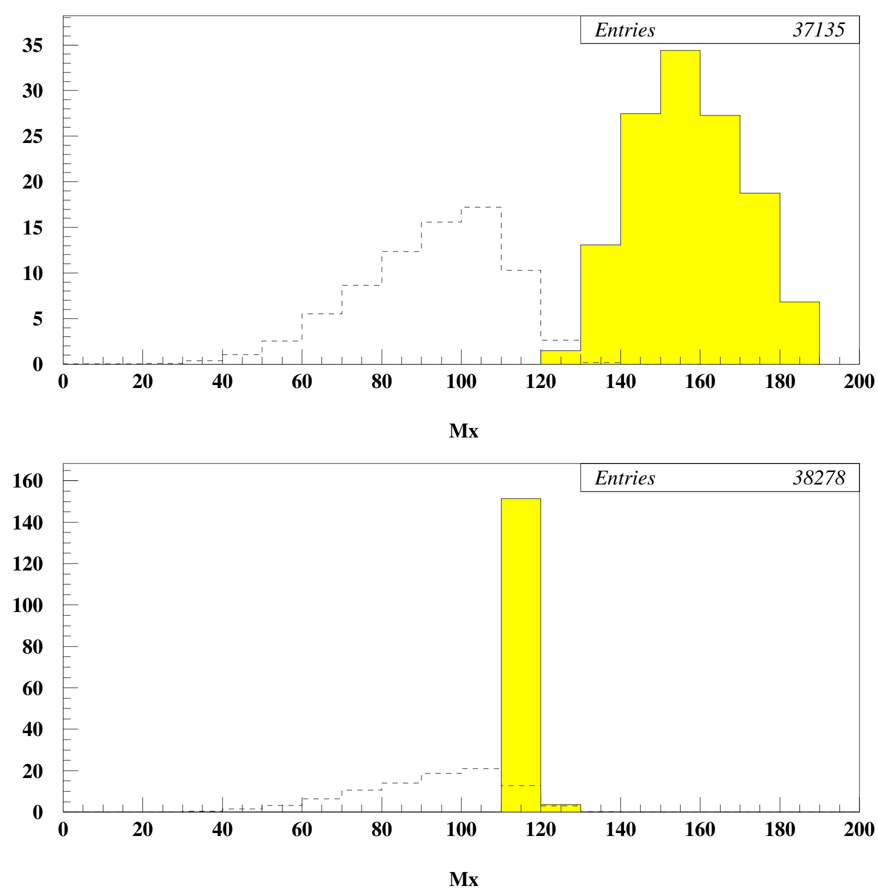
For events without radiation ($p\bar{p} \to p\bar{p}H$,

$M_H = \sqrt{\xi_p \xi_{\bar{p}} S}$, perfect reconstruction of the Higgs mass.



Advantage of the diffractive events?

What about QCD radiation? The missing mass method does not work so nicely, since the total energy is used to produce the Higgs as before, but some of it is lost because of radiation (”pomeron remant”)



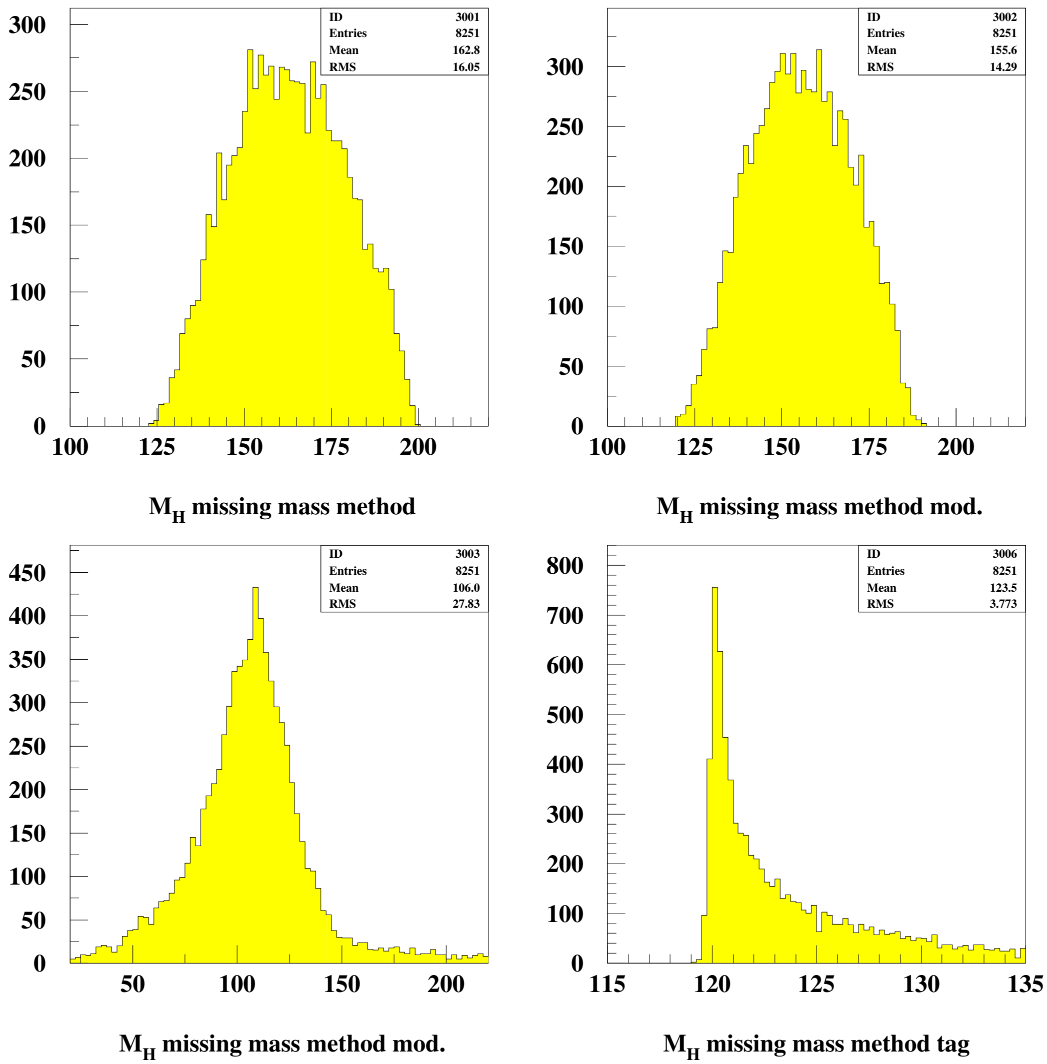
H mass reconstruction

We will compare different Higgs mass reconstruction method

- Missing mass method: $M_H = \sqrt{\xi_p \xi_{\bar{p}} S}$
- Modified missing mass method: $M_H = \sqrt{\xi_p \xi_{\bar{p}} S}.\frac{E_{jet1}+E_{jet2}+E_p+E_{\bar{p}}}{2.E_{beam}}$
- ξ rescaling method: $\xi = 1 - (1 - \xi_{old}/fac)$ where $fac = (etot - ejet - etag)/ebeam$, where $etot$ is the total energy in the detector, $etag$ and $ejet$ respectively the tagged energy and the jet energy closest in rapidity to the tagged proton, $M_H = \sqrt{\xi_p \xi_{\bar{p}} S}$
- Tagged method: If we are able to measure the mass of the pomeron remnant $M_{Remnant}$, $M_H = \sqrt{\xi_p \xi_{\bar{p}} S} - M_{remnant}$

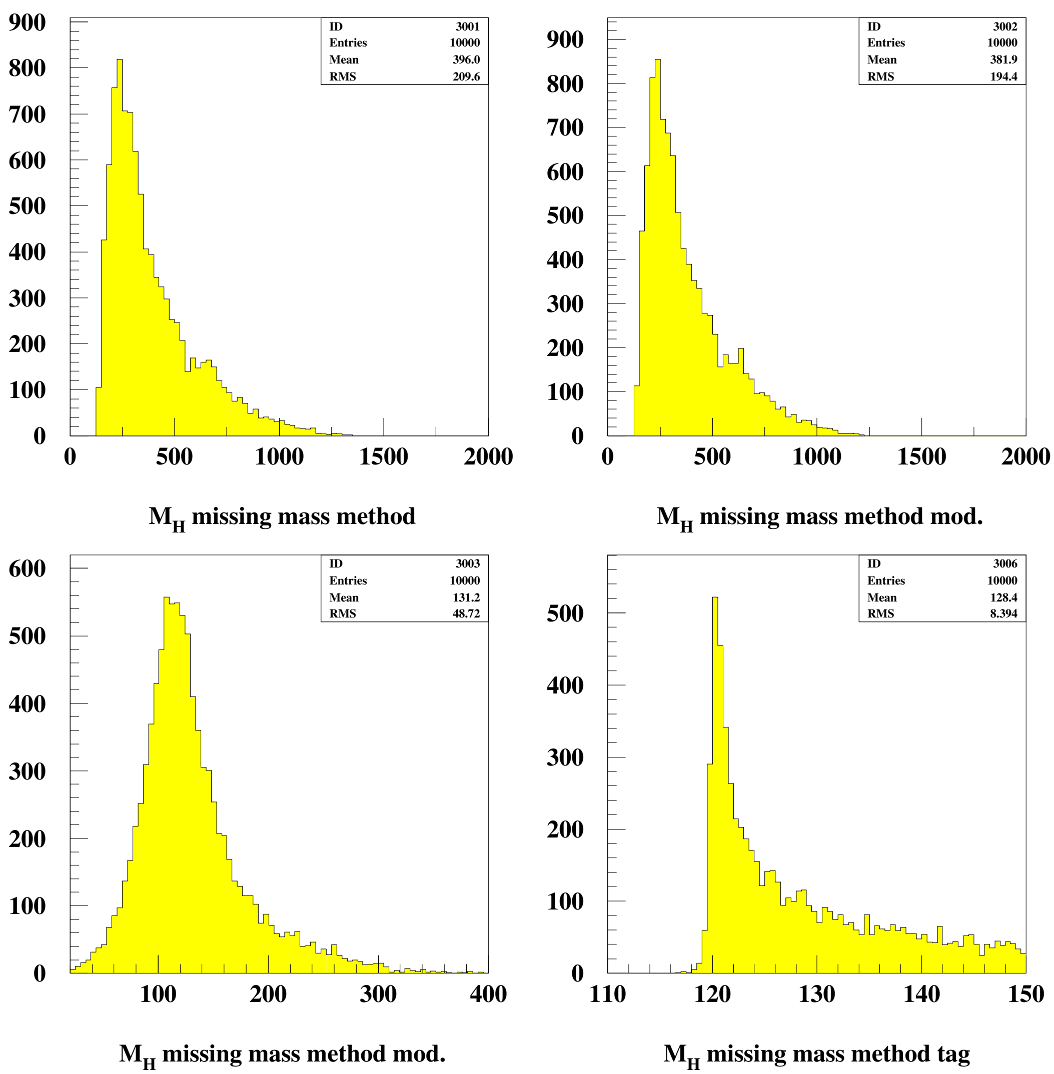
H mass reconstruction

120 GeV Higgs, Tevatron



H mass reconstruction

120 GeV Higgs, LHC



Pomeron remnant tagging possibility

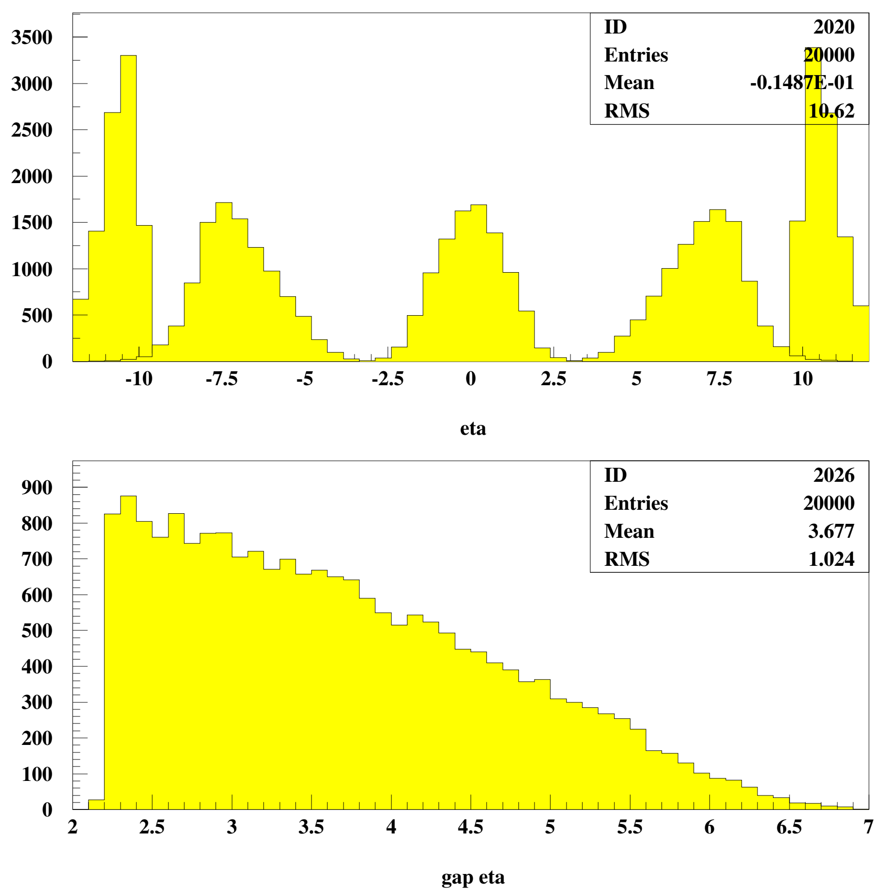
- Higgs mass reconstruction: $M_{Higgs} = \sqrt{\xi_1 \xi_2 S}$ nice method to reconstruct Higgs mass provided radiation is not too big. We just saw that the resolution is much worse without the possibility of measuring the pomeron remnants.
- Question: Where are the pomeron remnants going in pseudorapidity? Is it possible to tag them?
- New taggers at high η: CMS might have the possibility to install such taggers up to $\eta = 10$.
- In the simulated plots, we assume a resolution of $50\%/\sqrt{E}$ for the taggers

η of pomeron remnant

$M_{Higgs} = 120$ GeV at LHC

tagged protons, pomeron remnants and decay products of Higgs

rapidity gap between the tagged proton and the pomeron remnant

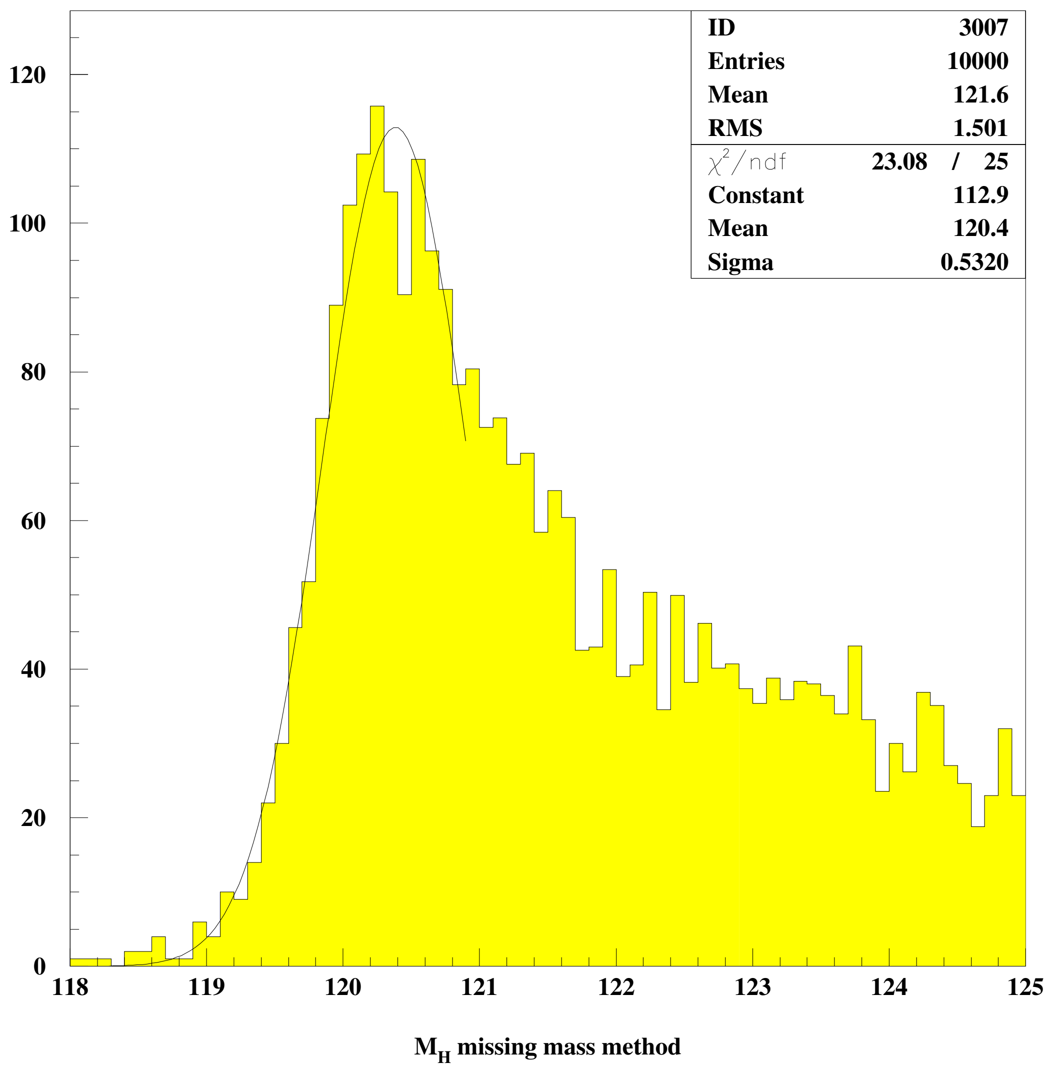


η of pomeron remnant

- Tevatron, $M_H = 120$ GeV: rapidity between 5 and 7 for the pomeron remnants
- LHC, $M_H = 120$ GeV: rapidity between 3.5 and 10 for the pomeron remnants (most events around 7)
- LHC, $M_H = 200$ GeV: rapidity between 5 and 10 for the pomeron remnants (most events around 7.5)
- LHC, $M_H = 500$ GeV: rapidity between 6 and 10 for the pomeron remnants (most events around 8)
- Conclusion: Taggers needed...
- NB: for high masses, no rapidity gap visible in detector...

Resolution on Higgs mass

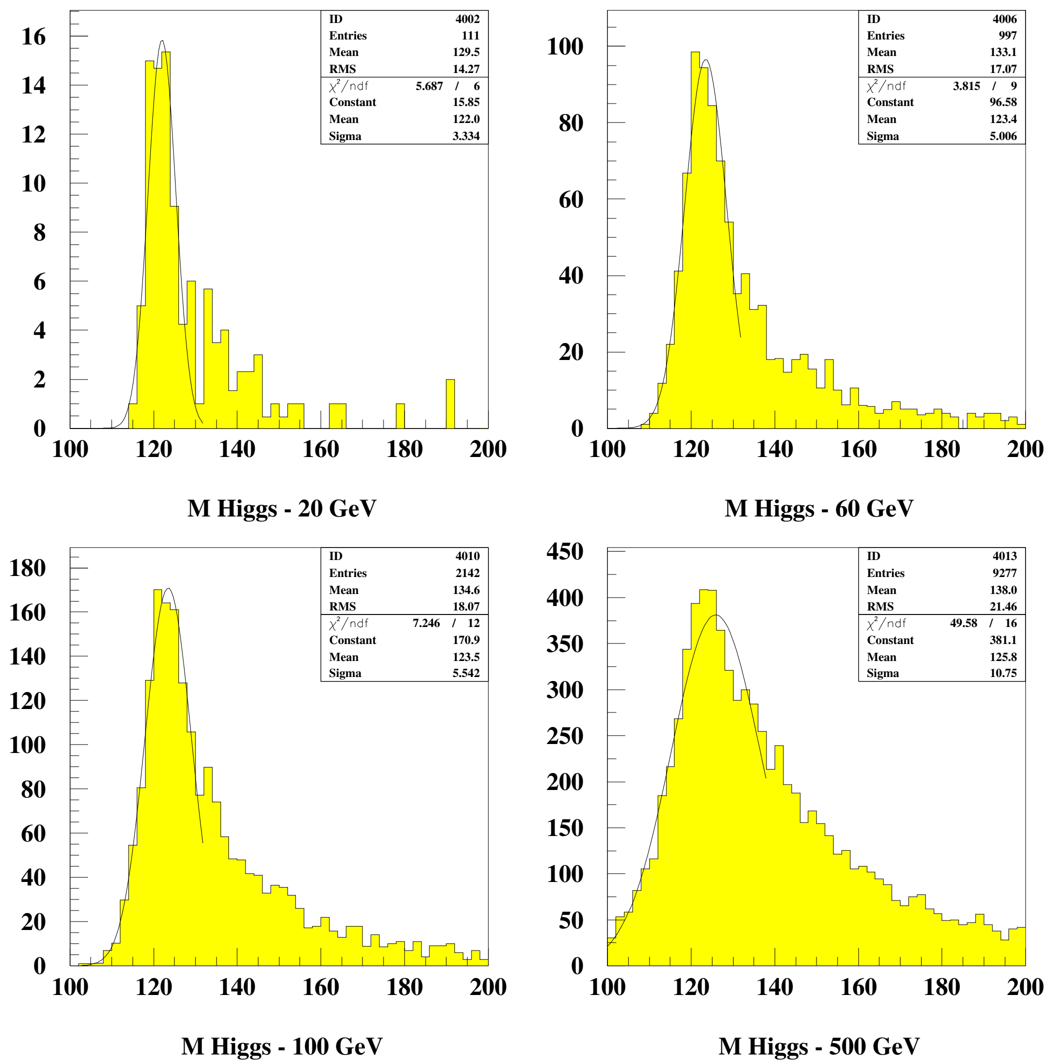
$M_{Higgs} = 120$ GeV at LHC at generator level



Resolution on Higgs mass

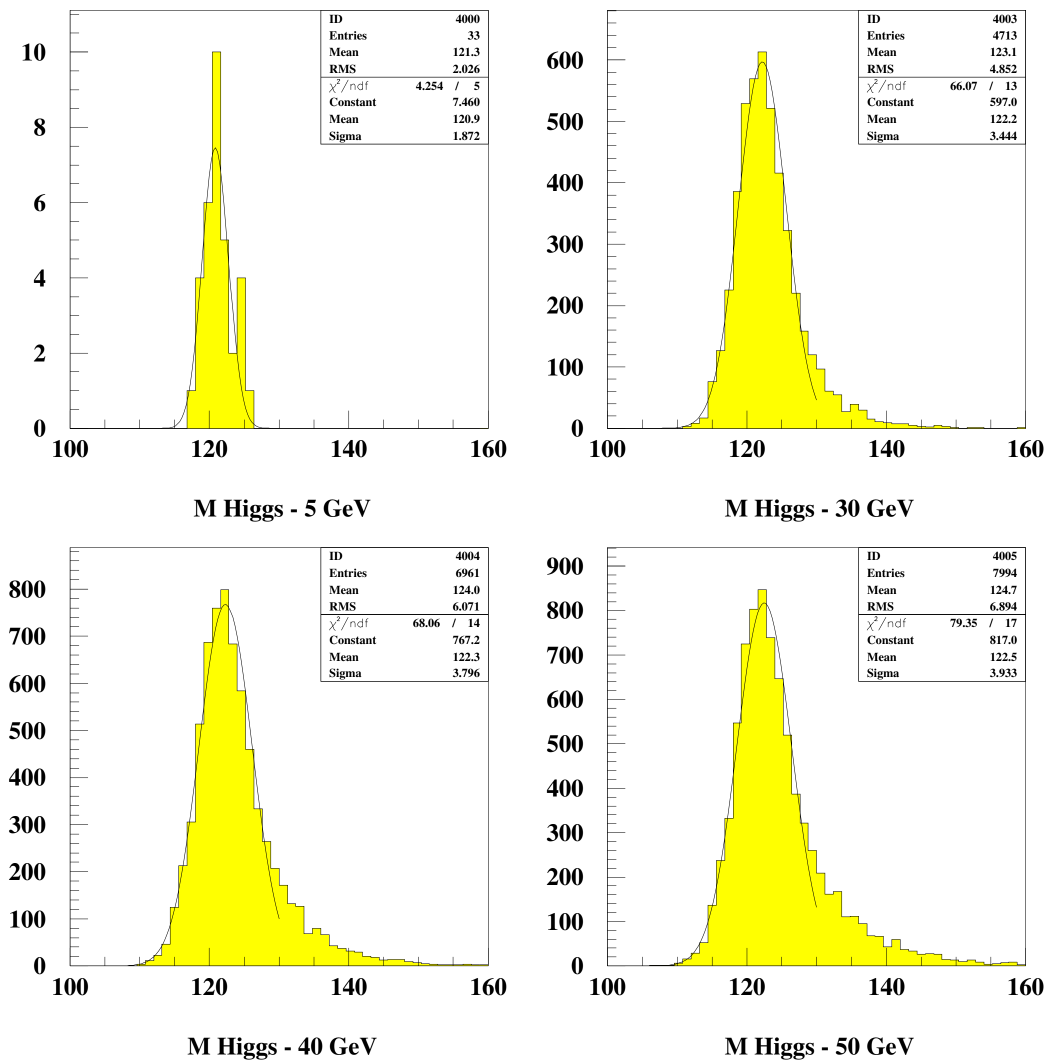
$M_{Higgs} = 120$ GeV at LHC at simulation level

(assumed resolution of taggers $\sim 50\%/\sqrt{E}$)



Resolution on Higgs mass

$M_{Higgs} = 120$ GeV at Tevatron at simulation level (assumed resolution of taggers $\sim 50\%/\sqrt{E}$)



Resolution on Higgs mass

- Generator level at LHC: for $M_{Higgs} = 120$ GeV, we get a resolution of 500 MeV, $M_{Higgs} = 200$ GeV, 800 MeV, $M_{Higgs} = 500$ GeV, 1.5 GeV

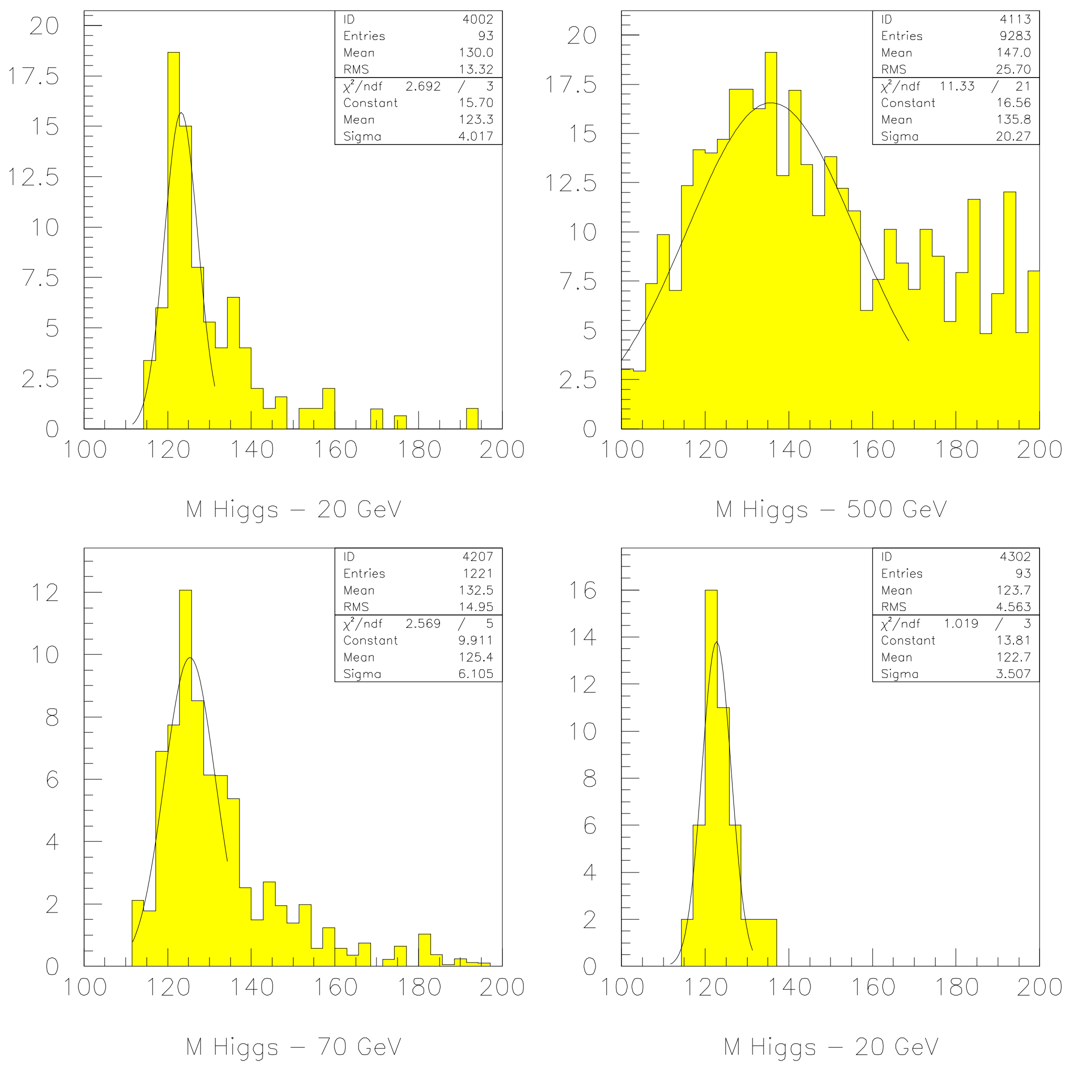
- Simulation level at LHC (assuming a resolution of $50\%/\sqrt{E}$ for taggers): for $M_{Higgs} = 120$ GeV, we get a resolution of 3.3 GeV, $M_{Higgs} = 200$ GeV, 4.5 GeV, $M_{Higgs} = 500$ GeV, 6.4 GeV

- At Tevatron, the resolution is even better: 270 MeV, and 1.9 GeV for a 120 GeV Higgs, but low cross section...

The importance of a full roman pot system

- Good resolution on Higgs mass: when the energy of the pomeron remnant is low, the resolution of the taggers was assumed to be $50\%/\sqrt{E}$
- $M_{Higgs} + M_{remnant} = \sqrt{\xi_1 \xi_2 s}$: when $M_{Higgs} \sim 120 - 150$ GeV, $\xi \sim 0.01$, needs good acceptance in this kinematical domain!!!
- $M_{Higgs} \sim 120 - 150$ GeV: needs pots in the WARM region and much better in the COLD region

The importance of a full roman pot system



Advantage of the diffractive events?

- New possibility of improving the Higgs mass reconstruction: Cut on the amount of radiation emitted at high $|\eta|$ by tagging this energy, possible at LHC because of the high value of the cross section, difficult at Tevatron since the cross section is already low

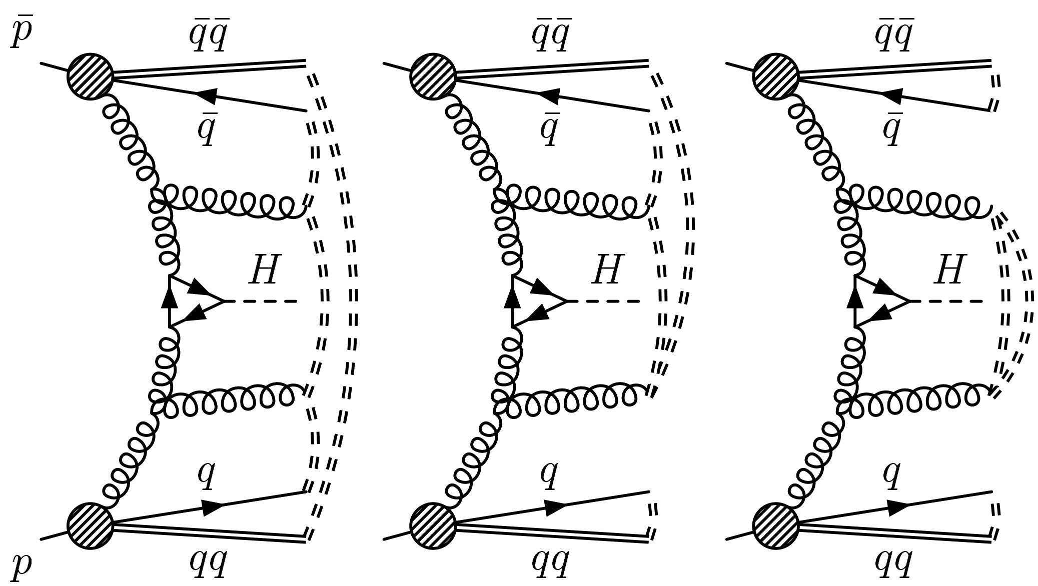
- Background rejection in the $b\bar{b}$ channel: b tagging easier for diffractive events since they are not "polluted" by the proton remnants, and further more, the improvement on Higgs mass reconstruction using roman pot detectors can help selecting the Higgs events

- Background in the WW and $\tau\tau$ channel: negligible

Soft Colour Interaction Models

- A completely different model to explain diffractive events: Soft Colour Interaction (R.Enberg, G.Ingelman, N.Timneanu, hep-ph/0106246)
- Principle: Variation of colour string topologies, giving a unified description of final states for diffractive and non-diffractive events
- Soft Colour Interaction model: Probability to make a soft colour interaction between the coloured parton, which changes the colour but not the momentum
- Generalized Area Law model: Probability of interactions between strings connecting the partons

Soft Colour Interaction Models



Color rearrangement in the final state

Higgs cross section

- Estimate of the diffractive Higgs production cross section at Tevatron and LHC: $M_H = 115$ GeV

	Tev.	LHC
σ_{tot} (fb)	600	27000
R_H^{SD} (%)	0.2	0.6-0.7
σ_{SD} (fb)	1.2	162-189
R_H^{DPE}(%)	0.01-0.02	0.1
σ_{DPE}	1.2-2.4 10^{-4}	0.162-0.189

- Comments: In this model, it is quite difficult to predict the event topologies when a p or a $\bar{p}$ is tagged in the final state. Also, gap between jets cannot be predicted.

Summary

	(1)	(2)	(3)	(4)
H ∼120 GeV, TeV. Tev. 1 fb^{-1}	0.03	0.3 0.03	2.2	0.00012
H ∼120 GeV, LHC	14	412	1020	0.2
H ∼160 GeV, LHC	55	146	670	?

- 1: proton induced model
- 2: pomeron induced model (factorizable case)
- 3: pomeron induced model (non factorizable case)
- 4: SCI
- Diffractive photon production allows to distinguish proton and pomeron induced models and probably SCI, and the dijet cross section measurement as a function of the dijet mass allows to distinguish between both pomeron based model

Conclusion

- Four different models studied: Quite low cross sections for Tevatron, high cross sections for LHC
- High uncertainties: Due to the diffractive cuts, the jet energy scale (if we are lucky, it might give a high enough cross section for Tev.)
- Distinguish between models: measure the diffractive photon production, and measure the pomeron intercept with the dijet cross section at Tevatron
- Advantages of the diffractive Higgs?: Mass constraint using the roman pot detectors (we get a good mass resolution at LHC if we are able to measure the pomeron remnants), low background (negligible in the WW and $\tau\tau$ case)

Some references...

- J.Bjorken, Phys.Rev. D 47 (1993)
- A.Bialas, P.V.Landshoff, Phys.Lett. B256 (1990) 540; A.Bialas, W.Szeremeta, Phys.Lett. B296 (1992) 191, A.Bialas, R.Janik. Zeit. für Phys. C62 (1994) 487
- M.Boonekamp, R.Peschanski, C.Royon, Phys.Rev.Lett. 87 (2001) 251806
- J.R.Cudell, O.F.Hernandez, Nucl.Phys.B471 (1996) 471
- E.Levin, hep-ph/9912403 and references therein
- V.Khoze, A.Martin, M.Ryskin, Eur. Phys. J.C19 (2001) 477, Phys. Rev. D56 (1997) 5967, hep-ph/0006005, hep-ph/0103007, hep-ph/0105224.
- A. Berera and J.C. Collins, Nucl. Phys.B474 (1996) 183, A.Berera, Phys. Rev. D62 (2000) 015015

- J.Pumplin, Phys. Rev. D52 (1995) 1477
- M.Albrow,A. Rostovtsev, hep-ph/0009336
- B.Cox, J.Forshaw, B.Heinemann, hep-ph/0110173, R.Appleby, J.Forshaw, hep-ph/0111077
- R.Enberg, G.Ingelman, N.Timneanu, hep-ph/0106246, hep-ph/011210
- O.Eboli, E.Gregores, F.Halzen, Phys.Rev.D61 (200) 034003