Determination of the gluon distribution at LHC using the process "Z+jet"

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Process:

$$PP \to Z + jet; \qquad Z \to \mu^+\mu^- \tag{1}$$

The subrocesses are:

$$qg \to Z + q$$
$$q\bar{q} \to Z + g$$

The differential cross sections:

$$\frac{d\sigma}{d\eta_1 d\eta_2 dp_t^2} = \sum_{a,b}[x_a f_{x_a}^P(x_a, Q^2) x_b f_{x_b}^P(x_b, Q^2) \frac{d\sigma}{d\hat{t}}(ab \to Z + j) \tag{2}$$

with

$$x_{a,b} = \frac{p_T}{\sqrt{s}}[exp(\pm\eta_1) + exp(\pm\eta_2)] \tag{3}$$

where $a, b = q, \bar{q}, g, \eta_1 = \eta^Z, \eta_2 = \eta^j, P_T = P_T^Z$.

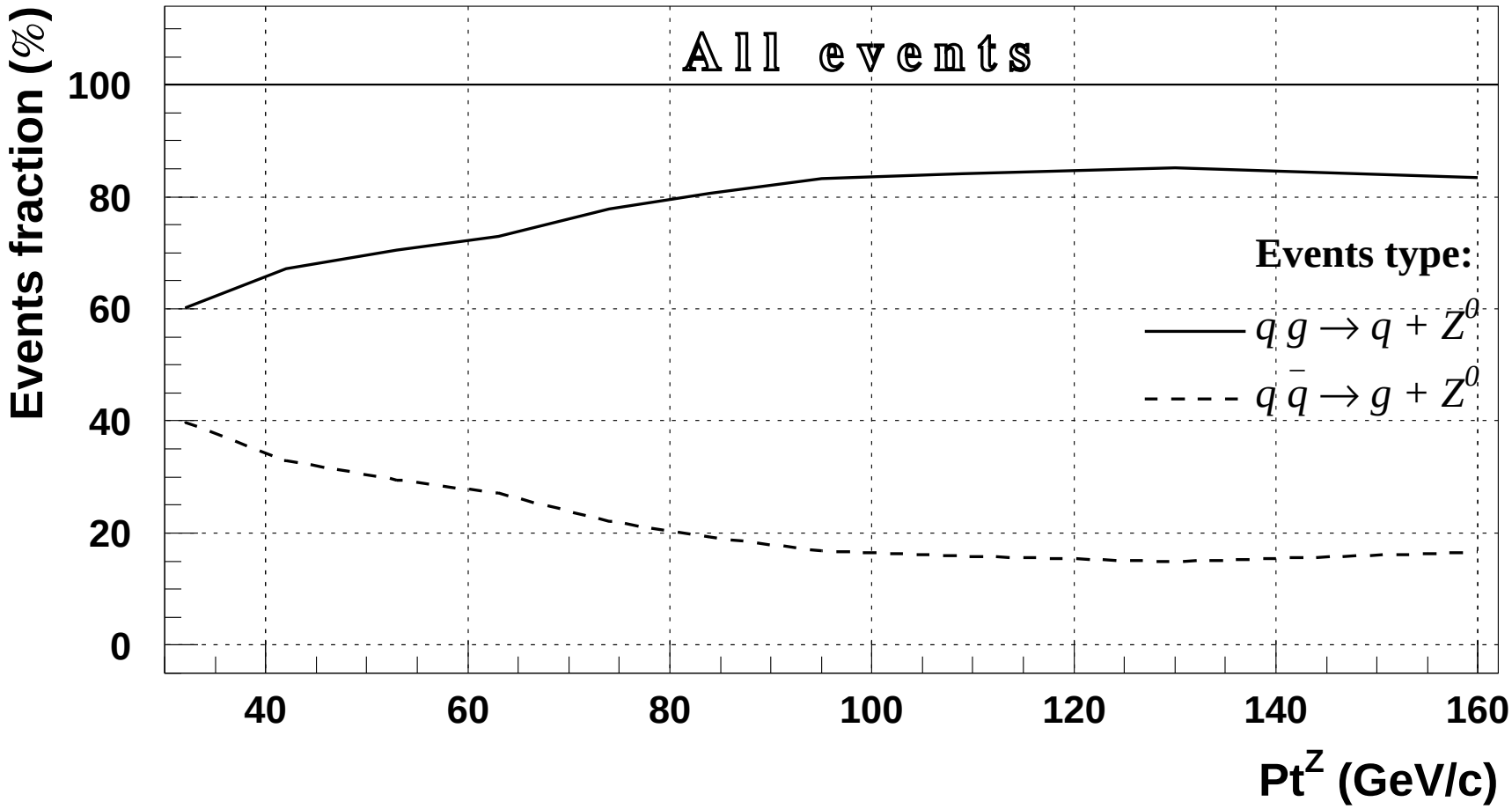
Strategy

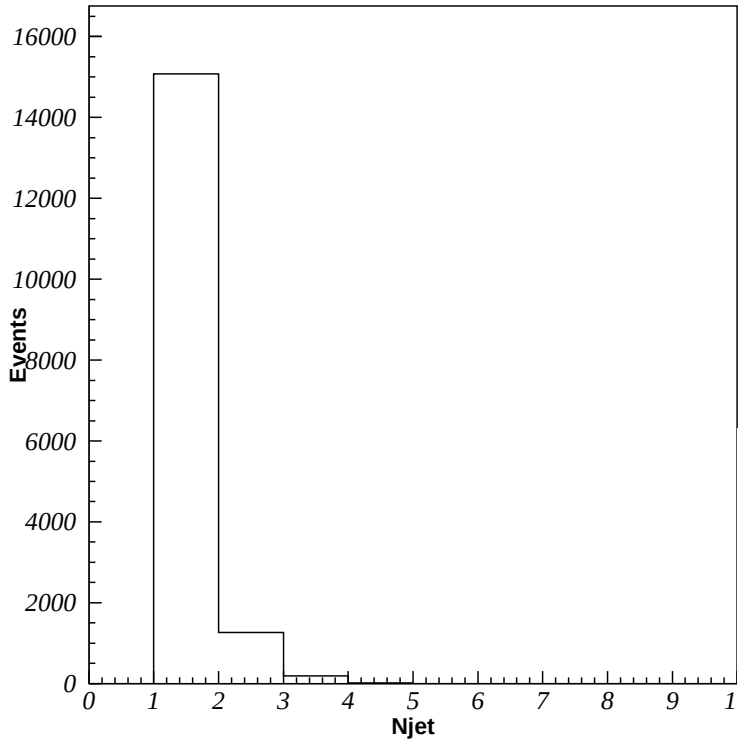
- Estimate the event rate for Z+jet process for different x and Q^2
- Inputting the knowledge of $f^P_{x_q}(x_q, Q^2), f^P_{x_{\bar{q}}}(x_{\bar{q}}, Q^2)$possible to find out $f^P_{x_g}(x_g, Q^2)$

The lepton rapidity distributions from W^+ and W^- provide the benchmark process to predict the $f^P_{x_q}(x_q, Q^2), f^P_{x_{\bar{q}}}(x_{\bar{q}}, Q^2)$ fluxes in proton.

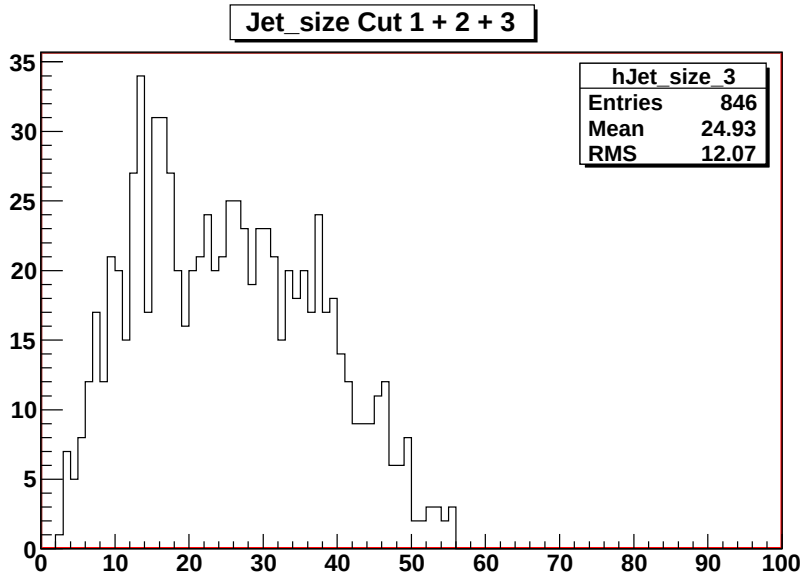
- All QCD processes are the main source of backgrounds!!

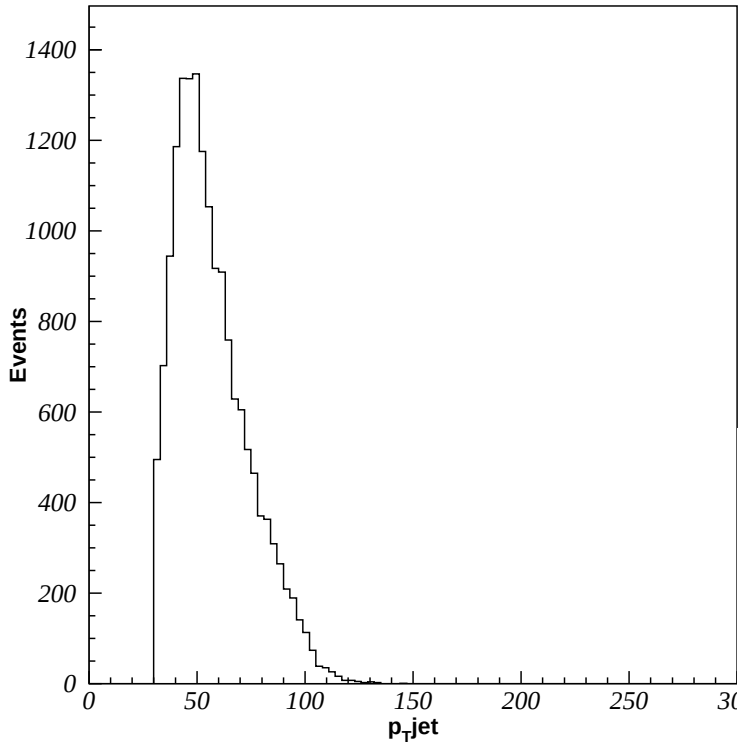
Event Selections:
$p_T > 10\ GeV$ and $|\eta| < 2.4$.
Jets with $p_T > 30\ GeV$ and $|\eta| < 4.5$.
$|m_Z - m_{ll}| < 10\ GeV$


All events
Events fraction (%)
100
80
60
40
20
0
40
60
80
100
120
140
160
Pt^Z (GeV/c)
Events type:
$q\,g \to q + Z^0$
$q\,\bar{q} \to g + Z^0$

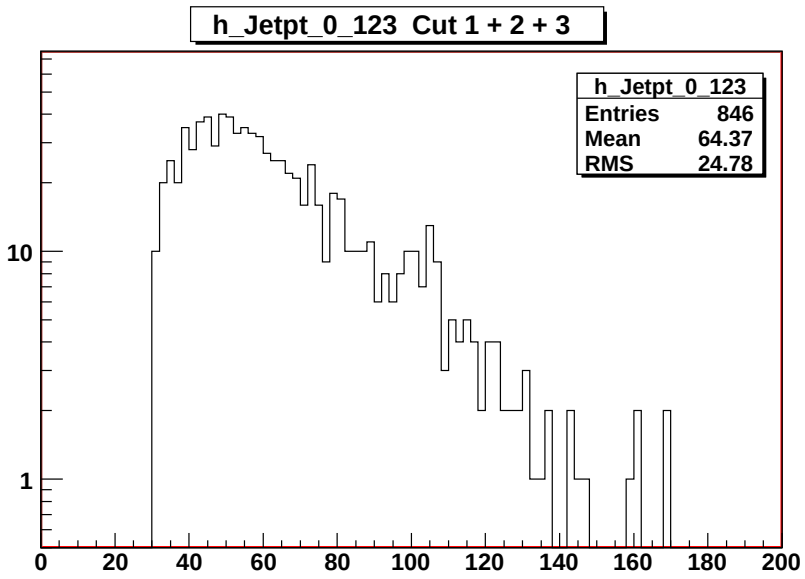

16000
14000
12000
10000
8000
6000
4000
2000
0
Events
0 1 2 3 4 5 6 7 8 9 1
Njet

CMSSW


Jet_size Cut 1 + 2 + 3
hJet_size_3
Entries 846
Mean 24.93
RMS 12.07
35
30
25
20
15
10
5
0
0 10 20 30 40 50 60 70 80 90 100


Events
1400
1200
1000
800
600
400
200
0
0
50
100
150
200
250
$p_T$jet

CMSSW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h_Jetpt_0_123
Entries 846
Mean 64.37
RMS 24.78
10
1
0
20
40
60
80
100
120
140
160
180
200