Central Exclusive Production in Hadron-Hadron Collisions

WHAT DOES IT MEAN? **HOW COME THIS QUESTION AFTER THE WHOLE WEEK??**

This is what I believe – I hope we can agree:

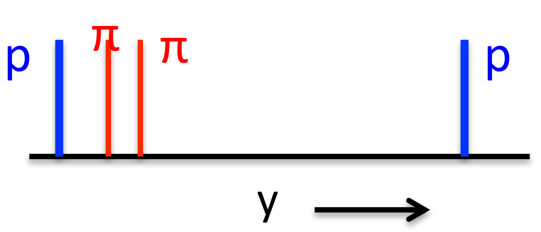
"PRODUCTION" :

Obvious, particle(s) after the collision that were not there before, i.e. "created"

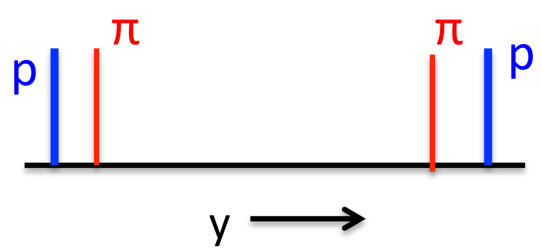
"CENTRAL":

No crisp, precise definition.

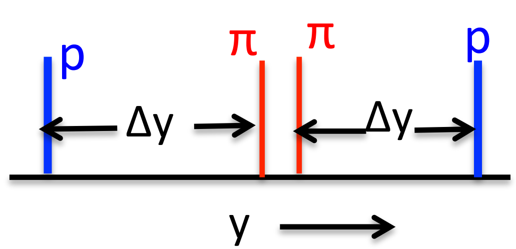
But rapidity differences Δy are invariant under boosts



SDE = Single diffractive excitation
Not central!



DDE = Double diffractive excitation
Not central!



Central production

How big should Δy be to be called **CENTRAL** ?

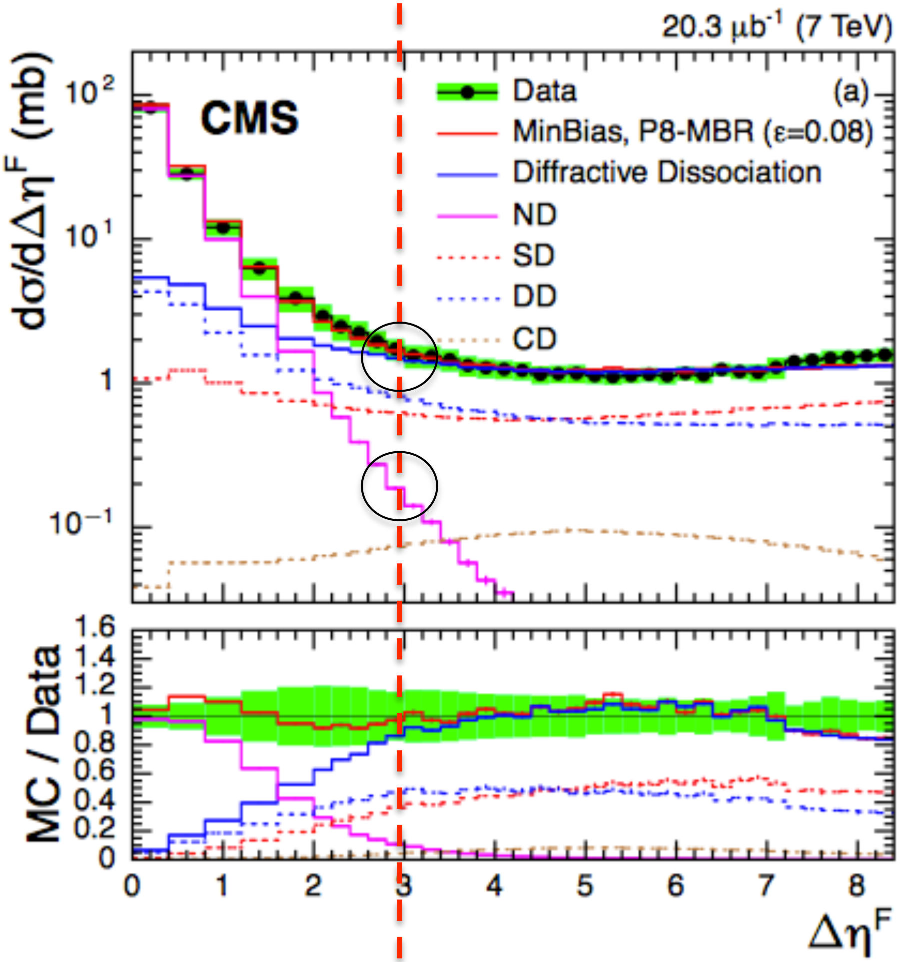
It depends on your physics interest, but physics of X (= ππ etc) changes when Δy >~ 3, 4ish

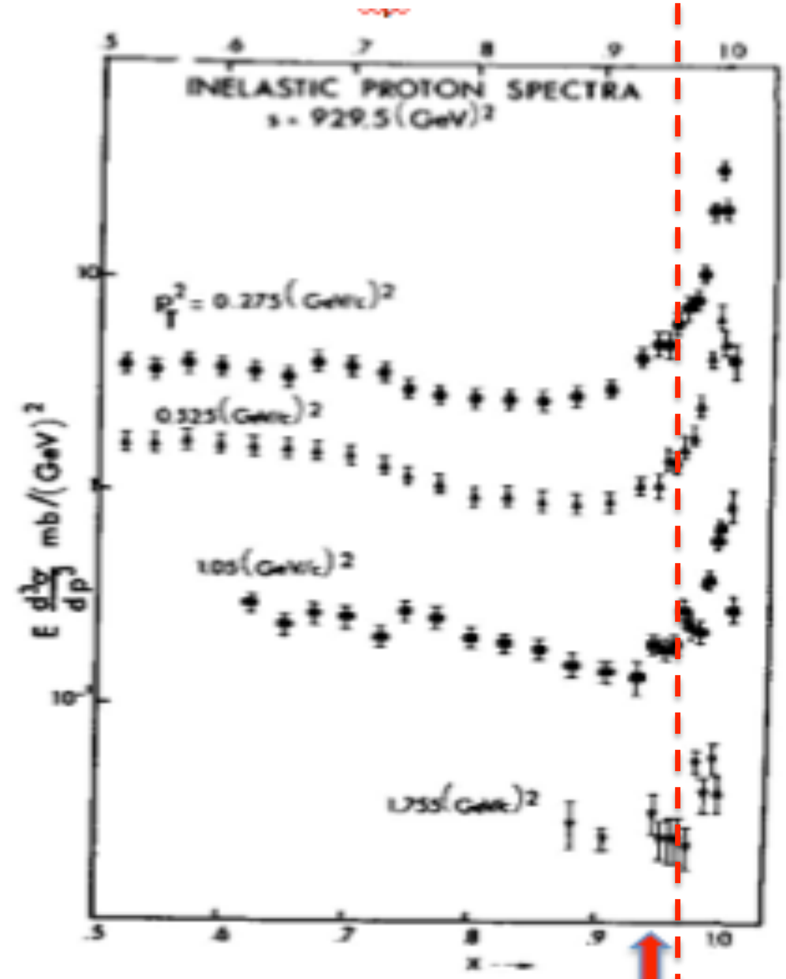
This is due to dominance of pomeron exchange, as reggeon exchanges die out.

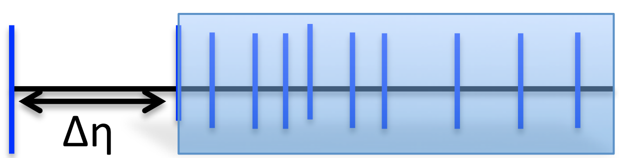
Evidence: →

What's special about 3 – 4 units Δy ? From dozens of examples at this meeting:

Δη ≠ Δy except for photons, but usually OK



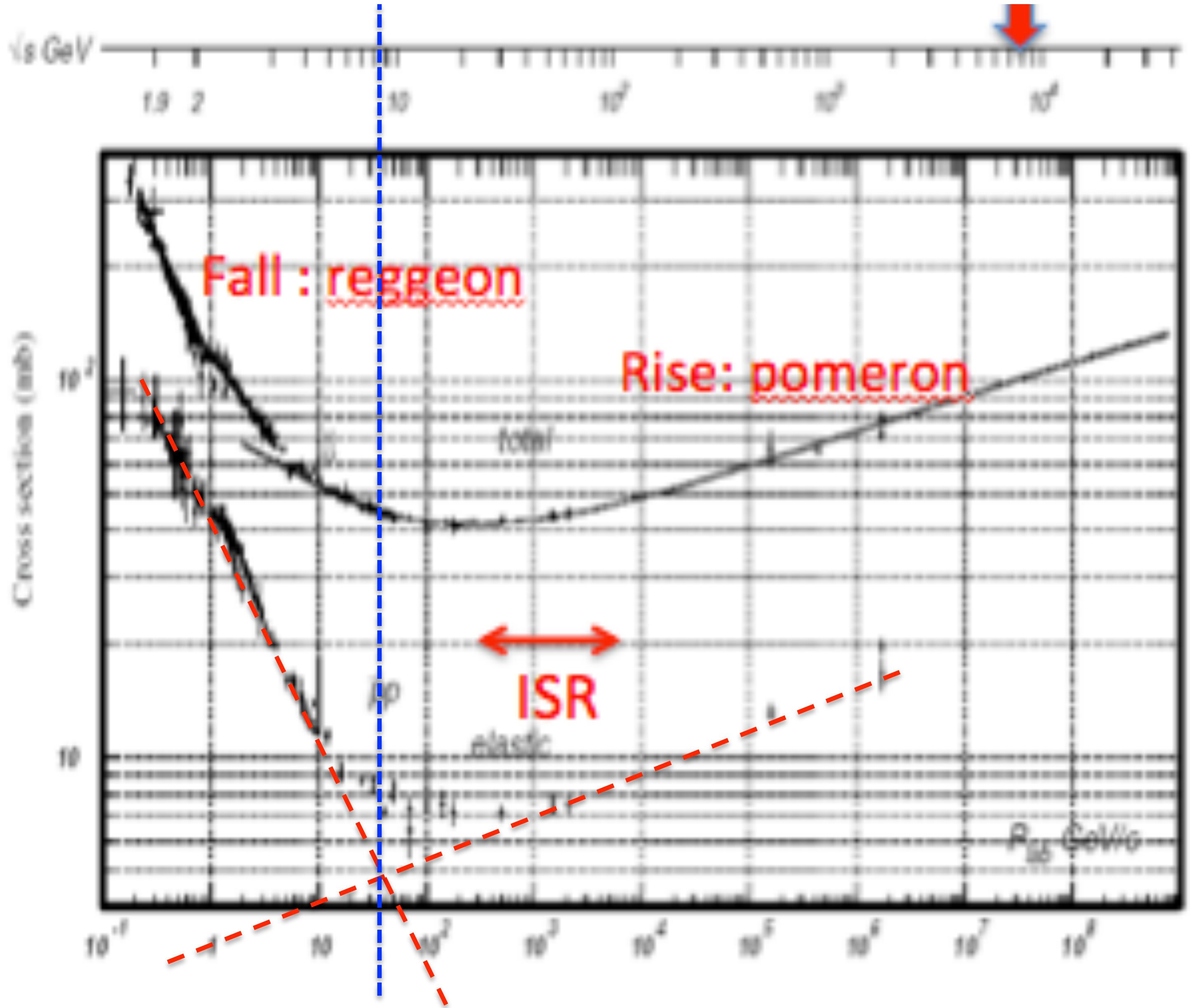




(Pseudo)rapidity

Feynman x = pz/pbeam
xF = 0.95 equiv.to Δy = 3

$\sqrt{s}$ ~ 7 GeV,
Δy = 2. ln($\sqrt{s}$/mp) = 4



So if both gaps in p + X + p are Δη (better, Δy) > 3 (better, >4) then pomeron exchange should dominate. Reggeon exchanges present but small and dying with increasing gaps.

This is due to pomeron intercept > 1 and reggeon intercepts < ~ 0.5
BUT also spin γ = 1 and photon exchange (& odderon maybe) stays high :
have IP + IP & γ + IP & γ + γ all can be **Central Exclusive Production.**

→ **Define "exclusive"**

All final state particles are measured or inferred (e.g. by E,p conservation)
(Wlodek Guryn disputes "or inferred")

Example: Elastic scattering **p + p → p + p** ... 0 hadrons produced (soft photons inevitable)
Note: if only one proton was detected, and missing 4-momentum infers the other, it's OK (IMO)
Example 2 : **π^- + p → π^0 + n**   Example 3 : **p + p → p + (pππ)** SDE all measured

ISR "invented?" inclusive cross sections p + p → π^+ + anything, now Z, H, ... + anything
At high energy colliders, central (Δy > 3) exclusive p + X+ p with :
X = e+e-, μ+μ-, π+π-, W+W-, Z, H, etc with **0** additional particles produced (+ soft photons)
In case of W^+W^- → e μ +missing E_T (2ν) neutrinos are inferred, can still call it exclusive WW.
If protons not detected, only gaps, can infer p or p* (pππ, nπ,..) call it **quasi-exclusive** ?
But assuming X does not care if p or p*, we call it (loosely) exclusive.
Events with undetected central hadrons are a background to our "exclusive" spectrum.