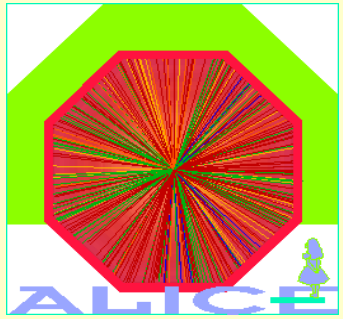
A low multiplicity trigger for peripheral collisions in ALICE



- The ALICE experiment
- Trigger strategy for diffractive events
- Two examples of diffractive ALICE physics
- Rates
- Conclusions, outlook

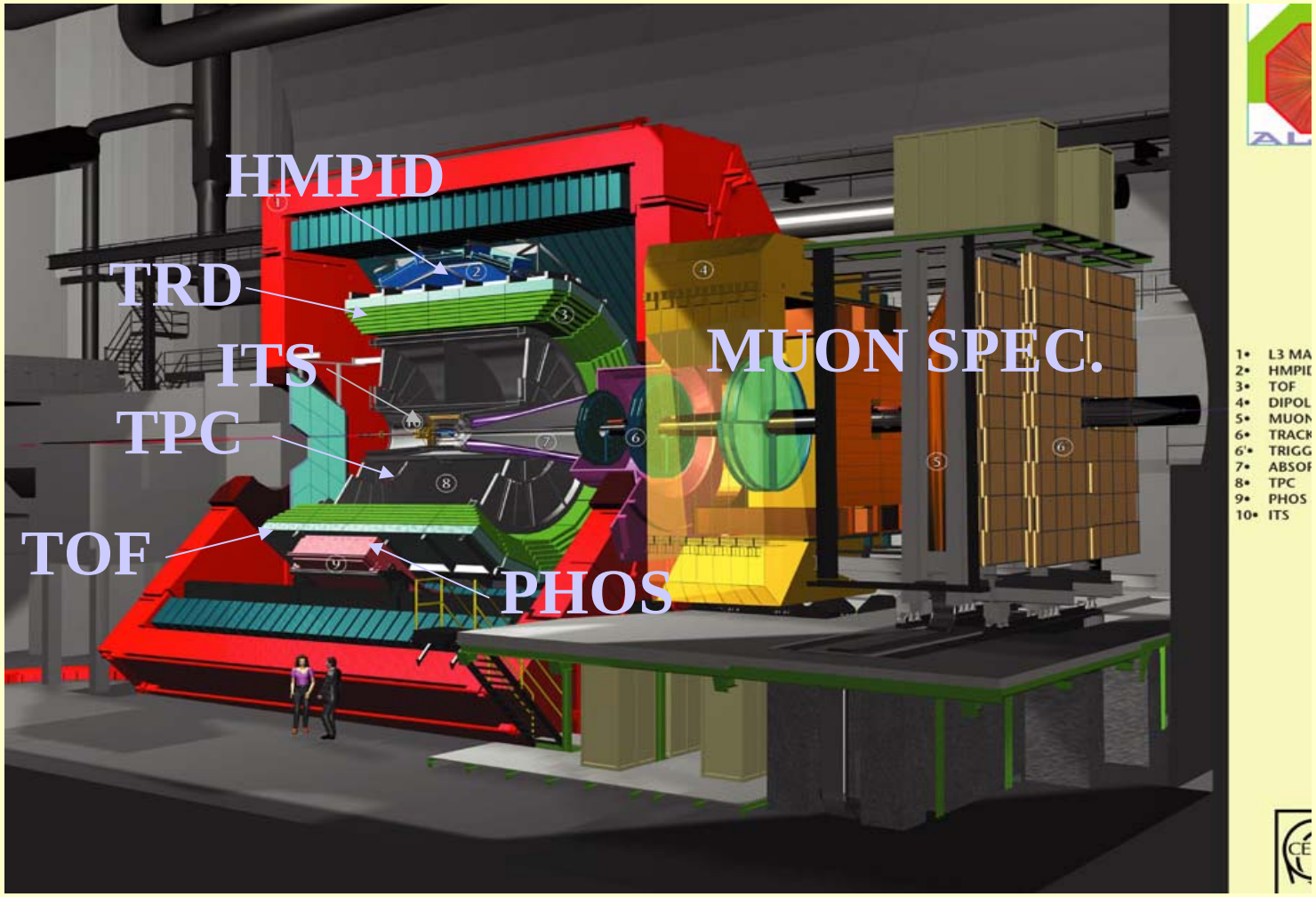
The ALICE experiment

Acc central barrel

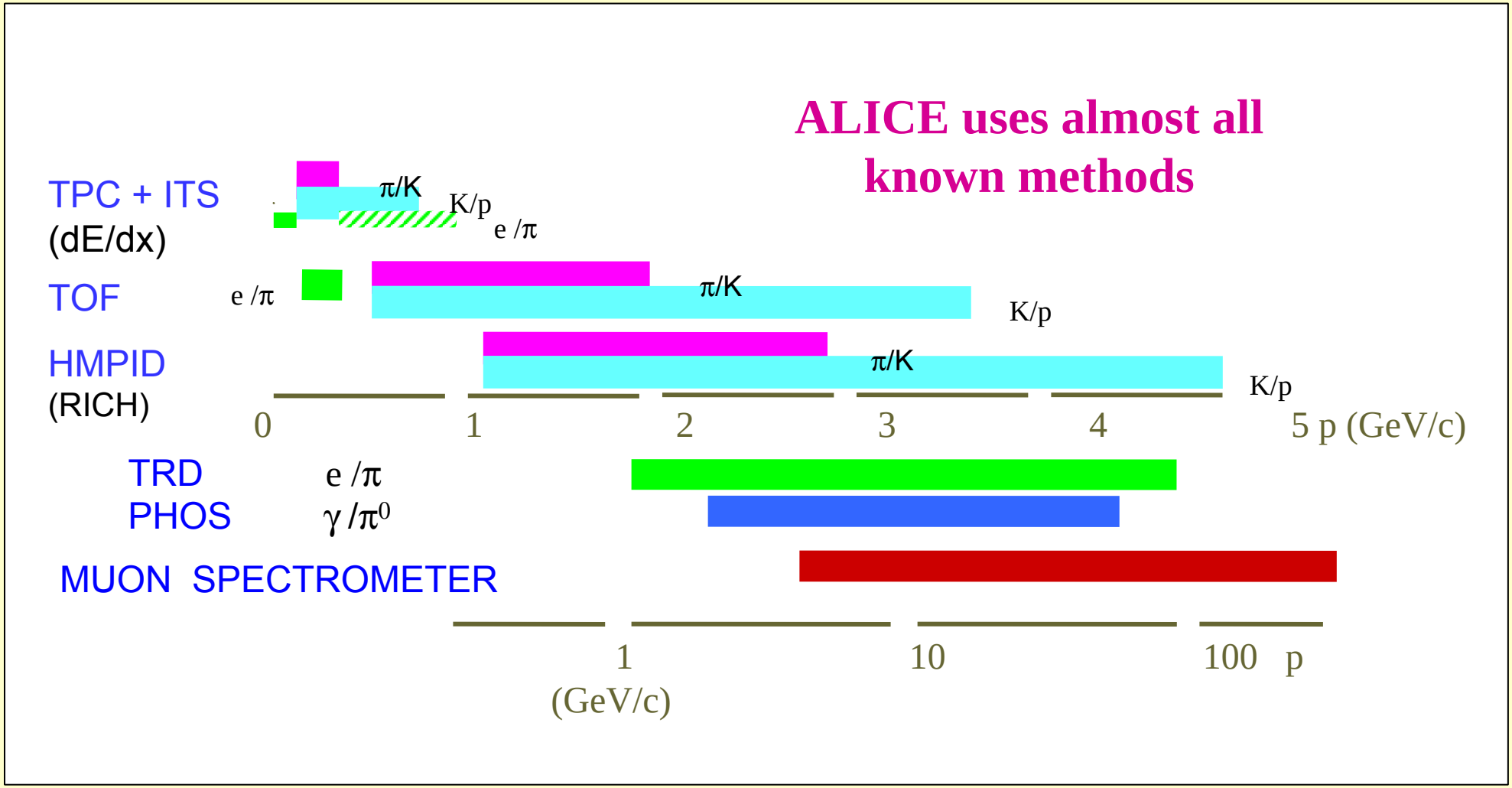
$-0.9 < \eta < 0.9$

Acc muon spec

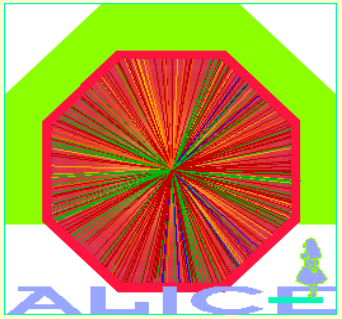
$2.5 < \eta < 4.$



Particle identification in ALICE



ALICE pseudorapidity coverage



→ *good particle identification*
Δη = 2 at midrapidity

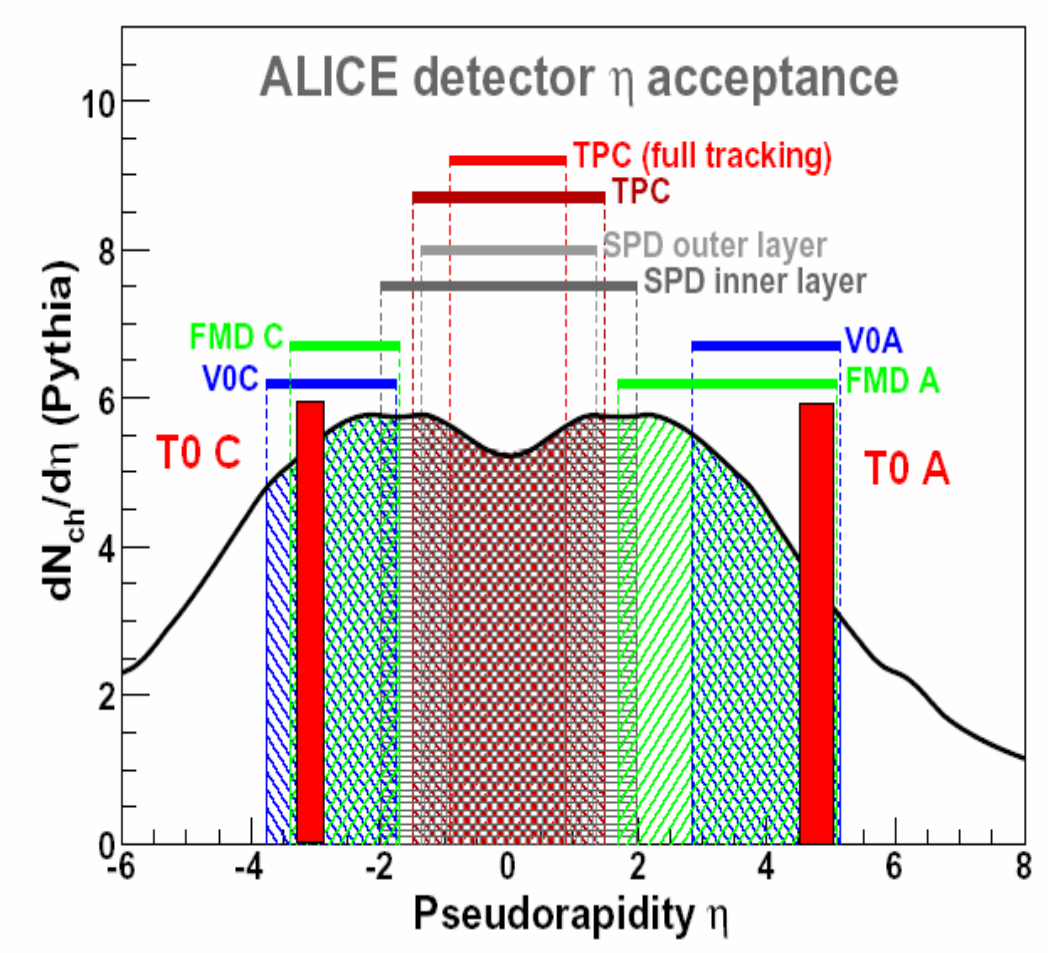
→*additional forward detectors (no particle identification)*

$-4 < \eta < -1$

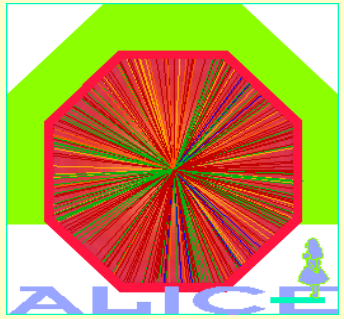
$1 < \eta < 5$

→ **L = 5x10^{30}cm^{-2}s^{-1} :**

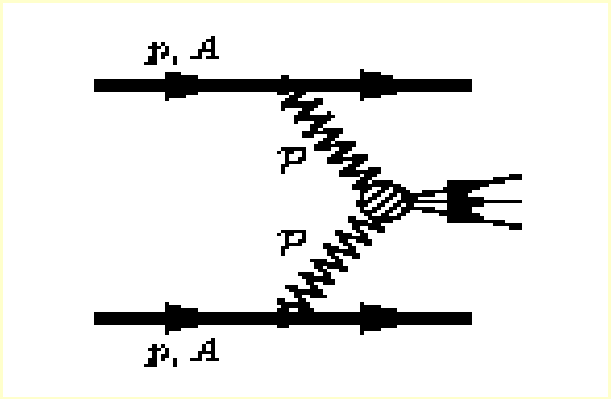
one interaction/ 80 bunches

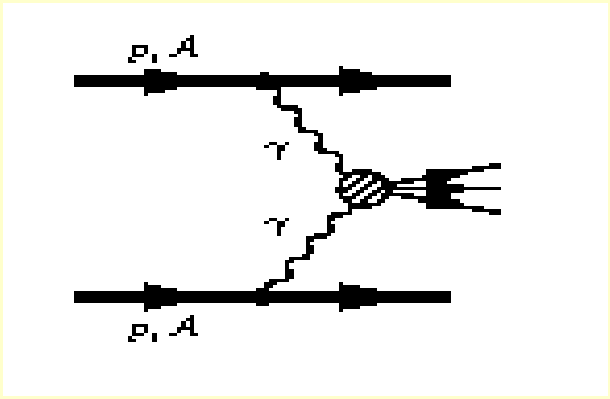


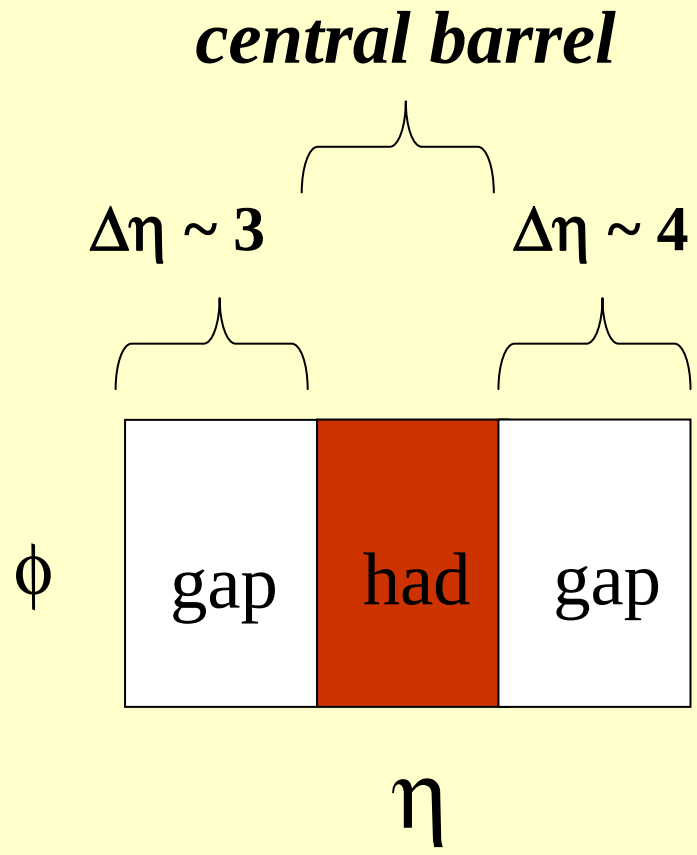
ALICE pseudorapidity acceptance



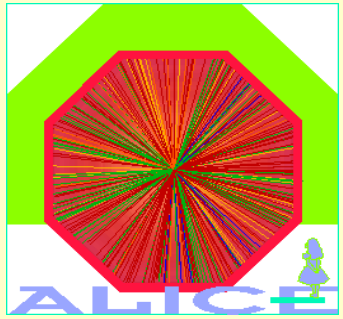
- ALICE acceptance matched to diffractive central exclusive production







ALICE diffractive trigger



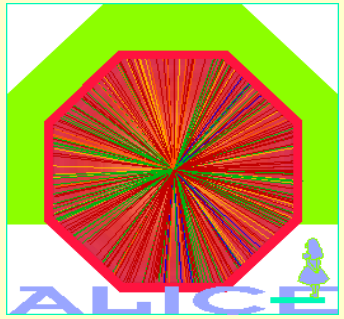
- ALICE diffractive trigger
  - low multiplicity in central barrel TOF/ITS multiplicity
  - forward detector V0 empty

  hardware implementation on L0 level

- ZDC at Level1 available (discussion Level0)

→ currently no discussion on Roman pots

ALICE diffractive L0 trigger rate



- pp @ 14 TeV: L = 5×10^{30} cm^{-2} s^{-1}

TOF= TOF MULT, NV0 = V0A mult = V0C mult

	NV0=0 TOF ≥ 2	NV0<3 TOF ≥ 2	NV0<5 TOF ≥ 2	NV0<7 TOF ≥ 2	NV0=0 + topology
non-diffractive	100 Hz	1.7 kHz	6.5 kHz	15 kHz	~ 5 Hz
diffractive	1.1 kHz	7.0 kHz	20 kHz	36 kHz	~ 5Hz/μb
S/B	11	4.1	3.0	2.4	~ 1 /μb

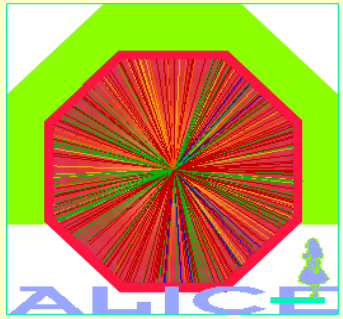
PYTHIA

pp cross section: 100 mb

(nondiff 70 mb, diff 30 mb)

resonance prod: J/Ψ,Υ

Diffractive min bias analysis



- Look at events with hard/soft scale: $P_T \gtrless P_{Thresh}$
  - P_T distribution
  - Multiplicity
  - Mass
  - Correlations P_T – multiplicity – mass
- ZDC information

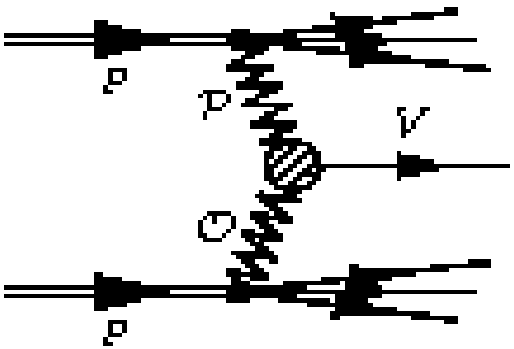
A search for the Odderon I

Look at exclusive processes with rapidity gaps

Examples:

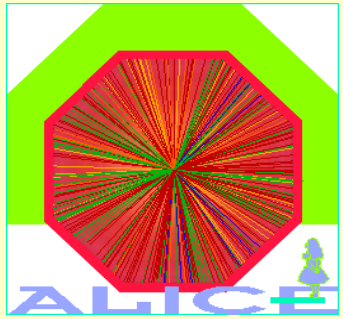
diffractive pseudo scalar and tensor meson production:
C = +1 states

diffractive vector meson production:
C = -1 states



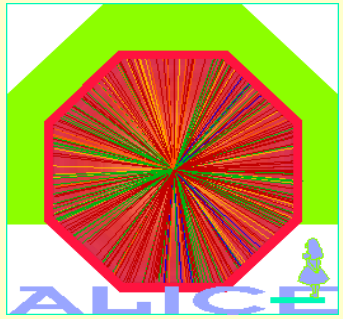
→ *measure cross sections*

Analysis strategy I



- Production cross sections in pp at LHC energies
  - Look for diffractive π^0,η,η_c production: $J^{PC} = 0^{-+}$
    - → Photon-Photon, Photon-Odderon contributions
  - Look for diffractive J/Ψ production
    - → Photon-Pomeron, Odderon-Pomeron contribution

Diffractive J/Ψ production in pp at LHC



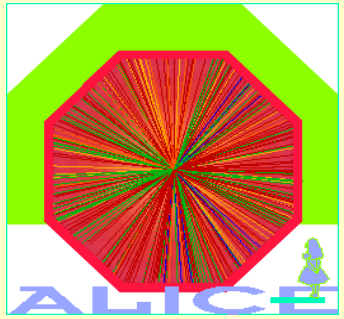
- HERA-LHC workshop CERN june 06 (Motyka et al):
  - Photon: t-integrated $\left.\frac{d\sigma}{dy}\right|_{y=0}$ ~ 12 nb
  - Odderon: t-integrated $\left.\frac{d\sigma}{dy}\right|_{y=0}$ ~ 0.3 - 5 nb

At L = 5×10^{30} $cm^{-2}s^{-1}$:

→ ***0.12 J/Ψ in ALICE central barrel in 1 s, 120k in 10^6 s***

→ ***7200 in e^+e^- channel in 10^6 s***

A search for the Odderon II

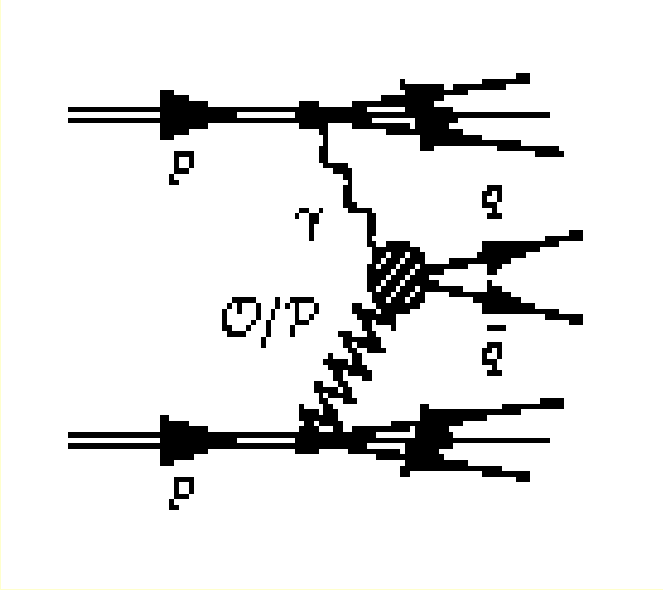


- Cross sections contain squared Odderon amplitudes

  → ***Odderon-Pomeron interference !***

$$d\sigma \sim |A\gamma(A_P + A_O)|^2 \, d^N q$$

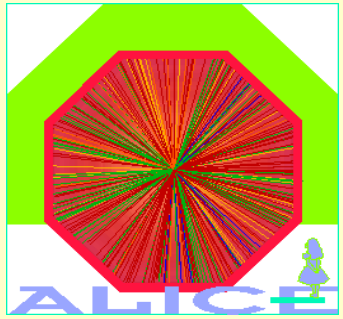
$$\sim |A_P|^2 + 2\mathrm{Re}(A_P A_O^*) + |A_O|^2$$



→ ***look at final states which can be produced by Odderon or Pomeron exchange***

→ ***find signatures for interference of C-odd and C-even amplitude***

Analysis strategy II



- Interference effects (relative contribution C = – 1)
  - Asymmetries in $\pi^+\pi^-$ and K^+K^- pairs (C = ±1) in continuum

  → charge asymmetry relative to polar angle of π^+ in dipion rest frame

  C-even: $\vec{P}_{sum}$: sum of transverse momenta of π^+,π^-

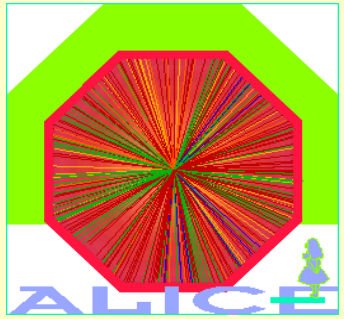
  C-odd : $\vec{P}_{diff}$: difference of transverse momenta of π^+,π^-

  → look at distribution of angle α ($\vec{P}_{diff}$ relative to $\vec{P}_{sum}$)

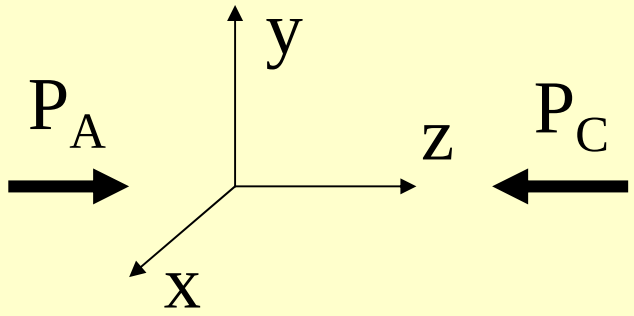
  C-transformation: $\alpha \rightarrow \alpha + \pi$

  → expect sin(2ϕ) and cos(2ϕ) terms in Fourier transform

beam-beam symmetry



- Exchange symmetry proton A side ↔ proton C side



Symmetry: rotation around
1) $\vec{e}_x$ by π
2) $\vec{e}_y$ by π

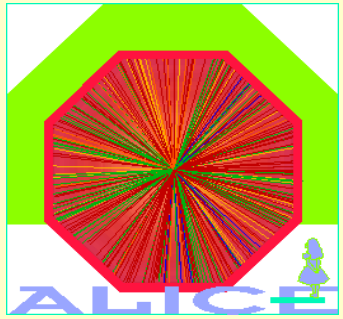
α ($\vec{P}_{diff}$ /$\vec{P}_{sum}$): α → 2π – α

→ this symmetry is reflected in Fourier transform

→ ***beam-beam symmetry broken in pp → pN*X***

→ neutron tagging in ZDC

Conclusions, Outlook



- ALICE has capability to do γγ/diffractive physics
  - Diffractive trigger: low mult central barrel, gap trigger
  - HLT trigger: FMD information
- QCD studies, Pomeron and Odderon phenomenology
- Two Photon physics