Central Diffraction in ALICE

- ALICE detector
- Selection of central diffractive single/double gap events
- Central Meson production in min. bias pp-collisions at $\sqrt{s} = 7$ TeV
- Analysis of $f_0(980)$ and $f_2(1270)$ production
- A hardware L0 trigger for double gap events
- Conclusions, outlook

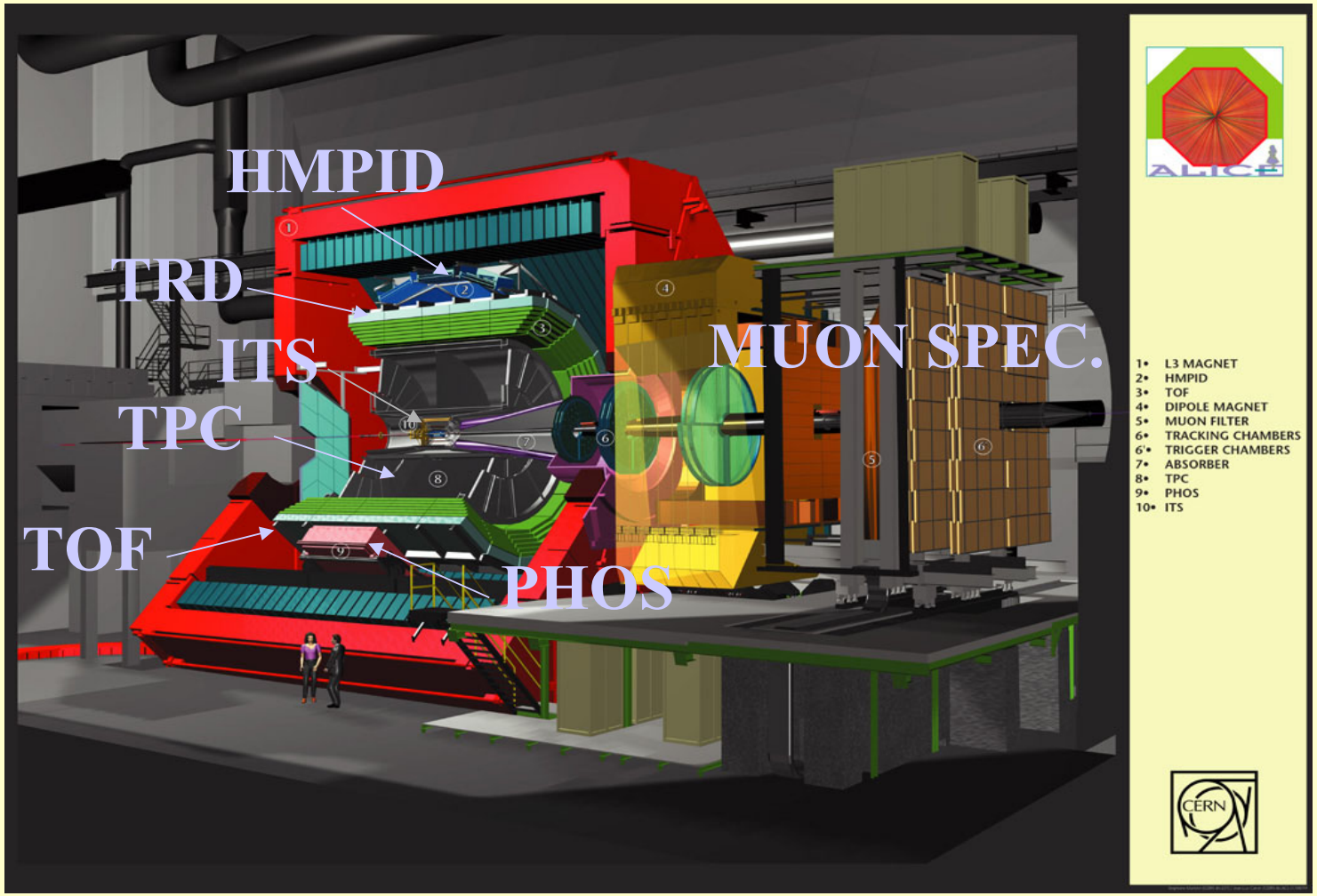
The ALICE experiment

Acceptance central barrel

$-0.9 < \eta < 0.9$

Acceptance muon spectr.

$-2.5 < \eta < -4.$



ALICE pseudorapidity acceptance

→ *additional forward detectors*
(no particle identification)

$1 < \eta < 5$ *and* $-4 < \eta < -1$

→ *definition of gaps* η_+, η_-

p-p luminosity L = $5 \times 10^{30} cm^{-2} s^{-1}$:

→ reduced prob. overlapping events

diffractive L0 trigger (hardware):

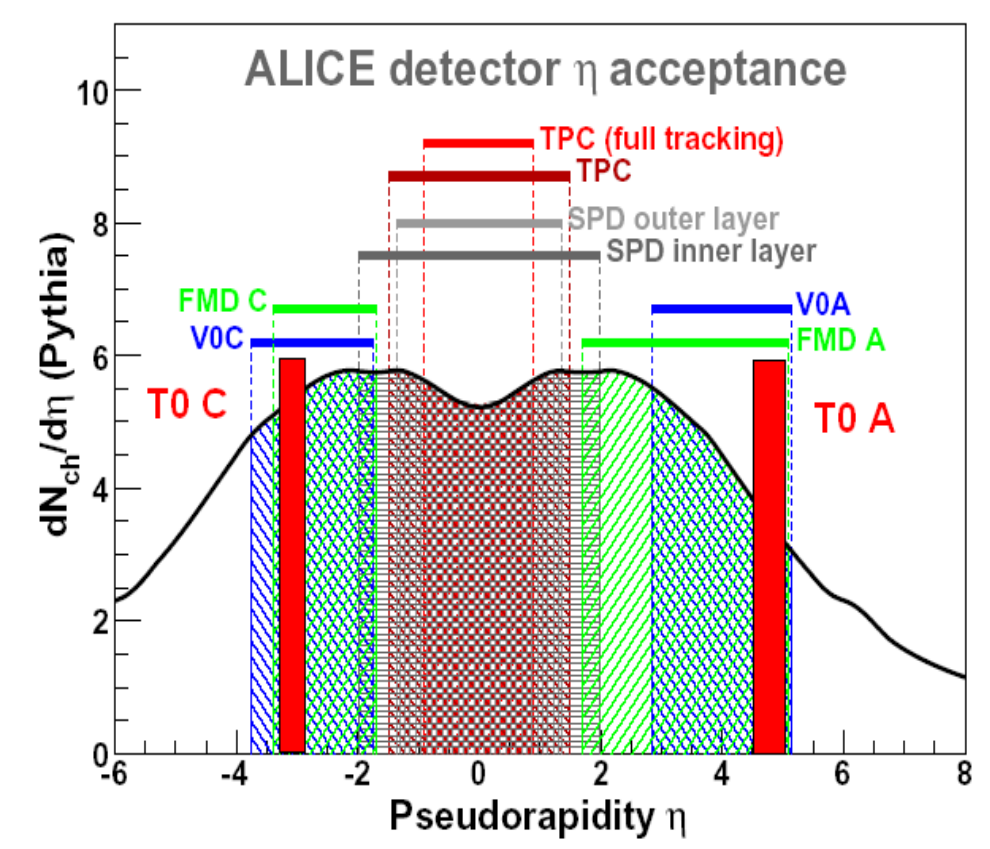
Pixel or TOF mult (central barrel)

V0A: gap η_+*:* $3 < \eta < 5 \rightarrow \Delta\eta \sim 0.5$

V0C: gap η_-*:* $-2 < \eta < -4 \rightarrow \Delta\eta \sim 0.5$

high level trigger (software):

gap η_+: $0.9 < \eta < 5.1$
gap η_-: $-3.7 < \eta < -0.9$
} V0-FMD-SPD-TPC

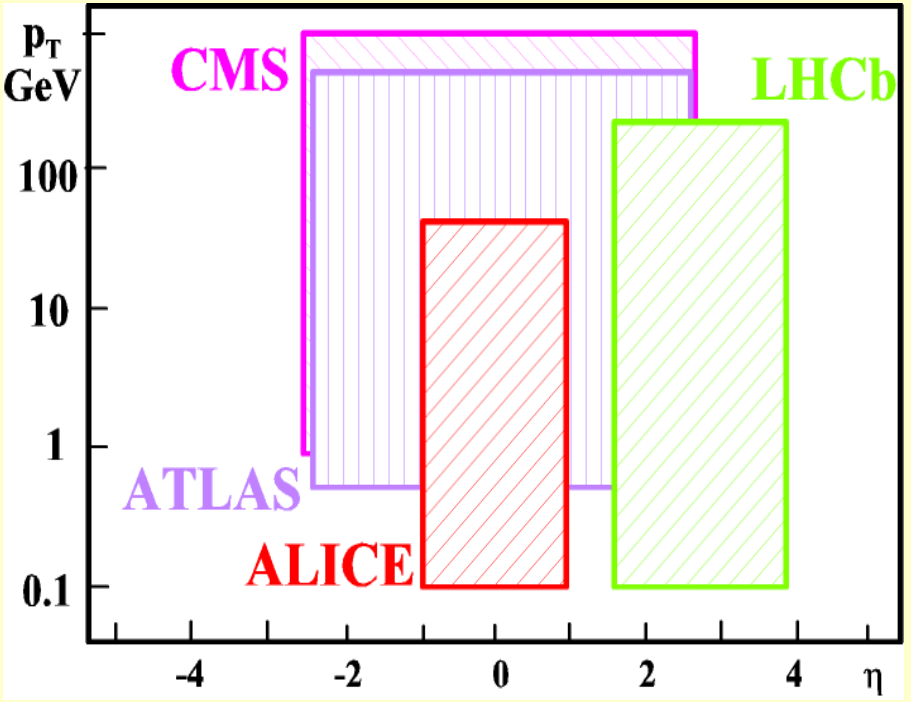


ALICE central barrel comparison to other LHC detectors

low magnetic field

	Magn. field (T)	P_T cutoff GeV/c	Material x/x0 (%)
ALICE	**0.2-0.5**	**0.1-0.25**	**7**
ATLAS	**2.0**	**0.5 (0.08)**	**20**
CMS	**4.0**	**0.75 (0.2)**	**30**
LHCb	**4Tm**	**0.1**	**3.2**

η–pt acceptance



→ *low p_T trigger ?*

ALICE acceptance

- ALICE acceptance matched to diffractive central production:

C-side	*central barrel*	*A-side*
Δη~3	*Δη~2*	*Δη~4*
gap	had	gap

Activity table

yes	yes	no
no	yes	no
no	yes	yes
yes	yes	yes

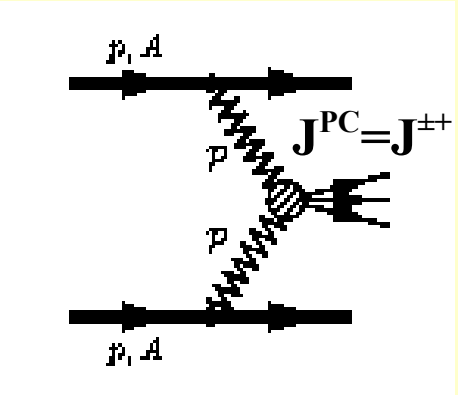
gap A

double gap

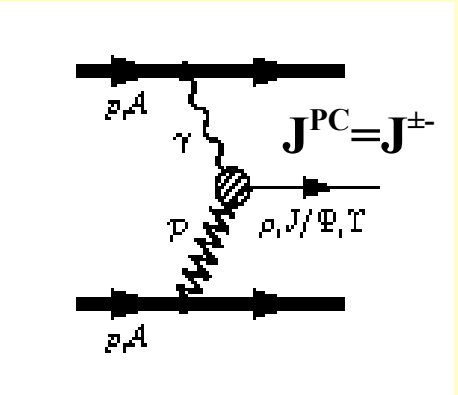
gap C

no gap

double pomeron



γ –pomeron



Data taking:

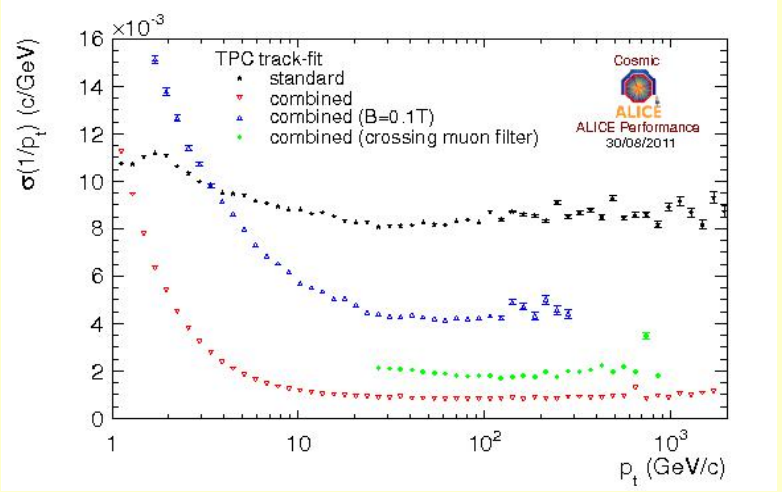
pp @ L = $5\text{x}10^{30}$ cm^{-2}s $\left(\rightarrow \frac{d\sigma}{dy}\Big|_{y=0} \sim nb\right)$

pPb @ L = 10^{29} $\text{cm}^{-2}\text{s}^{-1}$

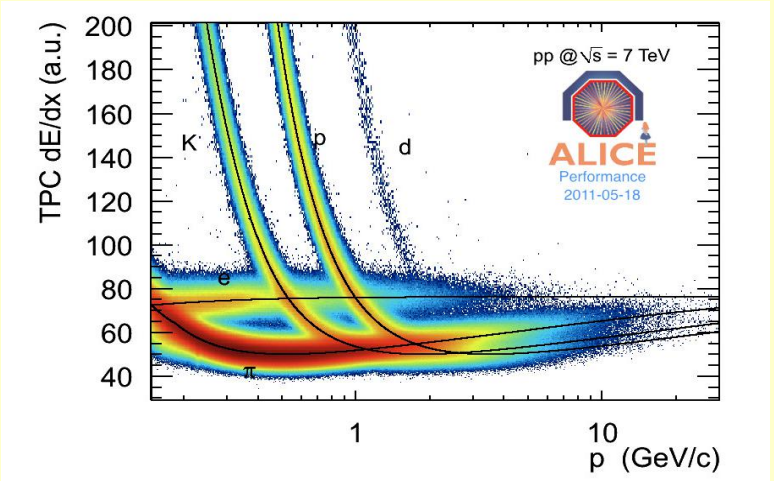
PbPb @ L = 10^{27} $\text{cm}^{-2}\text{s}^{-1}$

Performance ALICE Time-Projection Chamber TPC

- trans. mom. resolution in TPC
  from analysis of cosmic muons



- particle identification in TPC
  by energy loss dE/dx

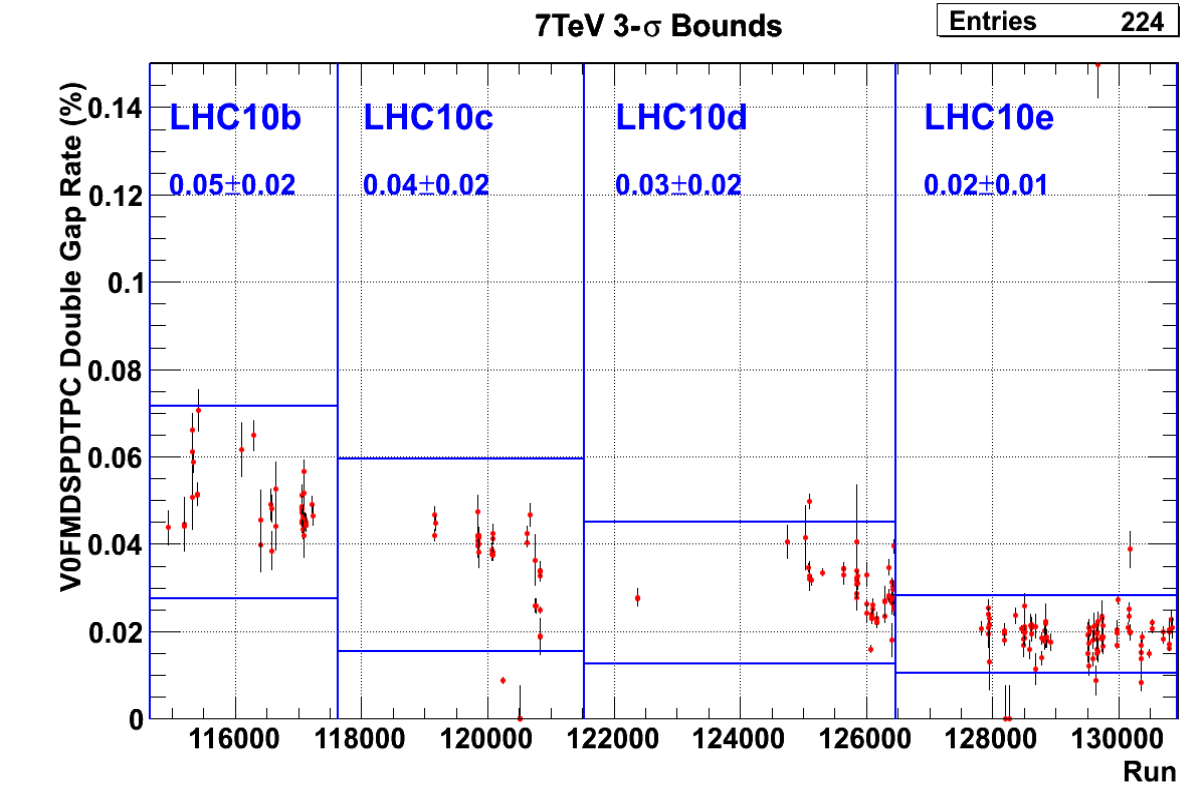


Central Meson production in pp-collisions at $\sqrt{s}$ = 7 TeV

- Data taken in 2010-2011 with minimum bias trigger
- Offline analysis event type: no gap/gap A/gap C/double gap
- Compare single/double gap events to no gap events
- Analysis of multiplicity-distribution
- Analysis of $f_0(980)$ and $f_2(1270)$ production

First analysis min bias data

3 σ cut on single gap, double gap fraction on a run basis

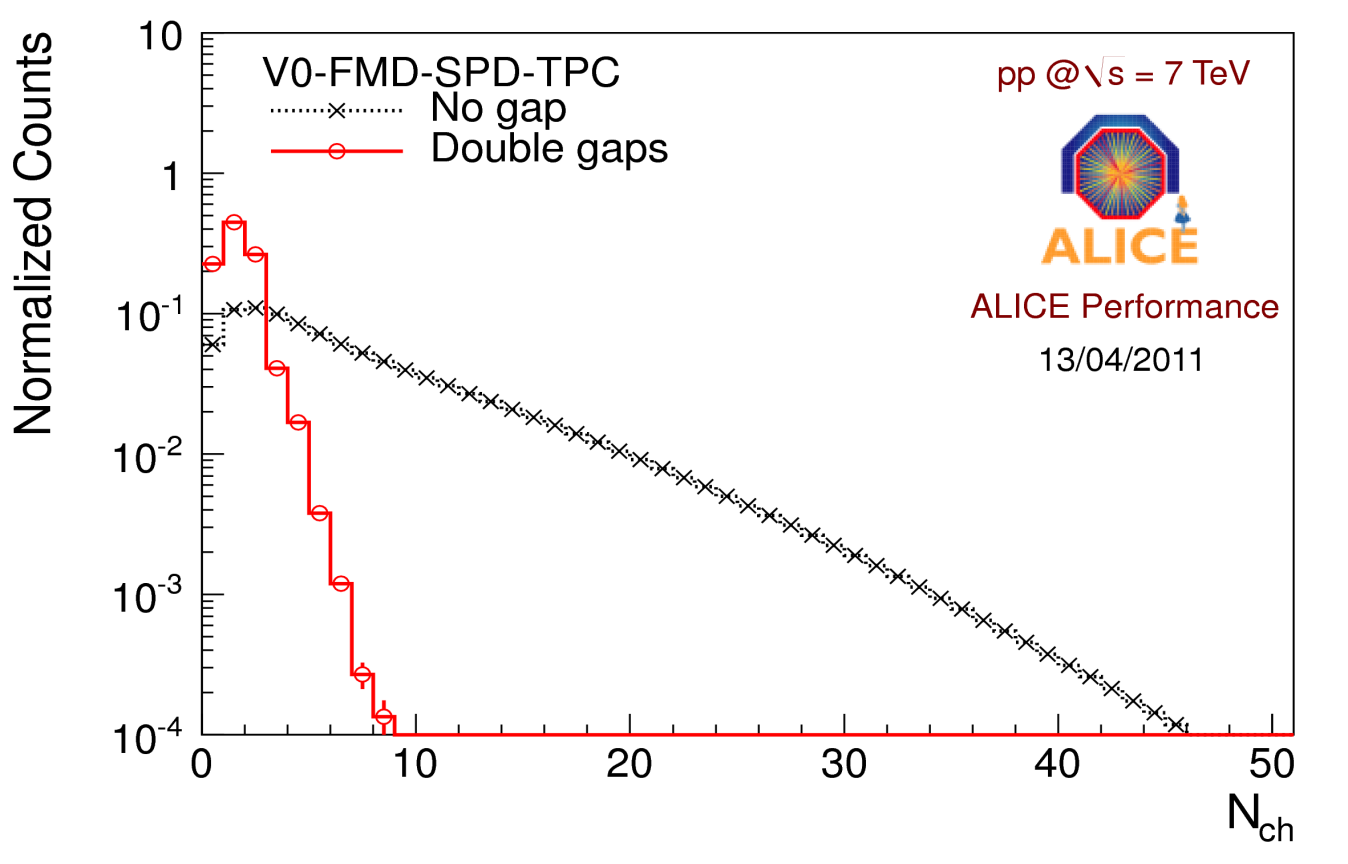


Data sample min. bias pp-collisions at $\sqrt{s}$ = 7 TeV

- Physics selection 3.5×10^8
- Primary vertex 2.9×10^8
- 2-track events total 3.2×10^7
  - no gap 3.1×10^7
  - double gap V0 (L0 trigger) 1.6×10^5
  - double gap V0-FMD-SPD-TPC 2.2×10^4

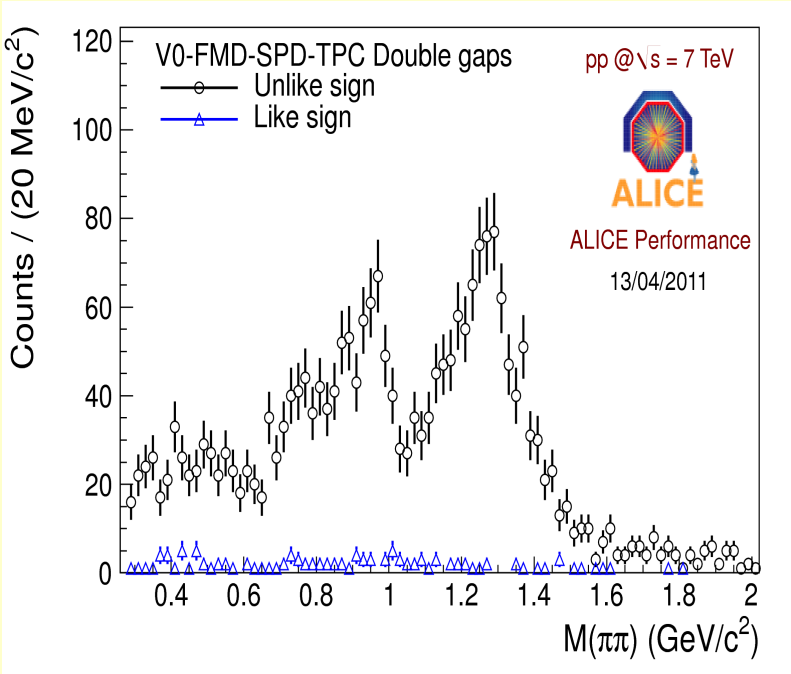
Multiplicity distribution

- Multiplicity distribution of gap and no gap events (good tracks)

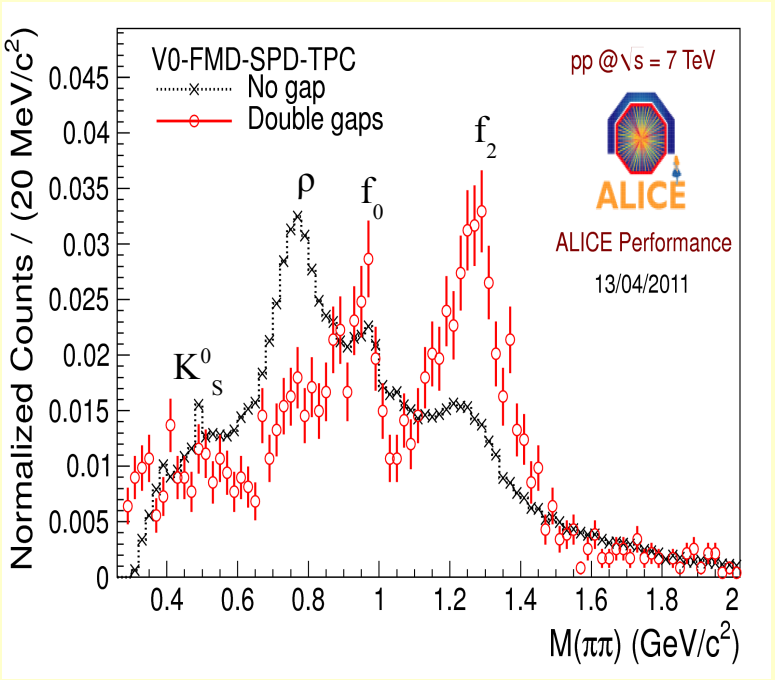


Invariant mass distribution

- Invariant mass distribution of pion pairs



distribution for double gap events unlike and like-sign pairs



like-sign corrected distribution for double and no-gap events

→ *enhanced f_0, f_2 production in double gap events*

Hardware double gap L0 trigger

- Hardware double gap L0 trigger for future data taking
- tested sep – oct, 2011
- double gap data sample taken
  - estimated number of events about 3 times larger than from analysis of minimum bias events
  - analysis ongoing

Conclusions, outlook

- Analysis of double gap events from min. bias pp-collisions at $\sqrt{s} = 7$ TeV
  - Double gap events show different multiplicity distribution
  - Two track invariant mass distribution of double gap events can be understood as continuum plus f_0, f_2 resonance contribution
  - f_0, f_2 enhancement in double gap events as compared to no-gap events
- Analysis ongoing of double gap events taken with hardware L0 trigger
  - improved statistics by a factor of about 3