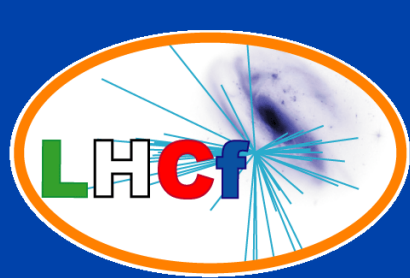


Discussion

- Analysis -

**LHCf collaboration meeting,
4-6 April 2017, Nagoya, Japan**

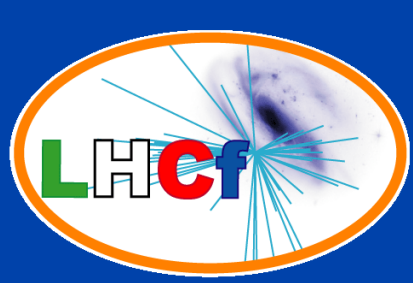


Summary

	γ	n	π^0	η	Joint ATLAS
p-p $\sqrt{s}=0.9\text{TeV}$	○		-	-	-
p-p $\sqrt{s}=2.76\text{TeV}$			○	-	
p-p $\sqrt{s}=7\text{TeV}$	○	○	○	-	-
p-p $\sqrt{s}=13\text{TeV}$	Submitted to CERN review	On- going		On-going	On-going MC study -> Submitted
p-Pb $\sqrt{s_{NN}}=5\text{TeV}$			○	-	△
p-Pb $\sqrt{s_{NN}}=8\text{TeV}$	Done in 2016				
RHICf p-p $\sqrt{s}=510\text{GeV}$	June(May), 2017				

Lists of current activities

- Photon at p-p, 13TeV (Makino, Alessio)
 - > Submitted
- Neutron at p-p, 13TeV (Eugenio, Zhou, Ueno)
 - > Arm2 done, Arm1 doing
 - Eugenio is starting a preparation of combine.
 - Target of publication: around September.
 - > Performance paper: around September.
- Eta at p-p, 13TeV (Shinoda)
 - > She showed raw spectra with photon analysis criteria.
 - Next is optimization of method and corrections.
 - Target of publication : ~ 1 year.
- LPM effect with p-p, 13TeV (Matsubayashi)
 - > Comparing with data and MC ????
 - Target of publication : ????
- Diffractive physics with ATLAS (Zhou)
 - > Data sharing was done. Preliminary results were shown.
 - Going to the corrections of spectra and systematic studies.
 - Target of analysis completion : within a few month (Publication-> Dec.)



What's next ?

	γ	n	π^0	η	Joint ATLAS
p-p $\sqrt{s}=0.9\text{TeV}$	○		-	-	-
p-p $\sqrt{s}=2.76\text{TeV}$			○	-	
p-p $\sqrt{s}=7\text{TeV}$	○	○	○	-	-
p-p $\sqrt{s}=13\text{TeV}$	Submitted to CERN review	On-going		On-going	On-going MC study -> Submitted
p-Pb $\sqrt{s_{NN}}=5\text{TeV}$			○	-	△
p-Pb $\sqrt{s_{NN}}=8\text{TeV}$	Done in 2016				
RHICf p-p $\sqrt{s}=510\text{GeV}$	June(May), 2017				

What's next ?

- p-p 0.9-13TeV
 - π^0 13 TeV; -> Update of the Energy Scaling test
 - Full analysis of photons, neutrons
Full coverage of η more than 8.4
=> full detector area, the higher detector position data set.
- p-Pb, 5 and 8 TeV
 - Need to show some results of the 2016 data set in a LHCC
 - Nuclear modification factors of π^0
- Joint analysis with ATLAS
=> Next slide.

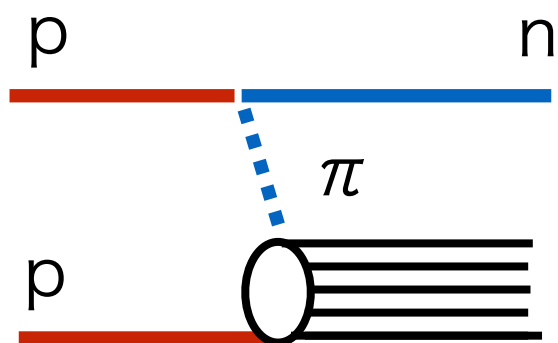
Joint analysis with ATLAS

- Agreement with the ATLAS physics coordinators.
 - p-p; soft-QCD group -> L. Adamczyk
 - p-Pb; heavy ion group -> No one is assigned yet.
- Current status
 - First target was set to “the measurement of diffractive contribution on the forward neutron production cross-section.
=> Analysis for ~ a few months and publication for 0.5~1 year.
 - Next target is not fixed yet.
 - Event-matching was already done for fill 3855.
=> We can cook it as we want.
 - Adamczyk may have a student for this joint activity in the future.
(~ 1 year from now.)

Candidate of next targets of joint analysis.

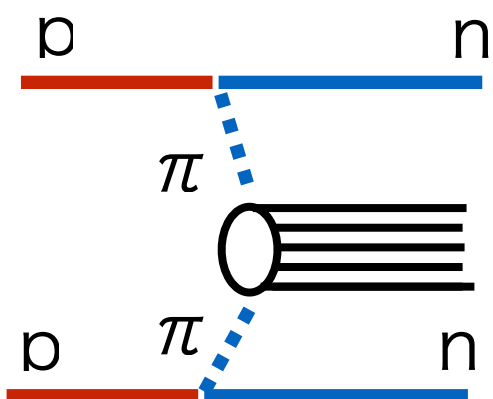
- More detailed analysis for diffractive physics

- Measurement of p - π collisions



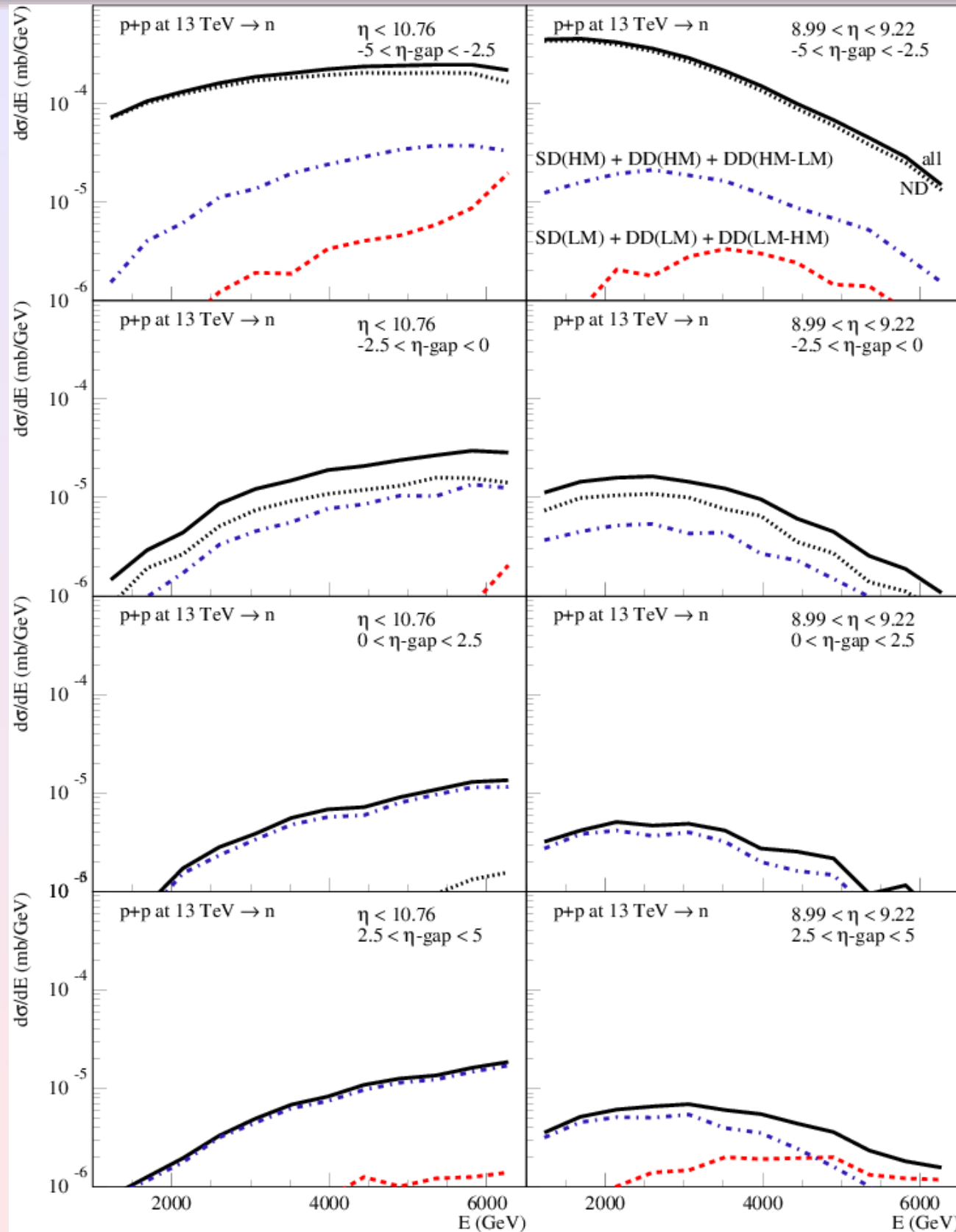
- p - π collisions are important for air-shower development especially the muon excess issue.
- p - π total cross section can be estimated from the forward neutron energy spectrum with some assumption. -> arxiv:1612.03418
- ATLAS-LHCf helps to confirm the model and cut background from diffractive collisions.

- Measurement of π - π collisions

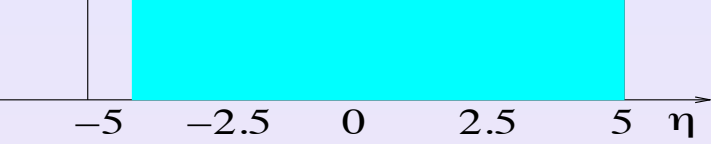
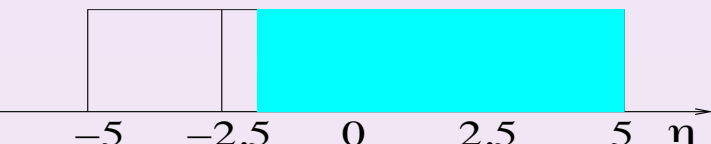
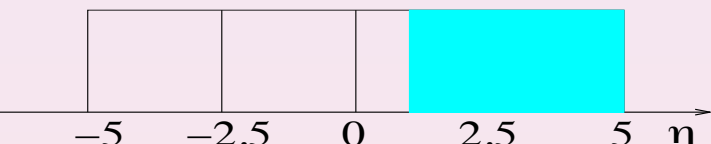
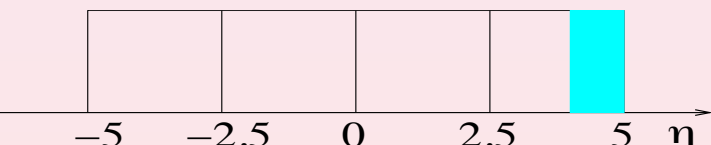
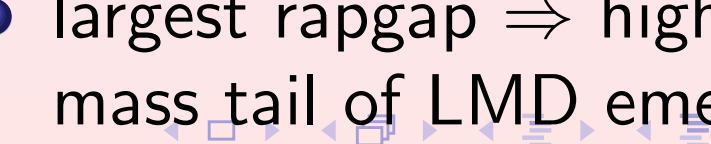


- Measurement of such small system collisions of π - π interests in the hadron physics.
- By tagging double neutrons in the LHCf detectors, pure π - π samples can be selected.

Forward n spectra: LHC + backward rapgap in ATLAS



Study by S.Ostapchenko

- 
 small rapgap in ATLAS:
 mostly fluctuations in ND
- 
 LMD: due to DD(LM-HM)
- 
 larger rapgap \Rightarrow both ND & LMD suppressed
- 
 very large rapgap:
 only HM diffraction
- 
 largest rapgap \Rightarrow high mass tail of LMD emerges

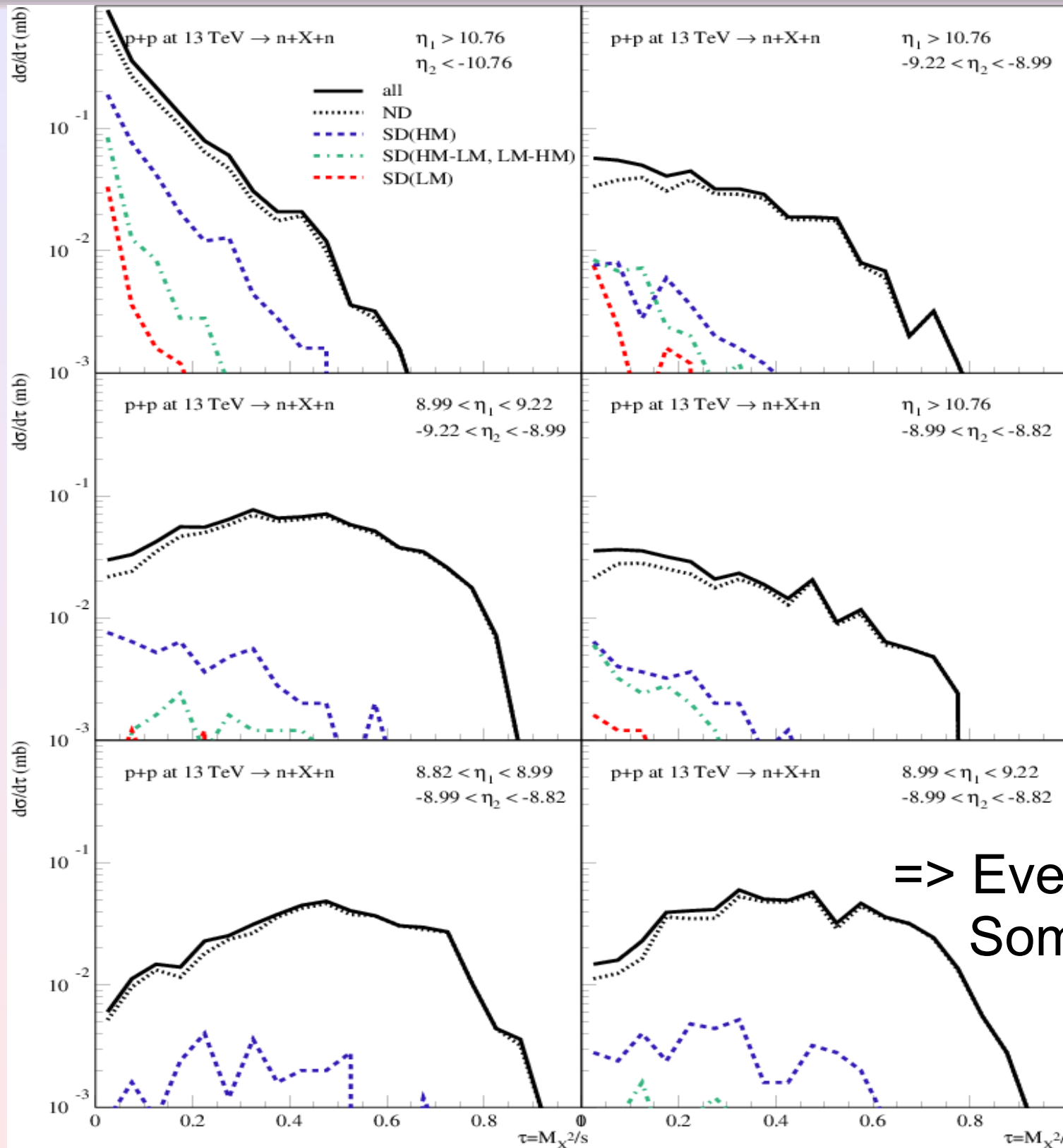
Double neutron detection: 'pion-pion interaction'

Study by S.Ostapchenko

ND: π - π interaction
 SD: diffractive collisions
 HM: high mass
 LM: low mass

- negligible LMD
 (except the most forward selection)

=> Even only LHCf detectors,
 Something can be measured.



Total pion-proton cross-section from the new LHCf data on leading neutrons spectra.

R.A. Ryutin^{a1}

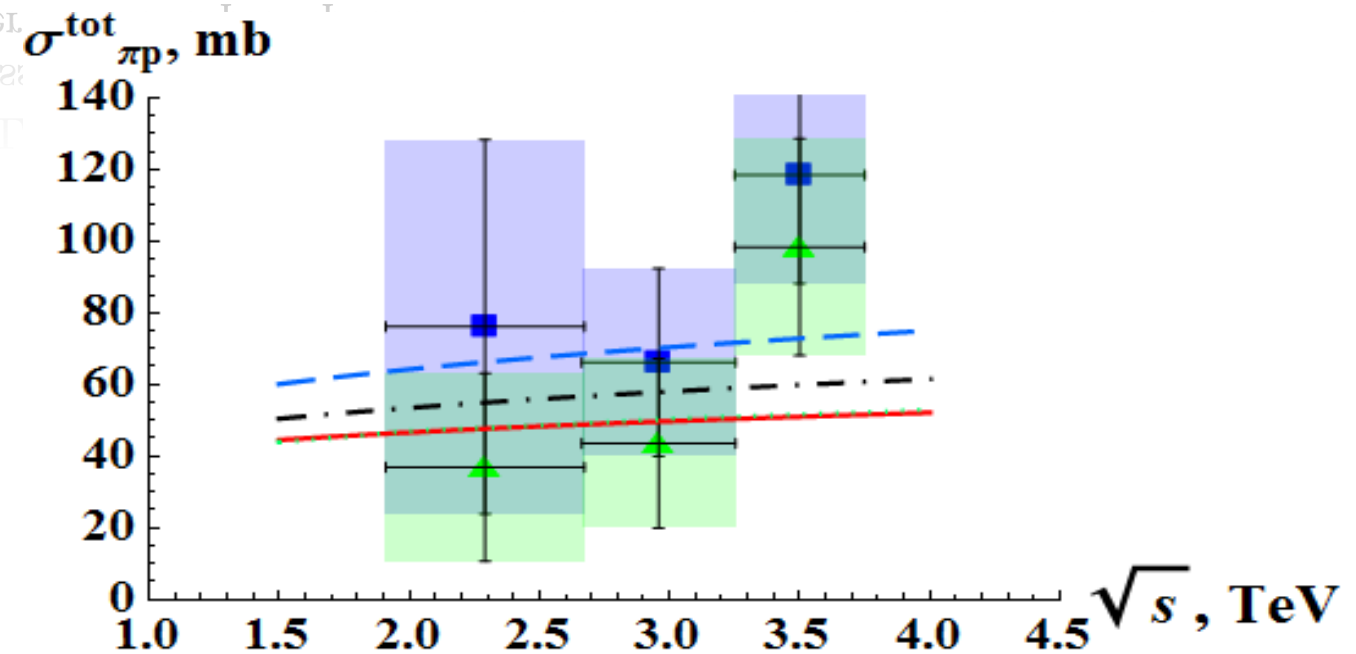
Institute for High Energy Physics, NRC “Kurchatov Institute”, Protvino 142 281, Russia

Received: date / Revised version: date

Abstract. In the light of the latest data by LHCf collaboration of the LHC on leading neutrons spectra it is possible to obtain total pion-proton cross-sections in the TeV energy region. In this work the exact extraction procedure is shown. Final numbers for the pion-proton cross-section are collected at several different values of the colliding energy and compared with some popular theoretical predictions. Errors of results are estimated.

results are estimated.

\sqrt{s} , TeV (ξ_{LHCf})	$\sigma_{\pi p}^{tot}$, mb ($ t $, GeV ²)	
	$8.99 < \eta < 9.22$	$8.81 < \eta < 8.99$
2.291 ± 0.382 (0.107 ± 0.035)	76.1 ± 52.3 (0.0192 ± 0.0018)	36.9 ± 26.3 (0.0231 ± 0.0021)
2.958 ± 0.296 (0.179 ± 0.035)	66.1 ± 26.2 (0.058 ± 0.0055)	43.5 ± 23.7 (0.0699 ± 0.0064)
3.5 ± 0.25 (0.25 ± 0.035)	118.5 ± 30.3 (0.125 ± 0.012)	98.4 ± 30.3 (0.15 ± 0.014)



How we organize ?

■ Manpower

- Japanese; Menjo, Zhou(D3), Ueno(D1), Shinoda(M2), Ohashi(M1), (Sato(M2))
- Italians; Eugenio, Alessio

■ Publication Schedule

- Neutron, p-p 13TeV; ~ September
- Neutron performance; ~ September
- π^0 , p-p 13TeV; ~ one year.
- First joint analysis; < 1 year.

■ Tools, Libraries

- Two independent libraries: Nagoya's library, Mitsuki's library.