

# ROGER HERNÁNDEZ (ESR)

- Start date : June 1st, 2011
- Host Country: Argentina
- Home Country : México

## Education Background

B. Sc. in Physical Engineering

Faculty of Engineering, UADY, Yucatán, MEX

“Study of the pinning forces in high  $T_c$  superconductors”

M. Sc. in Physics

Physics Department, CINVESTAV-IPN, México City, MEX

“A gauge model for right handed neutrinos as dark matter”



LHCphenonnet



# Position

University : Physics Department, FCEyN  
University of Buenos Aires, Argentina  
Project : Global analysis of  
Fragmentation Functions  
Supervisor : Dr. Daniel de Florian

PhD. Institute : Physics Department,  
CINVESTAV-IPN, México  
PhD. Project : Dark Matter in  
Physics Beyond the Standard Model  
PhD. Thesis Advisor :  
Dr. Abdel Perez Lorenzana

16-20 Sept, 2012



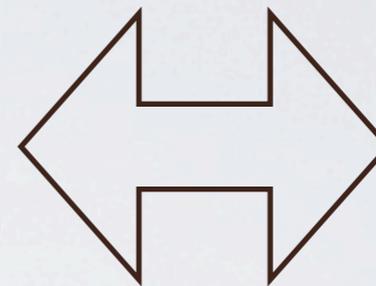
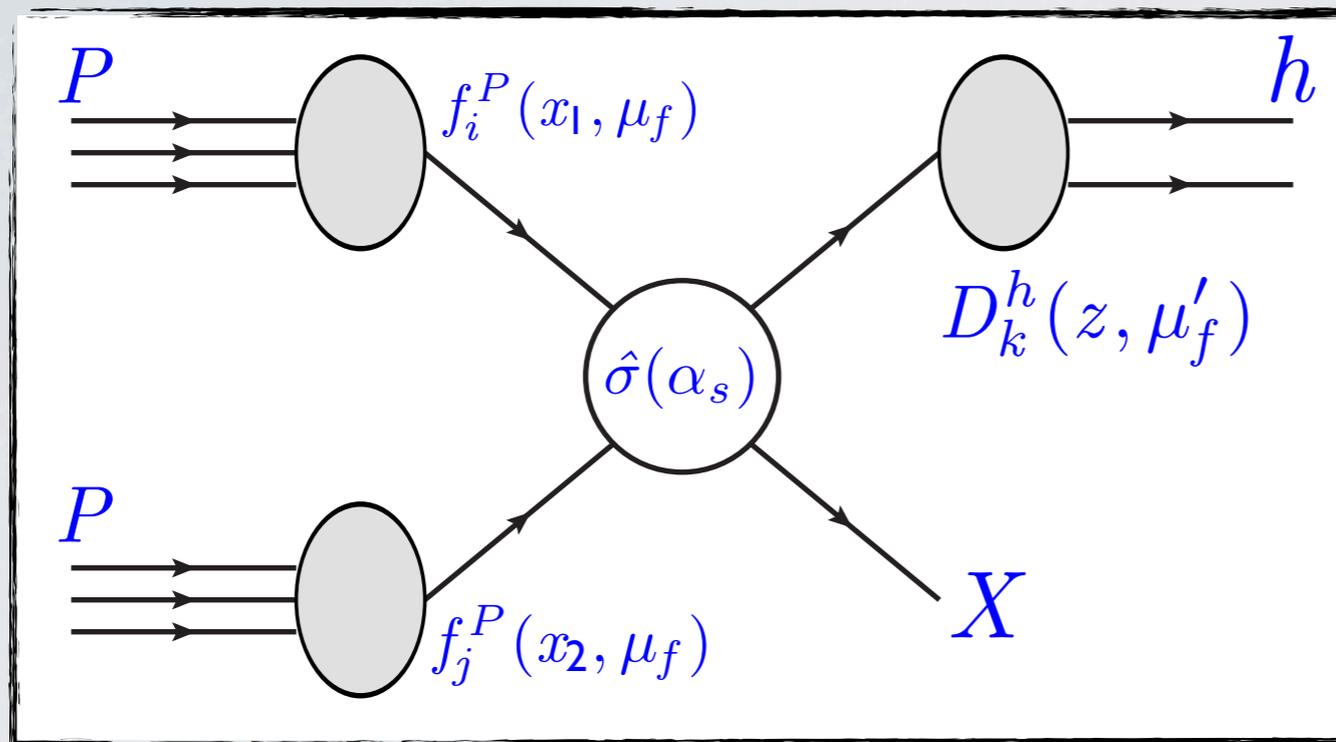
LHCPhenonet Mid-Term Meeting

# Project Overview



- ◆ Parton Distribution Functions and Fragmentation Functions contain the description of particles into an scattering process.
- ◆ Both distributions are sensitive to the data, although they are non perturbative objects, data is necessary to their understanding.
- ◆ In order to know its behavior, one need to look at the nucleon substructure.
- ◆ Fragmentation functions are relevant any time a hadronic particle is produced in High Energy Collisions such as at the LHC.
- ◆ Describe the collinear transition of a massless parton “ $q$ ” into a massless hadron “ $h$ ” carrying fractional momentum “ $z$ ”.

# Hadron-Hadron Collisions

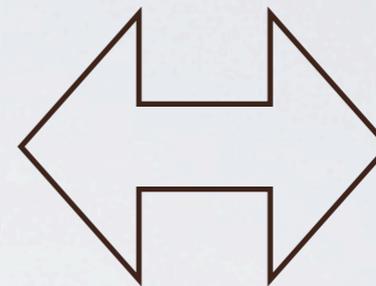
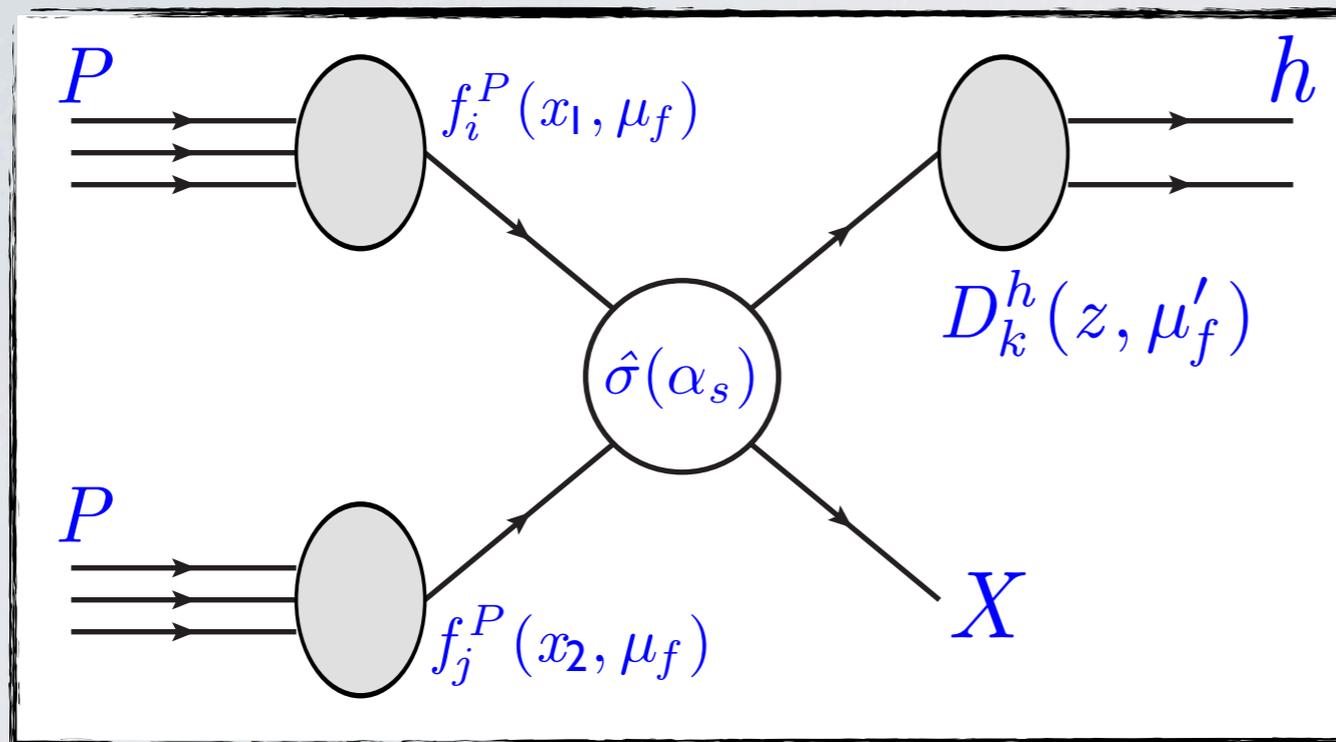


- $q\bar{q} \rightarrow g$
- $qq \rightarrow q$
- $qg \rightarrow g$
- $qg \rightarrow q$
- $gg \rightarrow q$
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Transverse momentum distribution is

$$\frac{d\sigma(pp \rightarrow hX)}{dp_T d\eta} = \sum_{i,j,k} \int_0^1 dx_1 \int_0^1 dx_2 \int_0^1 dz f_i^P(x_1, \mu_f) f_j^P(x_2, \mu_f) D_k^h(z, \mu'_f) \frac{d\hat{\sigma}(ij \rightarrow kX')}{dp_T d\eta}$$

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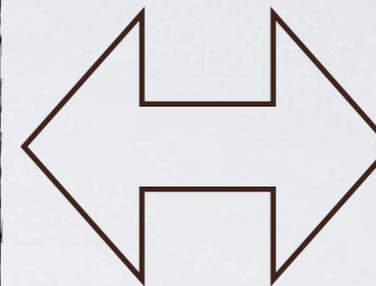
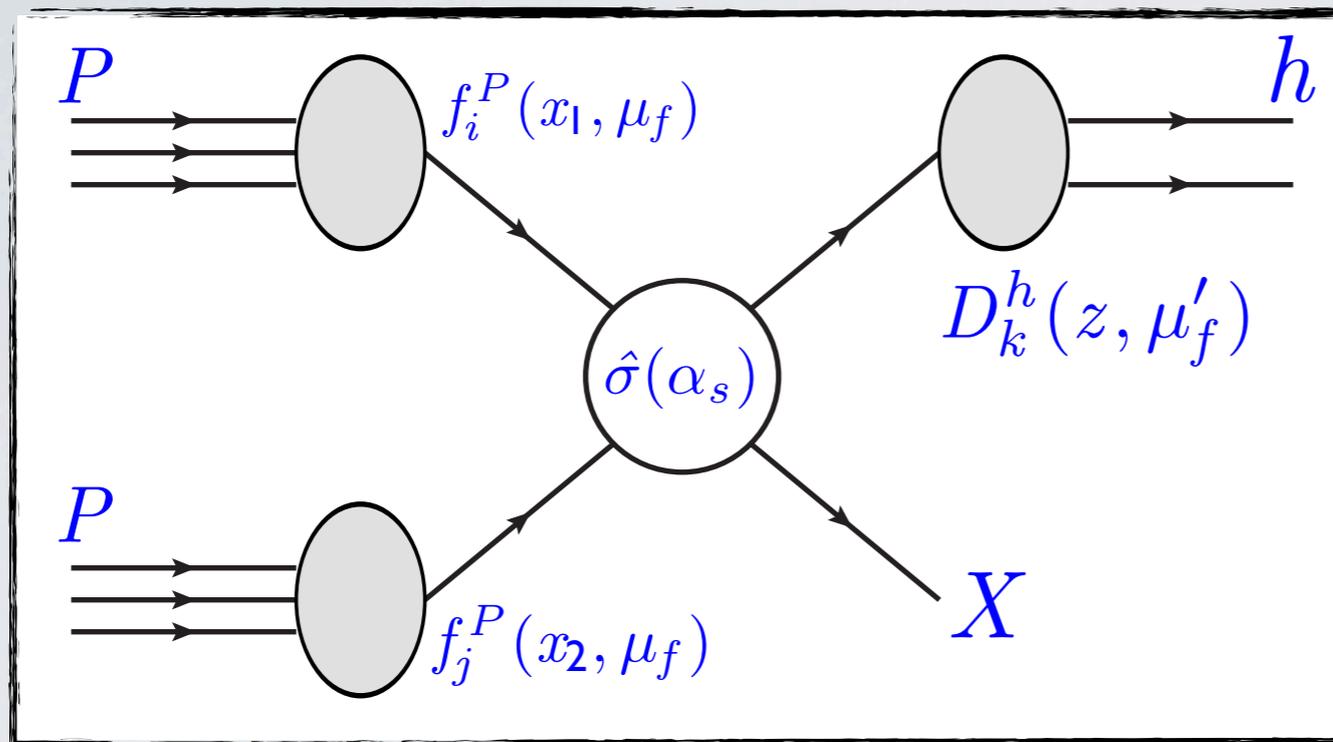
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Experimental distributions

# Hadron-Hadron Collisions



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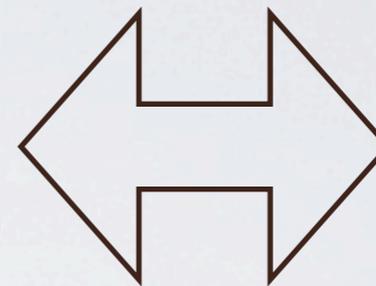
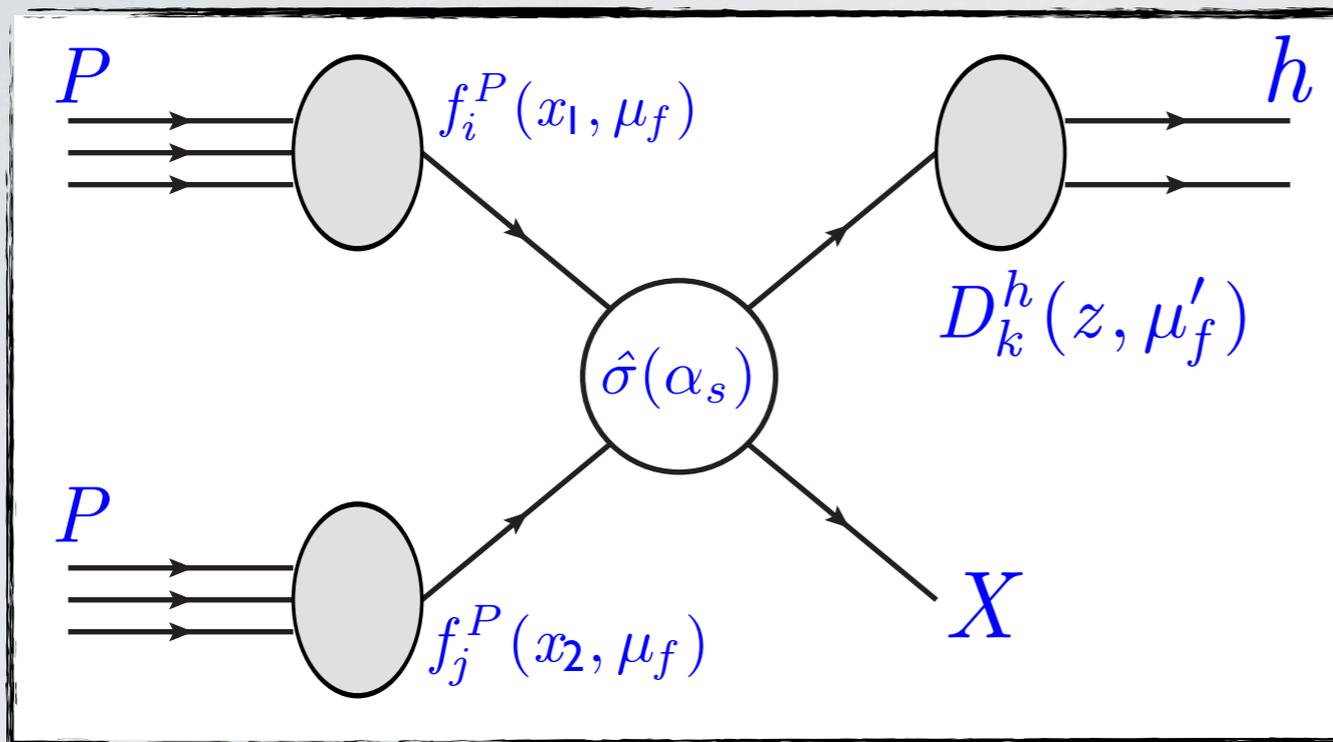
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Experimental distributions

Calculable using perturbative methods

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Experimental distributions

Calculable using perturbative methods

Extracted using experimental and theoretical results

Model Ansatz for FFs with initial set of parameters

Evolve FFs to relevant scale using DGLAP

Calculate the observable and the  $\chi^2$

Minimum  $\chi^2$ ??

yes

no

all data points

adjust parameters

$$D_i^H(z, Q_0^2) = N_i z^{\alpha_i} (1-z)^{\beta_i} [1 + \gamma_i (1-z)^{\delta_i}]$$

33 parameters to fit

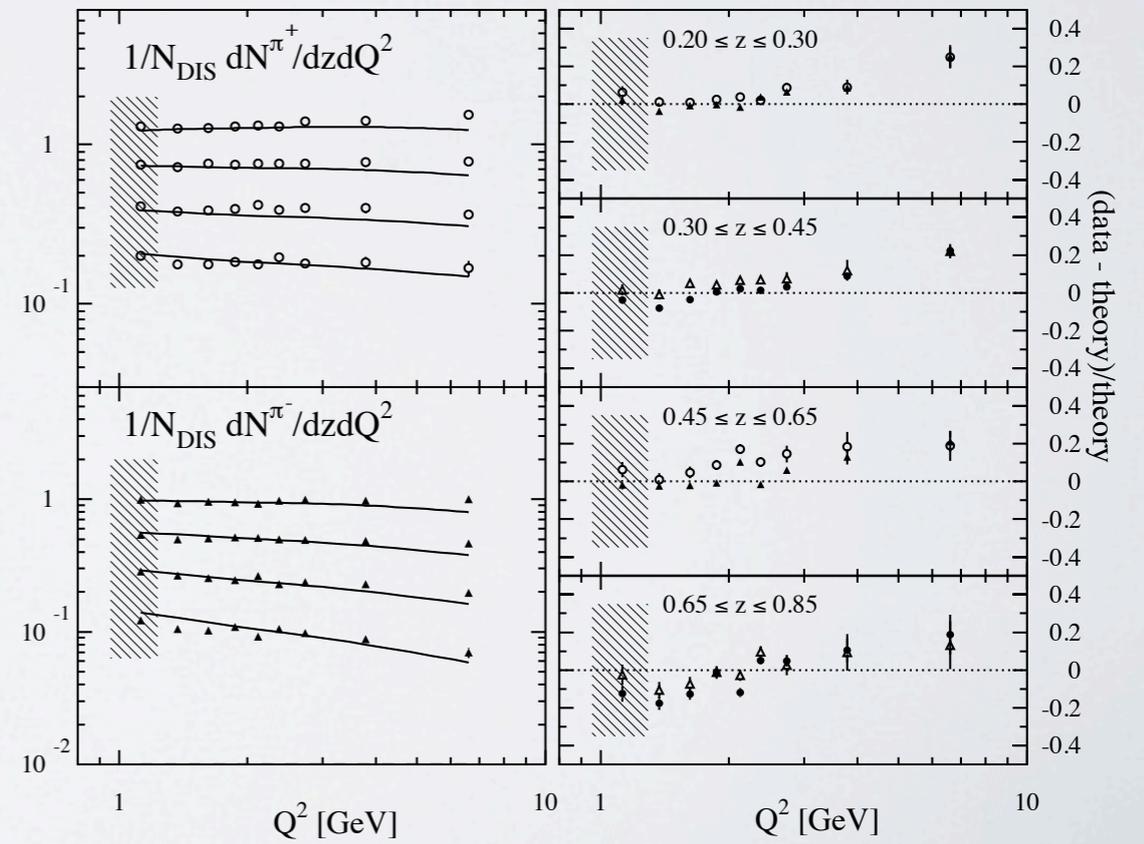
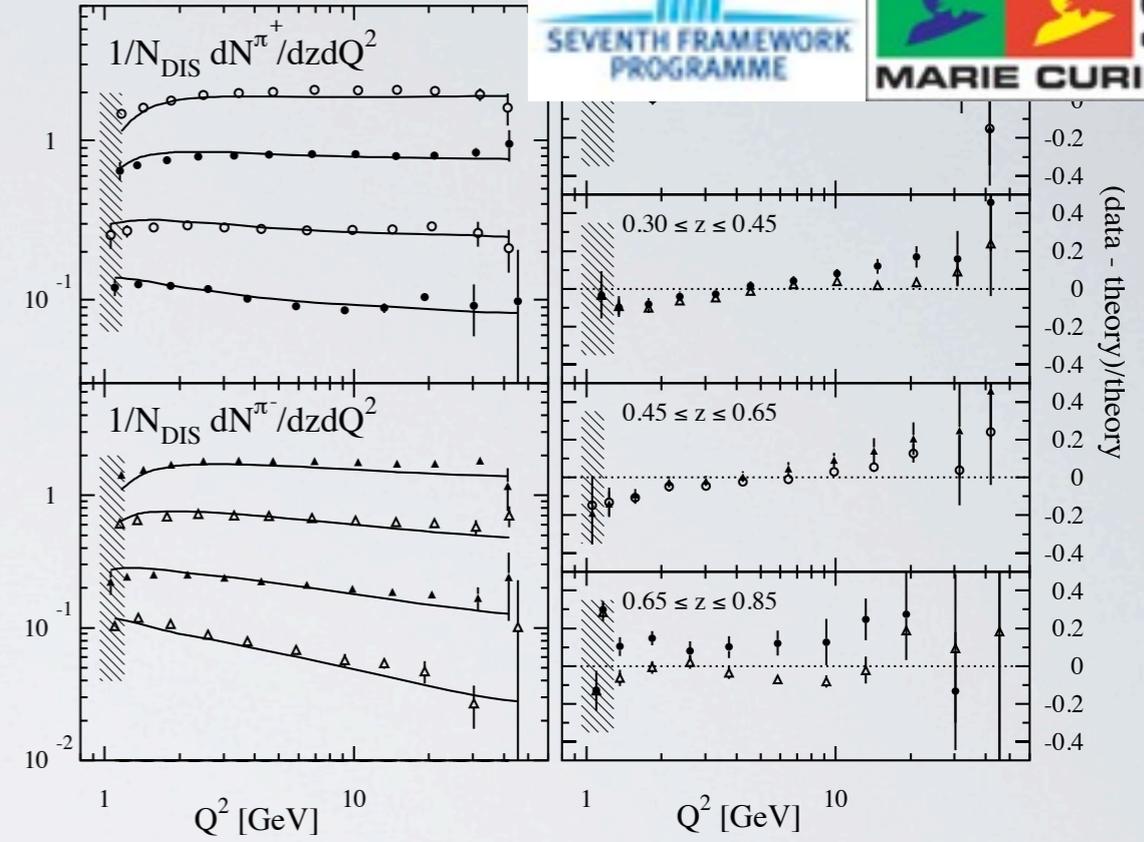
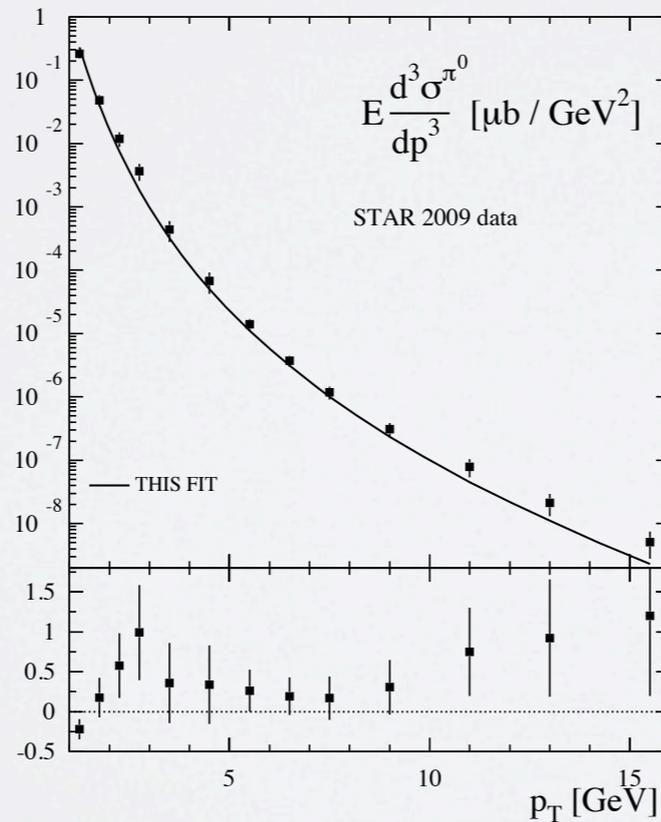
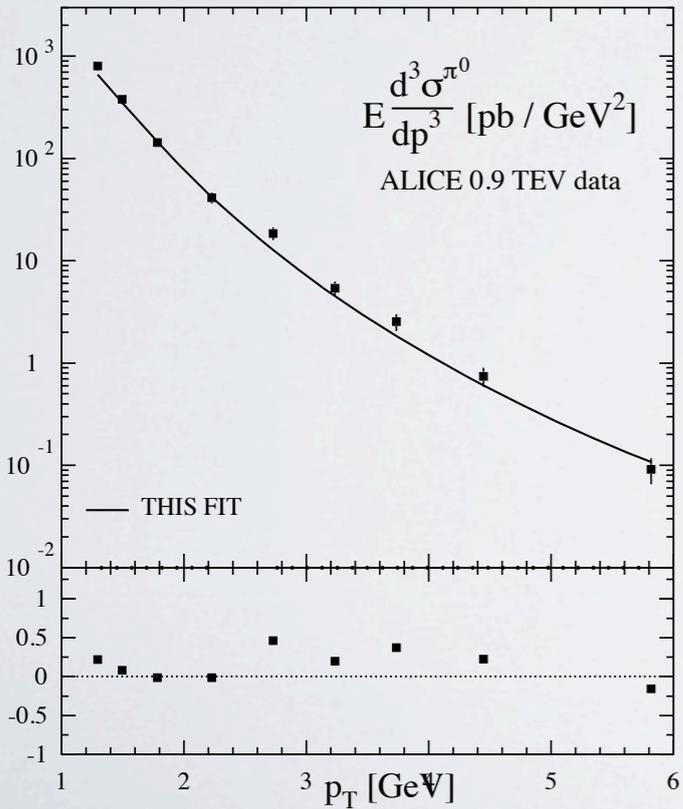
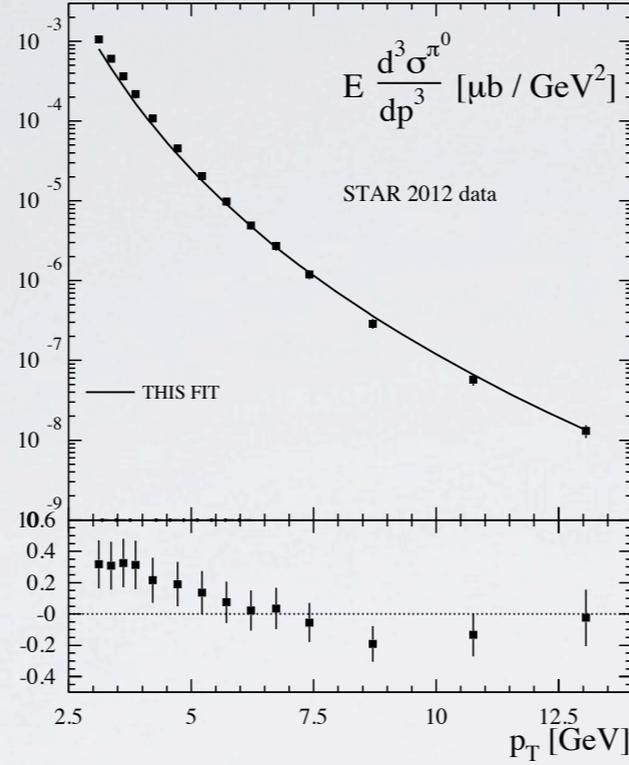
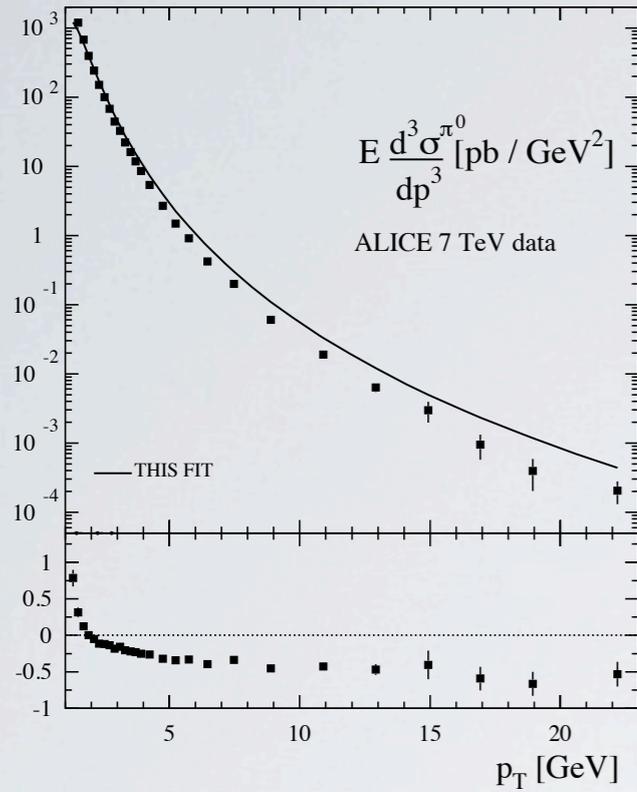
Integration using the Mellin Technique

$$\otimes \rightarrow \cdot$$

New grids using NLO  
MSTW2008 PDFs

Standard  $\chi^2$  minimization  
(MINUIT)

# Preliminary Results



16-20 Sept, 2012

LHCPhenonet Mid-Term Meeting

# Training Overview



## Training Events

- ◆ Phenomenology Workshop, July 2011, Buenos Aires, ARGENTINA.
- ◆ PreSUSY 2011 Summer School, August 2011, University of Chicago, Illinois, USA.
- ◆ LHCPhenoNet Winter School 2012, January 2012, Ascona, SWITZERLAND.
- ◆ 2012 CTEQ-Fermilab Summer School, July 30th-August 9th, Lima, PERU.

## Complementary training

- ◆ Representative of the LHCPhenonet Fellows in the Supervisory Board.
- ◆ Member of the organizing committee of the next Workshop at Buenos Aires in April/May.
- ◆ Member of the organizing committee of the PASI2012: Exploring the Terascale and beyond.
- ◆ Visit to the Swiss node in January 2012.
- ◆ Collaboration with members of the network ( Dr. Rodolfo Sassot, UBA) and outer of the network (Dr. Marco Stratmann, Berkeley National Laboratory, USA).
- ◆ Help to the members of the University of Buenos Aires with their coding and use of some HEP packages

# Talks in conferences and seminars



- ◆ “Neutrinos and Dark Matter in the minimal B-L SUSY Model”.  
19th International Conference on Supersymmetry and Unification of Fundamental Interactions, **USA, Aug-Sept 2011.**
- ◆ “SUSY DM in the minimal B-L model”.  
Essential Cosmology for the next generation, **MEXICO, January 2012.**
- ◆ “Global Analyses of Fragmentation Functions”.  
HEP Seminar at CINVESTAV, **MEXICO, February 2012.**
- ◆ “Searching the Fragmentation Functions with Global Analyses”.  
PASI 2012: Exploring the Terascale and Beyond, **ARGENTINA, March 2012.**
- ◆ “Upgrade on Fragmentation Functions”.  
LHCPhenonet Annual Meeting, **UNITED KINGDOM, March 2012.**
- ◆ “B-L neutralino DM”.  
18th International Symposium on Particles Strings and Cosmology, **MEXICO, June 2012.**



- ◆ “Extracting the fragmentation functions with global analyses”.  
18th International Symposium on Particles Strings and Cosmology, MEXICO, June 2012.
- ◆ “Supersymmetric Dark Matter and Beyond”.  
Seminar at the Instituto de Ciencias Nucleares, UNAM, MEXICO, June 2012.
- ◆ “Supersymmetric extensions of the Standard Model for Dark Matter”.  
Seminar at the FCFM, BUAP, MEXICO, June 2012.
- ◆ “New extraction of fragmentation functions”  
LHCPhenonet Mid-Term Meeting, ITALY, September 2012.

## Publications

- ◆ “B-L neutralino DM”. To appear in the Proceedings of the 18th International Symposium on Particles Strings and Cosmology, Merida, Mexico.
- ◆ “Extracting the fragmentation functions with global analyses”. To appear in the Proceedings of the 18th International Symposium on Particles Strings and Cosmology, Merida, Mexico.