General Scaling Law of Inclusive reactions

Rajendran Raja

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Fermilab

P-907 collaboration updated list

Y. Fisyak
Brookhaven National Laboratory
T.Bergfeld,A.Godley,S.R.Mishra,C.Rosenfeld,
University of South Carolina
R. Winston
EFI, University of Chicago
J.Brack,R.J.Peterson,D.Prull,R.Ristinen
University of Colorado, Boulder,
E.Swallow
Elmhurst College and EFI
J.Hylen, N. Mokhov,J.Morfin, C.T.Murphy, A.Para, R.Raja,
S. Striganov
Fermi National Accelerator Laboratory
M. Messier
Harvard University
D.Asner,P.D.Barnes Jr., D.Fujino, E.Hartouni,S.Johnson, R.Soltz, D.Wright,
C.Wuest
Lawrence Livermore Laboratory
L.Liu,S.Mashnik,A.Sierk,
Los Alamos National Laboratory
H.R.Gustafson,M.Longo,A.Lehmann,H-K.Park,
University of Michigan
B.Cole,
Nevis Laboratories
L.Gutay,
Purdue University
S.Chernichenko, Y.Galitsky,Y.Gutnikov,V.Onuchin,E.Melnikov,V.Semenov
IHEP Protvino
S.Wojcicki
Stanford University

Purpose of the experiment

- Test a scaling law of particle fragmentation
- Measure particle spectra with 120 GeV/c protons on the NUMI target.
- Measure particle production off various nuclei- Useful for Nuclear (RHIC) physics.
- Neutrino factory/Muon Collider type measurements
- Indirect benefit for collider experiments by helping with Geant cross sections.
- Revisit the study of non-perturbative QCD hadron production dynamics by measuring particle interactions with excellent particle identification, high acceptance and rate.

General scaling law of particle fragmentation

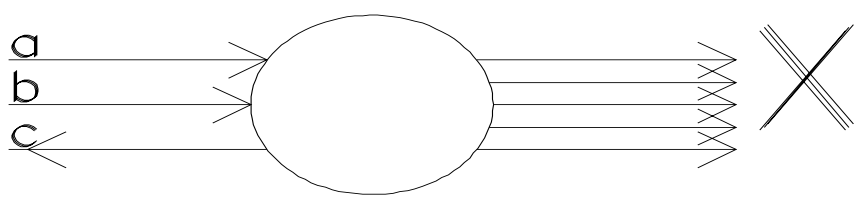
- States that the ratio of a semi-inclusive cross section to an inclusive cross section

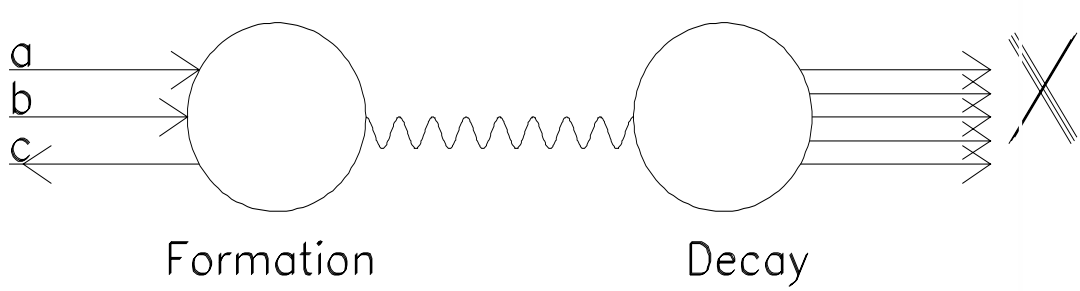
$$\frac{f(a+b\rightarrow c+X_{subset})}{f(a+b\rightarrow c+X)} \equiv \frac{f_{subset}(M^2,s,t)}{f(M^2,s,t)} = \beta_{subset}(M^2)$$

- where M^2,s and t are the Mandelstam variables for the missing mass squared, CMS energy squared and the momentum transfer squared between the particles a and c. PRD18(1978)204.
- Using EHS data, we have tested and verified the law in 12 reactions (DPF92) but only at fixed s.
- The proposed experiment will test the law as a function of s and t for various particle types a ,b and c for beam energies between ~5 GeV/c and 120 GeV/c to unprecedented statistical and systematic accuracy.

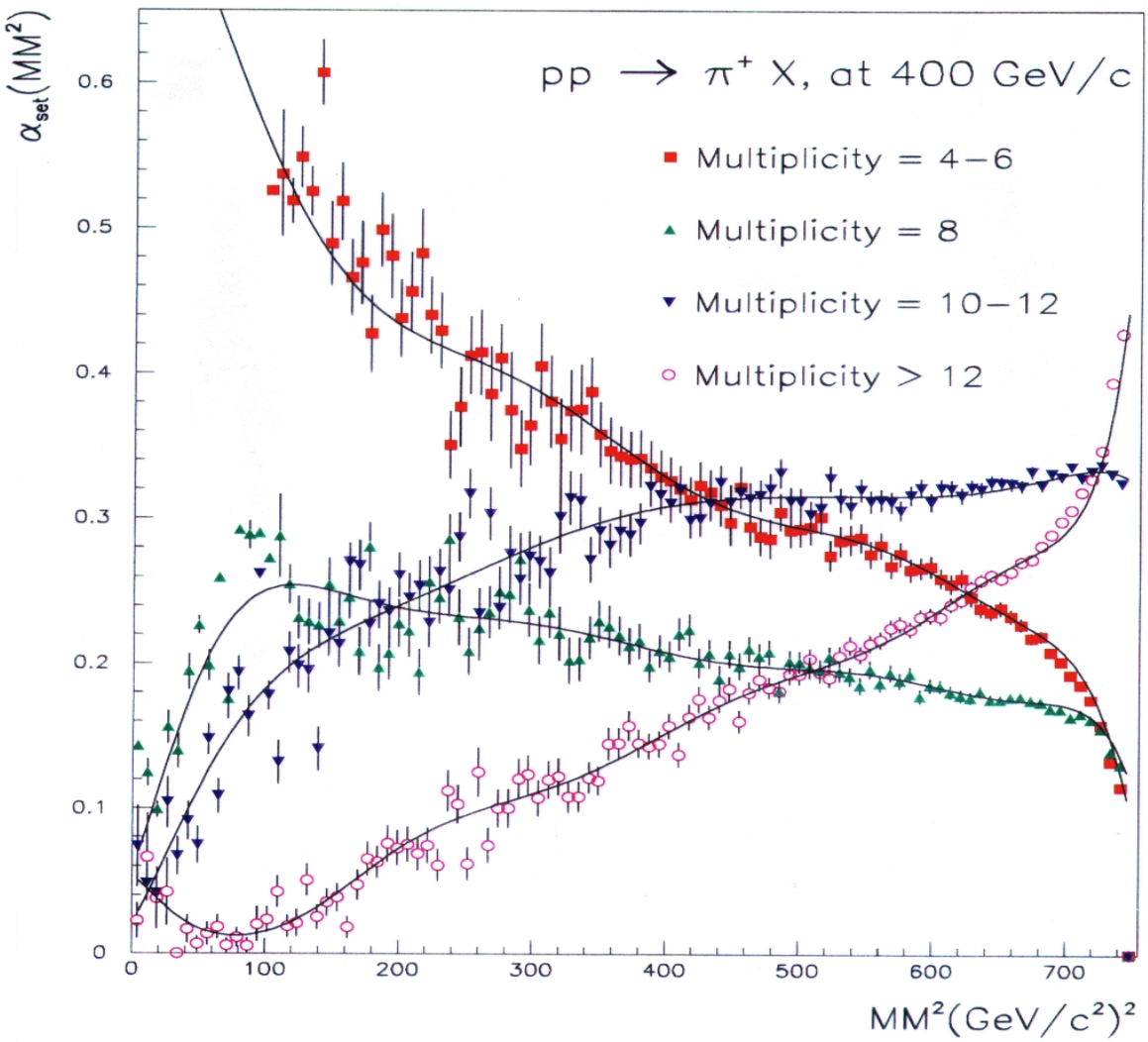
Scaling Law

- Physics behind law is the factorization of 3 body scattering cross section.





Scaling law-EHS results



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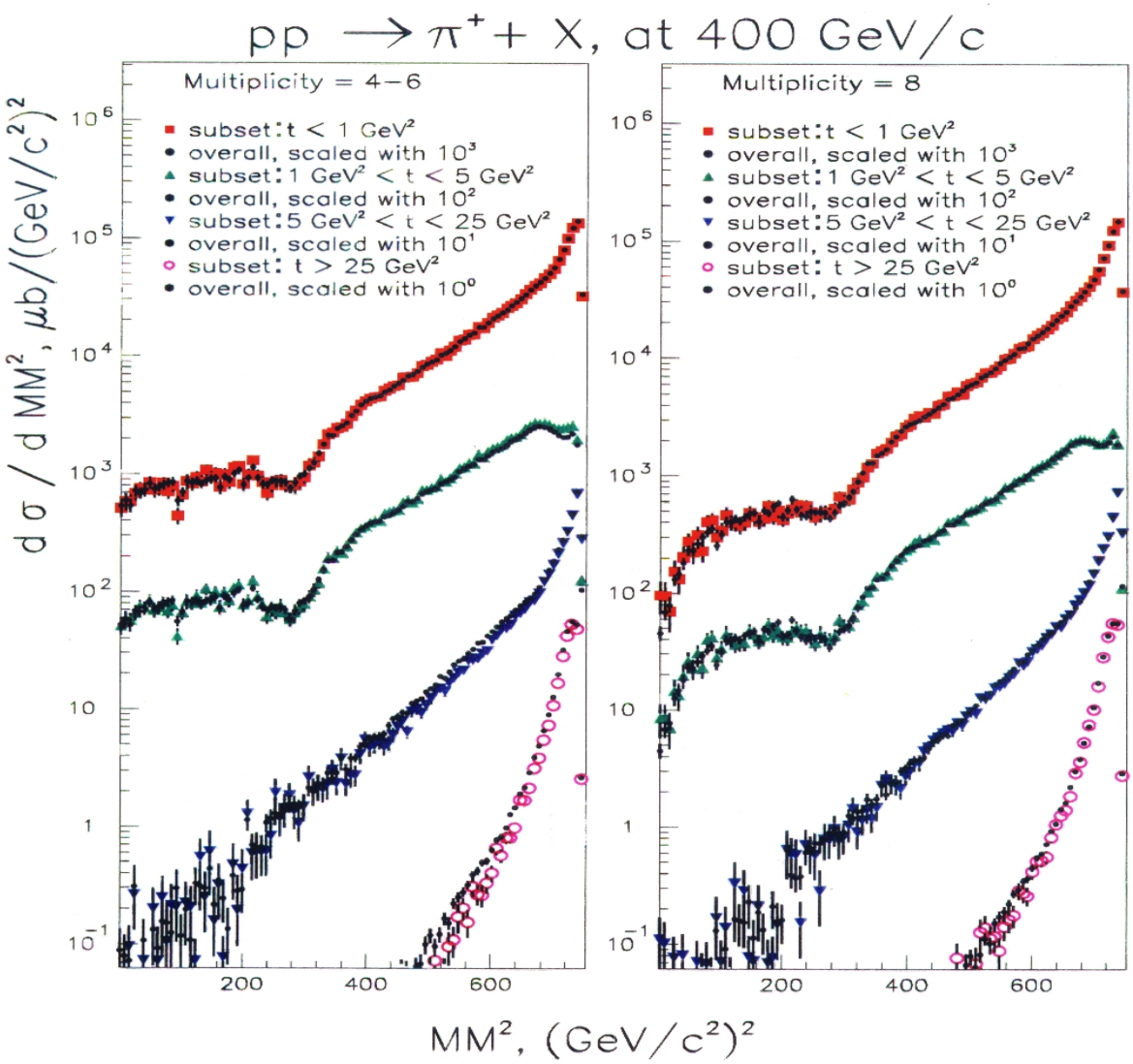
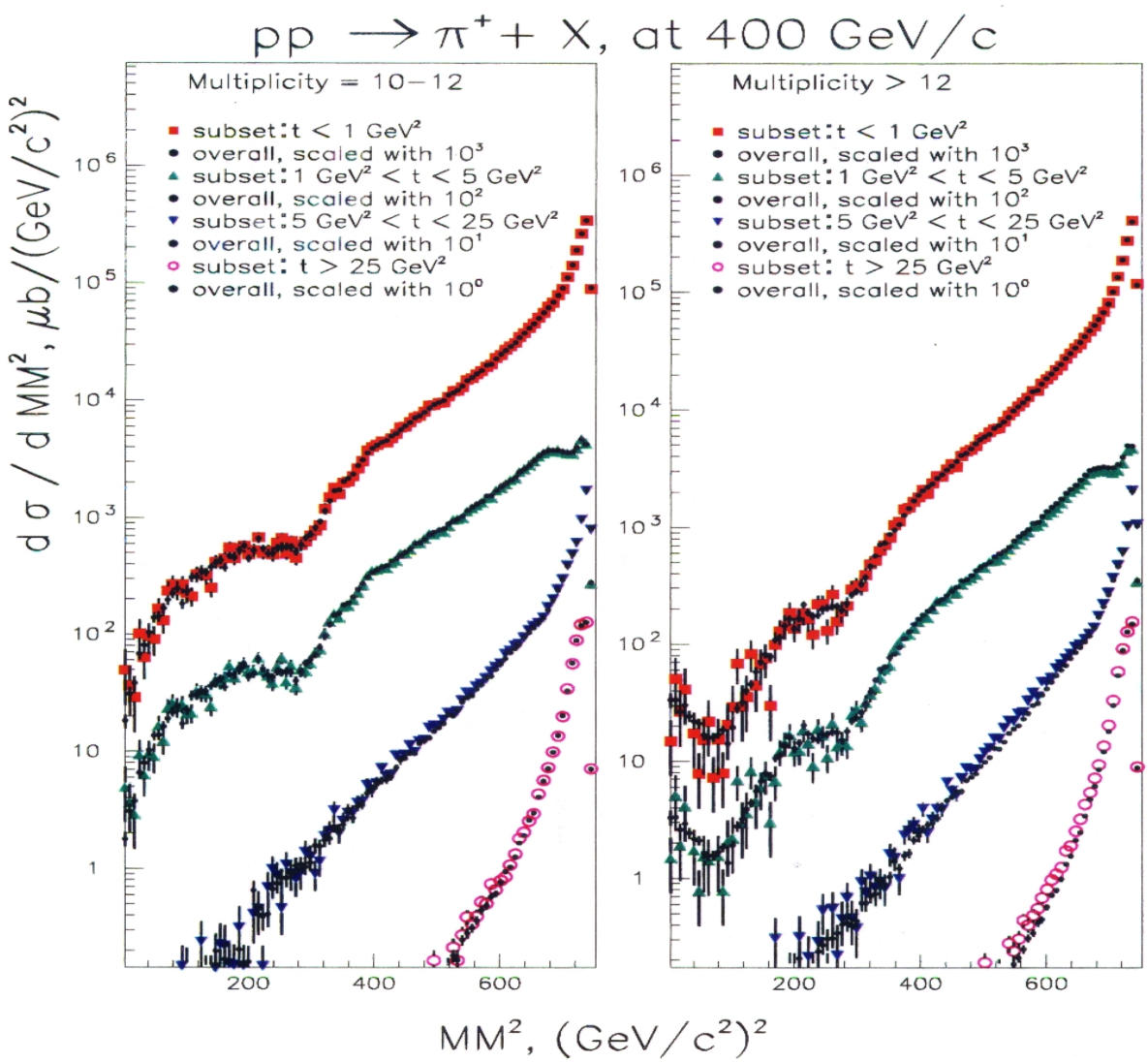


Scaling Law-EHS results



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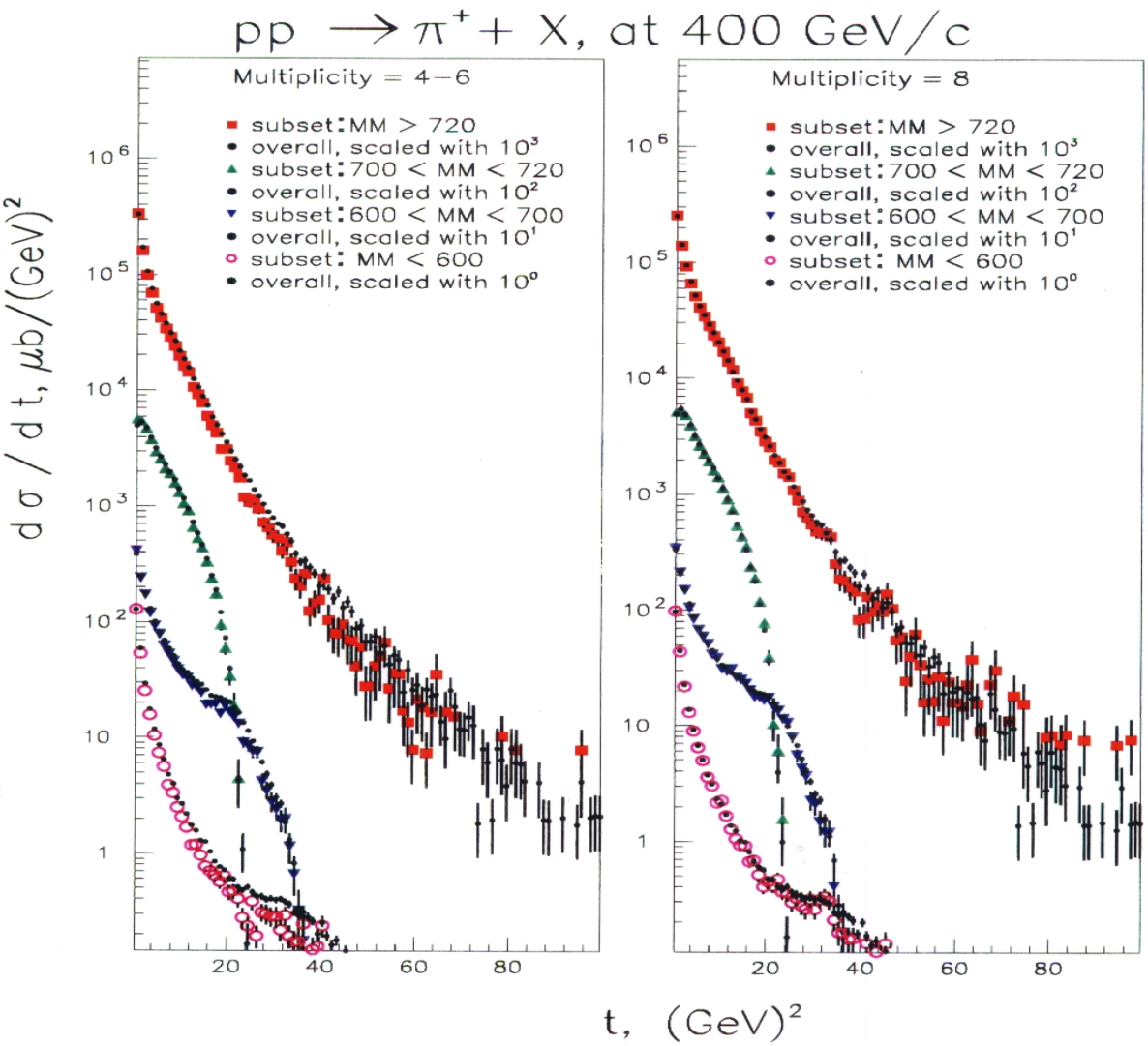
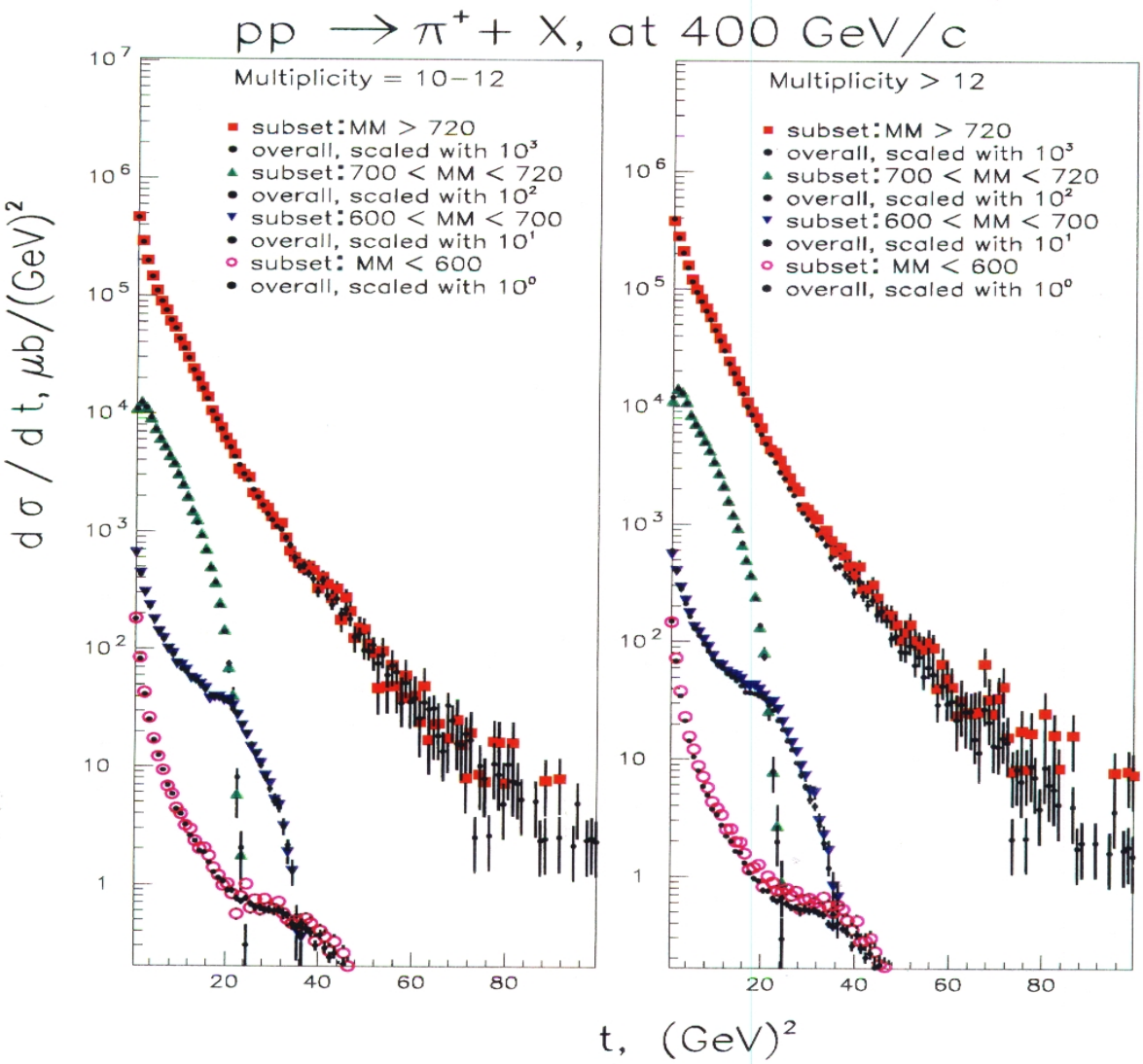
Scaling Law -EHS results