ИЗУЧЕНИЕ ПРОЦЕССОВ С РОЖДЕНИЕМ ПРЯМЫХ ФОТОНОВ И АССОЦИИРОВАННЫХ АДРОННЫХ СТРУЙ В ЭКСПЕРИМЕНТЕ DØ НА ТЭВАТРОНЕ

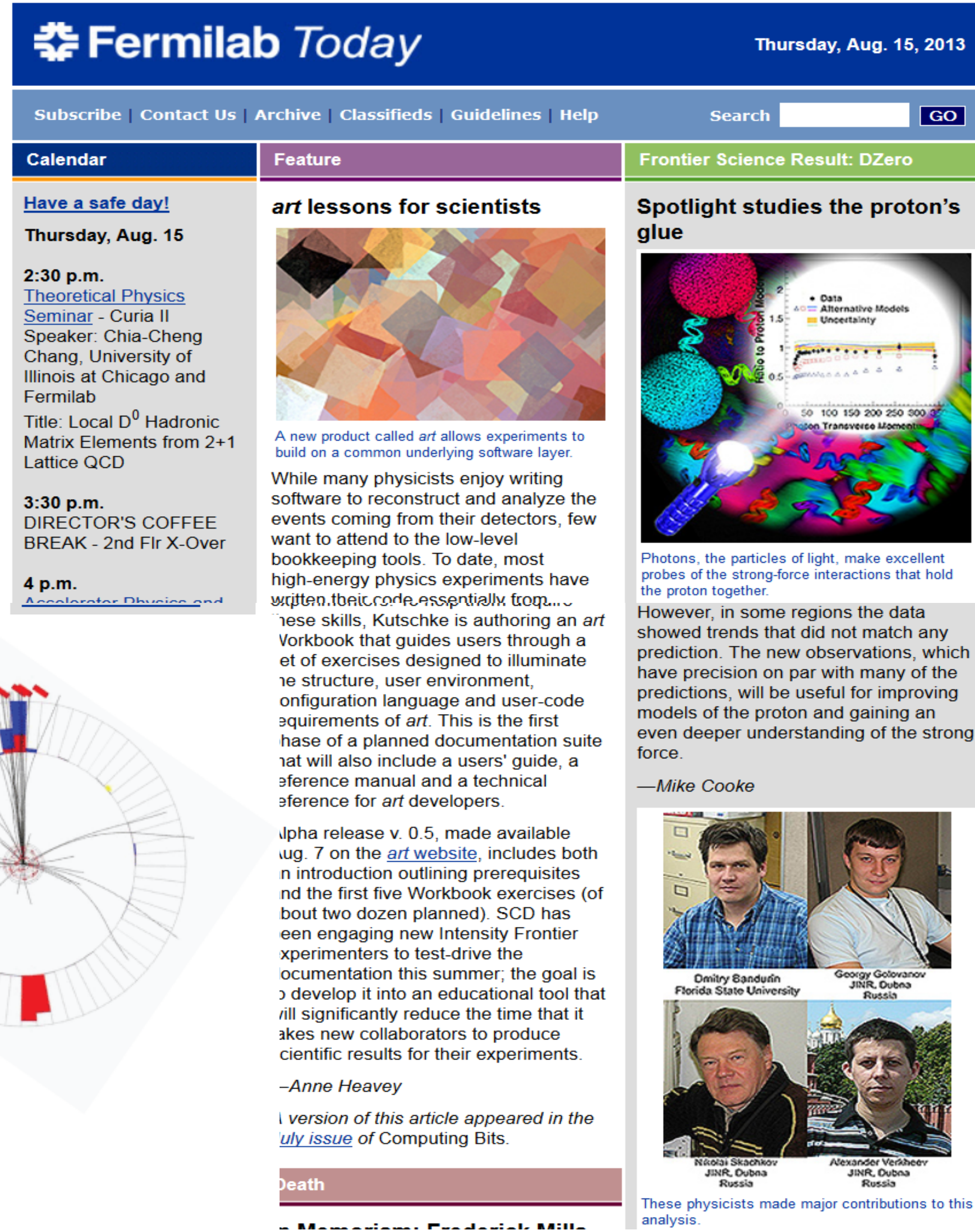
АЛЕКСАНДР ВЕРХЕЕВ

ЛЯП ОИЯИ

Алушта, 2015

OUTLINE

- Motivation
- Tevatron and DØ experiment
- Signal fraction extraction
- Results



Fermilab Today — Thursday, Aug. 15, 2013

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Calendar

Have a safe day!

Thursday, Aug. 15

2:30 p.m.
Theoretical Physics Seminar - Curia II
Speaker: Chia-Cheng Chang, University of Illinois at Chicago and Fermilab
Title: Local D^0 Hadronic Matrix Elements from 2+1 Lattice QCD

3:30 p.m.
DIRECTOR'S COFFEE BREAK - 2nd Flr X-Over

4 p.m.
Accelerator Physics and

Feature

***art* lessons for scientists**

A new product called *art* allows experiments to build on a common underlying software layer.

While many physicists enjoy writing software to reconstruct and analyze the events coming from their detectors, few want to attend to the low-level bookkeeping tools. To date, most high-energy physics experiments have written their code essentially from...
...ese skills, Kutschke is authoring an *art* Workbook that guides users through a ...et of exercises designed to illuminate ...e structure, user environment, ...onfiguration language and user-code ...equirements of *art*. This is the first ...hase of a planned documentation suite ...at will also include a users' guide, a ...eference manual and a technical ...eference for *art* developers.

...lpha release v. 0.5, made available ...ug. 7 on the *art* website, includes both ...n introduction outlining prerequisites ...nd the first five Workbook exercises (of ...bout two dozen planned). SCD has ...een engaging new Intensity Frontier ...xperimenters to test-drive the ...ocumentation this summer; the goal is ...o develop it into an educational tool that ...ill significantly reduce the time that it ...akes new collaborators to produce ...cientific results for their experiments.

–Anne Heavey

...version of this article appeared in the ...uly issue of Computing Bits.

...eath

...n Memoriam: Frederick Mills

Frontier Science Result: DZero

Spotlight studies the proton's glue

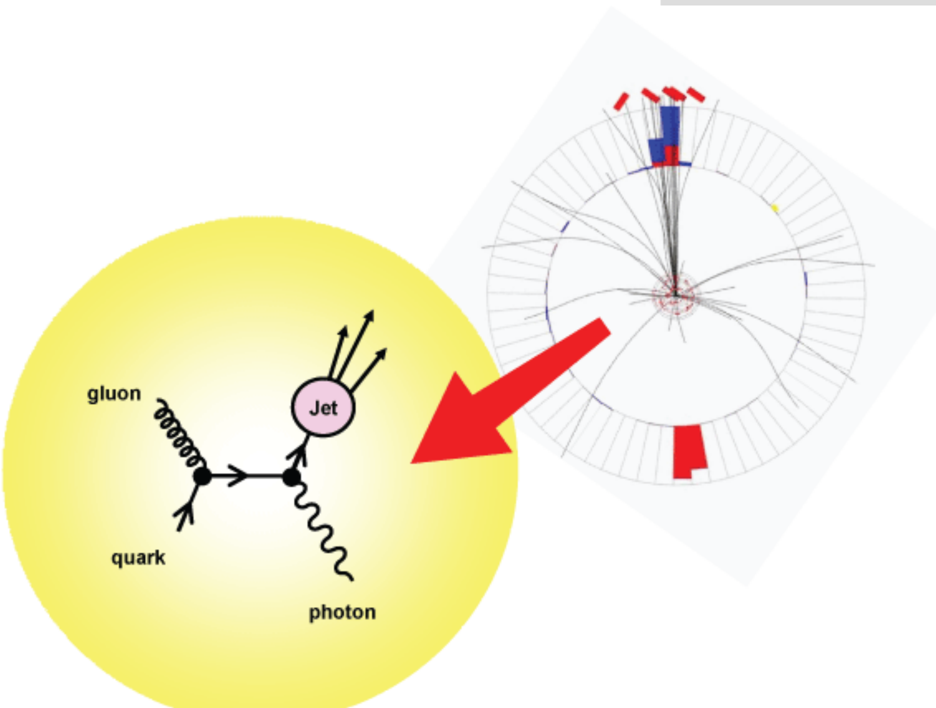
Photons, the particles of light, make excellent probes of the strong-force interactions that hold the proton together.

However, in some regions the data showed trends that did not match any prediction. The new observations, which have precision on par with many of the predictions, will be useful for improving models of the proton and gaining an even deeper understanding of the strong force.

—Mike Cooke

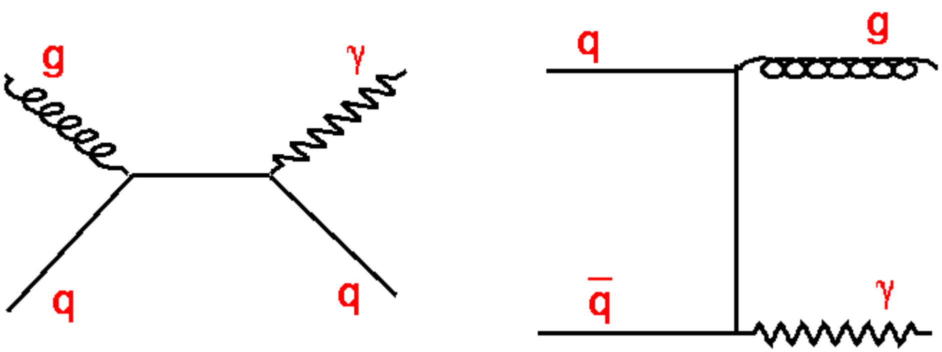
Dmitry Bandurin, Florida State University
Georgy Golovanov, JINR, Dubna, Russia
Nikolai Skachkov, JINR, Dubna, Russia
Alexander Verkheev, JINR, Dubna, Russia

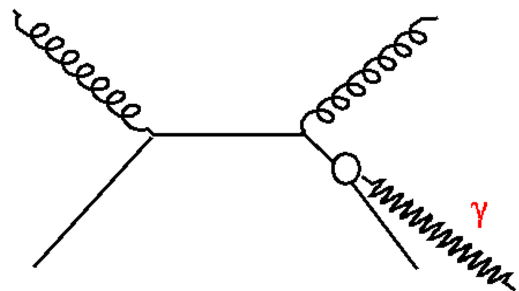
These physicists made major contributions to this analysis.



MOTIVATION

The physics prospects here are mostly based on the usage of associated production process of direct photon with jet in the final state.





Compton-like scattering and annihilation subprocesses
(2 main sources of direct photons)

fragmentation (can be suppressed)

Direct photons are one of substantial backgrounds to many physical processes.

Extension of previous $1 fb^{-1}$ measurement [Phys. Lett. B 666, 435 (2008).]

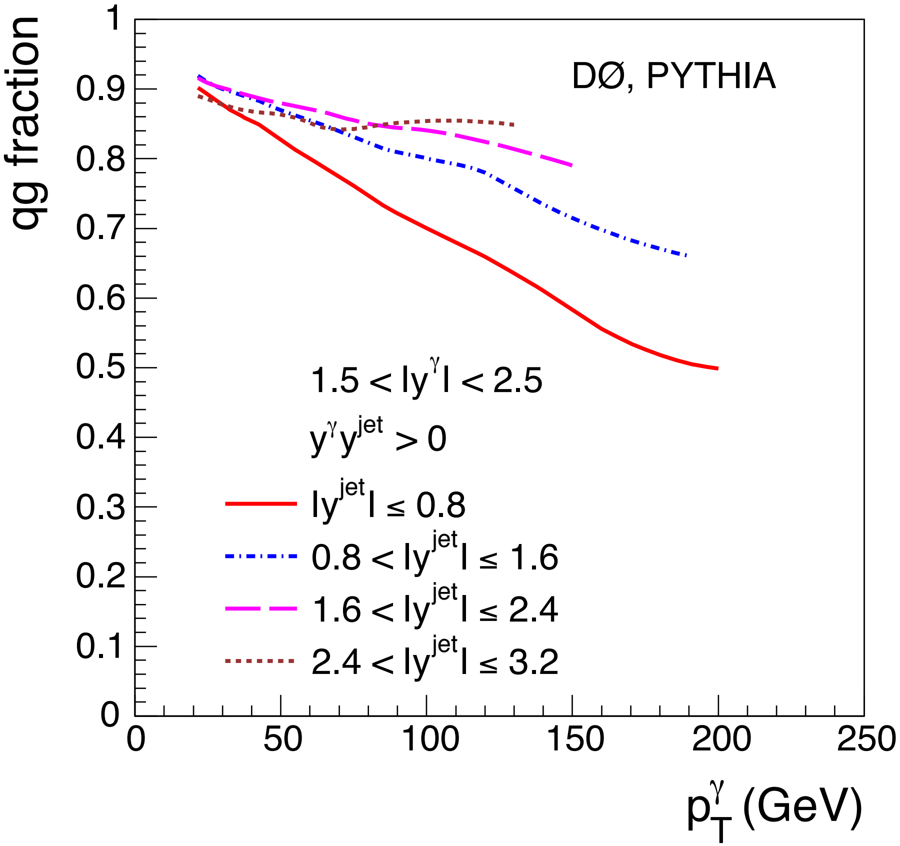
МОТИВАЦИЯ

Photon: |y| < 1.0 (CC), 1.5 < |y| < 2.5 (EC);

Jet: |y| < 0.8, 0.8 < |y| < 1.6, 1.6 < |y| < 2.4, 2.4 < |y| < 3.2;

Product of same (opposite) rapidities $y^{\gamma} \times y^{jet} > 0,\ y^{\gamma} \times y^{jet} \leq 0$

16 regions



$$L \approx 8.7\, fb^{-1}$$

Different compositions of subprocesses.

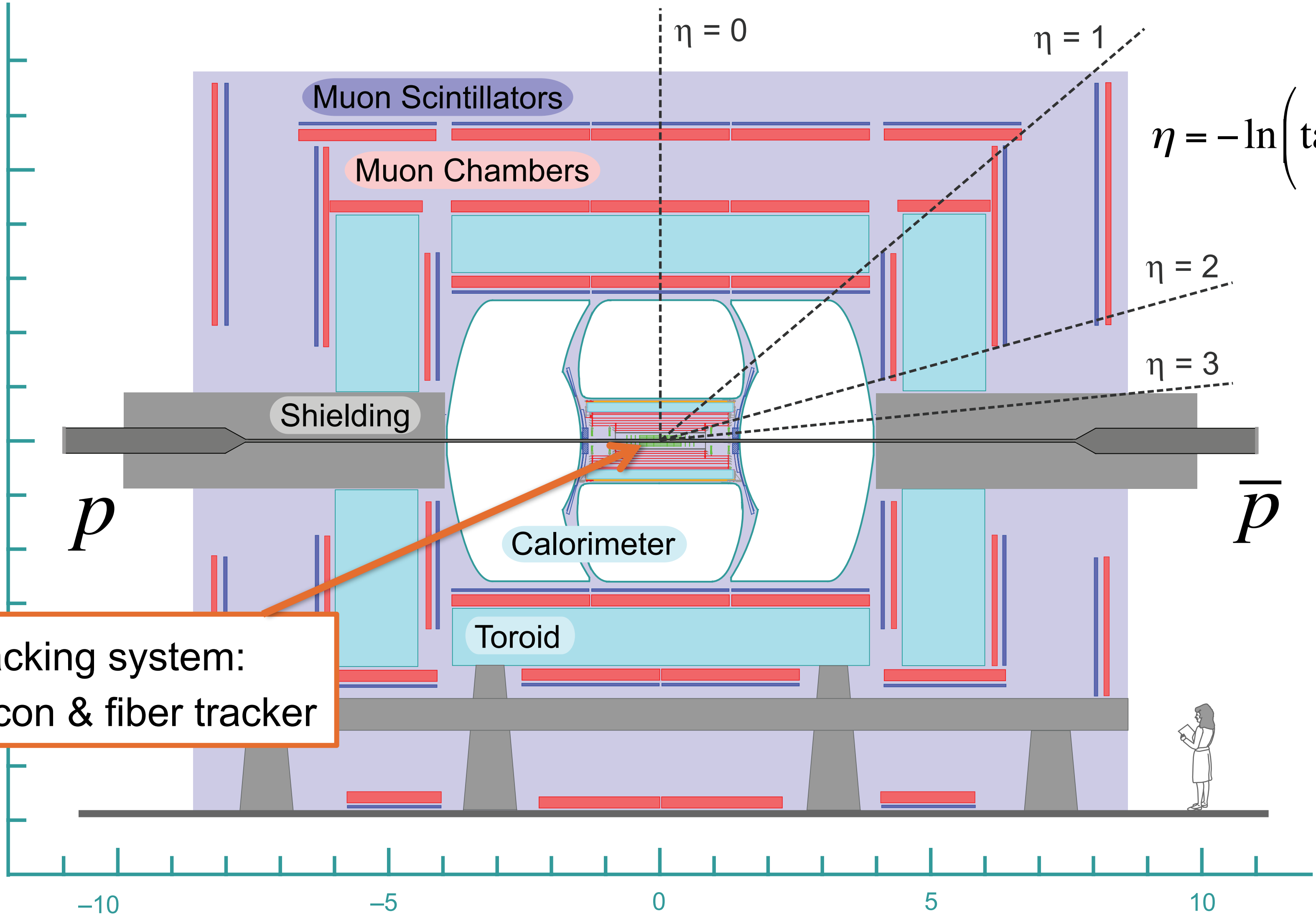
The production of cross section may give us an opportunity for extracting/ tuning a form of the gluon distribution that still has noticeable uncertainties.

TEVATRON

CDF
DØ
Booster
Tevatron
pbar source
Main Injector & Recycler
Alex Verkheev, JINR

TEVATRON

DØ DETECTOR



Tracking system:
silicon & fiber tracker

CROSS SECTION CALCULATION

$$\frac{d^3\sigma}{dp_T^\gamma dy^\gamma dy^{jet}} = \frac{NP}{L_{\text{int}} \Delta p_T^\gamma \Delta y^\gamma \Delta y^{jet} A \varepsilon_{tr} \varepsilon_s^\gamma \varepsilon_s^{jet} \varepsilon_s^{evt}}$$

N – the number of gam+jet candidates in the selected samples;

P – the signal event purity;

L – the integrated luminosity;

A – the geometric and kinematic acceptance;

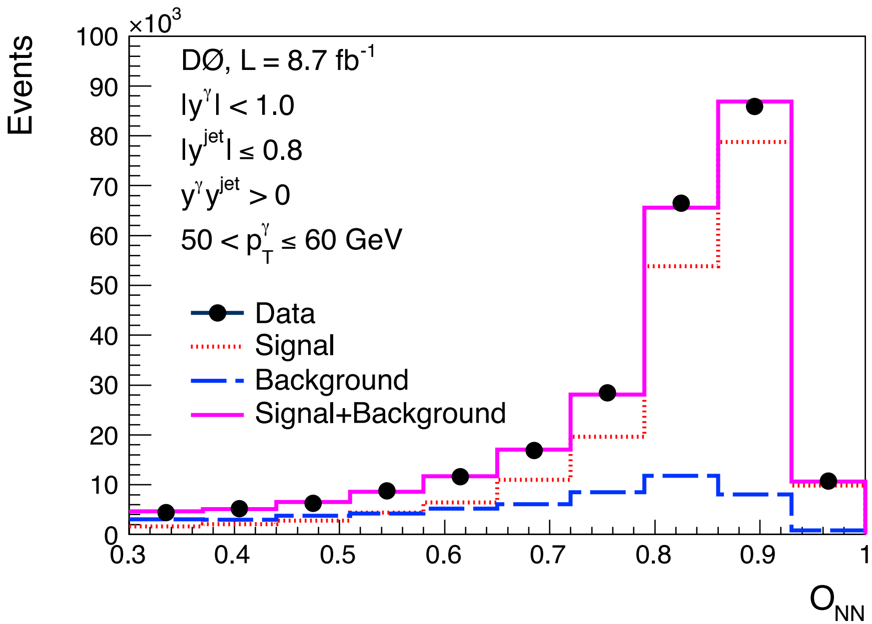
$\Delta p_T^\gamma \Delta y^\gamma \Delta y^{jet}$ - bin sizes in photon transverse momentum, photon and jet rapidities;

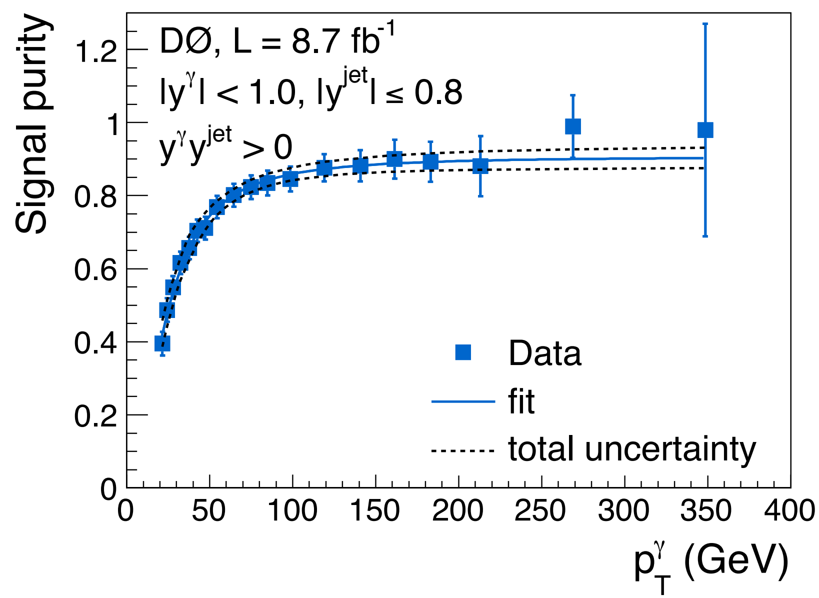
$\varepsilon_{tr} \varepsilon_s^\gamma \varepsilon_s^{jet} \varepsilon_s^{evt}$ - trigger efficiency, efficiencies of the photon and jet selection criteria, and event selection efficiency.

PURITY

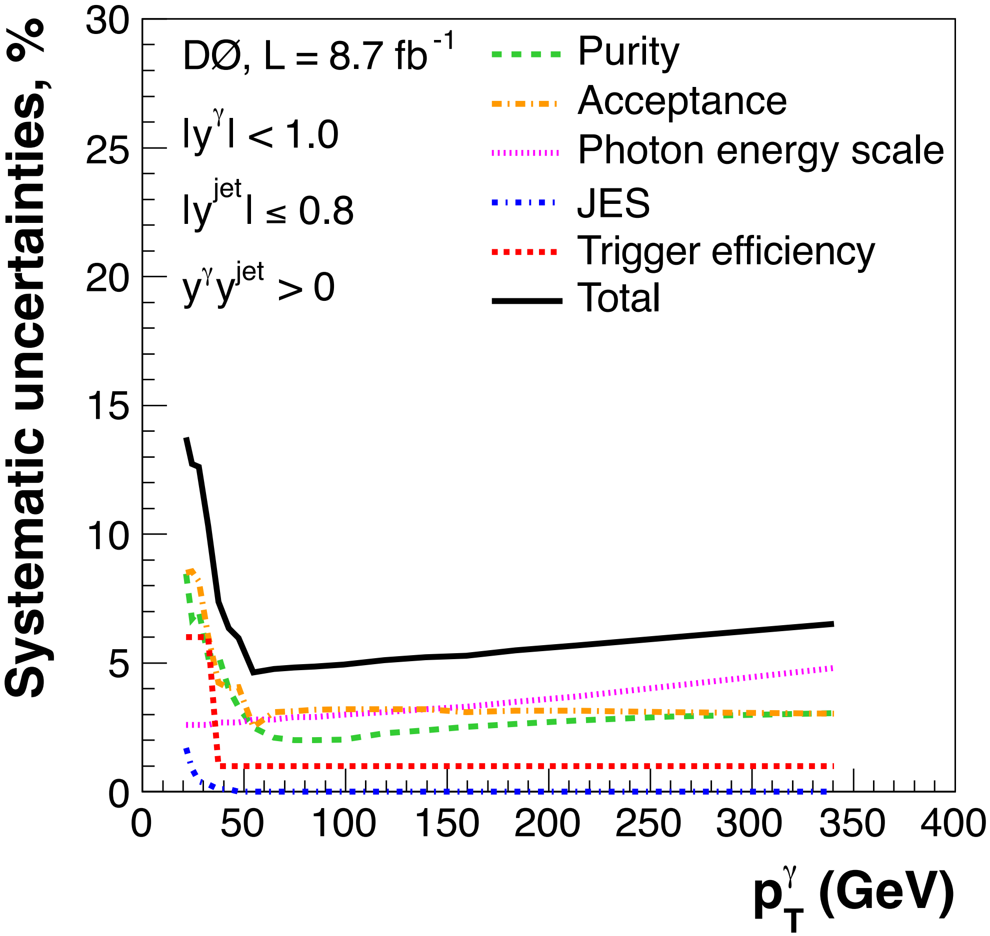
1. Obtain photon NN output distributions for each p_T^γ bin for Data, Signal, Background.

2. Fit Data distributions by MC using maximum likelihood fit and extract purity as fraction of Signal MC.





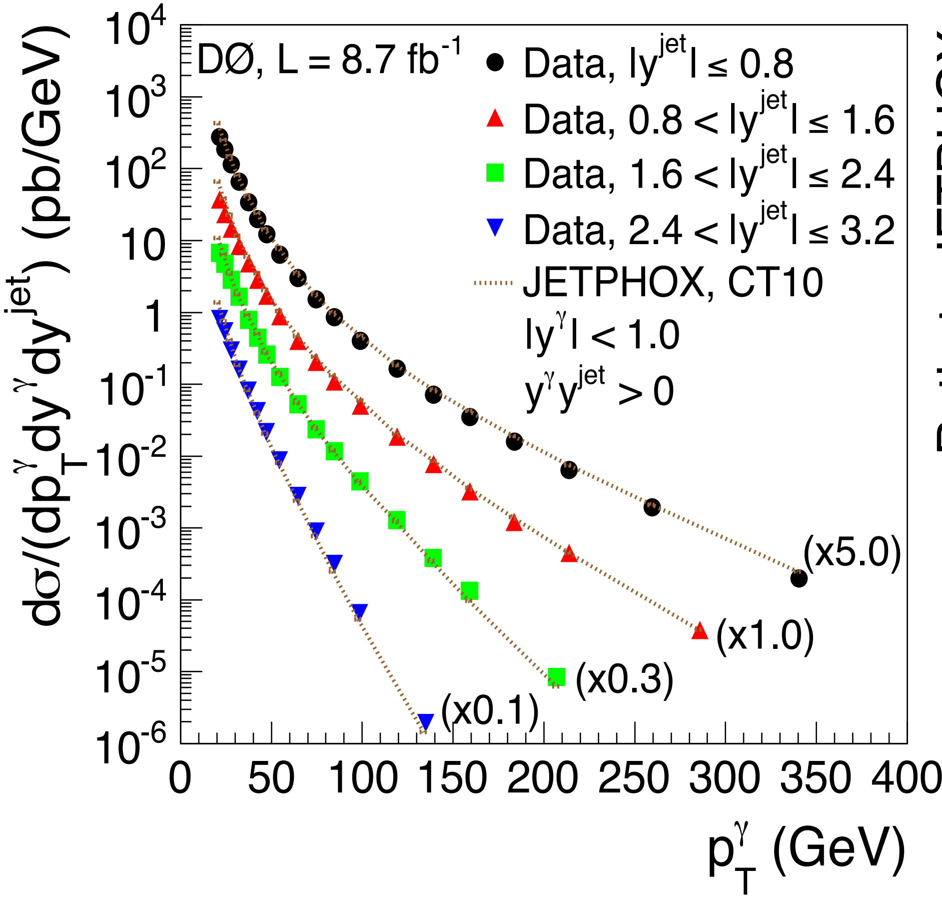
SYSTEMATIC UNCERTAINTY

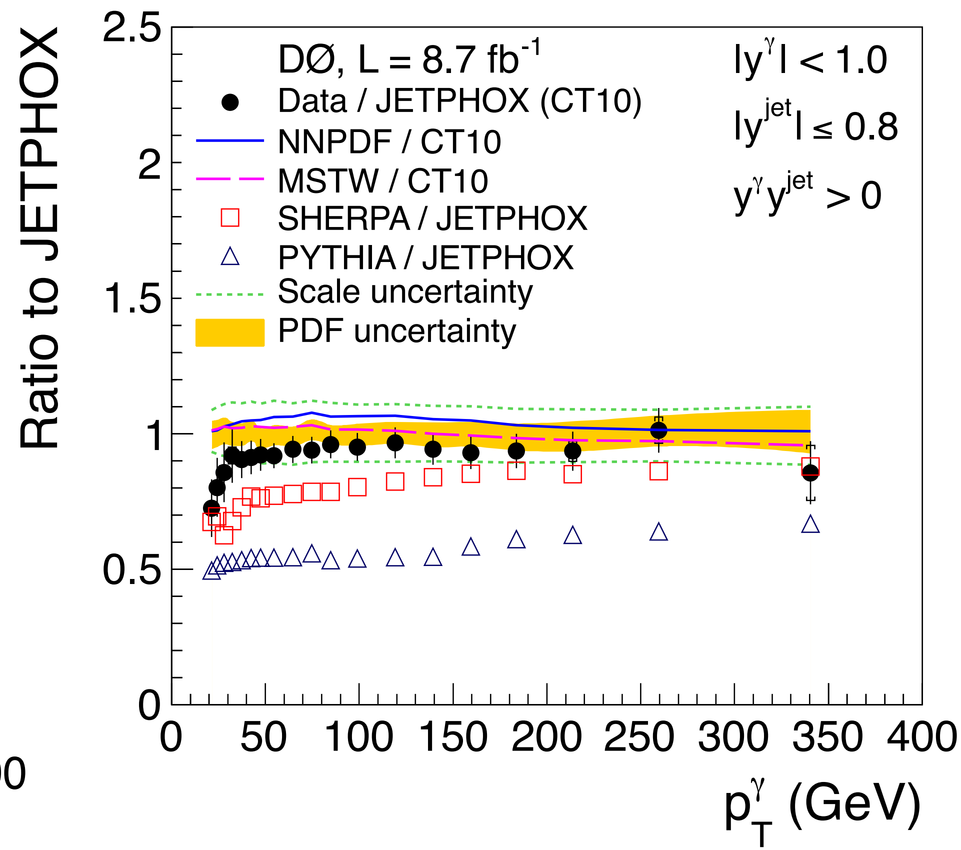


Trigger eff.	1.0 – 9.0%
Acceptance	2.0 – 8.0%
Purity	1.0 – 7.0 %

Overall correlated systematic ~ 7% due to luminosity and photon selection

CROSS SECTION





NLO theory (with CT10 and NNPDFv2.1, MSTW) agrees with data except low and high p_T^{γ} with very forward jets.

SUMMARY

- Measured the triple differential cross section for production of photon+jet in the range 20 < p_T^γ < 400 (230) GeV in 16 photon-jet rapidity regions.
- Compared with JetPhox NLO MC (CT10, NNPDFv2, MSTW pdf data sets).
- Observed a disagreement with the theory for small and high p_T^γ with very forward jets.
- More details in **Phys. Rev. D 88, 072008 (2013)**

  and in the DLNP seminar on the 17th of June.