

Recent results from TOTEM @ LHC with Hungarian participation

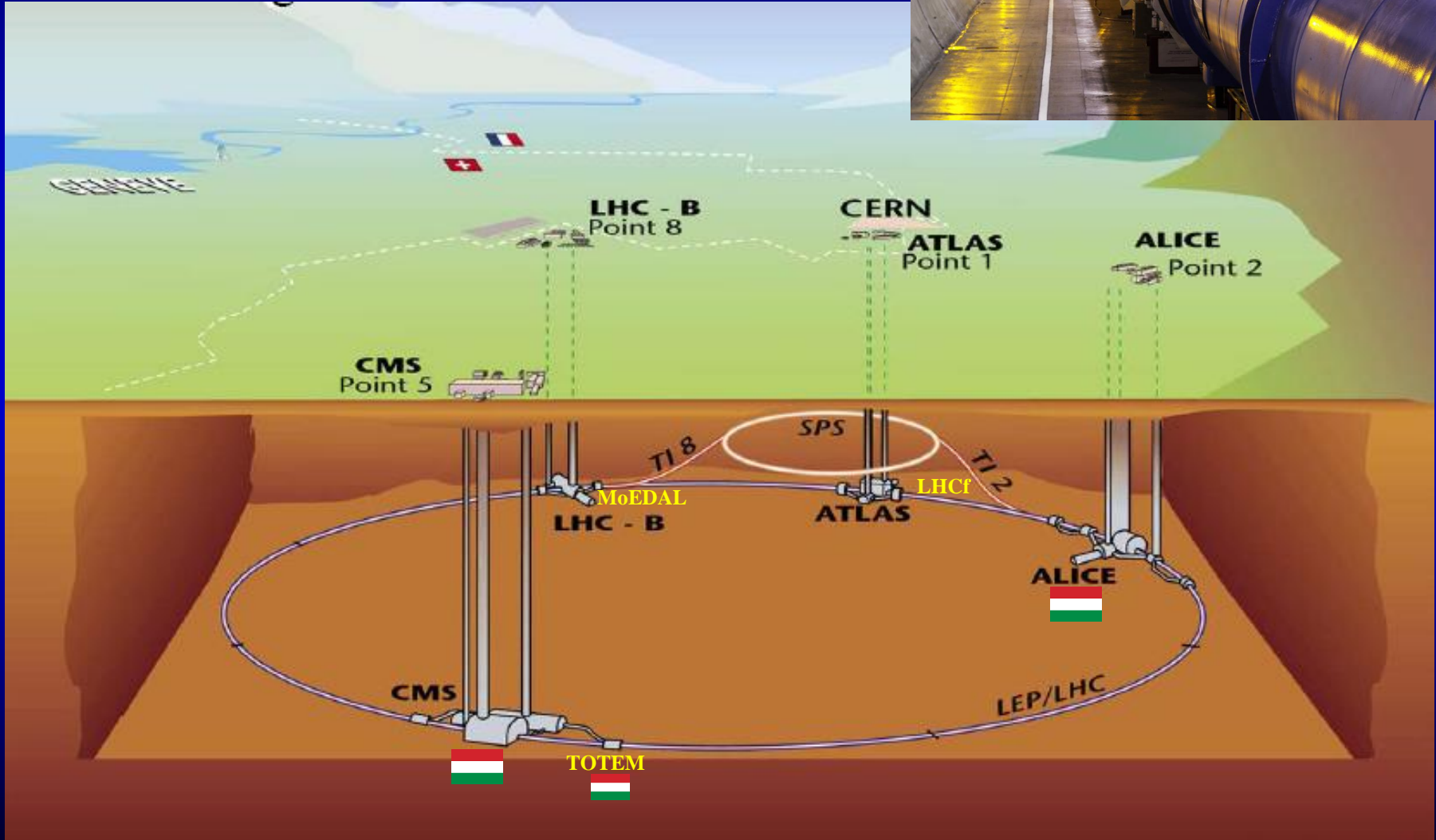
T. Csörgő

**Wigner RCP
Hungarian Academy of Sciences
Budapest, Hungary**

**Introduction to TOTEM & LHC
Recent results
Hungarian participation in TOTEM**

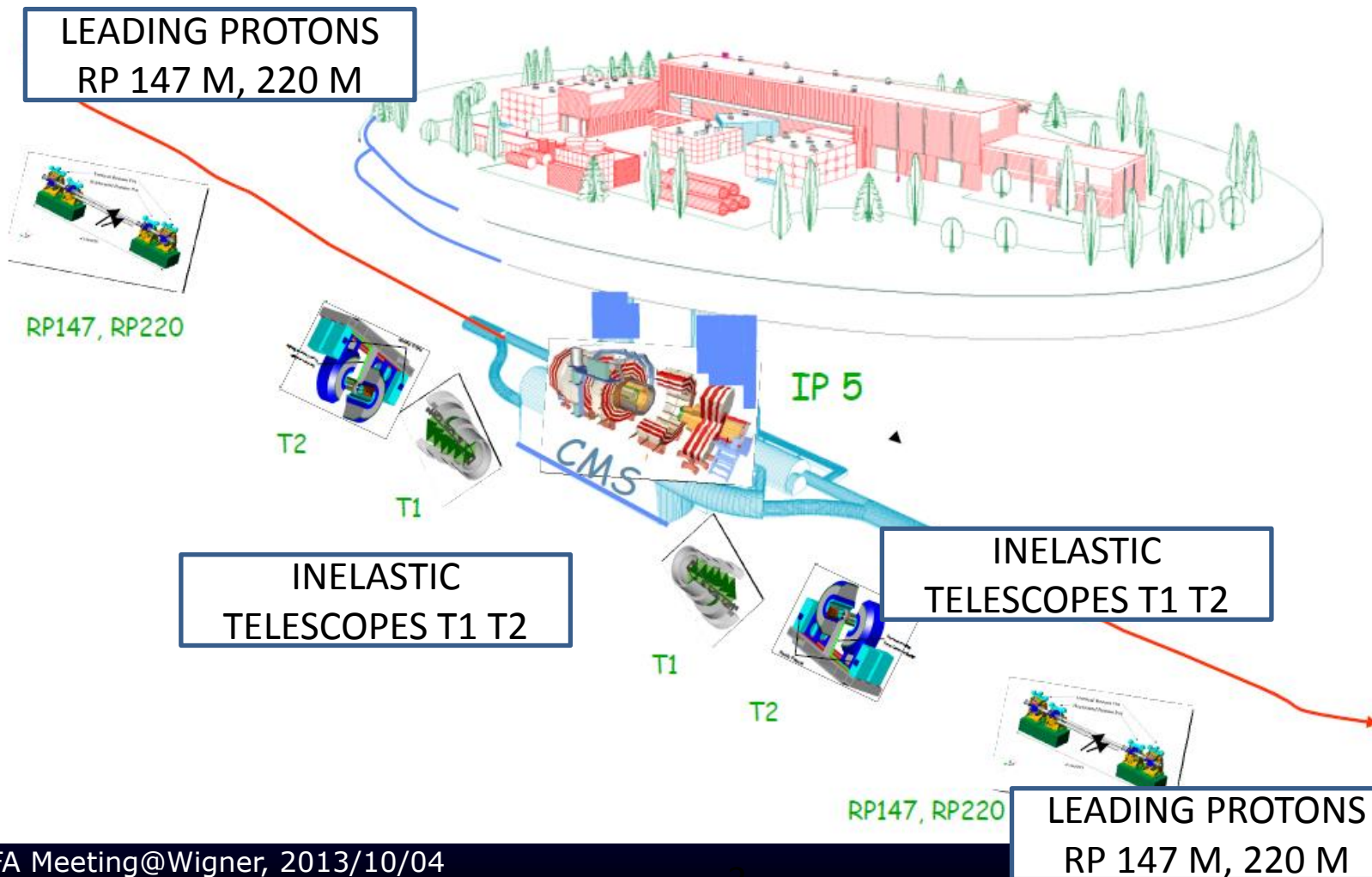
Large Hadron Collider @ CERN

and its 6+1 Experiments



TOTEM OVERVIEW @ LHC-IP5

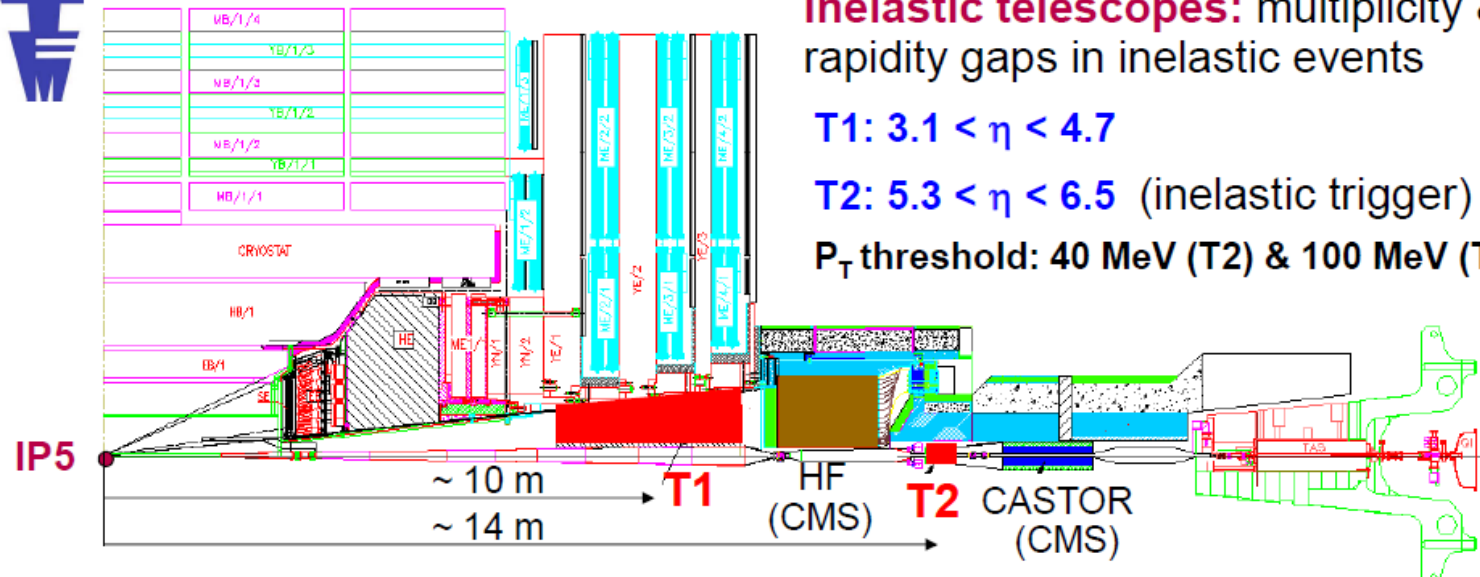
TOTEM



TOTEM DETAILS @ LHC-IP5



Experimental setup @ IP5



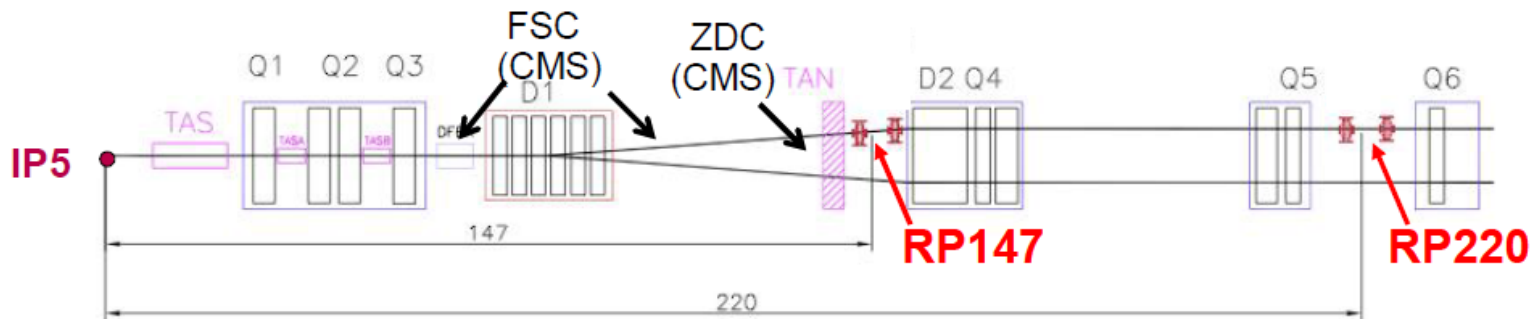
Inelastic telescopes: multiplicity & rapidity gaps in inelastic events

T1: $3.1 < \eta < 4.7$

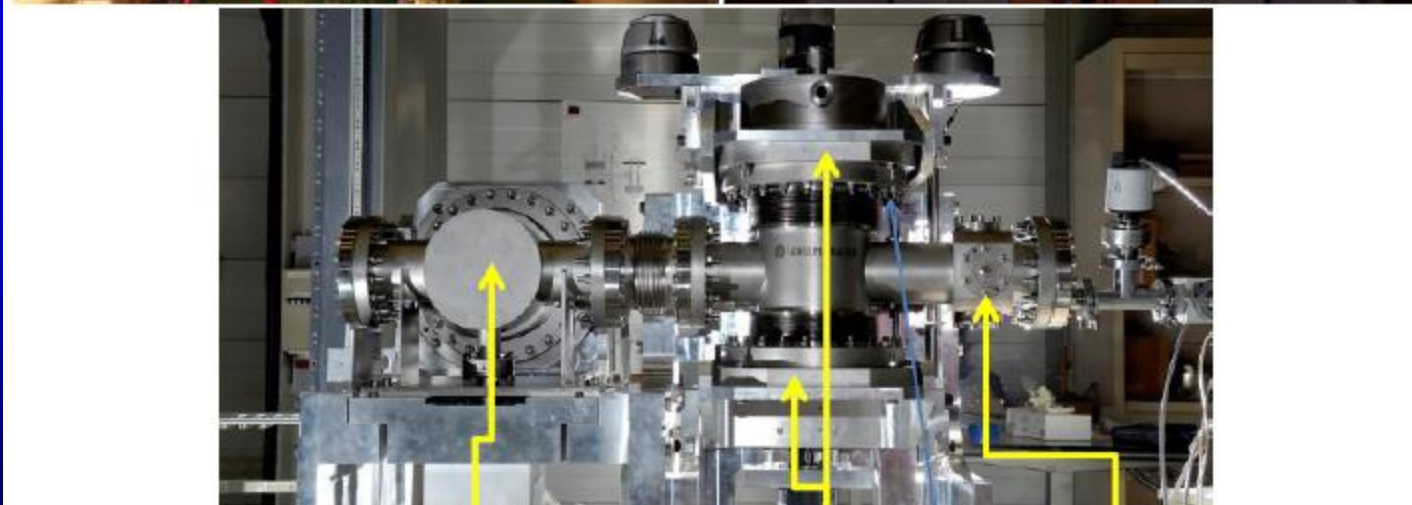
T2: $5.3 < \eta < 6.5$ (inelastic trigger)

P_T threshold: 40 MeV (T2) & 100 MeV (T1)

Roman Pots: elastic & diffractive protons (di-proton trigger)



TOTEM STRUCTURE, DETAILS

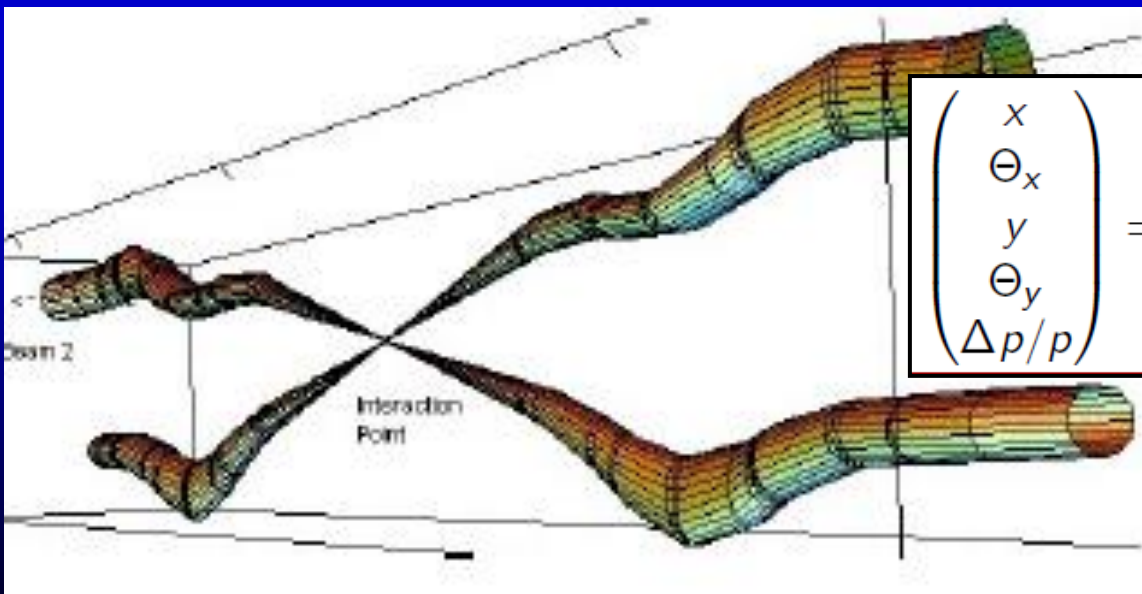
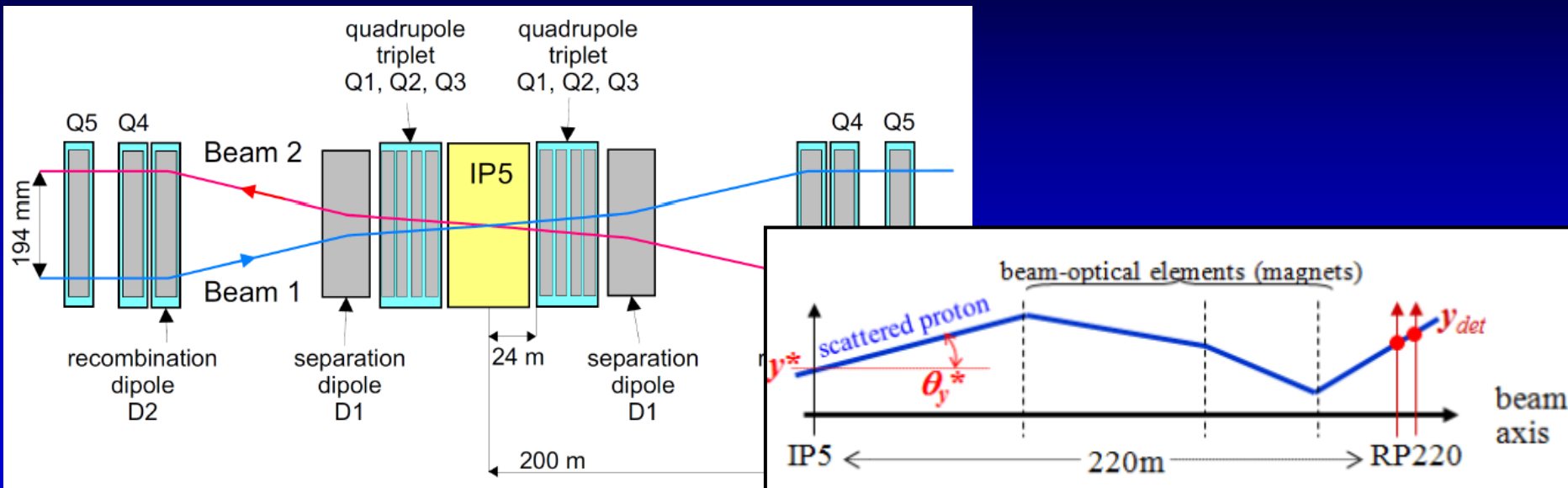


RP 220 M
HORIZONTAL POT

RP 220 M
VERTICAL POTS

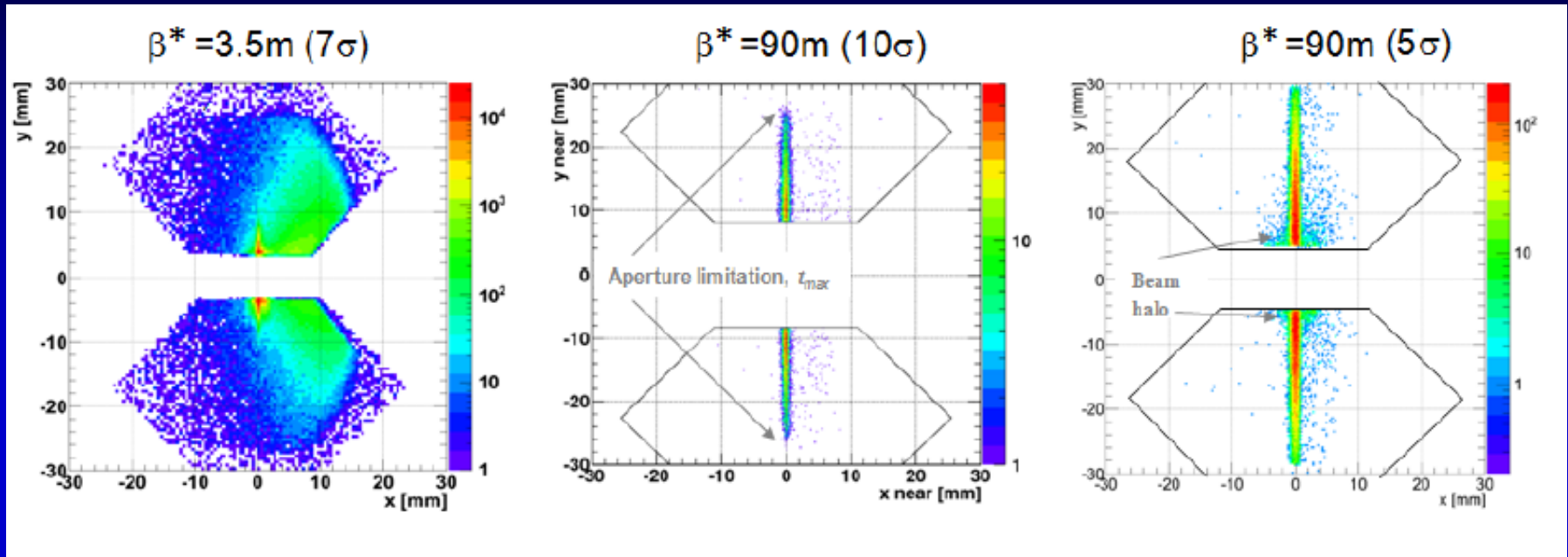
RP 220 M
BEAM POLARIMETER

LHC BEAM STRUCTURE @ IP5



$$\begin{pmatrix} x \\ \Theta_x \\ y \\ \Theta_y \\ \Delta p/p \end{pmatrix} = \begin{pmatrix} \nu_x & L_x & 0 & 0 & D_x \\ \nu'_x & L'_x & 0 & 0 & D'_x \\ 0 & 0 & \nu_y & L_y & 0 \\ 0 & 0 & \nu'_y & L'_y & 0 \\ 0 & 0 & 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} x^* \\ \Theta_x^* \\ y^* \\ \Theta_y^* \\ \Delta p/p \end{pmatrix}$$

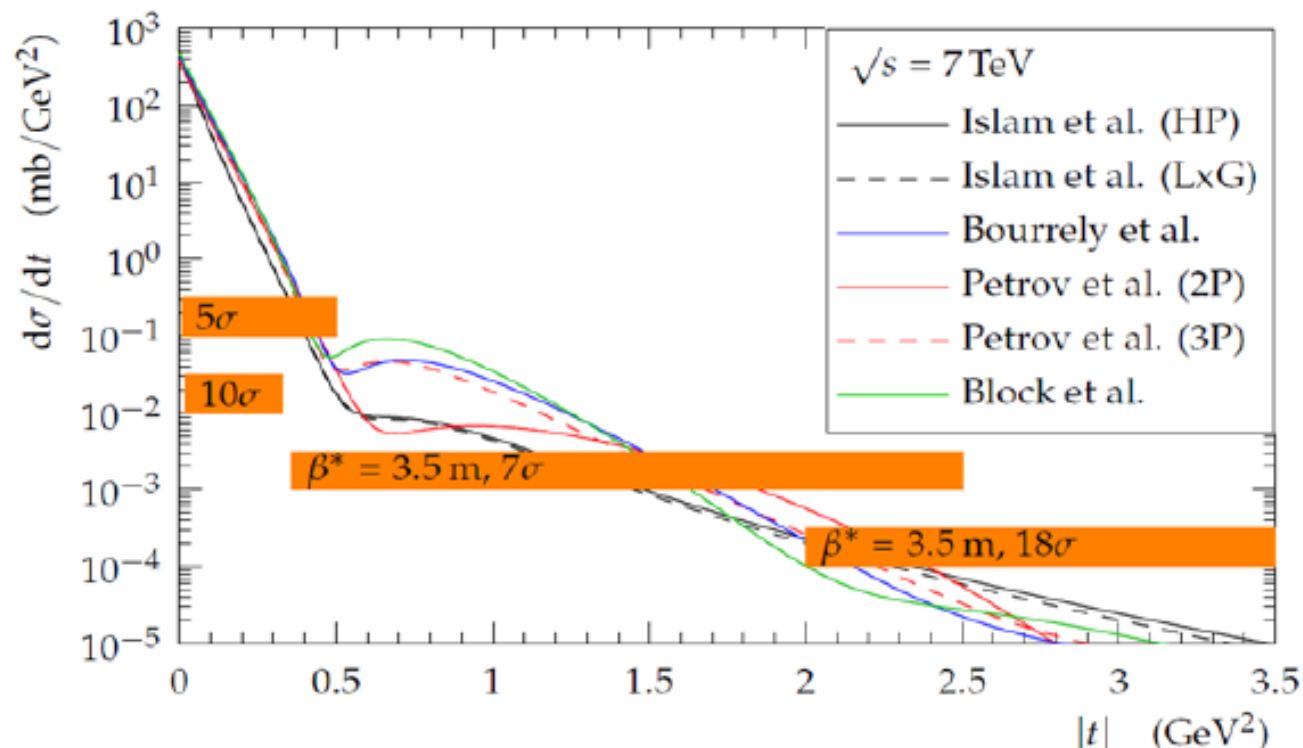
TOTEM CALIBRATE LHC BEAM FROM DATA



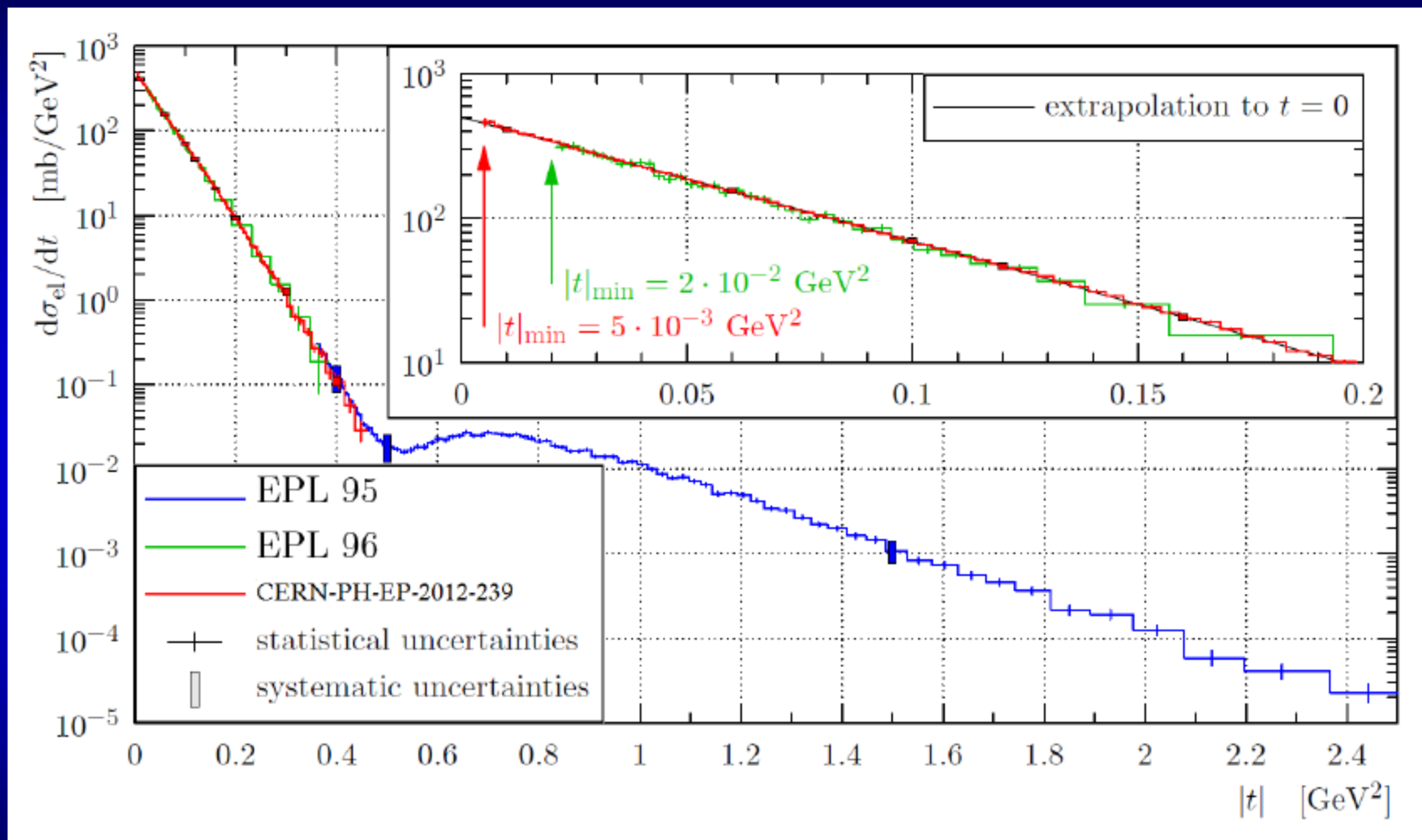
F. Nemes (ELTE-Wigner)
Member of TOTEM 2009-
Funded by TOTEM @ CERN
Reconstruction of LHC optics
from TOTEM data
TOTEM Roman Pot and other
Geant Simulations for upgrade
Supervised H. Niewodamski,
TOTEM optics paper in preparation

TOTEM APPROACHING BEAM @ LHC-IP5

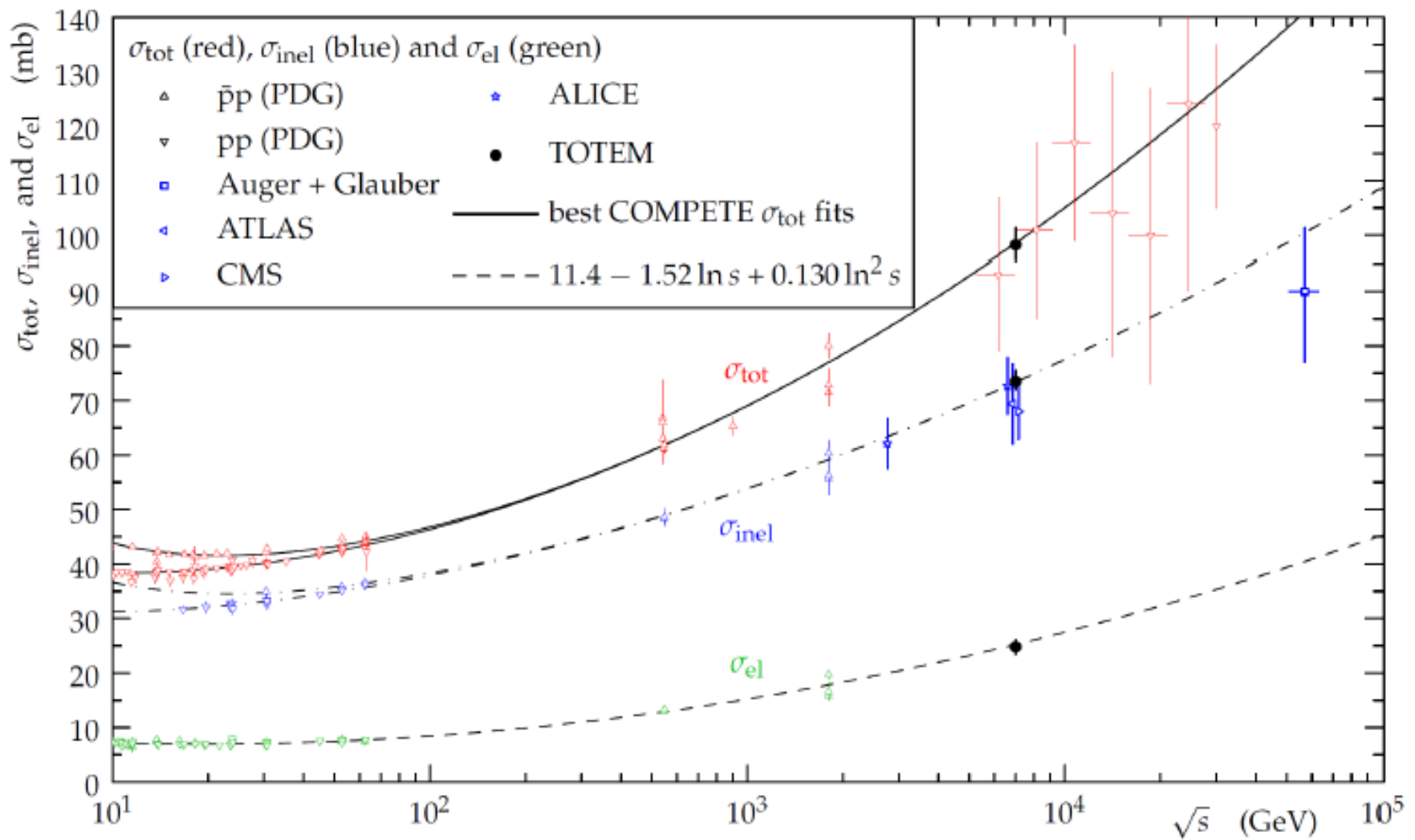
β^* [m]	nyalábtávolság	\mathcal{L} [μb^{-1}]	t -tartomány [GeV^2]
90	5σ	83	0.005 – 0.5
90	10σ	1.7	0.02 – 0.4
3.5	7σ	0.07	0.36 – 3.0
3.5	18σ	2.3	2 – 3.5



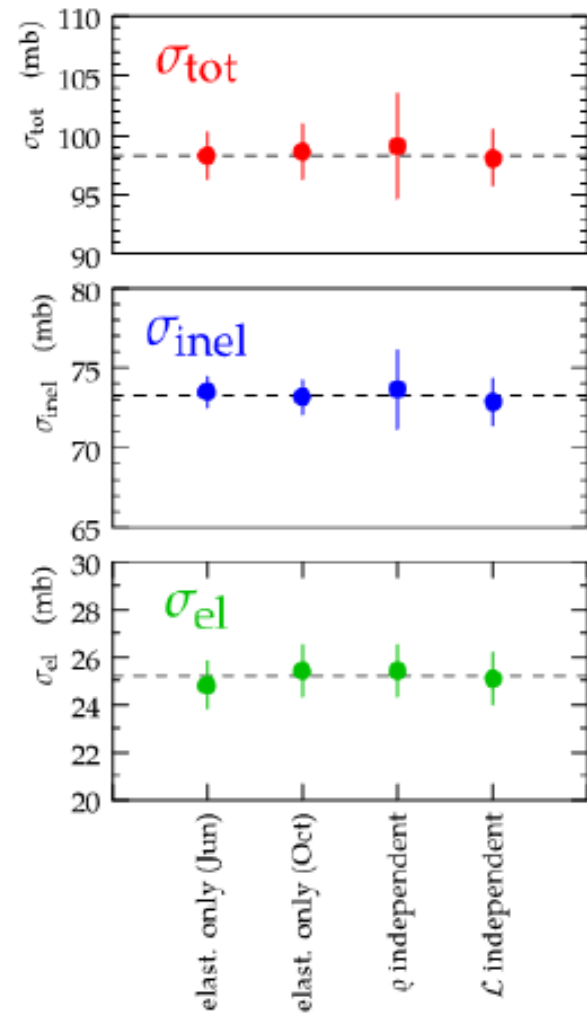
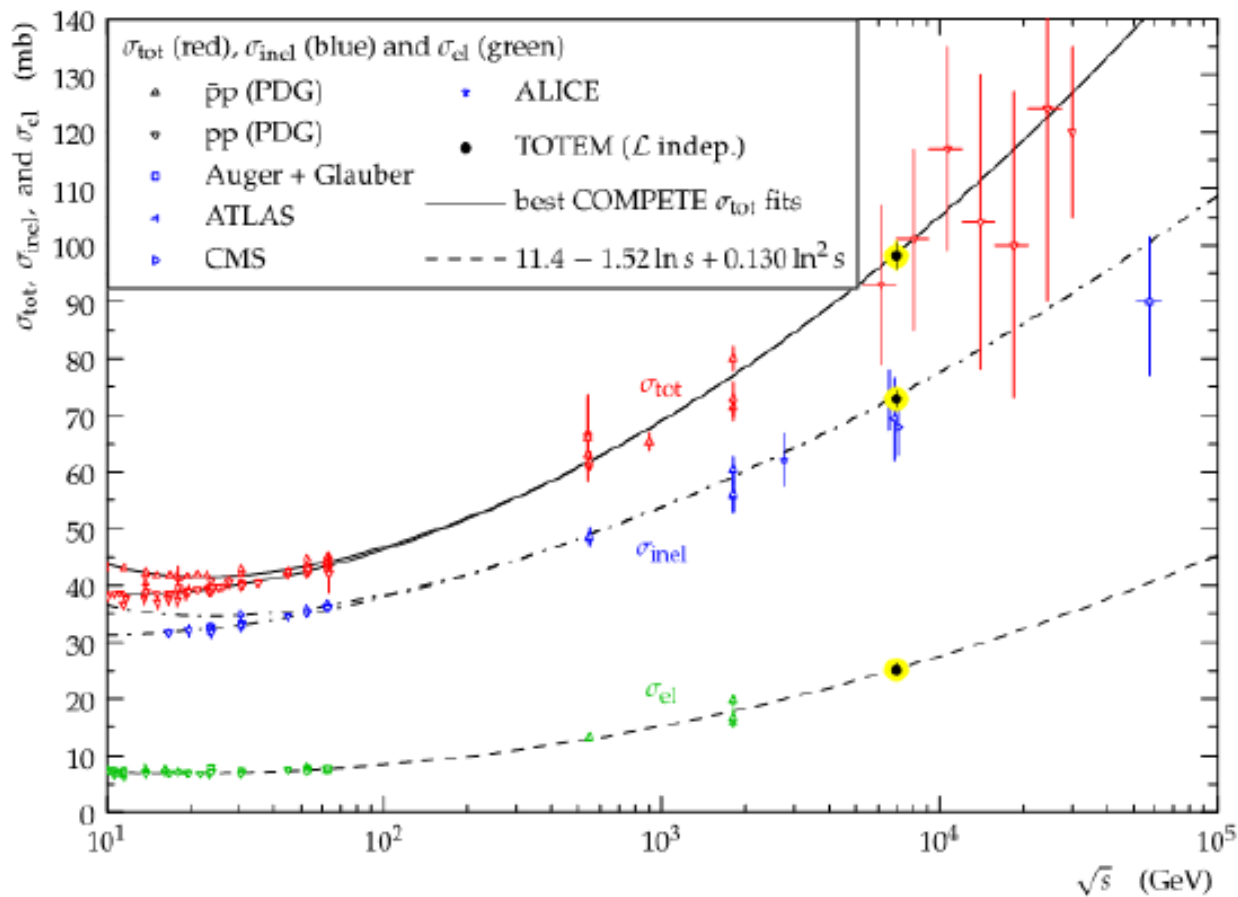
TOTEM FIRSTS, ELASTIC PP @ 7 TEV



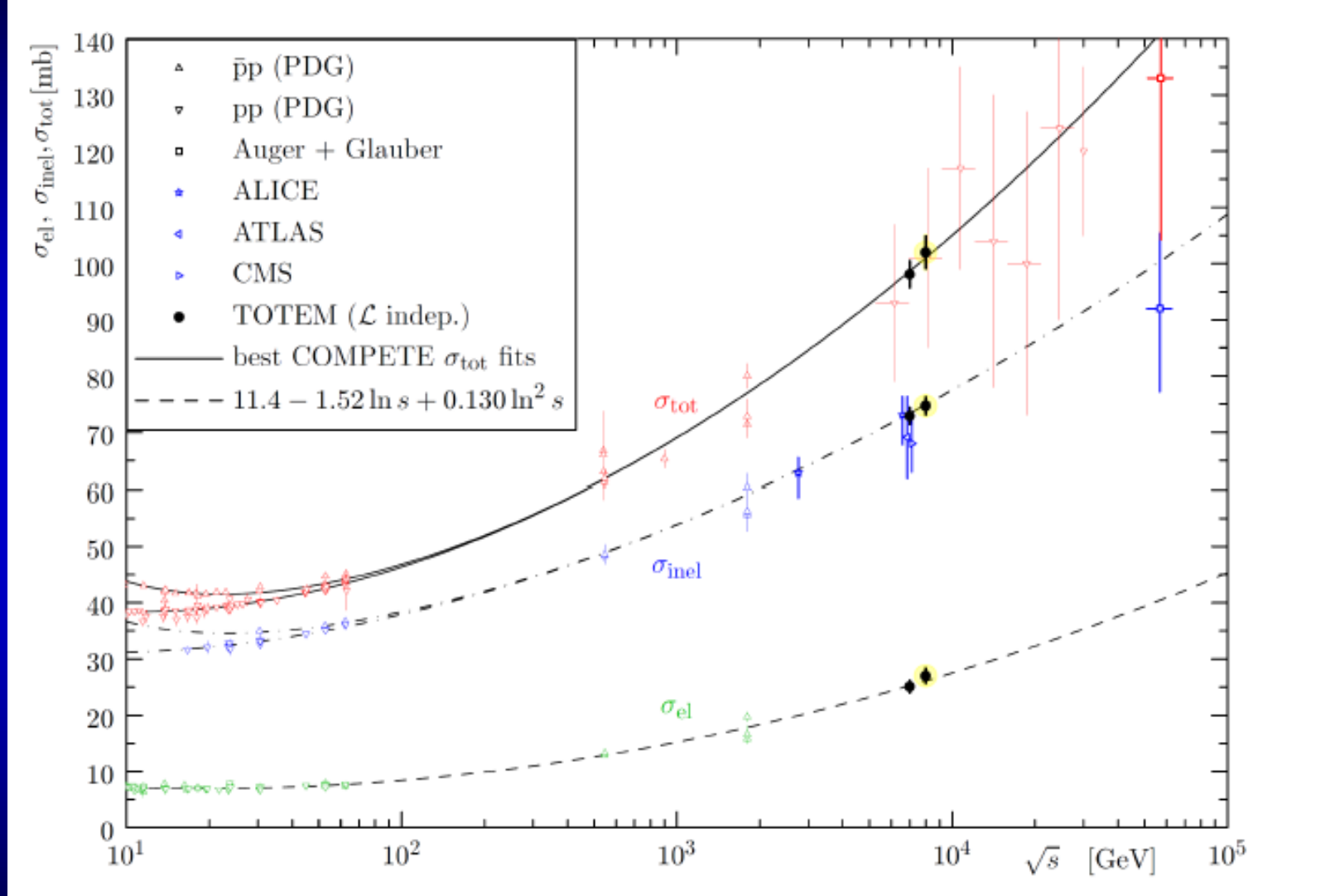
TOTEM TOTAL CROSS SECTION @ 7 TEV



SYSTEMATIC CHECKS, DIFFERENT METHODS

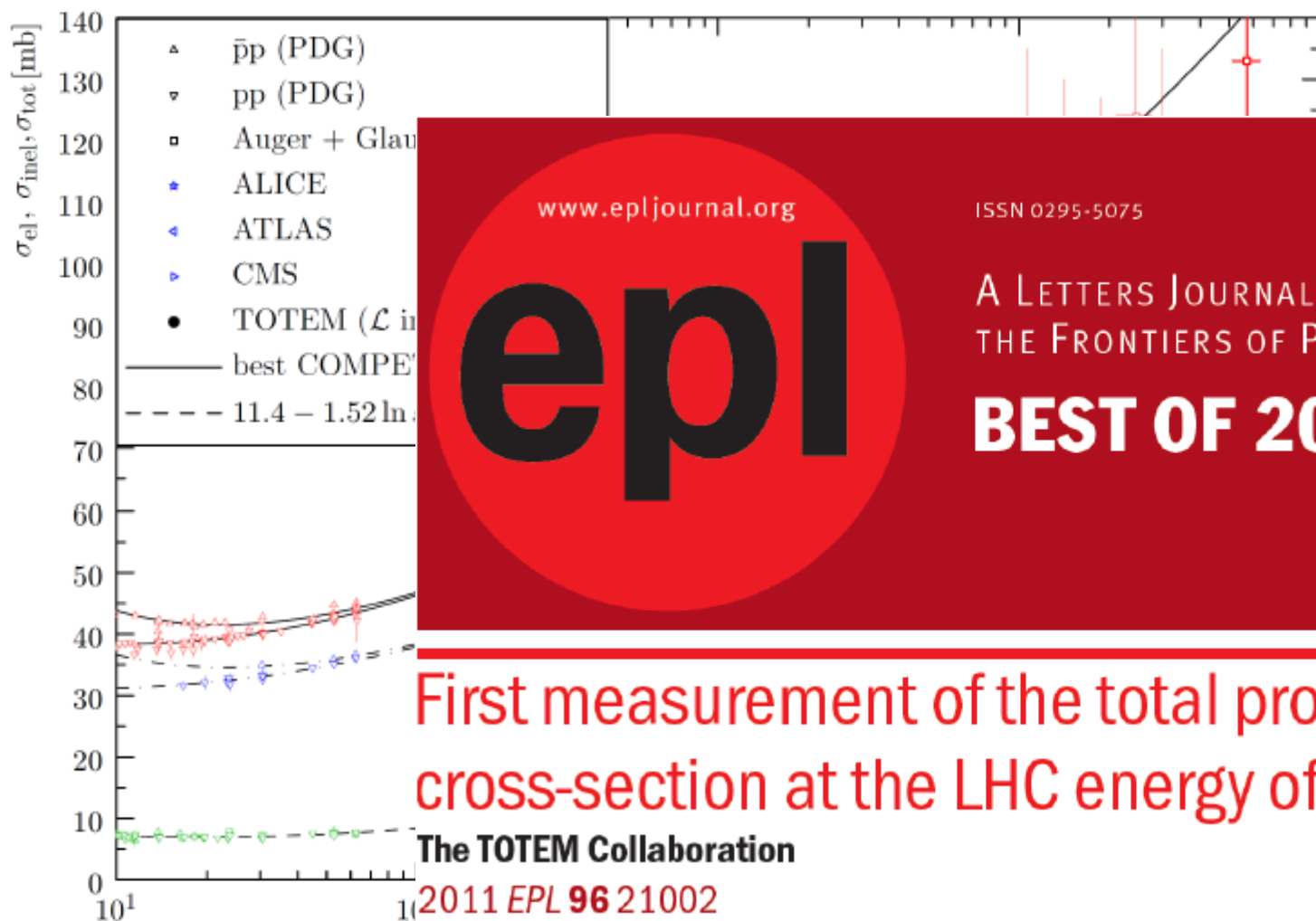


TOTEM TOTAL CROSS SECTION @ 8 TEV



CONSISTENT RESULTS, UNPRECEDENTED PRECISION

TOTEM TOTAL CROSS SECTION @ 8 TEV



www.epljournal.org ISSN 0295-5075

epl

A LETTERS JOURNAL EXPLORING
THE FRONTIERS OF PHYSICS

BEST OF 2011

First measurement of the total proton-proton cross-section at the LHC energy of $\sqrt{s} = 7$ TeV

The TOTEM Collaboration
2011 EPL 96 21002

CONSISTENT RESULTS, UNPRECEDENTED PRECISION

TOTEM RECENT RESULTS



Recent publications (since June LHCC)

- "Double diffractive cross-section measurement in the forward region at LHC", CERN-PH-EP-2013-170, [arXiv:1308.6722](https://arxiv.org/abs/1308.6722), submitted to PRL.
- "Performance of the TOTEM Detectors at the LHC", CERN-EP-2013-173.

EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

TOTEM 2013-001



CERN-PH-EP-2013-170
27 August 2013

Double diffractive cross-section measurement in the forward region at LHC

The TOTEM Collaboration

EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH



TOTEM 2013-02
3 September 2013

Performance of the Totem Detectors at the LHC.

The TOTEM Collaboration



CERN-PH-EP-2013-173
9 September 2013

Also "Luminosity-Independent Measurement of the Proton-Proton Total Cross Section at $\sqrt{s} = 8 \text{ TeV}$ " now out in PRL

PRL 111, 012001 (2013)

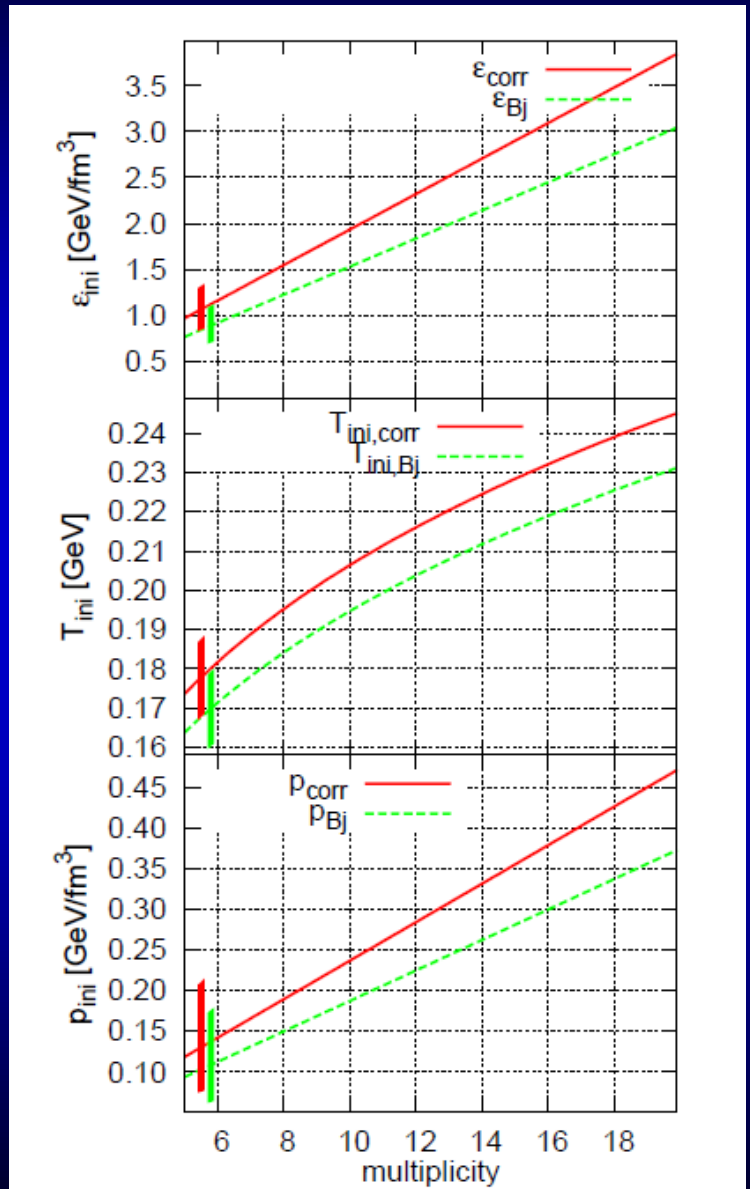
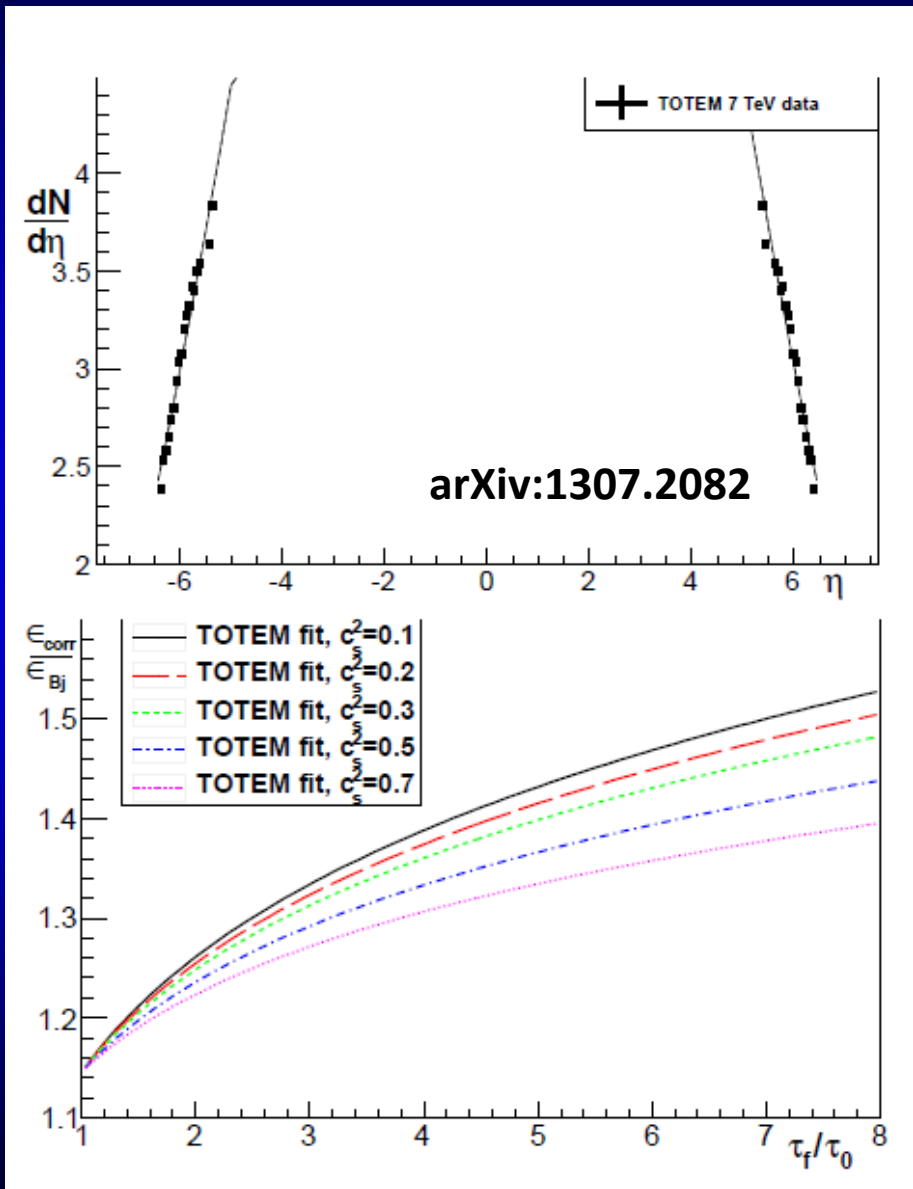
PHYSICAL REVIEW LETTERS

week ending
5 JULY 2013

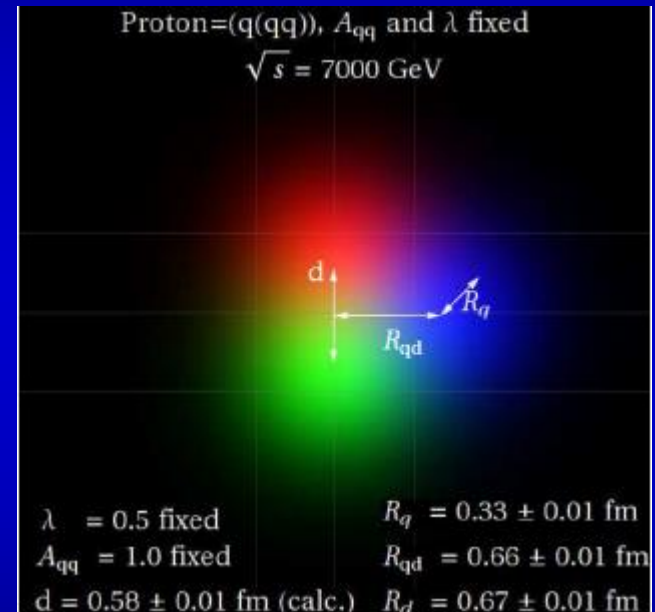
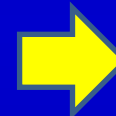
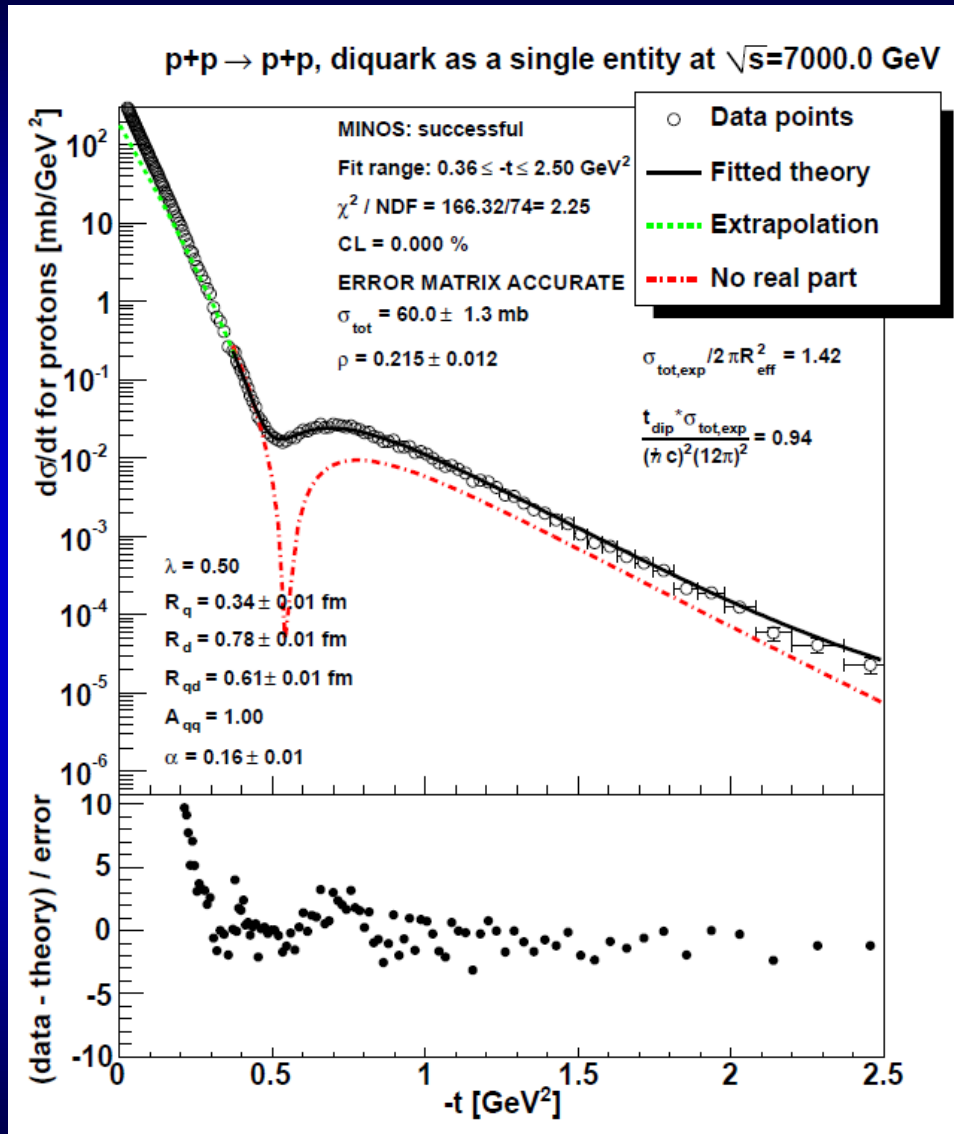
Luminosity-Independent Measurement of the Proton-Proton Total Cross Section at $\sqrt{s} = 8 \text{ TeV}$

G. Antchev *et al.**
(TOTEM Collaboration)

TOTEM dn/dη data@7 TeV (+8 TeV w CMS)



Results for TOTEM $d\sigma/dt$



Imaging on the sub-femtometer scale

TOTEM OUTREACH

HIGGS BOSON – ON YOUR OWN, MADE AT HOME

T. Csörgő

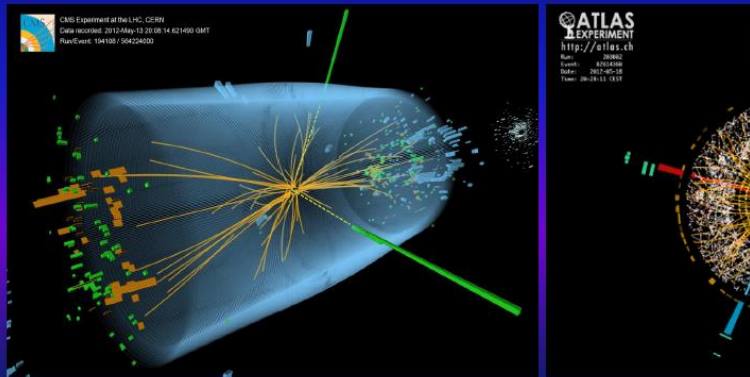
tamas.ferenc.csorgo @ cern.ch

[arXiv:1303.2732](https://arxiv.org/abs/1303.2732) [physics.pop-ph]

[arXiv:1303.2798](https://arxiv.org/abs/1303.2798) [physics.pop-ph]



From Brookhaven National Lab
(USA) outreach
To CERN outreach



3rd ENGLISH ED. IN BNL'S STORE

Lulu Author Spotlight

Brookhaven's Store

QUARK MATTER
CARD GAME



More Detail

Quark Matter
Card Game

By Judit Csörgő, Csaba Török,
Tamás Csörgő

Paperback: List Price: \$27.04

\$19.56 You Save: 30%

Ships in 3-5 business days



New card games for kids with
gleaming eyes - as well as for
their relatives, laypersons,
teachers, scholars and
researchers, 5-99 years of age:
for anyone, who is interested in a
playful and hands-on... More >

Add to Cart

QUARK MATTER
CARD GAME



More Detail

Quark Matter
Card Game

By Judit Csörgő,
Csaba Török,
Tamás Csörgő

eBook (PDF): \$

Download imme

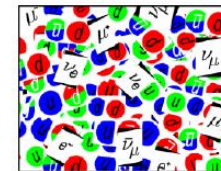
★★★★★

New card game
gleaming eyes
their relatives,
teachers, sch
researchers,
for anyone, w
playful and ha

Add to C

QUARK MATTER CARD GAME

ELEMENTARY PARTICLES - ON YOUR OWN
THIRD, REVISED AND EXTENDED ENGLISH EDITION



JUDIT CSÖRGŐ
CSABA TÖRÖK
TAMÁS CSÖRGŐ

Demonstrations of Higgs card
game

For kids, adults, pensioners
at CERN Open Days 2013
both at CERN
and in Hungary

First (and only) item, Brookhaven's lulu.com store

Hungarian Participants in TOTEM@LHC



T. Csörgő, PI (Wigner RCP)
Member of TOTEM 2008-
TOTEM Collab. Board, LHC RRB,
EB-arXiv.org, data taking



J. Sziklai (Wigner RCP)
Member of TOTEM 2008-
TOTEM DCS, Remote DCS controll from
Wigner, data taking



M. Csanád (ELTE)
Member of TOTEM 2008-
TOTEM DAQ, analysis framework,
p+Pb data taking and analysis
 $dn/d\eta$ analysis of p+p



E. Dénes (Wigner)
Member of TOTEM 2008-2009.
TOTEM DAQ libraries



T. Novák (KRF)
Member of TOTEM 2008-
TOTEM DCS box construction
data taking, p+Pb cross-section
Glauber calculations



A. Ster (Wigner RCP)
Member of TOTEM 2007-10
TOTEM DAQ front-end progr.
p+Pb cross-section Glauber
DIPSY Monte Carlo



F. Nemes (ELTE-Wigner)
Member of TOTEM 2009-
Funded by TOTEM @ CERN
Reconstruction of LHC optics
from TOTEM data
TOTEM Roman Pot and other
Geant Simulations for upgrade
p+Pb data taking and analysis

Hungarian Institutions in TOTEM



Institute for Particle and Nuclear Physics
Wigner Research Centre for Physics
Hungarian Academy of Sciences
(Coordinates Hungarian participation)



Department for Atomic Physics
Eötvös Loránd University
Budapest
(TOTEM affiliation through Wigner RCP)



Dept for Methodology, Informatics and Economy
Károly Róbert University College
Gyöngyös, Hungary
(TOTEM affiliation through Wigner RCP)

HUNGARIAN TOTEM SUPPORT

The only LHC experiment in Hungary that is
NOT a state project but an individual initiative

- based on interesting forward physics of RHIC
- funded by

OTKA 74458, NKTH HA07-C

OTKA NK 73143 (2008-2011)

OTKA NK 101438 (2012-15)

Charles Simonyi Fund (2012-13)

**Salaries: Hungarian Academy of Sciences
ELTE University, KRF Gyöngyös**

Inspirational: Prof. R.J. Glauber (Harvard)

THANKS A LOT for the SUPPORT

GLAUBER in TOTEM @ CERN, 2010



GLAUBER in TOTEM @ WIGNER, 2012

