A NUON based particle zoo

heresy?, joke?,

ATLAS meeting 27 January 2012

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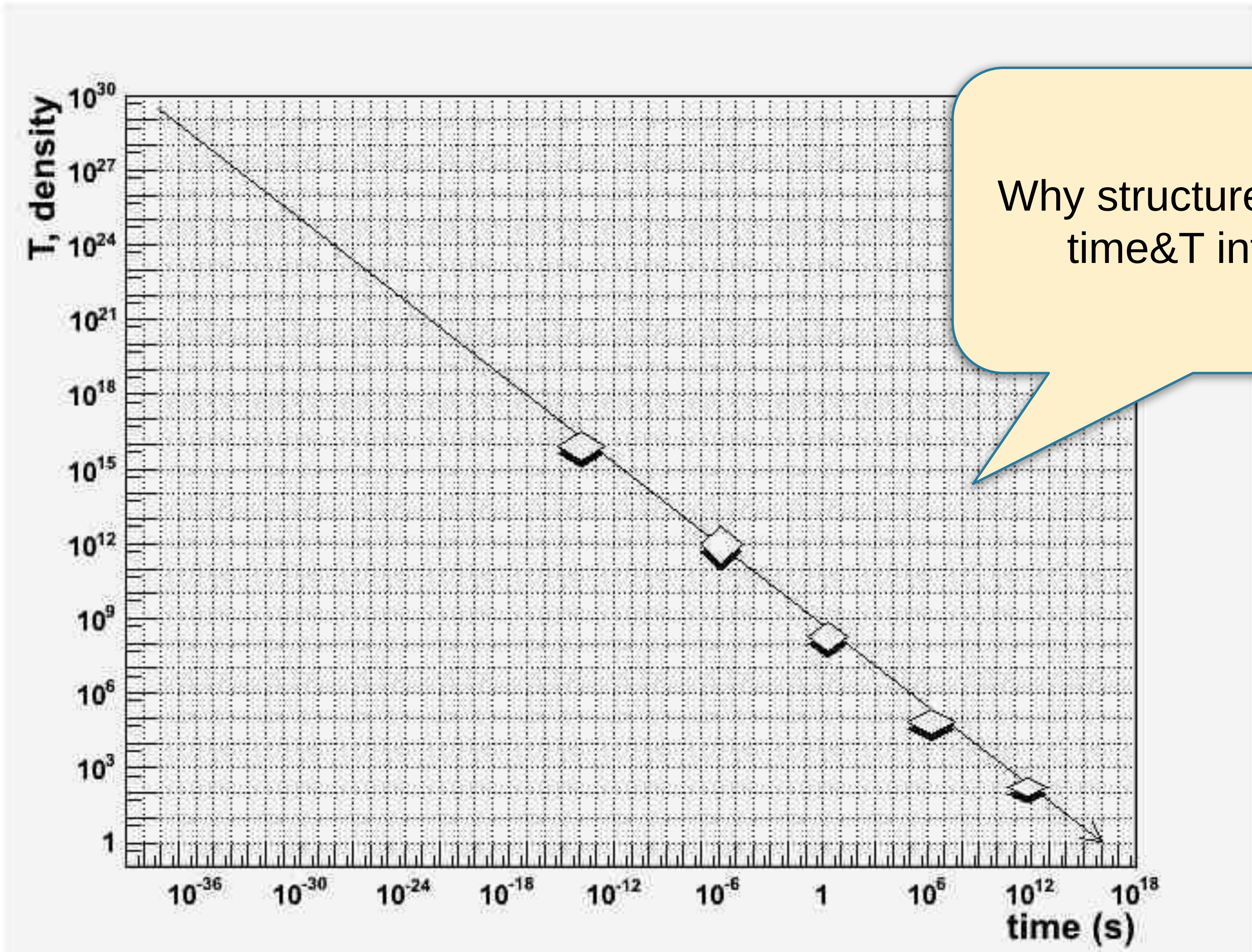
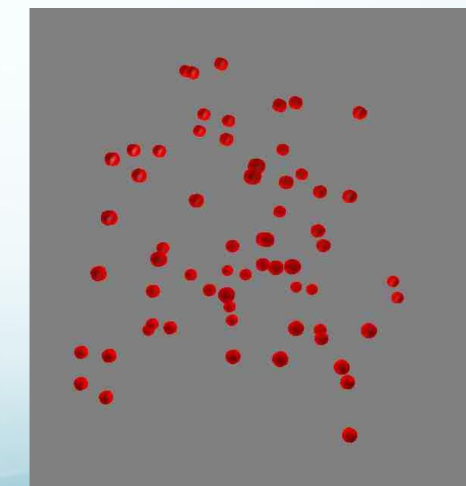
Context

- I am just about to retire (in fact already done).
- After 39 years in the computing scene, I am now investigating some crazy ideas that flourished in my head in the past decade, and somehow a continuation of the work I did for my thesis in 1973.
- I have been the witness of the development and success of the standard Model during my contributions to R602,NA4,OPAL,ALICE and applications of GEANT to about 100 experiments.
- I have been working on the plumbing services with my work on HBOOK, PAW, GEANT, ROOT.

Structures with time and T



Why structures appear at time&T intervals ?

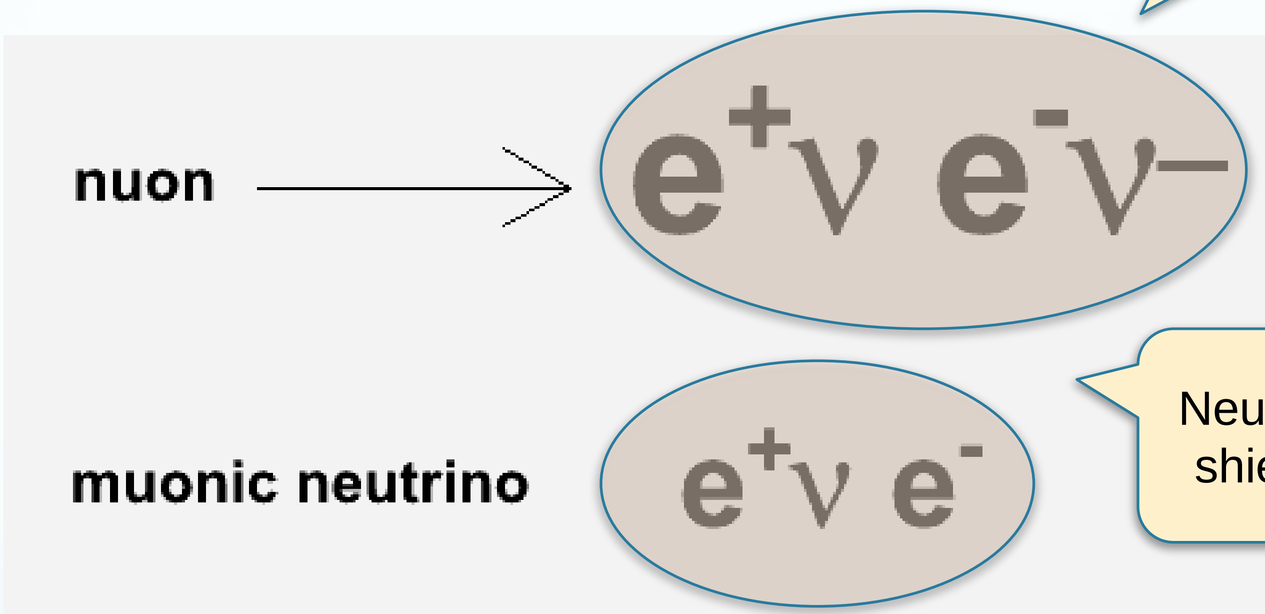


Starting point

- All particles decay at the end into electrons,positrons,neutrinos, antineutrinos + (photon) + (proton).
- Imagine a model where all particles are built out of the 4 main basic particles or a bound state of these particles (a nuon).
- Imagine a process explaining how a set of N nuons distributed randomly in a cube can converge to a stable or nearly stable situation.

the Nuon

For the time being assume this to be a solid bound state



Neutrinos act as a shielding system

Decays

μ^- DECAY MODES		Fraction (Γ_i/Γ)	Co
$e^- \overline{\nu}_e \nu_\mu$		$\approx 100\%$	
$e^- \overline{\nu}_e \nu_\mu \gamma$	[d]	(1.4 ± 0.4) %	
$e^- \overline{\nu}_e \nu_\mu e^+ e^-$	[e]	$(3.4 \pm 0.4) \times 10^{-5}$	

π^0 DECAY MODES		Fraction (Γ_i/Γ)	Confidence level	(M
2γ		(98.798 ± 0.032) %	S=1.1	
$e^+ e^- \gamma$		(1.198 ± 0.032) %	S=1.1	
γ positronium		$(1.82 \pm 0.29) \times 10^{-9}$		
$e^+ e^+ e^- e^-$		$(3.14 \pm 0.30) \times 10^{-5}$		
$e^+ e^-$		$(6.2 \pm 0.5) \times 10^{-8}$		
4γ		$< 2 \times 10^{-8}$	CL=90%	
$\nu \overline{\nu}$	[e]	$< 2.7 \times 10^{-7}$	CL=90%	
$\nu_e \overline{\nu}_e$		$< 1.7 \times 10^{-6}$	CL=90%	
$\nu_\mu \overline{\nu}_\mu$		$< 1.6 \times 10^{-6}$	CL=90%	
$\nu_\tau \overline{\nu}_\tau$		$< 2.1 \times 10^{-6}$	CL=90%	
$\gamma \nu \overline{\nu}$		$< 6 \times 10^{-4}$	CL=90%	

π^+ DECAY MODES		Fraction (Γ_i/Γ)	Confidence
$\mu^+ \nu_\mu$	[b]	(99.98770 ± 0.00004) %	
$\mu^+ \nu_\mu \gamma$	[c]	$(2.00 \pm 0.25) \times 10^{-4}$	
$e^+ \nu_e$	[b]	$(1.230 \pm 0.004) \times 10^{-4}$	
$e^+ \nu_e \gamma$	[c]	$(1.61 \pm 0.23) \times 10^{-7}$	
$e^+ \nu_e \pi^0$		$(1.036 \pm 0.006) \times 10^{-8}$	
$e^+ \nu_e e^+ e^-$		$(3.2 \pm 0.5) \times 10^{-9}$	
$e^+ \nu_e \nu \overline{\nu}$		$< 5 \times 10^{-6}$	

			Confidence level	(MeV/c)
		2) %	S=1.1	67
		2) %	S=1.1	67
γ positronium		$(1.82 \pm 0.29) \times 10^{-9}$		67
$e^+ e^+ e^- e^-$		$(3.14 \pm 0.30) \times 10^{-5}$		67
$e^+ e^-$		$(6.2 \pm 0.5) \times 10^{-8}$		67
4γ		$< 2 \times 10^{-8}$	CL=90%	67
$\nu \overline{\nu}$	[e]	$< 2.7 \times 10^{-7}$	CL=90%	67
$\nu_e \overline{\nu}_e$		$< 1.7 \times 10^{-6}$	CL=90%	67
$\nu_\mu \overline{\nu}_\mu$		$< 1.6 \times 10^{-6}$	CL=90%	67
$\nu_\tau \overline{\nu}_\tau$		$< 2.1 \times 10^{-6}$	CL=90%	67
$\gamma \nu \overline{\nu}$		$< 6 \times 10^{-4}$	CL=90%	67

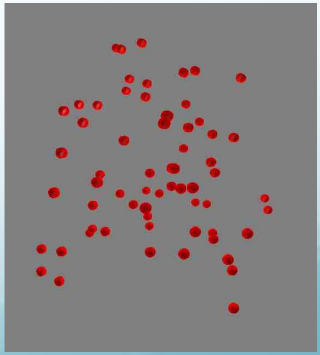
Charged and neutral particles

- For a given particle type (say pion) how to explain the very interesting mass difference between the charged and neutral case?
- My solution:
  - Charged particles have a positron/electron at the center.
  - Neutral particles have a muonic neutrino instead.
- Simple solution to the neutron decay system

$$p\,e^{-}\,\overline{\nu}_e$$

Minimization procedure

- Assuming N nuons at x(i),y(i),z(i)
- Assuming ONLY Coulomb forces, compute the sum of all forces (matrix) between them, ie FC.
- Force a spherical object FS (will move to an ellipsoid).
- Call MINUIT to minimize the function FC^2 + FS^2 at the center of the object.



Computing the particle mass

taken from Wikipedia

Scalar moment of inertia for many bodies

[edit]

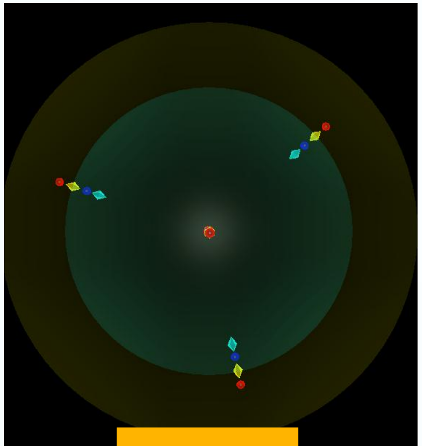
Consider a rigid body rotating with angular velocity ω around a certain axis. The body consists of N point masses m_i whose distances to the axis of rotation are denoted r_i. Each point mass will have the speed $v_i = \omega r_i$, so that the total kinetic energy T of the body can be calculated as

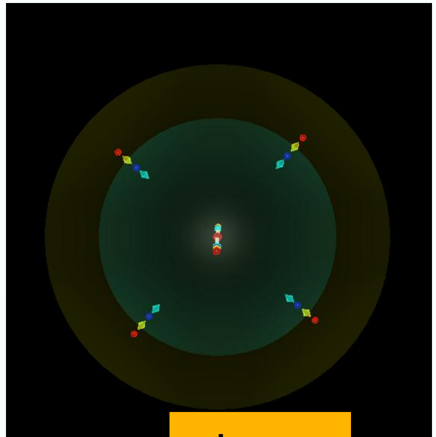
$$T = \sum_{i=1}^{N} \frac{1}{2} m_i v_i^2 = \sum_{i=1}^{N} \frac{1}{2} m_i (\omega r_i)^2 = \frac{1}{2} \omega^2 \left(\sum_{i=1}^{N} m_i r_i^2 \right).$$

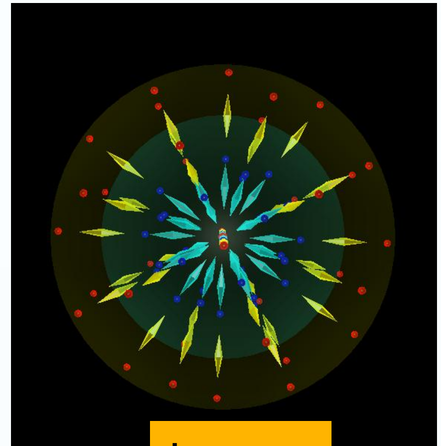
In this expression the quantity in parentheses is called the **moment of inertia** of the body (with respect to the specified axis of rotation). It is a purely geometric characteristic of the object, as it depends only on its shape and the position of the rotation axis. The moment of inertia is usually denoted with the capital letter I:

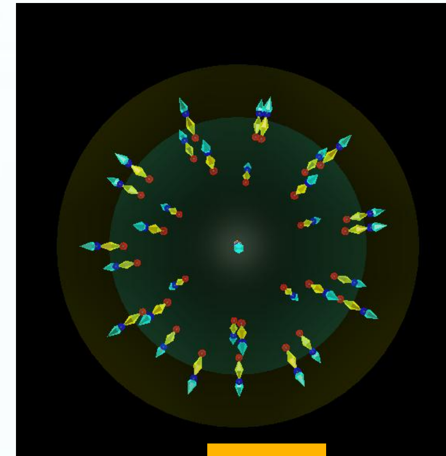
$$I = \sum_{i=1}^{N} m_i r_i^2 \ .$$

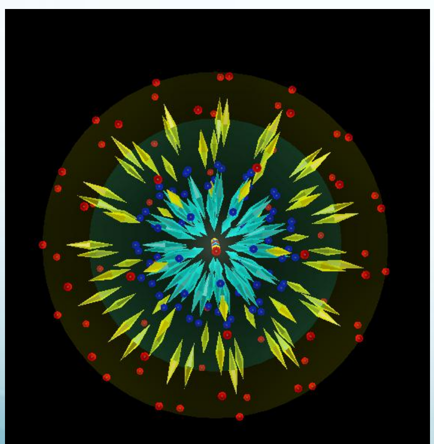
some particles

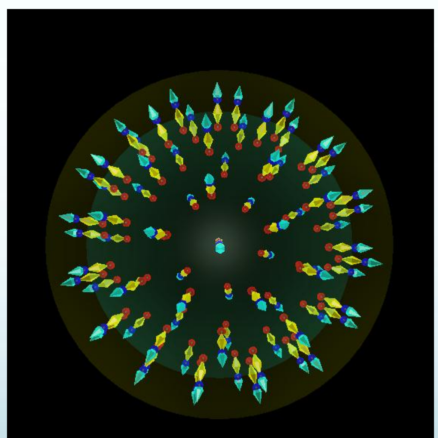

muon

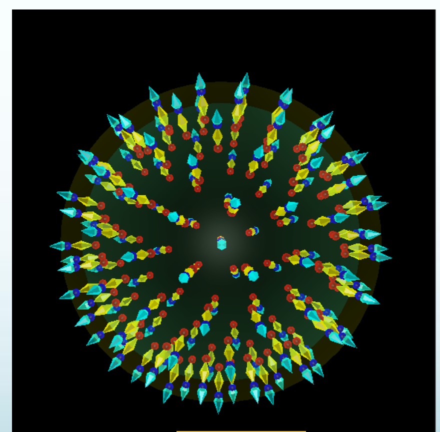

pion


kaon


K0


proton

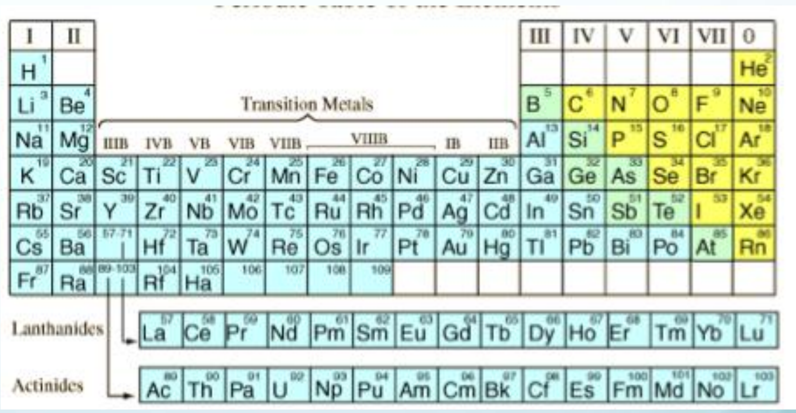

Lambda

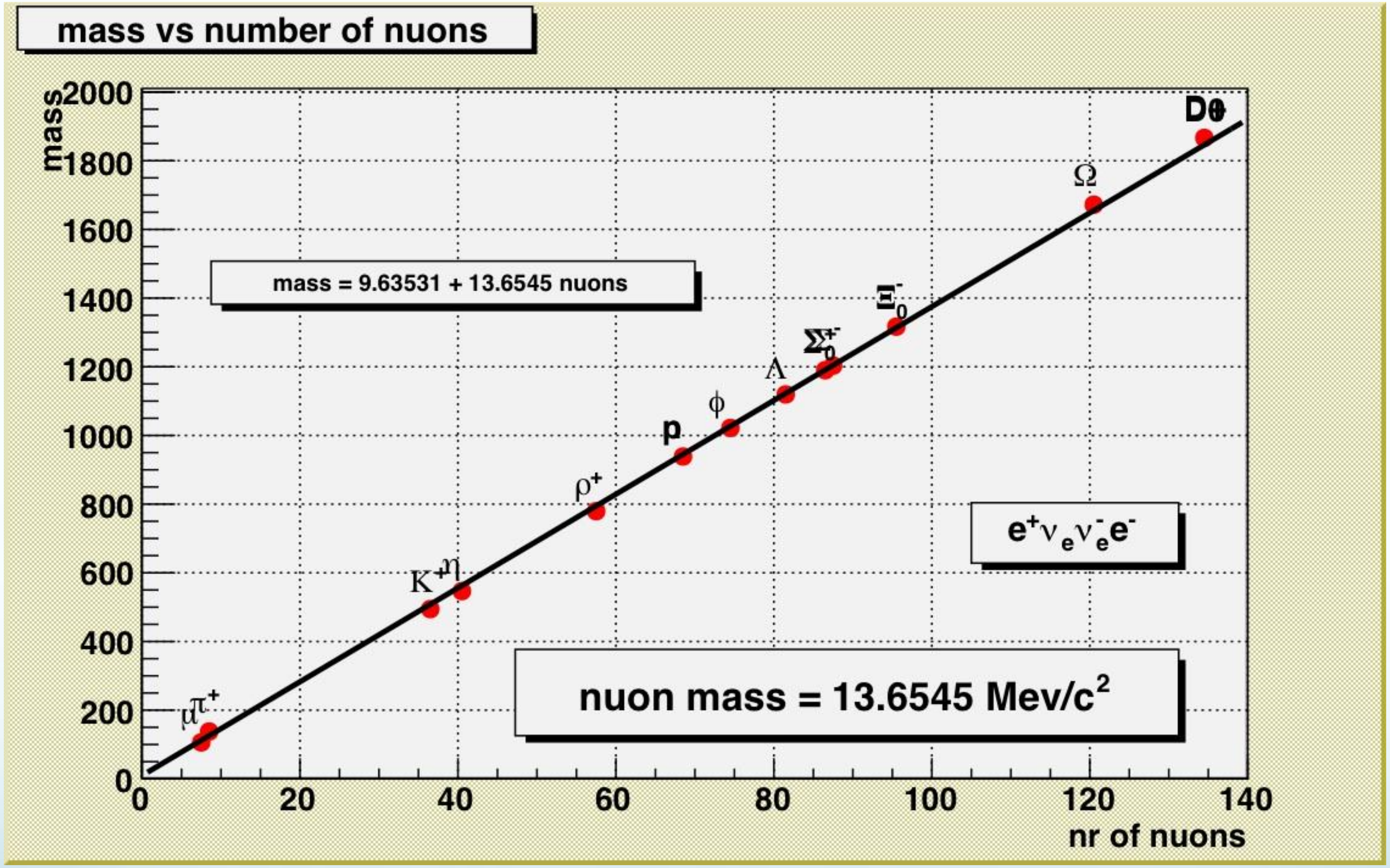

D0

05/allcur.root with 394716 events Thu Jan 26 18:55:36 2012

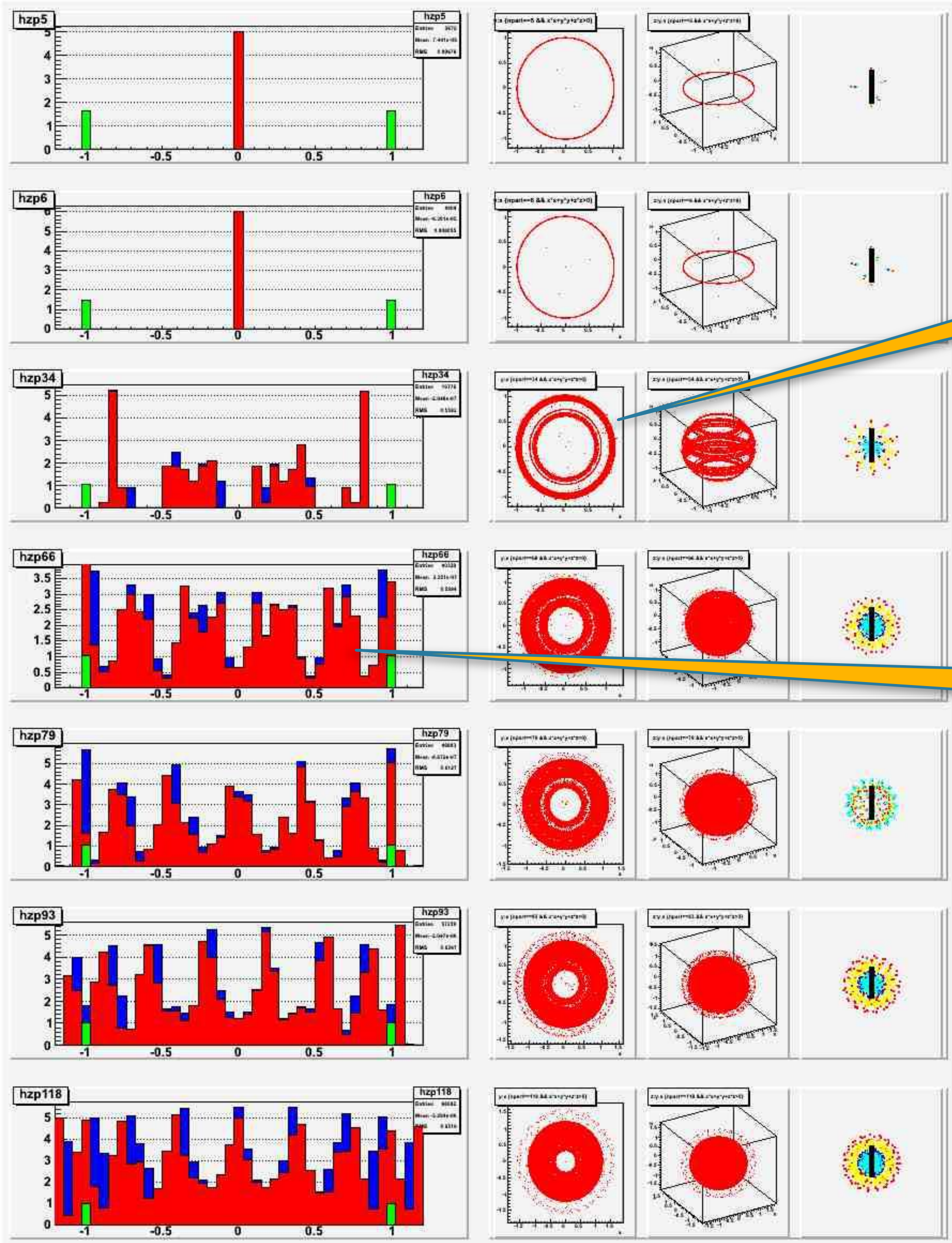
nuons	PDG	me	rel diff	life time
m 3	105.7	106.105 +- 1.14867	0.00383151 (49638)	2.2e-06
p^+ 4	139.57	140.653 +- 1.10739	0.00775967 (99126)	2.6e-08
p_0 4	134.976	135.015 +- 0.546546	0.000291878 (99362)	8.4e-17
K^+ 32	493.677	493.331 +- 6.83121	-0.000700061 (49347)	1.24e-08
K_0 32	497.677	495.511 +- 3.41828	-0.0043529 (49532)	5.11e-08
h 36	547.5	546.709 +- 9.26051	-0.00144432 (4946)	3.5e-08
r^+ 53	775.4	778.061 +- 1.84235	0.00343231 (4974)	4.5e-24
r_0 53	775.49	781.006 +- 2.56131	0.00711248 (4930)	4.5e-24
p 64	938.272	937.143 +- 3.35986	-0.00120358 (9971)	1e+40
n 64	939.565	940.211 +- 4.57472	0.000687472 (9886)	885.7
f 70	1019.45	1021.9 +- 2.16417	0.00241077 (2494)	1.55e-22
L 77	1115.7	1119.43 +- 2.08756	0.00333921 (2551)	2.63e-10
S^+ 82	1189.37	1189.51 +- 0.888493	0.000119654 (1512)	8.02e-11
S_0 82	1192.64	1190.22 +- 2.3951	-0.00202729 (1542)	7.4e-20
S^- 83	1197.45	1203.4 +- 0.996729	0.00496571 (1446)	1.48e-10
X^- 91	1321.3	1317.21 +- 1.4983	-0.00309202 (978)	1.64e-10
X_0 91	1314.8	1316.23 +- 2.6538	0.00108399 (969)	2.9e-10
W 116	1672	1671.9 +- 0.584524	-5.8363e-05 (504)	8.21e-11
D+ 130	1869.3	1871.56 +- 1.81497	0.00121141 (518)	1.04e-18
D0 130	1864	1861.02 +- 3.36684	-0.00159798 (490)	4.1e-17

Massses are computed at the per mille level





mass vs number of nuons
mass = 9.63531 + 13.6545 nuons
nuon mass = 13.6545 Mev/c2
mass
nr of nuons
0
200
400
600
800
1000
1200
1400
1600
1800
2000
20
40
60
80
100
120
140



R(x,y) distribution of nuons in kaon

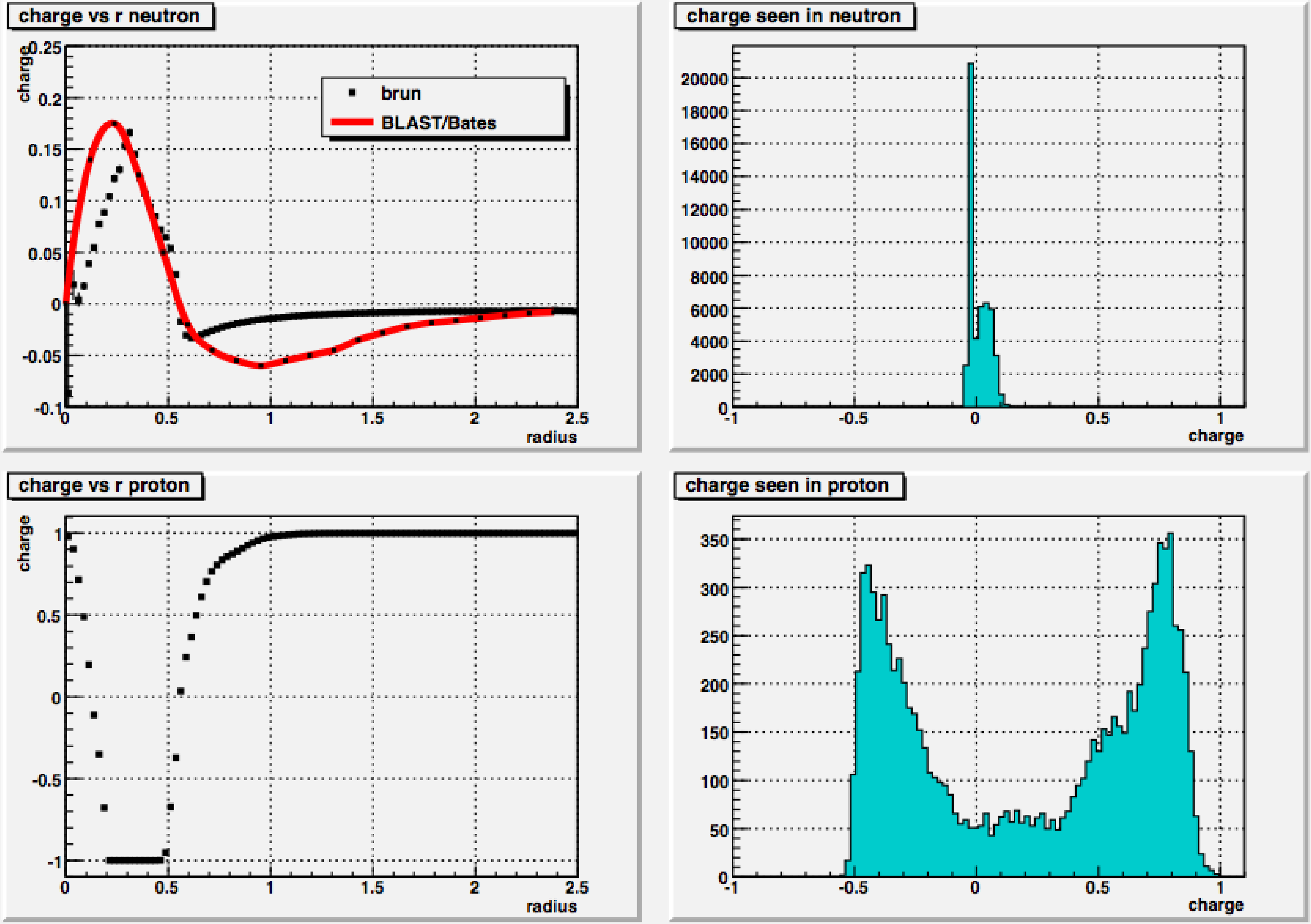
Z distribution of nuons in proton

nuons	name	S2	S4	S8	S16	S32	S64	Tri Car Pen Hex
3	m							T
4	p							C
5								P
6								H
8								PT
9								HT
10								P2
12								H2
16								C4
18								H3
20								P4
24								H4
30								P6
32	K							C8,C2H4
36	h							H6,C3H4
40								P8
48								H8
50								P10
52								C13
53	r							PH8,P10T
60								C15,P12,H10
64	p							C16,C1P12,C1H10
70	f							C16H1,P14
72								C18,H1
76								C19,C1H12
77	L							C18P1
82	S							C18P2
91	X							C22T
96								C24
116	W							C29
128								C32
130	D							P26

Just started investigaing life times, binding energy

Charge density in proton and neutron

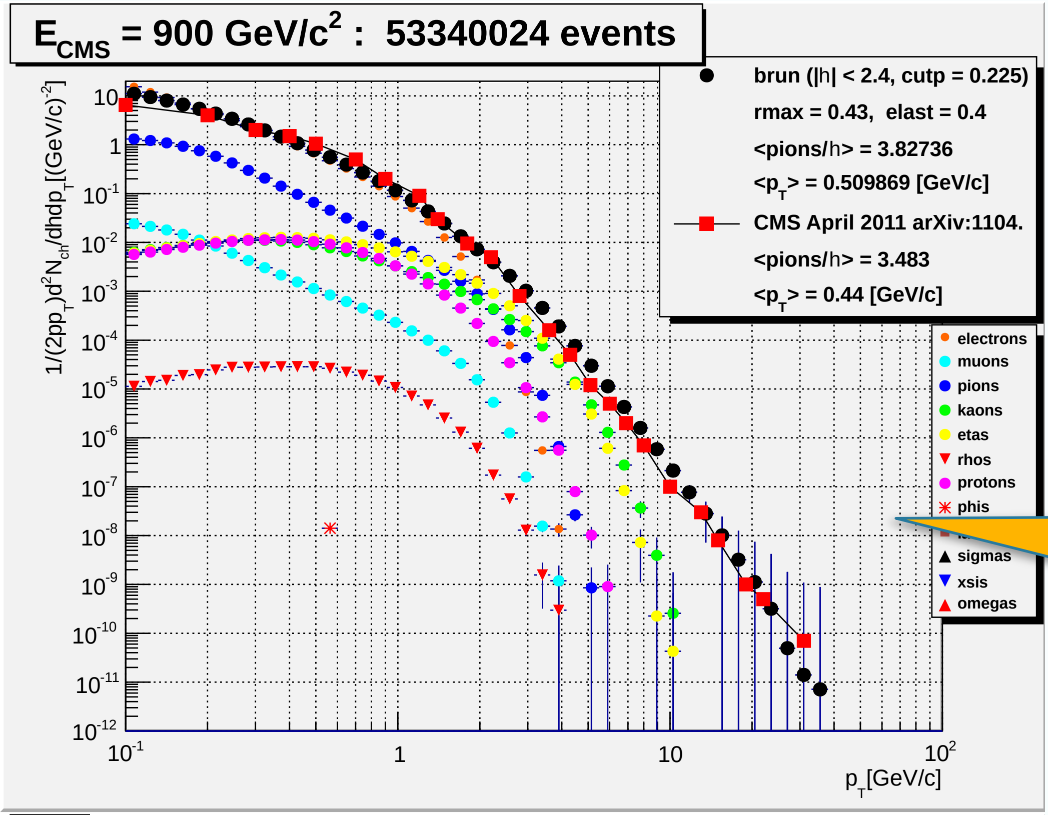
- I computed the charge density in the proton and neutron by sending electrons through them.
- In the case of the neutron, I compared with the interesting results from JLAB and Blast/Bates experiments


charge vs r neutron
charge
radius
brun
BLAST/Bates
charge seen in neutron
charge
charge vs r proton
charge
radius
charge seen in proton
charge

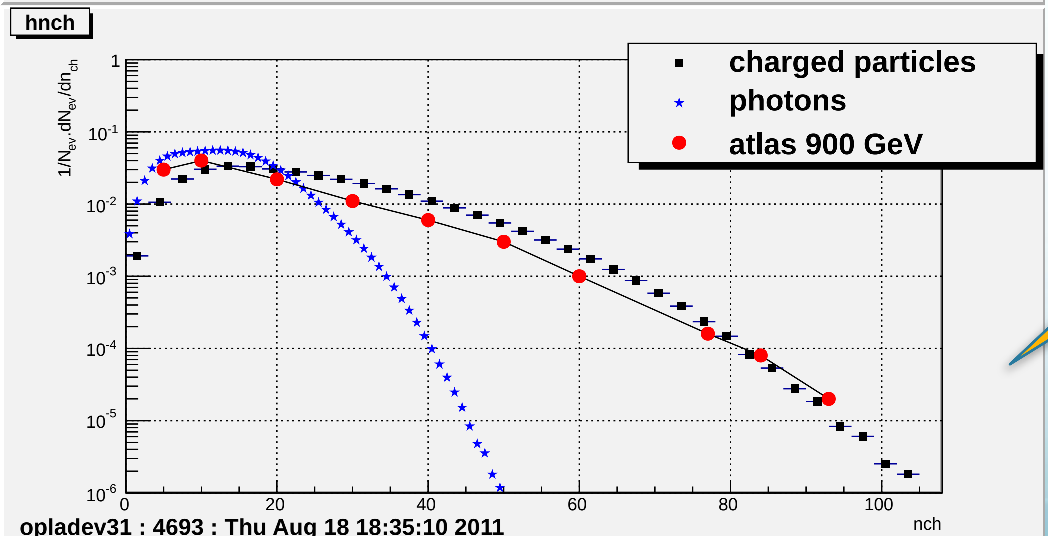
Colliding particles

- I implemented a particle collision system to investigate the corresponding particle multiplicity, Pt distribution and ratios of the generated particle types.
- I had to implement my « own Pythia » with a simple hadronization model.
- I compared the results with the 2010/2011 results from Alice, Atlas and CMS.

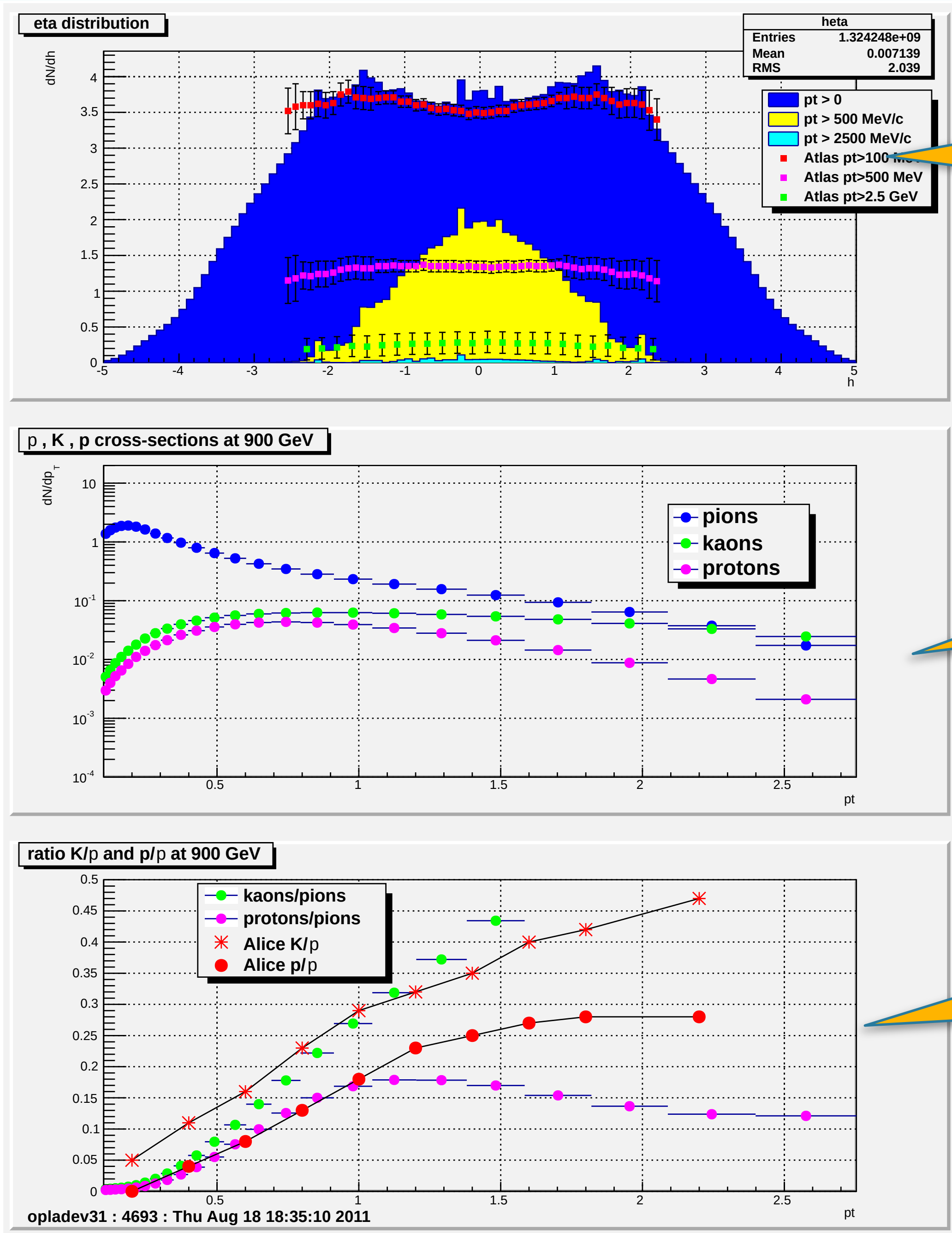
900 GeV



The Pt distribution is in excellent agreement with LHC results over 12 orders of magnitude



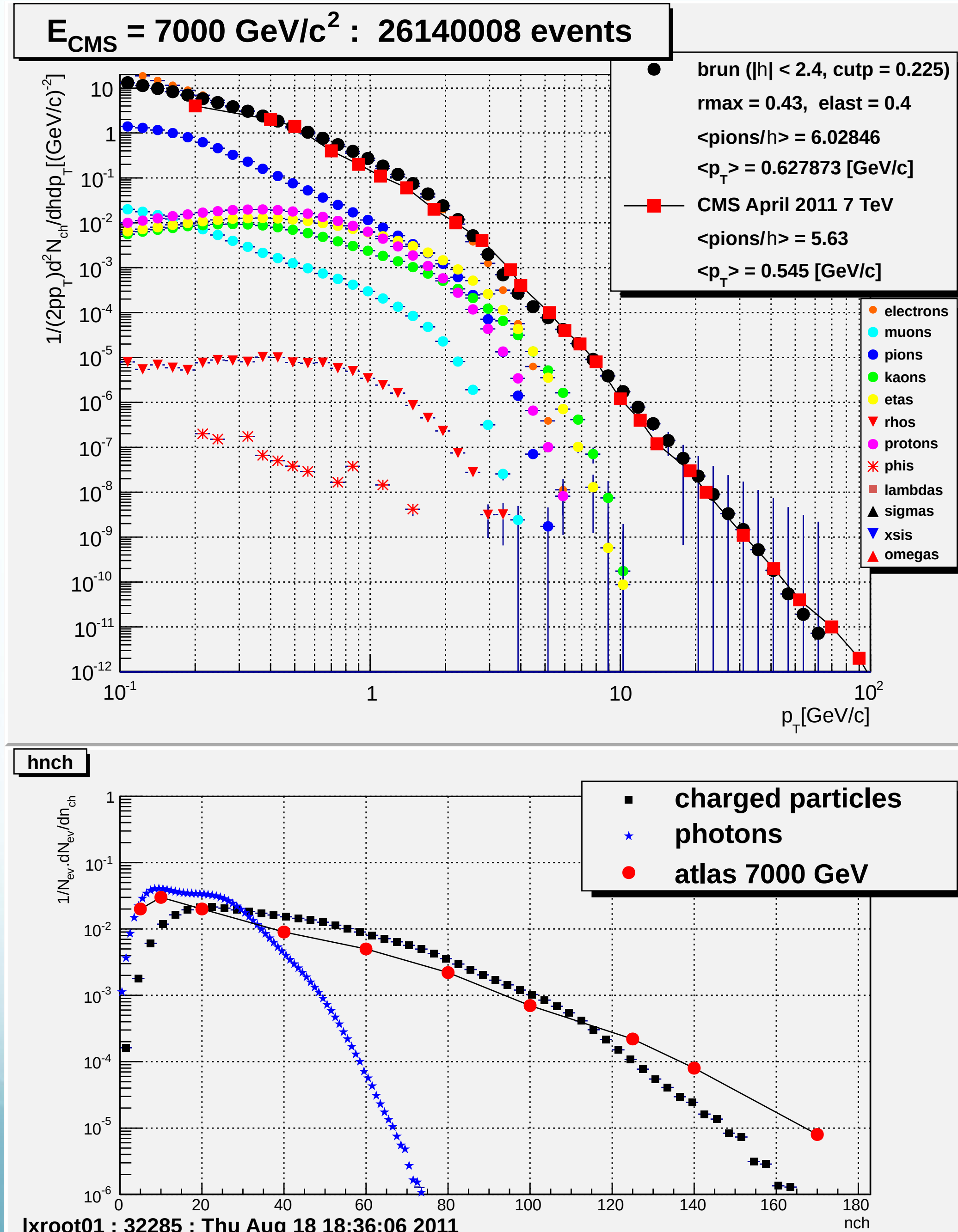
Multiplicity distribution as well



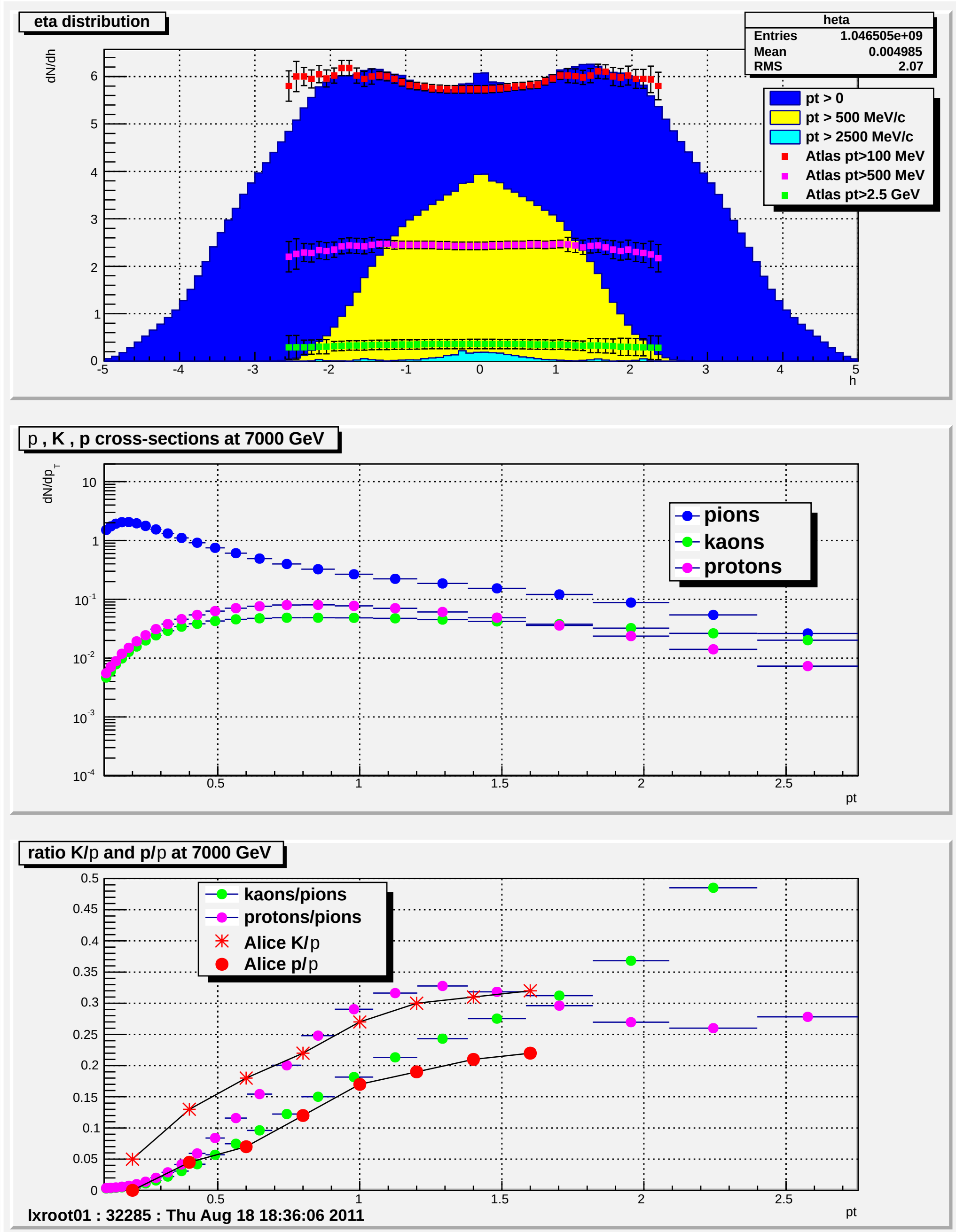
Pseudo rapidity Compared to Atlas results

Pions, kaons, protons spectra compared with Alice

Ratio kaons/pions and protons/pions compared with Alice



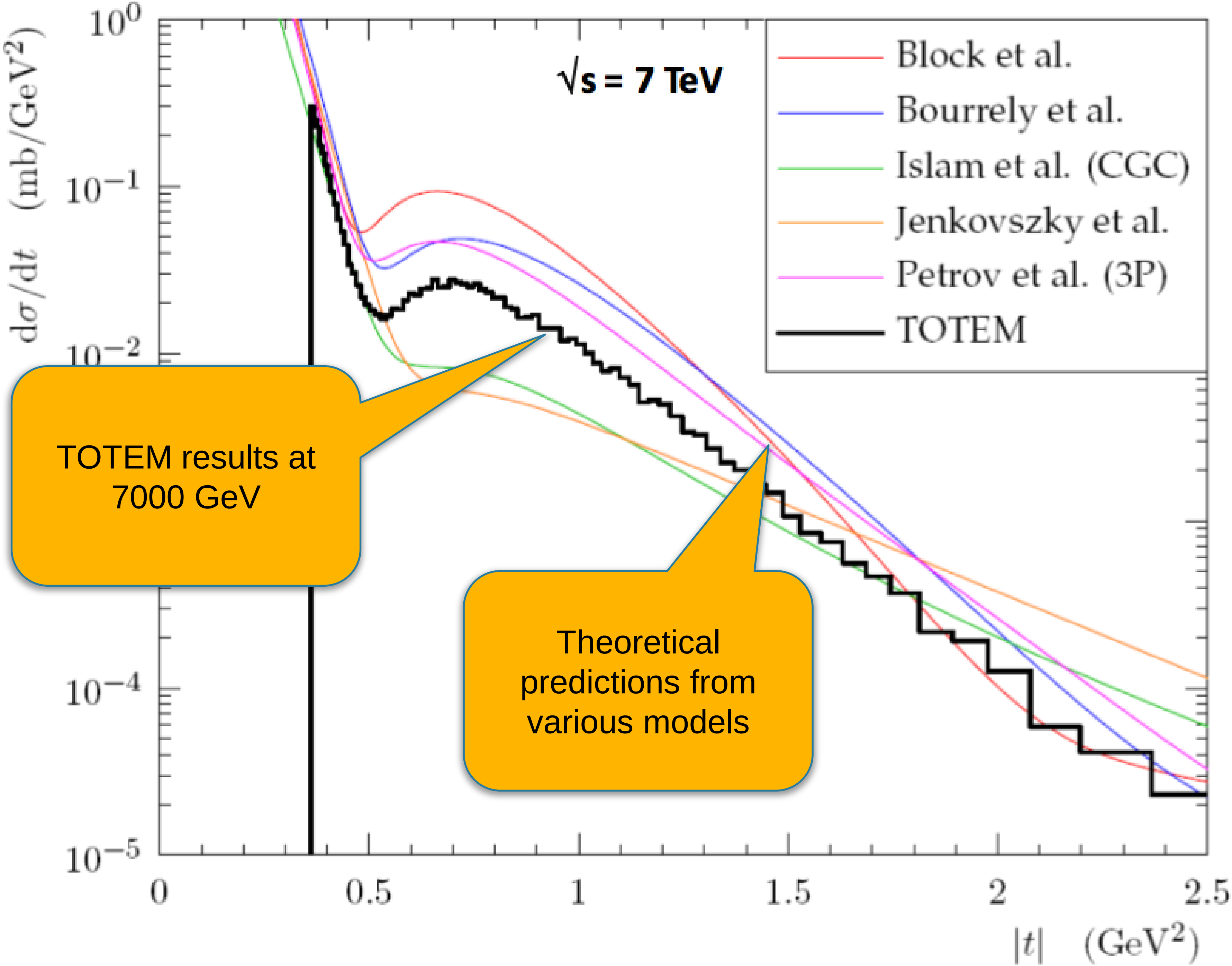
Same at 7000 GeV



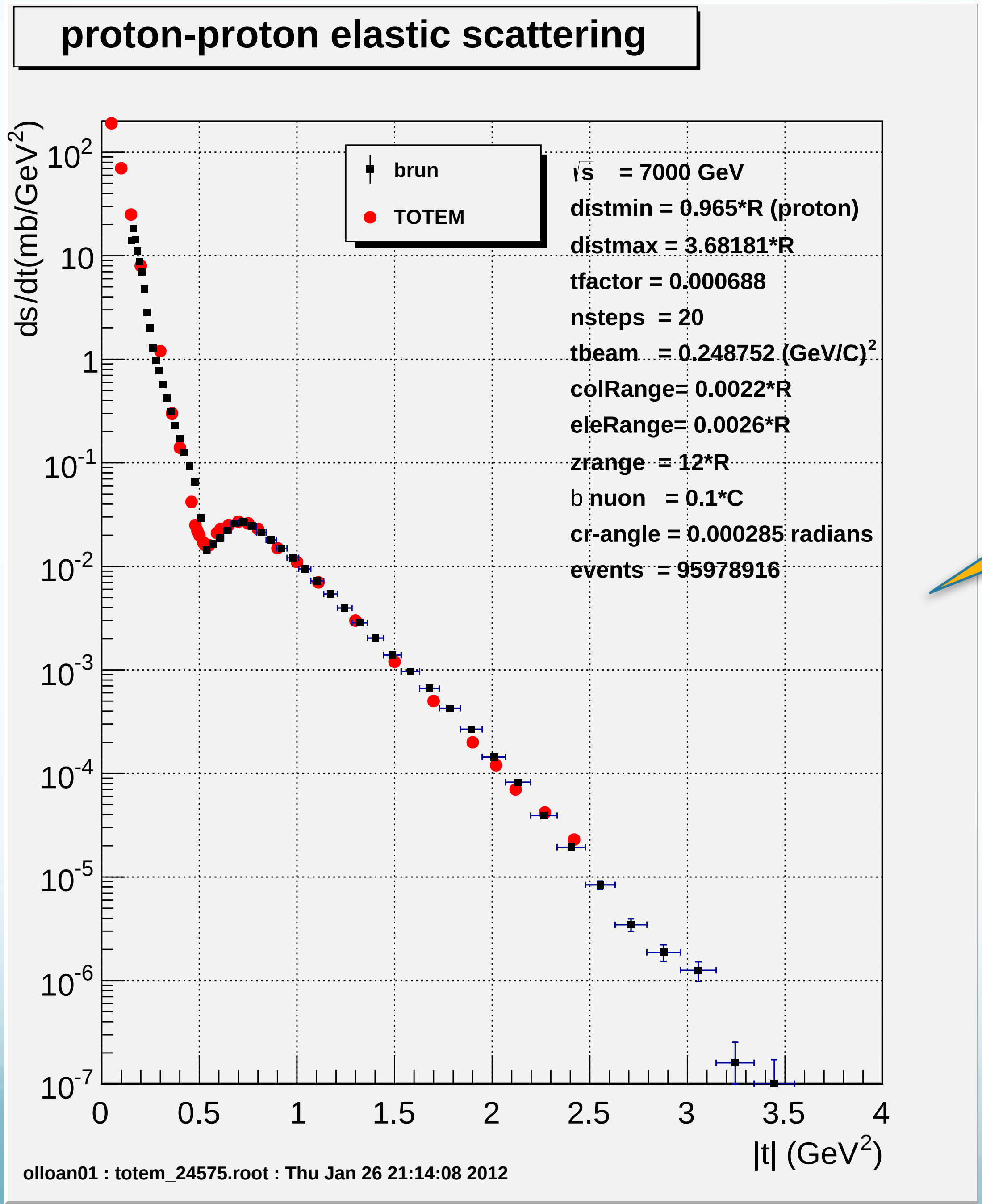
Same at 7000 GeV

Proton-proton elastic scattering

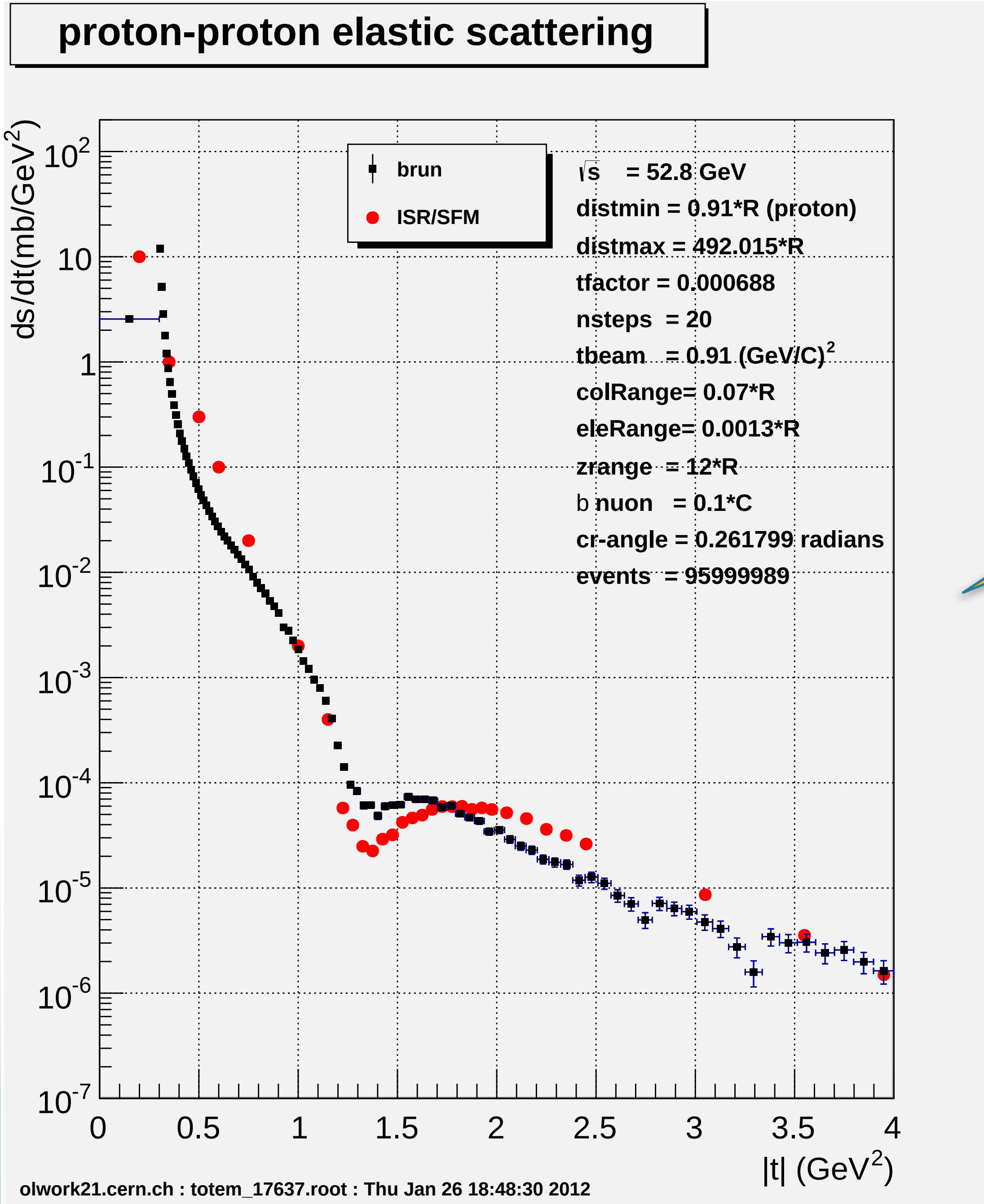
- Elastic scattering is a fantastic system to test the proton shape.
- I implemented a system « colliding » protons taken randomly from my proton data base.
- I computed the momentum transfer distribution and compared my results with TOTEM and ISR results (still on going)



√s = 7 TeV
Block et al.
Bourrely et al.
Islam et al. (CGC)
Jenkovszky et al.
Petrov et al. (3P)
TOTEM
TOTEM results at 7000 GeV
Theoretical predictions from various models
dσ/dt (mb/GeV²)
|t| (GeV²)
10⁰
10⁻¹
10⁻²
10⁻⁴
10⁻⁵
0
0.5
1
1.5
2
2.5

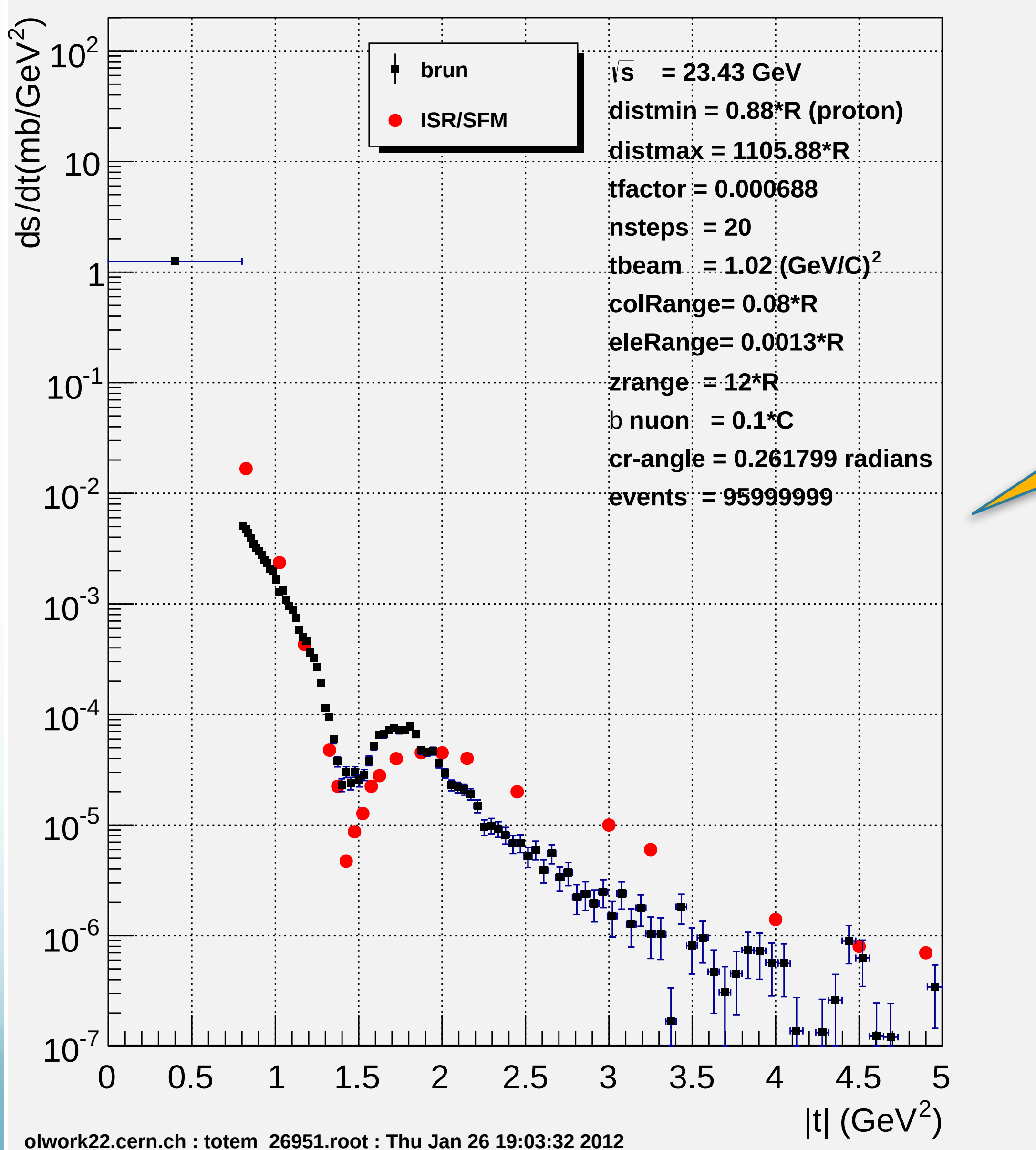


My results at 7000 GeV compared to TOTEM



My results at 52.8 GeV compared to ISR/SFM

proton-proton elastic scattering



My results at 23.4 GeV compared to ISR/SFM

Matter/antimatter asymmetry

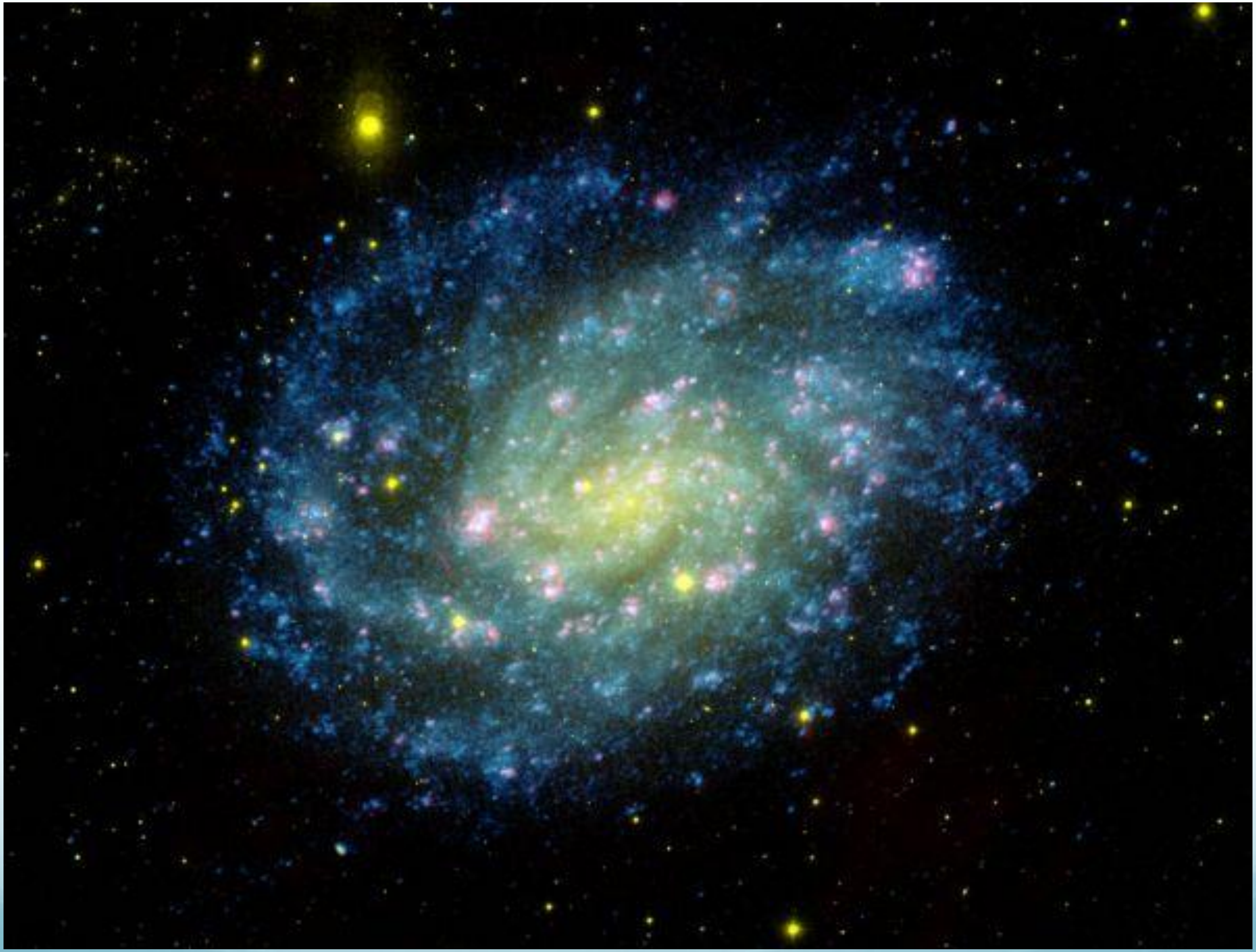
- In my model a nuon is « charge, etc » symmetric.
- A proton and antiproton differ only by the central positron or electron.
- An hydrogen atom is fully symmetric
- So, the problem disappears :☺

Neutrino oscillations ?

- In my model this problem is seen in a different way.
- An electronic neutrino coming from the sun can interact with the 150 million kms of dust and capture an e+e- (from an other nuon) and become a muonic neutrino.
- Vice-versa a muonic neutrino coming from CERN can interact with the 750 km of earth to Gran Sasso and lose its e+e-, becoming an electronic neutrino.
- Like muonic neutrinos, tau neutrinos can be though as muonic neutrinos with a few more electrons/neutrinos around.

Dark matter, energy

- My model is a possible solution to the question of missing matter and univers expansion.
- Particles interactions in stars produce a huge amount of invisible nuons that behave like neutrinos. These nuons escape the galaxy, but contribute to its mass.
- These same nuons are at the fore front of the univers expansion attracting everything else, explaining the acceleration of the expansion.



Open questions

- Of course I have considered only a tiny aspect of the particle zoo and particle interactions problems.
- I am currently thinking about the next steps, how to adapt the model to be consistent with the observations of the heavier quarks or jets without having quarks and gluons.
- Investigating this takes time and energy. Contributors are welcome!!
- And, of course, comments are welcome !!!!!!!