

Etapa II: Dezvoltarea Centrului de date NIHAM:
componenta GRID-ului ALICE si analiza,
interpretarea datelor simulate Monte Carlo
Proiect: Stari exotice ale materiei, efecte
in-mediu si dinamica
Contract: CAPACITATI Modulul III,
CERN/ALICE: 9-EU/13.03.2009
Director de proiect: Prof. Dr. M. Petrovici

Decembrie 2, 2009

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- Obiectivele etapei
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- Descrierea stiintifica si tehnica
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Obiectivul general

Obiectivul principal al experimentului ALICE este studiul materiei nucleare într-un regim de temperatura care depaseste mult temperatura critica unde are loc tranzitia catre faza deconfinata a materiei la densitati de energie de peste doua ordine de marime fata de materia nucleara care ne inconjoara.

Obiectivele etapei

Obiectivele fazei de executie se inscriu in urmatoarele obiective mai largi ale proiectului:

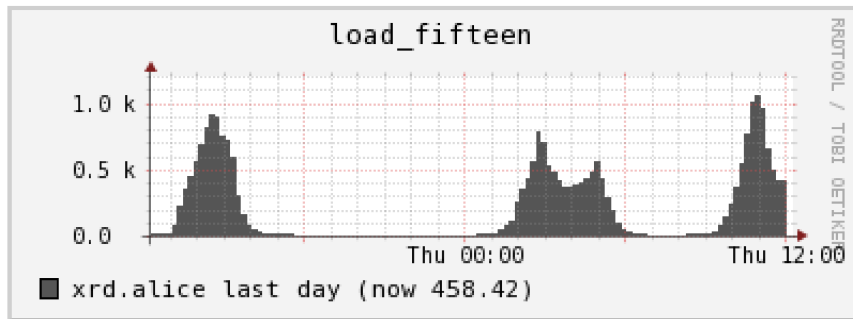
- Dezvoltarea Centrului de date NIHAM: componentele GRID si NAF.
- Analiza si interpretarea datelor simulate Monte Carlo si experimentale obtinute cu detectorul ALICE.

Descrierea stiintifica si tehnica

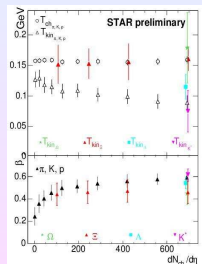
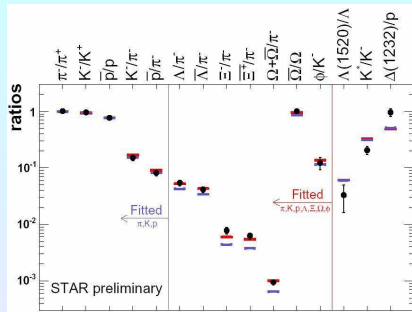
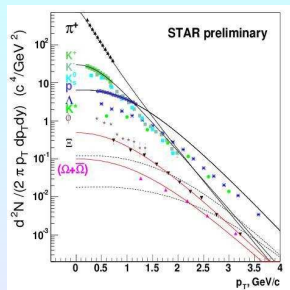
- Dezvoltarea Centrului de date NIHAM
- Analiza si interpretarea datelor simulate Monte Carlo
 - Analiza si interpretarea datelor de la RHIC
 - Analiza si interpretarea datelor simulate proton-proton la ALICE

Dezvoltarea Centrului de date NIHAM

- Dezvoltarea componentei GRID:
Achizitii in cadrul Proiectului EVSONRI,
Contract nr. 8/CAPACITATI-Modul I:
 - Putere de calcul: ~ 1200 cores
 - Capacitate de stocare: ~ 800 TB
- Dezvoltarea componentei NAF:
Achizitii pe proiectul prezent:
 - servere de calcul (la nivel de ~ 80 cores)
 - servere de stocare si HDD corespunzatoare (la nivel de ~ 200 TB)



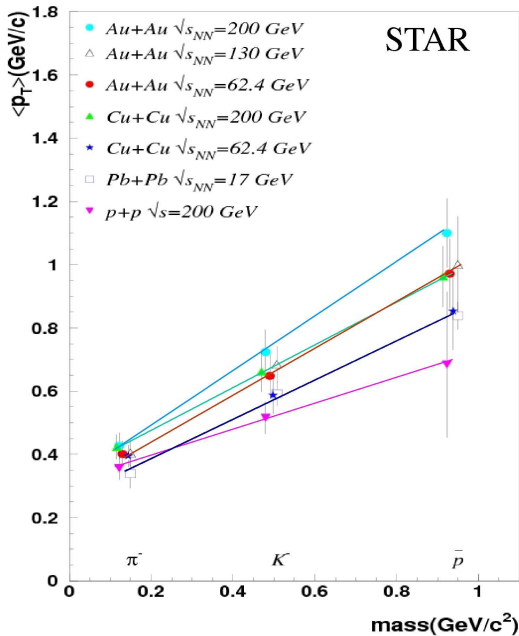
Analiza si interpretarea datelor de la RHIC



Particle	T_{kin} (MeV)	$\langle\beta\rangle$ (c)
π, K, p	89 ± 10	0.59 ± 0.05
K^*	75 ± 35	0.62 ± 0.05
$\Lambda, \bar{\Lambda}$	115 ± 20	0.54 ± 0.05
$\Xi^-, \bar{\Xi}^+$	161 ± 20	0.46 ± 0.10
$\Omega, \bar{\Omega}$	179 ± 60	0.45 ± 0.10

nucl-ex/0403014

STAR



$\pi^\pm, K^\pm, p, \bar{p}$

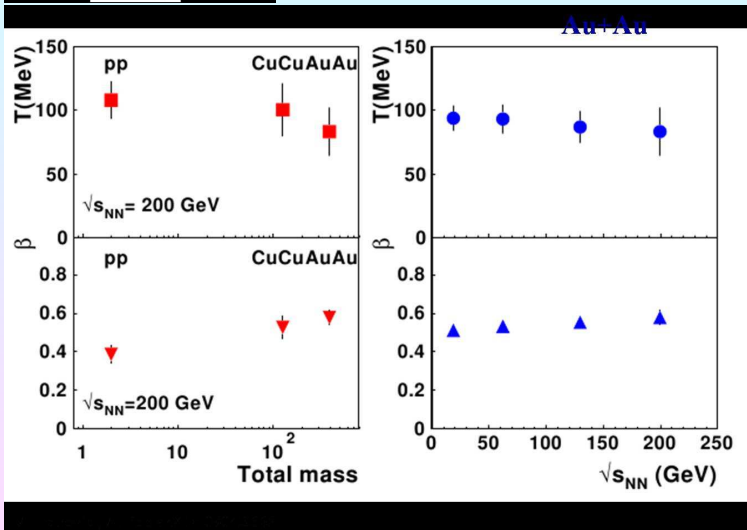
$$\langle p_t \rangle = \frac{\int_0^\infty p_t^2 f(p_t) dp_t}{\int_0^\infty p_t f(p_t) dp_t}$$

$$f(p_t) \sim \int_0^R r dr m_e I_0 \left(\frac{p_t \sinh \rho}{T} \right) K_1 \left(\frac{m_e \cosh \rho}{T} \right)$$

$$\rho = \tanh^{-1} \beta_r$$

$$\beta_r(r) = \beta_s \left(\frac{r}{R} \right)^n$$

$$m_e = \sqrt{m^2 + p_z^2}$$

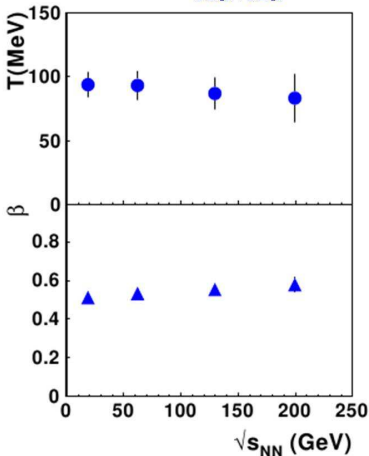
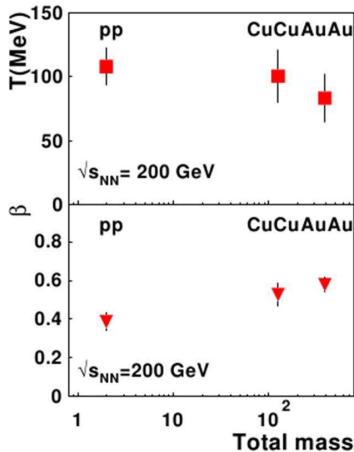


$$\pi^\pm, K^\pm, p, \bar{p}$$

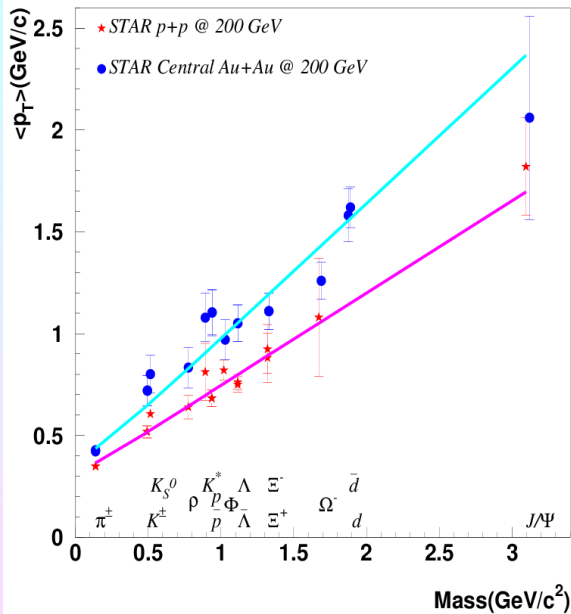
$$f(p_t) = m_t \int_{-Y}^Y \cosh(y) dy \int_{-\pi}^{\pi} d\phi \int_0^R r dr \left(1 + \frac{q-1}{T} (m_t \cosh(y) \cosh(\rho) - p_t \sinh(\rho) \cos(\phi)) \right)^{-1/(q-1)}$$

$$\langle p_t \rangle = \frac{\int_0^\infty p_t^2 f(p_t) dp_t}{\int_0^\infty p_t f(p_t) dp_t}$$

Au+Au



$\pi^\pm, K^\pm, p, \bar{p}$



$\pi^\pm, K^\pm, K^*, K_s^0, \bar{p}, \Lambda, \bar{\Lambda}, \Xi^\pm, \Omega^-, d, \bar{d}, J/\psi$

System	p + p	p + p	Au + Au	Au + Au
Model	BGBW	TBW	BGBW	TBW
T [MeV]	111.6±23.8	78.86±10.13	109.8±16.5	86.8 ±1.54
β	0.39±0.06	0.027±0.10	0.50±0.04	0.48±0.04
q	1.0	1.0874	1.0	1.0247

$\pi^\pm, K^\pm, K^*, p, \bar{p}, d, \bar{d}$

	Au + Au	Au + Au
	BGBW	TBW
T [MeV]	98.7±19.5	79.05±0.04
β	0.54±0.04	0.53±0.0005
q	1.0	1.0175

$\Lambda, \bar{\Lambda}, \Xi^\pm, \Omega^-, J/\psi$

	Au + Au
	TBW
T [MeV]	198.0±7.6
β	0.32±0.012
q	1.0247

M. Petrovici, A. Pop arXiv: 0904.3666

Analiza si interpretarea datelor simulate proton-proton la ALICE

date simulate p-p (productia LHC09a4 = pp minimum bias, 10TeV; 1800 kevents)

AliRoot 4-17-02 (ROOT 5-23-02) & AliRoot 4.18.01AN (ROOT 5-24-00)

MC "cuts": - particule primare - generate cu Pythia

- $\eta = -0.2 - 0.2$

ESD "cuts": - particule primare:

- MaxSigmaToVertex(2.0)

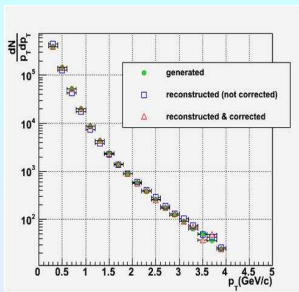
- AcceptKinkDaughters(kFALSE)

- $\eta = -0.2 - 0.2$

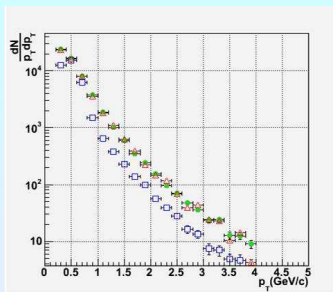
- "track quality cuts": spectrele de protoni PWG2

- PID: - AliPID

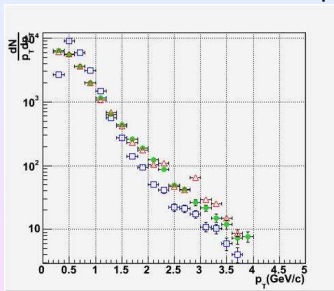
- particule selectate numai daca prob > 0.9



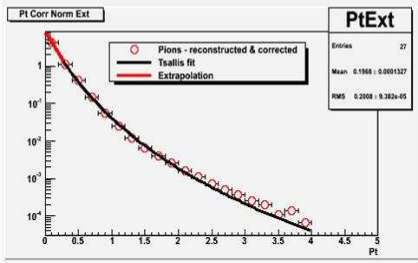
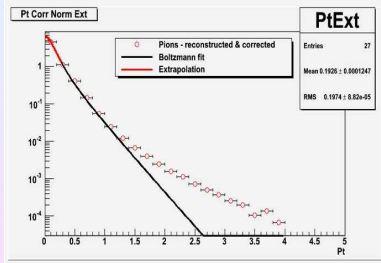
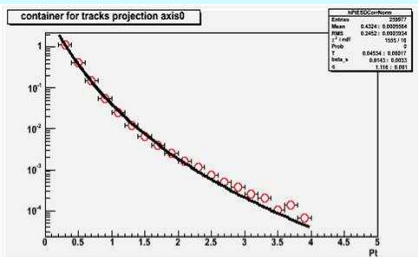
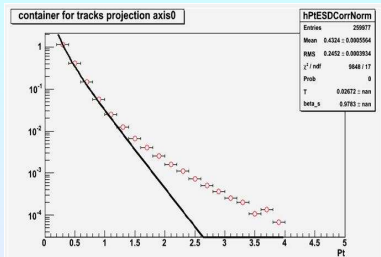
pioni

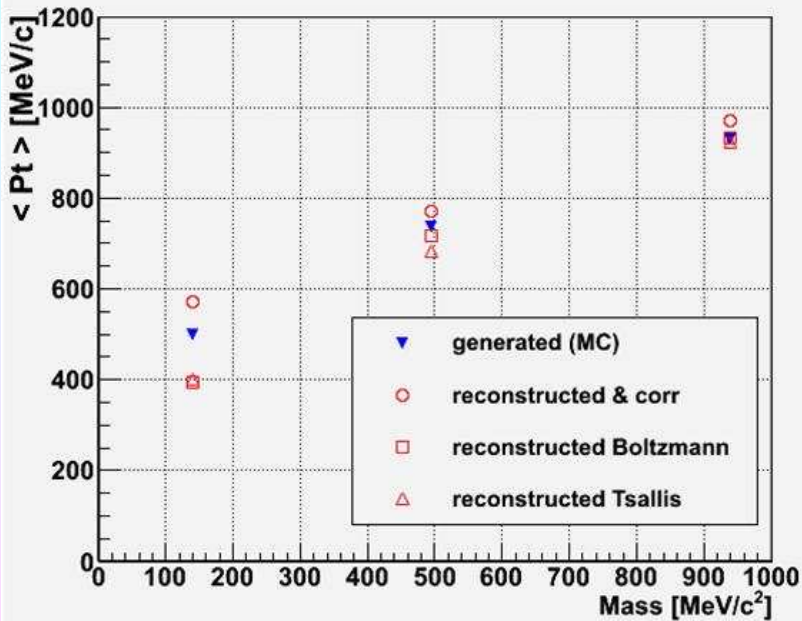


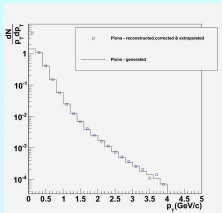
kaoni



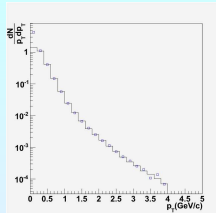
protoni



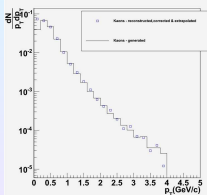




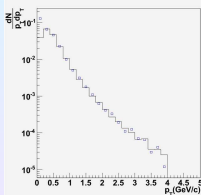
Boltzmann



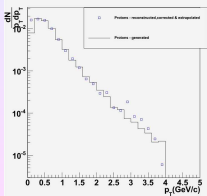
Tsallis



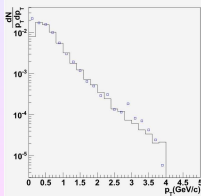
Boltzmann



Tsallis

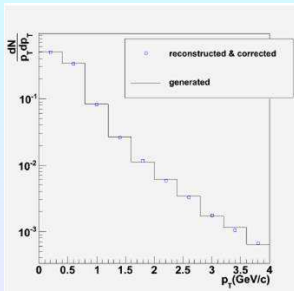


Boltzmann

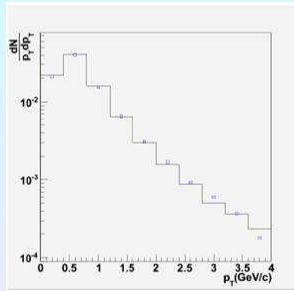


Tsallis

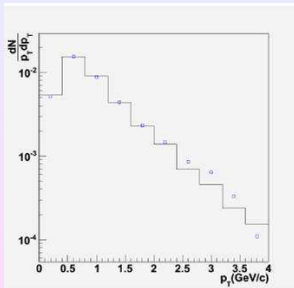
Bin: 0.4 GeV/c



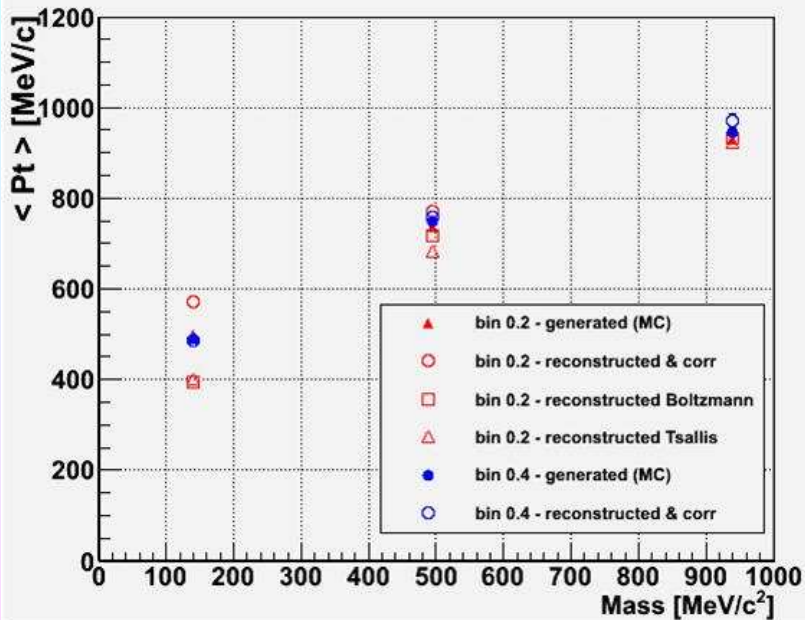
pioni



kaoni



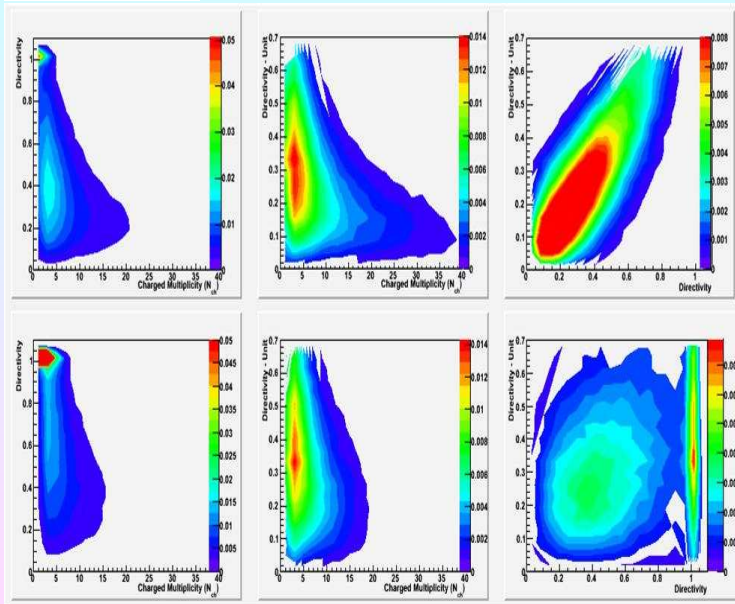
protoni



bin size = 0.4					
Tsallis				Boltzmann	
	T[MeV]	$\langle\beta\rangle$	q	T	$\langle\beta\rangle$
MC	74.06+/-0.95	0.+/-0.101	1.135+/-0.0012	92.103+/- 0.861	0.519+/- 0.
ESD corected	70.33+/-0.395	0.012+/-0.0001	1.141+/-0.0005	88.766+/- 1.623	0.531+/- 0.043

bin size = 0.2					
Tsallis				Boltzmann	
	T [MeV]	$\langle\beta\rangle$	q	T	$\langle\beta\rangle$
MC	77.62+/-0.66	0.0024+/-0.0007	1.128+/-0.	98.263 +/- 0.602	0.503+/- 0.002
ESD corrected	96.396+/-0.03	0.055+/-0.00005	1.121+/-0.	119.3+/- 1.5	0.489+/- 0.
ESD ext Boltzmann	47.193+/-0.19	0.025+/-0.18	1.149+/-0.0003	63.353+/- 1.172	0.552+/- 0.003
ESD ext Tsallis	52.299+/-0.819	0.0048+/-0.0009	1.144+/-0.0003	69.081+/- 0.785	0.536+/- 0.025

$$D = \frac{|\sum_i p_t^i|}{\sum_i |p_t^i|} \Big|_{\eta > 0},$$



Lucrarea:

"Azimuthal isotropic expansion in highly central collisions"

C. Andrei, I. Berceanu, A. Herghelegiu, M. Petrovici, A. Pop,
C. Schiaua

Alice Week, CERN, 19-23 octombrie 2009, PWG2

<http://indico.cern.ch/conferenceDisplay.py?confId=70834>

First proton–proton collisions at the LHC as observed with the ALICE detector: measurement of the charged particle pseudorapidity density at $\sqrt{s} = 900$ GeV

ALICE collaboration

K. Aamodt⁷⁸, N. Abel⁴³, U. Abeyssekara³⁰, A. Abrahantes Quintana⁴², A. Acero⁶³, D. Adamová⁸⁶, M.M. Aggarwal²⁵, G. Aglieri Rinella⁴⁰, A.G. Agocs¹⁸, S. Aguilar Salazar⁶⁶, Z. Ahammed⁵⁵, A. Ahmad², N. Ahmad², S.U. Ahn^{50a}, R. Akimoto¹⁰⁰, A. Akindinov⁶⁸, D. Aleksandrov⁷⁰, B. Alessandro¹⁰², R. Alfaro Molina⁶⁶, A. Alici¹³, E. Almaráz Aviña⁶⁶, J. Alme⁸, T. Alt^{43b}, V. Altini⁶, S. Altinpinar³², C. Andrei¹⁷, A. Andronic³², G. Anelli⁴⁰, V. Angelov^{43c}, C. Anson²⁷, T. Antičić¹¹³, F. Antinori^{40d}, S. Antinori¹³, K. Antipin³⁷, D. Antończyk³⁷, P. Antonioli¹⁴, A. Anzo⁶⁶, L. Aphecetche⁷⁵, H. Appelshäuser³⁷, S. Arcelli¹³, R. Arceo⁶⁶, A. Arend³⁷, N. Armesto⁹², R. Arnaldi¹⁰², T. Aronsson⁷⁴, I.C. Arsene^{78e}, A. Asryan⁹⁸, A. Augustinus⁴⁰, R. Averbeck³², T.C. Awes⁷⁶, J. Äystö⁴⁹, M.D. Azmi², S. Bablok⁸, M. Bach³⁶, A. Badalà²⁴, Y.W. Baek^{50f}, S. Bagnasco¹⁰², R. Bailhache^{32g}, R. Bala¹⁰¹, A. Baldisseri⁸⁹, A. Baldit²⁶, J. Bán⁵⁸, R. Barbera²³, G.G. Barnaföldi¹⁸, L. Barnby¹², V. Barret²⁶, J. Bartke²⁹, F. Barile⁵, M. Basile¹³, V. Basmanov⁹⁴, N. Bastid²⁶, B. Bathen⁷², G. Batigne⁷⁵, B. Batyunya³⁵, C. Baumann^{72h}, I.G. Bearden²⁸, B. Becker²⁰ⁱ, I. Belikov⁹⁹, R. Bellwied³⁴, E. Belmont-Moreno⁶⁶, A. Belogianni⁴, L. Benhabib⁷⁵, S. Beolé¹⁰¹, I. Berceanu¹⁷, A. Bercuci^{32j}, E. Berdermann³², Y. Berdnikov³⁹, L. Betev⁴⁰, A. Bhasin⁴⁸, A.K. Bhati²⁵, L. Bianchi¹⁰¹, N. Bianchi³⁸, C. Bianchin⁷⁹, J. Bielčik⁸¹, J. Bielčiková⁸⁶, A. Bilandžić³, L. Bimbot⁷⁷, E. Biolcati¹⁰¹, A. Blanc²⁶, F. Blanco^{23k}, F. Blanco⁶³, D. Blau⁷⁰, C. Blume³⁷, M. Boccioni⁴⁰, N. Bock²⁷, S. Böttger⁴³, A. Bogdanov⁶⁹, H. Bøggild²⁸, M. Bogolyubsky⁸³, J. Bohm⁹⁶, L. Boldizsár¹⁸, M. Bombara¹²¹, C. Bombonati^{79m}, M. Bondila⁴⁹, H. Borel⁸⁹, V. Borshchov⁵¹, C. Bortolin⁷⁹, S. Bose⁵⁴, L. Bosio¹⁰³, F. Bossú¹⁰¹, M. Botje³, G. Bourdaud⁷⁵, B. Boyer⁷⁷, M. Braun⁹⁸, P. Braun-Munzinger^{32,33n}, L. Bravina⁷⁸, M. Bregant^{103o}, T. Breitner⁴³, G. Bruckner⁴⁰, R. Brun⁴⁰,

Concluzii

- A fost extins sistemul de calcul local al Centrului de date NIHAM in vederea eficientizarii activitatii de analiza a datelor simulate si experimentale de la experimentul ALICE.
- A fost facuta o analiza a datelor de la RHIC, privind impulsul transvers mediu ca functie de masa. Rezultatele au fost publicate sub forma unui preprint:nucl-ex/0904.3666
- A fost facuta pe GRID acelasi tip de analiza pe date simulate ALICE. Ca urmare acest tip de analiza a fost inclus in trenul de analiza al PWG2.

Indicatori de realizare a etapei

- Investitii noi in infrastructura CDI: 167 486,76 lei
- Numar de reviste ISI: 8
- Lucrari accesibile pe web: 2
- Participari la proiecte internationale: 1
- Numar de entitati sustinute: 1