Proposal for π^o and K_s production studies in ion-nuclear collisions at Hyperon+ Setup

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- **Intoductory remarks**
- **Hyperon setup**
- **Physics motivation**
- **UrQMD simulations**
- **Conclusion**

Introductory remarks

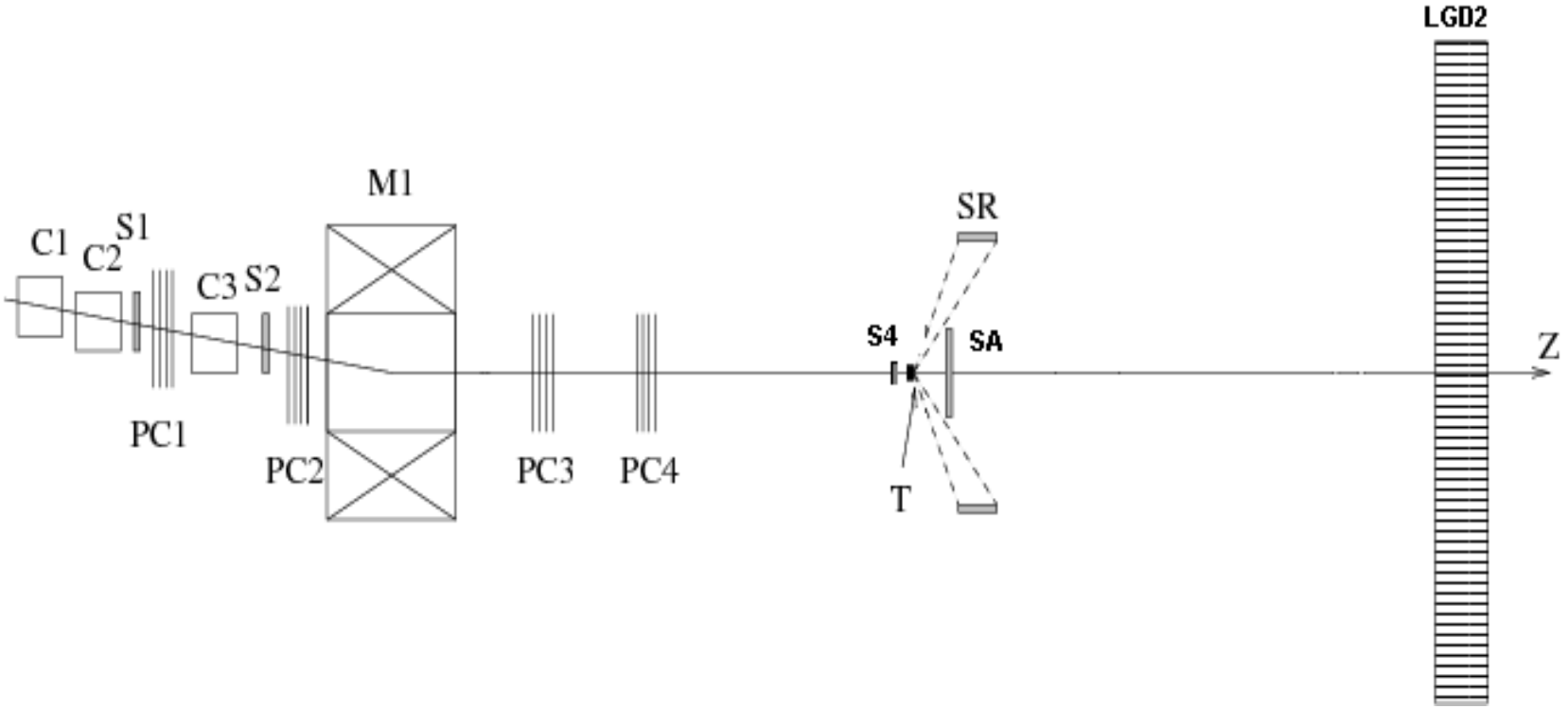
- **The Light Ion Program in IHEP is on a good way, and we are expecting the first ion beams with moments up to 35 AGeV/c in 2009**
- **The main idea of experementalists is to joint the very interesting physics of relativistic ion collisions with the existing experimental setups in IHEP**
- **The present talk concerns the Hyperon setup installed on the 18-th channel of the U70 accelerator**

The present schema of the Hyperon Setup

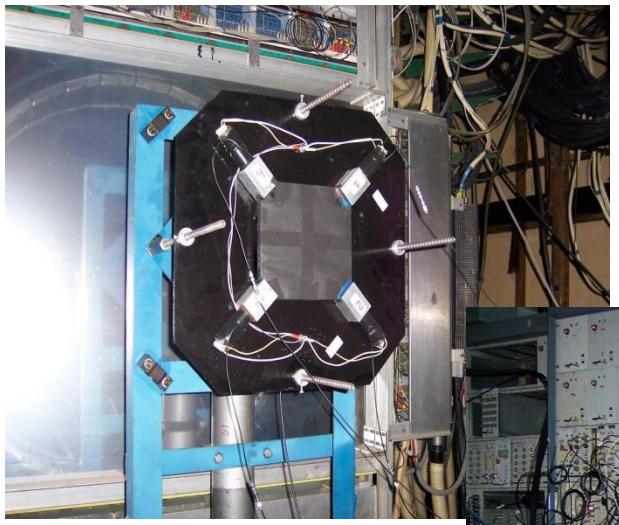
Positive beam (π^+, K^+, p), Plab = 7 GeV/c

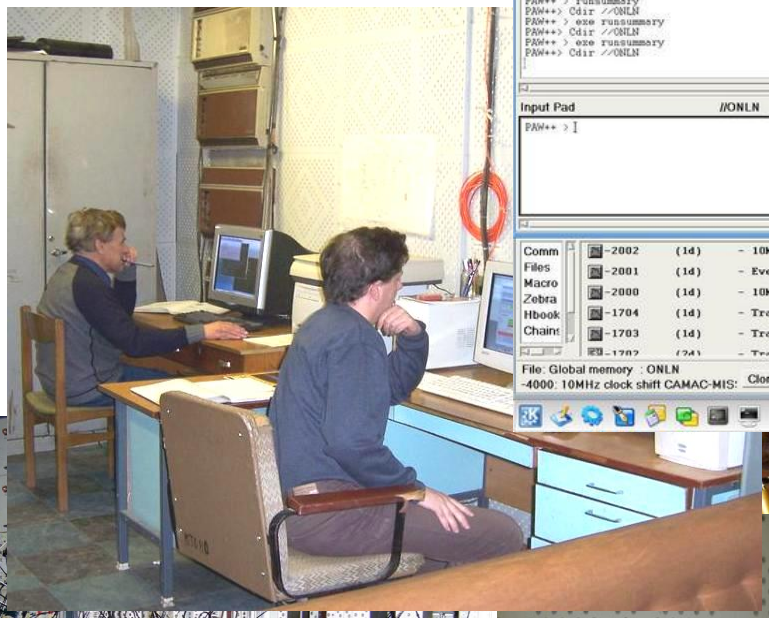
trig = S1*S2*S4*C1(π^+)*SA

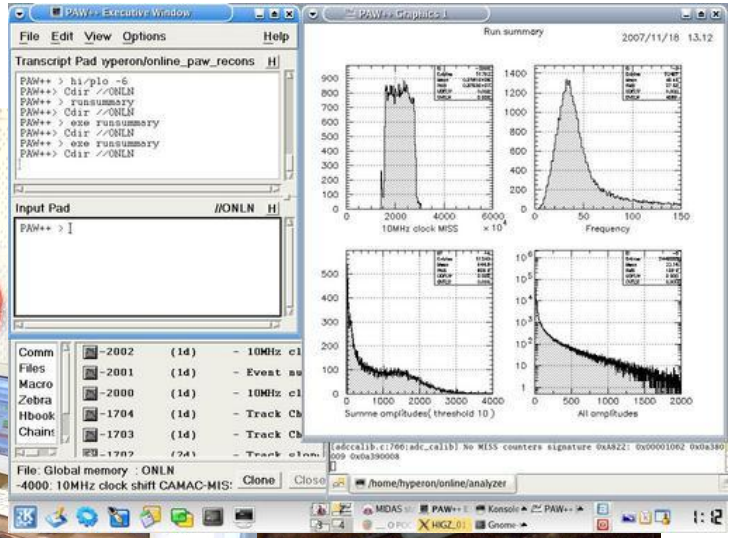
LGD2: Lead Glass Detector with 624 8.5x8.5x35 cm^3 Cherenkov radiators
The target-to-LGD2 distance is 4 m

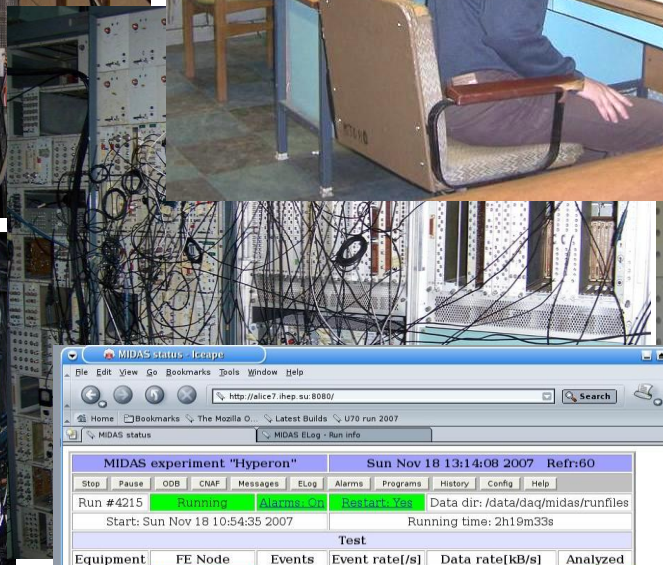


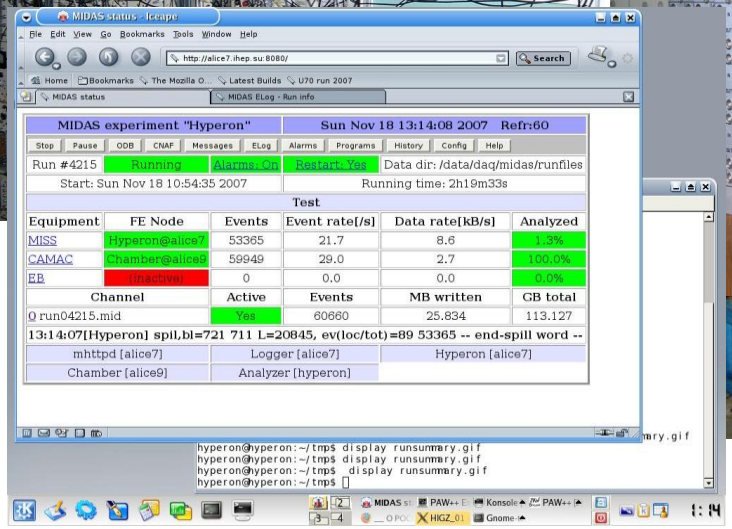
Hyperon setup, some pictures:



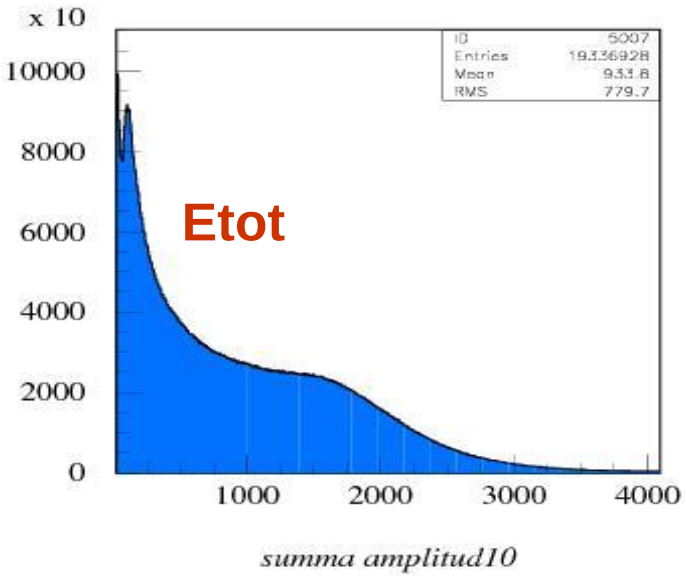








Hyperon November'07 data: Be target, trig = S1*S2*S4*C1(π^+)*SA



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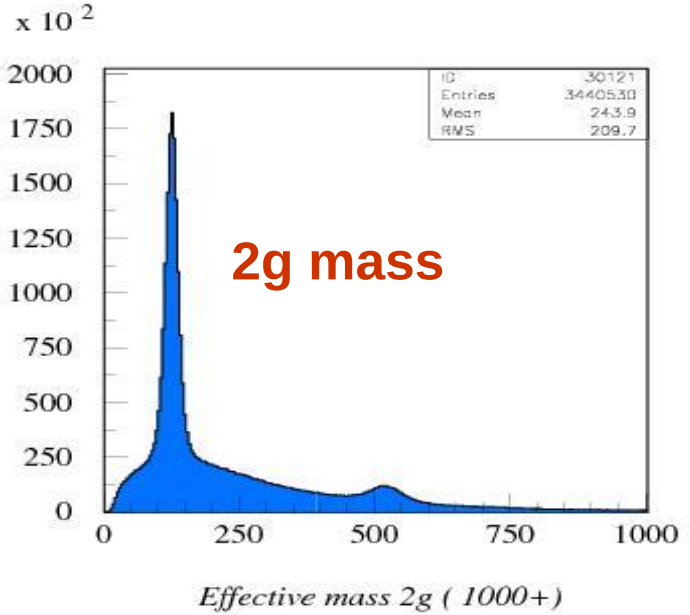
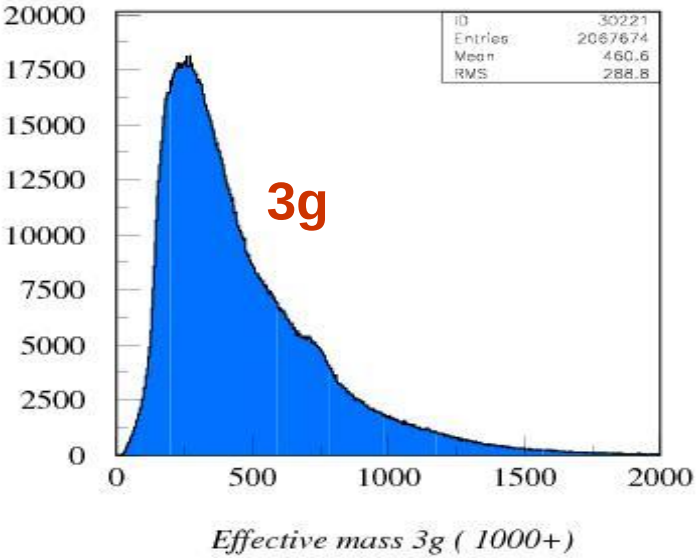
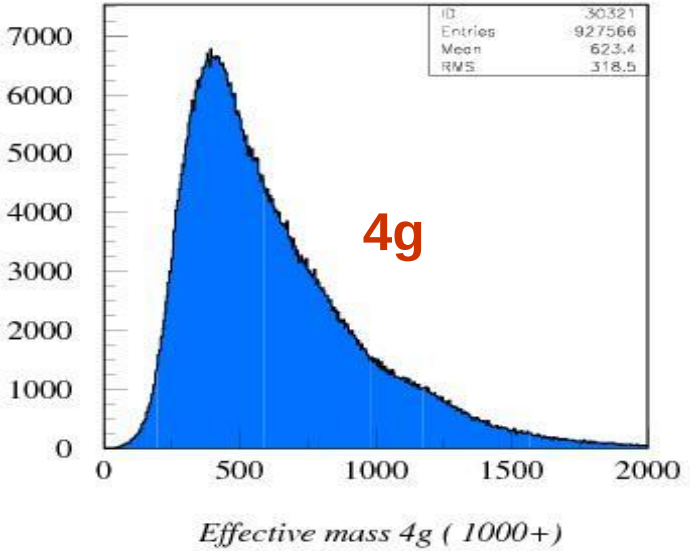


Effective mass 2g (1000+)



Effective mass 3g (1000+)



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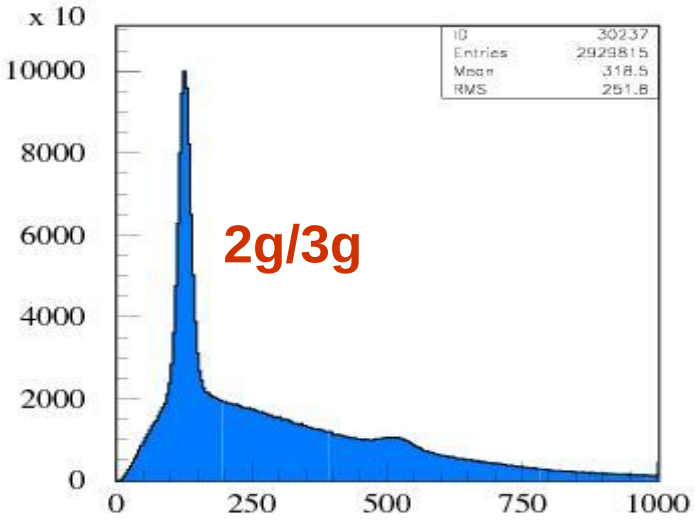
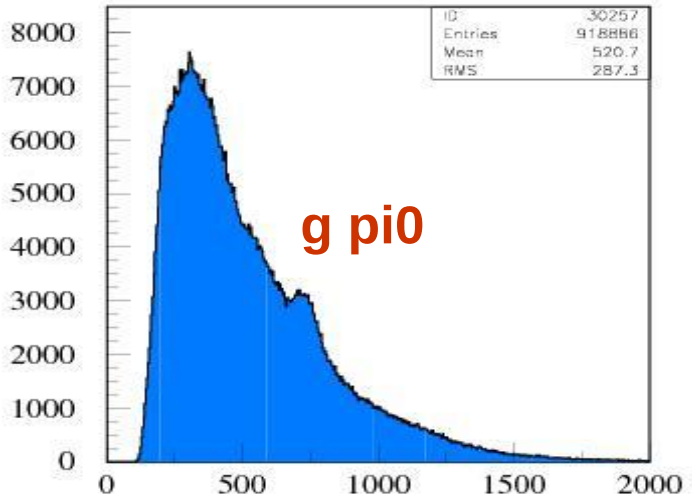
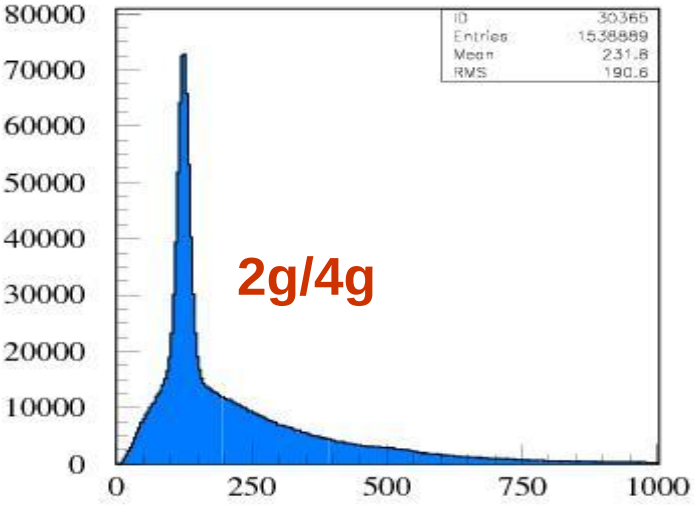


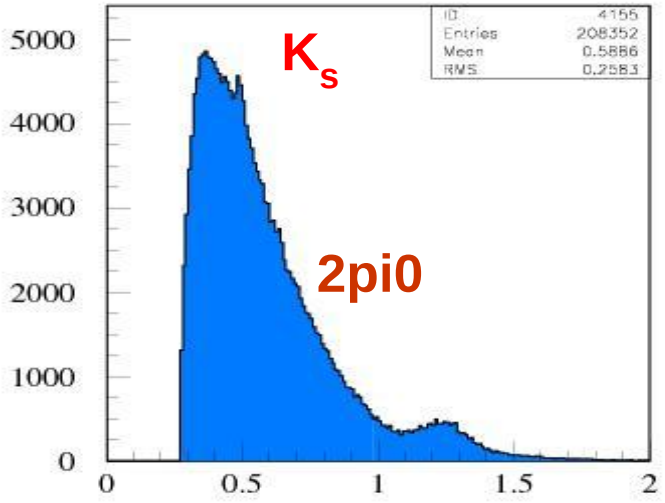
kombinatorika 3g (4000+)



efmass with pi0 3g (4000+)

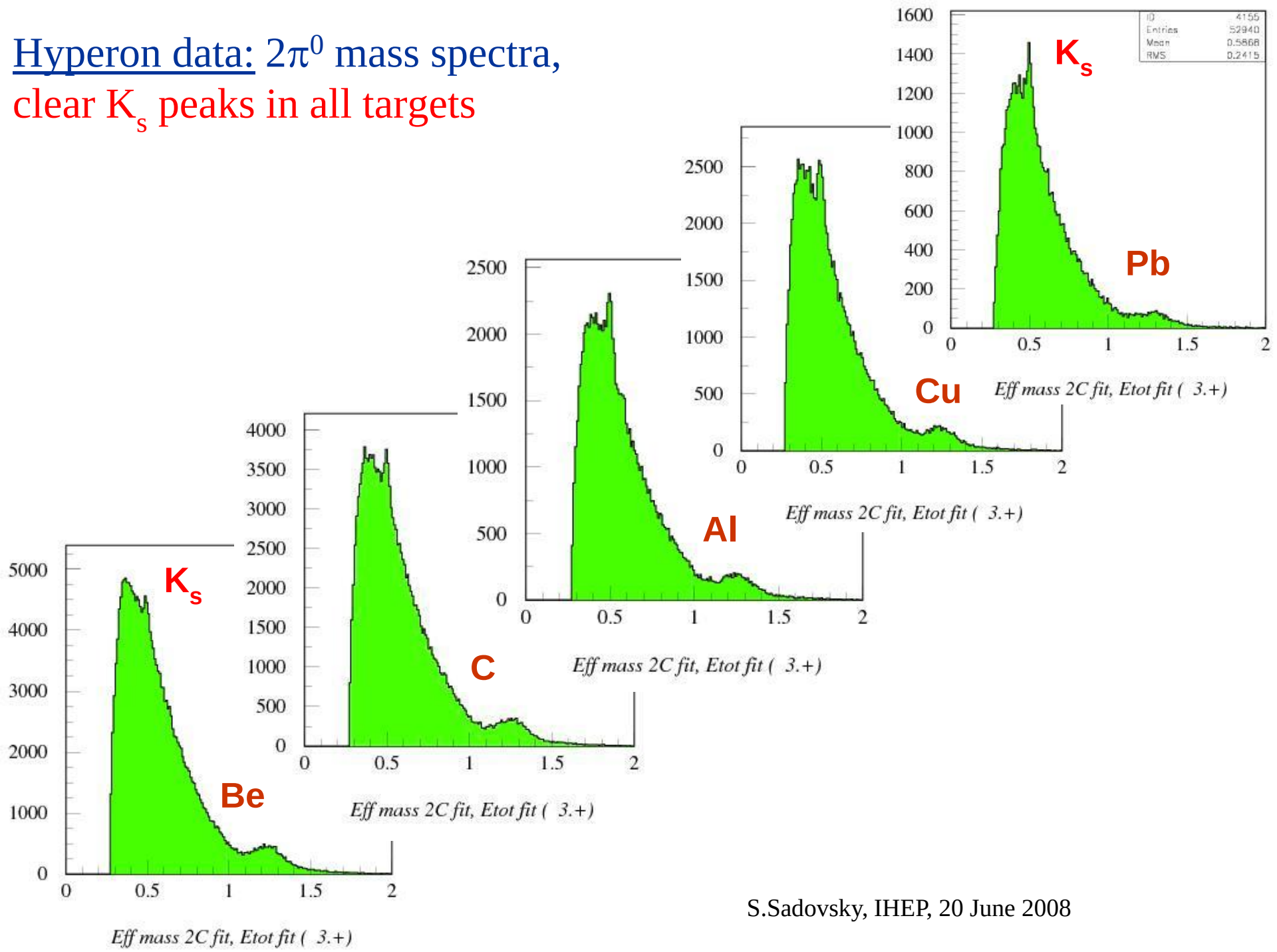


dopolnenie k pi0 4g (3000+)



Eff mass 2C fit, Etot fit (3.+)

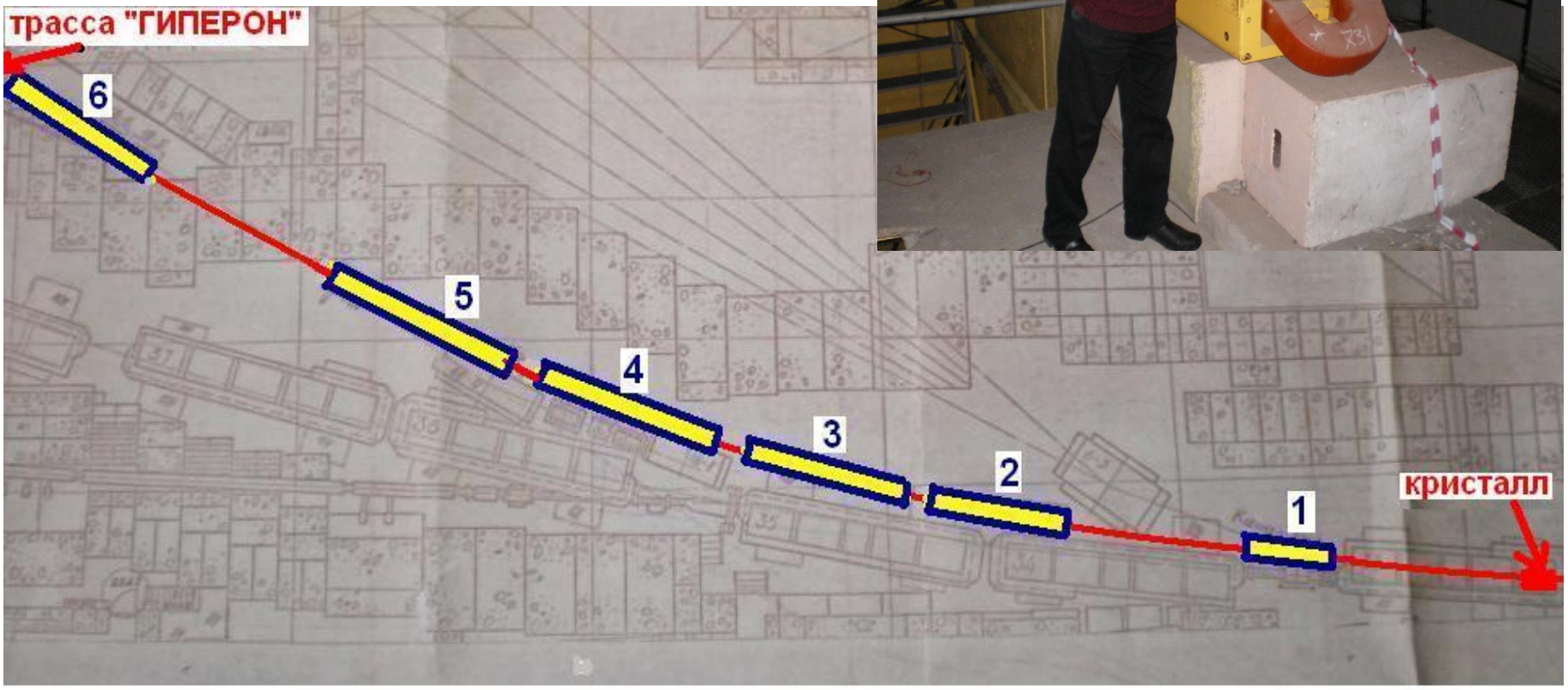
Hyperon data: $2\pi^0$ mass spectra, clear K_s peaks in all targets



S.Sadovsky, IHEP, 20 June 2008

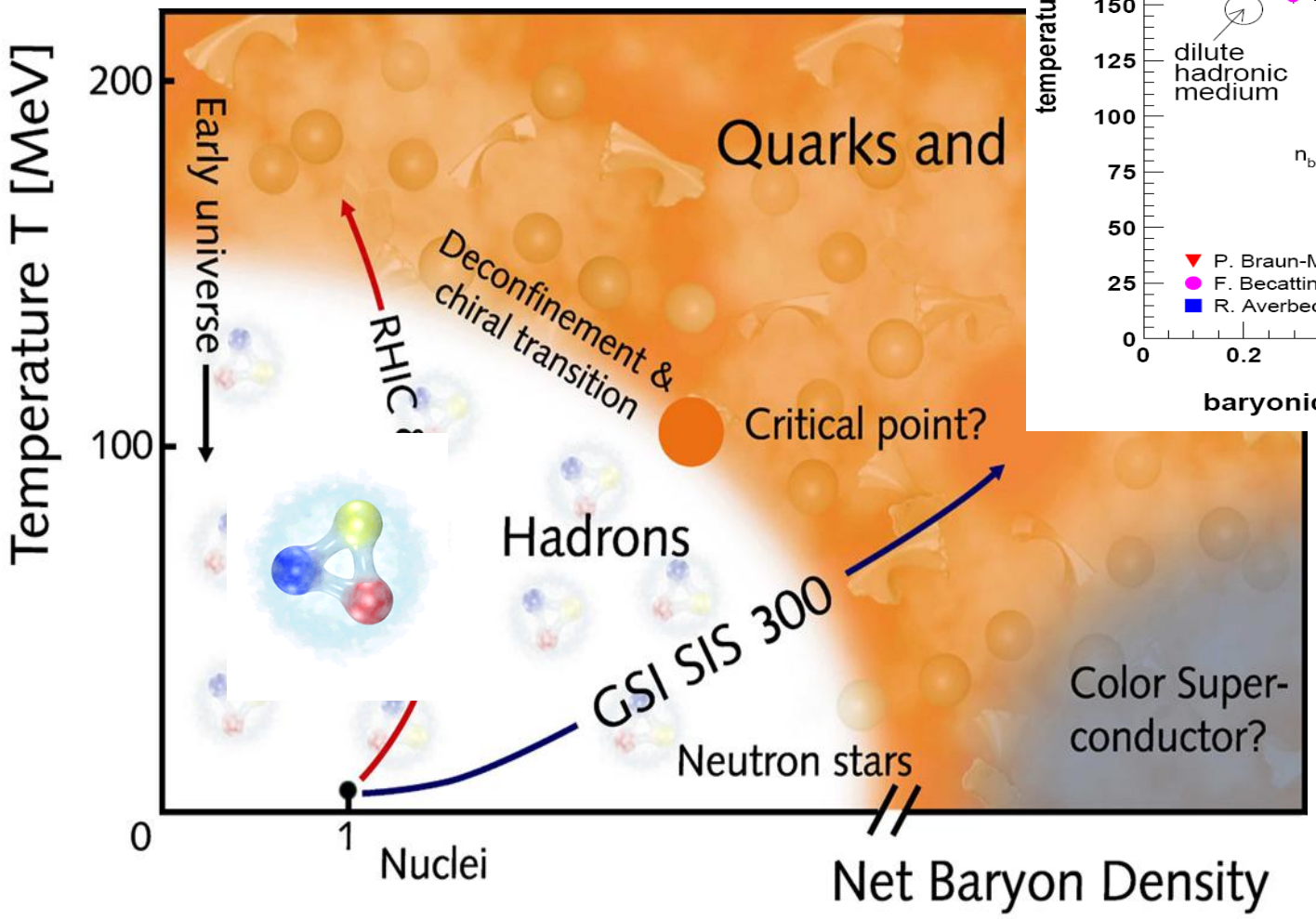
The possibility of ion extraction to the 18-th channel according to the IHEP crystal team calculations:

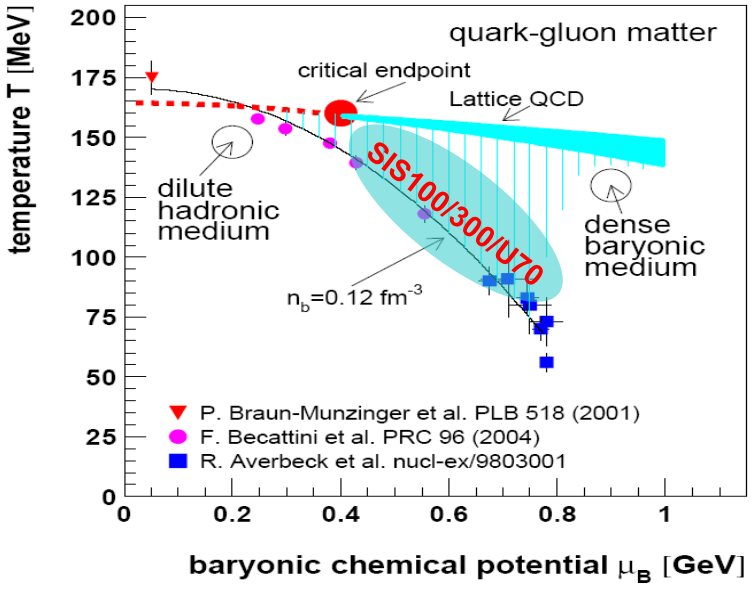
- The 70 mrad crystall has to be installed in block Nb 33 of U70
- New vacuum chamber in block Nb 33
- Ion beam transportation with 6 UNK magnets
- Maximun ion energy is 25 AGeV



The phase diagram of strongly interacting matter

P.Senger, 2004





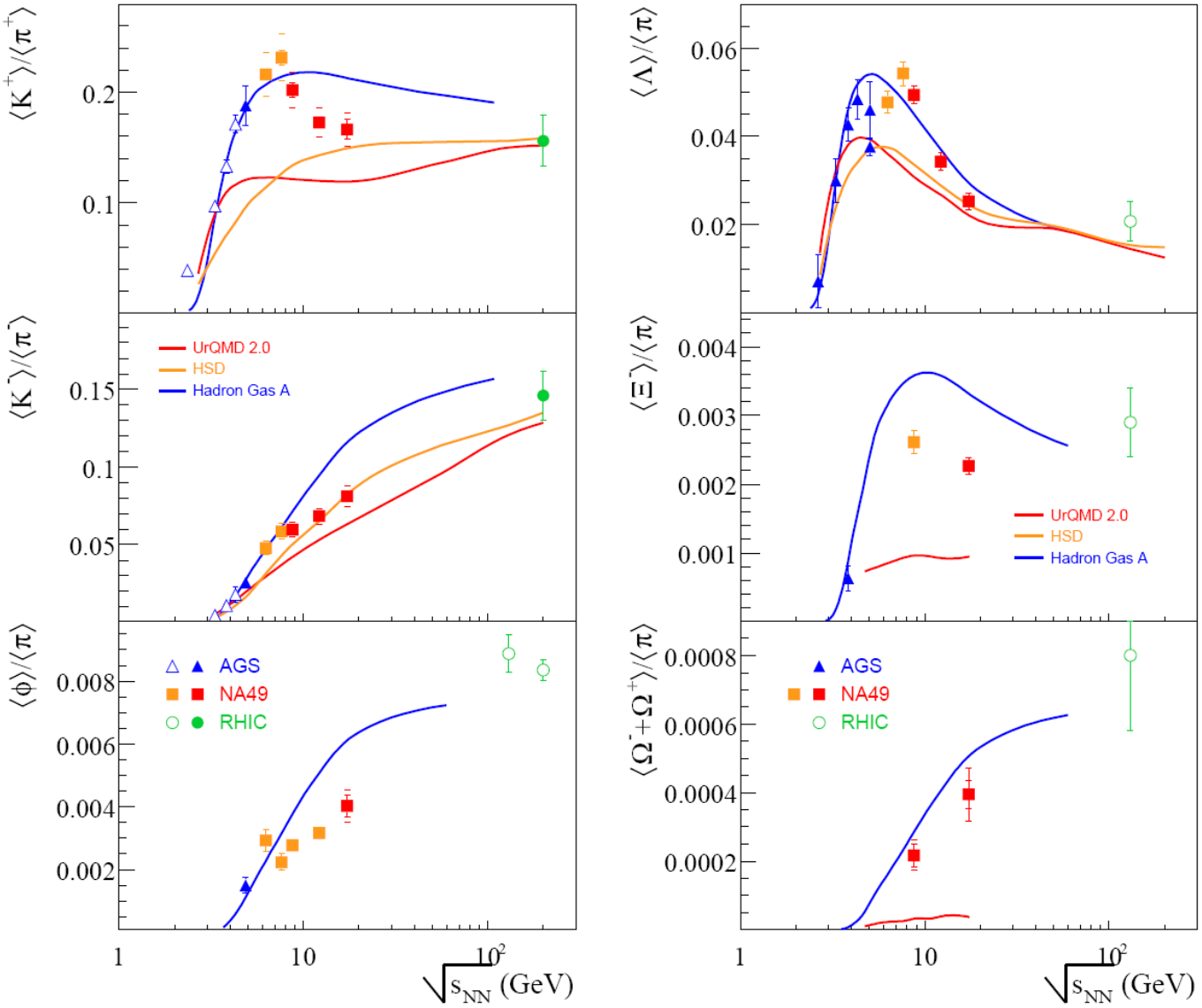
RHIC, LHC: high temperature, low baryon density

FAIR, U70: moderate temperature, high baryon density

Strangeness/pion ratios versus beam energy

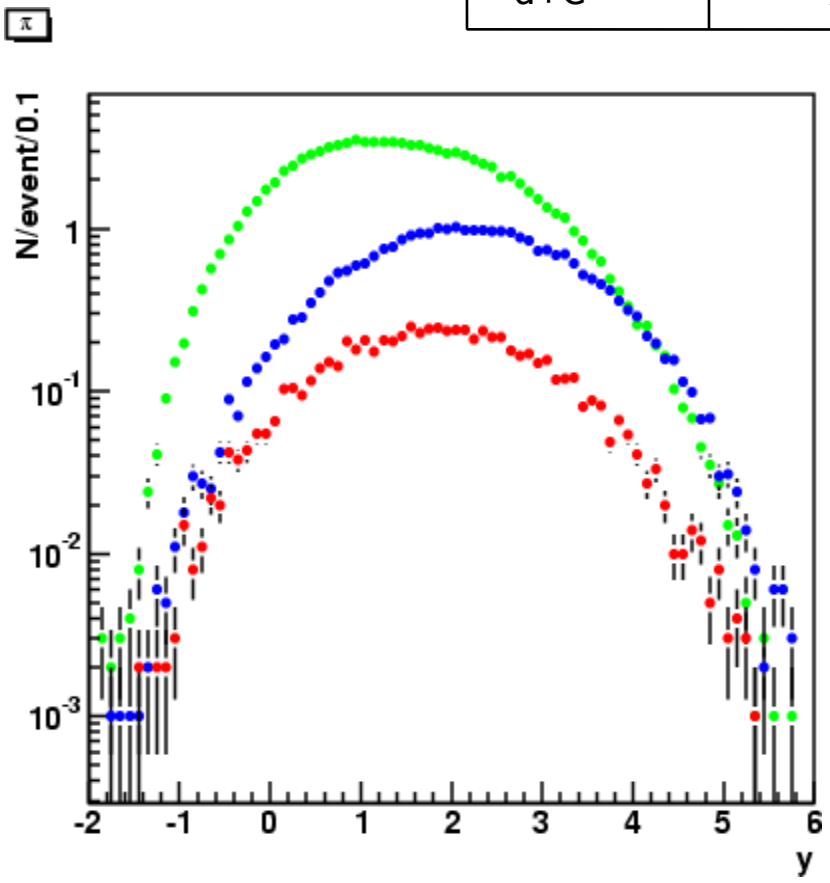
One of the main signatures of the phase transition is the $\langle K^+ \rangle / \langle \pi^+ \rangle$ ratio:

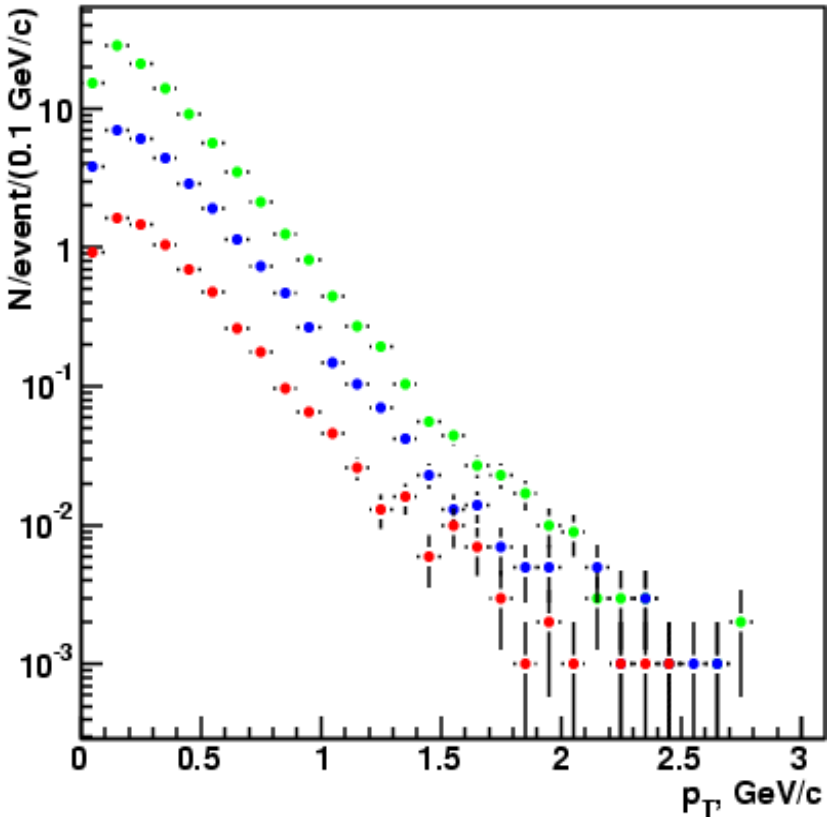
C. Blume et al., nucl-ex/0409008



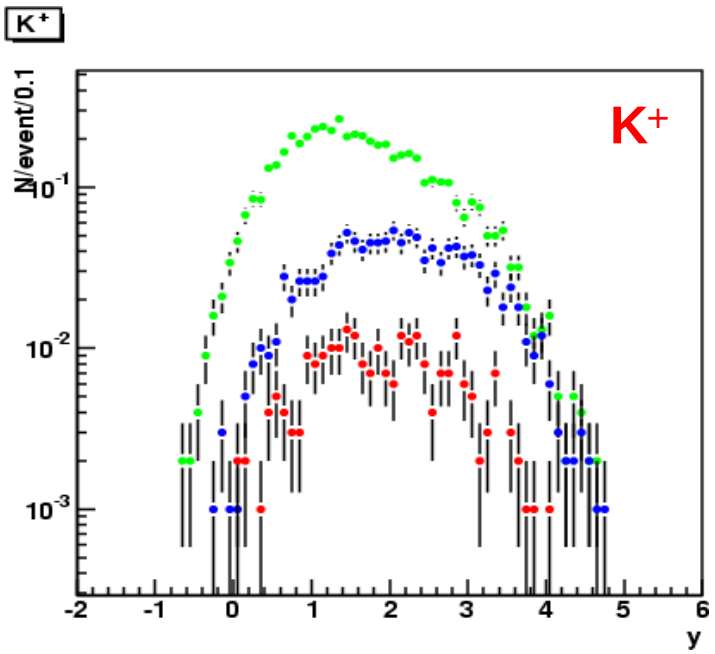
UrQMD simulation: ion in central collisions, 25 AGeV/c, rapidity and P_T spectra of pions

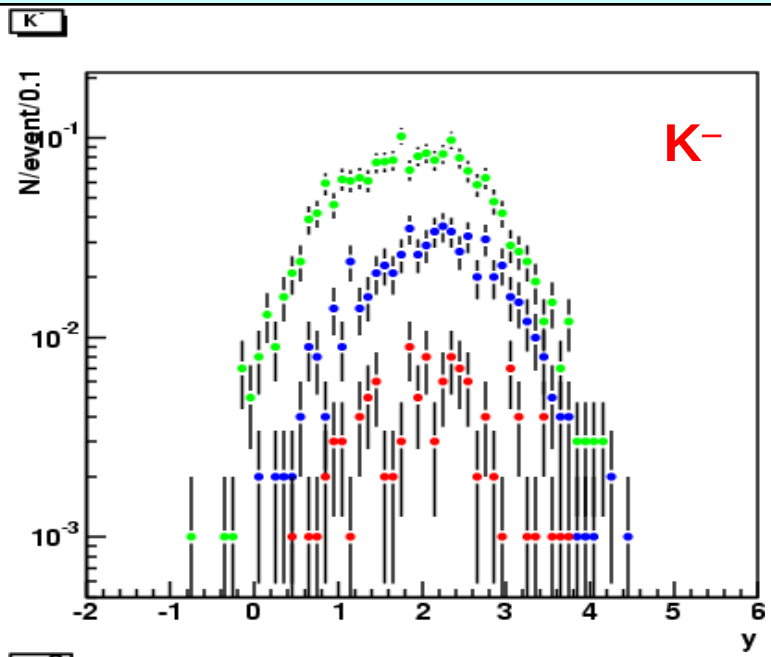
Collision	Total multiplicity	Multiplicity p_T>0.1 GeV.c
C+Pb	102	87
C+C	29	25
d+C	7	6

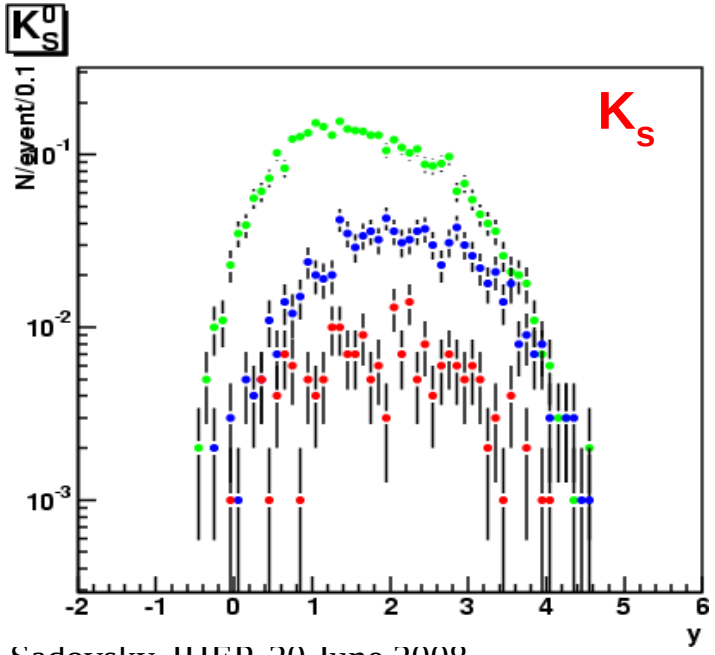


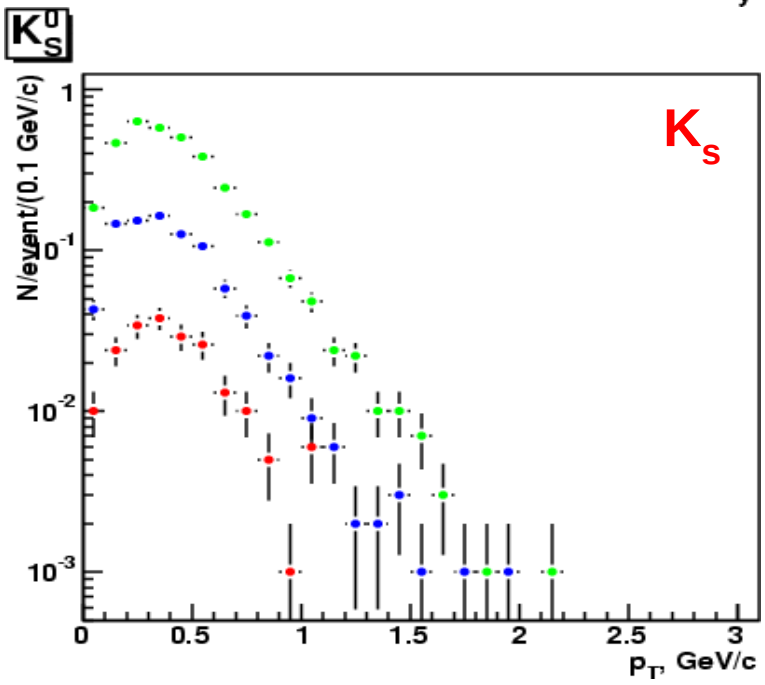


Kaons in the central collisions: $\langle K^+ \rangle / \langle \pi^+ \rangle = \langle K^o \rangle / \langle \bar{\pi}^o \rangle$

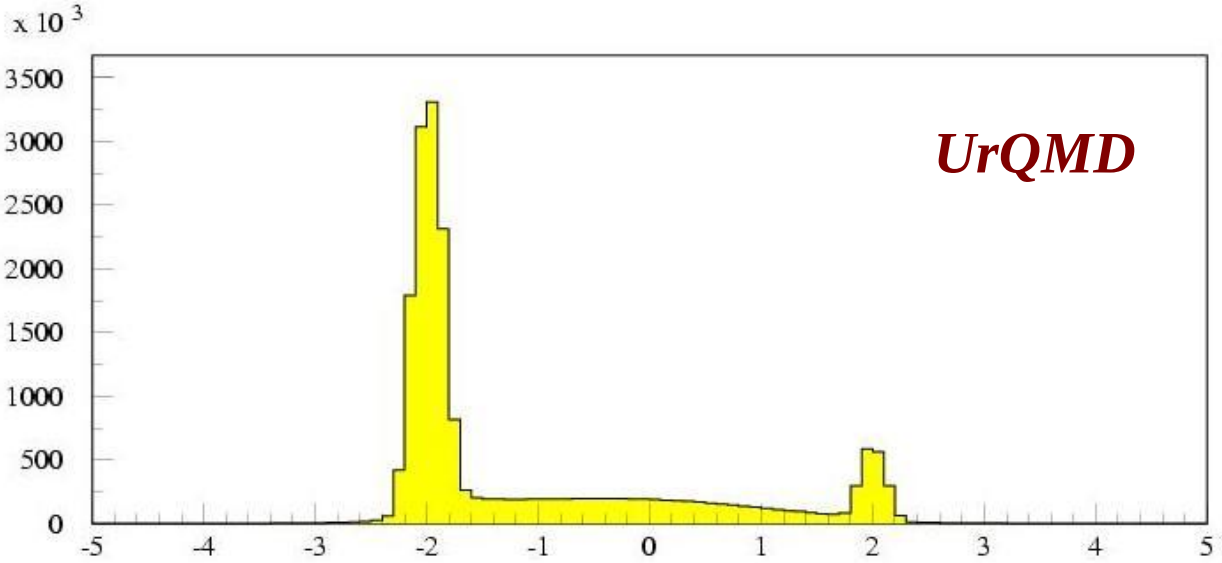


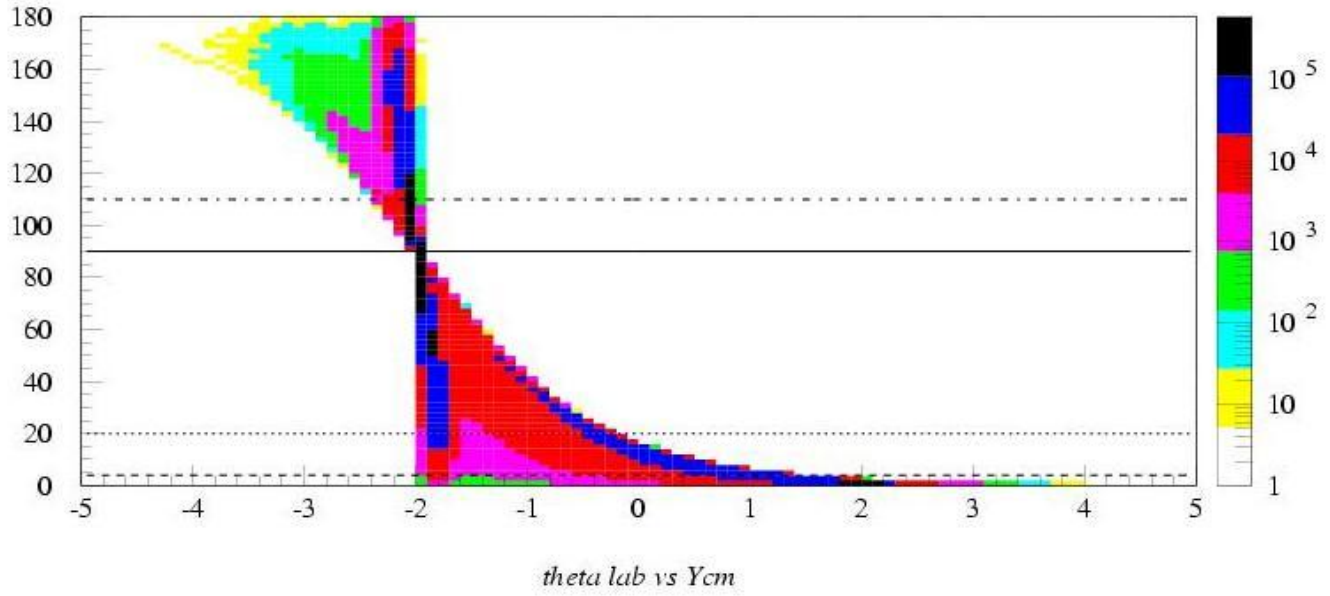




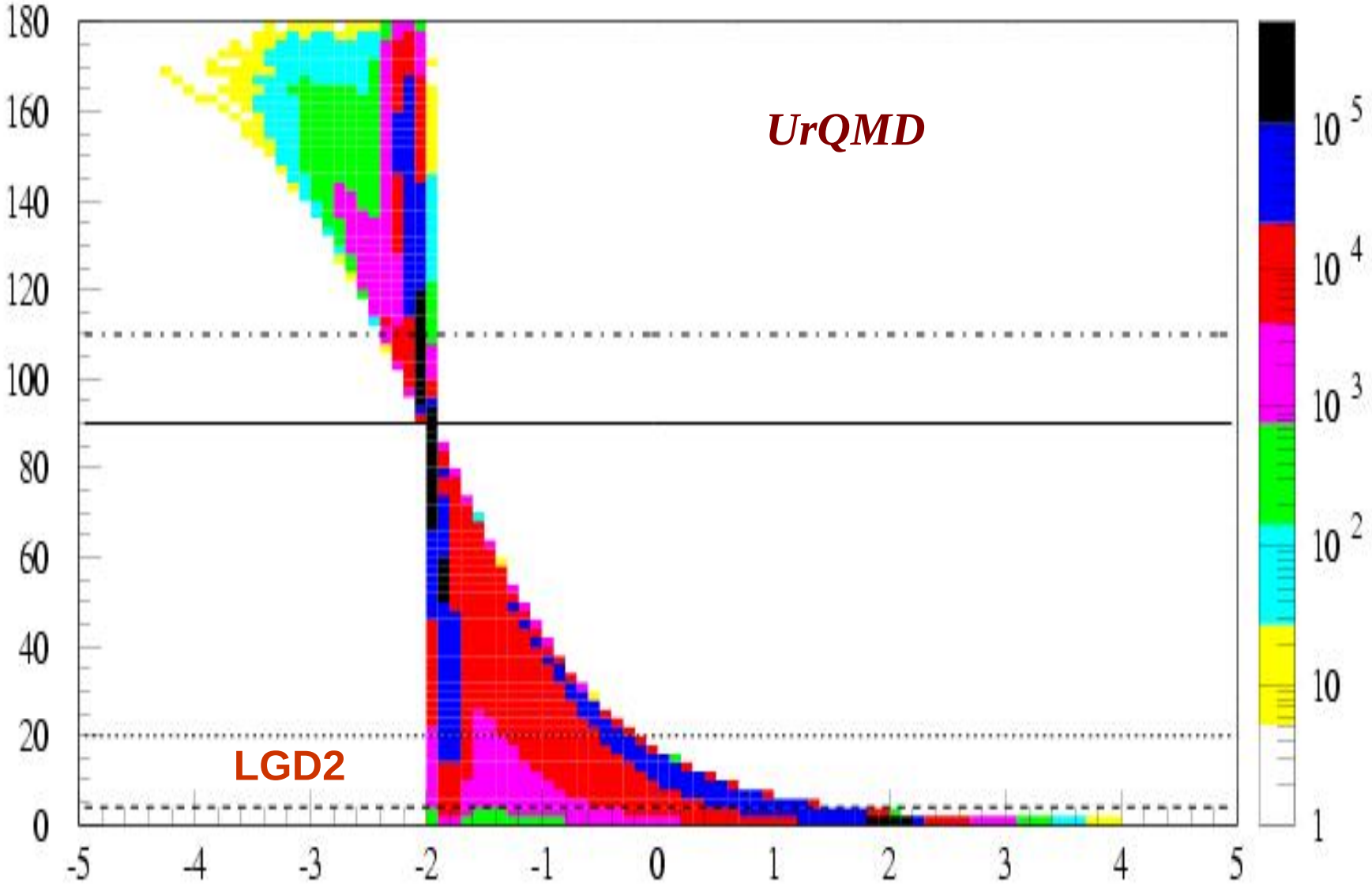


Hyperon setup, Ion kinematics: C-Cu collisions, P = 25AGeV/c, *theta* vs *Ycm* distibution

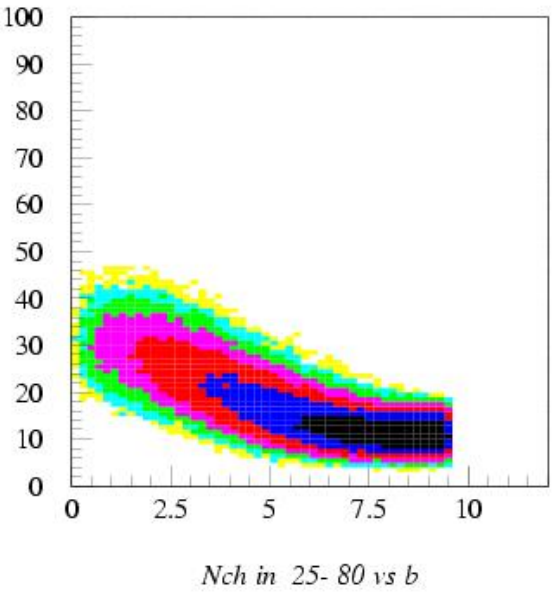




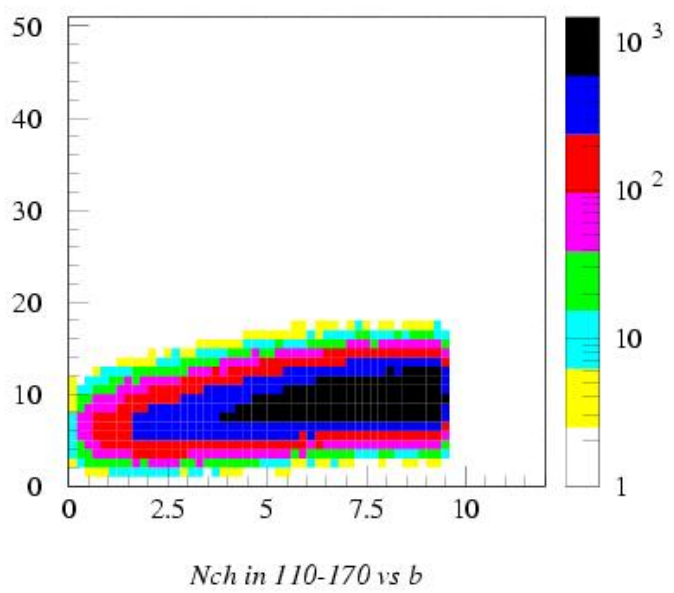
Ion kinematics: C-Cu collisions, P = 25AGeV/c,
theta vs *Ycm* distibution (2)



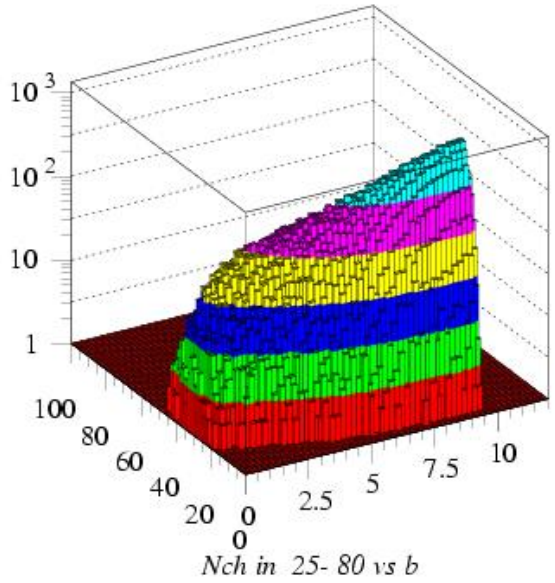
Ion kinematics: C-Cu collisions, P = 25AGeV/c,
Nb of charged particles in different *theta*-regions



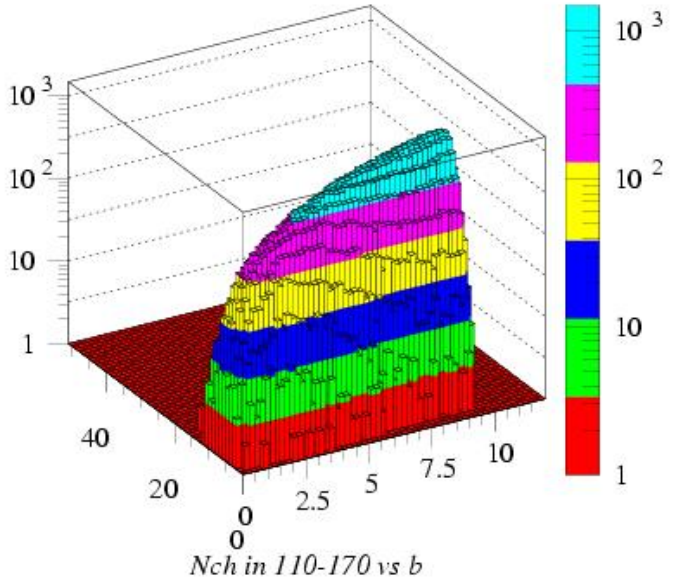
Nch in 25- 80 vs b



Nch in 110-170 vs b

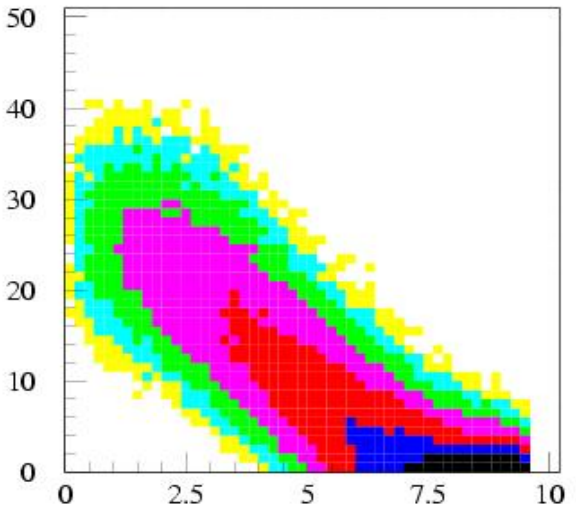


Nch in 25- 80 vs b

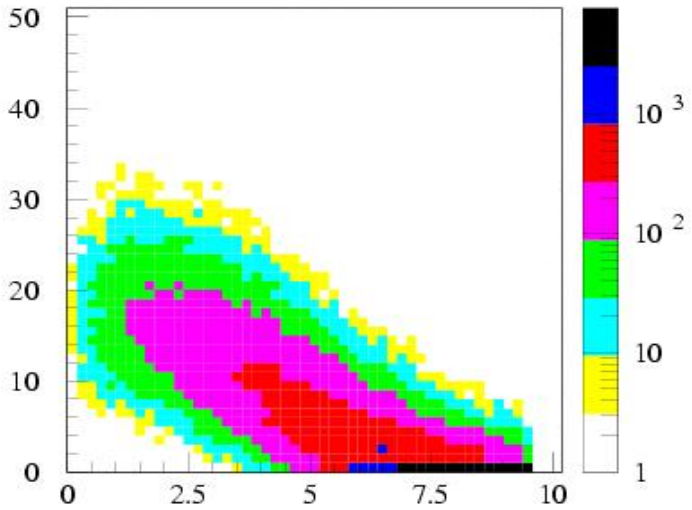


Nch in 110-170 vs b

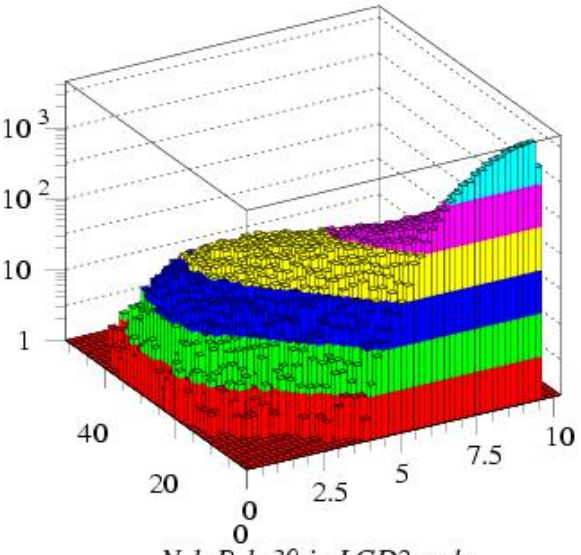
Ion kinematics: C-Cu collisions, P = 25AGeV/c,
Nb of charged particles & photons in LDG2



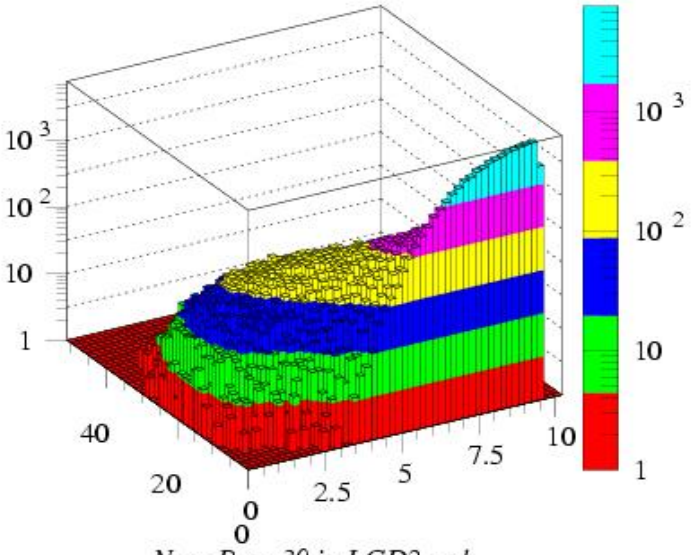
Nch Rch 30 in LGD2 vs b



Ngm Rgm 30 in LGD2 vs b



Nch Rch 30 in LGD2 vs b

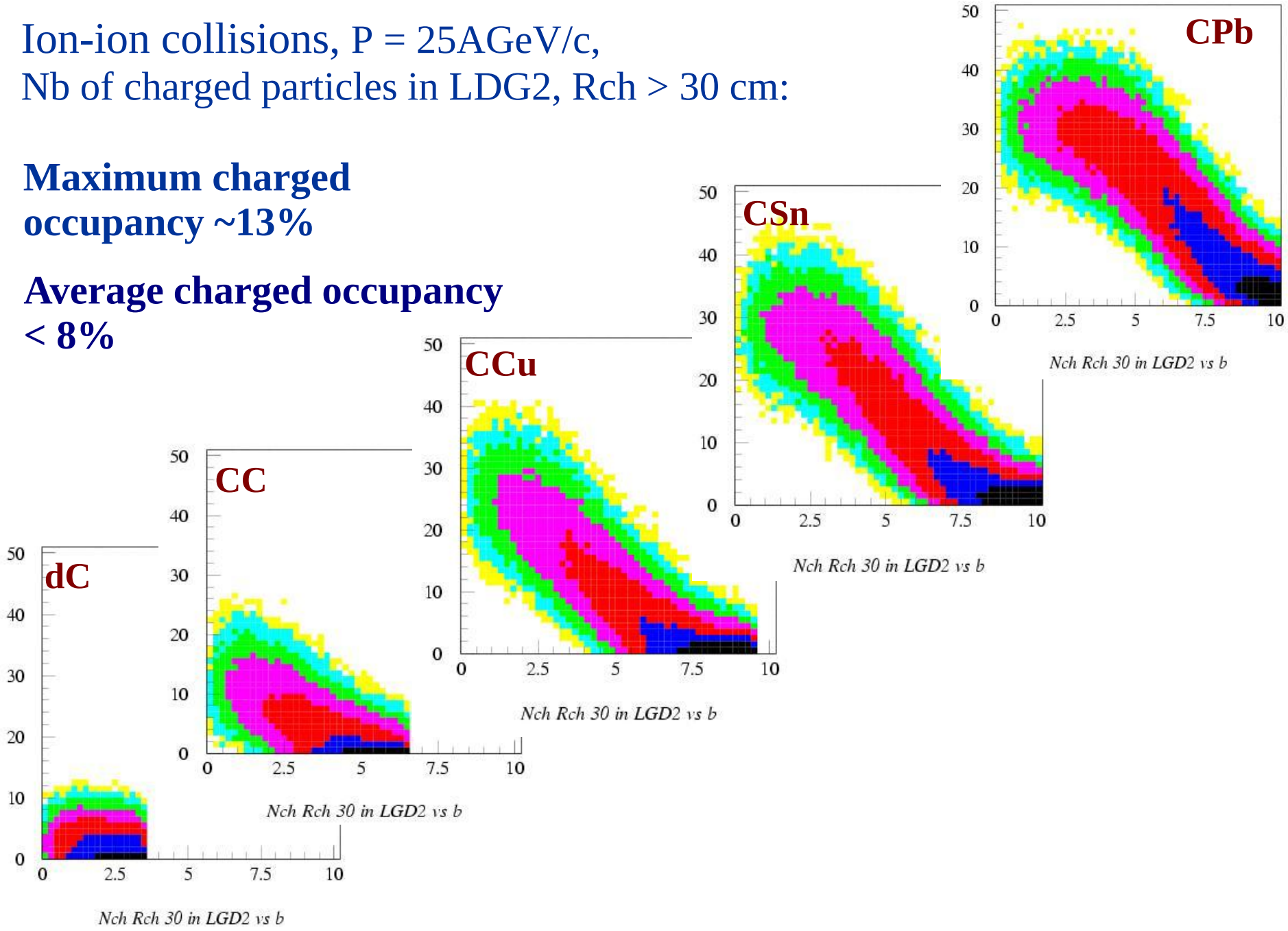


Ngm Rgm 30 in LGD2 vs b

Ion-ion collisions, P = 25AGeV/c,
Nb of charged particles in LDG2, Rch > 30 cm:

Maximum charged occupancy ~13%

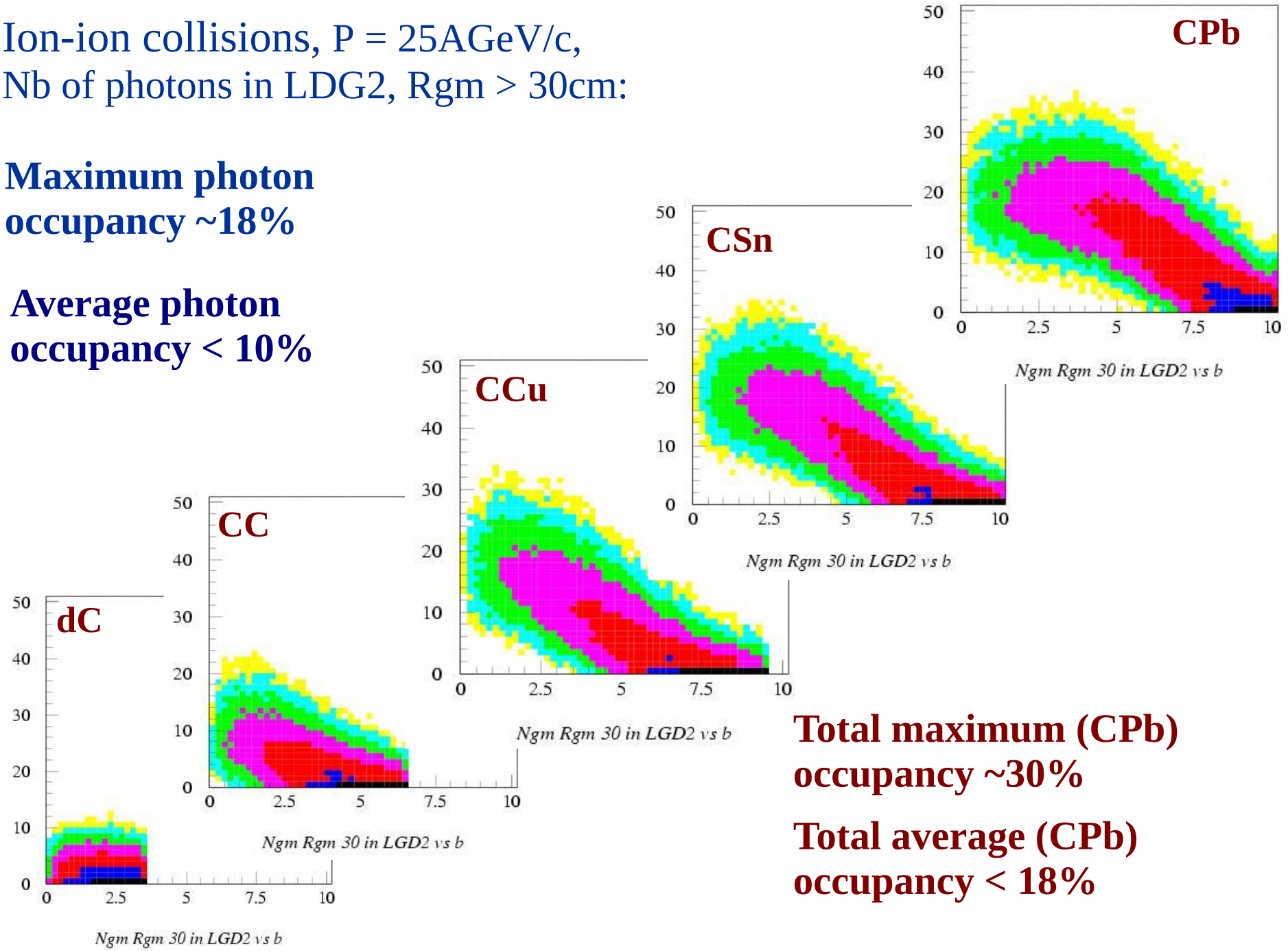
Average charged occupancy < 8%



Ion-ion collisions, P = 25AGeV/c,
Nb of photons in LDG2, Rgm > 30cm:

Maximum photon occupancy ~18%

Average photon occupancy < 10%



Total maximum (CPb) occupancy ~30%

Total average (CPb) occupancy < 18%

Conclusion

1. Extraction of the light ion beam with the momentum up to 25AGeV/c is possible for the 18-th chanel of Hyperon setup. The relevant solution has been proposed by the IHEP Crystal Team.

2. The total (charged+photon) occupancy of the LGD2 spectrometer at R>30cm in CA-collisions (from CC and up to CPb) is of the order of 20-30%, that is still resonable for event reconstruction in LGD2

3. The pi0 and Ks in LGD2 can be identified by its two-photon and two-pi0 decays respectivelly, thus the production ratio <Ks>/<pi0> can be studied in central ion collisions from dC and up to CPb at 25AGeV/c

4. The detector for centrality measurement in AA-collisions is the obligatory device for such kind of experiment

5. A traking for charged hadron identification in LGD2 would be useful to suppress background from charged particles

6. More detail simulations are needed.