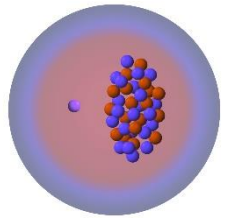
White Book, Chapter 7

‘Hadrons and dileptons as probes of strongly interacting matter’

Status report

Convenors: Jörg Aichelin, Elena Bratkovskaya, Manuel Lorenz

“QCD at FAIR -- Physics perspectives with hadron beams for the next decade (“first science”)
GSI, Darmstadt
11-14 November 2024



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Email exchange + Zoom meeting: 14th Oct. 2024:

The structure of the Chapter 7 has been settled

Structure of Chapter 7:

7.1 State of the art

7.2 p(π) + p(n) reactions

7.2.1 Inclusive and exclusive cross sections and excitation functions of hadrons
7.2.2 Isospin effects in p+p and p+n
7.2.3 Systematic excitation of resonance in π + p reactions
7.2.4 Possibilities with dileptons

7.3 p(π) + A reactions

7.3.1 In-medium hadron properties
7.3.2 Possibilities with dileptons
7.3.3 Cold nuclear matter as reference
7.3.4 Formation of clusters in nuclear matter
7.3.5 Influence of the electromagnetic fields on particle dynamics in nuclear matter
7.3.6 Short-range correlations
7.3.7 Dark Matter search

7.4 Individual contributions

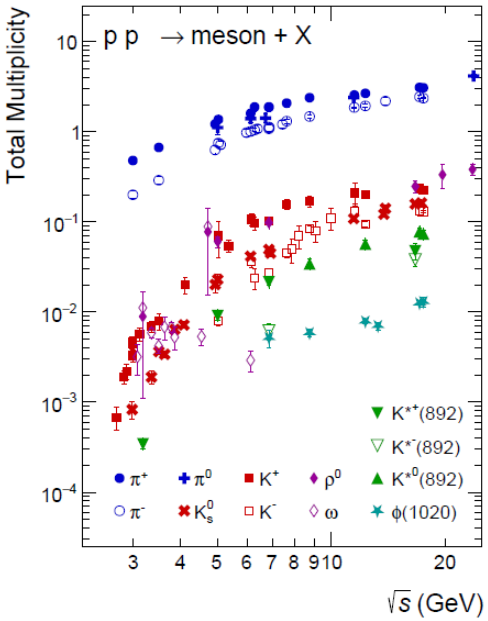
– will be incorporated in the chapter text

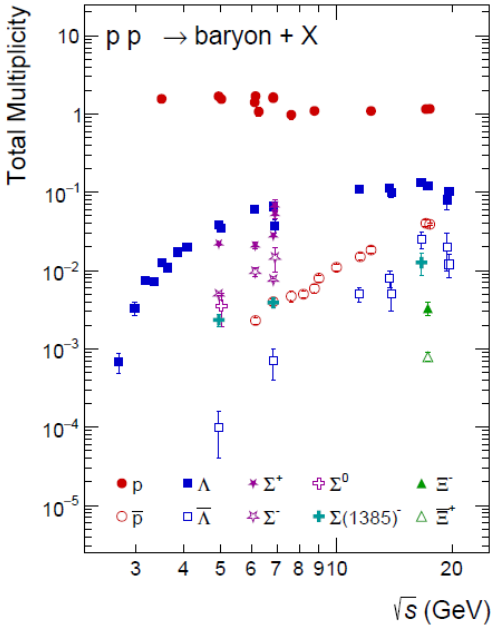
Chapter 7.1: State of the art

Elementary *p+p, p+n(d)* reactions – where we are now?

I. Present experimental situation at the FAIR energy range:

- poor data on (light and strange) hadron multiplicities in pp reactions
- practically NO data on hadron production in pn reactions !
- little information on differential spectra, correlations etc.
- now elastic scattering data for p_{Lab} > 1GeV (urgently needed for transport approaches)





NEW compilation by C. Blume

II. Present theory situation at the FAIR energy range:

- pp → X complicated region for theoretical descriptions:
- transition from resonance production mechanisms (2 → 2, 2 → 3) to multiparticle production (2 → n)
- Beam energy where transition from nuclear resonance models (3d phase space) to string formation and decay (longitudinal phase space) is not well known
- little experimental information about multi-step processes

Chapter 7.2: p(π) + p(n) reactions

7.2.1 Inclusive and exclusive cross sections and excitation functions of hadrons

Special focus - rarely measured hadrons containing strangeness like the hyperons Ω, Ξ and the mesons ϕ,K−.

7.2.2 Isospin effects in p+p and p+n

7.2.3 Systematic excitation of resonance in π + p reactions

Advantage of π + p vs. p + p – direct excitation of baryonic resonances

7.2.4 Possibilities with dileptons

Information on production mechanizms

Chapter 7.3: p(π) + A reactions

7.3.1 In-medium hadron properties

Advantage of π + A vs. p + A: low momenta of secondary π beam vs. p – good for probing in-medium effects

7.3.2 Possibilities with dileptons

undistorted signal

7.3.3 Cold nuclear matter as reference

role of rescattering

7.3.4 Formation of clusters in nuclear matter

7.3.5 Influence of the electromagnetic fields on particle dynamics in nuclear matter

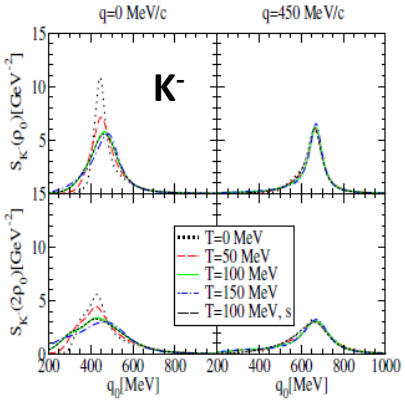
7.3.6 Short-range correlations

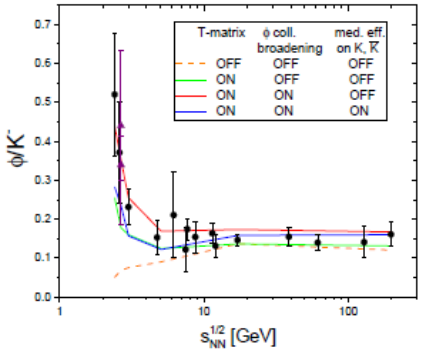
7.3.7 Dark Matter search

Chapter 7.4: Individual contributions

Christoph Blume
Compilation of measured, inclusive meson and baryon multiplicities in p+p collisions as a function of the center-of-mass energy

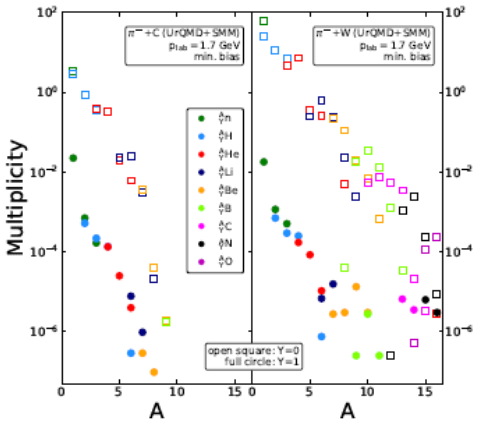
Claudia Hoehne:
strangeness, K1* resonances (incorporated)





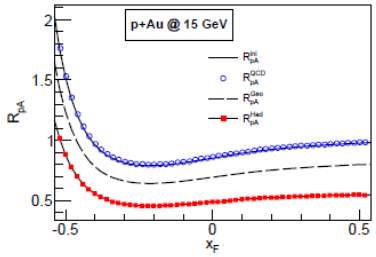
LAURA TOLOS:
- Strange pseudoscalar mesons in nuclear matter
- Strange vector mesons in nuclear matter

TAESOO SONG:
Strangeness production in heavy-ion collisions



TOM REICHERT:
For the π + A section – light nuclei and hypernuclei production

PARTHA PRATIM BHADURI: Possibility to probe J/ψ interaction in nuclear matter via SIS100 p+A collisions at FAIR SIS100 (dissosiation cross section by measurement of R_{pA})



Gyuri Wolf: study of in-medium spectral function of J/Ψ