MULTIFRAGMENTATION as a TOOL for MEASURING DENSITIES of the COMPRESSED and DILUTED NUCLEAR SYSTEMS

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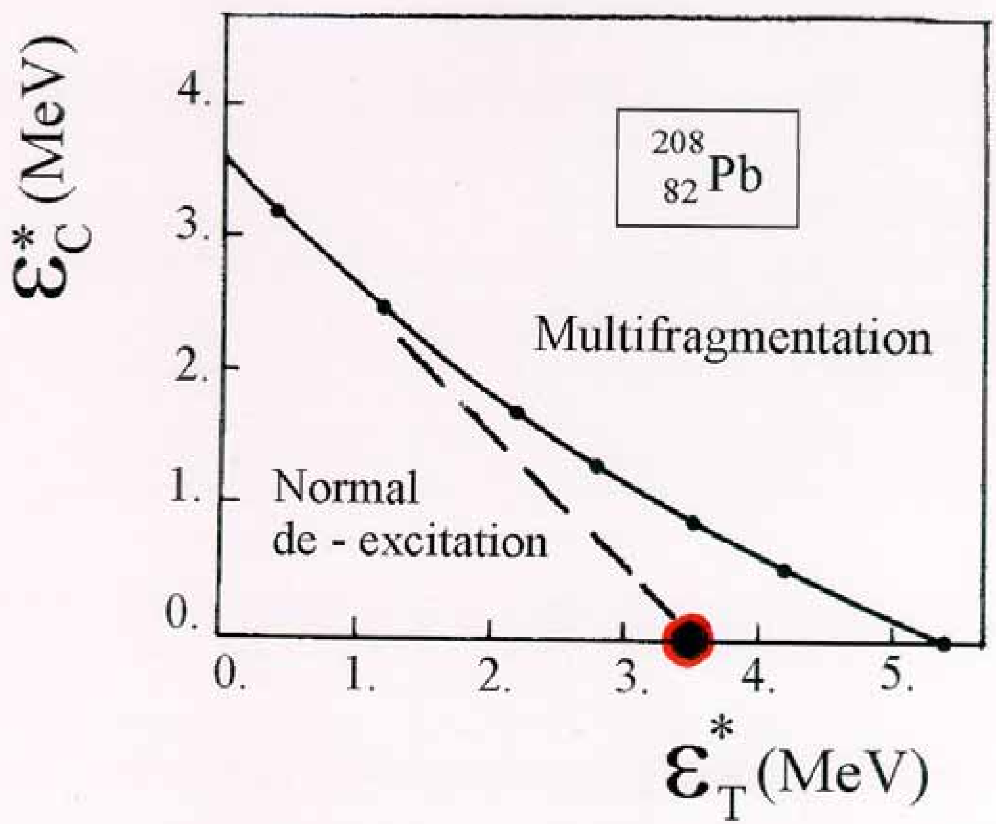
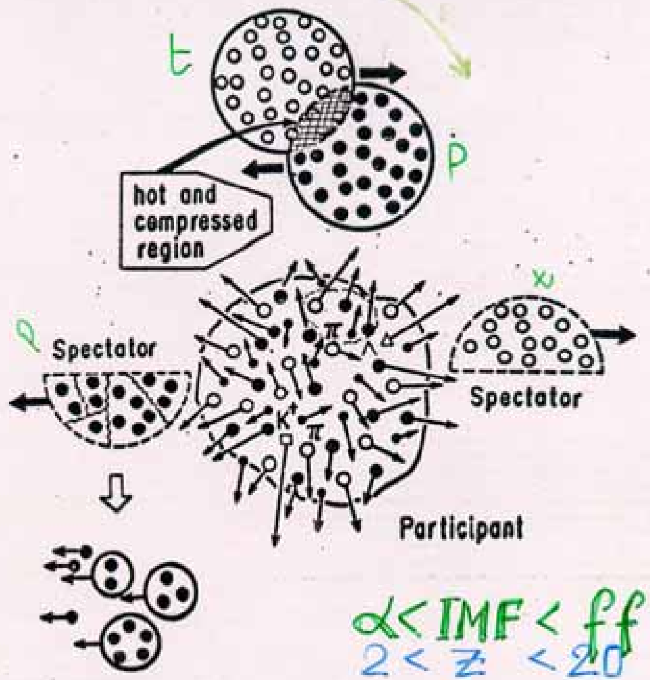
(1)

Hydrodynamical model + site-bond percolation.

J. Desbois.., C. Ngo..
Z. Phys. A 328(87)101



A+A - collisions

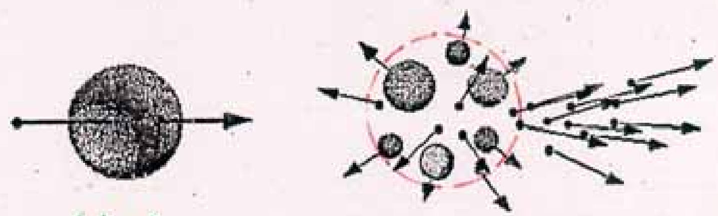


$\alpha <$ IMF $<$ ff

$2 < Z < 20$

"Dynamic" (DMF)

Relativistic Light Ions + A



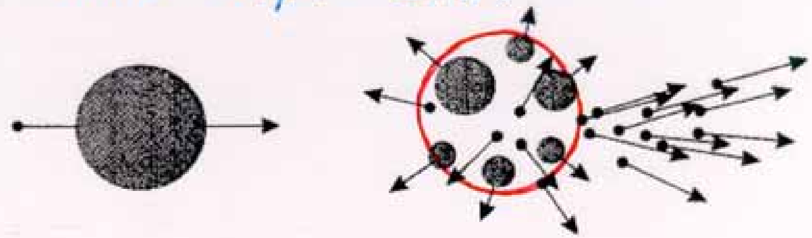
(Au)

$E \gtrsim 500-600$ MeV

"Thermal" (TMF)

1+3 main conclusions :

INC + Exp. + SMM



- Multifragmentation : $a + A \rightarrow x \cdot IMF + \ldots$

$$IMF : 3 \leq Z < 20$$

- «Thermal Multifragmentation» takes place

  when light relativistic ions (p, He, … ^{12}C) are used :

$$E^{*} \approx E_{thermal}$$

- «Dynamic Multifragmentation» — for very heavy

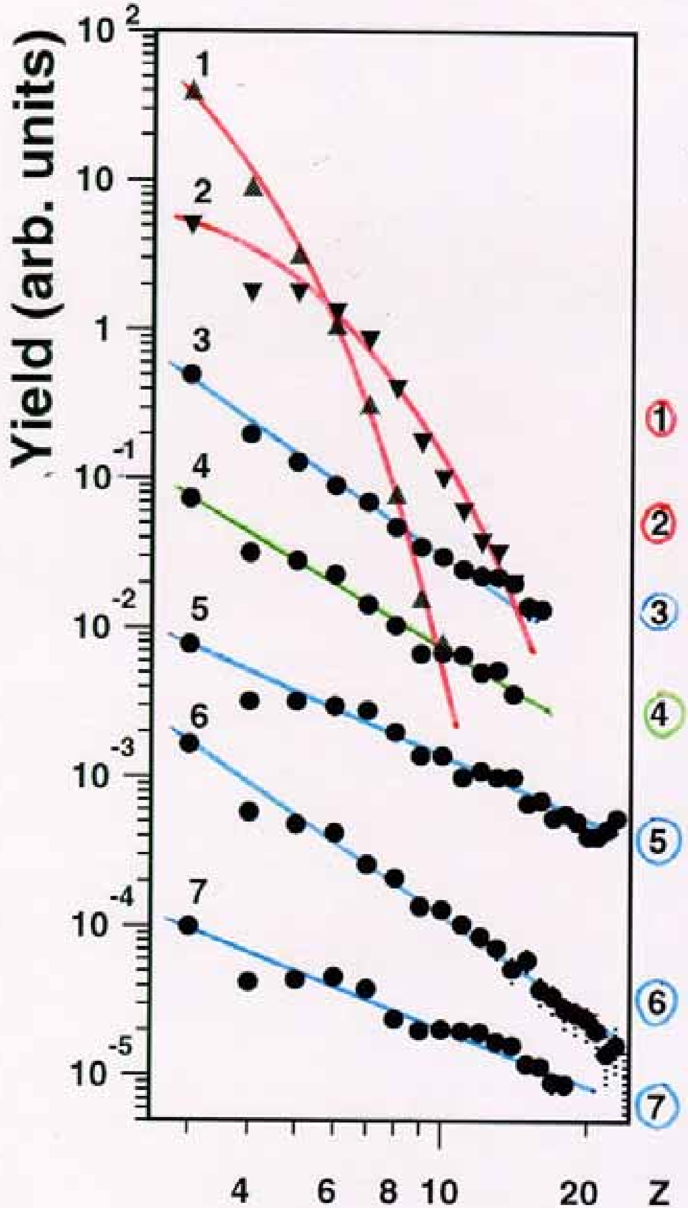
  ions collisions :

$$E^{*} = E_{thermal} + E_{compression} + E_{rotation}$$

- Threshold energy for multifragmentation :

$$E^{*}_{MF} \geq 400\ MeV.$$

TMF - is a new (multibody) decay mode of very hot nuclei.



$Y(Z) \sim Z^{-\tau}$ (Thermal)

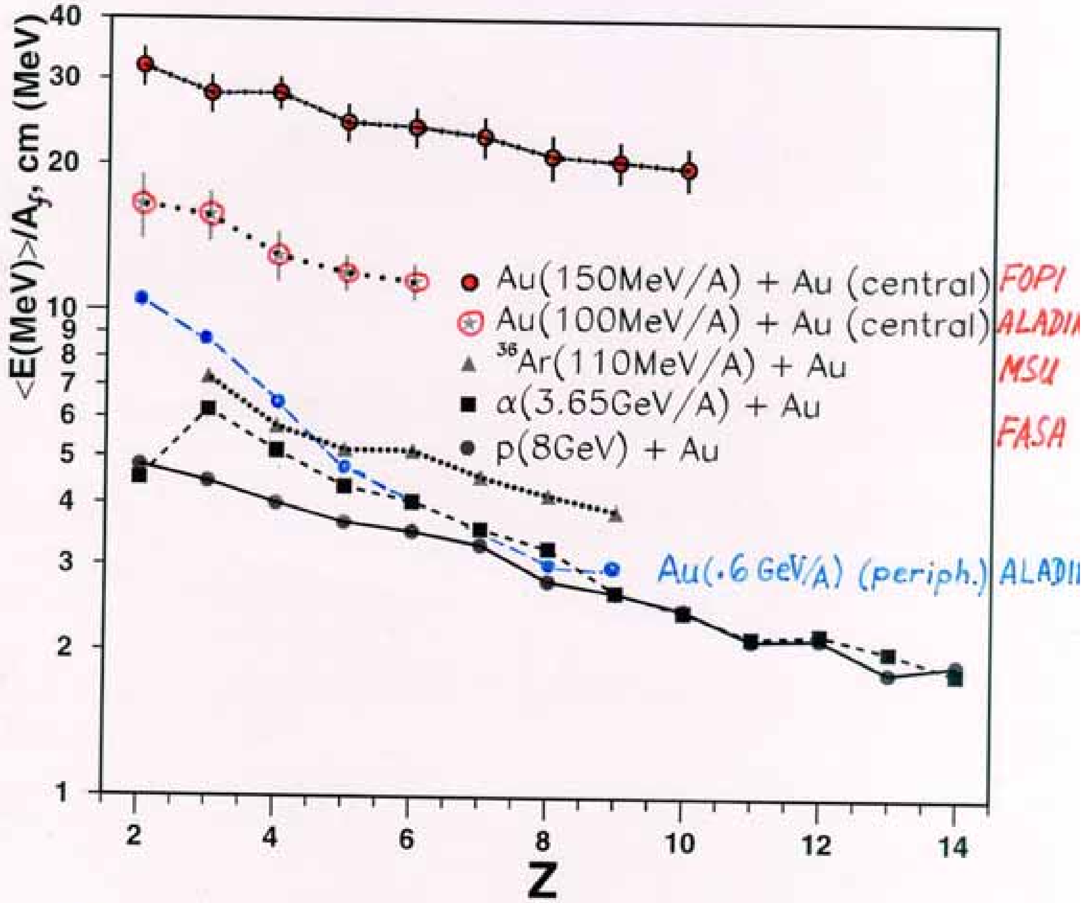
$Y(Z) \sim \exp(-\alpha Z)$ (Dynamical)

1. Au(400MeV/A) + Au (centr.)
2. Au(100MeV/A) + Au (centr.)
3. Au(100MeV/A) + Au (peripheral)
4. p(8.1GeV) + Au
5. Kr(35MeV/A) + Au
6. Ar(220MeV/A) + Au
7. Ar(30MeV/A) + Au

Coalescence :

Thermal & Dynamic multifragment.

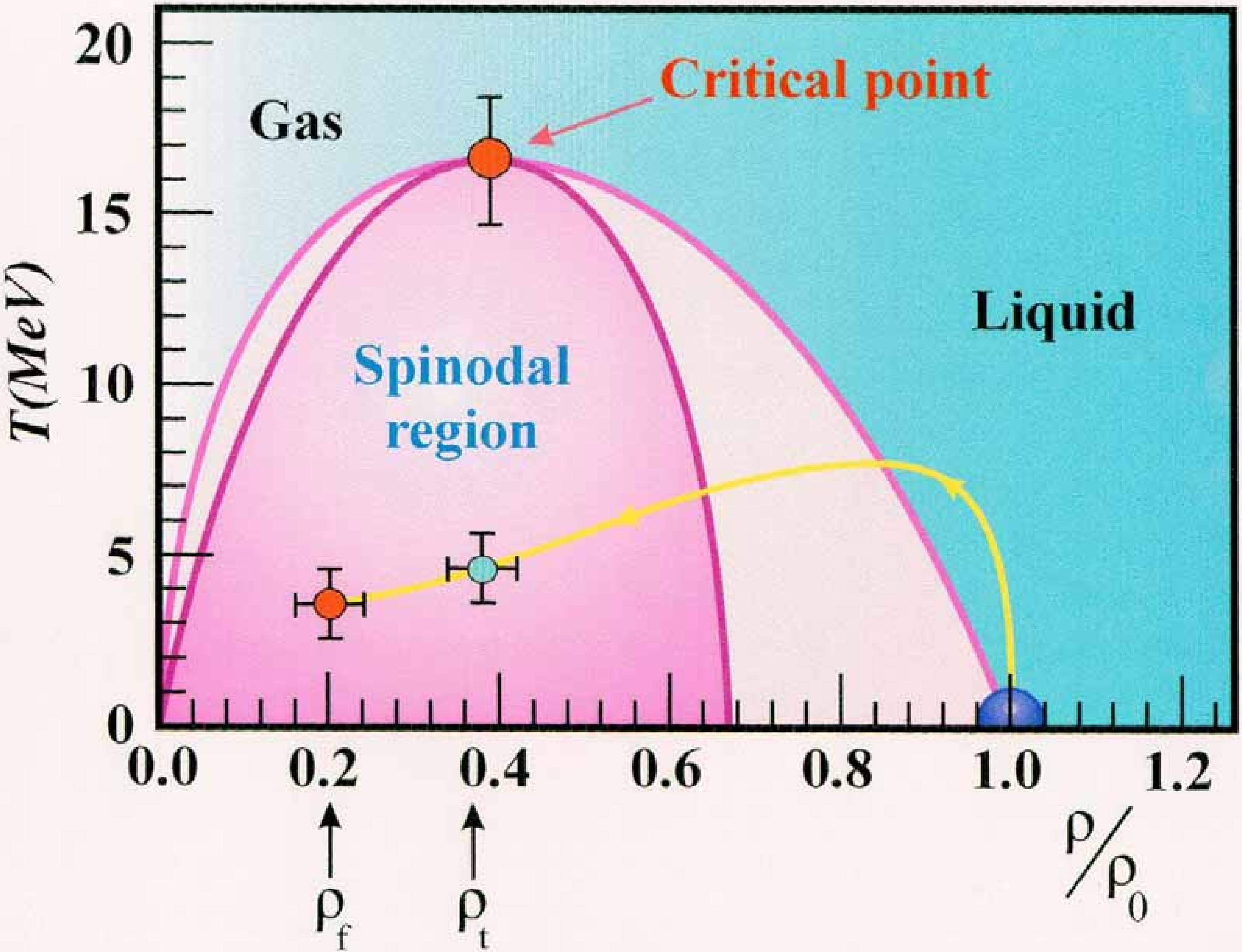
$a + Au \rightarrow mIMF + \ldots$

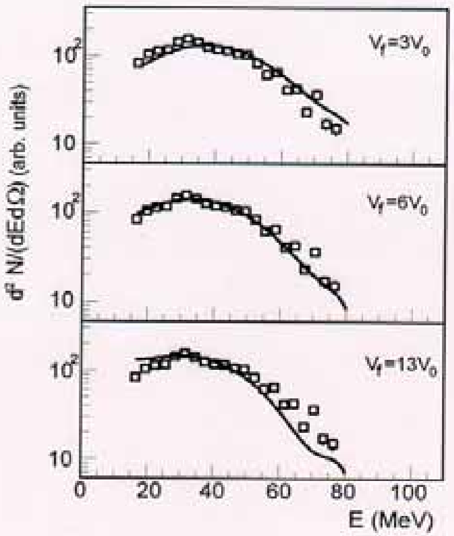


HI : $E_{IMF} = E_T + E_{Coul.} + \underline{E_{compr.}} + E_{Rot.}$

P : $E_{IMF} = E_T + \underline{E_{Coul.}}$ (25% + 75%)

Nuclear spinodal region with experimental points obtained for p+Au collisions at 8.1 GeV. The combined model INC+Expansion+SMM was used for data analysis.

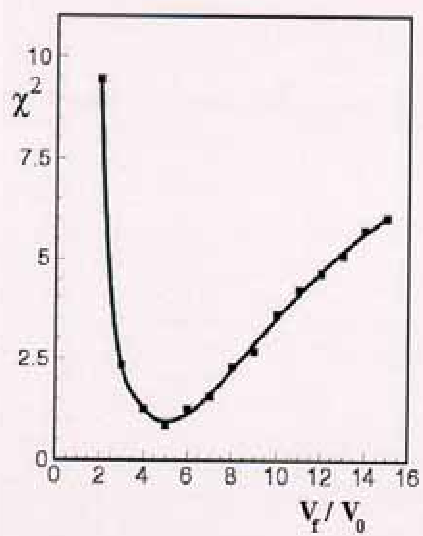




Kinetic enery spectrum of carbon produced in p(8.1GeV)+Au collisions.

□ – data, FASA collab.

— calculations with INC+SMM+many body Coulomb trajectory code (V_f, freeze-out volume, as a parameter)



$$V_f=(5.0\pm1.0)\,V_0$$

Dynamical multifragmentation

W. Reisdorf et al. / Nuclear Physics A 612 (1997) 493–556

Table 3
Results from blast model fit for central Au+Au collisions.

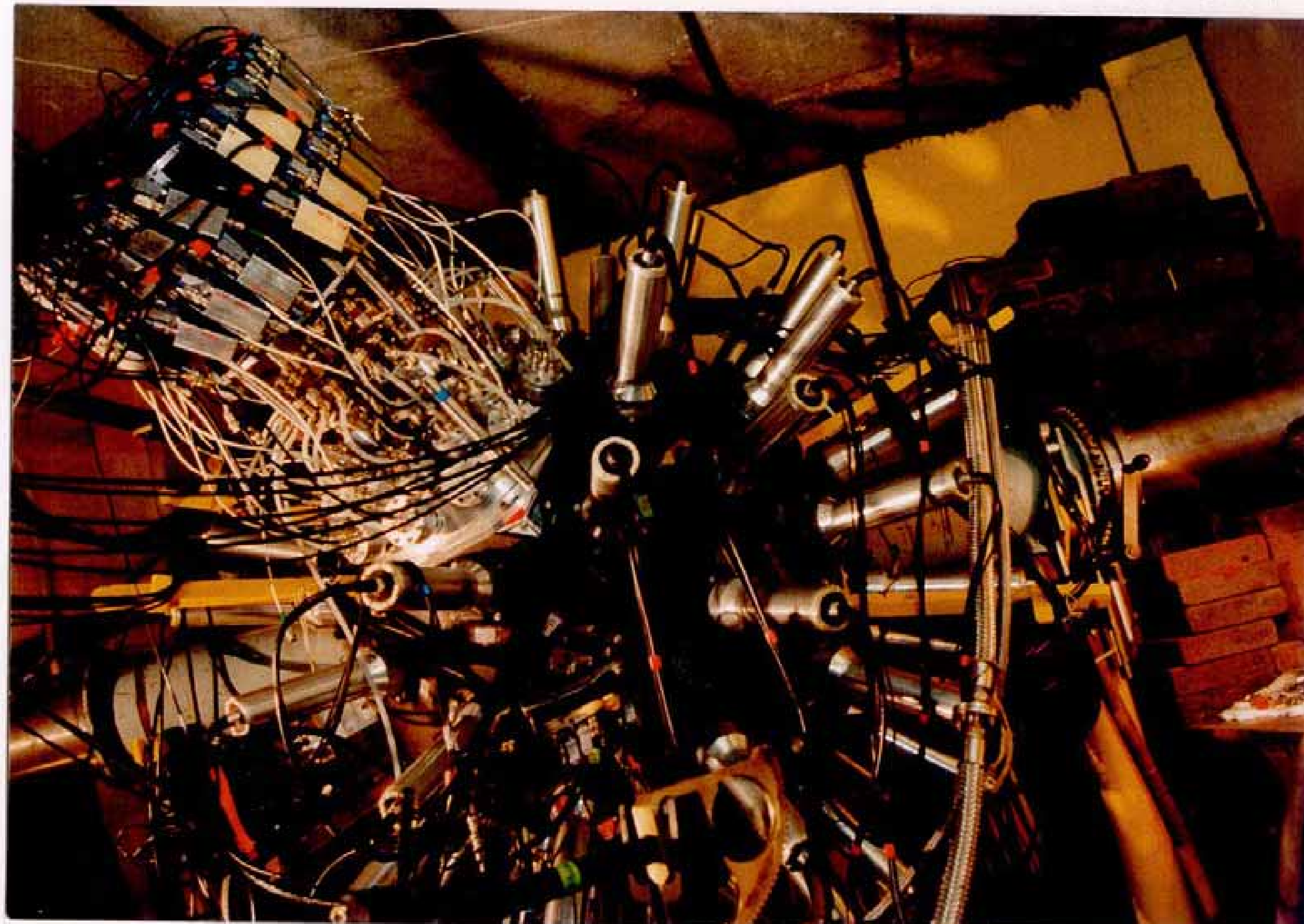
E/A	150	250	400	MeV/A
$\mathcal{E}_{coll}$	61.3 ± 7.0	61.3 ± 7.0	63.4 ± 7.0	% of TK
E_{cm}/A	36.8	60.5	95.1	MeV/A
Q_{vl}/A	−4.3	−5.0	−5.5	MeV/A
$\langle\beta_t\rangle$	0.204 ± 0.011	0.263 ± 0.014	0.334 ± 0.017	units of
$\mathcal{E}_{coll}/A$ flow	19.9 ± 2.3	34.0 ± 3.9	56.8 ± 6.3	MeV
$\mathcal{E}_{th}/A$	12.6 ± 2.3	21.5 ± 3.9	32.8 ± 6.3	MeV
T	17.2 ± 3.4	26.2 ± 5.1	36.7 ± 7.5	MeV
M	191 ± 11	208 ± 9	223 ± 6	includes n
Z_{sum} error	−14%	−2%	+5%	extrapol. 4π

$$\mathcal{E}_{coll}/A = \frac{K}{18}\left(\frac{\rho-\rho_0}{\rho_0}\right)^2$$

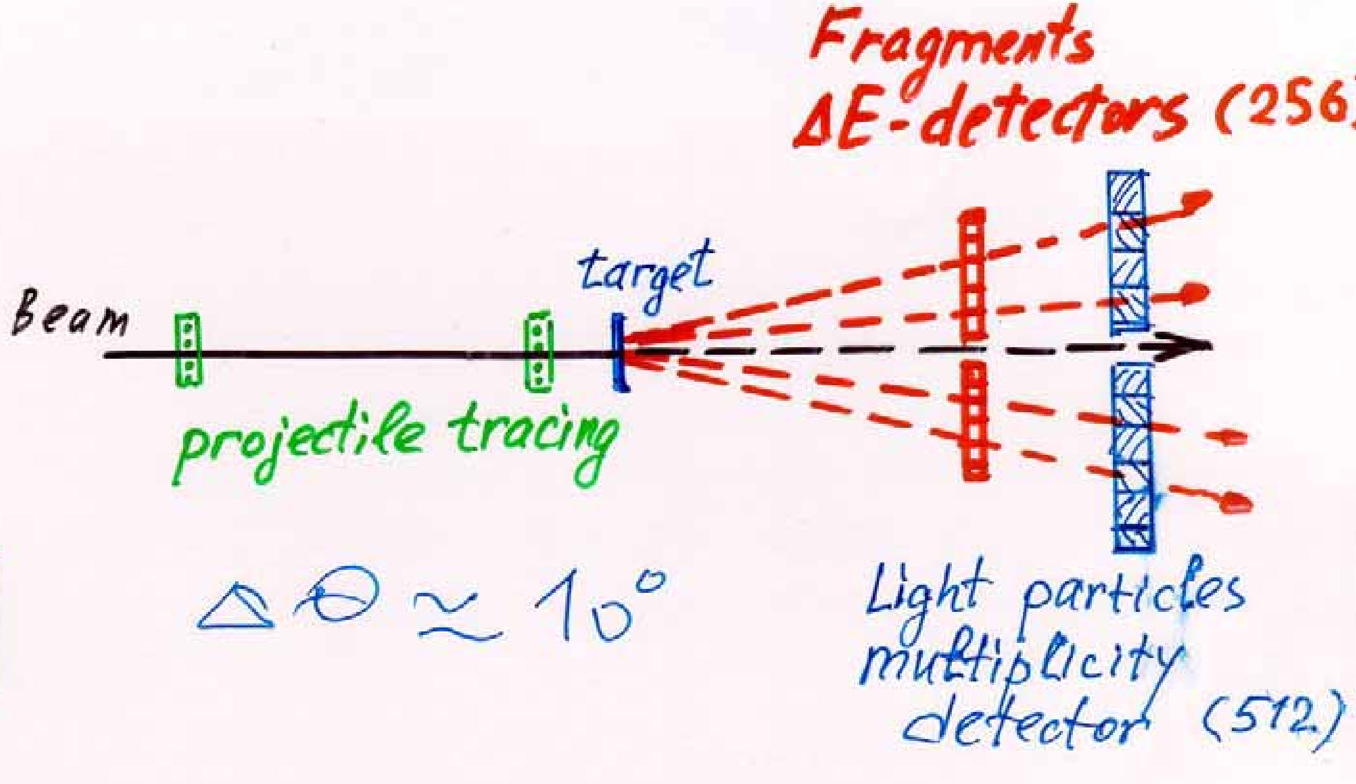
$$\rho/\rho_0 = \left(\frac{18\cdot\mathcal{E}_{coll}}{K\cdot A}\right)^{1/2} + 1$$

$$\rho/\rho_0 = \left(\frac{\mathcal{E}_{coll}/A}{11}\right)^{1/2} + 1 \quad \text{for } K = 200\,\text{MeV}$$

FASA-2



Number of counters - 129
Number of el. cannals - 193



$$\frac{\partial N}{\partial p_\perp} \rightarrow \langle p_\perp \rangle \rightarrow \varepsilon_{Compr.}(\rho) \rightarrow \rho$$