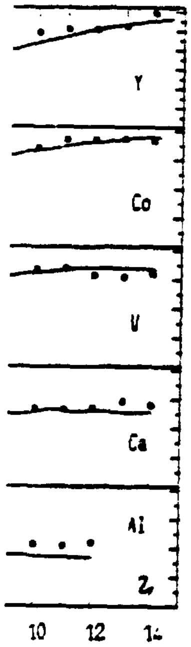

ɛtween the average
ɡy of the fragment
ıe primary fragment
ɔe interaction of
^{3}Co and ^{89}Y +151 MeV
laboratory. The
ɛ experimental points;
re the best fits,
ion corrections,
) using li = lcr + 1
the neck length δ

and energy loss. Following our previous analysis$^{1)}$ we consider that at 40°, far enough from the grazing, as seen on table 1, li is near lcr the critical angular momentum. The fusion cross section data for Al, Ca and Co give for lcr values that are well reproduced by the interaction potential of Ngô $^{5)}$ for a critical radius r_o = 0.93 fm ; we thus adopt the values so found for V and Y for which fusion cross sections dot no exist. Calculations with li = lcr + 1 and for a neck length of the order of δ = -0.5 (see table 1) that correspond to an interaction distance of about $d=1.1(A_1^{1/3}+A_2^{1/3})$ are represented on fig. 1. It is clearly noticeable, perhaps with the exception of the Al, that the data are well reproduced by these calculations based on a fully equilibrated dinuclear complex formed by a maximum overlap of the colliding nuclei in the initial stage. The discrepancy found in the Al results may be explained, perhaps, by structure effects still to much pronounced in such a light target, by the symmetry of the entrance channel and also, due to these features, by a great sensibility of the evaporation corrections versus the threshold energy.

°, the situation is quite different ; the collisions are almost at
for Y and Co with an overlap a little bit more important for the
s. Then, the equilibrium is not yet established enough and the
gy, in that case, is a function of the amount of nucleon transfer.
of a transfer that grows with the degree of overlaping and thus
the impact parameter and so, with the initital angular momentum.
ude model of Simbel and Abul Magd $^{6)}$ we get li as a function of Z
other free parameter, lgr and Rgr being extracted (see table 1)
stic scattering results. The best fits represented on fig. 2 are
h values of δ(see table 1) of the order of 5 fm ; as already
s value that corresponds to the large deformation of the nuclei at
notably larger than δ = 2 fm usually used for fission results.
will probably still be larger when the work of substracting the
c component of the spectra will be done. The effect of this
at increases ⟨TKE⟩ is clearly visible, particularly for Y and Co

at Z_F = 8, 9 and 10. This
in such a way that a preci
the work that we are doing

In conclusion, the
collisions and far from t
ambiguous as already notec
a more precise analysis of

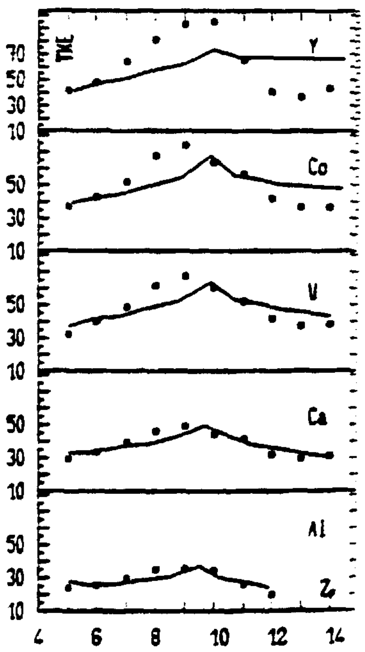

Fig.2. Same as fig. 1 but at 20°
the laboratory and with values of
L_i deduced from the calculations
ref. $^{6)}$.

1) Nguyen Van Sen, J.C. G
Phys. Rev. C22 (1980)
2) J. Blocki, J. Randrup,
Ann. Phys. (N.Y.) 105
3) L.C. Vaz and J.M. Ale
4) P. Wastyn, H. Feldmei
A. Richter, G. Schrie
5) C. Ngô, B. Tamain, J.
Nucl. Phys. A240 (197
6) M.H. Simbel and A.Y.
7) R.R. Betts and S.B. D

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ENERGY TRANSFER IN DEEPLY INELASTIC COLLISIONS WITH ^{20}Ne AT 151 MeV

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Recent investigations of the deep inelastic collisions (D.I.
focused mainly their attention to the shape of the fragment spectra
in the heavy ion collisions. For the projectile like fragments the
these spectra is governed by two components : the quasi elastic pea
high energy side of the spectra and the deep inelastic part at much
energy. The first component is particularly important at forward an
around the grazing angle but only for fragments corresponding to sm
transfert of nucleons. Unhappily, these two components widely overl
a way that it is very difficult to extract pure D.I.C. data. After
previous analysis [1]) done at the Grenoble Cyclotron with ^{20}Ne at 15
^{40}Ca then on ^{27}Al and ^{59}Co (to be published), we try to get more ac
results by bombarding, always with ^{20}Ne, a lot of targets ranging f
Bi and looking from only two angles, 20° and 40°, but with a good s
In the paper, we study the final fragment average center of mass en
for fragments between $Z = 5$ and $Z = 14$ and for some of the targets
illustrated in fig. 1 and fig. 2.

As in the ref. [1]) we consider the total final kinetic energy of a
rotating system at scission :

$$E_F = V_{coul}\,(d) + V_{NUCL}\,(d) + F^2\,\frac{li\,(li+1)\hbar^2}{2\mu_F d^2}$$

where μ_F is the reduced mass of the exit channel, F is the ratio o
channel angular momentum to the entrance channel angular momentum
the separation of the two mass center at scission :

$$d = 1.2\,(A_1^{1/3} + A_2^{1/3}) + \delta$$

where δ is the neck length.

The kinetic energy calculated with V_{nucl} which is taken to be modi
proximity potential [2,3]) is then roughly corrected [4]) and so, the
of the emitted fragments, in order to take account for evaporation

at Z_F = 8, 9 and 10. This effect is moreover mixed with the evaporation ones, in such a way that a precise analysis of the whole process is needed ; this is the work that we are doing at the present.

In conclusion, the present data show that in the deep inelastic collisions and far from the total relaxation, the situation is still ambiguous as already noted by Betts and Di Cenzo [7]. It seems however, that a more precise analysis of the experimental data done for various systems and at different energies may gives, with some more refinements of the theoretical approach, a much better understanding of the deep inelastic collisions mecanism.

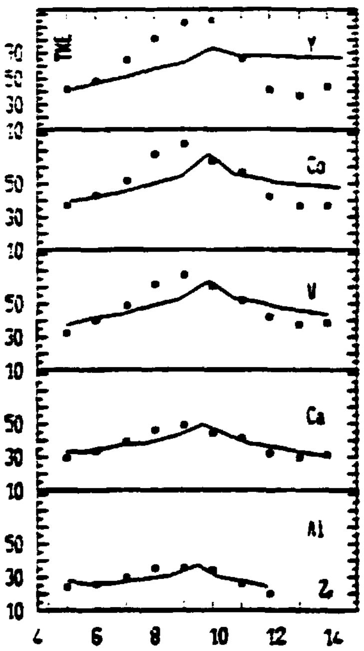

Fig.2. Same as fig. 1 but at 20° in the laboratory and with values of L_g deduced from the calculations of ref. [6].

Table 1

The different parameters used in the present analysis for collisions of $^{20}_{10}$Ne at 151 MeV on some targets : The grazing angular momentum lgr is deducted from the quarter-point $\theta_{1/4}$; the critical angular momentum lcr is deduced a) from the fusion cross section and b) calculated with the interaction potential of Ngô [5] for a critical radius r_0 = 0.93 fm ; the values for the neck length δ are extracted from the best fits at 20° and 40°.

target	$\theta_{1/4}$ (Lab)	L_{cr}	L_{cr}	$\delta_{40°}$ (fm)	$\delta_{20°}$ (fm)
$^{27}_{13}$Al	6.2	53	38 a)	- 0.47	5.0
$^{40}_{20}$Ca	13.4	65	44 a)	- 0.73	5.6
$^{51}_{23}$V	15.1	71	48 b)	0.02	3.7
$^{59}_{27}$Co	17.5	75	50 a)	- 0.23	4.3
$^{89}_{39}$Y	24.3	84.5	54 b)	- 0.31	3.9

REFERENCES

1) Nguyen Van Sen, J.C. Gondrand, F. Merchez and R. Darves-Blanc, Phys. Rev. C22 (1980) 2424.
2) J. Blocki, J. Randrup, W.J. Swiatecki and C.F. Tsang, Ann. Phys. (N.Y.) 105 (1977) 427.
3) L.C. Vaz and J.M. Alexander, Phys. Rev. C18 (1978) 2152.
4) P. Wastyn, H. Feldmeier, F. Beck, M. Dworzecka, H. Genz, M. Muttener, A. Richter, G. Schrieder and J.P. Theobald, Nucl. Phys. A332 (1979) 455.
5) C. Ngô, B. Tamain, J. Galin, M. Beiner and R.J. Lombard, Nucl. Phys. A240 (1975) 353.
6) M.H. Simbel and A.Y. Abul-Magd, Z. Physic. A294 (1980) 277.
7) R.R. Betts and S.B. Di Cenzo, Phys. Rev. C19 (1979) 2070.