Studies of pair transfer processes with the SPES beams

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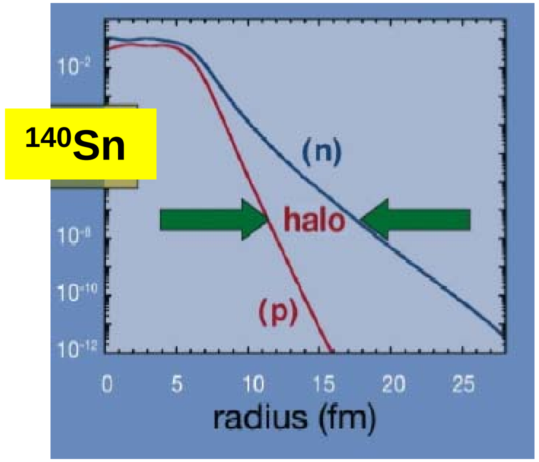
Multinucleon transfer reactions with radioactive beams

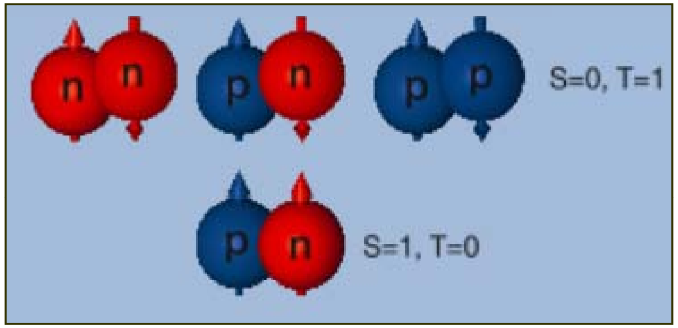
Do the degrees of freedom and the corresponding matrix elements tested with stable beams hold with RIBs ?

Do the form factors for one and two particle transfer and their strength need to be modified with RIBs ?

modification of nn correlations (neutron rich nuclei)



neutron-proton correlations (proton rich nuclei)



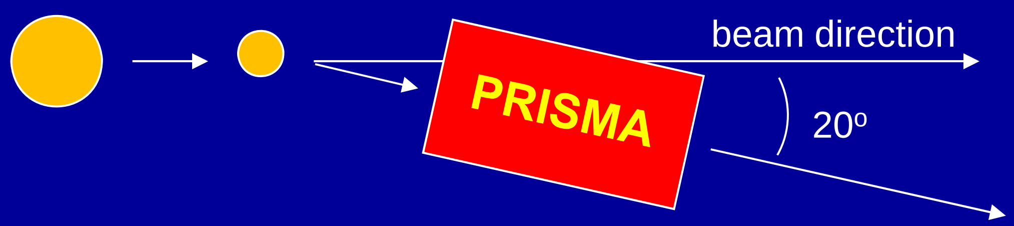
Transfer studies at energies below the Coulomb barrier : advantages

few reaction channels are opened → one reduces uncertainties with nuclear potentials

Q-value distributions get much narrower → one can probe nucleon correlation close to the ground states

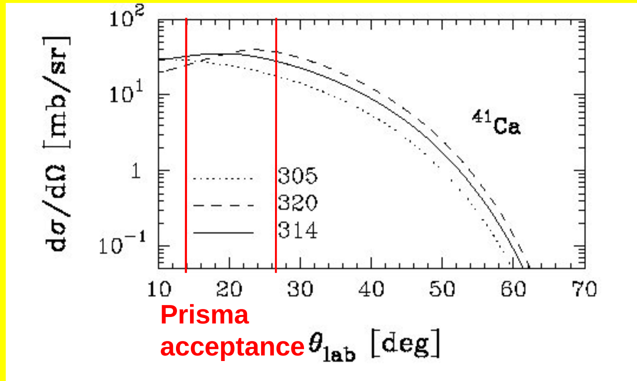
Detection of (light) target like ions in inverse kinematics with PRISMA

^{96}Zr ^{40}Ca **L.Corradi et al, PRC84(2011)034603**

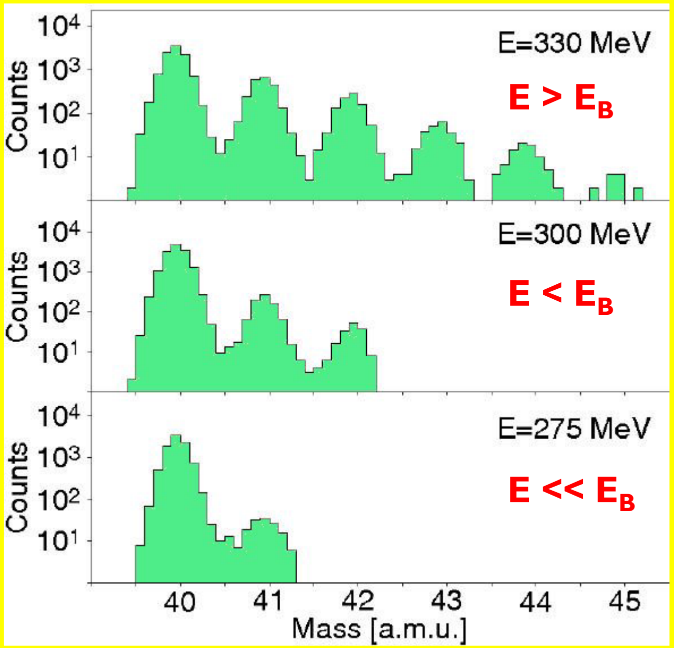


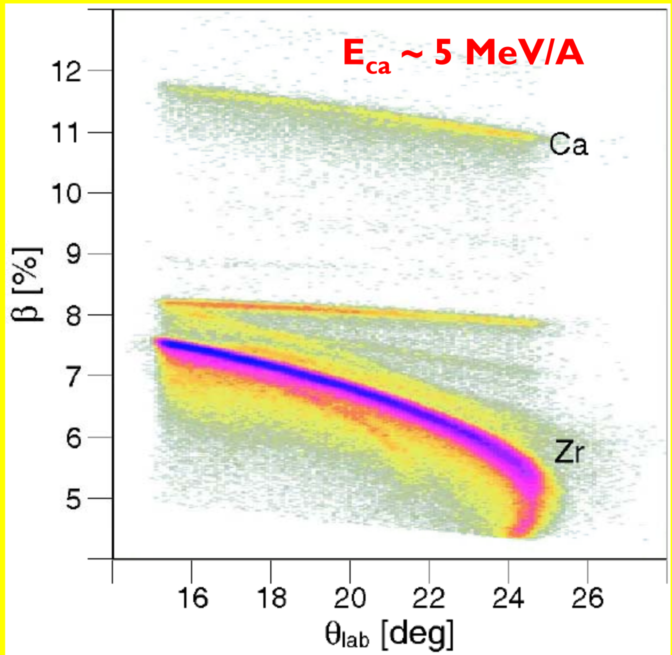
^{116}Sn ^{60}Ni **D.Montanari et al, INPC2013**

^{92}Mo ^{54}Fe **S.Szilner et al, exp April 2013**

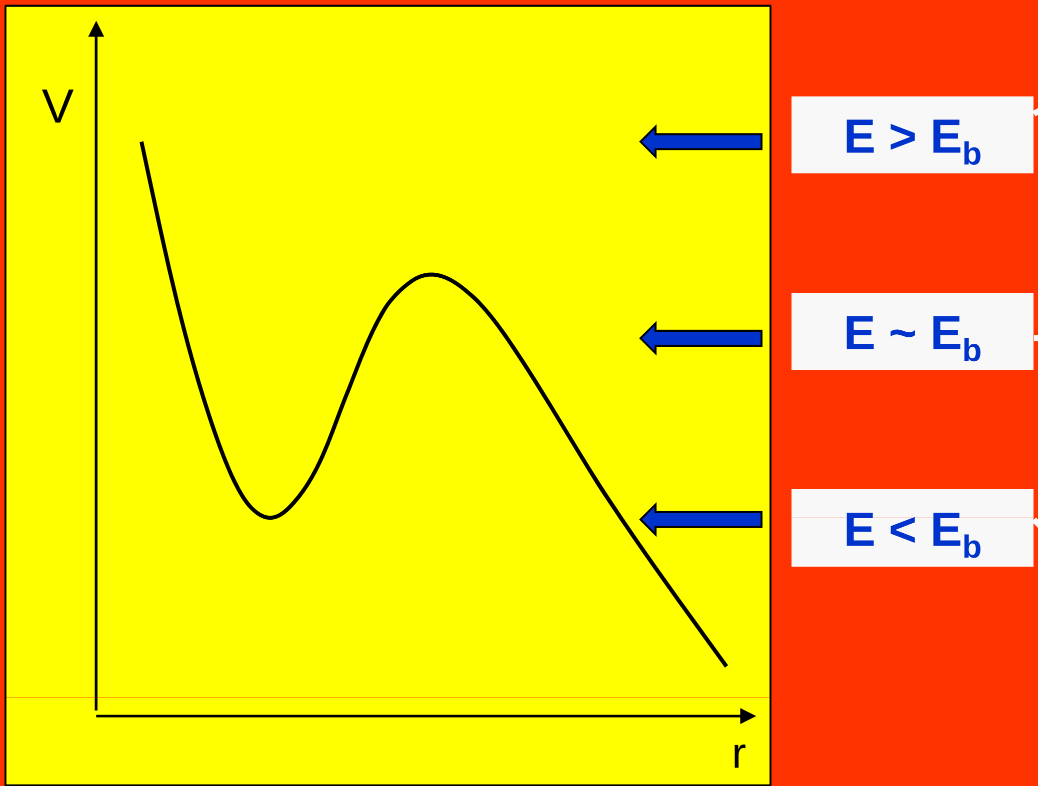


MNT channels have been measured down to 25 % below the Coulomb barrier

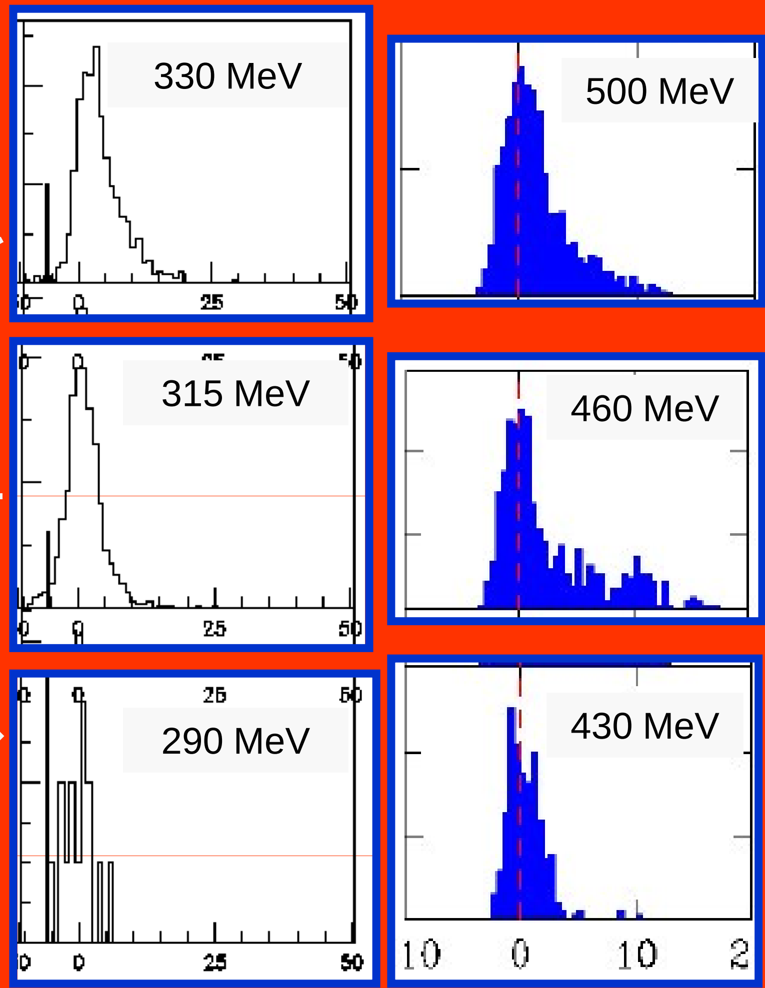




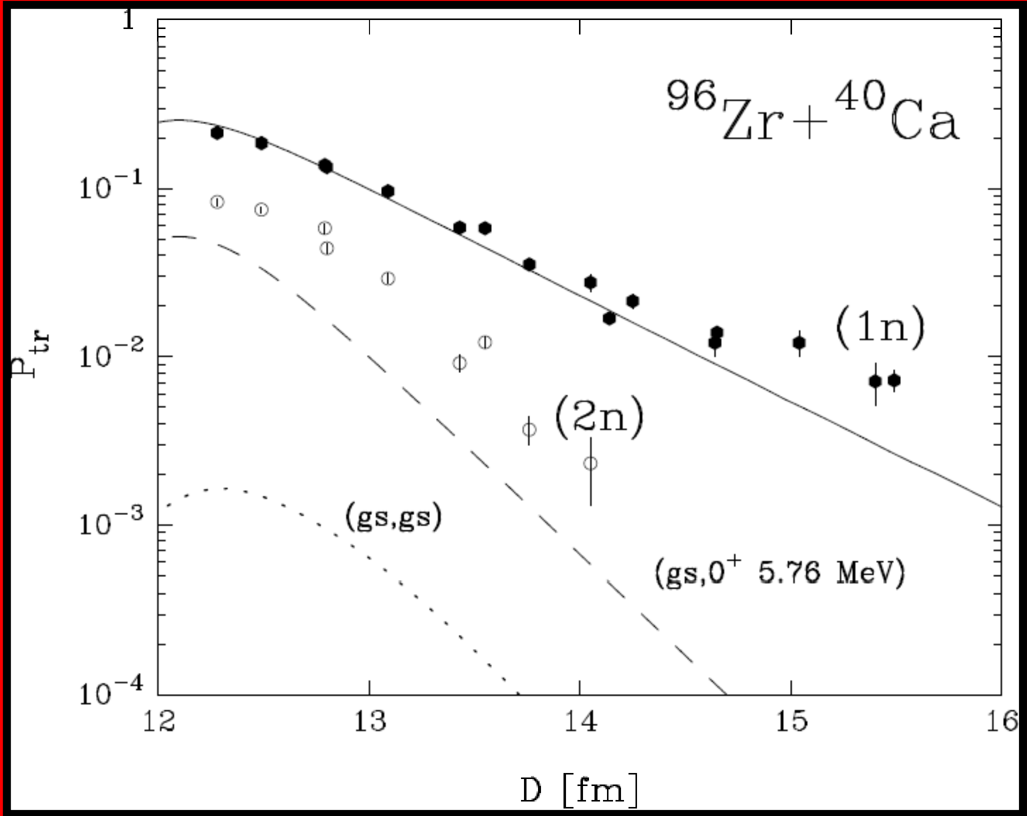
A smooth transition between QE and DIC processes



$^{96}Zr(^{40}Ca,^{42}Ca)$ Q_{gs} = +5.6 MeV	$^{116}Sn(^{60}Ni,^{62}Ni)$ Q_{gs} = +1.3 MeV



Comparison between experimental and theoretical transfer probabilities

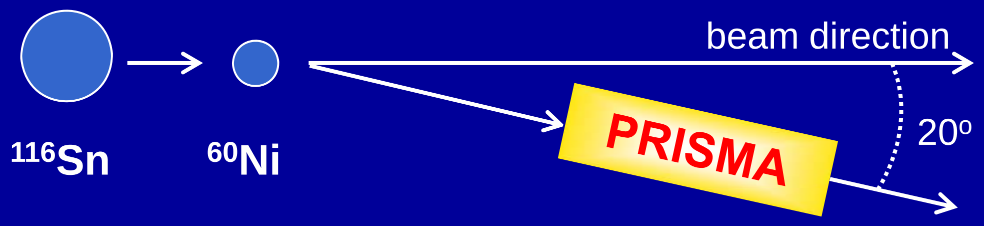


microscopic calculations based on semiclassical theory

importance of high energy 0^+ states and of states of different multipolarity

L.Corradi, S.Szilner, G.Pollarolo et al, PRC84(2011)034603

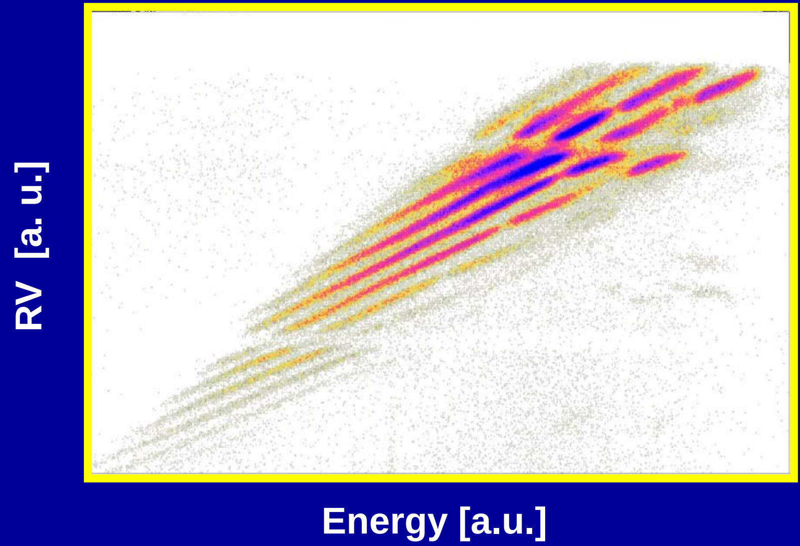
Detection of (light) target like ions in inverse kinematics with PRISMA

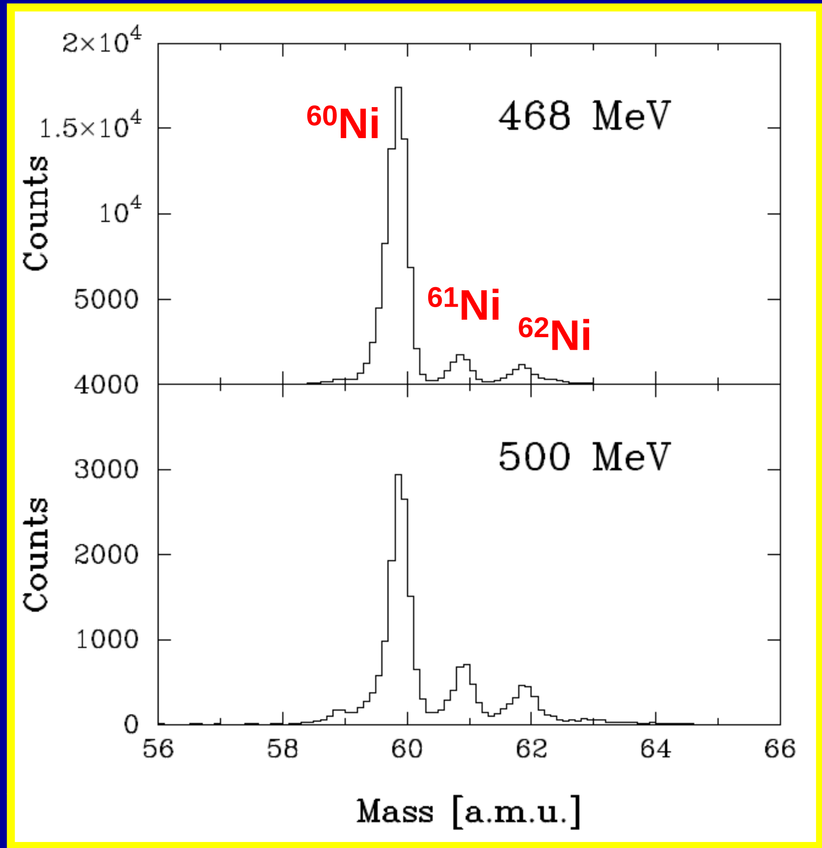


Excitation function

E_{beam} = 410 MeV – 500 MeV

(D ~ 12.3 to 15.0 fm)





g.s. Q-values	+1n	+2n	+3n	+4n
^{96}Zr + ^{40}Ca	+ 0.51	+ 5.53	+ 5.24	+ 9.64
^{116}Sn + ^{60}Ni	- 1.74	+ 1.31	- 2.15	- 0.24

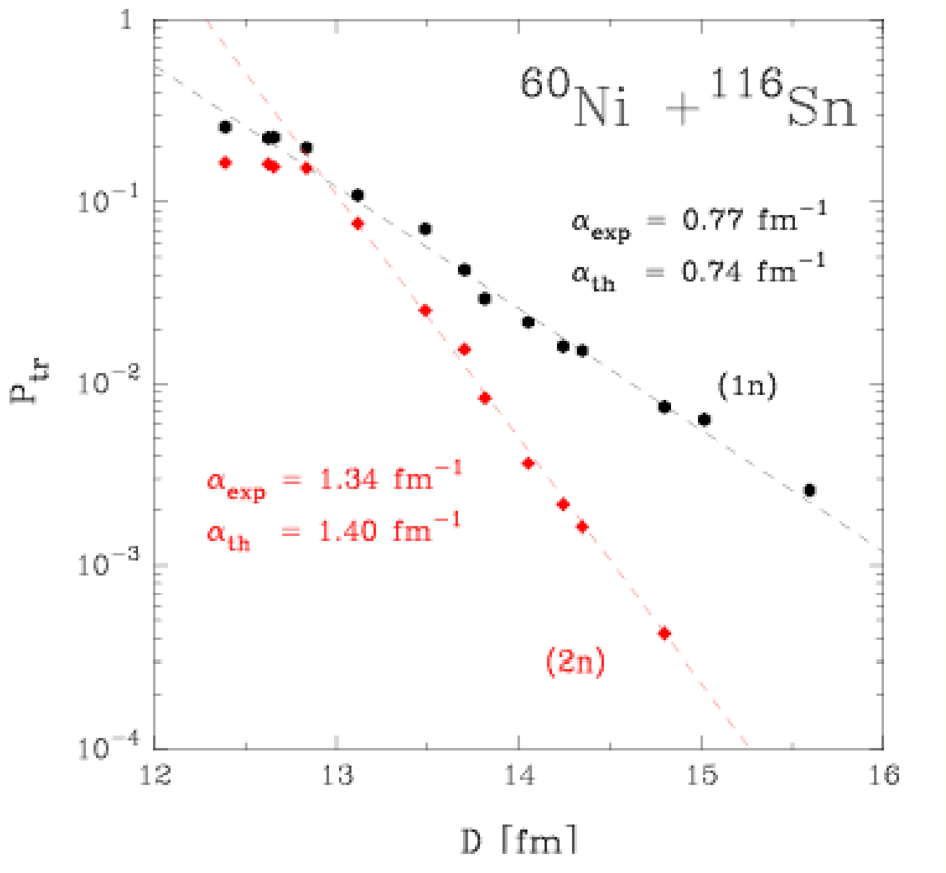
D.Montanari et al., INPC2013 and in preparation

P_{tr} slope

$$P_{tr} \propto e^{-2\alpha D} \qquad \alpha = \sqrt{\frac{2mB}{\hbar^2}}$$

B → binding energy

The ^{60}Ni+^{116}Sn system : experimental results



experimental slopes well match the ones expected from the binding energies

one gets an enhancement factor significantly larger than usual for pure neutron transfer

ground state Q-values (MeV) for neutron pick-up channels

	-1n	-2n	-3n	-4n
$^{96}Zr + ^{40}Ca$	+ 0.51	+ 5.53	+ 5.24	+ 9.64
$^{116}Sn + ^{60}Ni$	- 1.74	+ 1.31	- 2.15	- 0.24
$^{132}Sn + ^{40}Ca$	+ 1.05	+ 7.32	+ 7.57	+ 13.34
$^{132}Sn + ^{64}Ni$	- 1.21	+ 2.55	+ 0.66	+ 3.11

Requests

Beams : Sn [Mo,Pd] (n-rich)

Energies : close to the Coulomb barrier (well matching ALPI range)

Beam I on target : 10^6 - 10^8 ions/sec

Set-up : PRISMA (100 msr)
Ca,Ni [...] target thickness : 100-300 $\mu g/cm^2$

Goals : measurements of multinucleon transfer channels
(+1n,+2n,-1n,-2n,+1p,+2p,-1p,-2p, ...)

To be measured : $d\sigma/d\Omega$, σ_{tot}, TKEL