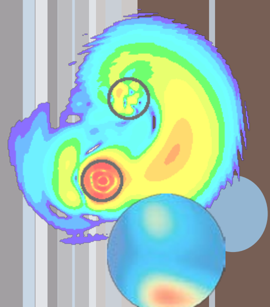


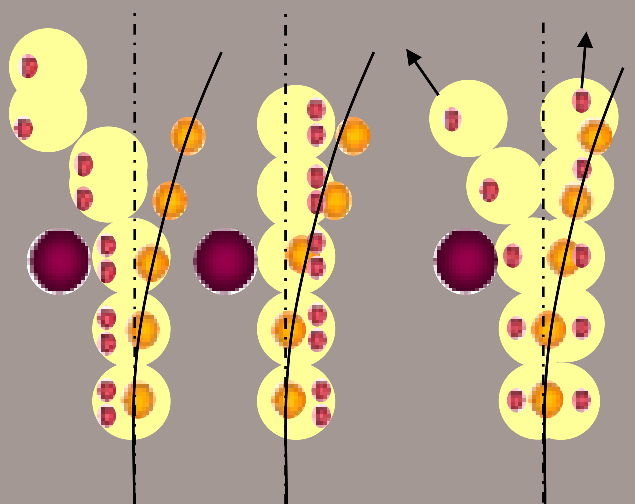
Probingnucleonscorrelations withNuclearBreak-up

Marlène Assié, Jean-AntoineScarpaci — IPN Orsay

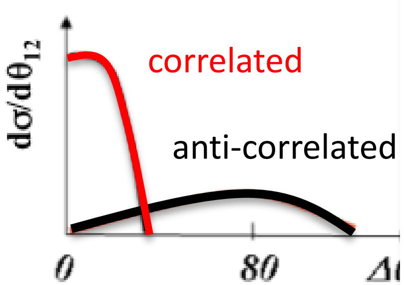
Denis Lacroix — GANIL

Two-nucleons Nuclear Break-Up Mechanism

Nuclear break-up



correlated anti-correlated



Time Dependent Density Matrix (TDDM^P)

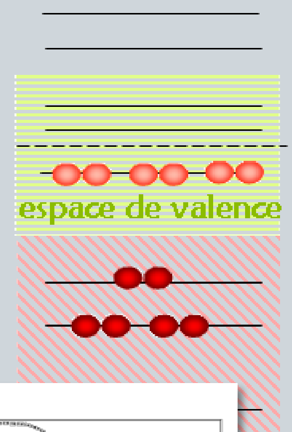
$$\rho_{12} = A(\rho_1\rho_2) + C_{12} \quad \begin{cases} i\hbar\dot{\rho}_1 = [h, \rho 1] + Tr_2[v_{12}, C_{12}] \\ i\hbar\dot{C}_{12} = [h, C_{12}] + P + B \end{cases}$$

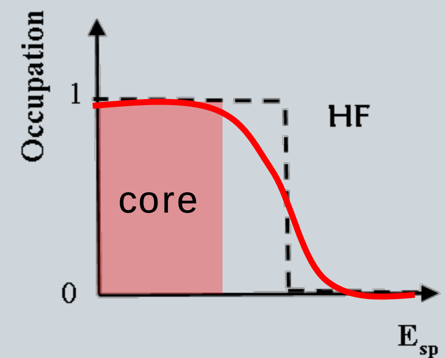
pairing & dissipation

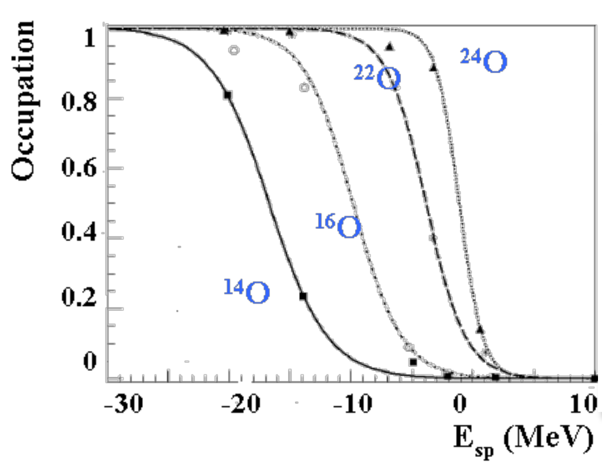
$$v_{12} = v0\left(1 + \beta\left(\frac{\rho}{\rho_0}\right)^\alpha\right)$$

Assié, Lacroix, PRL 2009

Test case : isotopic chain of Oxygen



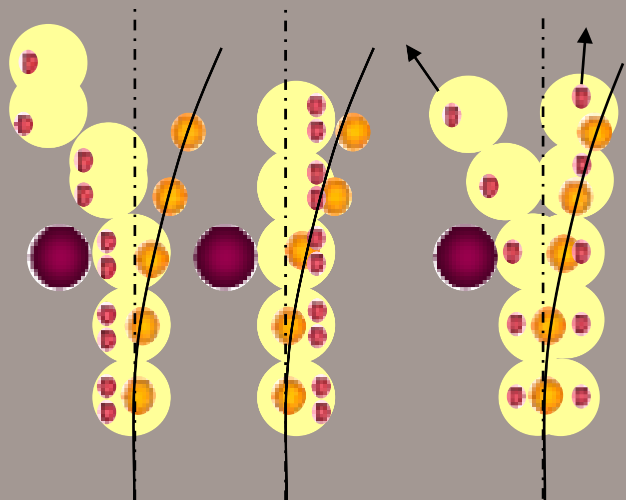




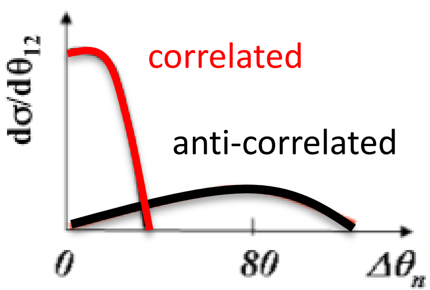
	TDDM	Our calculation	HFB
^{22}O	-3,1 MeV	**-3,5 MeV**	-3,3 MeV
^{24}O	-2,5 MeV	**-3,1 MeV**	-3,4 MeV

TWO-NUCLEONS NUCLEAR BREAK-UP MECHANISM

Nuclear break-up



correlated anti-correlated

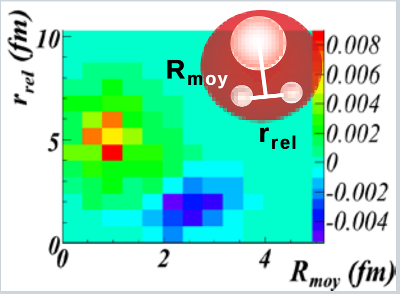


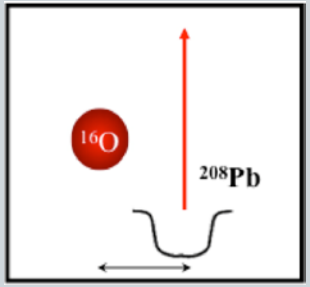
Time Dependent Density Matrix (TDDM)

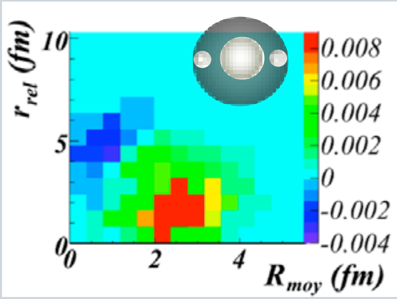
$$\rho_{12} = A(\rho_1\rho_2) + C_{12} \quad \begin{cases} i\hbar\dot{\rho}_1 = [h, \rho 1] + Tr_2[v_{12}, C_{12}] \\ i\hbar\dot{C}_{12} = [h, C_{12}] + P + B \end{cases}$$

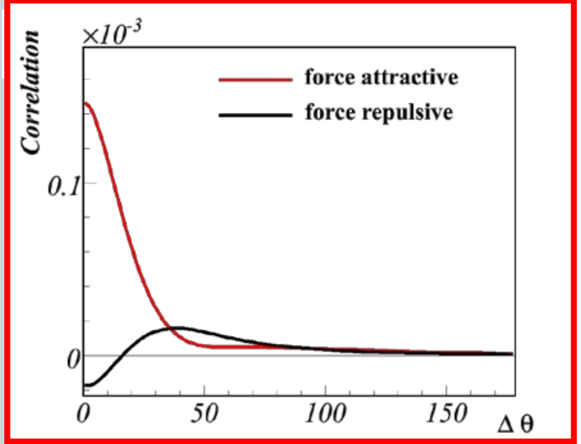
pairing & dissipation

$$v_{12} = v0\left(1 + \beta\left(\frac{\rho}{\rho_0}\right)^{\alpha}\right)$$





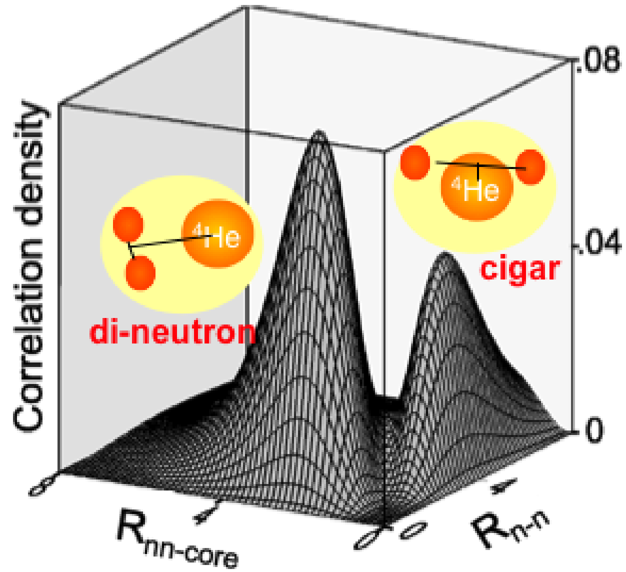




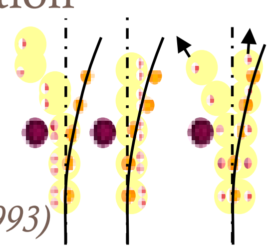
Assié, Lacroix, PRL 2009

Nuclear break-up is a probe of nucleons correlations

THE ^{6}HE CASE



➔Nuclearbreak-upcould help to disentangleeach configuration



M.V. Zhukov et al, Phys. Rep. 231, 151 (1993)

In favor of di-neutron configuration

2n-transfer

2n-transfer dominant
sequentialtransferweak

Y. Oganessian et al , PRL (1999)
D.T. Khoa et al, PLB (2004)
A. Chatterjee et al, PRL (2009)

t-transfer

^{6}He (p,t)^{4}He

$S_{\alpha-2n}$=1 S_{t-t}=0,08

L. Giot et al , PRC71 (2005)

In favor of cigar-configuration

Radiative capture

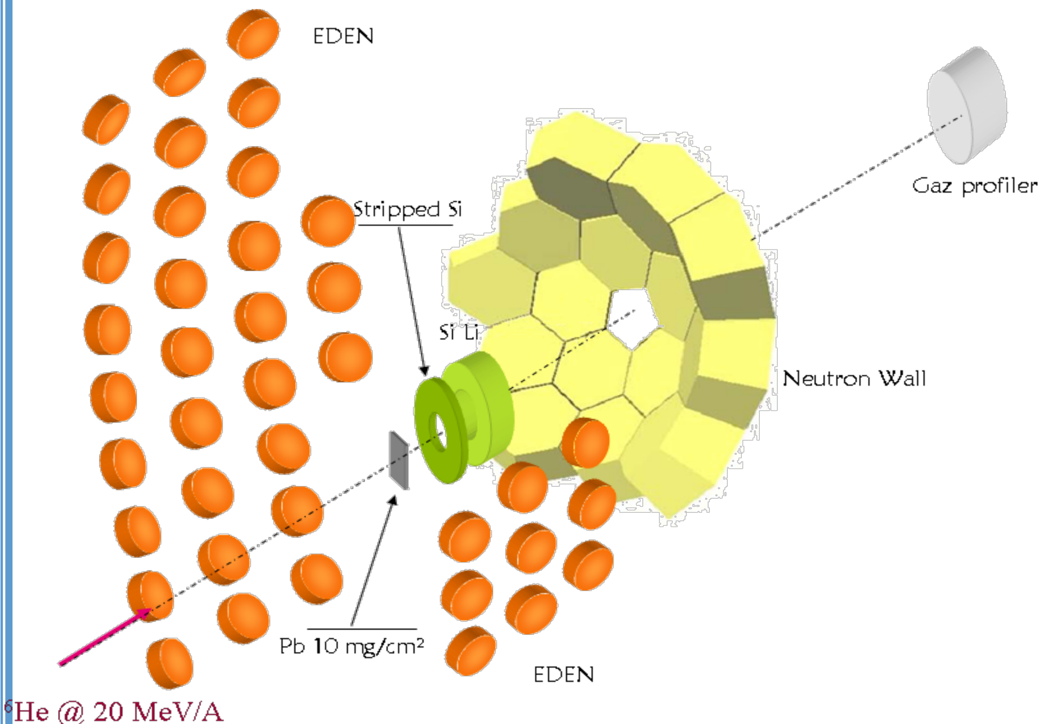
^{6}He(p,γ)x @ 40 MeV/A   no α + t decay

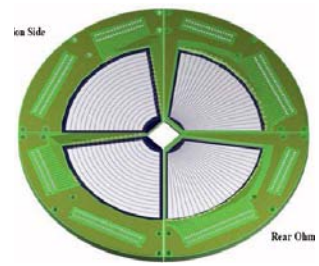
E. Sauvan et al, PRL 87 (2001)

Coulomb break-up &interferometry :

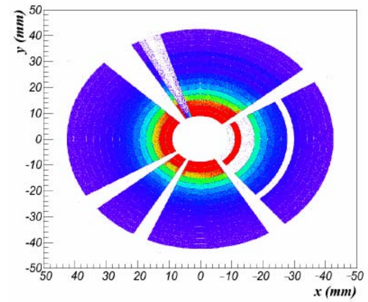
G.Normand PhD thesis
F.M. Marquès et al, PLB 476 (2000)

EXPERIMENTALSET-UPAT GANIL

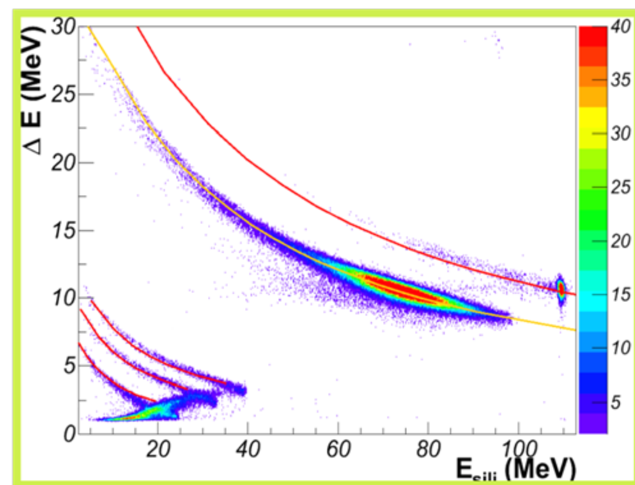




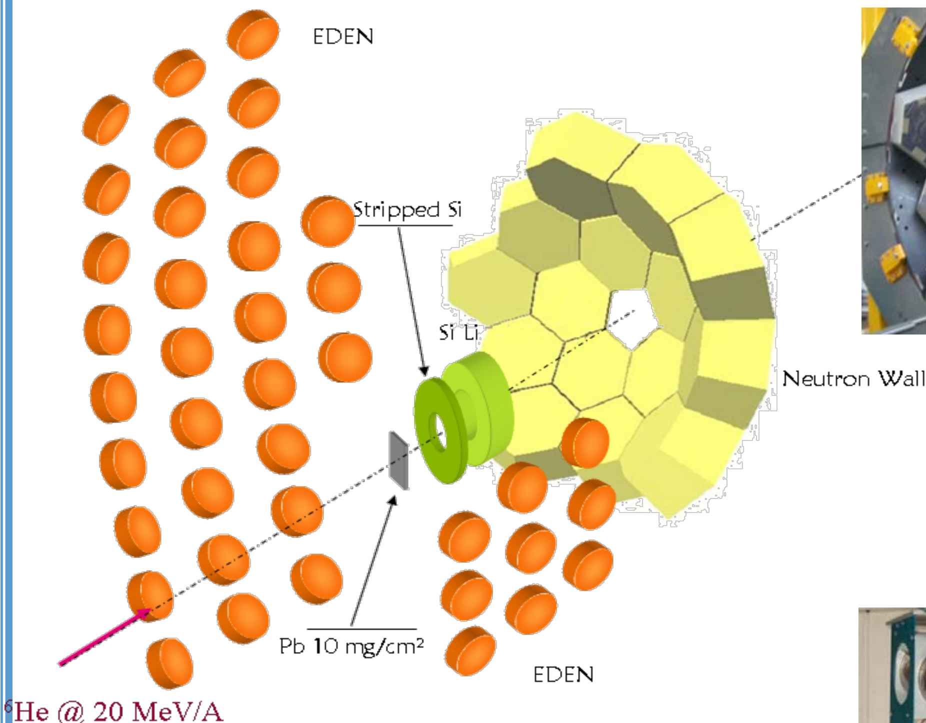
Stripped Si:
- 500 µm
-from 8° à 18°
- 4*16 rings (2mm)
- 4*24 sectors(3,4°)

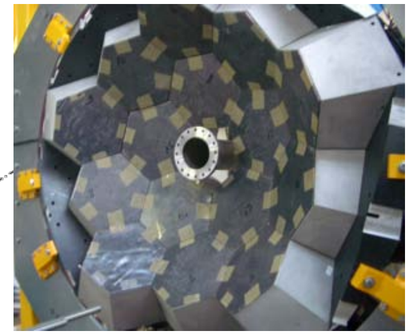


SiLi
-3,4 mmthick



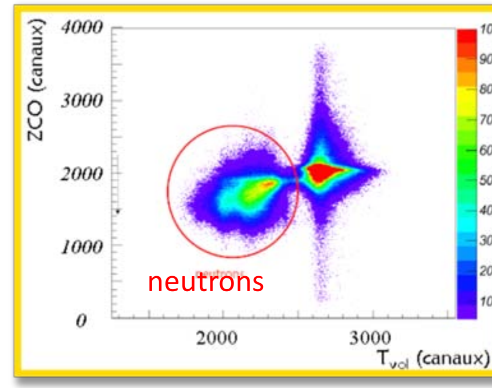
Experimentalset-upat GANIL

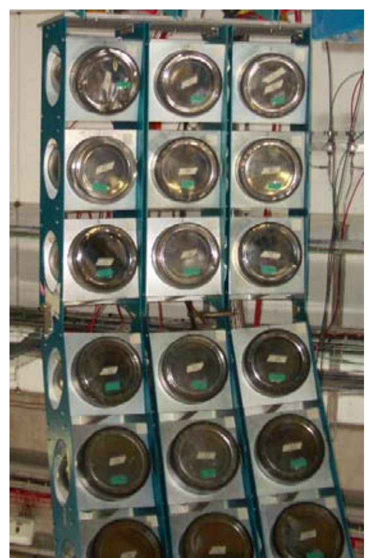




Neutron Wall

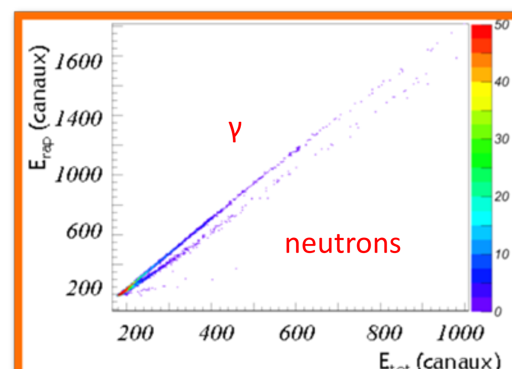
- 45 modules (liquidscintillator)
-51cm fromtarget / 14cm thick
-Energyresolution: 40%
-ε(20 MeV) ≈30%



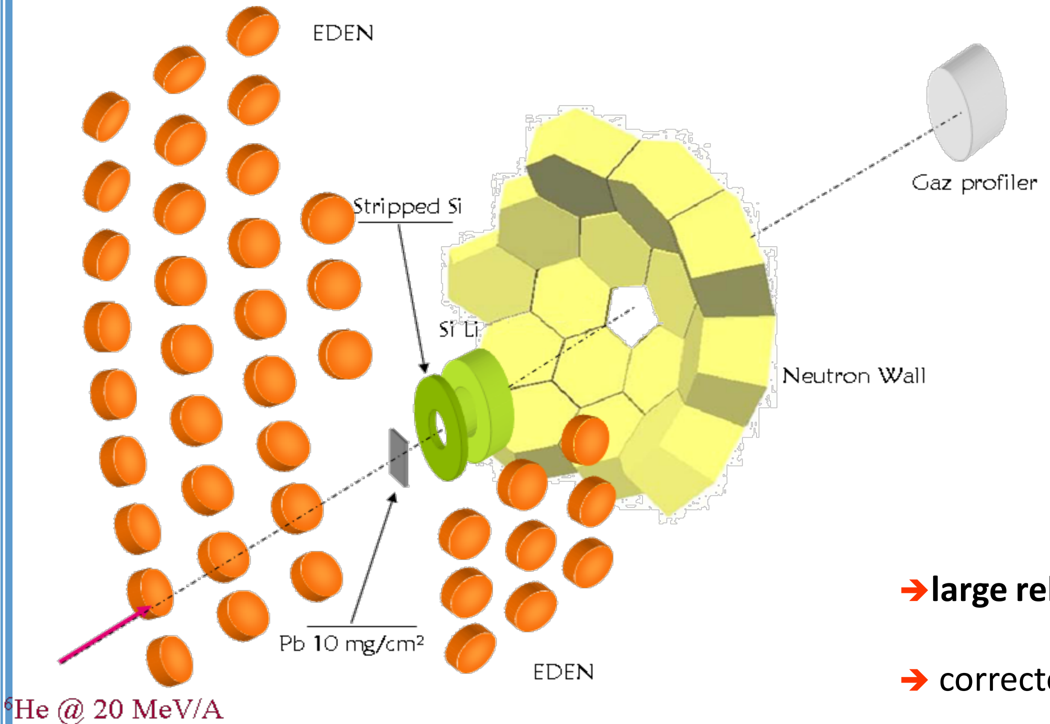


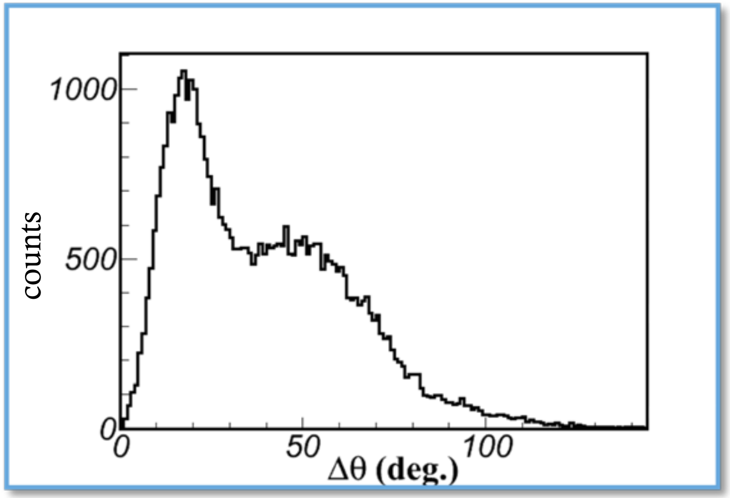
EDEN

- 39 modules (liquidscintillator)
-1,8 mfromtarget/ 5cm thickness
-Energyresolution: 4%
- ε(20 MeV) ≈15%



EXPERIMENTALSET-UPAT GANIL





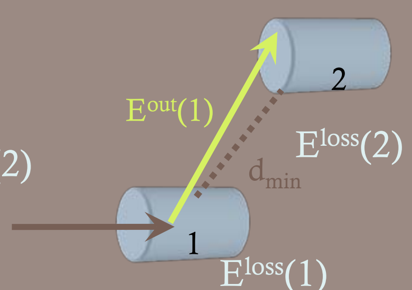
➔ **large relative angle coverage** of experimental set-up

➔ corrected from **crosstalk** contribution

Crosstalk rejection

- $E_{tof} < E^{loss}$
- $E^{out}(1) > E_{min}$

$\& E^{out}(1) > E^{loss}(2)$



- GEANT4 simulation : 20% crosstalk
  4% residualafter rejection

- Test with ^{12}C beam (by selecting ^{10}B) : 20 % de crosstalk
  2 % residual

Correlationfunction

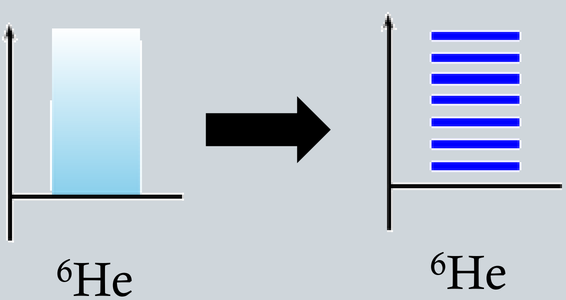
Correlationfunction

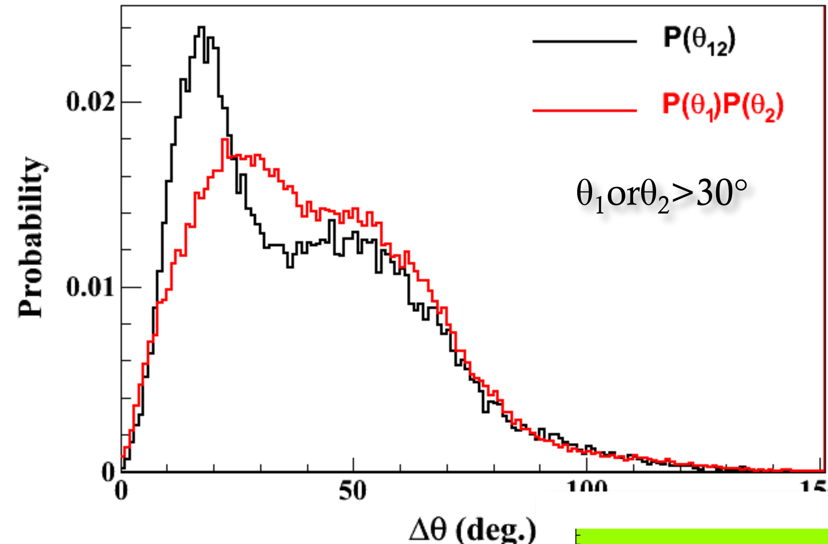
experimental distribution : emission of correlated neutrons

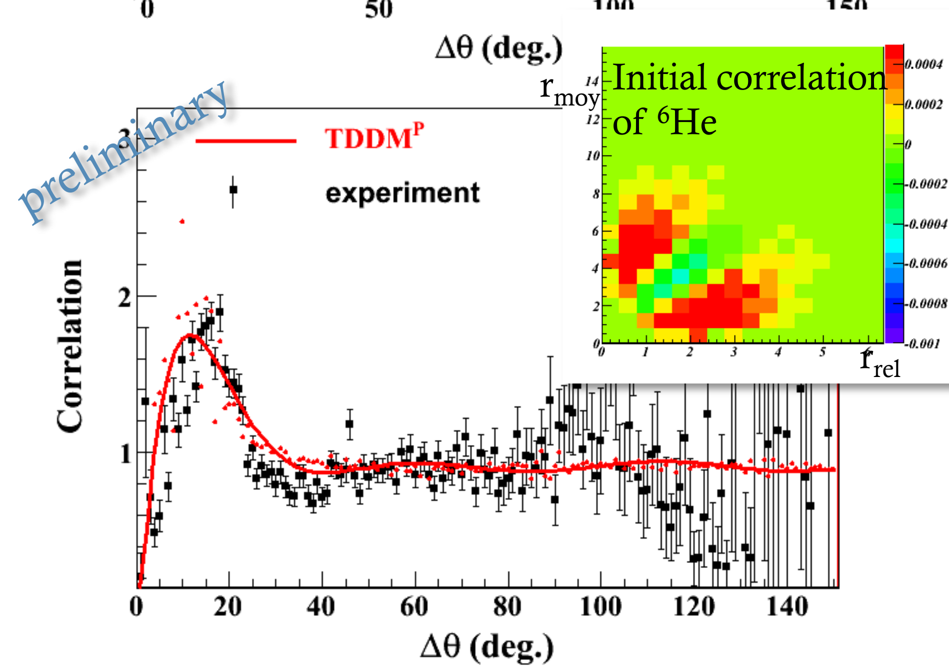
$$C_{12} = \frac{P(n_1, n_2)}{P(n_1)\, P(n_2)}$$

independentemission

4-body CDCC calculations in progress
M. Rodriguez-Gallardo (PRC 72 2008)

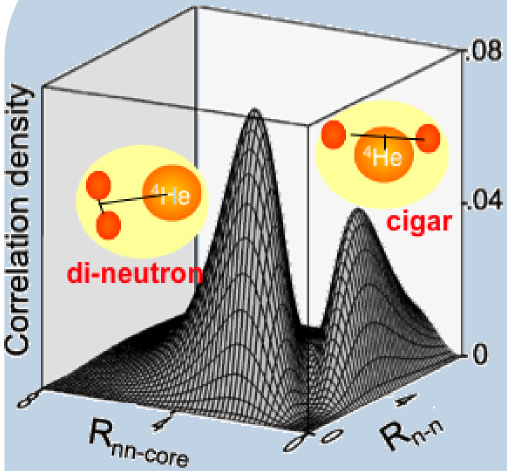






Assié, Scarpaciet al, EPJA 2009

THE ^{6}LI CASE

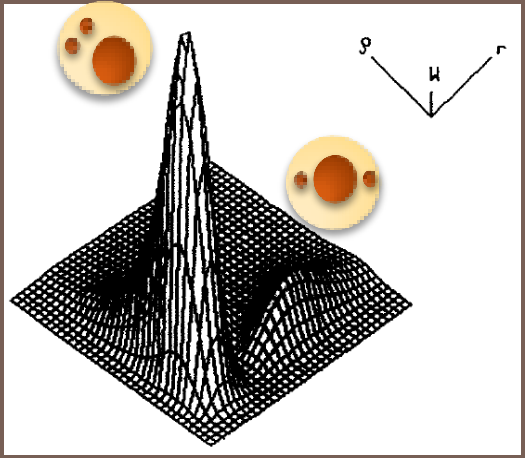


E_1=0.875 MeV

T=1 2+ 1.797MeV

T=1 0+ g.s

g.s J=1+, T=0



S_α=1.47 MeV

N=Z=3

T=0 2+ 4.3 MeV

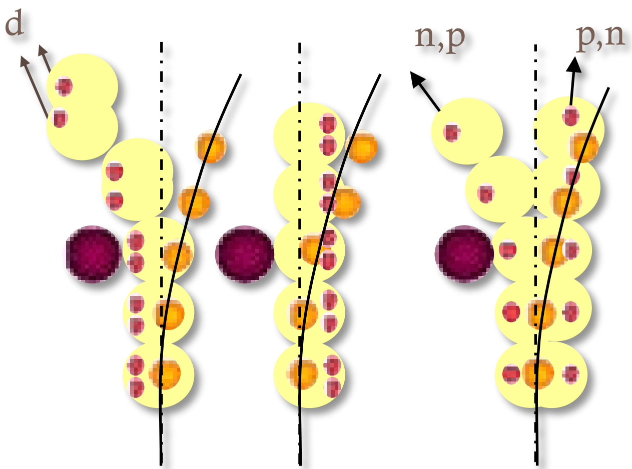
T=1 0+ 3.56 MeV

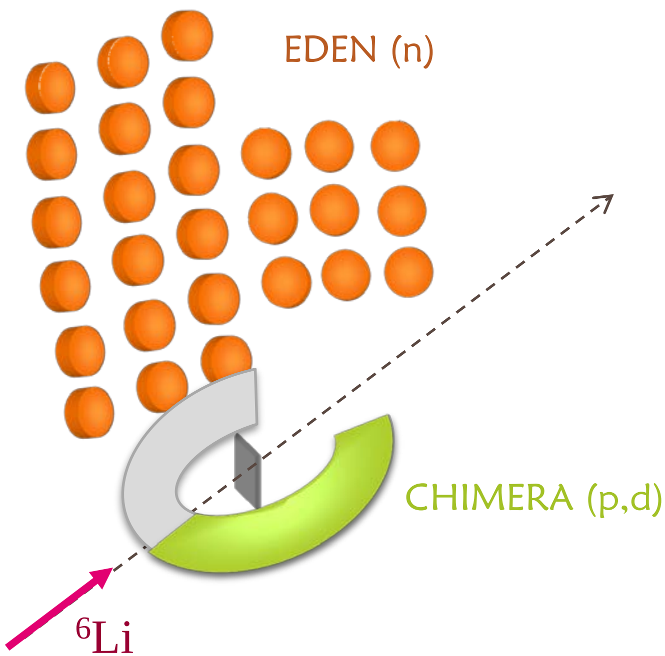
T=0 3+ 2.186 MeV

T=0 1+ g.s

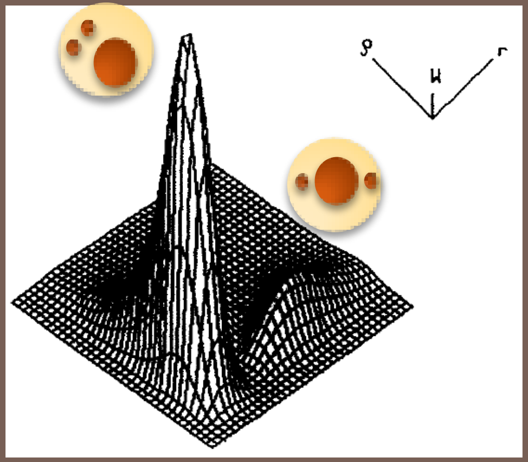
V.I. Kukulin, NPA (1995)

THE ^{6}Li CASE





g.s J=1+, T=0



S_{α}=1.47 MeV

N=Z=3

V.I. Kukulin, NPA (1995)

Theoretical support :

- 3-body CDCC (α+d)
- 4-body CDCC (α+p+n)