Neutron correlations in the continuum of core+4n systems

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for the R3B Collaboration

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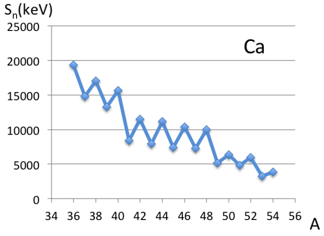
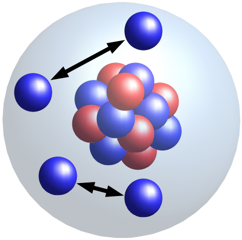
Motivation

- Pairing correlations play essential role in atomic nuclei and in neutron stars
  - oscillations in S_n values
  - enhanced pair transfer

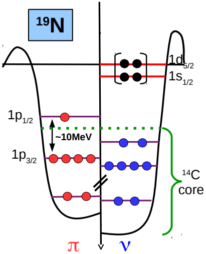


- Pairing scheme towards the drip-line ?
  - Study n-n correlations in various systems (core+xn, haloes, drip-line nuclei...)
  - Decay modes and spectroscopy of intermediate states
  - Correlation functions of the pairs
  - Average distance r_{nn} between neutrons



- Possible tetra neutron correlations
  - role in describing superfluidity in nuclei ?
  - first hints at GANIL and RIKEN

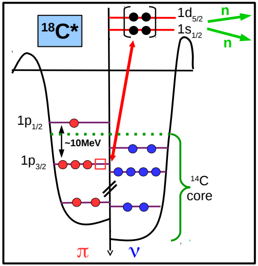
Neutron correlations in isotones - ^{18}C & ^{20}O



-1p

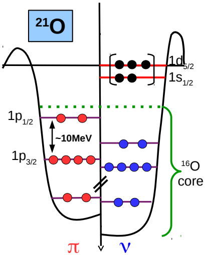
$\longrightarrow$

($\simeq$ 400 MeV/u)

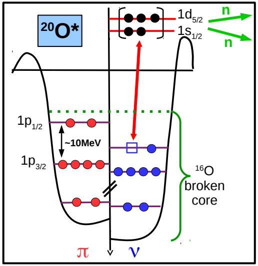


- High energy proton knock-out (p,2p)
  $\rightarrow$Quasi-free reaction
- Deeply bound proton
  $\rightarrow$Promote neutrons into the continuum
- Neutron correlations unaffected by proton knock-out
- Deduce correlations from subsequent decay patterns

Neutron correlations in isotones - ^{18}C & ^{20}O

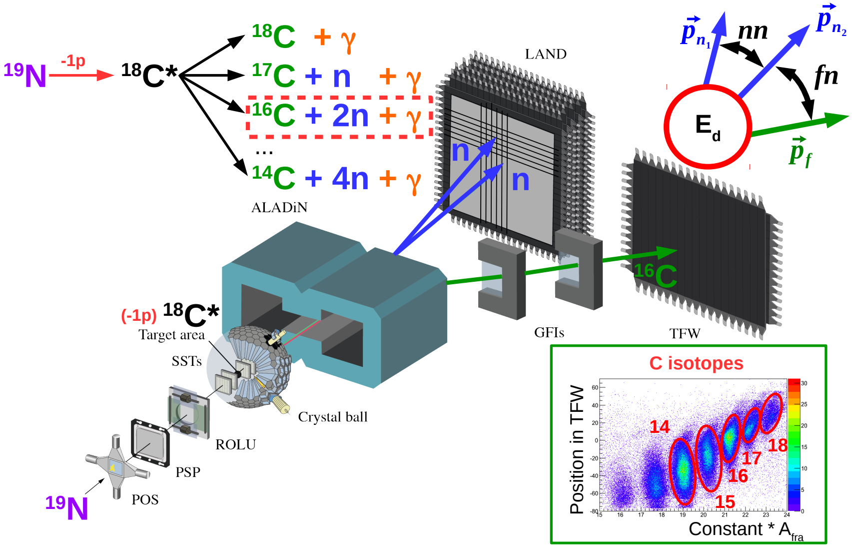


-1n
⟶
($\simeq$ 400 MeV/u)

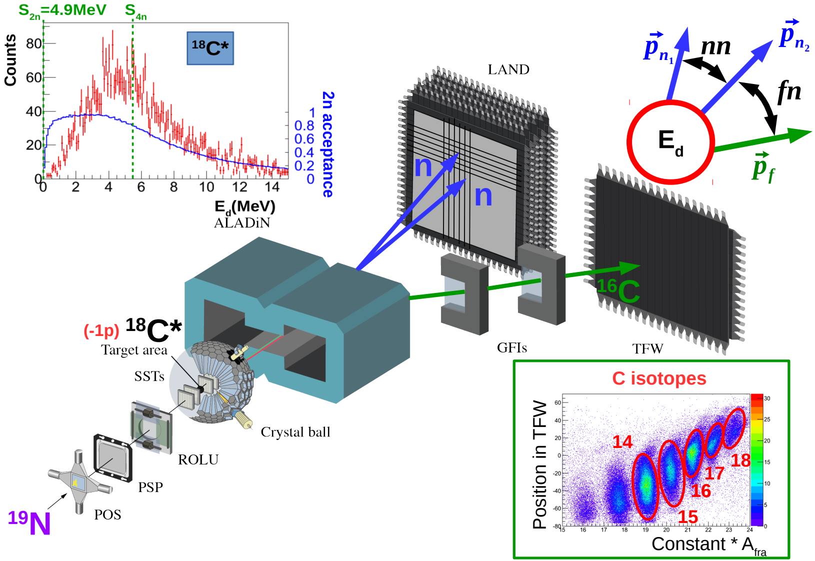


- High energy neutron knock-out (p,pn)
  →Quasi-free reaction
- Deeply bound neutron
  →Promote neutrons into the continuum
- Neutron correlations likely affected by neutron knock-out
- Qualitative/quantitative differences between ^{20}O and ^{18}C isotones?

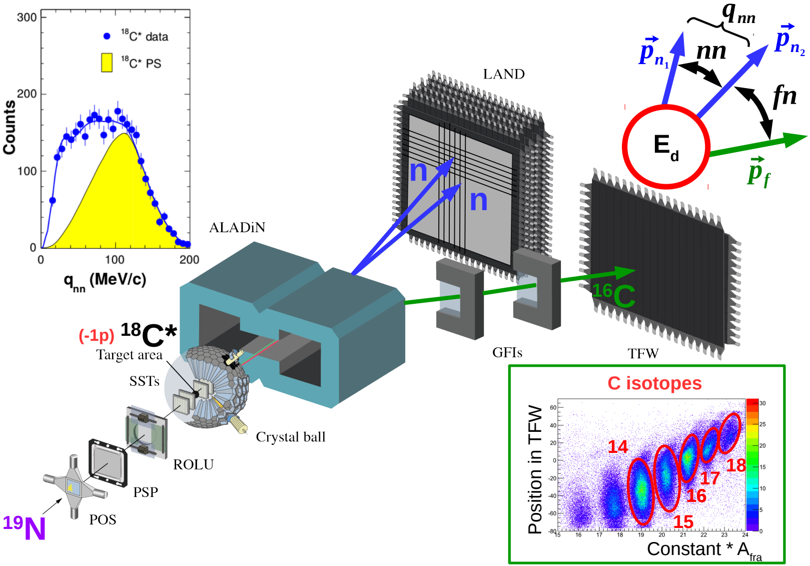
GSI : Setup and principle



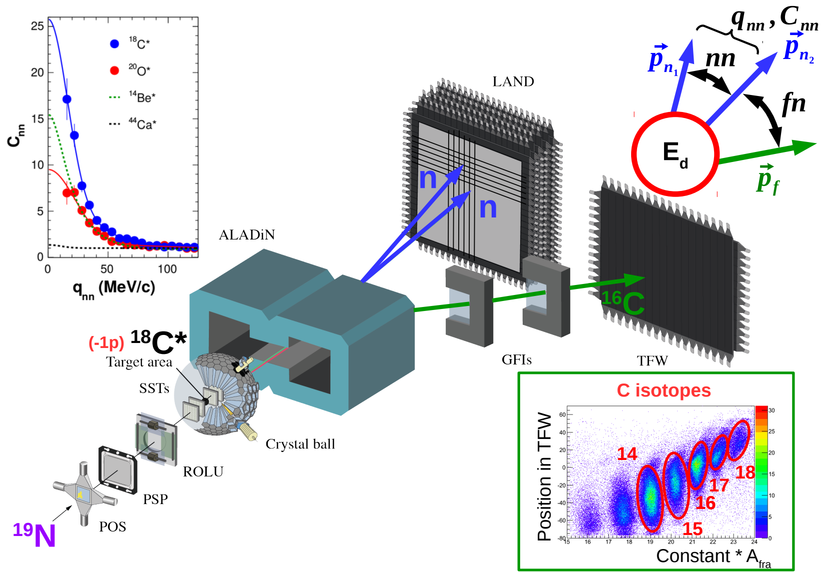
Decay energy (E_d)



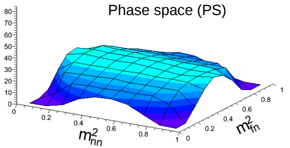
Relative momentum distribution (q_{nn})

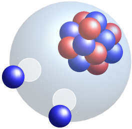


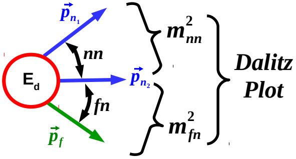
n-n correlation function (C_{nn})



Dalitz plots & correlations (MC Simulations)







[1] Lednicky&Lyuboshits, SJNP 35 (1982) 770

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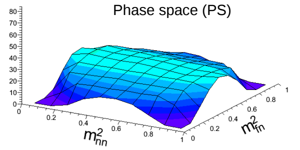

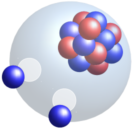

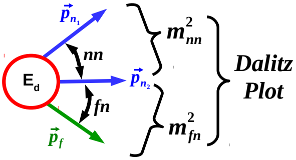

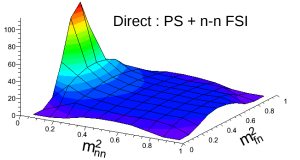

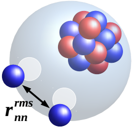

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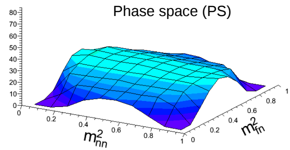

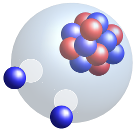

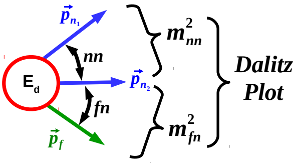

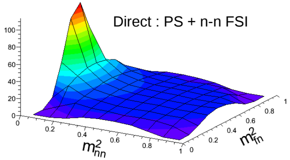

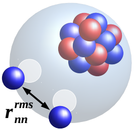

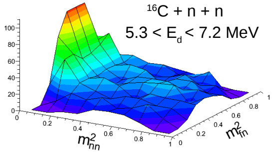

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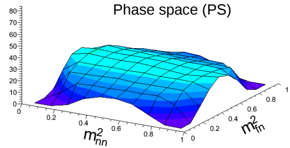

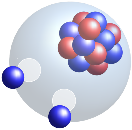

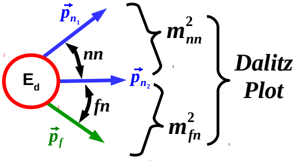

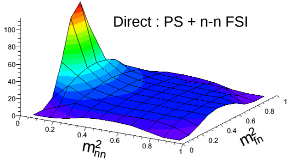

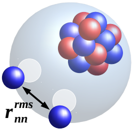

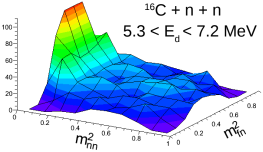

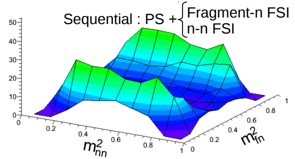

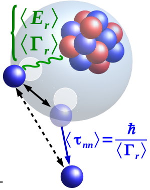

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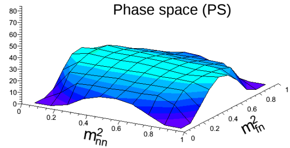

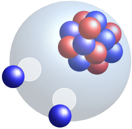

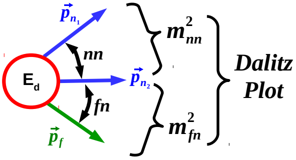

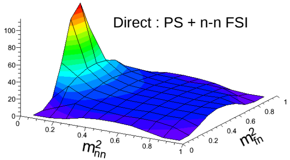

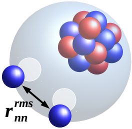

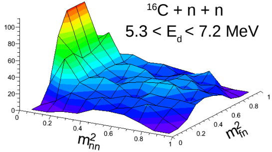

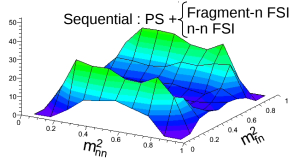

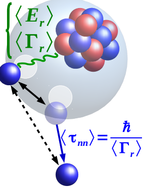

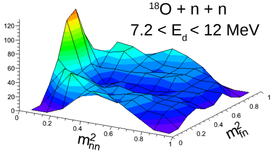

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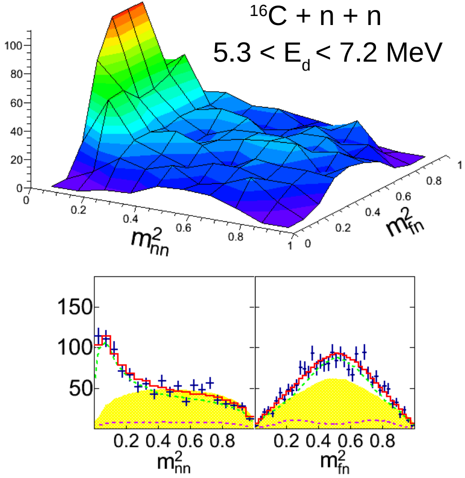
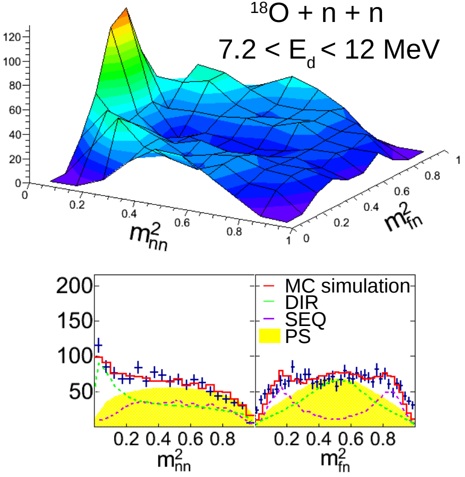
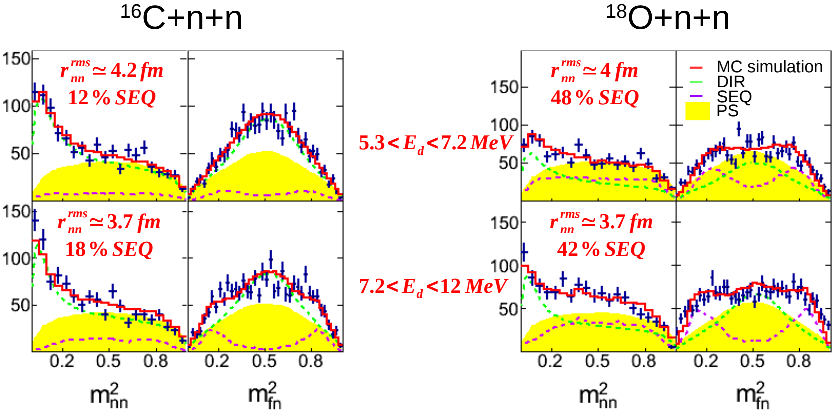
How is E_d shared between the three particles?





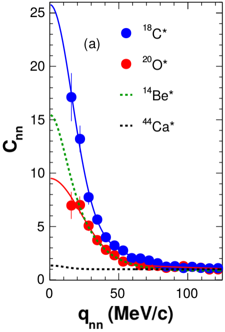
Results summary

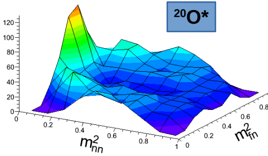


- ^{18}C* enhanced pairing : 85% direct emission
- ^{20}O* inhibited pairing : 50% sequential emission
- Neutron source size of the order of A=18-20 liquid drop

Conclusion & Perspectives

- n-n pairing in neighboring isotones
- ^{18}C* strongest correlations observed :
  - Due to (core+4n) configuration ?
- Difference between ^{18}C* and ^{20}O* :
  - Influence of reaction mechanism ?





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Coming next...

- Evolution of r_{nn}, C_{nn} and m^2_{nn} toward the drip-line
- Explore core+4n correlations with NeuLAND
- Build a bridge between experiment and theory