

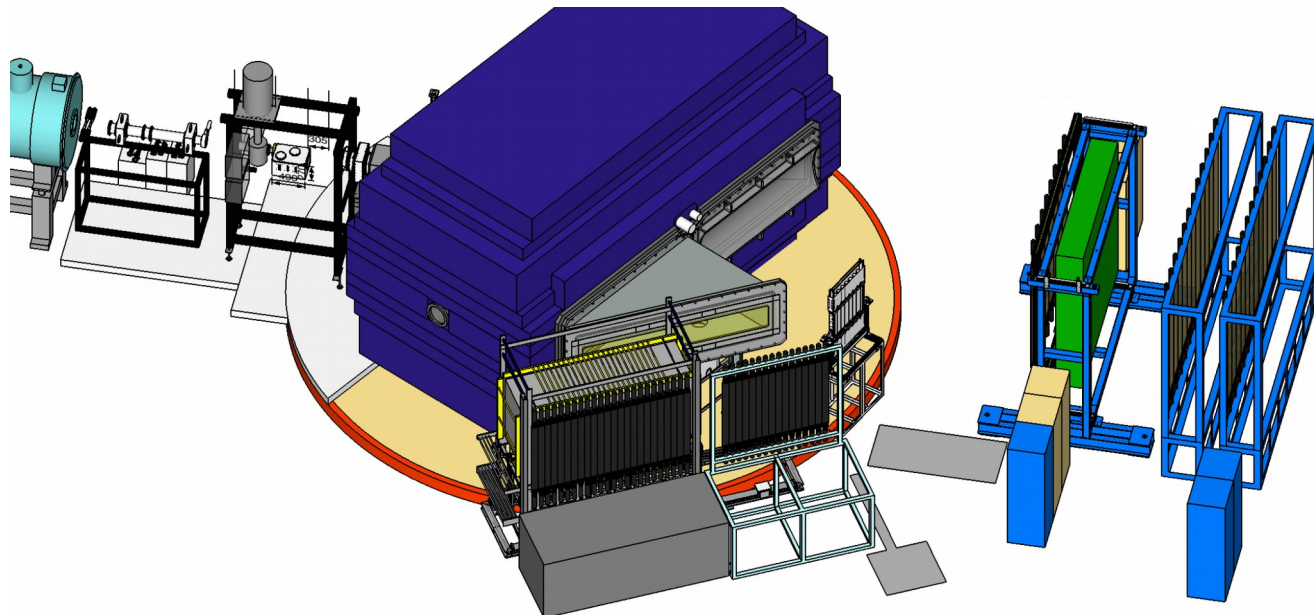
Low-energy dipole response of the halo nuclei ${}^6,{}^8\text{He}$

A05: Clustering in nuclei: Halo nuclei and alpha clustering



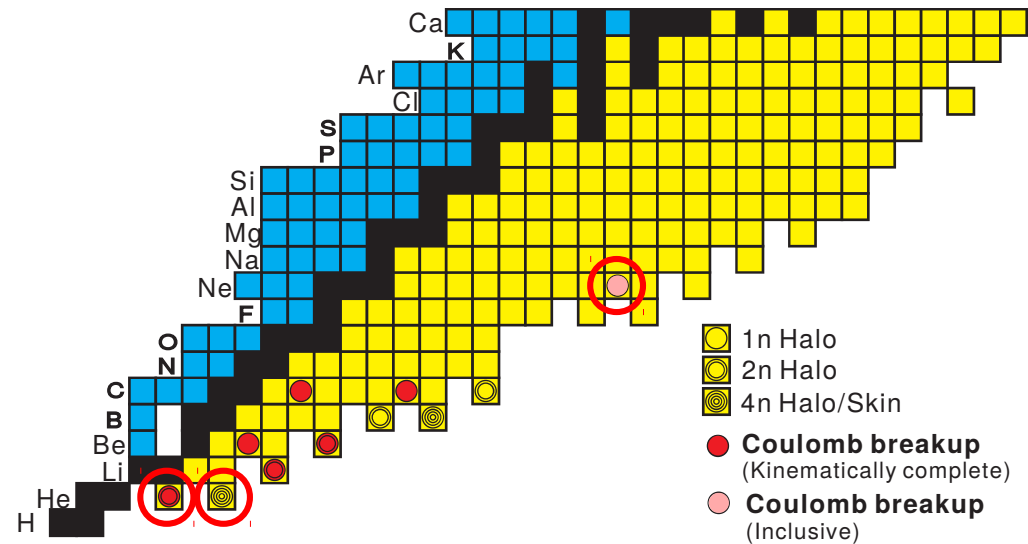
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SFB Workshop, Mainz-Budenheim
Christopher Lehr, 04.10.2017



Motivation

- Enhanced electric dipole response at low excitation energies in halo systems
- Investigate low-energy dipole response of ${}^6\text{He}$ and ${}^8\text{He}$ after Coulomb excitation
- 2- and 4-neutron halo nuclei with alpha plus 2n and 4n structure
- Measure differential cross section via invariant-mass method
- Extract dipole-strength distribution $\text{dB}(E1)/\text{dE}$

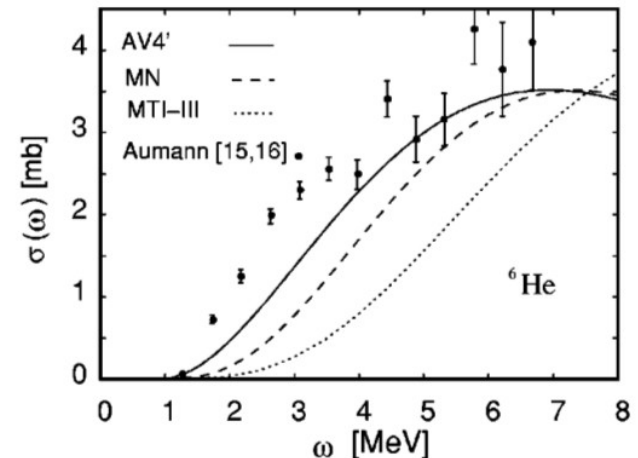
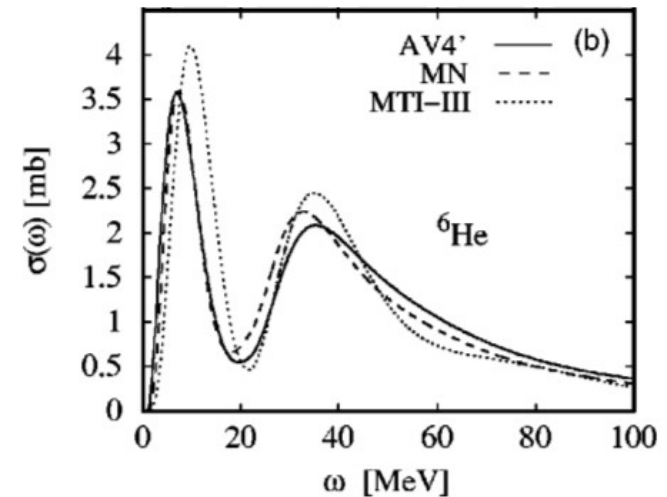


Picture taken from T. Aumann and T. Nakamura, *Phys. Scr. T152 (2013) 014012 (27pp)*

${}^6\text{He}$



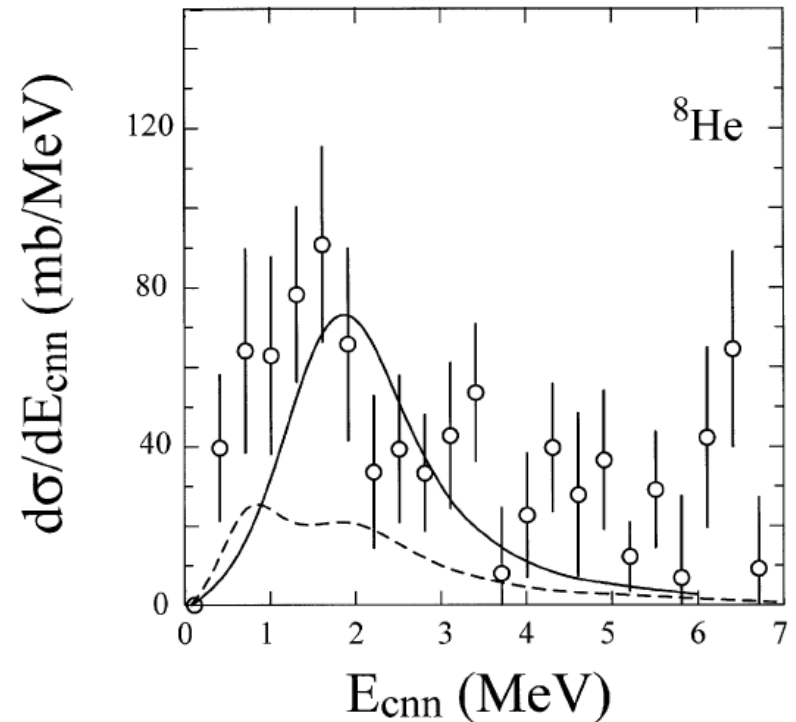
- So far, experimental data only up to 7 MeV (Aumann et al., Phys. Rev. C 59 (1999) 1252)
- Extend dipole-strength distribution up to 15 MeV
- New data to compare to theory and ${}^8\text{He}$
- ${}^6\text{He}$ as good test candidate for models of soft E1 excitation in 2n halos
- $B(E1)$ gives insight in n-n-correlations in ${}^6\text{He}$ ground state



Pictures taken from S. Bacca et al., Phys. Rev. C 69 (2004) 057001

^8He

- Decay after electric dipole excitation via two- and four-neutron emission
- Challenging: 4n channel: identification and extraction of individual momentum
- Only 2n channel measured by Meister et al., Nucl. Phys. A 700 (2002) 3
- Good statistics needed up to 15 MeV → only possible at RIKEN with NeuLAND + Nebula
- Observe possible genuine soft-dipole mode
- Correlations: possible alpha + tetraneutron component



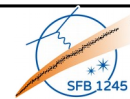
Picture taken from M. Meister et al., Nucl. Phys. A 700 (2002) 3

^{18}O Campaign



Beam-time schedule

Proposal Number	Experiment Leader	Course	Particle	Energy (MeV/u)	Intensity	Time Frame (days)	start-time	end-time	June														July														
									20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
RIBF (SRC)									Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	
NP1406 -SAMURAI19R1 -01	Dominic ROSSI	SAMURAI	^{18}O	220	500 pA	8	6/24 9:00	7/2 9:00							^{18}O Beam Accrlation (3days)	BTU																					
NP1512 -SAMURAI37 -01	Thomas AUMANN	SAMURAI	^{18}O	220	300 pA	5.5	7/3 9:00	7/8 21:00																													
NP1512 -SAMURAI34 -01	Miguel MARQUES	SAMURAI	^{18}O	220	500(max) pA	6	7/8 21:00	7/14 21:00																													



^{18}O Campaign



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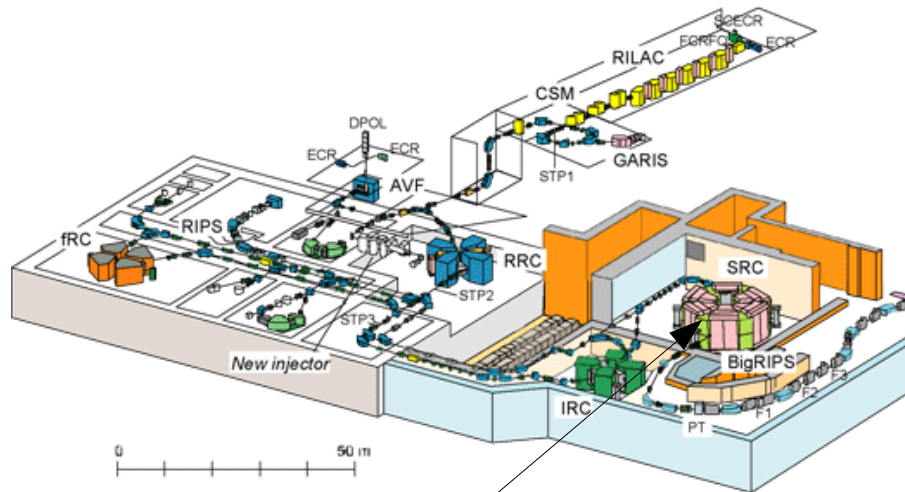
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A06: see next talk by
F. Schindler
"Tetraneutron"

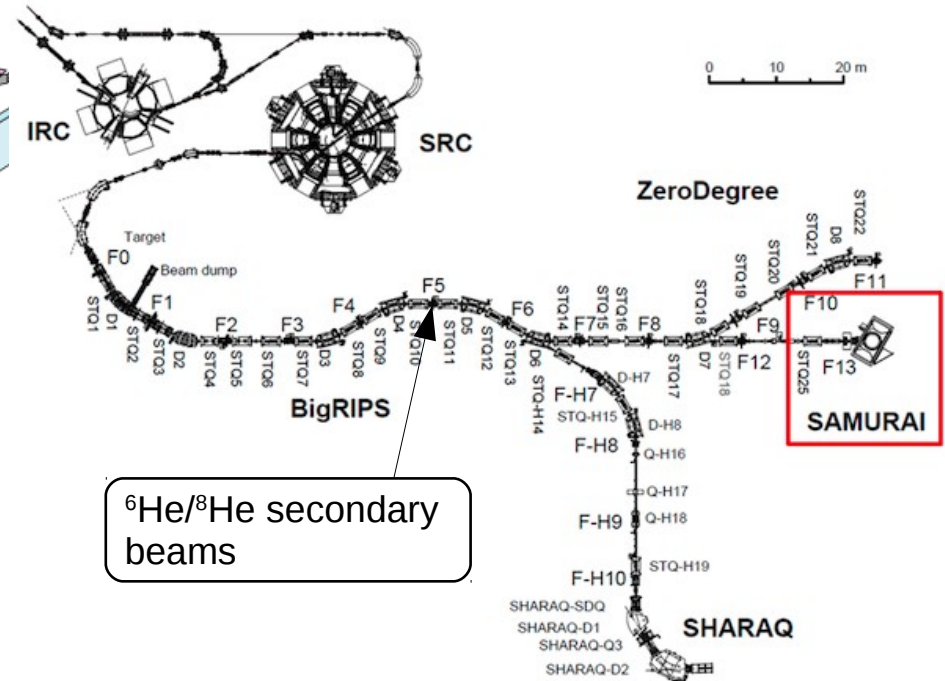
A05: see next slides

Experiment at RIKEN



^{18}O primary beam
@ 220 A MeV

Experiment carried out in
June/July 2017 at RIBF



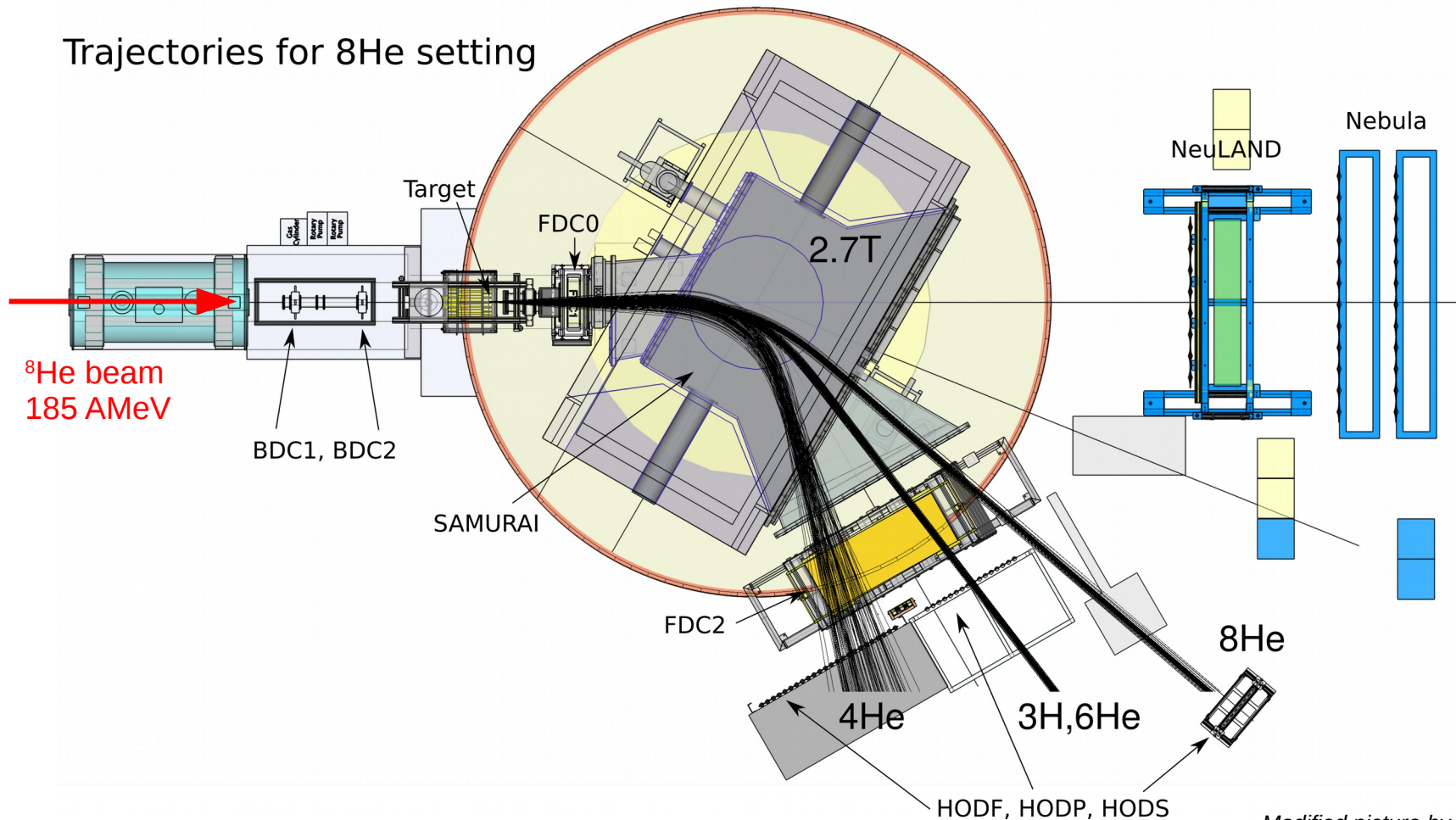
$^6\text{He}/^8\text{He}$ secondary
beams

The SAMURAI setup



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Trajectories for 8He setting



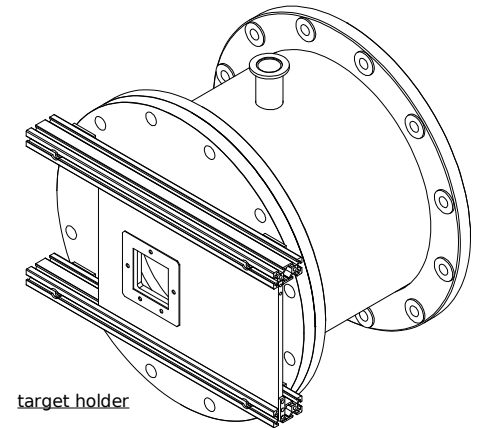
Modified picture by V. Panin

Targets

Nuclear contribution usually determined by carbon target measurement

→ Use several targets to get precise information

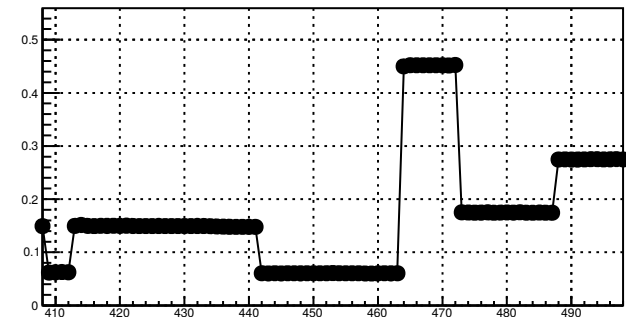
Target	^8He setting – target thickness (g/cm 2)	^6He setting – target thickness (g/cm 2)
Pb	3.16	1.52
Sn	2.92	1.09
Ti	3.12	1.35
C	2.37	1.10
CH $_2$	/	1.1
Empty	0	0



target holder

Picture by A. Saito

Trigger 4 rate (beam x hodf x nebula) in %



Latest Progress

- Experiment was a great success
- Data under analysis...

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Thank you for your attention!