Physics with Exotic Nuclei and Exotic Atoms at Relativistic Energies

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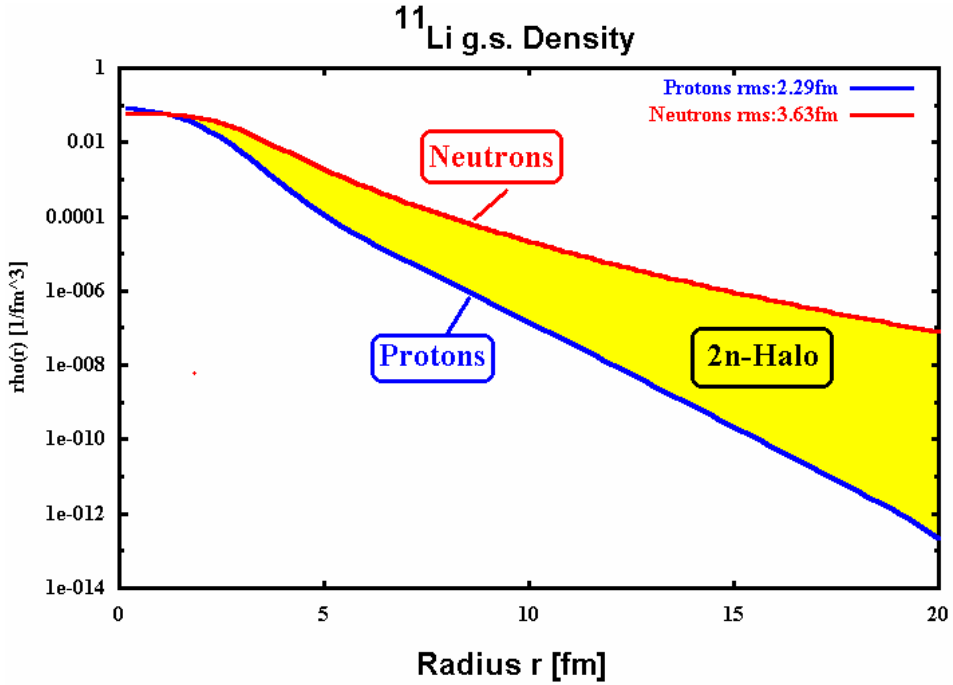
Euroschool Valencia, September 2003

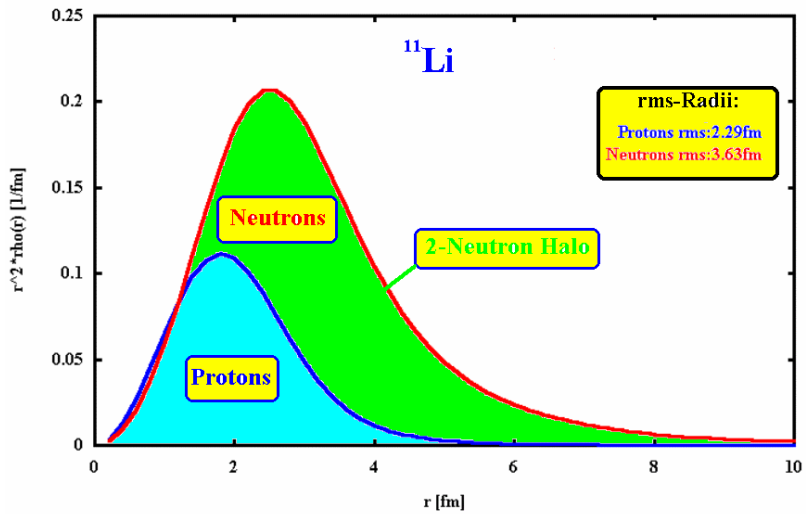
- Introduction √
- Momentum Measurements, Ion Optics, Spectrometers √
- Atomic Interaction of Heavy Ions √
- Exotic Atoms √
- Production and Separation of Exotic Nuclei √
- **Halo and Skin Nuclei**

^{11}Li : Continuum HFB g.s. Densities

g.s. Densities :



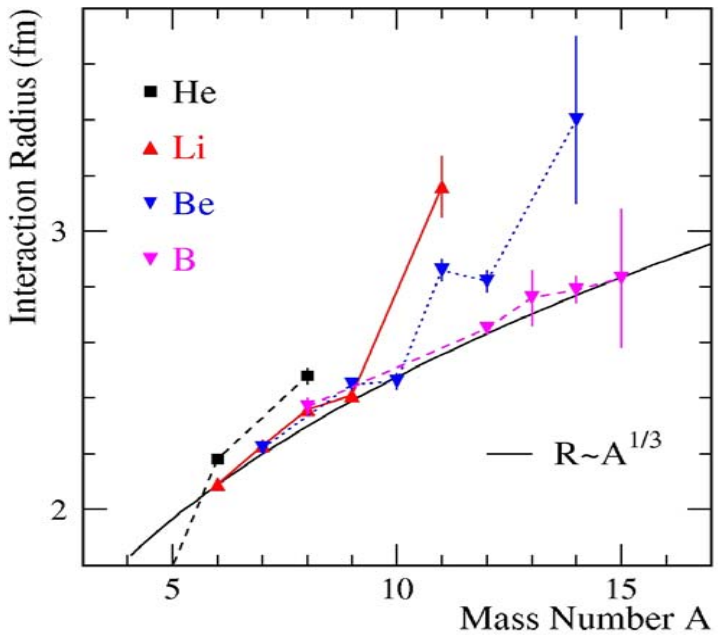
g.s. Densities $\times$ r^2 :



H. Lenske

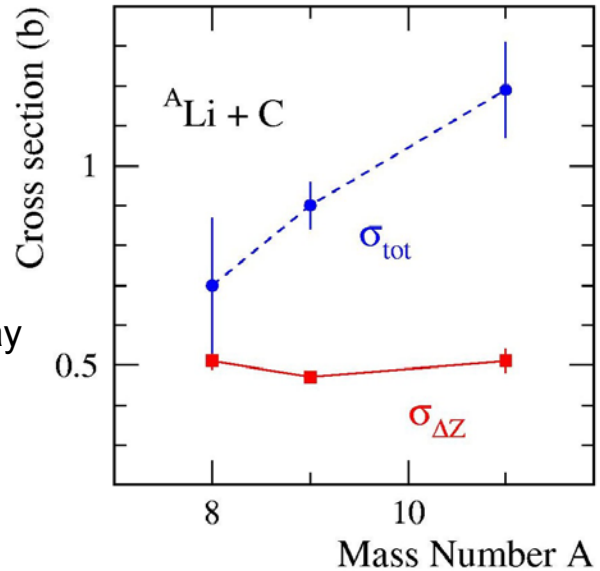
Discovery of the Neutron Halo in Light Dripline Nuclei

Interaction Radii extracted from Interaction cross section measurements



Bevalac@LBL, I. Tanihata et al.,
PRL 55 (1985) 2676, PLB 206 (1988) 592

Charge-changing cross sections



SATURNE@Saclay
B. Blank et al.,
Z.Phys. A 343
(1992) 375

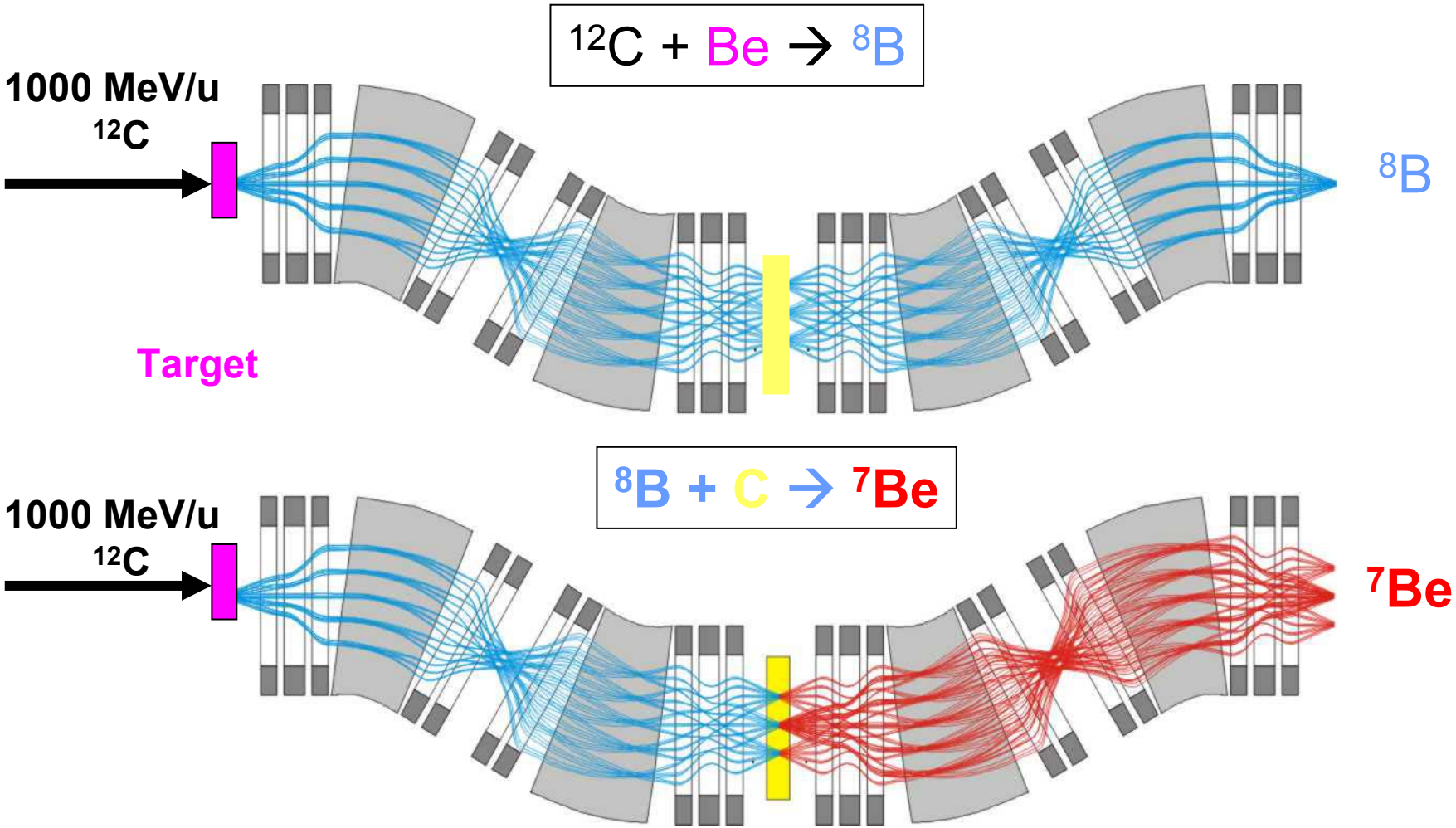
Quadrupole moments

$Q(^{11}Li) \approx Q(^{9}Li)$

ISOLDE@CERN,
E. Arnold et al., Phys.
Lett. B 281 (1992) 16

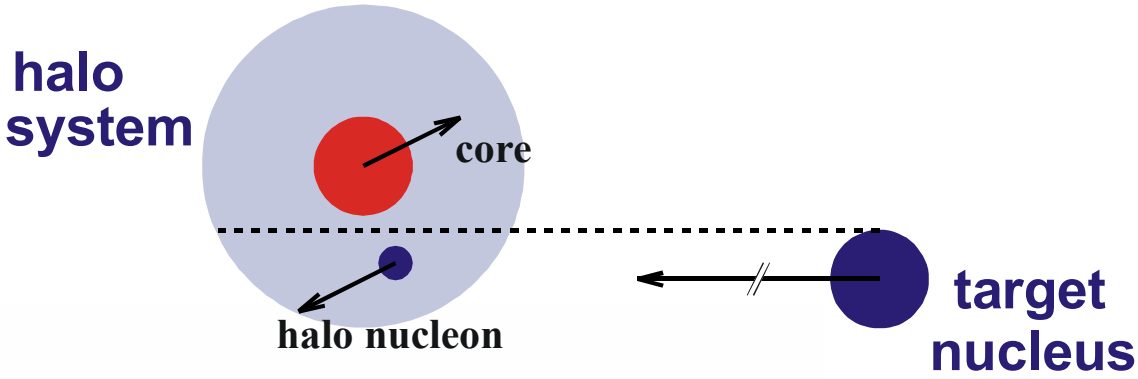
$\Rightarrow$ Large neutron tail (Halo)

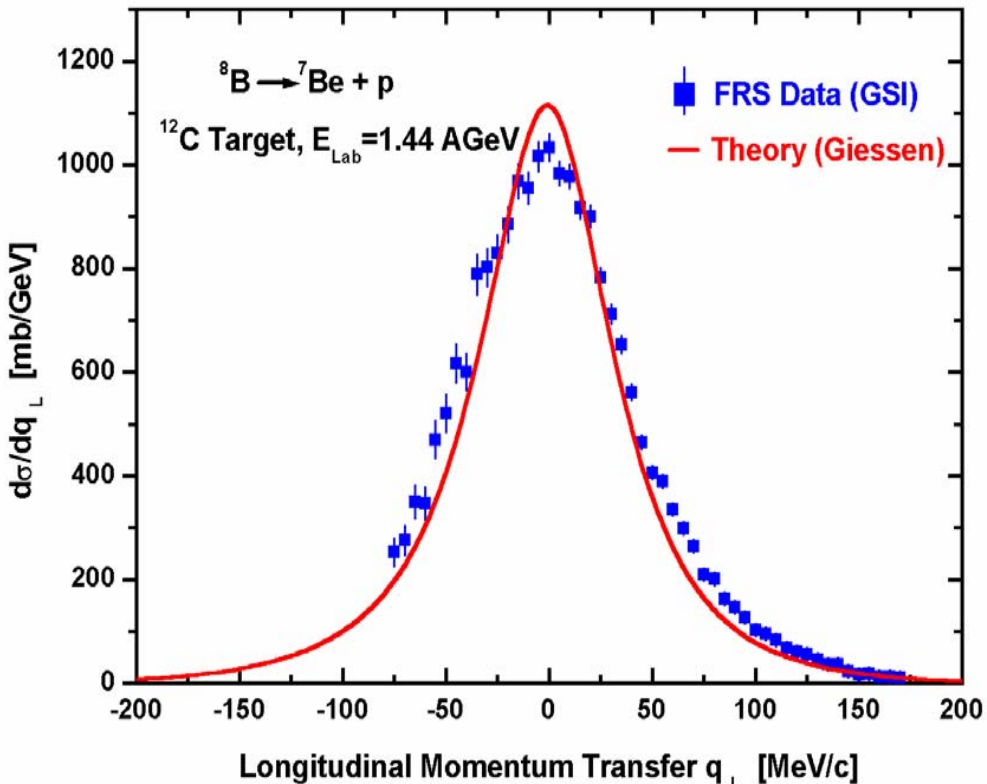
Precise Momentum Measurements reveal Nuclear Structure



W. Schwab et al., Z. Phys. A350 (1995) 283

Discovery of the Proton Halo in ^{8}B

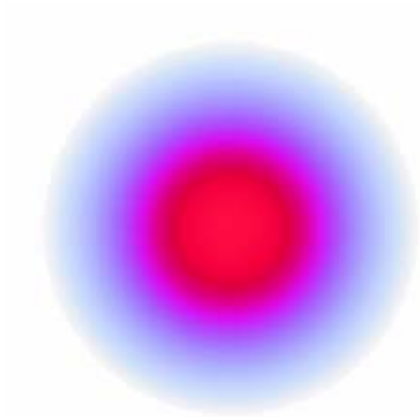


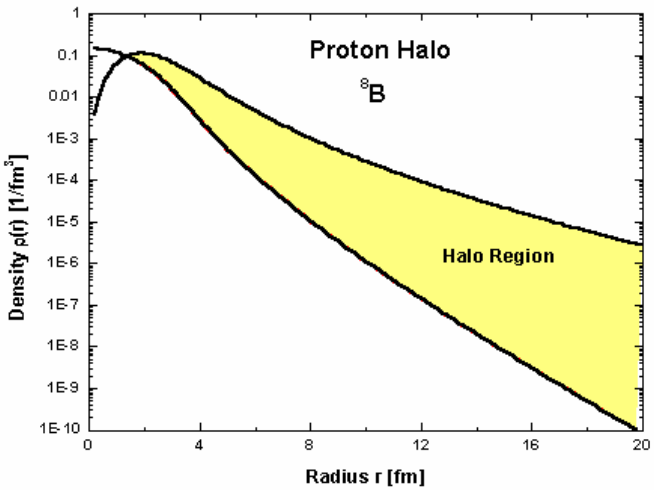


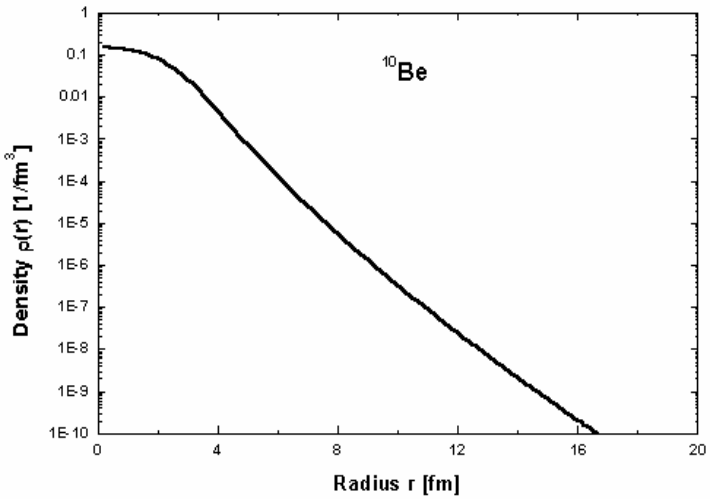
W. Schwab et al.,
Z.Phys. A350 (1995) 283
; H. Lenske,
Prog. Part. Nucl. Phys. 46 (2001)

Discovery of the Proton Halo in ^{8}B with FRS

Experiment GSI — Theory Uni. Giessen, Z. Phys. A350 (1995) 283

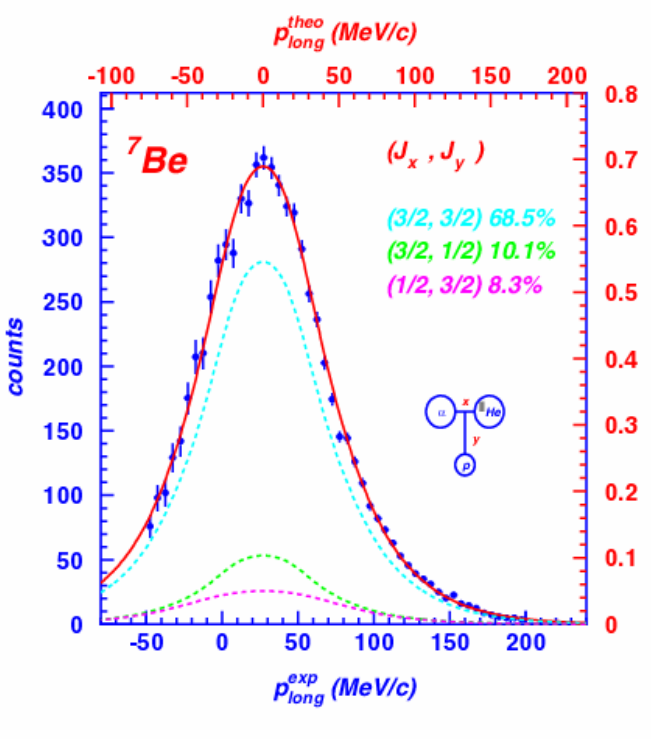






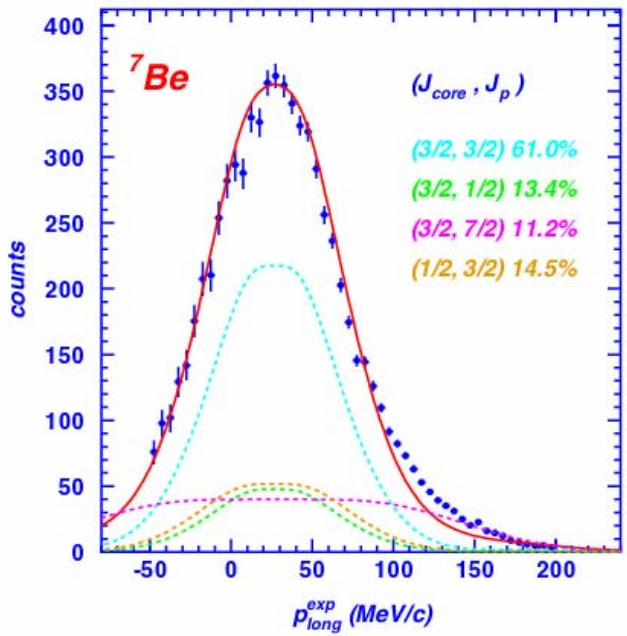
Experiment and Models

Cluster Model
(Goetheborg)



^{7}Be(3/2-,0.0) p3/2: 69%
^{7}Be(3/2-,0.0) p1/2: 10%
^{7}Be(1/2-,0.420) p3/2: 8%

Mean-Field & RPA
(Giessen)



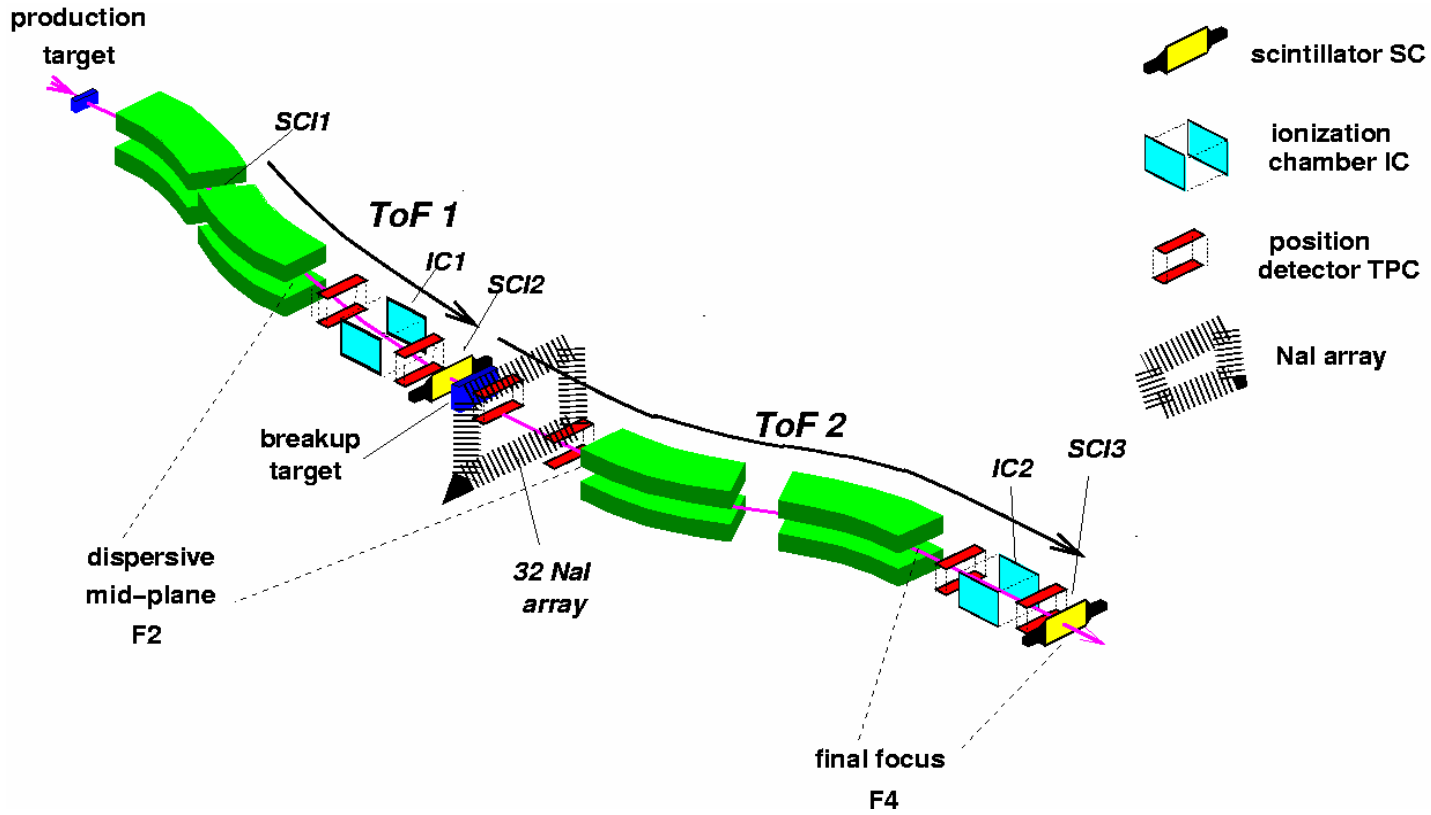
^{7}Be(3/2-,0.0) p3/2: 71%
^{7}Be(3/2-,0.0) p1/2: 13%
^{7}Be(3/2-,0.0) f 7/2: 11%
^{7}Be(1/2-,0.420) p3/2: 15%

^{8}B(2+,g.s.): a confirmed Proton-Halo Nucleus

EXPERIMENTAL SETUP

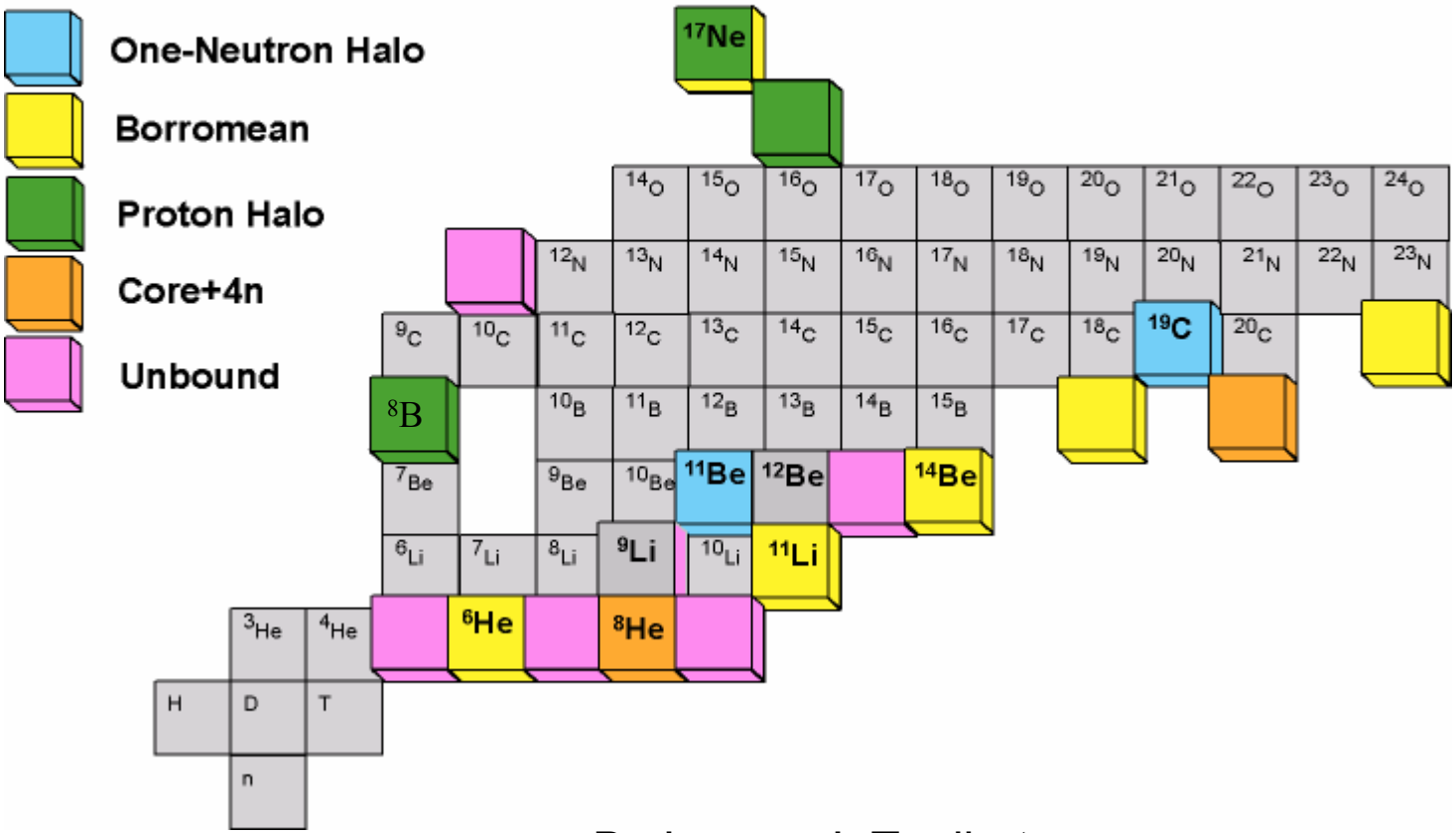
^{12}C (1. 10 ^{8} p/spill)

J. Fernandez, Student Presentation 3



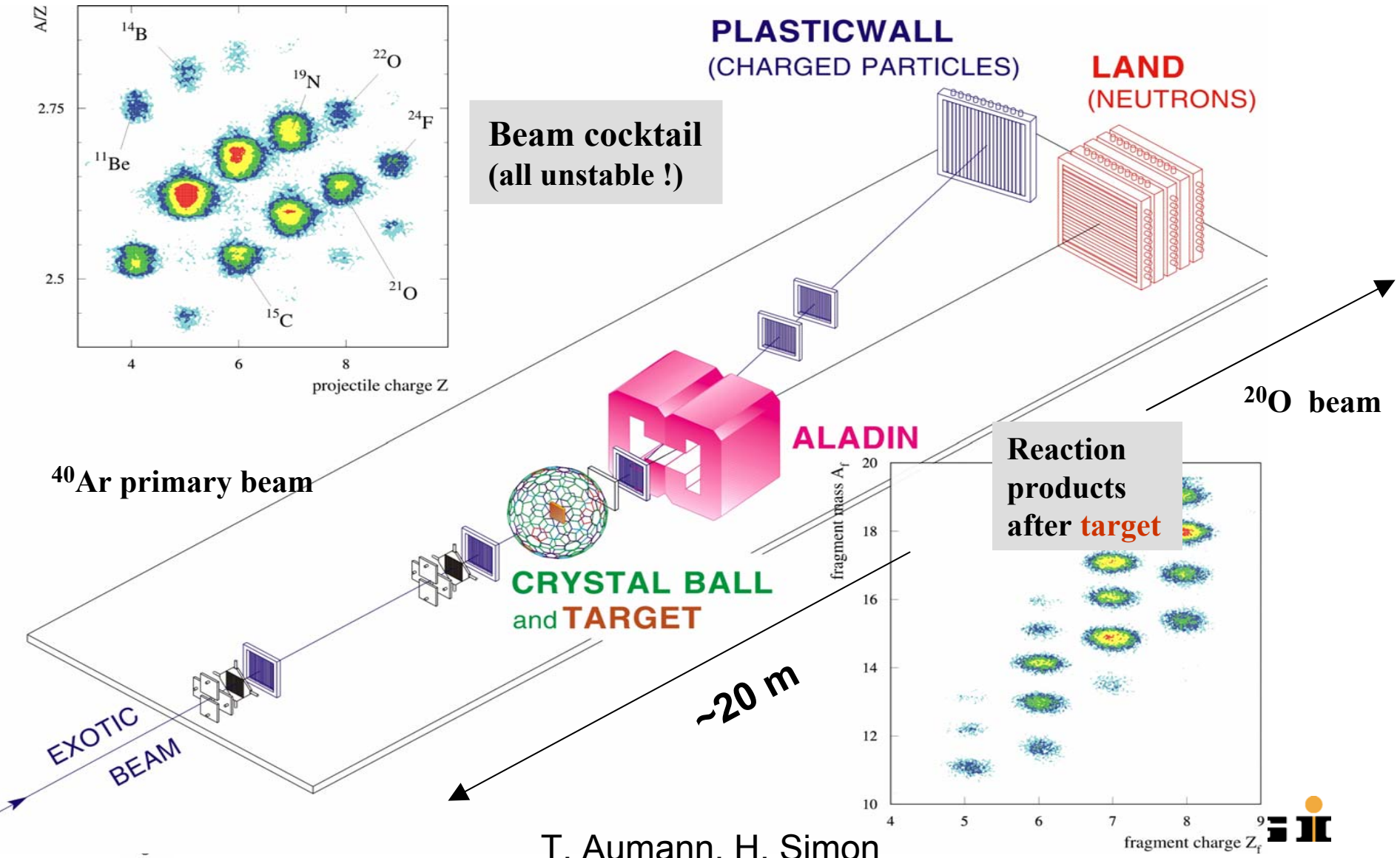
D. Cortina-Gil et al., Phys. Lett. B259 (2002) 36

Halo Nuclei at the Driplines



B. Jonson, I. Tanihata

Experimental Setup: LAND, ALADIN



T. Aumann, H. Simon