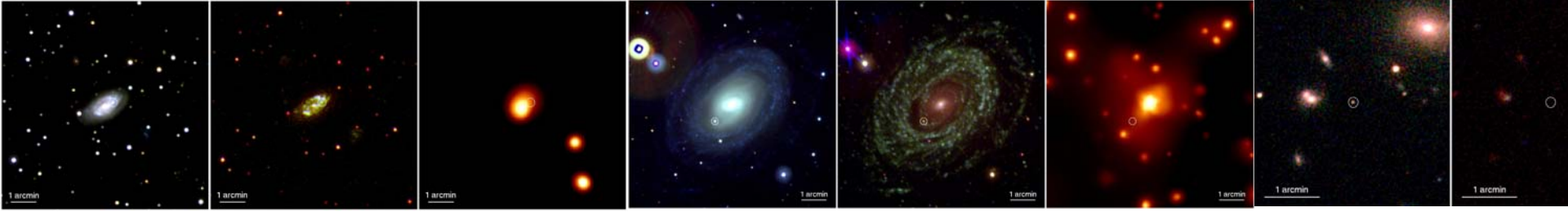
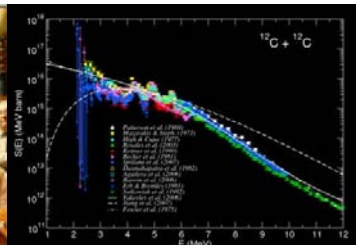
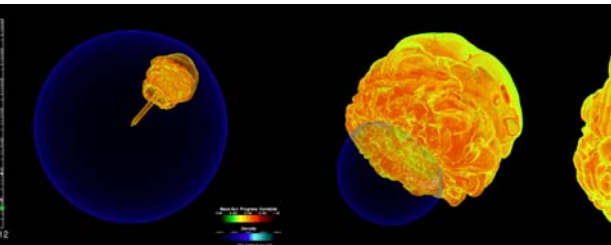


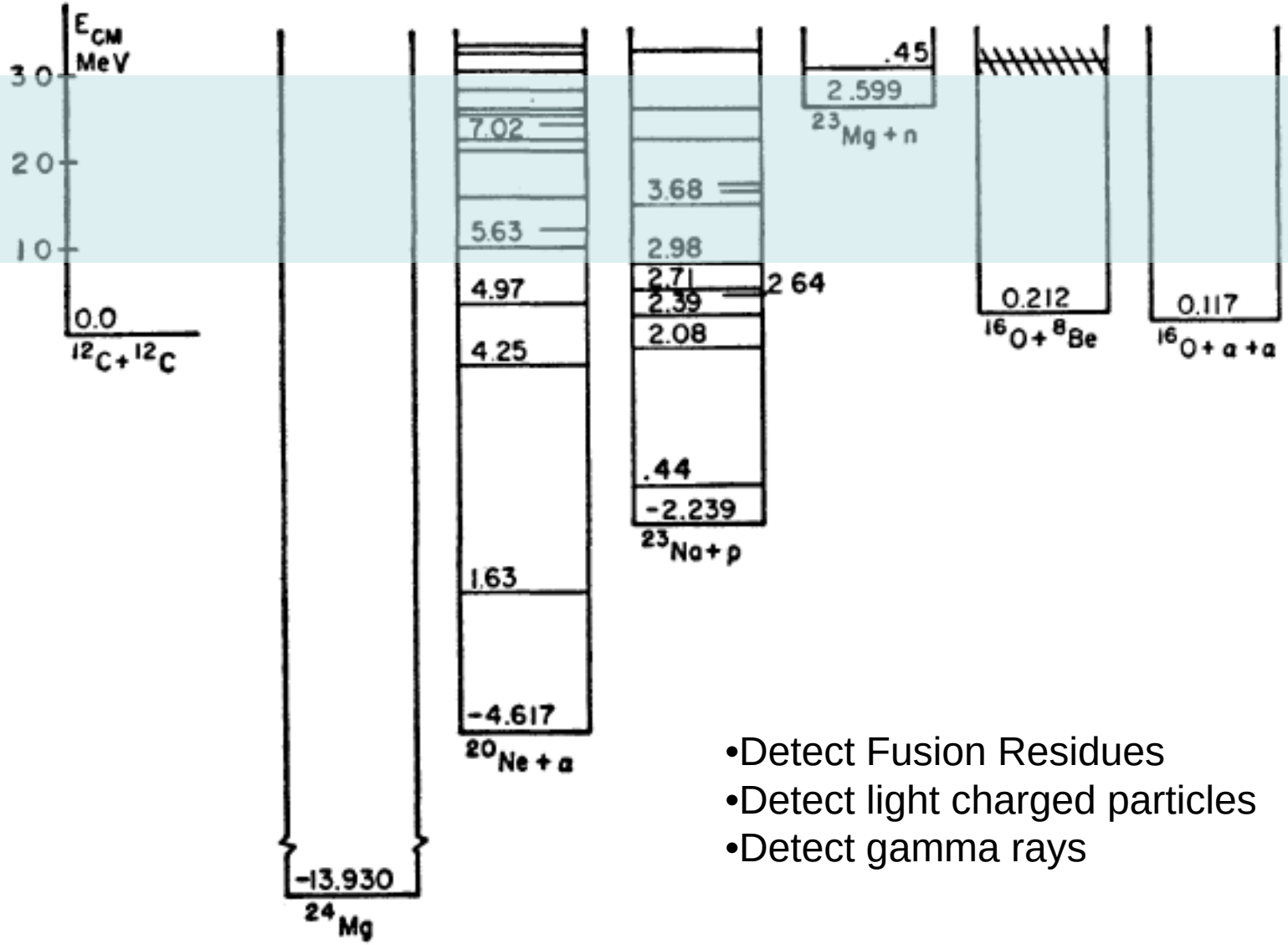
Carbon Burning in the Universe and the Laboratory

X. Tang

University of Notre Dame

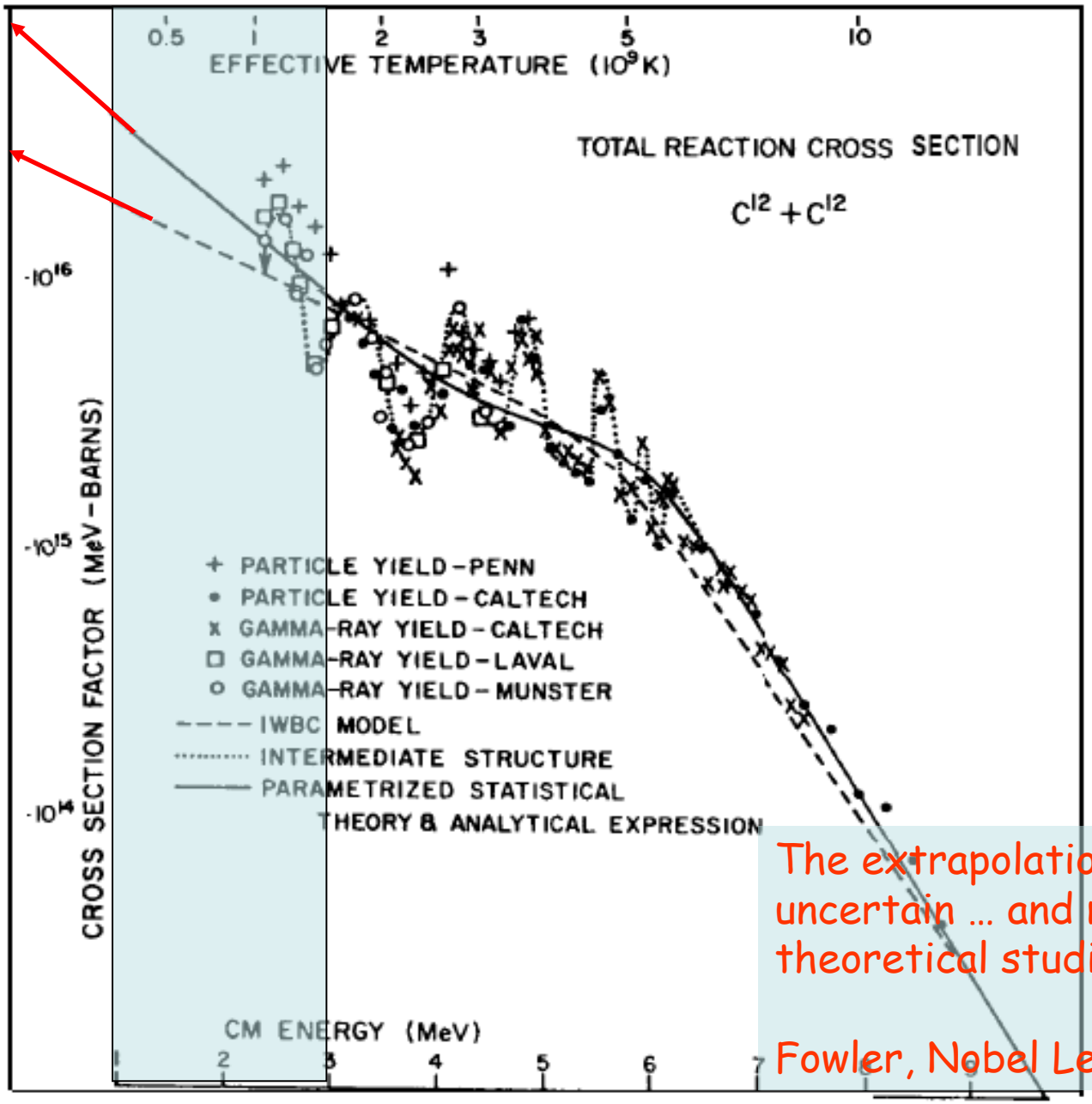


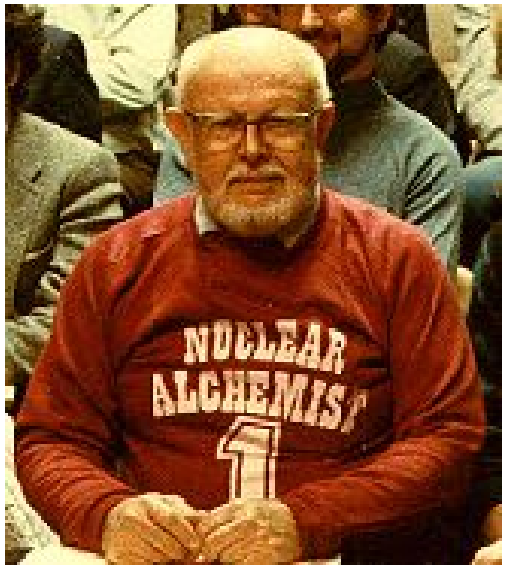




- Detect Fusion Residues
- Detect light charged particles
- Detect gamma rays

FIG. 1.—The $^{12}C + ^{12}C$ system and its decay modes

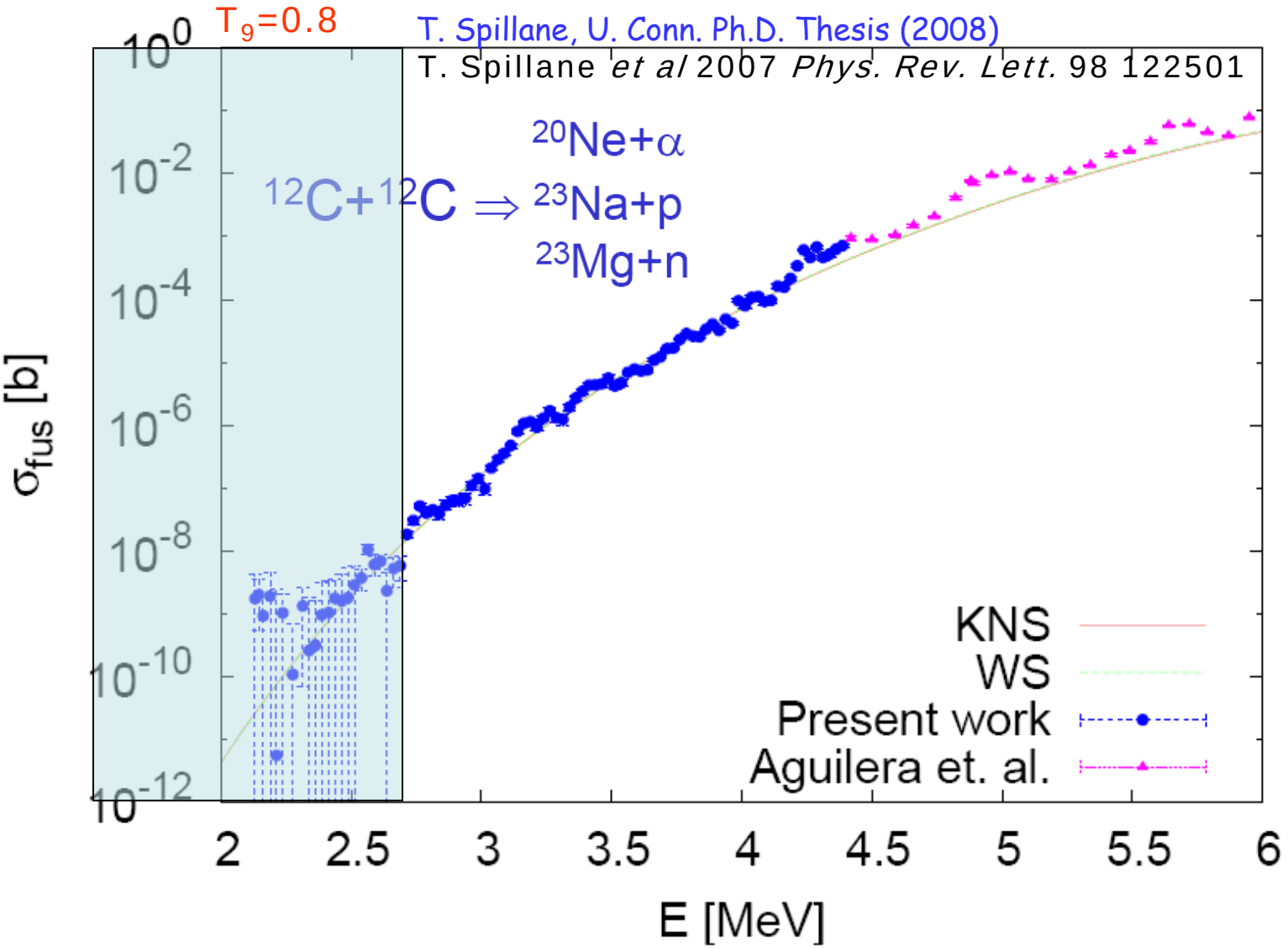




The extrapolation to low energy is uncertain … and more experimental and theoretical studies are urgently needed.

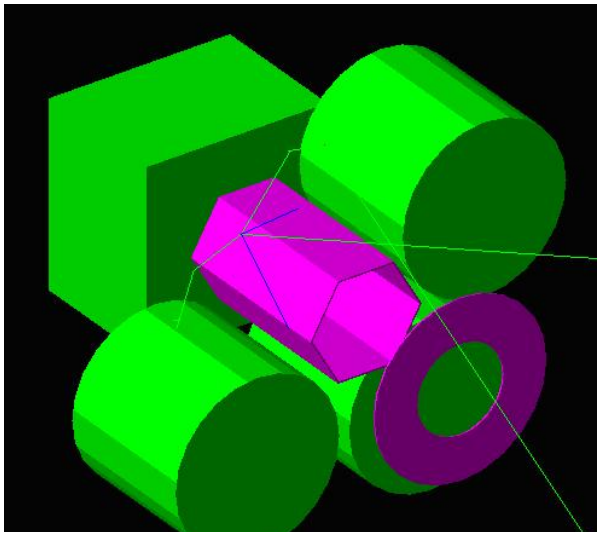
Fowler, Nobel Lecture (1983)

C. A. Barnes, P.193, *Essays in Nuclear Astrophysics (1982)*



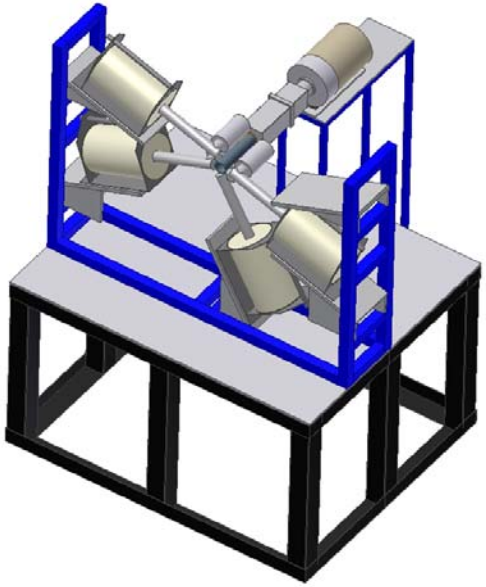
1) How to extrapolate average cross section?
2) Are there any resonances around Gamow window?
3) What are the branching ratios for p, n and alpha?

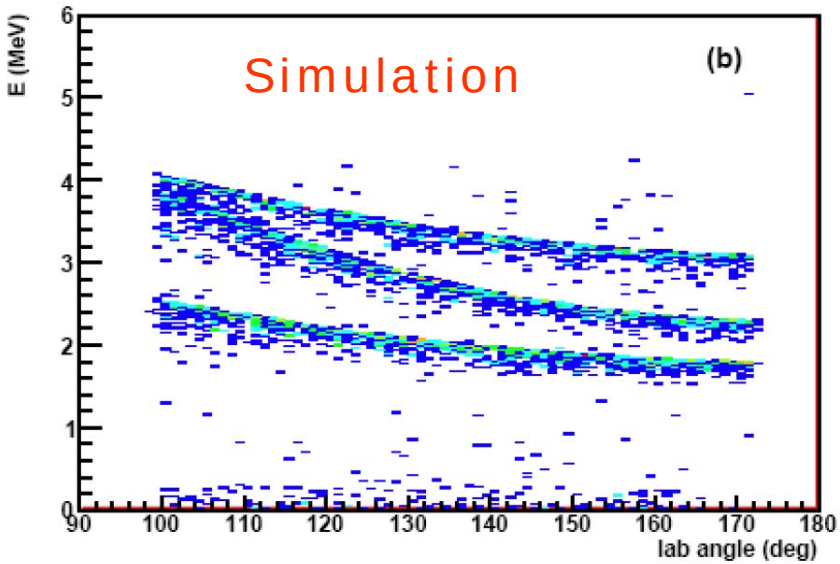
Particle-gamma dectection



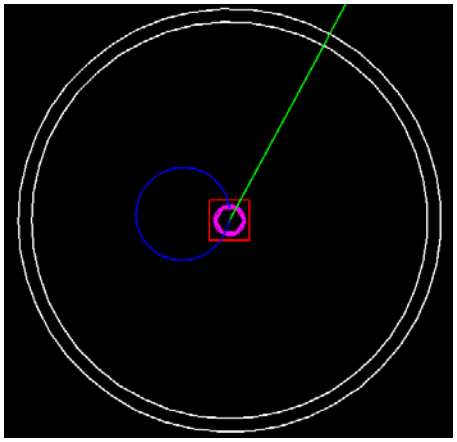
Magenta: Silicon detector array
Green: GEORGINA Ge array

Particle efficiency: 30%
Gamma peak efficiency: 20%

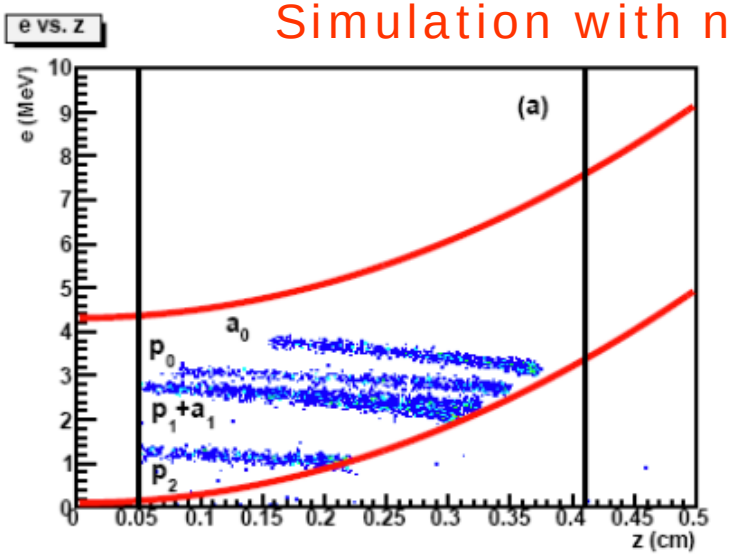


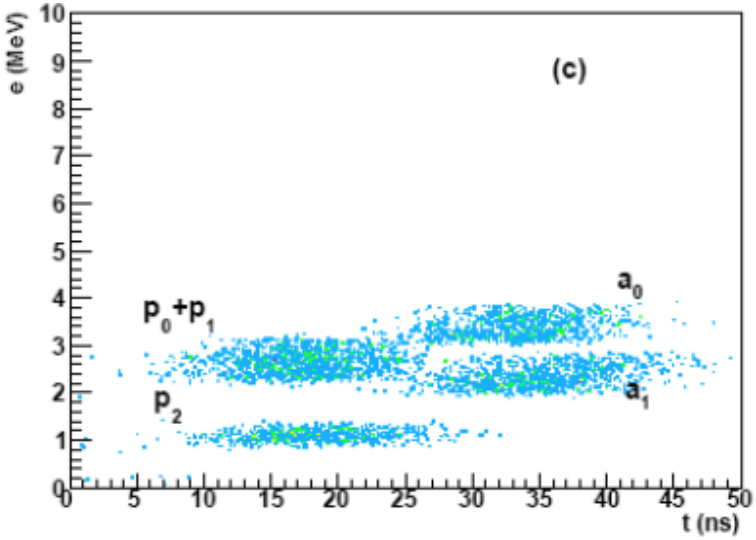


Upgrade TWINSOL for complimentary particle channel detection

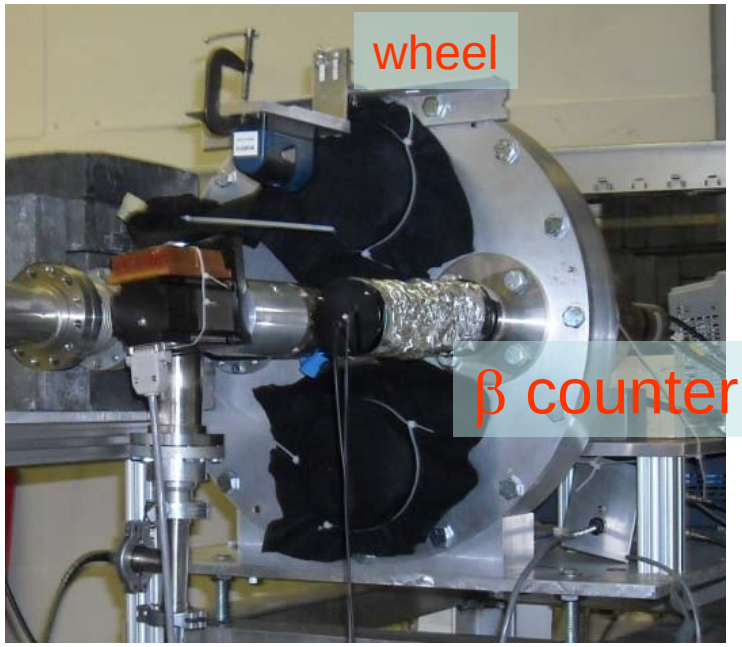


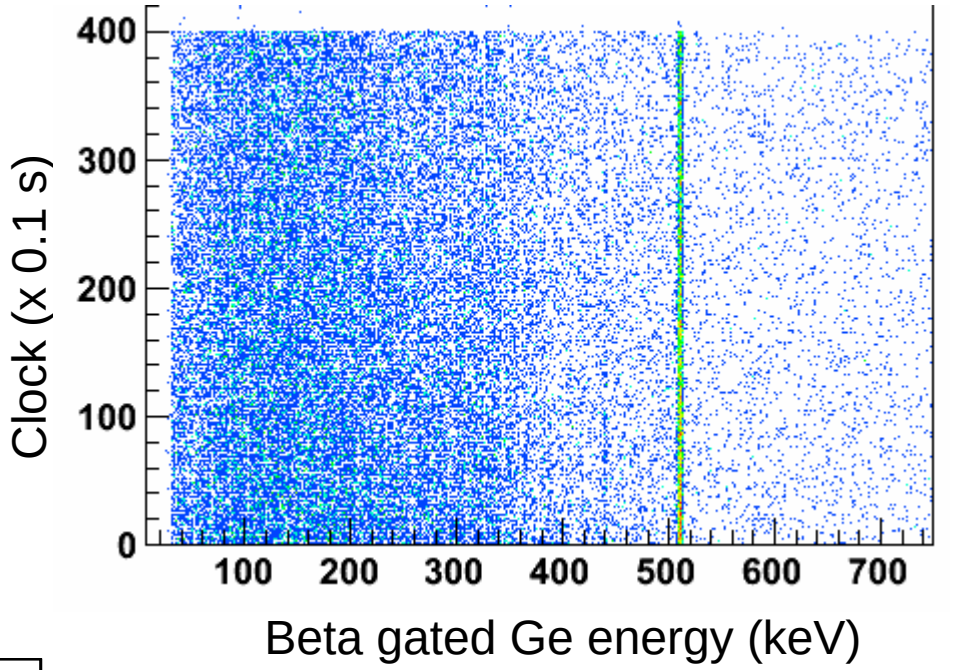
Simulation with non-uniform field

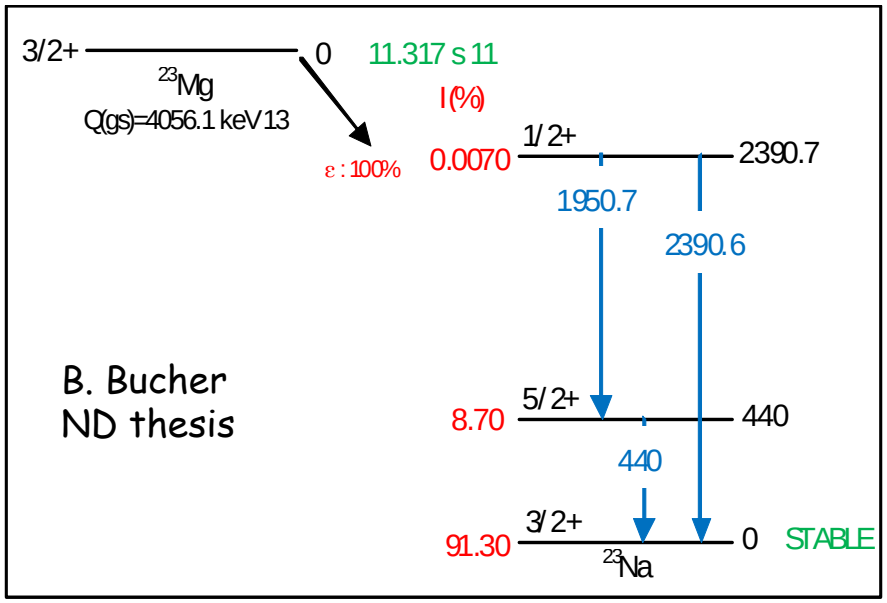


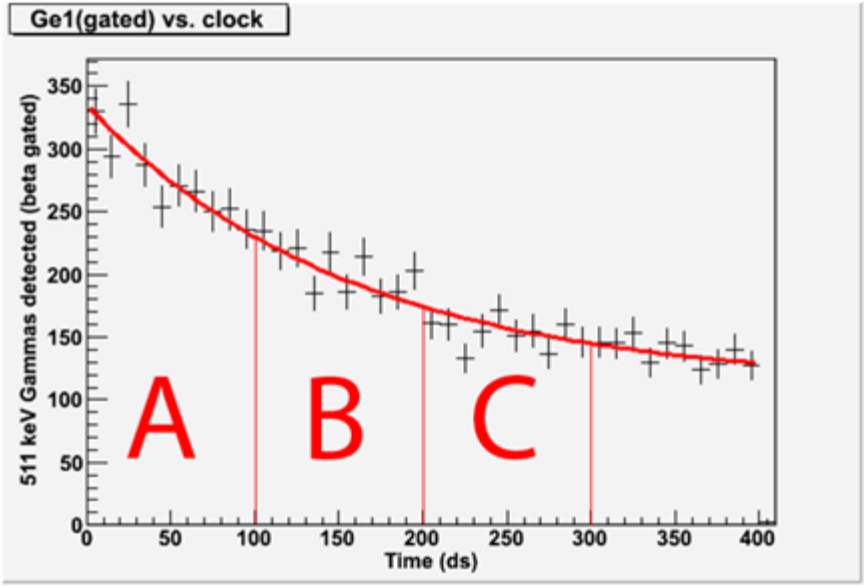


Measurement of $^{12}C+^{12}C->^{23}Mg+n$





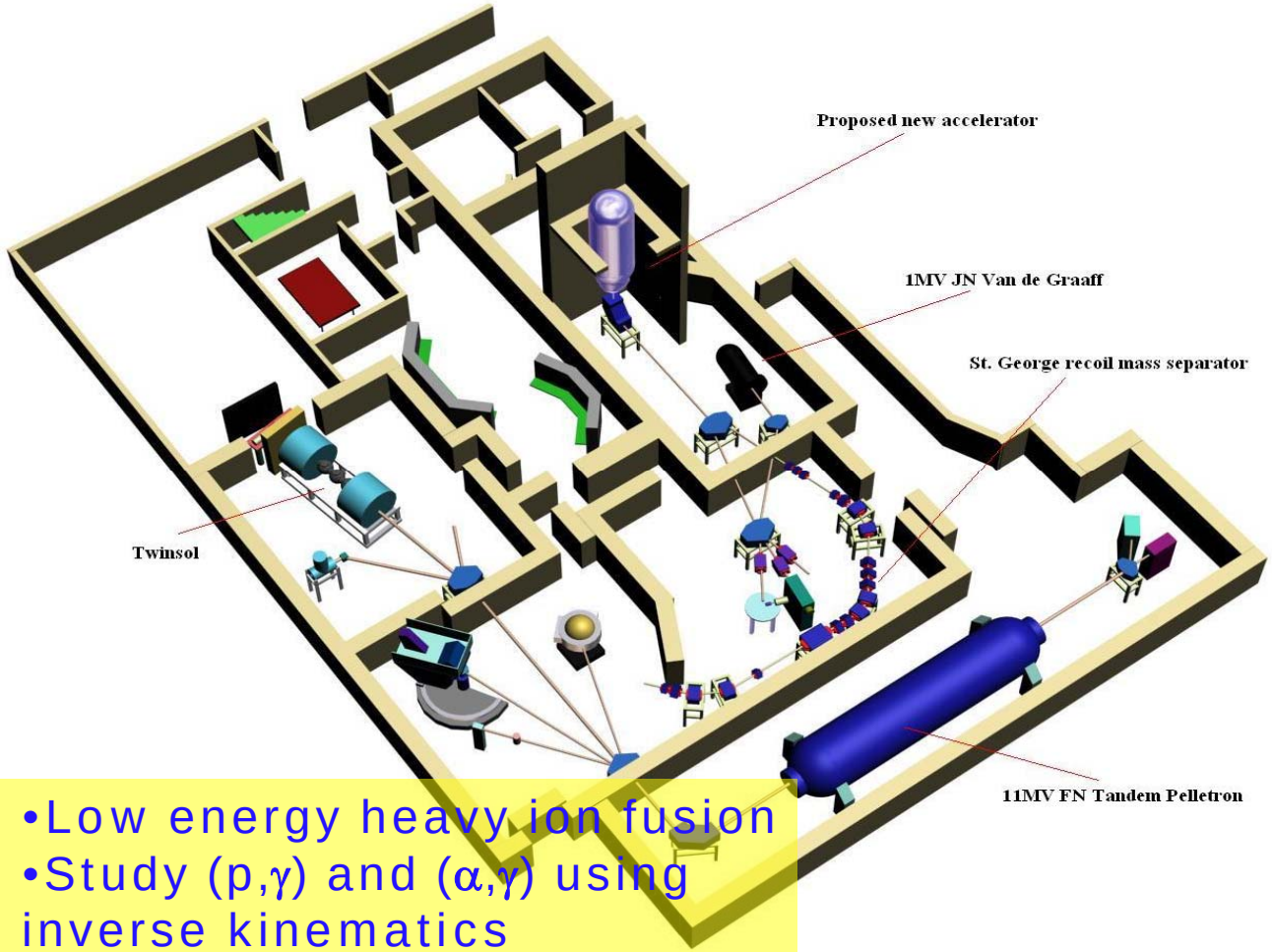




- Future Plans @ ND -

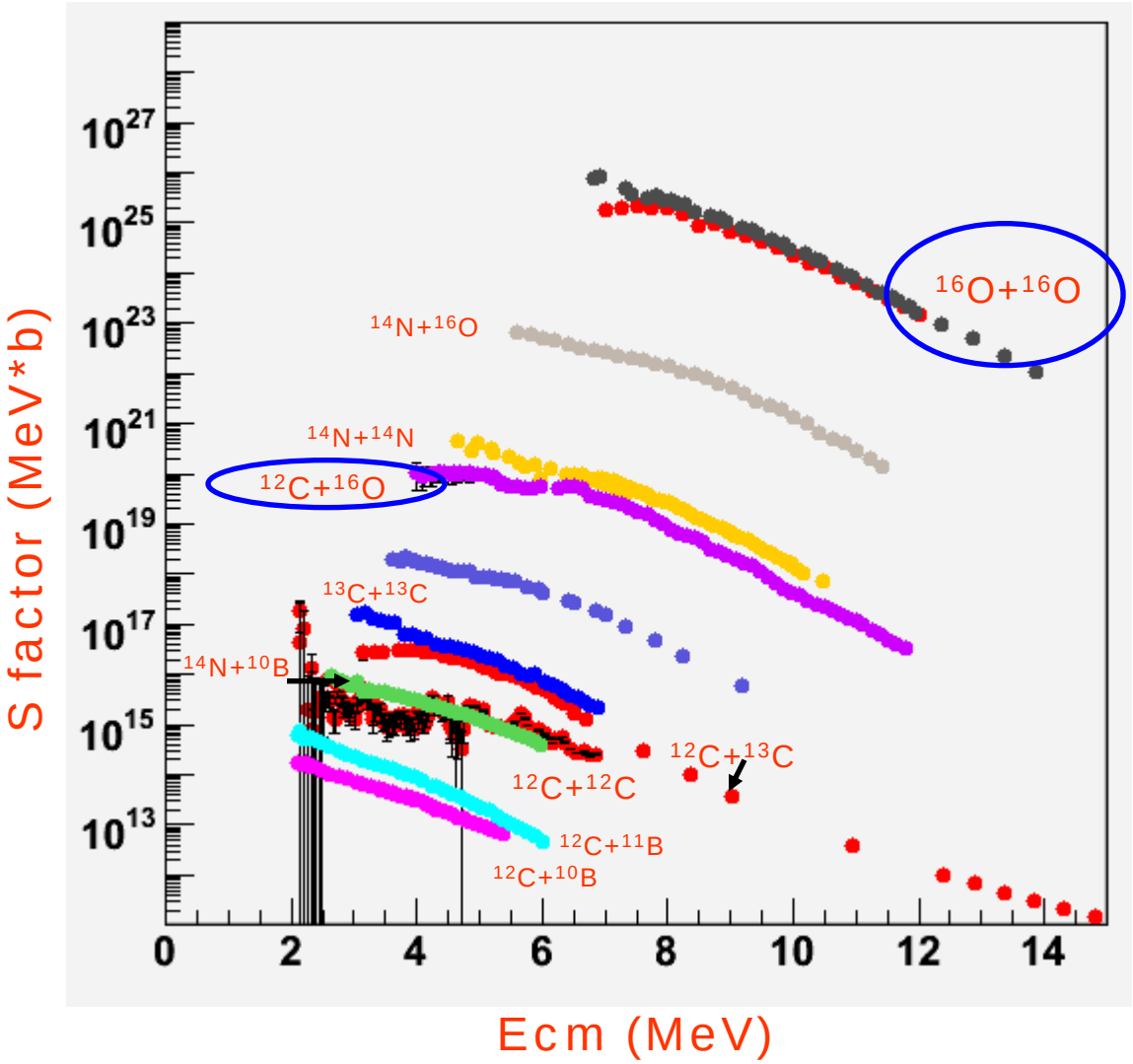
the next generation accelerator with high intensity low and heavy ion beam capability

Total costs $5M including building has been funded! Expect to finish on 2011.

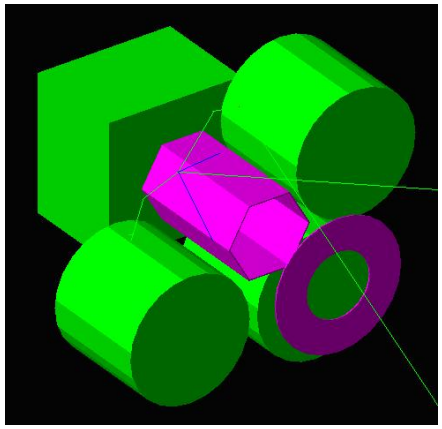


A 5 MV Pelletron with ECR source in terminal.

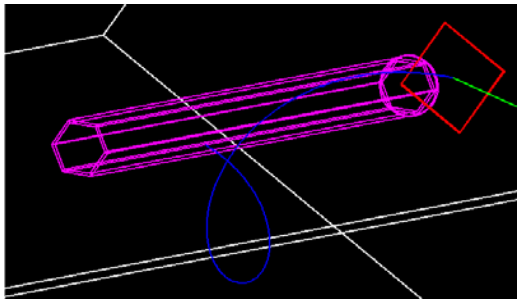
- Low energy heavy ion fusion
- Study (p,γ) and (α,γ) using inverse kinematics


S factor (MeV*b)
Ecm (MeV)
10^{27}
10^{25}
10^{23}
10^{21}
10^{19}
10^{17}
10^{15}
10^{13}
0
2
4
6
8
10
12
14
$^{16}O+^{16}O$
$^{14}N+^{16}O$
$^{14}N+^{14}N$
$^{12}C+^{16}O$
$^{13}C+^{13}C$
$^{14}N+^{10}B$
$^{12}C+^{13}C$
$^{12}C+^{12}C$
$^{12}C+^{11}B$
$^{12}C+^{10}B$

Instruments to be built



Compact Si array:
6 Position Sensitive Si detector (PSD) + 1 CD type Si (DSSD)
(2 PSD have been purchased. Full array will be finished in 2011.)



Pencil-like Si array for the Solenoid Spectrometer:
6*7 PSDs (each detector covers 5cmx1cm)
(We will set up a test experiment with 2 existing PSDs in the fall. Need find financial support for the detectors.)

The team

Graduate students: B. Bucher, X. Fang
Undergraduate students: J. Browne, A. Alongi
Funding support: NSF

Possible contribution from China: ???