Is There a Significant Difference Between CD of ^{8}B and DC measurements

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1. Some Strong Statement Appeared in Publications
   (a) on Exaggerated Accuracy of $S_{17}(0)$
   (b) on Disagreement Between DC and CD

2. Statement on slope difference:
   Bad Analysis of RIKEN2 data.
   Selection of DC data.

3. Statement on $S_{17}(0)$ Difference:
   Misunderstanding of CD data

Maui, ASP/JPS Meeting, September 21, 2005

The Laboratory for Nuclear Science
At Avery Point


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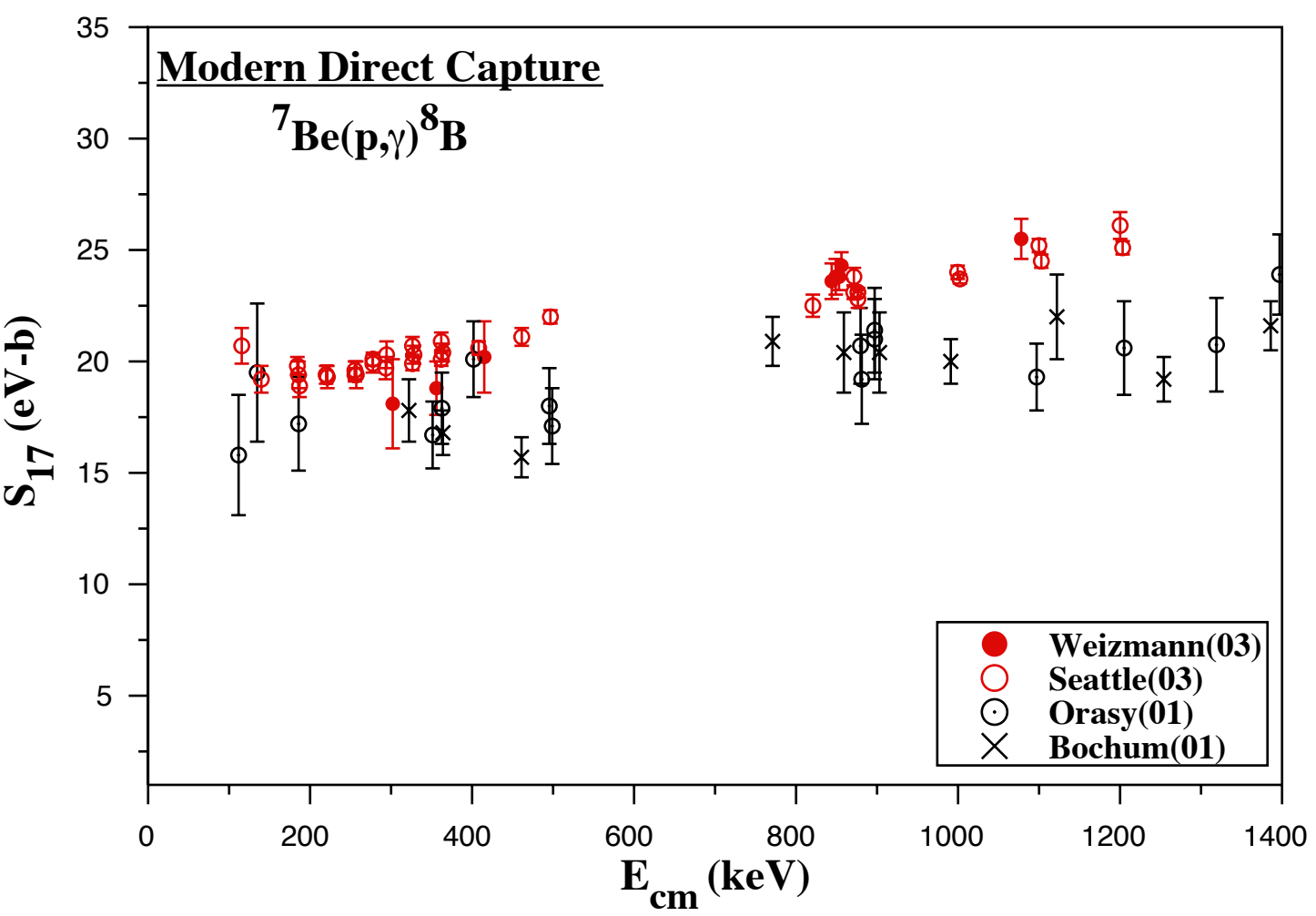
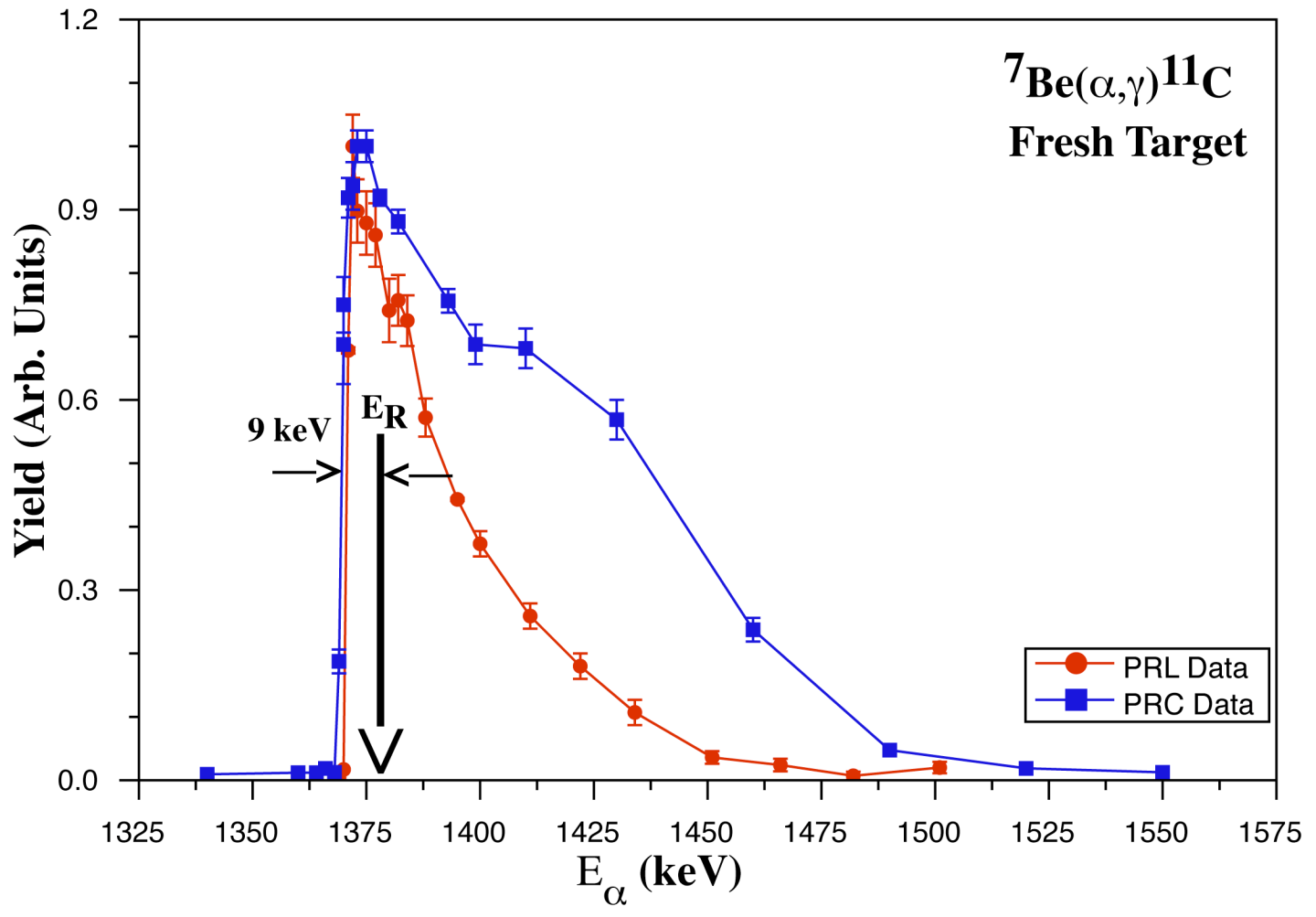
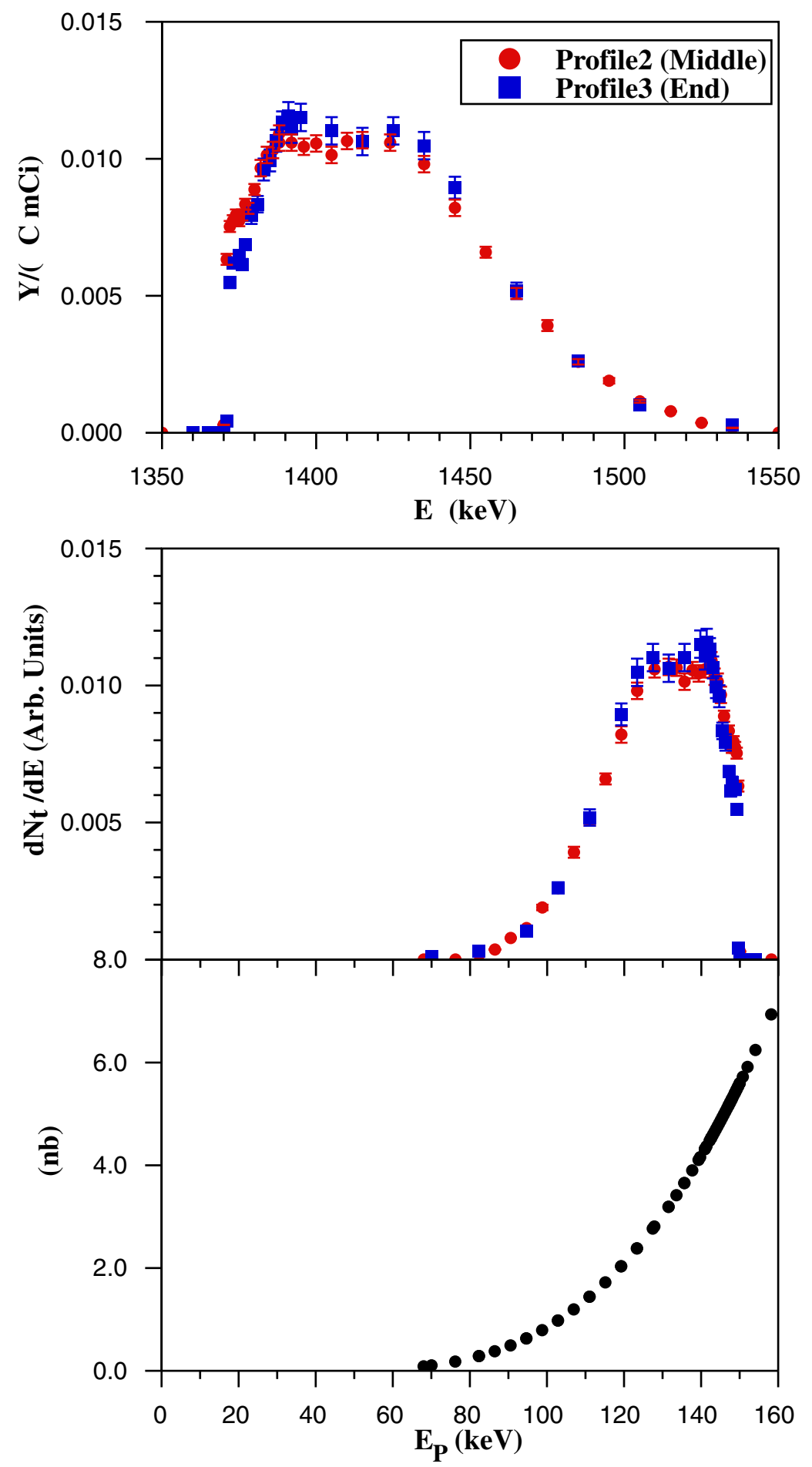

Modern Direct Capture
$^{7}Be(p,\gamma)^{8}B$
S_{17} (eV-b)
E_{cm} (keV)
35
30
25
20
15
10
5
0
200
400
600
800
1000
1200
1400
Weizmann(03)
Seattle(03)
Orasy(01)
Bochum(01)


$^{7}Be(\alpha,\gamma)^{11}C$
Fresh Target
Yield (Arb. Units)
E_α (keV)
9 keV
E_R
PRL Data
PRC Data
0.0
0.3
0.6
0.9
1.2
1325
1350
1375
1400
1425
1450
1475
1500
1525
1550
1575


Profile2 (Middle)
Profile3 (End)
Y/(C mCi)
0.015
0.010
0.005
0.000
1350
1400
1450
1500
1550
E (keV)
dNt /dE (Arb. Units)
0.015
0.010
0.005
8.0
(nb)
6.0
4.0
2.0
0.0
0
20
40
60
80
100
120
140
160
E_P (keV)

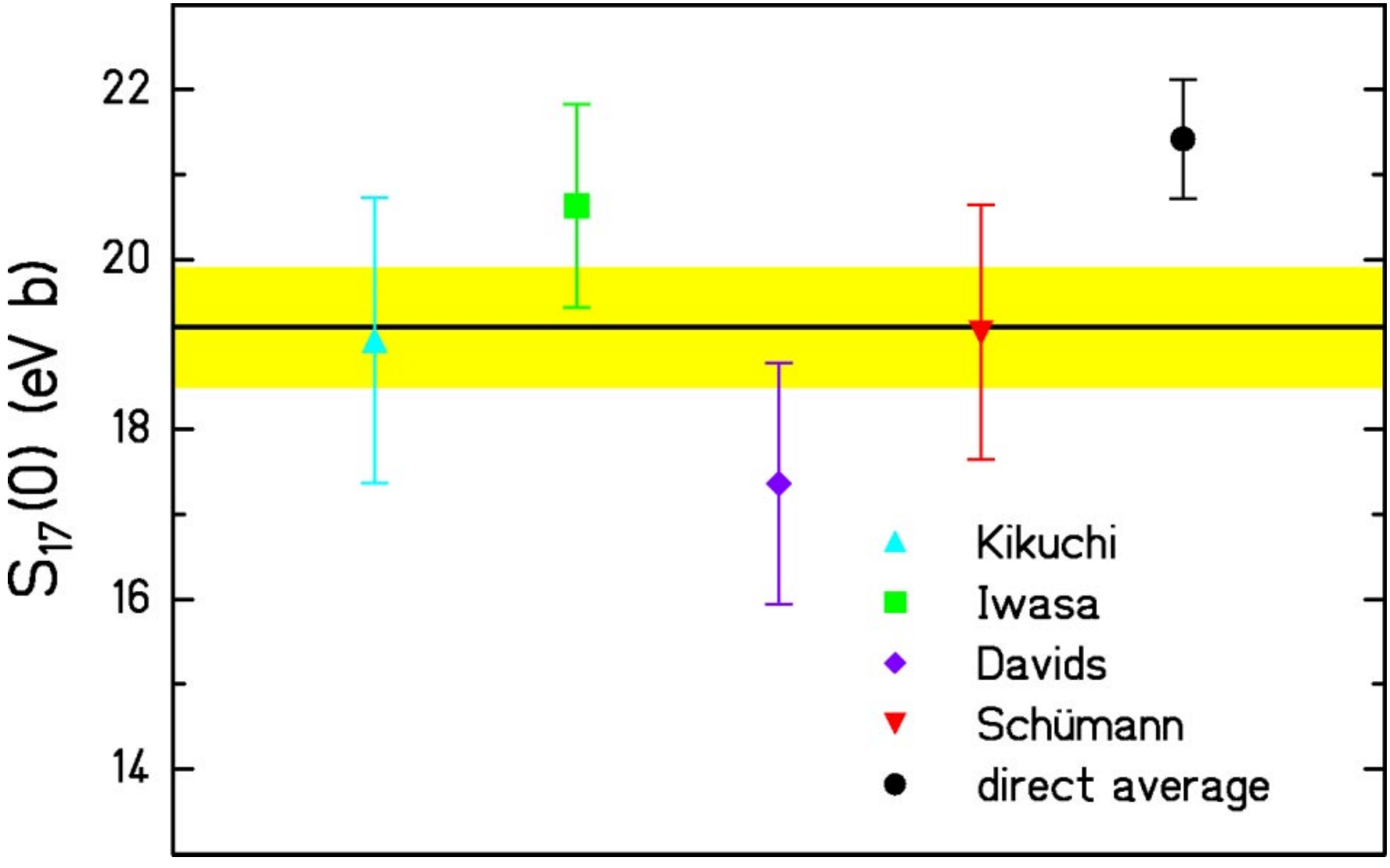
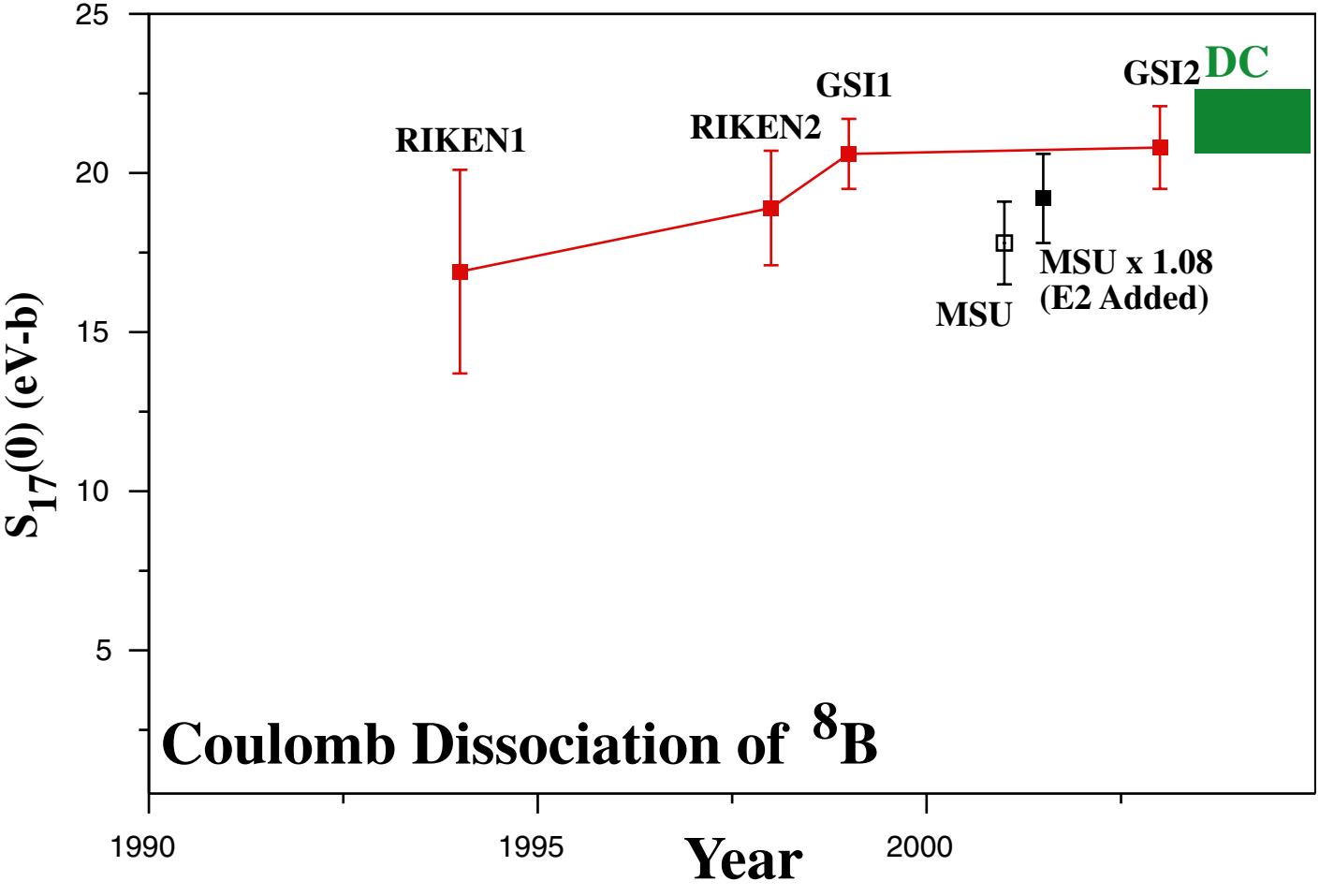
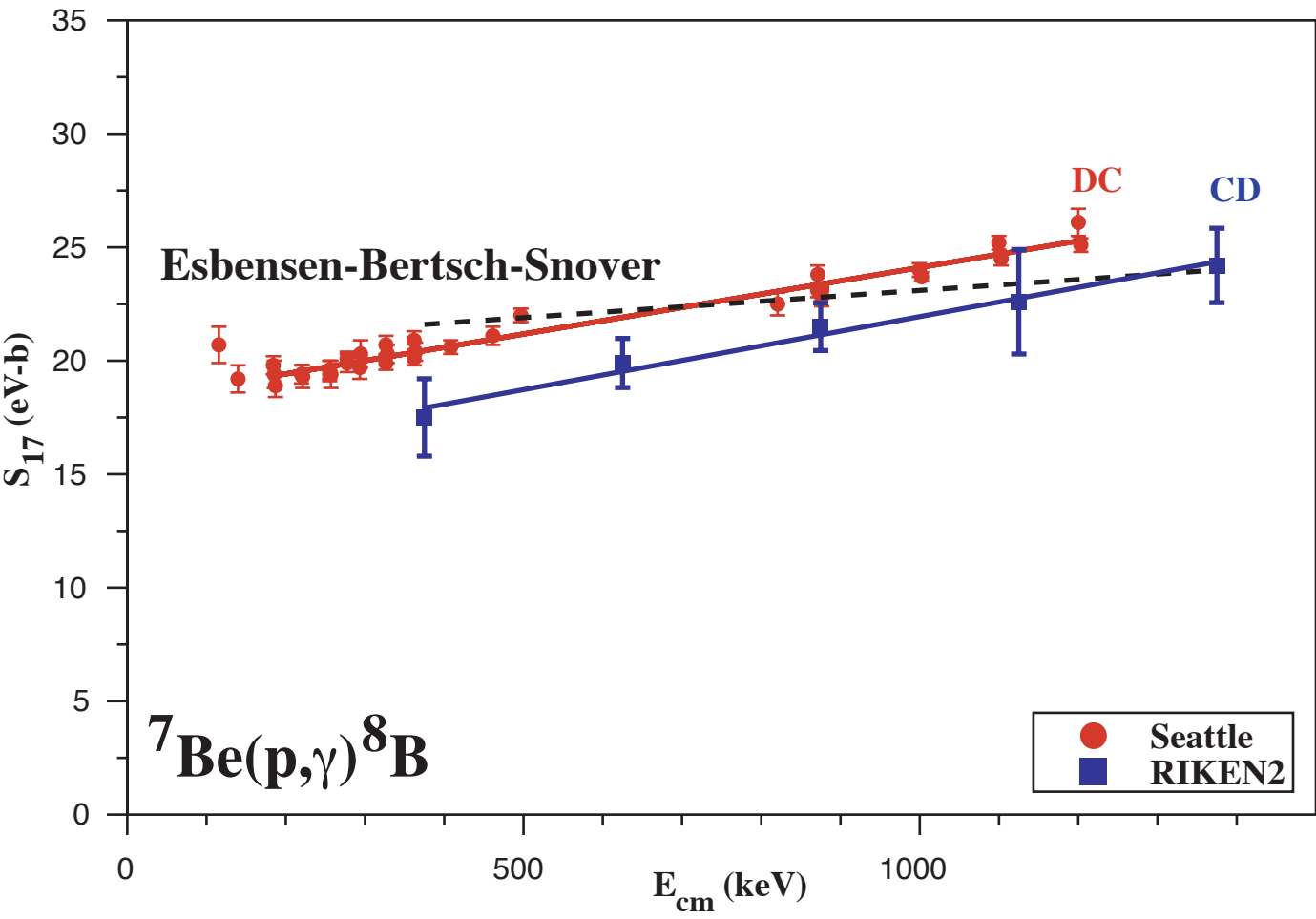


FIG. 20. (Color online) CD $S_{17}(0)$ values from DB fits to $S_{17}(\overline{E}_{\text{c.m.}})$ values below 425 keV, compared to the direct mean. The total uncertainties are shown. The horizontal solid and dashed lines indicate the CD mean value $S_{17}(0)=19.2\pm0.7$ eV b.


25
20
15
10
5
$S_{17}(0)$ (eV-b)
RIKEN1
RIKEN2
GSI1
GSI2
DC
MSU
MSU x 1.08
(E2 Added)
Coulomb Dissociation of ^{8}B
1990
1995
2000
Year


Esbensen-Bertsch-Snover
DC
CD
^{7}Be(p,γ)^{8}B
Seattle
RIKEN2
S_{17} (eV-b)
E_{cm} (keV)
0
5
10
15
20
25
30
35
0
500
1000

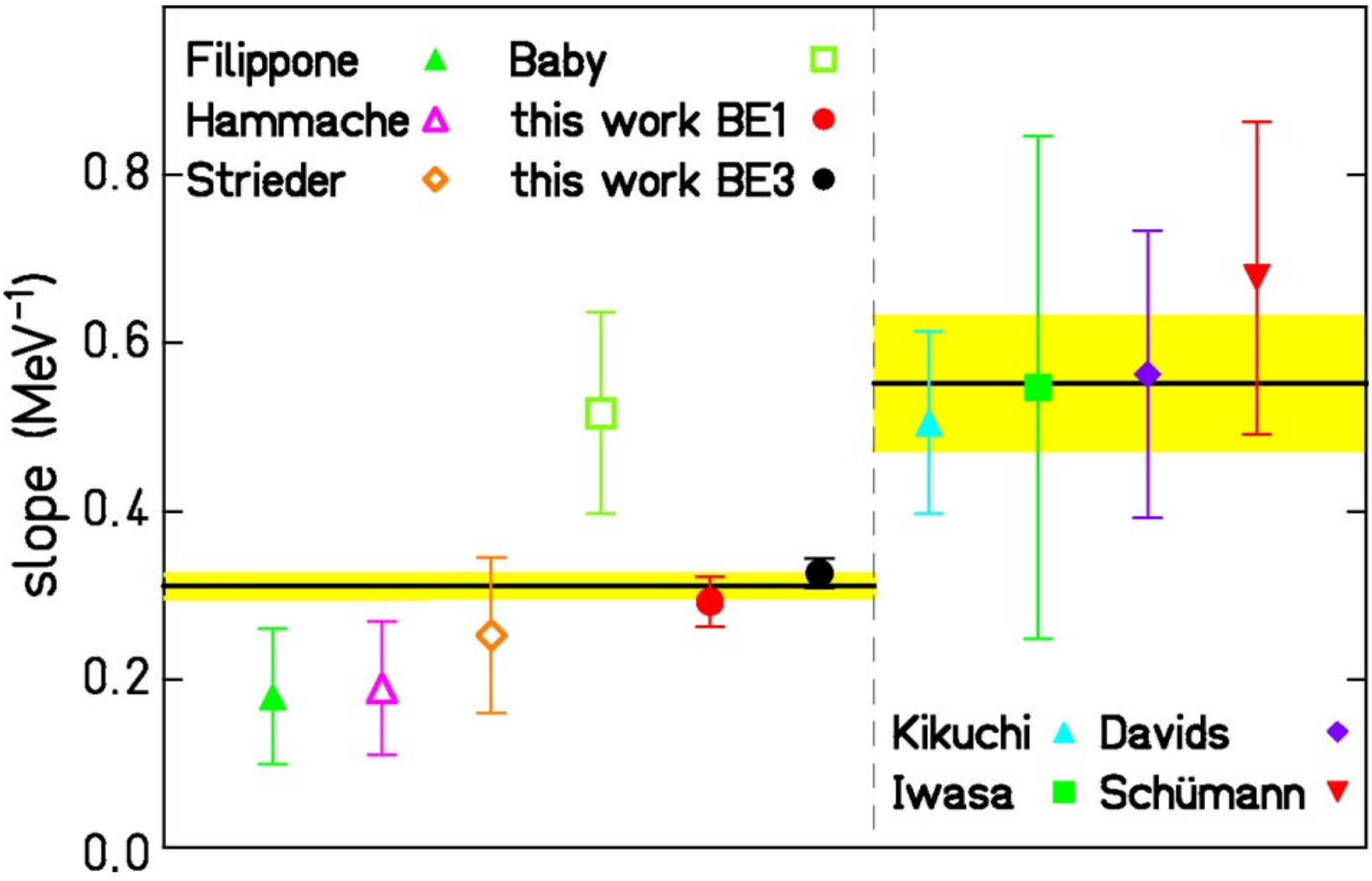
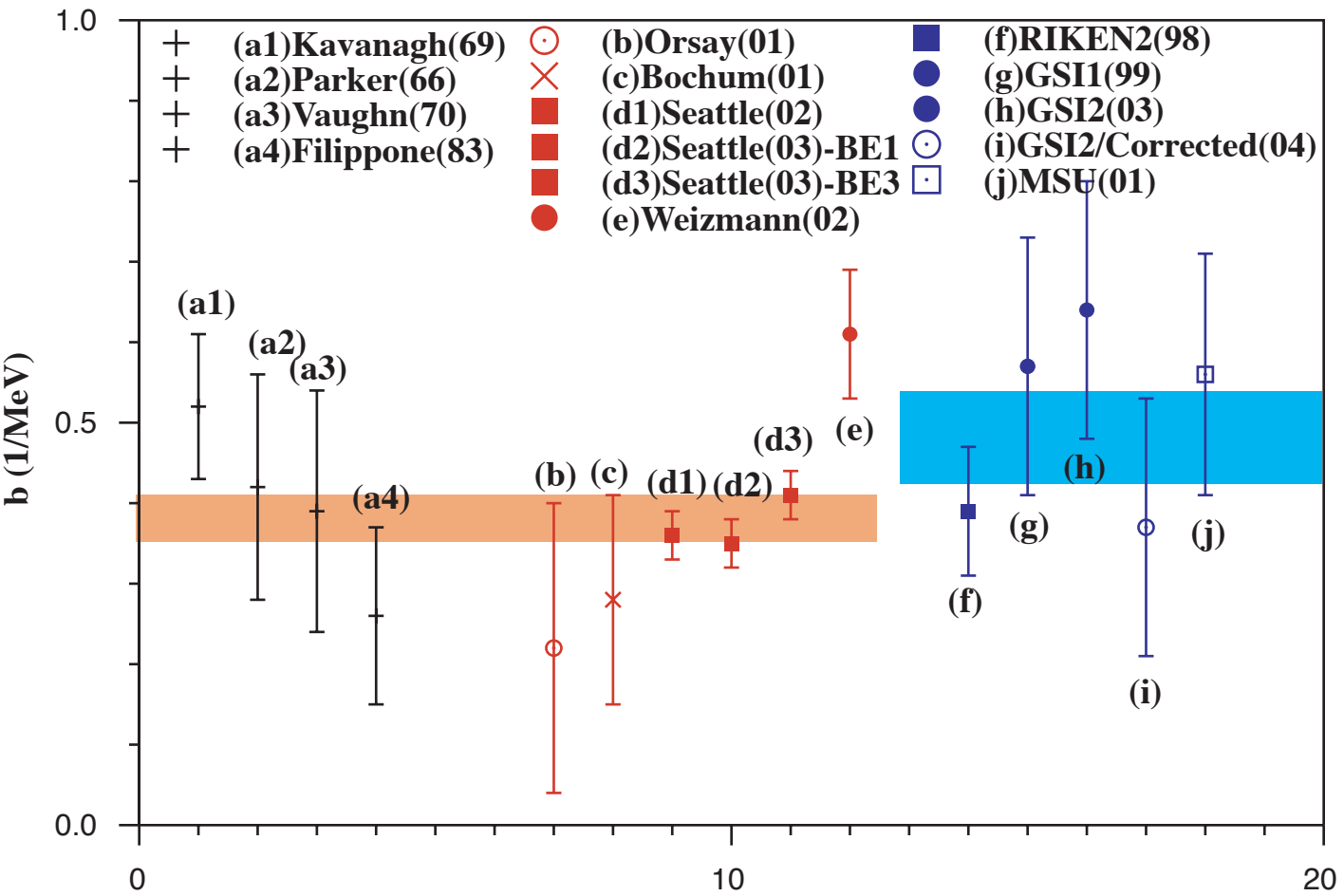


FIG. 19. (Color online) $S_{17}(\overline{E}_{\mathrm{c.m.}})$ slopes determined from straight-line fits to direct $S_{17}(\overline{E}_{\mathrm{c.m.}})$ data (corrected for the 1^+ resonance tail) (left panel) and to $S_{17}(\overline{E}_{\mathrm{c.m.}})$ values inferred from CD experiments (right panel). The horizontal lines and shaded regions correspond to the mean values and uncertainties determined from the direct data and from the CD data, respectively.


(a1)Kavanagh(69)
(a2)Parker(66)
(a3)Vaughn(70)
(a4)Filippone(83)
(b)Orsay(01)
(c)Bochum(01)
(d1)Seattle(02)
(d2)Seattle(03)-BE1
(d3)Seattle(03)-BE3
(e)Weizmann(02)
(f)RIKEN2(98)
(g)GSI1(99)
(h)GSI2(03)
(i)GSI2/Corrected(04)
(j)MSU(01)
b (1/MeV)
1.0
0.5
0.0
0
10
20

Baye: below 100 keV (external capture) [1]:

$$S(E) = S(0)[1 + s_1 \times E] \qquad \text{(equ 1)}$$

$$S(0) = S_d(0) + S_s(0) \qquad \text{(equ 2)}$$

and,

$$s_1 = \frac{S_s(0)}{S(0)}[s_{1s} + s_{1d} \times \frac{S_d(0)}{S_s(0)}] \qquad \text{(equ 3)}$$

Seattle: at all energies up to 1,300 keV [2] :

$$S(E) = a(1 + bE)$$

How about Newton's old idea of a slope S' = dS/dE? [3]

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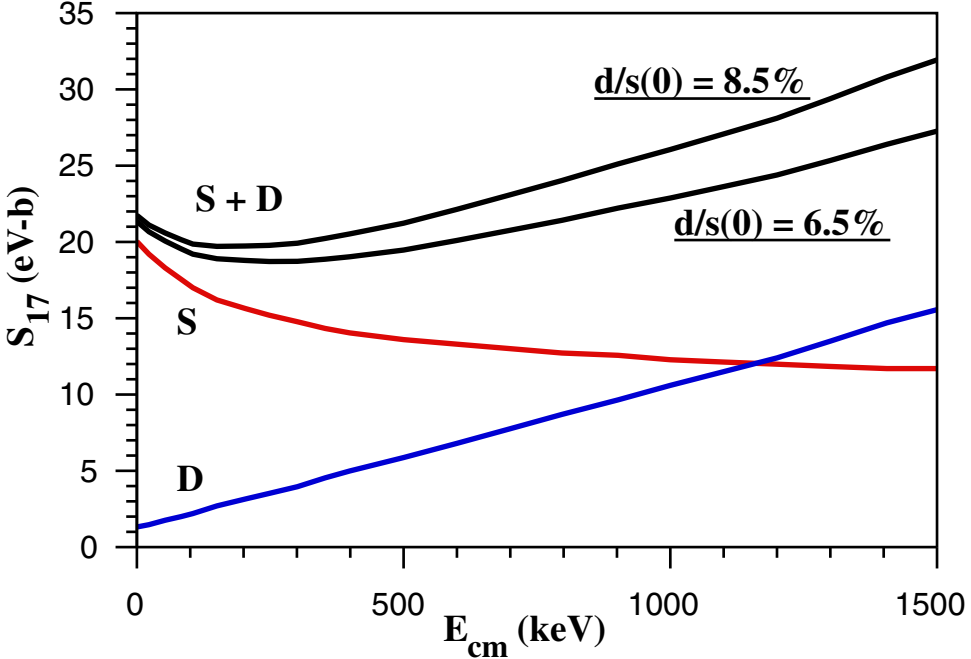
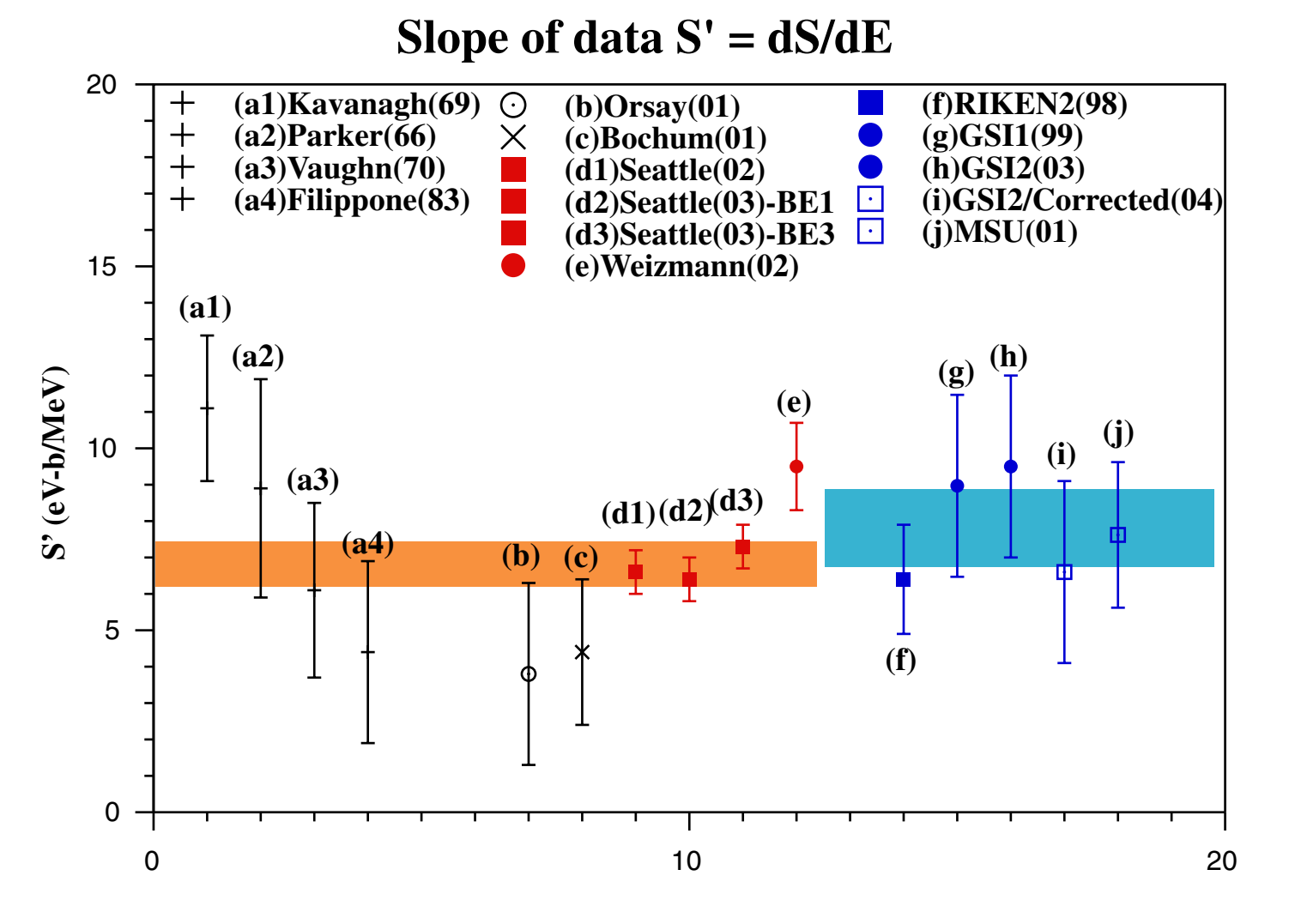
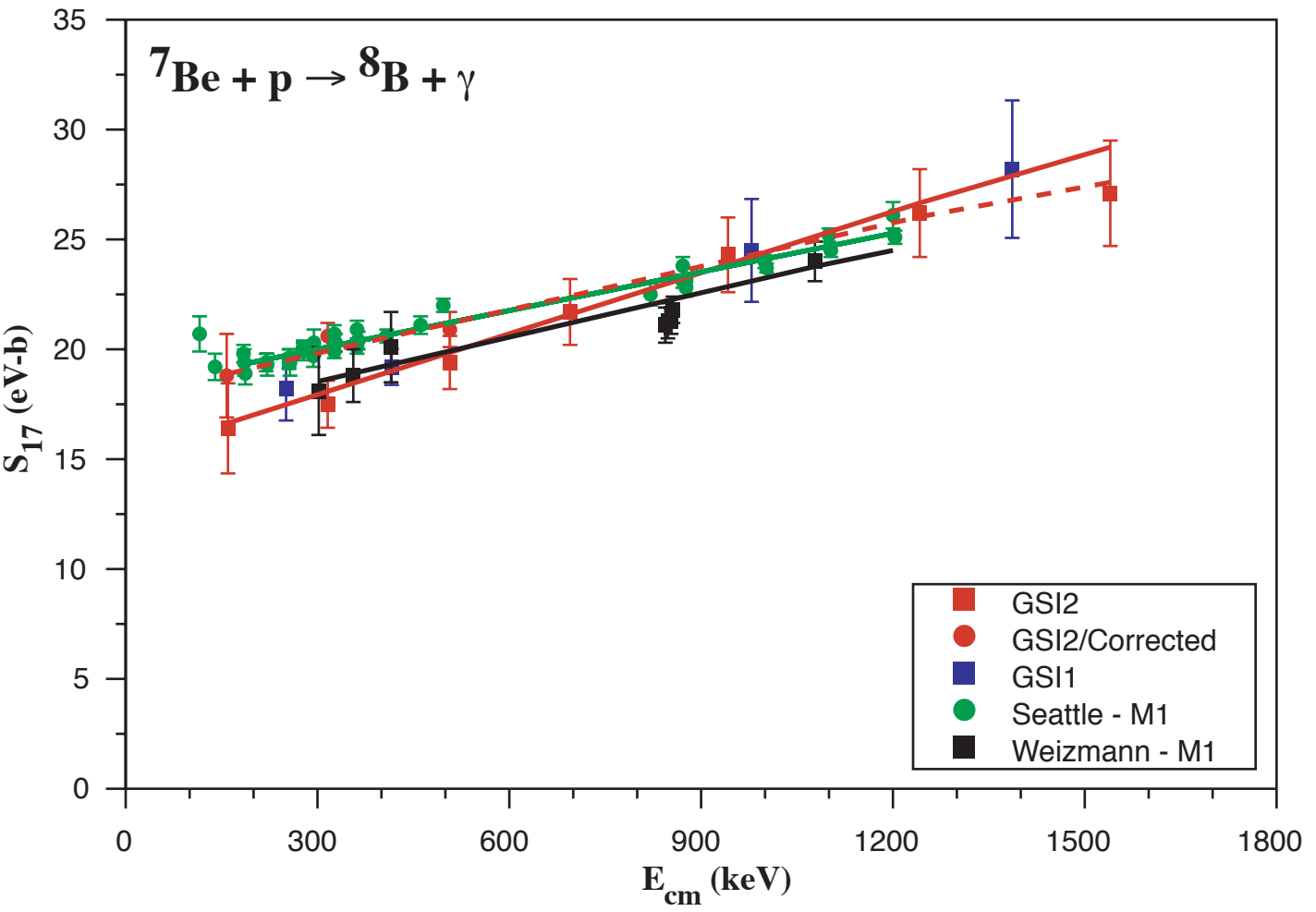
[1] D. Baye; Phys. Rev. **C62**(2000)065803.

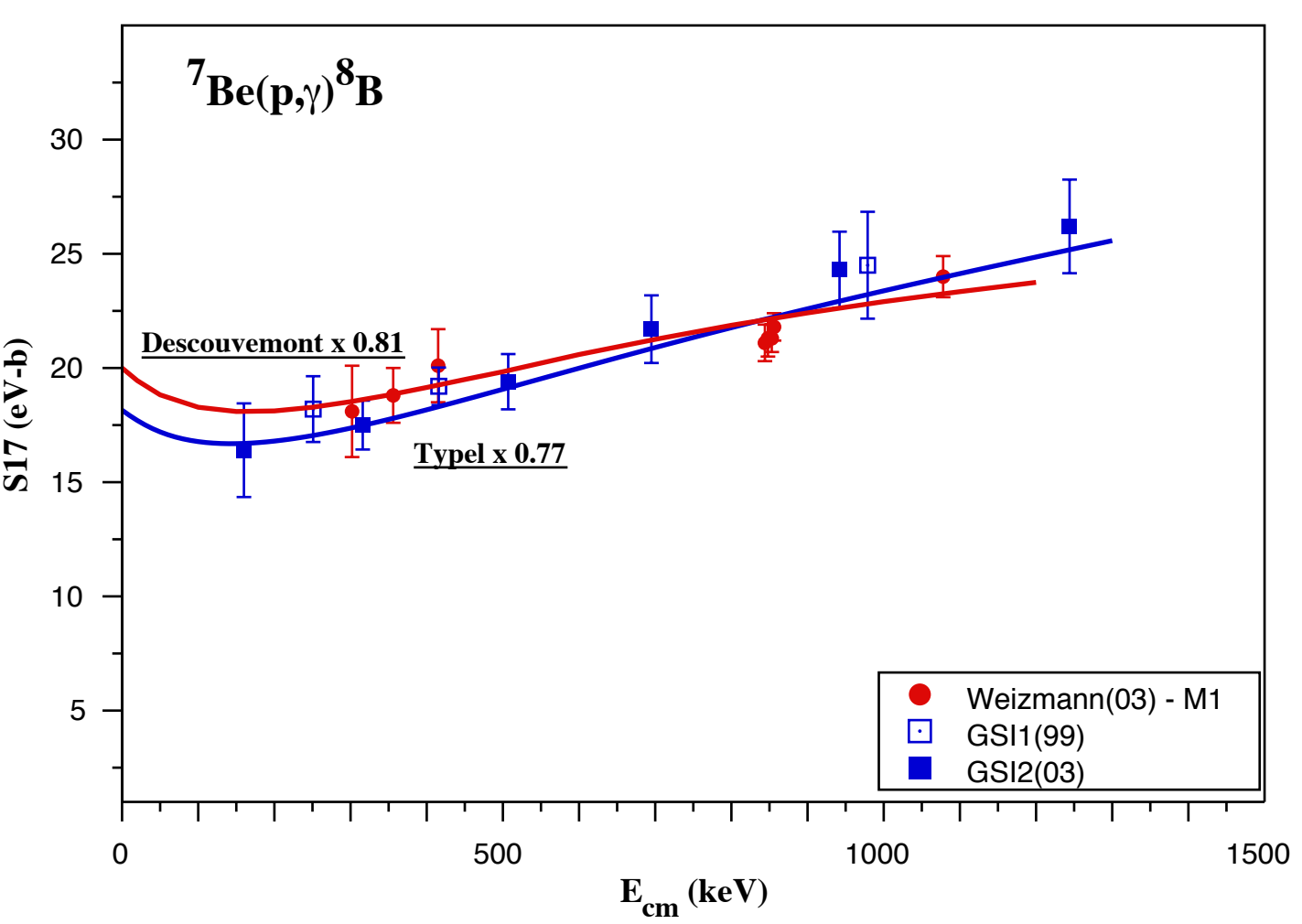
[2] A.R. Junghans *et al.*; Phys. Rev. **C68**(2003)065803.

[3] I. Newton, Principia, 1687.


35
30
25
20
15
10
5
0
0
500
1000
1500
S_{17} (eV-b)
E_{cm} (keV)
d/s(0) = 8.5%
d/s(0) = 6.5%
S + D
S
D


Slope of data S' = dS/dE
(a1)Kavanagh(69)
(a2)Parker(66)
(a3)Vaughn(70)
(a4)Filippone(83)
(b)Orsay(01)
(c)Bochum(01)
(d1)Seattle(02)
(d2)Seattle(03)-BE1
(d3)Seattle(03)-BE3
(e)Weizmann(02)
(f)RIKEN2(98)
(g)GSI1(99)
(h)GSI2(03)
(i)GSI2/Corrected(04)
(j)MSU(01)
S' (eV-b/MeV)
0
5
10
15
20
0
10
20


$^7Be + p \rightarrow {}^8B + \gamma$
S_{17} (eV-b)
E_{cm} (keV)
0
5
10
15
20
25
30
35
0
300
600
900
1200
1500
1800
GSI2
GSI2/Corrected
GSI1
Seattle - M1
Weizmann - M1


$^{7}Be(p,\gamma)^{8}B$
Descouvemont x 0.81
Typel x 0.77
Weizmann(03) - M1
GSI1(99)
GSI2(03)
S17 (eV-b)
E_{cm} (keV)
30
25
20
15
10
5
0
500
1000
1500

Seattle Result on $^7Be + \mathrm{p} \rightarrow {}^8B + \gamma$:

$$S_{17}(0) = 21.4 \pm 0.5 \text{ (expt)} \pm 0.6 \text{ (theory) eV-b} \qquad [1]$$

Previous Compilation:

$$S_{17}(0) = 19 \ +4 \ -2 \text{ eV-b} \qquad [2]$$

Reasonable Conservative Estimate:

$$S_{17}(0) = 21.4 \pm 0.8 \text{ (expt)} \ {}^{+0.0}_{-3.0} \text{ (extrap) eV-b} \qquad [3]$$

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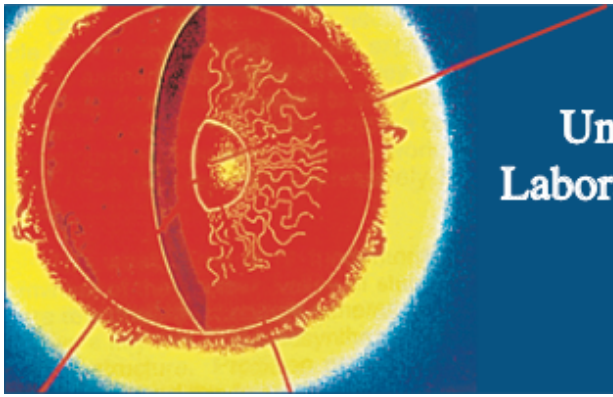
[1] A.R. Junghans *et al.*; Phys. Rev. **C68**(2003)065803.

[2] E.G. Adelberger *et al.*; rev. Mod. Phys. **70**(1998)1265.

[3] M. Gai; nucl-ex/0312003.



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^{8}B Solar Neutrino Flux:

S_{34} soon will be known (<5%)

S_{17} Seattle result must be checked

Extrapolation must be checked

Claim of Exaggerated Accuracy (NO)

Claim of Discrepancy Between CD and DC (NO)

Is SSM/Flux = 1.17 significant?