Minor *Fe* isotopes in Fast Region

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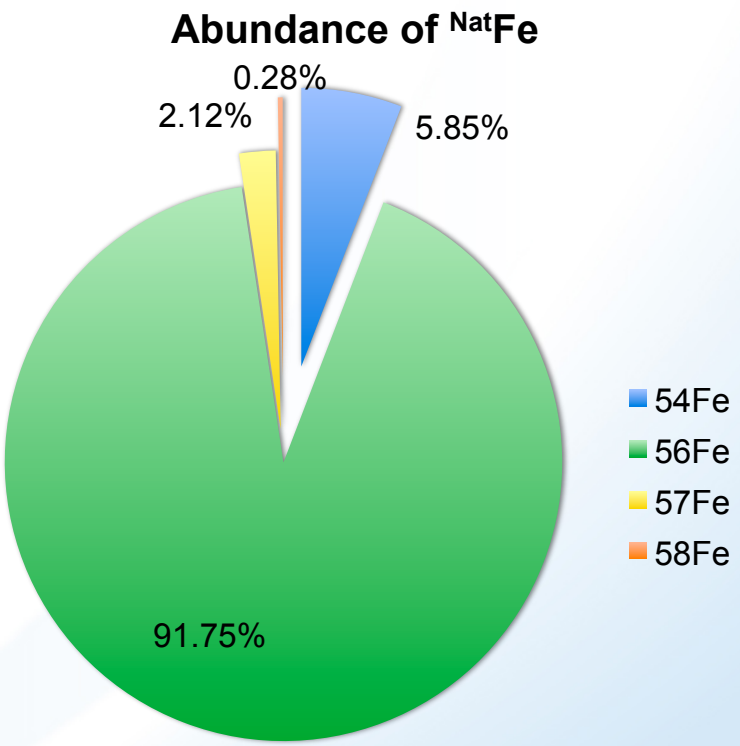
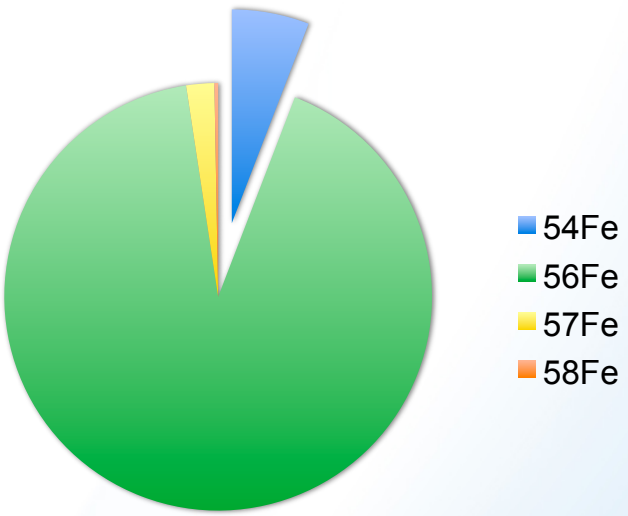
Minor isotopes: inspired on ^{56}Fe input

- CC for incident/outgoing channels + DWBA
- Soukhovitskii and Capote dispersive OMP
- Gilbert-Cameron level densities
- Consistency among level-density parameters

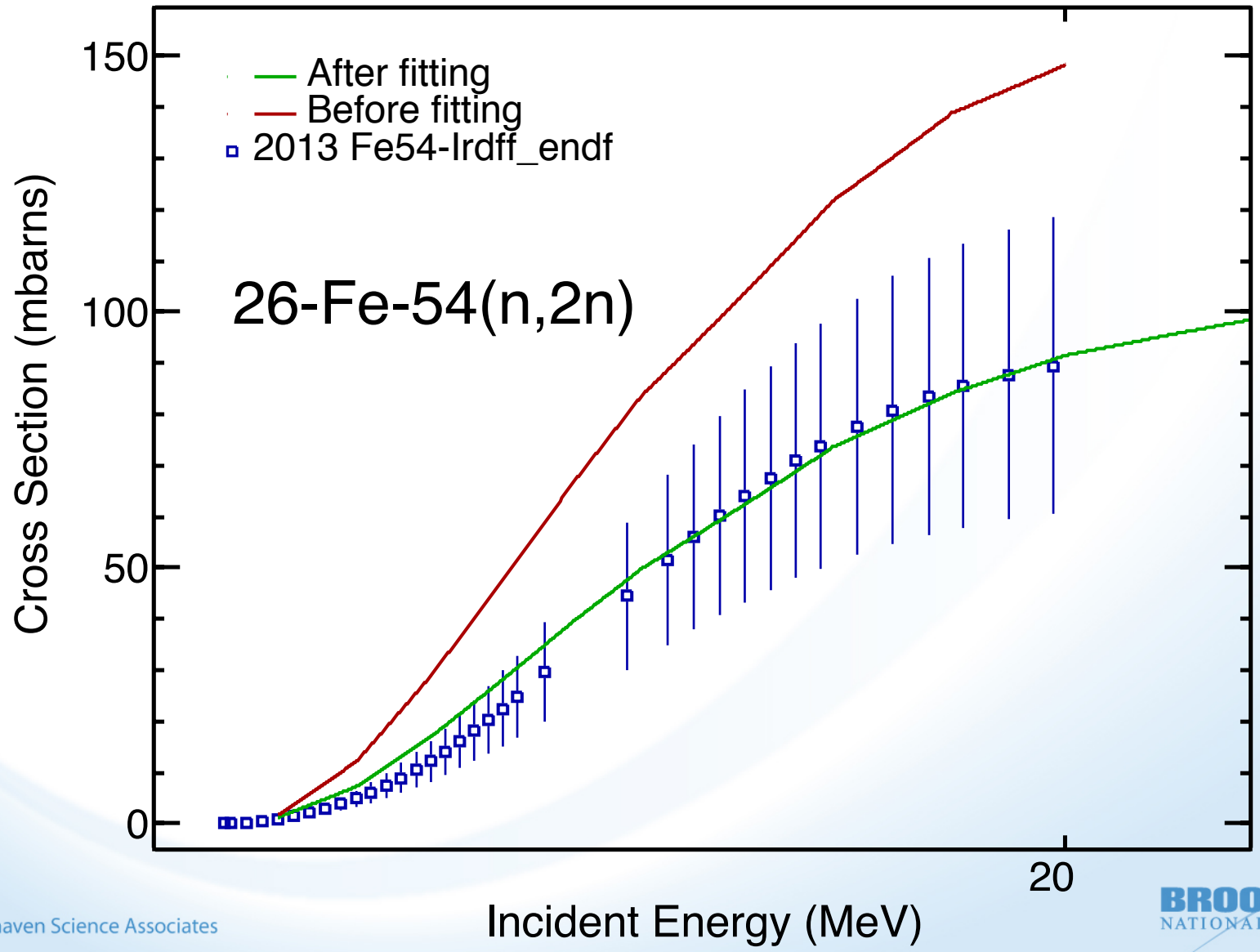


^{54}Fe

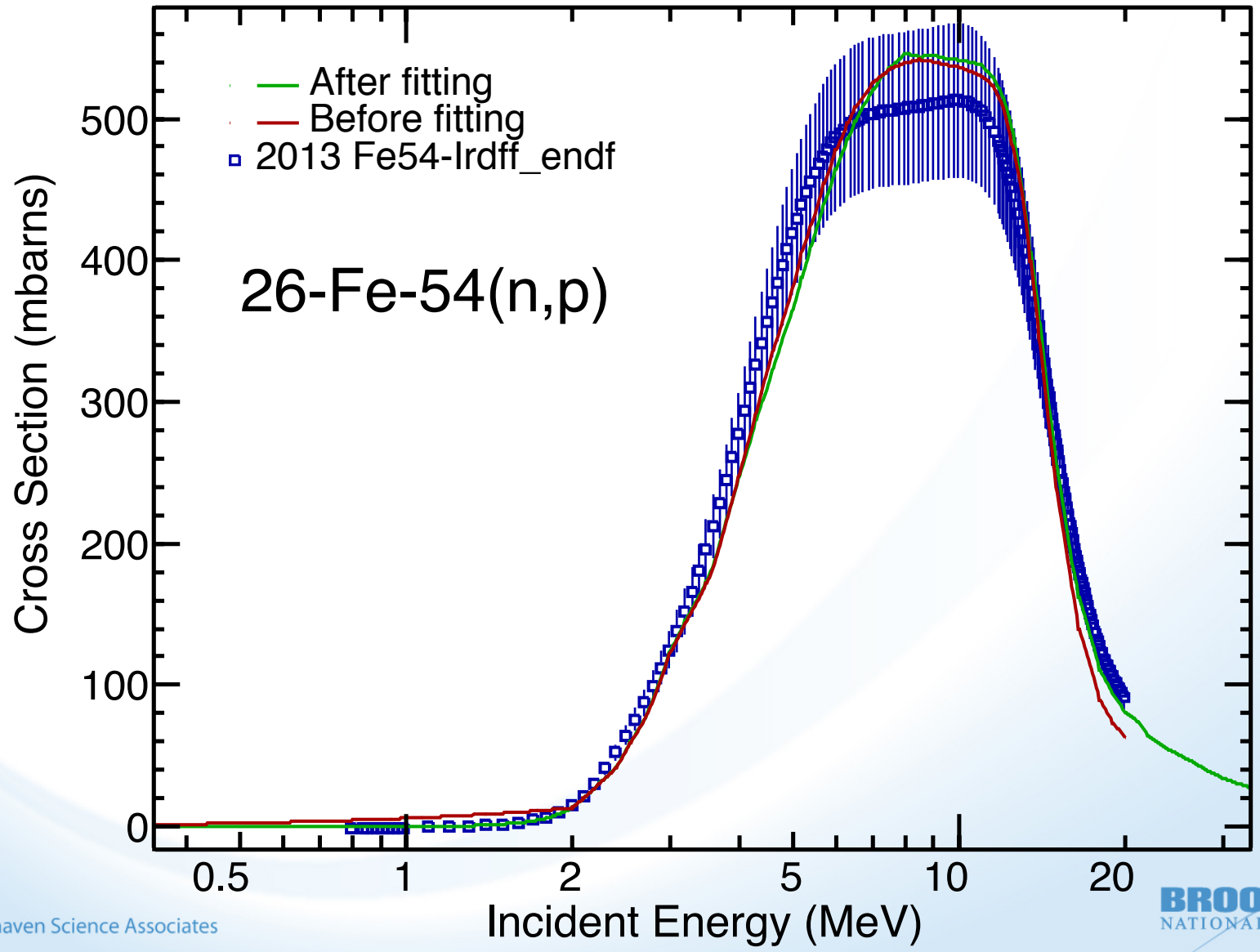
- Same Soukhovitskii and Capote dispersive OMP
- Same energy-dependent reduction of (n,tot) up to 3 MeV
- Fitted new LD parameters to (n,p), (n,2n) and (n,α) to dosimetry (IRDFF)
- Kept pre-equilibrium parameters within reasonable range
- Fitted deformation of DWBA levels to fill gap in double-differential neutron spectra



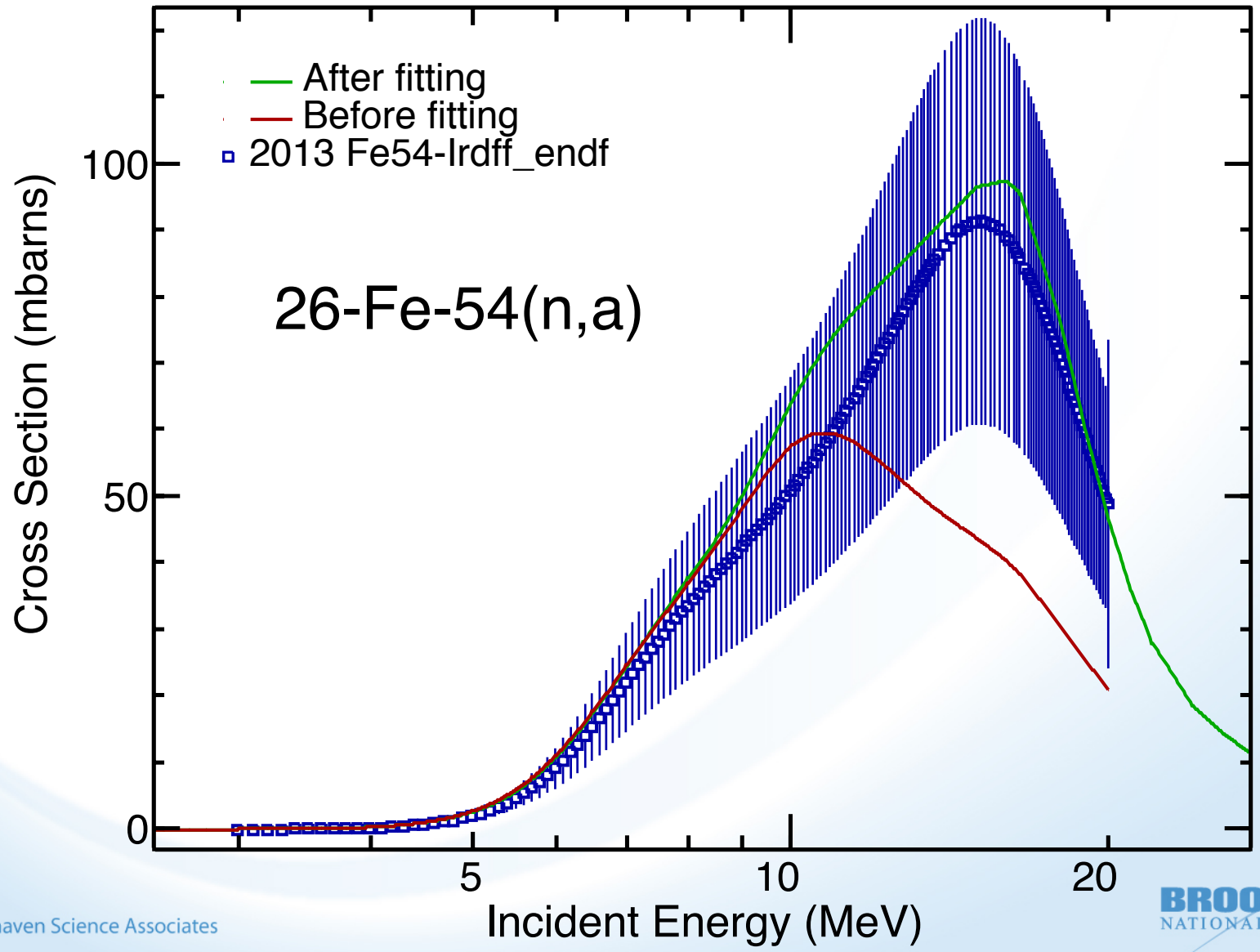
^{54}Fe


After fitting
Before fitting
2013 Fe54-Irdff_endf
26-Fe-54(n,2n)
Cross Section (mbarns)
150
100
50
0
20
Incident Energy (MeV)

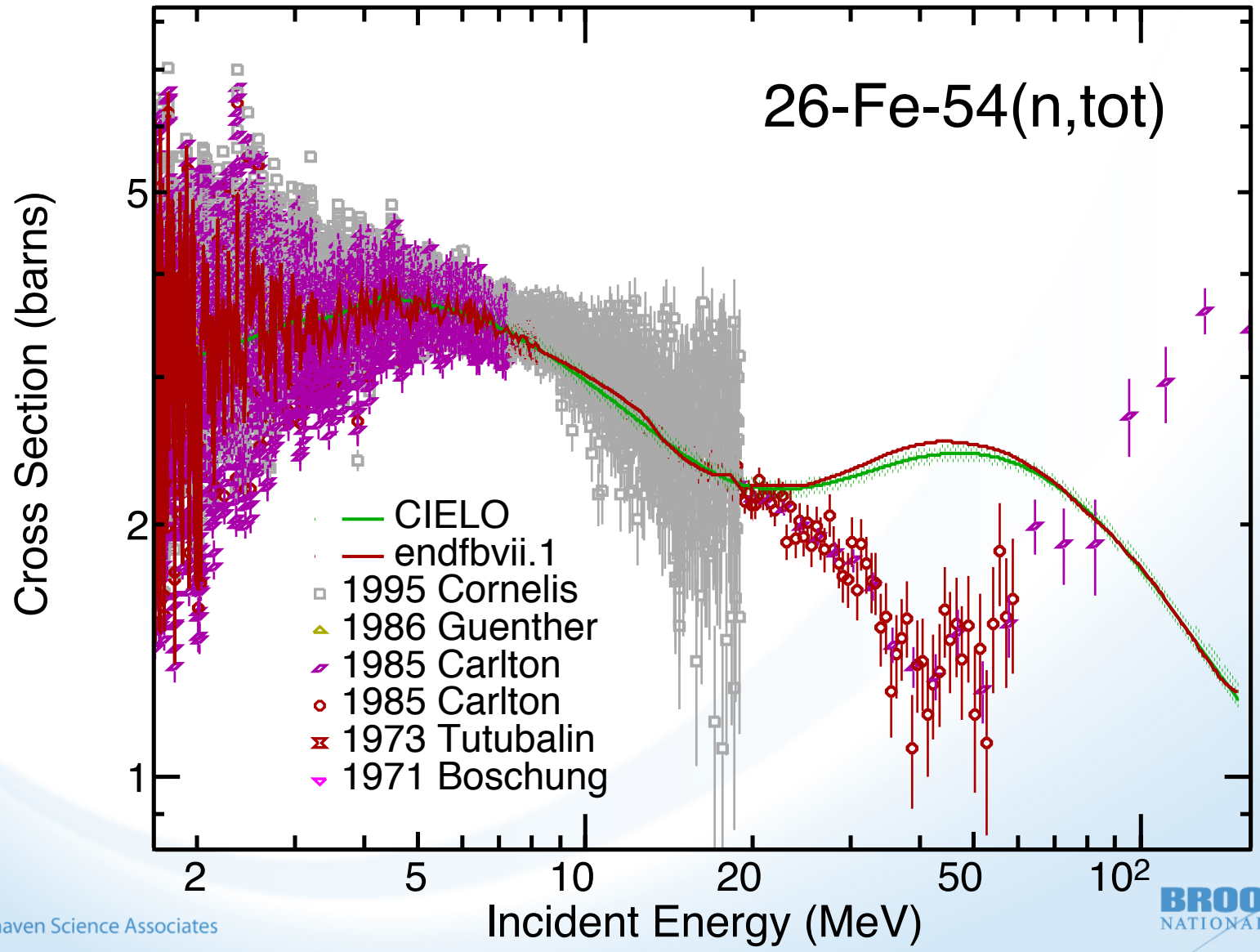
^{54}Fe


After fitting
Before fitting
2013 Fe54-Irdff_endf
26-Fe-54(n,p)
Cross Section (mbarns)
0
100
200
300
400
500
0.5
1
2
5
10
20
Incident Energy (MeV)

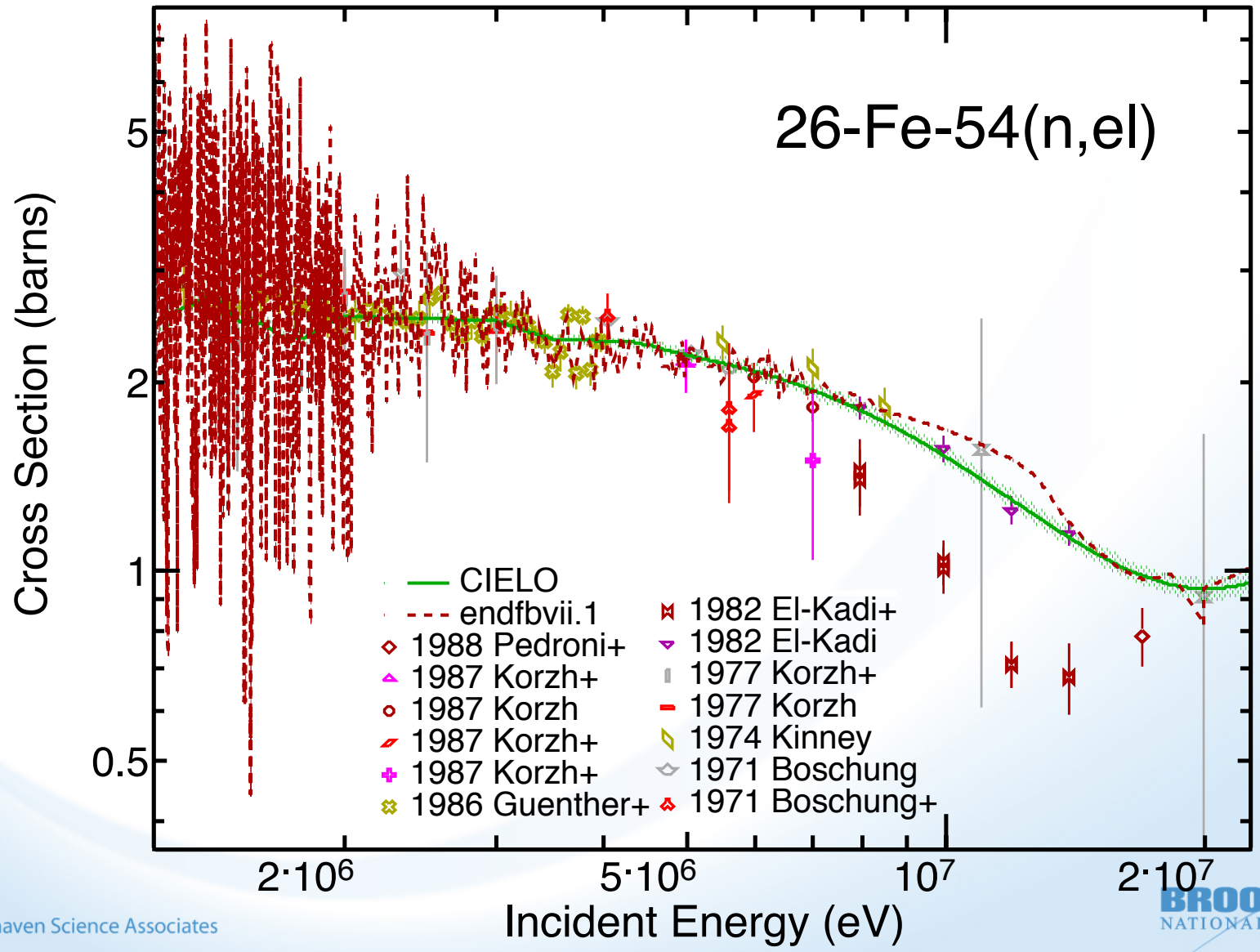
^{54}Fe


After fitting
Before fitting
2013 Fe54-Irdff_endf
26-Fe-54(n,a)
Cross Section (mbarns)
100
50
0
5
10
20
Incident Energy (MeV)

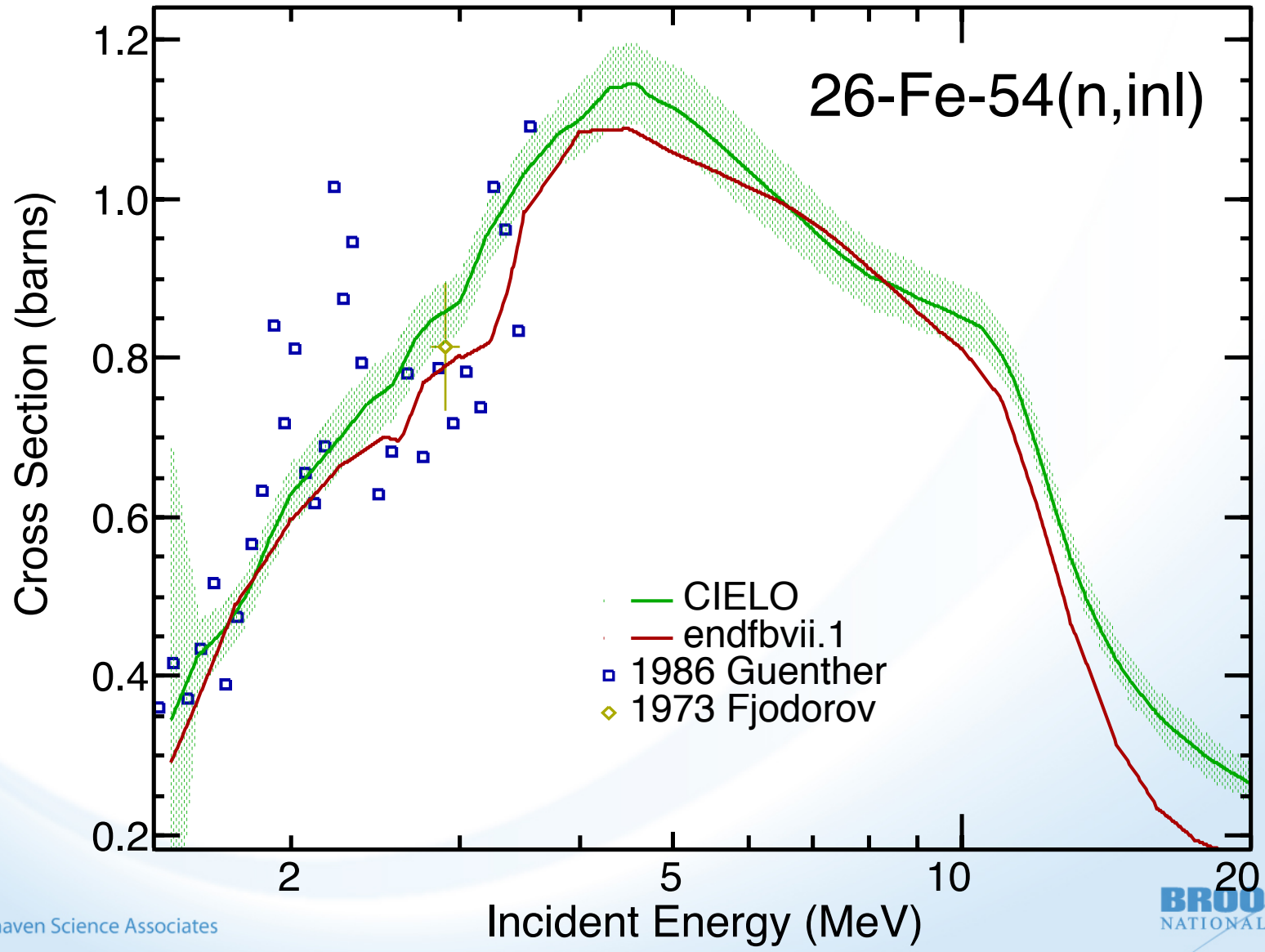
^{54}Fe


26-Fe-54(n,tot)
Cross Section (barns)
Incident Energy (MeV)
5
2
1
2
5
10
20
50
10²
CIELO
endfbvii.1
1995 Cornelis
1986 Guenther
1985 Carlton
1985 Carlton
1973 Tutubalin
1971 Boschung

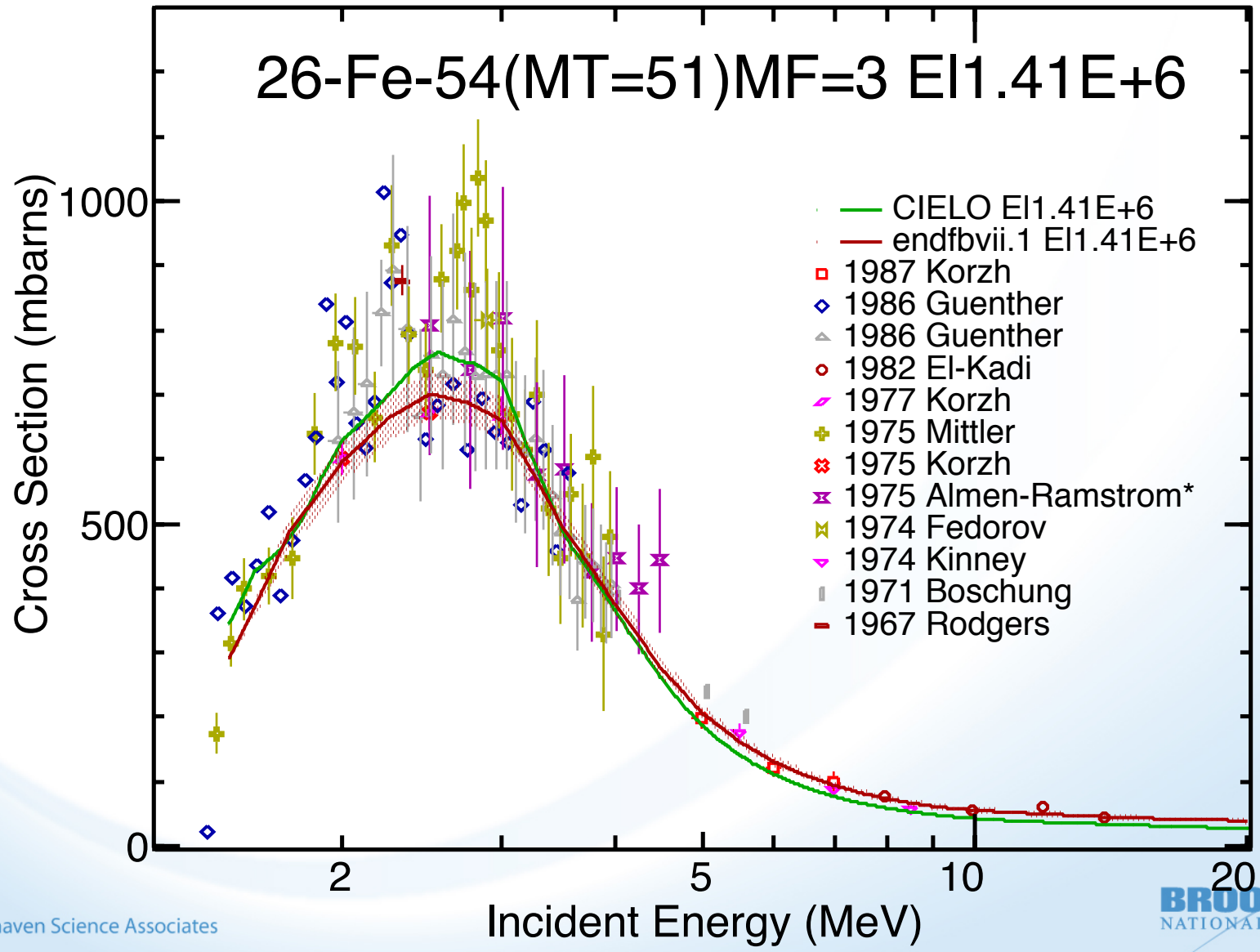
^{54}Fe


26-Fe-54(n,el)
Cross Section (barns)
5
2
1
0.5
2·10^6
5·10^6
10^7
2·10^7
Incident Energy (eV)
CIELO
endfbvii.1
1988 Pedroni+
1987 Korzh+
1987 Korzh
1987 Korzh+
1987 Korzh+
1986 Guenther+
1982 El-Kadi+
1982 El-Kadi
1977 Korzh+
1977 Korzh
1974 Kinney
1971 Boschung
1971 Boschung+

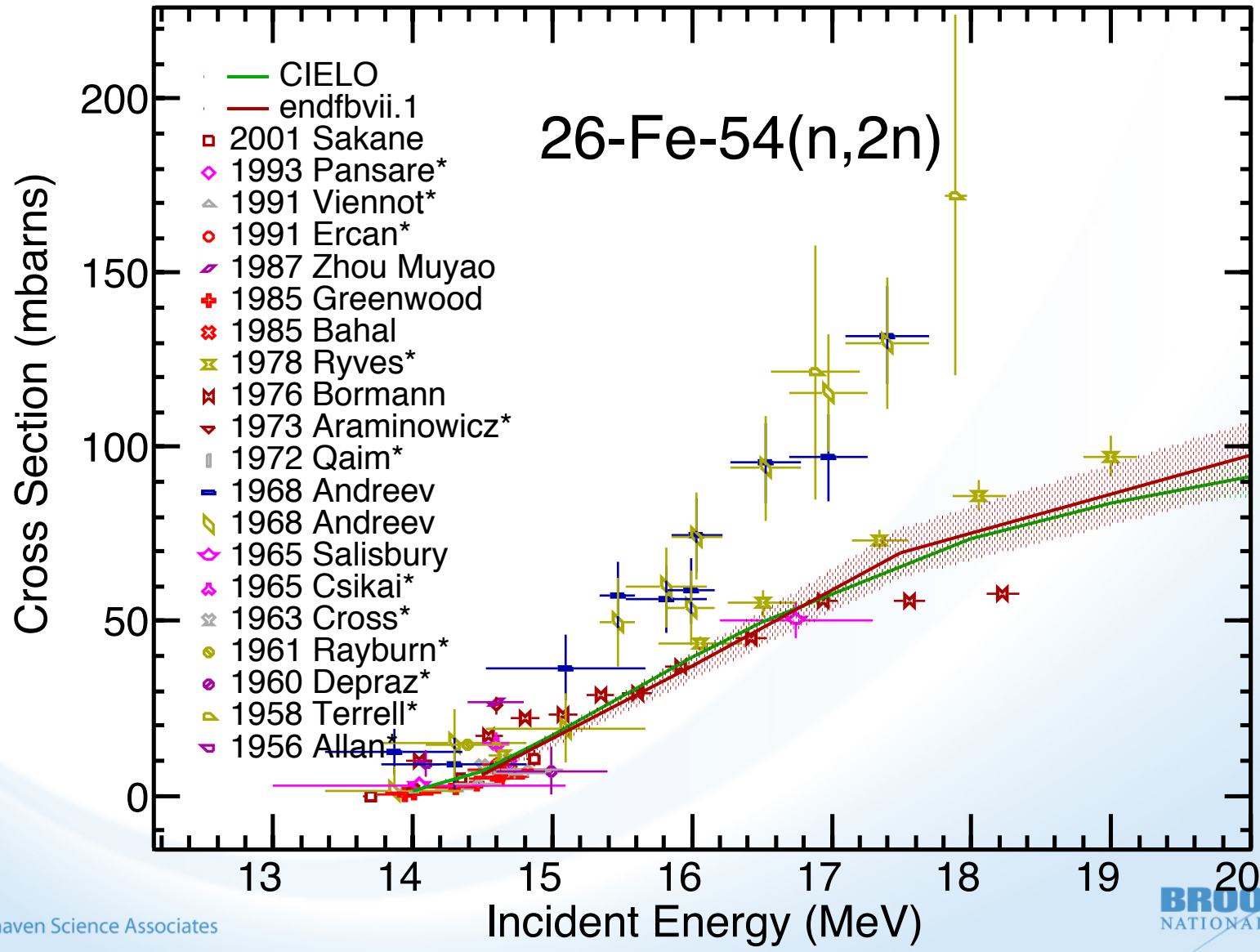
^{54}Fe


26-Fe-54(n,inl)
Cross Section (barns)
1.2
1.0
0.8
0.6
0.4
0.2
2
5
10
20
Incident Energy (MeV)
CIELO
endfbvii.1
1986 Guenther
1973 Fjodorov

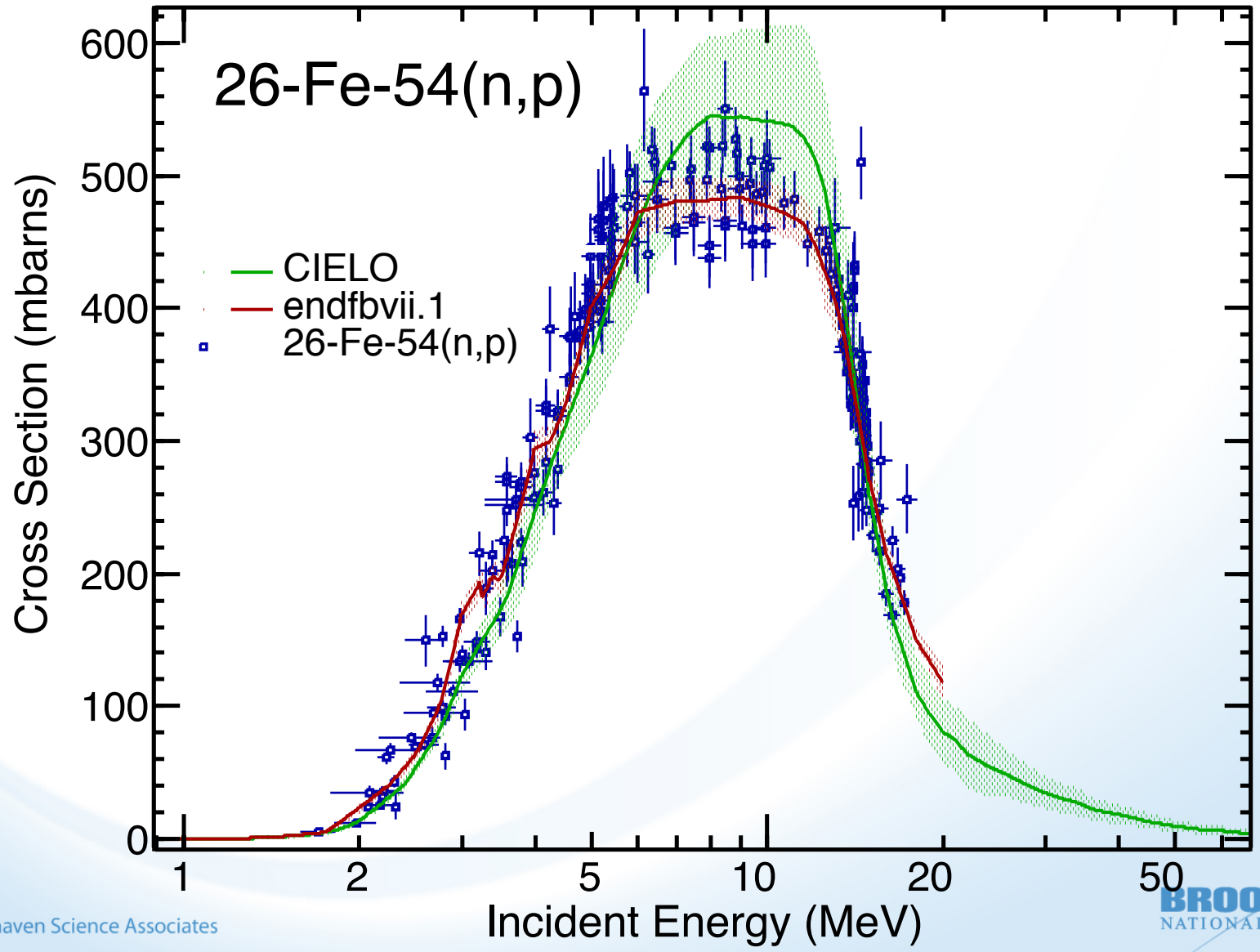
^{54}Fe


26-Fe-54(MT=51)MF=3 El1.41E+6
Cross Section (mbarns)
1000
500
0
2
5
10
20
Incident Energy (MeV)
CIELO El1.41E+6
endfbvii.1 El1.41E+6
1987 Korzh
1986 Guenther
1986 Guenther
1982 El-Kadi
1977 Korzh
1975 Mittler
1975 Korzh
1975 Almen-Ramstrom*
1974 Fedorov
1974 Kinney
1971 Boschung
1967 Rodgers

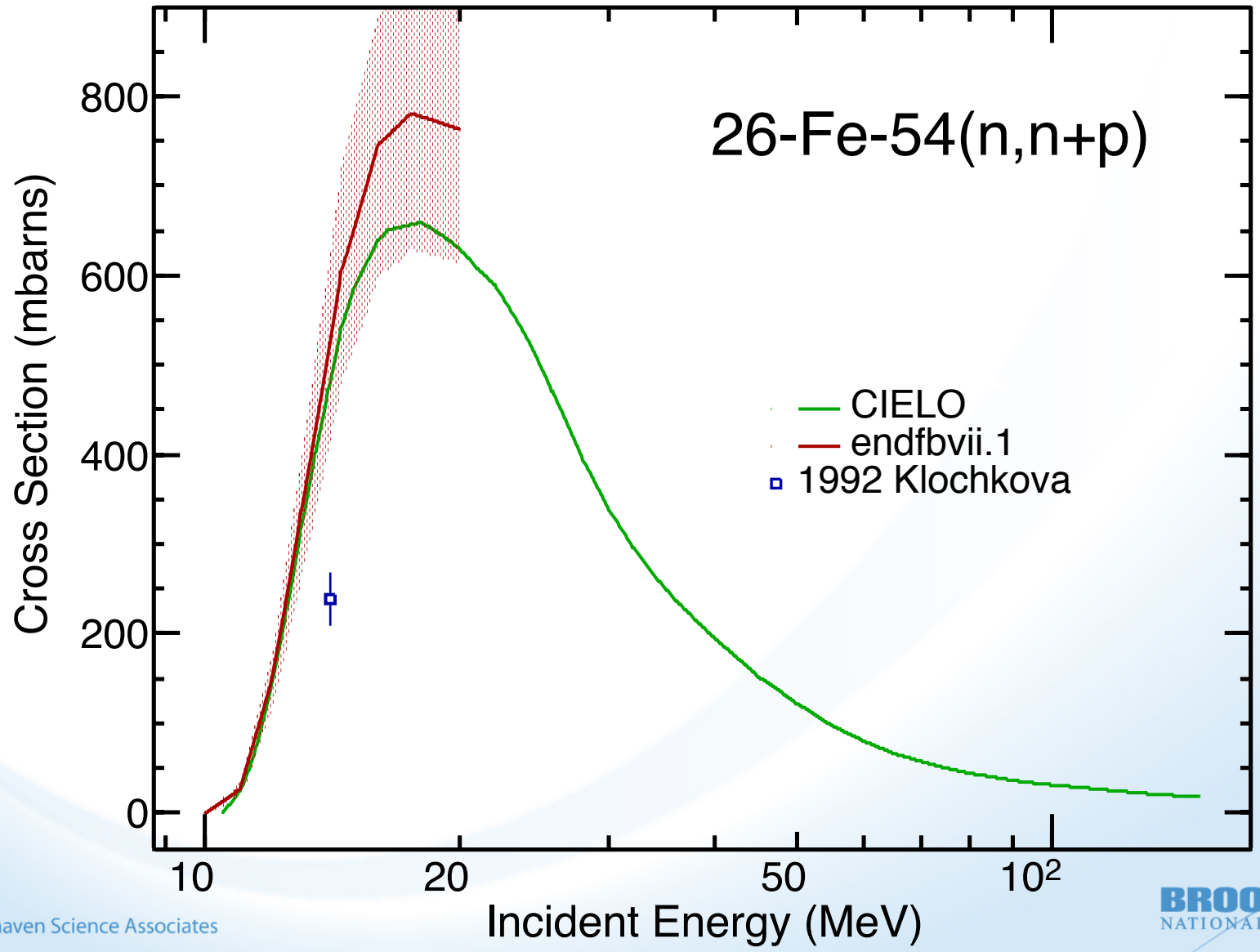
^{54}Fe


26-Fe-54(n,2n)
CIELO
endfbvii.1
2001 Sakane
1993 Pansare*
1991 Viennot*
1991 Ercan*
1987 Zhou Muyao
1985 Greenwood
1985 Bahal
1978 Ryves*
1976 Bormann
1973 Araminowicz*
1972 Qaim*
1968 Andreev
1968 Andreev
1965 Salisbury
1965 Csikai*
1963 Cross*
1961 Rayburn*
1960 Depraz*
1958 Terrell*
1956 Allan*
Cross Section (mbarns)
0
50
100
150
200
13
14
15
16
17
18
19
20
Incident Energy (MeV)

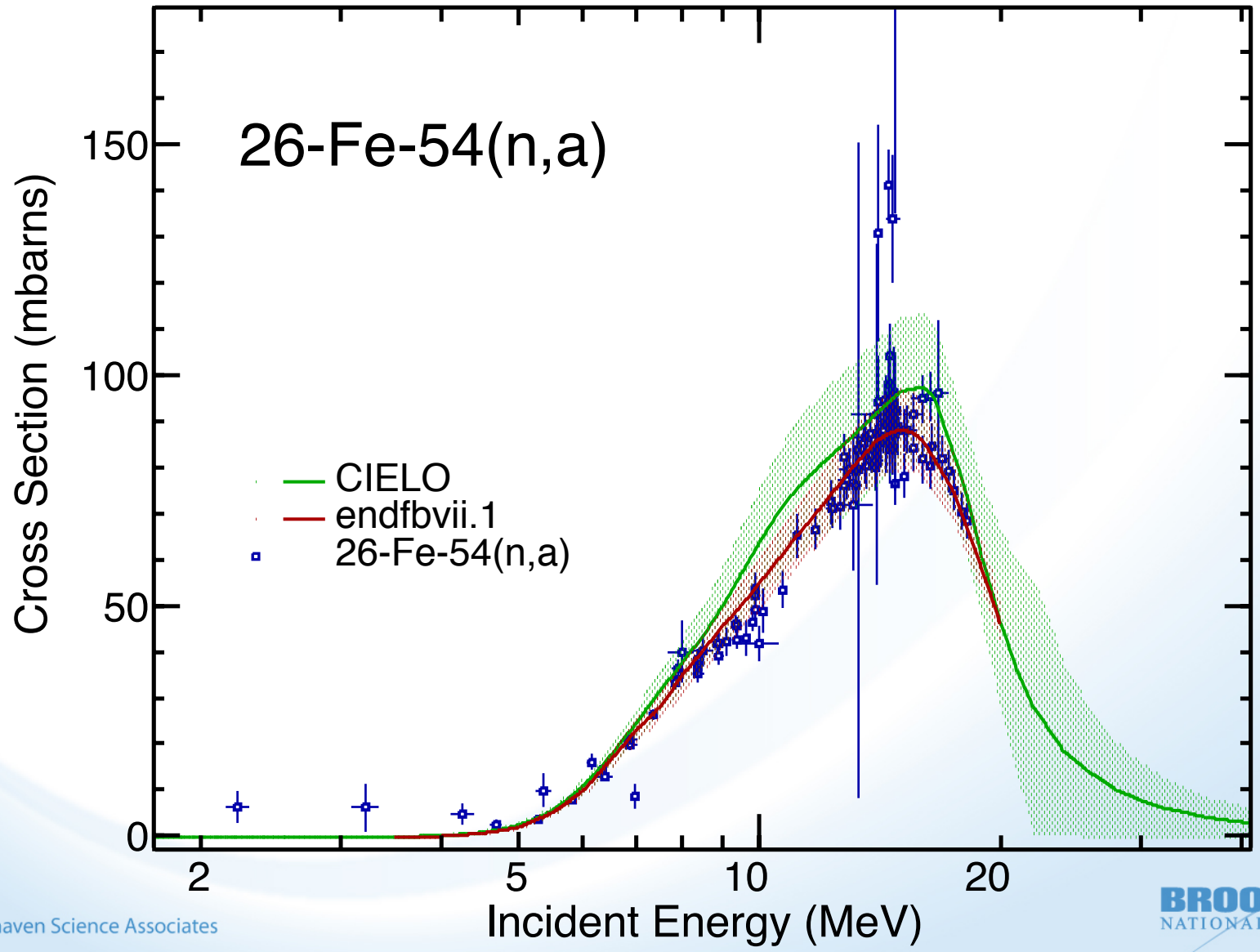
^{54}Fe


26-Fe-54(n,p)
CIELO
endfbvii.1
26-Fe-54(n,p)
Cross Section (mbarns)
Incident Energy (MeV)
0
100
200
300
400
500
600
1
2
5
10
20
50

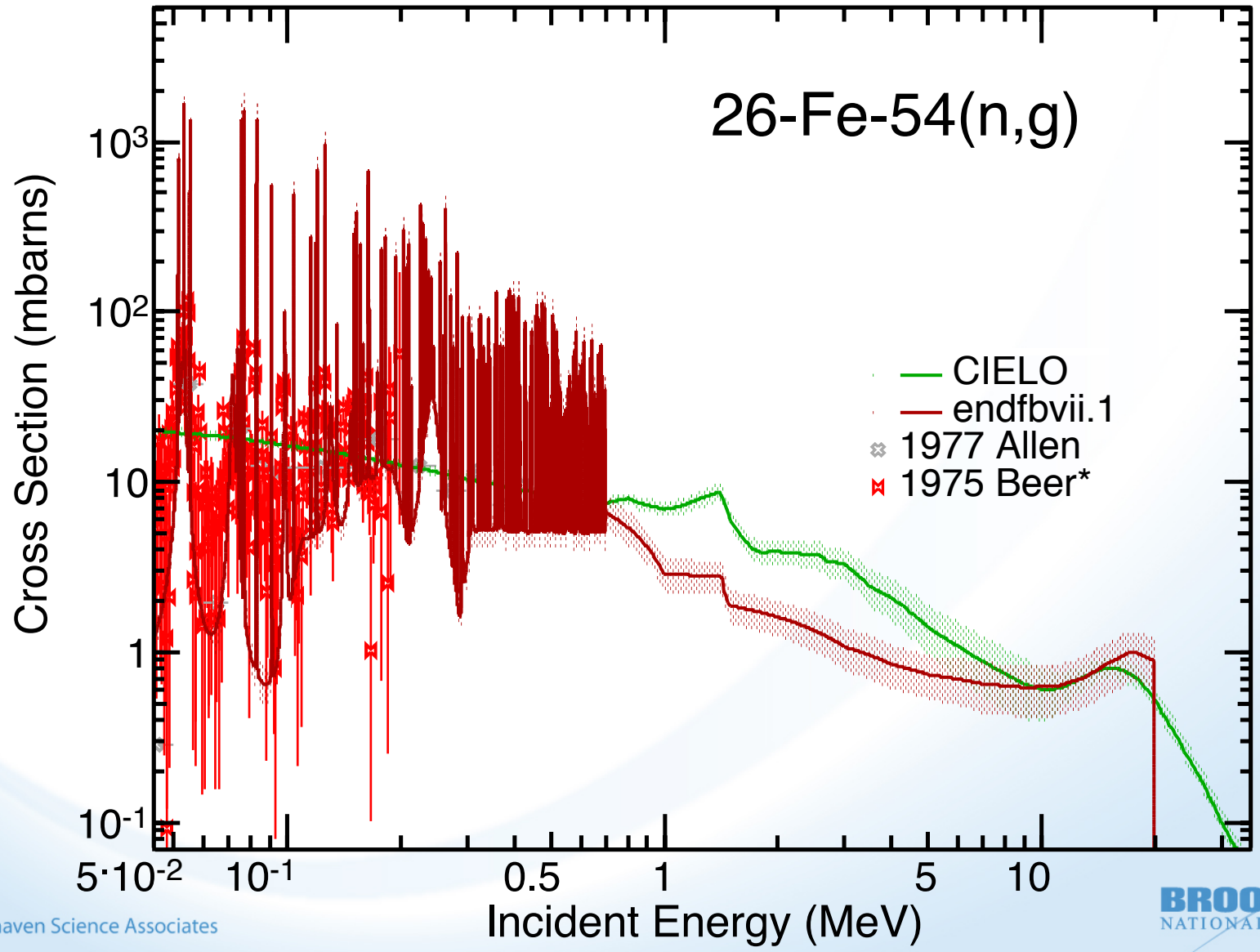
^{54}Fe


26-Fe-54(n,n+p)
CIELO
endfbvii.1
1992 Klochkova
Cross Section (mbarns)
0
200
400
600
800
10
20
50
10^2
Incident Energy (MeV)

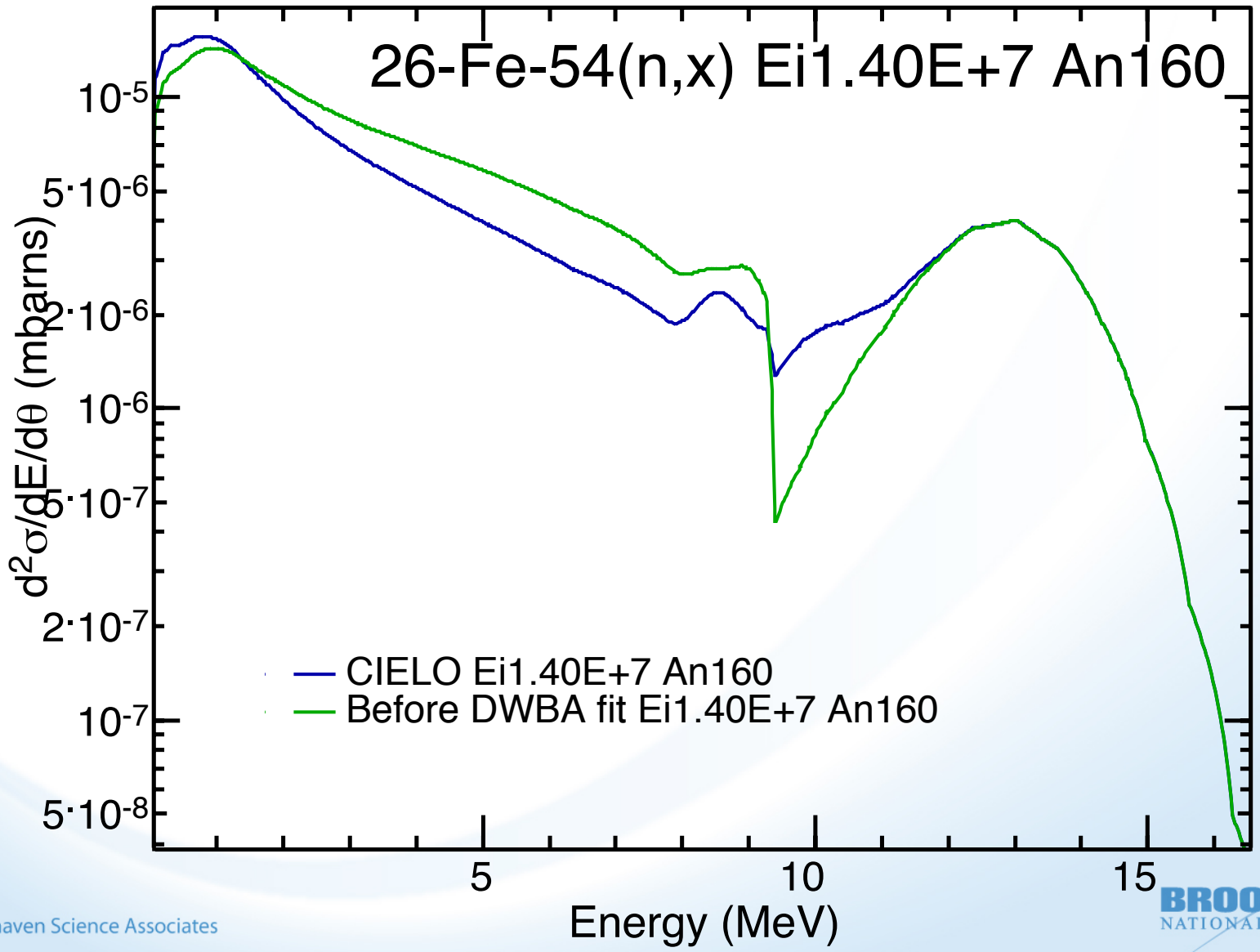
^{54}Fe


26-Fe-54(n,a)
CIELO
endfbvii.1
26-Fe-54(n,a)
Cross Section (mbarns)
0
50
100
150
2
5
10
20
Incident Energy (MeV)

^{54}Fe

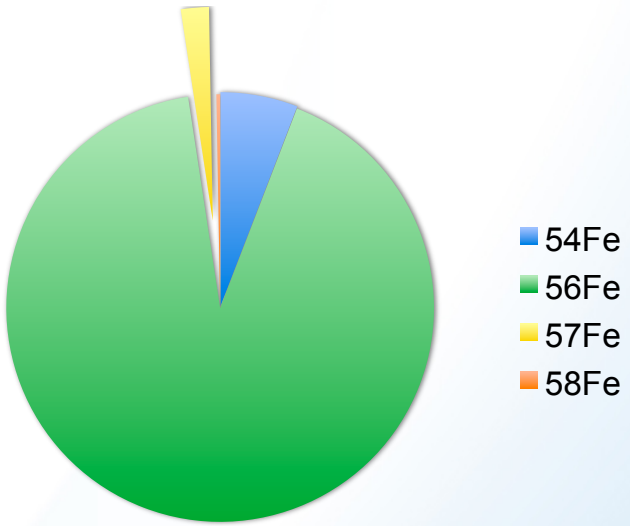

26-Fe-54(n,g)
CIELO
endfbvii.1
1977 Allen
1975 Beer*
Cross Section (mbarns)
Incident Energy (MeV)
10^3
10^2
10
1
10^-1
5·10^-2
10^-1
0.5
1
5
10

^{54}Fe

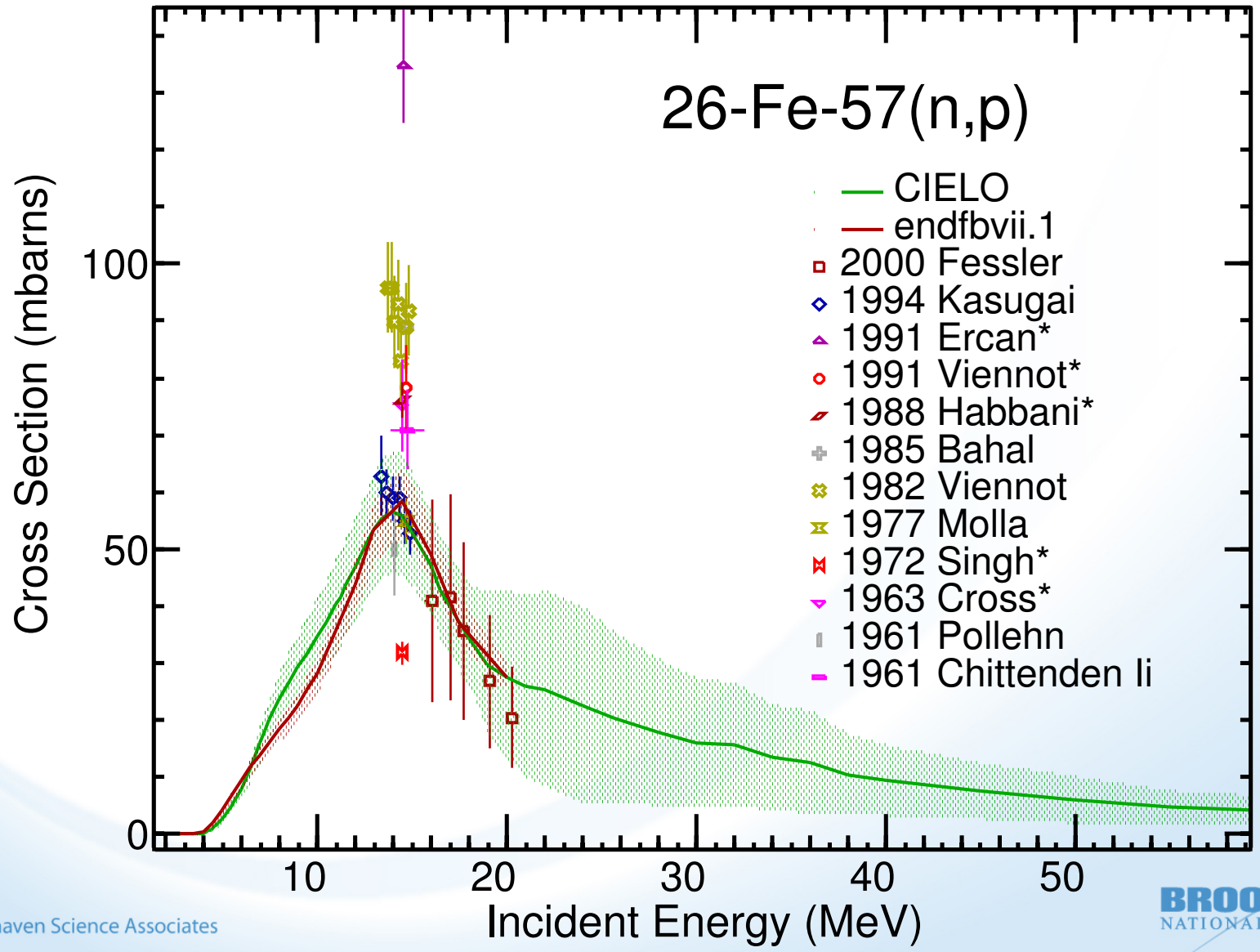

26-Fe-54(n,x) Ei1.40E+7 An160
CIELO Ei1.40E+7 An160
Before DWBA fit Ei1.40E+7 An160
d²σ/dE/dθ (mbarns)
Energy (MeV)
10-5
5·10-6
2·10-6
10-6
5·10-7
2·10-7
10-7
5·10-8
5
10
15

^{57}Fe

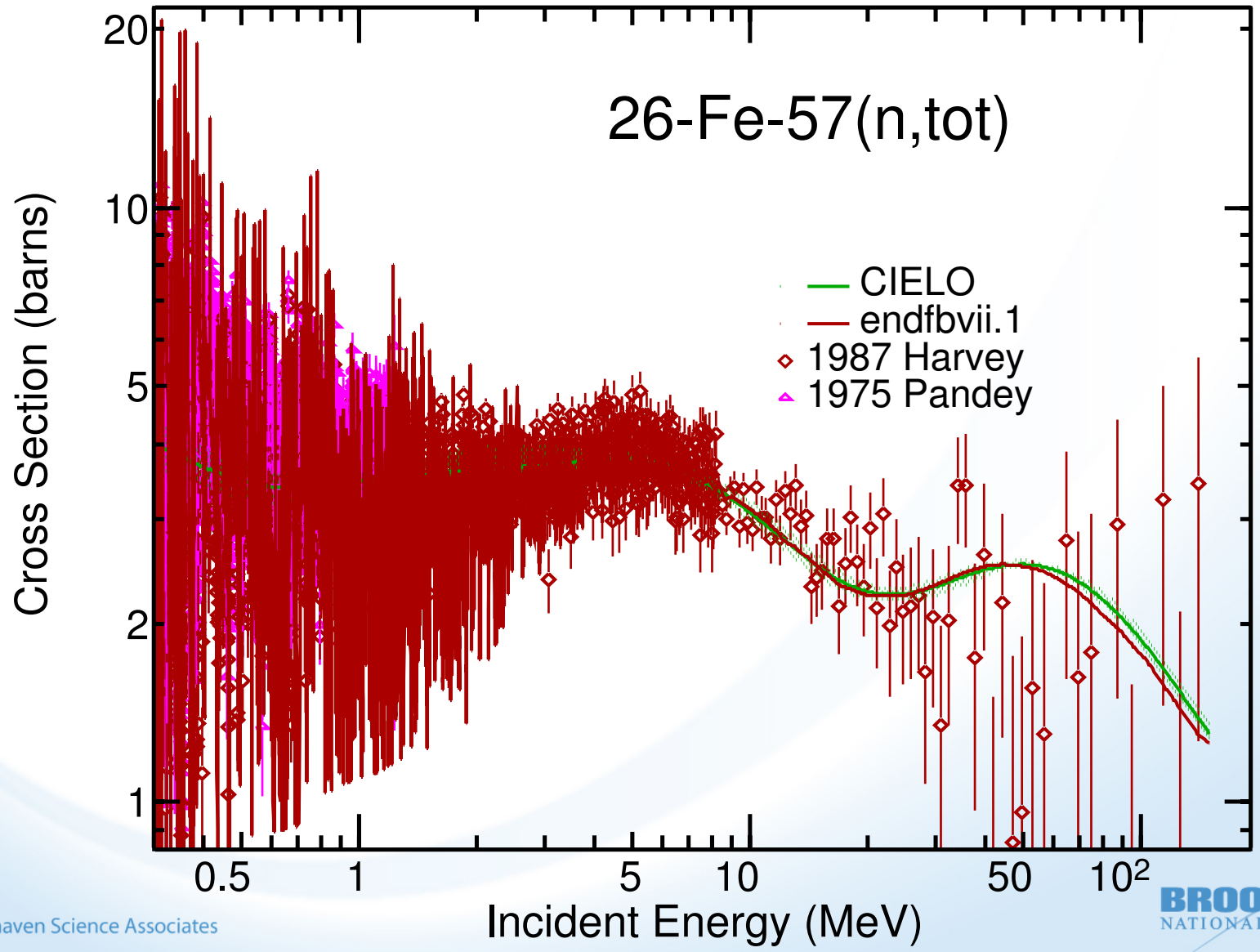
- Soukhovitskii-Capote OMP for odd iron isotopes
- No reduction of (n,tot) necessary
- Few experimental datasets (No dosimetry file)
- Fit (n,p) to select experiments
- Low-energy peak for inelastic cross section



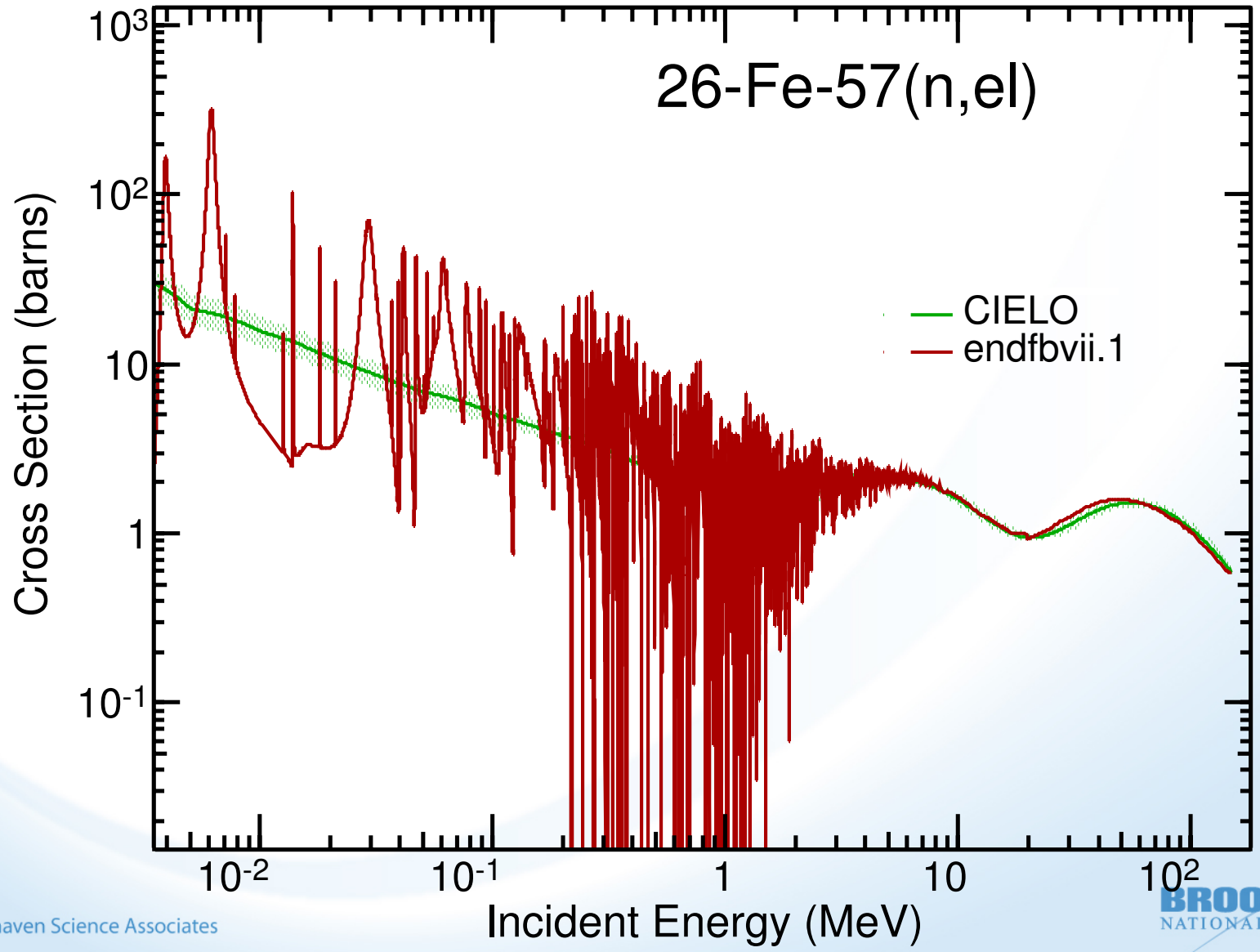
^{57}Fe


26-Fe-57(n,p)
CIELO
endfbvii.1
2000 Fessler
1994 Kasugai
1991 Ercan*
1991 Viennot*
1988 Habbani*
1985 Bahal
1982 Viennot
1977 Molla
1972 Singh*
1963 Cross*
1961 Pollehn
1961 Chittenden li
Cross Section (mbarns)
0
50
100
10
20
30
40
50
Incident Energy (MeV)

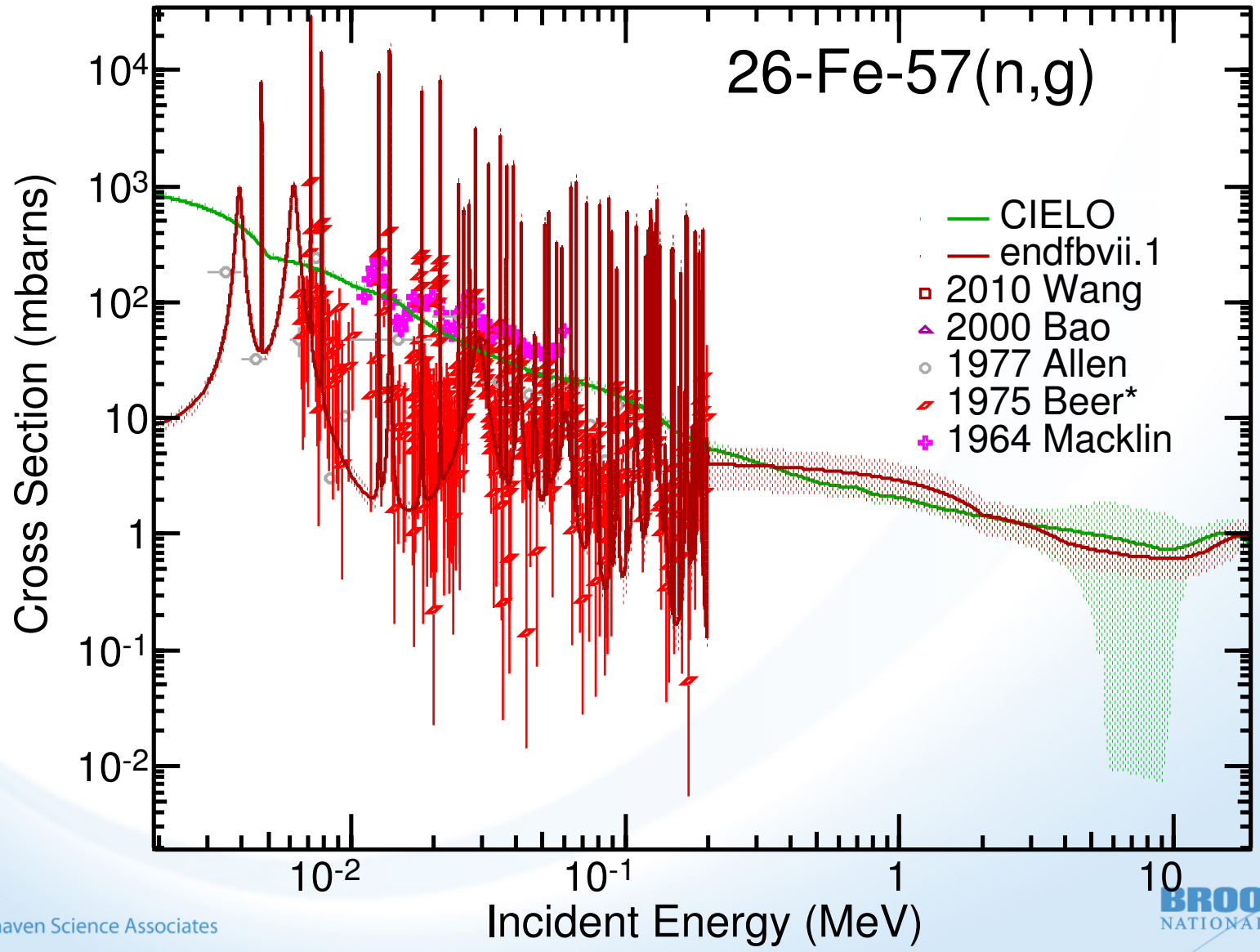
^{57}Fe


26-Fe-57(n,tot)
CIELO
endfbvii.1
1987 Harvey
1975 Pandey
Cross Section (barns)
Incident Energy (MeV)
20
10
5
2
1
0.5
1
5
10
50
10²

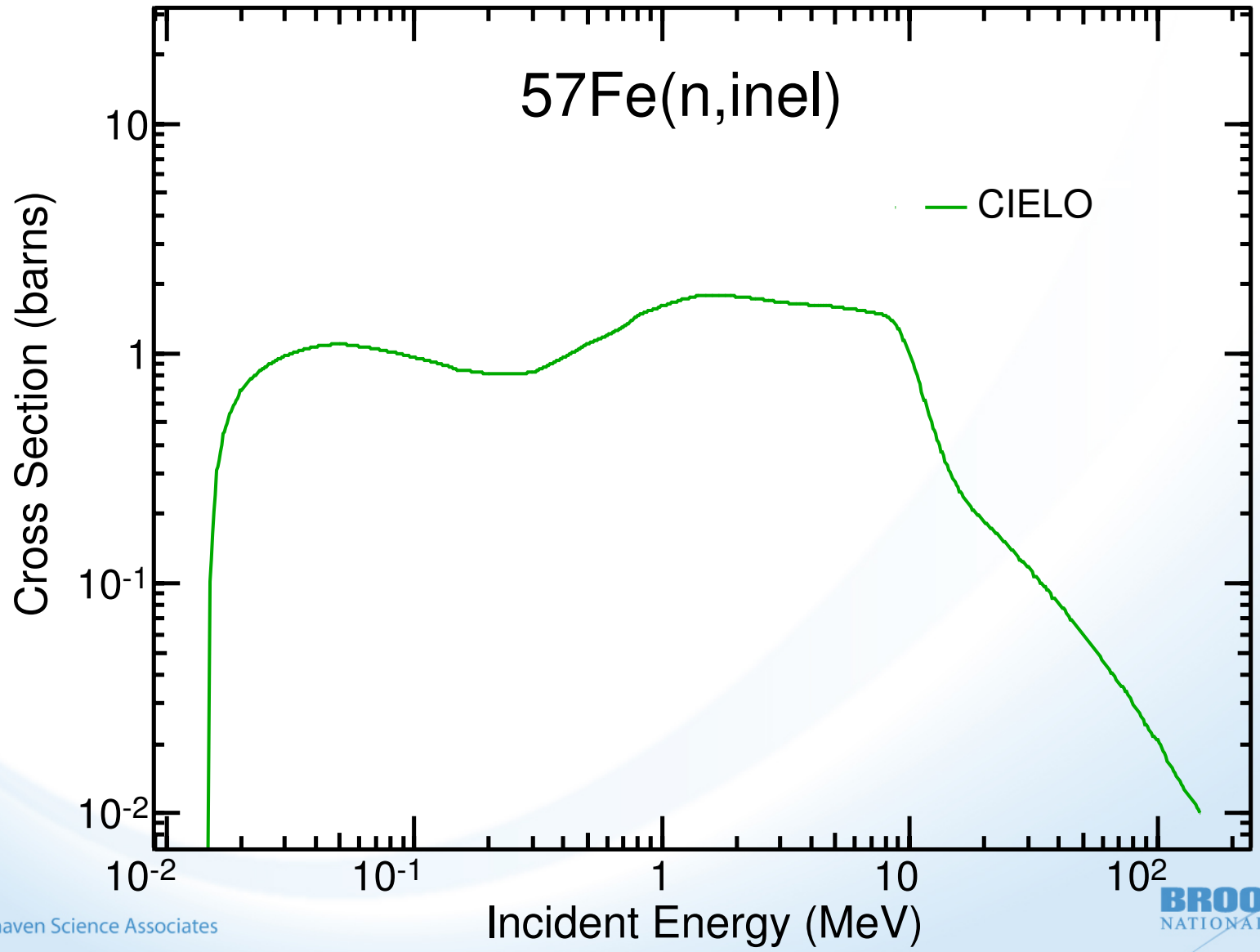
^{57}Fe


26-Fe-57(n,el)
CIELO
endfbvii.1
Cross Section (barns)
Incident Energy (MeV)
10^3
10^2
10
1
10^-1
10^-2
10^-1
1
10
10^2

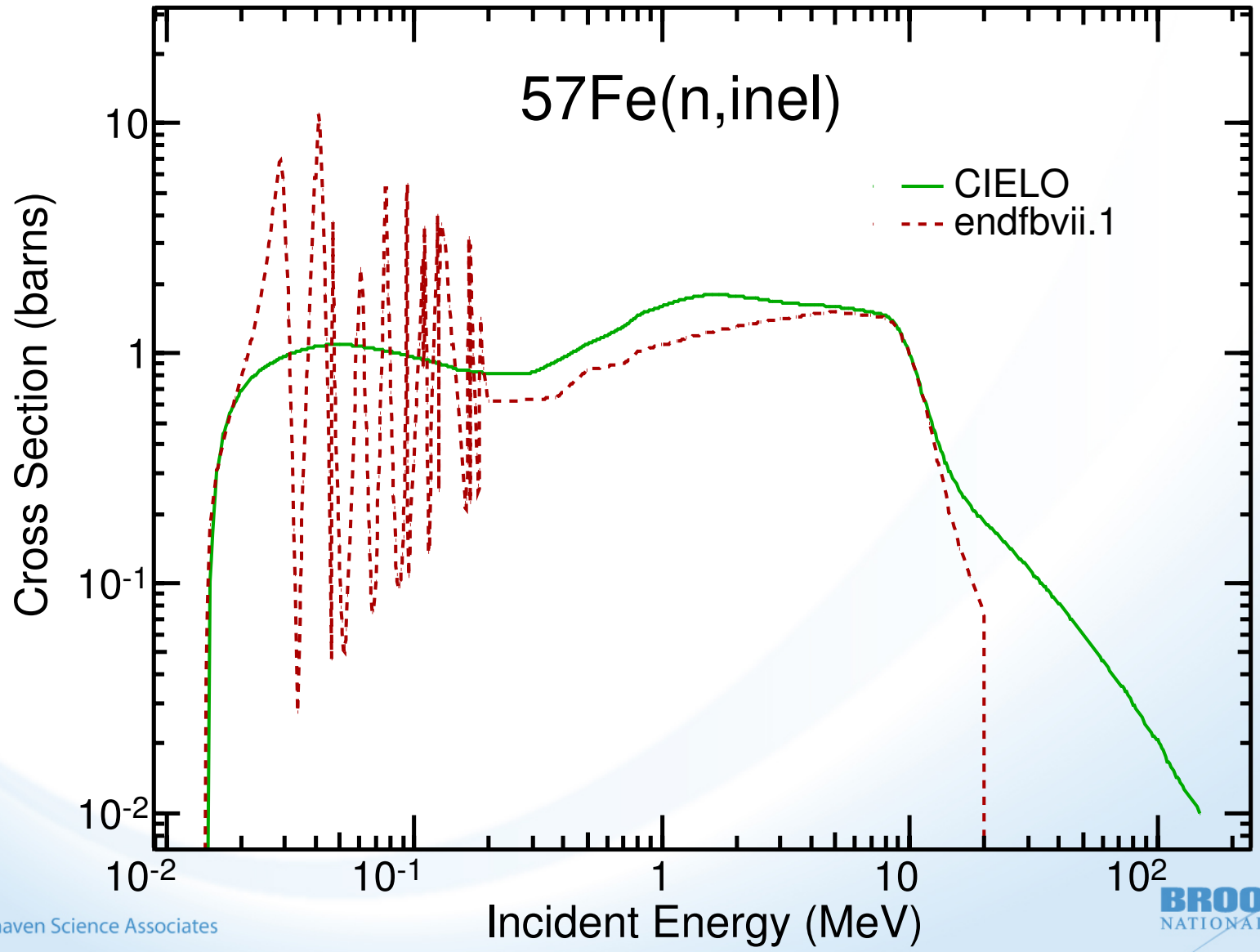
^{57}Fe


26-Fe-57(n,g)
CIELO
endfbvii.1
2010 Wang
2000 Bao
1977 Allen
1975 Beer*
1964 Macklin
Cross Section (mbarns)
Incident Energy (MeV)
10^4
10^3
10^2
10
1
10^-1
10^-2
10^-2
10^-1
1
10

^{57}Fe

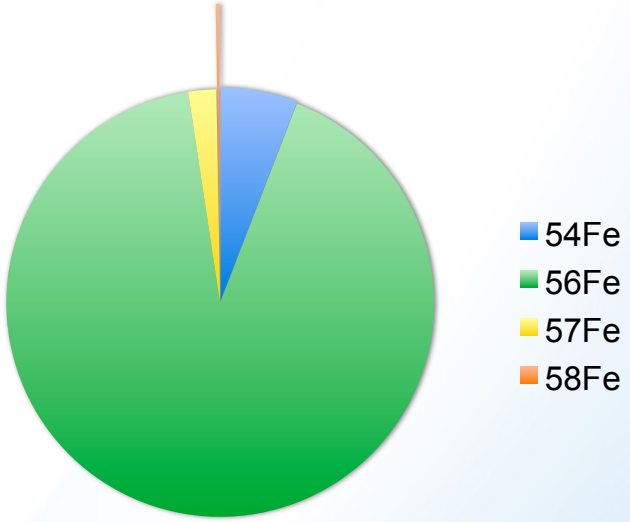

57Fe(n,inel)
CIELO
Cross Section (barns)
10
1
10-1
10-2
10-2
10-1
1
10
102
Incident Energy (MeV)

^{57}Fe

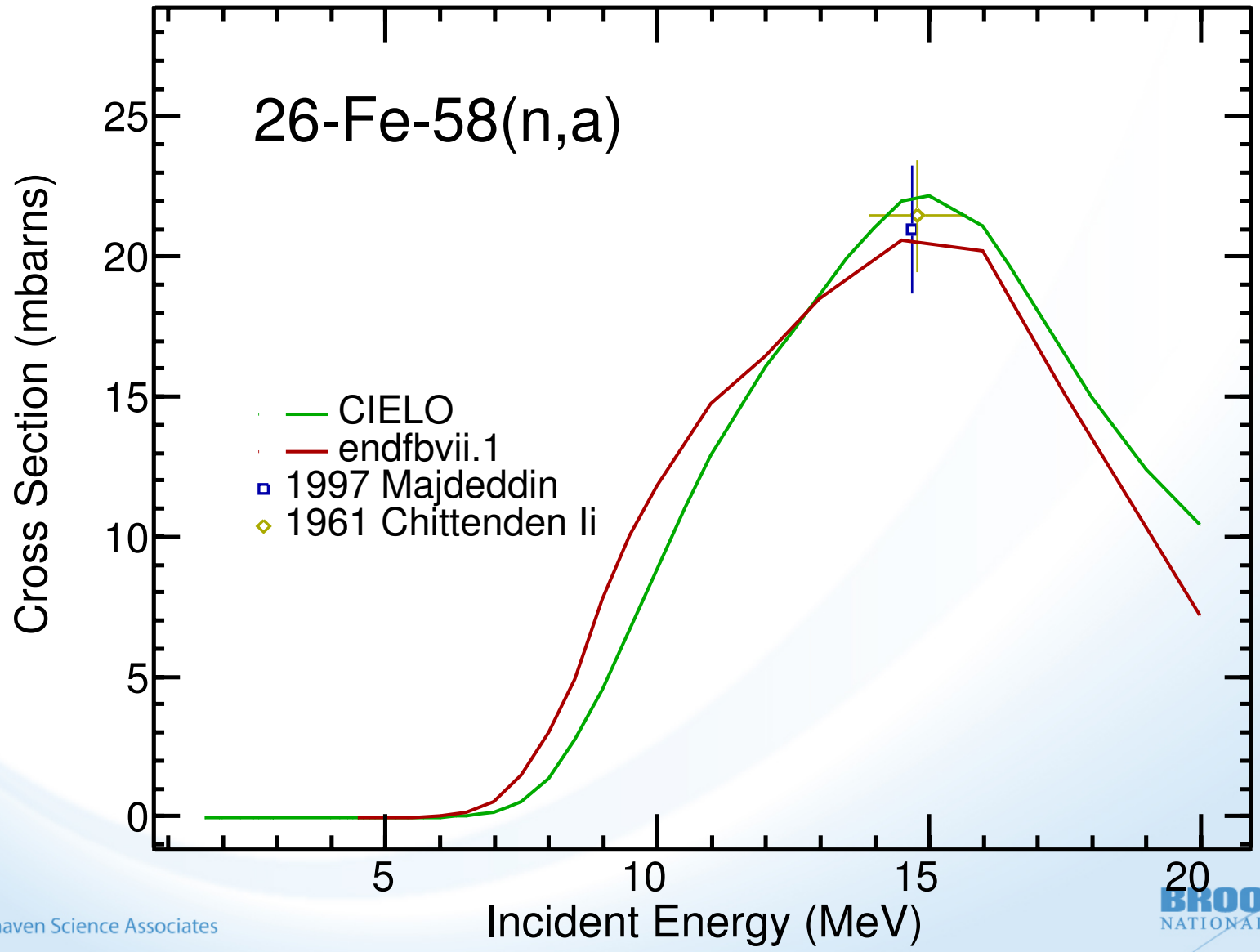

57Fe(n,inel)
CIELO
endfbvii.1
Cross Section (barns)
Incident Energy (MeV)
10
1
10-1
10-2
10-2
10-1
1
10
102

^{58}Fe

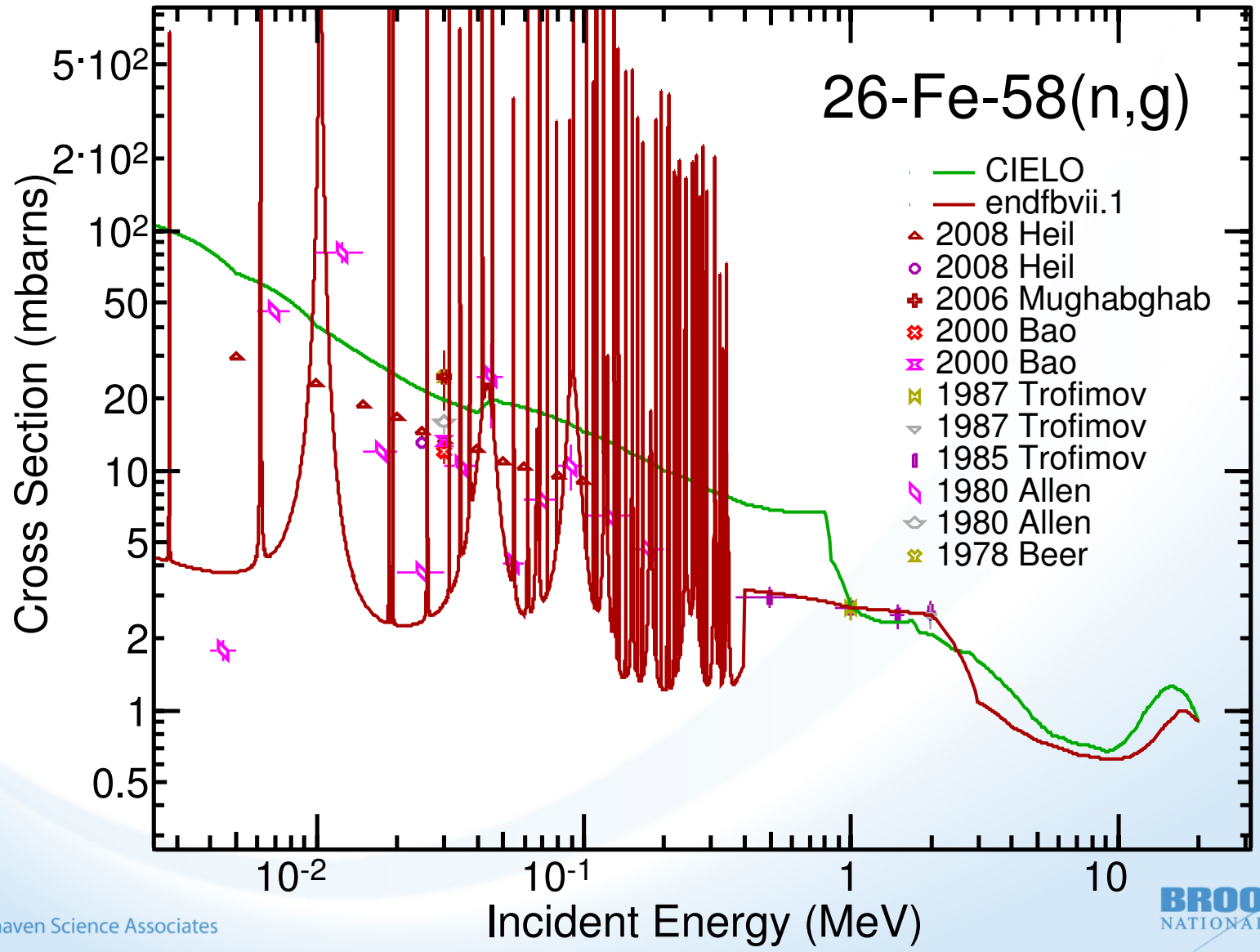
- Soukhovitskii-Capote OMP for even iron isotopes
- No reduction of (n,tot) necessary
- Even fewer experimental datasets (No dosimetry file)
- Fit (n,a) to the few experiments available



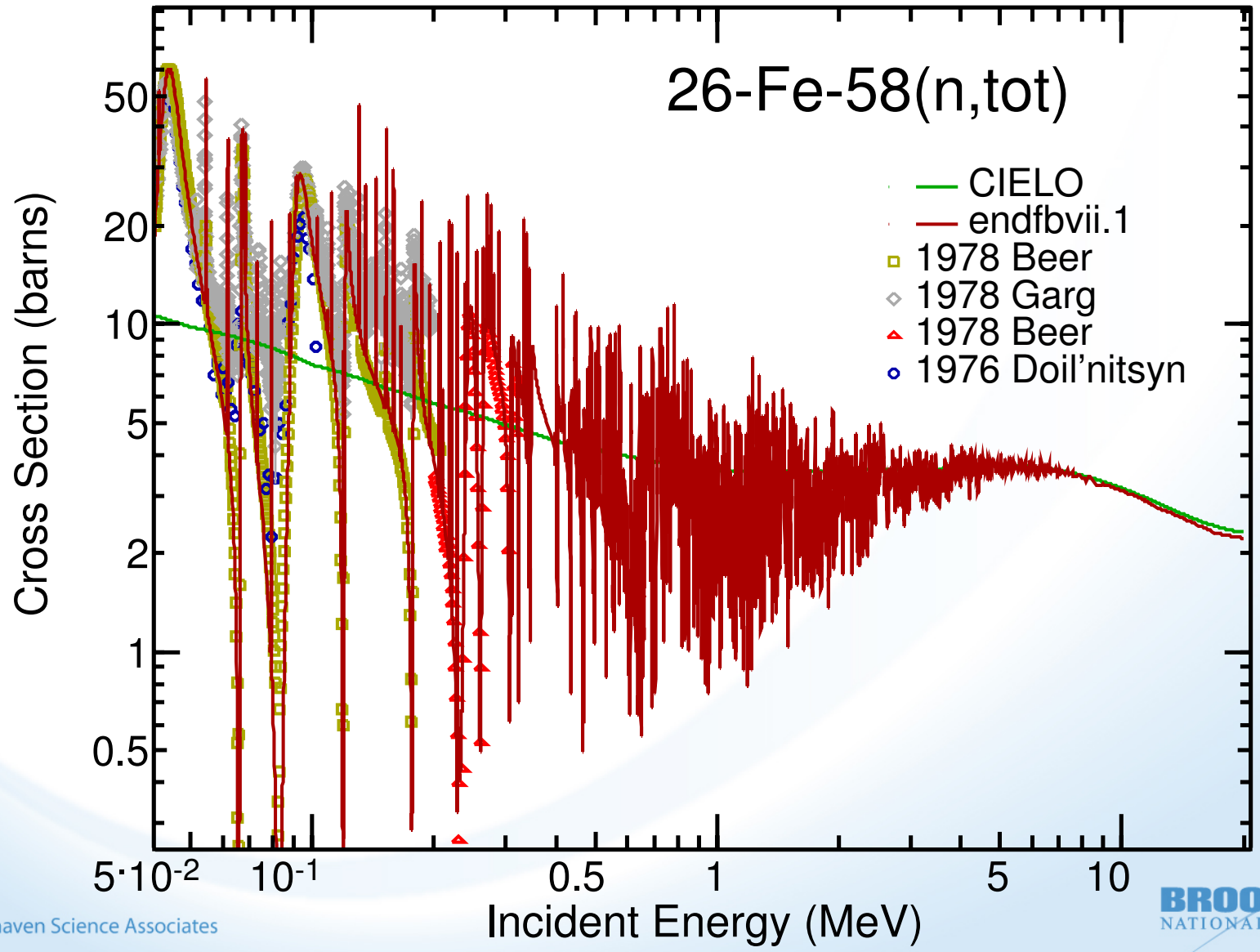
^{58}Fe


26-Fe-58(n,a)
CIELO
endfbvii.1
1997 Majdeddin
1961 Chittenden Ii
Cross Section (mbarns)
Incident Energy (MeV)
0
5
10
15
20
25
5
10
15
20

^{58}Fe


26-Fe-58(n,g)
CIELO
endfbvii.1
2008 Heil
2008 Heil
2006 Mughabghab
2000 Bao
2000 Bao
1987 Trofimov
1987 Trofimov
1985 Trofimov
1980 Allen
1980 Allen
1978 Beer
Cross Section (mbarns)
5·10²
2·10²
10²
50
20
10
5
2
1
0.5
10⁻²
10⁻¹
1
10
Incident Energy (MeV)

^{58}Fe


26-Fe-58(n,tot)
CIELO
endfbvii.1
1978 Beer
1978 Garg
1978 Beer
1976 Doil'nitsyn
Cross Section (barns)
50
20
10
5
2
1
0.5
5·10-2
10-1
0.5
1
5
10
Incident Energy (MeV)

Conclusions

- First versions of evaluated files for iron isotopes are ready
- Promising results even though minor improvements will be necessary
- Preliminary calculations of covariances were performed for main reactions
- Validation and tests have begun
- Consistency among isotope parameters