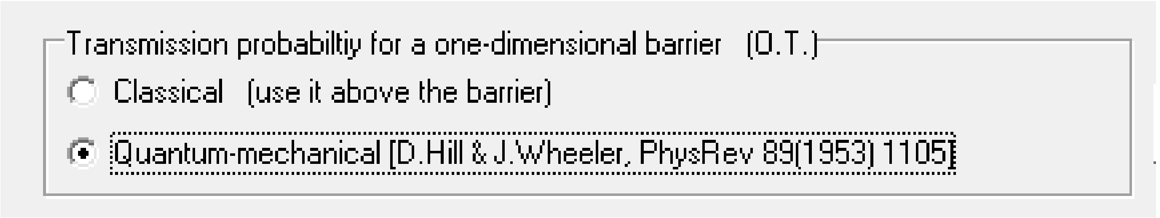
Quantum-mechanical transmission update in PACE IV

PACE version : 4.20
In LISE++ package v.9.6.31
from 23-May-2013



1. R_fusion value has been used to calculate partial waves L in QM mode, in order to avoid "classical" subroutines in at energies below the barrier.
However this assumption gives some serious jumps (it will be shown later), and the code has been modified to avoid this problem, coming back above the barrier to the classical solution in QM mode.

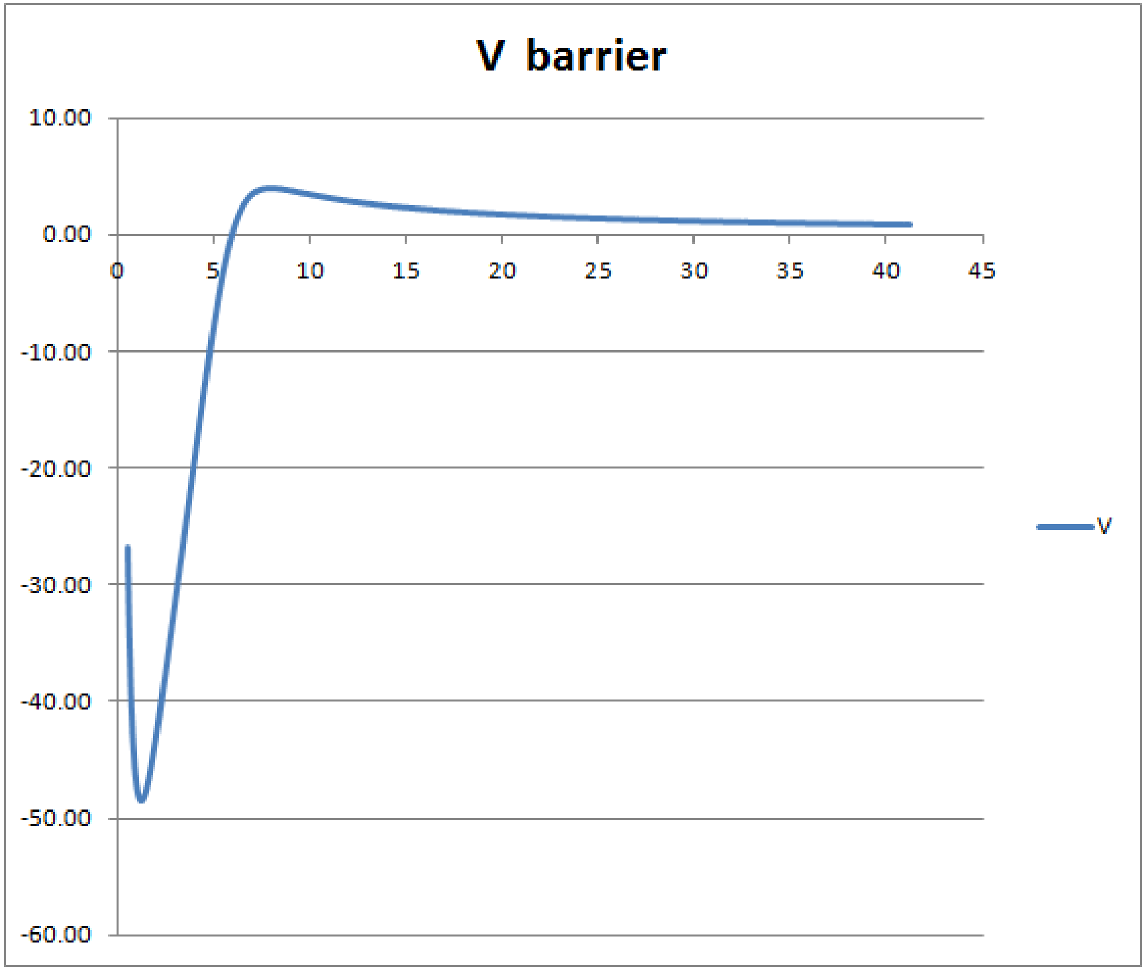
2. Default value of AGRAZ which was equal to 4, now set to 2

All examples in this presentation were done for the combination
$^{10}Be + ^{12}C$

Why the jump had place at 30 MeV ($^{10}Be+^{12}C$)

Bass subroutine

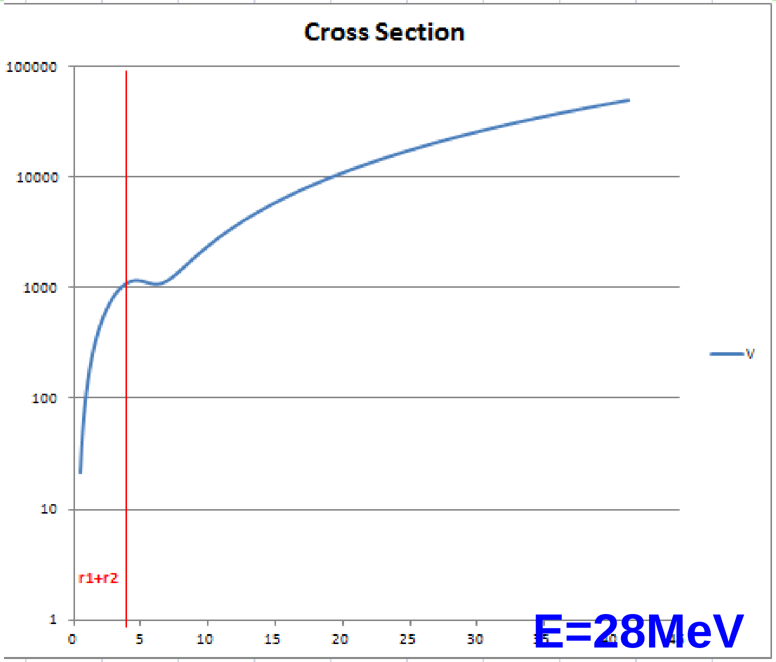
R1	1.914	fm
R2	2.088	fm
A1	10	
A2	12	
Z1	4	
Z2	6	

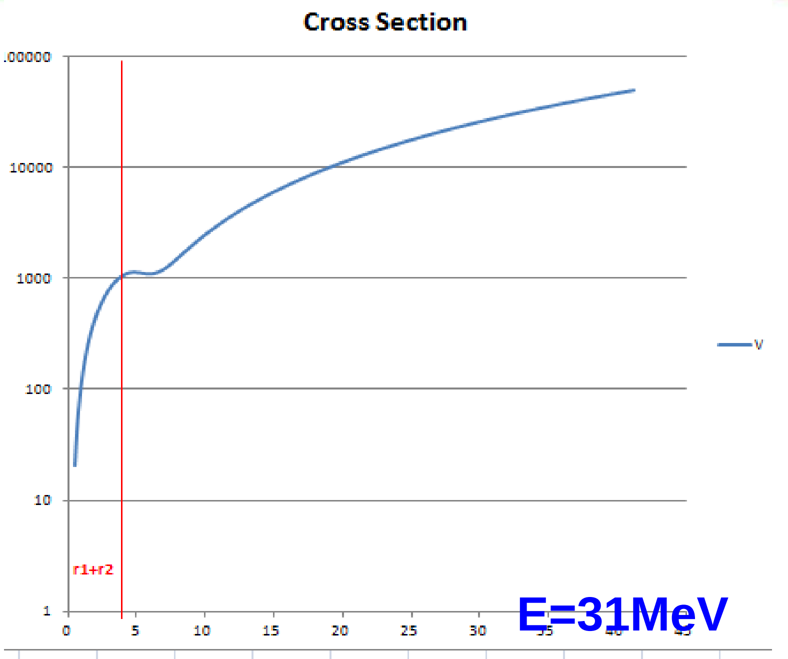


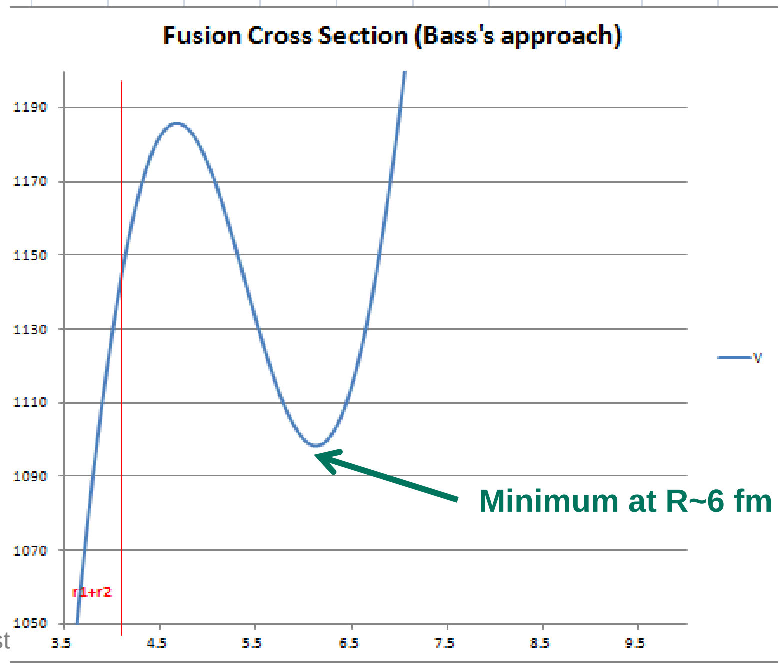
Why the jump had place at 30 MeV ($^{10}Be+^{12}C$)

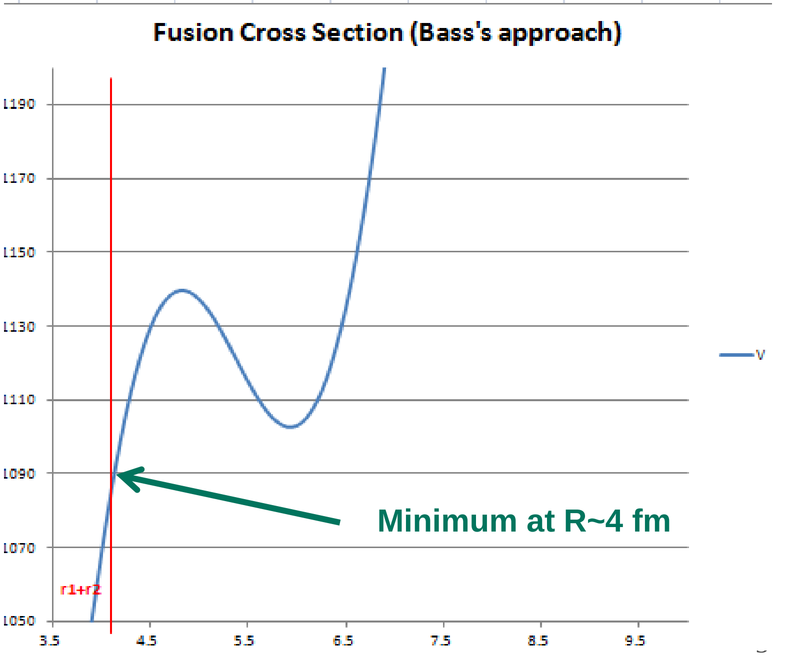
Bass Subroutine

Search for minimum CS









$^{10}Be+^{12}C$ -> comparison between versions in QM mode

	mb	mb	mb	events	mb
Elab	Fusion	Bass	Fission	Alpha	Alpha
5	24.3	23.6	0	295	7.2
13	710	777	0	405	287.6
21	880	1040	0	568	499.8
29	868	1100	0	663	575.5
37	403	986	0	729	293.8
45	423	903	0	867	366.7
50	441	864	0	931	410.6
100	494	690	2.47	1331	657.5
150	477	631.5	14.8	1277	609.1
200	487	602	36.5	1281	623.8
250	508	585	68.6	1312	666.5
260	489	582	72.4	1307	639.1
270	511	580	82.8	1273	650.5
280	493	578	90.7	1271	626.6
290	514	575.4	97.7	1250	642.5
300	497	573	91	1264	628.2
310	516	571.5	102	1238	638.8
320	503	570	110	1146	576.4
330	496	568	121	1202	596.2
340	509	567	140	1188	604.7
350	494	565	139	1125	555.8
400	497	559	171	1065	529.3

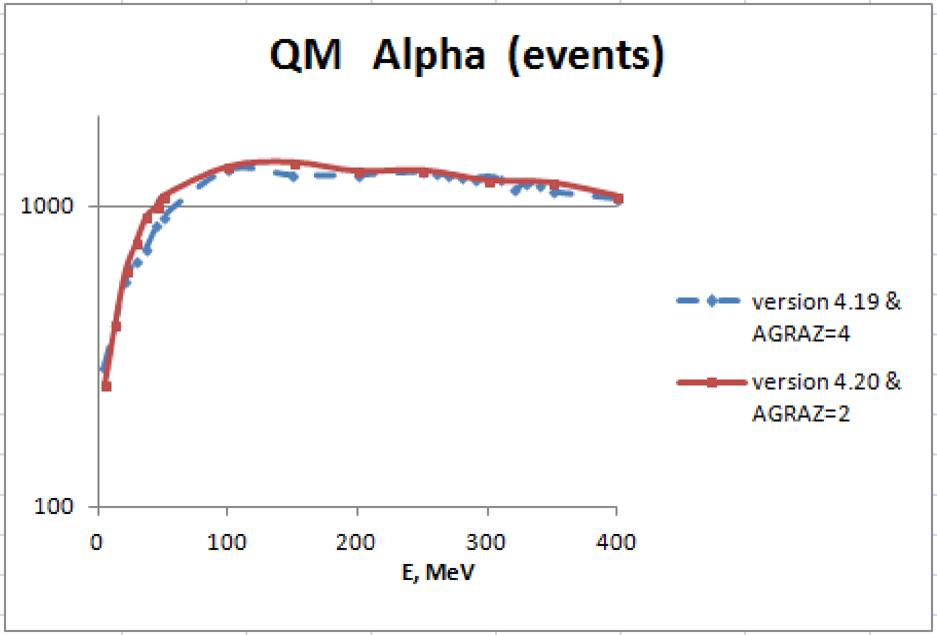
AGRAZ=4
version 4.19

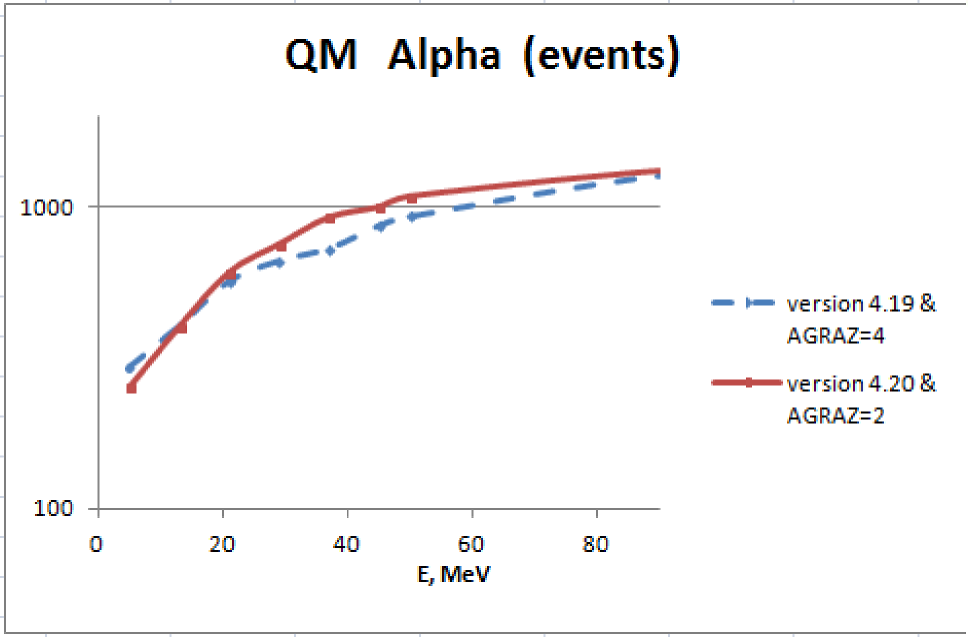
1000 event	mb	mb	events	mb
Elab	Fusion	Fission	Alpha	Alpha
5	24.3		255	6.2
13	776		404	313.5
21	1040		609	633.4
29	1100		753	828.3
37	986		923	910.1
45	903		997	900.3
50	863		1082	933.8
100	689	9.65	1355	933.6
150	631	23.4	1401	884.0
200	602	47	1308	787.4
250	585	70.2	1319	771.6
300	573	100	1220	699.1
350	565	145	1199	677.4
400	559	170	1084	606.0

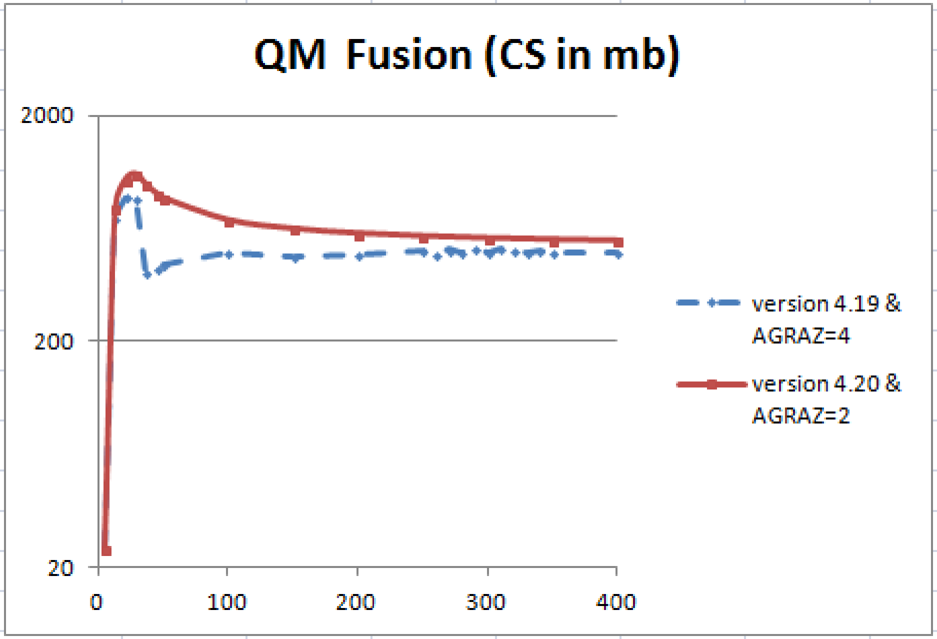
AGRAZ=2
version 4.20

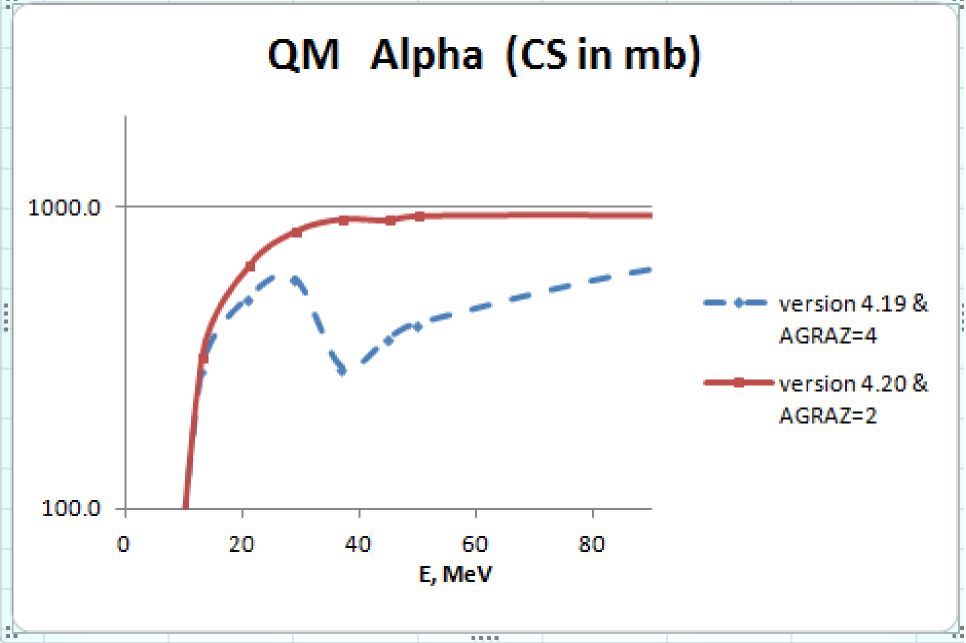
See the next slide for figures with these data

$^{10}Be+^{12}C$ -> comparison between versions in QM mode









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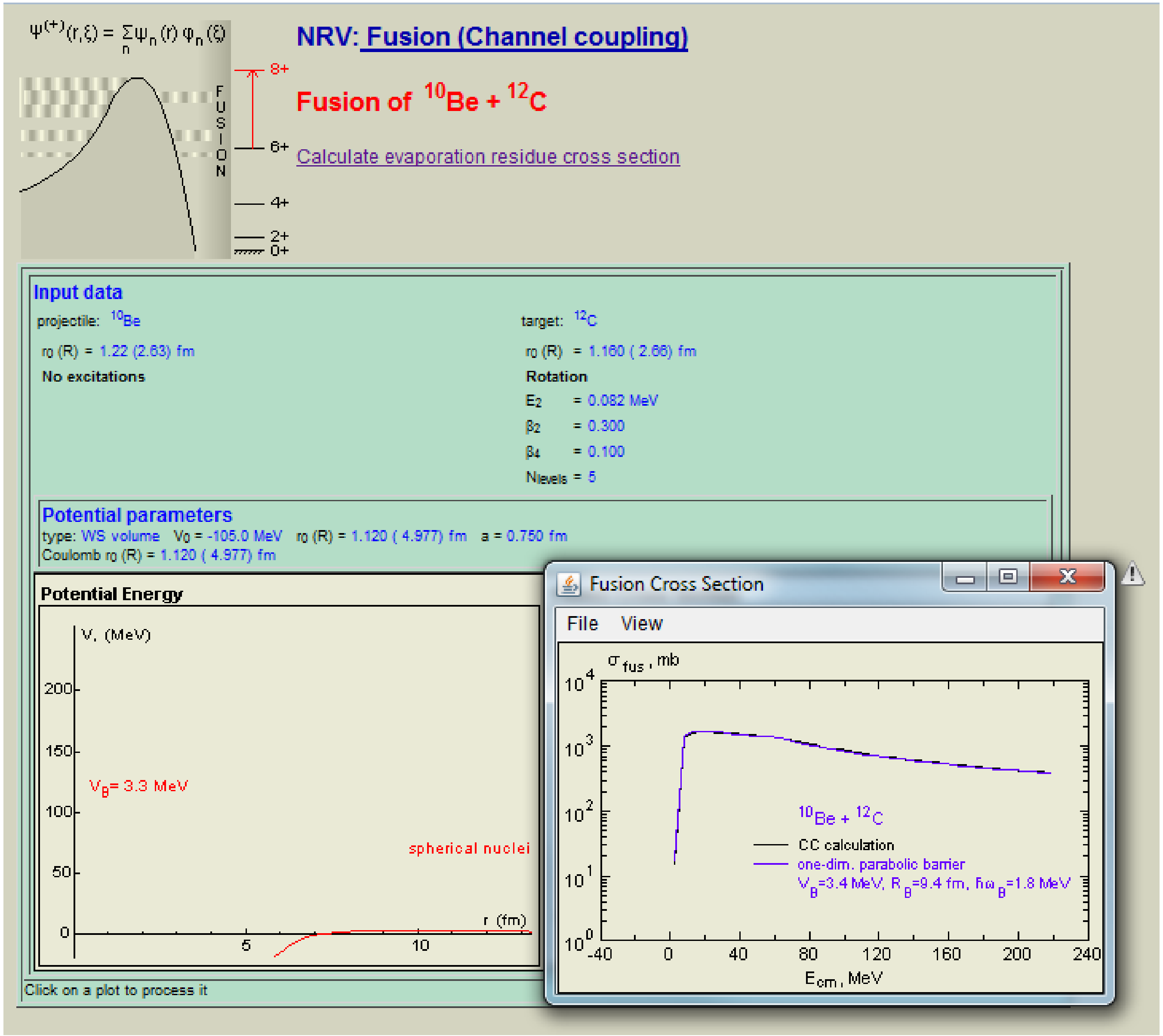
LISE++ partner site

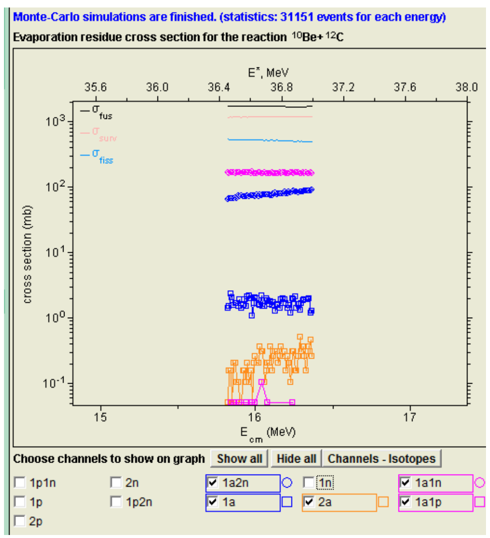
http://nrv.jinr.ru/nrv/webnrv/fusion/

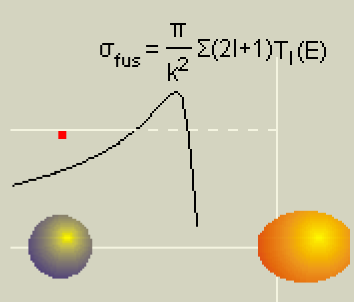


$^{10}Be+^{12}C$ -> NRV

LISE++ partner site

http://nrv.jinr.ru/nrv/webnrv/fusion/





NRV: Fusion (Empirical model)

Fusion of $^{10}Be + ^{12}C$

Calculate evaporation residue cross section

Input data

projectile: ^{10}Be target: ^{12}C

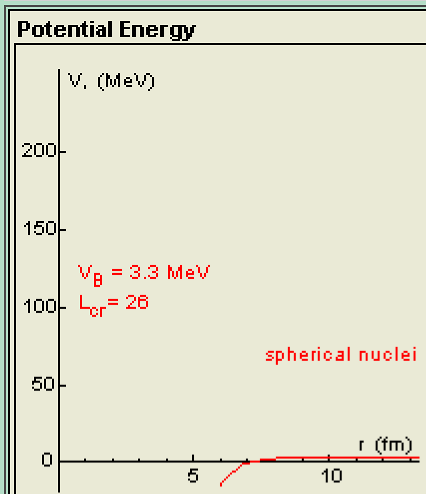
projectile	target
r_0 (R) = 1.220 (2.63) fm	r_0 (R) = 1.160 (2.66) fm
λ = 2	λ = 2
C = 8.85 MeV fm^{-2}	C = 4.50 MeV fm^{-2}

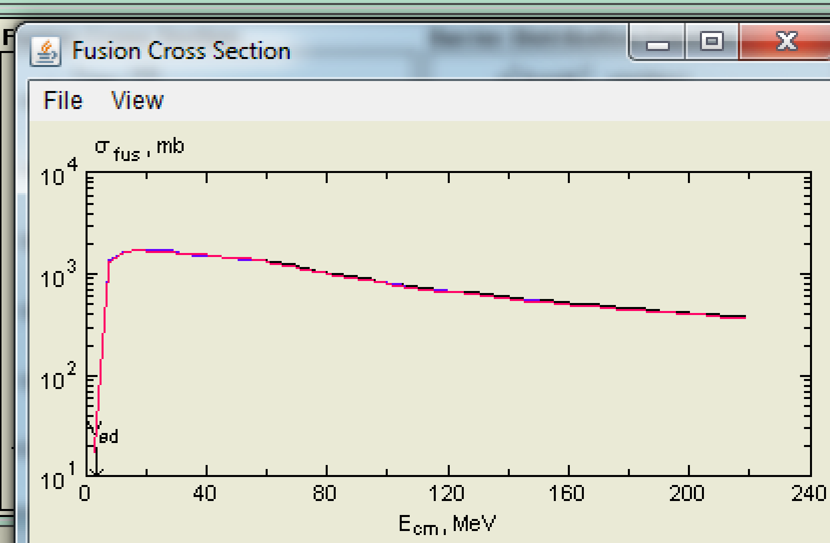
Potential parameters

type: WS volume V_0 = -105.0 MeV r_0 (R) = 1.120 (4.977) fm a = 0.750 fm
Coulomb r_0 (R) = 1.120 (4.977) fm

Derived data

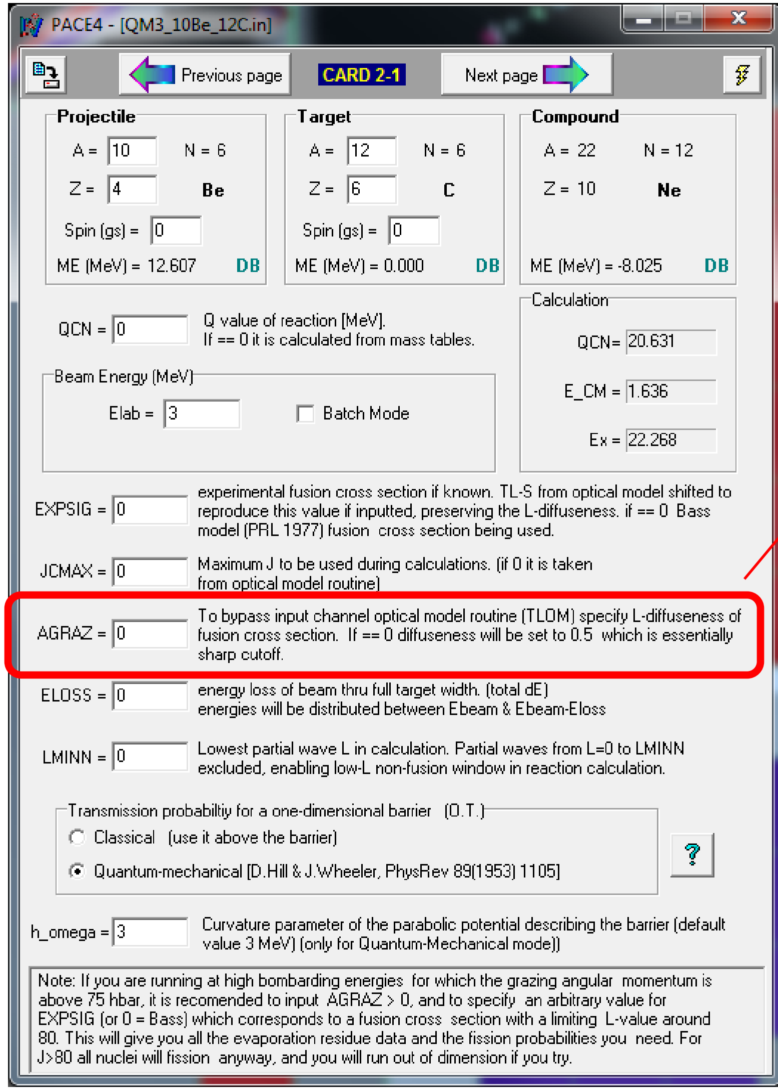
V_C^B(spherical) = 3.389 fm
R_C^B = 9.380 fm
$\hbar\omega$ = 1.19 MeV
L_{cr} = 26
E_{cr} = 59.3 MeV
dynamic deformation:
V^B(saddle) = 3.38 MeV
R(saddle) = 9.362 fm
β(saddle) = 0.060
Bass barrier = 4.05 MeV





Click on a plot to process it

Default values



Set "0" to run TLOM model To obtain this diffuseness parameter

So, for this reaction at 30 MeV the Diffuseness parameter is equal to 0.7 from TLOM!

In version 4.19 AGRAZ default value was set to 4.0

In version 4.20 new default value is 2.0

Please, use the same parameters in input files if you compare different PACE2, PACE3, PACE4 versions!