AccApp2009 Satellite meeting Intercomparison.

Vienna, Austria

Results with INCL4.

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- Introduction
- From INCL4.2 to INCL4.5
- Comparison INCL4.3↔INCL4.5 with ABLA (v3p)
- Conclusion

1. Introduction

INCL4.2:

-parameter-free

-good description of data (with ABLA_v3p)

But:

- no composite emission
- no pion potential
- problems residue distributions
- problems at low energy

2. From INCL4.2 to INCL4.5

1. Introduction of a dynamical coalescence model for composites (INCL4.3)
   satisfactory at high energy

2. Development of INCL4.5 (and of ABLA07) in EUROTRANS

3. Comparison INCL4.3↔INCL4.5 with ABLA_v3p

Main features of INCL4.5

Known phenomenology

- Isopin and energy-dependence of the nucleon mean field
- Pion potential
- Curved trajectories in the Coulomb field (in & out)

Cluster emission

- check for a particle trying to escape with E>Ethr (position)
- potential clusters are constructed (compactness criteria, a parameter per cluster for light clusters A>5)
- the most bound (per nucleon) cluster is emitted provided it tunnels through the Coulomb barrier (otherwise the driving nucleon is emitted, if it satisfies the same criterion)
- $A \leq 4$ clusters are not emitted if the direction of propagation is too tangential ($\cos \vartheta > 0.3$) (except for 1st cluster...)
- Short-lived clusters (ex: ^{5}Li) are forced to decay

Pauli blocking

- Two nucleons below Fermi level do not interact
- Strict Pauli blocking on the first collision

Soft collisions and low energy

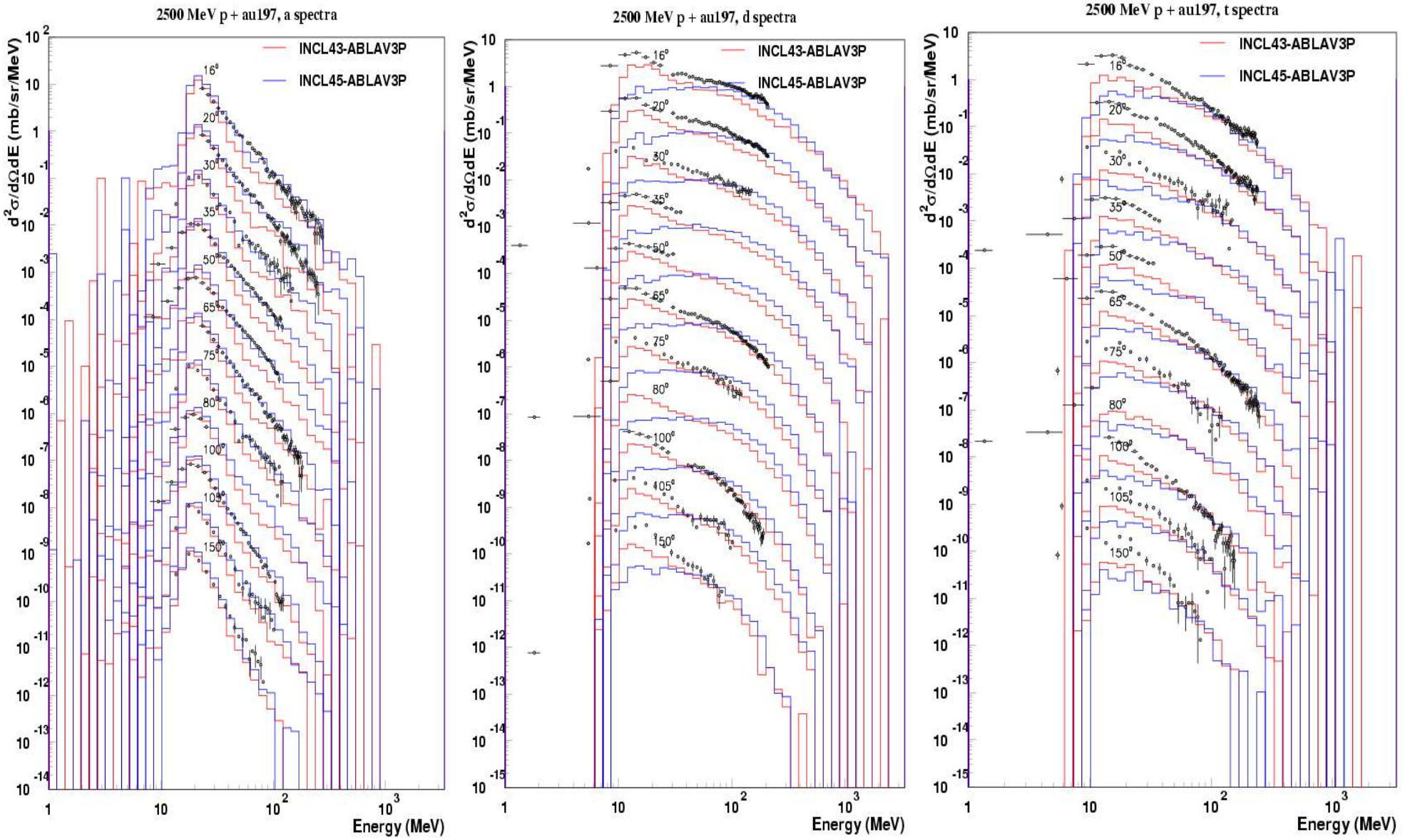
- No soft collisions (below $\sqrt{s}$ =1910 MeV)
- No restriction on the first collision
- "localE": correction of local Fermi energy on the first collision

Fuzzy Fermi surface or imperfect quasi-particles

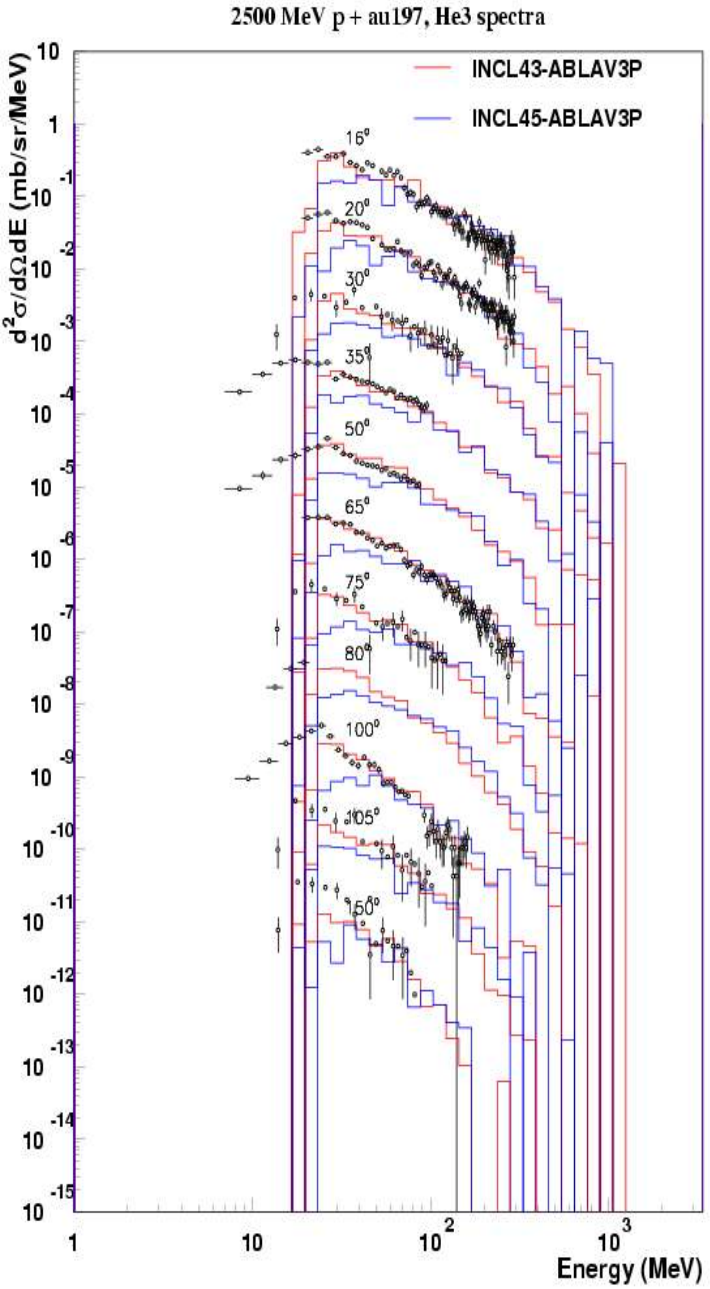
- if after a collision or a Δ-decay, a nucleon has $E<E_F+\zeta$ (18 MeV), it is considered as a spectator again
- cascade is stopped if $t>t_{fin}$ or if $N_{part} = 0$ and N_π (inside)=0

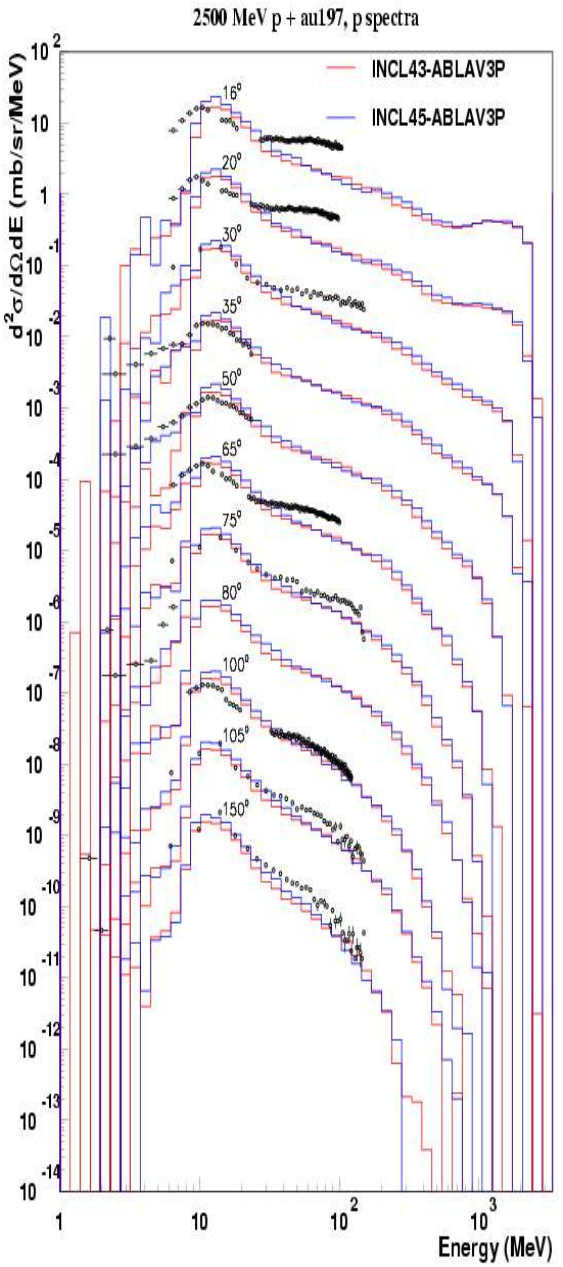
3. Comparison

INCL4.3 ↔INCL4.5



p(2.5 GeV) + ^{197}Au

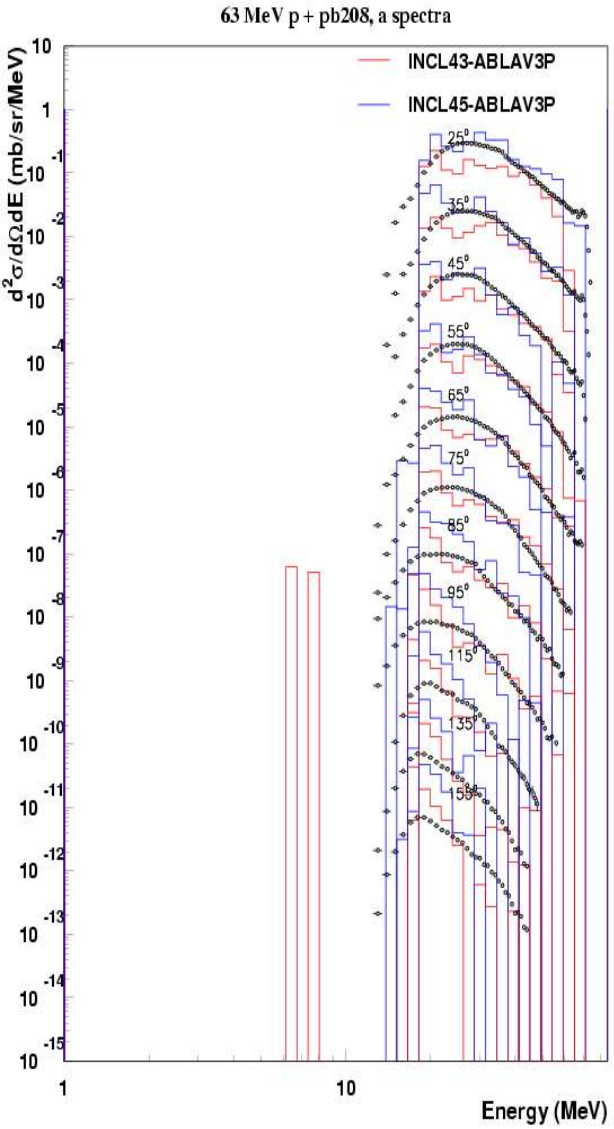


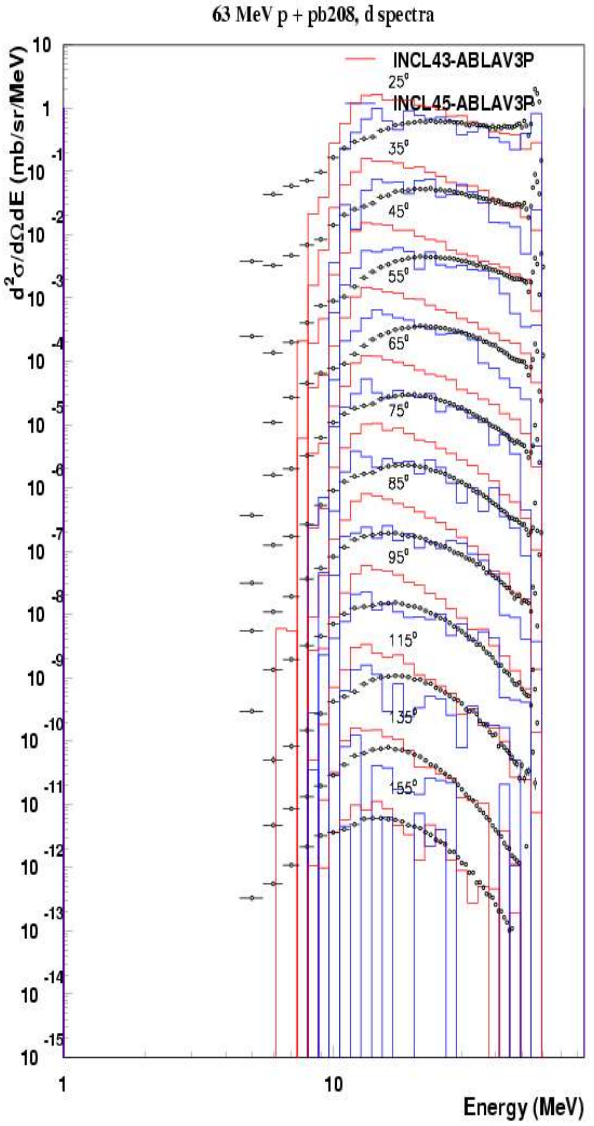


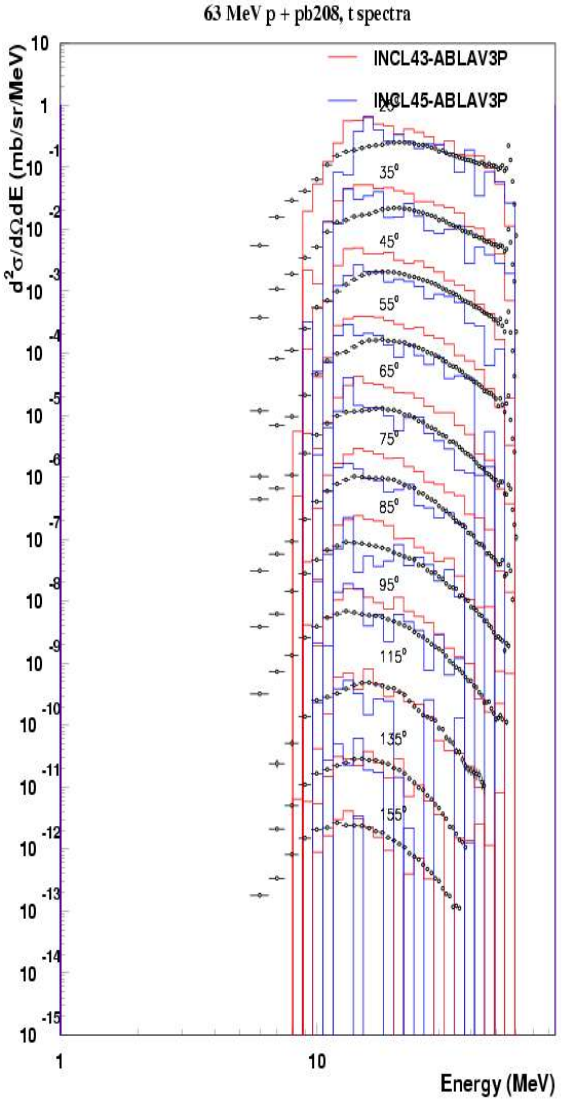
INCL4.5 is slightly better

p underestimated

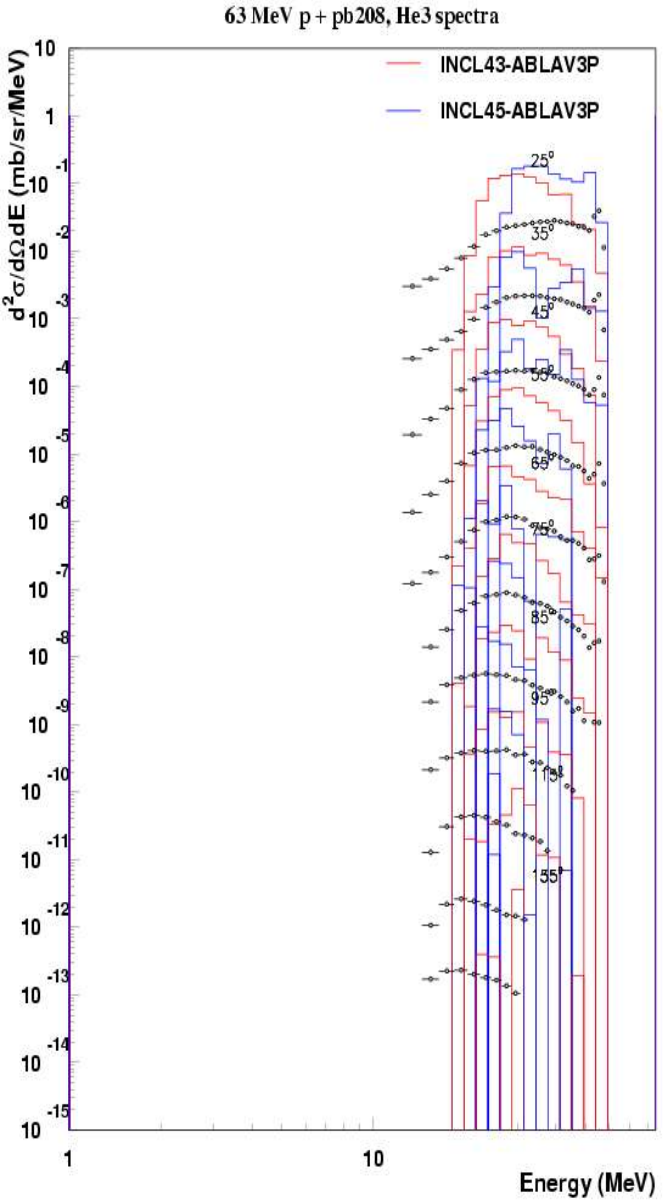
Similar results for p(1.2 GeV) on ^{197}Au and ^{181}Ta

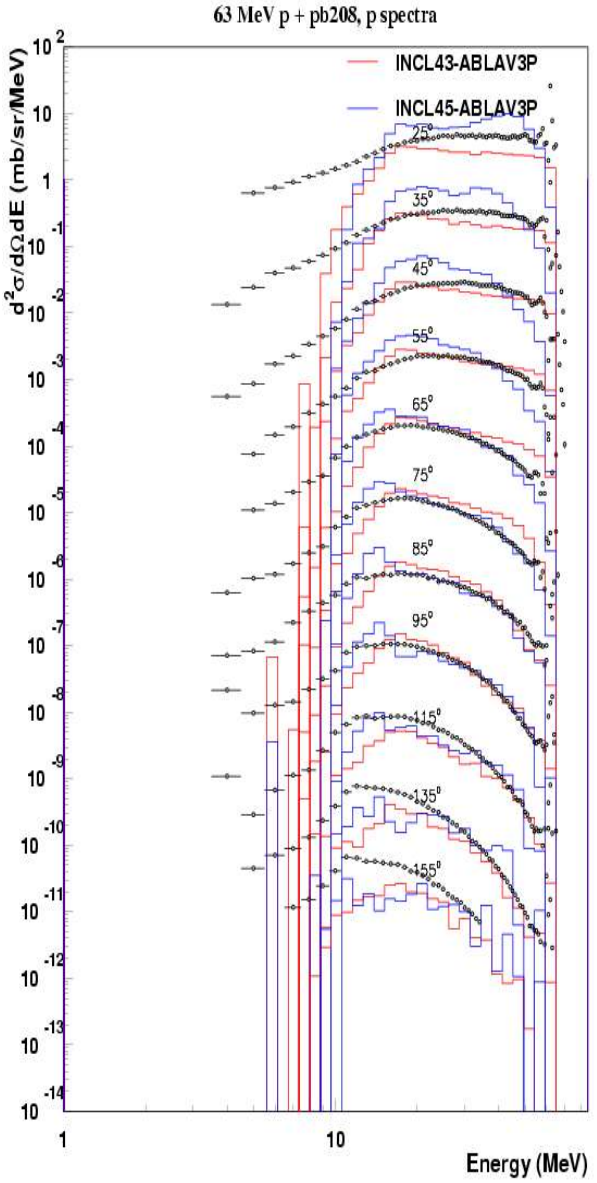


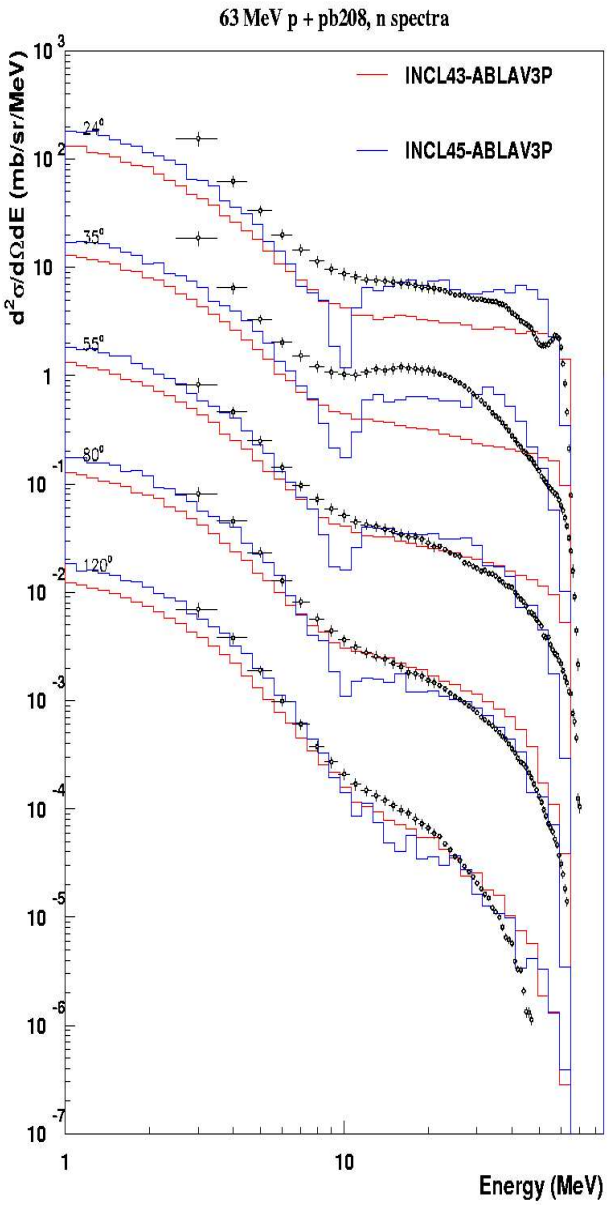




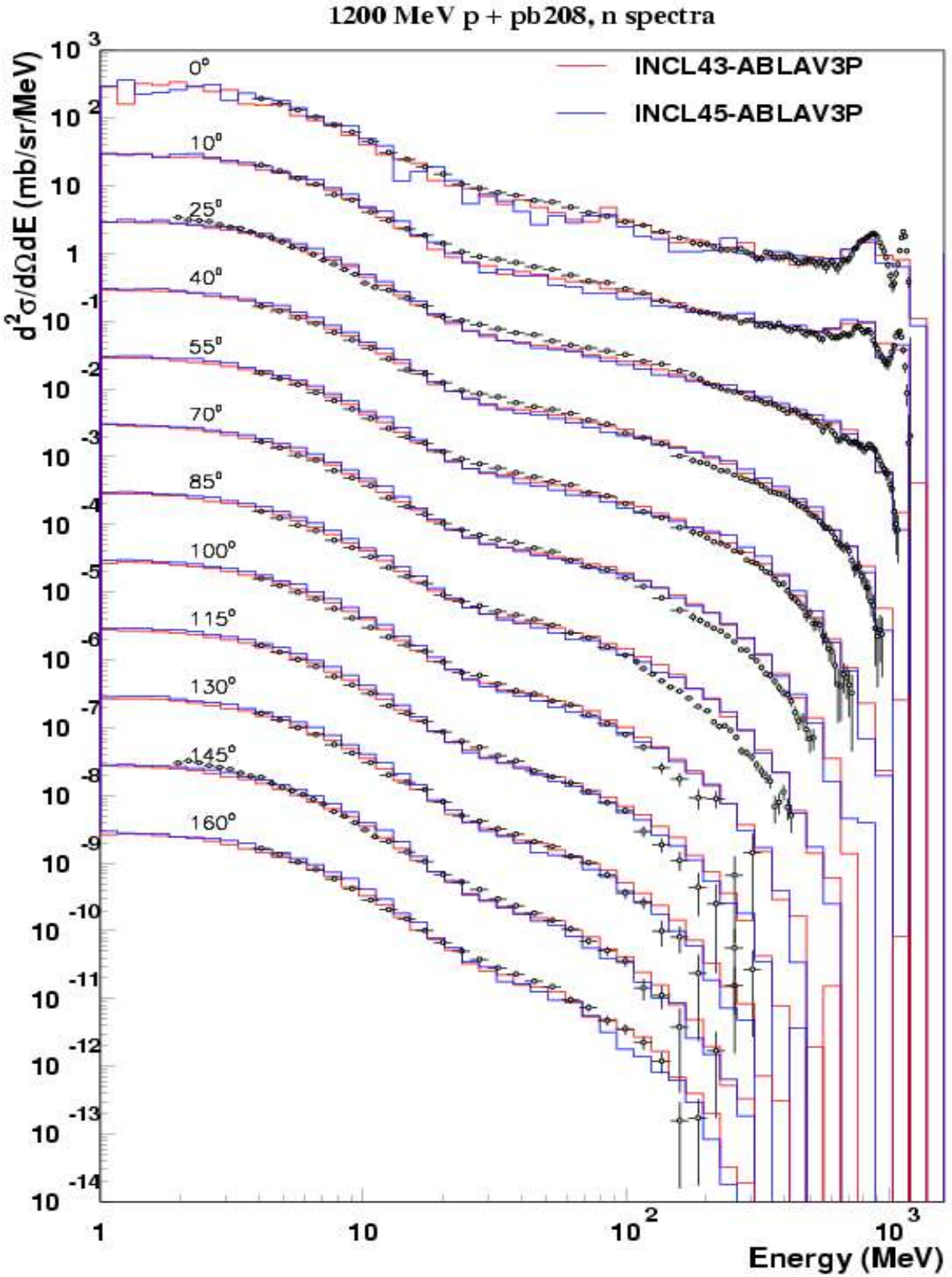
p (63 MeV) + ^{208}Pb



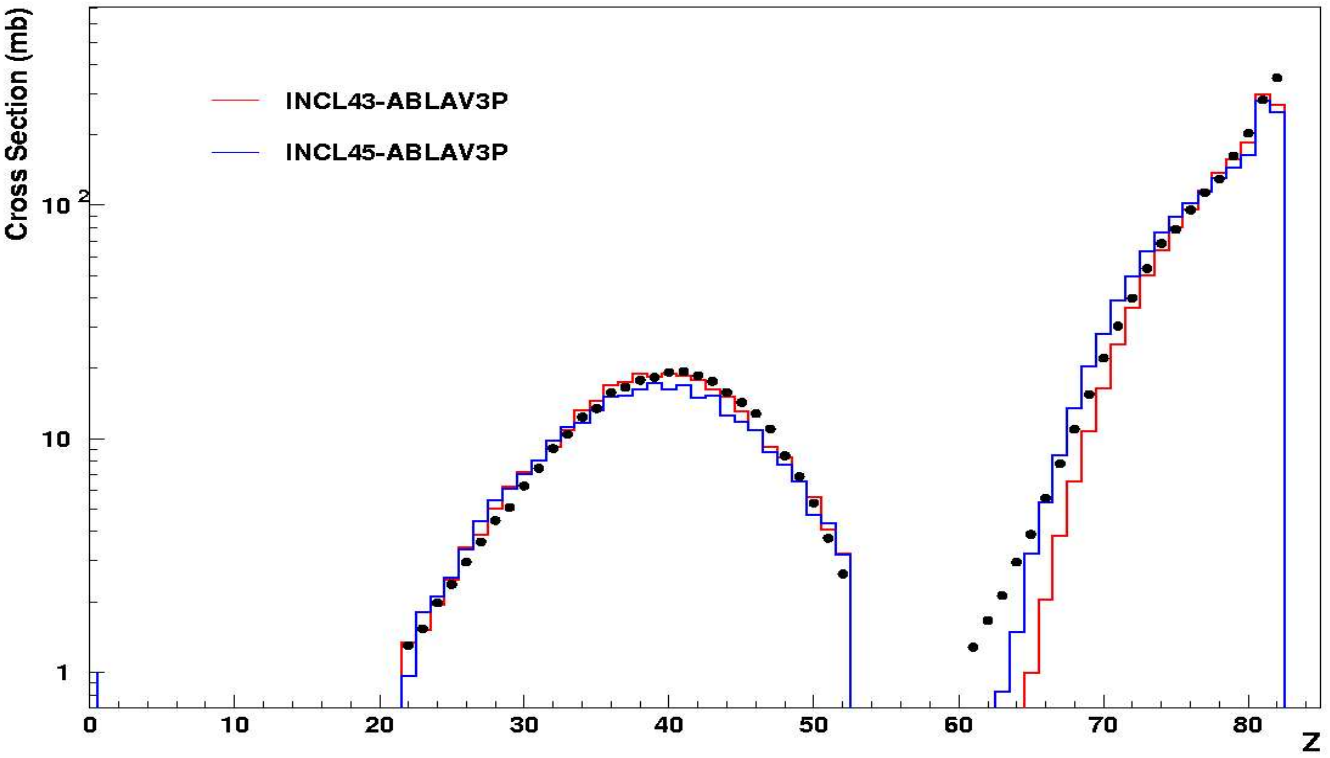


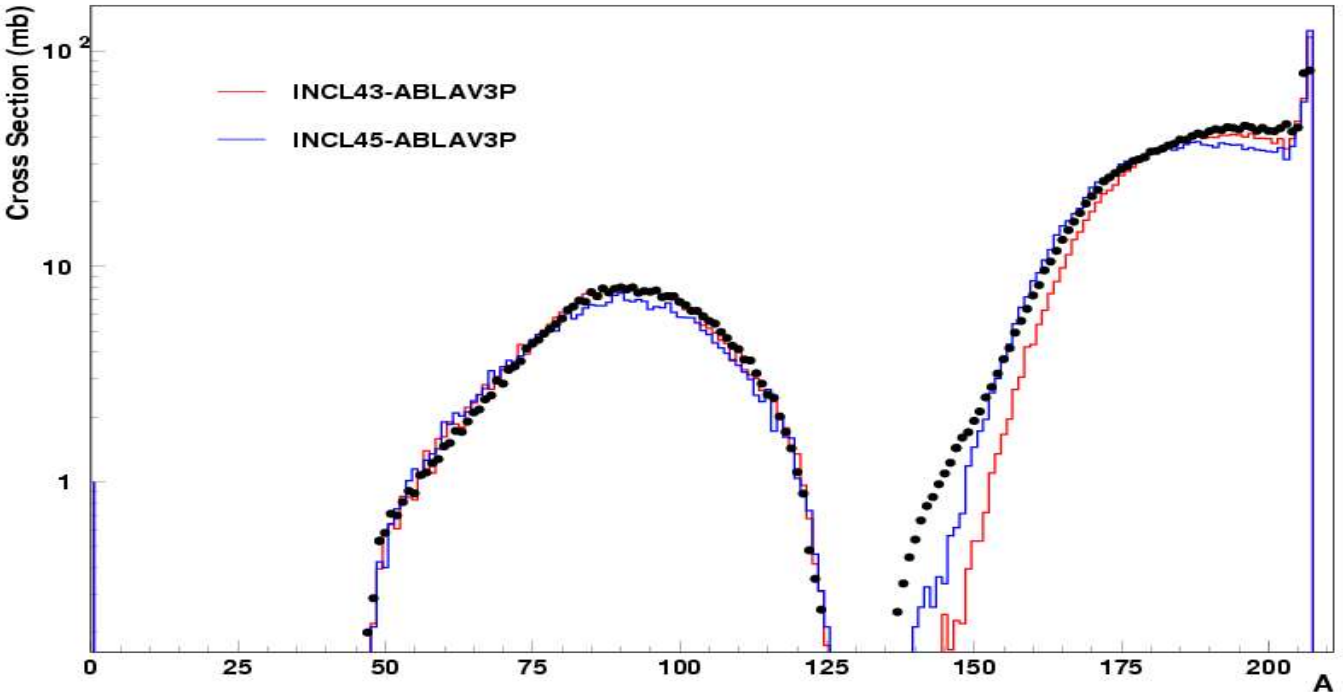


Conclusion (on composites): satisfactory results, except on p @HE and n @LE

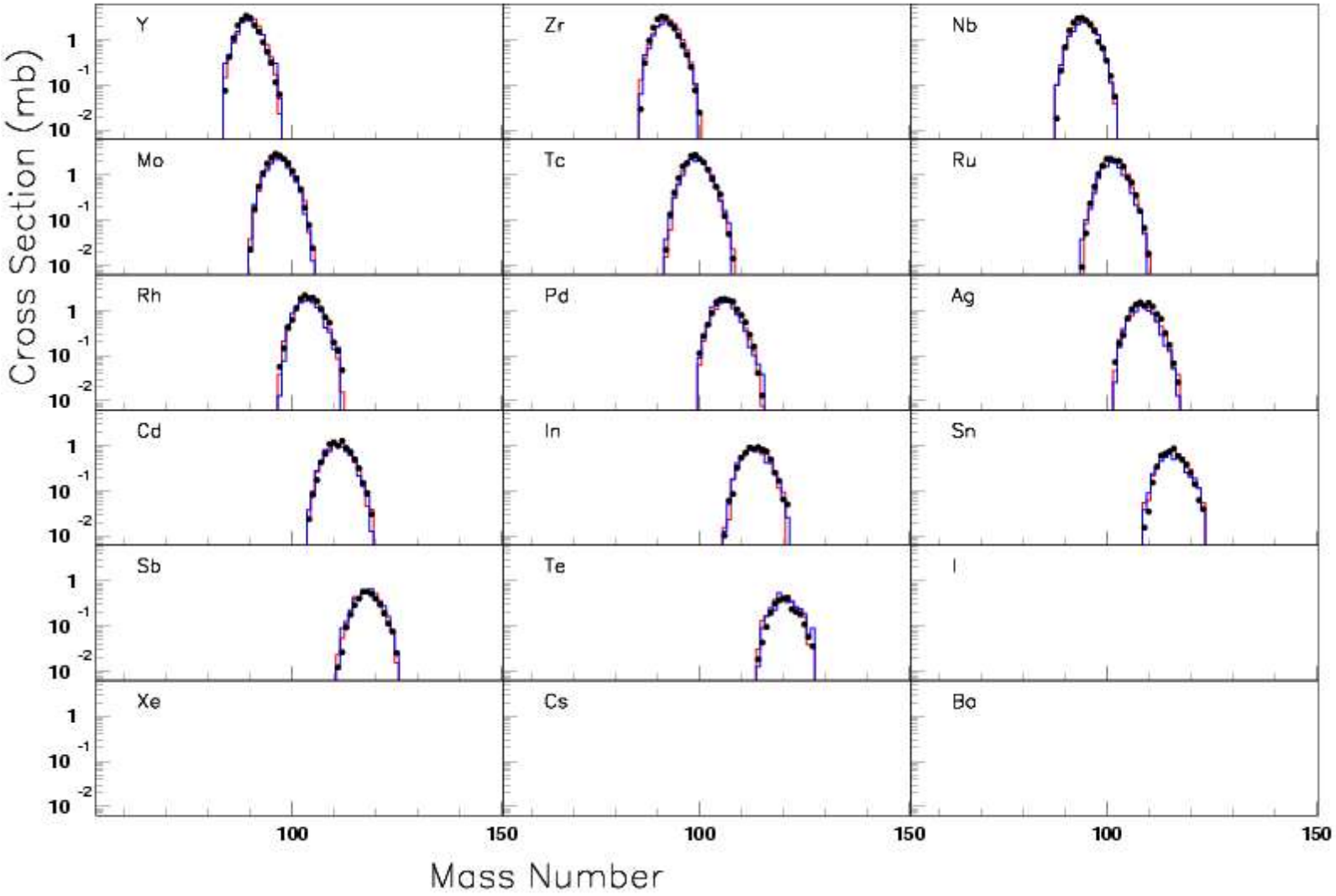


slightly less good

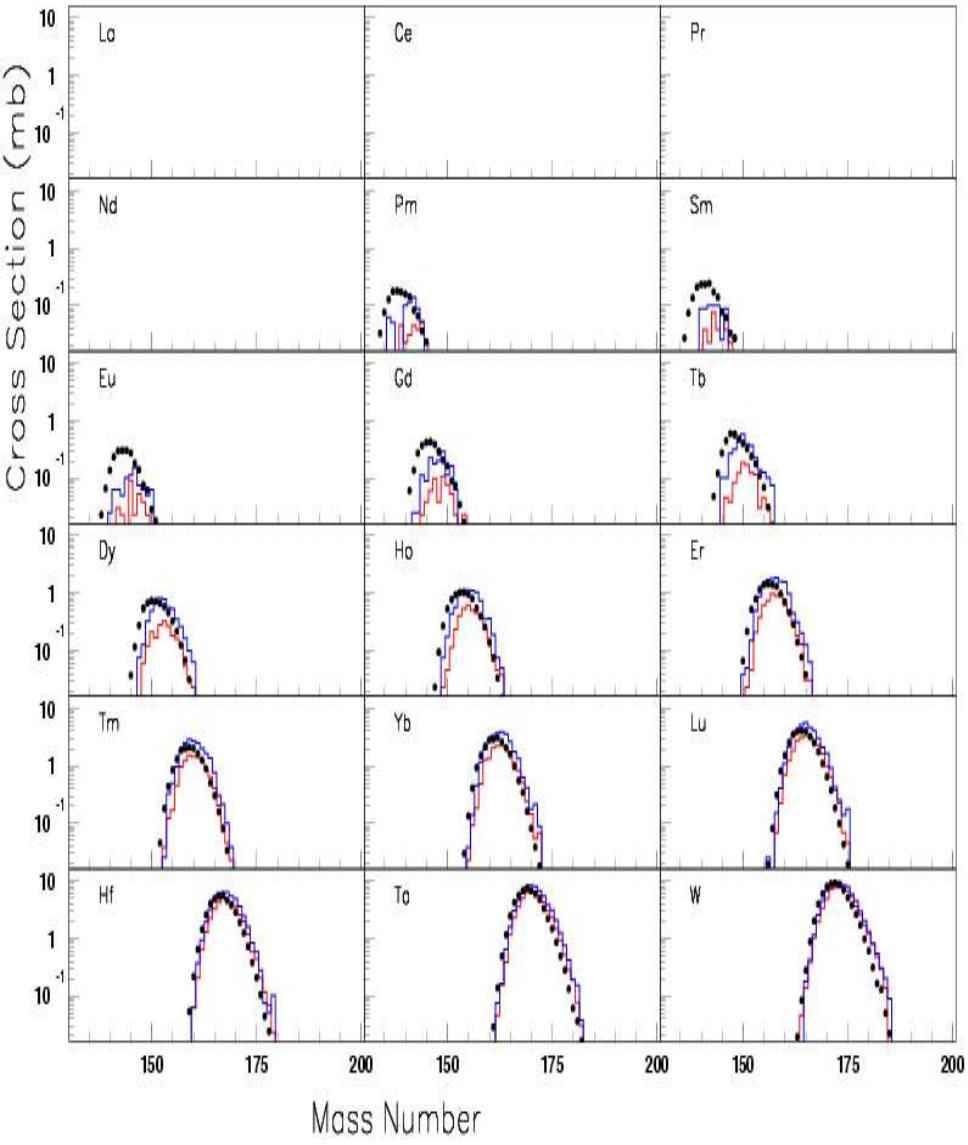


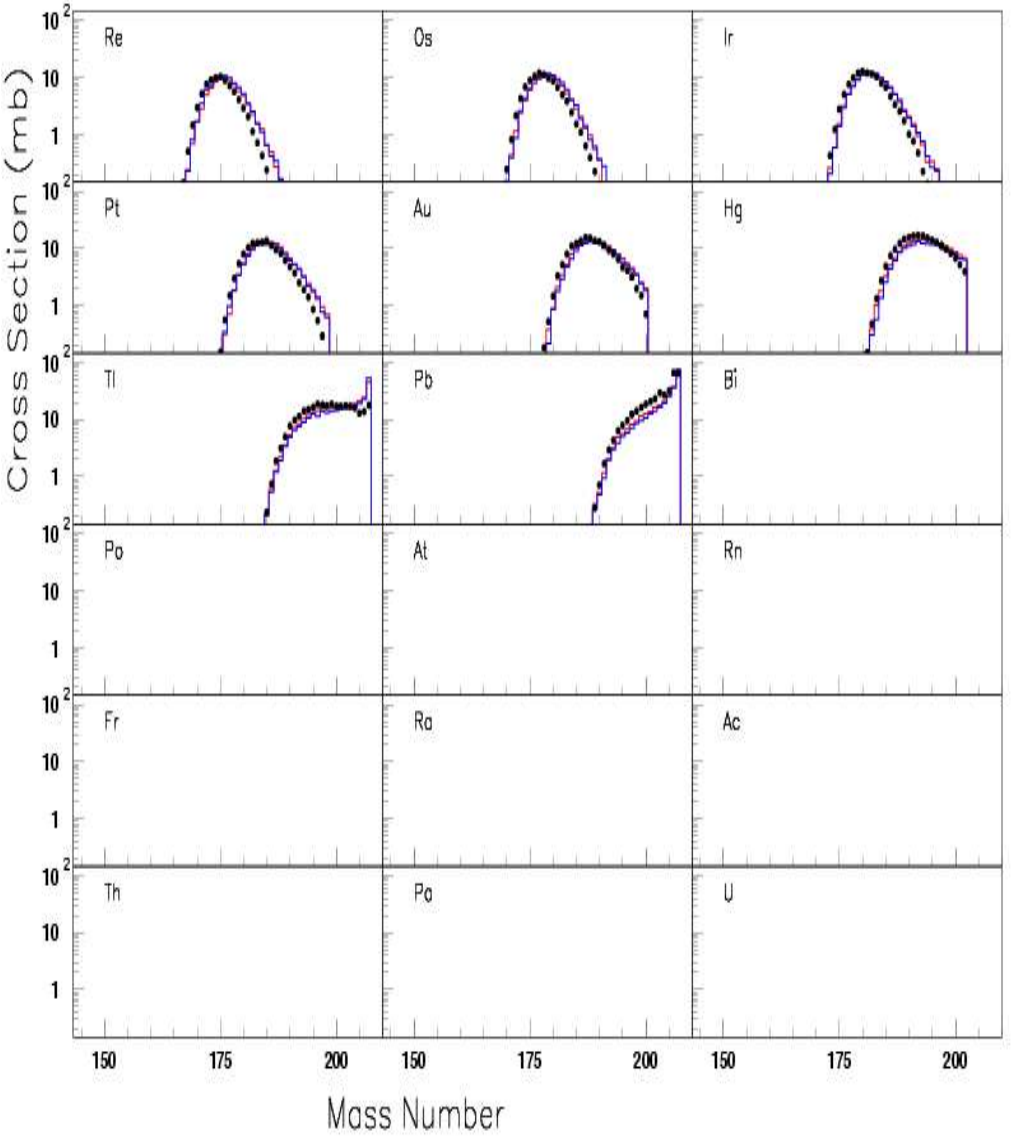


INCL4.5: better or not?



virtue of ABLA


La
Ce
Pr
Nd
Pm
Sm
Eu
Gd
Tb
Dy
Ho
Er
Tm
Yb
Lu
Hf
Ta
W
Cross Section (mb)
Mass Number
150
175
200


Re
Os
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Au
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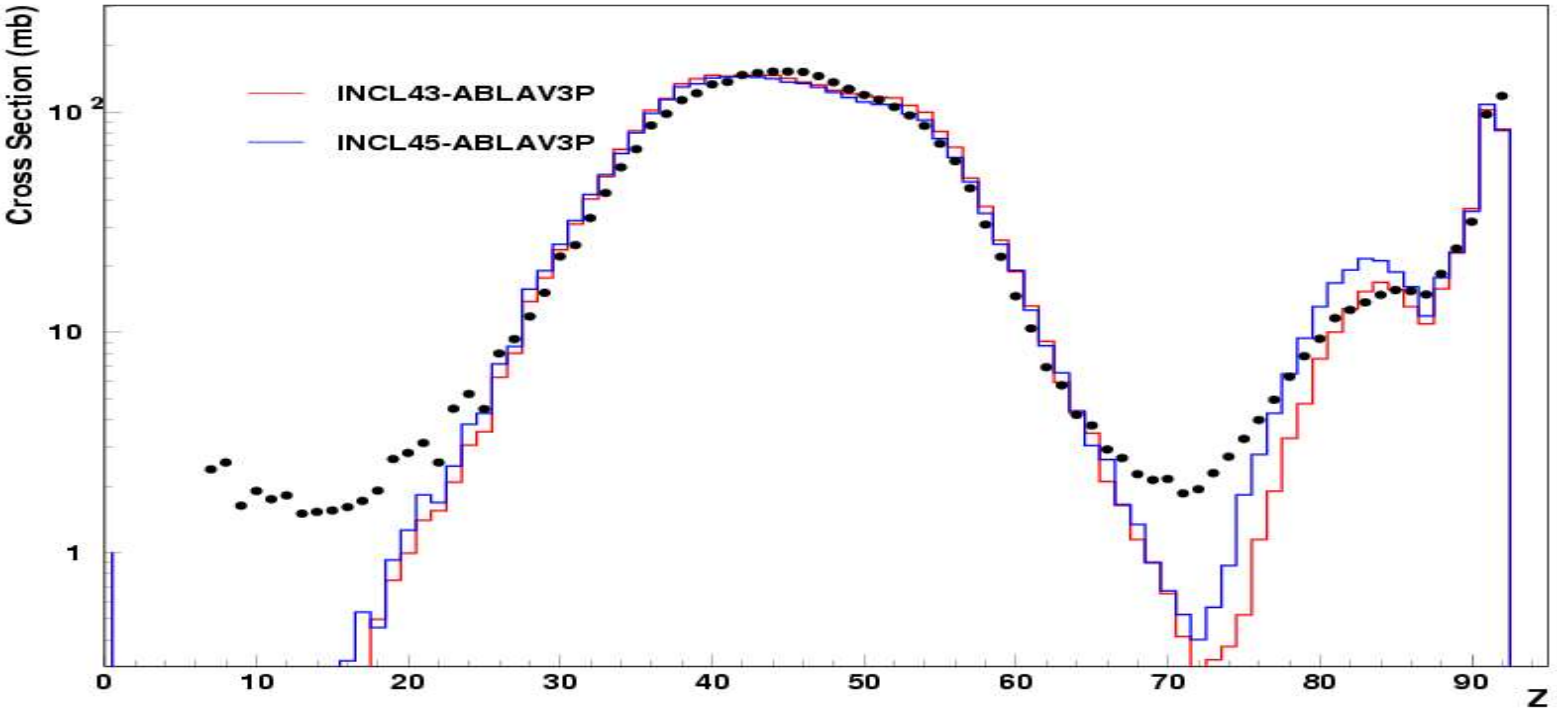
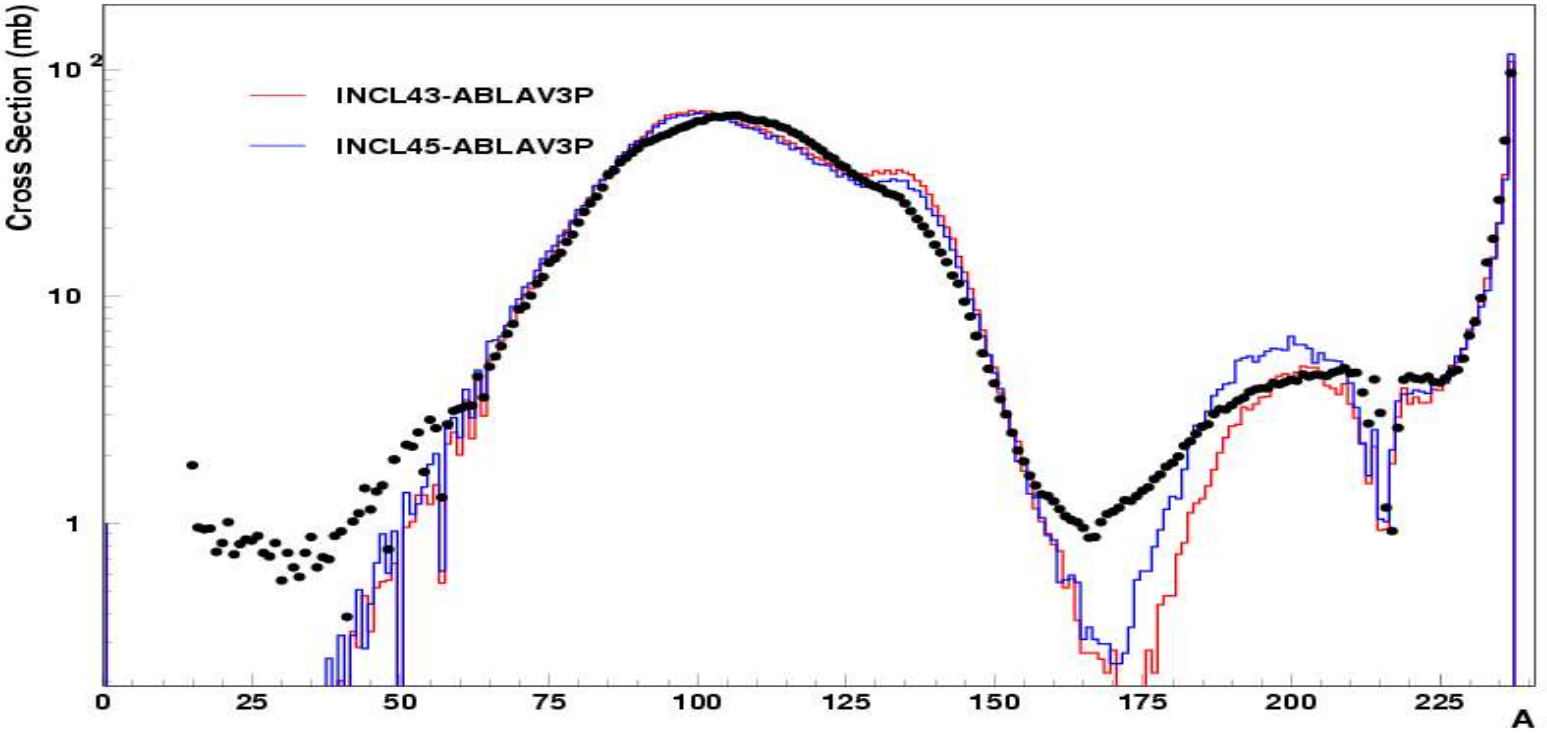
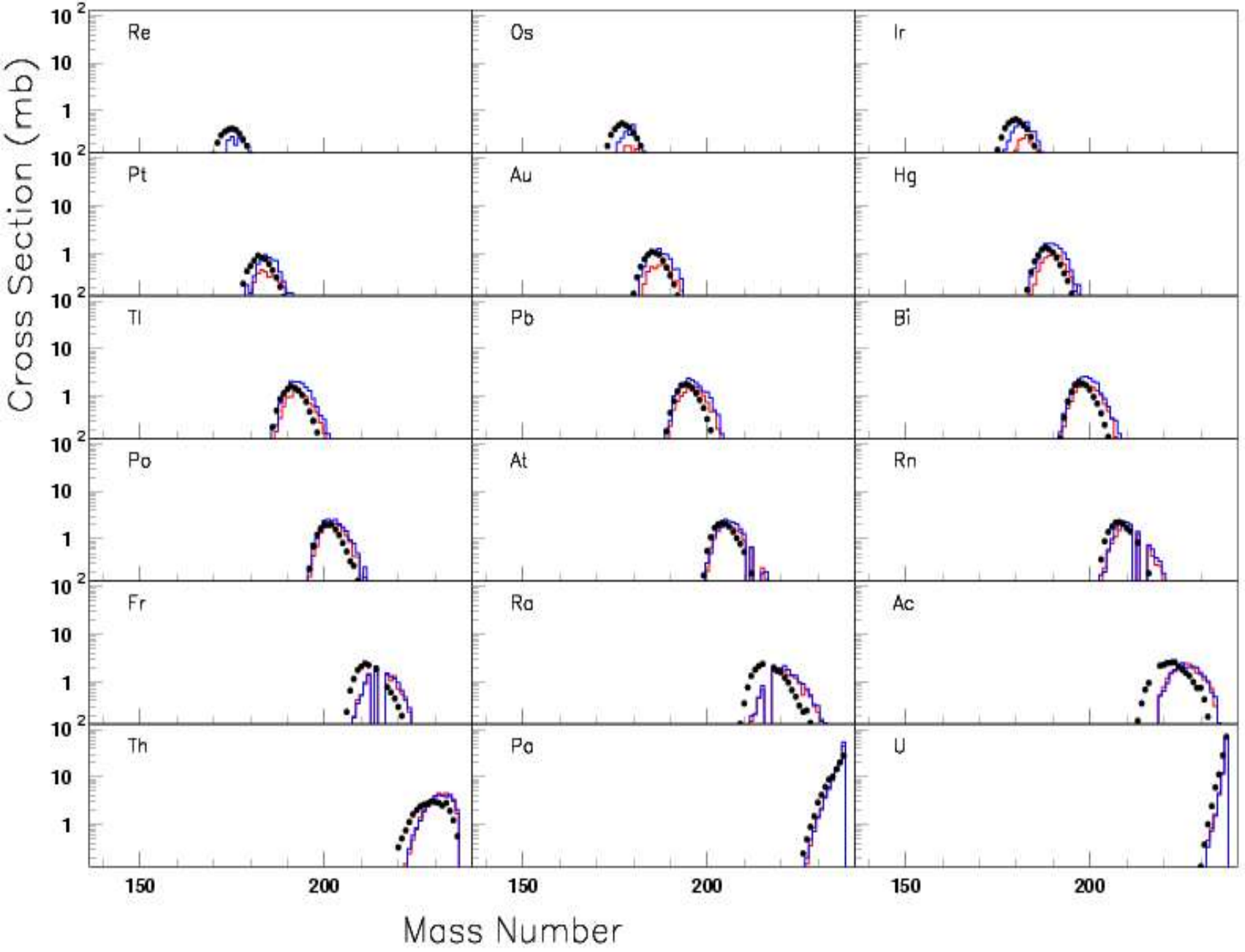
Cross Section (mb)
Mass Number
150
175
200


Cross Section (mb)
INCL43-ABLAV3P
INCL45-ABLAV3P
10 2
10
1
0
10
20
30
40
50
60
70
80
90
Z


Cross Section (mb)
INCL43-ABLAV3P
INCL45-ABLAV3P
10 2
10
1
0
25
50
75
100
125
150
175
200
225
A

p(1GeV)+^{238}U


Cross Section (mb)
Mass Number
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10 2
10
1
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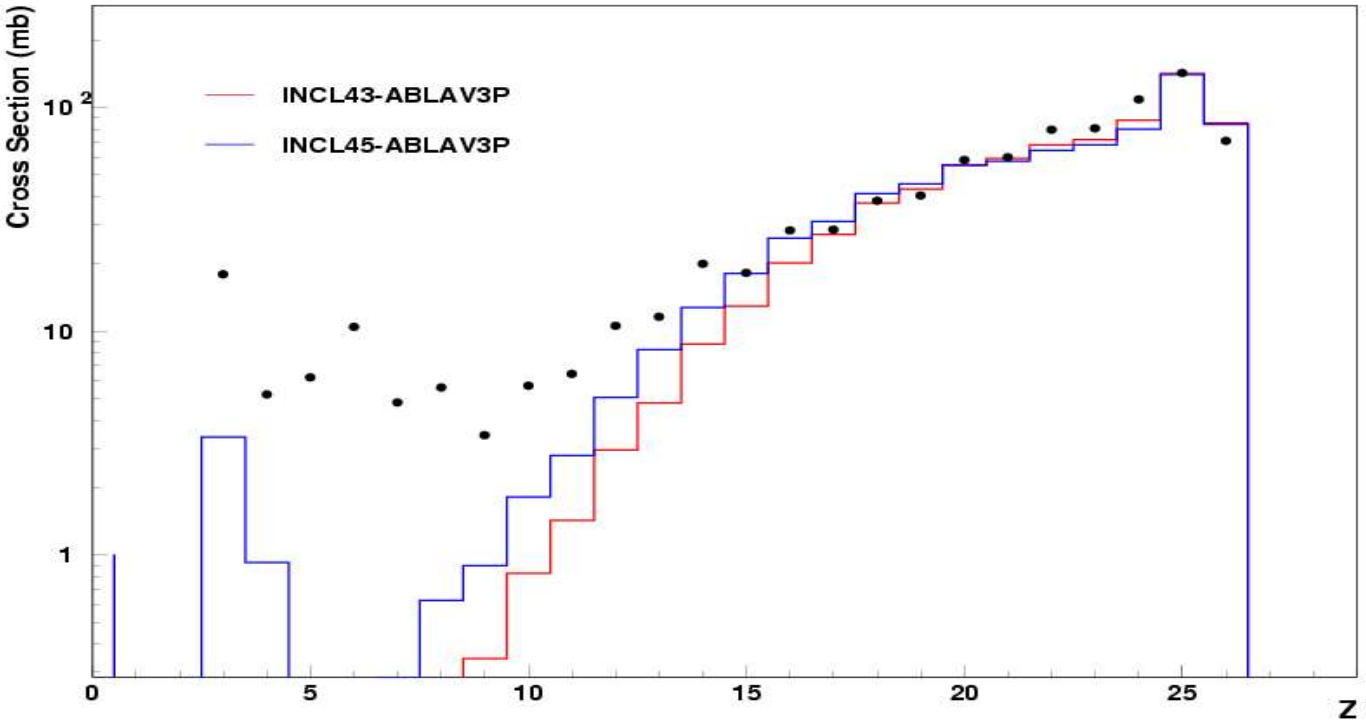
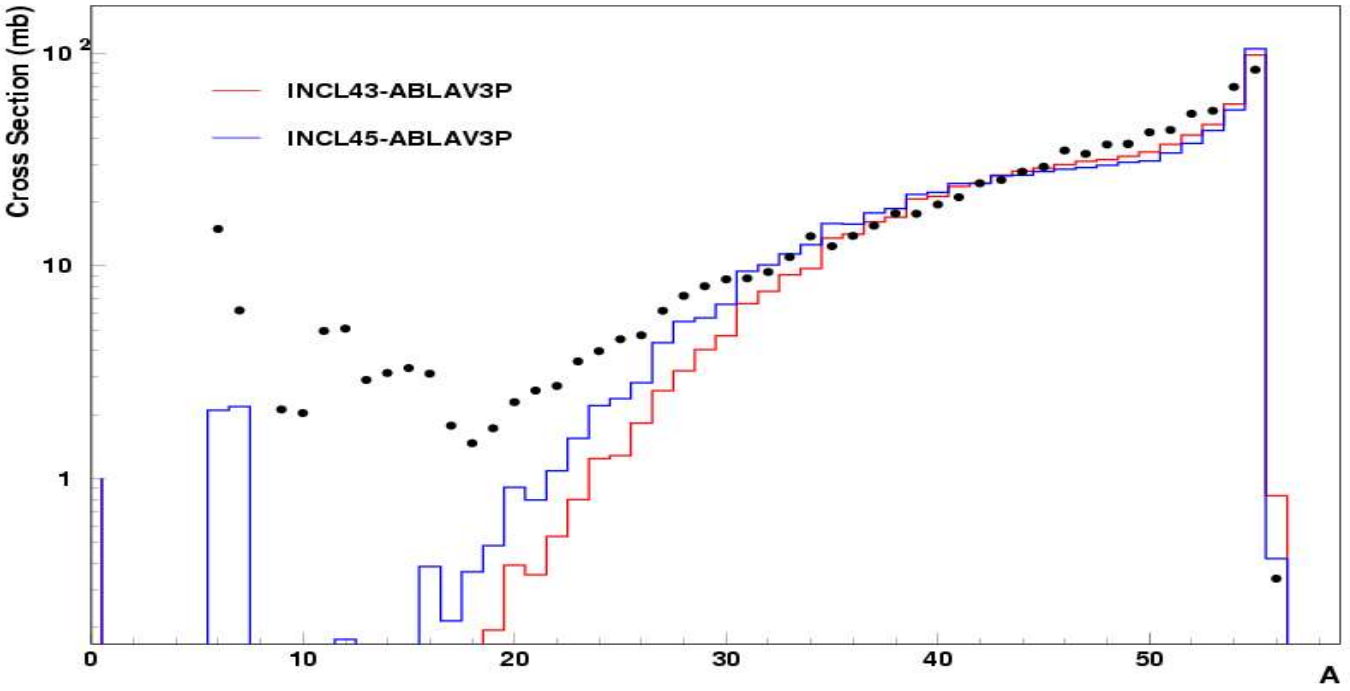
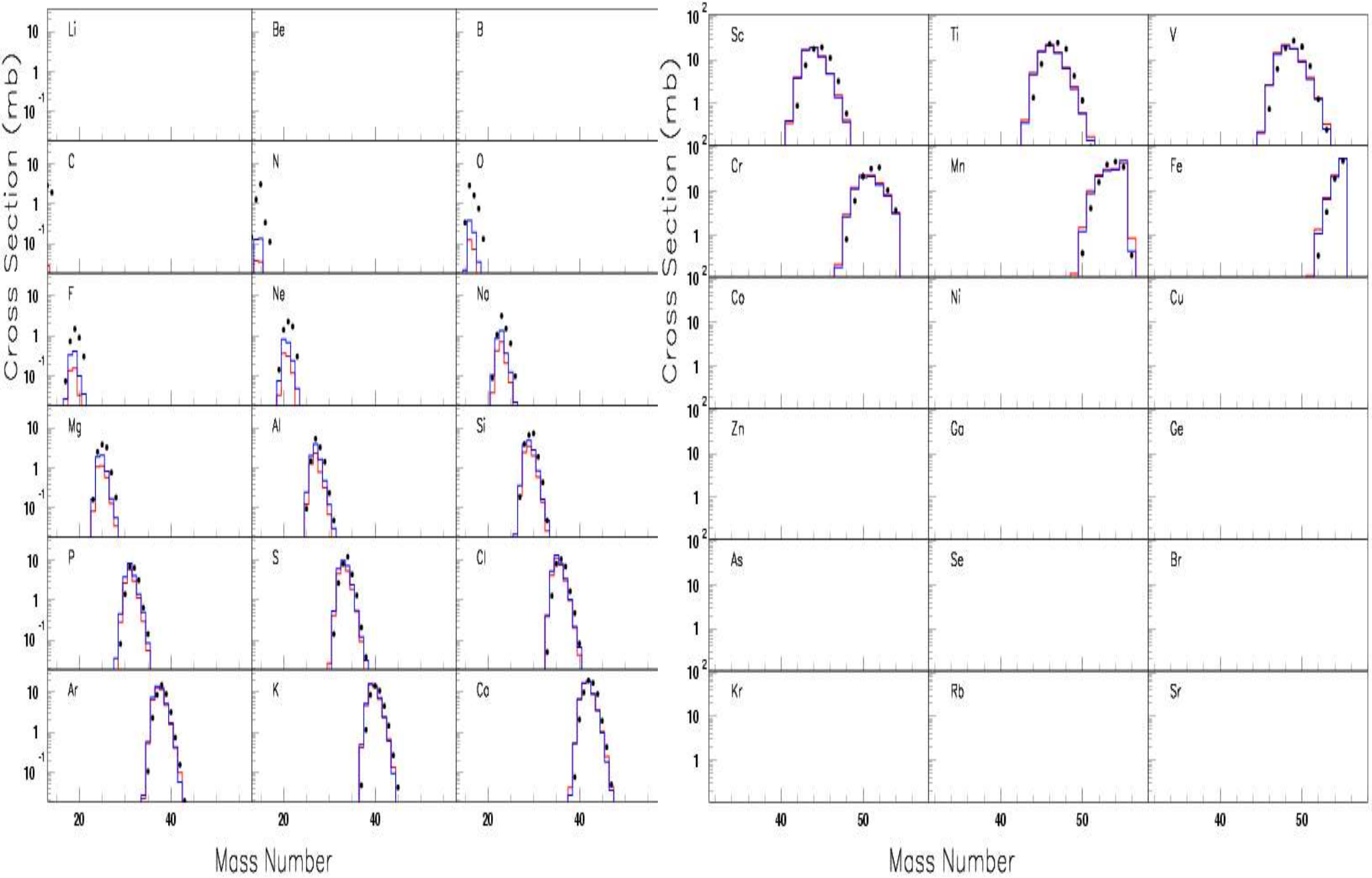

Cross Section (mb)
INCL43-ABLAV3P
INCL45-ABLAV3P
Z

p(1GeV)+^{56}Fe


Cross Section (mb)
INCL43-ABLAV3P
INCL45-ABLAV3P
A


Li
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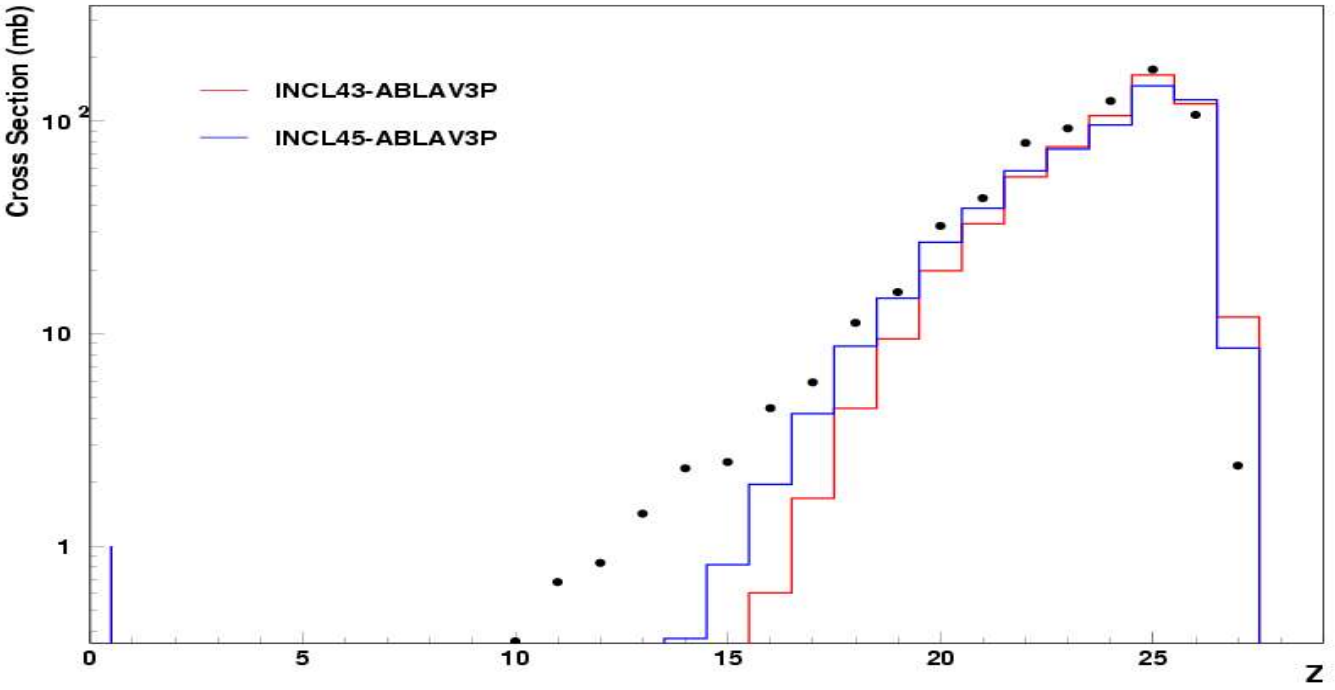
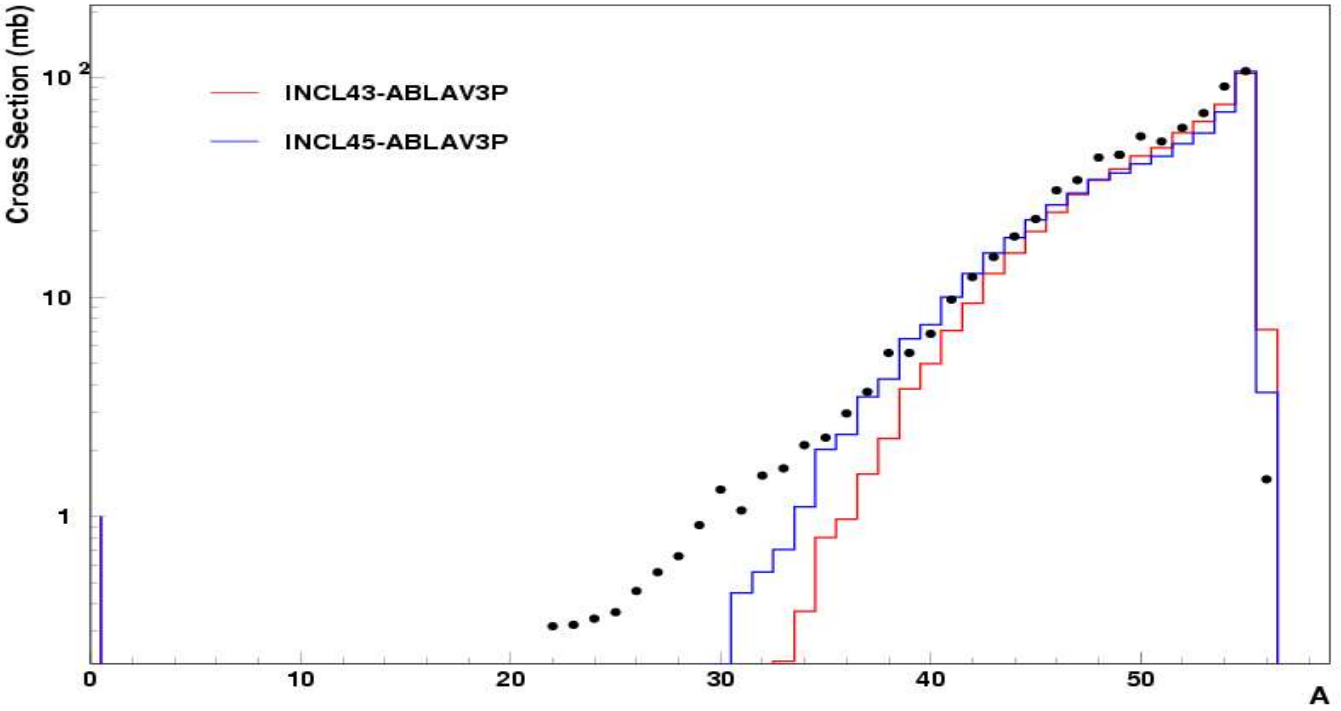
Cu
Zn
Ga
Ge
As
Se
Br
Kr
Rb
Sr
Cross Section (mb)
Mass Number





p(300MeV)+^{56}Fe

Conclusion:

- INCL4.5 is slightly better
- persistent problem for residues close to the projectile
- end of spallation peak and IMF emission?

4. Conclusion

- INCL4.5: sophistication, empirism
- Cluster production is improved
- Nucleon spectra are less good
- Slight improvement on the residues (but this implies de-excitation models)
- Development is going on