

Alessia Embriaco

Cross Section

Proton on ^{12}C , ^{16}O , ^{40}Ca



Istituto Nazionale di Fisica Nucleare

Results
published on

Assessment of nuclear-reaction codes for proton-induced reactions on light nuclei below 250 MeV

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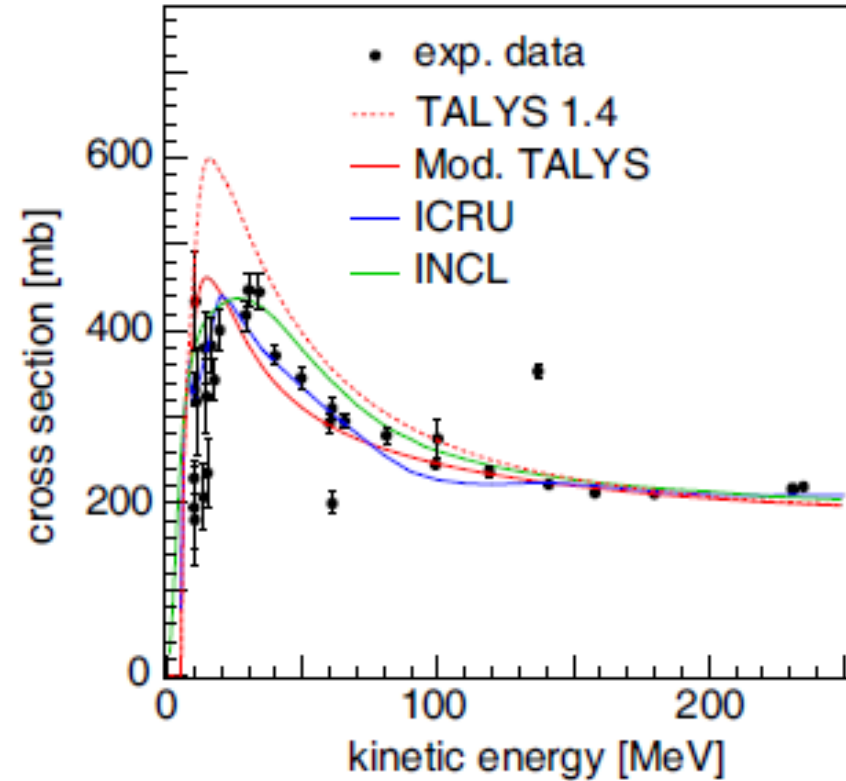
Abstract. We assess the suitability of nuclear-reaction codes for the generation of accurate cross-section libraries targeted at the simulation of the transport of high-energy protons (up to 250 MeV) in the human body, or in any material containing light nuclides. To this end we present an extensive study of elastic, reaction and fragmentation cross sections for proton-induced reactions on several nuclides. We compare TALYS evaluations against experimental data and, wherever applicable, against the predictions of the INCL/ABLA07 nuclear-reaction model. The TALYS evaluations have been cast in the form of a new cross-section library, which also includes evaluated proton-proton cross sections based on the NN-OnLine tool.

Data compared with

- TALYS code (version 1.4) can be used to produce evaluated data libraries
→ TENDL 2011
- TALYS modified, where the surface and volume component of the imaginary part of the optical model potential were interactively tuned
- INCL: the reaction mechanism is described as an avalanche of binary collisions (intranuclear cascade) . INCL was couple to the ABLA07 de-excitation code, that includes model for evaporation, fission and multifragmentation.
- ICRU63 evaluation
- NN-OnLine in case p-p angle differential cross section

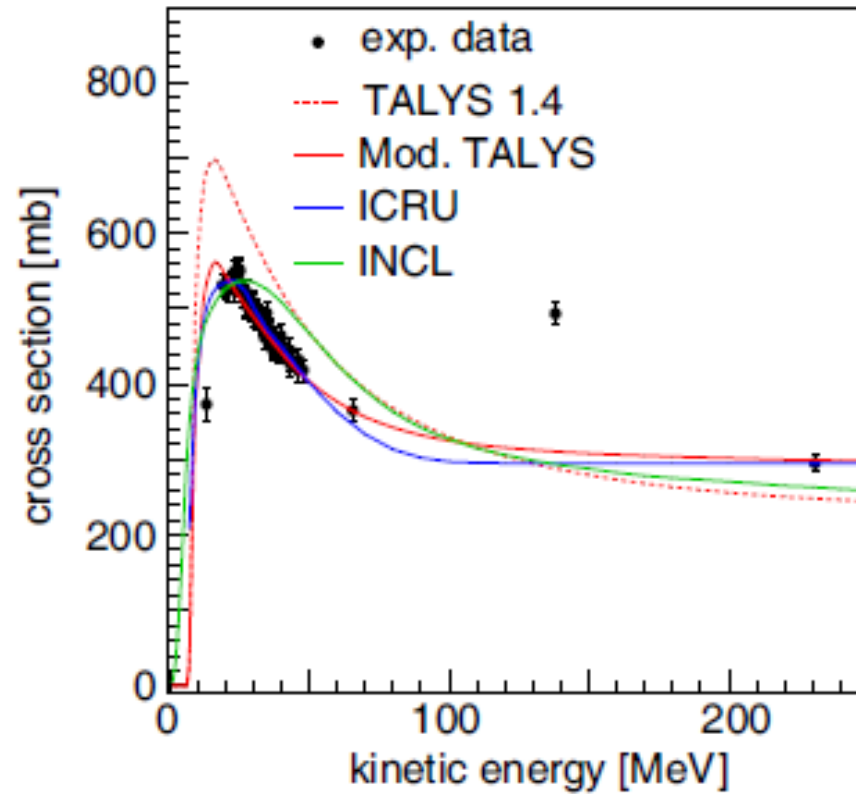
Reaction Cross Section:

Proton on ^{12}C



Experimental data are drawn from the EXFOR database and are represented by black dots; results of TALYS 1.4 (dashed red), Modified TALYS (solid red), ICRU (solid blue) and INCL (solid green) are also shown.

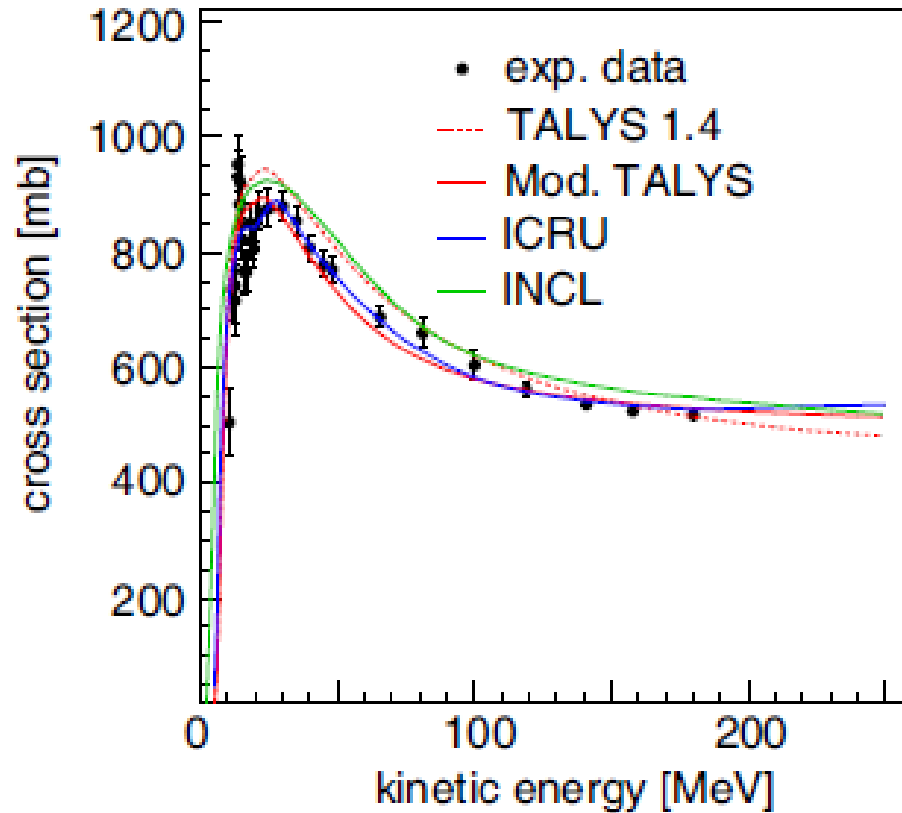
Reaction Cross Section: *Proton on ^{16}O*



Experimental data are drawn from the EXFOR database and are represented by black dots; results of TALYS 1.4 (dashed red), Modified TALYS (solid red), ICRU (solid blue) and INCL (solid green) are also shown.

Reaction Cross Section:

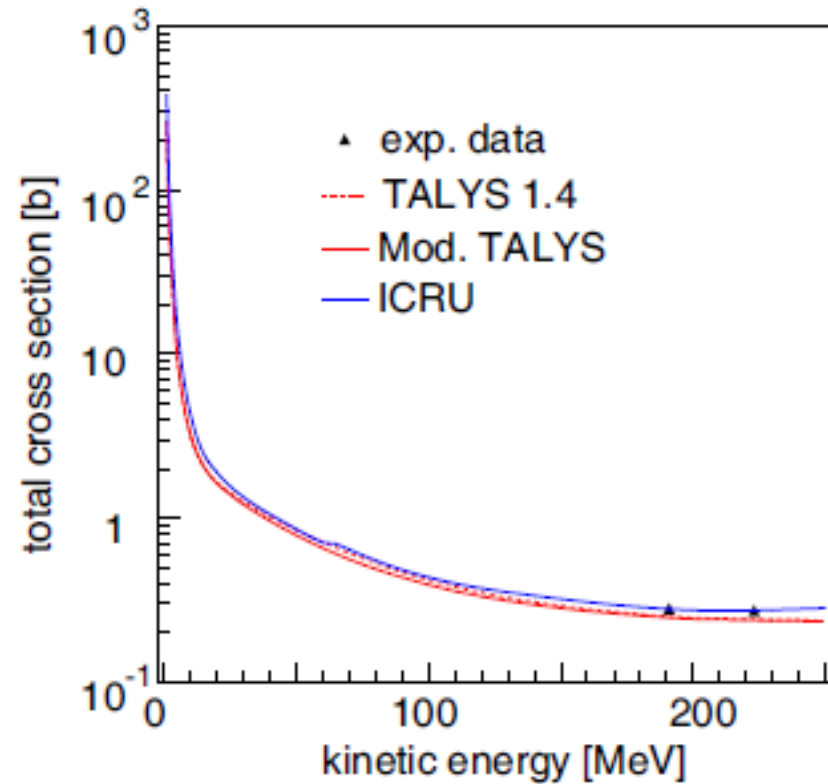
Proton on ^{40}Ca



Experimental data are drawn from the EXFOR database and are represented by black dots; results of TALYS 1.4 (dashed red), Modified TALYS (solid red), ICRU (solid blue) and INCL (solid green) are also shown.

Total Cross Section:

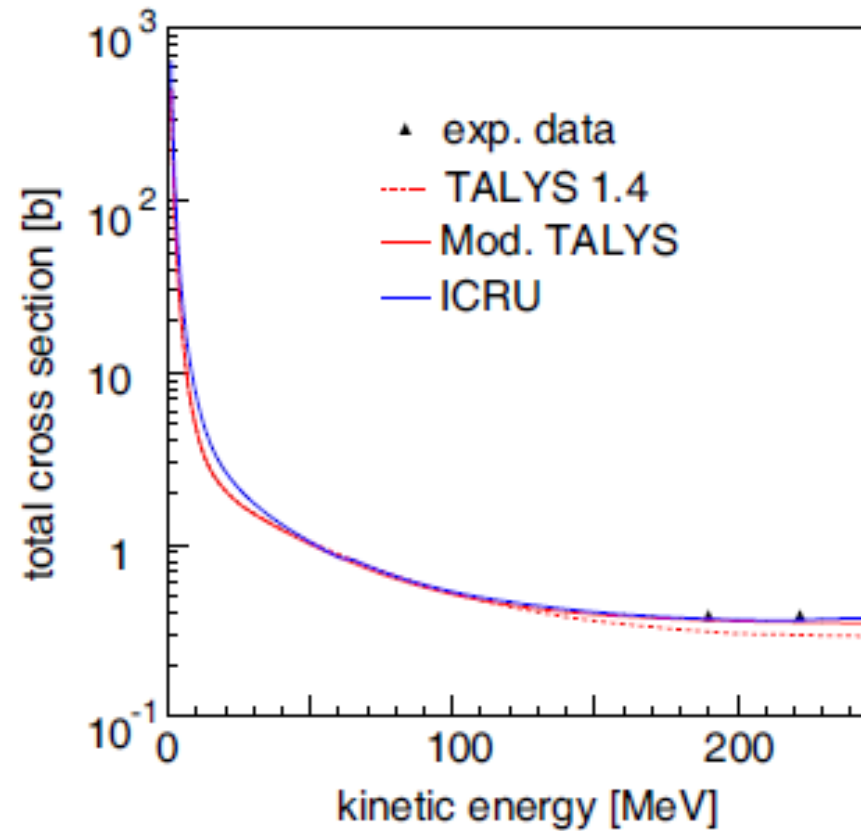
Proton on ^{12}C



Experimental data are drawn from the EXFOR database and are represented by black dots; results of TALYS 1.4 (dashed red), Modified TALYS (solid red) and ICRU (solid blue) are also shown.

Total Cross Section:

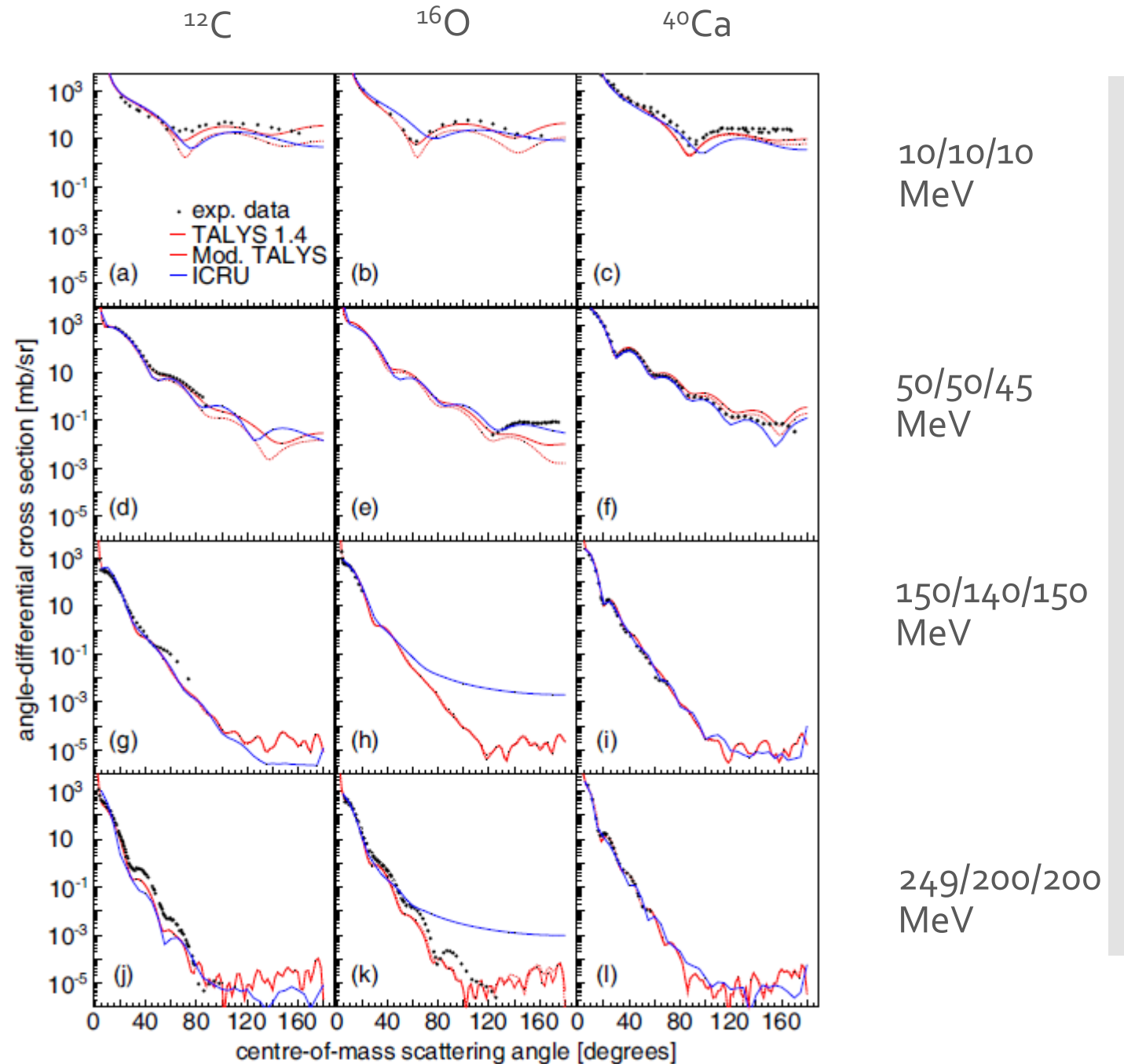
Proton on ^{16}O



Experimental data are drawn from the EXFOR database and are represented by black dots; results of TALYS 1.4 (dashed red), Modified TALYS (solid red) and ICRU (solid blue) are also shown.

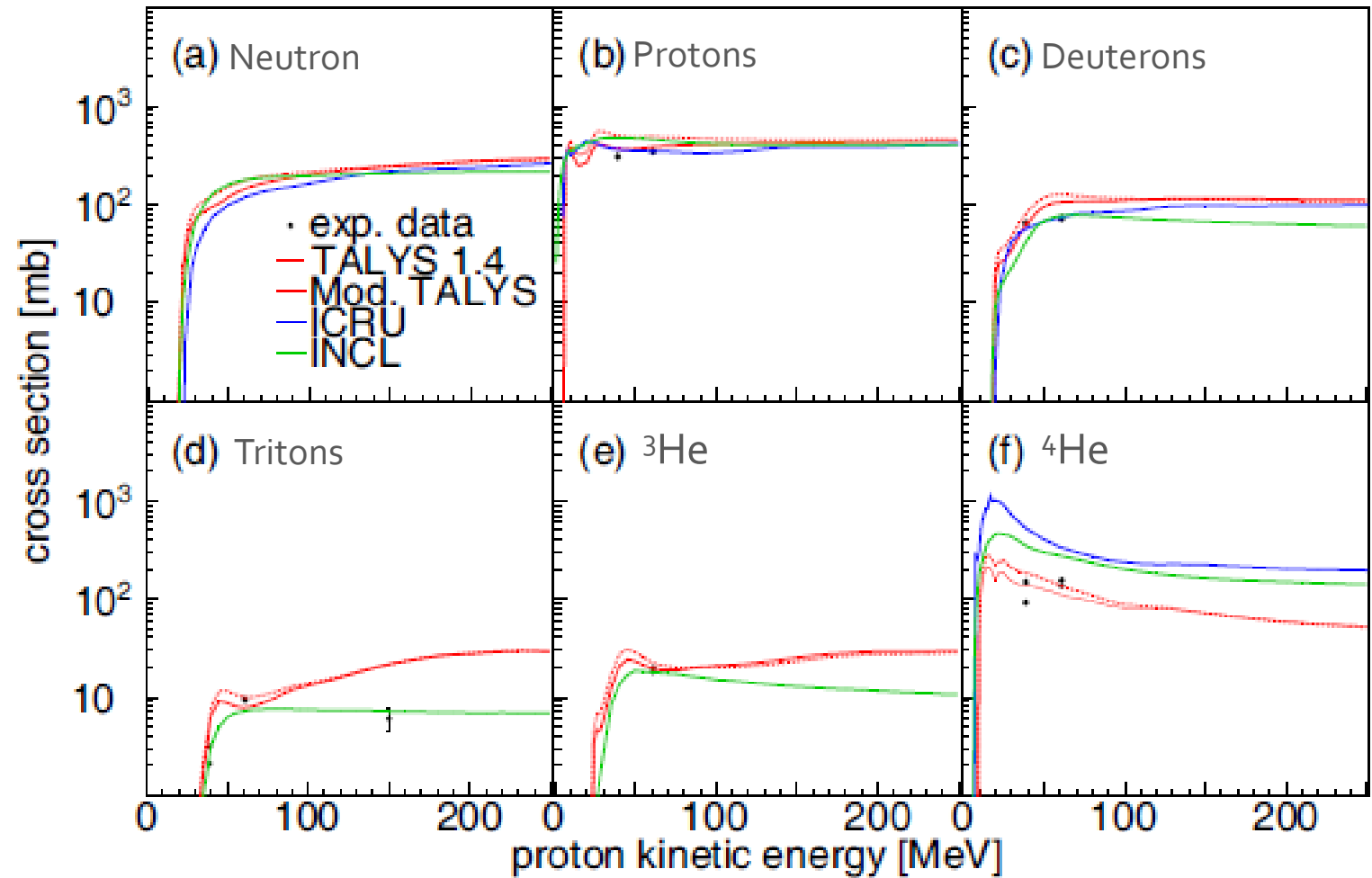
Angle differential elastic cross section:

Proton on ^{12}C , ^{16}O , ^{40}Ca



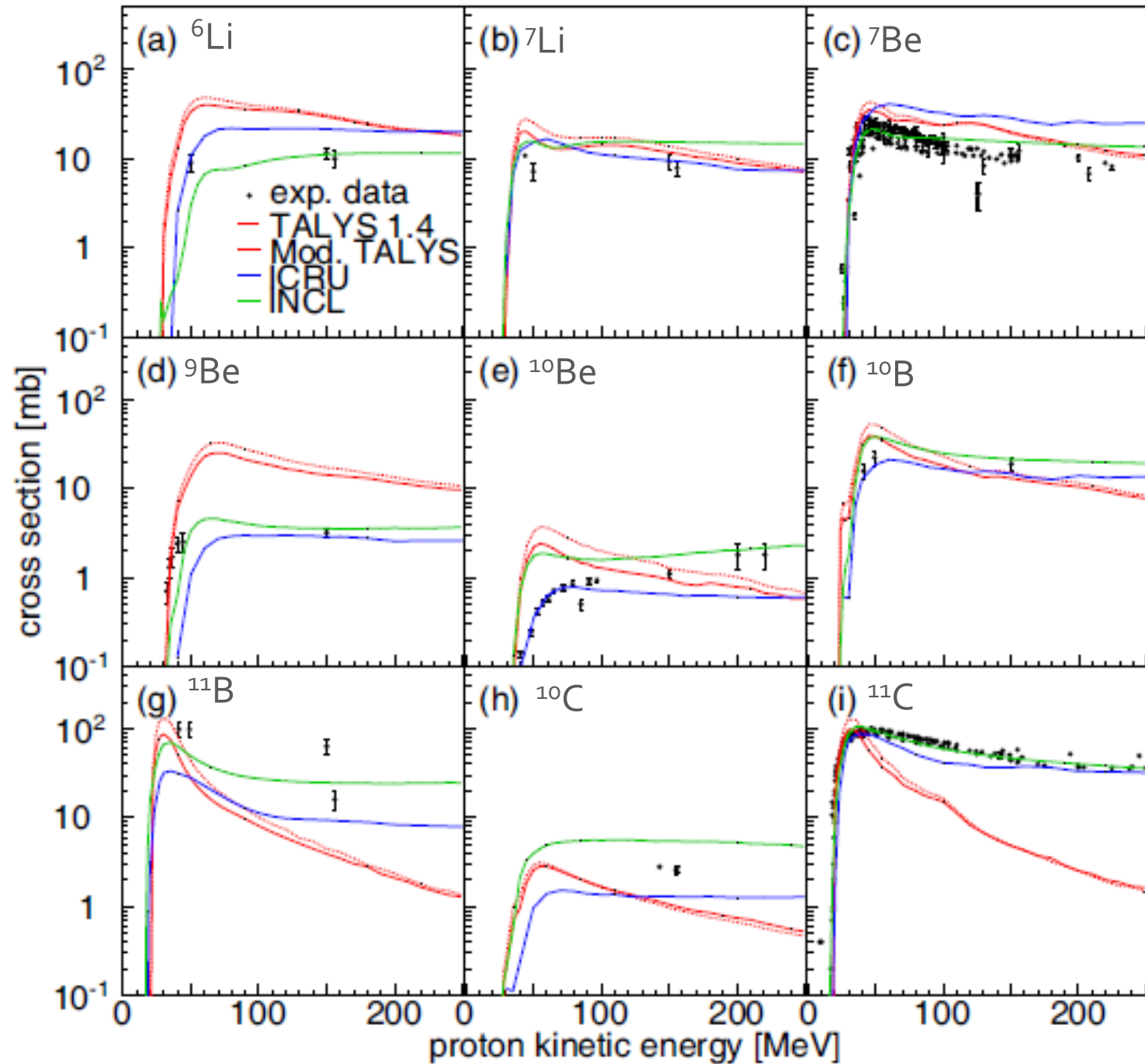
Production cross section:

Proton on ^{12}C



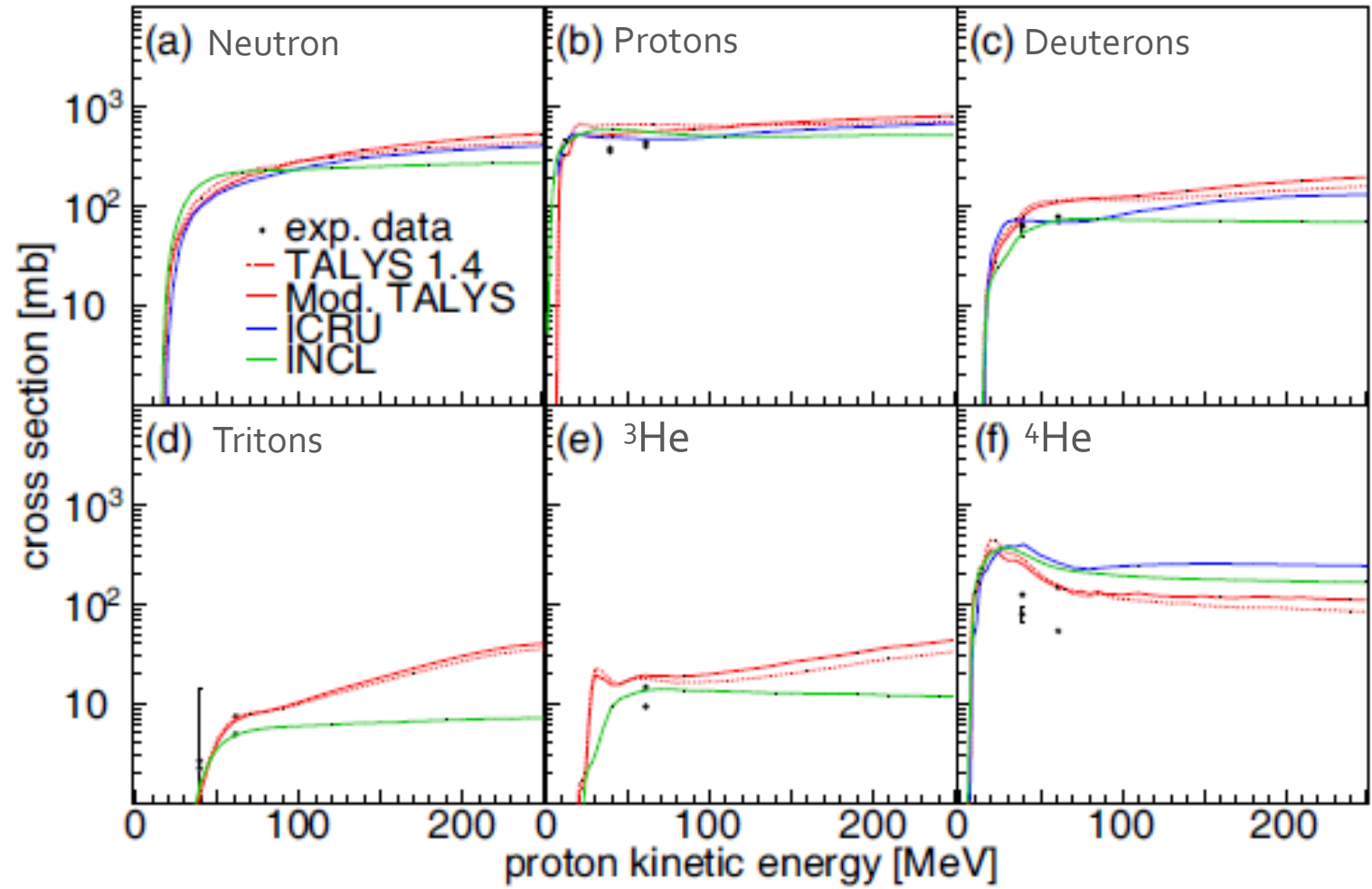
Experimental data are taken from the Landolt-Bornstein compilation.

Production cross section: *Proton on ^{12}C*



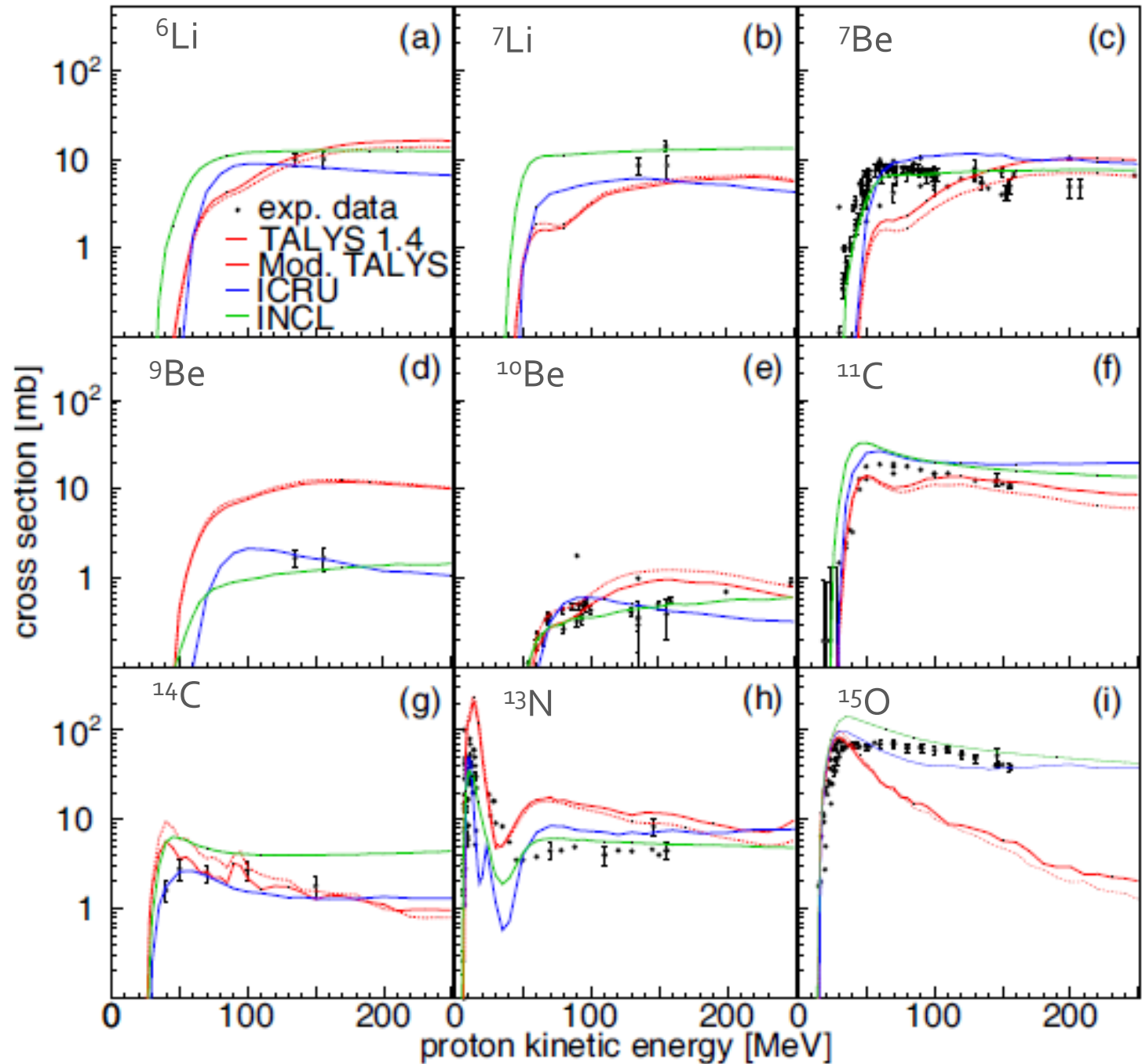
Production cross section:

Proton on ^{16}O



Experimental data are taken from the Landolt-Bornstein compilation.

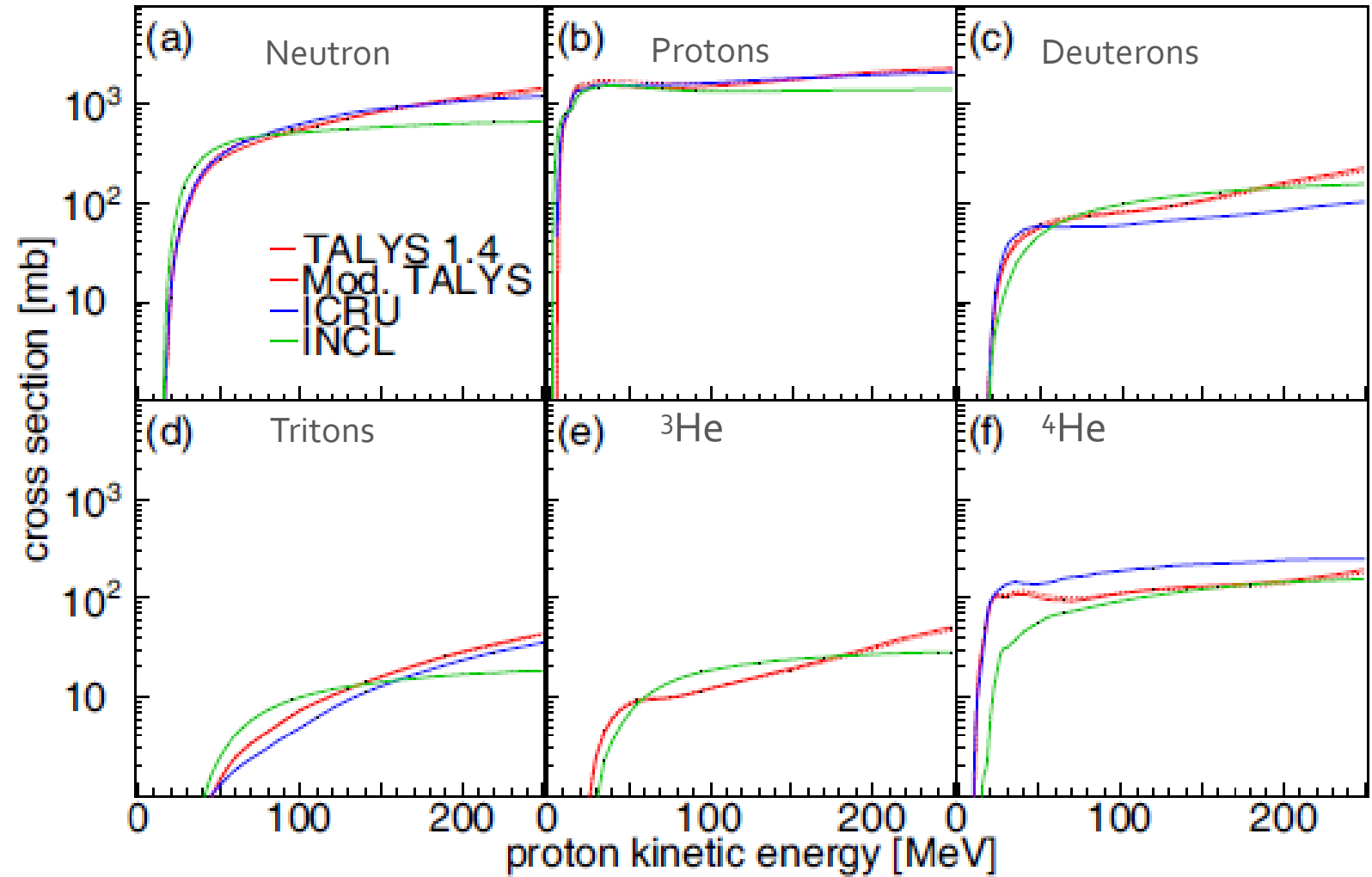
Production cross section: *Proton on ^{16}O*



Experimental data are taken from the Landolt-Bornstein compilation.

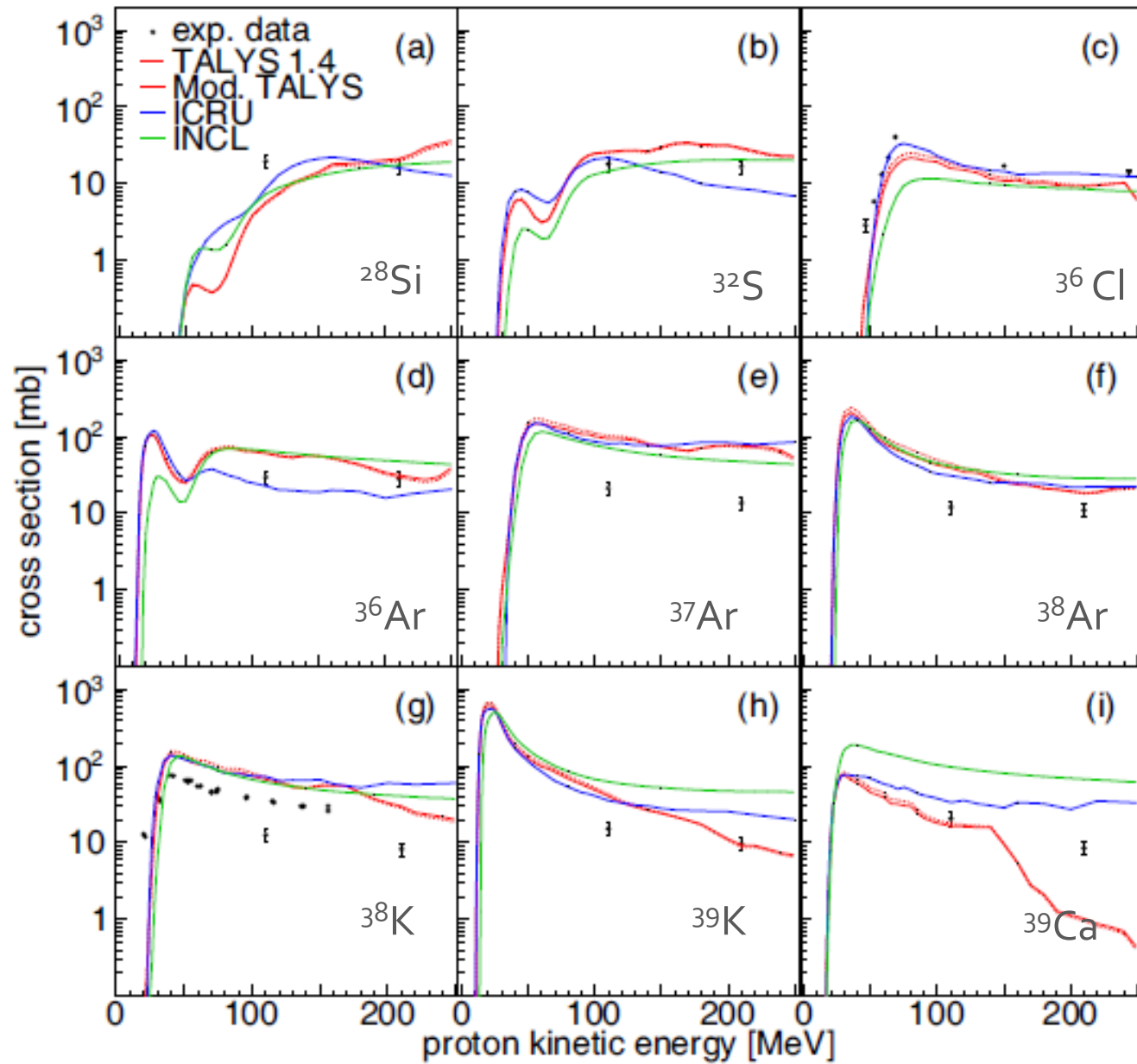
Production cross section:

Proton on ^{40}Ca



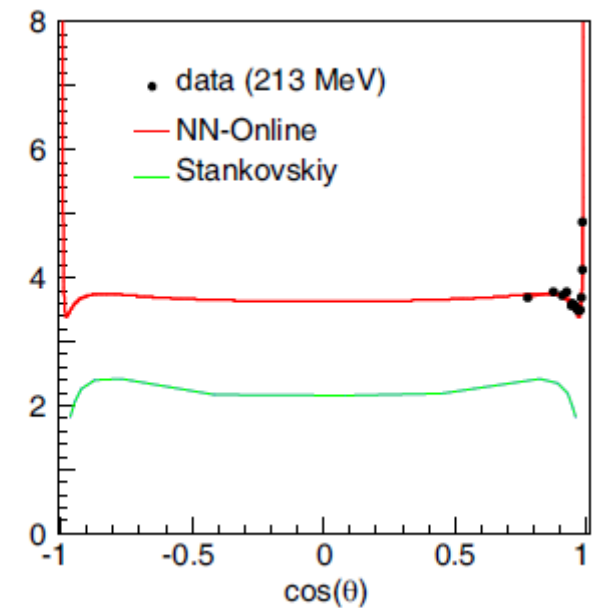
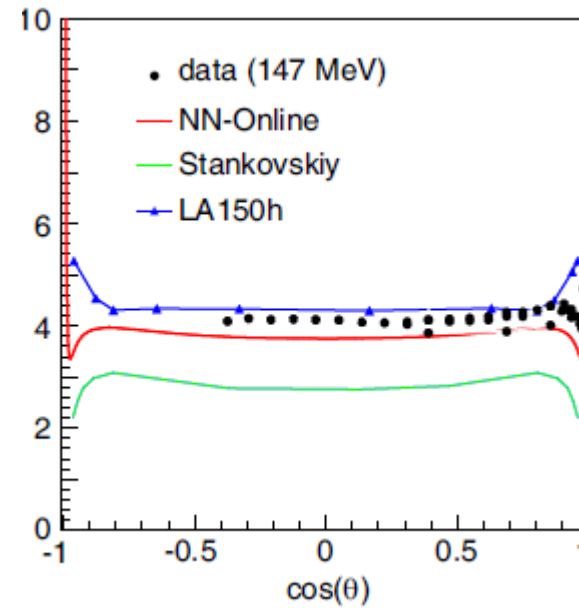
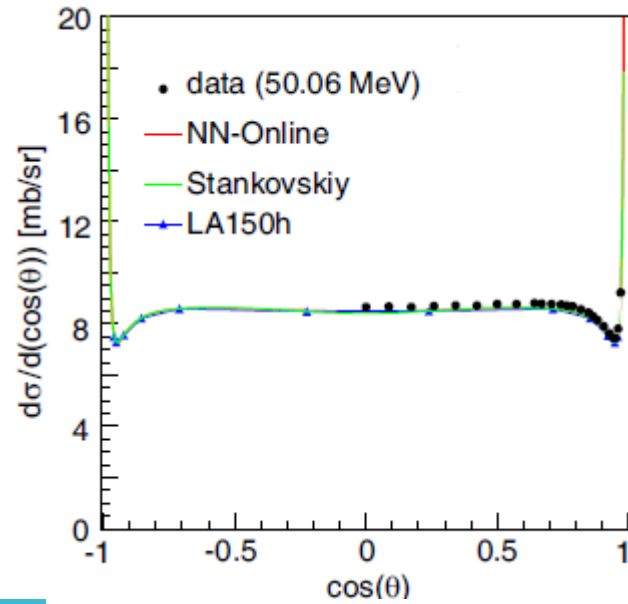
Experimental data are taken from the Landolt-Bornstein compilation.

Production cross section: *Proton on ^{40}Ca*

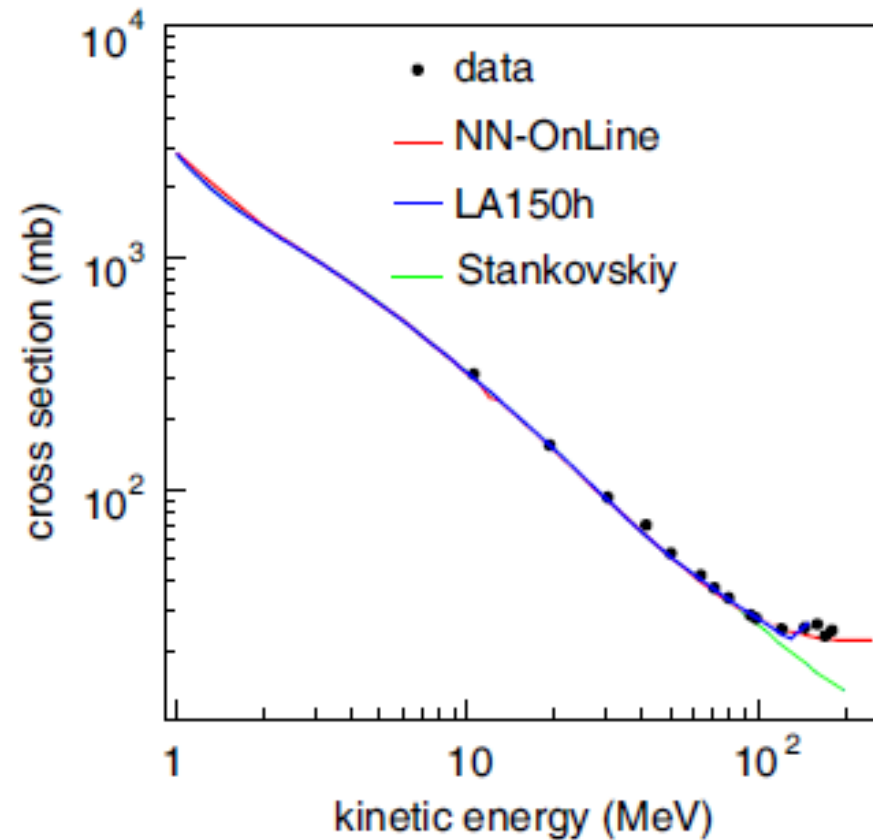


Experimental data are taken from the Landolt-Bornstein compilation.

Proton-proton angle differential cross sections



Proton-proton elastic nuclear cross sections



Elastic nuclear cross section for p-p scattering, as calculated by the NN-OnLine (red), LA150h (blue) and Stankovskiy (green) evaluations. Experimental data are taken from the Particle Data Group compilation.

Conclusions

- Only experimental data for $\frac{d\sigma}{dN}$ and $\frac{d\sigma}{d\Omega}$ are shown.
- Fragmentation cross section: $\frac{d\sigma}{dE}$ aren't reported.
- Isotopic identification could be investigated studying: Iljinov et al. Production of radionuclides at intermediate energies, Landolt-Bornstein, New Series, Subvol. I/13 (Springer-Verlag, Berlin-Heidelberg, 1991)