WPEC Subgroup 25 Conclusions and Outlook on Decay Heat

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WPEC Subgroup 25
Beta Decay and Decay Heat

http://www.nea.fr/html/science/projects/SG25/

Participants

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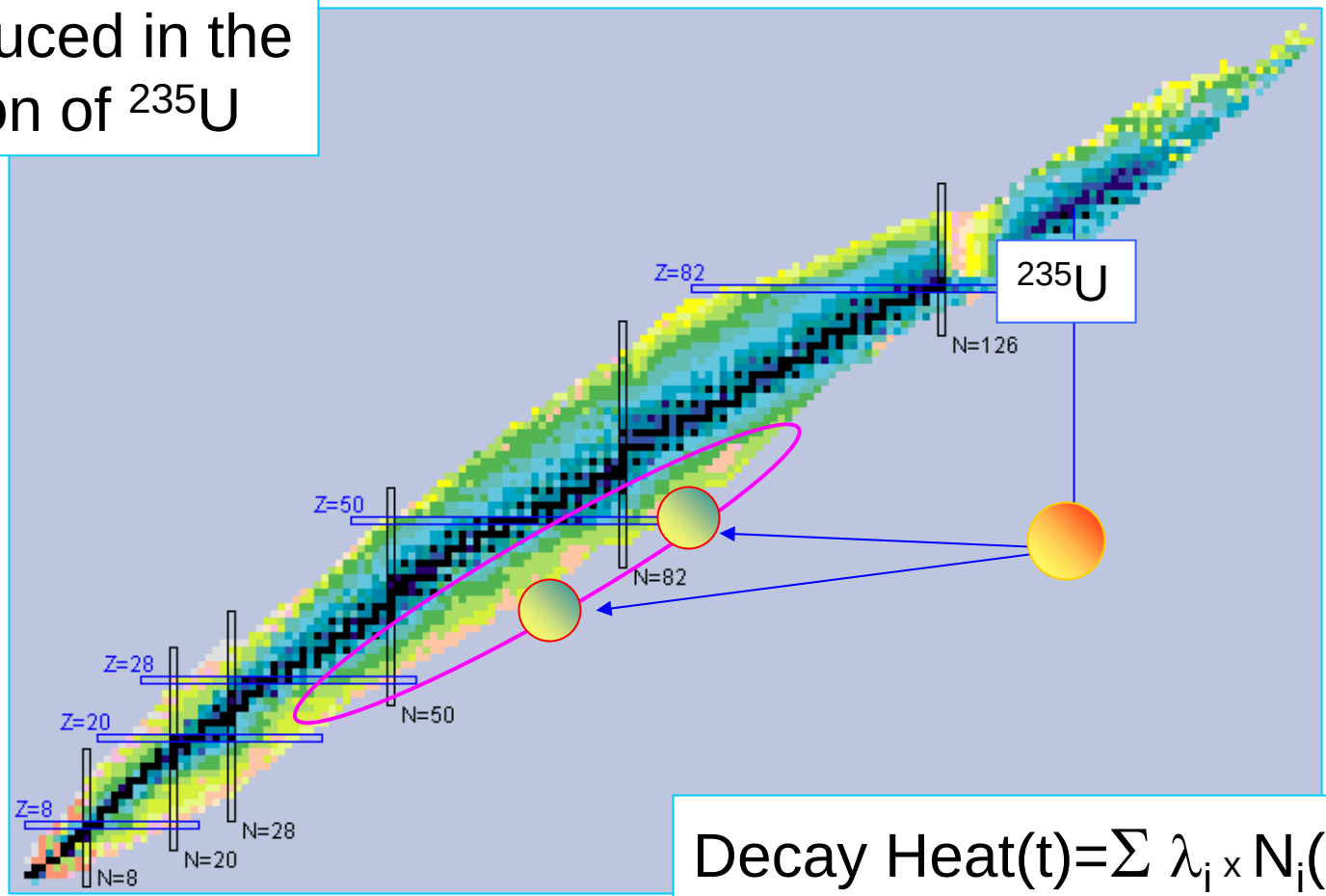
Goals

- Understand differences between measured and calculated decay heats
- Resolve discrepancies between 21st century decay data libraries
- Produced a priority list of nuclides to be studied
- Make new data and results available to the community

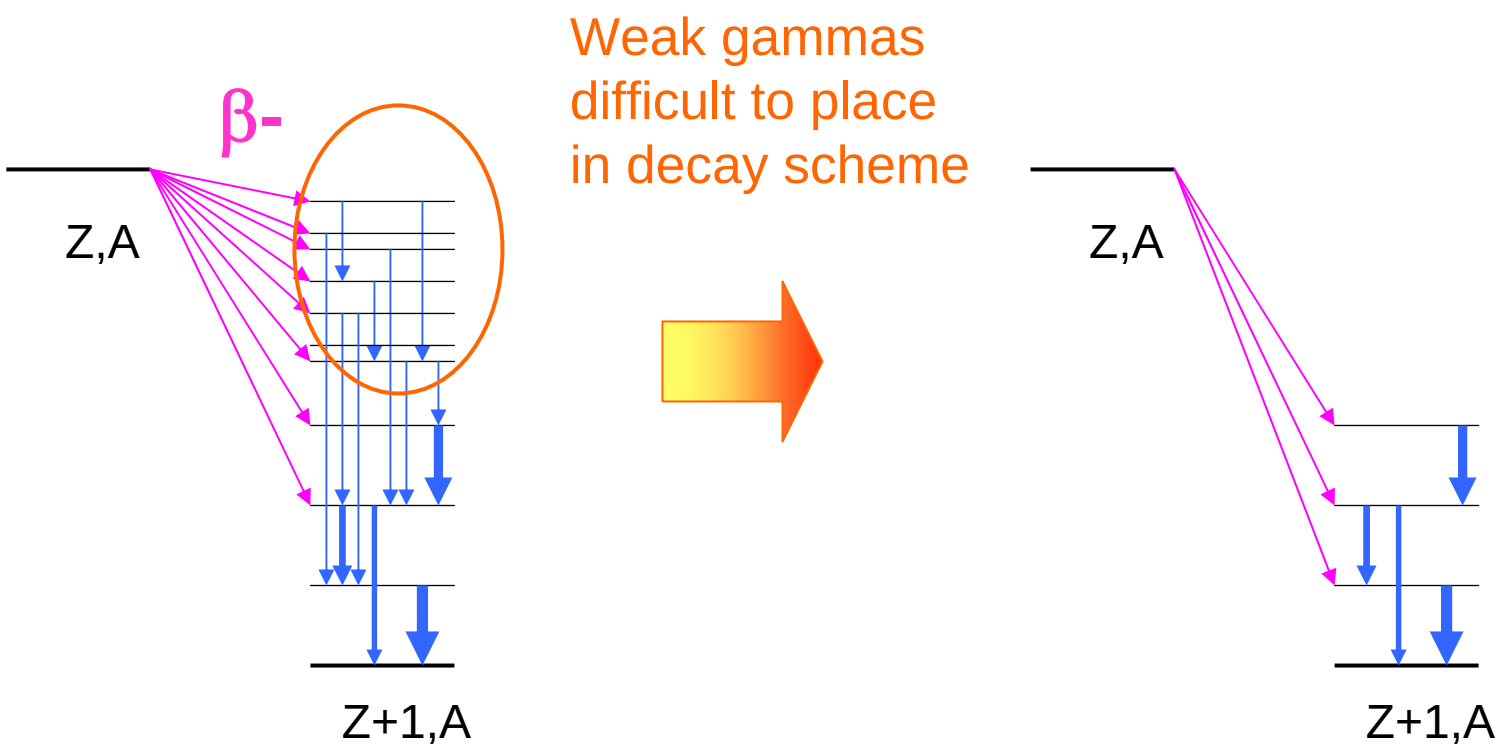
More than 800 nuclides produced in the fission of ^{235}U



Decay Heat(t)=$\Sigma\ \lambda_i \times N_i(t) \times E_i$

E_i: energy released in decay

Beta-minus decay of neutron rich nuclides



Electromagnetic Energy=$\Sigma I_{\gamma}E_{\gamma} + \Sigma I_{xr}E_{xr}$

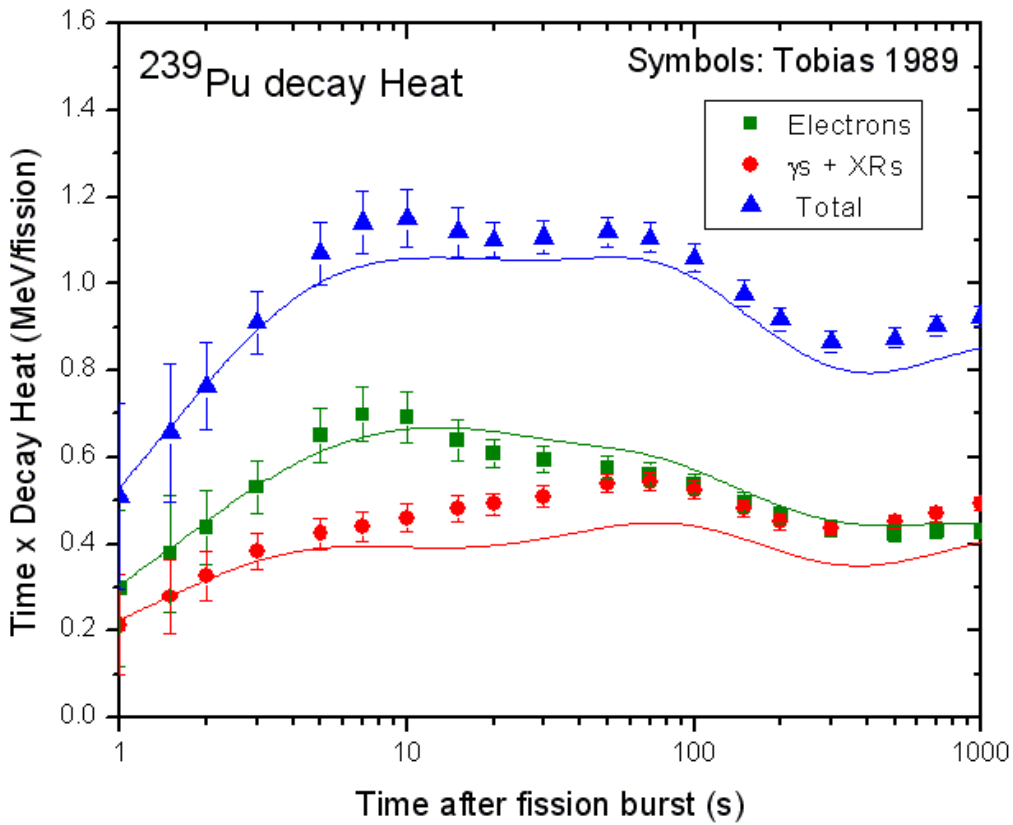
Light Particle Energy=$\Sigma I_{\beta-}E_{\beta-} + \Sigma I_{ce}E_{ce} + \Sigma I_{Auger}E_{Auger}$

Total Energy=EE+LPE+$E_{neutrino}$= Q(β-)

Resulting in smaller EE and larger LPE values

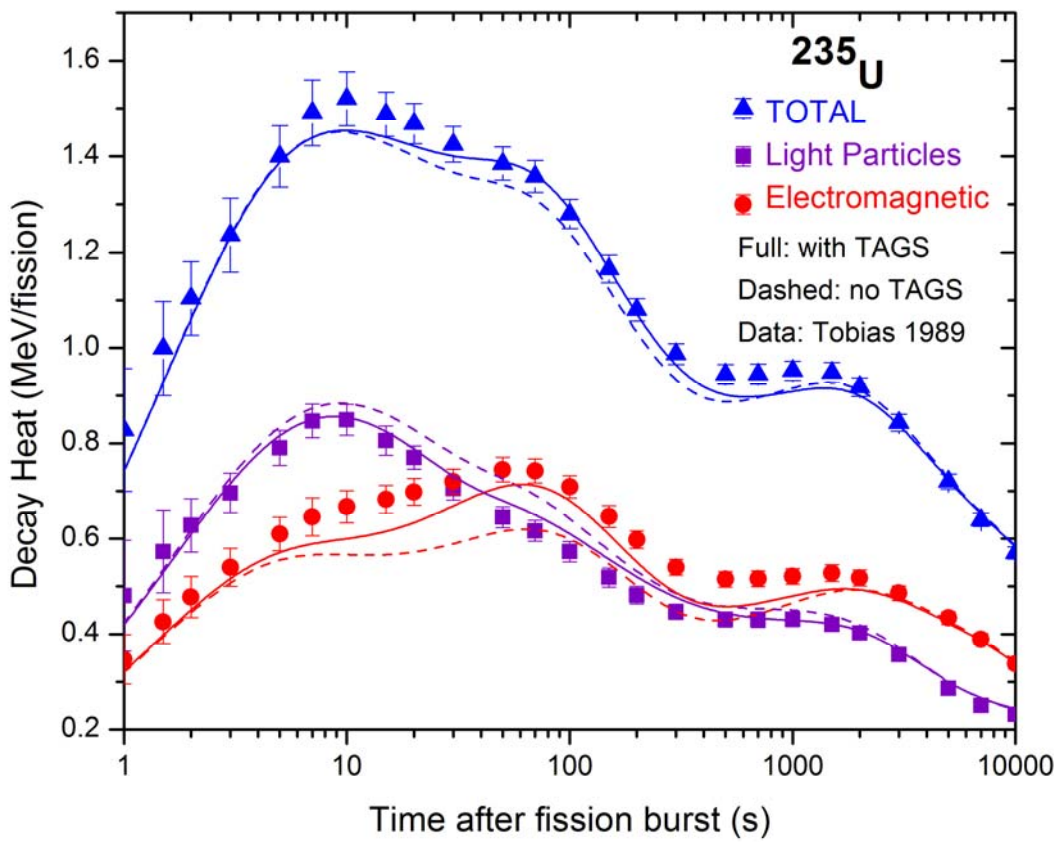
Decay Heat Calculations

Missing gamma decay heat due to incomplete decay schemes for neutron rich nuclei



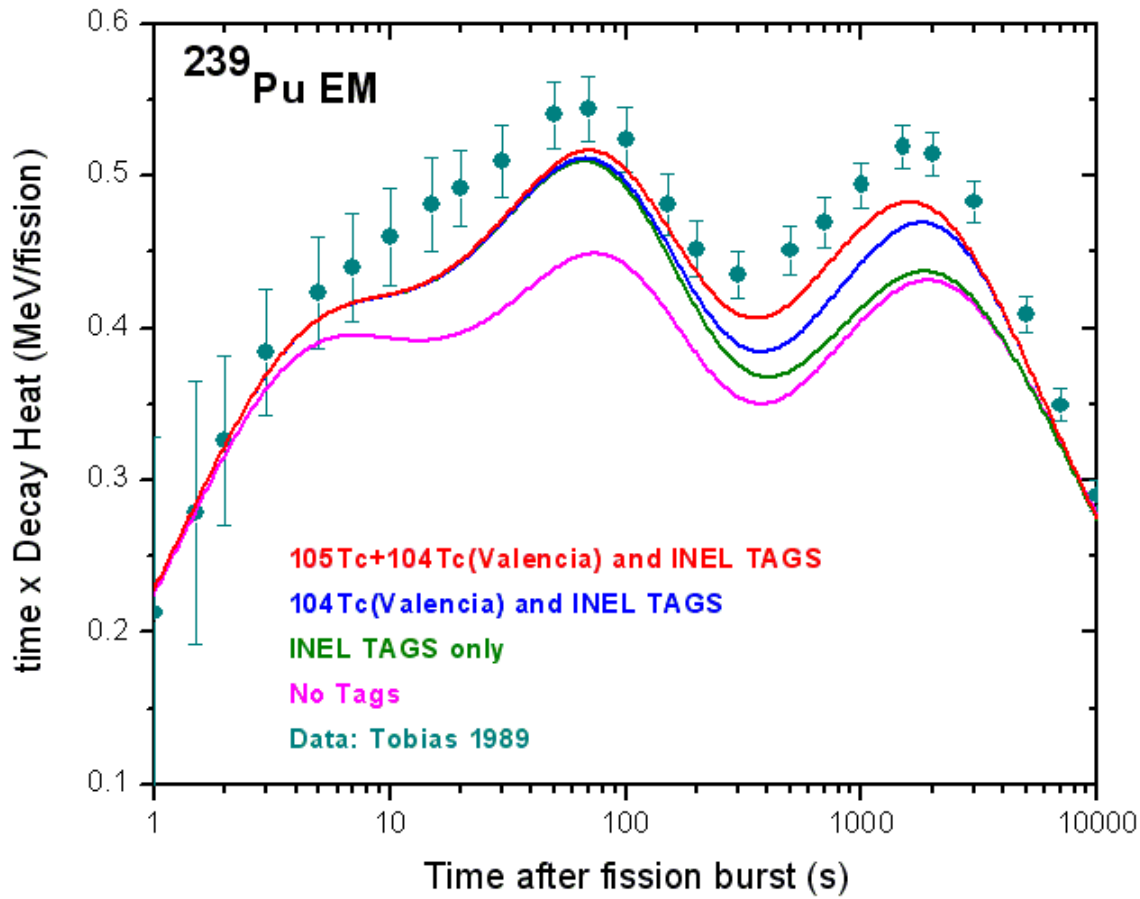
Using Total Absorption Gamma Spectrometer (TAGS) Data

- INEL TAGS data, 49 cases
- ^{252}Cf ISOL source
- Single NaI(Tl)
- γ-β coincidences
- Mid 1980s to mid 1990s
- Usefulness of data first realized by Yoshida and collaborators
- More TAGS data may require RIA facility



New TAGS Data

- New TAGS data from Valencia and collaborators
- Experiments performed in Isolde and Jyvaskyla
- Only 2 nuclides considerably improved the prediction of EM decay heat



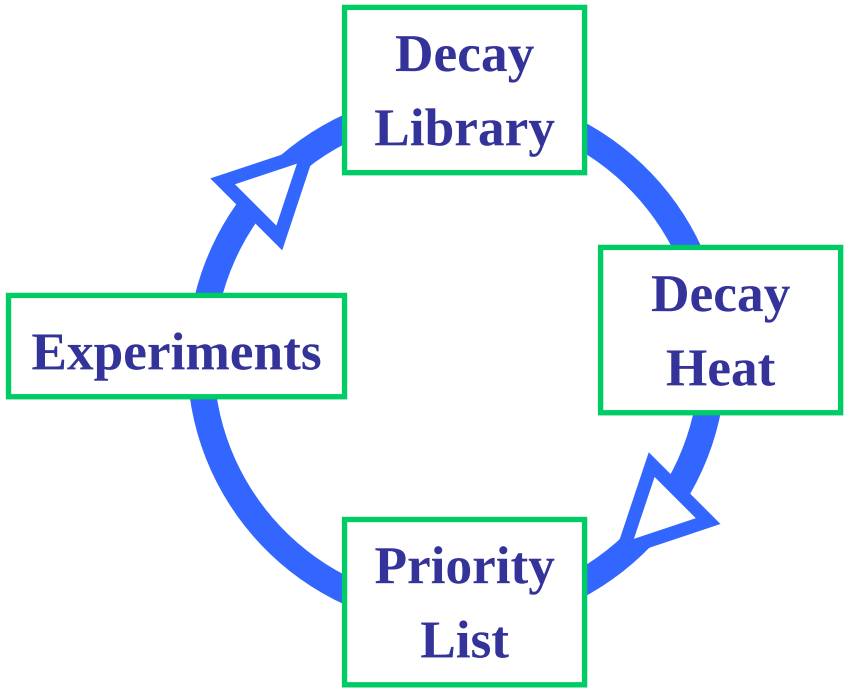
Nuclei that deserve TAGS experiments

- Sensitivity study to determine most important cases
- Experimental data incomplete
- Prepare priority list, preliminary, final list will be in subgroup's report

^{86,87,88}Br
^{89,90}Kr
^{92}Rb
^{89}Sr
^{96}Y
^{99,100}Zr
^{100,101,102}Nb
^{103,105}Mo
^{102,103}Tc
^{132}Sb
^{135}Te
^{136,137}I
^{137,139,140}Xe
^{142}Cs
^{145}Ba
^{143,145}La

Conclusions

- Comparison of JENDL 3.3, JEFF 3.1 and ENDF/B-VII Decay Data Libraries
- Study effect of incorporating INEL and Valencia TAGS data
- Decay Heat calculations for ^{235}U and ^{239}Pu at thermal energies
- Sensitivity study to obtain list of priority nuclides



Future

- Proposal by Valencia group for dedicated setup at ALTO-ORSAY
- Decay Heat calculations for other actinides at thermal and fast energies (NNDC)
- Looking forward to collaborations (NNDC)