Fission Product Yield Measurements from LANSCE & TUNL

Mark B. Chadwick (LANL), Anton Tonchev (LLNL), Fredrik Tovesson (LANL)
At higher energies the FPY for $^{147}$Nd turns over and decreases.

- The TUNL measurements at 14.8 MeV is in a very good agreement with LLNL value.
- Compared to the FPY at 4.6 MeV, the FPY has decreased by 37% at 14.8 MeV.
- Our new measurement helps resolve the long-standing discrepancy at 14.8 MeV!
The slope of $^{147}$Nd FPY is positive from 0.5 to 2.6 MeV in all three fissile actinides.

The slope of $^{147}$Nd FPY from 4.6 to 14.8 MeV is negative in all three fissile actinides.

Joint LLNL/LANL theoretical teams, using this data, are spearheading a renaissance in fission theory resulting in expanded capabilities to understand detailed fission properties.
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Fission mass yields with SPIDER

- Spontaneous fission of Cf-252 is used as benchmark
- U-235 and Pu-239 for thermal neutrons can be compared to data from ILL, Grenoble
- Current mass resolution is 1.2 amu for light fragment group and 1.6 amu for heavy fragment group
- Lujan thermal measurement establishes accuracy
Total Kinetic Energy (TKE) results

- **$^{238}\text{U}(n, f)$**
  - Zöller et al. data for U-238 extends beyond 30 MeV
  - For U-235 no previous data above 9 MeV
  - For Pu-239 no data beyond 5 MeV

- **$^{235}\text{U}(n, f)$**
  - Madland evaluation is fit to experimental data
  - Not intended for extrapolation
  - ENDF values for 14 MeV never the less are extrapolations

- **$^{239}\text{Pu}(n, f)$**
  - Semi-empirical modeling by Lestone et al. in close agreement with new data
  - J.P. Lestone, T.T. Strother, Nuclear Data Sheets 118, 208 (2014)

- **ENDF** $^{239}\text{Pu}$ fission energy deposition needs to be increased by 2 MeV
Current status and future plans

- **Fission yields**
  - Thermal mass yields obtained for U-235, Pu-239
  - First test with fast neutrons completed
  - Remainder of FY2015
    - Complete data analysis
    - Improve mass resolution from 1.2 to 0.8%
  - FY2016
    - Measure fission fragment coincidence measurement on Pu-239
    - Make decision on SPIDER scale-up for fast neutron measurements at LANSCE/WNR

- **Total kinetic energy release**
  - Completed measurements for U-238, U-235, Pu-239
  - Remainder of FY2015
    - Publish U-238, U-235
  - FY2016
    - Publish Pu-239
    - Measure other isotopes?
    - Combine with fission neutron detection
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