IRSN
INSTITUT
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ET DE SÛRETÉ NUCLÉAIRE

Enhancing nuclear safety

Strategy used for evaluating structural: angular data from resonance parameters, is it a viable Option?

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Outline

- ENDF representation
- SAMMY (Blatt-Biedenharn)
- ^{56}Fe fitting of DDX
- Remarks

ENDF representation

$$\sigma(\mu, E) = \frac{\sigma_s(E)}{2\pi} f(\mu, E)$$

$$\sigma(\mu, E) = \frac{\sigma_s(E)}{2\pi} \sum_{l=0}^{N} \frac{2l+1}{2} a_l(E) P_l(\mu)$$

$$\int_{-1}^{+1} f(\mu, E) d\mu = 1$$

ENDF representation

$$f(\mu, E) = \frac{2\pi}{\sigma_s(E)} \sigma(\mu, E)$$

Or

$$f(\mu, E) = \sum_{l=0}^{N} \frac{2l+1}{2} a_l(E) P_l(\mu)$$

Where

ENDF representation

μ cosine of the scattered angle in the LAB or COM systems; E energy of the incident particle in the LAB system; $\sigma_s(E)$ the scattering cross section given in FILE 3; l is the Legendre polynomial order; $\sigma(\mu, E)$ the differential scattering cross section; $a_l(E)$ energy dependent Legendre polynomial coefficient;

$a_0 = 1.0$

SAMMY (Blatt-Biedenharn

$$\frac{d\sigma_{\alpha\alpha'}}{d\Omega_{CM}} = \sum_{L} B_{L\alpha\alpha'}(E) P_L(cos\beta)$$

$$B_{L\alpha\alpha'}(E) = \frac{1}{4k_\alpha^2} \sum_{J_1} \sum_{J_2} \sum_{l_1 s_1} \sum_{l_1' s_1'} \sum_{l_2 s_2} \sum_{l_2' s_2'} \frac{1}{(2i+1)(2I+1)} G_{\{l_1 s_1 l_1' s_1' J\}\{l_2 s_2 l_2' s_2' J\}L} \; Re\left[(\delta_{c_1 c_1'}\right.$$

$B_{L\alpha\alpha'}(E)$ Relates to the collision matrix *U* and consequently to the R-matrix parameters

No need of FILE 3 cross section representation !!

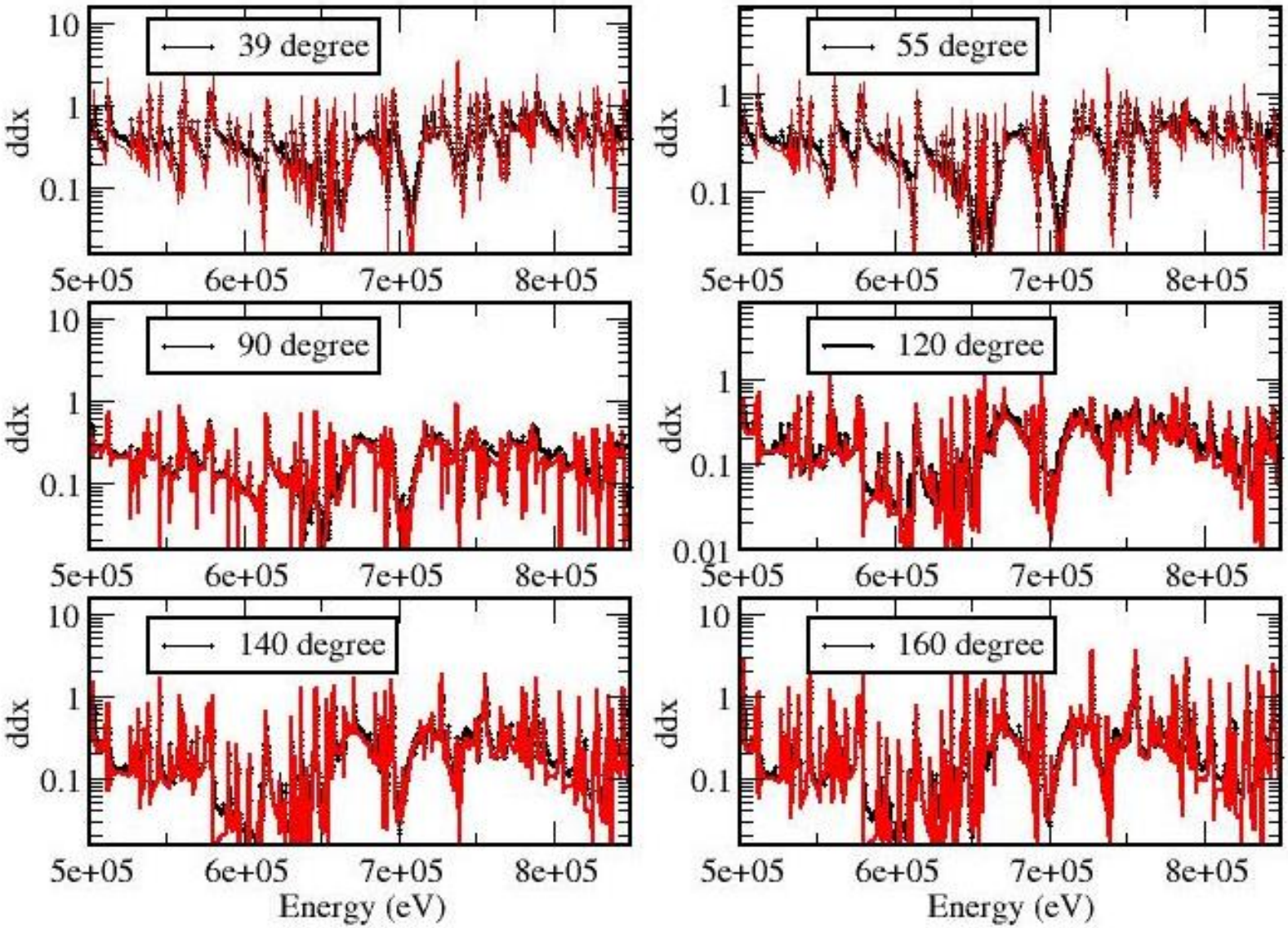
Structural Material

Stainless Steel: Components are Cr, Ni, Mo, Si, Al, Fe

Fe is added to carbon to produce steel is the main component

Other structural materials: Ti, W, etc

Comparison of SAMMY Fits to Perey Differential Elastic ^{56}Fe data



Angular Reconstruction from Resonance Parameters

- Consistency FILE 2 and FILE 4
- Resonance spin assignment (right scattering)
- Leads to better understanding of the capture cross section
- ENDF format can accommodate more sophisticate RR representation
- Processing capabilities available: GAIA, GALILÉE, AMPX, NJOY, PREPRO
- Angular data covariance, FILE32 to FILE34
- Fits well on the GND format !!