Covariance Processing Issues in ENDF/B-VII.0 and ENDF/A

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Methodology

Selection of Materials

- **ENDF/A (16 materials)**
  - F-19, Cl-35, Cl-37, K-39, K-41, Mn-55, Pu-239, Pu-240 U-233, U-235, U-238, W-180, W-182, W-183, W-184, W-186

- **ENDF/B-VII.0 (14 materials)**
  - Gd-152, Gd-153, Gd-154, Gd-155, Gd-156, Gd-157, Gd-158, Gd-160, Ir-191, Ir-193, Li-7, Tc-99, Th-232, Y-89

Processing Codes

- **NJOY-99.305 (with A. Trkov's patch)**
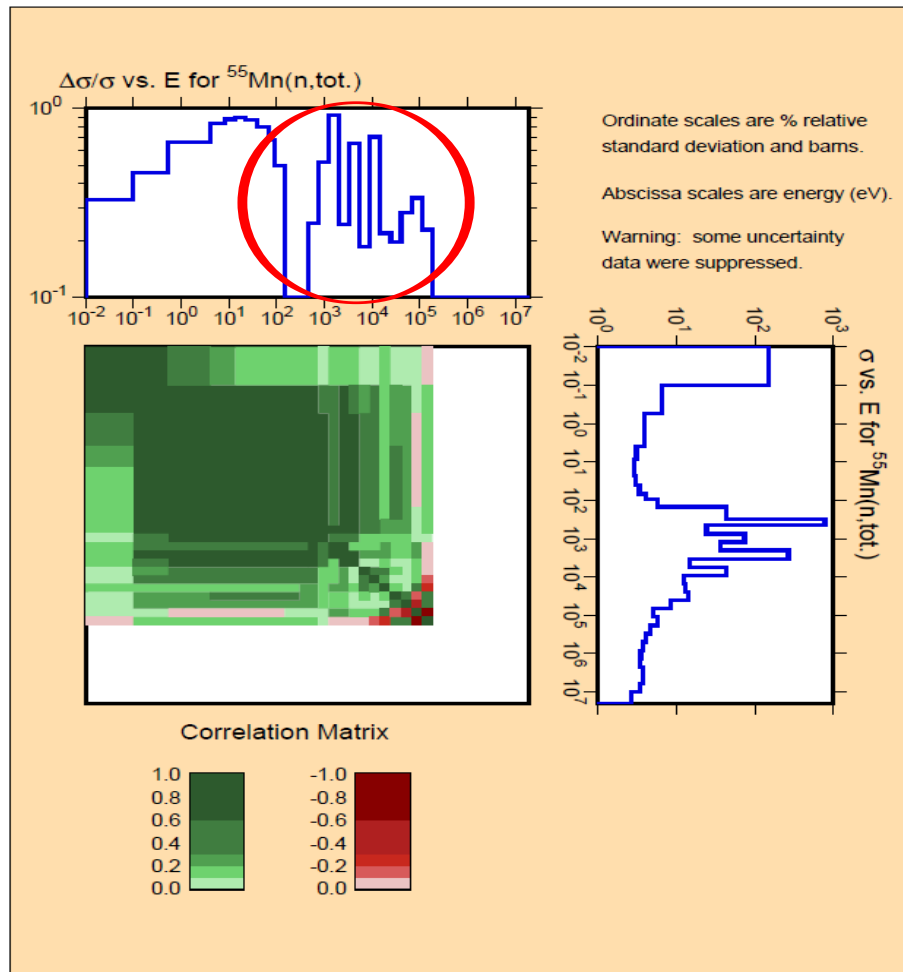- **PUFF-IV 10_02_2009**

Test Criteria

- **Processability with NJOY-99.305 and/or PUFF-IV 10_02_2009**

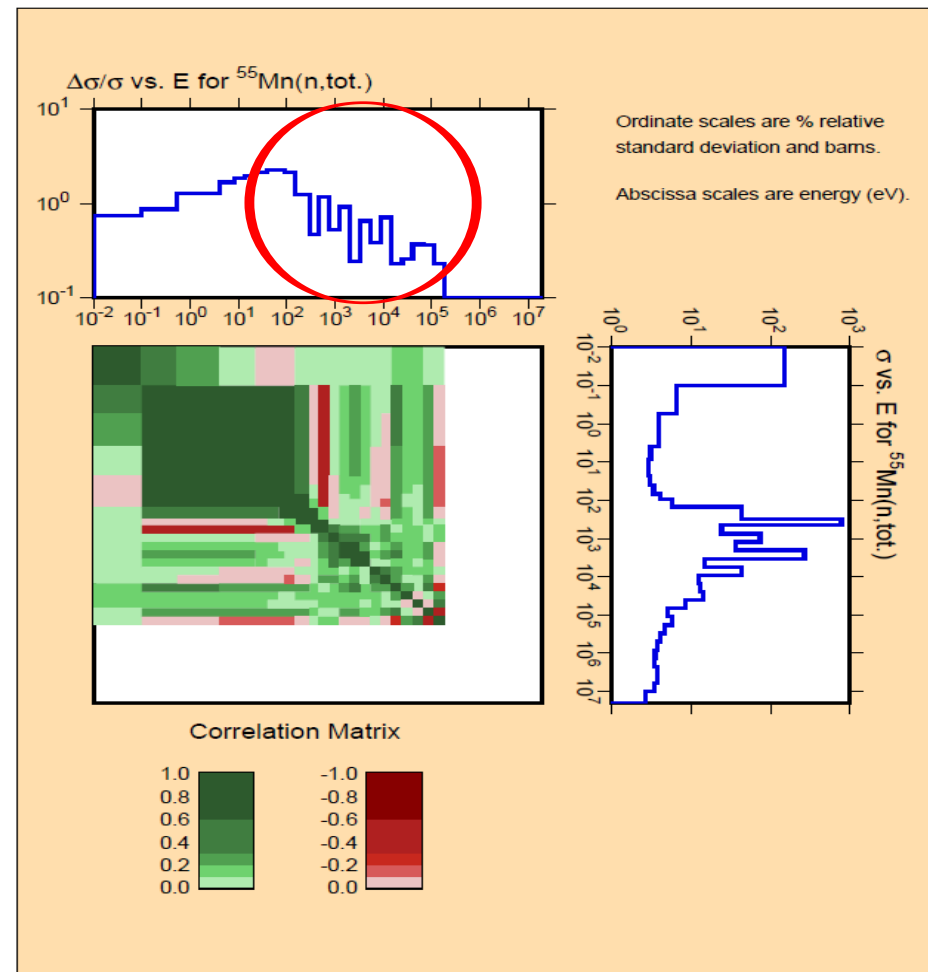- **If processable, differences between NJOY and PUFF results**

NJOY-99.305 (w/ A.Trkov's Patch)
Fixed bug in ERRORJ

Summary of Results
Websites Constructed

ENDF/B-VII.0

Search the NNDC: [Go]

NNDC Site Index
AFCI Covariance Library
ENDF/B-VII.0 covariances
Sigma
ENDF/B-VII.0 covariances
ENDF/A neutron files
33-energy group structure
Empire methodology
Report 2008

The library contains 14 materials with
NJOY and PUFF, NJOY-99.305 and F
their covariances using 1/E flux and Af
the columns marked 'Yes' under 'Proc
correlation matrices for a specific mat

Material	Covariance data	Processa... NJOY
Li-7	same as ENDF/B-VI.8	Yes
Y-89	all data in MF33	Yes
Tc-99	all data in MF33	Yes
Gd-152	MF32, MF33	Yes
Gd-153	MF32, MF33	Yes
Gd-154	MF32, MF33	Yes
Gd-155	MF32, MF33	Yes
Gd-156	MF32, MF33	Yes
Gd-157	MF32, MF33	Yes
Gd-158	MF32, MF33	Yes
Gd-160	MF32, MF33	Yes
Ir-191	all data in MF33	Yes
Ir-193	all data in MF33	Yes
Th-232	MF31, MF32, MF33	Yes

Responsible: Pavel Oblozinsky, NNDC, B
Web: Boris Pritychenko, Plots: Alejandr

http://ndclx1.nndc.bnl.gov/gnep/E

National Nuclear Data Center

NNDC Databases: ENDF | CSISRS | Sigma | NuDat | NSR | XUNDL | ENSDF | MIRD

Search the NNDC: [Go]

NNDC Site Index
AFCI Covariance Library
ENDF/A covariances
Sigma
ENDF/B-VII.0 covariances
ENDF/A neutron files
33-energy group structure
Empire methodology
Report 2008

ENDF/A Covariances

The library contains 9 materials with complete covariances. The latest versions of NJOY and PUFF, NJOY-99.305 and PUFF-IV 10_02_2009, were used to process their covariances using 1/E flux and AFCI's 33-energy group structure. Click on any of the columns marked 'Yes' under 'Processability' to view the plots of uncertainties and correlation matrices for a specific material.

Material	Covariance data	Processability NJOY	Processability PUFF	NJOY/PUFF Agree?	Comments on Processing
W-180	MF33, MF34	Yes	Yes	Yes	
W-182	MF32, MF33, MF34	Yes	Yes	Yes	
W-183	MF32, MF33, MF34	Yes	Yes	Yes	
W-184	MF32, MF33, MF34	Yes	Yes	No	Discrepancies: total, elastic, capture
W-186	MF32, MF33, MF34	Yes	Yes	Yes	
U-233	MF31, MF33 (MF32 converted to MF33)	Yes	Yes	Yes	
U-235	MF31, MF33 (MF32 converted to MF33)	Yes	Yes	Yes	
U-238	MF31, MF33 (MF32 converted to MF33)	Yes	Yes	Yes	
Pu-239	MF31, MF33 (MF32 converted to MF33), MF35	Yes	Yes	Yes	

The library also contains 7 materials with partial covariances. These covariances were also processed by NJOY-99.305 and PUFF-IV 10_02_2009 using 1/E flux and AFCI's 33-energy group structure. Click on any of the columns marked 'Yes' under 'Processability' to view the plots of uncertainties and correlation matrices for a specific material.

Material	Covariance data	Processability NJOY	Processability PUFF	NJOY/PUFF Agree?	Comments on Processing

http://ndclx1.nndc.bnl.gov/gnep/ENDFA/endfa.jsp

Summary of Results
Discrepancies: ENDF/B-VII.0

Complete Covariances					
Material	Covariance Data	Processability		NJOY/PUFF Agree?	Comments on Processing
		NJOY	PUFF		
Gd-156	MF32,MF33	Yes	Yes	No	Discrepancies: elastic, capture
Th-232	MF31,MF32 MF33	Yes	Yes	No	Discrepancies: total, capture

Summary of Results
Discrepancies: ENDF/A Materials

Complete Covariances					
Material	**Covariance Data**	**Processability**		**NJOY/PUFF Agree?**	**Comments on Processing**
		NJOY	**PUFF**		
W-184	MF32, MF33, MF34	Yes	Yes	No	Discrepancies: total, elastic, capture
Partial Covariances					
Cl-35	MF32	No	No	N/A	
F-19	MF32, MF33	No	Yes	N/A	
Mn-55	MF32	Yes	Yes	No	Discrepancies: total, elastic, capture

Gd-156 Discrepancies: elastic
1/E Flux, 33-group (AFCI)

NJOY-99.305
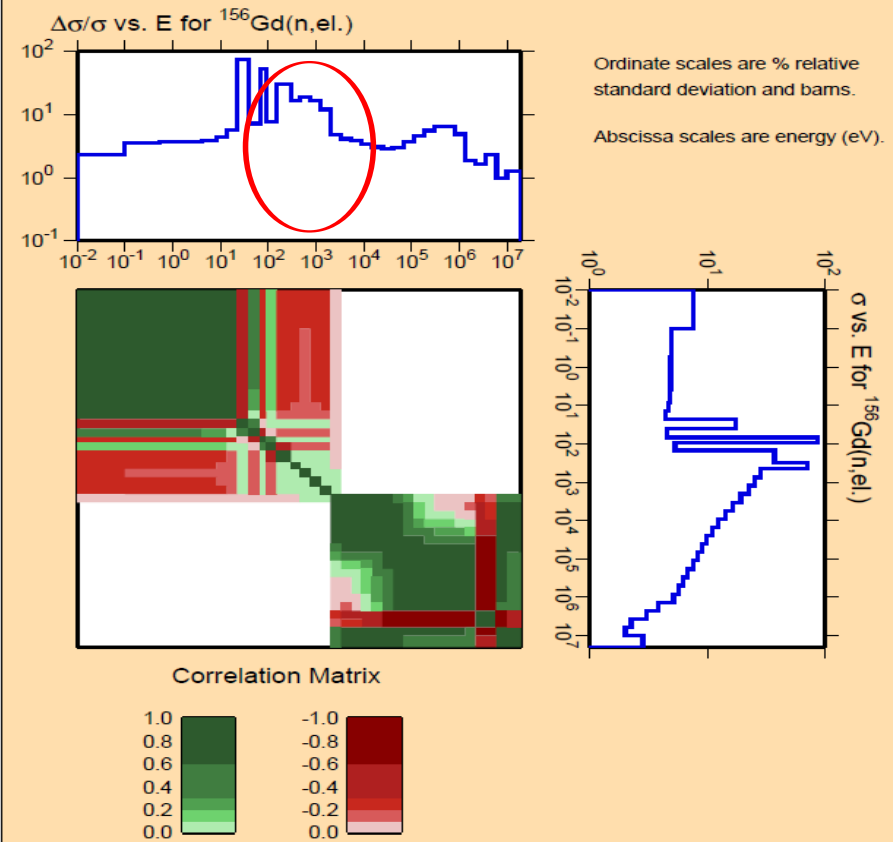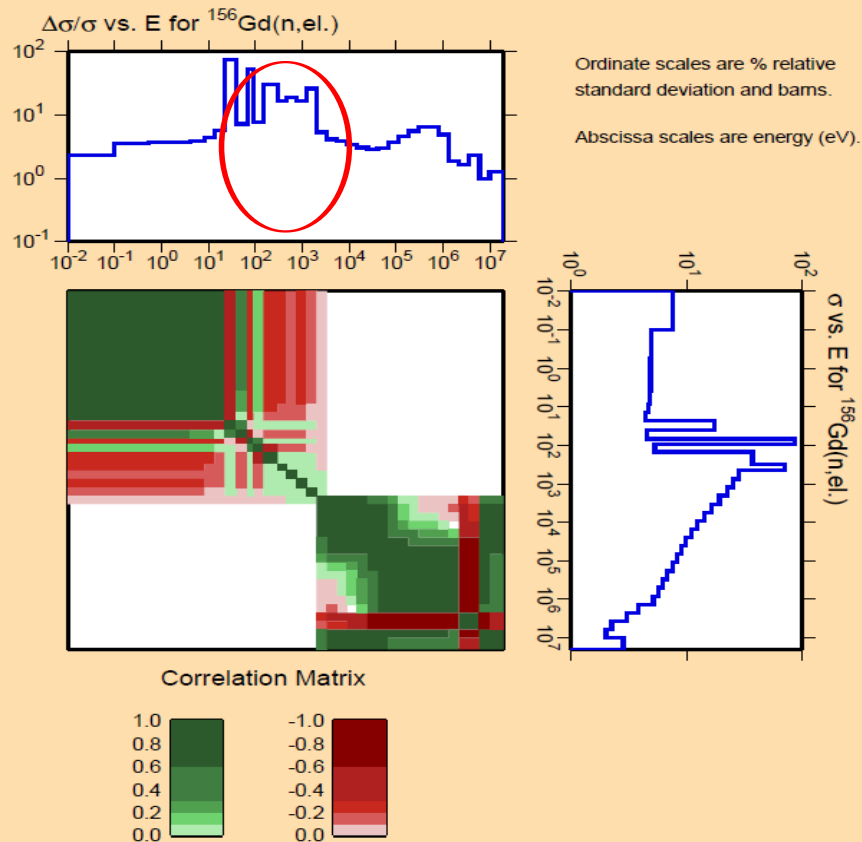
PUFF-IV 10_02_2009

Gd-156 Discrepancies: capture
1/E Flux, 33-group (AFCI)
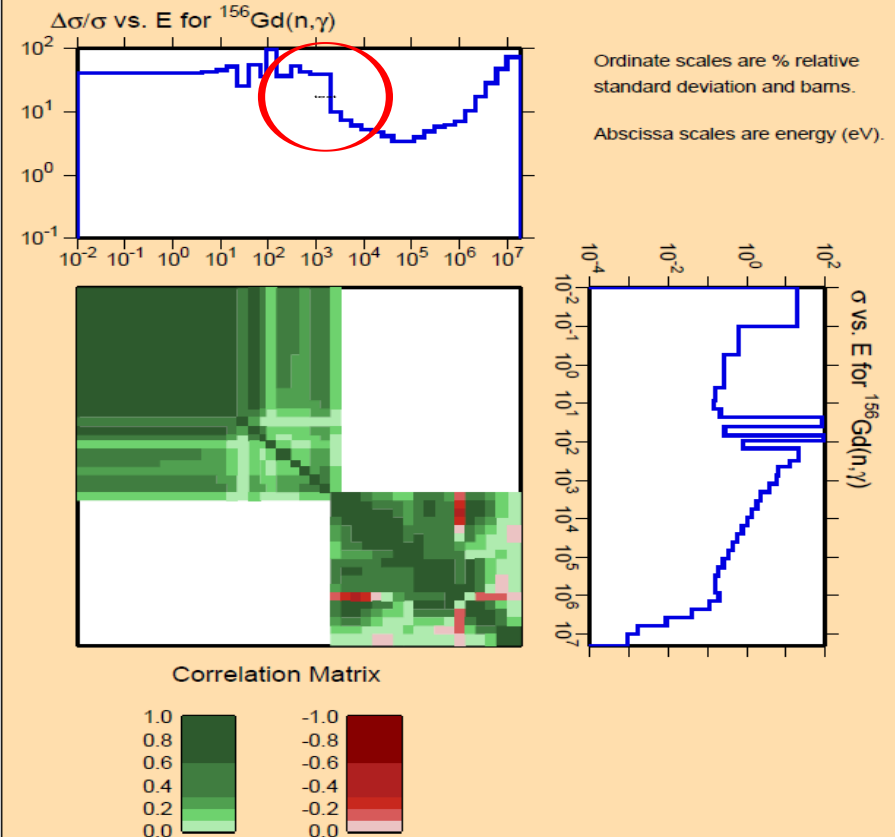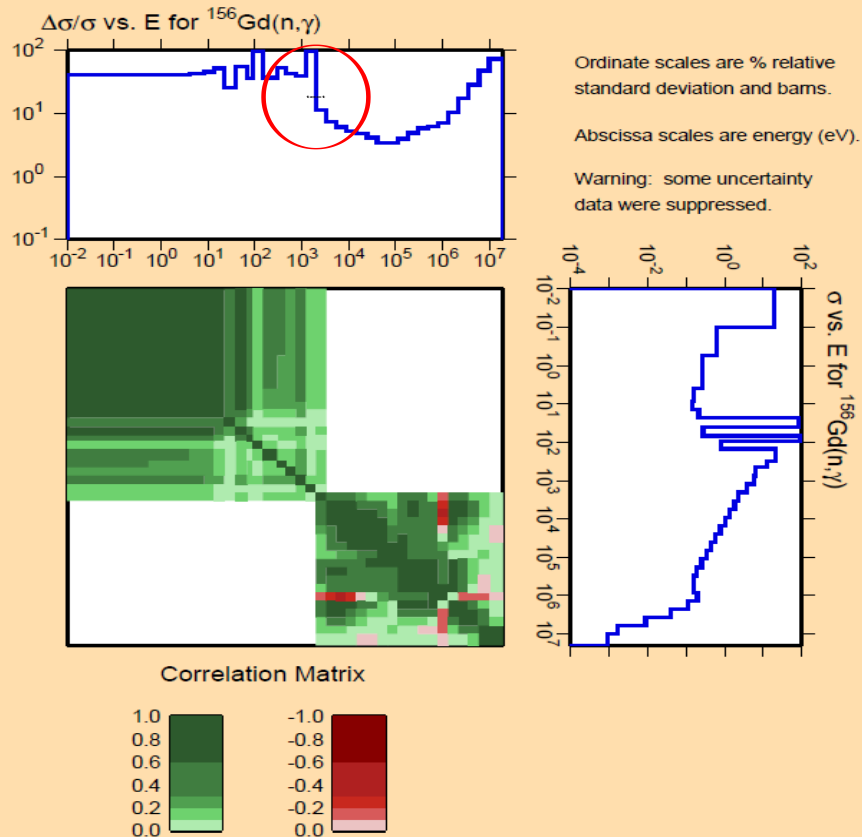
NJOY-99.305

PUFF-IV 10_02_2009

Th-232 Discrepancies: total
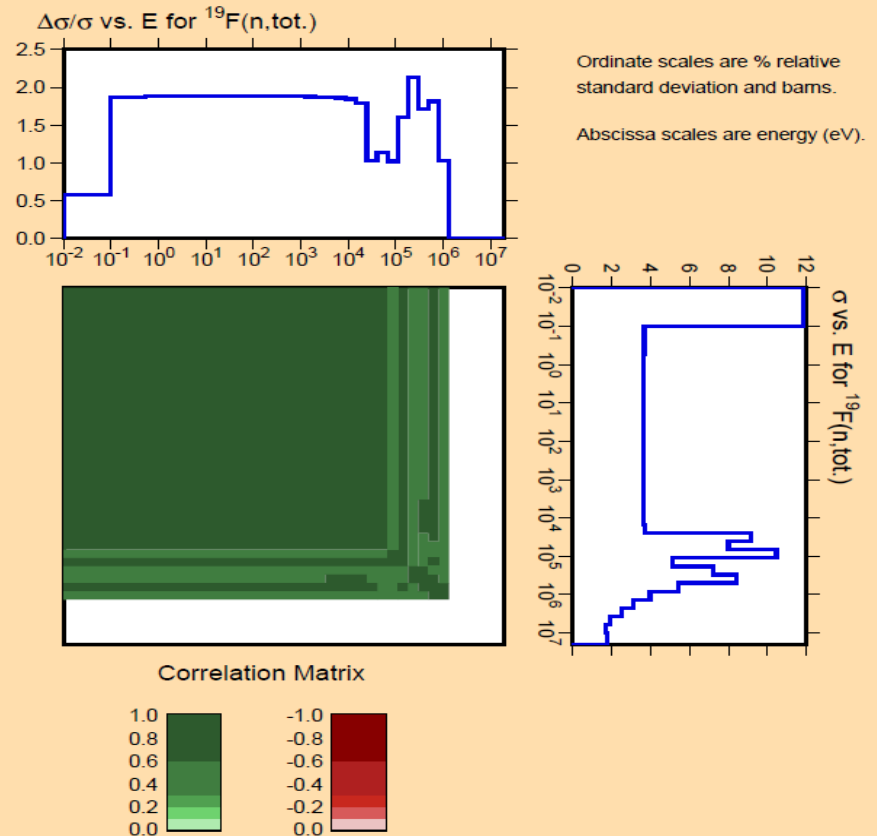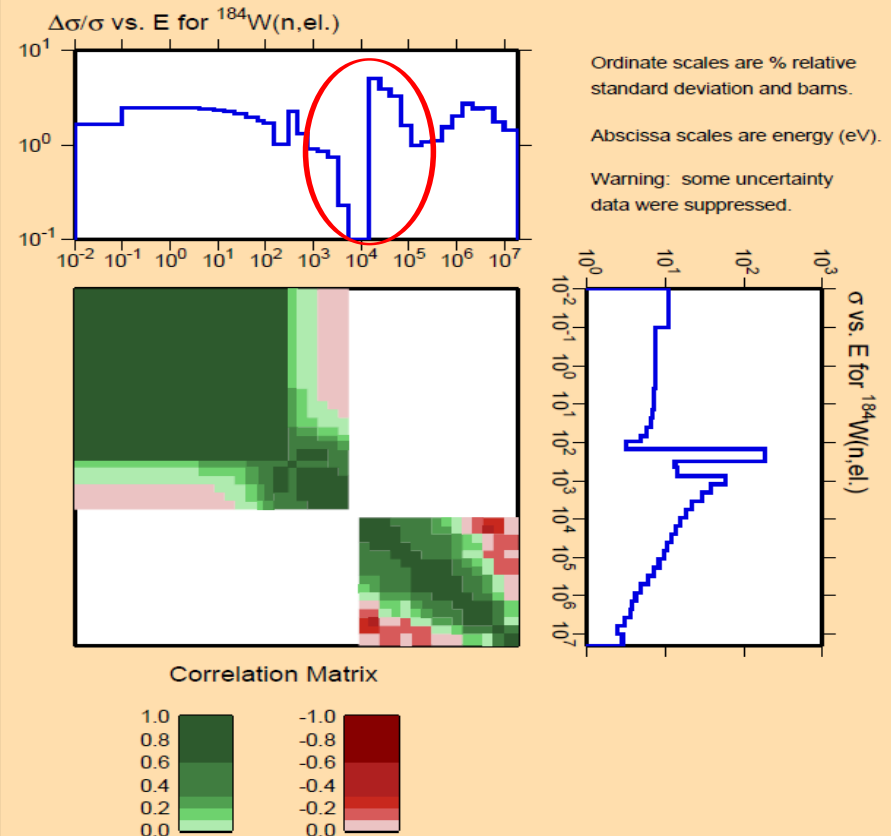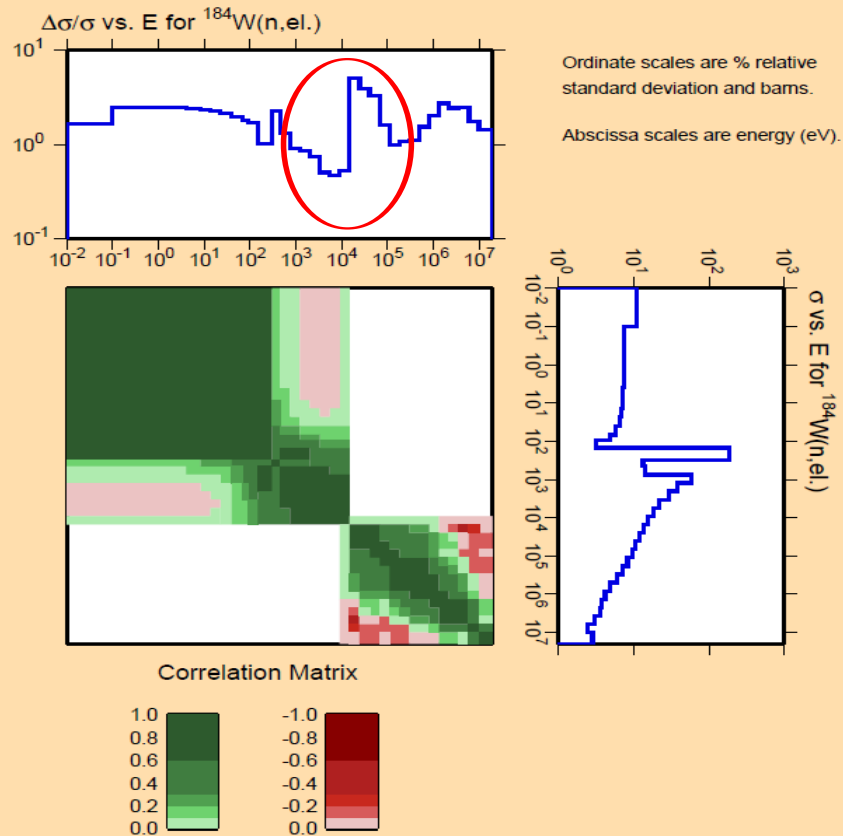## 1/E Flux, 33-group (AFCI)
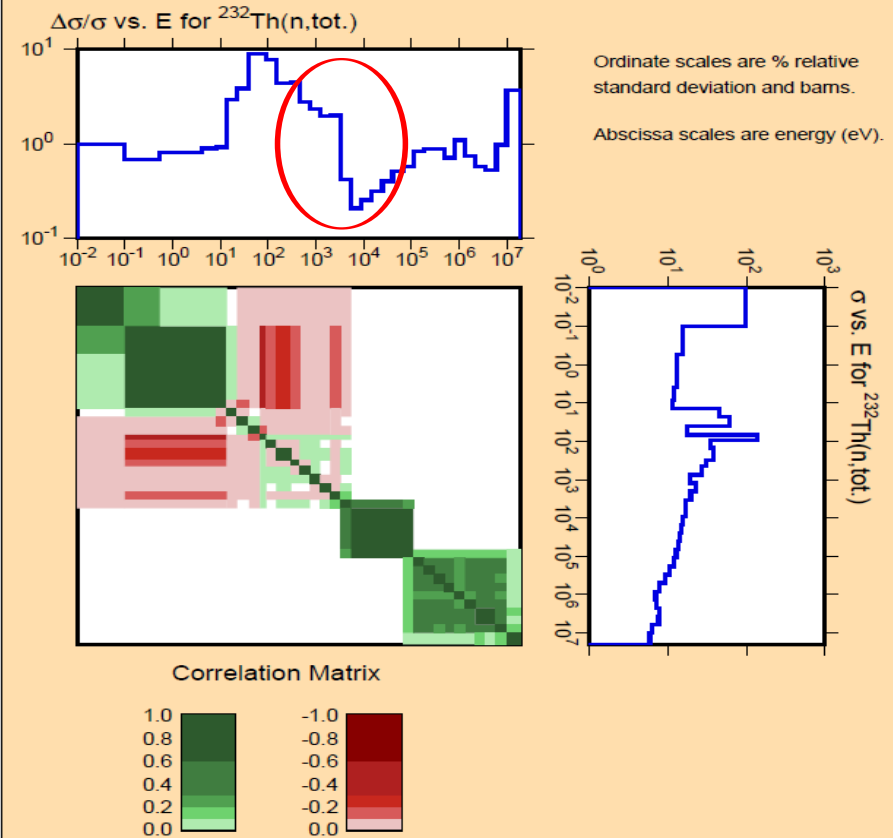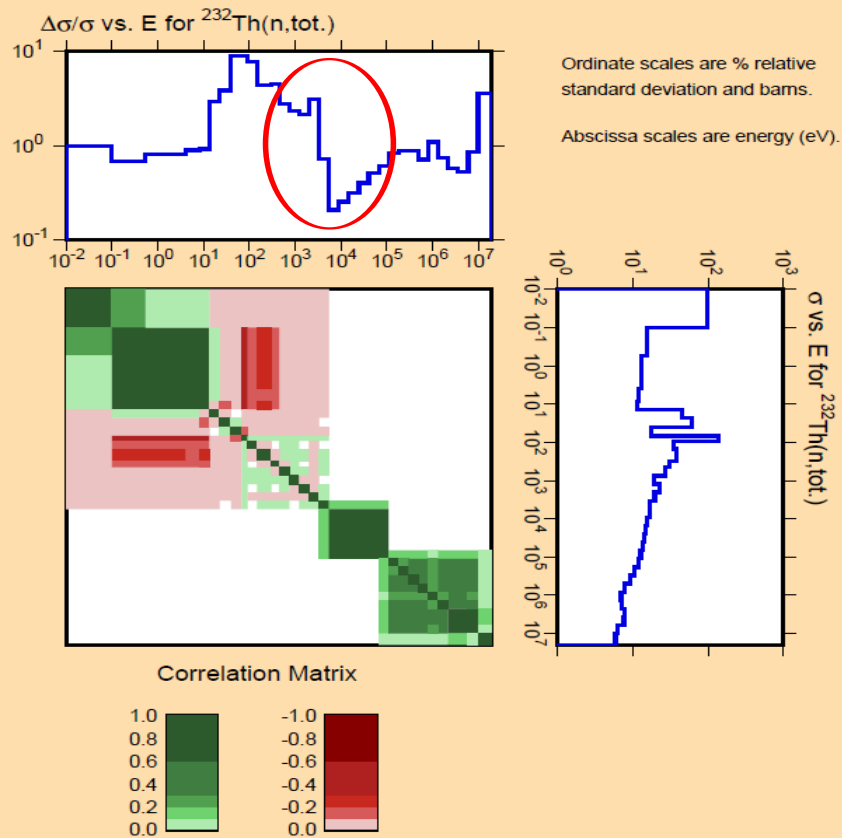
Th-232 Discrepancies: capture
1/E Flux, 33-group (AFCI)

NJOY-99.305

PUFF-IV 10_02_2009

Δσ/σ vs. E for ^{232}Th(n,γ)

Ordinate scales are % relative standard deviation and barns.

Abscissa scales are energy (eV).

σ vs. E for ^{232}Th(n,γ)

Correlation Matrix

1.0	-1.0
0.8	-0.8
0.6	-0.6
0.4	-0.4
0.2	-0.2
0.0	0.0
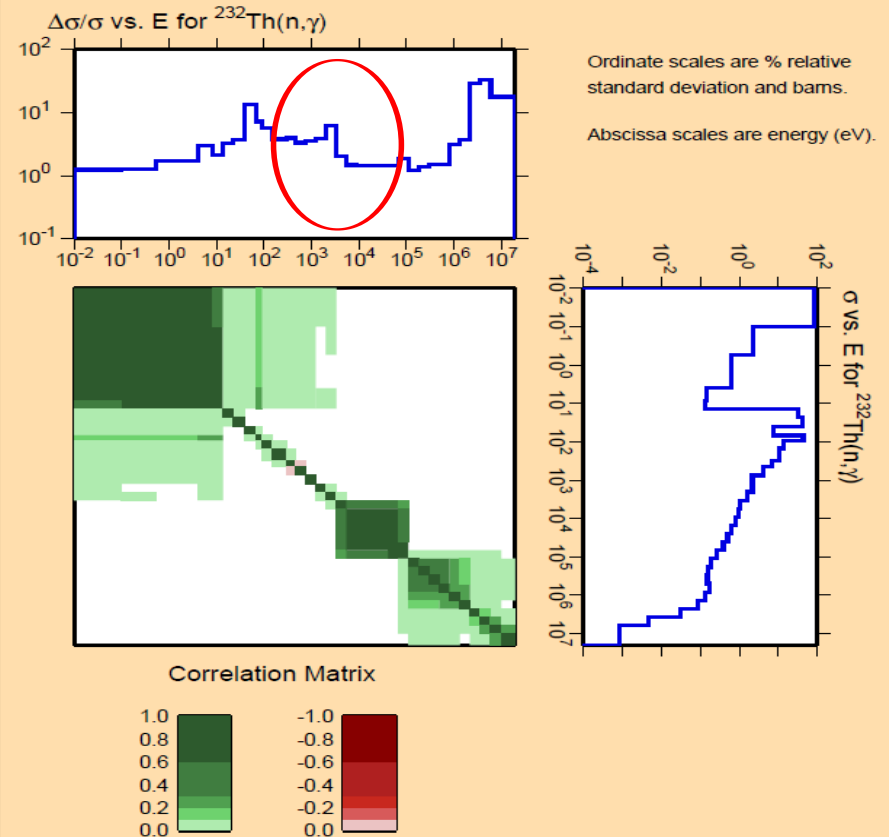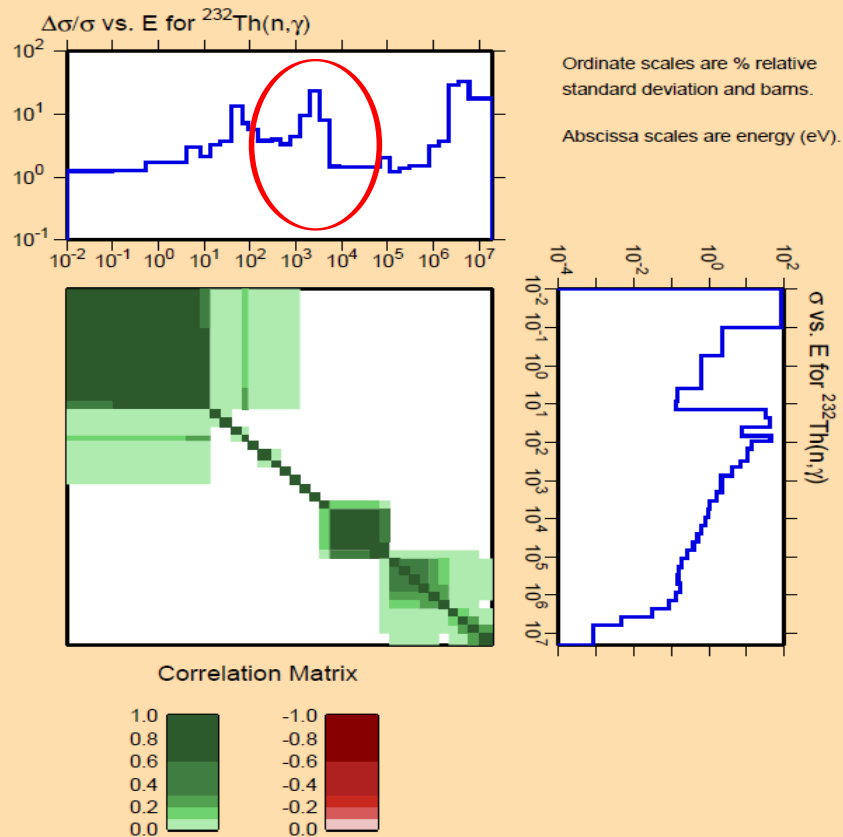
F-19 Discrepancies: total
1/E Flux, 33-group (AFCI)

NJOY-99.305

reconr...

 error in rdfil2illegal resonance mode

error in rdfil2illegal resonance mode

NOTE: Cl-35 processing also generated same error.

PUFF-IV 10_02_2009

$\Delta\sigma/\sigma$ vs. E for ^{19}F(n,tot.)

Ordinate scales are % relative standard deviation and barns.

Abscissa scales are energy (eV).

σ vs. E for ^{19}F(n,tot.)

Correlation Matrix

W-184 Discrepancies: total
1/E Flux, 33-group (AFCI)

NJOY-99.305
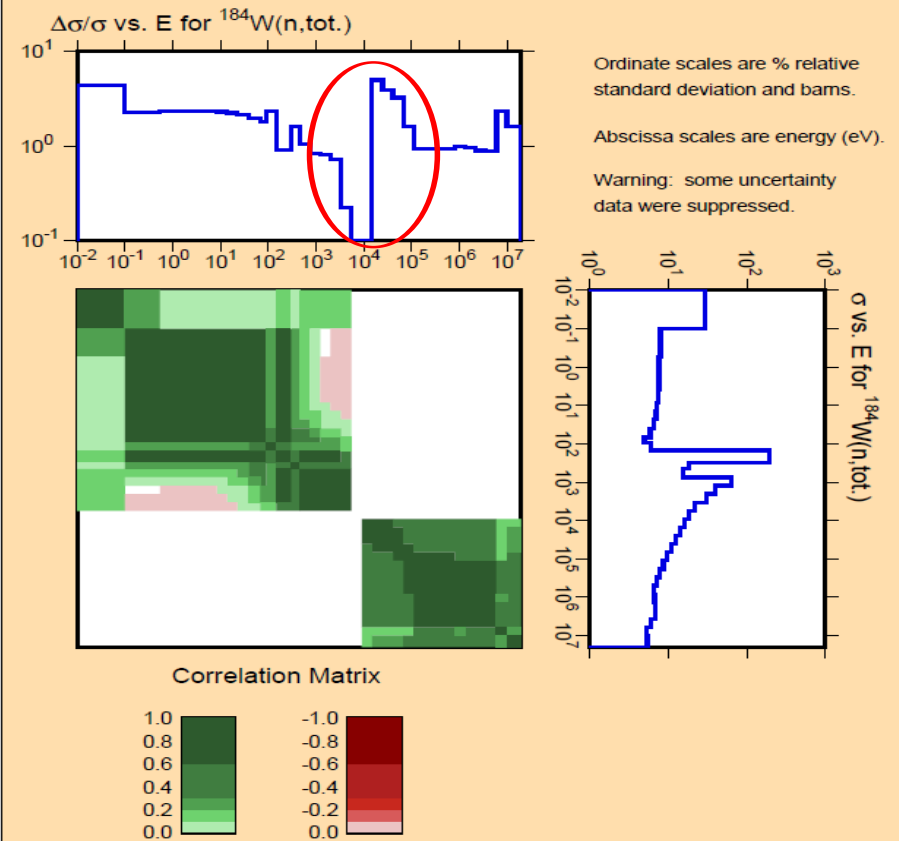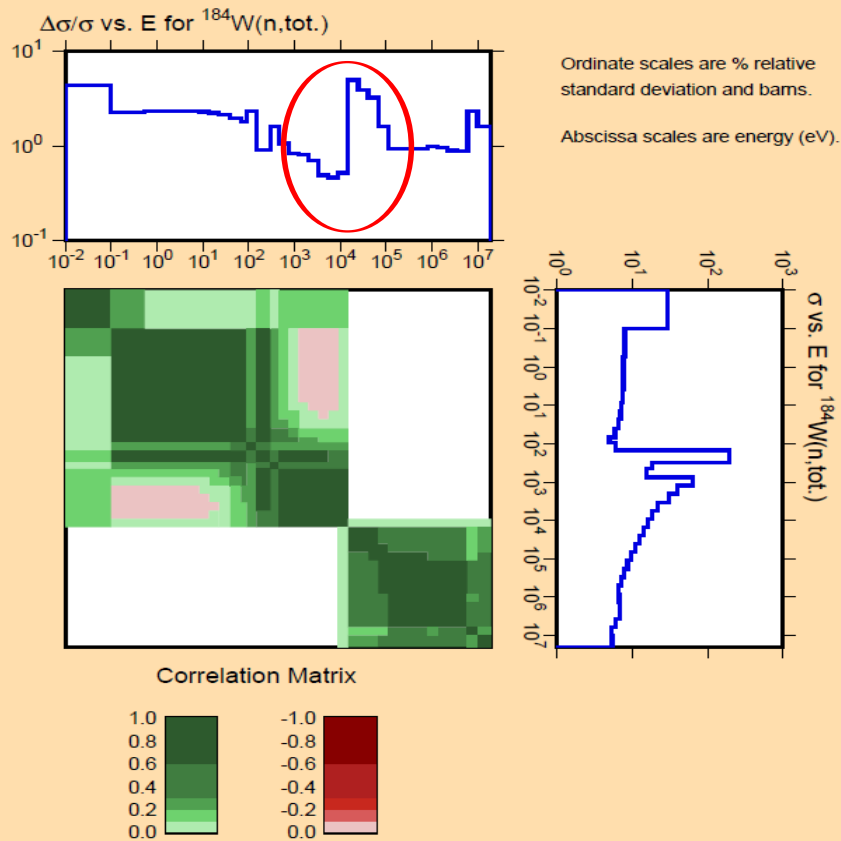
PUFF-IV 10_02_2009

W-184 Discrepancies: elastic
1/E Flux, 33-group (AFCI)

NJOY-99.305

PUFF-IV 10_02_2009

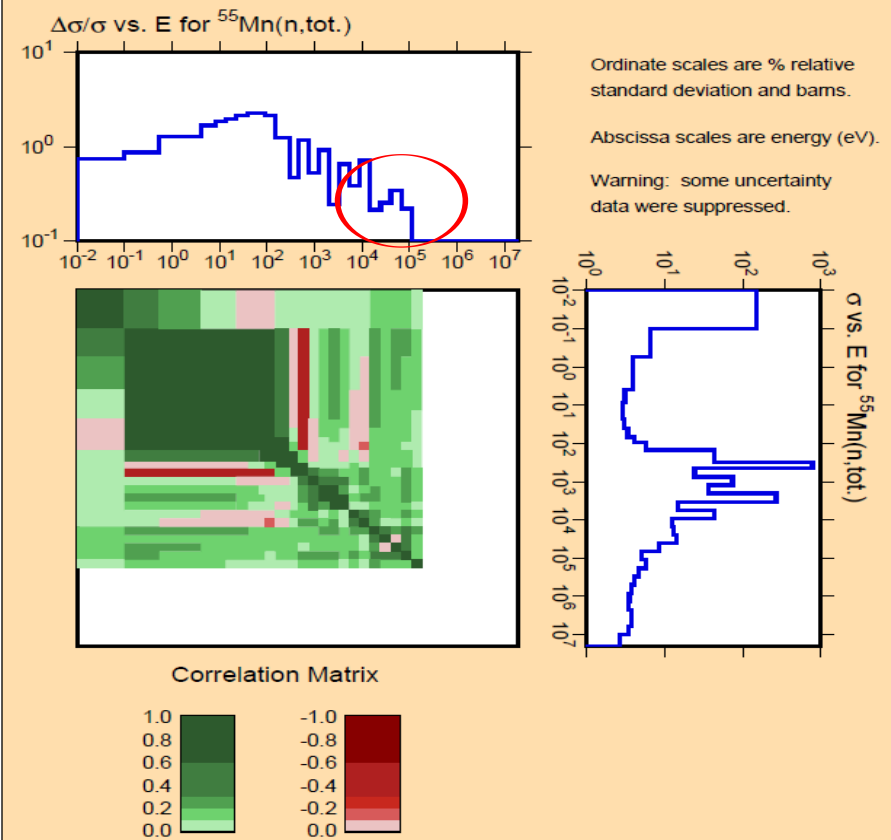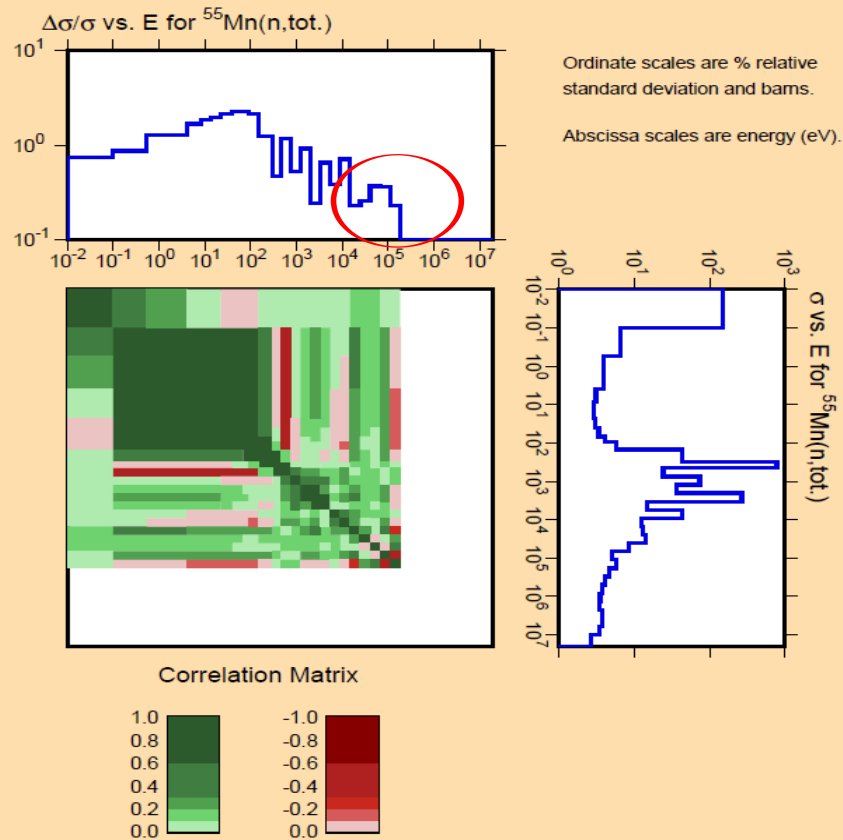# W-184 Discrepancies: capture
1/E Flux, 33-group (AFCI)

NJOY-99.305
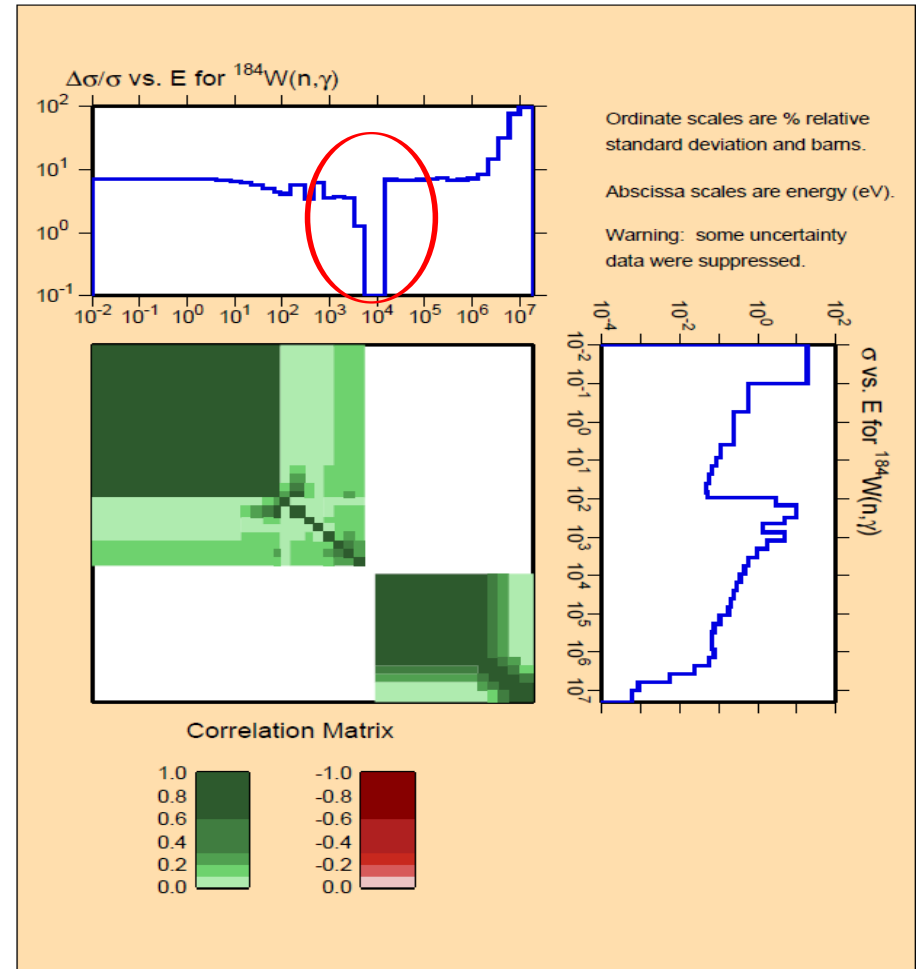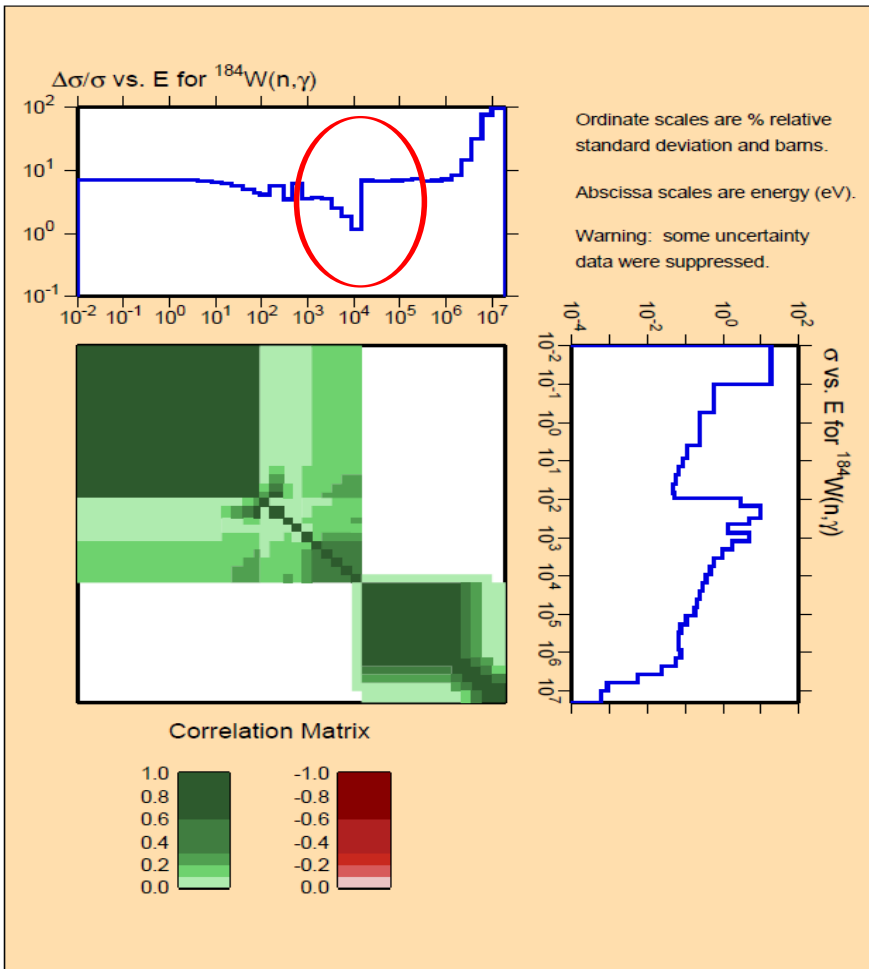
PUFF-IV 10_02_2009

Mn-55 Discrepancies: total
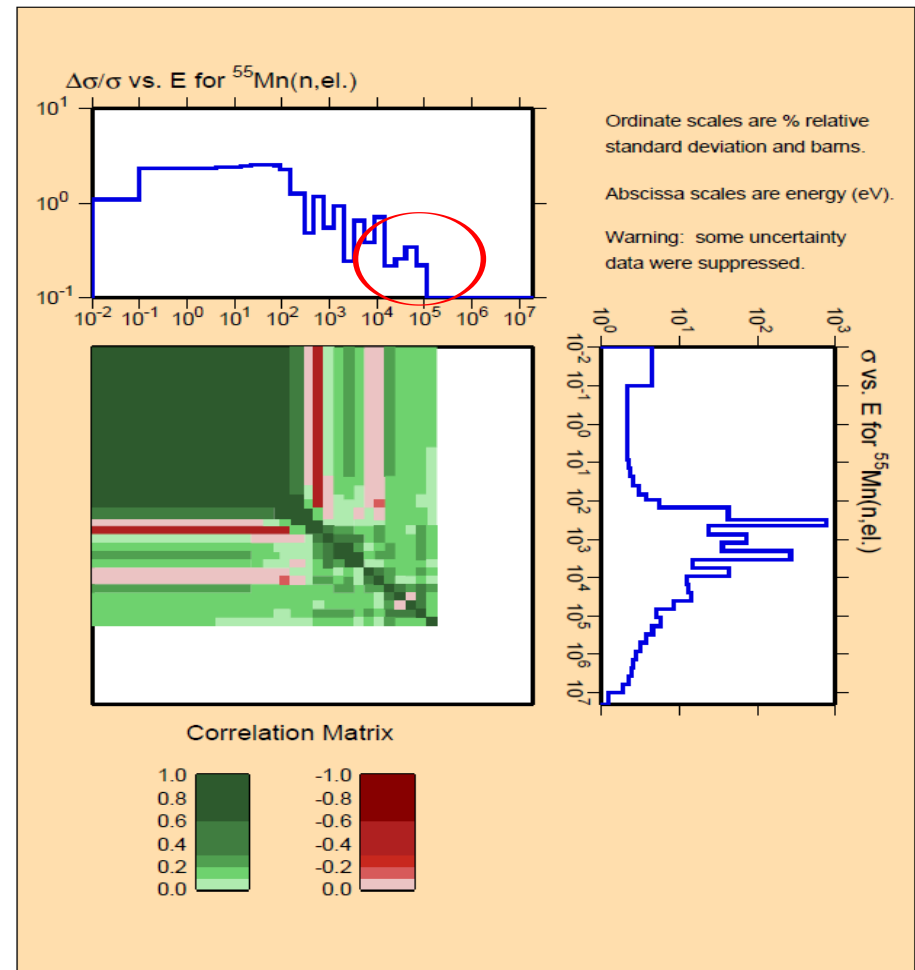## 1/E Flux, 33-group (AFCI)
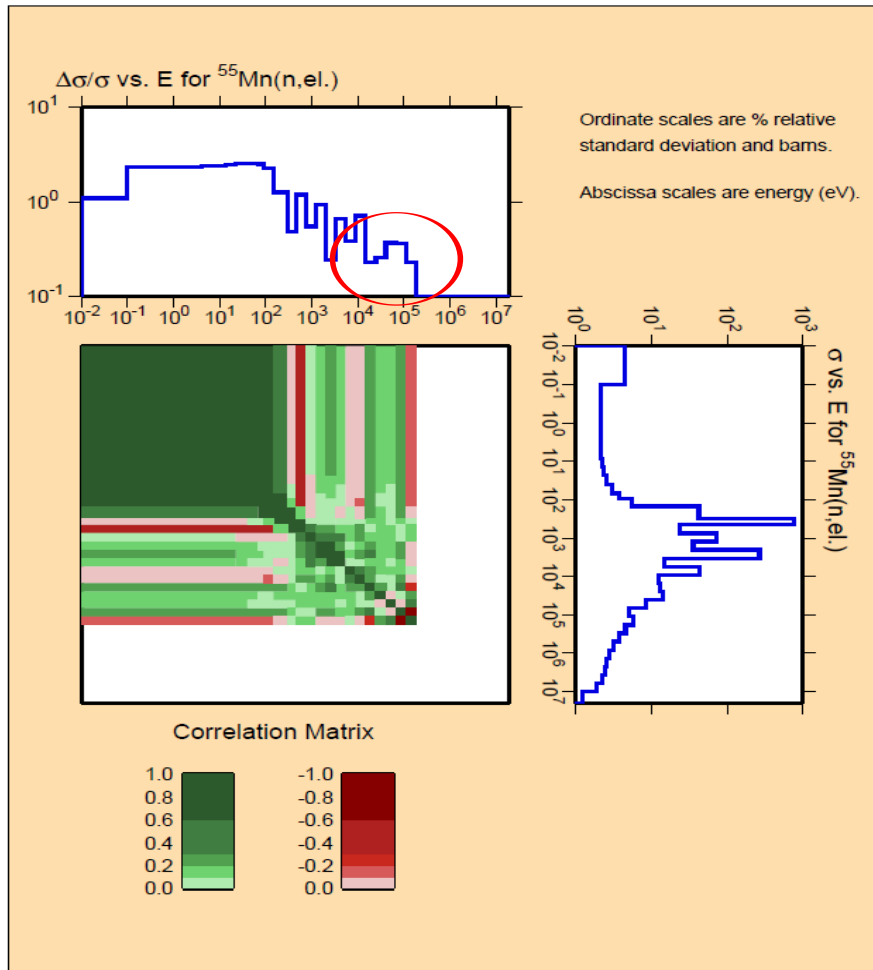

NJOY-99.305

PUFF-IV 10_02_2009

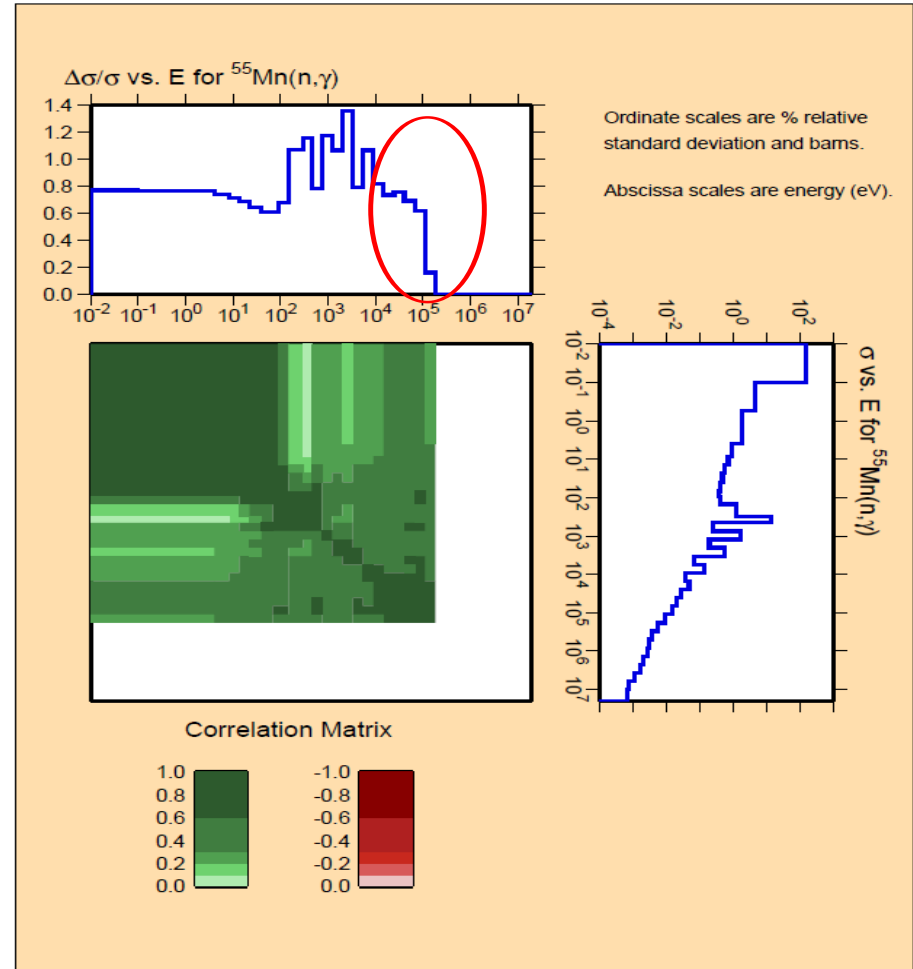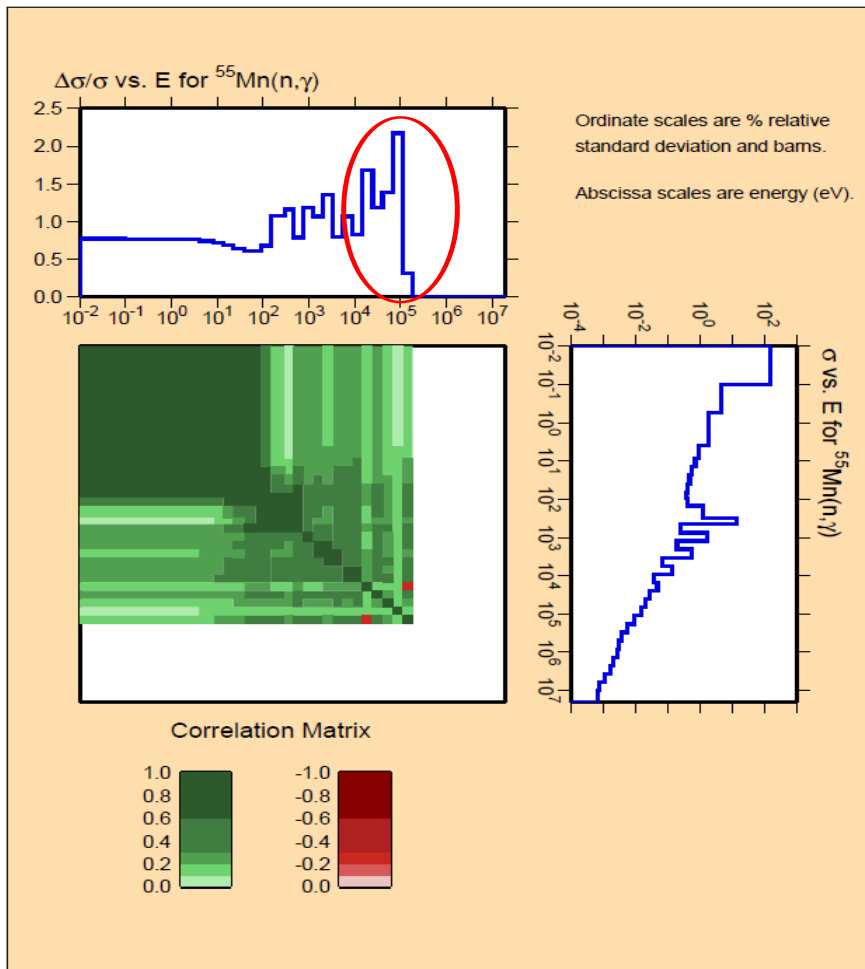# Mn-55 Discrepancies: elastic
1/E Flux, 33-group (AFCI)

NJOY-99.305

PUFF-IV 10_02_2009

Mn-55 Discrepancies: capture
1/E Flux, 33-group (AFCI)

Conclusions

For benefit of end-users

- **Urgent need for NJOY capability to process materials with new *R-Matrix Limited* (LRF=7) format**

- **Urgent need to investigate and fix NJOY and PUFF discrepancies, mostly in the resonance region**