

- How to run the utility
- 1st step calculation
 - Reaction mechanism settings
 - IFN area settings
 - Results
- 2nd step calculation
 - Settings (N_{points} , Statistics, Output)
 - Analysis result output
 - *Initial (Parent) Fissile Nuclei [IFN]*
 - *Final Fission Fragment [FFF]*
- Batch file mode
- First results
 - IFN analysis for isotopes of $Z=26,30,32^*,36,40,41,42,45^*,50,56,62,67,71$ (* - includes IFN plots)
 - Comparison of results by the 3EER, IFN1, and IFN3 models
- Next Steps

v.11.0.27 02/15/19
 v.11.0.37 02/28/19 update
 v.11.0.38 03/01/19 correction*

* - correction at the IFN3 model.

1. From the Abrasion-Fission dialog

The screenshot shows the 'Abrasion-Fission' dialog box. The 'Settings' button is circled in red. A red arrow points from this button to the 'Initial fissile nucleus analysis for selected fragment' utility option, which is also circled in red. The dialog box contains various settings for energy regions, transmission calculations, and fission properties.

2. From the Evaporation calculator

The screenshot shows the 'Evaporation calculator' dialog box. The 'Initial Fissile nucleus plot for final fragment' button is circled in red. A red arrow points from this button back to the 'Initial fissile nucleus analysis for selected fragment' utility option in the previous screenshot. The dialog box contains various settings for initial nucleus, modes, and final nucleus.

3. From the Calculators menus

The screenshot shows the 'Calculators' menu. The 'Calculators' menu item is circled in red. A red arrow points from this menu item to the 'Initial Fissile Nuclei analyzer' option, which is also circled in red. The menu lists various calculation utilities such as Goodies, Calibrations, and Kinematics calculator.

1st step settings

Bath mode settings and run

Abrasion-Fission: Initial fission nuclei

238U (140.0 MeV/u) + Be

Choose Final fission fragment:

Calculate ALL I & II

Calculate - I : Fission channels after Abrasion* + CF

Calculate - II : Fission of nuclei gated on Final Fragment**

Settings - I (Select region)

coef for Zb = 0.1 < coef <= 1; recommendation: 0.75 Z_stop = 74

coef for Nb = 0.1 < coef <= 1; recommendation: 0.80 N_stop = 124

Include Coulomb fission channel determine low Z (element number) where Abrasion-Ablation stops. Zstop = coef * Zbeam

Settings - II

Cross-section minimum threshold of to use a nucleus in calculations (mb)

Number of points from excitation energy distribution to use in calculations

Statistical values to show in the result frames

1: only mean value <E>

3: E-v, <E>, E+v (v=HWHM)

Mean value and Standard Deviations

More Probable value and its variances

Median value and its variances (default)

Detailed output 23892_00904_13250_p1m

General log file IFN

Batch file mode

Show 2D: Fissile Nuclei CS for each run

Results - I (Fissile channels after abrasion)

Total fission cross section in the region (mb)

Number of fissile nuclei in the region (I)

Number of fissile nuclei used to gate on the final fragment (II)

Results - IIa: Parent Fissile Nuclei Gated on the Final Fission Fragment

E*, MeV

Z

N

Results - IIb: Final Fission Fragment

Final fragment cross section mb

Initial fiss. fragment excitation energy MeV

Velocity in CMS cm/ns

Number of nucleons emitted to reach FFF

mdn (-vrns; +vrns), where "mdn": median; "vrnc": variance

Make default

2nd step settings

1st step results

2nd step results

Fission properties

Evaporation settings

Prefragment excit.energy

Fission properties

Cross sections

- Use Odd-Even corrections for fragments
- Include post-scission (n,p,a) evaporation

Parameters for shell structures ***

Shell position (N sh.)	Strength (dU) (MeV)	Curvature (2C sh.) (MeV)	
1	83	-2.65	0.7
2	90	-3.8	0.15

Potential energy plot

Put original values *1*

Put "2005" values *2*

1 J. Benliure et al., NPA628(1998)458
2 see LISE++ v.7.5 documentation

Cross section suppression values

Fragment excitation (TXE) depends on

- Dissipated energy [NPA 628(1998)458]
TXE = E* - Bf + Edis
- Reaction Q-value [EPHysJA14(2002)459]
TXE = (a1 + a2) (f Q)^2 + E*
f = 0.0045 default 0.0035

Fragment Excitation Energy

St.Dev. = 7 MeV

Angular distribution cut by the momentum slits

- Do not use
- Use just for "MatrixKinematics" class
- Use for all Angular Distributions (default)

Angular distribution shape

Isotropic Anisotropic

OK Cancel Help Make default

Evaporation calculations settings

Dimension of evaporation distributions [32]

Version of Cross-Section evaporation file brief

Correction dR for the deduced effective Coulomb barrier for the TUNNELLING mode

Fission Barrier

Model = "FisRot" - RLDM(Cohen)

BarFac = 1 settings

Mode

- manual
- auto

For "daughter" nucleus excitation energy distribution apply:

- energy distribution of the emitted light particle (qualitatively)
- average energy of the emitted light particle (fast)

State density

- [A] - Equidistant model
- [B] - as [A] + pairing corrections
- [C] - as [B] + shell corrections

Dissipative effects in fission

- use Kramers factor
- use Gamma_f(t) as a step function

Reduced dissipation coefficient "beta" (10^-21)/s

beta = 1

Break-up parameters

The limiting temperature calculated from the curve based on three points for masses 50,150,250

T (A=050) = 8 8.0 default from Zi.Li & M.Liu, PRC69, 034615 (2004), Fig.5

T (A=150) = 5.9 5.9

T (A=250) = 4.7 4.7

Diffuseness = 0.05 0.05

State density & T plots

Probability & Width plots

OK Cancel Help

Excitation Energy of prefragment

Prefragment

A Element Z

238 Pa 91

Beta-decay

Reaction 238U + Be

Excitation Energy in the code = 54.00 MeV

Models

- A. J.W.Wilson et al., NIM B18 (1987) 225-231
- B. J.-J.Gaimard and K.-H.Schmidt, NPA531 (1991) 709
- C. Parametrized Gaussian distribution
- D. Exponential excitation-energy distribution

Apply the limiting temperature threshold: T=min(T, Tlim) "Isospin-thermometer model", corresponds to Fig.9 K.-H.Schmidt et al., NPA 710 (2002) 157

Apply LISE++ geometrical corrections for A-A model

Apply thermalization for Excitat.energy according to J.-J.Gaimard & K.-H.Schmidt, NPA531 (1991) 709; see Equation 3.4

Excitation Energy = 6.30 MeV

Standard deviation = 13.58 MeV

$$E^* = (\gamma \cdot f \cdot \Delta S)_{geom} + E_{friction}$$

f: Correction factor of Surface distortion excitation

$$f = 1 + coef1 \cdot d_{abr} / Ap + coef2 \cdot (d_{abr} / Ap)^2$$

c1 = 1.5 c2 = 2.5 f = 1.01

Hole depth (MeV) <E*> = 13.36 * d_abr [MeV]

sigma = 9.43 * d_abr^(0.5) [MeV]

Parametrized Gaussian distribution -- simplified combination

<E*> sigma

0 * d_abr^2 + 0 * d_abr + 0 [MeV]

27 * d_abr + 18 * d_abr^(1/2) + 0 [MeV]

Mass table model

Production Mechanism

Reactions / Energy Loss, Straggling / Charge states / Databases: Masses, Isomers

238U(140.0 MeV/u) + Be -> 132Sn

Masses

- Database + Calculations
- only Calculations

Database [0 - AME2016 (database)]

OR

Formula [2 - LDM#1 + shell corrections (O.T.)]

User's MassExcess File [WS4_RBF.lme] Browse

Ion mass

- Take into account electron binding energies for ion mass calculations: (Recommended)

The default file* can be loaded from here
http://lise.nslc.msu.edu/10_1/fission.lpp

* as well used in the current calculations

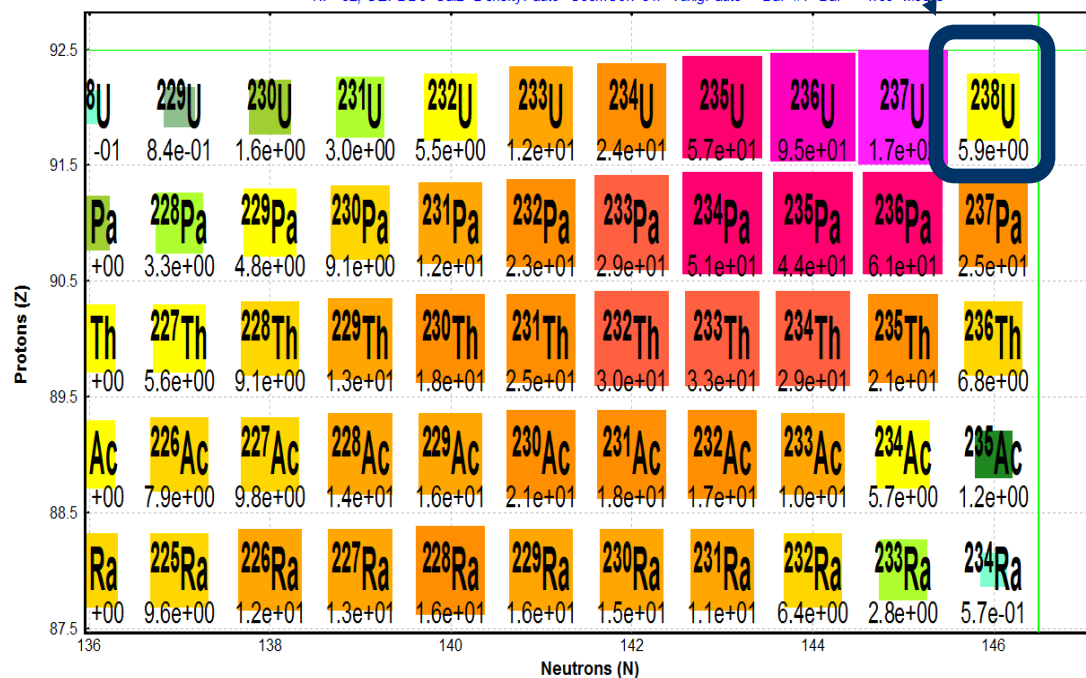
238U (140.0 MeV/u) + Be

Include Coulomb fission channel

Include Coulomb fission channel

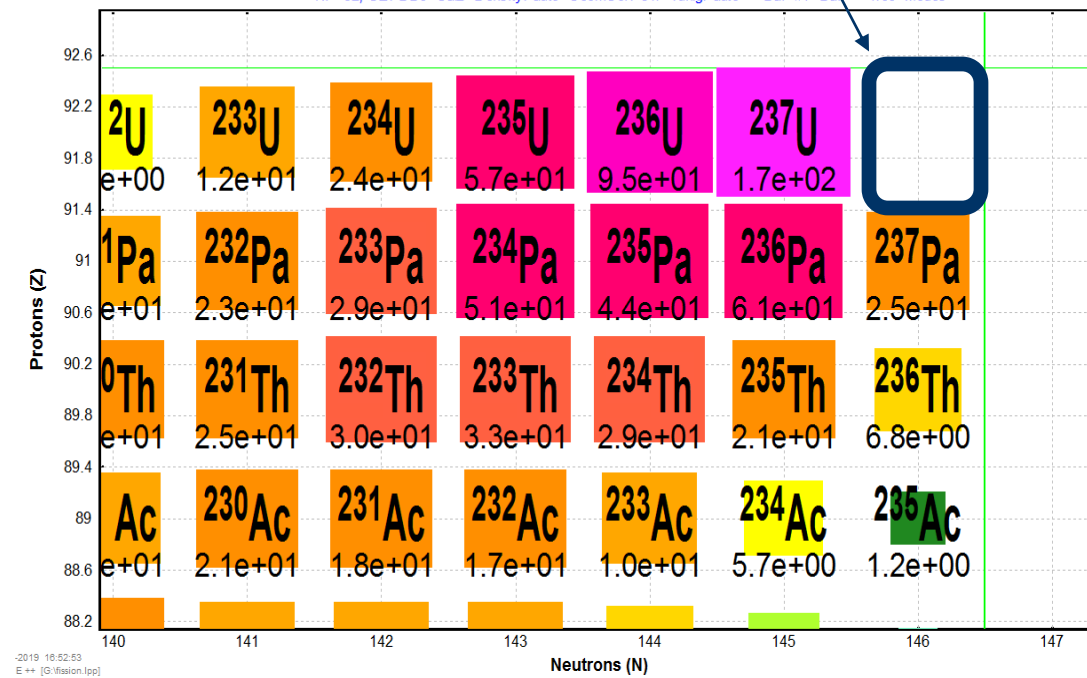
Fission channel cross-sections

ABRASION-ABLATION - 238U + Be
 Excit.Energy Method:< 2 >; <E*>:27.0*dA MeV Sigma:18.00; No Intrin.Thermalztn; LimitTemp: No
 NP=32; SE:"DB0+Cal2" Density:"auto" GeomCor:"Off" Tunlg:"auto" F#Bar=#1 BarFac=1.00 Modes=1010 1000 110



Fission channel cross-sections

ABRASION-ABLATION - 238U + Be
 Excit.Energy Method:< 2 >; <E*>:27.0*dA MeV Sigma:18.00; No Intrin.Thermalztn; LimitTemp: No
 NP=32; SE:"DB0+Cal2" Density:"auto" GeomCor:"Off" Tunlg:"auto" F#Bar=#1 BarFac=1.00 Modes=1010 1000 110

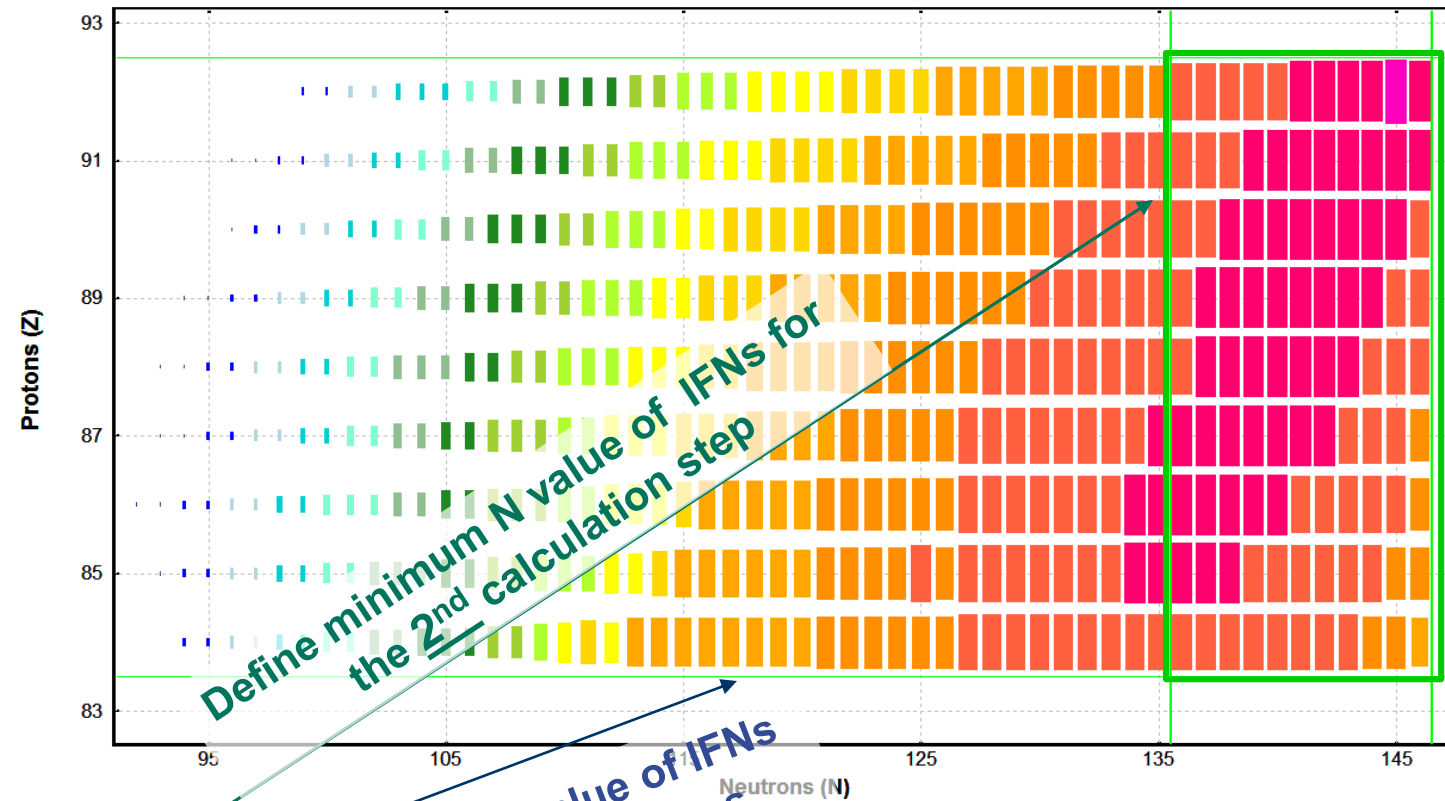


Important for heavy targets !

(though already sufficient for Z ≥ 13, so for 238U(140 MeV/u) + Al → CoulFis=46mb)

Fission channel cross-sections

ABRASION-ABLATION - $^{238}\text{U} + \text{Al}$
 Excit.Energy Method: < 2 >; <E*>: 27.0*dA MeV Sigma: 18.00; No Intrin. Thermalztn; LimitTemp: No
 NP=32; SE:"DB0+Ca2" Density:"auto" GeomCor:"Off" Tunig:"auto" FisBar=#1 BarFac=1.00 Modes=1010 1000 110



Define minimum N value of IFNs for
 the 2nd calculation step

Define minimum Z value of IFNs
 for both calculation steps

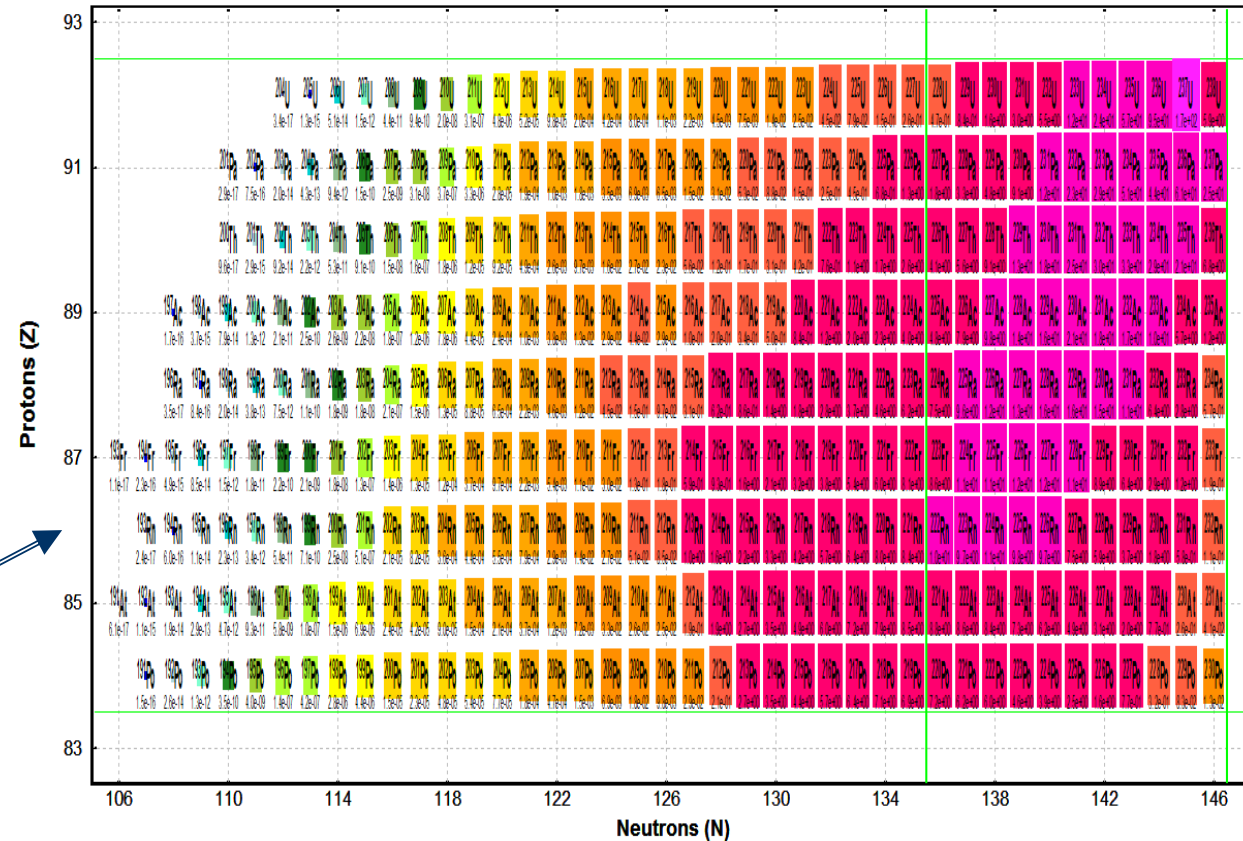
Settings - I (Select region)

coef for Zb =	<input type="text" value="0.91"/>	0.1 < coef <= 1; recommendation: 0.75	<input type="text" value="Z_stop = 84"/>
coef for Nb =	<input type="text" value="0.93"/>	0.1 < coef <= 1; recommendation: 0.80	<input type="text" value="N_stop = 136"/>

Not enable
(gray color)

Fission channel cross-sections

ABRASION-ABLATION - ²³⁸U + Be
 Excit.Energy Method:< 2 >; <E*>:27.0*dA MeV Sigma:18.00; No Intrin.Thermatzn; LimitTemp: No
 NP=32; SE:"DB0+Ca2" Density:"auto" GeomCor:"Off" Tunlg:"auto" FisBar=#1 BarFac=1.00 Modes=1010 1000 110



99 isotopes will be used for the 2nd step calculations gated by the selected region (Z_{stop} , N_{stop}) and the cross-section threshold value (2nd step settings) from 349 isotopes calculated at Step #1.

- Number of points from excitation energy distribution to use in calculations
- 1 : only mean value $\langle E \rangle$
 - 3 : $E-v$, $\langle E \rangle$, $E+v$ ($v=HWHM/2$)

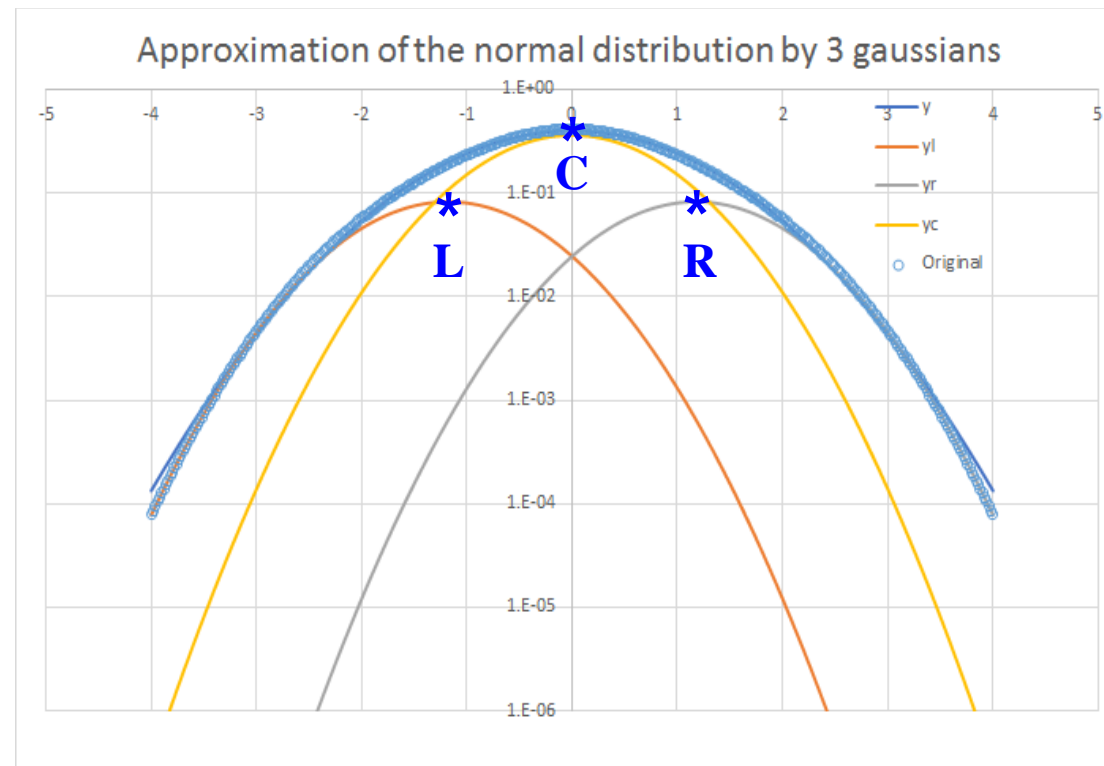
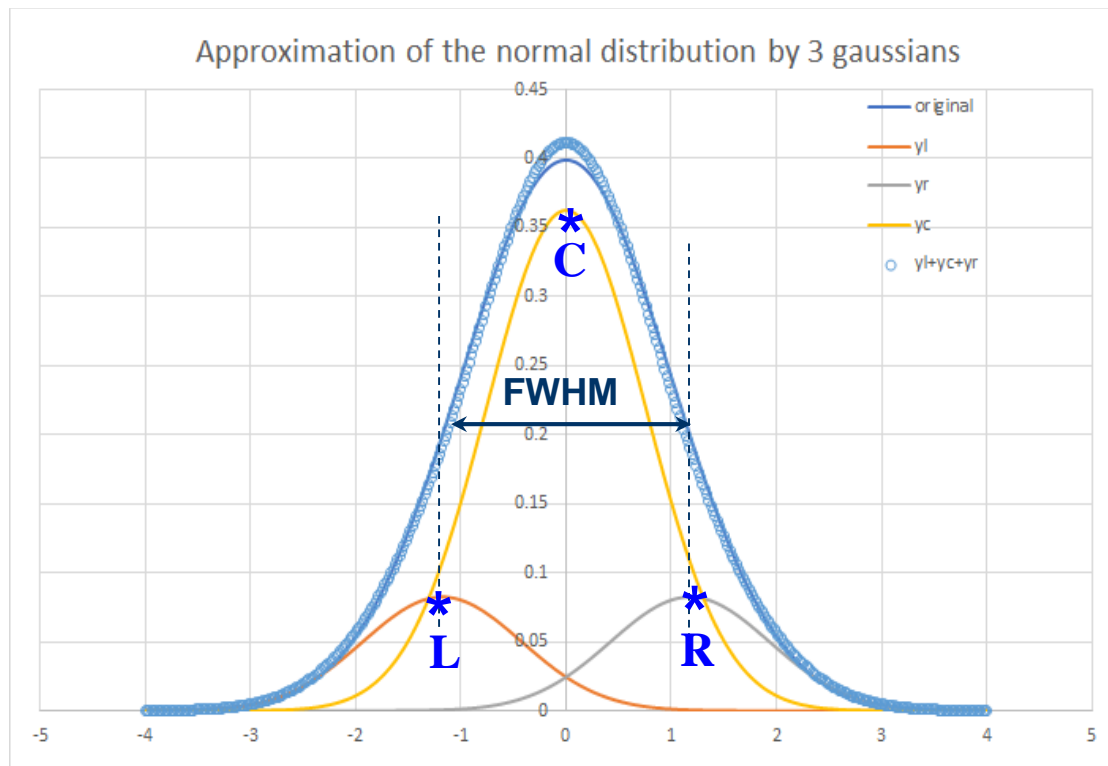
IFN1

IFN3

Using 3 excitation energy points
(and evidently it takes 3 times more than IFN1 method)

$\text{Sigma2} = 0.75627 * \text{Sigma1}$

AreaL	15.64%
AreaC	68.72%
AreaR	15.64%

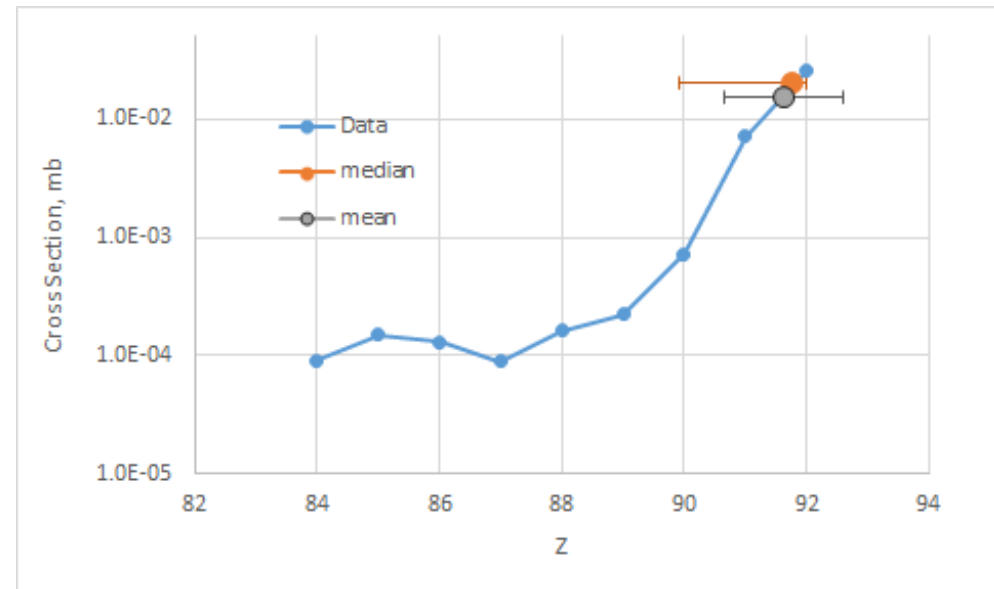
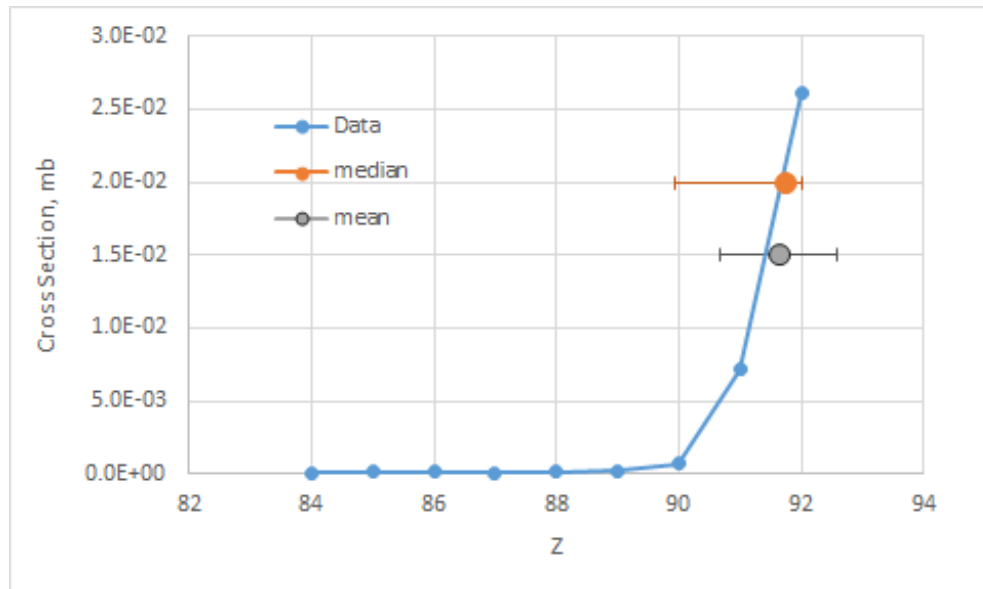


Statistical values to show in the result frames

- Mean value and Standard Deviations
- More Probable value and its variances
- Median value and its variances (default)

with “more probable value” choice might be troubles in the case of two similar peaks

recommended



Detailed output file for the selected final fission fragment (FFF)

LISE++ proposes automatically file name,
The user can browse manually

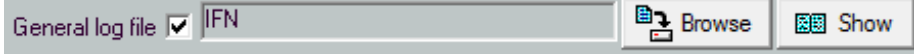
Beam Target Fragment N_p Statistics



Region (0,1,2)



!	El	Z	N	Pri	CS	E*	Vcm	dN	dZ
1	237U	92	145	0	1.33E-02	26.99	1.014	2.749	0
2	237Pa	91	146	0	5.56E-03	31.14	1.002	3.464	0
3	236U	92	144	0	6.41E-04	31.36	1.004	3.121	0
4	235U	92	143	0	1.06E-05	38.04	0.984	3.556	0
5	234U	92	142	0	5.86E-08	51.79	0.956	4.814	0
6	233U	92	141	0	3.02E-09	68.28	0.953	5.468	0
12	236Pa	91	145	0	1.57E-03	36.77	0.983	3.686	0
13	235Pa	91	144	0	2.75E-05	48.72	0.959	4.934	0
14	234Pa	91	143	0	4.70E-06	55.06	0.956	5.3	0
15	233Pa	91	142	0	4.46E-07	69.38	0.929	5.777	0
16	232Pa	91	141	0	1.42E-07	75.83	0.922	5.539	0
22	236Th	90	146	0	4.26E-04	44.01	0.957	4.925	0



Calculation result information for each calculation run.
Important in the Batch mode!

c:\user\c\lise_pp_11\CrossSections\IFN.log

l	Date	Stop Time	Elapsed	El	Zff	Nf	Zstop	Nstop	Threshld	TotalCS	N_FisN	Nused	N_P	Zpfn	-sZpfn	+sZpfn	Npfn	-sNpfn	+sNpfn	E*pf	-sE*pf	+sE*pf	CSf	E*iff	-siff
19-02-19	14:52:45	35.4	132Sn	50	82	86	140	1.00e-05	1.336e+03	267	48	1	91.61	1.31	0.39	145.17	0.37	0.83	37.95	20.19	35.76	2.073e-02	29.60	6.0	
19-02-19	14:54:44	110.0	132Sn	50	82	86	140	1.00e-05	1.336e+03	267	48	3	91.65	1.00	0.35	144.84	1.09	0.45	17.32	15.44	20.81	2.652e-01	19.15	6.0	
19-02-19	19:35:49	96.7	132Sn	50	82	86	140	1.00e-05	1.336e+03	267	48	1	91.61	1.31	0.39	145.17	0.37	0.83	37.95	20.19	35.76	2.073e-02	29.60	6.0	
20-02-19	17:00:44	5.4	110Rh	45	65	89	143	1.00e-05	9.770e+02	147	15	1	91.30	1.08	0.70	143.64	0.64	0.94	64.91	29.25	41.48	8.207e+00	41.84	10.0	
20-02-19	17:00:50	5.4	111Rh	45	66	89	143	1.00e-05	9.770e+02	147	15	1	91.48	1.18	0.52	144.07	0.73	1.04	55.51	26.24	41.15	1.626e+01	38.18	8.0	
20-02-19	17:00:55	5.4	112Rh	45	67	89	143	1.00e-05	9.770e+02	147	15	1	91.53	1.12	0.47	144.41	0.93	0.74	50.04	24.17	38.47	1.553e+01	35.02	7.0	
20-02-19	17:01:01	5.4	113Rh	45	68	89	143	1.00e-05	9.770e+02	147	15	1	91.57	1.10	0.43	144.63	1.05	0.59	46.10	22.77	36.19	1.861e+01	34.11	7.0	
20-02-19	17:02:43	4.8	110Rh	45	65	90	142	1.00e-05	8.428e+02	108	14	1	91.34	0.86	0.66	143.43	0.89	1.12	68.94	30.88	38.59	9.318e+00	44.13	11.0	
20-02-19	17:02:48	4.8	111Rh	45	66	90	142	1.00e-05	8.428e+02	108	14	1	91.50	0.97	0.50	143.93	1.25	0.83	56.97	26.90	39.06	1.700e+01	38.88	9.0	
20-02-19	17:02:52	4.7	112Rh	45	67	90	142	1.00e-05	8.428e+02	108	14	1	91.55	0.95	0.45	144.37	1.08	0.77	50.27	24.26	36.36	1.567e+01	35.13	7.0	
20-02-19	17:02:57	4.8	113Rh	45	68	90	142	1.00e-05	8.428e+02	108	14	1	91.59	0.94	0.41	144.62	1.16	0.59	45.86	22.69	33.29	1.848e+01	34.04	7.0	
20-02-19	17:03:32	5.2	110Rh	45	65	90	142	1.00e-05	8.428e+02	108	14	1	91.34	0.86	0.66	143.43	0.89	1.12	68.94	30.88	38.59	9.318e+00	44.13	11.0	
20-02-19	17:03:39	6.4	111Rh	45	66	90	142	1.00e-05	8.428e+02	108	14	1	91.50	0.97	0.50	143.93	1.25	0.83	56.97	26.90	39.06	1.700e+01	38.88	9.0	
20-02-19	17:03:43	4.7	112Rh	45	67	90	142	1.00e-05	8.428e+02	108	14	1	91.55	0.95	0.45	144.37	1.08	0.77	50.27	24.26	36.36	1.567e+01	35.13	7.0	
20-02-19	17:03:48	4.8	113Rh	45	68	90	142	1.00e-05	8.428e+02	108	14	1	91.59	0.94	0.41	144.62	1.16	0.59	45.86	22.69	33.29	1.848e+01	34.04	7.0	

2nd step calculation results: Initial Fissile Nuclei (IFN) gated to the selected Final Fission Fragment (FFF) - a

FFF=¹³²Sn, N_p=1; Small IFN region (99)

Abrasion-Fission: Initial fission nuclei

238U (140.0 MeV/u) + Be

Choose Final fission fragment: **132Sn**

Calculate ALL I & II

Calculate - I: Fission channels after Abrasion* + CF

Calculate - II: Fission of nuclei gated on Final Fragment**

* - takes ~ a minute; ** ~ 10 minutes - a hour

Fission properties, Evaporation settings, Prefragment excit.energy

Batch file mode: Show 2D: Fissile Nuclei CS for each run

no file or bad file

Run the batch file! Takes time..

Settings - I (Select region): coef for Zb = 0.91, coef for Nb = 0.93

Settings - II: Cross-section minimum th, Number of points from excitati distribution to use in calcul

Detailed output: 23892_009

General log file: IFN

Results - I (Fissile channels a): Total fission cross section in the, Number of fissile nuclei is th, Number of fissile to gate on the final f

Results - IIa: Parent Fissile Nuclei Gated on the Final Fission Fragment

2D: Fissile Nuclei CS

E*, MeV: 29.3 (-21.4; +43.8)

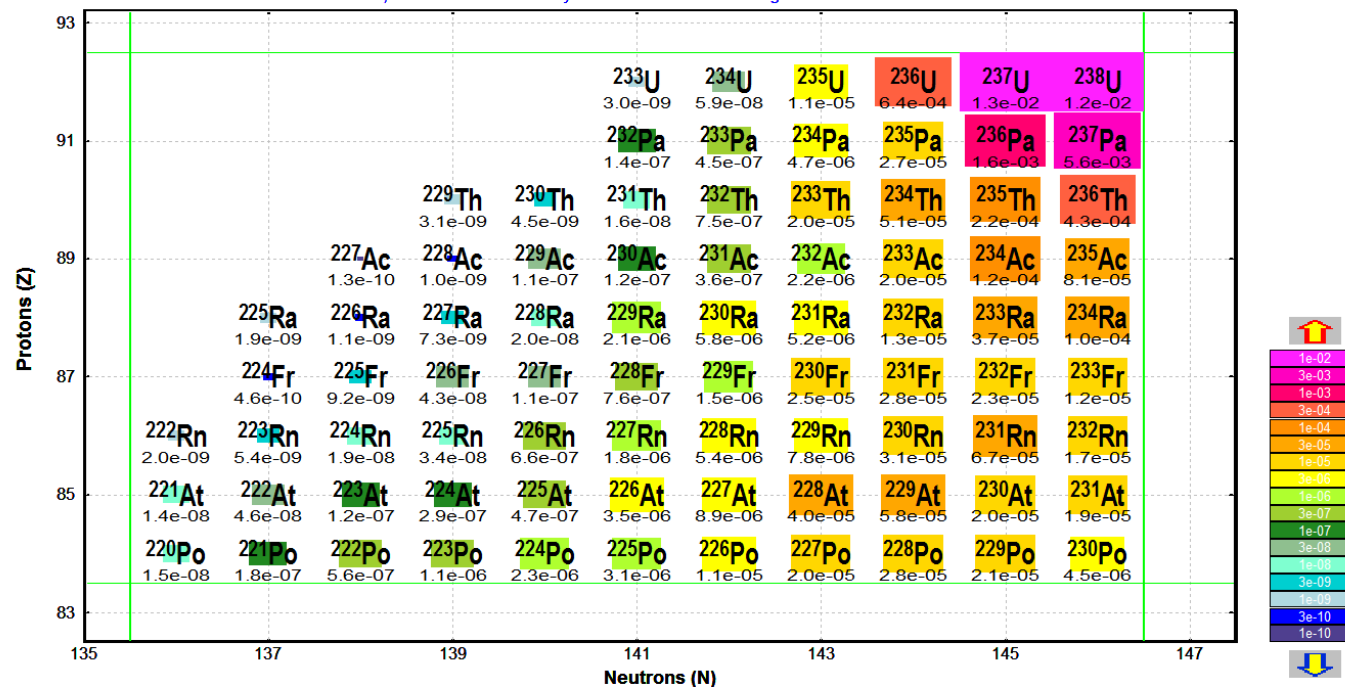
Z: 91.75 (-1.82; +0.25)

N: 145.48 (-0.66; +0.52)

Results - IIb: Final Fission: Final fragment cross section, Initial fiss.fragment excitation energy, Velocity in CMS: 1.0, Number of nucleons emitted to reach FFF: 2

Initial Fissile Nuclei for ¹³²Sn final fragment

ABRASION-ABLATION - ²³⁸U + Be; C_{zbound}=0.91; C_{nbound}=0.93; C_{S_{thrshd}}=1.0e-05 mb; sE^{*}_{fission}=7.0 MeV; N_{e-points}=1
 Excit.Energy Method:< 2 >; <E*>:27.0*dA MeV Sigma:18.00; No Intrin.Thermalztn; LimifTemp: No
 NP=32; SE:"DB0+Ca2" Density:"auto" GeomCor:"Off" Tunlg:"auto" FisBar=#1 BarFac=1.00 Modes=1010 1000 110



FFF=¹³²Sn, N_p=1; Small IFN region (99)

Make default
 OK
 Cancel
 Help

Results - IIa: Parent Fissile Nuclei
 Gated on the Final Fission Fragment
 2D: Fissile Nuclei CS
 E*, MeV: 29.3 (-21.4; +43.8)
 Z: 91.75 (-1.82; +0.25)
 N: 145.48 (-0.66; +0.52)

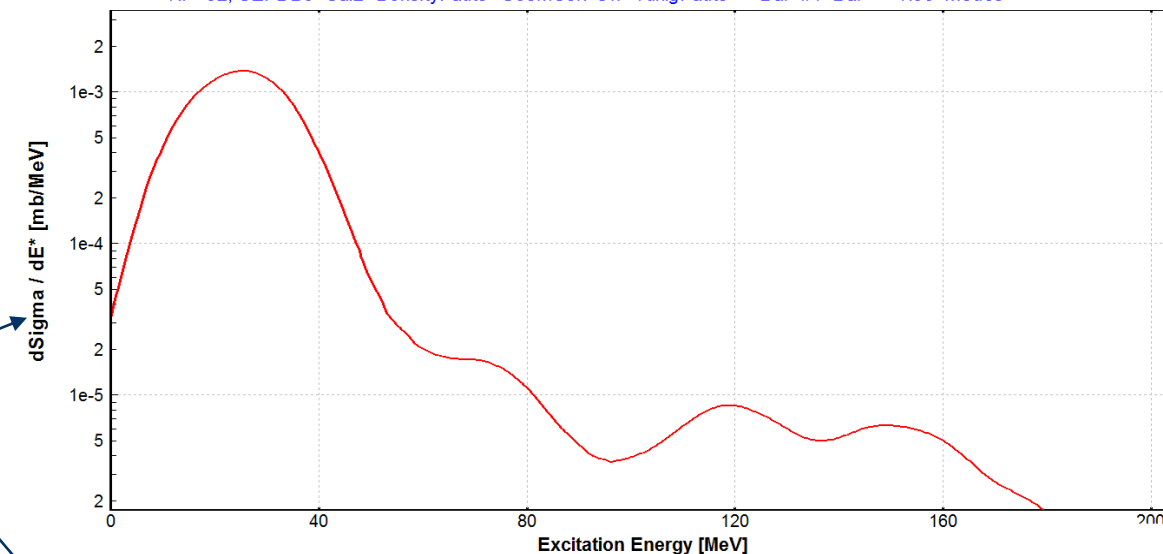
Results - IIb: Final Fission Fragment
 Final fragment cross section: 3.48e-02 mb
 Initial fission fragment excitation energy: 25.4 (-9.6; +22.4) MeV
 Velocity in CMS: 1.013 (-0.039; +0.019) cm/ns
 Number of nucleons emitted to reach FFF: 2.72 (-0.77; +1.56)

mdn [-vms; +vms], where
 "mdn": median; "vms": variance

1D: Excitation Energy
 1D: Velocity in CMS
 dA, dN, dZ

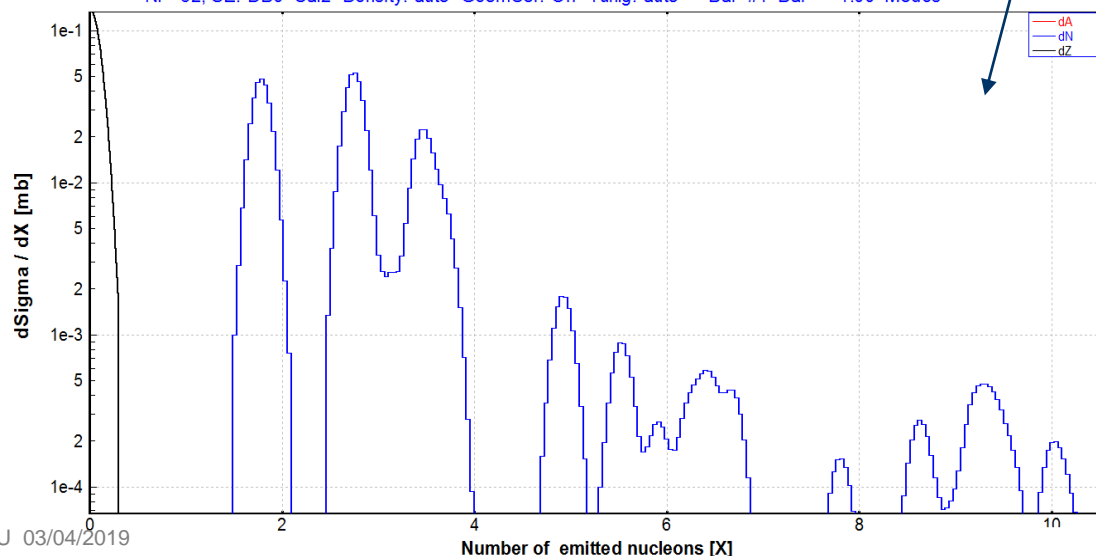
Excitation energy of initial fission fragments coming to ¹³²Sn final fragment

ABRASION-ABLATION - ²³⁸U + Be; C_{bound}=0.91; C_{Nbound}=0.93; C_Sthrshld=1.0e-05 mb; sE^{*}_{fission}=7.0 MeV; N_{e-points}=1
 Excit.Energy Method:< 2 >; <E^{*}>:27.0*dA MeV Sigma:18.00; No Intrin.Thermalztn; LimitTemp: No
 NP=32; SE:"DB0+Cal2" Density:"auto" GeomCor:"Off" Tunlg:"auto" FisBar=#1 BarFac=1.00 Modes=1010 1000 110



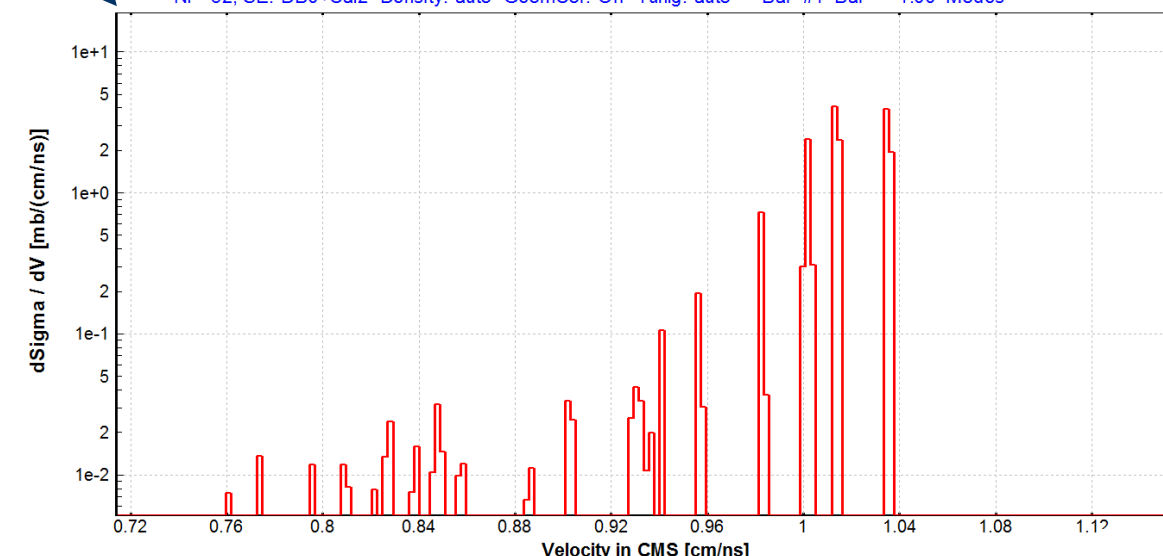
Emitted nucleons from initial fission fragment coming to ¹³²Sn

ABRASION-ABLATION - ²³⁸U + Be; C_{bound}=0.91; C_{Nbound}=0.93; C_Sthrshld=1.0e-05 mb; sE^{*}_{fission}=7.0 MeV; N_{e-points}=1
 Excit.Energy Method:< 2 >; <E^{*}>:27.0*dA MeV Sigma:18.00; No Intrin.Thermalztn; LimitTemp: No
 NP=32; SE:"DB0+Cal2" Density:"auto" GeomCor:"Off" Tunlg:"auto" FisBar=#1 BarFac=1.00 Modes=1010 1000 110



¹³²Sn final fragment velocity in CMS

ABRASION-ABLATION - ²³⁸U + Be; C_{bound}=0.91; C_{Nbound}=0.93; C_Sthrshld=1.0e-05 mb; sE^{*}_{fission}=7.0 MeV; N_{e-points}=1
 Excit.Energy Method:< 2 >; <E^{*}>:27.0*dA MeV Sigma:18.00; No Intrin.Thermalztn; LimitTemp: No
 NP=32; SE:"DB0+Cal2" Density:"auto" GeomCor:"Off" Tunlg:"auto" FisBar=#1 BarFac=1.00 Modes=1010 1000 110



2nd step calculation results: Initial Fissile Nuclei (IFN) gated to the selected Final Fission Fragment (FFF) - b

Abrasion-Fission: Initial fission nuclei

238U (140.0 MeV/u) + Be

Choose Final fission fragment: 136Sn

Calculate ALL I & II

Settings - I (Select region): coef for Zb = 0.76, coef for Nb = 0.85

Settings - II: Cross-section minimum threshold, Number of points from excitation distribution to use in calculation

Results - I (Fissile channels a): Total fission cross section in the region, Number of fissile nuclei in the region, Number of fissile nuclei to gate on the final fission fragment

Results - IIa: Initial Fissile Nuclei Gated on the Final Fission Fragment

2D: Fissile Nuclei CS

E*, MeV: 632.7 (-275.1; +29.9)

Z: 79.03 (-1.53; +6.21)

N: 136.94 (-2.26; +4.01)

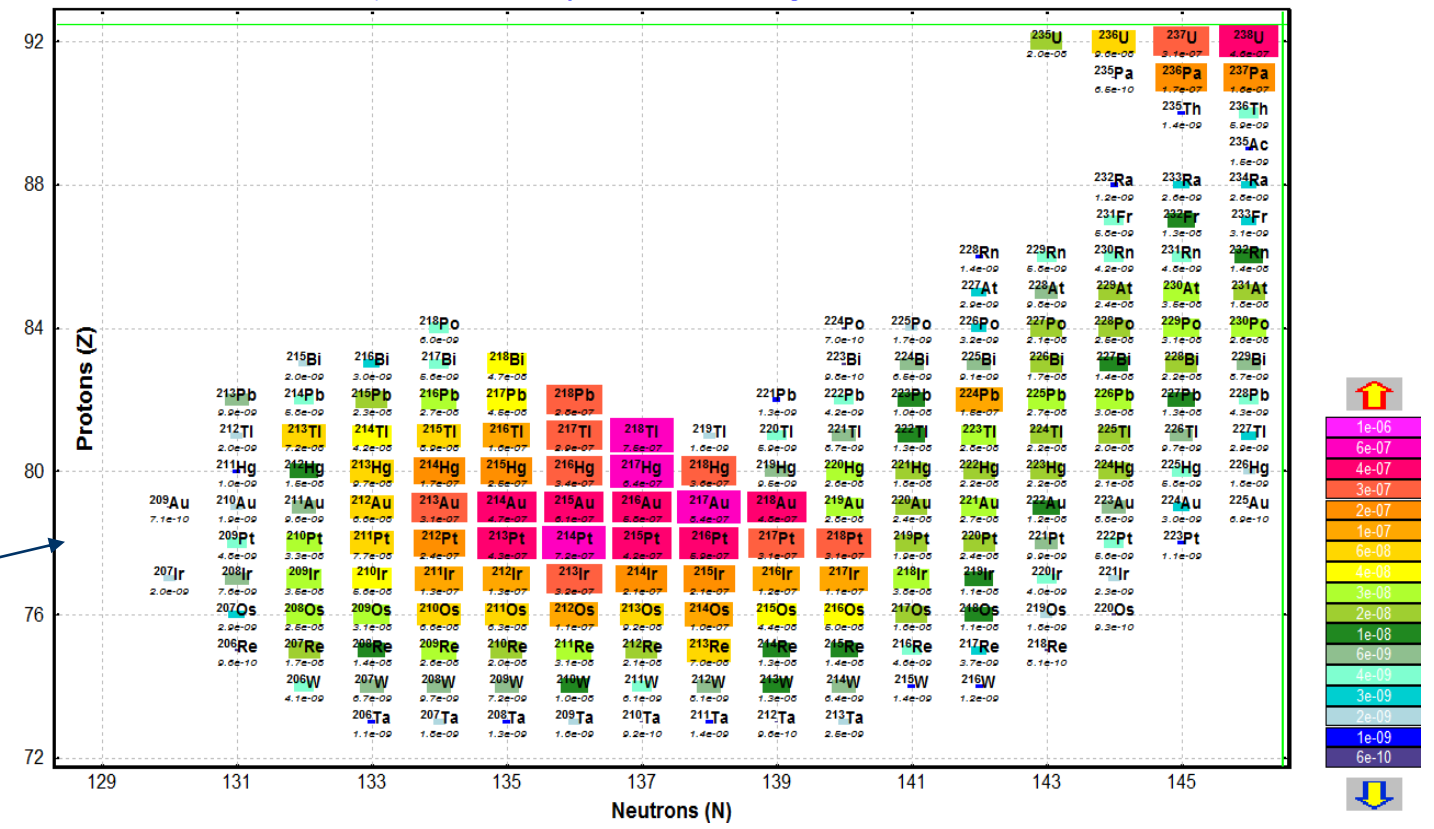
FFF=¹³⁶Sn, N_p=3; Large IFN region (489)

Initial Fissile Nuclei for ¹³⁶Sn final fragment

ABRASION-ABLATION - 238U + Be; C_{Zbound}=0.76; C_{Nbound}=0.85; C_Sthrsld=1.0e-07 mb; sE*_{fission}=7.0 MeV; N_e-points=3

Excit.Energy Method:< 2 >; <E*>:27.0*dA MeV Sigma:18.00; No Intrin.Thermatztn; LimitTemp: No

NP=32; SE:"DB0+Ca2" Density:"auto" GeomCor:"Off" Tung:"auto" FisBar=#1 BarFac=1.00 Modes=1010 1000 110



FFF=¹³⁶Sn, N_p=3; Large IFN region (489)

Evaporation settings
 Prefragment excit.energy
 Batch file mode
 Show 2D: Fissile Nuclei CS for each run
 z26 [n=34]
 Run the batch file! Takes time..

Detailed output: 23892_00904_13650_p3m
 General log file: IFN

Results - I (Fissile channels after abrasion)
 Total fission cross section in the region (mb): 1.60e+03
 Number of fissile nuclei in the region (I): 1029
 Number of fissile nuclei used to gate on the final fragment (II): 489

Results - IIa: Initial Fissile Nuclei
 Gated on the Final Fission Fragment
 2D: Fissile Nuclei CS
 E*, MeV: 632.7 (-275.1; +29.9)
 Z: 79.03 (-1.53; +6.21)
 N: 136.94 (-2.26; +4.01)

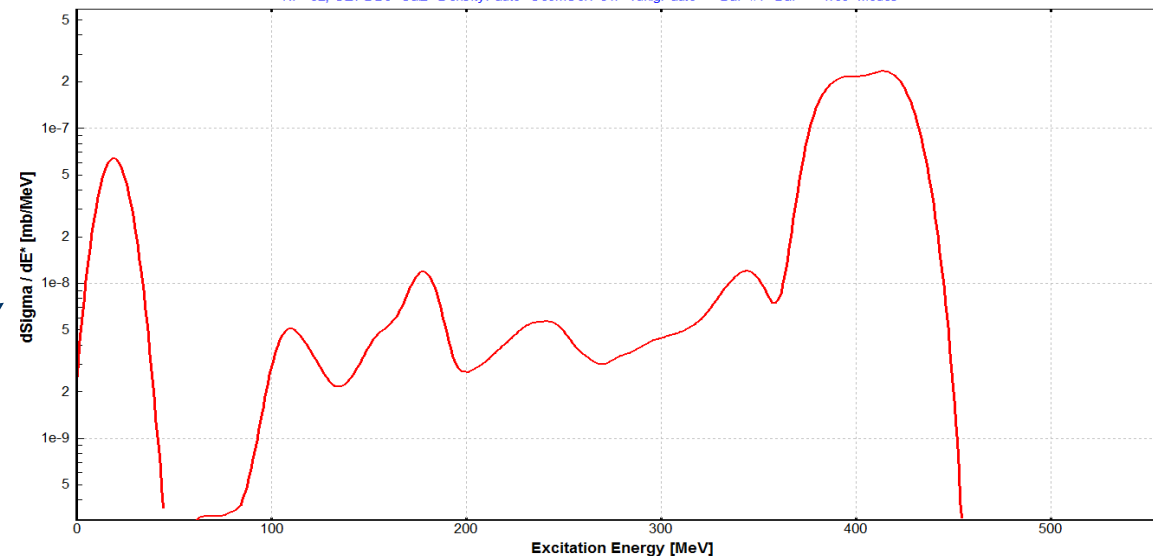
Results - IIb: Final Fission Fragment
 Final fragment cross section: 1.47e-05 mb
 Initial fission fragment excitation energy: 399.0 (-175.2; +20.1) MeV
 Velocity in CMS: 0.623 (-0.043; +0.133) cm/ns
 Number of nucleons emitted to reach FFF: 8.60 (-2.49; +1.99)

mdn (-vms; +vms), where "mdn": median; "vms": variance

1D: Excitation Energy
 1D: Velocity in CMS
 dA, dN, dZ

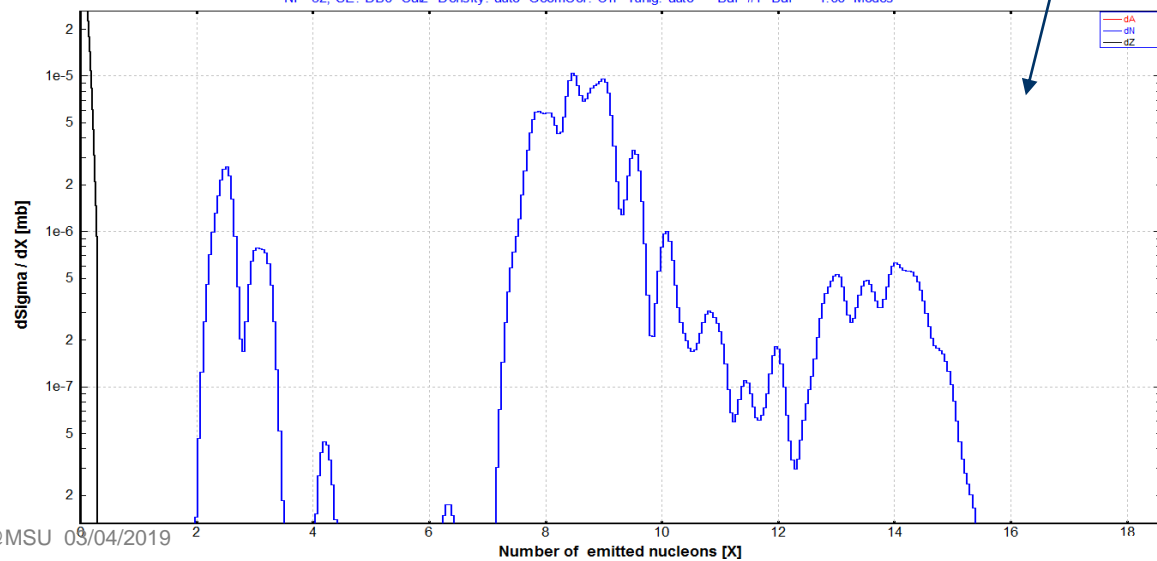
Excitation energy of initial fission fragments coming to ¹³⁶Sn final fragment

ABRASION-ABLATION - ²³⁸U + Be; C_{zbound}=0.76; C_{nbound}=0.85; C_{S_{thrshd}}=1.0e-07 mb; sE_{fission}=7.0 MeV; N_{a-points}=3
 Excit.Energy Method:< 2 >; <E*>:27.0*dA MeV Sigma:18.00; No Intrin.Thermalztn; LimitTemp: No
 NP=32; SE:"DB0+Ca2" Density:"auto" GeomCor:"Off" Tunlg:"auto" F_{isBar}=#1 BarF_{ac}=1.00 Modes=1010 1000 110



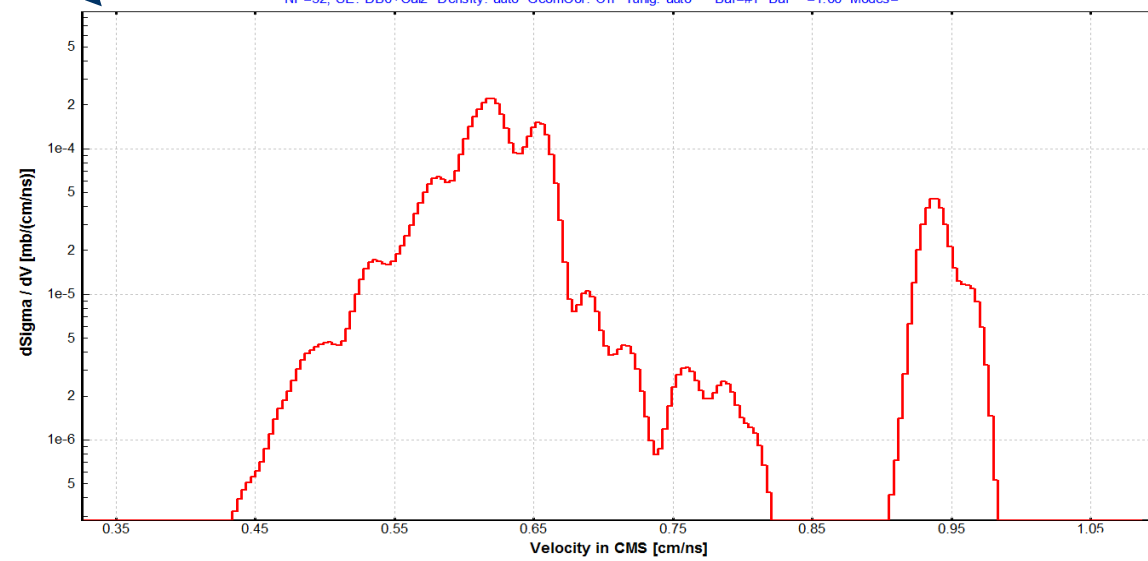
Emitted nucleons from initial fission fragment coming to ¹³⁶Sn

ABRASION-ABLATION - ²³⁸U + Be; C_{zbound}=0.76; C_{nbound}=0.85; C_{S_{thrshd}}=1.0e-07 mb; sE_{fission}=7.0 MeV; N_{a-points}=3
 Excit.Energy Method:< 2 >; <E*>:27.0*dA MeV Sigma:18.00; No Intrin.Thermalztn; LimitTemp: No
 NP=32; SE:"DB0+Ca2" Density:"auto" GeomCor:"Off" Tunlg:"auto" F_{isBar}=#1 BarF_{ac}=1.00 Modes=1010 1000 110



¹³⁶Sn final fragment velocity in CMS

ABRASION-ABLATION - ²³⁸U + Be; C_{zbound}=0.76; C_{nbound}=0.85; C_{S_{thrshd}}=1.0e-07 mb; sE_{fission}=7.0 MeV; N_{a-points}=3
 Excit.Energy Method:< 2 >; <E*>:27.0*dA MeV Sigma:18.00; No Intrin.Thermalztn; LimitTemp: No
 NP=32; SE:"DB0+Ca2" Density:"auto" GeomCor:"Off" Tunlg:"auto" F_{isBar}=#1 BarF_{ac}=1.00 Modes=1010 1000 110



“ZN” extension
Two-columns (Z,N) file

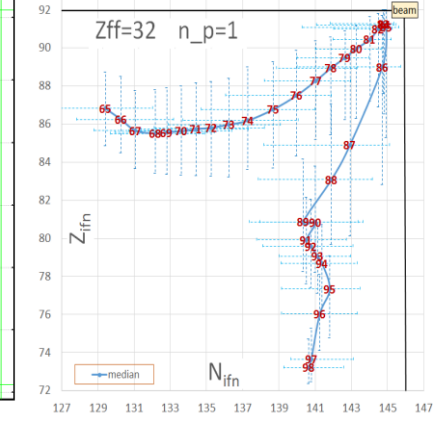
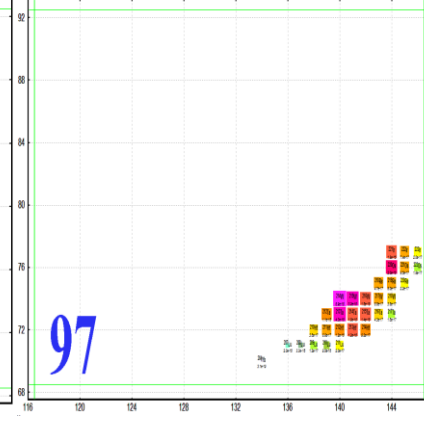
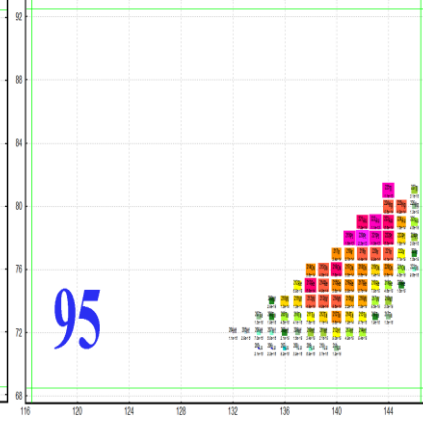
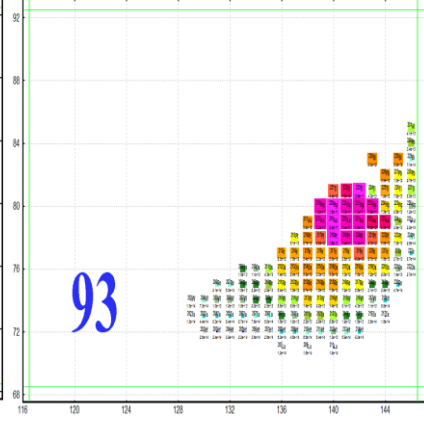
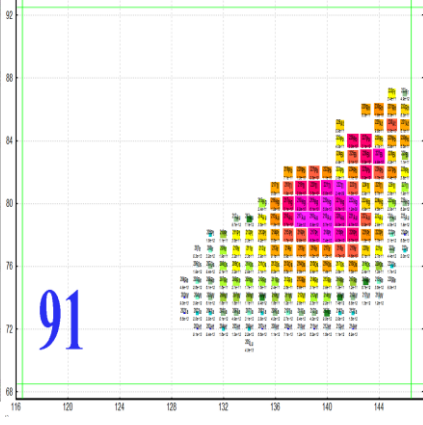
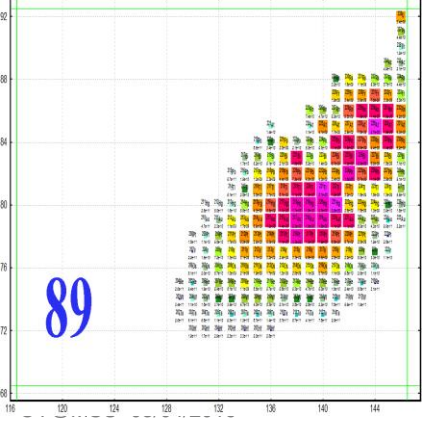
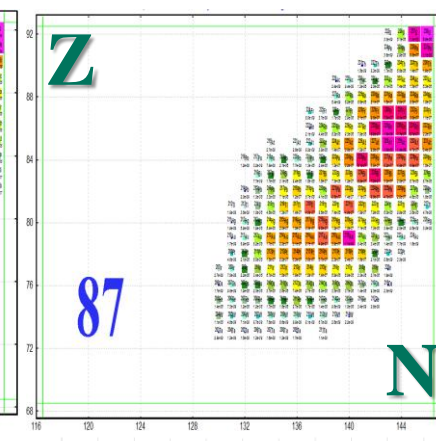
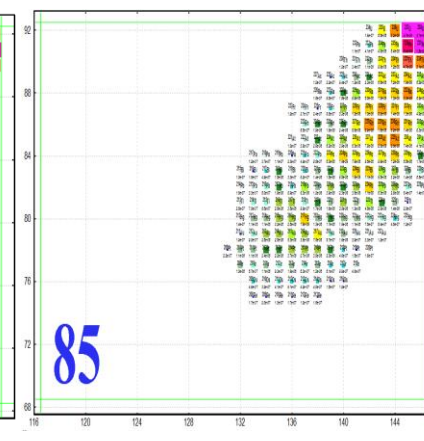
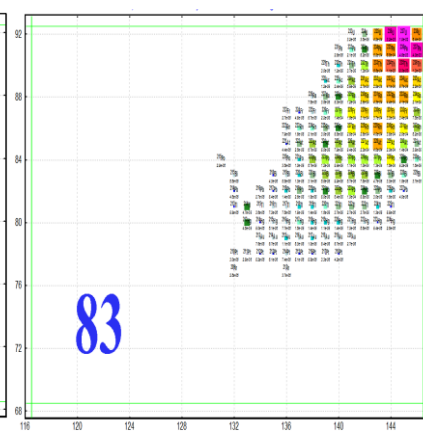
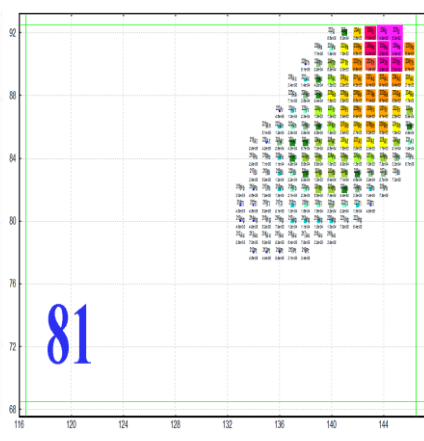
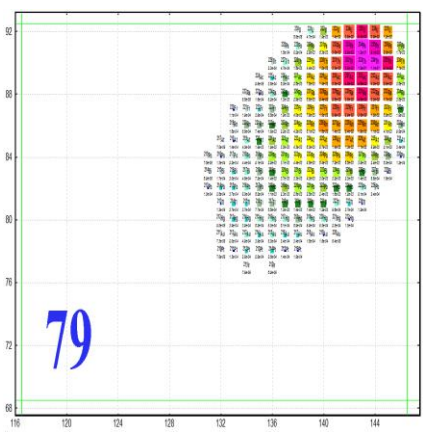
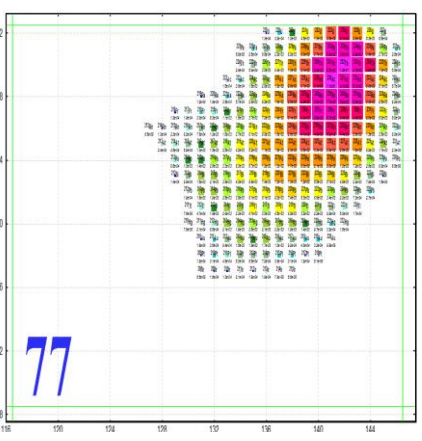
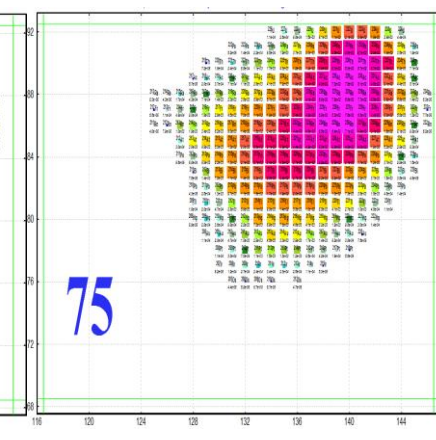
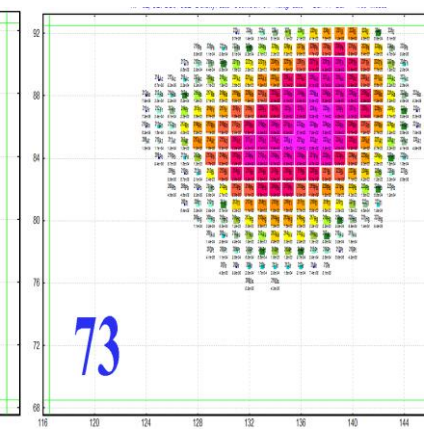
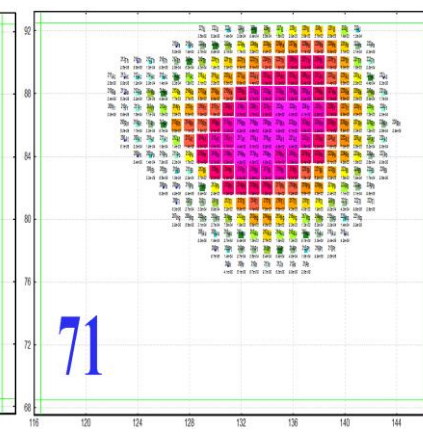
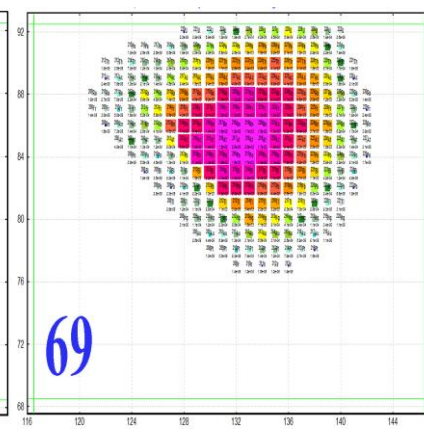
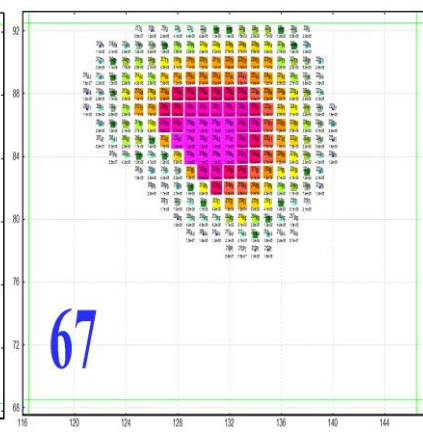
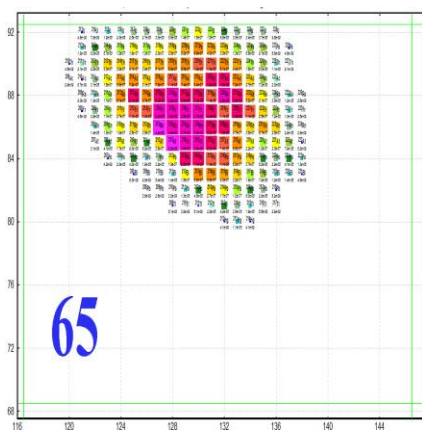
'/>

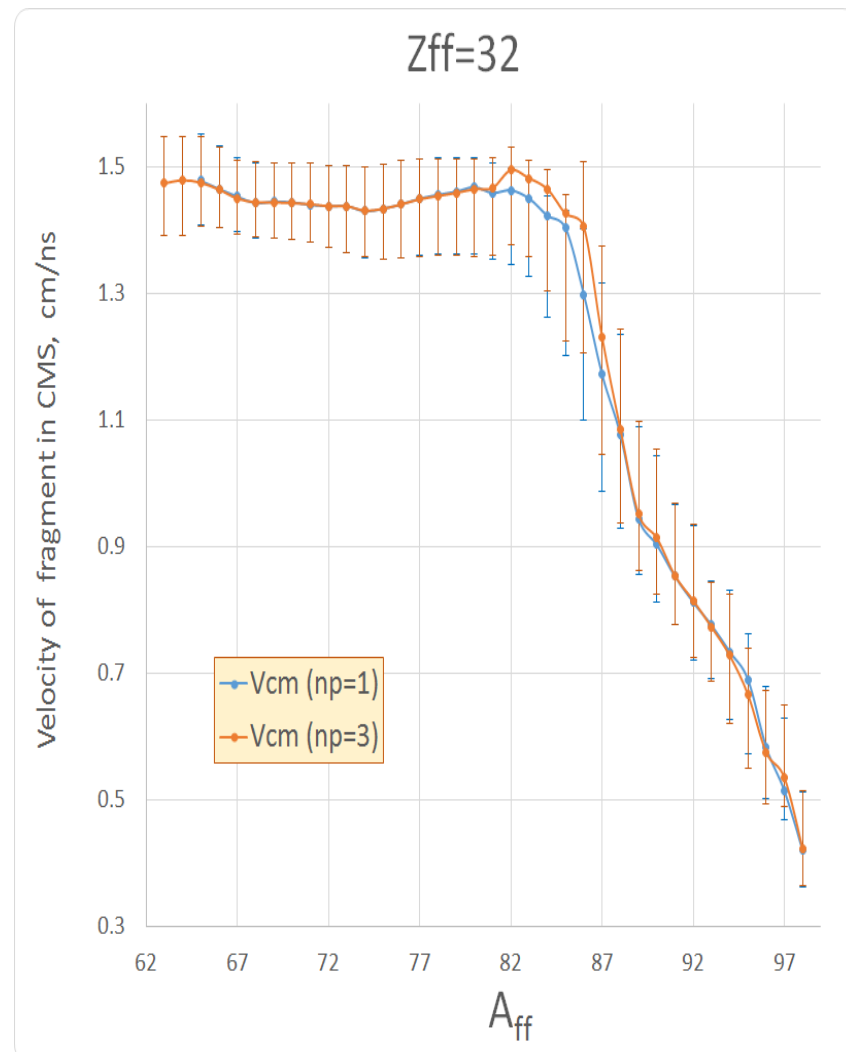
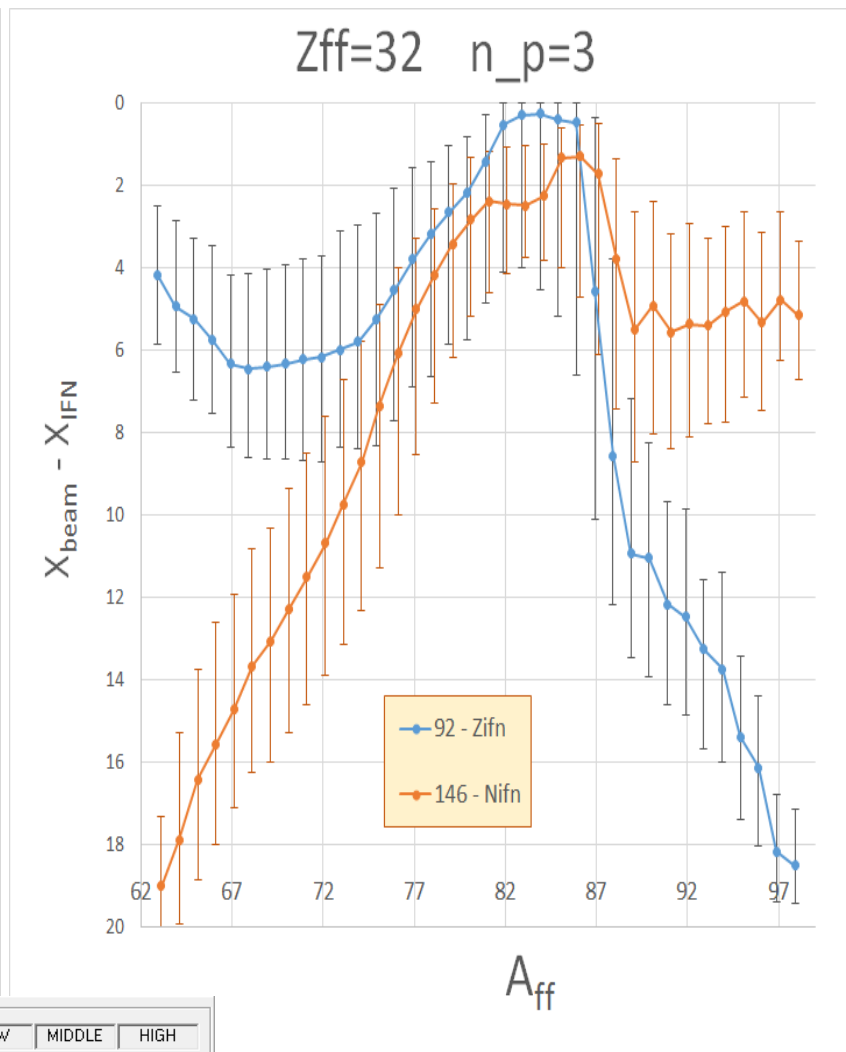
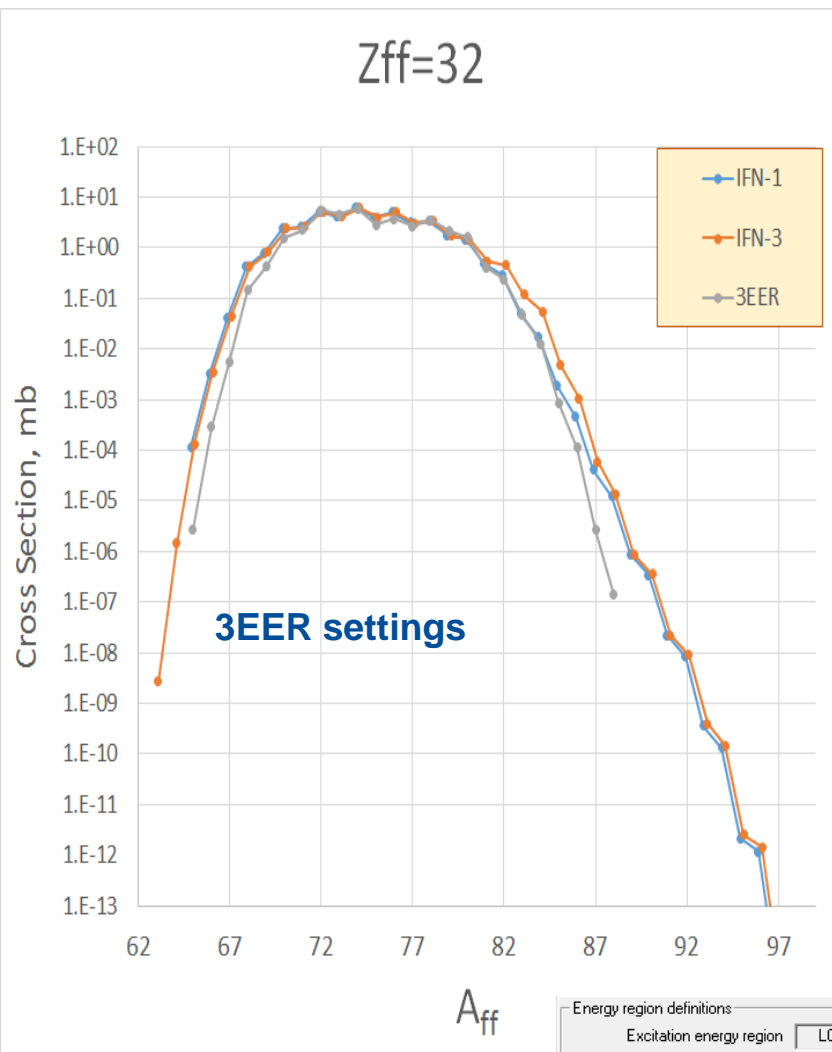
RUN

It takes time!

1st and 2nd steps settings
will be used for all runs!

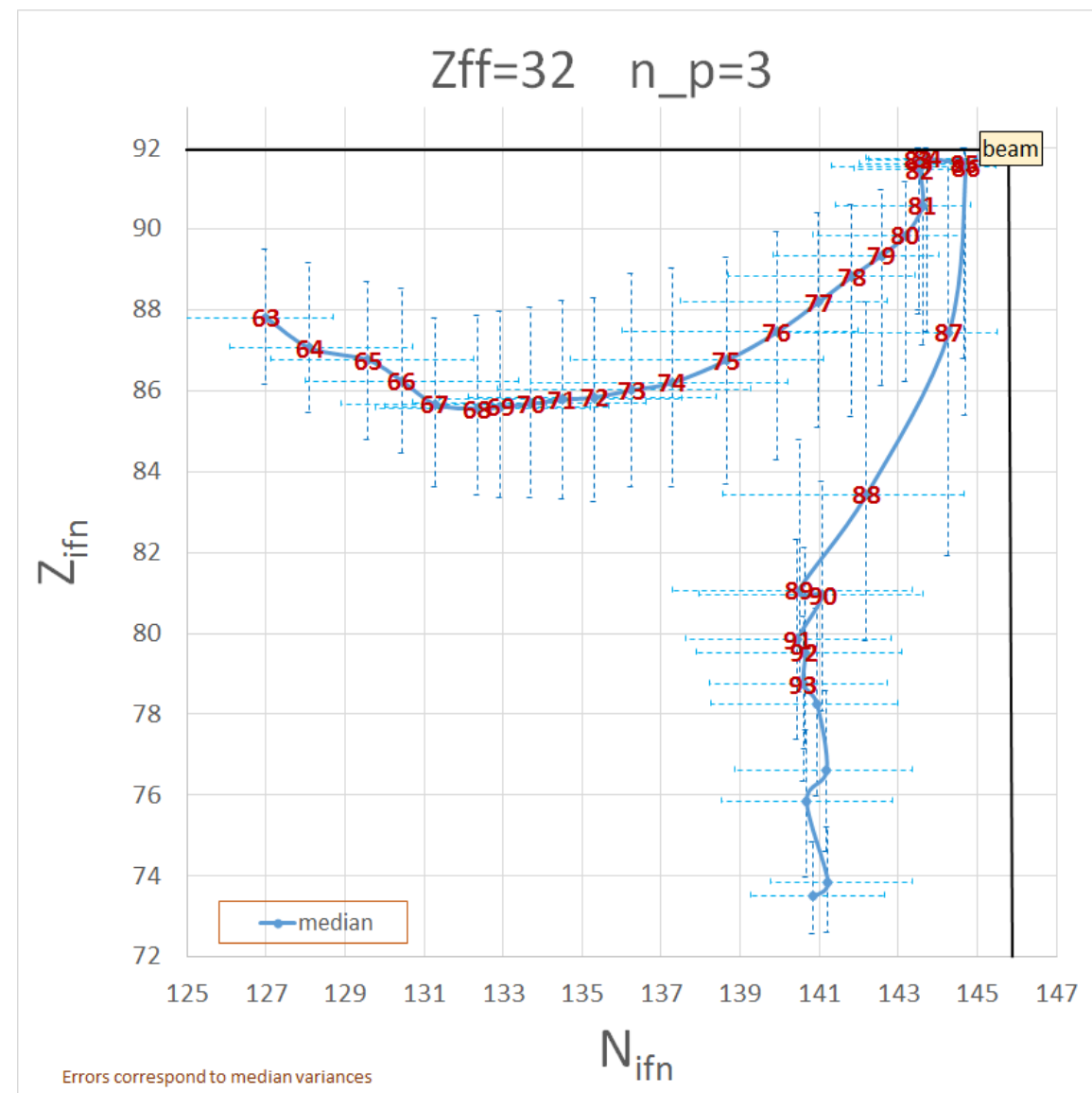
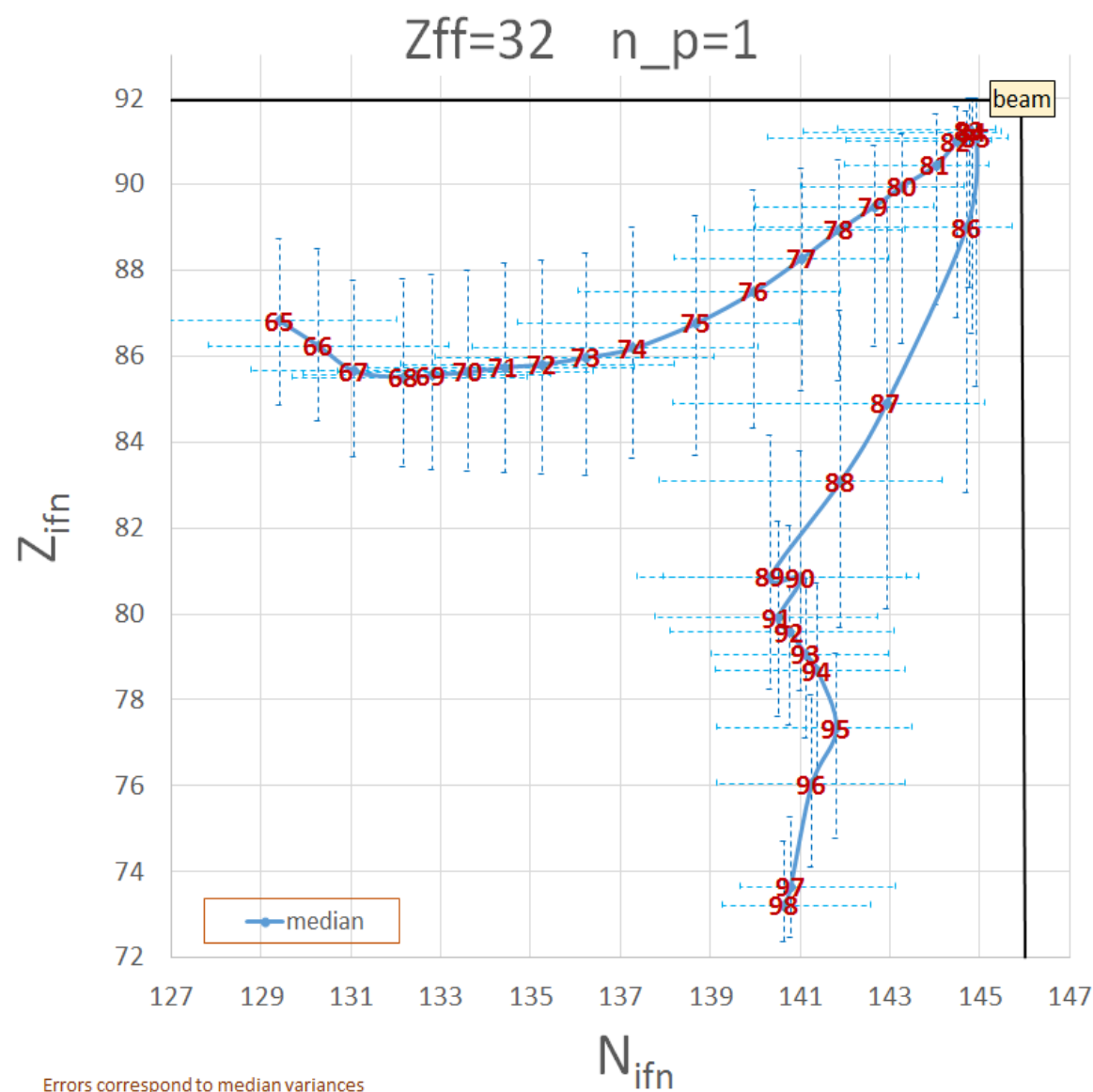
Initial Fissile Nuclei (IFN) for final Ge-isotopes (Z=32)

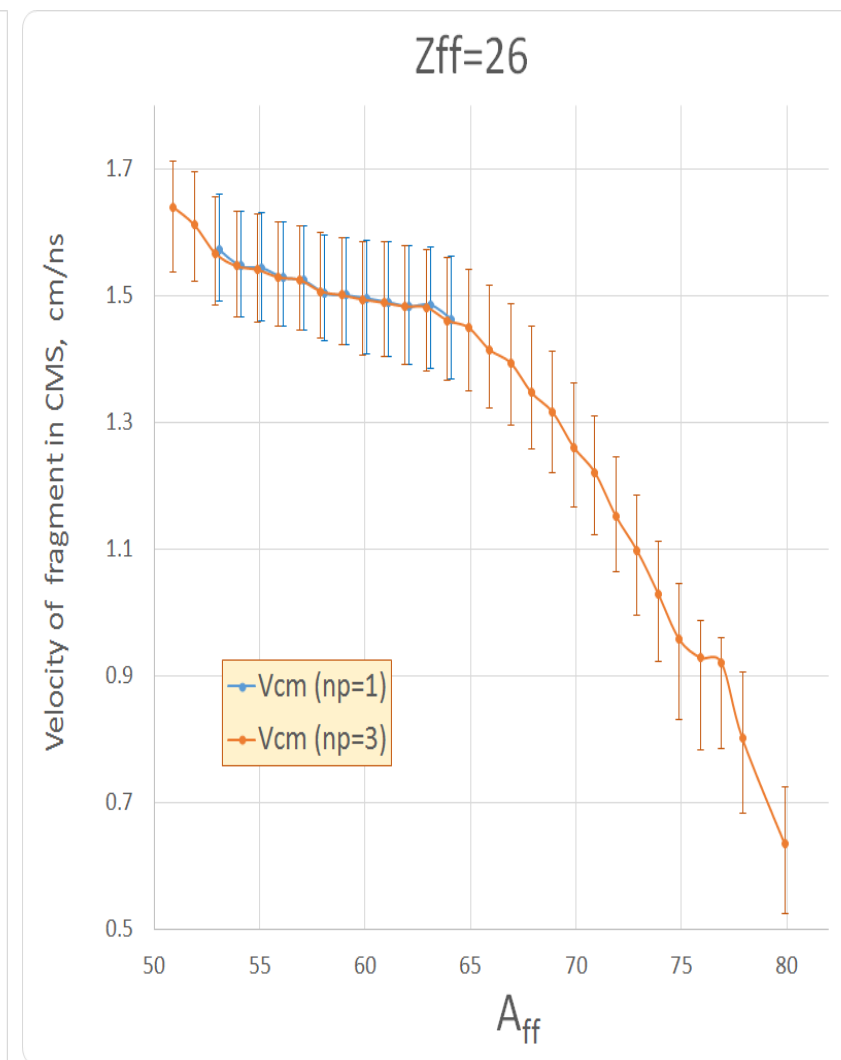
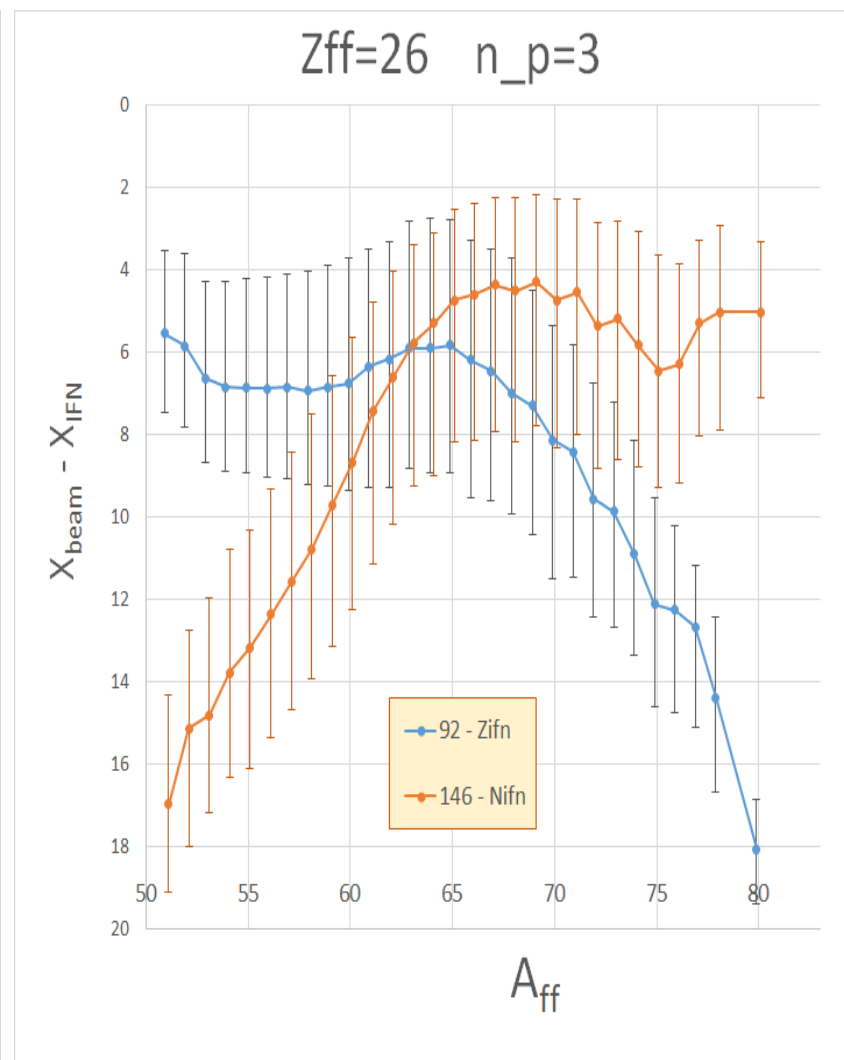
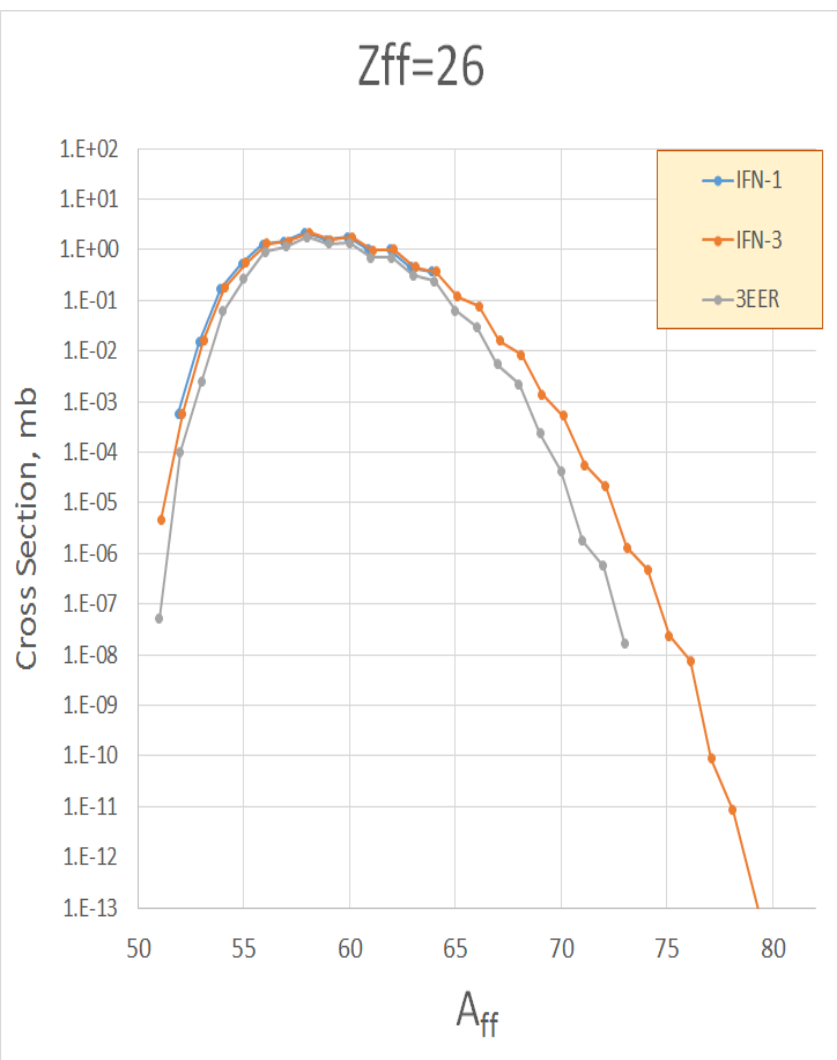


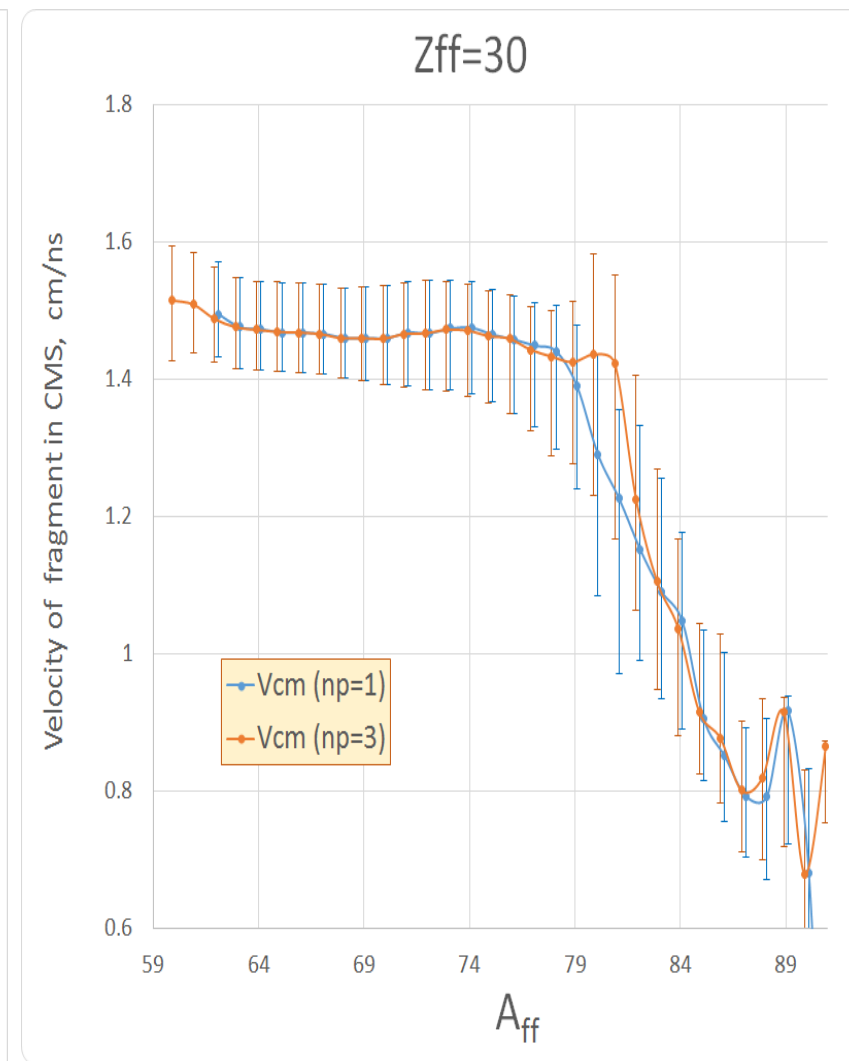
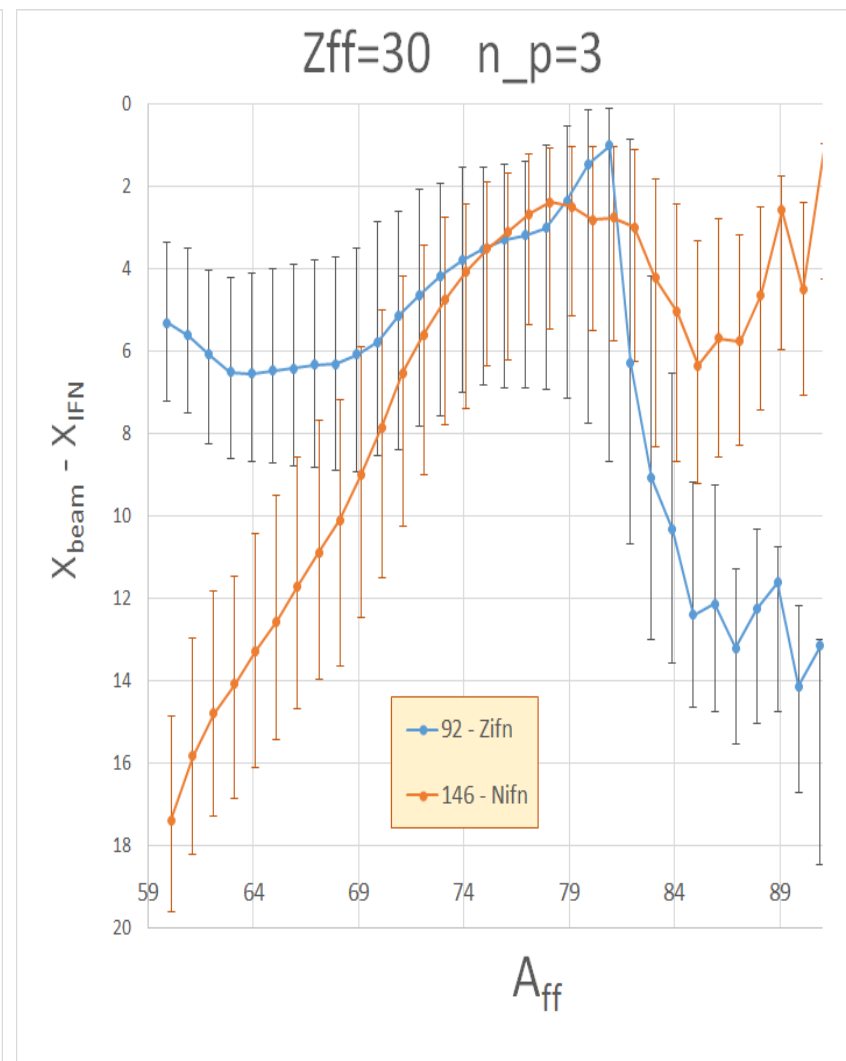
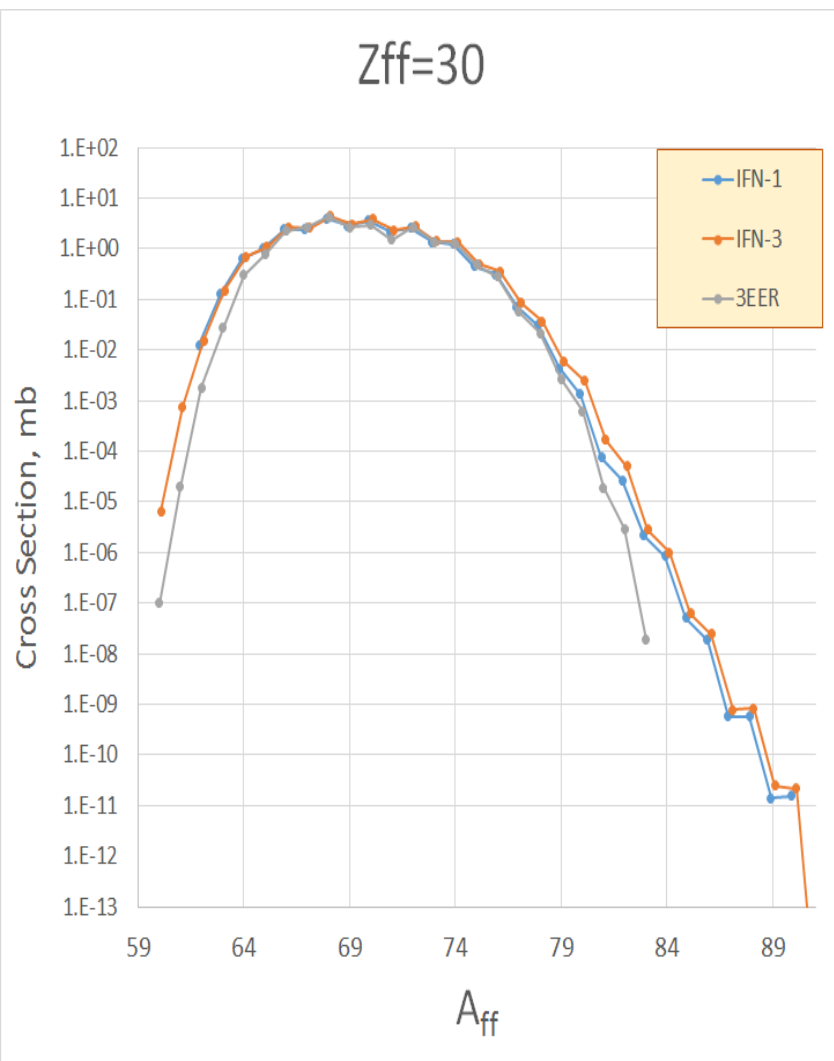


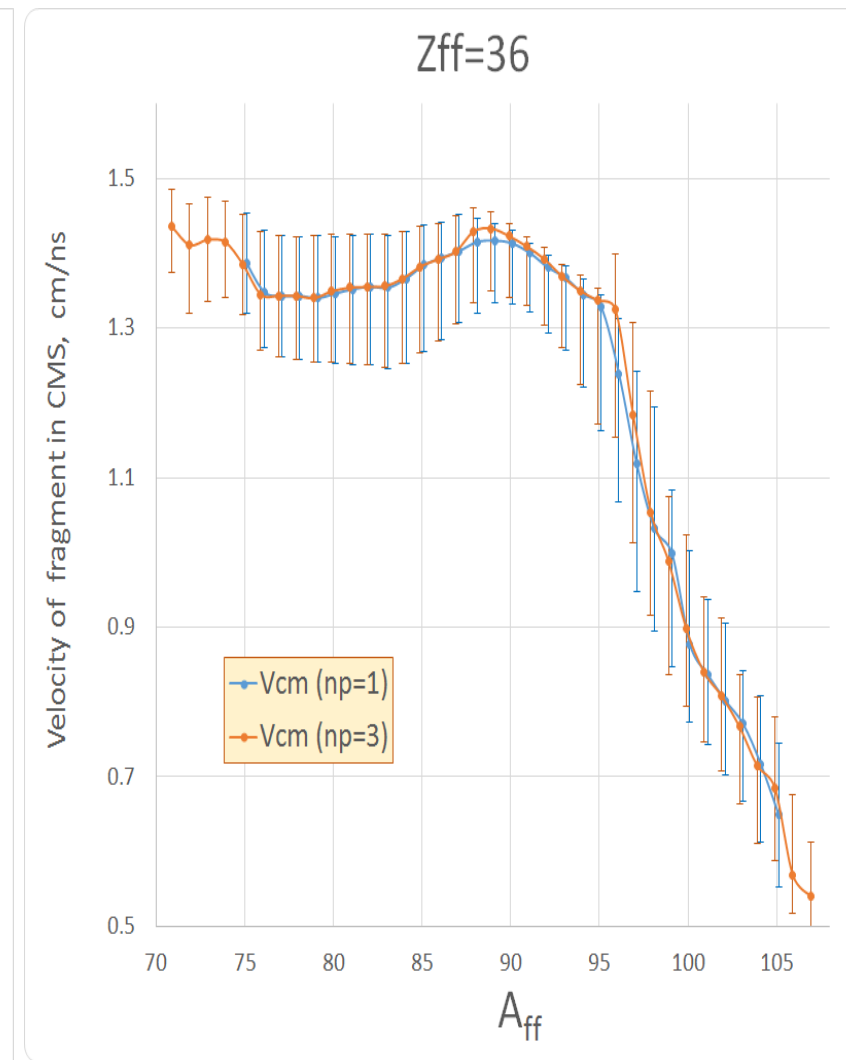
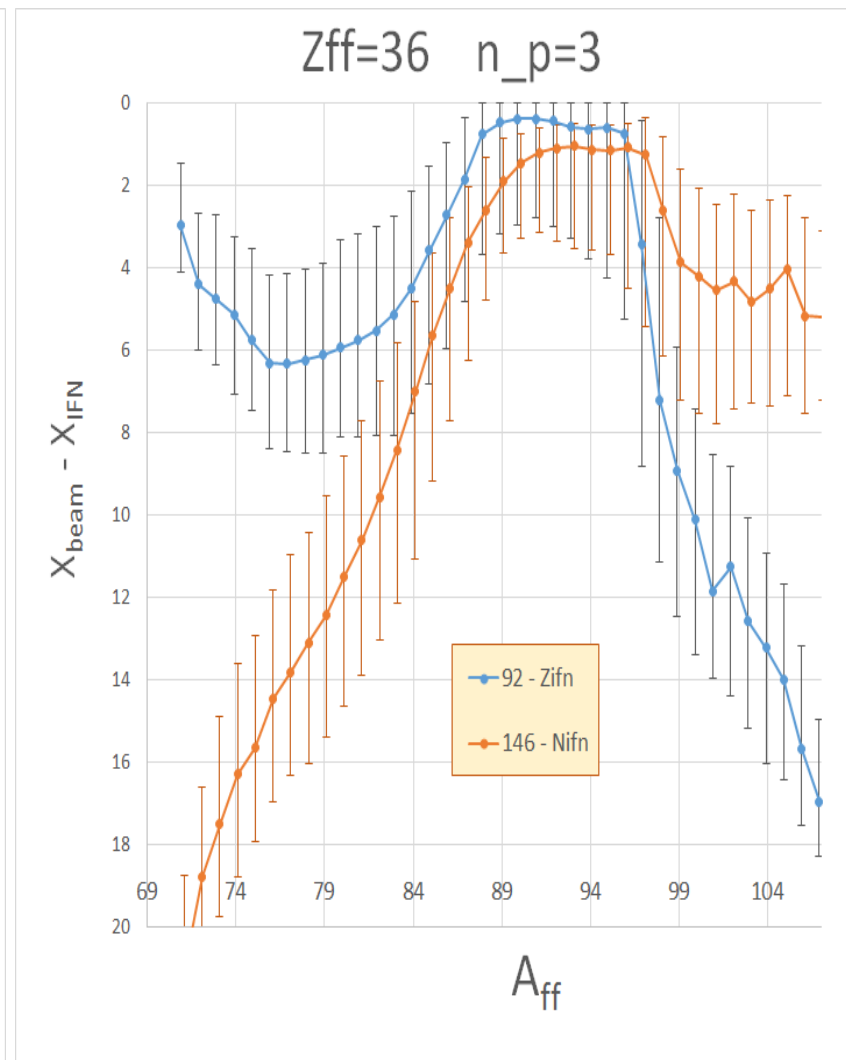
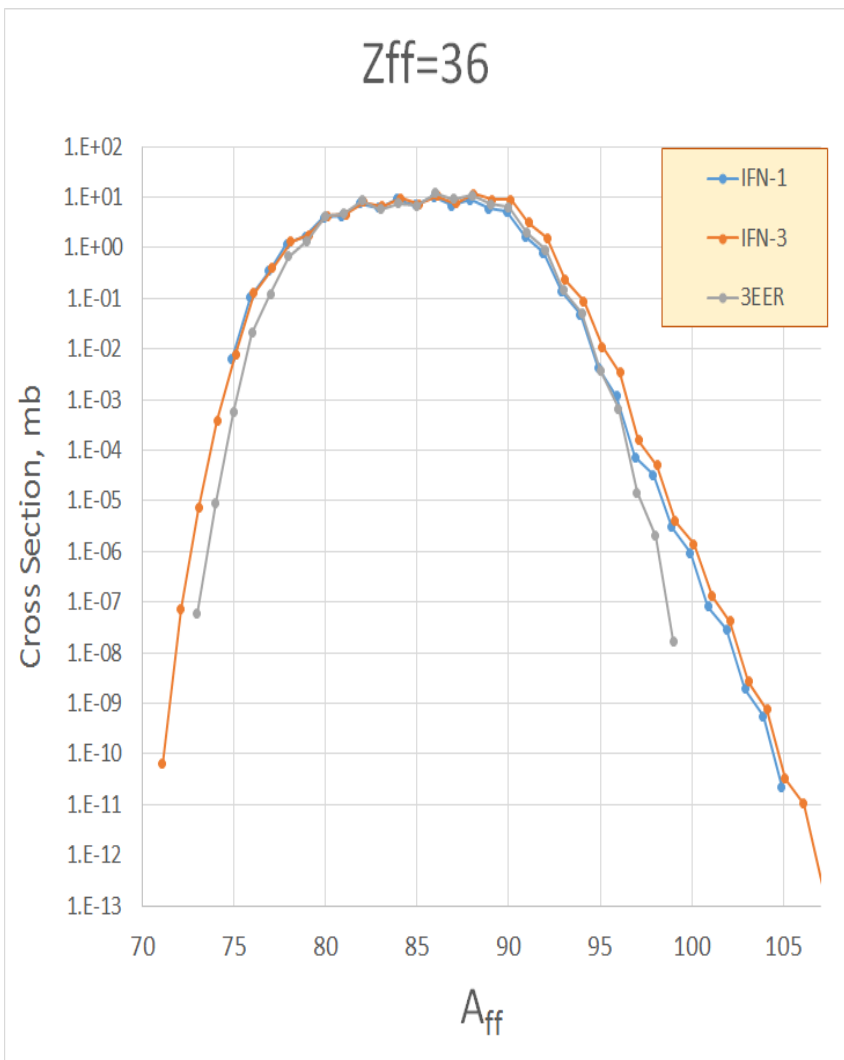
Energy region definitions

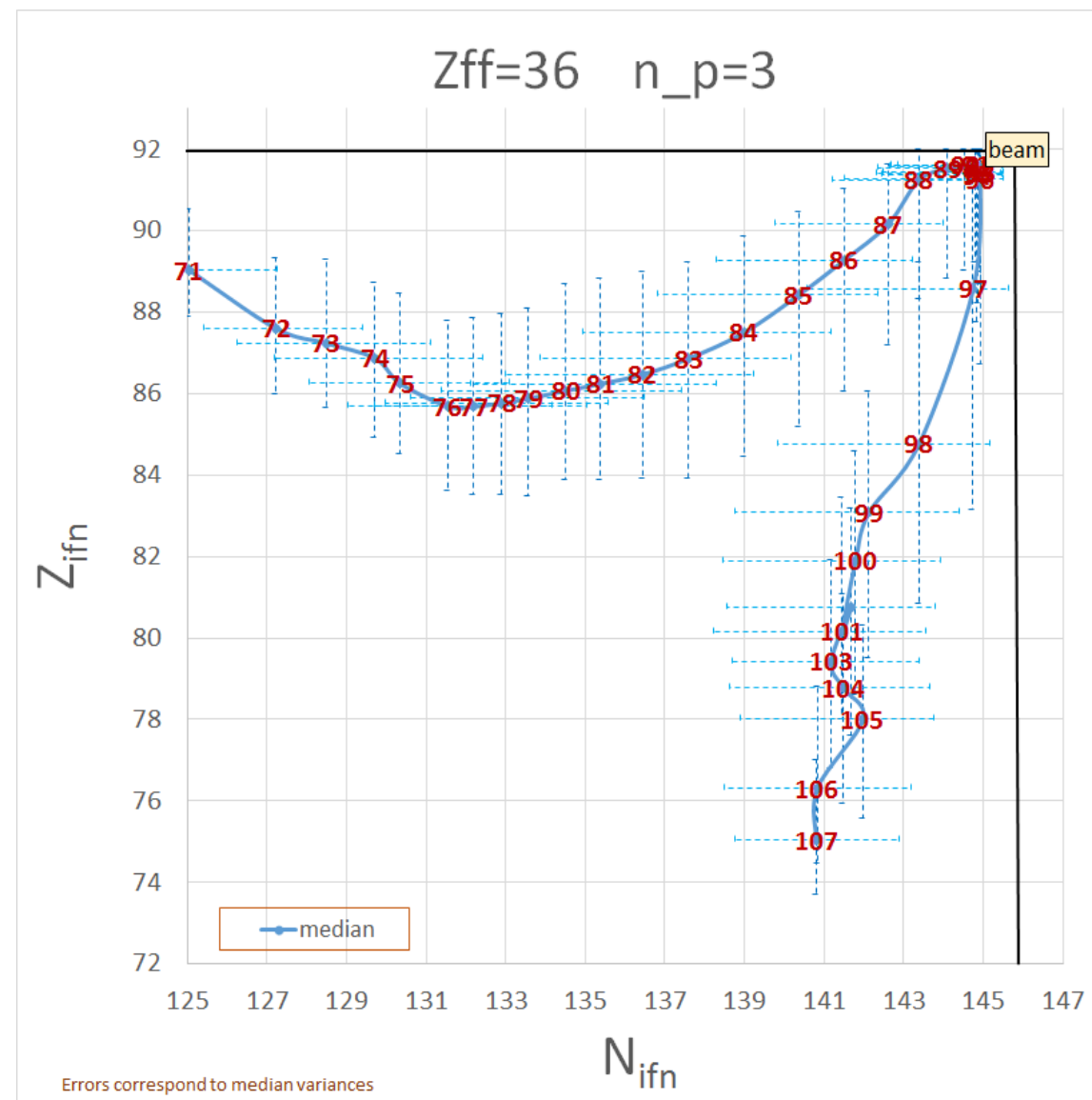
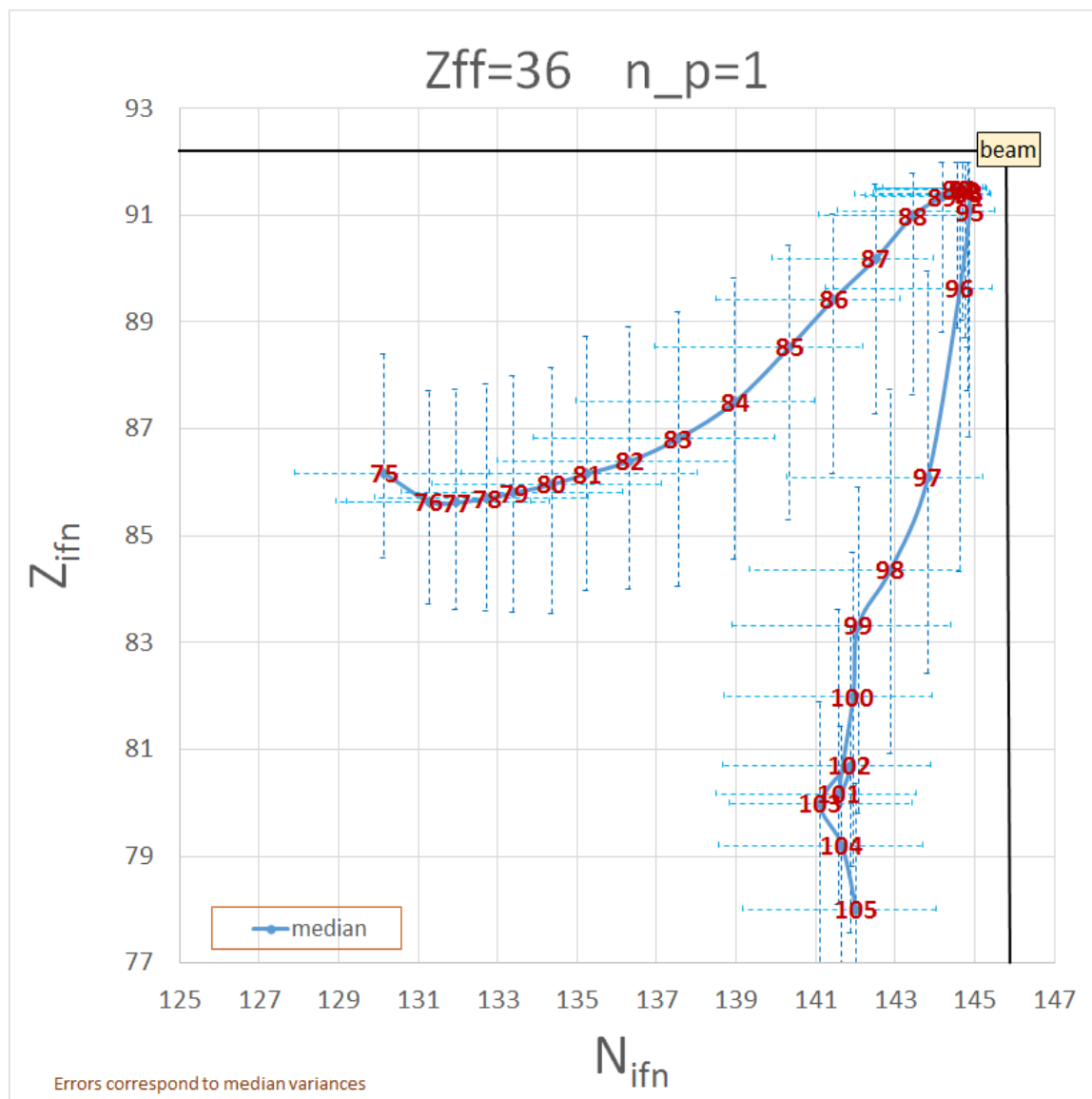
Excitation energy region	LOW	MIDDLE	HIGH
Choose a primary reaction	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
Perform transmission calculations for this energy region	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Choose FISSILE nucleus	237U	232Th	222Rn
Excitation energy (MeV)	34	108.2	394
Cross section (mb)	425.3	637.3	538.3
Restore previous settings	Cross sections sum (mb) 1600.9		

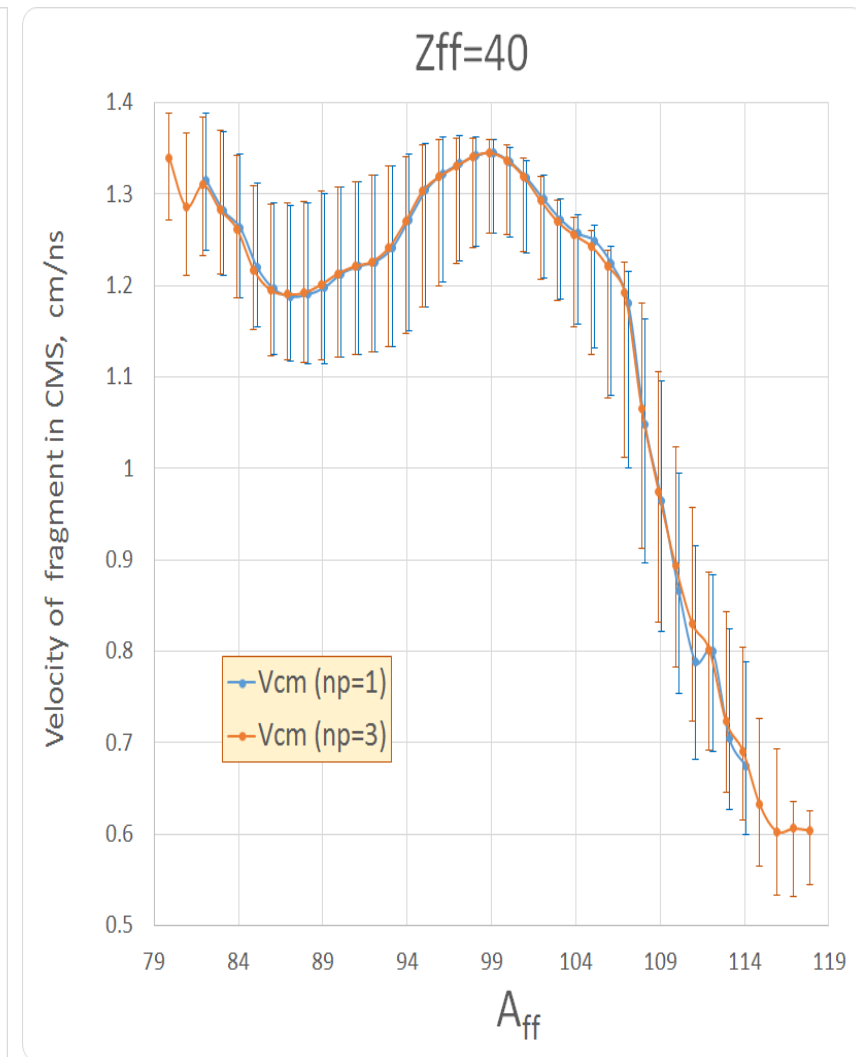
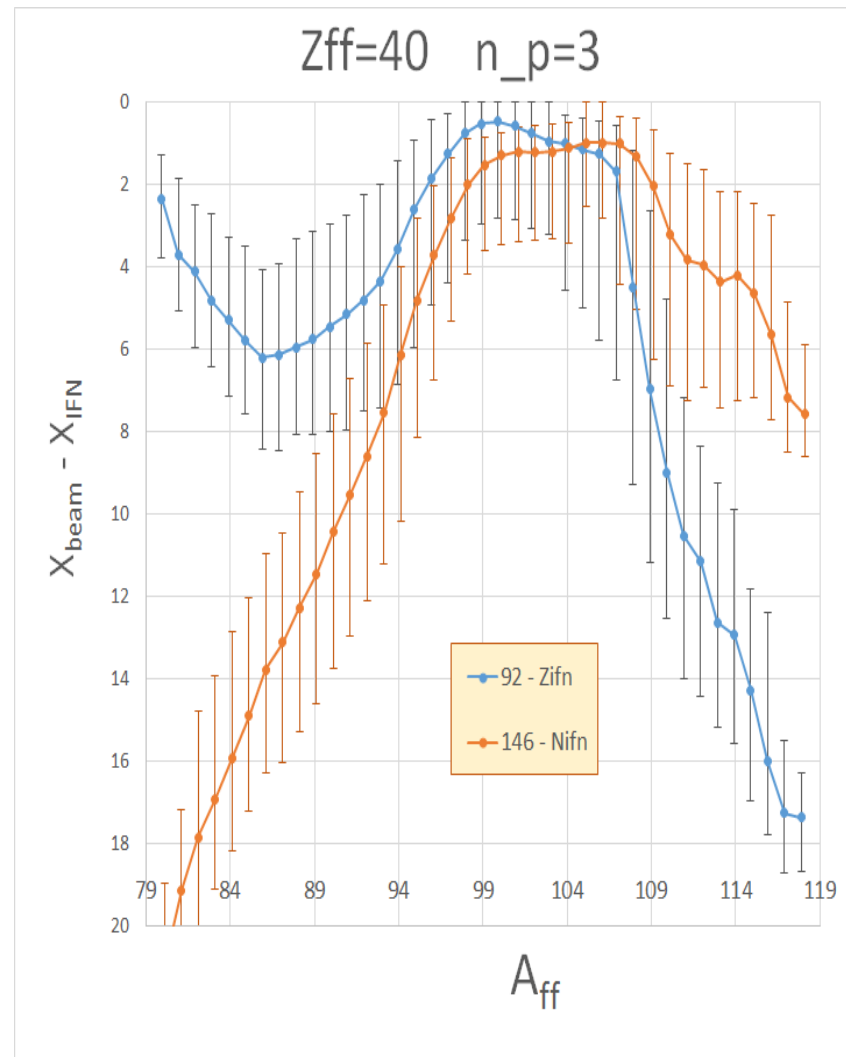
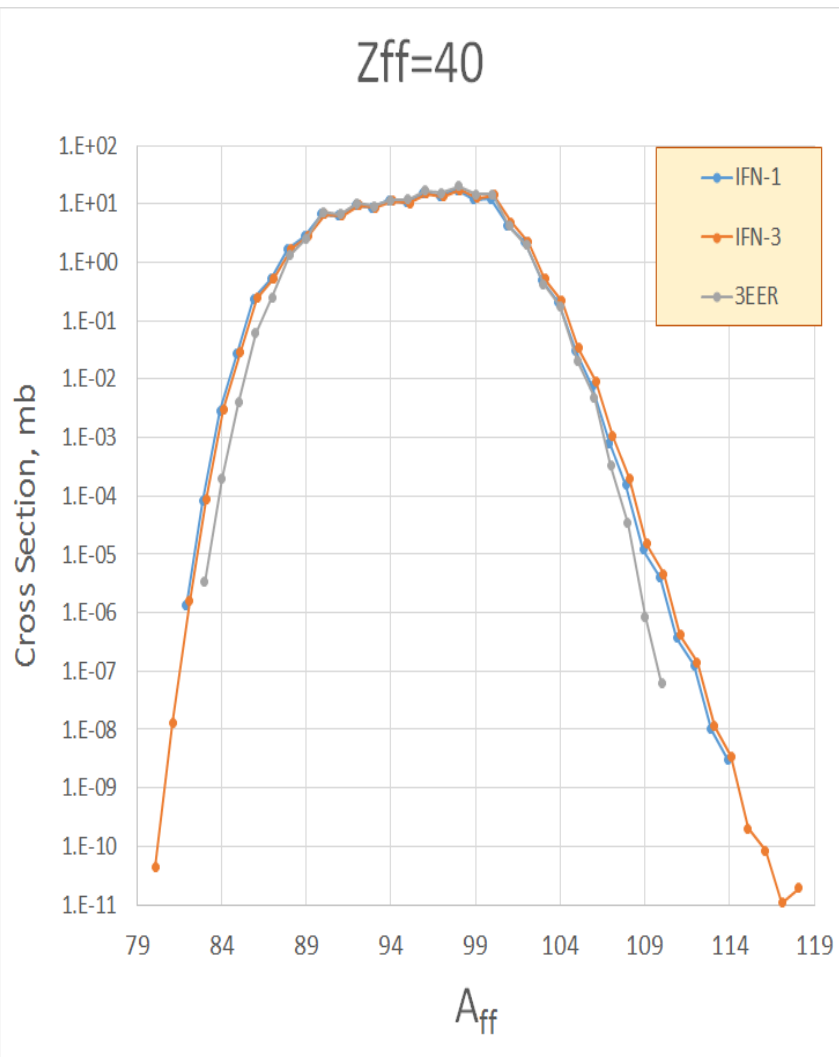


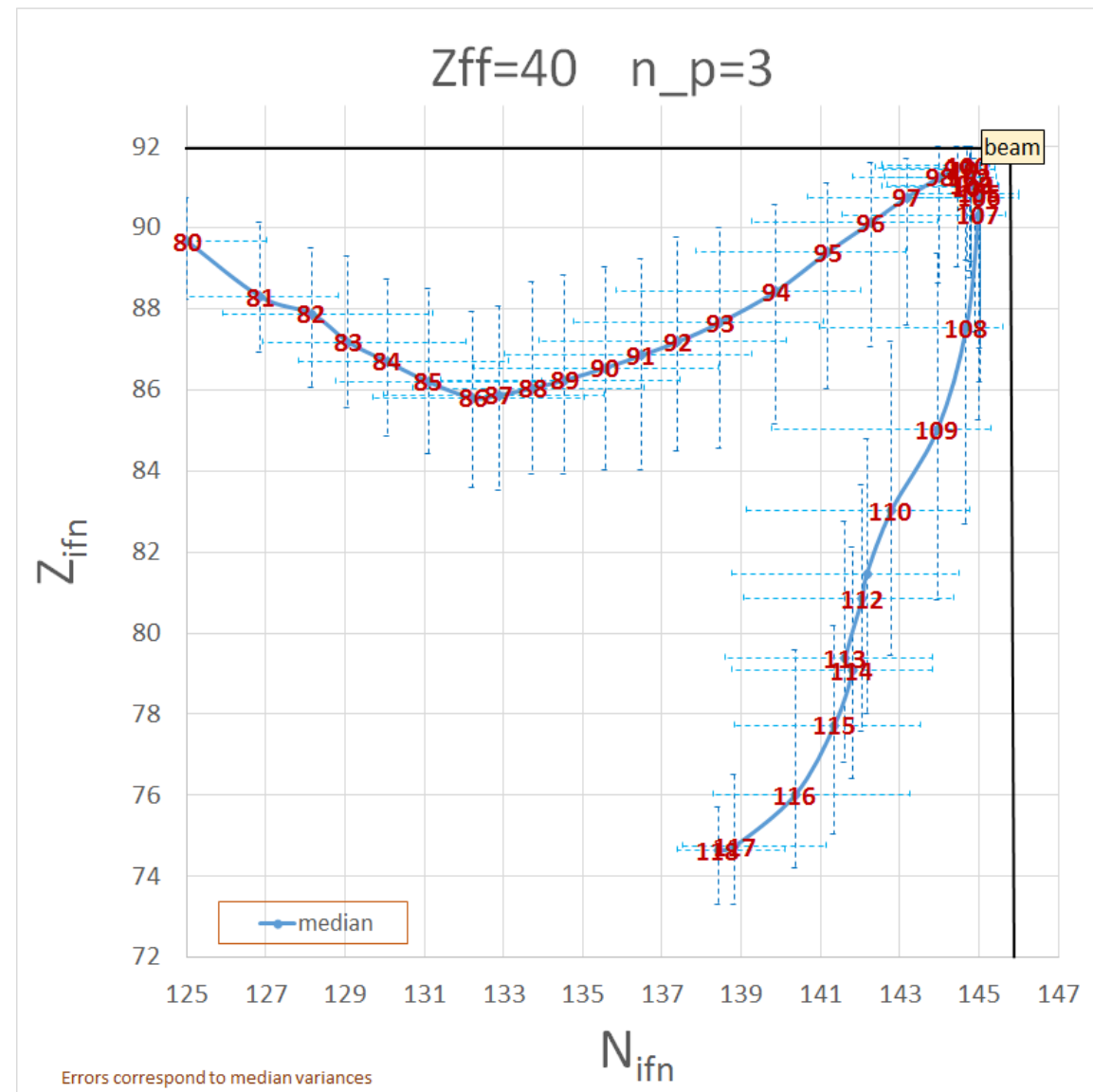
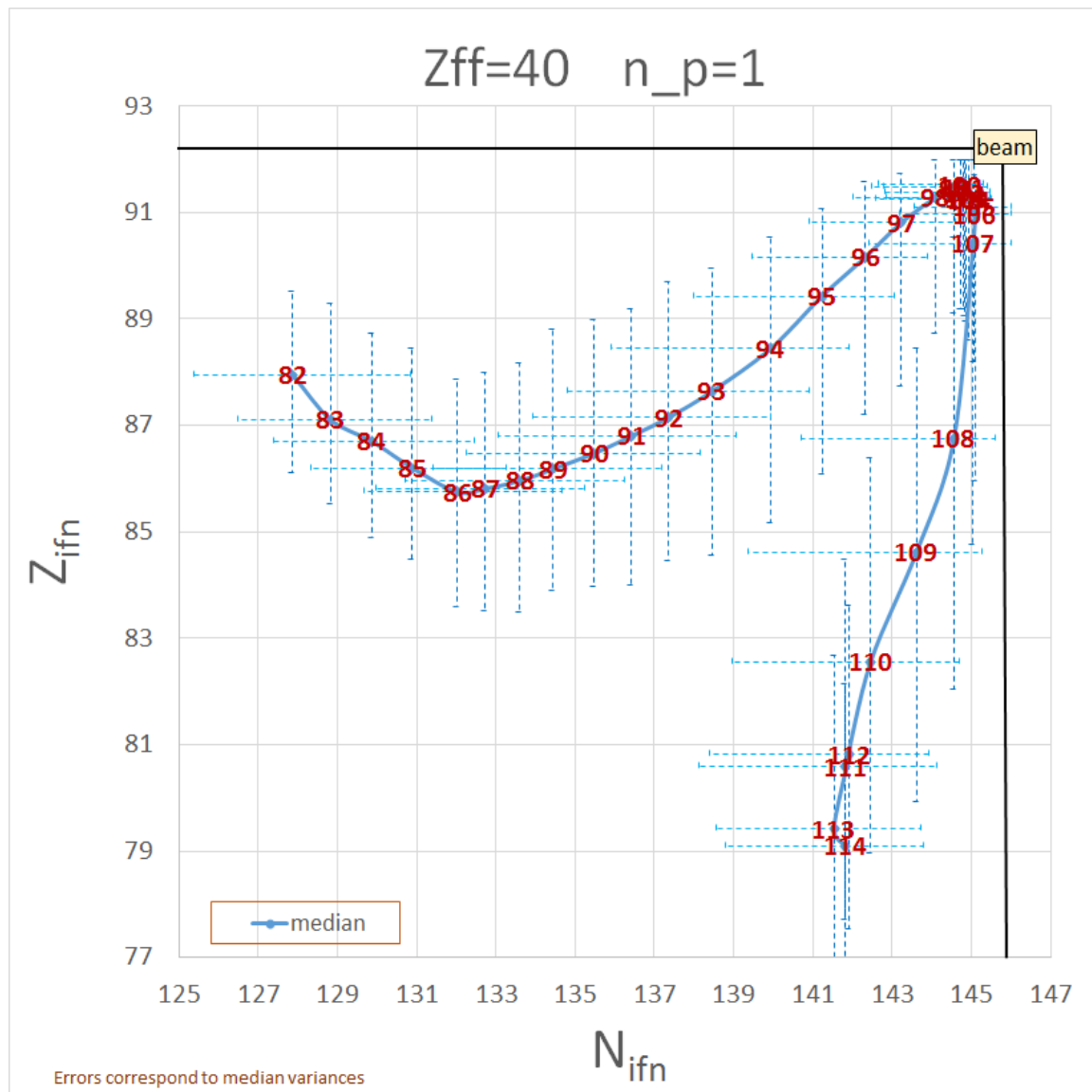


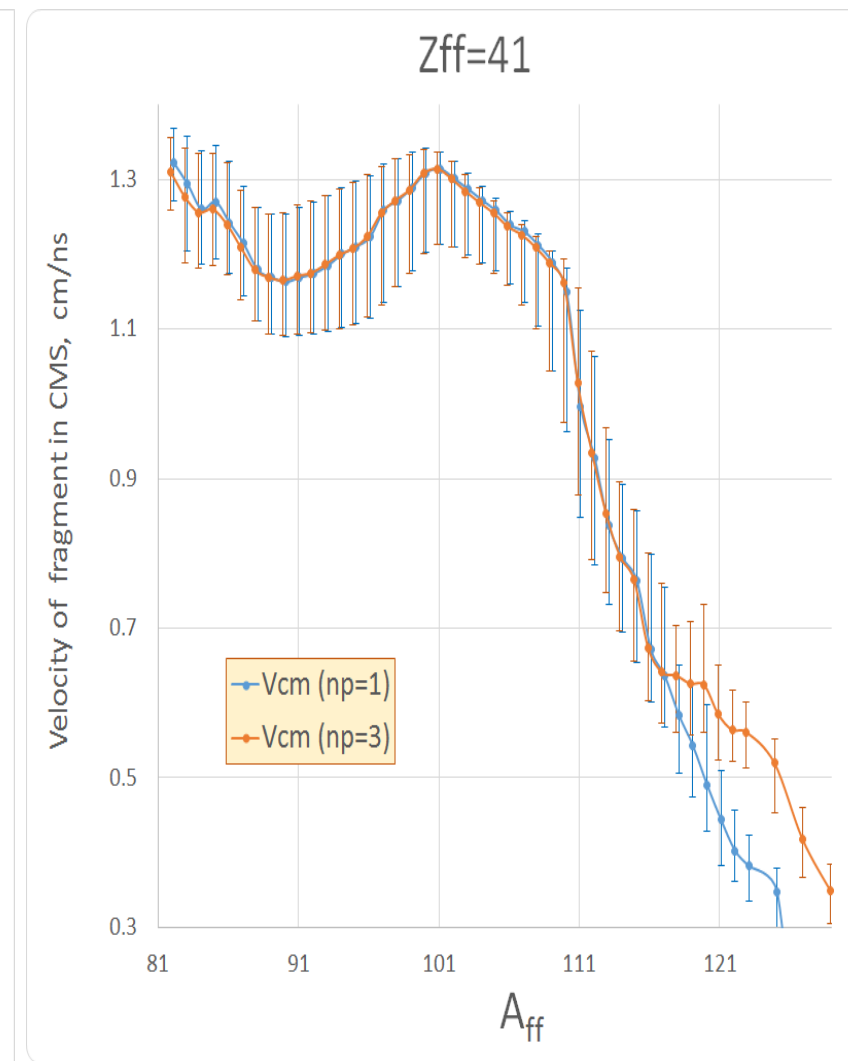
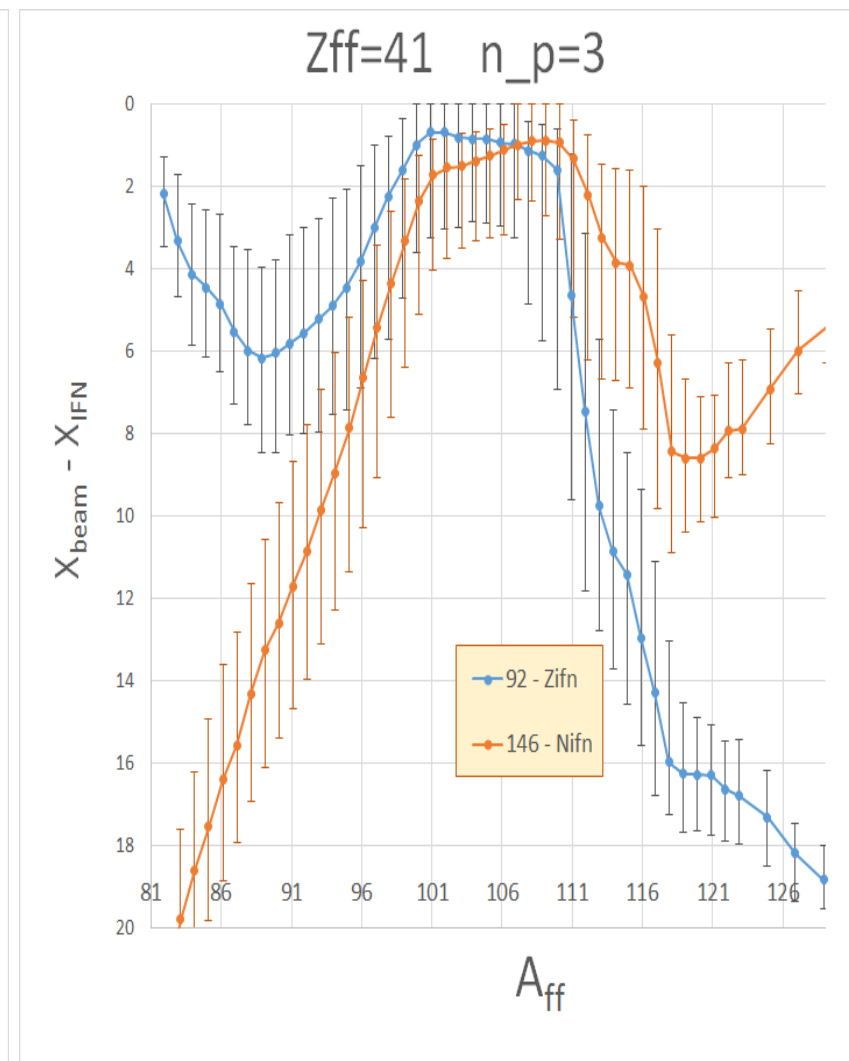
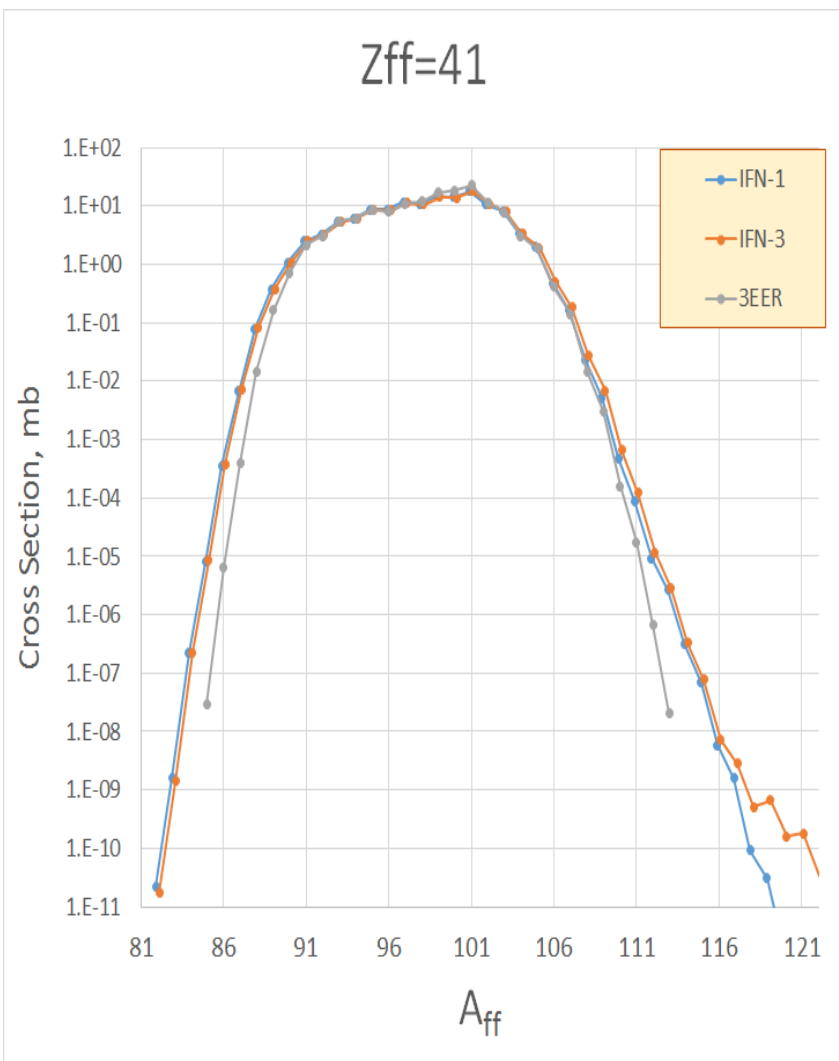


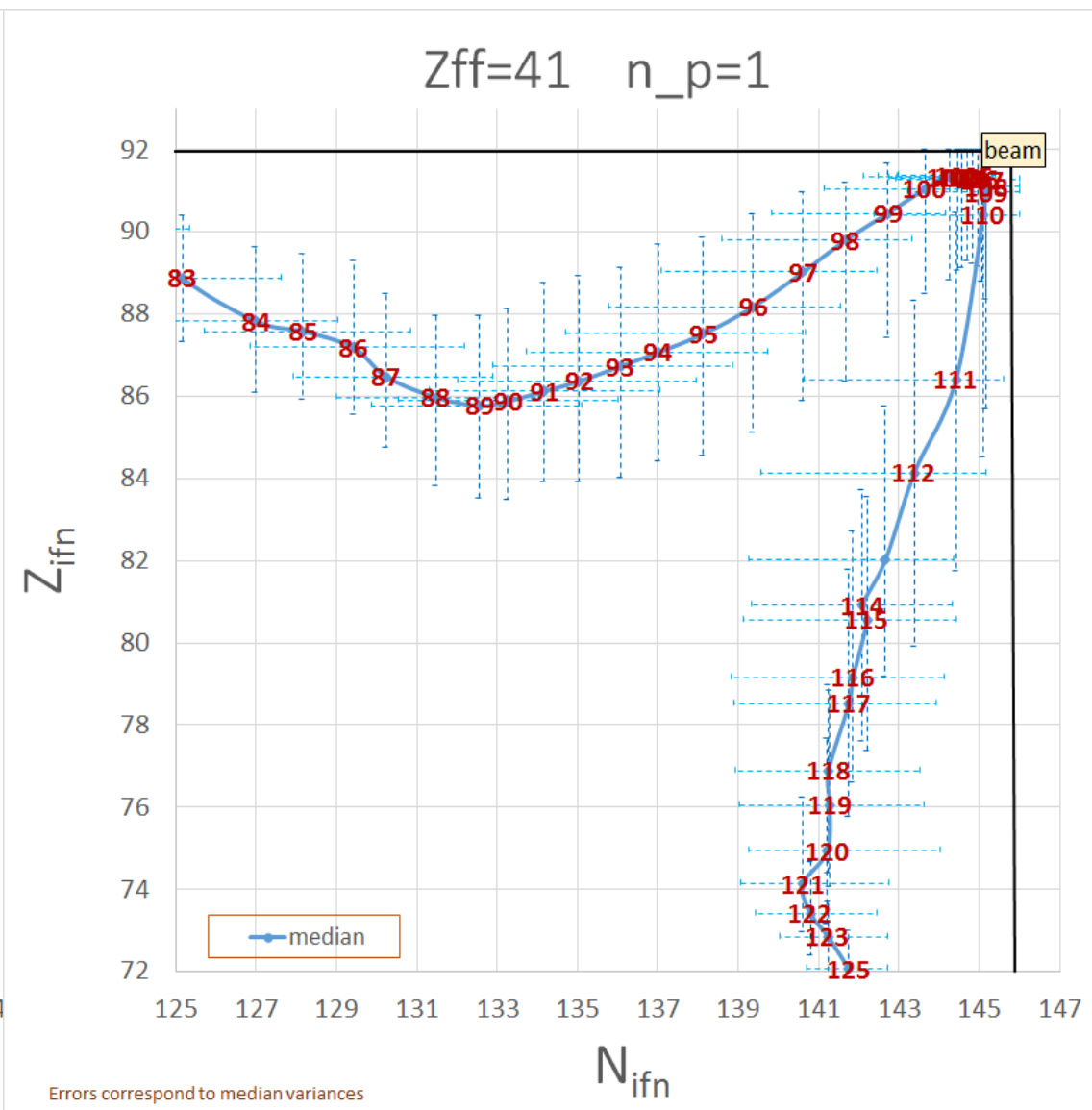
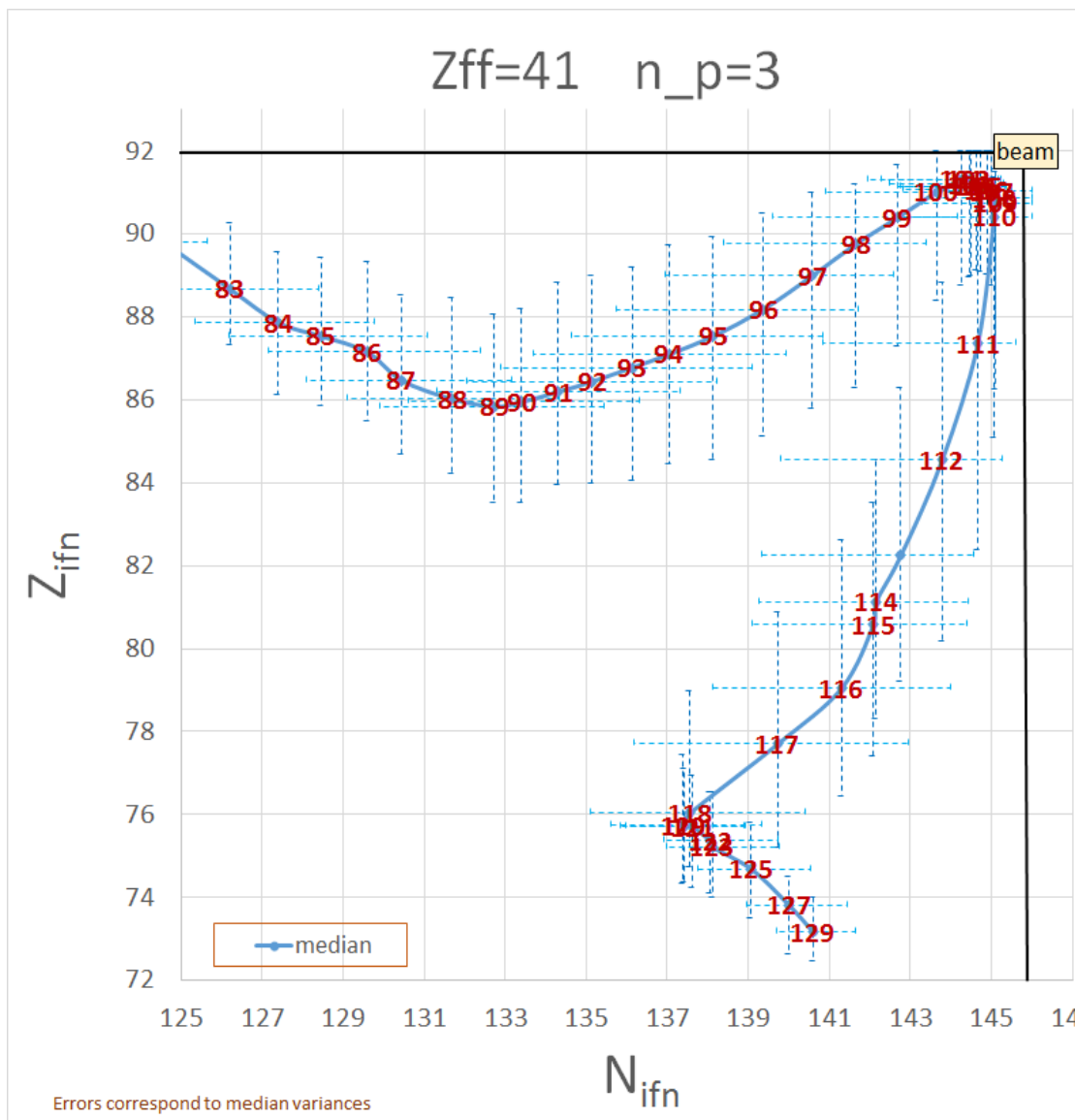


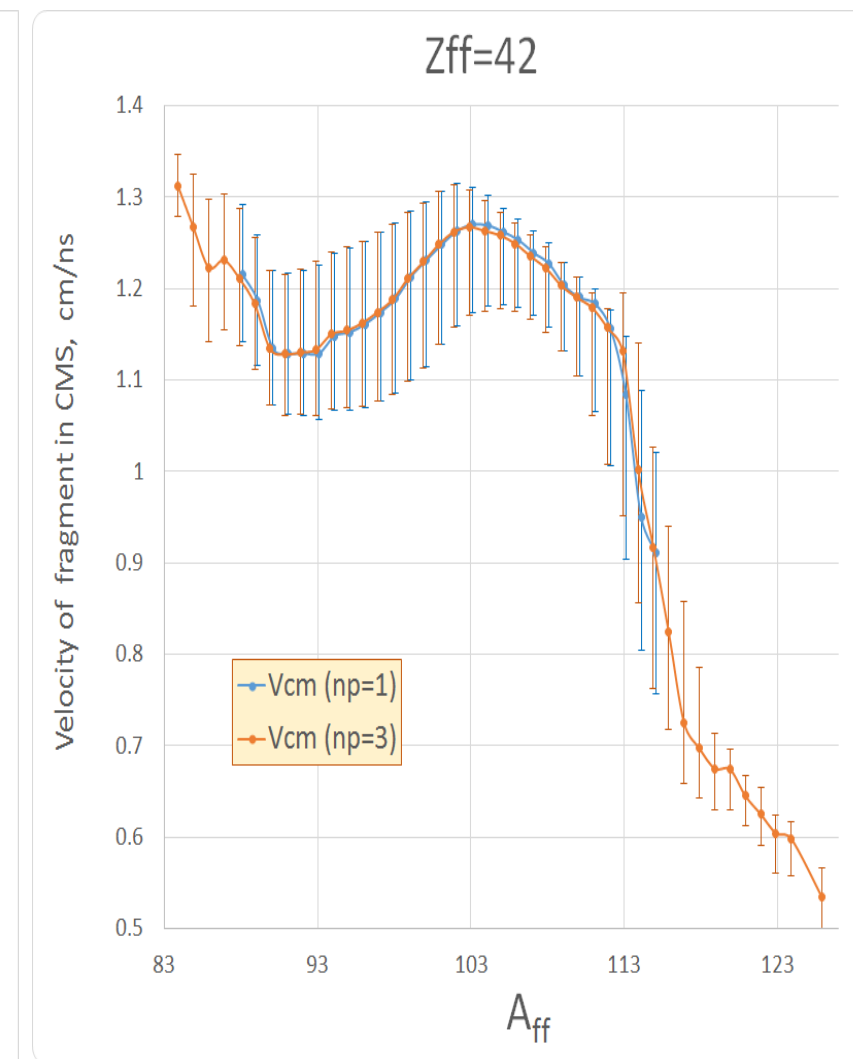
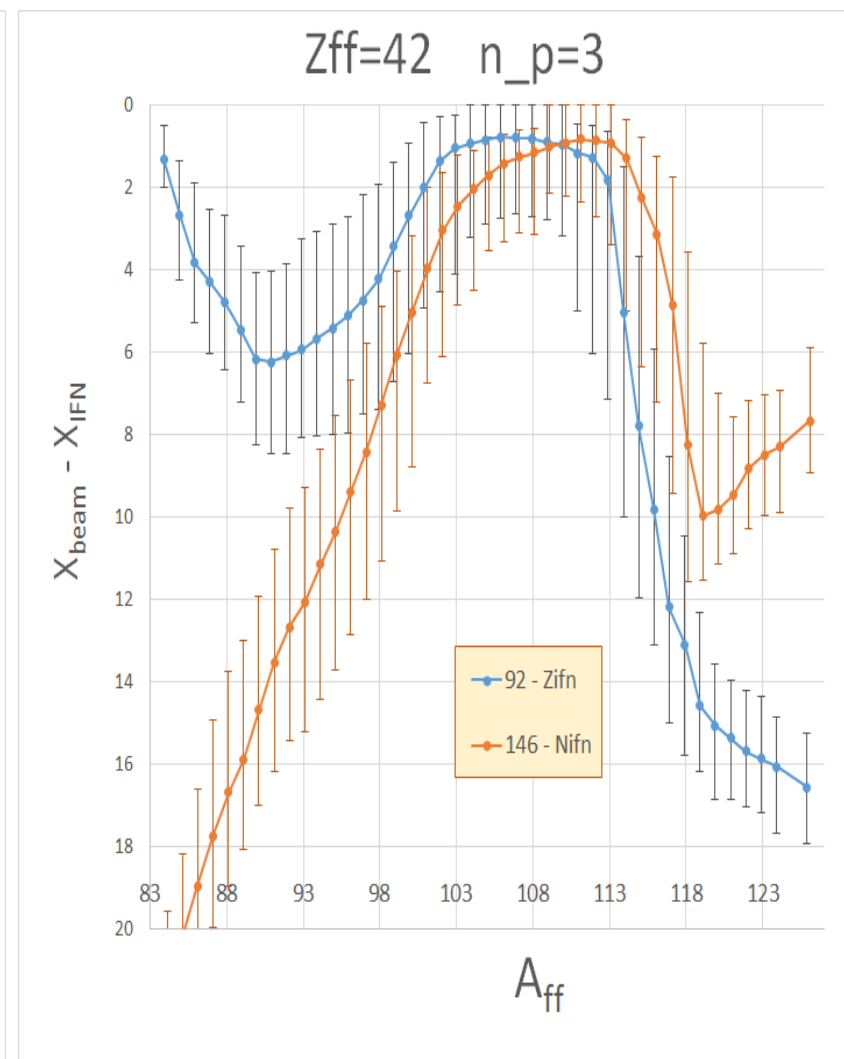
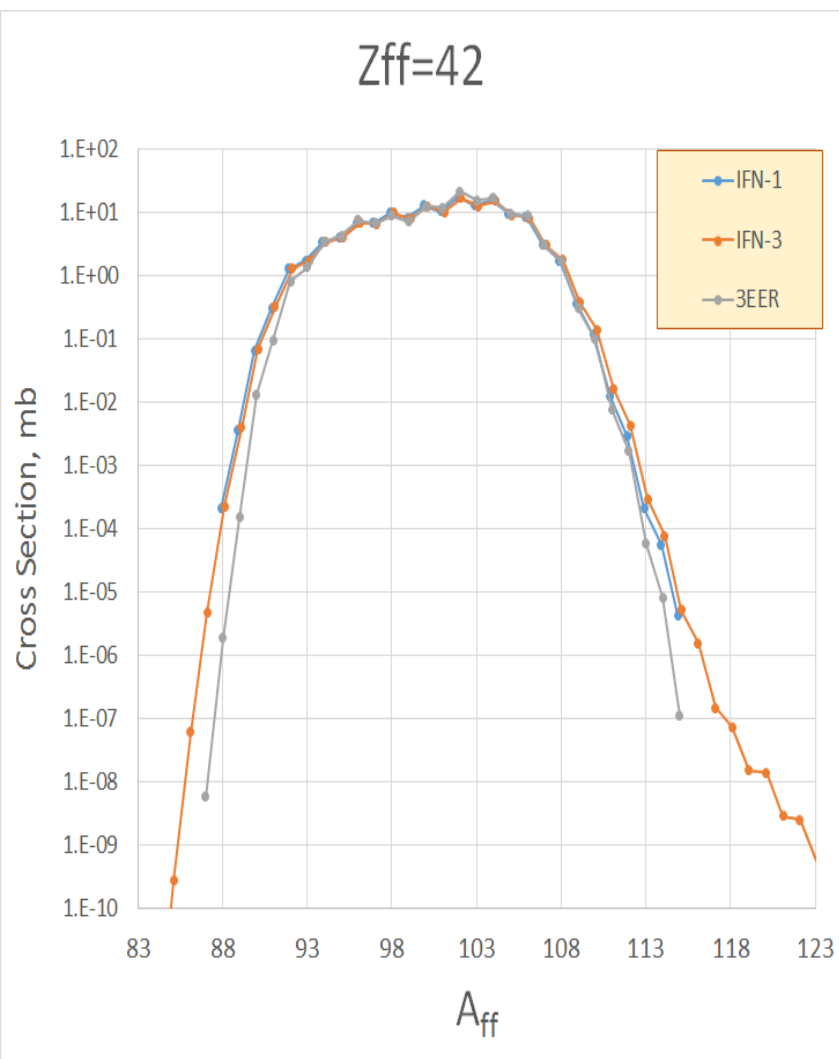


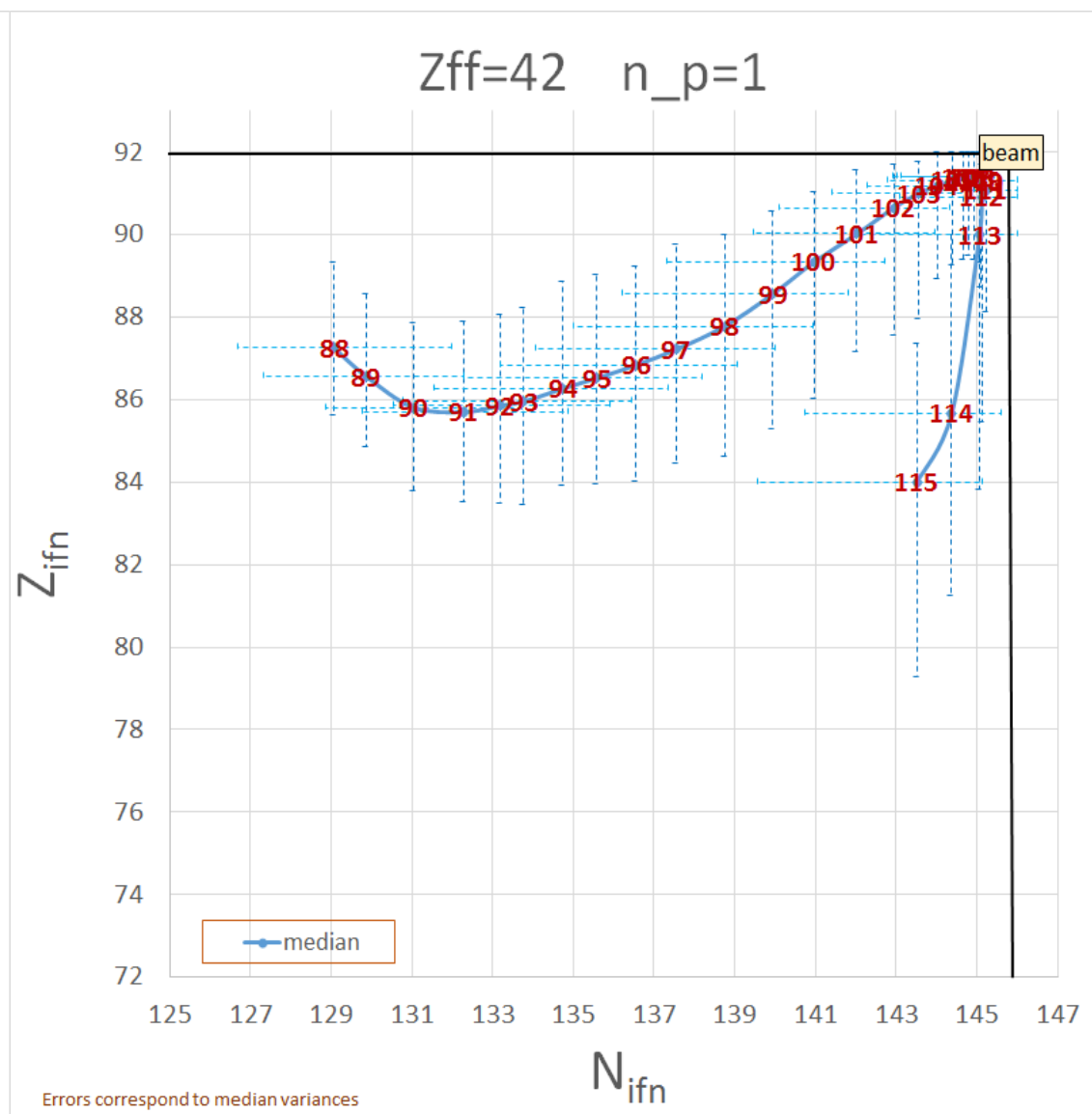
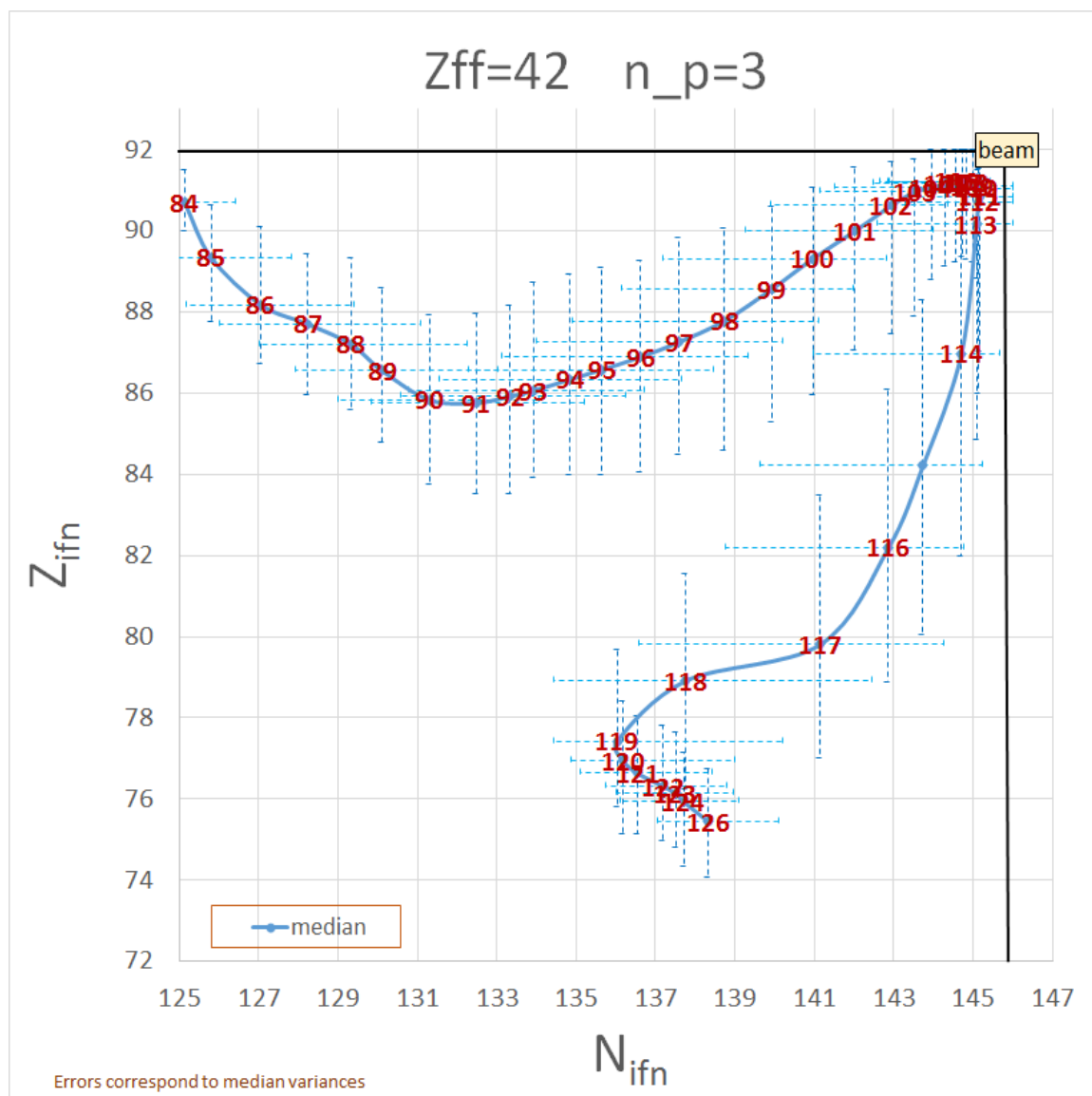




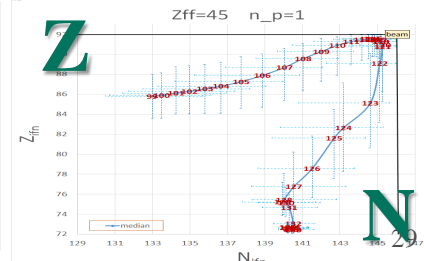
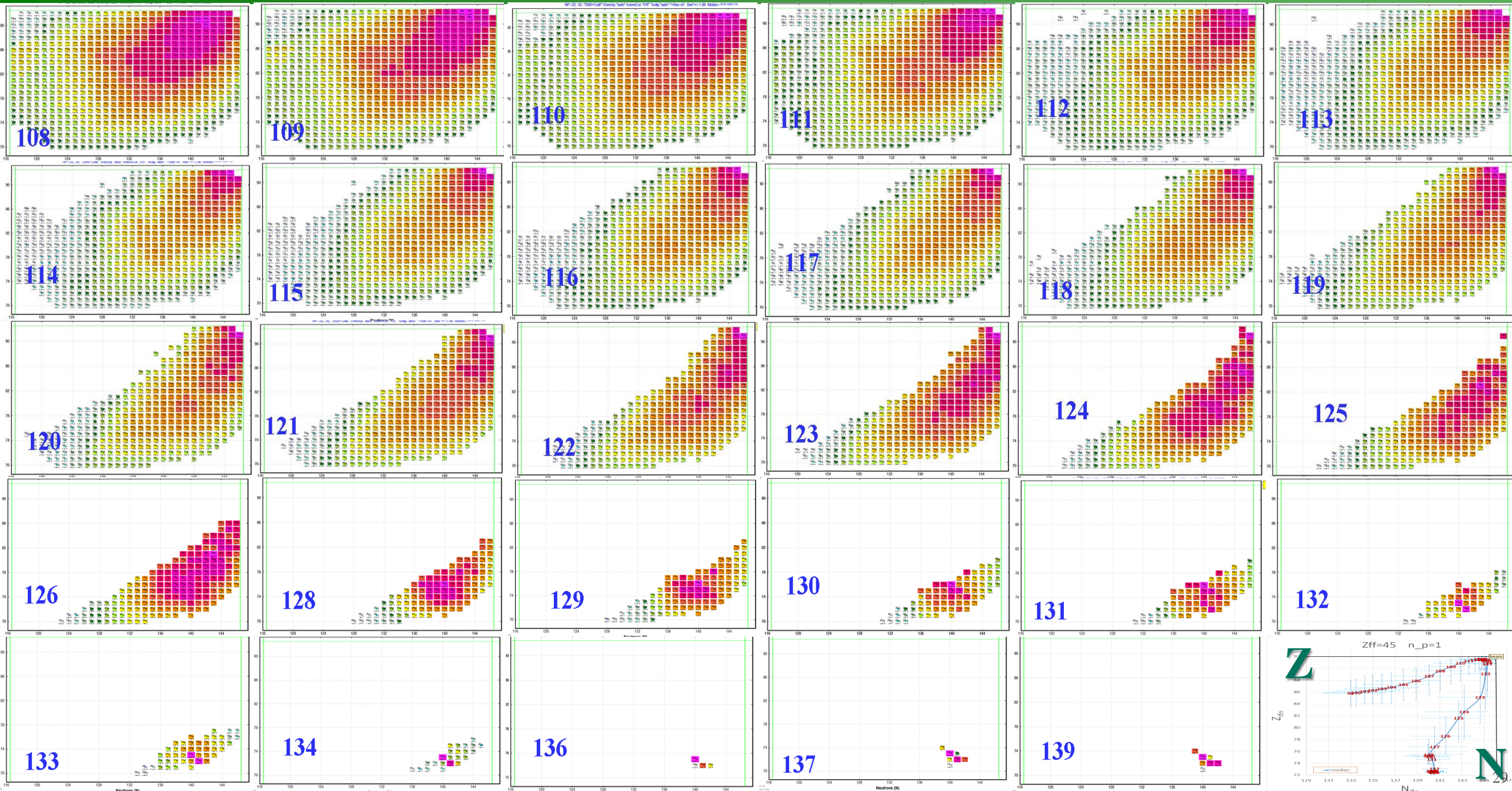


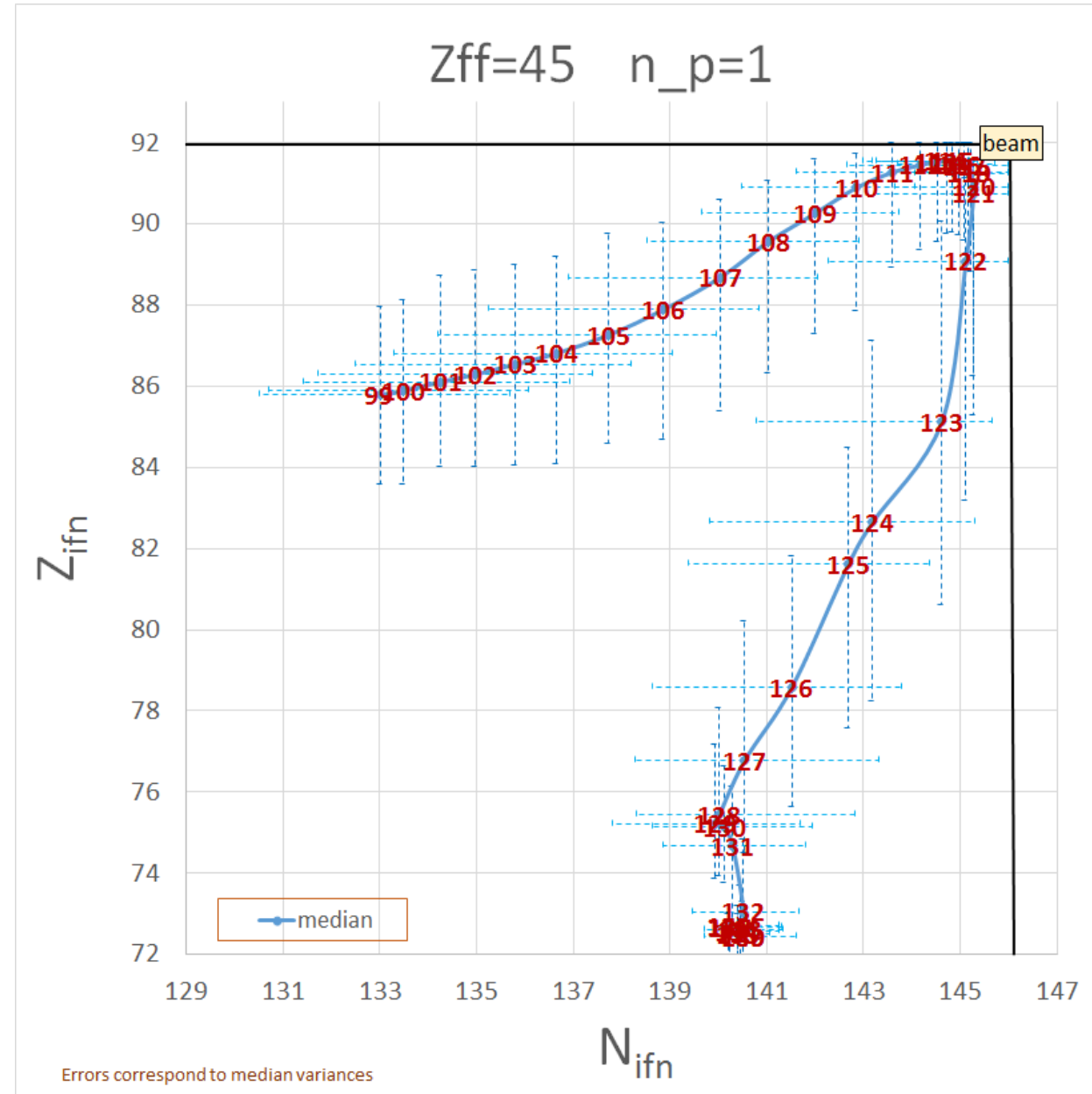
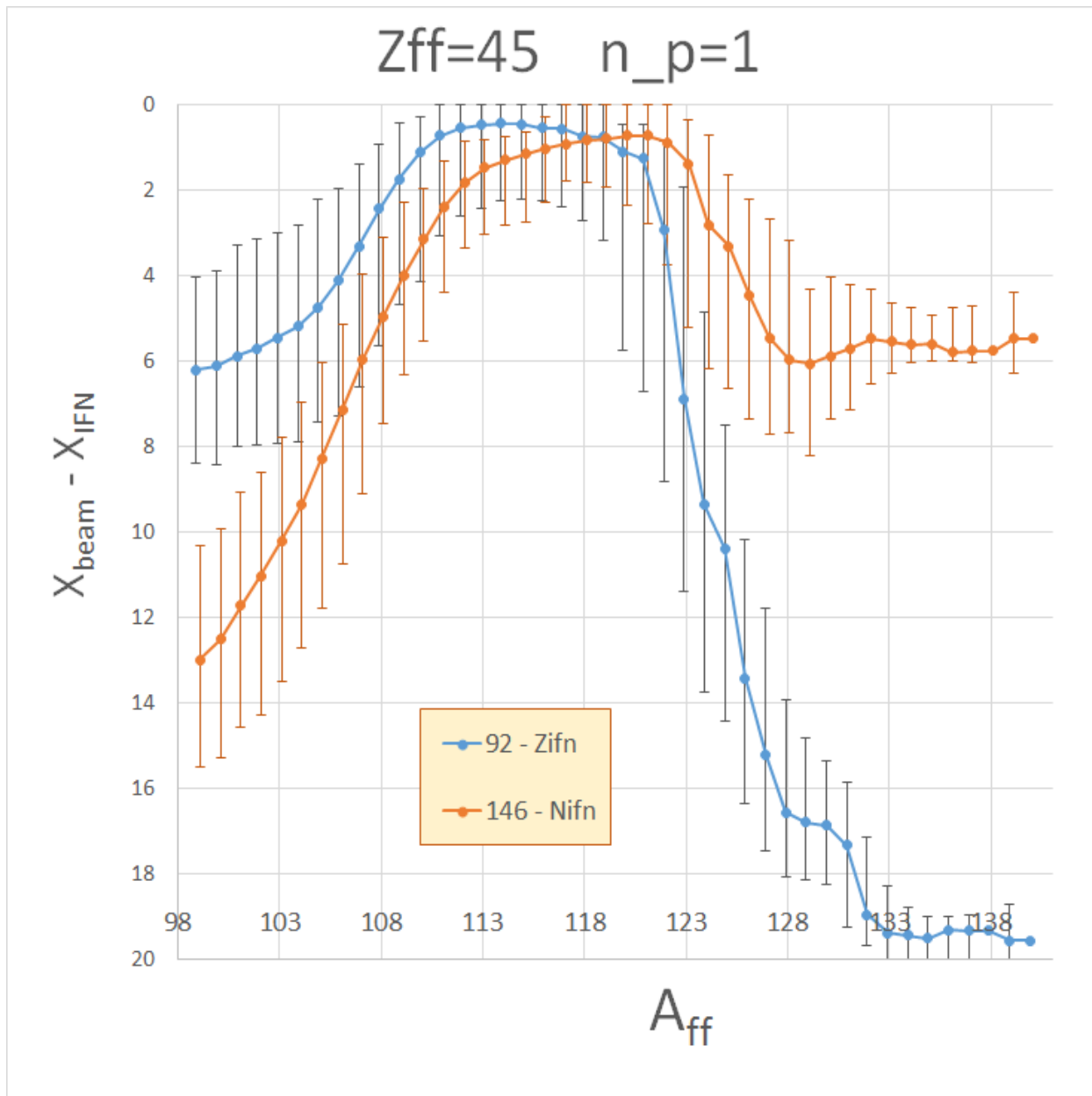


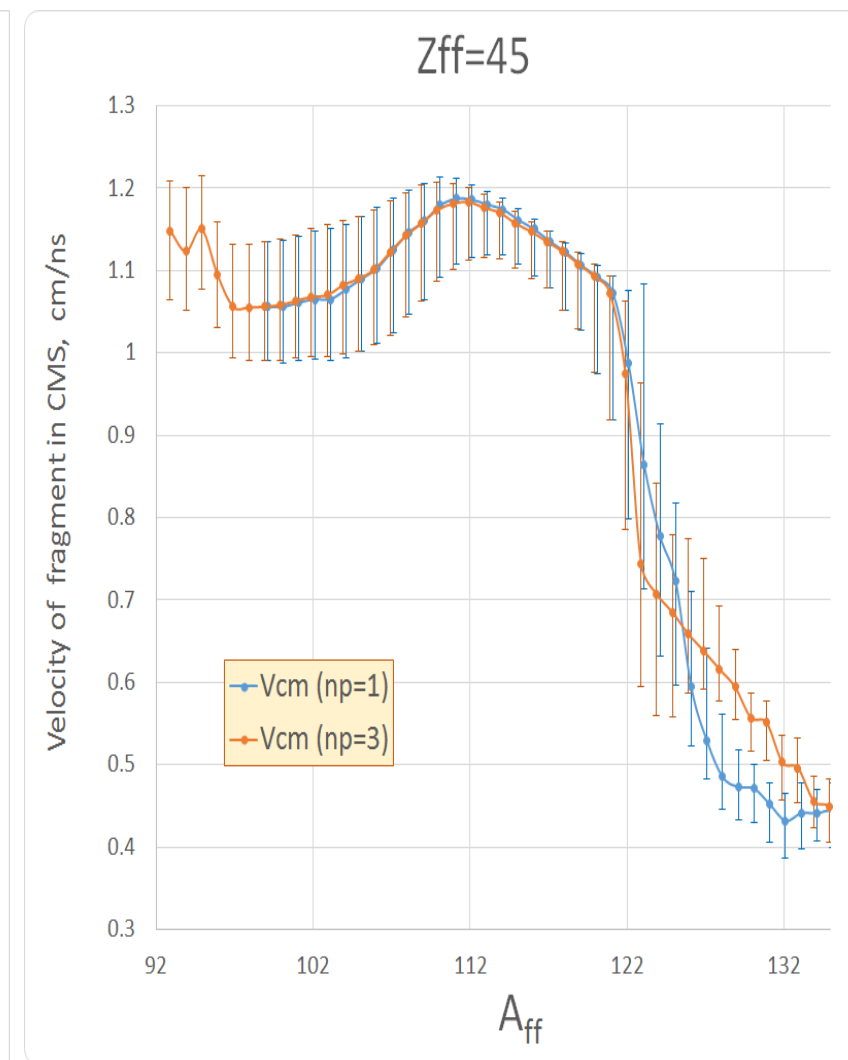
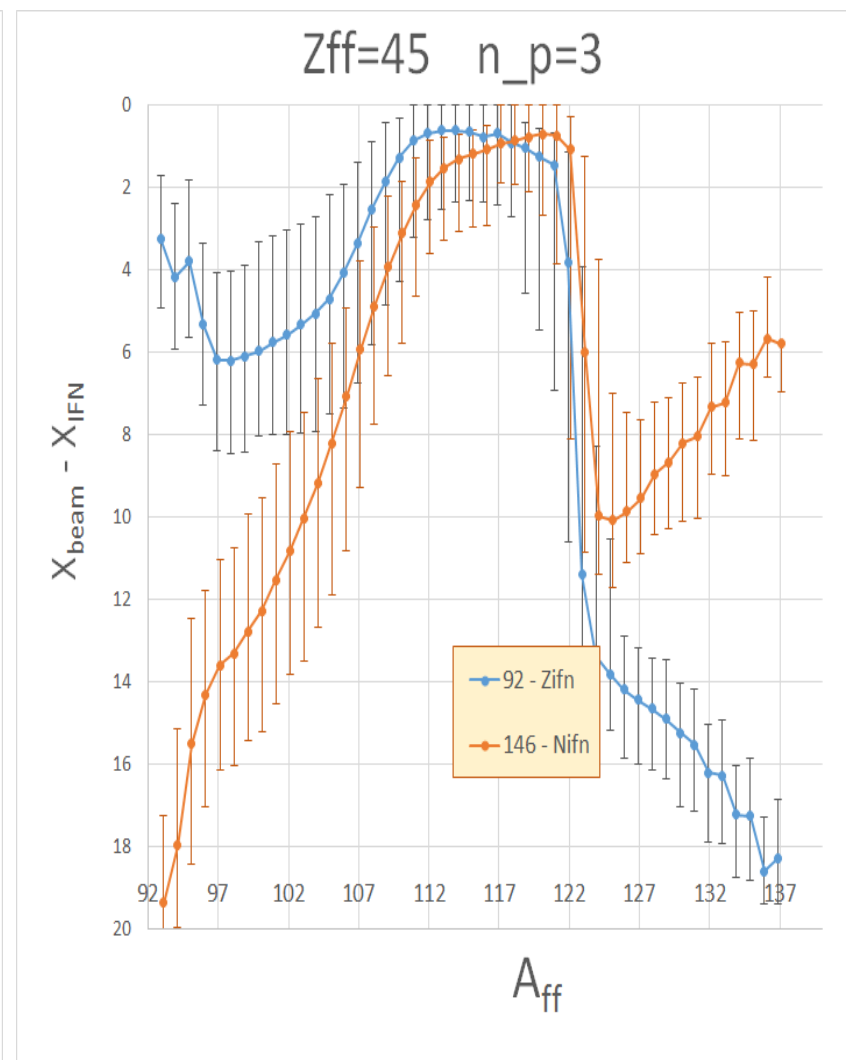
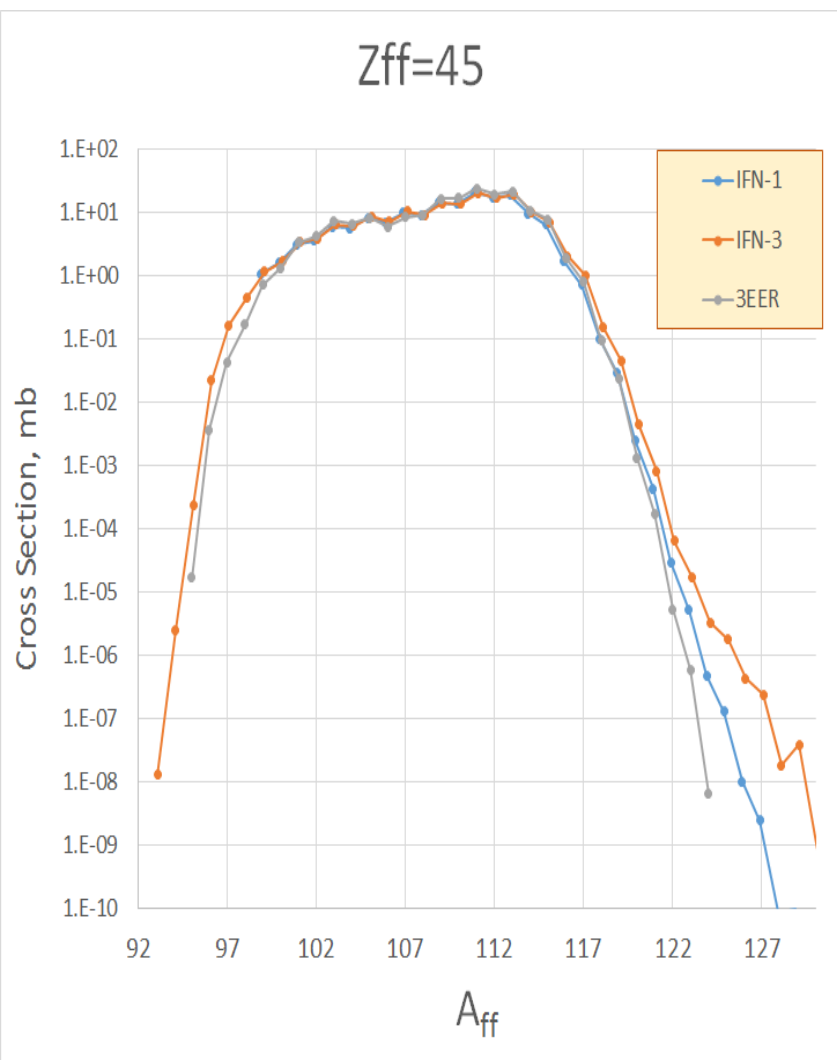


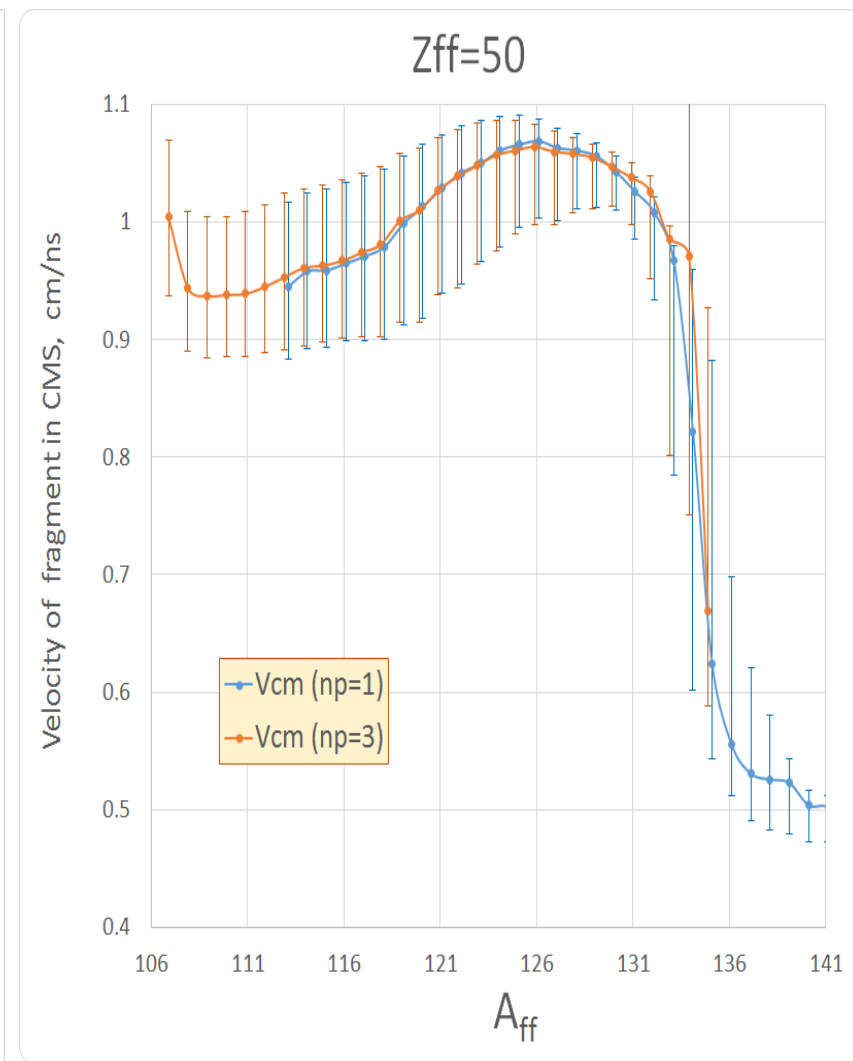
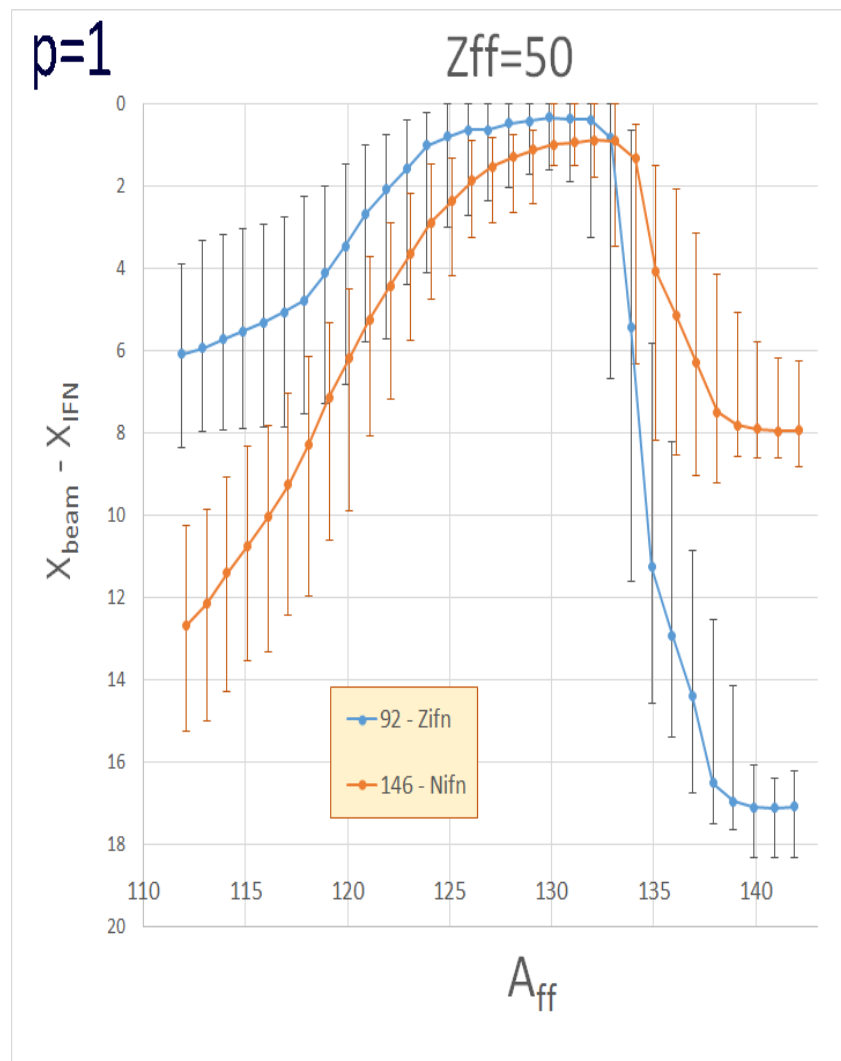
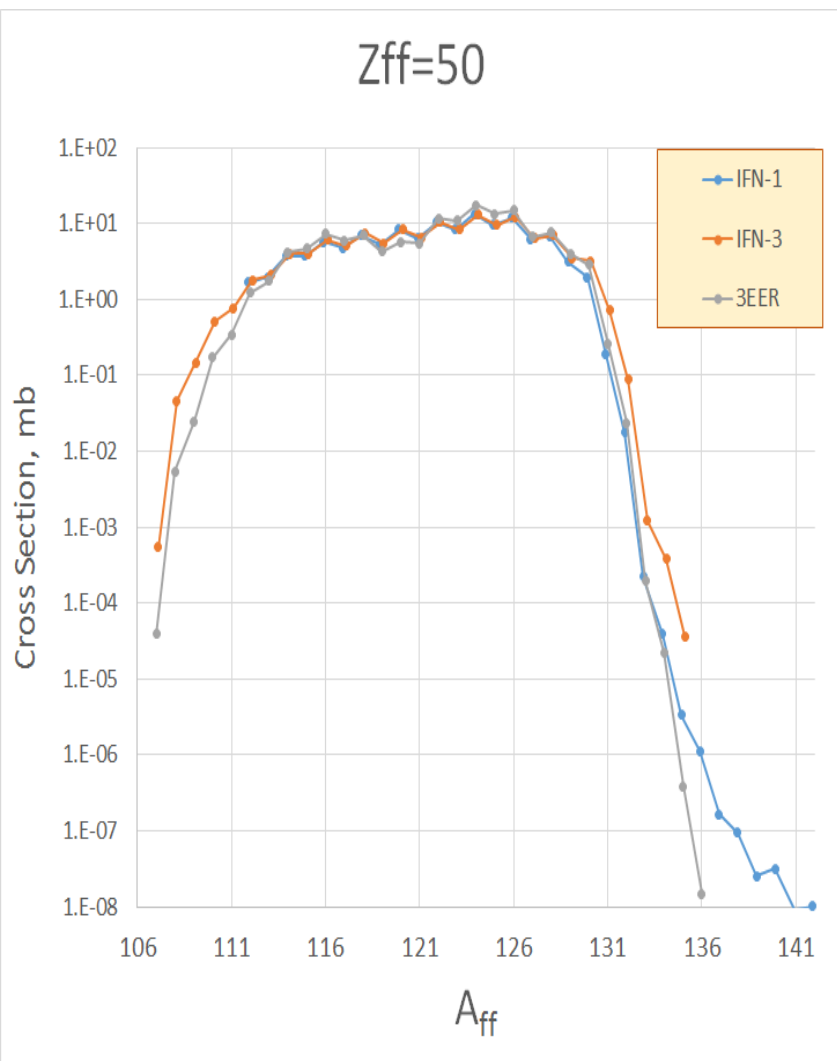


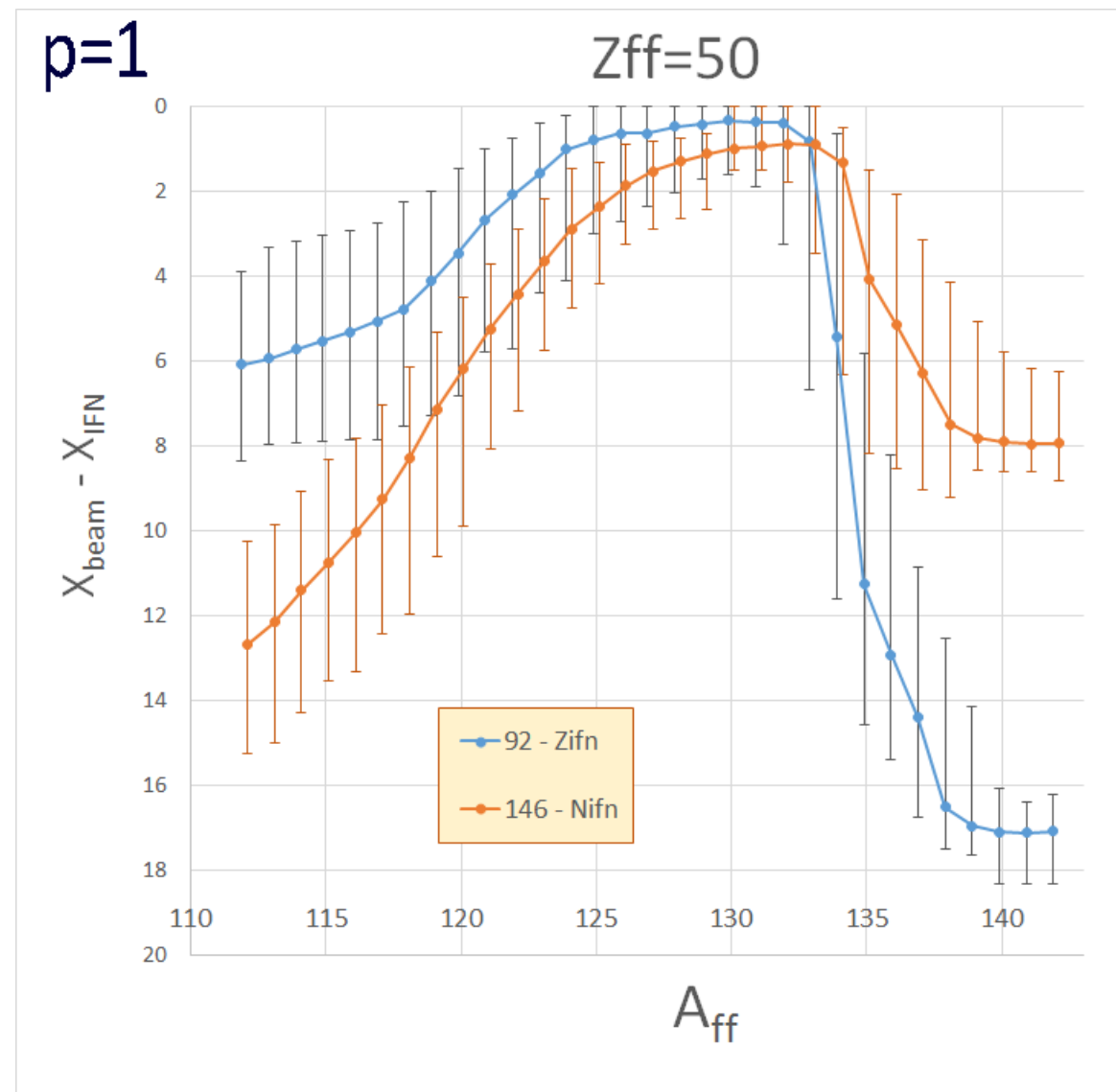
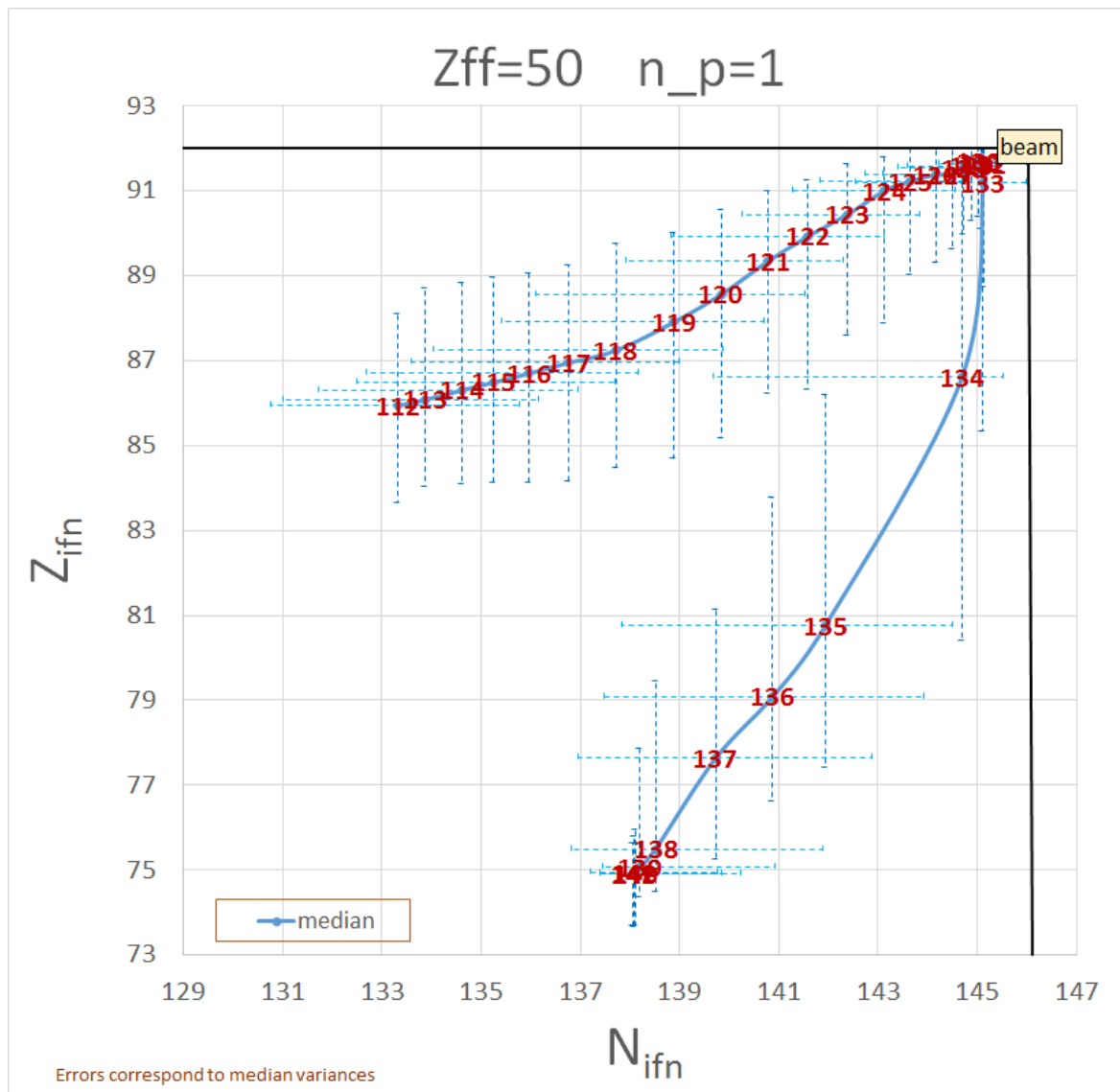
Initial Fissile Nuclei (IFN) for final Rh-isotopes (Z=45)

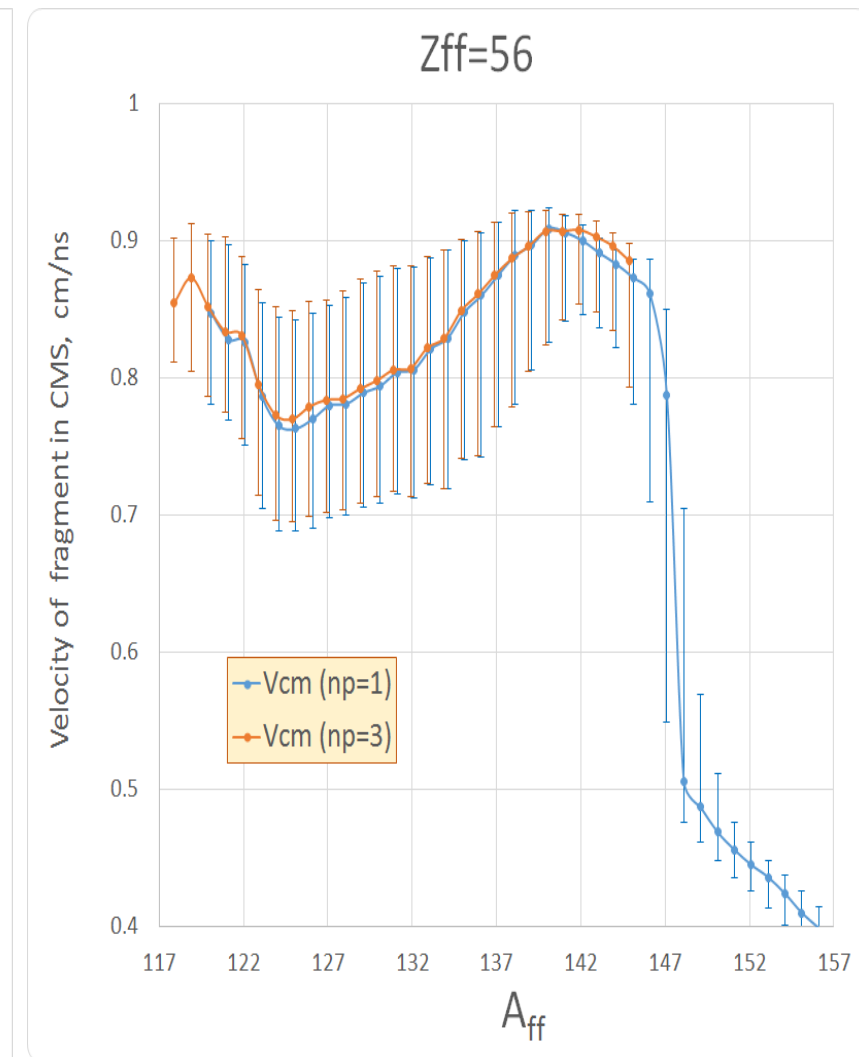
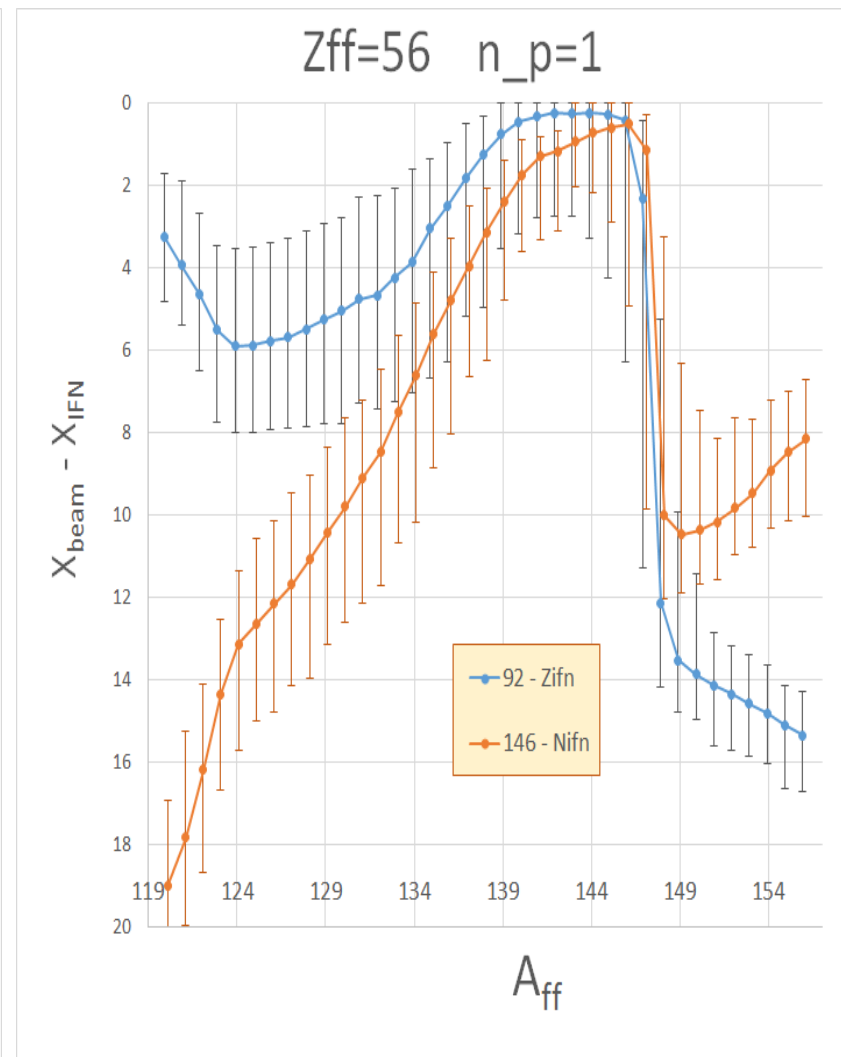
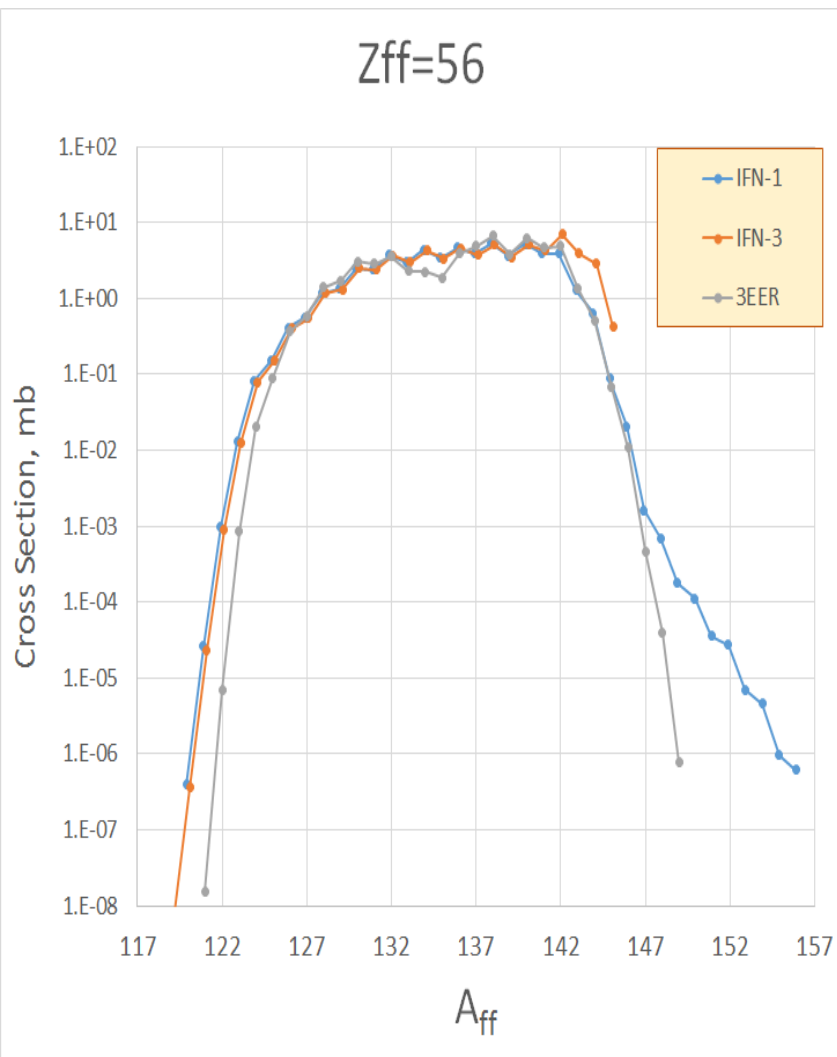


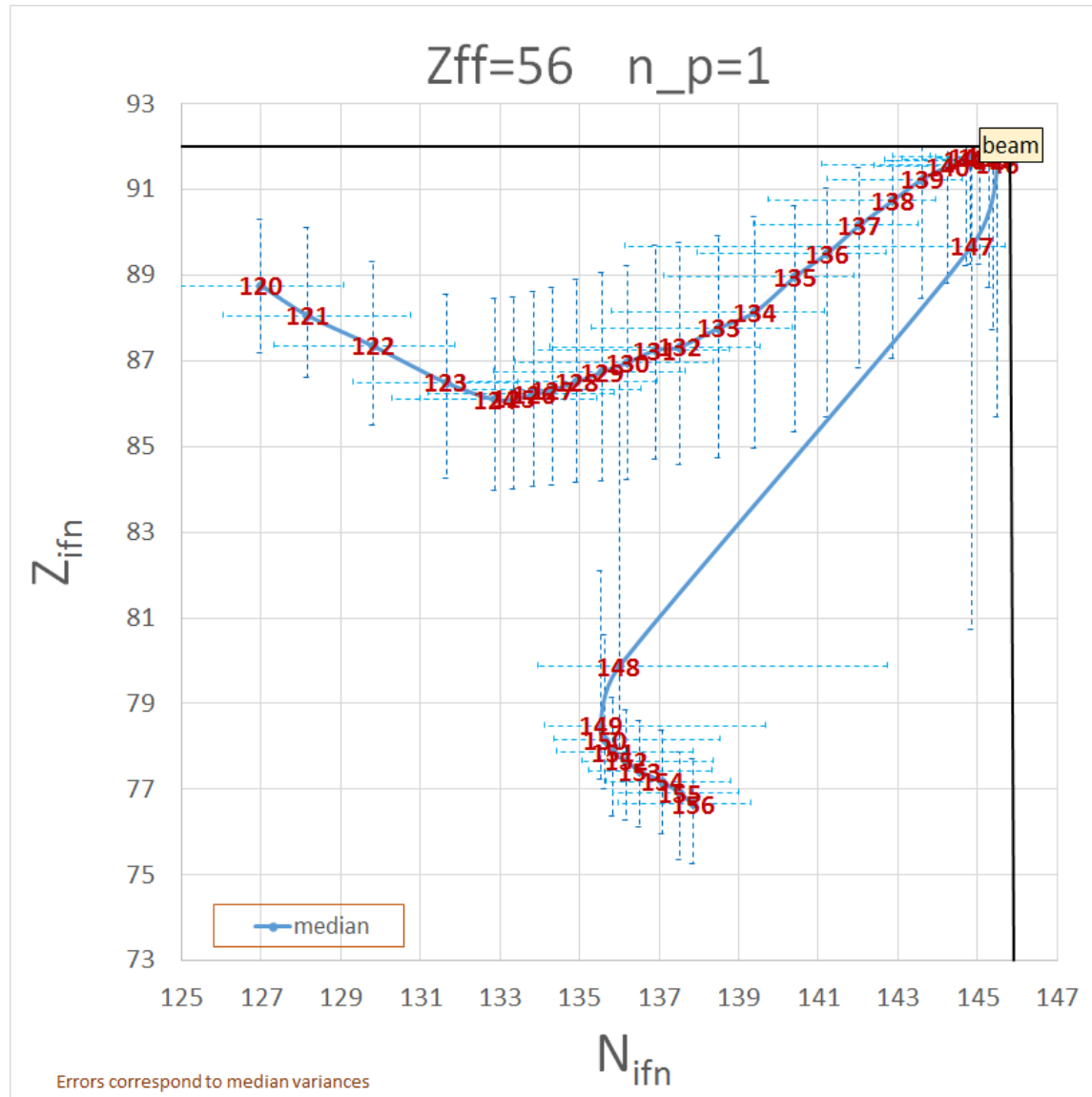


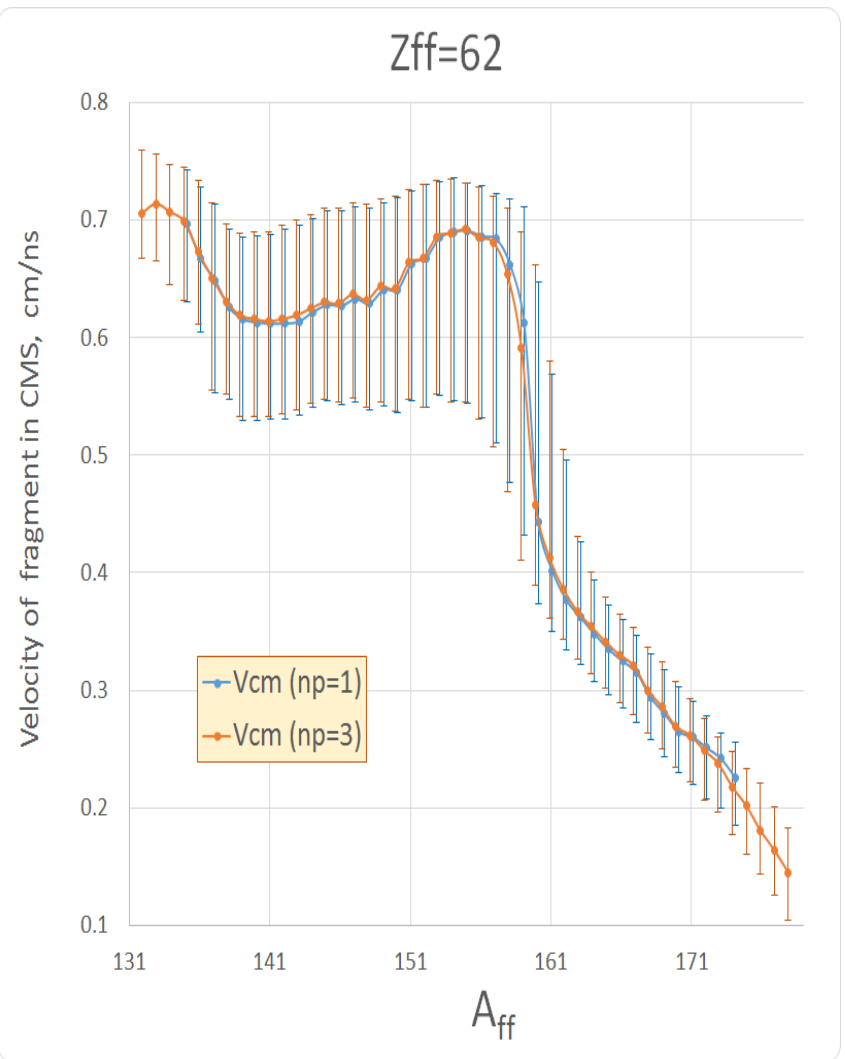
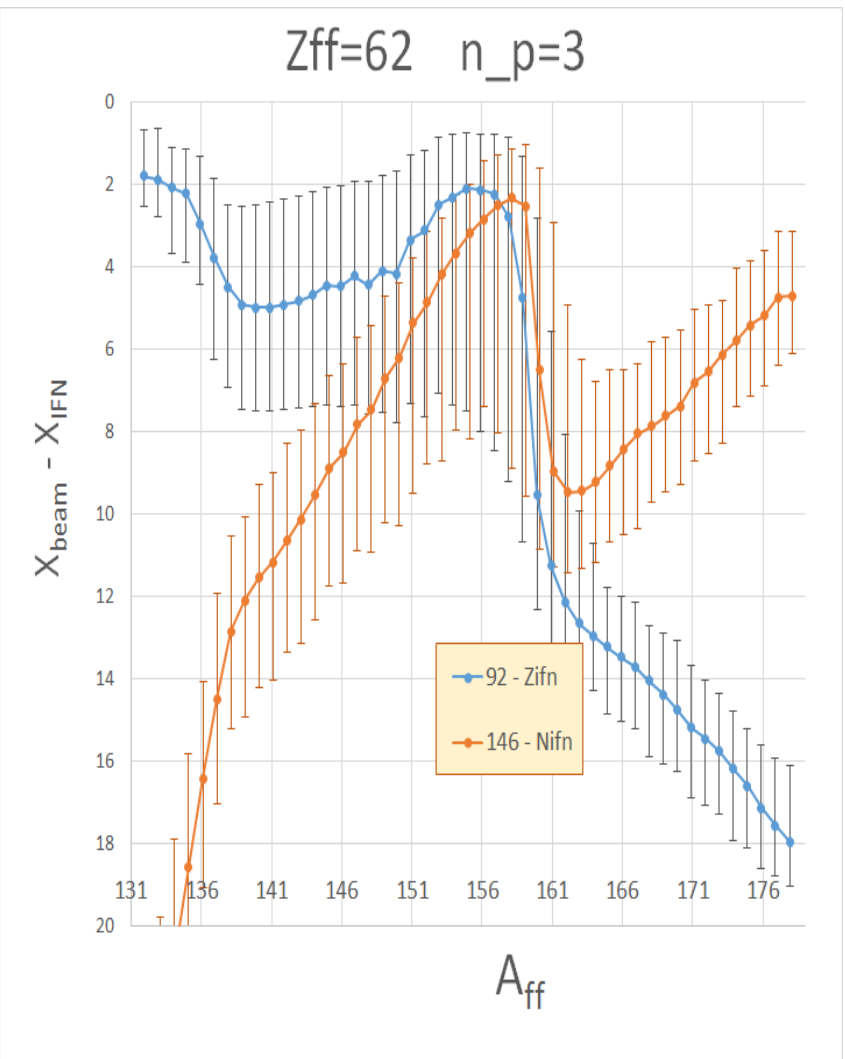
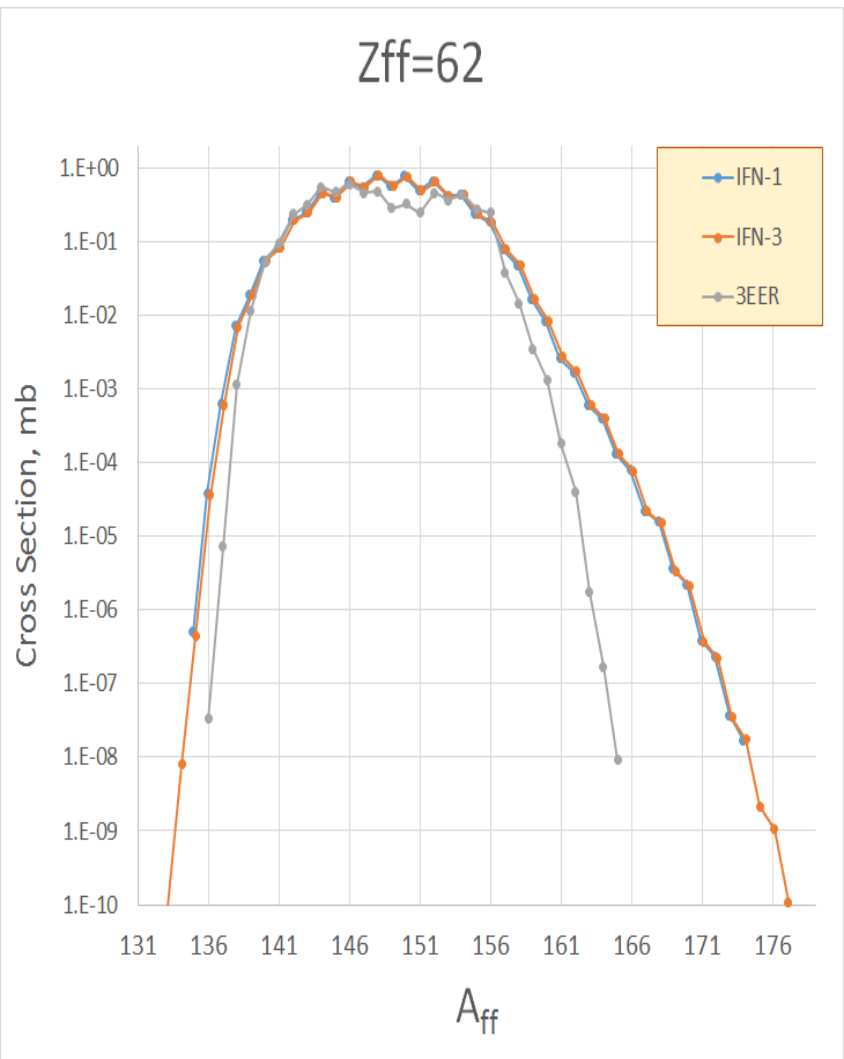


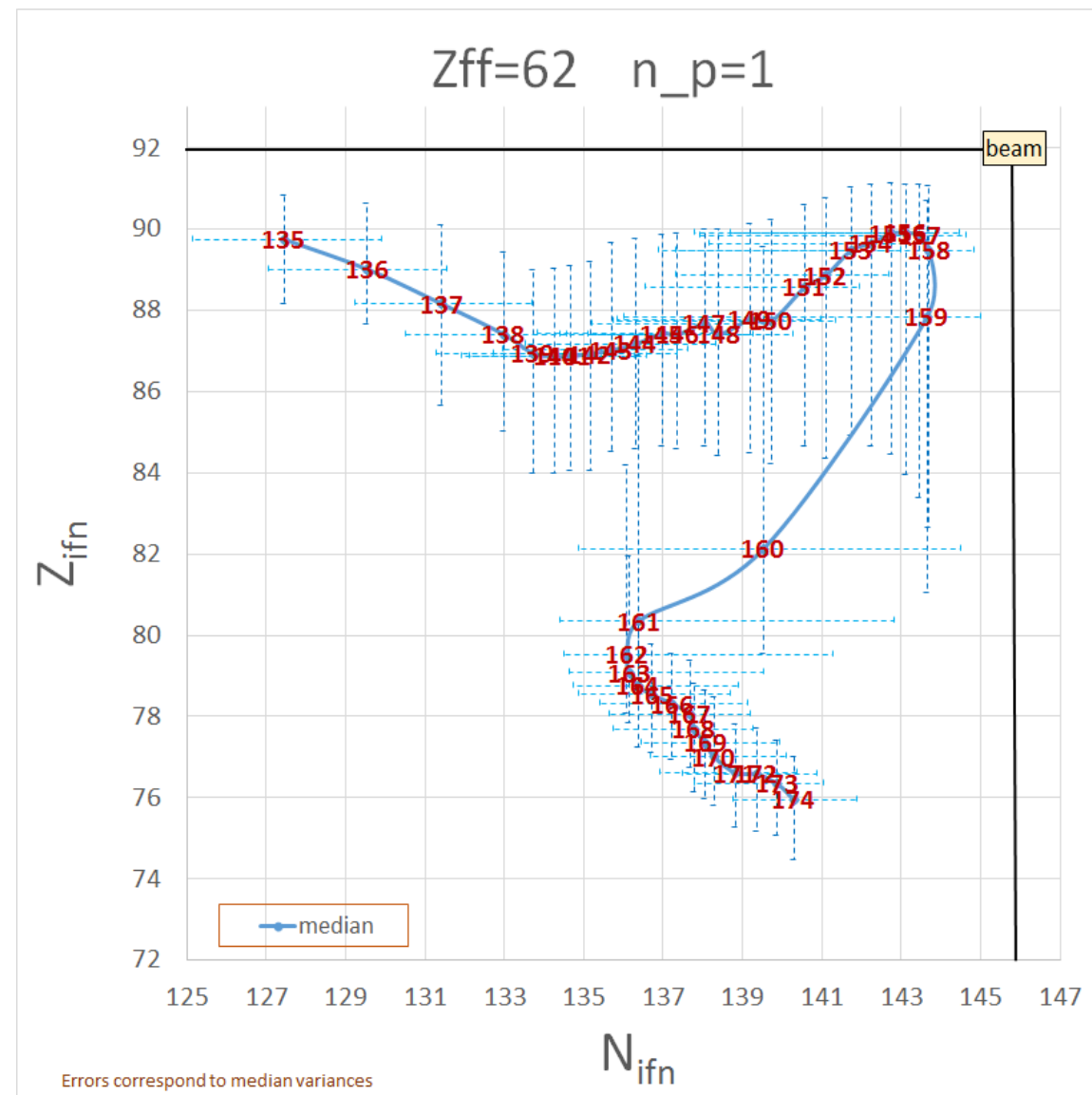
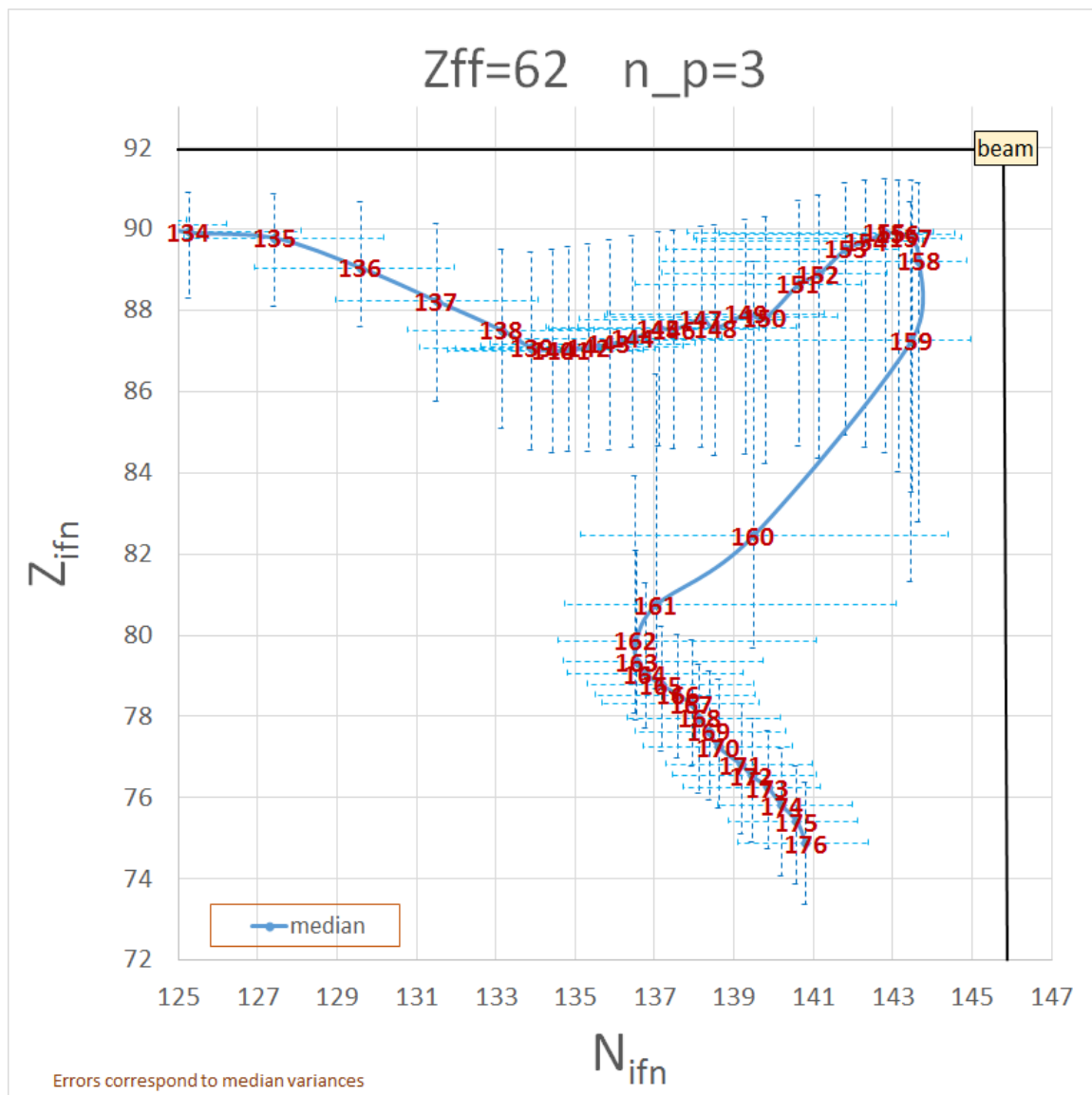


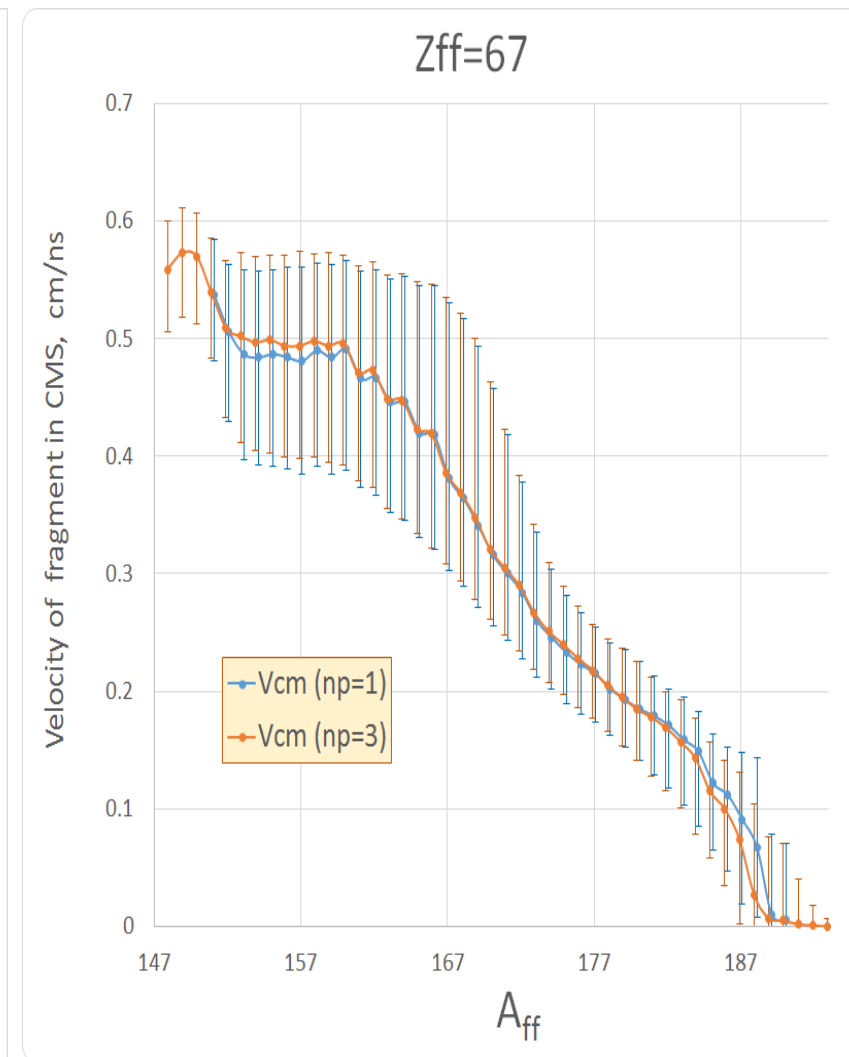
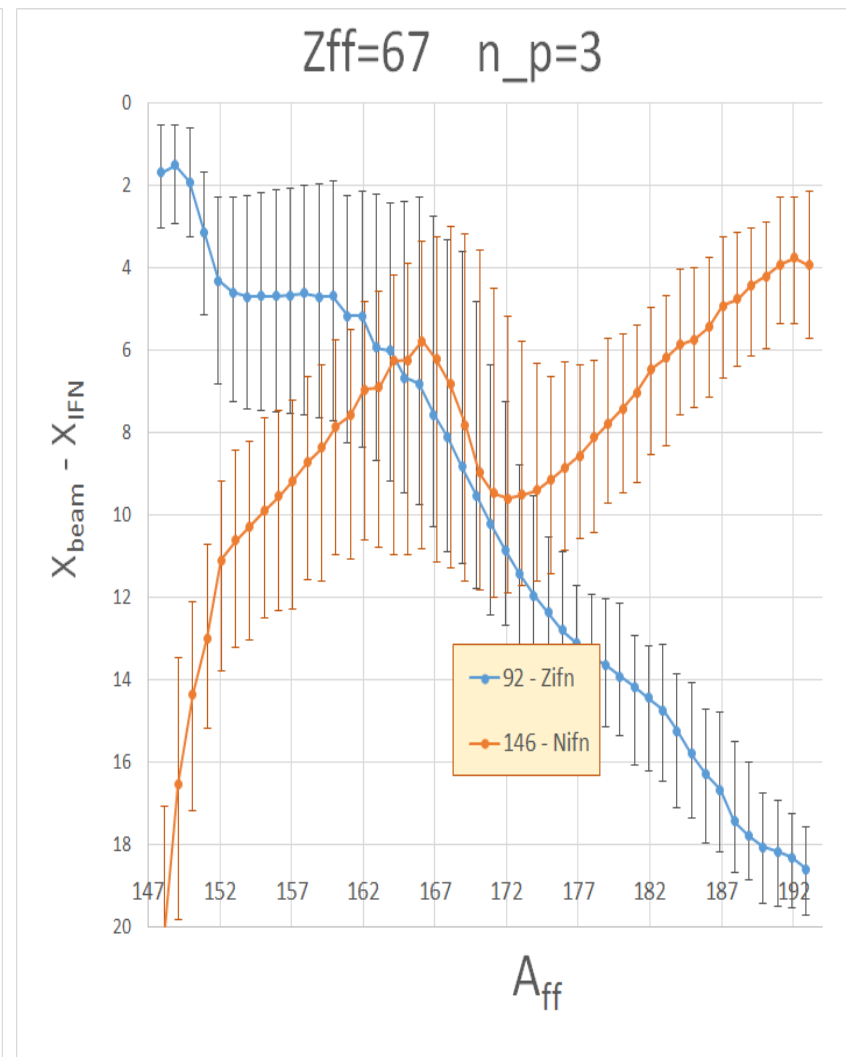
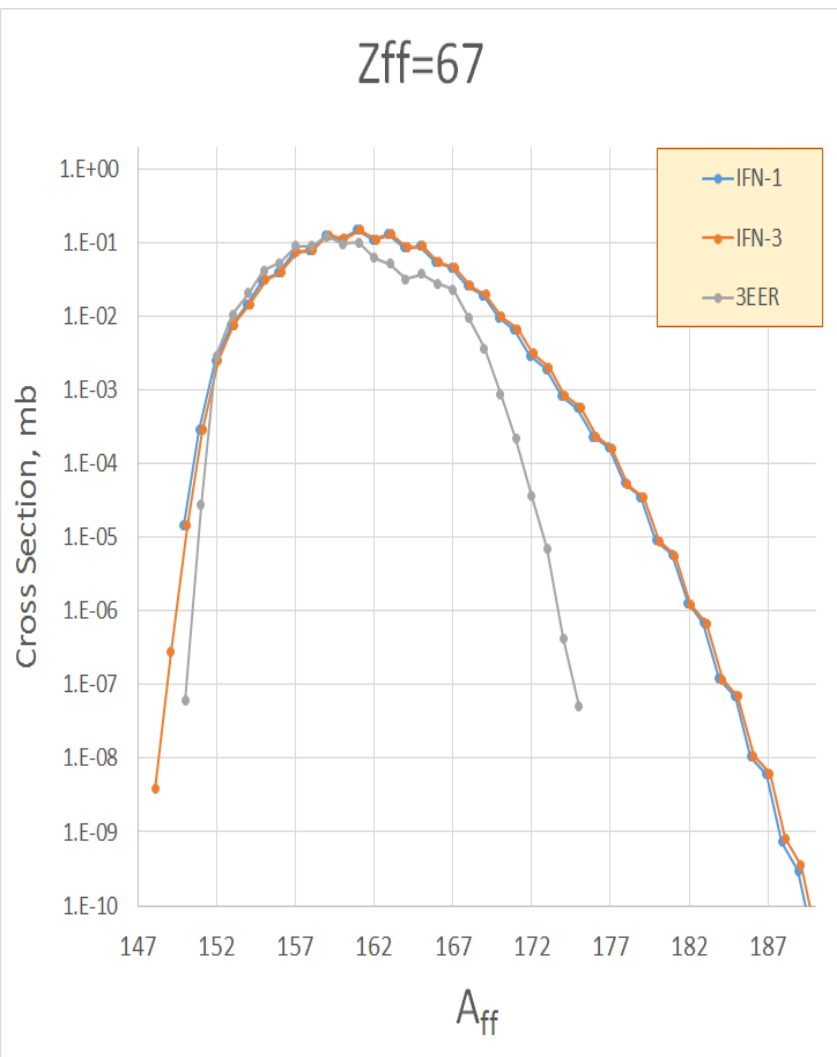


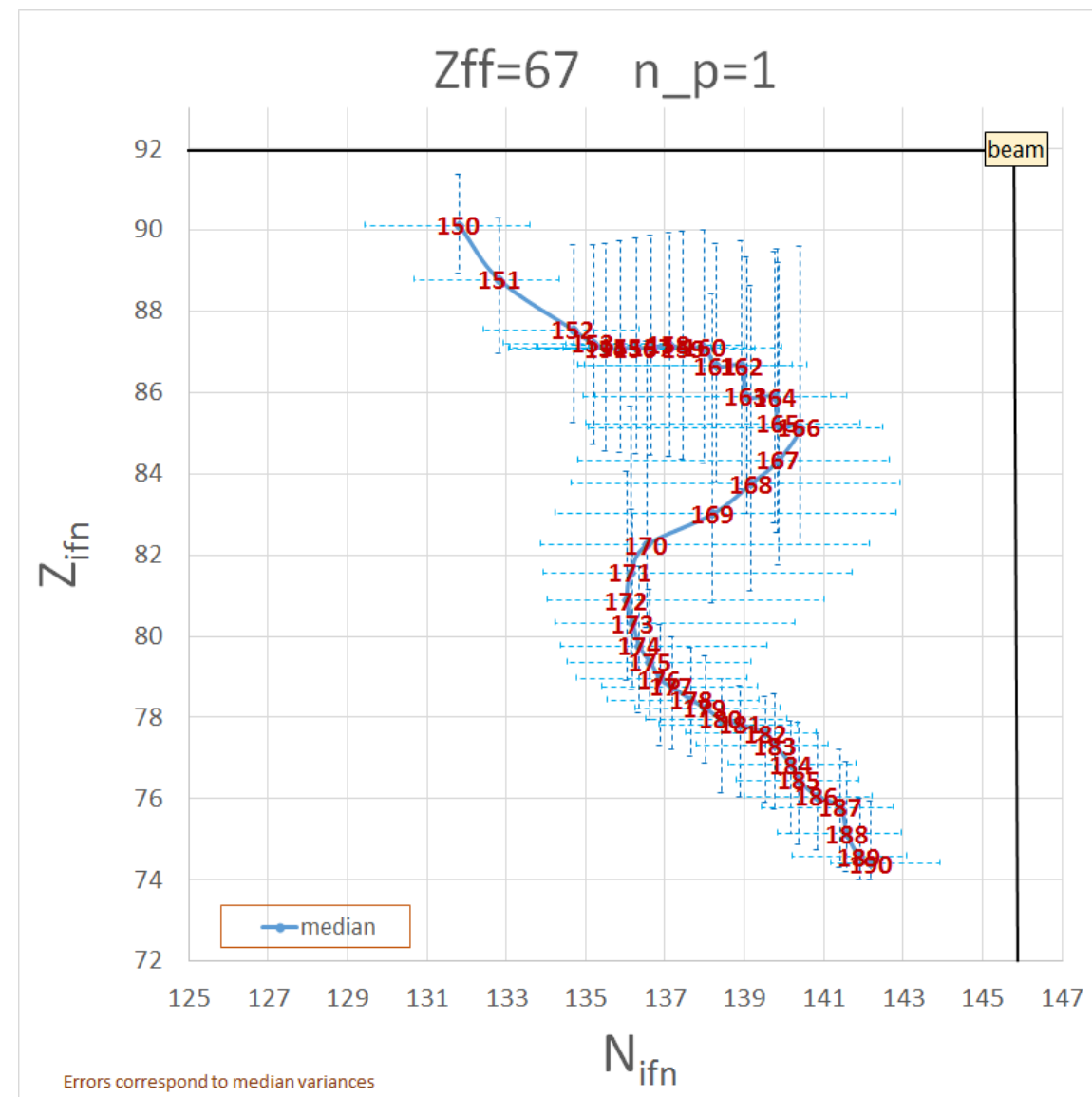
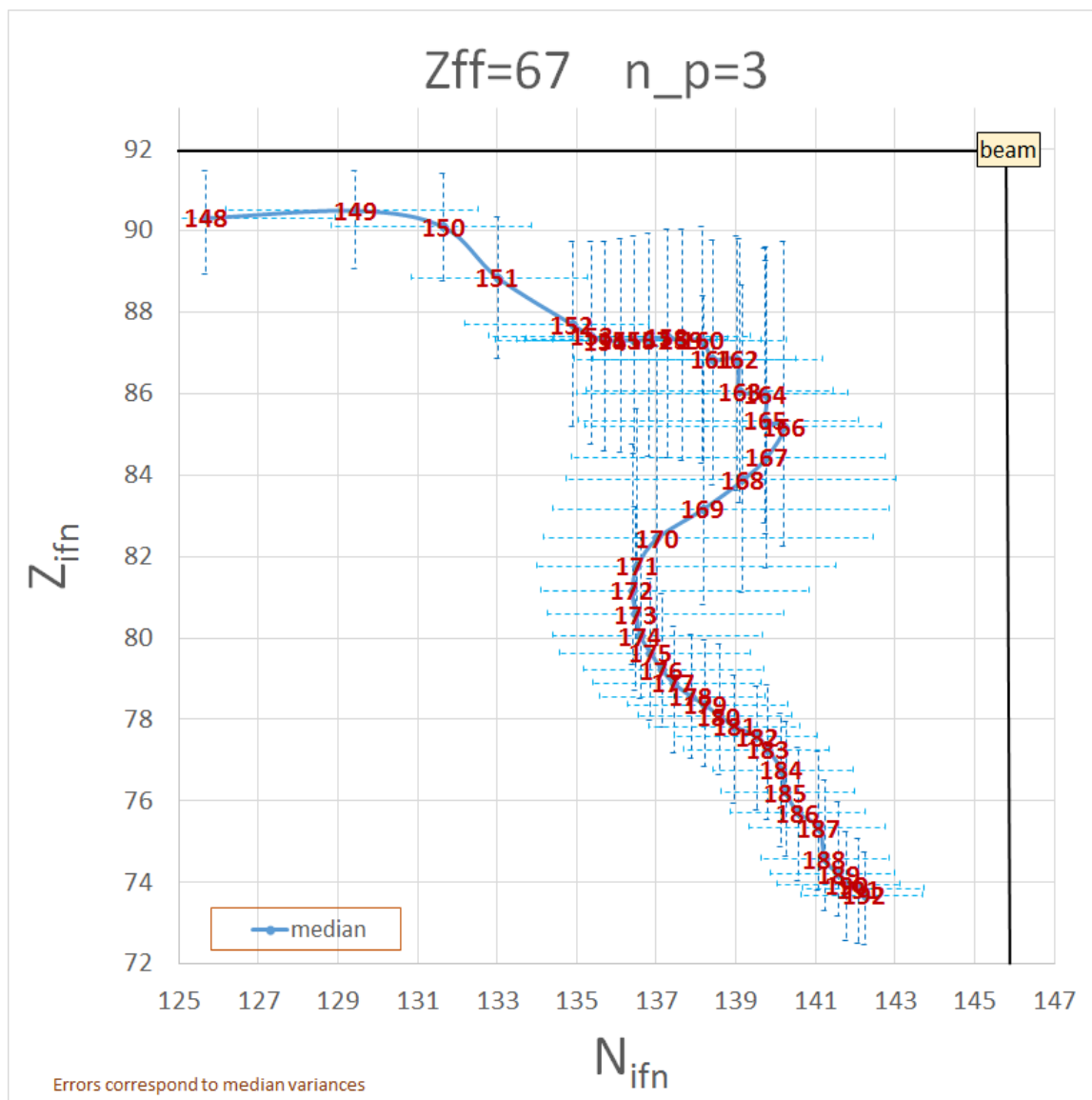


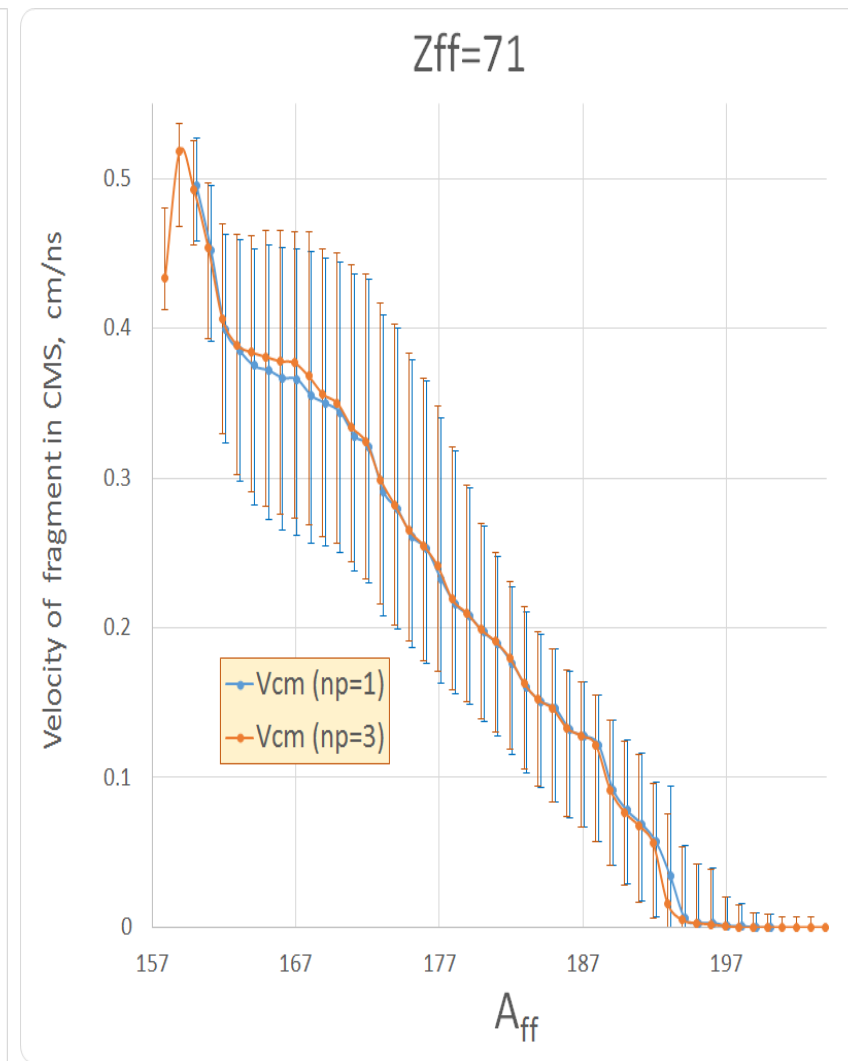
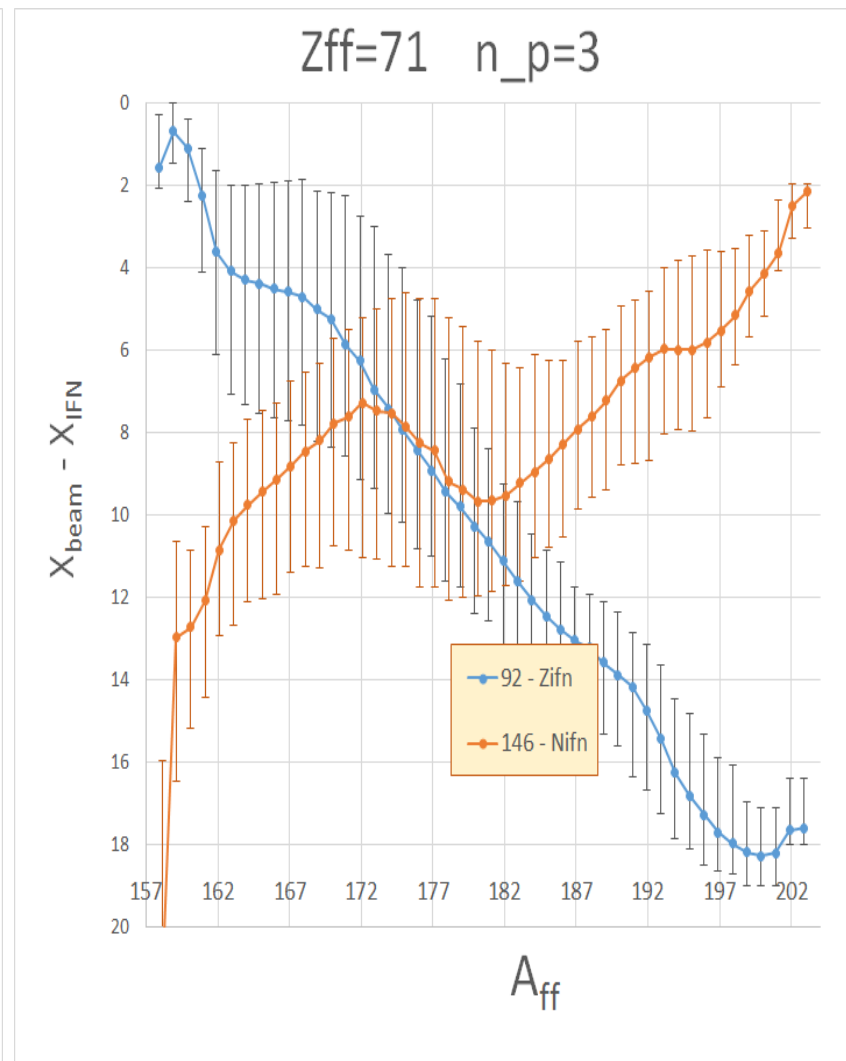
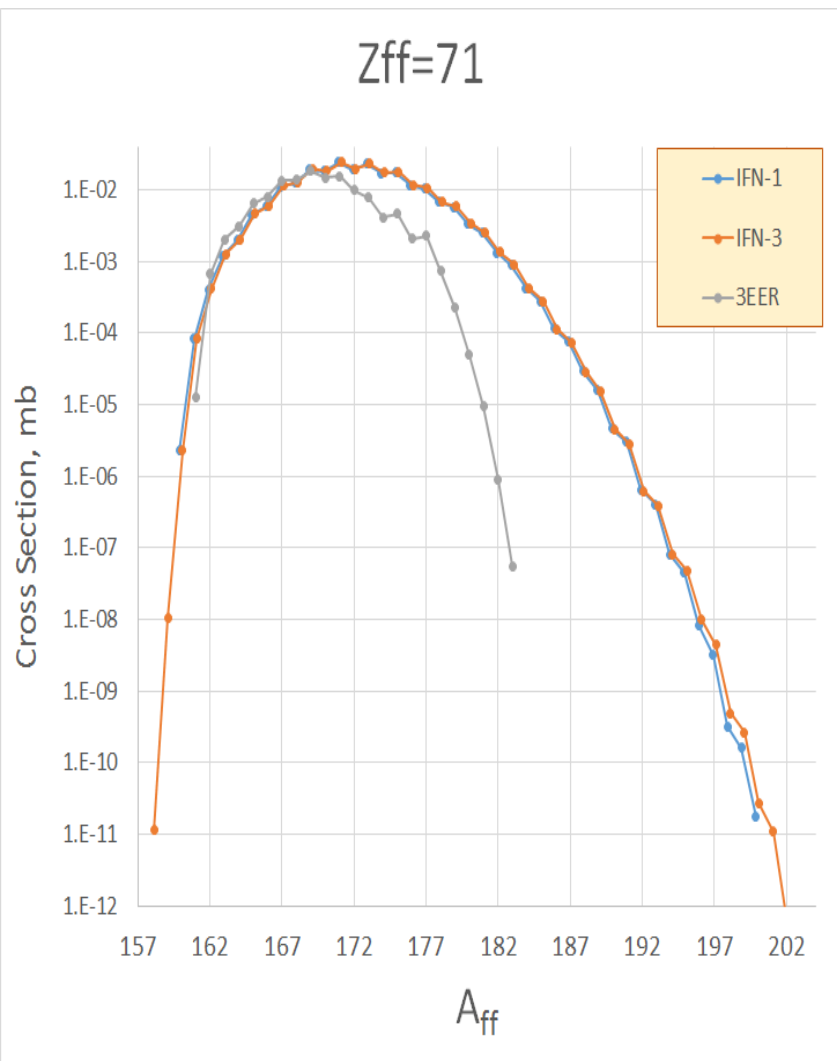


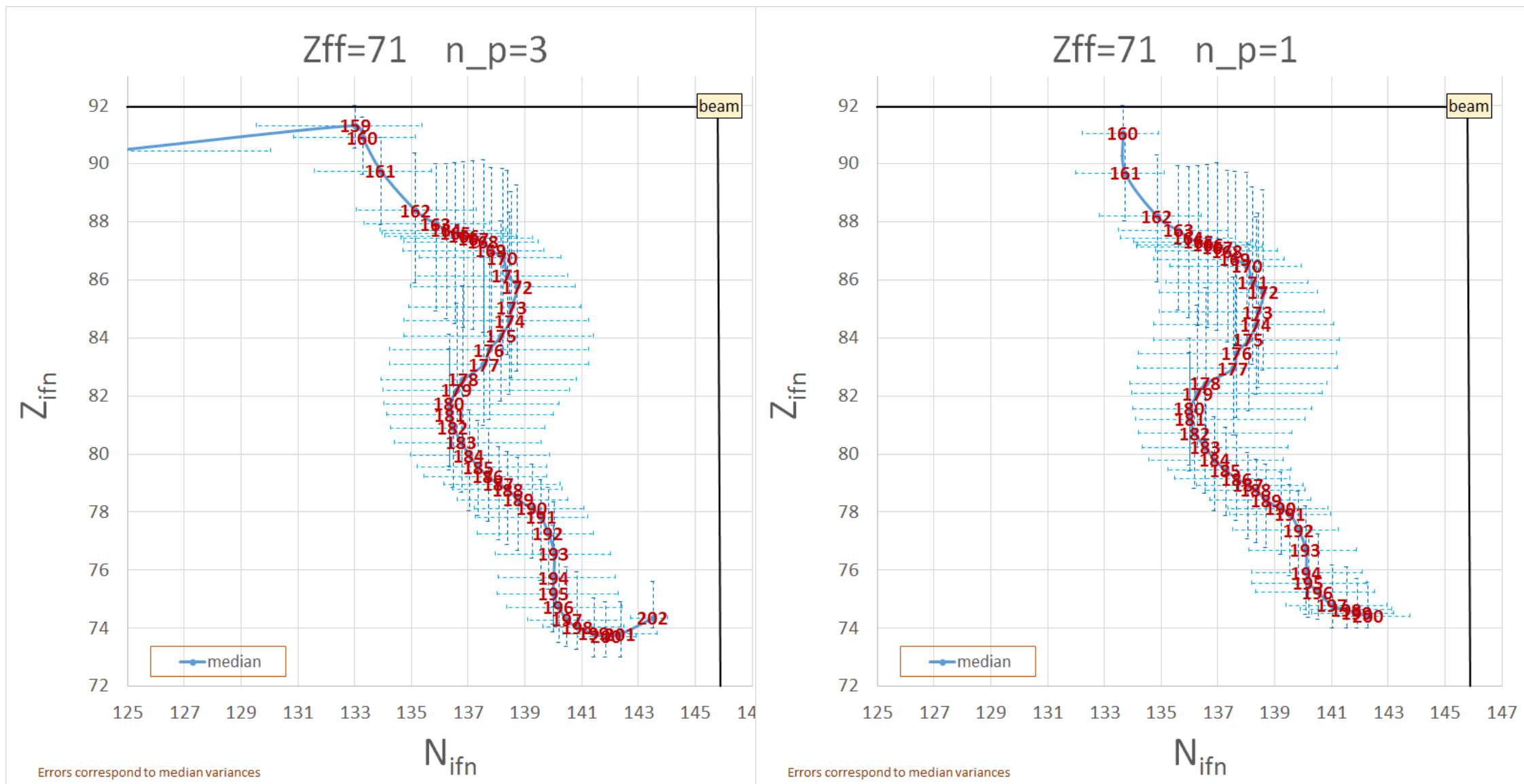


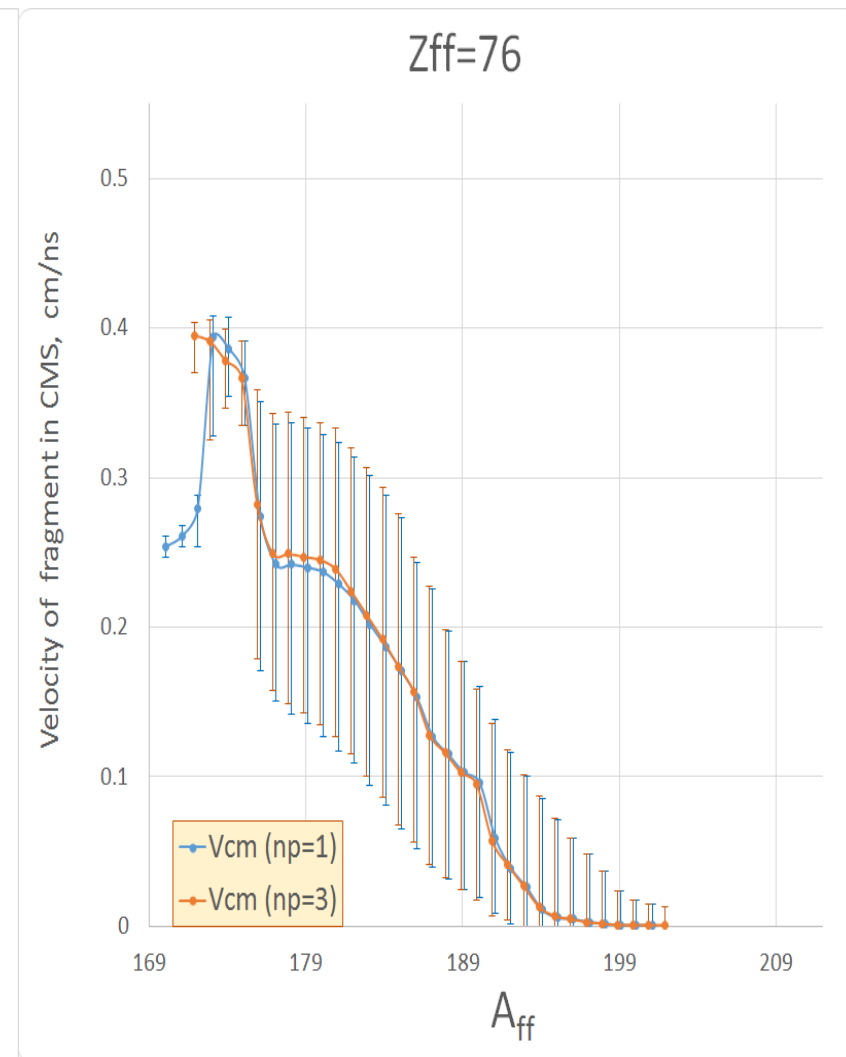
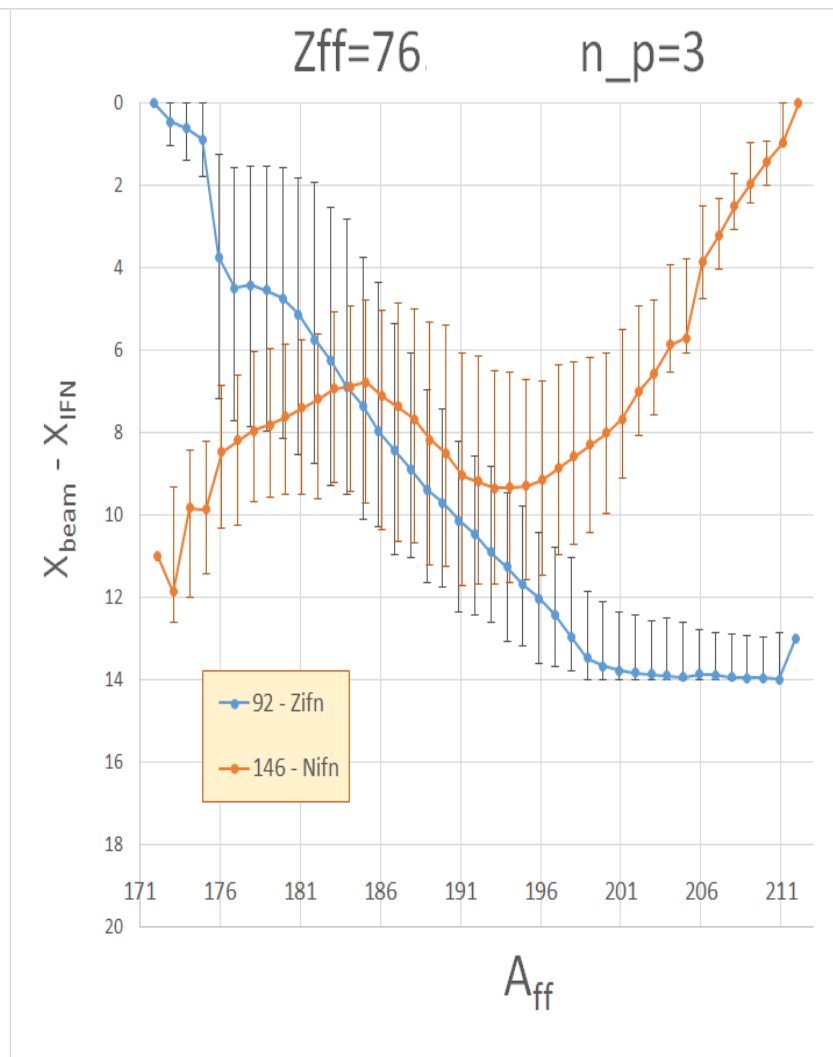
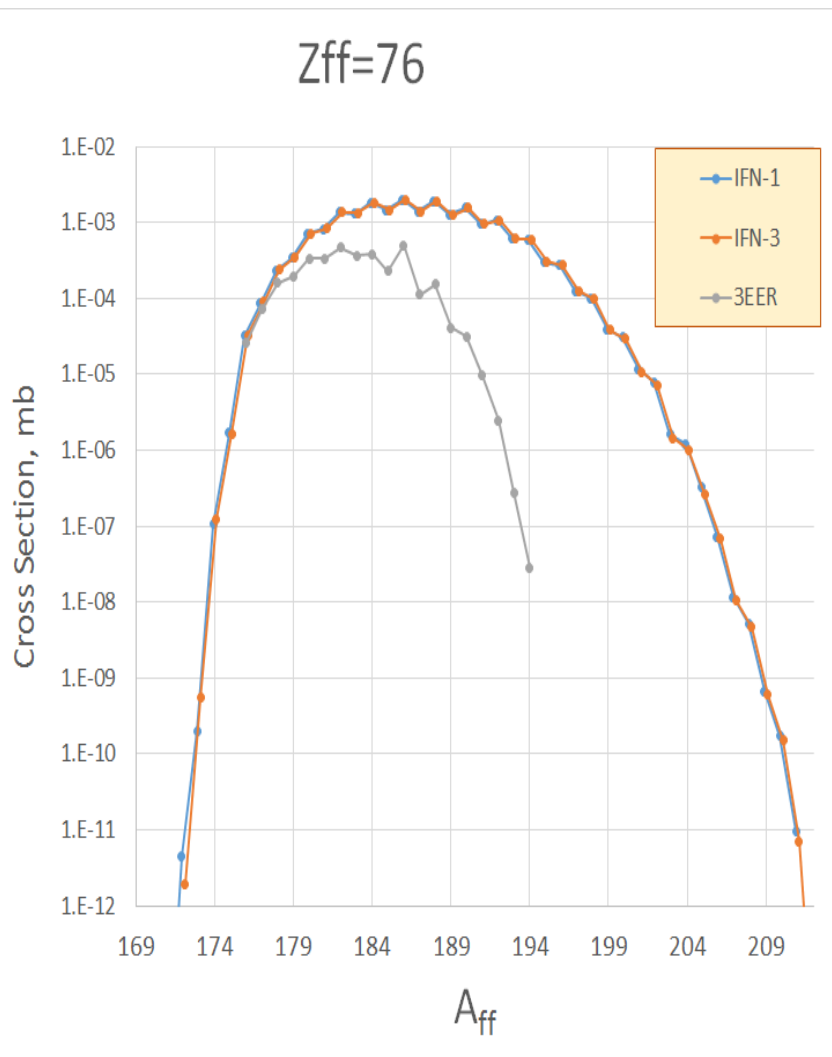


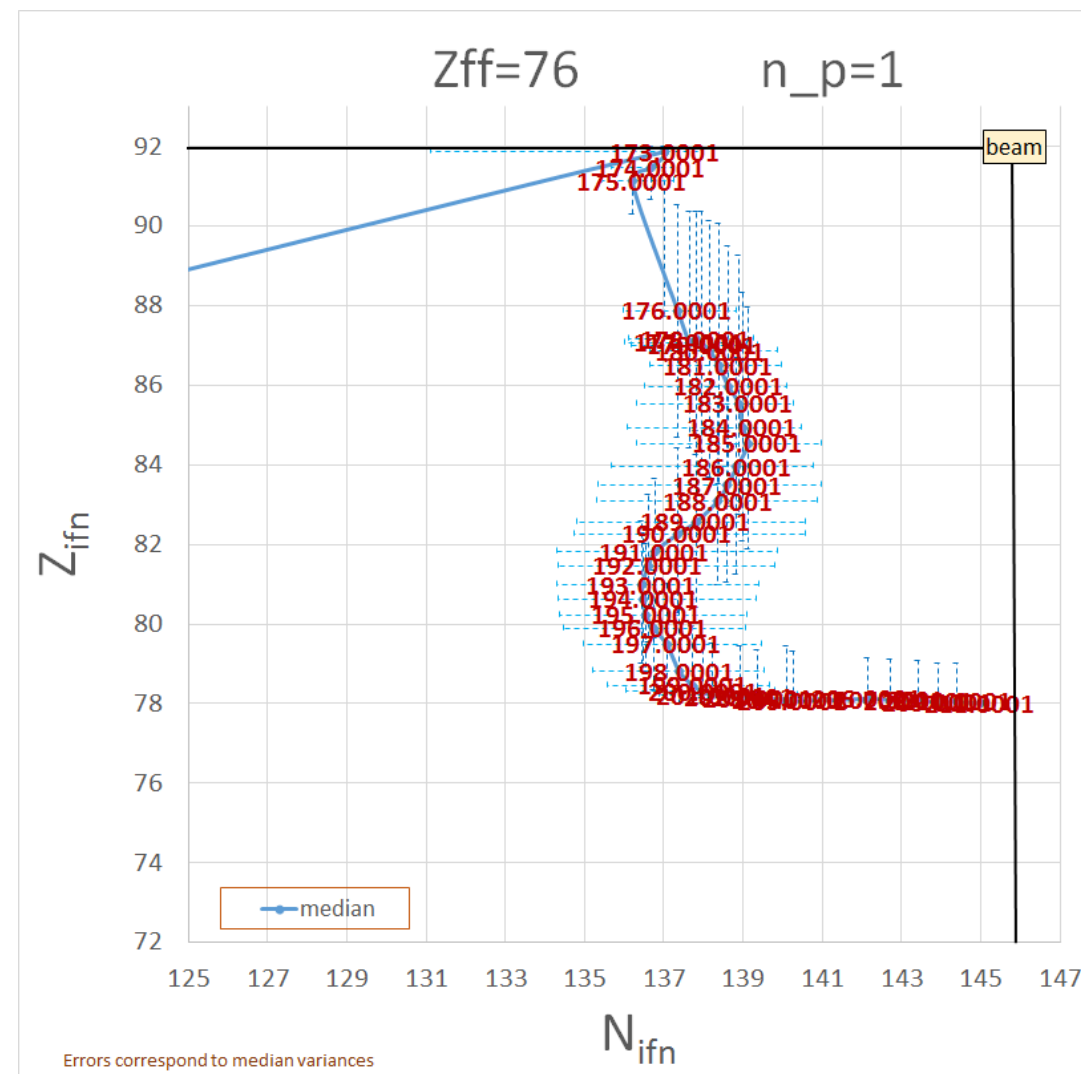
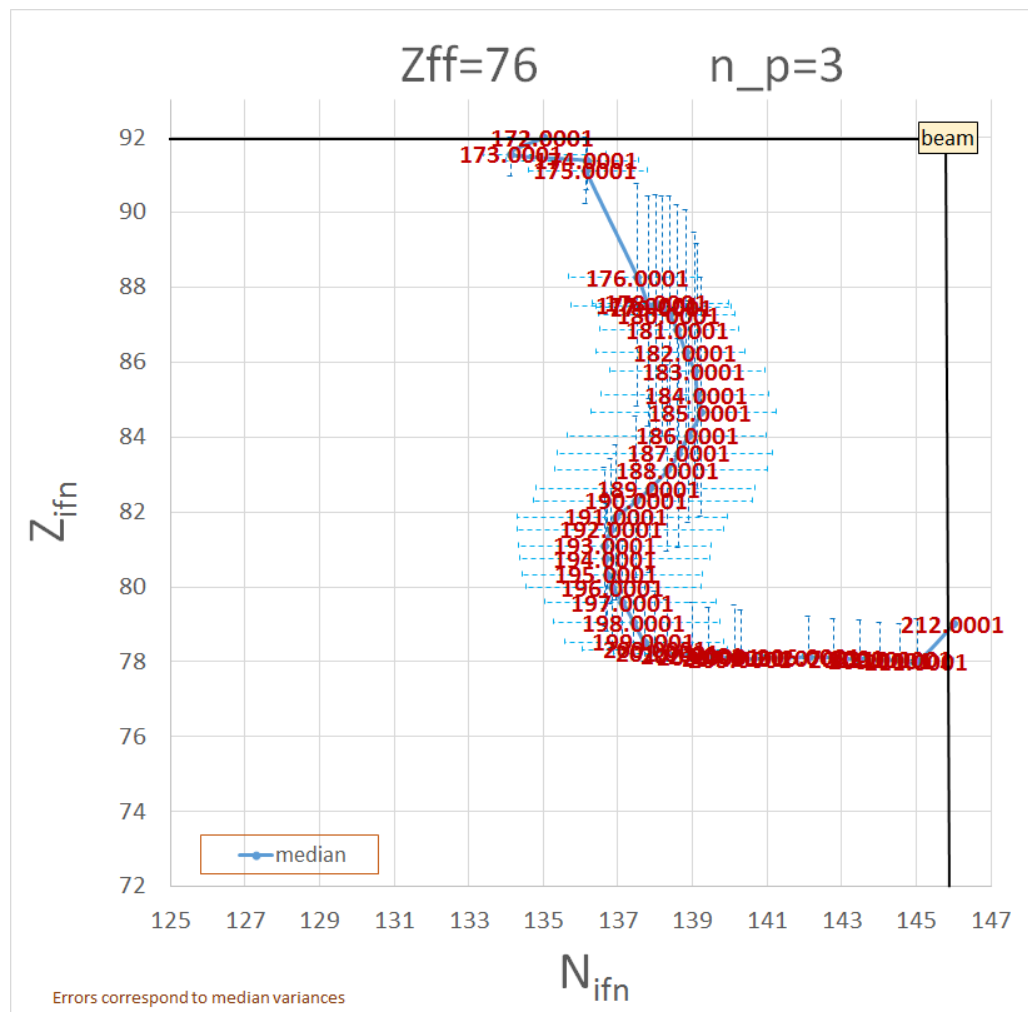












Comparison of results by the 3EER, IFN1, and IFN3 models

method	Excitation energy points	Number of fission nuclei	calculation time		Quality for		Remark
					low Z	High Z	
3EER	1	3	minutes for all Z		bad reproduction for both edges of isotope distributions	very bad reproduction for neutron-rich isotopes	
IFN1	1	defined by user (recommended >200)	~ 10 minutes for one FFF calculation	~ hour for detail one FFF calculation	moderate reproduction for neutron-rich isotopes	the same	less sensitive to Low Ex than IFN3
IFN3	3		3 times longer than IFN1				

- Utility calculation speed optimization
- Using the new utility try to define Fission, Evaporation, AA excitation energy parameters for best agreement with experimental data
- Generate Z-full range IFN1 and IFN3 tables for different targets (and energies?)
- Develop new Abrasion-Fission mode to use IFN tables, that provides more fast and qualitative yield calculations