



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 08:54 AM UTC

PDB ID : 8CWT / pdb_00008cwt
Title : Complex structure of WhiB3 and the SigmaAr4-RNAP Beta flap tip chimera
in space group P43212
Authors : Wan, T.; Zhang, L.
Deposited on : 2022-05-19
Resolution : 1.35 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

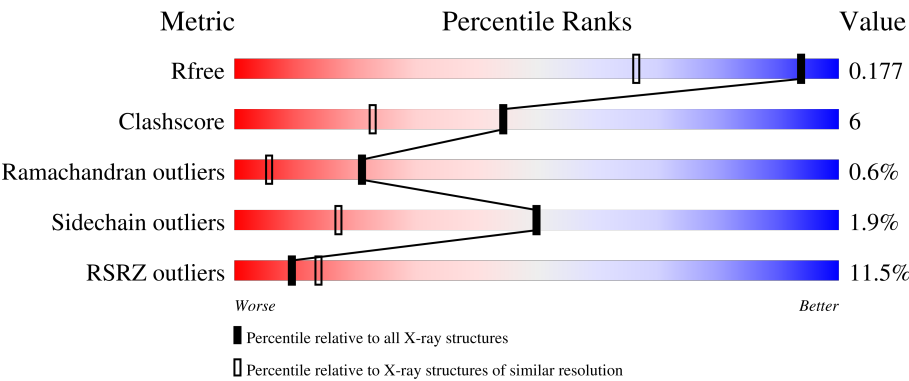
MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

1 Overall quality at a glance i

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 1.35 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R _{free}	180053	1216 (1.36-1.36)
Clashscore	190562	1232 (1.36-1.36)
Ramachandran outliers	187476	1220 (1.36-1.36)
Sidechain outliers	187428	1220 (1.36-1.36)
RSRZ outliers	180081	1214 (1.36-1.36)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions $\leq 5\%$. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	90	14% 73% 9% . 17%
1	C	90	9% 73% 10% . 17%
1	E	90	17% 72% 10% . 16%
2	B	112	7% 85% 9% . .
2	D	112	7% 88% 6% .. .

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Mol	Chain	Length	Quality of chain
2	F	112	

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
4	SO4	C	104	-	-	X	-
4	SO4	D	607	-	-	X	-

2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 5398 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called Redox- and pH-responsive transcriptional regulator WhiB3.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	75	Total	C	N	O	S	0	7	0
			652	400	128	117	7			
1	C	75	Total	C	N	O	S	0	7	0
			644	396	124	117	7			
1	E	76	Total	C	N	O	S	0	4	0
			641	395	124	115	7			

- Molecule 2 is a protein called RNA polymerase sigma factor SigA,DNA-directed RNA polymerase subunit beta.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	108	Total	C	N	O	S	0	17	0
			939	585	178	175	1			
2	D	108	Total	C	N	O	S	0	9	0
			908	563	177	167	1			
2	F	108	Total	C	N	O	S	0	12	0
			912	569	171	171	1			

There are 42 discrepancies between the modelled and reference sequences:

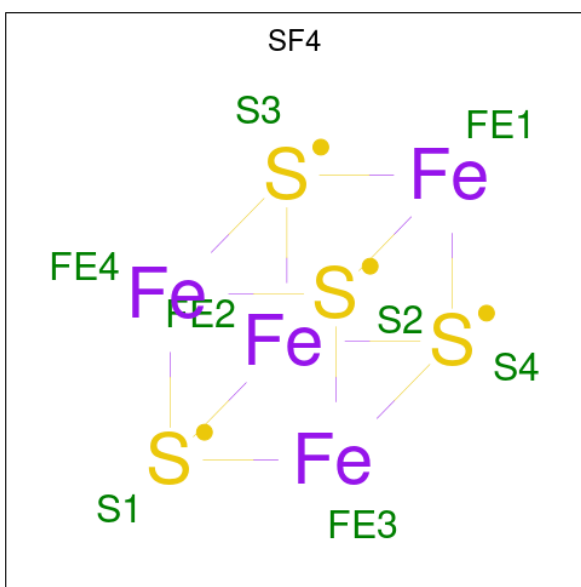
Chain	Residue	Modelled	Actual	Comment	Reference
B	438	MET	-	initiating methionine	UNP P9WGI1
B	439	ALA	-	expression tag	UNP P9WGI1
B	440	HIS	-	expression tag	UNP P9WGI1
B	441	HIS	-	expression tag	UNP P9WGI1
B	442	HIS	-	expression tag	UNP P9WGI1
B	443	HIS	-	expression tag	UNP P9WGI1
B	444	HIS	-	expression tag	UNP P9WGI1
B	445	HIS	-	expression tag	UNP P9WGI1
B	529	GLY	-	linker	UNP P9WGI1
B	530	SER	-	linker	UNP P9WGI1
B	531	SER	-	linker	UNP P9WGI1
B	532	GLY	-	linker	UNP P9WGI1

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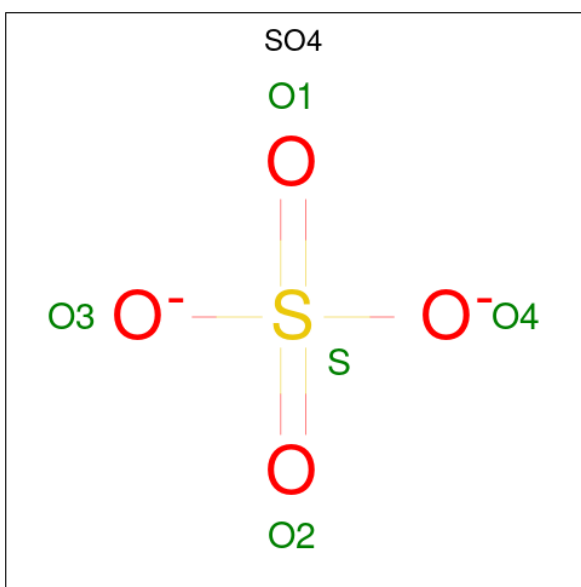
Chain	Residue	Modelled	Actual	Comment	Reference
B	533	SER	-	linker	UNP P9WGI1
B	534	GLY	-	linker	UNP P9WGI1
D	438	MET	-	initiating methionine	UNP P9WGI1
D	439	ALA	-	expression tag	UNP P9WGI1
D	440	HIS	-	expression tag	UNP P9WGI1
D	441	HIS	-	expression tag	UNP P9WGI1
D	442	HIS	-	expression tag	UNP P9WGI1
D	443	HIS	-	expression tag	UNP P9WGI1
D	444	HIS	-	expression tag	UNP P9WGI1
D	445	HIS	-	expression tag	UNP P9WGI1
D	529	GLY	-	linker	UNP P9WGI1
D	530	SER	-	linker	UNP P9WGI1
D	531	SER	-	linker	UNP P9WGI1
D	532	GLY	-	linker	UNP P9WGI1
D	533	SER	-	linker	UNP P9WGI1
D	534	GLY	-	linker	UNP P9WGI1
F	438	MET	-	initiating methionine	UNP P9WGI1
F	439	ALA	-	expression tag	UNP P9WGI1
F	440	HIS	-	expression tag	UNP P9WGI1
F	441	HIS	-	expression tag	UNP P9WGI1
F	442	HIS	-	expression tag	UNP P9WGI1
F	443	HIS	-	expression tag	UNP P9WGI1
F	444	HIS	-	expression tag	UNP P9WGI1
F	445	HIS	-	expression tag	UNP P9WGI1
F	529	GLY	-	linker	UNP P9WGI1
F	530	SER	-	linker	UNP P9WGI1
F	531	SER	-	linker	UNP P9WGI1
F	532	GLY	-	linker	UNP P9WGI1
F	533	SER	-	linker	UNP P9WGI1
F	534	GLY	-	linker	UNP P9WGI1

- Molecule 3 is IRON/SULFUR CLUSTER (CCD ID: SF4) (formula: Fe₄S₄) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	Fe	S	0	0
			8	4	4		
3	C	1	Total	Fe	S	0	0
			8	4	4		
3	E	1	Total	Fe	S	0	0
			8	4	4		

- Molecule 4 is SULFATE ION (CCD ID: SO4) (formula: O₄S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	O	S	0	0
			5	4	1		

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	O	S	0	0
			5	4	1		
4	A	1	Total	O	S	0	0
			5	4	1		
4	B	1	Total	O	S	0	0
			5	4	1		
4	B	1	Total	O	S	0	0
			5	4	1		
4	B	1	Total	O	S	0	0
			5	4	1		
4	B	1	Total	O	S	0	0
			5	4	1		
4	B	1	Total	O	S	0	0
			5	4	1		
4	B	1	Total	O	S	0	0
			5	4	1		
4	C	1	Total	O	S	0	0
			5	4	1		
4	C	1	Total	O	S	0	0
			5	4	1		
4	C	1	Total	O	S	0	0
			5	4	1		
4	D	1	Total	O	S	0	0
			5	4	1		
4	D	1	Total	O	S	0	0
			5	4	1		
4	D	1	Total	O	S	0	0
			5	4	1		
4	D	1	Total	O	S	0	0
			5	4	1		
4	D	1	Total	O	S	0	0
			5	4	1		
4	E	1	Total	O	S	0	0
			5	4	1		
4	E	1	Total	O	S	0	0
			5	4	1		
4	E	1	Total	O	S	0	0
			5	4	1		
4	F	1	Total	O	S	0	0
			5	4	1		

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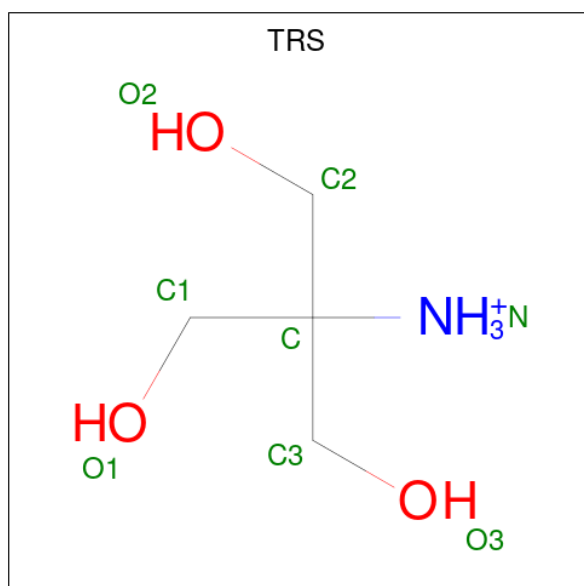
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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	F	1	Total	O	S	0	0
			5	4	1		
4	F	1	Total	O	S	0	0
			5	4	1		
4	F	1	Total	O	S	0	0
			5	4	1		

- Molecule 5 is NICKEL (II) ION (CCD ID: NI) (formula: Ni) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	B	3	Total	Ni	0	0
			3	3		
5	D	2	Total	Ni	0	0
			2	2		
5	F	2	Total	Ni	0	0
			2	2		

- Molecule 6 is 2-AMINO-2-HYDROXYMETHYL-PROPANE-1,3-DIOL (CCD ID: TRS) (formula: C₄H₁₂NO₃).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
6	B	1	Total	C	N	O	0	0
			8	4	1	3		
6	D	1	Total	C	N	O	0	0
			8	4	1	3		

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Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
6	F	1	Total	C	N	O	0	0
			8	4	1	3		

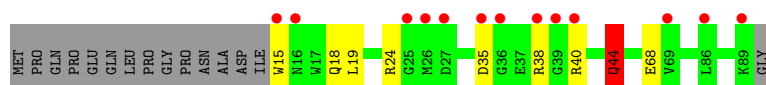
- Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	56	Total	O	0	0
			56	56		
7	B	117	Total	O	0	0
			117	117		
7	C	71	Total	O	0	0
			71	71		
7	D	114	Total	O	0	0
			114	114		
7	E	74	Total	O	0	0
			74	74		
7	F	90	Total	O	0	0
			90	90		

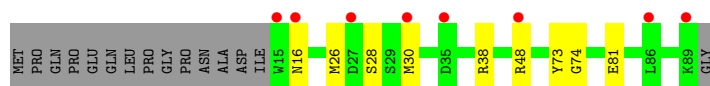
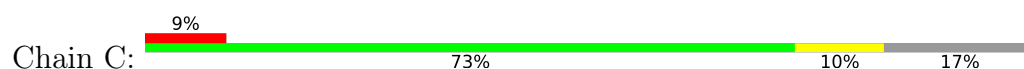
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density ($RSRZ > 2$). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

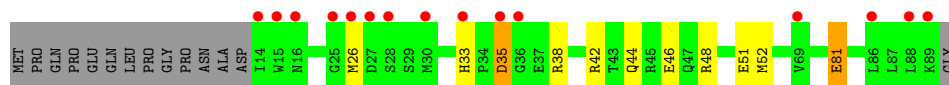
- Molecule 1: Redox- and pH-responsive transcriptional regulator WhiB3



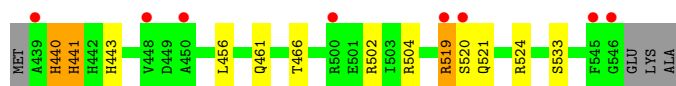
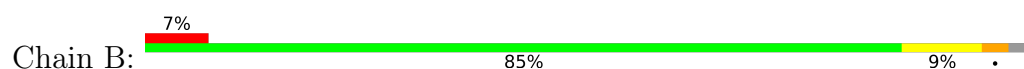
- Molecule 1: Redox- and pH-responsive transcriptional regulator WhiB3



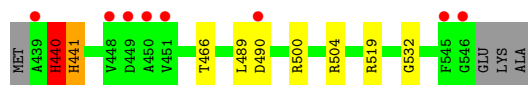
- Molecule 1: Redox- and pH-responsive transcriptional regulator WhiB3



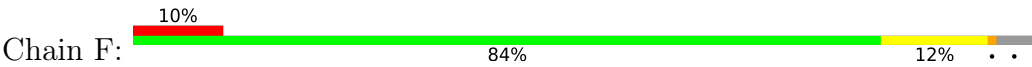
- Molecule 2: RNA polymerase sigma factor SigA, DNA-directed RNA polymerase subunit beta



- Molecule 2: RNA polymerase sigma factor SigA, DNA-directed RNA polymerase subunit beta



- Molecule 2: RNA polymerase sigma factor SigA, DNA-directed RNA polymerase subunit beta



4 Data and refinement statistics

Property	Value	Source
Space group	P 43 21 2	Depositor
Cell constants a, b, c, α , β , γ	121.83Å 121.83Å 114.31Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	41.68 – 1.35 41.68 – 1.35	Depositor EDS
% Data completeness (in resolution range)	99.9 (41.68-1.35) 99.9 (41.68-1.35)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.69 (at 1.35Å)	Xtriage
Refinement program	PHENIX 1.15.2_3472	Depositor
R, R_{free}	0.152 , 0.174 0.154 , 0.177	Depositor DCC
R_{free} test set	9186 reflections (4.58%)	wwPDB-VP
Wilson B-factor (Å ²)	19.5	Xtriage
Anisotropy	0.199	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 39.5	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.34$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.97	EDS
Total number of atoms	5398	wwPDB-VP
Average B, all atoms (Å ²)	30.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.32% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: SF4, NI, SO4, TRS

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	# $ Z > 5$	RMSZ	# $ Z > 5$
1	A	0.83	2/683 (0.3%)	1.11	2/913 (0.2%)
1	C	0.73	2/678 (0.3%)	1.03	2/907 (0.2%)
1	E	0.68	0/666	0.97	1/891 (0.1%)
2	B	0.99	8/1004 (0.8%)	1.13	7/1351 (0.5%)
2	D	0.80	2/949 (0.2%)	1.00	0/1277
2	F	0.83	3/962 (0.3%)	1.06	7/1297 (0.5%)
All	All	0.83	17/4942 (0.3%)	1.05	19/6636 (0.3%)

All (17) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	441	HIS	CE1-NE2	10.72	1.43	1.32
2	F	441	HIS	CE1-NE2	9.74	1.42	1.32
2	D	441	HIS	CE1-NE2	9.17	1.41	1.32
1	C	16[A]	ASN	C-O	7.30	1.32	1.24
1	C	16[B]	ASN	C-O	7.30	1.32	1.24
1	A	44[A]	GLN	C-O	7.11	1.32	1.24
1	A	44[B]	GLN	C-O	7.11	1.32	1.24
2	B	461[A]	GLN	C-O	6.57	1.31	1.24
2	B	461[B]	GLN	C-O	6.57	1.31	1.24
2	F	522[A]	VAL	C-O	6.50	1.32	1.24
2	F	522[B]	VAL	C-O	6.50	1.32	1.24
2	B	533[A]	SER	C-O	6.47	1.31	1.24
2	B	533[B]	SER	C-O	6.47	1.31	1.24
2	D	441	HIS	ND1-CE1	6.45	1.39	1.32
2	B	441	HIS	ND1-CE1	6.05	1.38	1.32
2	B	521[A]	GLN	C-O	5.91	1.31	1.24
2	B	521[B]	GLN	C-O	5.91	1.31	1.24

All (19) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	44[A]	GLN	CA-C-O	8.18	129.22	120.55
1	A	44[B]	GLN	CA-C-O	8.18	129.22	120.55
2	B	521[A]	GLN	CA-C-O	7.72	128.96	120.63
2	B	521[B]	GLN	CA-C-O	7.72	128.96	120.63
2	F	522[A]	VAL	CA-C-O	7.41	128.49	120.57
2	F	522[B]	VAL	CA-C-O	7.41	128.49	120.57
2	B	461[A]	GLN	CA-C-O	7.00	128.19	120.63
2	B	461[B]	GLN	CA-C-O	7.00	128.19	120.63
1	E	81	GLU	CB-CG-CD	5.67	122.23	112.60
2	F	443	HIS	CE1-NE2-CD2	-5.65	103.35	109.00
2	B	519	ARG	CB-CA-C	5.61	120.33	110.35
1	C	16[A]	ASN	N-CA-C	5.56	122.64	110.80
1	C	16[B]	ASN	N-CA-C	5.56	122.64	110.80
2	B	533[A]	SER	CA-C-O	5.53	127.05	120.70
2	B	533[B]	SER	CA-C-O	5.53	127.05	120.70
2	F	490	ASP	CA-CB-CG	5.34	117.94	112.60
2	F	519	ARG	CB-CA-C	-5.14	102.70	111.02
2	F	537	GLU	CB-CG-CD	5.13	121.32	112.60
2	F	441	HIS	CB-CG-ND1	-5.06	115.11	122.70

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts ⓘ

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	652	0	635	13	0
1	C	644	0	628	8	0
1	E	641	0	623	12	0
2	B	939	0	979	8	0
2	D	908	0	931	13	0
2	F	912	0	939	6	0
3	A	8	0	0	0	0
3	C	8	0	0	0	0
3	E	8	0	0	0	0
4	A	15	0	0	0	0
4	B	30	0	0	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	C	15	0	0	4	0
4	D	30	0	0	2	0
4	E	15	0	0	0	0
4	F	20	0	0	1	0
5	B	3	0	0	0	0
5	D	2	0	0	0	0
5	F	2	0	0	0	0
6	B	8	0	9	1	0
6	D	8	0	9	1	0
6	F	8	0	9	1	0
7	A	56	0	0	2	0
7	B	117	0	0	5	0
7	C	71	0	0	1	0
7	D	114	0	0	0	0
7	E	74	0	0	2	0
7	F	90	0	0	1	0
All	All	5398	0	4762	58	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 6.

All (58) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:D:500:ARG:HH21	2:D:504[C]:ARG:NH2	1.57	1.02
1:C:30:MET:HE2	1:C:48[A]:ARG:HH21	1.26	0.99
1:E:44[B]:GLN:HG2	1:E:48[B]:ARG:NH1	1.84	0.92
2:D:500:ARG:NH2	2:D:504[C]:ARG:NH2	2.20	0.88
2:D:500:ARG:HH21	2:D:504[C]:ARG:HH21	1.30	0.79
2:B:443:HIS:HB3	2:B:456[B]:LEU:HD23	1.69	0.75
2:D:490:ASP:OD1	2:D:500:ARG:HD2	1.94	0.68
2:D:466:THR:O	2:D:519[B]:ARG:NH2	2.27	0.68
2:D:500:ARG:NH2	2:D:504[C]:ARG:HH21	1.90	0.67
2:B:441:HIS:NE2	4:D:607:SO4:O1	2.29	0.64
1:A:24[A]:ARG:HG2	7:B:753:HOH:O	1.97	0.64
1:A:24[A]:ARG:CG	7:B:753:HOH:O	2.45	0.64
1:E:44[B]:GLN:CG	1:E:48[B]:ARG:NH1	2.61	0.62
6:F:607:TRS:H21	7:F:727:HOH:O	1.98	0.61
1:C:81[A]:GLU:HB2	4:C:104:SO4:O1	2.03	0.59
1:E:33:HIS:CD2	1:E:42:ARG:HG3	2.40	0.57
1:C:30:MET:CE	1:C:48[A]:ARG:HH21	2.09	0.57

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:19:LEU:HD23	2:B:524[B]:ARG:NH1	2.20	0.56
1:A:35:ASP:OD2	2:B:502:ARG:NH2	2.39	0.56
1:A:68[A]:GLU:HG3	7:A:243:HOH:O	2.06	0.54
2:D:532:GLY:HA3	2:F:446[B]:VAL:HG12	1.90	0.53
1:E:33:HIS:NE2	1:E:46[A]:GLU:HG3	2.23	0.52
1:A:18:GLN:O	1:A:24[A]:ARG:HD3	2.09	0.52
1:E:44[B]:GLN:CD	1:E:48[B]:ARG:HH12	2.19	0.51
6:B:610:TRS:H31	7:B:749:HOH:O	2.10	0.51
1:E:51[B]:GLU:HG3	7:E:211:HOH:O	2.11	0.51
1:C:26:MET:HE3	1:C:30:MET:HE1	1.93	0.50
2:F:500:ARG:NH1	2:F:504:ARG:HH22	2.10	0.50
2:F:500:ARG:HH12	2:F:504:ARG:HH22	1.59	0.50
1:A:24[C]:ARG:NH1	7:A:204:HOH:O	2.45	0.49
1:A:15:TRP:HB2	1:A:18:GLN:HG3	1.95	0.49
1:A:40:ARG:HE	1:A:44[B]:GLN:NE2	2.11	0.48
2:D:500:ARG:NH2	2:D:504[C]:ARG:HH22	2.05	0.48
4:C:104:SO4:O3	7:C:201:HOH:O	2.20	0.48
1:A:19:LEU:HD22	4:B:608:SO4:O1	2.13	0.47
2:B:524[B]:ARG:NH2	7:B:702:HOH:O	2.33	0.47
2:D:441:HIS:NE2	4:D:607:SO4:O1	2.42	0.47
1:C:28:SER:CB	2:D:519[B]:ARG:HD2	2.45	0.46
2:F:461[A]:GLN:HE22	2:F:476[A]:ARG:HH22	1.64	0.46
1:E:44[B]:GLN:HG2	1:E:48[B]:ARG:HH12	1.76	0.46
1:C:30:MET:HE3	1:C:30:MET:HB2	1.84	0.45
2:D:490:ASP:OD1	2:D:500:ARG:CD	2.62	0.45
1:E:44[B]:GLN:CD	1:E:48[B]:ARG:NH1	2.75	0.45
1:A:44[A]:GLN:HE21	1:A:44[A]:GLN:HB2	1.47	0.45
1:A:35:ASP:CG	2:B:502:ARG:HH22	2.26	0.44
1:C:73:TYR:HA	4:C:104:SO4:O1	2.18	0.44
1:E:81:GLU:HG3	7:E:251:HOH:O	2.17	0.44
2:D:440:HIS:CE1	6:D:609:TRS:O1	2.71	0.43
1:E:33:HIS:CE1	1:E:46[A]:GLU:OE1	2.72	0.43
1:E:35:ASP:OD1	1:E:35:ASP:N	2.51	0.43
1:C:74:GLY:N	4:C:104:SO4:O1	2.53	0.42
2:F:500:ARG:NH2	4:F:604:SO4:O4	2.53	0.42
2:F:466:THR:C	2:F:519:ARG:HH22	2.27	0.41
1:E:26:MET:HE3	1:E:52:MET:HE1	2.03	0.41
2:B:504[B]:ARG:NH1	7:B:706:HOH:O	2.46	0.41
2:B:466:THR:OG1	2:B:519:ARG:NH2	2.36	0.41
2:D:489:LEU:HD13	2:D:504[C]:ARG:HG3	2.03	0.40
1:A:24[C]:ARG:HH21	1:A:24[C]:ARG:HG2	1.87	0.40

There are no symmetry-related clashes.

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	80/90 (89%)	80 (100%)	0	0	100	100
1	C	80/90 (89%)	78 (98%)	2 (2%)	0	100	100
1	E	78/90 (87%)	77 (99%)	1 (1%)	0	100	100
2	B	123/112 (110%)	120 (98%)	2 (2%)	1 (1%)	16	3
2	D	115/112 (103%)	113 (98%)	1 (1%)	1 (1%)	14	2
2	F	118/112 (105%)	115 (98%)	2 (2%)	1 (1%)	16	3
All	All	594/606 (98%)	583 (98%)	8 (1%)	3 (0%)	21	7

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	B	440	HIS
2	D	440	HIS
2	F	440	HIS

5.3.2 Protein sidechains [i](#)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	70/75 (93%)	67 (96%)	3 (4%)	26	3
1	C	70/75 (93%)	69 (99%)	1 (1%)	59	28

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
1	E	68/75 (91%)	66 (97%)	2 (3%)	37 8
2	B	111/97 (114%)	108 (97%)	3 (3%)	39 9
2	D	103/97 (106%)	102 (99%)	1 (1%)	68 40
2	F	106/97 (109%)	104 (98%)	2 (2%)	50 17
All	All	528/516 (102%)	516 (98%)	12 (2%)	50 13

All (12) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	38	ARG
1	A	44[A]	GLN
1	A	44[B]	GLN
2	B	440	HIS
2	B	520[A]	SER
2	B	520[B]	SER
1	C	38	ARG
2	D	440	HIS
1	E	35	ASP
1	E	38	ARG
2	F	464[A]	LEU
2	F	464[B]	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	E	33	HIS

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry

Of 38 ligands modelled in this entry, 7 are monoatomic - leaving 31 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
4	SO4	A	103	-	4,4,4	0.34	0	6,6,6	0.09	0
4	SO4	A	104	-	4,4,4	0.38	0	6,6,6	0.06	0
3	SF4	E	101	1	0,12,12	-	-	-		
4	SO4	E	102	-	4,4,4	0.24	0	6,6,6	0.23	0
4	SO4	F	603	-	4,4,4	0.35	0	6,6,6	0.15	0
4	SO4	D	608	-	4,4,4	0.39	0	6,6,6	0.13	0
6	TRS	F	607	5	7,7,7	0.76	0	9,9,9	1.99	4 (44%)
4	SO4	B	604	-	4,4,4	0.46	0	6,6,6	0.13	0
6	TRS	B	610	5	7,7,7	0.69	0	9,9,9	2.11	4 (44%)
4	SO4	B	606	-	4,4,4	0.37	0	6,6,6	0.14	0
6	TRS	D	609	5	7,7,7	1.04	1 (14%)	9,9,9	1.04	1 (11%)
4	SO4	D	603	-	4,4,4	0.36	0	6,6,6	0.19	0
4	SO4	B	605	-	4,4,4	0.36	0	6,6,6	0.22	0
4	SO4	F	606	-	4,4,4	0.34	0	6,6,6	0.17	0
4	SO4	D	605	-	4,4,4	0.35	0	6,6,6	0.25	0
4	SO4	B	607	-	4,4,4	0.28	0	6,6,6	0.16	0
4	SO4	B	609	-	4,4,4	0.49	0	6,6,6	0.06	0
4	SO4	B	608	-	4,4,4	0.59	0	6,6,6	0.37	0
4	SO4	D	604	-	4,4,4	0.46	0	6,6,6	0.19	0
4	SO4	E	103	-	4,4,4	0.45	0	6,6,6	0.12	0
4	SO4	F	605	-	4,4,4	0.33	0	6,6,6	0.08	0
4	SO4	D	606	-	4,4,4	0.39	0	6,6,6	0.12	0
4	SO4	A	102	-	4,4,4	0.39	0	6,6,6	0.19	0
3	SF4	A	101	1	0,12,12	-	-	-		
4	SO4	C	102	-	4,4,4	0.22	0	6,6,6	0.20	0
4	SO4	E	104	-	4,4,4	0.32	0	6,6,6	0.09	0
3	SF4	C	101	1	0,12,12	-	-	-		
4	SO4	D	607	-	4,4,4	0.23	0	6,6,6	0.35	0
4	SO4	C	103	-	4,4,4	0.35	0	6,6,6	0.25	0
4	SO4	F	604	-	4,4,4	0.42	0	6,6,6	0.24	0
4	SO4	C	104	-	4,4,4	0.40	0	6,6,6	0.10	0

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
6	TRS	D	609	5	-	3/9/9/9	-
6	TRS	F	607	5	-	4/9/9/9	-
3	SF4	E	101	1	-	-	0/6/5/5
3	SF4	A	101	1	-	-	0/6/5/5
3	SF4	C	101	1	-	-	0/6/5/5
6	TRS	B	610	5	-	4/9/9/9	-

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	D	609	TRS	O1-C1	-2.44	1.34	1.42

All (9) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	B	610	TRS	O3-C3-C	-3.51	101.09	110.88
6	B	610	TRS	O1-C1-C	3.27	119.99	110.88
6	F	607	TRS	O2-C2-C	-3.10	102.25	110.88
6	F	607	TRS	O3-C3-C	2.87	118.87	110.88
6	F	607	TRS	C3-C-C1	2.68	117.78	110.66
6	B	610	TRS	C2-C-C1	2.63	117.65	110.66
6	D	609	TRS	C2-C-C1	-2.48	104.05	110.66
6	B	610	TRS	O2-C2-C	2.43	117.65	110.88
6	F	607	TRS	O1-C1-C	2.16	116.88	110.88

There are no chirality outliers.

All (11) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
6	D	609	TRS	C2-C-C1-O1
6	D	609	TRS	C3-C-C1-O1
6	D	609	TRS	N-C-C1-O1
6	B	610	TRS	C1-C-C2-O2
6	F	607	TRS	C1-C-C3-O3
6	B	610	TRS	N-C-C2-O2
6	F	607	TRS	N-C-C3-O3
6	B	610	TRS	C3-C-C2-O2

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Mol	Chain	Res	Type	Atoms
6	F	607	TRS	C2-C-C3-O3
6	B	610	TRS	C2-C-C1-O1
6	F	607	TRS	C3-C-C1-O1

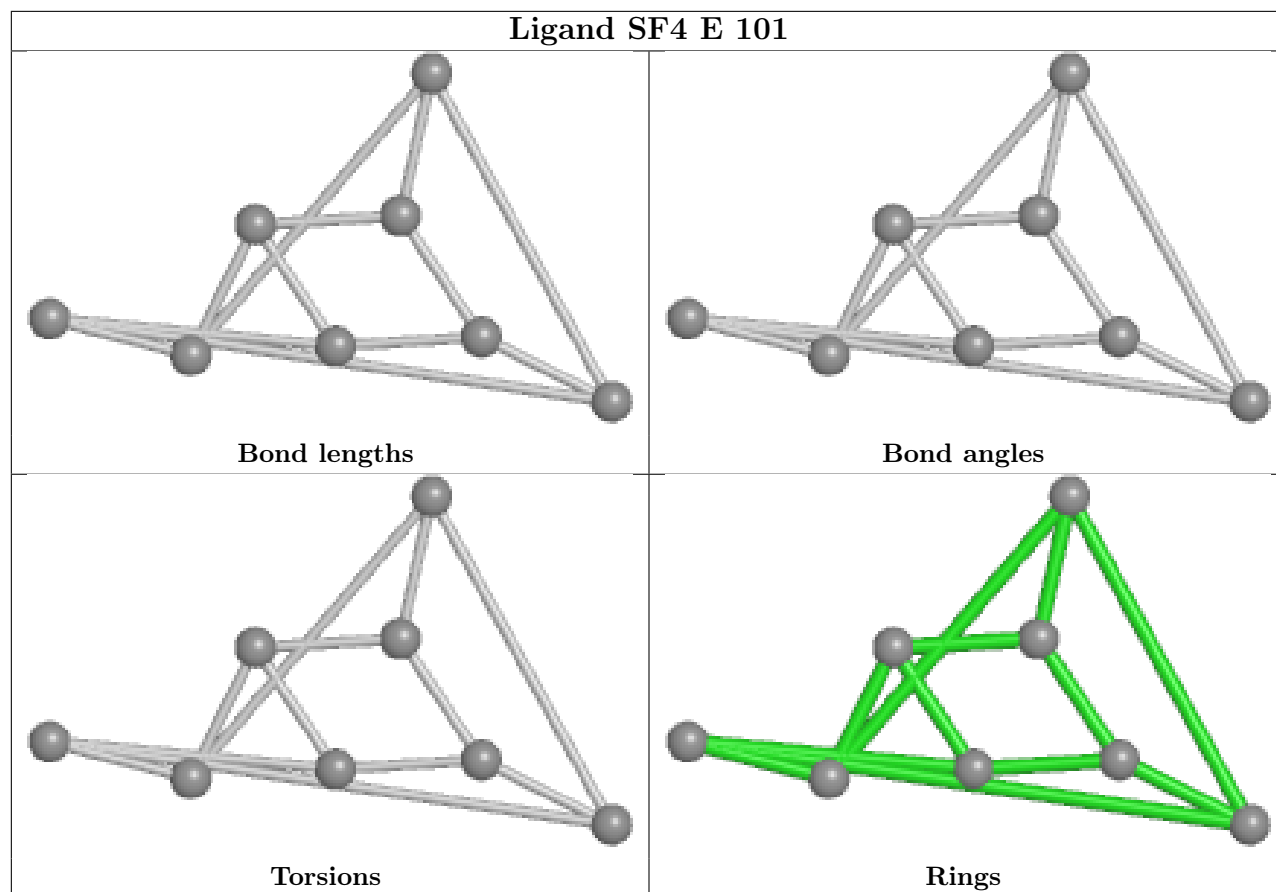
There are no ring outliers.

7 monomers are involved in 11 short contacts:

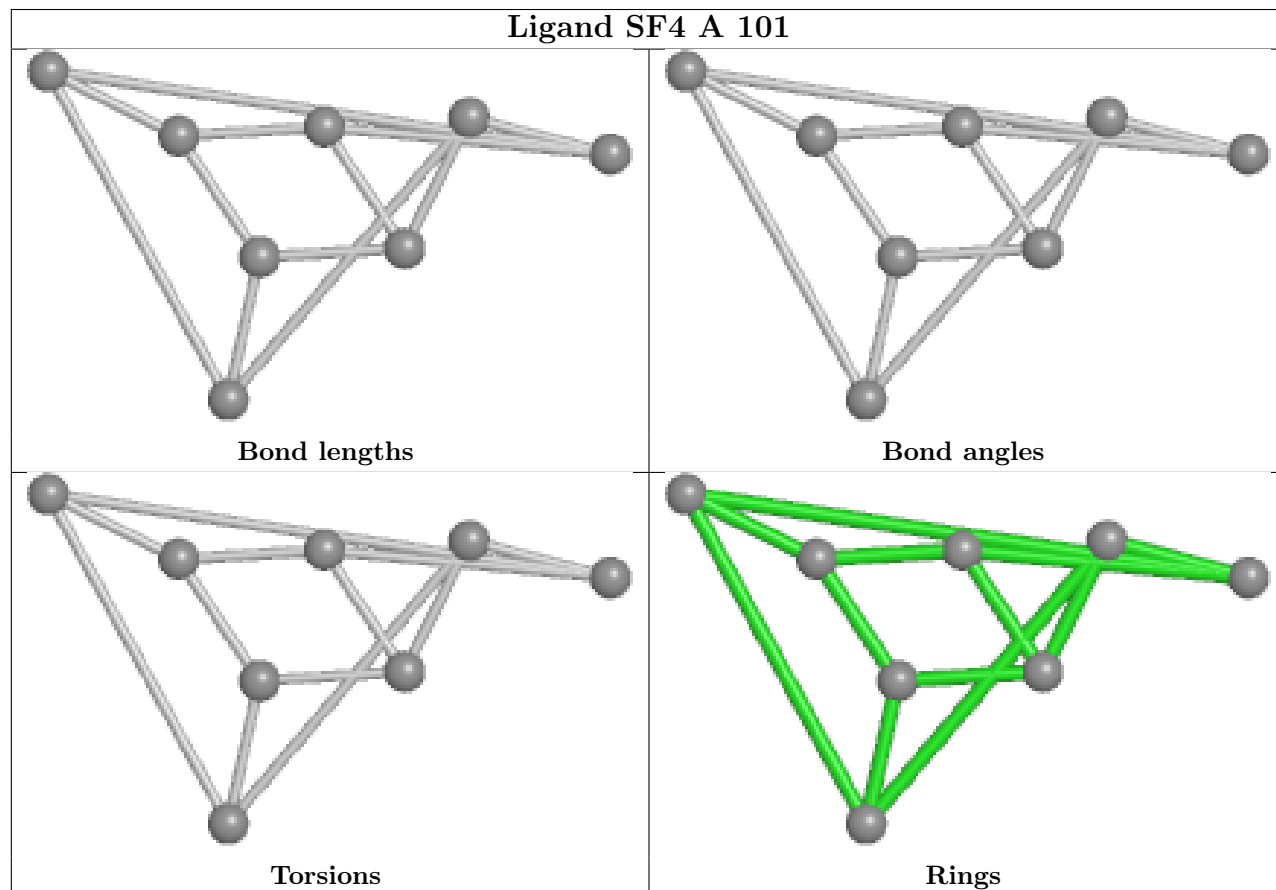
Mol	Chain	Res	Type	Clashes	Symm-Clashes
6	F	607	TRS	1	0
6	B	610	TRS	1	0
6	D	609	TRS	1	0
4	B	608	SO4	1	0
4	D	607	SO4	2	0
4	F	604	SO4	1	0
4	C	104	SO4	4	0

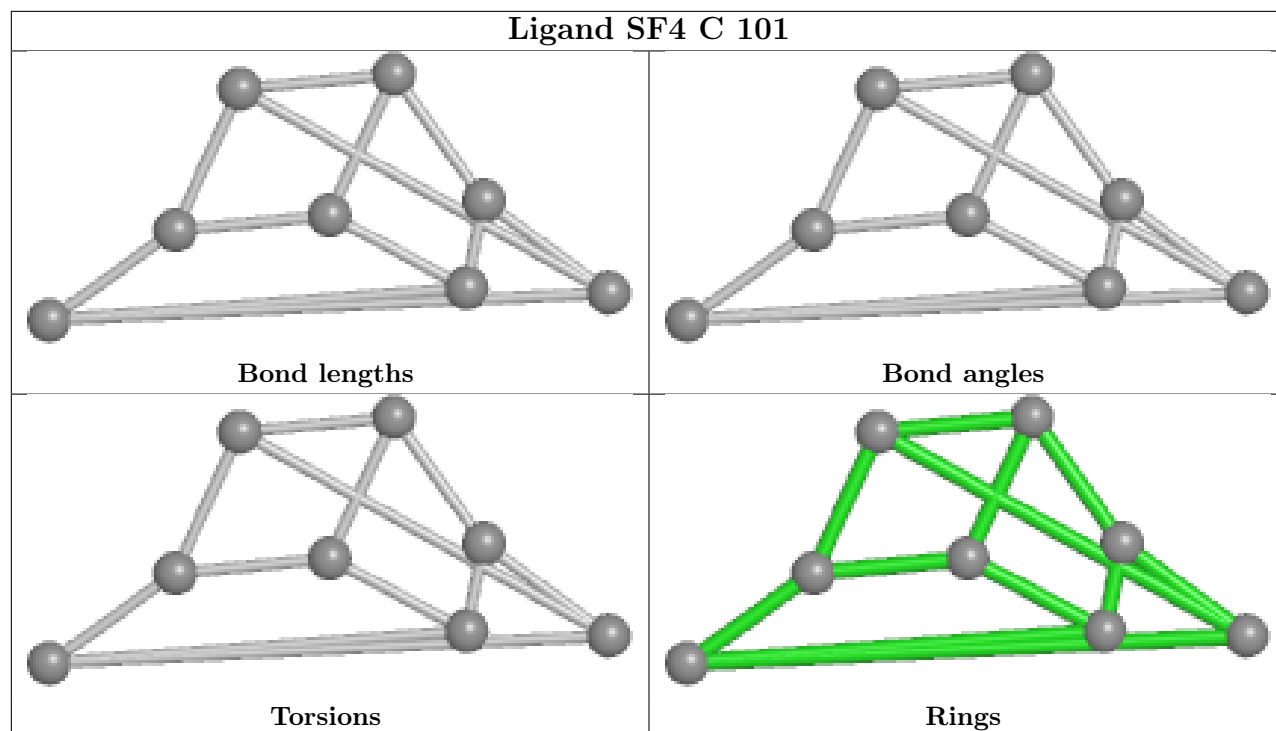
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.

Ligand SF4 E 101



Ligand SF4 A 101





5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data ⓘ

6.1 Protein, DNA and RNA chains ⓘ

In the following table, the column labelled ‘#RSRZ> 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q< 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	75/90 (83%)	0.94	13 (17%) 4 7	16, 28, 51, 58	7 (9%)
1	C	75/90 (83%)	0.78	8 (10%) 11 15	15, 26, 42, 54	7 (9%)
1	E	76/90 (84%)	0.94	15 (19%) 3 5	17, 29, 49, 58	4 (5%)
2	B	108/112 (96%)	0.40	8 (7%) 20 28	11, 23, 36, 58	17 (15%)
2	D	108/112 (96%)	0.54	8 (7%) 20 28	11, 24, 38, 58	9 (8%)
2	F	108/112 (96%)	0.51	11 (10%) 12 17	11, 24, 41, 62	12 (11%)
All	All	550/606 (90%)	0.65	63 (11%) 9 14	11, 25, 45, 62	56 (10%)

All (63) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	15	TRP	9.4
1	A	15	TRP	7.9
1	E	15	TRP	7.2
1	A	25	GLY	6.3
1	E	14	ILE	6.0
2	D	545	PHE	4.8
2	D	546	GLY	4.8
1	E	27	ASP	4.7
2	B	545	PHE	4.7
1	C	16[A]	ASN	4.7
2	B	439	ALA	4.6
1	A	26	MET	4.5
2	F	546	GLY	4.3
2	D	450	ALA	4.2
2	D	439	ALA	4.0
2	B	450	ALA	3.9
1	A	40	ARG	3.8
2	B	546	GLY	3.7
2	F	448	VAL	3.6

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Mol	Chain	Res	Type	RSRZ
2	F	450	ALA	3.3
1	E	28	SER	3.3
1	E	89	LYS	3.3
1	A	89	LYS	3.2
2	F	449	ASP	3.2
2	D	448	VAL	3.1
2	F	545	PHE	3.1
1	E	26	MET	3.1
1	C	89	LYS	3.1
1	E	25	GLY	3.0
1	E	36	GLY	3.0
1	A	39	GLY	3.0
1	A	27	ASP	3.0
1	C	27	ASP	2.9
1	A	86	LEU	2.8
1	E	88	LEU	2.8
1	E	86	LEU	2.8
1	A	35	ASP	2.7
2	F	447	ALA	2.7
2	F	439	ALA	2.6
2	D	449	ASP	2.6
1	C	35	ASP	2.6
2	B	520[A]	SER	2.6
1	A	38	ARG	2.5
1	E	35	ASP	2.5
2	F	519	ARG	2.5
1	A	36	GLY	2.5
2	B	500	ARG	2.5
2	D	490	ASP	2.4
1	A	16[A]	ASN	2.4
2	F	500	ARG	2.4
2	F	494	GLN	2.4
1	A	69	VAL	2.4
1	C	48[A]	ARG	2.4
1	E	33	HIS	2.4
1	C	86	LEU	2.3
1	E	16	ASN	2.2
2	B	448	VAL	2.2
2	B	519	ARG	2.1
2	F	451	VAL	2.1
1	C	30	MET	2.1
1	E	30	MET	2.1

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Mol	Chain	Res	Type	RSRZ
1	E	69	VAL	2.1
2	D	451	VAL	2.0

6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

6.4 Ligands [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q<0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
4	SO4	C	102	5/5	0.78	0.14	55,55,57,59	5
4	SO4	E	104	5/5	0.80	0.16	53,55,58,58	5
4	SO4	D	606	5/5	0.85	0.17	45,45,49,50	5
4	SO4	B	609	5/5	0.87	0.16	44,48,49,53	5
4	SO4	B	607	5/5	0.87	0.13	48,49,51,58	5
4	SO4	D	608	5/5	0.88	0.11	56,56,60,60	5
4	SO4	C	103	5/5	0.89	0.15	38,38,39,40	5
4	SO4	F	603	5/5	0.89	0.16	33,37,39,40	5
4	SO4	E	103	5/5	0.90	0.16	42,42,45,48	5
4	SO4	A	103	5/5	0.90	0.10	91,91,91,91	0
4	SO4	A	104	5/5	0.90	0.14	45,46,48,52	5
6	TRS	D	609	8/8	0.91	0.13	20,27,34,38	0
6	TRS	F	607	8/8	0.91	0.15	21,29,37,38	0
4	SO4	D	603	5/5	0.92	0.14	34,37,39,40	5
4	SO4	F	606	5/5	0.92	0.12	41,42,45,50	5
6	TRS	B	610	8/8	0.93	0.13	20,29,35,36	0
4	SO4	B	605	5/5	0.94	0.12	31,36,37,38	5
4	SO4	B	606	5/5	0.94	0.13	38,41,42,46	5
4	SO4	C	104	5/5	0.94	0.23	31,33,36,36	5
4	SO4	F	605	5/5	0.94	0.12	40,43,43,46	5
4	SO4	D	605	5/5	0.95	0.09	42,43,44,53	5

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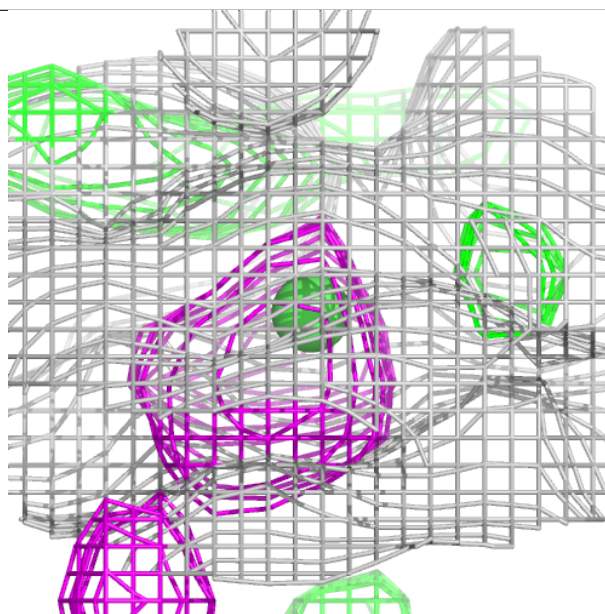
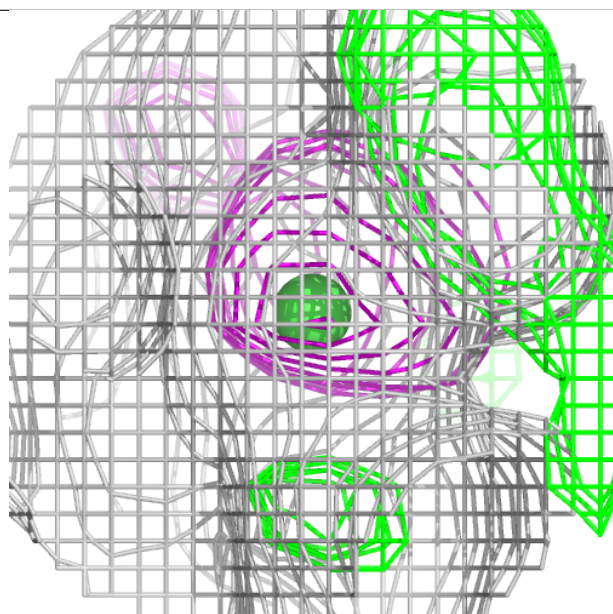
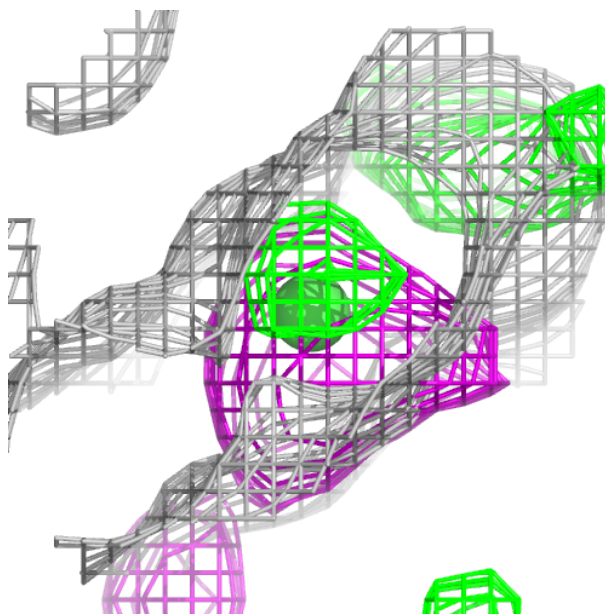
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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
4	SO4	D	604	5/5	0.95	0.12	41,41,43,43	5
4	SO4	D	607	5/5	0.95	0.08	37,40,44,45	0
4	SO4	A	102	5/5	0.96	0.08	40,41,42,47	5
4	SO4	F	604	5/5	0.97	0.07	38,39,40,46	0
4	SO4	B	604	5/5	0.97	0.07	39,40,41,44	0
4	SO4	B	608	5/5	0.98	0.07	20,20,22,24	5
5	NI	D	601	1/1	0.99	0.05	25,25,25,25	0
4	SO4	E	102	5/5	0.99	0.05	20,20,21,23	5
5	NI	B	602	1/1	1.00	0.01	18,18,18,18	0
5	NI	B	603	1/1	1.00	0.06	25,25,25,25	0
3	SF4	C	101	8/8	1.00	0.01	17,17,18,18	0
5	NI	D	602	1/1	1.00	0.01	19,19,19,19	0
5	NI	F	601	1/1	1.00	0.01	19,19,19,19	0
5	NI	F	602	1/1	1.00	0.04	24,24,24,24	0
3	SF4	E	101	8/8	1.00	0.02	19,19,20,20	0
3	SF4	A	101	8/8	1.00	0.01	18,19,19,19	0
5	NI	B	601	1/1	1.00	0.01	14,14,14,14	0

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.

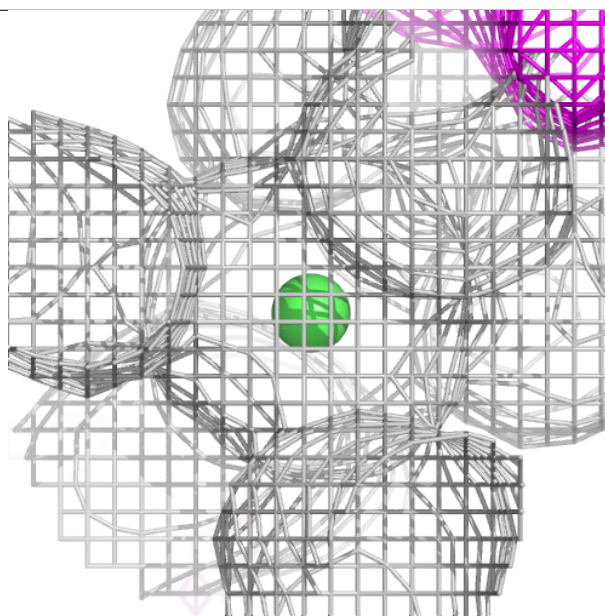
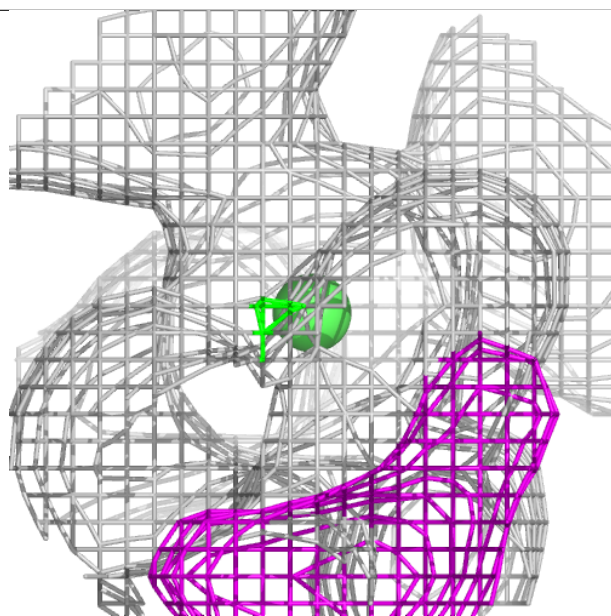
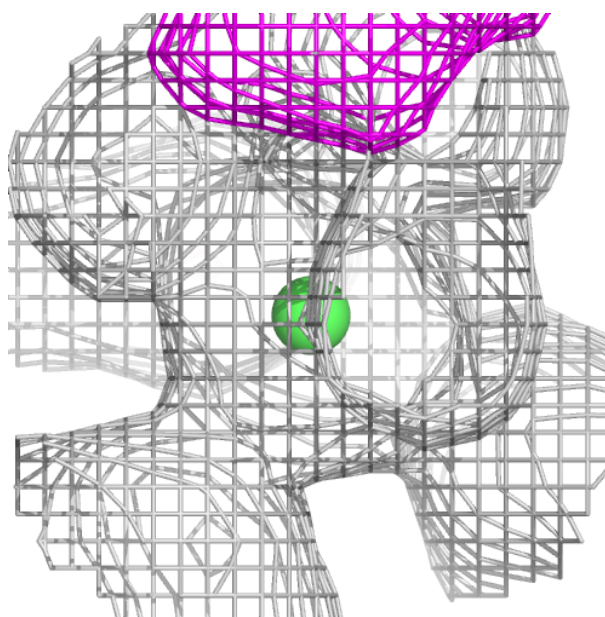
Electron density around NI D 601:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



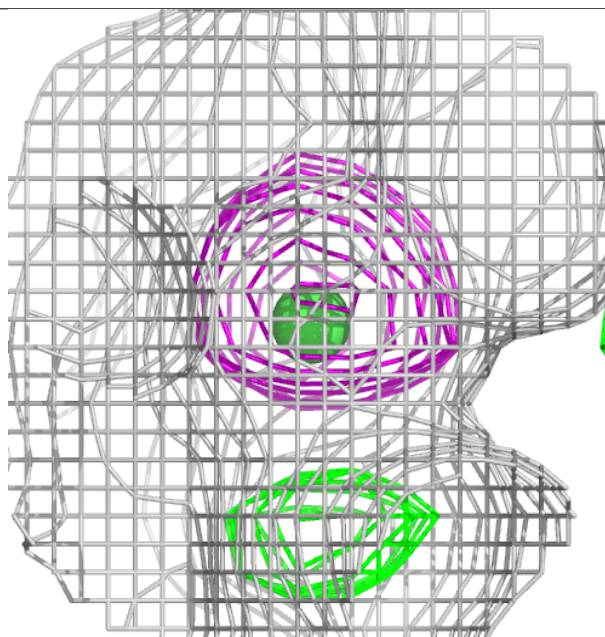
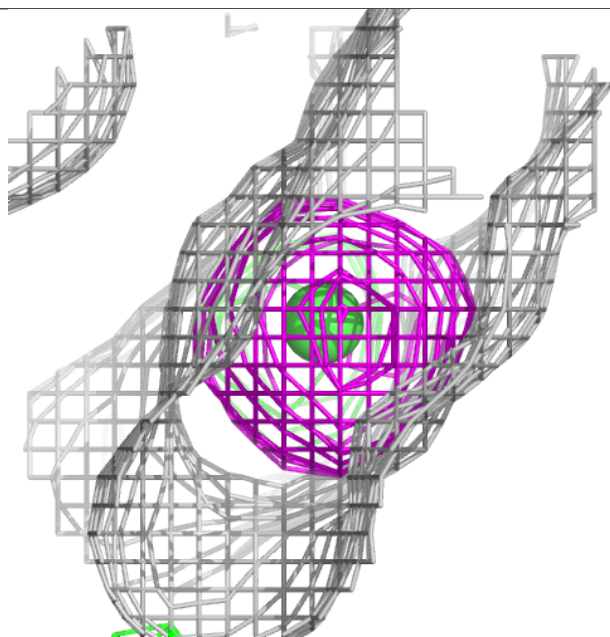
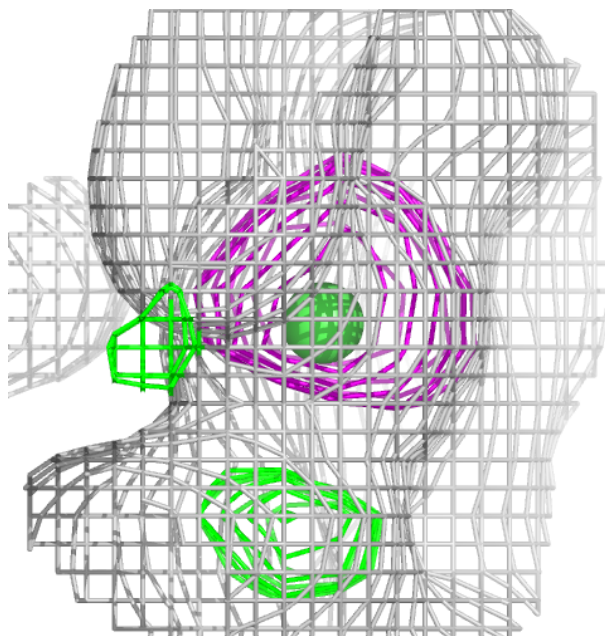
Electron density around NI B 602:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



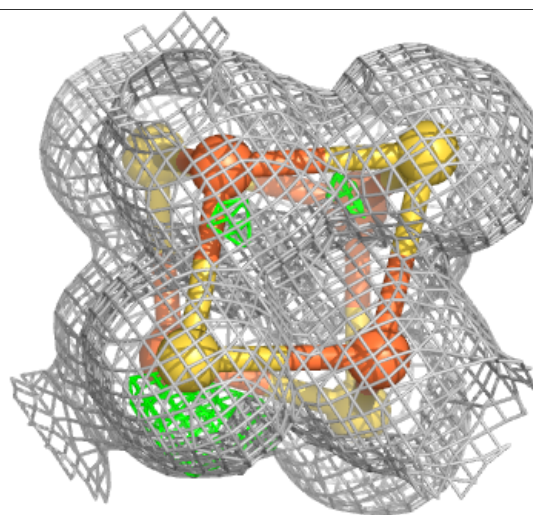
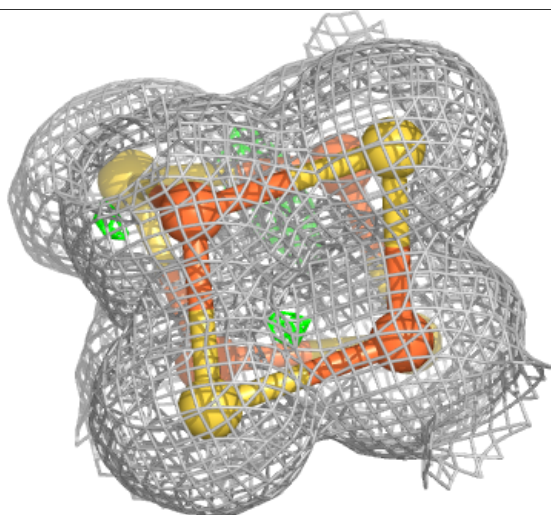
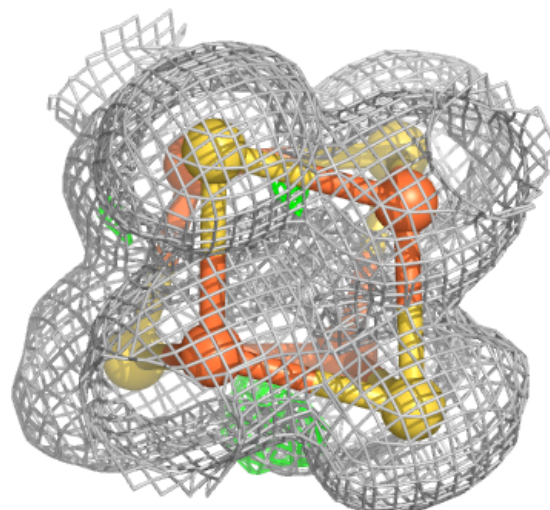
Electron density around NI B 603:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



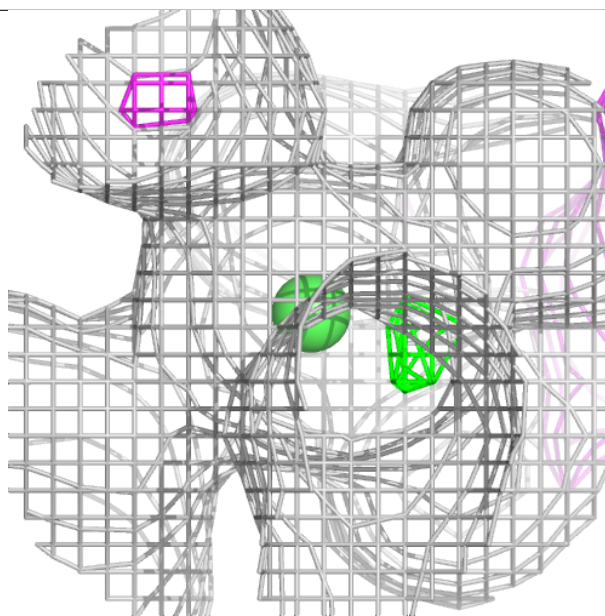
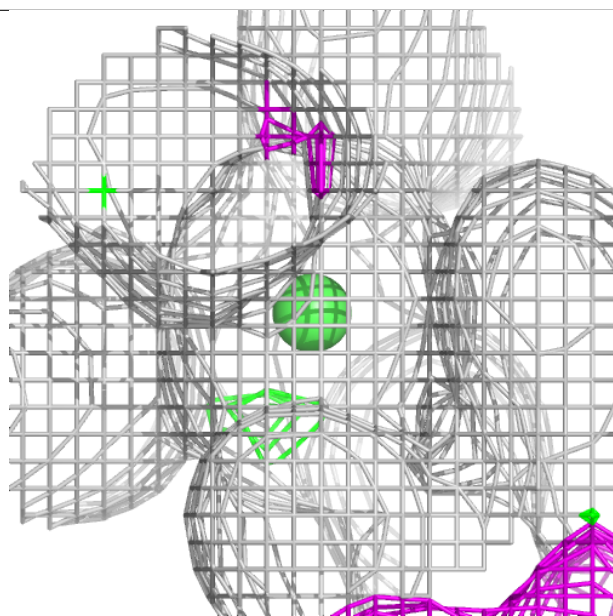
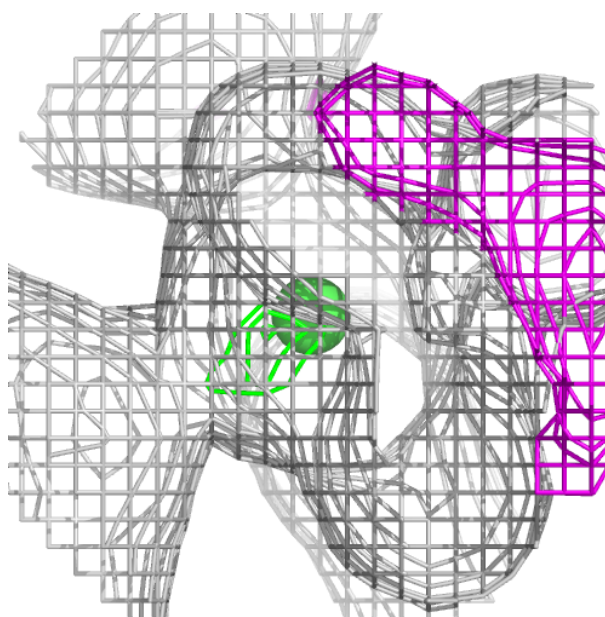
Electron density around SF4 C 101:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



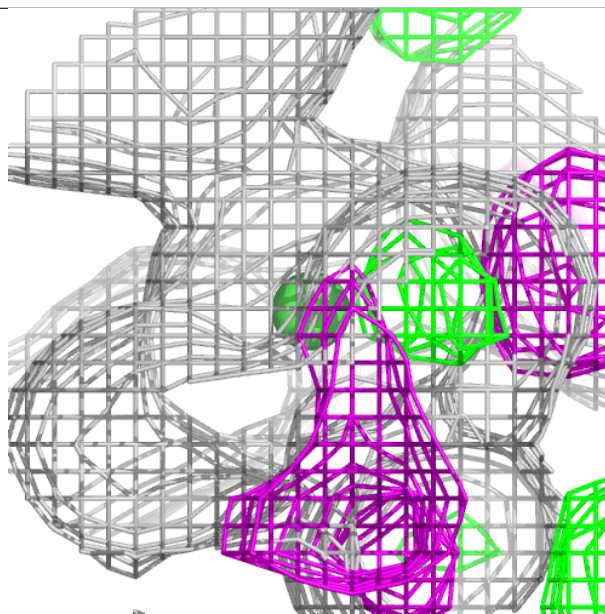
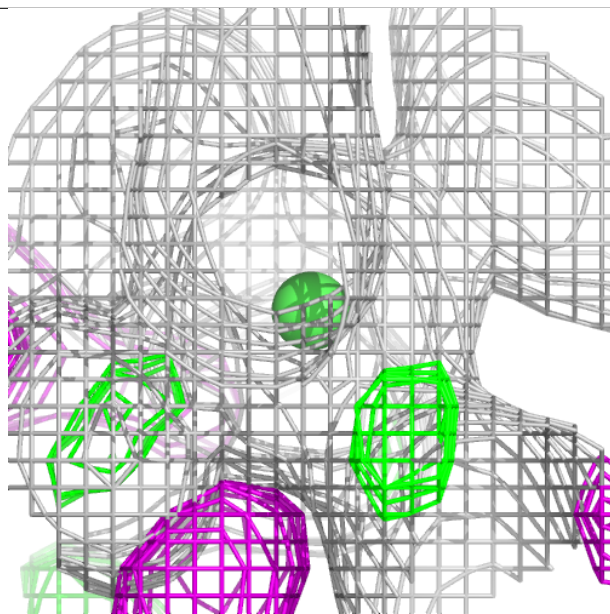
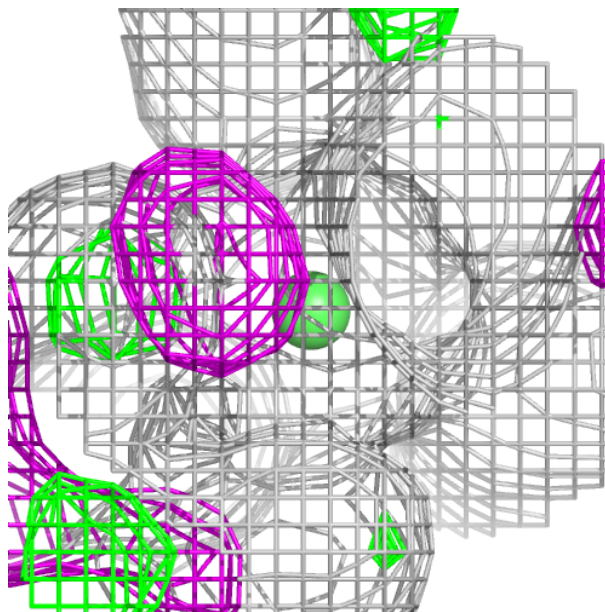
Electron density around NI D 602:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



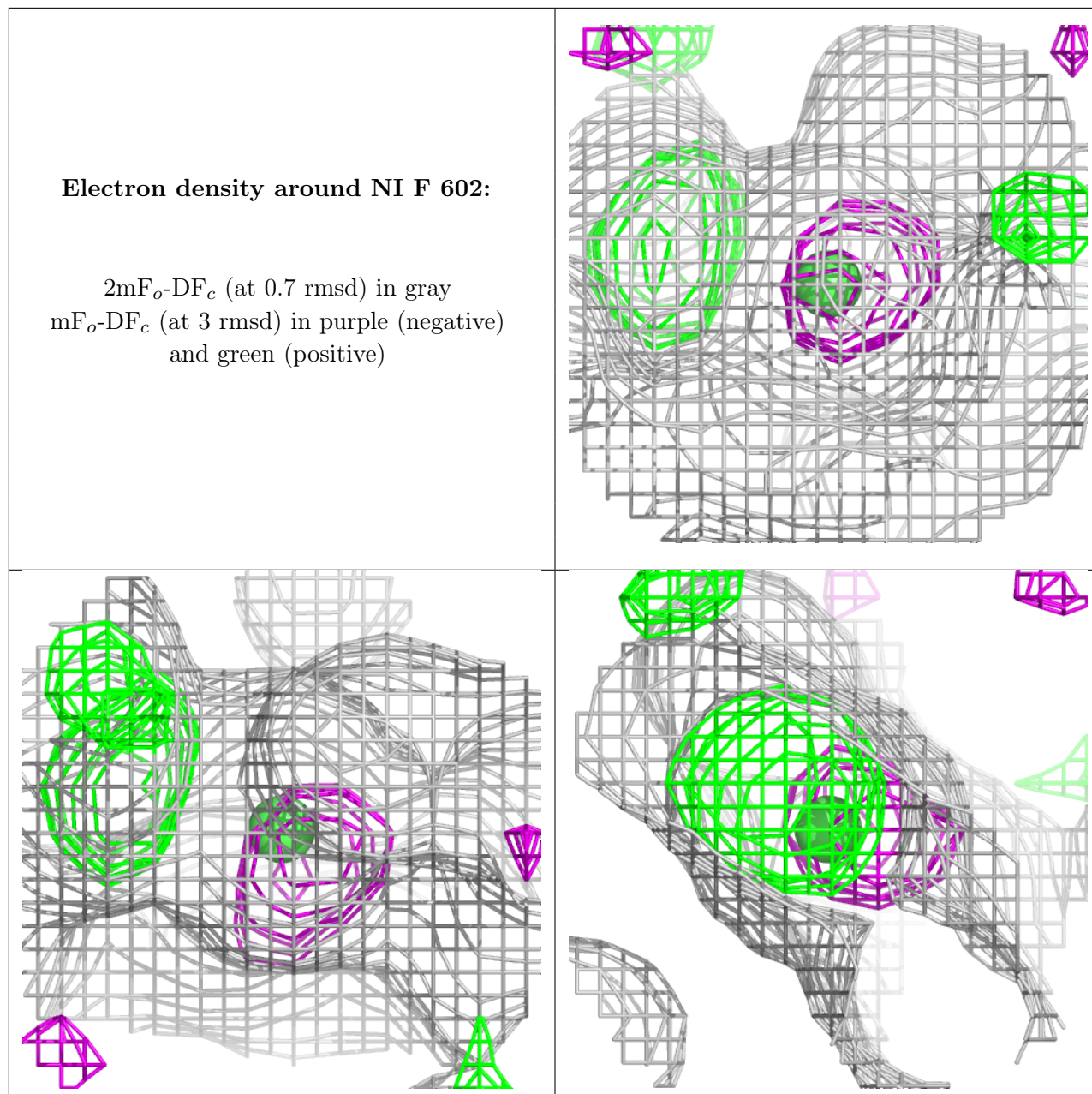
Electron density around NI F 601:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



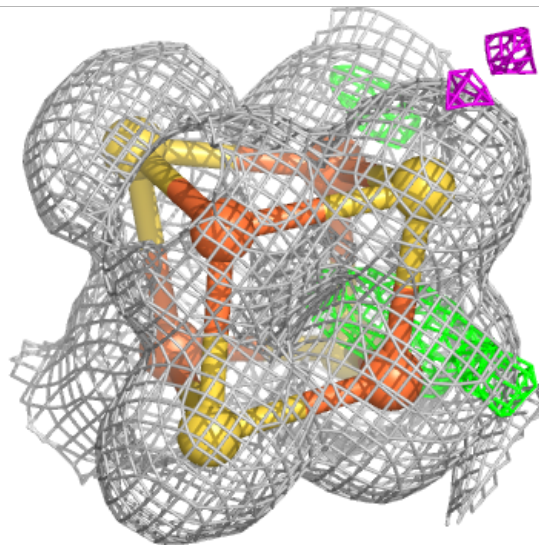
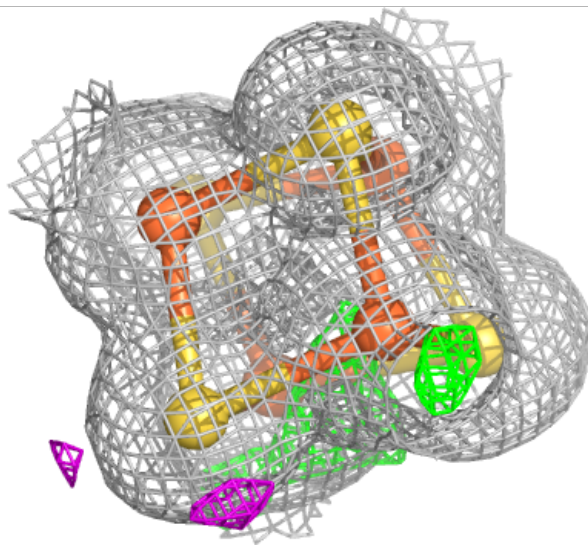
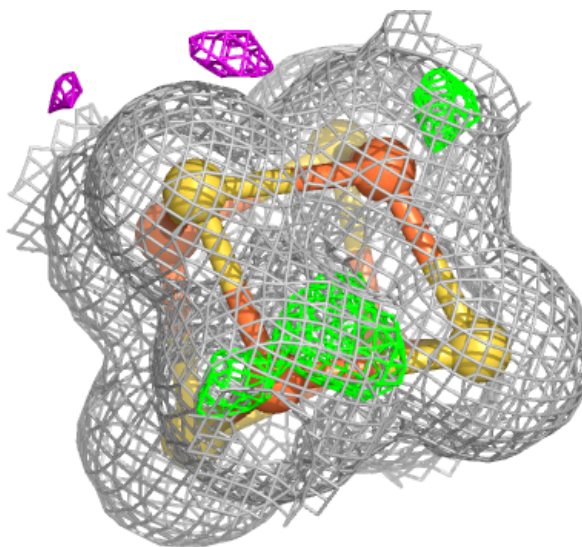
Electron density around NI F 602:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



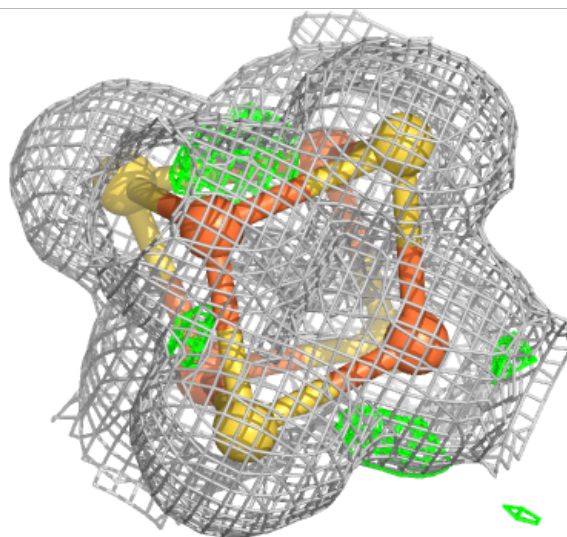
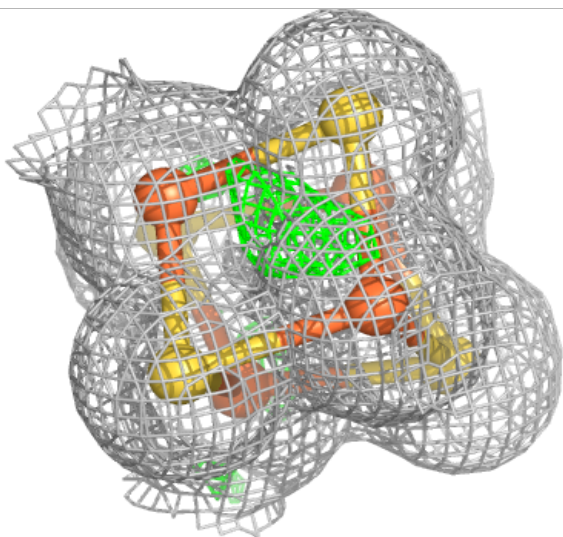
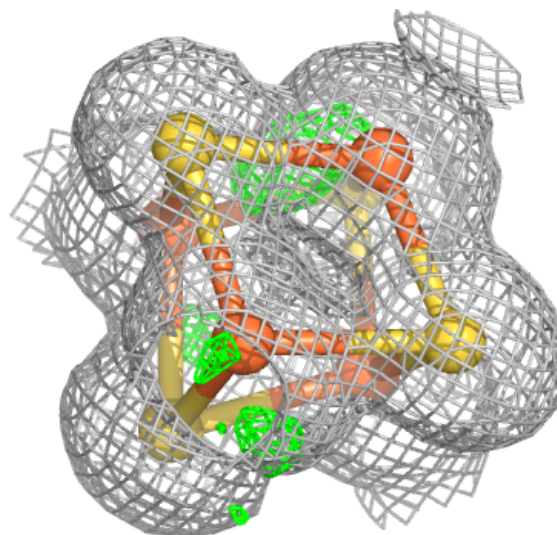
Electron density around SF4 E 101:

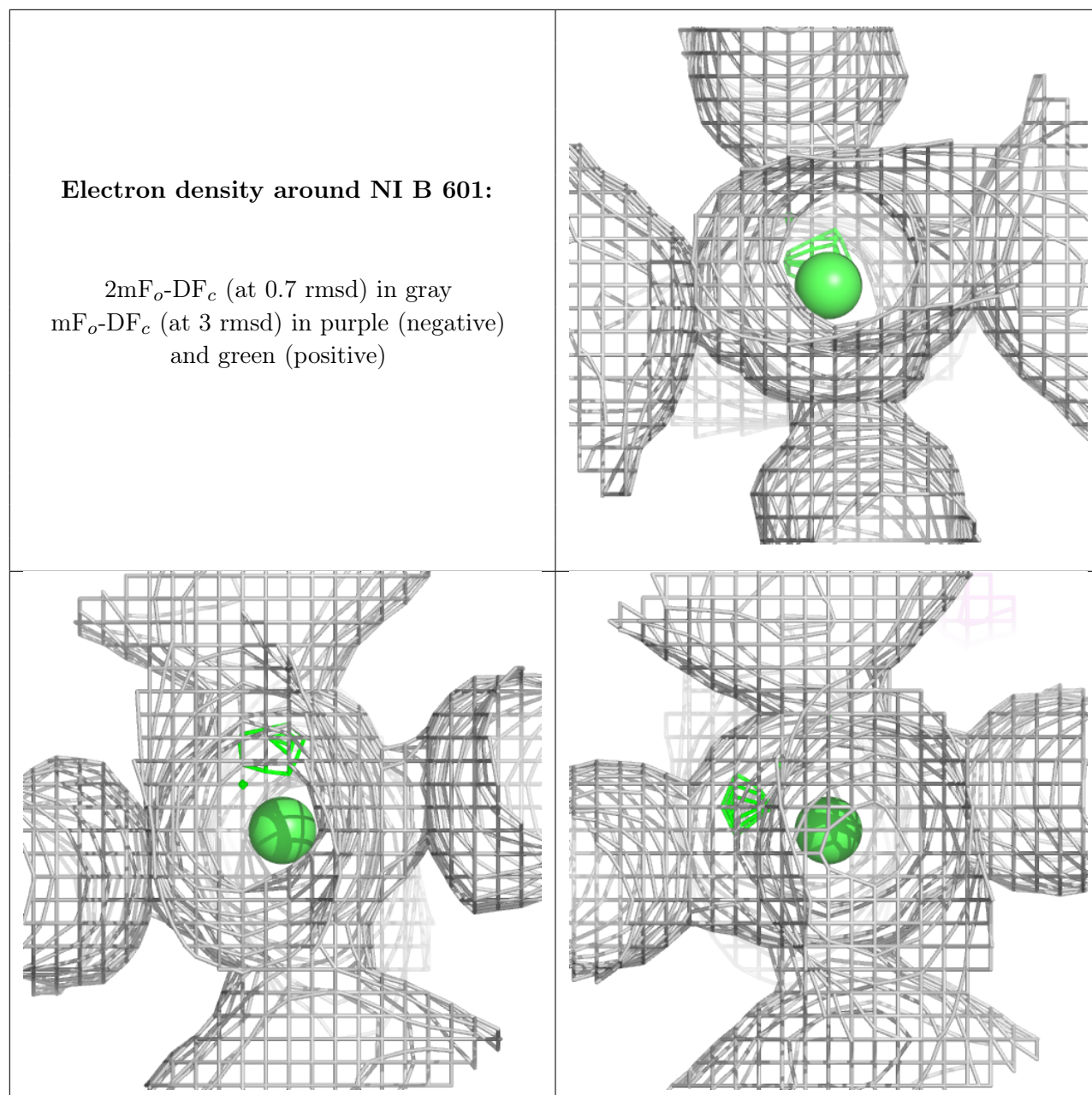
$2mF_o - DF_c$ (at 0.7 rmsd) in gray
 $mF_o - DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)



Electron density around SF4 A 101:

2mF_o-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)





6.5 Other polymers ⓘ

There are no such residues in this entry.