



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 8, 2026 – 02:36 AM UTC

PDB ID : 8THM / pdb_00008thm
Title : Beta carbonic anhydrase from the carboxysome of Cyanobium PCC 7001
Authors : Pulsford, S.B.; Jackson, C.J.
Deposited on : 2023-07-17
Resolution : 2.30 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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)
Xtrriage (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

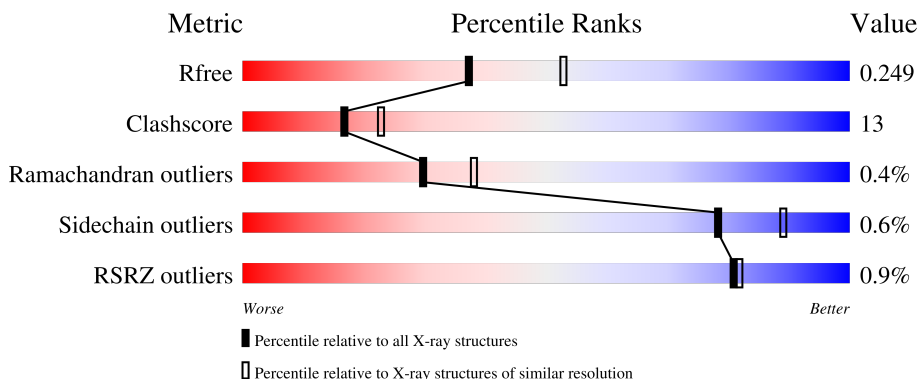
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.30 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.



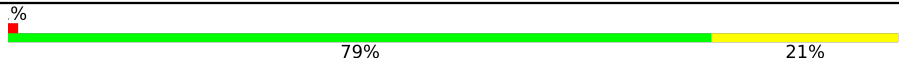
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	180053	6319 (2.30-2.30)
Clashscore	190562	6919 (2.30-2.30)
Ramachandran outliers	187476	6854 (2.30-2.30)
Sidechain outliers	187428	6854 (2.30-2.30)
RSRZ outliers	180081	6325 (2.30-2.30)

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	462	79% 20%
1	B	462	76% 23%
1	C	462	75% 24%
1	D	462	78% 21%
1	E	462	78% 21%

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Mol	Chain	Length	Quality of chain
1	F	462	 % 79% 21%

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	E	603	-	-	X	-
5	EDO	F	606	-	-	X	-
6	RUB	A	608	-	-	X	-
6	RUB	C	605	-	-	X	-
6	RUB	D	605	-	-	X	-
6	RUB	E	610	-	-	X	-
6	RUB	F	609	-	-	X	-

2 Entry composition [i](#)

There are 9 unique types of molecules in this entry. The entry contains 23086 atoms, of which 75 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 Carboxysome shell carbonic anhydrase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	461	3674	2310	669	681	14	0	7	0
1	B	462	3626	2283	653	676	14	0	2	0
1	C	461	3635	2289	653	679	14	0	4	0
1	D	462	3656	2301	659	682	14	0	6	0
1	E	461	3676	2312	671	679	14	0	7	0
1	F	462	3697	2323	674	686	14	0	9	0

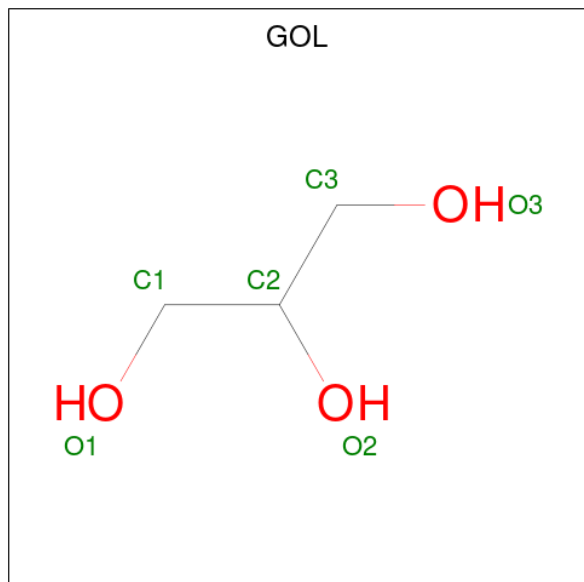
There are 12 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	116	SER	-	expression tag	UNP B5ILN4
A	117	MET	-	expression tag	UNP B5ILN4
B	116	SER	-	expression tag	UNP B5ILN4
B	117	MET	-	expression tag	UNP B5ILN4
C	116	SER	-	expression tag	UNP B5ILN4
C	117	MET	-	expression tag	UNP B5ILN4
D	116	SER	-	expression tag	UNP B5ILN4
D	117	MET	-	expression tag	UNP B5ILN4
E	116	SER	-	expression tag	UNP B5ILN4
E	117	MET	-	expression tag	UNP B5ILN4
F	116	SER	-	expression tag	UNP B5ILN4
F	117	MET	-	expression tag	UNP B5ILN4

- Molecule 2 is ZINC ION (CCD ID: ZN) (formula: Zn) (labeled as "Ligand of Interest" by depositor).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	2	Total Zn 2 2	0	0
2	B	2	Total Zn 2 2	0	0
2	C	1	Total Zn 1 1	0	0
2	D	1	Total Zn 1 1	0	0
2	E	1	Total Zn 1 1	0	0
2	F	1	Total Zn 1 1	0	0

- Molecule 3 is GLYCEROL (CCD ID: GOL) (formula: C₃H₈O₃).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total C O 6 3 3	0	0
3	B	1	Total C H O 14 3 8 3	0	0
3	D	1	Total C O 6 3 3	0	0

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



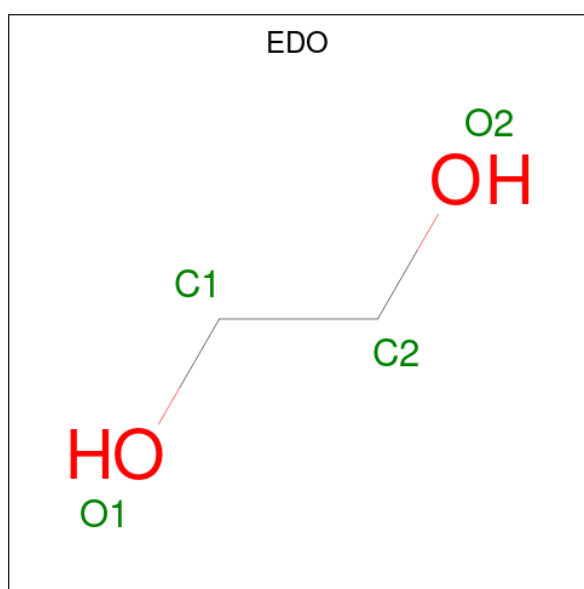
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	O	S	0	0
			5	4	1		
4	A	1	Total	O	S	0	0
			5	4	1		
4	A	1	Total	O	S	0	0
			5	4	1		
4	B	1	Total	O	S	0	0
			5	4	1		
4	B	1	Total	O	S	0	0
			5	4	1		
4	C	1	Total	O	S	0	0
			5	4	1		
4	C	1	Total	O	S	0	0
			5	4	1		
4	D	1	Total	O	S	0	0
			5	4	1		
4	D	1	Total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

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

- Molecule 5 is 1,2-ETHANEDIOL (CCD ID: EDO) (formula: C₂H₆O₂).



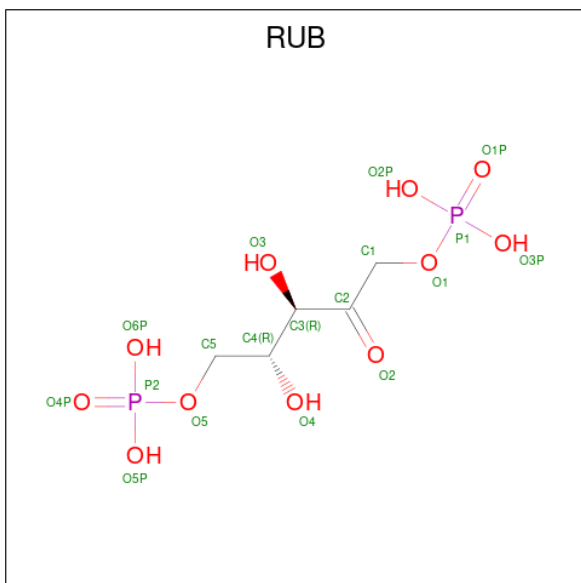
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	1	Total C O 4 2 2	0	0
5	B	1	Total C O 4 2 2	0	0
5	C	1	Total C H O 10 2 6 2	0	0
5	E	1	Total C O 4 2 2	0	0
5	E	1	Total C O 4 2 2	0	0
5	E	1	Total C H O 10 2 6 2	0	0
5	E	1	Total C H O 10 2 6 2	0	0

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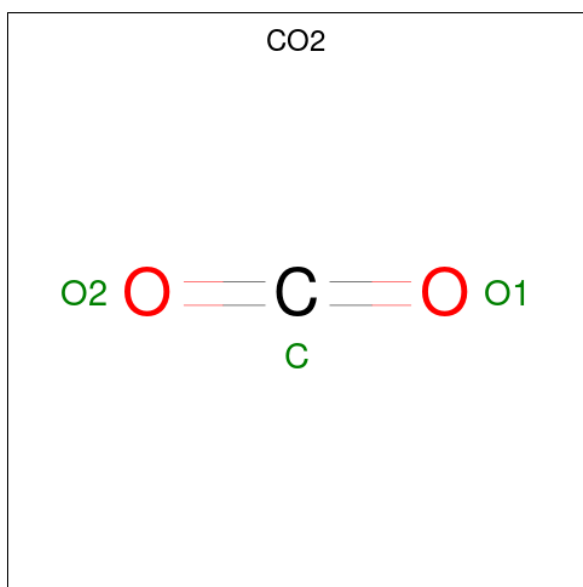
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	F	1	Total	C	O	0	0
			4	2	2		
5	F	1	Total	C	O	0	0
			4	2	2		
5	F	1	Total	C	O	0	0
			4	2	2		

- Molecule 6 is RIBULOSE-1,5-DIPHOSPHATE (CCD ID: RUB) (formula: $C_5H_{12}O_{11}P_2$) (labeled as "Ligand of Interest" by depositor).



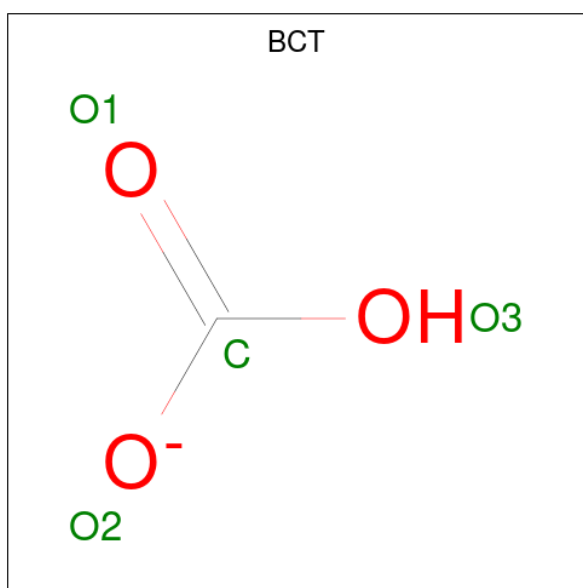
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
6	A	1	Total	C	H	O	P	0	0
			26	5	8	11	2		
6	B	1	Total	C	H	O	P	0	0
			26	5	8	11	2		
6	C	1	Total	C	H	O	P	0	0
			26	5	8	11	2		
6	D	1	Total	C	H	O	P	0	0
			26	5	8	11	2		
6	E	1	Total	C	H	O	P	0	0
			26	5	8	11	2		
6	F	1	Total	C	H	O	P	0	0
			26	5	8	11	2		

- Molecule 7 is CARBON DIOXIDE (CCD ID: CO2) (formula: CO_2).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
7	C	1	Total	C	O	0	0
			3	1	2		
7	D	1	Total	C	O	0	0
			3	1	2		

- Molecule 8 is BICARBONATE ION (CCD ID: BCT) (formula: CHO_3).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
8	D	1	Total	C	H	O	0	0
			5	1	1	3		

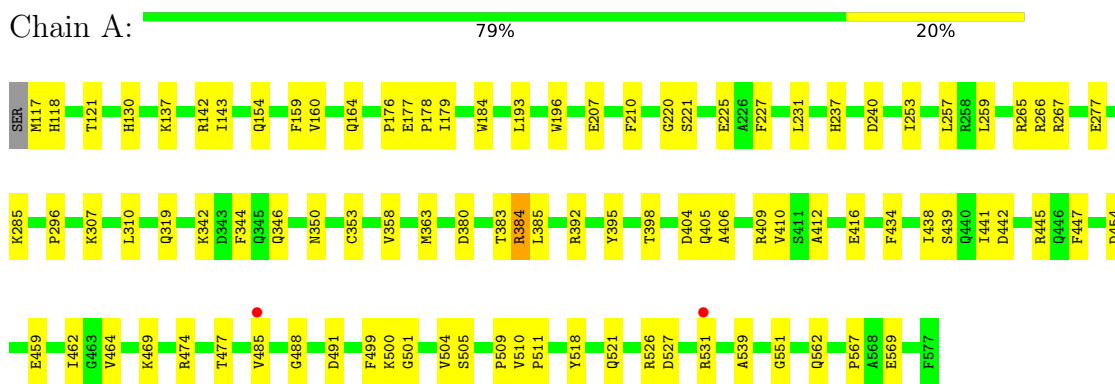
- Molecule 9 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
9	A	158	Total 158	O 158	0	0
9	B	126	Total 126	O 126	0	0
9	C	108	Total 108	O 108	0	0
9	D	128	Total 128	O 128	0	0
9	E	115	Total 115	O 115	0	0
9	F	138	Total 138	O 138	0	0

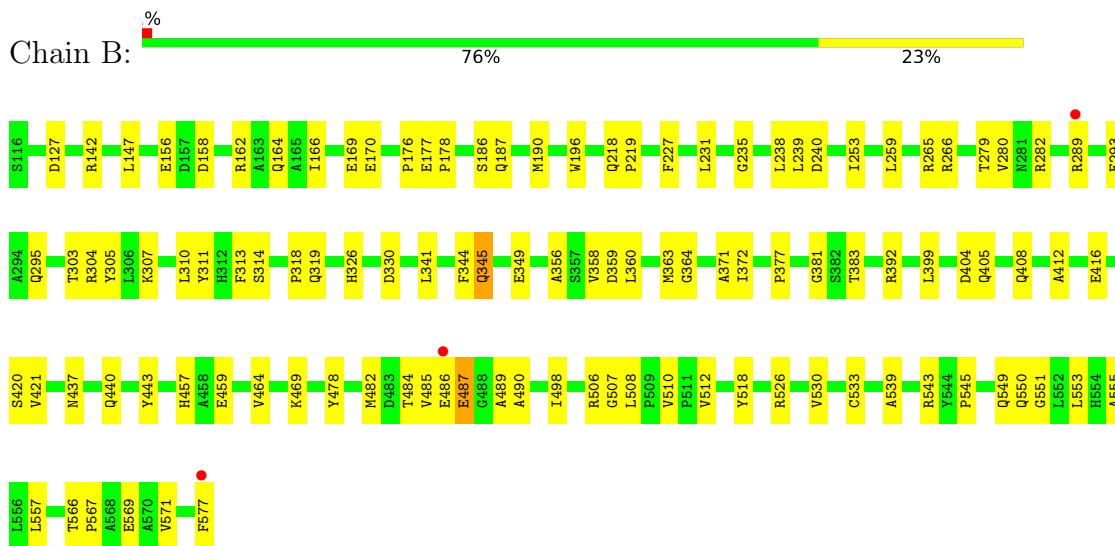
3 Residue-property plots

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.

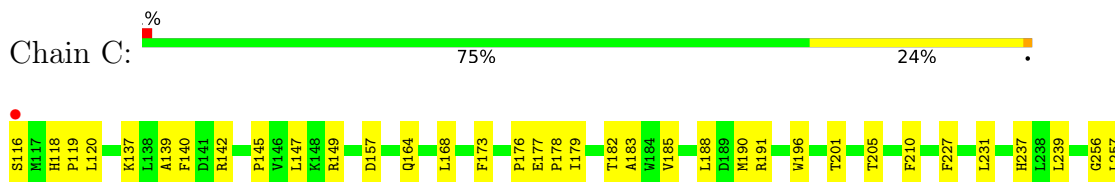
- Molecule 1: Carboxysome shell carbonic anhydrase

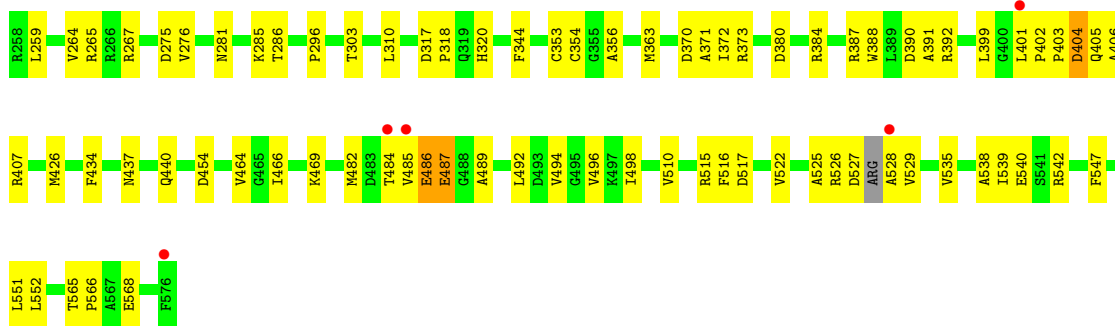


- Molecule 1: Carboxysome shell carbonic anhydrase

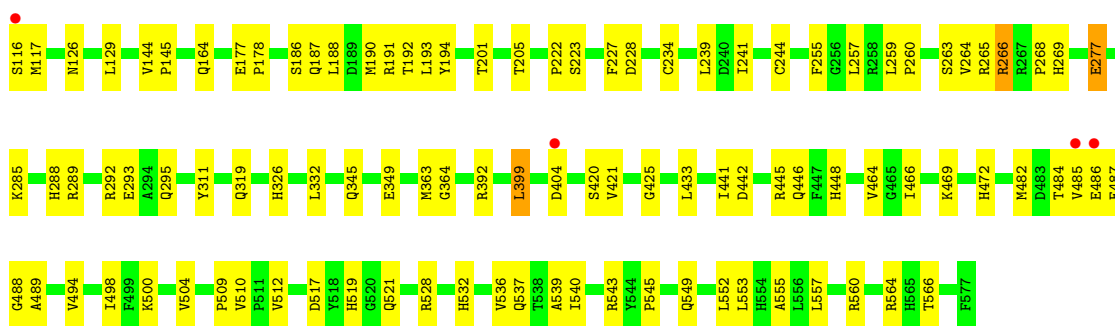
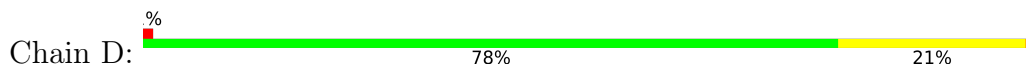


- Molecule 1: Carboxysome shell carbonic anhydrase

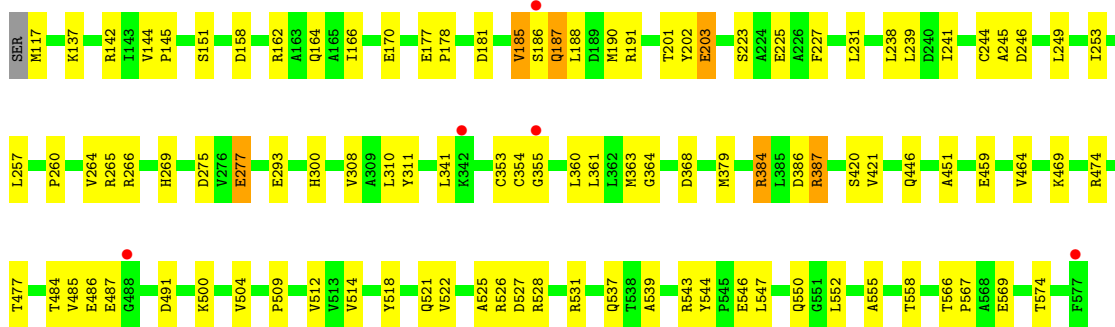
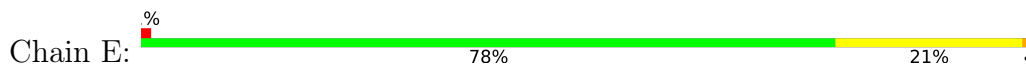




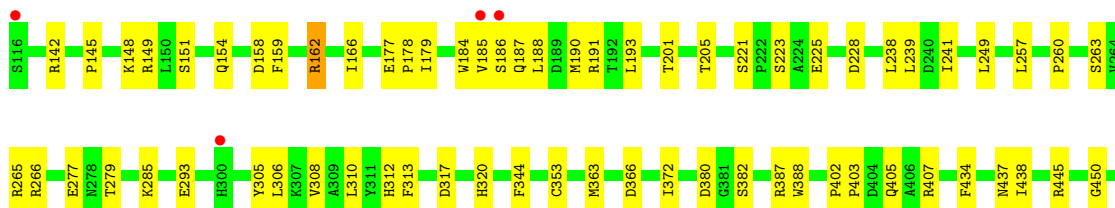
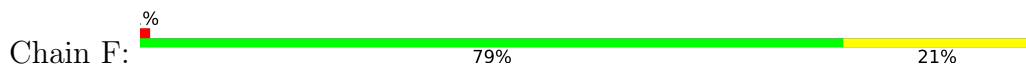
● Molecule 1: Carboxysome shell carbonic anhydrase



● Molecule 1: Carboxysome shell carbonic anhydrase



● Molecule 1: Carboxysome shell carbonic anhydrase





4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	104.31Å 181.85Å 190.06Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	47.51 – 2.30 47.51 – 2.30	Depositor EDS
% Data completeness (in resolution range)	99.9 (47.51-2.30) 100.0 (47.51-2.30)	Depositor EDS
R_{merge}	0.26	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.31 (at 2.29Å)	Xtrriage
Refinement program	PHENIX (1.18.2_3874: ???)	Depositor
R, R_{free}	0.193 , 0.247 0.196 , 0.249	Depositor DCC
R_{free} test set	7994 reflections (4.98%)	wwPDB-VP
Wilson B-factor (Å ²)	45.3	Xtrriage
Anisotropy	0.374	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 31.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	0.003 for -h,l,k	Xtrriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	23086	wwPDB-VP
Average B, all atoms (Å ²)	52.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.39% 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 [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: GOL, RUB, ZN, EDO, BCT, SO4, CO2

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	0.58	6/3768 (0.2%)	0.63	1/5120 (0.0%)
1	B	0.49	3/3717 (0.1%)	0.60	1/5055 (0.0%)
1	C	0.53	2/3725 (0.1%)	0.64	3/5065 (0.1%)
1	D	0.58	4/3751 (0.1%)	0.62	1/5100 (0.0%)
1	E	0.48	3/3770 (0.1%)	0.59	0/5121
1	F	0.45	1/3795 (0.0%)	0.59	0/5156
All	All	0.52	19/22526 (0.1%)	0.61	6/30617 (0.0%)

The worst 5 of 19 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	474	ARG	C-O	-6.29	1.16	1.23
1	D	193	LEU	C-O	-6.03	1.17	1.24
1	A	384	ARG	C-O	-5.94	1.16	1.24
1	A	342	LYS	C-O	-5.94	1.17	1.24
1	E	202	TYR	C-O	-5.93	1.17	1.24

The worst 5 of 6 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	401	LEU	CA-C-N	-6.93	113.24	120.38
1	C	401	LEU	C-N-CA	-6.93	113.24	120.38
1	D	399	LEU	N-CA-C	6.47	118.33	111.28
1	B	319	GLN	N-CA-C	6.28	121.08	113.41
1	C	405	GLN	N-CA-C	-5.67	105.86	112.89

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	3674	0	3553	76	0
1	B	3626	0	3498	82	0
1	C	3635	0	3507	115	0
1	D	3656	0	3526	102	0
1	E	3676	0	3563	94	0
1	F	3697	0	3571	102	0
2	A	2	0	0	0	0
2	B	2	0	0	0	0
2	C	1	0	0	0	0
2	D	1	0	0	0	0
2	E	1	0	0	0	0
2	F	1	0	0	0	0
3	A	6	0	8	0	0
3	B	6	8	8	2	0
3	D	6	0	8	0	0
4	A	15	0	0	1	0
4	B	10	0	0	0	0
4	C	10	0	0	1	0
4	D	15	0	0	1	0
4	E	20	0	0	2	0
4	F	20	0	0	1	0
5	A	4	0	6	0	0
5	B	4	0	6	0	0
5	C	4	6	6	0	0
5	E	16	12	24	1	0
5	F	12	0	18	6	0
6	A	18	8	8	11	0
6	B	18	8	8	5	0
6	C	18	8	8	7	0
6	D	18	8	8	10	0
6	E	18	8	8	7	0
6	F	18	8	8	14	0
7	C	3	0	0	0	0
7	D	3	0	0	0	0
8	D	4	1	1	1	0
9	A	158	0	0	12	0
9	B	126	0	0	10	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
9	C	108	0	0	13	0
9	D	128	0	0	16	0
9	E	115	0	0	8	0
9	F	138	0	0	7	0
All	All	23011	75	21351	558	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 13.

The worst 5 of 558 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)
1:E:341:LEU:HB3	1:E:360:LEU:HD22	1.30	1.10
1:E:249:LEU:HD22	9:E:778:HOH:O	1.57	1.03
1:C:406:ALA:HB3	9:C:701:HOH:O	1.57	1.01
1:A:265[A]:ARG:HA	6:A:608:RUB:H52	1.43	1.01
1:F:445:ARG:HD3	5:F:606:EDO:H22	1.45	0.98

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	466/462 (101%)	451 (97%)	15 (3%)	0	100 100
1	B	462/462 (100%)	443 (96%)	17 (4%)	2 (0%)	30 38
1	C	460/462 (100%)	441 (96%)	14 (3%)	5 (1%)	11 13
1	D	466/462 (101%)	448 (96%)	17 (4%)	1 (0%)	43 55
1	E	466/462 (101%)	446 (96%)	17 (4%)	3 (1%)	21 27
1	F	469/462 (102%)	459 (98%)	10 (2%)	0	100 100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
All	All	2789/2772 (101%)	2688 (96%)	90 (3%)	11 (0%)	30	38

5 of 11 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	487	GLU
1	C	157	ASP
1	D	404	ASP
1	C	404	ASP
1	E	187	GLN

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	384/378 (102%)	380 (99%)	4 (1%)	68	82
1	B	379/378 (100%)	379 (100%)	0	100	100
1	C	381/378 (101%)	381 (100%)	0	100	100
1	D	383/378 (101%)	381 (100%)	2 (0%)	81	90
1	E	384/378 (102%)	378 (98%)	6 (2%)	55	73
1	F	387/378 (102%)	382 (99%)	5 (1%)	61	77
All	All	2298/2268 (101%)	2281 (99%)	17 (1%)	78	87

5 of 17 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	F	387	ARG
1	F	487[B]	GLU
1	E	277[A]	GLU
1	E	277[B]	GLU
1	E	384	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 19 such sidechains are listed below:

Mol	Chain	Res	Type
1	E	346	GLN
1	E	562	GLN
1	F	281	ASN
1	E	448	HIS
1	D	204	GLN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 48 ligands modelled in this entry, 8 are monoatomic - leaving 40 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	D	603	-	4,4,4	0.28	0	6,6,6	0.50	0
6	RUB	F	609	-	17,17,17	1.46	3 (17%)	17,25,25	1.50	4 (23%)
5	EDO	F	606	-	3,3,3	0.53	0	2,2,2	0.17	0
4	SO4	C	602	-	4,4,4	1.00	0	6,6,6	0.51	0
4	SO4	A	604	-	4,4,4	0.16	0	6,6,6	0.34	0
4	SO4	D	602	-	4,4,4	0.29	0	6,6,6	0.34	0
5	EDO	E	606	-	3,3,3	0.48	0	2,2,2	0.33	0
5	EDO	E	608	-	3,3,3	0.58	0	2,2,2	0.05	0
4	SO4	C	603	-	4,4,4	0.28	0	6,6,6	0.27	0
5	EDO	A	607	-	3,3,3	0.52	0	2,2,2	0.47	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
5	EDO	B	605	-	3,3,3	0.53	0	2,2,2	0.27	0
6	RUB	E	610	-	17,17,17	1.39	3 (17%)	17,25,25	1.23	2 (11%)
7	CO2	D	607	-	2,2,2	1.20	0	1,1,1	0.44	0
5	EDO	F	608	-	3,3,3	0.53	0	2,2,2	0.23	0
4	SO4	F	605	-	4,4,4	0.33	0	6,6,6	0.24	0
4	SO4	A	606	-	4,4,4	0.29	0	6,6,6	0.39	0
5	EDO	E	609	-	3,3,3	0.57	0	2,2,2	0.37	0
4	SO4	F	604	-	4,4,4	0.31	0	6,6,6	0.18	0
4	SO4	F	603	-	4,4,4	0.17	0	6,6,6	0.34	0
7	CO2	C	606	-	2,2,2	1.32	0	1,1,1	0.46	0
6	RUB	D	605	-	17,17,17	1.31	2 (11%)	17,25,25	1.12	3 (17%)
4	SO4	A	605	-	4,4,4	0.25	0	6,6,6	0.44	0
8	BCT	D	608	-	3,3,3	0.97	0	2,3,3	3.78	1 (50%)
4	SO4	F	602	-	4,4,4	0.19	0	6,6,6	0.28	0
5	EDO	E	607	-	3,3,3	0.52	0	2,2,2	0.27	0
4	SO4	B	603	-	4,4,4	0.26	0	6,6,6	0.39	0
5	EDO	F	607	-	3,3,3	0.47	0	2,2,2	0.39	0
5	EDO	C	604	-	3,3,3	0.54	0	2,2,2	0.33	0
3	GOL	B	607	-	5,5,5	1.23	1 (20%)	5,5,5	1.21	1 (20%)
6	RUB	C	605	-	17,17,17	1.39	3 (17%)	17,25,25	1.84	4 (23%)
4	SO4	E	602	-	4,4,4	0.23	0	6,6,6	0.28	0
3	GOL	D	606	-	5,5,5	1.46	2 (40%)	5,5,5	0.75	0
6	RUB	A	608	-	17,17,17	1.27	1 (5%)	17,25,25	1.32	1 (5%)
4	SO4	E	604	-	4,4,4	0.28	0	6,6,6	0.25	0
4	SO4	E	605	-	4,4,4	0.20	0	6,6,6	0.39	0
4	SO4	E	603	-	4,4,4	0.21	0	6,6,6	0.28	0
3	GOL	A	603	-	5,5,5	1.23	0	5,5,5	0.91	0
6	RUB	B	606	-	17,17,17	1.07	1 (5%)	17,25,25	0.85	0
4	SO4	B	604	-	4,4,4	0.34	0	6,6,6	0.27	0
4	SO4	D	604	-	4,4,4	0.22	0	6,6,6	0.20	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. '2' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
6	RUB	F	609	-	-	15/20/20/20	-
5	EDO	F	606	-	-	1/1/1/1	-
5	EDO	E	606	-	-	0/1/1/1	-
5	EDO	E	608	-	-	0/1/1/1	-

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
5	EDO	A	607	-	-	1/1/1/1	-
5	EDO	B	605	-	-	0/1/1/1	-
6	RUB	E	610	-	-	12/20/20/20	-
5	EDO	F	608	-	-	1/1/1/1	-
5	EDO	E	609	-	-	0/1/1/1	-
6	RUB	D	605	-	-	7/20/20/20	-
5	EDO	E	607	-	-	0/1/1/1	-
5	EDO	F	607	-	-	0/1/1/1	-
5	EDO	C	604	-	-	0/1/1/1	-
3	GOL	B	607	-	-	2/4/4/4	-
6	RUB	C	605	-	-	11/20/20/20	-
3	GOL	D	606	-	-	0/4/4/4	-
6	RUB	A	608	-	-	14/20/20/20	-
3	GOL	A	603	-	-	4/4/4/4	-
6	RUB	B	606	-	-	8/20/20/20	-

The worst 5 of 16 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
6	C	605	RUB	P2-O5	3.27	1.70	1.60
6	D	605	RUB	O1-C1	-3.09	1.40	1.43
6	A	608	RUB	O1-C1	-3.01	1.40	1.43
6	E	610	RUB	O1-C1	-2.89	1.40	1.43
6	F	609	RUB	P2-O5	2.82	1.69	1.60

The worst 5 of 16 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
6	C	605	RUB	O4-C4-C3	-5.43	101.79	109.67
8	D	608	BCT	O2-C-O1	5.16	132.87	119.68
6	A	608	RUB	O5P-P2-O5	3.75	116.45	106.67
6	E	610	RUB	O3-C3-C4	-3.18	101.37	109.46
6	C	605	RUB	O5P-P2-O5	3.01	114.53	106.67

There are no chirality outliers.

5 of 76 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	603	GOL	C1-C2-C3-O3
3	B	607	GOL	C1-C2-C3-O3

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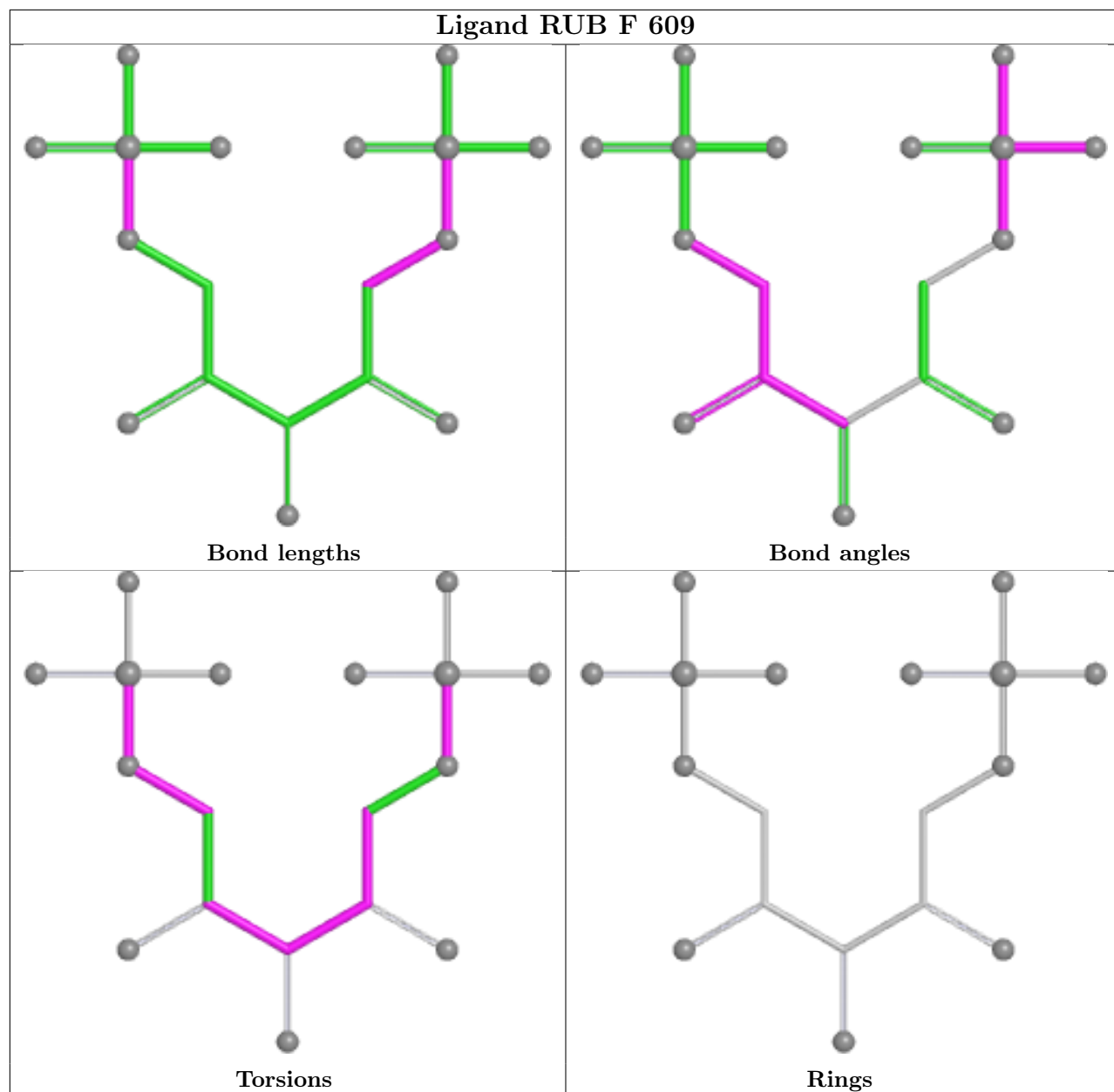
Mol	Chain	Res	Type	Atoms
6	A	608	RUB	O1-C1-C2-C3
6	A	608	RUB	O1-C1-C2-O2
6	A	608	RUB	O2-C2-C3-O3

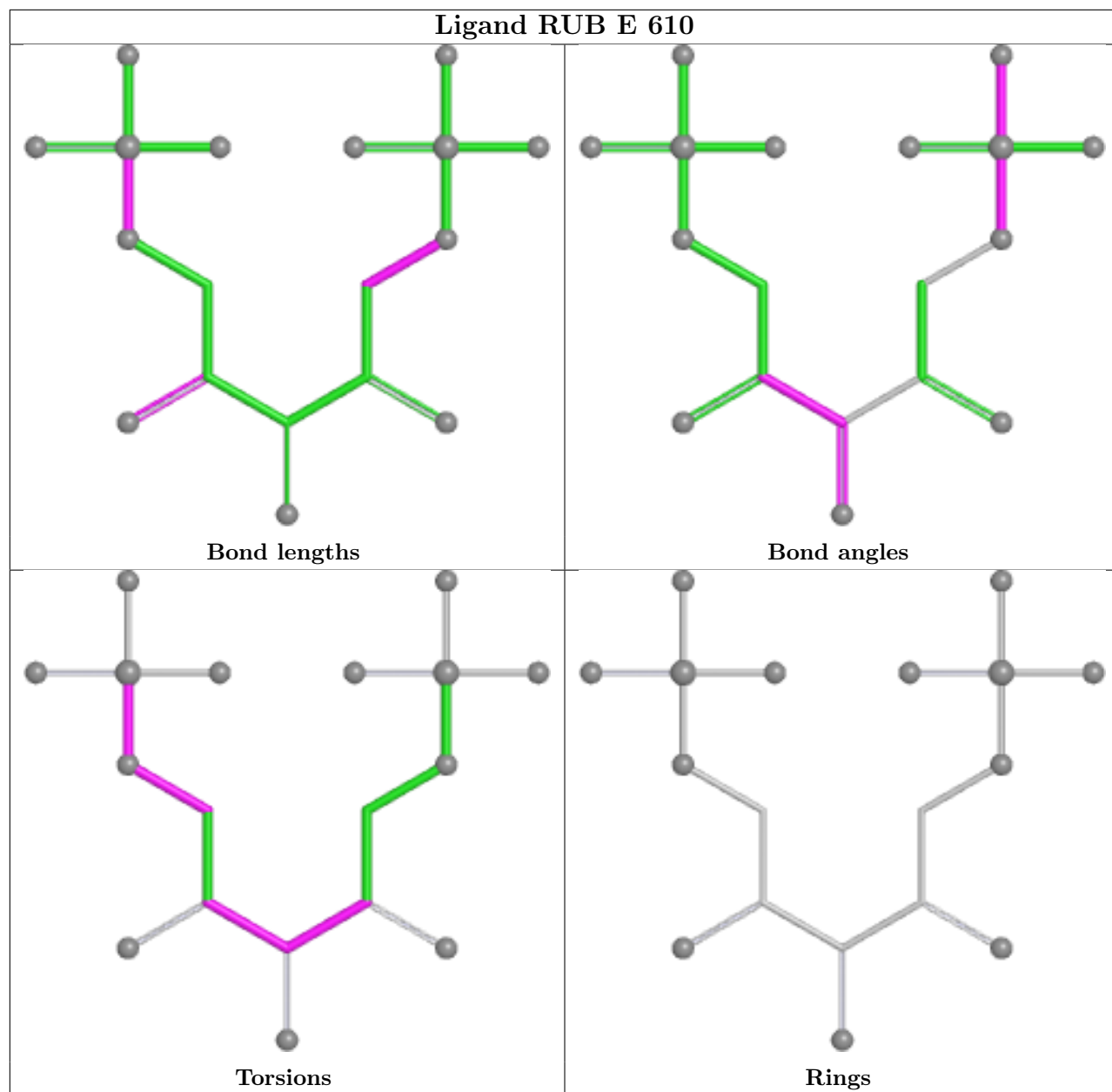
There are no ring outliers.

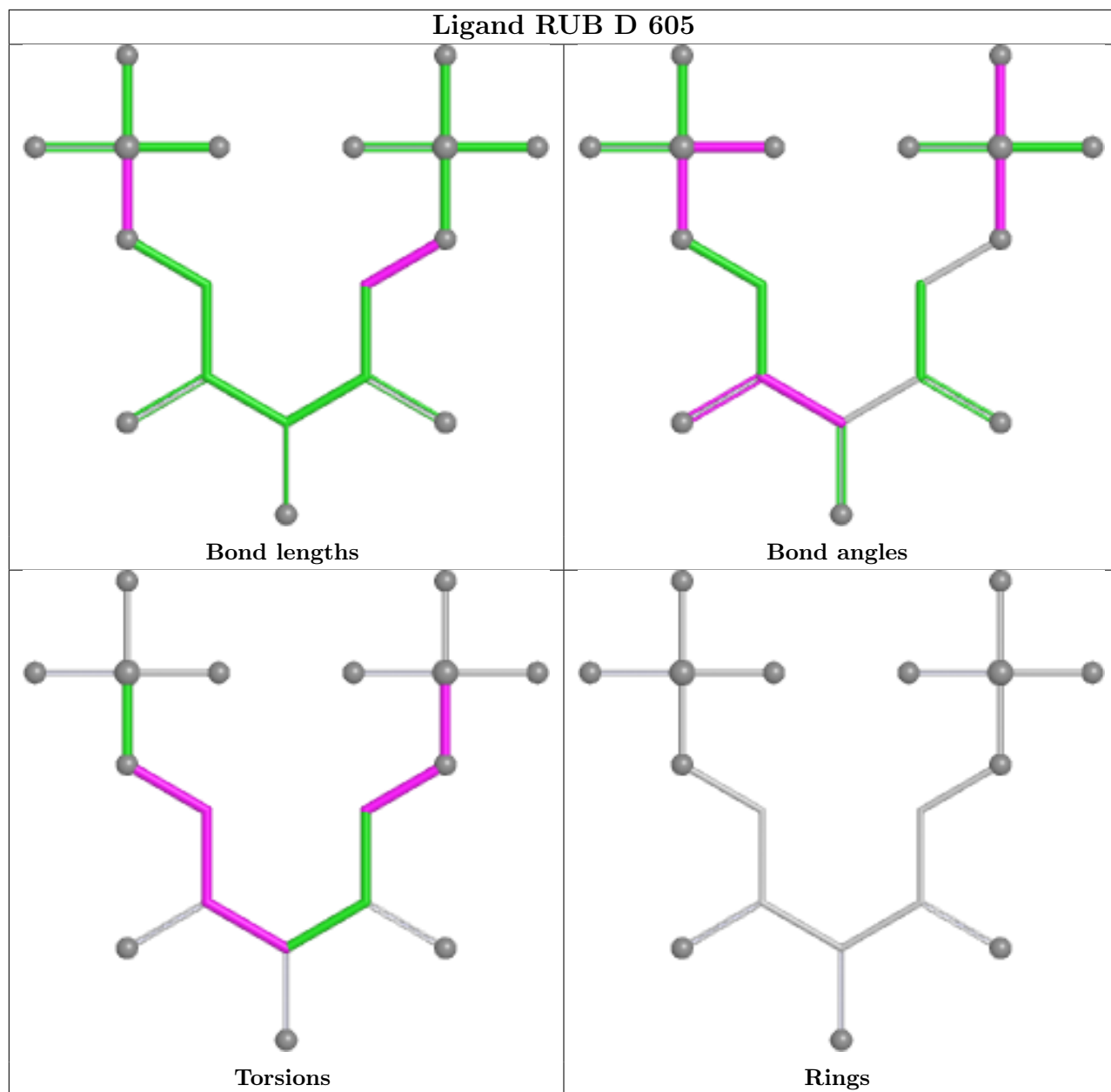
15 monomers are involved in 70 short contacts:

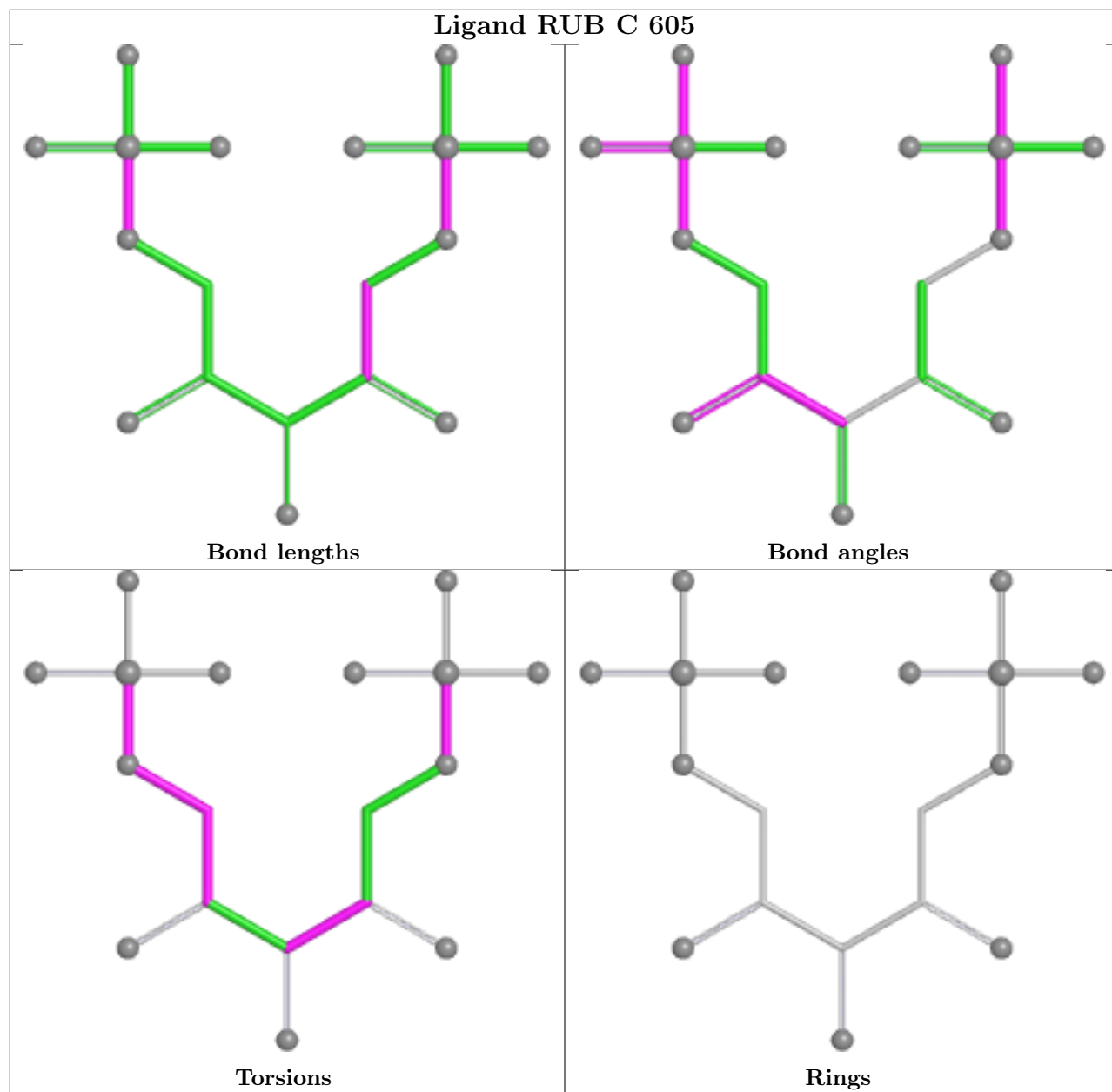
Mol	Chain	Res	Type	Clashes	Symm-Clashes
6	F	609	RUB	14	0
5	F	606	EDO	6	0
4	C	602	SO4	1	0
6	E	610	RUB	7	0
4	F	603	SO4	1	0
6	D	605	RUB	10	0
4	A	605	SO4	1	0
8	D	608	BCT	1	0
5	E	607	EDO	1	0
3	B	607	GOL	2	0
6	C	605	RUB	7	0
6	A	608	RUB	11	0
4	E	603	SO4	2	0
6	B	606	RUB	5	0
4	D	604	SO4	1	0

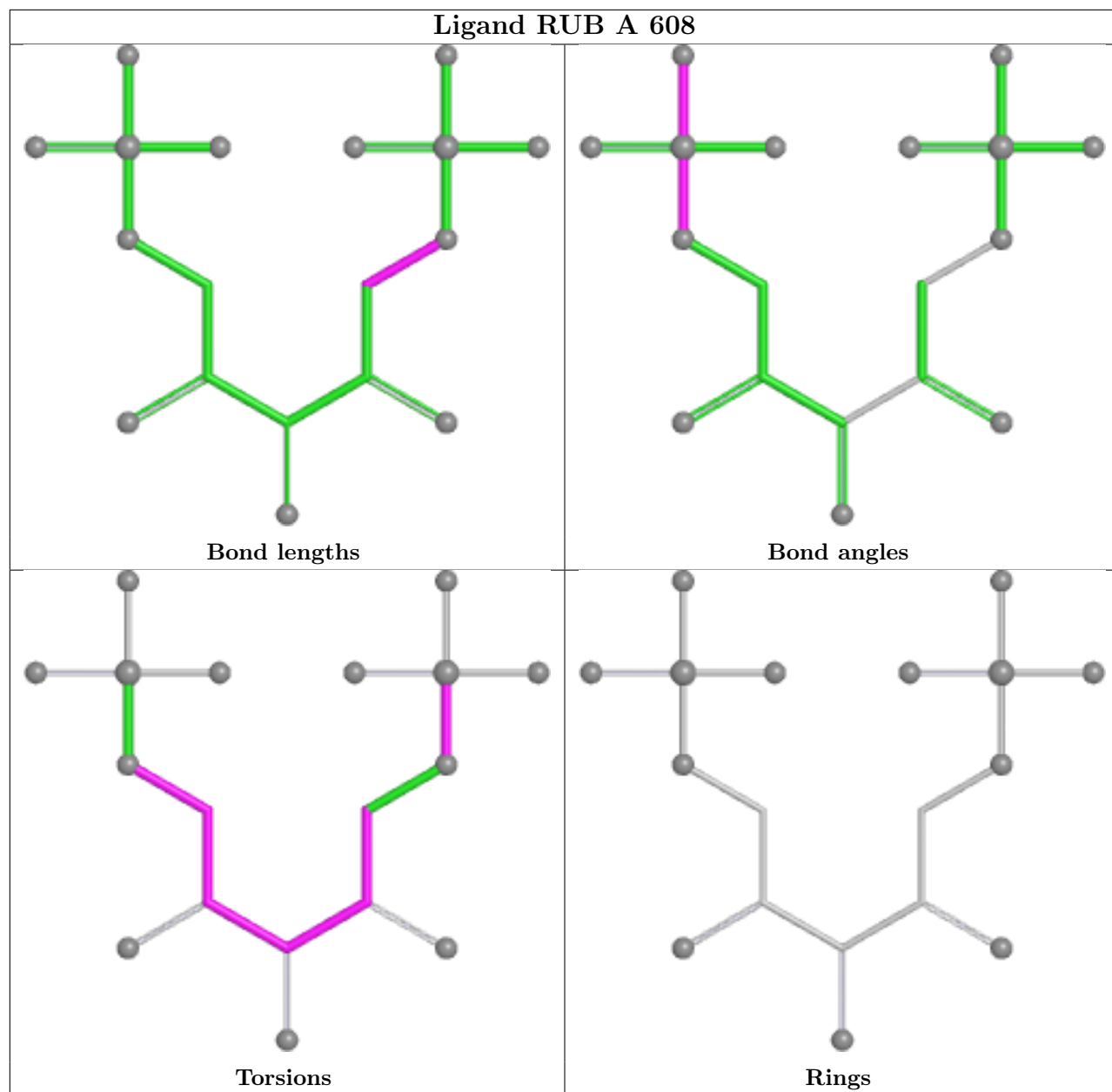
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. 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.

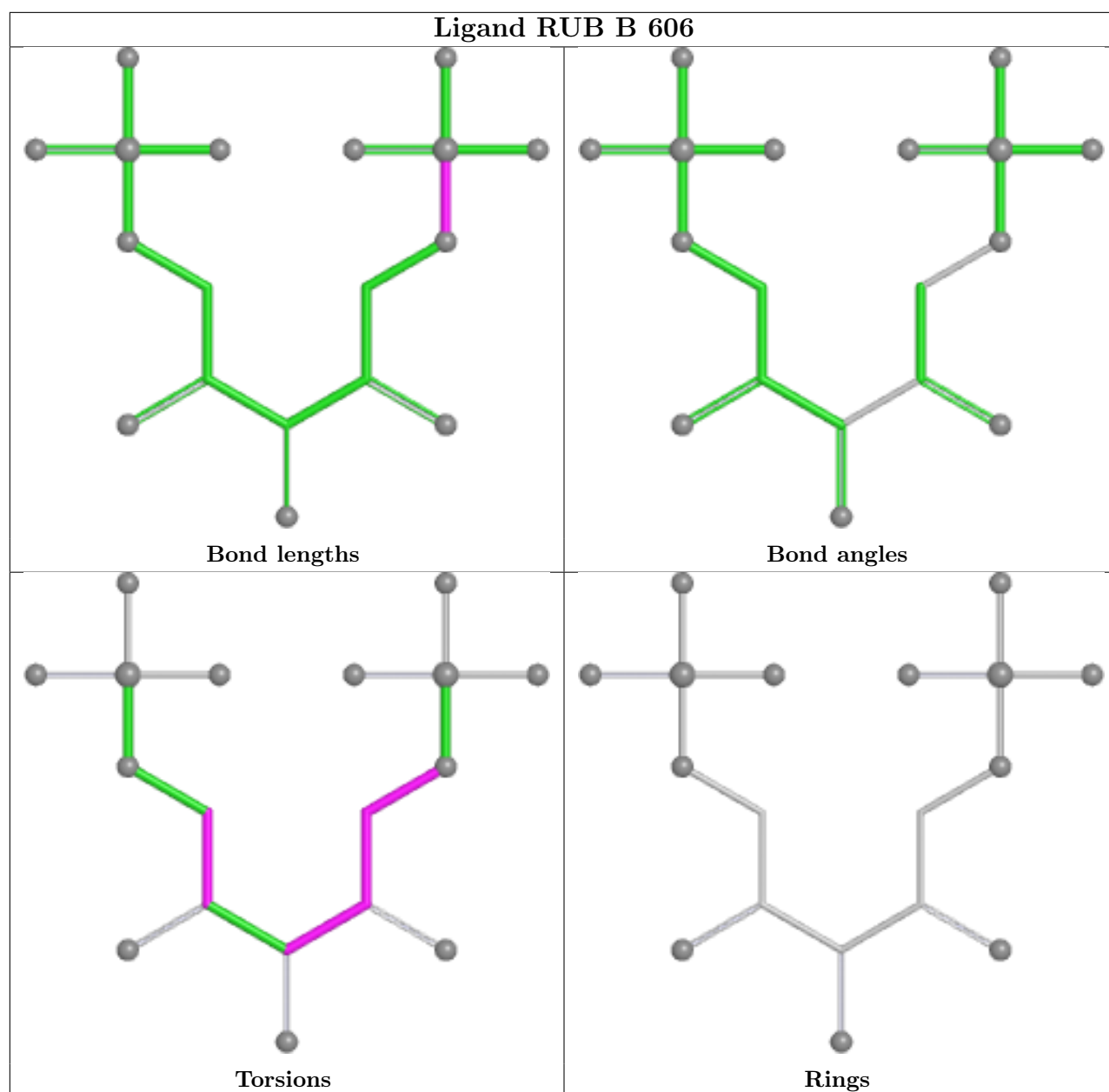












5.7 Other polymers [\(i\)](#)

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 [i](#)

6.1 Protein, DNA and RNA chains [i](#)

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	461/462 (99%)	-0.19	2 (0%) 88 89	23, 47, 67, 96	8 (1%)
1	B	462/462 (100%)	-0.08	3 (0%) 85 86	24, 49, 69, 103	2 (0%)
1	C	461/462 (99%)	0.20	6 (1%) 75 76	25, 55, 73, 94	4 (0%)
1	D	462/462 (100%)	0.03	4 (0%) 81 82	22, 51, 74, 92	6 (1%)
1	E	461/462 (99%)	0.07	5 (1%) 78 79	23, 52, 72, 93	9 (1%)
1	F	462/462 (100%)	-0.20	5 (1%) 78 79	22, 48, 63, 86	9 (1%)
All	All	2769/2772 (99%)	-0.03	25 (0%) 81 82	22, 50, 71, 103	38 (1%)

The worst 5 of 25 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	116[A]	SER	3.7
1	C	484	THR	3.6
1	C	528	ALA	3.3
1	E	577	PHE	3.0
1	D	485	VAL	3.0

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.

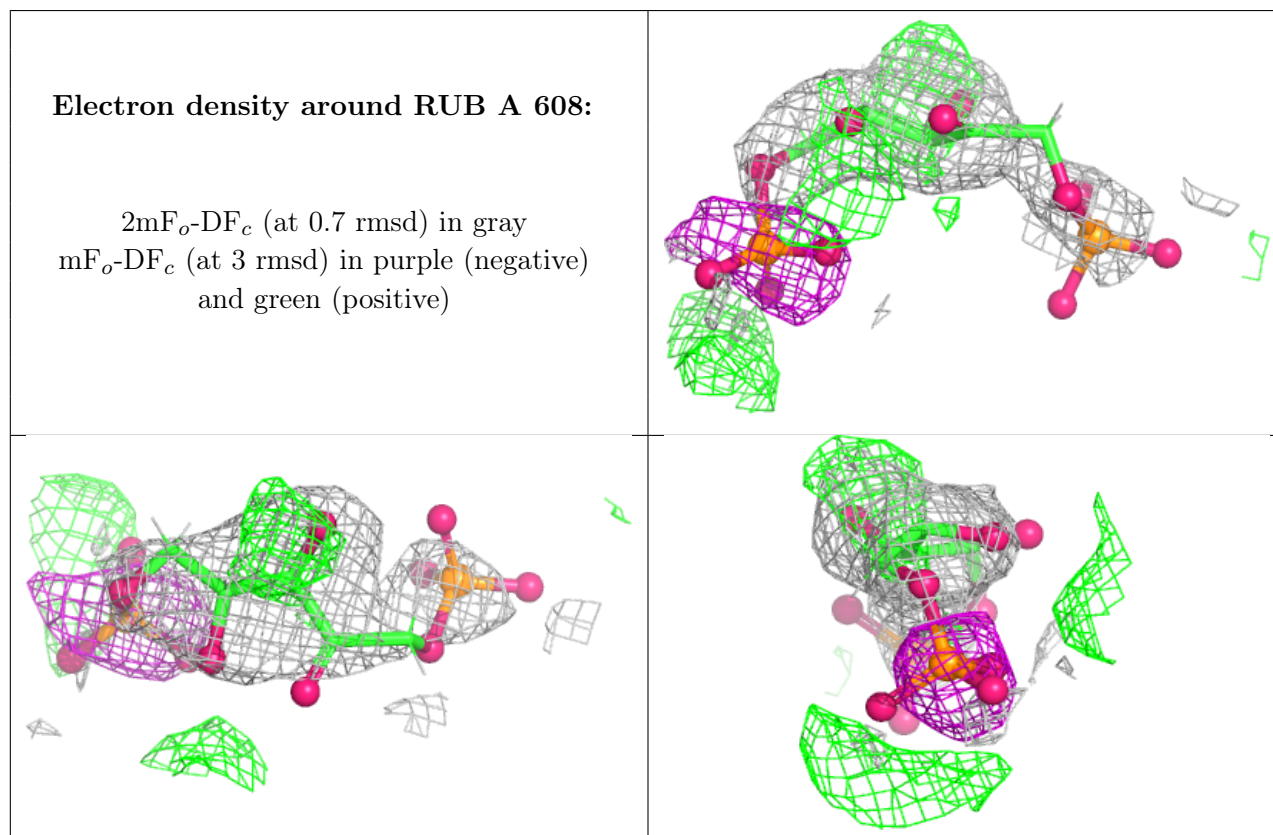
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
6	RUB	A	608	18/18	0.63	0.29	44,61,75,77	26
6	RUB	C	605	18/18	0.66	0.25	47,63,75,89	26
3	GOL	B	607	6/6	0.68	0.15	70,85,100,101	0
6	RUB	B	606	18/18	0.69	0.23	37,66,82,97	26
6	RUB	F	609	18/18	0.69	0.28	39,54,70,76	26
5	EDO	F	607	4/4	0.70	0.15	63,65,69,70	0
6	RUB	E	610	18/18	0.71	0.26	47,66,74,80	26
5	EDO	A	607	4/4	0.72	0.25	70,71,73,74	0
5	EDO	E	609	4/4	0.76	0.13	62,81,89,97	0
4	SO4	E	603	5/5	0.77	0.12	71,77,87,95	5
6	RUB	D	605	18/18	0.77	0.21	43,58,64,70	26
3	GOL	D	606	6/6	0.78	0.19	64,72,74,82	0
5	EDO	F	606	4/4	0.79	0.13	59,77,85,88	0
3	GOL	A	603	6/6	0.80	0.14	58,61,64,64	0
5	EDO	E	607	4/4	0.81	0.17	68,71,74,80	0
4	SO4	F	605	5/5	0.82	0.09	73,77,94,98	0
8	BCT	D	608	4/4	0.84	0.13	35,43,55,58	5
7	CO2	C	606	3/3	0.85	0.20	56,56,62,67	0
4	SO4	D	604	5/5	0.85	0.25	54,62,63,66	5
5	EDO	E	608	4/4	0.86	0.16	55,72,86,86	0
5	EDO	E	606	4/4	0.87	0.15	54,61,64,70	0
5	EDO	F	608	4/4	0.87	0.17	59,60,71,72	0
5	EDO	C	604	4/4	0.88	0.14	51,79,83,99	0
4	SO4	F	604	5/5	0.91	0.17	39,46,52,70	5
7	CO2	D	607	3/3	0.91	0.10	55,55,70,71	0
5	EDO	B	605	4/4	0.91	0.16	47,52,58,71	0
4	SO4	E	604	5/5	0.92	0.19	50,52,59,70	5
4	SO4	A	606	5/5	0.93	0.12	41,48,57,67	5
4	SO4	E	605	5/5	0.94	0.09	63,66,76,79	0
4	SO4	C	602	5/5	0.94	0.09	62,70,74,75	0
4	SO4	A	605	5/5	0.95	0.09	52,55,58,78	0
4	SO4	B	603	5/5	0.97	0.06	51,58,66,71	0
4	SO4	D	602	5/5	0.97	0.05	58,68,69,71	0
4	SO4	F	603	5/5	0.97	0.05	45,60,67,69	0
4	SO4	B	604	5/5	0.98	0.07	44,45,54,55	0
4	SO4	A	604	5/5	0.98	0.04	43,45,50,53	0
4	SO4	E	602	5/5	0.98	0.07	46,50,54,56	0

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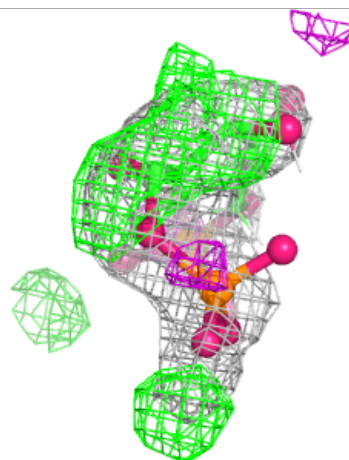
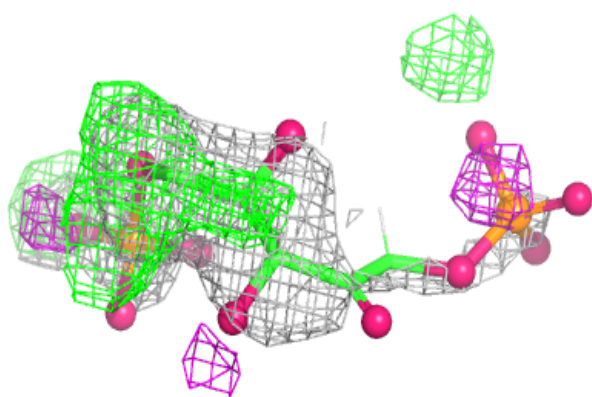
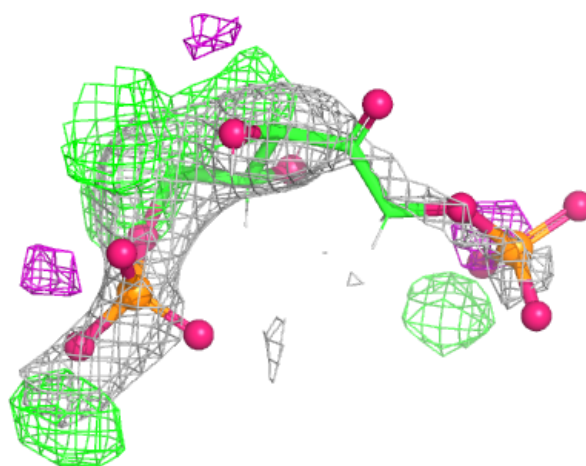
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
4	SO4	C	603	5/5	0.98	0.05	45,61,62,65	0
2	ZN	C	601	1/1	0.99	0.02	55,55,55,55	0
2	ZN	D	601	1/1	0.99	0.03	47,47,47,47	0
2	ZN	E	601	1/1	0.99	0.03	46,46,46,46	0
2	ZN	F	601	1/1	0.99	0.02	45,45,45,45	0
2	ZN	B	601	1/1	0.99	0.03	51,51,51,51	0
4	SO4	F	602	5/5	0.99	0.05	47,48,50,57	0
4	SO4	D	603	5/5	0.99	0.06	43,49,57,60	0
2	ZN	B	602	1/1	1.00	0.03	46,46,46,46	0
2	ZN	A	602	1/1	1.00	0.04	43,43,43,43	0
2	ZN	A	601	1/1	1.00	0.05	41,41,41,41	0

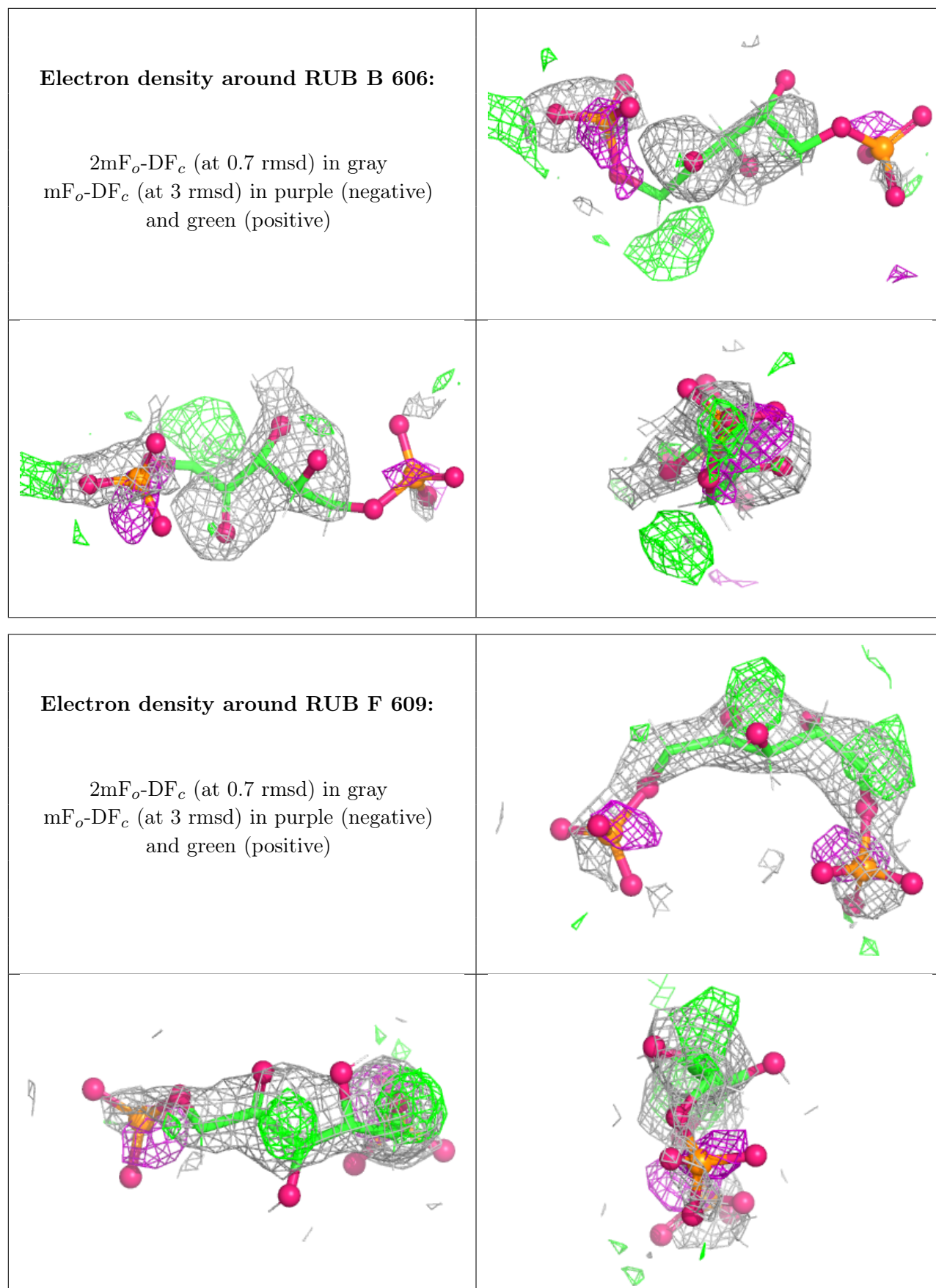
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

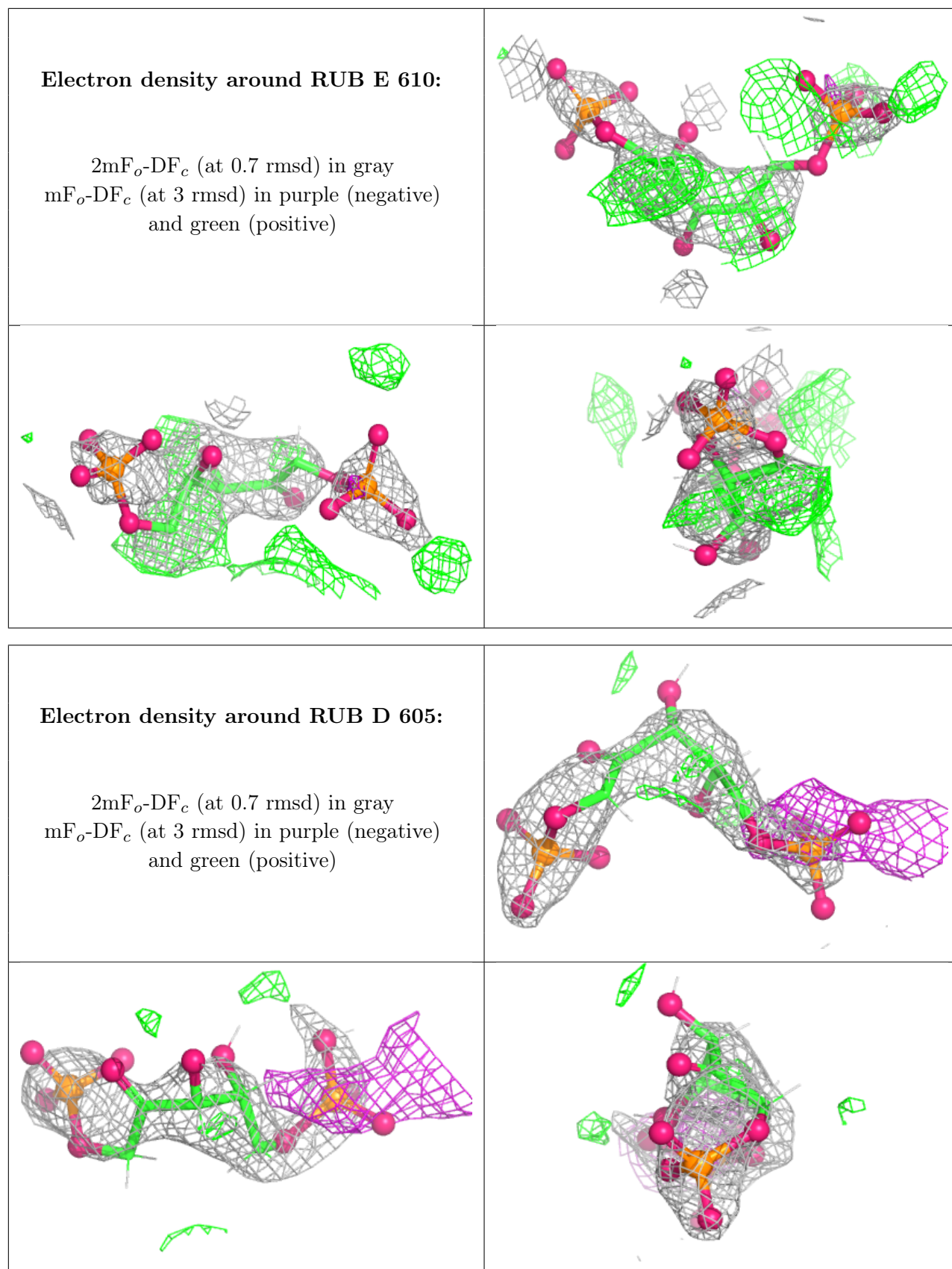


Electron density around RUB C 605:

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

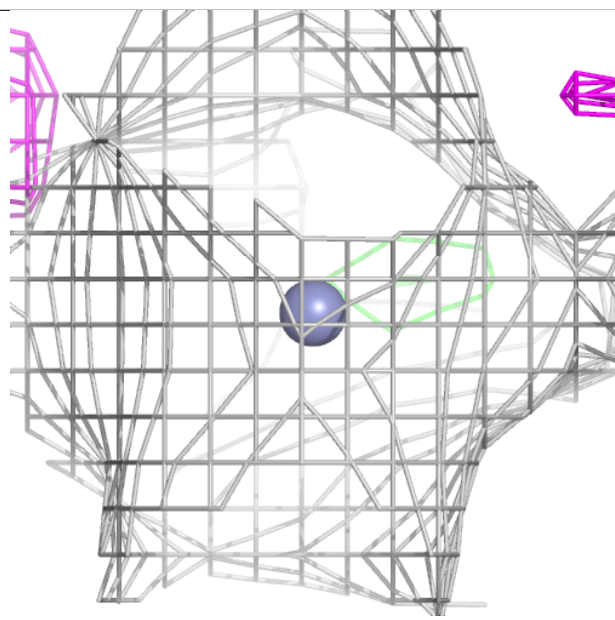
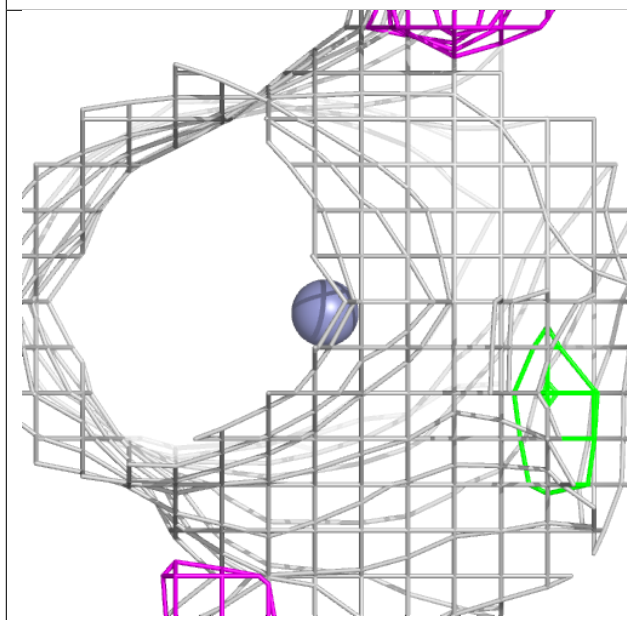
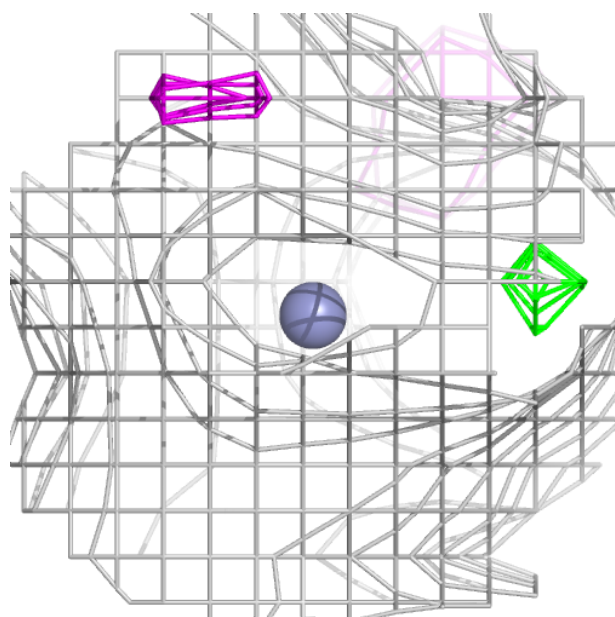






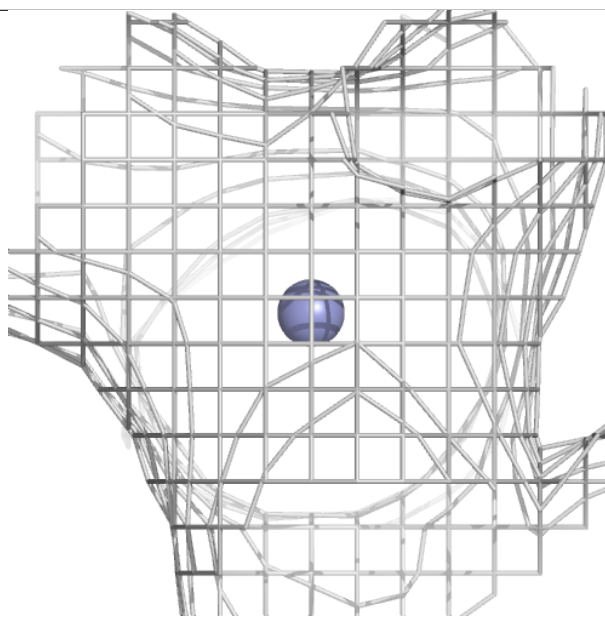
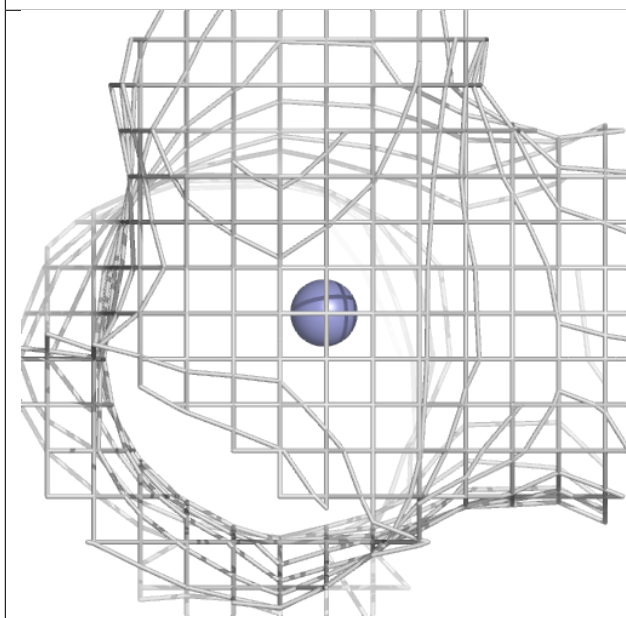
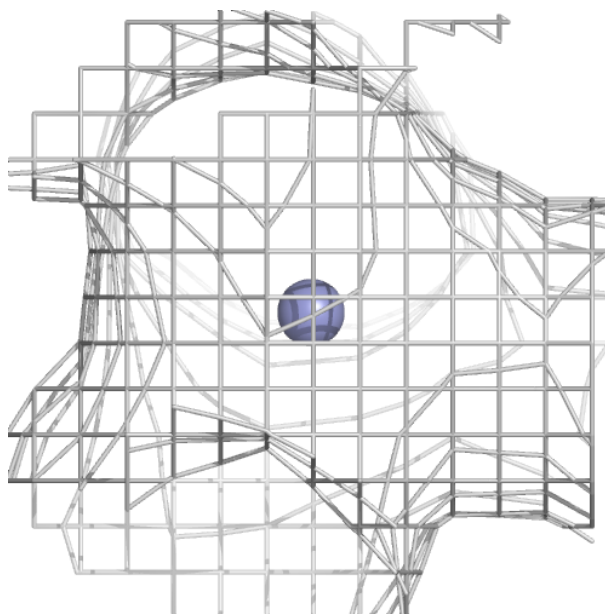
Electron density around ZN C 601:

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



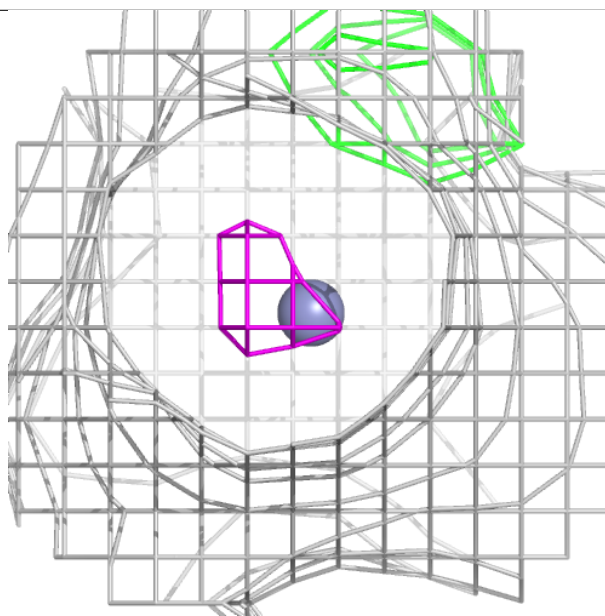
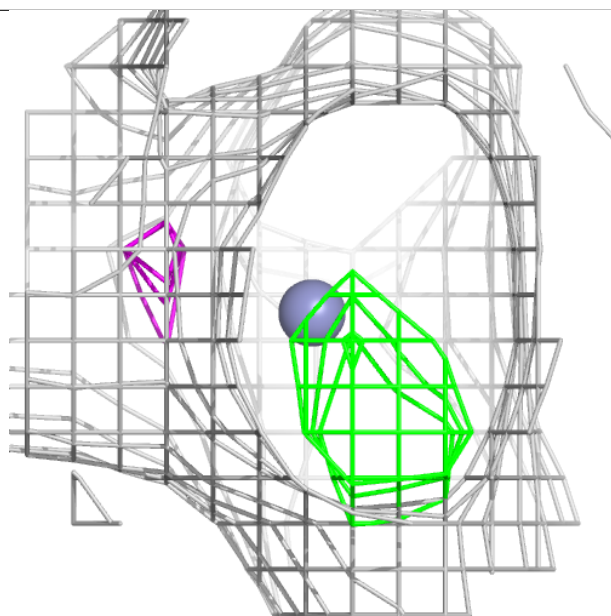
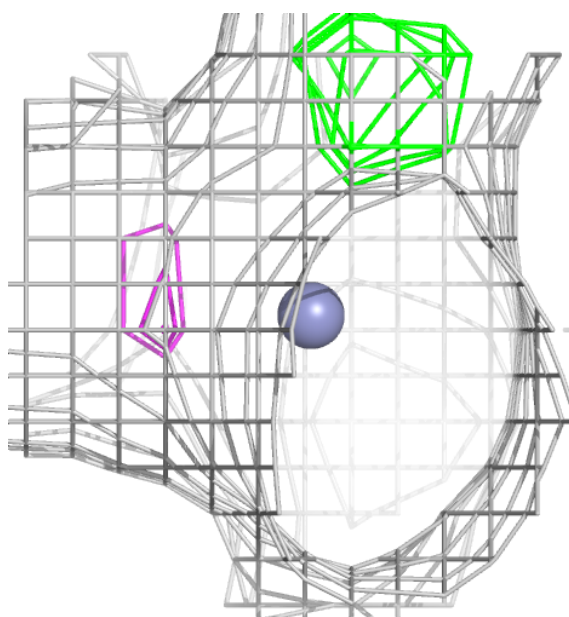
Electron density around ZN D 601:

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



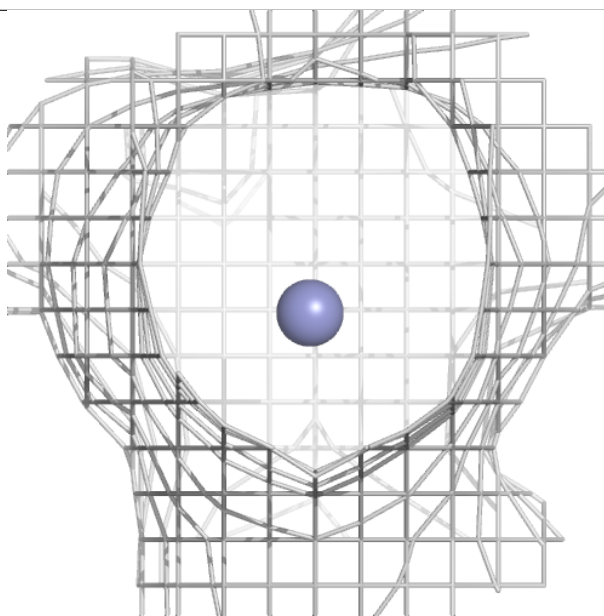
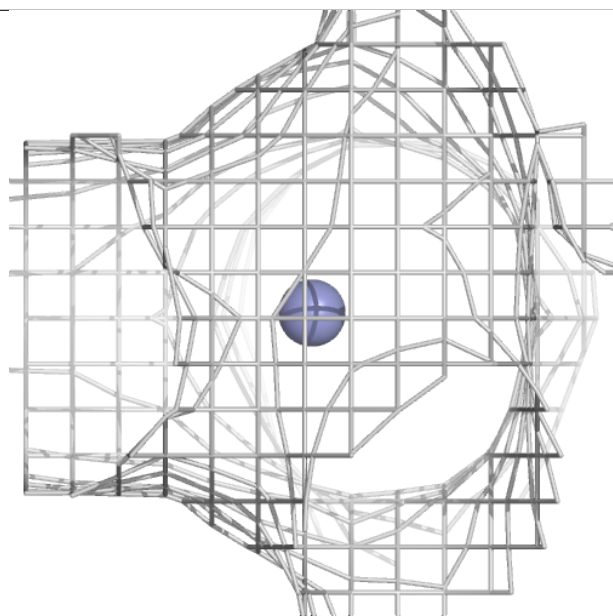
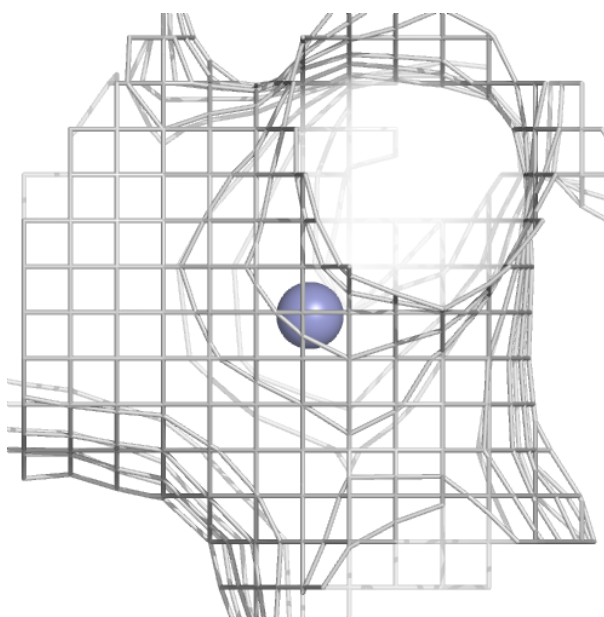
Electron density around ZN E 601:

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



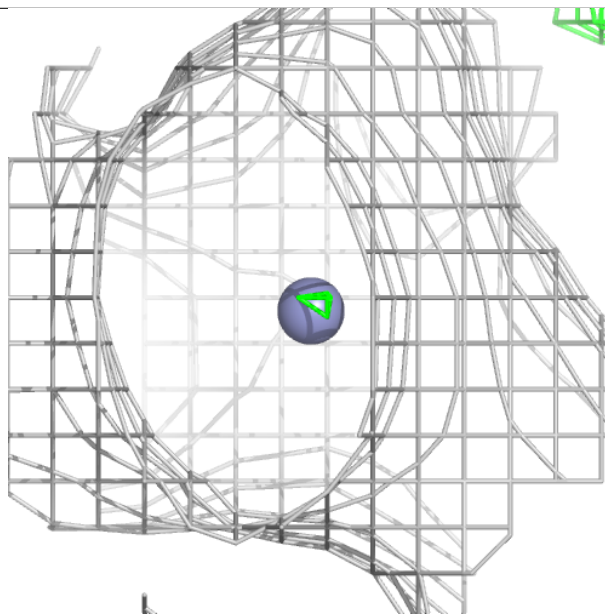
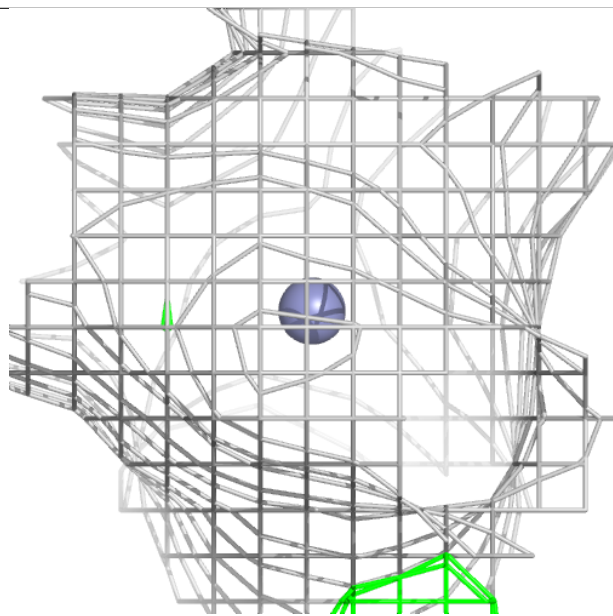
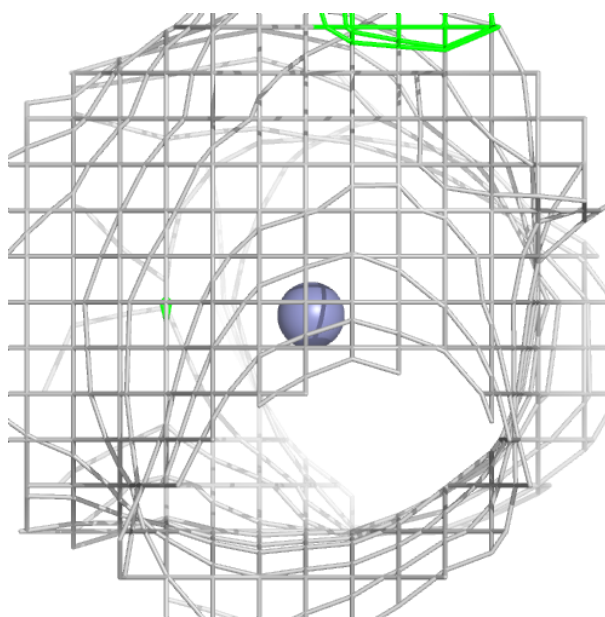
Electron density around ZN F 601:

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



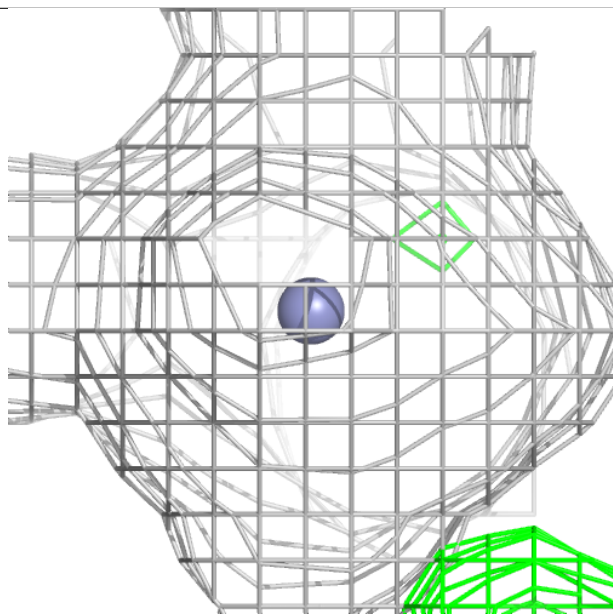
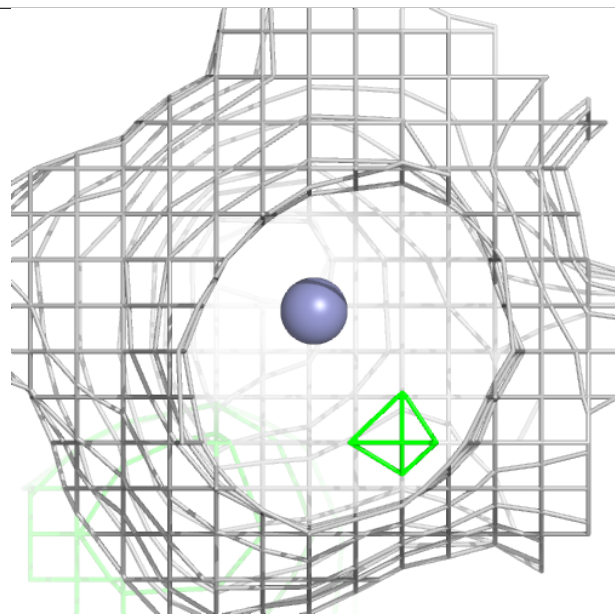
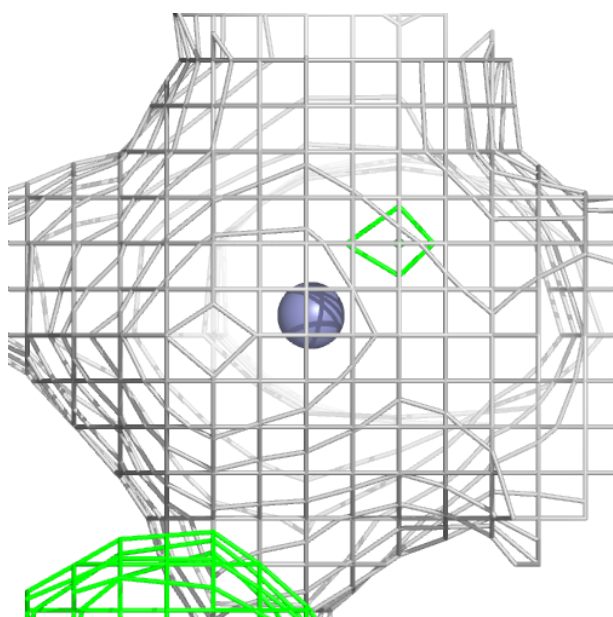
Electron density around ZN B 601:

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



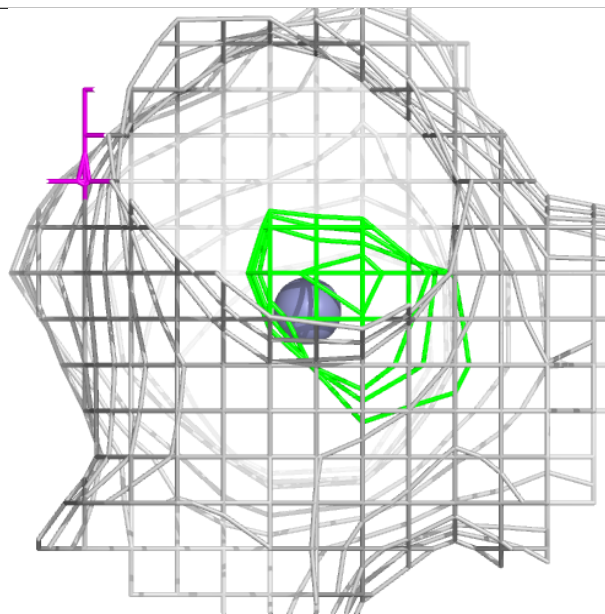
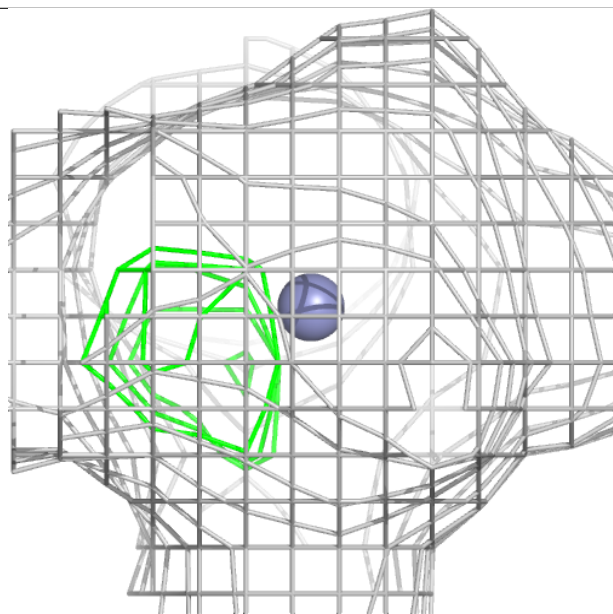
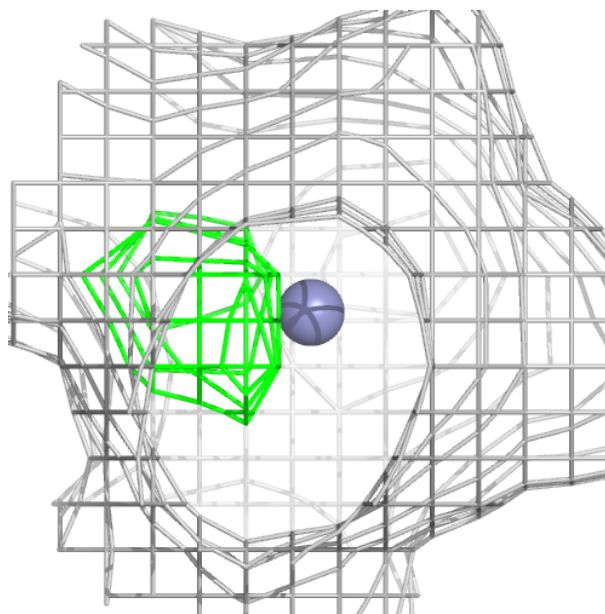
Electron density around ZN B 602:

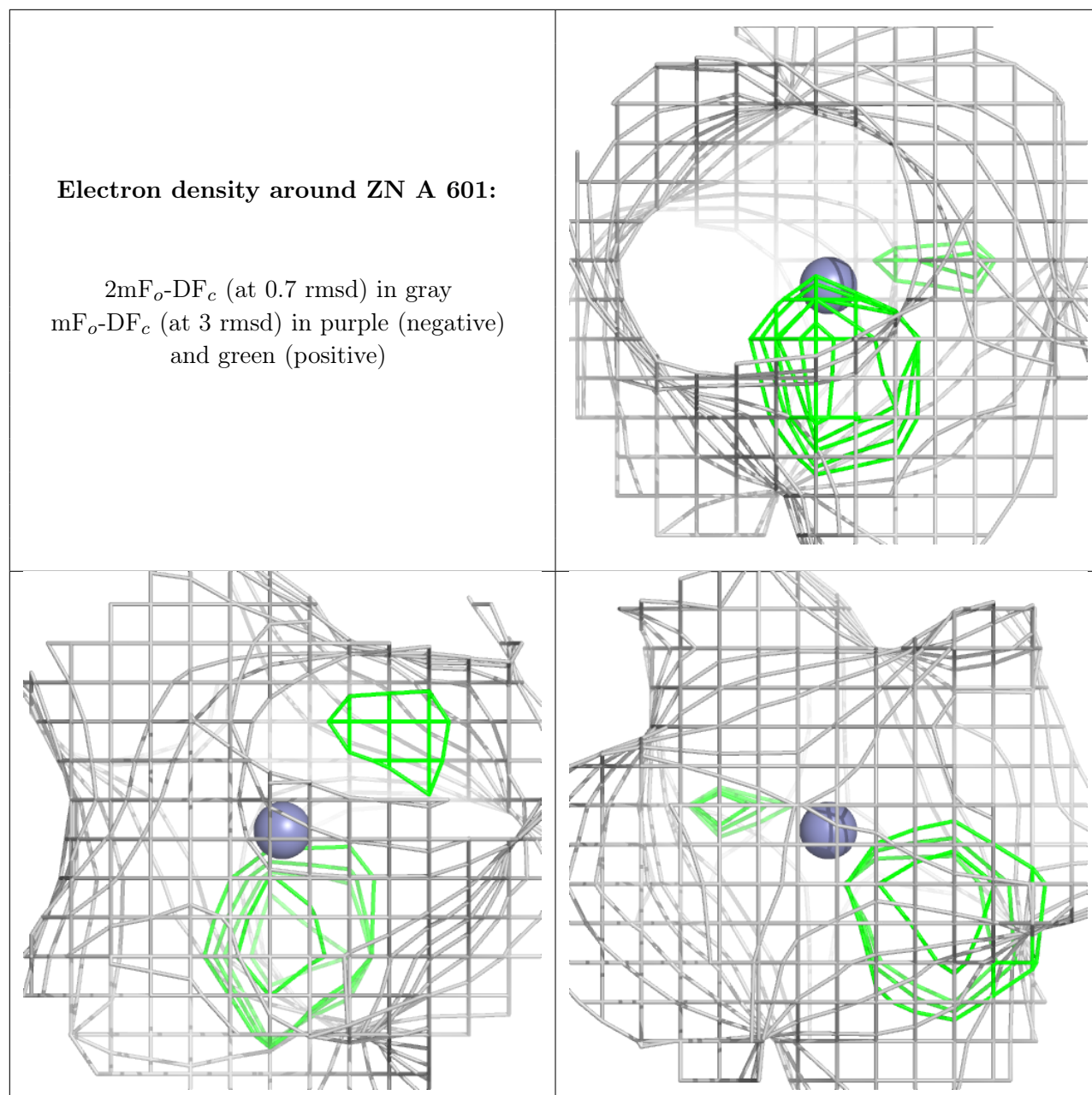
$2mF_o-DF_c$ (at 0.7 rmsd) in gray
 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)



Electron density around ZN A 602:

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





6.5 Other polymers [i](#)

There are no such residues in this entry.