



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 10, 2026 – 12:56 AM UTC

PDB ID : 8TCC / pdb_00008tcc
Title : GTP Cyclohydrolase-IB with dehydrocostus lactone
Authors : McWhorter, K.L.; Amaya Lopez, C.Y.; Davis, K.M.
Deposited on : 2023-06-30
Resolution : 3.10 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	:	NOT EXECUTED
Xtriage (Phenix)	:	2.0
EDS	:	NOT EXECUTED
Buster-report	:	NOT EXECUTED
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

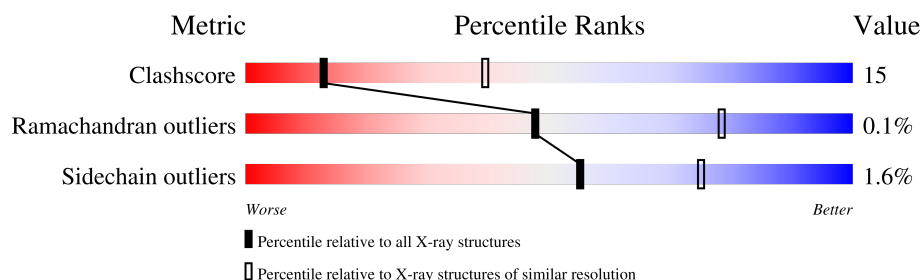
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.10 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))
Clashscore	190562	1539 (3.10-3.10)
Ramachandran outliers	187476	1467 (3.10-3.10)
Sidechain outliers	187428	1467 (3.10-3.10)

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 $\leq 5\%$.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	303	
1	B	303	
1	C	303	
1	D	303	

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
5	ZS9	C	301	X	-	-	-
5	ZS9	D	301[A]	X	-	-	-

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 6801 atoms, of which 12 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 GTP cyclohydrolase FolE2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	232	Total	C	N	O	S	0	0	0
			1564	994	270	293	7			
1	B	245	Total	C	N	O	S	0	2	0
			1707	1075	294	333	5			
1	C	246	Total	C	N	O	S	0	0	0
			1729	1091	296	337	5			
1	D	244	Total	C	N	O	S	0	1	0
			1684	1064	293	322	5			

There are 136 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-33	MET	-	initiating methionine	UNP A0A069BB45
A	-32	GLY	-	expression tag	UNP A0A069BB45
A	-31	SER	-	expression tag	UNP A0A069BB45
A	-30	SER	-	expression tag	UNP A0A069BB45
A	-29	HIS	-	expression tag	UNP A0A069BB45
A	-28	HIS	-	expression tag	UNP A0A069BB45
A	-27	HIS	-	expression tag	UNP A0A069BB45
A	-26	HIS	-	expression tag	UNP A0A069BB45
A	-25	HIS	-	expression tag	UNP A0A069BB45
A	-24	HIS	-	expression tag	UNP A0A069BB45
A	-23	SER	-	expression tag	UNP A0A069BB45
A	-22	SER	-	expression tag	UNP A0A069BB45
A	-21	GLY	-	expression tag	UNP A0A069BB45
A	-20	LEU	-	expression tag	UNP A0A069BB45
A	-19	VAL	-	expression tag	UNP A0A069BB45
A	-18	PRO	-	expression tag	UNP A0A069BB45
A	-17	ARG	-	expression tag	UNP A0A069BB45
A	-16	GLY	-	expression tag	UNP A0A069BB45
A	-15	SER	-	expression tag	UNP A0A069BB45
A	-14	HIS	-	expression tag	UNP A0A069BB45
A	-13	MET	-	expression tag	UNP A0A069BB45

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Chain	Residue	Modelled	Actual	Comment	Reference
A	-12	ALA	-	expression tag	UNP A0A069BB45
A	-11	SER	-	expression tag	UNP A0A069BB45
A	-10	MET	-	expression tag	UNP A0A069BB45
A	-9	THR	-	expression tag	UNP A0A069BB45
A	-8	GLY	-	expression tag	UNP A0A069BB45
A	-7	GLY	-	expression tag	UNP A0A069BB45
A	-6	GLN	-	expression tag	UNP A0A069BB45
A	-5	GLN	-	expression tag	UNP A0A069BB45
A	-4	MET	-	expression tag	UNP A0A069BB45
A	-3	GLY	-	expression tag	UNP A0A069BB45
A	-2	ARG	-	expression tag	UNP A0A069BB45
A	-1	GLY	-	expression tag	UNP A0A069BB45
A	0	SER	-	expression tag	UNP A0A069BB45
B	-33	MET	-	initiating methionine	UNP A0A069BB45
B	-32	GLY	-	expression tag	UNP A0A069BB45
B	-31	SER	-	expression tag	UNP A0A069BB45
B	-30	SER	-	expression tag	UNP A0A069BB45
B	-29	HIS	-	expression tag	UNP A0A069BB45
B	-28	HIS	-	expression tag	UNP A0A069BB45
B	-27	HIS	-	expression tag	UNP A0A069BB45
B	-26	HIS	-	expression tag	UNP A0A069BB45
B	-25	HIS	-	expression tag	UNP A0A069BB45
B	-24	HIS	-	expression tag	UNP A0A069BB45
B	-23	SER	-	expression tag	UNP A0A069BB45
B	-22	SER	-	expression tag	UNP A0A069BB45
B	-21	GLY	-	expression tag	UNP A0A069BB45
B	-20	LEU	-	expression tag	UNP A0A069BB45
B	-19	VAL	-	expression tag	UNP A0A069BB45
B	-18	PRO	-	expression tag	UNP A0A069BB45
B	-17	ARG	-	expression tag	UNP A0A069BB45
B	-16	GLY	-	expression tag	UNP A0A069BB45
B	-15	SER	-	expression tag	UNP A0A069BB45
B	-14	HIS	-	expression tag	UNP A0A069BB45
B	-13	MET	-	expression tag	UNP A0A069BB45
B	-12	ALA	-	expression tag	UNP A0A069BB45
B	-11	SER	-	expression tag	UNP A0A069BB45
B	-10	MET	-	expression tag	UNP A0A069BB45
B	-9	THR	-	expression tag	UNP A0A069BB45
B	-8	GLY	-	expression tag	UNP A0A069BB45
B	-7	GLY	-	expression tag	UNP A0A069BB45
B	-6	GLN	-	expression tag	UNP A0A069BB45
B	-5	GLN	-	expression tag	UNP A0A069BB45

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Chain	Residue	Modelled	Actual	Comment	Reference
B	-4	MET	-	expression tag	UNP A0A069BB45
B	-3	GLY	-	expression tag	UNP A0A069BB45
B	-2	ARG	-	expression tag	UNP A0A069BB45
B	-1	GLY	-	expression tag	UNP A0A069BB45
B	0	SER	-	expression tag	UNP A0A069BB45
C	-33	MET	-	initiating methionine	UNP A0A069BB45
C	-32	GLY	-	expression tag	UNP A0A069BB45
C	-31	SER	-	expression tag	UNP A0A069BB45
C	-30	SER	-	expression tag	UNP A0A069BB45
C	-29	HIS	-	expression tag	UNP A0A069BB45
C	-28	HIS	-	expression tag	UNP A0A069BB45
C	-27	HIS	-	expression tag	UNP A0A069BB45
C	-26	HIS	-	expression tag	UNP A0A069BB45
C	-25	HIS	-	expression tag	UNP A0A069BB45
C	-24	HIS	-	expression tag	UNP A0A069BB45
C	-23	SER	-	expression tag	UNP A0A069BB45
C	-22	SER	-	expression tag	UNP A0A069BB45
C	-21	GLY	-	expression tag	UNP A0A069BB45
C	-20	LEU	-	expression tag	UNP A0A069BB45
C	-19	VAL	-	expression tag	UNP A0A069BB45
C	-18	PRO	-	expression tag	UNP A0A069BB45
C	-17	ARG	-	expression tag	UNP A0A069BB45
C	-16	GLY	-	expression tag	UNP A0A069BB45
C	-15	SER	-	expression tag	UNP A0A069BB45
C	-14	HIS	-	expression tag	UNP A0A069BB45
C	-13	MET	-	expression tag	UNP A0A069BB45
C	-12	ALA	-	expression tag	UNP A0A069BB45
C	-11	SER	-	expression tag	UNP A0A069BB45
C	-10	MET	-	expression tag	UNP A0A069BB45
C	-9	THR	-	expression tag	UNP A0A069BB45
C	-8	GLY	-	expression tag	UNP A0A069BB45
C	-7	GLY	-	expression tag	UNP A0A069BB45
C	-6	GLN	-	expression tag	UNP A0A069BB45
C	-5	GLN	-	expression tag	UNP A0A069BB45
C	-4	MET	-	expression tag	UNP A0A069BB45
C	-3	GLY	-	expression tag	UNP A0A069BB45
C	-2	ARG	-	expression tag	UNP A0A069BB45
C	-1	GLY	-	expression tag	UNP A0A069BB45
C	0	SER	-	expression tag	UNP A0A069BB45
D	-33	MET	-	initiating methionine	UNP A0A069BB45
D	-32	GLY	-	expression tag	UNP A0A069BB45
D	-31	SER	-	expression tag	UNP A0A069BB45

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Chain	Residue	Modelled	Actual	Comment	Reference
D	-30	SER	-	expression tag	UNP A0A069BB45
D	-29	HIS	-	expression tag	UNP A0A069BB45
D	-28	HIS	-	expression tag	UNP A0A069BB45
D	-27	HIS	-	expression tag	UNP A0A069BB45
D	-26	HIS	-	expression tag	UNP A0A069BB45
D	-25	HIS	-	expression tag	UNP A0A069BB45
D	-24	HIS	-	expression tag	UNP A0A069BB45
D	-23	SER	-	expression tag	UNP A0A069BB45
D	-22	SER	-	expression tag	UNP A0A069BB45
D	-21	GLY	-	expression tag	UNP A0A069BB45
D	-20	LEU	-	expression tag	UNP A0A069BB45
D	-19	VAL	-	expression tag	UNP A0A069BB45
D	-18	PRO	-	expression tag	UNP A0A069BB45
D	-17	ARG	-	expression tag	UNP A0A069BB45
D	-16	GLY	-	expression tag	UNP A0A069BB45
D	-15	SER	-	expression tag	UNP A0A069BB45
D	-14	HIS	-	expression tag	UNP A0A069BB45
D	-13	MET	-	expression tag	UNP A0A069BB45
D	-12	ALA	-	expression tag	UNP A0A069BB45
D	-11	SER	-	expression tag	UNP A0A069BB45
D	-10	MET	-	expression tag	UNP A0A069BB45
D	-9	THR	-	expression tag	UNP A0A069BB45
D	-8	GLY	-	expression tag	UNP A0A069BB45
D	-7	GLY	-	expression tag	UNP A0A069BB45
D	-6	GLN	-	expression tag	UNP A0A069BB45
D	-5	GLN	-	expression tag	UNP A0A069BB45
D	-4	MET	-	expression tag	UNP A0A069BB45
D	-3	GLY	-	expression tag	UNP A0A069BB45
D	-2	ARG	-	expression tag	UNP A0A069BB45
D	-1	GLY	-	expression tag	UNP A0A069BB45
D	0	SER	-	expression tag	UNP A0A069BB45

- Molecule 2 is MANGANESE (II) ION (CCD ID: MN) (formula: Mn).

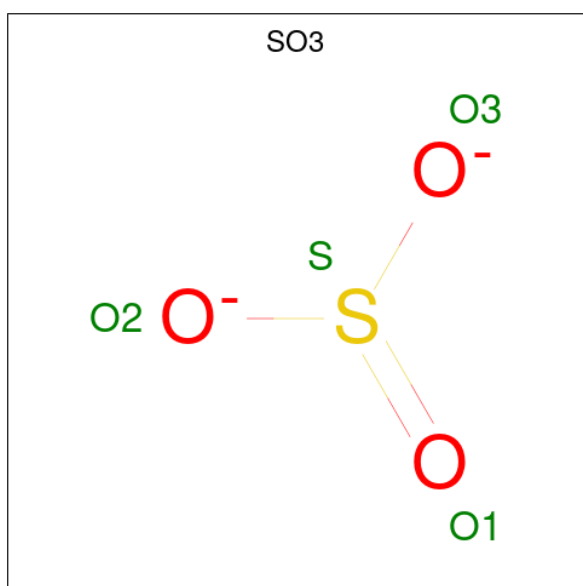
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	1	Total Mn 1 1	0	0

- Molecule 3 is 1,2-ETHANEDIOL (CCD ID: EDO) (formula: C₂H₆O₂).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	H	O	0	0
			10	2	6	2		
3	D	1	Total	C	H	O	0	0
			10	2	6	2		

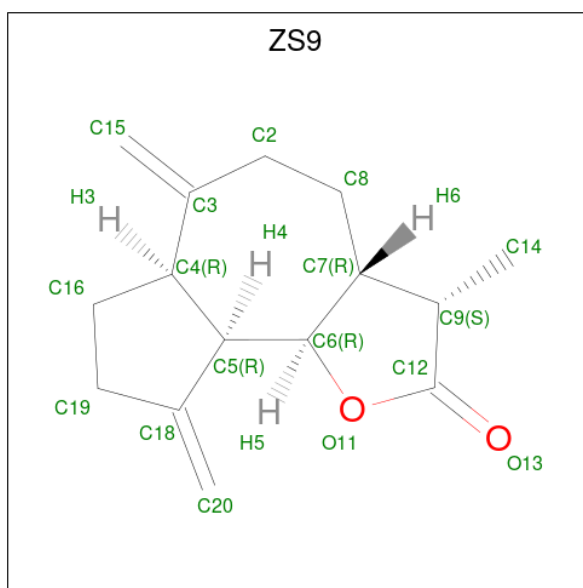
- Molecule 4 is SULFITE ION (CCD ID: SO3) (formula: O_3S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	O	S	0	1
			4	3	1		

- Molecule 5 is dehydrocostus lactone, bound form (CCD ID: ZS9) (formula: $C_{15}H_{20}O_2$) (la-

beled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	B	1	Total	C	O	0	1
			17	15	2		
5	C	1	Total	C	O	0	0
			17	15	2		
5	D	1	Total	C	O	0	1
			17	15	2		

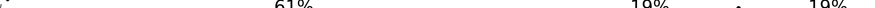
- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	6	Total	O	0	0
			6	6		
6	B	10	Total	O	0	0
			10	10		
6	C	13	Total	O	0	0
			13	13		
6	D	12	Total	O	0	0
			12	12		

Note EDS was not executed.

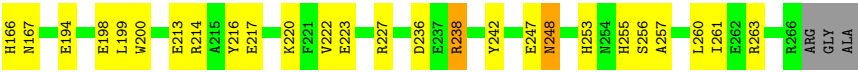
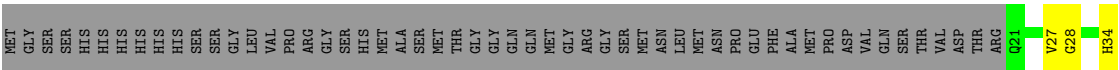
- Chain A:
-
- 57% 17% 23%
- Row 1: MET, GLY, SER, SER, GLY, HIS, HIS, HIS, HIS, HIS, SER, SER, GLY, LEU, VAL, PRO, ARG, GLY, SER, SER, MET, MET, MET, THR, GLY, GLY, GLN, GLN, MET, GLY, ARG, GLY, SER, MET, ASN, LEU, MET, MET, ASN, PRO, GLU, PHE, ALA, MET, PRO, ASP, VAL, GLN, SER, THR, VAL, ASP, THR, ARG, Q21, Q25, V38, P39
- Row 2: THR, ALA, GLU, GLU, GLU, T45, M53, V56, H57, M67, F70, E75, T82, A83, D84, A85, L90, L90, A101, I104, E105, F111, V112, N113, A116, V121, A123, L124, L125, D126, Y127, E128, V129, V135, R136, D137, P149, C154, P155, C156, S157, K158, C162, T169
- Row 3: GLY, ALA, H166, M167, Q168, I174, V182, P183, P184, I188, E192, L199, L202, R205, P206, D207, E208, R209, F210, V211, V211, T212, F213, E214, R214, L225, V226, R227, D228, D234, ALA, D236, E237, R238, L244, E245, E250, SER, ILE, H253, Y258, A259, D264, LYS, ARG, ARG, GLY, ALA

- Chain B:

- Chain C: 
- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-----|
| MET | GLY | SER | SER | HIS | HIS | HIS | HIS | HIS | SER | SER | GLY | VAL | PRO | ARG | GLY | SER | HIS | MET | ALA | SER | MET | THR | GLY | GLN | GLN | MET | GLY | ARG | SER | GLY | PHE | ALA | MET | PRO | ASP | VAL | GLN | THR | ASP | VAL | ARG | GLN | M22 | Q25 | Q29 |
| T40 | Q46 | N53 | L54 | D55 | V56 | H57 | L73 | P80 | L81 | T82 | A85 | L90 | M93 | I104 | E105 | V106 | S107 | F108 | P109 | Y110 | F111 | K114 | T115 | A116 | P117 | V118 | S119 | G120 | L131 | T132 | V135 | L136 | D137 | G138 | L139 | T140 | R141 | K145 | L146 | L147 | V148 | P149 | L153 | C154 | |



● Molecule 1: GTP cyclohydrolase FolE2



4 Data and refinement statistics

EDS was not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	69.31Å 71.32Å 193.02Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	47.16 – 3.10	Depositor
% Data completeness (in resolution range)	96.9 (47.16-3.10)	Depositor
R_{merge}	0.25	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.22 (at 3.12Å)	Xtriage
Refinement program	PHENIX 1.20.1_4487	Depositor
R, R_{free}	0.288 , 0.312	Depositor
Wilson B-factor (Å ²)	62.6	Xtriage
Anisotropy	0.638	Xtriage
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	0.029 for k,h,-l	Xtriage
Total number of atoms	6801	wwPDB-VP
Average B, all atoms (Å ²)	50.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.99% 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: ZS9, MN, SNC, EDO, SO3

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	0.62	0/1581	0.98	2/2171 (0.1%)
1	B	0.58	3/1734 (0.2%)	0.89	3/2383 (0.1%)
1	C	0.66	1/1755 (0.1%)	0.99	3/2413 (0.1%)
1	D	0.64	3/1709 (0.2%)	0.98	4/2339 (0.2%)
All	All	0.63	7/6779 (0.1%)	0.96	12/9306 (0.1%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	B	1	0

All (7) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	154[A]	CYS	N-CA	-9.54	1.34	1.46
1	D	154[A]	CYS	N-CA	-8.94	1.32	1.46
1	B	168	GLN	C-N	-7.67	1.23	1.33
1	C	154	CYS	N-CA	-7.06	1.34	1.46
1	D	154[A]	CYS	CA-C	-5.89	1.46	1.53
1	B	154[A]	CYS	C-O	-5.30	1.17	1.24
1	D	153	LEU	C-N	5.19	1.49	1.33

All (12) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	154[A]	CYS	N-CA-CB	18.90	134.18	110.17
1	D	154[A]	CYS	N-CA-CB	16.43	133.31	110.14

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	153	LEU	O-C-N	13.90	140.54	123.44
1	C	154	CYS	N-CA-CB	10.92	127.80	110.01
1	B	153	LEU	O-C-N	7.42	131.71	123.25
1	A	238	ARG	N-CA-C	-5.89	105.94	113.01
1	C	120	GLY	N-CA-C	-5.59	107.53	115.30
1	A	206	PRO	CB-CA-C	-5.53	103.50	112.62
1	B	153	LEU	CA-C-O	-5.14	115.78	121.33
1	D	248	ASN	N-CA-C	-5.13	100.36	108.73
1	D	238	ARG	N-CA-C	-5.05	106.80	113.17
1	C	179	ALA	N-CA-C	-5.01	107.17	113.28

All (1) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
1	B	154[A]	CYS	CA

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	1564	0	1311	56	0
1	B	1707	0	1499	60	0
1	C	1729	0	1511	44	0
1	D	1684	0	1433	50	0
2	A	1	0	0	0	0
3	A	4	6	6	0	0
3	D	4	6	6	0	0
4	A	4	0	0	0	0
5	B	17	0	0	2	0
5	C	17	0	0	1	0
5	D	17	0	0	2	0
6	A	6	0	0	0	0
6	B	10	0	0	0	0
6	C	13	0	0	0	0
6	D	12	0	0	0	0
All	All	6789	12	5766	189	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 15.

All (189) 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:B:154[A]:CYS:SG	1:B:166:HIS:NE2	2.37	0.98
1:B:166:HIS:HE2	5:B:301[A]:ZS9:C14	1.78	0.96
1:C:154:CYS:HB3	1:C:166:HIS:NE2	1.92	0.84
1:B:58:LEU:HD13	1:B:65:THR:HG23	1.64	0.79
1:A:113:ASN:HA	1:A:124:LEU:HD23	1.63	0.79
1:B:36:LEU:CD2	1:B:48:THR:HG23	2.13	0.78
1:A:113:ASN:HB2	1:A:124:LEU:HD21	1.66	0.78
1:B:36:LEU:HD21	1:B:48:THR:HG23	1.64	0.78
1:A:212:THR:HG21	1:B:157:SER:OG	1.83	0.77
1:A:226:VAL:HG11	1:A:259:ALA:HB3	1.69	0.74
1:A:101:ALA:HA	1:A:135:VAL:O	1.88	0.73
1:B:156:SNC:O	1:B:160:ILE:HG23	1.89	0.72
1:C:167:ASN:OD1	1:D:167:ASN:O	2.08	0.72
1:C:153:LEU:HD12	1:C:167:ASN:HB3	1.75	0.69
1:C:90:LEU:HD21	1:C:135:VAL:HG23	1.73	0.69
1:A:124:LEU:HD12	1:D:34:HIS:CE1	2.28	0.68
1:B:182:VAL:HG22	1:B:238:ARG:HE	1.58	0.68
1:D:166:HIS:NE2	5:D:301[A]:ZS9:C9	2.58	0.67
1:A:199:LEU:HD23	1:B:253:HIS:C	2.20	0.66
1:C:90:LEU:HD23	1:C:140:THR:HG23	1.78	0.65
1:D:27:VAL:CG1	1:D:58:LEU:HD13	2.26	0.64
1:A:90:LEU:HA	1:A:104:ILE:HD11	1.78	0.64
1:C:53:ASN:HB2	1:C:105:GLU:HG3	1.79	0.64
1:B:176:ALA:HB1	1:B:239:ILE:HG23	1.80	0.63
1:C:245:GLU:OE1	1:C:258:TYR:OH	2.16	0.62
1:C:210:PHE:O	1:C:214:ARG:HG2	1.99	0.62
1:D:46:GLN:HE22	1:D:111:PHE:HB2	1.65	0.62
1:C:82:THR:H	1:C:85:ALA:HB3	1.65	0.62
1:D:198:GLU:HG2	1:D:214:ARG:HH22	1.65	0.61
1:C:90:LEU:CD2	1:C:135:VAL:HG23	2.29	0.61
1:A:214:ARG:NE	1:A:214:ARG:HA	2.16	0.61
1:A:113:ASN:CA	1:A:124:LEU:HD23	2.31	0.61
1:D:136:ARG:O	1:D:137:ASP:C	2.43	0.61
1:A:67:MET:HA	1:A:70:PHE:HD2	1.66	0.60
1:C:80:PRO:O	1:C:82:THR:HG23	2.02	0.60
1:B:90:LEU:HG	1:B:135:VAL:HG23	1.83	0.59
1:D:36:LEU:HD21	1:D:48:THR:HG23	1.83	0.59

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:166:HIS:NE2	5:D:301[A]:ZS9:C12	2.65	0.59
1:A:214:ARG:HA	1:A:214:ARG:HE	1.66	0.59
1:B:166:HIS:NE2	5:B:301[A]:ZS9:C14	2.59	0.59
1:C:205:ARG:N	1:C:206:PRO:HD2	2.17	0.59
1:D:82:THR:H	1:D:85:ALA:HB3	1.68	0.59
1:C:108:PHE:HE1	1:C:131:LEU:HG	1.67	0.59
1:A:116:ALA:HB2	1:A:121:VAL:O	2.03	0.59
1:D:28:GLY:HA3	1:D:55:ASP:HA	1.85	0.58
1:A:113:ASN:HB2	1:A:124:LEU:CD2	2.32	0.58
1:A:82:THR:H	1:A:85:ALA:HB3	1.68	0.57
1:A:82:THR:O	1:A:83:ALA:C	2.46	0.57
1:B:59:PRO:HB2	1:B:61:ASP:OD1	2.04	0.57
1:C:53:ASN:HB2	1:C:105:GLU:CG	2.34	0.57
1:C:167:ASN:OD1	1:D:167:ASN:N	2.31	0.56
1:B:247:GLU:HA	1:B:257:ALA:O	2.05	0.56
1:C:252:ILE:HG13	1:C:253:HIS:CD2	2.40	0.56
1:C:116:ALA:HB3	1:C:119:SER:OG	2.06	0.56
1:C:230:ALA:HA	1:C:233:LEU:HD12	1.87	0.56
1:C:141:ARG:HE	1:C:177:GLU:CD	2.14	0.55
1:C:229:VAL:HB	1:C:244:LEU:HD21	1.87	0.55
1:C:153:LEU:HD22	1:C:216:TYR:HA	1.87	0.55
1:B:58:LEU:HD13	1:B:65:THR:CG2	2.34	0.55
1:B:156:SNC:O	1:B:160:ILE:CG2	2.55	0.54
1:B:179:ALA:HB2	1:B:240:VAL:HG13	1.89	0.54
1:B:90:LEU:O	1:B:94:LEU:HD23	2.08	0.54
1:A:174:ILE:HG12	1:A:244:LEU:HD13	1.89	0.54
1:B:38:VAL:HG13	1:B:46:GLN:HB3	1.89	0.54
1:A:90:LEU:HA	1:A:104:ILE:CD1	2.37	0.54
1:C:154:CYS:HB3	1:C:166:HIS:CD2	2.42	0.53
1:D:59:PRO:HB2	1:D:61:ASP:OD1	2.08	0.53
1:B:157:SER:CB	1:B:166:HIS:HD2	2.22	0.53
1:C:167:ASN:CG	1:D:167:ASN:H	2.16	0.53
1:A:111:PHE:HA	1:A:125:LEU:O	2.08	0.52
1:B:147:LEU:HD12	1:B:173:THR:OG1	2.10	0.52
1:C:25:GLN:HA	1:C:57:HIS:ND1	2.25	0.52
1:D:27:VAL:HG11	1:D:58:LEU:HD13	1.92	0.52
1:A:245:GLU:HA	1:A:259:ALA:O	2.10	0.51
1:C:28:GLY:HA3	1:C:55:ASP:HA	1.93	0.51
1:C:149:PRO:HB2	1:C:199:LEU:HD12	1.92	0.51
1:A:75:GLU:HG2	1:D:123:SER:HA	1.91	0.51
1:C:46:GLN:HE22	1:C:111:PHE:H	1.58	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:182:VAL:HG13	1:A:238:ARG:NH2	2.25	0.51
1:A:127:TYR:CD2	1:A:149:PRO:HD2	2.45	0.51
1:A:225:LEU:C	1:A:225:LEU:HD23	2.35	0.51
1:B:245:GLU:HG2	1:B:260:LEU:HD12	1.91	0.51
1:A:56:VAL:HG22	1:A:70:PHE:HZ	1.75	0.51
1:A:210:PHE:HE1	1:A:214:ARG:HH11	1.57	0.51
1:D:149:PRO:HB2	1:D:199:LEU:HD12	1.92	0.51
1:A:38:VAL:HG12	1:A:39:ARG:N	2.26	0.50
1:B:153:LEU:O	1:B:155:PRO:HD3	2.11	0.50
1:B:157:SER:HB2	1:B:166:HIS:HD2	1.76	0.50
1:D:105:GLU:HG3	1:D:132:THR:HG23	1.93	0.50
1:A:25:GLN:HA	1:A:57:HIS:ND1	2.27	0.49
1:B:156:SNC:O	1:B:160:ILE:HG12	2.12	0.49
1:B:168:GLN:HG3	1:B:248:ASN:O	2.12	0.49
1:D:247:GLU:HG2	1:D:256:SER:HB3	1.94	0.49
1:B:32:VAL:HG22	1:D:255:HIS:CB	2.42	0.49
1:B:68:SER:O	1:B:69:ARG:C	2.56	0.49
1:D:198:GLU:HG2	1:D:214:ARG:NH2	2.27	0.49
1:B:216:TYR:O	1:B:219:PRO:HD3	2.13	0.49
1:B:149:PRO:HB2	1:B:199:LEU:HD12	1.95	0.48
1:B:227:ARG:NH2	1:D:63:LYS:HA	2.28	0.48
1:A:226:VAL:HG11	1:A:259:ALA:CB	2.40	0.48
1:B:56:VAL:HG22	1:B:70:PHE:HZ	1.78	0.48
1:D:253:HIS:HB3	1:D:255:HIS:CD2	2.48	0.48
1:B:182:VAL:HG22	1:B:238:ARG:NE	2.28	0.48
1:A:188:ILE:O	1:A:192:GLU:HG3	2.13	0.48
1:B:257:ALA:HB1	1:D:67:MET:HE1	1.96	0.48
1:D:213:GLU:O	1:D:217:GLU:HG3	2.14	0.48
1:A:67:MET:HA	1:A:70:PHE:CD2	2.48	0.48
1:B:25:GLN:OE1	1:D:261:ILE:HA	2.14	0.48
1:C:251:SER:O	1:D:199:LEU:HD21	2.14	0.48
1:C:252:ILE:C	1:D:199:LEU:HD22	2.39	0.48
1:B:71:VAL:HB	1:C:202:LEU:HD13	1.96	0.47
1:B:145:LYS:HG3	1:B:175:ASP:HB2	1.95	0.47
1:B:154[A]:CYS:SG	1:B:166:HIS:CD2	3.06	0.47
1:B:194:GLU:HG2	1:B:232:ARG:NE	2.28	0.47
1:A:208:GLU:O	1:A:211:VAL:HG22	2.14	0.47
1:A:245:GLU:HB3	1:A:258:TYR:CE1	2.49	0.47
1:B:32:VAL:HG22	1:D:255:HIS:HB3	1.97	0.47
1:A:205:ARG:N	1:A:206:PRO:CD	2.78	0.47
1:B:115:THR:HG23	1:B:120:GLY:HA2	1.96	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:171:HIS:CG	1:B:249:PHE:HE2	2.32	0.47
1:B:145:LYS:HE2	1:B:173:THR:HG21	1.96	0.47
1:C:73:LEU:HD21	1:C:93:MET:HA	1.97	0.47
1:A:113:ASN:CB	1:A:124:LEU:HD21	2.43	0.46
1:A:168:GLN:OE1	1:A:168:GLN:N	2.31	0.46
1:C:153:LEU:CD2	1:C:216:TYR:HA	2.45	0.46
1:A:202:LEU:CD1	1:D:68:SER:HB2	2.45	0.46
1:A:113:ASN:CB	1:A:124:LEU:CD2	2.94	0.46
1:A:53:ASN:HB2	1:A:105:GLU:HB3	1.98	0.45
1:D:194:GLU:O	1:D:220:LYS:NZ	2.43	0.45
1:C:114:LYS:HB3	1:C:200:TRP:HE1	1.82	0.45
1:B:41:ALA:HB2	1:B:185:GLU:OE1	2.16	0.45
1:D:125:LEU:HD23	1:D:127:TYR:CZ	2.51	0.45
1:A:202:LEU:HB2	1:D:71:VAL:CG1	2.47	0.45
1:D:162:GLN:O	1:D:216:TYR:OH	2.33	0.45
1:B:61:ASP:OD1	1:B:62:GLN:N	2.50	0.44
1:B:111:PHE:HA	1:B:125:LEU:O	2.18	0.44
1:B:36:LEU:HD23	1:B:48:THR:HG23	1.97	0.44
1:B:25:GLN:O	1:B:57:HIS:HA	2.18	0.44
1:C:104:ILE:O	1:C:132:THR:HA	2.16	0.44
1:B:45:THR:HG22	1:B:46:GLN:N	2.33	0.44
1:B:182:VAL:HG13	1:B:238:ARG:HH21	1.83	0.44
1:B:198:GLU:HG3	1:B:200:TRP:CH2	2.53	0.44
1:C:137:ASP:O	1:C:139:LEU:HG	2.16	0.44
1:D:117:PRO:HG3	1:D:200:TRP:CH2	2.53	0.44
1:C:252:ILE:HG13	1:C:253:HIS:NE2	2.32	0.44
1:D:248:ASN:HB2	1:D:257:ALA:HB3	2.00	0.44
1:B:221:PHE:HB2	1:B:224:ASP:OD2	2.17	0.44
1:C:118:VAL:CB	1:C:206:PRO:HB2	2.48	0.44
1:B:81:LEU:HD11	1:B:86:PHE:HD1	1.82	0.44
1:D:222:VAL:HG12	1:D:223:GLU:OE1	2.18	0.43
1:C:147:LEU:HD11	1:C:171:HIS:HB3	2.00	0.43
1:A:90:LEU:HD13	1:A:104:ILE:HG13	2.00	0.43
1:D:130:THR:HB	1:D:145:LYS:HB2	2.01	0.43
1:A:226:VAL:CG2	1:A:227:ARG:N	2.80	0.43
1:D:154[A]:CYS:SG	1:D:166:HIS:NE2	2.91	0.43
1:B:244:LEU:O	1:B:260:LEU:HA	2.18	0.43
1:B:257:ALA:CB	1:D:67:MET:HE1	2.49	0.43
1:D:154[A]:CYS:HB3	1:D:166:HIS:NE2	2.34	0.43
1:A:226:VAL:HG23	1:A:227:ARG:N	2.33	0.42
1:C:40:THR:HG22	1:C:110:TYR:OH	2.19	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:154[A]:CYS:SG	1:D:156:SNC:N	2.92	0.42
1:C:114:LYS:HB3	1:C:200:TRP:NE1	2.34	0.42
1:A:113:ASN:CA	1:A:124:LEU:CD2	2.98	0.42
1:A:124:LEU:HD12	1:D:34:HIS:HE1	1.83	0.42
1:D:247:GLU:HA	1:D:257:ALA:O	2.20	0.42
1:A:136:ARG:O	1:A:137:ASP:C	2.62	0.42
1:A:157:SER:O	1:A:158:LYS:CB	2.67	0.42
1:A:129:VAL:HG11	1:A:184:VAL:HG11	2.01	0.42
1:A:250:GLU:HB3	1:A:253:HIS:HD2	1.85	0.42
1:A:38:VAL:CG1	1:A:39:ARG:N	2.83	0.41
1:A:207:ASP:O	1:A:208:GLU:C	2.62	0.41
1:A:208:GLU:HA	1:A:211:VAL:HG22	2.03	0.41
1:B:67:MET:O	1:B:68:SER:C	2.63	0.41
1:C:117:PRO:HB3	1:C:210:PHE:CD1	2.55	0.41
1:D:236:ASP:C	1:D:238:ARG:H	2.28	0.41
1:B:213:GLU:O	1:B:217:GLU:N	2.42	0.41
1:D:242:TYR:CZ	1:D:263:ARG:HB2	2.55	0.41
1:B:48:THR:OG1	1:B:49:VAL:N	2.54	0.41
1:D:157:SER:HB2	1:D:166:HIS:HD2	1.86	0.41
1:B:223:GLU:O	1:B:227:ARG:HG3	2.21	0.41
1:A:226:VAL:O	1:A:227:ARG:C	2.64	0.41
1:B:22:MET:O	1:D:227:ARG:NH1	2.54	0.41
1:C:145:LYS:HA	1:C:174:ILE:O	2.21	0.41
1:A:202:LEU:HB2	1:D:71:VAL:HG12	2.02	0.40
1:A:154:CYS:HA	1:A:155:PRO:HD3	1.92	0.40
1:C:106:VAL:CG1	1:C:131:LEU:HB2	2.51	0.40
1:A:210:PHE:CZ	1:A:214:ARG:HG3	2.57	0.40
1:C:252:ILE:HD11	5:C:301:ZS9:C6	2.52	0.40
1:D:59:PRO:HD2	1:D:62:GLN:CG	2.51	0.40

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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	219/303 (72%)	208 (95%)	10 (5%)	1 (0%)	24	57
1	B	241/303 (80%)	230 (95%)	11 (5%)	0	100	100
1	C	243/303 (80%)	230 (95%)	13 (5%)	0	100	100
1	D	237/303 (78%)	228 (96%)	9 (4%)	0	100	100
All	All	940/1212 (78%)	896 (95%)	43 (5%)	1 (0%)	48	78

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	155	PRO

5.3.2 Protein sidechains ⓘ

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	123/254 (48%)	119 (97%)	4 (3%)	33	63
1	B	151/254 (59%)	149 (99%)	2 (1%)	61	77
1	C	152/254 (60%)	151 (99%)	1 (1%)	76	82
1	D	136/254 (54%)	134 (98%)	2 (2%)	57	75
All	All	562/1016 (55%)	553 (98%)	9 (2%)	55	75

All (9) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	199	LEU
1	A	214	ARG
1	A	228	ASP
1	A	245	GLU
1	B	154[A]	CYS
1	B	168	GLN
1	C	252	ILE
1	D	154[A]	CYS
1	D	260	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	113	ASN
1	B	113	ASN
1	C	46	GLN
1	D	34	HIS
1	D	46	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](#)

Mogul was not executed - this section is therefore empty.

5.5 Carbohydrates [i](#)

Mogul was not executed - this section is therefore empty.

5.6 Ligand geometry [i](#)

Mogul was not executed - this section is therefore empty.

5.7 Other polymers [i](#)

Mogul was not executed - this section is therefore empty.

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

EDS was not executed - this section is therefore empty.

6.2 Non-standard residues in protein, DNA, RNA chains

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates

EDS was not executed - this section is therefore empty.

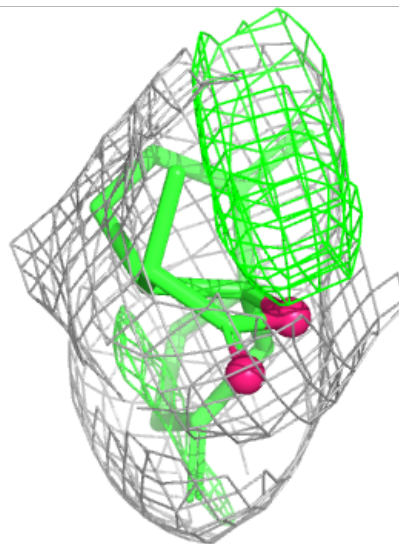
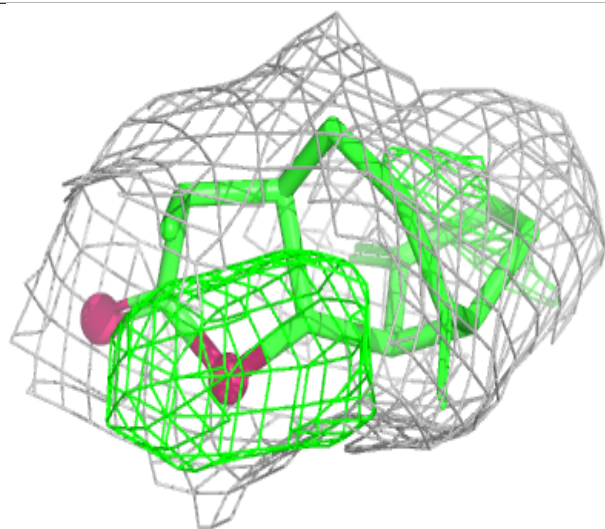
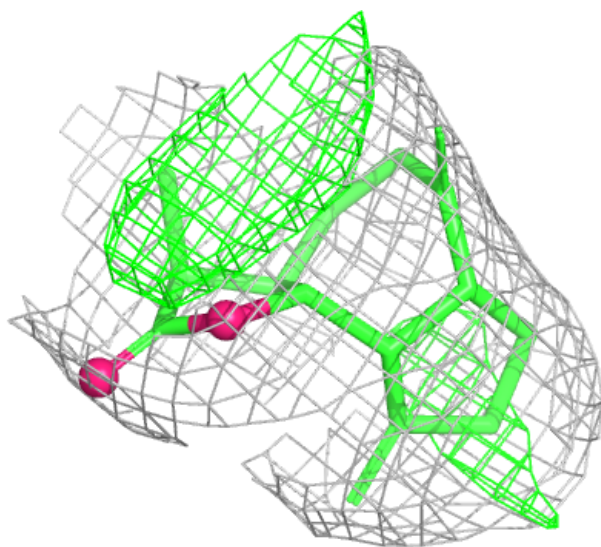
6.4 Ligands

EDS was not executed - this section is therefore empty.

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.

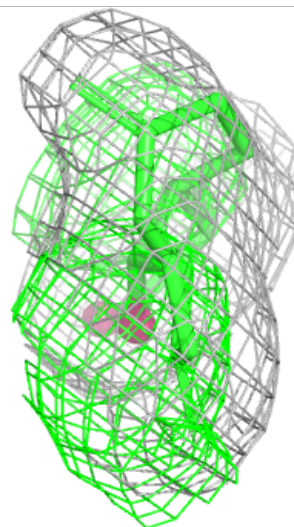
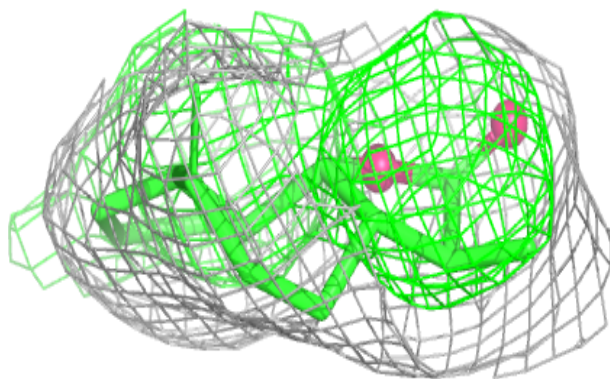
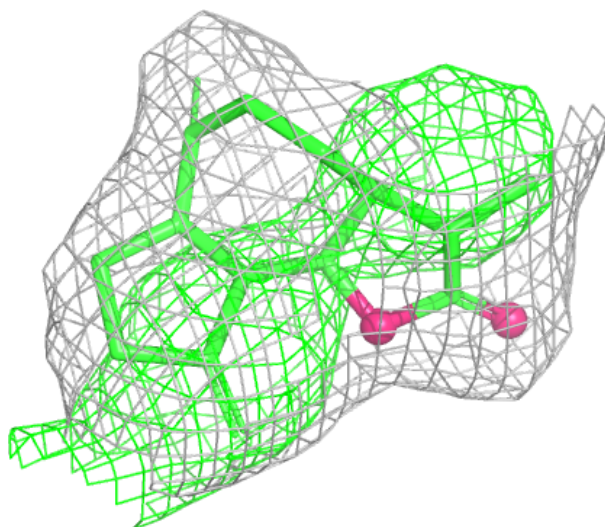
Electron density around ZS9 B 301 (A):

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



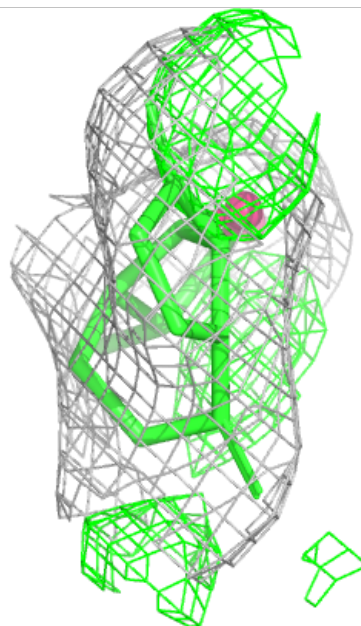
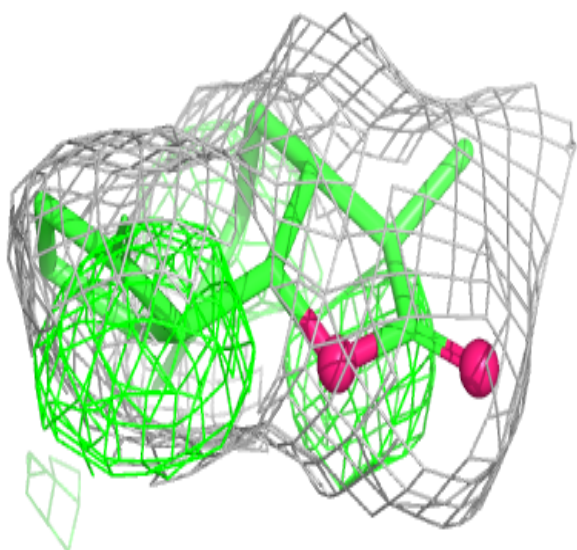
Electron density around ZS9 C 301:

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



Electron density around ZS9 D 301 (A):

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



6.5 Other polymers [i](#)

EDS was not executed - this section is therefore empty.