



Full wwPDB X-ray Structure Validation Report ⓘ

Aug 3, 2026 – 02:06 pm BST

PDB ID : 9S5I / pdb_00009s5i
Title : anammox-specific heterodimeric ketoacyl-ACP synthase (amxFabFhet) from *Brocadia fulgida* in complex with its anammox-specific acyl carrier protein (amxACP)
Authors : Granatino, P.; Barends, T.
Deposited on : 2025-07-29
Resolution : 2.07 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	:	1.8.4, CSD as541be (2020)
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	:	9.0.015 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.50

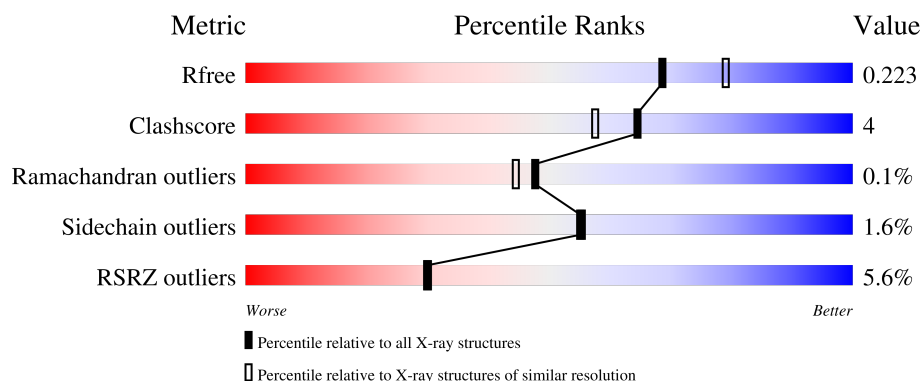
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.07 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	3774 (2.08-2.04)
Clashscore	190562	3883 (2.08-2.04)
Ramachandran outliers	187476	3860 (2.08-2.04)
Sidechain outliers	187428	3860 (2.08-2.04)
RSRZ outliers	180081	3775 (2.08-2.04)

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	413	10% 82% 15% ..
1	B	413	2% 88% 9% .
2	C	412	% 93% 7%
2	D	412	3% 93% 6%

Continued on next page...

Continued from previous page...

Mol	Chain	Length	Quality of chain
3	E	80	40% 79% 19%

2 Entry composition

There are 8 unique types of molecules in this entry. The entry contains 13614 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 3-oxoacyl-(Acyl-carrier-protein) synthase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	405	Total	C	N	O	S	0	6	0
			3022	1913	516	574	19			
1	B	405	Total	C	N	O	S	0	12	0
			3059	1937	523	579	20			

There are 14 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-4	ASN	-	expression tag	UNP A0A0M2USV6
A	-3	LEU	-	expression tag	UNP A0A0M2USV6
A	-2	TYR	-	expression tag	UNP A0A0M2USV6
A	-1	PHE	-	expression tag	UNP A0A0M2USV6
A	0	GLN	-	expression tag	UNP A0A0M2USV6
A	1	GLY	-	expression tag	UNP A0A0M2USV6
A	2	ALA	-	expression tag	UNP A0A0M2USV6
B	-4	ASN	-	expression tag	UNP A0A0M2USV6
B	-3	LEU	-	expression tag	UNP A0A0M2USV6
B	-2	TYR	-	expression tag	UNP A0A0M2USV6
B	-1	PHE	-	expression tag	UNP A0A0M2USV6
B	0	GLN	-	expression tag	UNP A0A0M2USV6
B	1	GLY	-	expression tag	UNP A0A0M2USV6
B	2	ALA	-	expression tag	UNP A0A0M2USV6

- Molecule 2 is a protein called 3-oxoacyl-(Acyl-carrier-protein) synthase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	C	411	Total	C	N	O	S	0	0	0
			3120	1965	535	607	13			
2	D	411	Total	C	N	O	S	0	0	0
			3120	1965	535	607	13			

- Molecule 3 is a protein called Acyl carrier protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	E	80	Total	C	N	O	S	0	1	0
			638	411	96	130	1			

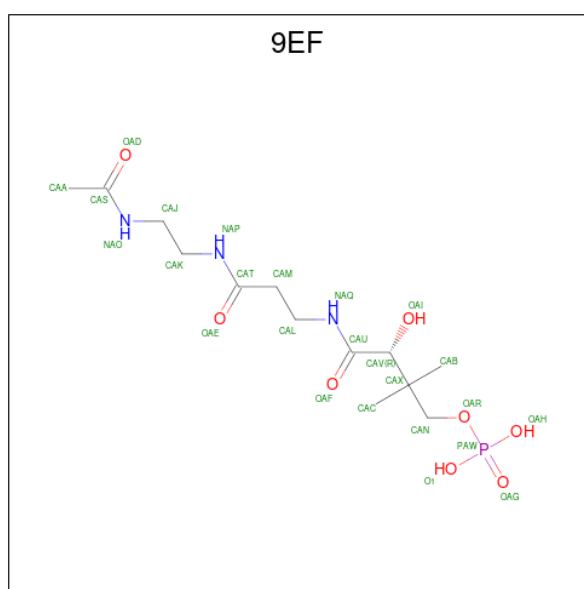
There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
E	4	ALA	-	expression tag	UNP A0A0M2UU63

- Molecule 4 is MAGNESIUM ION (CCD ID: MG) (formula: Mg).

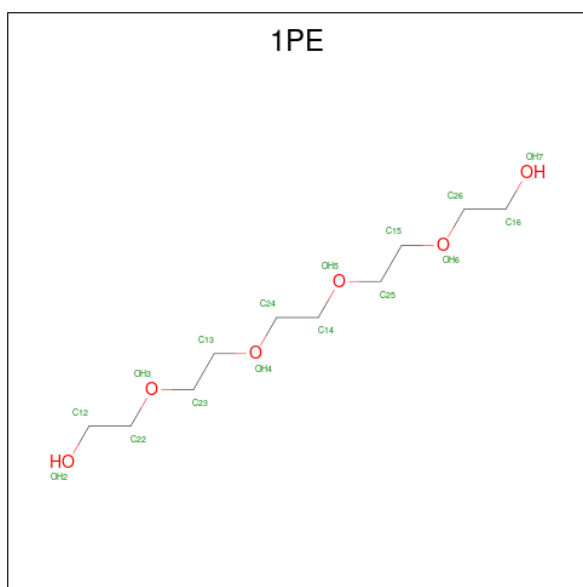
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	1	Total	Mg	0	0
			1	1		
4	B	1	Total	Mg	0	0
			1	1		

- Molecule 5 is N-[2-(acetylamino)ethyl]-N 3 -[(2R)-2-hydroxy-3,3-dimethyl-4-(phosphonoxy)butanoyl]-beta-alaninamide (CCD ID: 9EF) (formula: C₁₃H₂₆N₃O₈P) (labeled as "Ligand of Interest" by depositor).



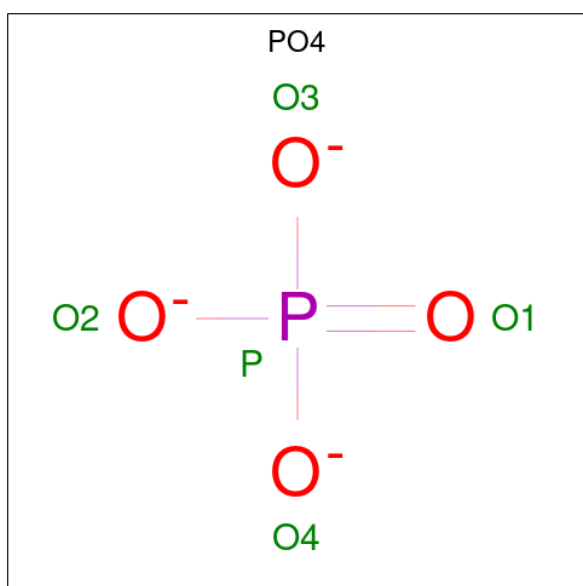
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
5	A	1	Total	C	N	O	P	0	0
			24	13	3	7	1		
5	B	1	Total	C	N	O	P	0	1
			38	20	4	12	2		

- Molecule 6 is PENTAETHYLENE GLYCOL (CCD ID: 1PE) (formula: C₁₀H₂₂O₆).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	C	1	Total	C	O	0	0
			14	9	5		
6	D	1	Total	C	O	0	0
			16	10	6		

- Molecule 7 is PHOSPHATE ION (CCD ID: PO4) (formula: O_4P).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
7	C	1	Total	O	P	0	0
			5	4	1		
7	D	1	Total	O	P	0	0
			5	4	1		

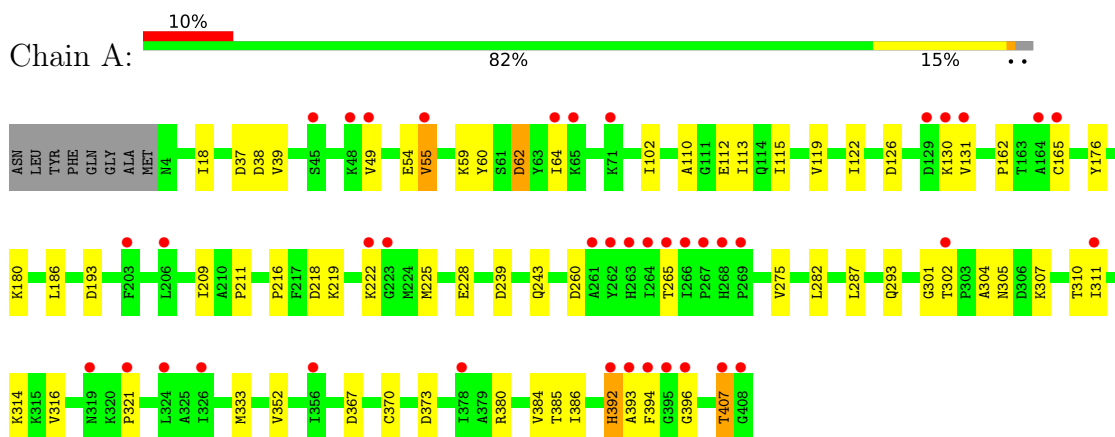
- Molecule 8 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
8	A	48	Total 48	O 48	0	0
8	B	204	Total 204	O 204	0	0
8	C	204	Total 204	O 204	0	0
8	D	94	Total 94	O 94	0	0
8	E	1	Total 1	O 1	0	0

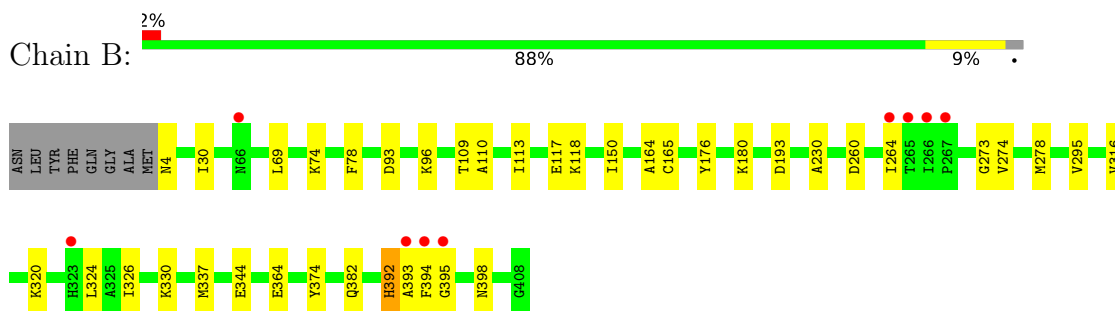
3 Residue-property plots [i](#)

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.

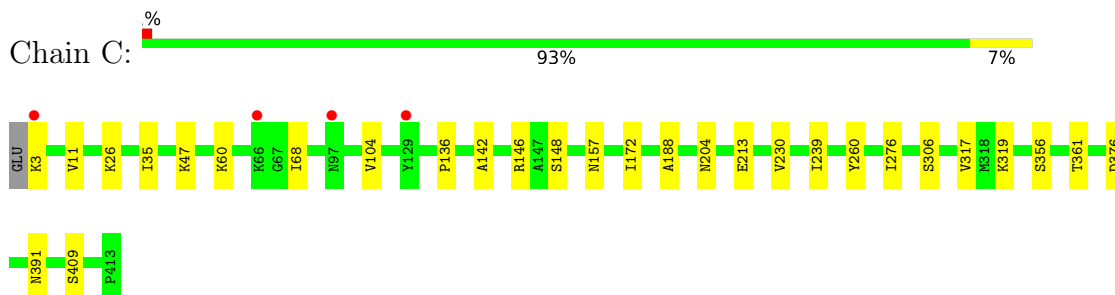
- Molecule 1: 3-oxoacyl-(Acyl-carrier-protein) synthase



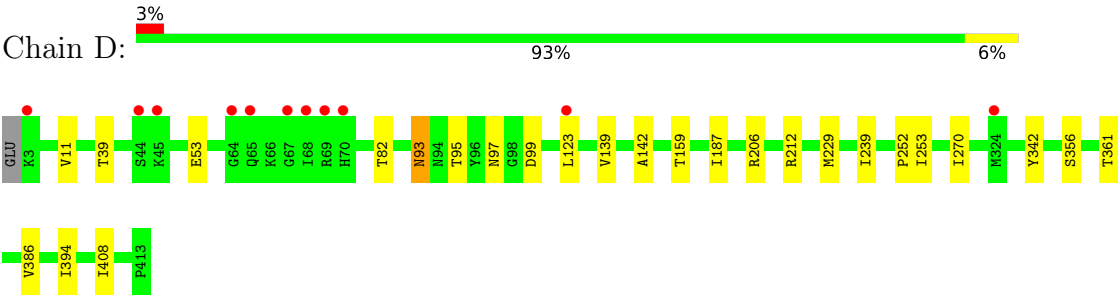
- Molecule 1: 3-oxoacyl-(Acyl-carrier-protein) synthase



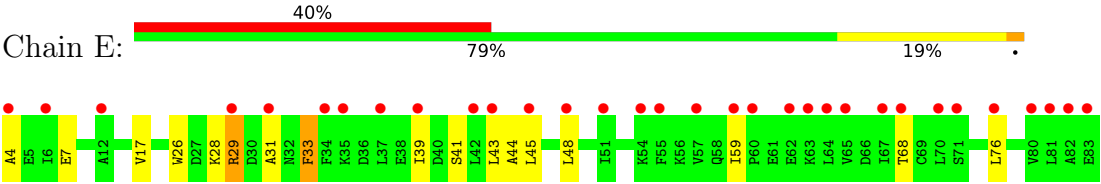
- Molecule 2: 3-oxoacyl-(Acyl-carrier-protein) synthase



- Molecule 2: 3-oxoacyl-(Acyl-carrier-protein) synthase



● Molecule 3: Acyl carrier protein



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, α , β , γ	122.60Å 163.21Å 101.66Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	67.93 – 2.07 67.93 – 2.08	Depositor EDS
% Data completeness (in resolution range)	94.8 (67.93-2.07) 94.8 (67.93-2.08)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.38 (at 2.07Å)	Xtriage
Refinement program	PHENIX 1.20.1_4487	Depositor
R, R_{free}	0.187 , 0.222 0.187 , 0.223	Depositor DCC
R_{free} test set	5893 reflections (4.76%)	wwPDB-VP
Wilson B-factor (Å ²)	30.0	Xtriage
Anisotropy	0.250	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.37 , 51.0	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	13614	wwPDB-VP
Average B, all atoms (Å ²)	45.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.95% 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: 1PE, 9EF, PO4, MG

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	0.13	0/3080	0.34	0/4169
1	B	0.18	0/3122	0.40	0/4225
2	C	0.18	0/3172	0.38	0/4297
2	D	0.13	0/3172	0.31	0/4297
3	E	0.10	0/643	0.31	0/868
All	All	0.15	0/13189	0.35	0/17856

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts [i](#)

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	3022	0	3034	40	0
1	B	3059	0	3065	25	0
2	C	3120	0	3136	15	0
2	D	3120	0	3136	15	0
3	E	638	0	661	8	0
4	A	1	0	0	0	0
4	B	1	0	0	0	0
5	A	24	0	0	0	0

Continued on next page...

Continued from previous page...

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
5	B	38	0	0	0	0
6	C	14	0	17	0	0
6	D	16	0	22	4	0
7	C	5	0	0	0	0
7	D	5	0	0	0	0
8	A	48	0	0	0	0
8	B	204	0	0	4	0
8	C	204	0	0	2	0
8	D	94	0	0	0	0
8	E	1	0	0	0	0
All	All	13614	0	13071	101	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 4.

All (101) 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:A:367:ASP:HB3	1:A:370:CYS:HB2	1.67	0.74
1:A:126:ASP:HB3	1:A:130:LYS:HD2	1.71	0.73
1:B:4:ASN:N	8:B:602:HOH:O	2.23	0.70
2:D:206:ARG:HB3	2:D:212:ARG:HE	1.56	0.70
1:A:112:GLU:HB3	1:A:115:ILE:HD13	1.73	0.70
2:C:47:LYS:HE2	2:C:213:GLU:HG2	1.80	0.63
1:B:382:GLN:NE2	8:B:604:HOH:O	2.29	0.63
1:A:165:CYS:HB2	1:A:393:ALA:HA	1.81	0.62
1:B:176:TYR:CZ	1:B:180:LYS:HD2	2.35	0.62
1:A:407:THR:O	1:A:407:THR:OG1	2.15	0.61
1:A:49:VAL:HG23	1:A:211:PRO:HA	1.84	0.59
2:D:252:PRO:HA	6:D:502:1PE:H231	1.85	0.59
1:A:60:TYR:CZ	1:A:64:ILE:HG21	2.37	0.58
1:B:118:LYS:NZ	8:B:607:HOH:O	2.34	0.57
1:A:211:PRO:HD3	1:A:222:LYS:HG2	1.87	0.56
2:D:93:ASN:OD1	2:D:95:THR:OG1	2.21	0.56
1:B:274:VAL:HG12	1:B:278:MET:HE2	1.89	0.55
1:B:392[B]:HIS:HD1	1:B:398:ASN:HB3	1.72	0.55
1:A:373:ASP:OD2	1:A:380:ARG:NH2	2.36	0.54
1:A:176:TYR:CZ	1:A:180:LYS:HD2	2.44	0.53
1:A:293:GLN:HE21	1:A:385:THR:H	1.57	0.53
1:B:164:ALA:HB3	1:B:393[A]:ALA:HB1	1.90	0.53
2:C:60:LYS:HD2	2:C:68:ILE:HD11	1.90	0.53

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:302:THR:HG22	1:A:304:ALA:H	1.74	0.52
2:C:142:ALA:O	2:C:146:ARG:HG2	2.09	0.52
1:A:37:ASP:OD1	1:A:38:ASP:N	2.43	0.51
1:A:310:THR:HG22	1:A:314:LYS:HD2	1.91	0.51
1:B:364:GLU:OE1	8:B:601:HOH:O	2.19	0.51
1:A:49:VAL:HG21	1:A:209:ILE:HG22	1.92	0.50
3:E:17:VAL:HG13	3:E:43:LEU:HD22	1.93	0.50
1:B:109:THR:HG21	1:B:337:MET:HE3	1.94	0.50
1:B:394[B]:PHE:CD1	1:B:394[B]:PHE:N	2.80	0.50
2:D:39:THR:OG1	2:D:53:GLU:OE2	2.28	0.50
2:D:139:VAL:HG23	2:D:142:ALA:HB2	1.94	0.50
2:D:252:PRO:HA	6:D:502:1PE:H242	1.94	0.49
1:A:260:ASP:HB2	1:A:396:GLY:HA3	1.94	0.49
2:C:3:LYS:N	8:C:610:HOH:O	2.46	0.49
3:E:26:TRP:O	3:E:29:ARG:HG3	2.12	0.49
2:D:229:MET:HE1	2:D:342:TYR:OH	2.14	0.47
2:D:253:ILE:H	6:D:502:1PE:H232	1.80	0.47
1:B:260:ASP:HB2	1:B:395[B]:GLY:C	2.40	0.47
1:A:119:VAL:HG13	1:A:131:VAL:HG11	1.97	0.47
1:A:282:LEU:HD12	1:A:287:LEU:HB2	1.98	0.46
1:A:293:GLN:NE2	1:A:385:THR:H	2.14	0.46
1:B:260:ASP:OD1	1:B:273:GLY:HA3	2.15	0.46
1:A:60:TYR:CE2	1:A:64:ILE:HG21	2.50	0.45
2:C:319:LYS:NZ	2:C:376:ASP:OD1	2.46	0.45
1:A:102:ILE:HA	1:A:186:LEU:O	2.17	0.45
1:B:110:ALA:HB1	1:B:113:ILE:HB	1.99	0.45
2:C:391:ASN:ND2	2:C:409:SER:OG	2.48	0.45
1:A:55:VAL:HG12	1:A:228:GLU:OE2	2.16	0.45
1:A:307:LYS:O	1:A:311:ILE:HG12	2.16	0.45
2:C:148:SER:HB3	2:C:157:ASN:ND2	2.32	0.45
1:B:74:LYS:HE2	1:B:78:PHE:CZ	2.52	0.45
2:C:356:SER:HB2	2:C:361:THR:O	2.17	0.45
1:A:305:ASN:HD21	1:A:392:HIS:CD2	2.34	0.44
1:A:275:VAL:HG22	1:A:316:VAL:HG23	1.98	0.44
1:B:93:ASP:OD2	1:B:96:LYS:HD3	2.18	0.44
1:B:320:LYS:HD3	1:B:320:LYS:HA	1.58	0.44
1:A:110:ALA:HB1	1:A:113:ILE:HB	1.99	0.44
1:B:278:MET:HE3	1:B:316:VAL:HG21	2.00	0.44
2:D:253:ILE:H	6:D:502:1PE:C23	2.30	0.44
1:B:264[A]:ILE:HG12	2:C:136:PRO:HB3	2.00	0.43
1:B:113:ILE:O	1:B:117:GLU:HG2	2.17	0.43

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
3:E:28:LYS:HB3	3:E:31:ALA:HB3	2.01	0.43
3:E:33:PHE:CD1	3:E:39:ILE:HD12	2.53	0.43
3:E:41[A]:SER:HA	3:E:44:ALA:HB3	2.00	0.43
2:C:26:LYS:HE2	2:C:26:LYS:HB3	1.87	0.43
1:A:352:VAL:HG12	1:A:384:VAL:HG12	1.99	0.43
2:C:276:ILE:HB	2:C:317:VAL:HG22	2.01	0.43
2:D:356:SER:HB2	2:D:361:THR:O	2.19	0.43
1:A:18:ILE:HG12	1:A:333:MET:HE2	2.01	0.43
2:D:82:THR:HG23	2:D:187:ILE:HD13	2.01	0.43
1:A:302:THR:HG22	1:A:304:ALA:N	2.34	0.42
1:A:216:PRO:HA	1:A:301:GLY:HA2	2.02	0.42
1:A:239:ASP:O	1:A:243:GLN:HG2	2.19	0.42
1:B:78:PHE:HB3	1:B:230:ALA:HB2	2.01	0.42
2:C:35:ILE:HD13	2:C:230:VAL:HG11	2.01	0.42
2:C:204:ASN:ND2	8:C:609:HOH:O	2.45	0.42
1:B:274:VAL:HG13	1:B:392[B]:HIS:CE1	2.54	0.42
1:A:39:VAL:HA	1:A:54:GLU:OE2	2.20	0.41
3:E:4:ALA:O	3:E:7:GLU:HG2	2.19	0.41
1:B:295:VAL:HG23	1:B:324:LEU:HD11	2.02	0.41
1:B:330:LYS:NZ	1:B:344:GLU:OE2	2.50	0.41
2:D:123:LEU:HD23	2:D:123:LEU:HA	1.88	0.41
1:A:162:PRO:HD2	2:D:159:THR:O	2.21	0.41
3:E:45:LEU:HD12	3:E:45:LEU:HA	1.87	0.41
1:A:265[A]:THR:HG22	1:A:394:PHE:HE2	1.86	0.41
2:D:97:ASN:ND2	2:D:99:ASP:HB2	2.35	0.41
1:A:211:PRO:HD3	1:A:222:LYS:CG	2.50	0.41
1:A:293:GLN:NE2	1:A:386:ILE:H	2.19	0.41
1:A:59:LYS:O	1:A:62:ASP:HB2	2.21	0.41
1:A:122:ILE:HG21	1:A:131:VAL:HA	2.03	0.41
1:A:218:ASP:OD1	1:A:219:LYS:N	2.54	0.41
2:C:172:ILE:HG23	2:C:260:TYR:CE1	2.56	0.41
2:D:394:ILE:HD13	2:D:408:ILE:HG12	2.03	0.41
1:A:265[A]:THR:HG22	1:A:394:PHE:CE2	2.56	0.40
1:B:69:LEU:HD21	1:B:150:ILE:HG21	2.03	0.40
2:C:104:VAL:O	2:C:188:ALA:HA	2.21	0.40
1:B:326:ILE:O	1:B:374:TYR:HA	2.21	0.40
3:E:48:LEU:HD22	3:E:59:ILE:HG13	2.04	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	403/413 (98%)	388 (96%)	14 (4%)	1 (0%)	43	38
1	B	409/413 (99%)	400 (98%)	9 (2%)	0	100	100
2	C	409/412 (99%)	396 (97%)	13 (3%)	0	100	100
2	D	409/412 (99%)	397 (97%)	12 (3%)	0	100	100
3	E	79/80 (99%)	73 (92%)	6 (8%)	0	100	100
All	All	1709/1730 (99%)	1654 (97%)	54 (3%)	1 (0%)	48	44

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	321	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	320/326 (98%)	314 (98%)	6 (2%)	50	49
1	B	323/326 (99%)	317 (98%)	6 (2%)	50	49
2	C	341/342 (100%)	338 (99%)	3 (1%)	70	74
2	D	341/342 (100%)	336 (98%)	5 (2%)	57	58
3	E	72/71 (101%)	68 (94%)	4 (6%)	19	12
All	All	1397/1407 (99%)	1373 (98%)	24 (2%)	55	53

All (24) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	55	VAL
1	A	62	ASP
1	A	193	ASP
1	A	225	MET
1	A	392	HIS
1	A	407	THR
1	B	30	ILE
1	B	165[A]	CYS
1	B	165[B]	CYS
1	B	193	ASP
1	B	392[A]	HIS
1	B	392[B]	HIS
2	C	11	VAL
2	C	239	ILE
2	C	306	SER
2	D	11	VAL
2	D	93	ASN
2	D	239	ILE
2	D	270	ILE
2	D	386	VAL
3	E	29	ARG
3	E	33	PHE
3	E	68	THR
3	E	76	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (23) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	50	HIS
1	A	293	GLN
1	A	305	ASN
1	B	305	ASN
2	C	50	GLN
2	C	70	HIS
2	C	90	ASN
2	C	128	ASN
2	C	157	ASN
2	C	288	GLN
2	C	295	ASN
2	C	349	GLN
2	D	90	ASN

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
2	D	121	GLN
2	D	137	ASN
2	D	157	ASN
2	D	279	ASN
2	D	288	GLN
2	D	367	ASN
2	D	391	ASN
2	D	395	ASN
3	E	32	ASN
3	E	58	GLN

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 9 ligands modelled in this entry, 2 are monoatomic - leaving 7 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	$\# Z > 2$
5	9EF	B	501[A]	1	17,23,24	2.29	5 (29%)	23,30,33	1.09	1 (4%)
5	9EF	B	501[C]	-	7,13,24	3.53	2 (28%)	11,18,33	1.74	2 (18%)
6	1PE	C	501	-	13,13,15	0.19	0	12,12,14	0.11	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
5	9EF	A	502	1	17,23,24	2.33	5 (29%)	23,30,33	1.16	2 (8%)
6	1PE	D	502	-	15,15,15	0.16	0	14,14,14	0.12	0
7	PO4	C	502	-	4,4,4	1.11	0	6,6,6	0.63	0
7	PO4	D	501	-	4,4,4	0.92	0	6,6,6	0.42	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
5	9EF	B	501[A]	1	-	8/27/29/30	-
5	9EF	B	501[C]	-	-	7/16/18/30	-
6	1PE	C	501	-	-	7/11/11/13	-
5	9EF	A	502	1	-	8/27/29/30	-
6	1PE	D	502	-	-	6/13/13/13	-

All (12) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	B	501[C]	9EF	CAU-NAQ	8.83	1.45	1.33
5	A	502	9EF	CAU-NAQ	5.41	1.45	1.33
5	B	501[A]	9EF	CAU-NAQ	5.35	1.45	1.33
5	A	502	9EF	CAT-NAP	5.26	1.45	1.33
5	B	501[A]	9EF	CAT-NAP	5.12	1.45	1.33
5	A	502	9EF	CAS-NAO	4.03	1.45	1.34
5	B	501[A]	9EF	CAS-NAO	3.91	1.45	1.34
5	B	501[A]	9EF	OAE-CAT	-2.28	1.18	1.23
5	A	502	9EF	OAE-CAT	-2.19	1.18	1.23
5	A	502	9EF	OAF-CAU	-2.16	1.19	1.23
5	B	501[C]	9EF	OAF-CAU	-2.15	1.19	1.23
5	B	501[A]	9EF	OAF-CAU	-2.04	1.19	1.23

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	B	501[C]	9EF	CAV-CAU-NAQ	4.96	119.55	116.32
5	B	501[C]	9EF	OAF-CAU-NAQ	-2.28	119.31	123.09
5	A	502	9EF	OAF-CAU-NAQ	-2.20	118.26	122.99
5	B	501[A]	9EF	CAL-NAQ-CAU	-2.17	118.72	122.59
5	A	502	9EF	CAL-NAQ-CAU	-2.01	119.00	122.59

There are no chirality outliers.

All (36) torsion outliers are listed below:

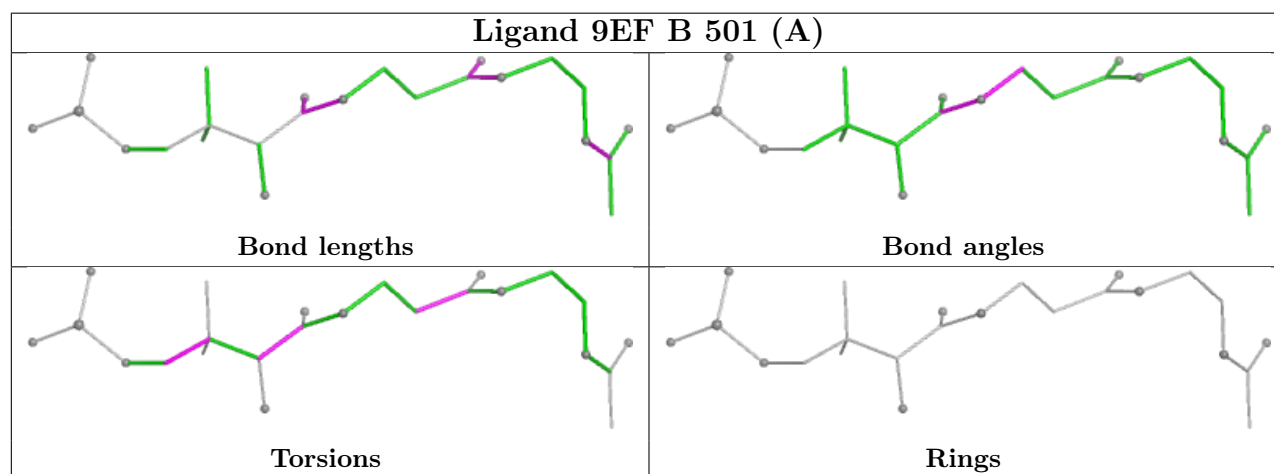
Mol	Chain	Res	Type	Atoms
5	A	502	9EF	OAF-CAU-CAV-OAI
5	A	502	9EF	NAQ-CAU-CAV-OAI
5	B	501[A]	9EF	OAR-CAN-CAX-CAV
5	B	501[C]	9EF	OAR-CAN-CAX-CAV
6	C	501	1PE	OH7-C16-C26-OH6
6	D	502	1PE	OH5-C14-C24-OH4
6	C	501	1PE	OH6-C15-C25-OH5
6	C	501	1PE	OH4-C13-C23-OH3
6	D	502	1PE	OH4-C13-C23-OH3
5	B	501[C]	9EF	OAR-CAN-CAX-CAB
5	B	501[C]	9EF	OAR-CAN-CAX-CAC
5	A	502	9EF	CAK-CAJ-NAO-CAS
6	D	502	1PE	OH7-C16-C26-OH6
5	B	501[A]	9EF	CAL-CAM-CAT-OAE
5	B	501[A]	9EF	OAF-CAU-CAV-OAI
5	B	501[C]	9EF	OAF-CAU-CAV-OAI
5	B	501[A]	9EF	OAR-CAN-CAX-CAB
5	B	501[A]	9EF	OAR-CAN-CAX-CAC
5	A	502	9EF	OAF-CAU-CAV-CAX
6	C	501	1PE	C13-C23-OH3-C22
5	A	502	9EF	NAQ-CAU-CAV-CAX
5	B	501[A]	9EF	NAQ-CAU-CAV-CAX
5	B	501[C]	9EF	NAQ-CAU-CAV-OAI
5	A	502	9EF	NAQ-CAL-CAM-CAT
6	D	502	1PE	C12-C22-OH3-C23
5	A	502	9EF	CAL-CAM-CAT-OAE
5	B	501[A]	9EF	CAL-CAM-CAT-NAP
5	B	501[A]	9EF	OAF-CAU-CAV-CAX
6	C	501	1PE	OH5-C14-C24-OH4
5	A	502	9EF	CAL-CAM-CAT-NAP
6	D	502	1PE	OH2-C12-C22-OH3
6	C	501	1PE	C15-C25-OH5-C14
5	B	501[C]	9EF	CAU-CAV-CAX-CAC
6	C	501	1PE	C23-C13-OH4-C24
6	D	502	1PE	C25-C15-OH6-C26
5	B	501[C]	9EF	CAU-CAV-CAX-CAN

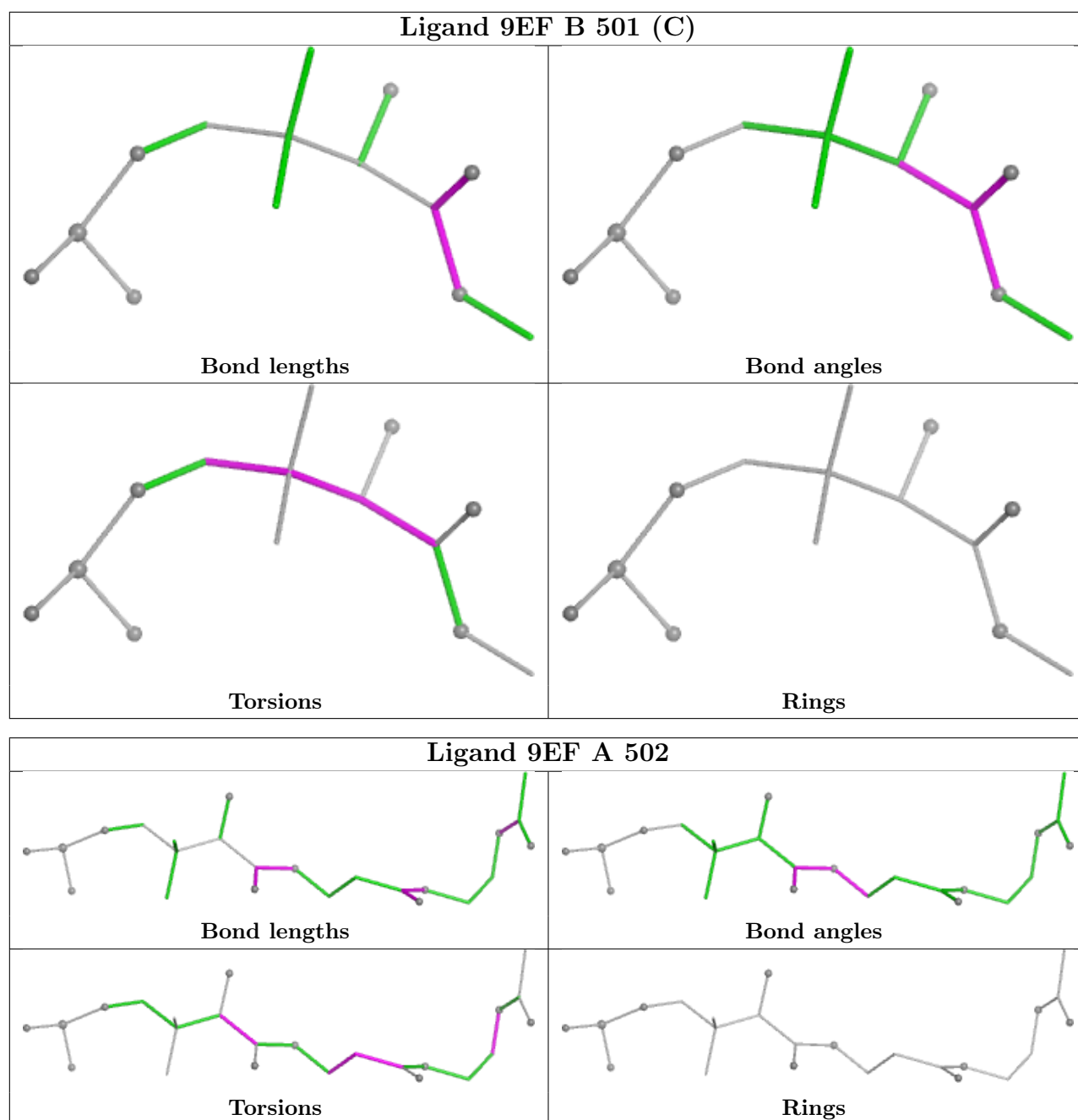
There are no ring outliers.

1 monomer is involved in 4 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
6	D	502	1PE	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.





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	405/413 (98%)	0.63	40 (9%) 13 13	30, 57, 97, 122	0
1	B	405/413 (98%)	-0.29	9 (2%) 62 64	15, 28, 48, 66	12 (2%)
2	C	411/412 (99%)	-0.37	4 (0%) 79 82	17, 28, 47, 84	0
2	D	411/412 (99%)	0.23	11 (2%) 56 58	28, 47, 88, 127	0
3	E	80/80 (100%)	1.82	32 (40%) 1 0	32, 84, 131, 142	1 (1%)
All	All	1712/1730 (98%)	0.13	96 (5%) 30 30	15, 38, 91, 142	13 (0%)

All (96) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	394[A]	PHE	9.2
1	A	394	PHE	6.3
1	A	267[A]	PRO	5.9
1	B	393[A]	ALA	5.5
1	B	395[A]	GLY	5.4
1	A	393	ALA	4.8
1	A	265[A]	THR	4.8
3	E	64	LEU	4.7
3	E	60	PRO	4.5
3	E	34	PHE	4.4
3	E	57	VAL	4.3
1	A	266[A]	ILE	4.3
3	E	81	LEU	4.2
1	A	264[A]	ILE	4.2
1	A	65	LYS	4.0
3	E	65	VAL	3.9
1	A	408	GLY	3.8
2	D	67	GLY	3.7
3	E	55	PHE	3.7
1	A	395	GLY	3.6

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
3	E	4	ALA	3.6
1	B	266[A]	ILE	3.5
1	A	164	ALA	3.4
1	A	222	LYS	3.4
3	E	82	ALA	3.4
1	A	407	THR	3.2
1	A	165	CYS	3.2
3	E	35	LYS	3.1
1	A	49	VAL	3.1
1	B	323	HIS	3.1
2	C	66	LYS	3.1
1	A	324	LEU	3.1
3	E	76	LEU	3.1
1	A	356	ILE	3.0
3	E	80	VAL	2.9
2	D	3	LYS	2.9
1	B	265[A]	THR	2.8
2	D	69	ARG	2.8
3	E	39	ILE	2.7
1	A	48	LYS	2.7
1	B	264[A]	ILE	2.7
2	C	3	LYS	2.7
2	D	45	LYS	2.6
3	E	31	ALA	2.6
3	E	37	LEU	2.6
3	E	45	LEU	2.6
3	E	63	LYS	2.6
1	A	64	ILE	2.6
2	D	68	ILE	2.6
1	A	378	ILE	2.5
1	A	268[A]	HIS	2.5
1	A	263[A]	HIS	2.5
3	E	67	ILE	2.5
1	A	302	THR	2.5
1	A	262	TYR	2.4
1	A	392	HIS	2.4
1	A	319	ASN	2.4
3	E	51	ILE	2.4
1	A	203	PHE	2.4
1	A	321	PRO	2.4
2	C	129	TYR	2.3
3	E	6	ILE	2.3

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	A	131	VAL	2.3
3	E	68	THR	2.3
1	B	66	ASN	2.3
3	E	71	SER	2.3
1	B	267[A]	PRO	2.3
1	A	129	ASP	2.3
1	A	130	LYS	2.3
1	A	396	GLY	2.3
2	D	70	HIS	2.2
2	D	44	SER	2.2
3	E	59	ILE	2.2
1	A	71	LYS	2.2
1	A	326	ILE	2.2
3	E	42	LEU	2.2
3	E	43	LEU	2.2
1	A	45	SER	2.2
2	C	97	ASN	2.2
1	A	269	PRO	2.1
2	D	65	GLN	2.1
3	E	48	LEU	2.1
1	A	206	LEU	2.1
3	E	62	GLU	2.1
3	E	83	GLU	2.1
1	A	261	ALA	2.1
2	D	123	LEU	2.1
2	D	324	MET	2.1
1	A	311	ILE	2.1
3	E	70	LEU	2.0
3	E	29	ARG	2.0
3	E	54	LYS	2.0
1	A	223	GLY	2.0
1	A	55	VAL	2.0
3	E	12	ALA	2.0
2	D	64	GLY	2.0

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

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

6.3 Carbohydrates

There are no oligosaccharides in this entry.

6.4 Ligands

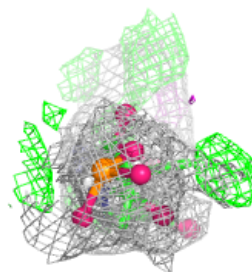
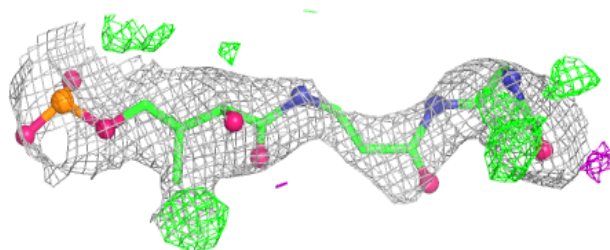
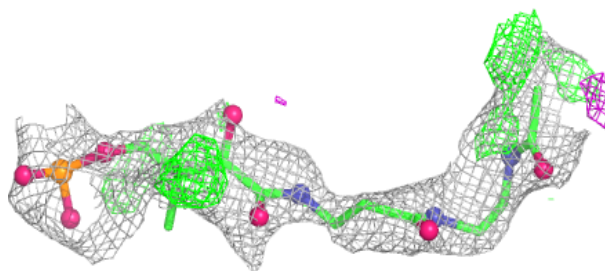
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
5	9EF	A	502	24/25	0.73	0.18	70,88,103,108	0
5	9EF	B	501[A]	24/25	0.75	0.22	33,52,65,68	24
5	9EF	B	501[C]	14/25	0.75	0.22	51,56,59,61	14
6	1PE	C	501	14/16	0.83	0.15	38,39,42,46	0
6	1PE	D	502	16/16	0.92	0.09	33,37,45,47	0
4	MG	A	501	1/1	0.97	0.08	43,43,43,43	0
7	PO4	D	501	5/5	0.97	0.07	38,42,47,50	0
7	PO4	C	502	5/5	0.98	0.05	26,27,30,32	0
4	MG	B	502	1/1	0.99	0.10	13,13,13,13	0

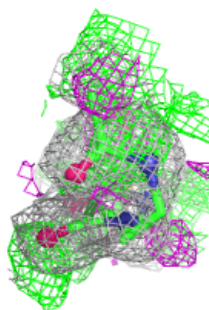
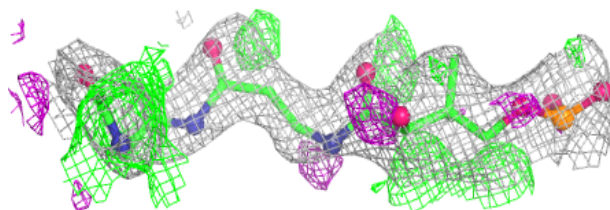
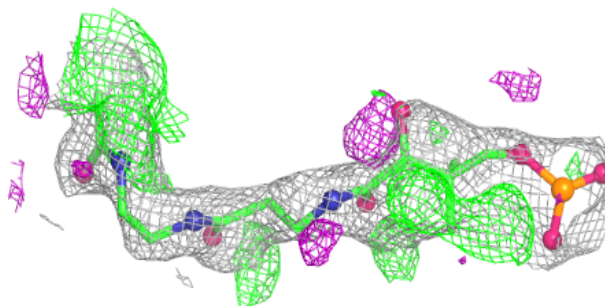
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around 9EF A 502:

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

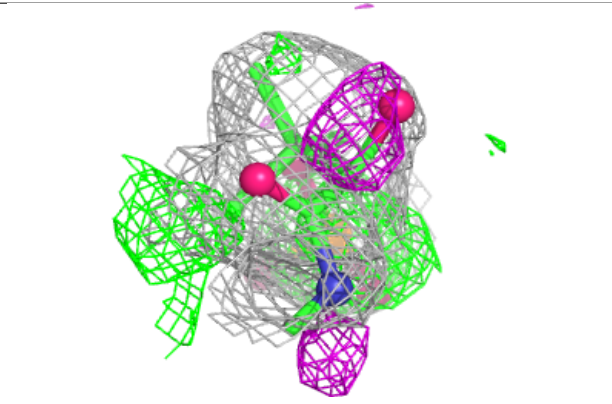
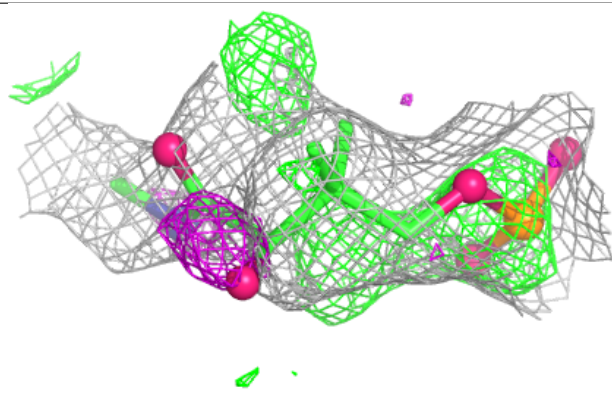
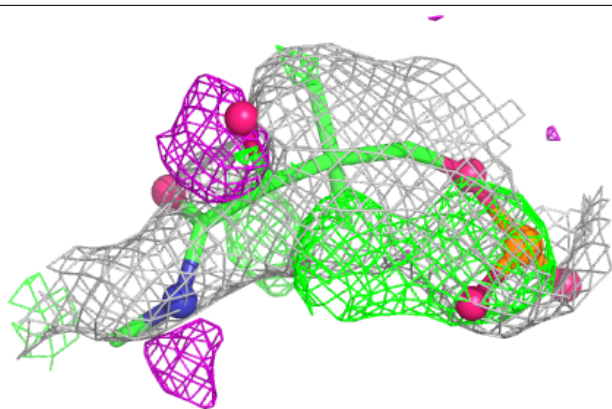
**Electron density around 9EF B 501 (A):**

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



Electron density around 9EF B 501 (C):

$2mF_o-DF_c$ (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.