



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 01:59 AM UTC

PDB ID : 5FBU / pdb_00005fbu
Title : Crystal structure of rifampin phosphotransferase RPH-Lm from *Listeria monocytogenes* in complex with rifampin-phosphate
Authors : Stogios, P.J.; Wawrzak, Z.; Skarina, T.; Yim, V.; Savchenko, A.; Anderson, W.F.; Center for Structural Genomics of Infectious Diseases (CSGID)
Deposited on : 2015-12-14
Resolution : 2.85 Å(reported)

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

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

A user guide is available at

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

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

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

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

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

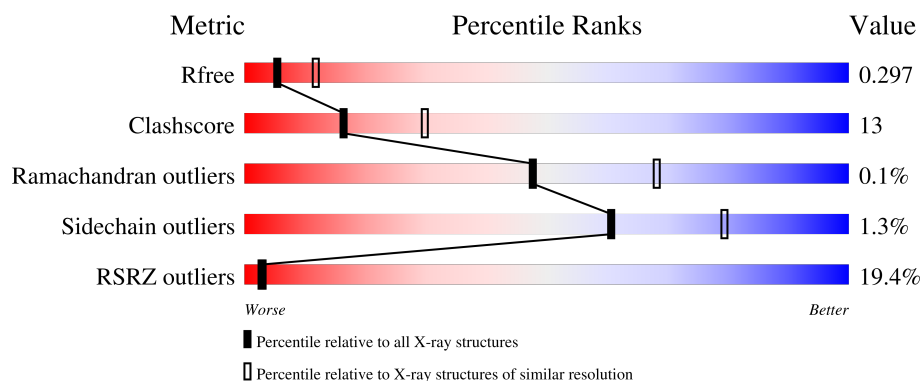
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.85 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	1407 (2.88-2.84)
Clashscore	190562	1446 (2.88-2.84)
Ramachandran outliers	187476	1406 (2.88-2.84)
Sidechain outliers	187428	1407 (2.88-2.84)
RSRZ outliers	180081	1408 (2.88-2.84)

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.

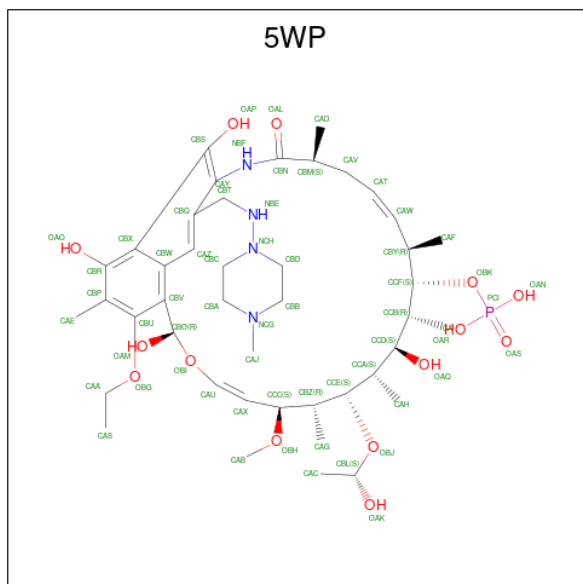
Mol	Chain	Length	Quality of chain
1	A	867	16% 66% 17% • 15%

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 Phosphoenolpyruvate synthase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	733	Total	C	N	O	S	0	0	0
			5442	3438	924	1058	22			

- Molecule 2 is Rifampin-phosphate (CCD ID: 5WP) (formula: $\text{C}_{43}\text{H}_{69}\text{N}_4\text{O}_{14}\text{P}$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total 62	C 43	N 4	O 14	P 1	0	0

- Molecule 3 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total Cl 1 1	0	0

- Molecule 4 is (4S)-2-METHYL-2,4-PENTANEDIOL (CCD ID: MPD) (formula: $C_6H_{14}O_2$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	C	O	0	0
			8	6	2		

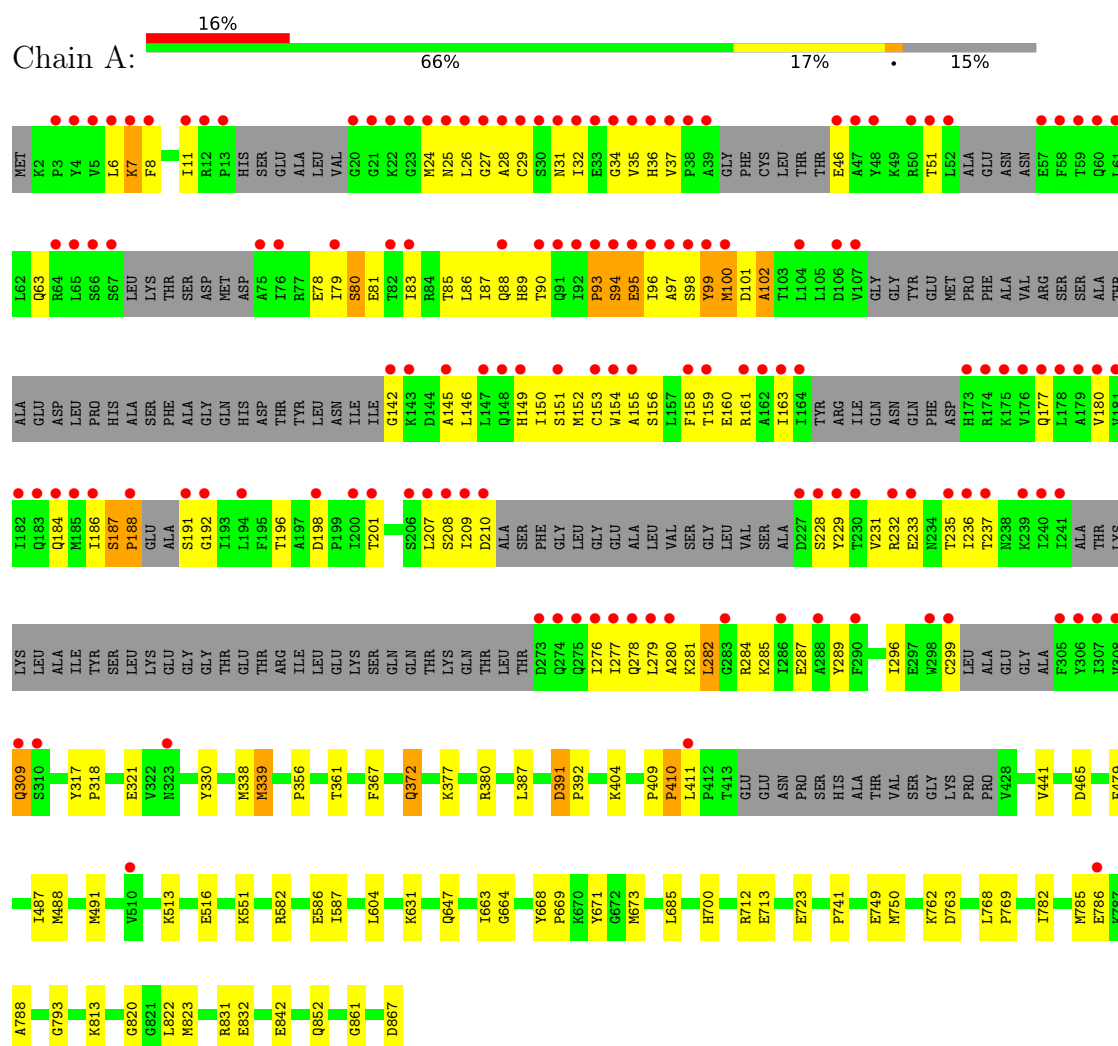
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	167	Total	O	0	0
			167	167		

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: Phosphoenolpyruvate synthase



4 Data and refinement statistics

Property	Value	Source
Space group	P 65 2 2	Depositor
Cell constants a, b, c, α , β , γ	151.63Å 151.63Å 191.51Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	49.63 – 2.85 49.63 – 2.85	Depositor EDS
% Data completeness (in resolution range)	99.9 (49.63-2.85) 94.7 (49.63-2.85)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.24 (at 2.86Å)	Xtriage
Refinement program	PHENIX 1.9_1692	Depositor
R, R_{free}	0.238 , 0.294 0.250 , 0.297	Depositor DCC
R_{free} test set	1463 reflections (4.73%)	wwPDB-VP
Wilson B-factor (Å ²)	58.3	Xtriage
Anisotropy	0.290	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.29 , 70.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.90	EDS
Total number of atoms	5680	wwPDB-VP
Average B, all atoms (Å ²)	76.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.77% 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: MPD, CL, 5WP

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	0.50	0/5525	1.02	43/7486 (0.6%)

There are no bond length outliers.

All (43) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	158	PHE	N-CA-C	22.32	135.24	111.14
1	A	158	PHE	CB-CA-C	-10.28	94.66	110.90
1	A	177	GLN	N-CA-C	9.41	124.36	109.50
1	A	37	VAL	C-N-CD	-9.05	87.91	125.00
1	A	187	SER	N-CA-C	7.80	117.11	108.14
1	A	94	SER	N-CA-C	-7.38	104.15	113.01
1	A	159	THR	N-CA-C	7.32	122.62	112.45
1	A	8	PHE	N-CA-C	7.26	119.20	111.28
1	A	36	HIS	N-CA-C	7.21	120.29	109.25
1	A	32	ILE	N-CA-C	7.02	123.94	109.34
1	A	237	THR	N-CA-C	6.83	118.52	111.14
1	A	647	GLN	N-CA-C	-6.44	107.28	114.62
1	A	34	GLY	CA-C-N	-6.35	114.76	123.46
1	A	34	GLY	C-N-CA	-6.35	114.76	123.46
1	A	93	PRO	N-CA-C	-6.27	101.34	111.19
1	A	102	ALA	N-CA-C	-6.19	105.30	112.92
1	A	276	ILE	N-CA-C	-6.17	104.28	111.00
1	A	8	PHE	CA-C-N	-6.15	110.23	120.68
1	A	8	PHE	C-N-CA	-6.15	110.23	120.68
1	A	278	GLN	N-CA-C	-6.14	104.58	111.28
1	A	410	PRO	N-CA-C	6.05	120.34	111.03
1	A	88	GLN	N-CA-C	-5.89	104.99	111.82
1	A	99	TYR	N-CA-C	-5.57	105.21	111.28
1	A	411	LEU	N-CA-C	-5.56	102.77	109.83

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	282	LEU	CA-C-N	5.54	126.09	119.94
1	A	282	LEU	C-N-CA	5.54	126.09	119.94
1	A	177	GLN	CA-C-N	5.48	130.19	122.09
1	A	177	GLN	C-N-CA	5.48	130.19	122.09
1	A	309	GLN	N-CA-C	5.46	117.98	109.52
1	A	188	PRO	CA-N-CD	-5.40	104.44	112.00
1	A	83	ILE	N-CA-C	-5.31	105.20	110.62
1	A	184	GLN	N-CA-C	5.31	118.72	110.17
1	A	151	SER	N-CA-C	-5.31	105.57	111.36
1	A	391	ASP	CA-C-N	5.30	124.96	119.56
1	A	391	ASP	C-N-CA	5.30	124.96	119.56
1	A	85	THR	N-CA-C	-5.26	107.03	113.50
1	A	100	MET	N-CA-C	-5.24	105.57	111.28
1	A	184	GLN	CA-C-N	5.15	128.86	121.50
1	A	184	GLN	C-N-CA	5.15	128.86	121.50
1	A	180	VAL	N-CA-C	5.12	116.34	108.71
1	A	51	THR	N-CA-C	-5.07	105.75	111.28
1	A	35	VAL	N-CA-C	5.03	114.66	108.53
1	A	80	SER	N-CA-C	-5.03	105.32	111.75

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	5442	0	5149	133	0
2	A	62	0	67	13	0
3	A	1	0	0	0	0
4	A	8	0	14	2	0
5	A	167	0	0	6	0
All	All	5680	0	5230	140	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.

All (140) 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:192:GLY:HA3	1:A:210:ASP:O	1.36	1.25
1:A:94:SER:O	1:A:96:ILE:N	1.71	1.20
1:A:149:HIS:HA	1:A:152:MET:CB	1.78	1.13
1:A:24:MET:O	1:A:27:GLY:N	1.93	1.01
1:A:186:ILE:HG22	1:A:187:SER:H	1.24	1.00
1:A:24:MET:C	1:A:27:GLY:H	1.75	0.92
1:A:78:GLU:O	1:A:81:GLU:CB	2.16	0.92
1:A:86:LEU:HA	1:A:89:HIS:CB	2.00	0.92
1:A:28:ALA:HB1	1:A:289:TYR:HE2	1.34	0.91
1:A:94:SER:C	1:A:96:ILE:N	2.23	0.91
1:A:186:ILE:HG22	1:A:187:SER:N	1.79	0.90
1:A:186:ILE:CG2	1:A:187:SER:H	1.85	0.88
1:A:86:LEU:O	1:A:90:THR:N	2.08	0.87
1:A:28:ALA:HB1	1:A:289:TYR:CE2	2.10	0.85
1:A:87:ILE:O	1:A:90:THR:HG22	1.77	0.84
1:A:94:SER:C	1:A:96:ILE:H	1.86	0.83
1:A:98:SER:O	1:A:102:ALA:N	2.10	0.83
1:A:94:SER:O	1:A:95:GLU:C	2.24	0.80
1:A:186:ILE:CG2	1:A:187:SER:N	2.45	0.78
1:A:86:LEU:O	1:A:89:HIS:C	2.28	0.76
1:A:90:THR:O	1:A:90:THR:HG23	1.86	0.75
1:A:231:VAL:HG22	1:A:236:ILE:HG12	1.66	0.75
1:A:279:LEU:HA	1:A:282:LEU:HD13	1.70	0.73
1:A:149:HIS:O	1:A:153:CYS:N	2.19	0.71
1:A:160:GLU:O	1:A:163:ILE:N	2.24	0.71
1:A:149:HIS:O	1:A:152:MET:N	2.24	0.70
1:A:231:VAL:HG13	1:A:235:THR:O	1.92	0.70
1:A:487:ILE:HD11	1:A:669:PRO:HG2	1.75	0.69
1:A:153:CYS:O	1:A:156:SER:HB3	1.92	0.69
1:A:79:ILE:O	1:A:80:SER:C	2.35	0.69
1:A:97:ALA:O	1:A:100:MET:N	2.27	0.68
1:A:192:GLY:CA	1:A:210:ASP:O	2.29	0.68
1:A:822:LEU:O	1:A:831:ARG:NH2	2.27	0.67
1:A:282:LEU:HD12	1:A:282:LEU:N	2.09	0.67
1:A:793:GLY:HA2	1:A:813:LYS:HD2	1.77	0.67
1:A:279:LEU:O	1:A:280:ALA:C	2.38	0.66
1:A:79:ILE:C	1:A:81:GLU:N	2.52	0.66
1:A:488:MET:HE1	2:A:901:5WP:H33	1.80	0.64
1:A:90:THR:O	1:A:90:THR:CG2	2.45	0.64
1:A:78:GLU:O	1:A:81:GLU:N	2.29	0.63
1:A:96:ILE:O	1:A:99:TYR:HB2	1.97	0.63

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:46:GLU:O	1:A:46:GLU:HG3	1.98	0.62
1:A:284:ARG:HD3	1:A:287:GLU:OE1	2.00	0.62
2:A:901:5WP:H43	2:A:901:5WP:H50	1.82	0.62
1:A:231:VAL:CG1	1:A:235:THR:O	2.49	0.61
1:A:87:ILE:O	1:A:90:THR:CG2	2.49	0.61
1:A:24:MET:C	1:A:26:LEU:N	2.49	0.59
1:A:94:SER:O	1:A:96:ILE:CA	2.50	0.59
1:A:99:TYR:HA	1:A:102:ALA:HB3	1.83	0.59
1:A:98:SER:O	1:A:102:ALA:HB2	2.02	0.59
1:A:79:ILE:O	1:A:81:GLU:N	2.36	0.59
1:A:387:LEU:HD11	2:A:901:5WP:H66	1.85	0.59
1:A:664:GLY:HA3	5:A:1006:HOH:O	2.02	0.59
1:A:24:MET:O	1:A:25:ASN:C	2.45	0.58
1:A:98:SER:O	1:A:102:ALA:CB	2.52	0.58
1:A:6:LEU:CB	1:A:11:ILE:HD11	2.34	0.57
1:A:232:ARG:O	1:A:233:GLU:HG2	2.04	0.57
1:A:768:LEU:HD12	1:A:769:PRO:HD2	1.88	0.56
1:A:149:HIS:C	1:A:152:MET:H	2.14	0.55
1:A:842:GLU:HG3	5:A:1034:HOH:O	2.06	0.55
1:A:86:LEU:O	1:A:89:HIS:CA	2.55	0.55
1:A:97:ALA:O	1:A:98:SER:C	2.50	0.54
1:A:338:MET:HE2	1:A:820:GLY:HA3	1.90	0.54
1:A:282:LEU:N	1:A:282:LEU:CD1	2.70	0.54
1:A:160:GLU:O	1:A:161:ARG:C	2.51	0.53
1:A:782:ILE:HD13	1:A:788:ALA:HA	1.91	0.53
1:A:513:LYS:HD2	1:A:631:LYS:HD3	1.90	0.53
1:A:96:ILE:O	1:A:99:TYR:N	2.40	0.53
1:A:196:THR:HG21	1:A:287:GLU:CD	2.34	0.52
1:A:852:GLN:HG2	1:A:867:ASP:OXT	2.10	0.52
1:A:491:MET:HG2	1:A:823:MET:HE2	1.92	0.52
1:A:149:HIS:O	1:A:150:ILE:C	2.51	0.52
1:A:296:ILE:HG23	1:A:309:GLN:O	2.10	0.51
1:A:208:SER:HA	1:A:229:TYR:O	2.09	0.51
1:A:79:ILE:C	1:A:81:GLU:H	2.17	0.51
1:A:465:ASP:OD1	1:A:712:ARG:NH2	2.32	0.51
1:A:404:LYS:NZ	1:A:749:GLU:OE1	2.32	0.50
1:A:279:LEU:O	1:A:281:LYS:N	2.45	0.50
1:A:377:LYS:HA	1:A:380:ARG:HB3	1.94	0.50
1:A:209:ILE:O	1:A:228:SER:HA	2.12	0.49
1:A:713:GLU:OE2	5:A:1001:HOH:O	2.20	0.49
1:A:582:ARG:NH1	1:A:586:GLU:OE2	2.46	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:281:LYS:O	1:A:285:LYS:HG3	2.13	0.49
1:A:723:GLU:OE1	1:A:723:GLU:N	2.31	0.49
1:A:488:MET:HE1	2:A:901:5WP:CAC	2.42	0.48
1:A:551:LYS:HD3	5:A:1134:HOH:O	2.12	0.48
1:A:153:CYS:O	1:A:156:SER:CB	2.61	0.48
1:A:86:LEU:O	1:A:89:HIS:N	2.46	0.48
1:A:372:GLN:HB3	5:A:1051:HOH:O	2.12	0.48
4:A:903:MPD:O4	4:A:903:MPD:O2	2.13	0.48
1:A:339:MET:HE2	1:A:587:ILE:HD11	1.95	0.48
1:A:7:LYS:HD3	1:A:7:LYS:HA	1.76	0.48
1:A:769:PRO:HD3	1:A:861:GLY:HA3	1.95	0.47
1:A:279:LEU:C	1:A:281:LYS:N	2.69	0.47
1:A:86:LEU:C	1:A:89:HIS:H	2.23	0.47
1:A:604:LEU:HG	1:A:785:MET:HE2	1.97	0.47
1:A:831:ARG:NH1	5:A:1008:HOH:O	2.47	0.47
1:A:95:GLU:C	1:A:96:ILE:HG23	2.40	0.47
2:A:901:5WP:H39	2:A:901:5WP:H48	1.41	0.47
1:A:330:TYR:HB3	1:A:367:PHE:HB3	1.97	0.46
1:A:29:CYS:C	1:A:31:ASN:H	2.22	0.46
1:A:93:PRO:C	1:A:95:GLU:N	2.73	0.46
1:A:339:MET:HB3	1:A:339:MET:HE3	1.66	0.46
1:A:96:ILE:O	1:A:97:ALA:C	2.59	0.46
1:A:441:VAL:HG13	1:A:668:TYR:CZ	2.51	0.46
1:A:516:GLU:HA	1:A:832:GLU:HA	1.98	0.46
1:A:279:LEU:CA	1:A:282:LEU:HD13	2.44	0.46
1:A:86:LEU:CA	1:A:89:HIS:CB	2.82	0.46
2:A:901:5WP:OAN	2:A:901:5WP:H52	2.16	0.46
1:A:361:THR:CG2	4:A:903:MPD:HM2	2.47	0.45
1:A:191:SER:HB2	1:A:299:CYS:HA	1.99	0.45
1:A:741:PRO:HG3	1:A:750:MET:HG2	1.98	0.45
1:A:97:ALA:O	1:A:100:MET:CB	2.65	0.45
1:A:146:LEU:O	1:A:150:ILE:CB	2.65	0.45
1:A:762:LYS:HD2	1:A:763:ASP:N	2.32	0.44
2:A:901:5WP:H20	2:A:901:5WP:H38	1.99	0.44
1:A:207:LEU:HD23	1:A:284:ARG:CZ	2.48	0.44
1:A:29:CYS:C	1:A:31:ASN:N	2.76	0.43
1:A:236:ILE:HG13	1:A:277:ILE:HD11	2.00	0.43
1:A:154:TRP:C	1:A:156:SER:N	2.73	0.43
1:A:142:GLY:O	1:A:145:ALA:HB3	2.18	0.43
1:A:582:ARG:HH21	1:A:671:TYR:HB2	1.84	0.43
1:A:631:LYS:HD2	1:A:631:LYS:HA	1.83	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:356:PRO:HD2	2:A:901:5WP:H14	2.01	0.43
1:A:101:ASP:N	1:A:101:ASP:OD1	2.52	0.42
1:A:198:ASP:OD2	1:A:201:THR:HG22	2.19	0.42
2:A:901:5WP:H26	2:A:901:5WP:H35	1.83	0.42
1:A:95:GLU:O	1:A:96:ILE:CG2	2.68	0.42
1:A:409:PRO:HA	1:A:410:PRO:HD3	1.70	0.41
1:A:317:TYR:HA	1:A:318:PRO:HD3	1.91	0.41
1:A:391:ASP:HA	1:A:392:PRO:HD3	1.86	0.41
1:A:154:TRP:O	1:A:155:ALA:C	2.63	0.41
1:A:387:LEU:HD21	2:A:901:5WP:H66	2.02	0.41
2:A:901:5WP:H30	2:A:901:5WP:H25	1.55	0.41
1:A:479:PHE:CZ	2:A:901:5WP:H56	2.56	0.41
1:A:685:LEU:HD22	1:A:700:HIS:CE1	2.56	0.41
1:A:93:PRO:C	1:A:95:GLU:H	2.28	0.41
1:A:279:LEU:O	1:A:282:LEU:HD13	2.20	0.40
1:A:663:ILE:HD12	1:A:663:ILE:HA	1.95	0.40
1:A:673:MET:SD	2:A:901:5WP:H58	2.61	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	709/867 (82%)	672 (95%)	36 (5%)	1 (0%)	48	68

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	95	GLU

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	538/746 (72%)	531 (99%)	7 (1%)	61 79

All (7) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	7	LYS
1	A	63	GLN
1	A	188	PRO
1	A	321	GLU
1	A	339	MET
1	A	372	GLN
1	A	786	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	450	HIS
1	A	630	HIS

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

Of 3 ligands modelled in this entry, 1 is monoatomic - leaving 2 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	MPD	A	903	-	7,7,7	0.55	0	9,10,10	0.52	0
2	5WP	A	901	-	65,65,65	2.76	18 (27%)	87,94,94	1.99	15 (17%)

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
4	MPD	A	903	-	-	0/5/5/5	-
2	5WP	A	901	-	-	39/68/81/81	0/3/4/4

All (18) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	901	5WP	CAY-NBE	11.85	1.60	1.47
2	A	901	5WP	CBU-CBV	11.00	1.48	1.37
2	A	901	5WP	CBV-CBW	5.53	1.53	1.43
2	A	901	5WP	OAQ-CBR	4.77	1.50	1.35
2	A	901	5WP	CBU-CBP	3.97	1.46	1.39
2	A	901	5WP	OAP-CBS	3.80	1.47	1.35
2	A	901	5WP	CBS-CBX	3.29	1.52	1.43
2	A	901	5WP	CBV-CBO	3.22	1.55	1.51
2	A	901	5WP	CAZ-CBW	3.20	1.48	1.42
2	A	901	5WP	OAL-CBN	-3.20	1.17	1.23
2	A	901	5WP	CBW-CBX	3.16	1.49	1.42
2	A	901	5WP	CAZ-CBQ	2.98	1.42	1.37
2	A	901	5WP	OBI-CBO	2.94	1.44	1.41
2	A	901	5WP	OBG-CBU	2.63	1.44	1.39
2	A	901	5WP	CAH-CCA	-2.56	1.48	1.53
2	A	901	5WP	CAW-CAT	2.45	1.41	1.31

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	901	5WP	OBG-CAA	-2.33	1.35	1.43
2	A	901	5WP	OBI-CAU	2.02	1.42	1.37

All (15) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	901	5WP	CBT-NBF-CBN	8.35	139.34	123.12
2	A	901	5WP	OAL-CBN-NBF	-6.02	111.20	123.92
2	A	901	5WP	CBQ-CAY-NBE	-5.99	101.17	110.88
2	A	901	5WP	CAY-NBE-NCH	-5.54	105.21	111.71
2	A	901	5WP	CBM-CBN-NBF	4.57	127.22	114.96
2	A	901	5WP	CBB-NCG-CBA	4.11	116.09	109.54
2	A	901	5WP	CAV-CBM-CBN	3.80	115.28	109.83
2	A	901	5WP	OBJ-CCE-CCA	3.57	112.44	108.23
2	A	901	5WP	CAA-OBG-CBU	3.14	128.23	115.83
2	A	901	5WP	CBV-CBU-CBP	-2.64	120.60	123.78
2	A	901	5WP	CAY-CBQ-CAZ	-2.61	119.55	121.92
2	A	901	5WP	CAZ-CBQ-CBT	2.42	122.25	118.80
2	A	901	5WP	CCA-CCE-CBZ	-2.30	110.03	114.68
2	A	901	5WP	CAV-CAT-CAW	-2.15	116.52	125.93
2	A	901	5WP	CBR-CBX-CBW	2.12	120.09	117.38

There are no chirality outliers.

All (39) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	901	5WP	OAM-CBO-CBV-CBW
2	A	901	5WP	OBI-CBO-CBV-CBU
2	A	901	5WP	OAM-CBO-OBI-CAU
2	A	901	5WP	CAX-CAU-OBI-CBO
2	A	901	5WP	CAX-CCC-OBH-CAB
2	A	901	5WP	CBZ-CCC-OBH-CAB
2	A	901	5WP	CCE-CBZ-CCC-CAX
2	A	901	5WP	CAG-CBZ-CCC-OBH
2	A	901	5WP	CCE-CBZ-CCC-OBH
2	A	901	5WP	CCC-CBZ-CCE-OBJ
2	A	901	5WP	CCC-CBZ-CCE-CCA
2	A	901	5WP	CAG-CBZ-CCE-OBJ
2	A	901	5WP	CAG-CBZ-CCE-CCA
2	A	901	5WP	CBZ-CCE-OBJ-CBL
2	A	901	5WP	OAK-CBL-OBJ-CCE
2	A	901	5WP	CAI-CCB-CCD-OAQ

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Mol	Chain	Res	Type	Atoms
2	A	901	5WP	CCF-CCB-CCD-OAQ
2	A	901	5WP	CAF-CBY-CCF-CCB
2	A	901	5WP	CAV-CBM-CBN-OAL
2	A	901	5WP	CAV-CBM-CBN-NBF
2	A	901	5WP	CCF-CCB-CCD-CCA
2	A	901	5WP	CCD-CCB-CCF-CBY
2	A	901	5WP	CAI-CCB-CCD-CCA
2	A	901	5WP	CAT-CAW-CBY-CAF
2	A	901	5WP	CAH-CCA-CCE-OBJ
2	A	901	5WP	CAG-CBZ-CCC-CAX
2	A	901	5WP	CAT-CAW-CBY-CCF
2	A	901	5WP	CCD-CCA-CCE-OBJ
2	A	901	5WP	CAF-CBY-CCF-OBK
2	A	901	5WP	OBI-CBO-CBV-CBW
2	A	901	5WP	CAD-CBM-CBN-OAL
2	A	901	5WP	CAD-CBM-CBN-NBF
2	A	901	5WP	CAH-CCA-CCE-CBZ
2	A	901	5WP	NBE-CAY-CBQ-CAZ
2	A	901	5WP	CAI-CCB-CCF-CBY
2	A	901	5WP	CBQ-CAY-NBE-NCH
2	A	901	5WP	CCD-CCA-CCE-CBZ
2	A	901	5WP	NBE-CAY-CBQ-CBT
2	A	901	5WP	CAI-CCB-CCF-OBK

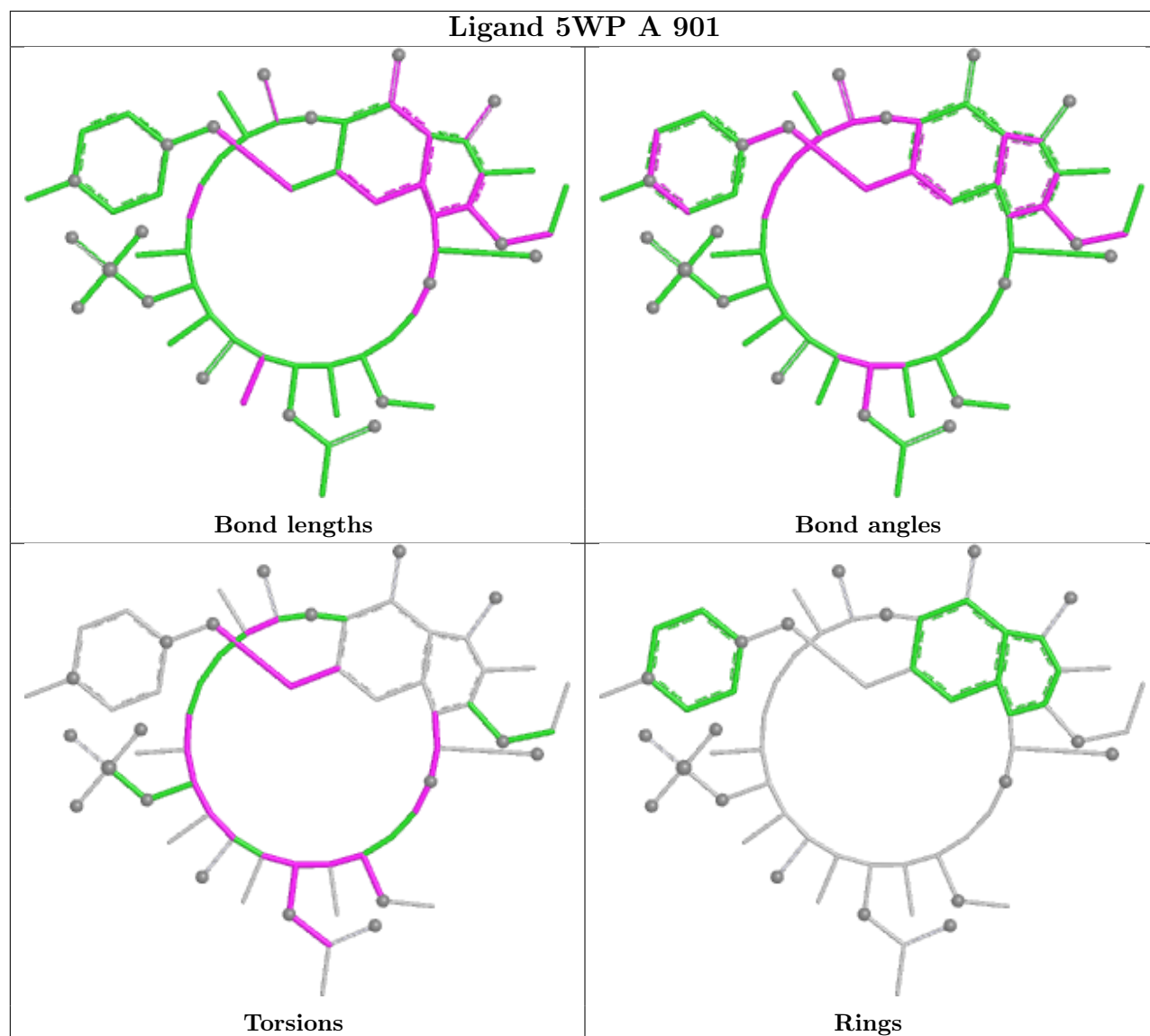
There are no ring outliers.

2 monomers are involved in 15 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	903	MPD	2	0
2	A	901	5WP	13	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	733/867 (84%)	0.72	142 (19%) 3 3	32, 60, 186, 259	0

All (142) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	308	VAL	8.7
1	A	306	TYR	8.0
1	A	307	ILE	8.0
1	A	192	GLY	7.1
1	A	299	CYS	7.1
1	A	180	VAL	6.9
1	A	179	ALA	6.6
1	A	227	ASP	6.2
1	A	310	SER	6.1
1	A	96	ILE	6.0
1	A	39	ALA	6.0
1	A	67	SER	5.9
1	A	182	ILE	5.7
1	A	183	GLN	5.6
1	A	283	GLY	5.5
1	A	91	GLN	5.5
1	A	309	GLN	5.5
1	A	8	PHE	5.4
1	A	90	THR	5.4
1	A	241	ILE	5.3
1	A	37	VAL	5.3
1	A	162	ALA	5.3
1	A	31	ASN	5.2
1	A	147	LEU	5.2
1	A	148	GLN	5.2
1	A	35	VAL	5.2
1	A	154	TRP	5.1

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Mol	Chain	Res	Type	RSRZ
1	A	6	LEU	5.0
1	A	26	LEU	5.0
1	A	305	PHE	4.8
1	A	184	GLN	4.8
1	A	11	ILE	4.6
1	A	4	TYR	4.6
1	A	232	ARG	4.6
1	A	164	ILE	4.5
1	A	273	ASP	4.4
1	A	178	LEU	4.3
1	A	28	ALA	4.3
1	A	33	GLU	4.3
1	A	208	SER	4.3
1	A	298	TRP	4.2
1	A	66	SER	4.1
1	A	185	MET	4.1
1	A	47	ALA	4.0
1	A	13	PRO	4.0
1	A	210	ASP	4.0
1	A	65	LEU	4.0
1	A	277	ILE	3.9
1	A	229	TYR	3.9
1	A	97	ALA	3.8
1	A	23	GLY	3.8
1	A	88	GLN	3.8
1	A	286	ILE	3.8
1	A	52	LEU	3.8
1	A	20	GLY	3.8
1	A	92	ILE	3.7
1	A	163	ILE	3.7
1	A	233	GLU	3.7
1	A	240	ILE	3.7
1	A	191	SER	3.6
1	A	83	ILE	3.5
1	A	106	ASP	3.5
1	A	99	TYR	3.5
1	A	173	HIS	3.5
1	A	278	GLN	3.4
1	A	186	ILE	3.4
1	A	36	HIS	3.4
1	A	181	VAL	3.4
1	A	174	ARG	3.4

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Mol	Chain	Res	Type	RSRZ
1	A	188	PRO	3.4
1	A	274	GLN	3.4
1	A	149	HIS	3.3
1	A	155	ALA	3.3
1	A	57	GLU	3.3
1	A	50	ARG	3.3
1	A	75	ALA	3.3
1	A	27	GLY	3.3
1	A	98	SER	3.2
1	A	206	SER	3.2
1	A	100	MET	3.2
1	A	228	SER	3.2
1	A	200	ILE	3.2
1	A	46	GLU	3.2
1	A	93	PRO	3.2
1	A	29	CYS	3.1
1	A	48	TYR	3.1
1	A	151	SER	3.1
1	A	34	GLY	3.1
1	A	159	THR	3.1
1	A	5	VAL	3.0
1	A	209	ILE	3.0
1	A	30	SER	3.0
1	A	21	GLY	2.9
1	A	94	SER	2.9
1	A	161	ARG	2.9
1	A	51	THR	2.9
1	A	276	ILE	2.9
1	A	142	GLY	2.8
1	A	237	THR	2.8
1	A	24	MET	2.8
1	A	107	VAL	2.8
1	A	158	PHE	2.8
1	A	59	THR	2.8
1	A	38	PRO	2.8
1	A	153	CYS	2.8
1	A	22	LYS	2.8
1	A	95	GLU	2.7
1	A	76	ILE	2.7
1	A	288	ALA	2.7
1	A	64	ARG	2.7
1	A	175	LYS	2.7

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Mol	Chain	Res	Type	RSRZ
1	A	60	GLN	2.6
1	A	3	PRO	2.6
1	A	207	LEU	2.6
1	A	104	LEU	2.6
1	A	236	ILE	2.6
1	A	145	ALA	2.5
1	A	323	ASN	2.5
1	A	61	LEU	2.5
1	A	280	ALA	2.4
1	A	58	PHE	2.4
1	A	279	LEU	2.4
1	A	198	ASP	2.4
1	A	82	THR	2.4
1	A	230	THR	2.4
1	A	194	LEU	2.4
1	A	177	GLN	2.3
1	A	411	LEU	2.3
1	A	79	ILE	2.3
1	A	12	ARG	2.3
1	A	32	ILE	2.2
1	A	235	THR	2.2
1	A	510	VAL	2.2
1	A	176	VAL	2.1
1	A	143	LYS	2.1
1	A	239	LYS	2.1
1	A	275	GLN	2.1
1	A	7	LYS	2.1
1	A	25	ASN	2.1
1	A	786	GLU	2.1
1	A	290	PHE	2.0
1	A	201	THR	2.0

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

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

6.3 Carbohydrates [i](#)

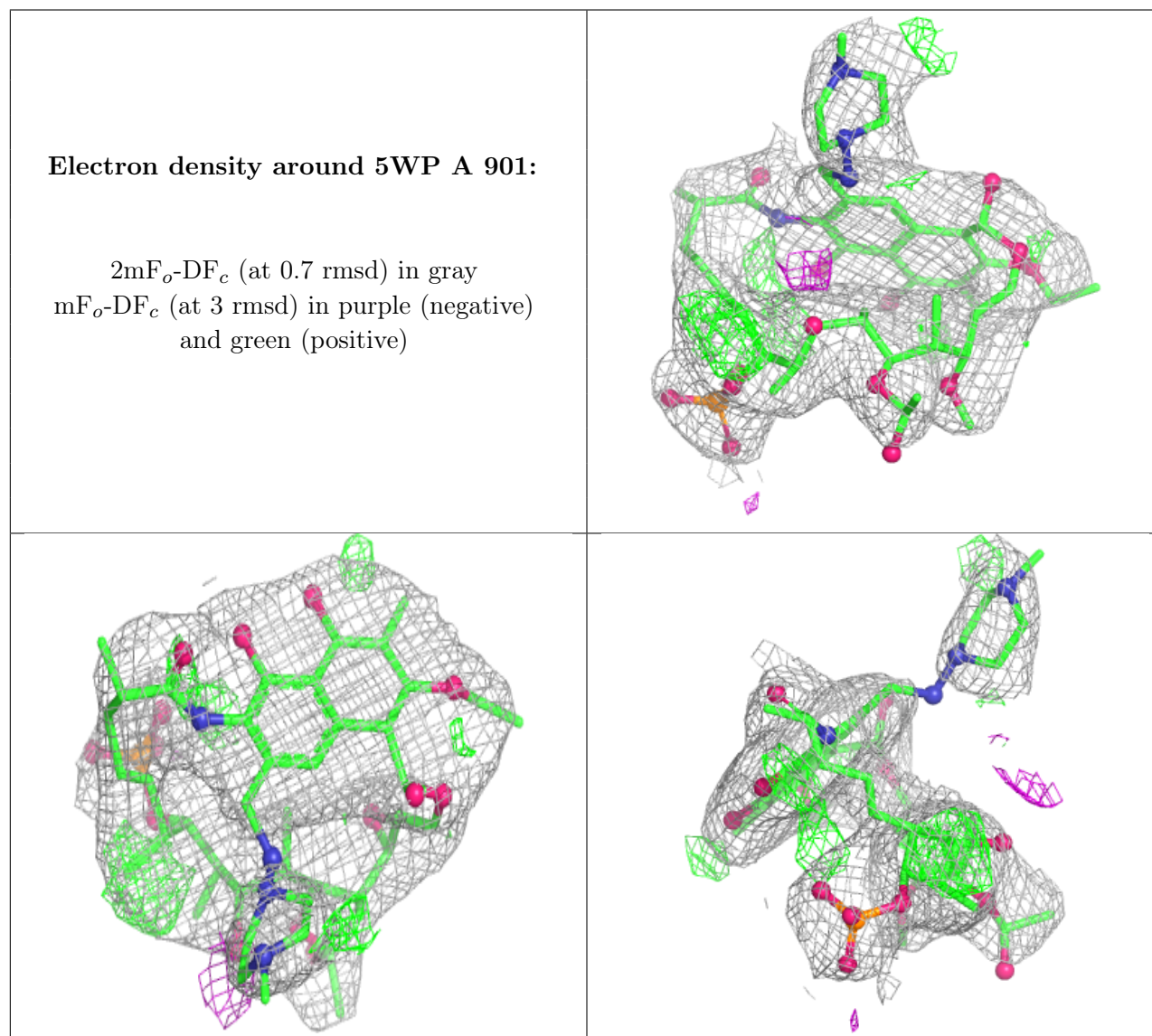
There are no oligosaccharides in this entry.

6.4 Ligands ⓘ

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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
4	MPD	A	903	8/8	0.82	0.18	62,72,76,86	0
2	5WP	A	901	62/62	0.90	0.18	23,69,104,113	0
3	CL	A	902	1/1	0.97	0.12	84,84,84,84	1

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.



6.5 Other polymers [i](#)

There are no such residues in this entry.