Full wwPDB X-ray Structure Validation Report (i)

Oct 23, 2021 – 11:51 AM EDT

PDB ID	:	2TRS
Title	:	CRYSTAL STRUCTURES OF MUTANT (BETAK87T) TRYPTOPHAN SYNTHASE ALPHA2 BETA2 COMPLEX WITH LIGANDS BOUND TO THE ACTIVE SITES OF THE ALPHA AND BETA SUBUNITS REVEAL LIGAND-INDUCED CONFORMATIONAL CHANGES
Authors	:	Rhee, S.; Parris, K.D.; Hyde, C.C.; Ahmed, S.A.; Miles, E.W.; Davies, D.R.
Deposited on	:	1997-01-07
Resolution	:	2.04 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 (i) symbol.

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

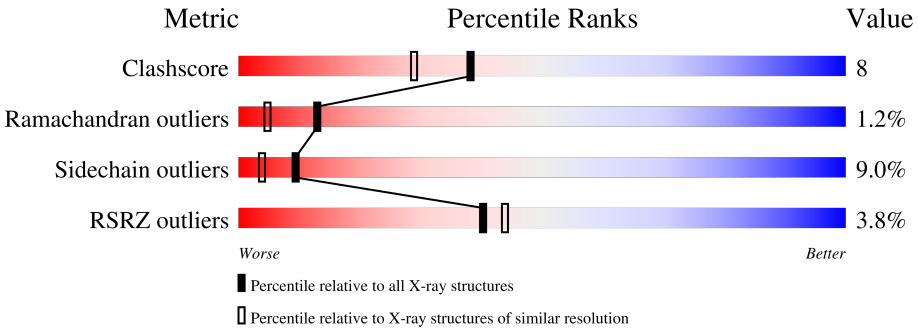
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.23.2
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.23.2

1 Overall quality at a glance (i)

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

The reported resolution of this entry is 2.04 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	141614	1773 (2.04-2.04)
Ramachandran outliers	138981	1752 (2.04-2.04)
Sidechain outliers	138945	1752 (2.04-2.04)
RSRZ outliers	127900	1672 (2.04-2.04)

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 <=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	268	7% 69% 25%
2	B	397	% 72% 21%

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 5153 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 TRYPTOPHAN SYNTHASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	262	1976	1253	343	372	8	0	0	0

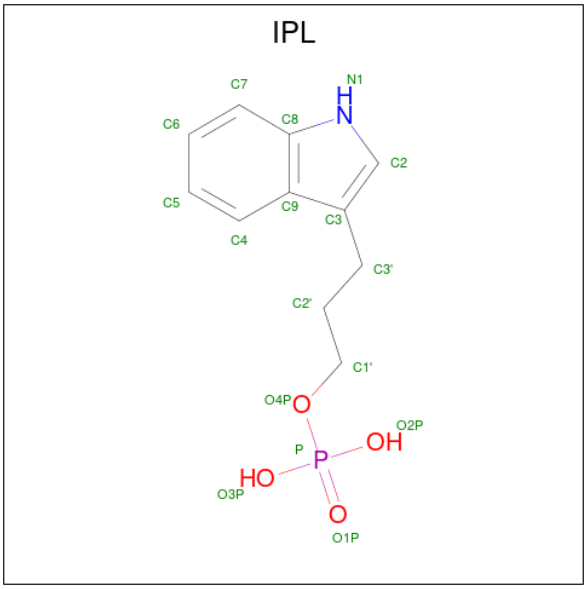
- Molecule 2 is a protein called TRYPTOPHAN SYNTHASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	389	2948	1853	517	559	19	0	0	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	87	THR	LYS	engineered mutation	UNP P0A2K1
B	396	LEU	GLU	conflict	UNP P0A2K1

- Molecule 3 is INDOLE-3-PROPANOL PHOSPHATE (three-letter code: IPL) (formula: $C_{11}H_{14}NO_4P$).

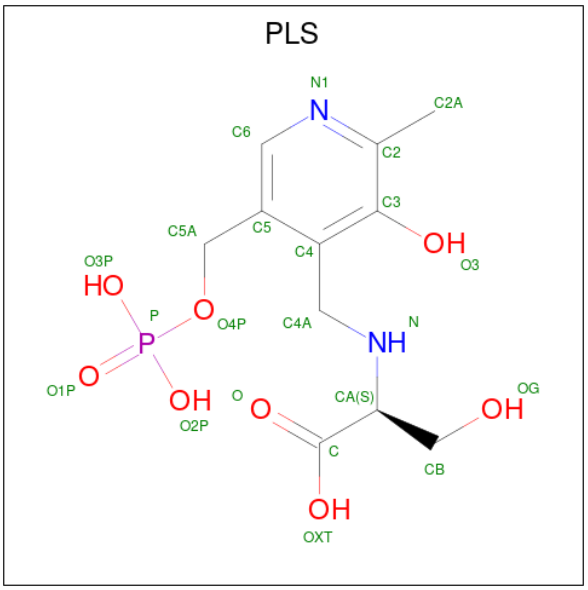


Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	A	1	Total	C	N	O	P	0	0
			17	11	1	4	1		

- Molecule 4 is SODIUM ION (three-letter code: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	B	1	Total	Na	0	0
			1	1		

- Molecule 5 is [3-HYDROXY-2-METHYL-5-PHOSPHONOOXYMETHYL-PYRIDIN-4-YL METHYL]-SERINE (three-letter code: PLS) (formula: $C_{11}H_{17}N_2O_8P$).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
5	B	1	Total	C	N	O	P	0	0
			22	11	2	8	1		

- Molecule 6 is water.

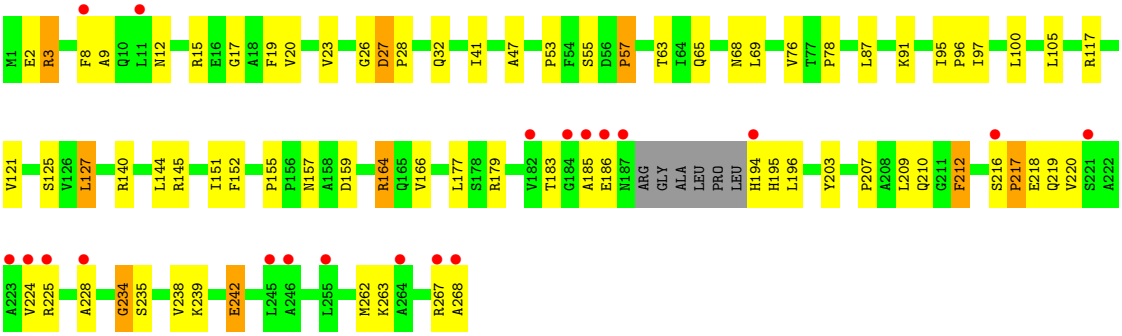
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	49	Total	O	0	0
			49	49		
6	B	140	Total	O	0	0
			140	140		

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.

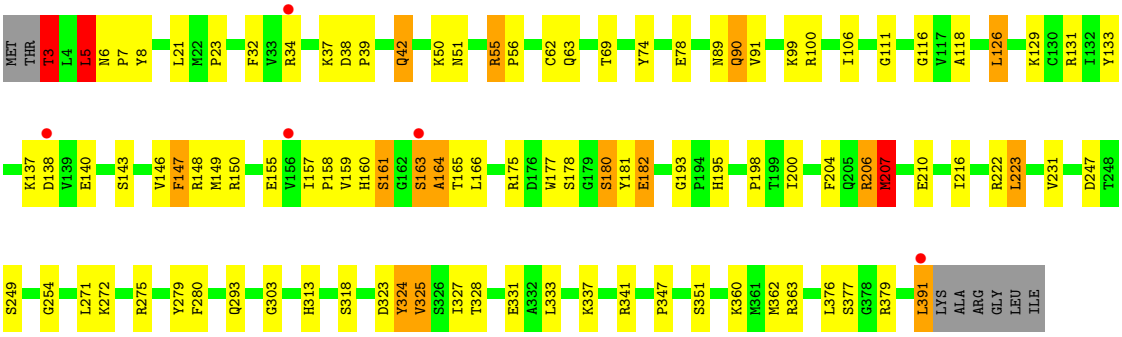
• Molecule 1: TRYPTOPHAN SYNTHASE

Chain A:



• Molecule 2: TRYPTOPHAN SYNTHASE

Chain B:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α, β, γ	184.20Å 61.30Å 67.90Å 90.00° 94.50° 90.00°	Depositor
Resolution (Å)	8.00 – 2.04 58.15 – 2.04	Depositor EDS
% Data completeness (in resolution range)	76.1 (8.00-2.04) 77.3 (58.15-2.04)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.90 (at 2.05Å)	Xtriage
Refinement program	X-PLOR 3.1	Depositor
R, R_{free}	0.214 , (Not available) 0.201 , (Not available)	Depositor DCC
R_{free} test set	No test flags present.	wwPDB-VP
Wilson B-factor (Å^2)	28.4	Xtriage
Anisotropy	0.476	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.35 , 139.3	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	5153	wwPDB-VP
Average B, all atoms (Å^2)	43.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.85% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ 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: NA, PLS, IPL

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	0.75	0/2014	1.43	13/2733 (0.5%)
2	B	0.88	1/3006 (0.0%)	1.55	35/4063 (0.9%)
All	All	0.83	1/5020 (0.0%)	1.50	48/6796 (0.7%)

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
2	B	0	1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	56	PRO	CA-CB	-5.34	1.42	1.53

All (48) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	145	ARG	NE-CZ-NH1	10.36	125.48	120.30
2	B	379	ARG	NE-CZ-NH2	10.02	125.31	120.30
1	A	3	ARG	NE-CZ-NH2	9.17	124.89	120.30
2	B	148	ARG	NE-CZ-NH2	7.92	124.26	120.30
2	B	8	TYR	CB-CG-CD2	-7.90	116.26	121.00
1	A	140	ARG	NE-CZ-NH2	7.70	124.15	120.30
2	B	177	TRP	CD1-CG-CD2	7.51	112.31	106.30
2	B	55	ARG	CA-CB-CG	7.01	128.83	113.40
2	B	175	ARG	NE-CZ-NH2	6.84	123.72	120.30
2	B	360	LYS	CB-CG-CD	-6.74	94.08	111.60

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	B	207	MET	CG-SD-CE	-6.73	89.44	100.20
2	B	161	SER	N-CA-C	-6.71	92.88	111.00
2	B	379	ARG	NE-CZ-NH1	-6.66	116.97	120.30
2	B	206	ARG	NE-CZ-NH1	-6.60	117.00	120.30
2	B	363	ARG	NE-CZ-NH2	6.60	123.60	120.30
2	B	74	TYR	CB-CG-CD1	-6.59	117.04	121.00
2	B	279	TYR	CB-CG-CD1	-6.58	117.05	121.00
1	A	145	ARG	NE-CZ-NH2	-6.43	117.08	120.30
2	B	231	VAL	CG1-CB-CG2	-6.30	100.82	110.90
2	B	325	VAL	N-CA-CB	-6.15	97.98	111.50
2	B	177	TRP	CE2-CD2-CG	-6.13	102.39	107.30
2	B	391	LEU	CA-CB-CG	6.10	129.33	115.30
2	B	55	ARG	N-CA-CB	-5.99	99.82	110.60
2	B	133	TYR	CB-CG-CD2	-5.97	117.42	121.00
2	B	159	VAL	CA-C-N	-5.94	104.13	117.20
2	B	222	ARG	NE-CZ-NH1	-5.88	117.36	120.30
1	A	164	ARG	NE-CZ-NH2	5.68	123.14	120.30
2	B	150	ARG	NE-CZ-NH2	5.67	123.14	120.30
1	A	23	VAL	CG1-CB-CG2	-5.66	101.84	110.90
1	A	140	ARG	NE-CZ-NH1	-5.66	117.47	120.30
2	B	131	ARG	NE-CZ-NH1	5.55	123.08	120.30
2	B	3	THR	CA-CB-CG2	5.49	120.09	112.40
2	B	206	ARG	NE-CZ-NH2	5.44	123.02	120.30
2	B	328	THR	N-CA-CB	-5.43	99.98	110.30
2	B	62	CYS	CA-CB-SG	-5.43	104.23	114.00
2	B	341	ARG	NE-CZ-NH2	5.32	122.96	120.30
1	A	210	GLN	CA-CB-CG	-5.20	101.97	113.40
2	B	363	ARG	NE-CZ-NH1	-5.18	117.71	120.30
2	B	223	LEU	CA-CB-CG	5.17	127.18	115.30
2	B	247	ASP	N-CA-C	-5.17	97.05	111.00
1	A	212	PHE	CB-CG-CD2	-5.15	117.19	120.80
2	B	126	LEU	CA-CB-CG	5.12	127.09	115.30
2	B	5	LEU	CA-CB-CG	5.12	127.08	115.30
2	B	325	VAL	CB-CA-C	5.10	121.09	111.40
1	A	242	GLU	CA-CB-CG	5.04	124.49	113.40
1	A	97	ILE	CA-CB-CG2	-5.04	100.83	110.90
1	A	15	ARG	NE-CZ-NH2	5.03	122.81	120.30
1	A	121	VAL	CG1-CB-CG2	-5.01	102.89	110.90

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
2	B	324	TYR	Sidechain

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	1976	0	1977	36	0
2	B	2948	0	2920	41	0
3	A	17	0	12	2	0
4	B	1	0	0	0	0
5	B	22	0	14	2	0
6	A	49	0	0	3	0
6	B	140	0	0	4	0
All	All	5153	0	4923	75	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 8.

All (75) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:3:THR:HG23	2:B:5:LEU:O	1.89	0.71
1:A:185:ALA:HB2	1:A:235:SER:HB2	1.73	0.70
1:A:91:LYS:HB2	6:A:550:HOH:O	1.91	0.69
2:B:160:HIS:HA	2:B:164:ALA:HB2	1.76	0.67
2:B:318:SER:HB2	6:B:575:HOH:O	1.95	0.66
1:A:20:VAL:HG22	1:A:47:ALA:HB3	1.78	0.65
1:A:225:ARG:HH21	1:A:268:ALA:HB1	1.65	0.60
1:A:234:GLY:O	1:A:238:VAL:HG23	2.03	0.58
2:B:34:ARG:HE	2:B:100:ARG:HE	1.52	0.58
2:B:7:PRO:HA	2:B:195:HIS:CD2	2.39	0.58
1:A:217:PRO:HA	1:A:262:MET:SD	2.45	0.57
2:B:143:SER:HA	2:B:146:VAL:HG23	1.87	0.56
2:B:116:GLY:HA3	2:B:149:MET:SD	2.46	0.55
1:A:152:PHE:HB2	1:A:166:VAL:HG23	1.88	0.55
2:B:327:ILE:HG23	2:B:331:GLU:HB2	1.89	0.55
1:A:220:VAL:O	1:A:224:VAL:HG23	2.06	0.55

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:157:ASN:ND2	2:B:23:PRO:HG2	2.22	0.55
2:B:193:GLY:HA2	2:B:280:PHE:O	2.07	0.53
1:A:55:SER:O	1:A:57:PRO:HD3	2.09	0.52
2:B:90:GLN:HA	2:B:204:PHE:HB3	1.92	0.52
2:B:89:ASN:HB3	2:B:207:MET:HE1	1.91	0.52
1:A:183:THR:HG22	1:A:212:PHE:CE1	2.45	0.51
1:A:212:PHE:CD1	3:A:273:IPL:H1'2	2.46	0.51
2:B:143:SER:HA	2:B:146:VAL:CG2	2.40	0.51
2:B:91:VAL:HG11	2:B:118:ALA:O	2.12	0.49
1:A:212:PHE:HD1	3:A:273:IPL:H1'2	1.78	0.49
1:A:53:PRO:HA	1:A:68:ASN:OD1	2.13	0.49
1:A:3:ARG:HB3	1:A:96:PRO:HG3	1.94	0.49
2:B:313:HIS:HD2	2:B:324:TYR:OH	1.96	0.48
1:A:224:VAL:HA	1:A:228:ALA:O	2.14	0.48
2:B:34:ARG:HE	2:B:100:ARG:NE	2.10	0.48
1:A:157:ASN:HB2	6:A:572:HOH:O	2.14	0.47
1:A:26:GLY:HA3	1:A:76:VAL:HG21	1.96	0.47
1:A:155:PRO:HA	1:A:177:LEU:HB2	1.95	0.47
2:B:303:GLY:O	5:B:398:PLS:H5A1	2.13	0.47
1:A:157:ASN:HD22	2:B:23:PRO:HG2	1.80	0.46
2:B:78:GLU:HB2	2:B:377:SER:HA	1.96	0.46
2:B:6:ASN:HA	2:B:7:PRO:HD3	1.73	0.46
1:A:216:SER:HB3	1:A:219:GLN:HB2	1.96	0.46
1:A:164:ARG:HD2	1:A:203:TYR:CD1	2.51	0.46
2:B:147:PHE:HB2	6:B:497:HOH:O	2.15	0.45
2:B:32:PHE:CD1	2:B:200:ILE:HG12	2.51	0.45
1:A:27:ASP:HA	1:A:28:PRO:HA	1.90	0.45
1:A:144:LEU:HD13	6:A:577:HOH:O	2.17	0.45
1:A:41:ILE:HG12	1:A:95:ILE:HD13	1.99	0.45
2:B:38:ASP:HA	2:B:39:PRO:HD2	1.82	0.45
2:B:333:LEU:O	2:B:337:LYS:HG3	2.17	0.45
2:B:34:ARG:HG3	2:B:100:ARG:HH11	1.82	0.45
2:B:271:LEU:O	2:B:271:LEU:HD23	2.16	0.44
1:A:9:ALA:O	1:A:12:ASN:HB3	2.18	0.44
2:B:69:THR:HG21	2:B:362:MET:HG2	1.99	0.44
2:B:200:ILE:HD13	2:B:200:ILE:HG21	1.78	0.44
2:B:111:GLY:O	2:B:138:ASP:HB3	2.17	0.44
2:B:157:ILE:HA	2:B:158:PRO:HD3	1.77	0.44
1:A:8:PHE:CZ	1:A:209:LEU:HD21	2.53	0.43
2:B:42:GLN:HG2	6:B:505:HOH:O	2.18	0.43
2:B:254:GLY:O	2:B:324:TYR:HA	2.19	0.43

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:19:PHE:CE1	1:A:262:MET:HG2	2.54	0.43
1:A:239:LYS:O	1:A:242:GLU:HB3	2.18	0.43
1:A:55:SER:H	2:B:293:GLN:NE2	2.17	0.42
2:B:272:LYS:HE2	2:B:324:TYR:O	2.20	0.42
1:A:26:GLY:CA	1:A:76:VAL:HG21	2.50	0.42
2:B:21:LEU:HD21	2:B:178:SER:HA	2.01	0.41
2:B:180:SER:O	2:B:182:GLU:N	2.54	0.41
2:B:206:ARG:O	2:B:210:GLU:HG3	2.21	0.41
2:B:275:ARG:HH21	2:B:275:ARG:HD3	1.76	0.41
1:A:125:SER:HB2	1:A:151:ILE:HD11	2.03	0.41
1:A:17:GLY:O	1:A:263:LYS:NZ	2.53	0.41
1:A:65:GLN:O	1:A:69:LEU:HD23	2.21	0.41
1:A:100:LEU:HD23	1:A:127:LEU:HD13	2.03	0.41
5:B:398:PLS:H5A1	5:B:398:PLS:H4A1	1.89	0.41
1:A:216:SER:O	1:A:219:GLN:HB2	2.21	0.40
2:B:376:LEU:HD12	2:B:376:LEU:HA	1.90	0.40
2:B:50:LYS:NZ	2:B:51:ASN:HD21	2.18	0.40
2:B:323:ASP:HB3	6:B:515:HOH:O	2.21	0.40

There are no symmetry-related clashes.

5.3 Torsion angles (i)

5.3.1 Protein backbone (i)

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

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

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
1	A	258/268 (96%)	239 (93%)	14 (5%)	5 (2%)	8 2
2	B	387/397 (98%)	363 (94%)	21 (5%)	3 (1%)	19 10
All	All	645/665 (97%)	602 (93%)	35 (5%)	8 (1%)	13 5

All (8) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	179	ARG
2	B	163	SER
2	B	181	TYR
1	A	207	PRO
1	A	57	PRO
2	B	164	ALA
1	A	234	GLY
1	A	78	PRO

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	204/208 (98%)	188 (92%)	16 (8%)	12 5
2	B	305/311 (98%)	275 (90%)	30 (10%)	8 3
All	All	509/519 (98%)	463 (91%)	46 (9%)	9 4

All (46) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	2	GLU
1	A	27	ASP
1	A	32	GLN
1	A	63	THR
1	A	87	LEU
1	A	105	LEU
1	A	117	ARG
1	A	127	LEU
1	A	159	ASP
1	A	186	GLU
1	A	194	HIS
1	A	195	HIS
1	A	196	LEU
1	A	217	PRO
1	A	218	GLU
1	A	267	ARG

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
2	B	3	THR
2	B	5	LEU
2	B	37	LYS
2	B	42	GLN
2	B	55	ARG
2	B	63	GLN
2	B	90	GLN
2	B	99	LYS
2	B	106	ILE
2	B	126	LEU
2	B	129	LYS
2	B	137	LYS
2	B	140	GLU
2	B	147	PHE
2	B	155	GLU
2	B	161	SER
2	B	163	SER
2	B	165	THR
2	B	166	LEU
2	B	180	SER
2	B	182	GLU
2	B	198	PRO
2	B	207	MET
2	B	216	ILE
2	B	223	LEU
2	B	249	SER
2	B	325	VAL
2	B	347	PRO
2	B	351	SER
2	B	391	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (8) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	6	ASN
1	A	10	GLN
2	B	51	ASN
2	B	195	HIS
2	B	215	GLN
2	B	288	GLN
2	B	293	GLN
2	B	313	HIS

5.3.3 RNA

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates

There are no monosaccharides 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	$\#\|Z\| > 2$
3	IPL	A	273	-	17,18,18	1.80	4 (23%)	20,25,25	2.61	4 (20%)
5	PLS	B	398	-	19,22,22	3.65	9 (47%)	25,31,31	3.91	11 (44%)

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
3	IPL	A	273	-	-	2/8/8/8	0/2/2/2
5	PLS	B	398	-	-	6/13/17/17	0/1/1/1

All (13) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	B	398	PLS	P-O1P	-9.66	1.19	1.50

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	B	398	PLS	P-O4P	-6.44	1.39	1.60
5	B	398	PLS	C3-C2	5.16	1.46	1.40
5	B	398	PLS	CB-CA	-4.87	1.45	1.52
5	B	398	PLS	C3-C4	4.15	1.46	1.40
3	A	273	IPL	O4P-C1'	-3.89	1.28	1.44
5	B	398	PLS	C6-C5	3.81	1.45	1.37
3	A	273	IPL	C5-C4	3.57	1.44	1.36
5	B	398	PLS	P-O3P	-3.48	1.41	1.54
5	B	398	PLS	C2A-C2	2.83	1.55	1.50
3	A	273	IPL	C2-N1	2.70	1.42	1.36
3	A	273	IPL	C8-N1	-2.64	1.30	1.38
5	B	398	PLS	C4A-N	-2.12	1.40	1.46

All (15) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
5	B	398	PLS	O3P-P-O4P	12.30	139.46	106.73
5	B	398	PLS	C4A-N-CA	8.84	130.80	113.83
3	A	273	IPL	C3'-C2'-C1'	7.46	138.45	113.34
5	B	398	PLS	C4-C4A-N	7.38	132.11	111.78
3	A	273	IPL	P-O4P-C1'	7.07	137.76	118.30
5	B	398	PLS	OG-CB-CA	4.72	121.98	111.51
5	B	398	PLS	O4P-C5A-C5	3.23	115.51	109.35
3	A	273	IPL	O4P-C1'-C2'	3.22	119.75	108.99
5	B	398	PLS	O3P-P-O1P	-3.15	98.37	110.68
5	B	398	PLS	O3-C3-C2	3.13	124.31	117.49
5	B	398	PLS	C6-N1-C2	3.02	124.76	119.17
5	B	398	PLS	CB-CA-N	2.74	115.96	108.81
5	B	398	PLS	O2P-P-O4P	-2.62	99.75	106.73
3	A	273	IPL	C5-C4-C9	-2.36	117.62	120.89
5	B	398	PLS	C5-C6-N1	-2.23	120.10	123.82

There are no chirality outliers.

All (8) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	273	IPL	O4P-C1'-C2'-C3'
5	B	398	PLS	CB-CA-N-C4A
5	B	398	PLS	C-CA-N-C4A
5	B	398	PLS	C-CA-CB-OG
5	B	398	PLS	C4-C5-C5A-O4P
3	A	273	IPL	C1'-C2'-C3'-C3

Continued on next page...

Continued from previous page...

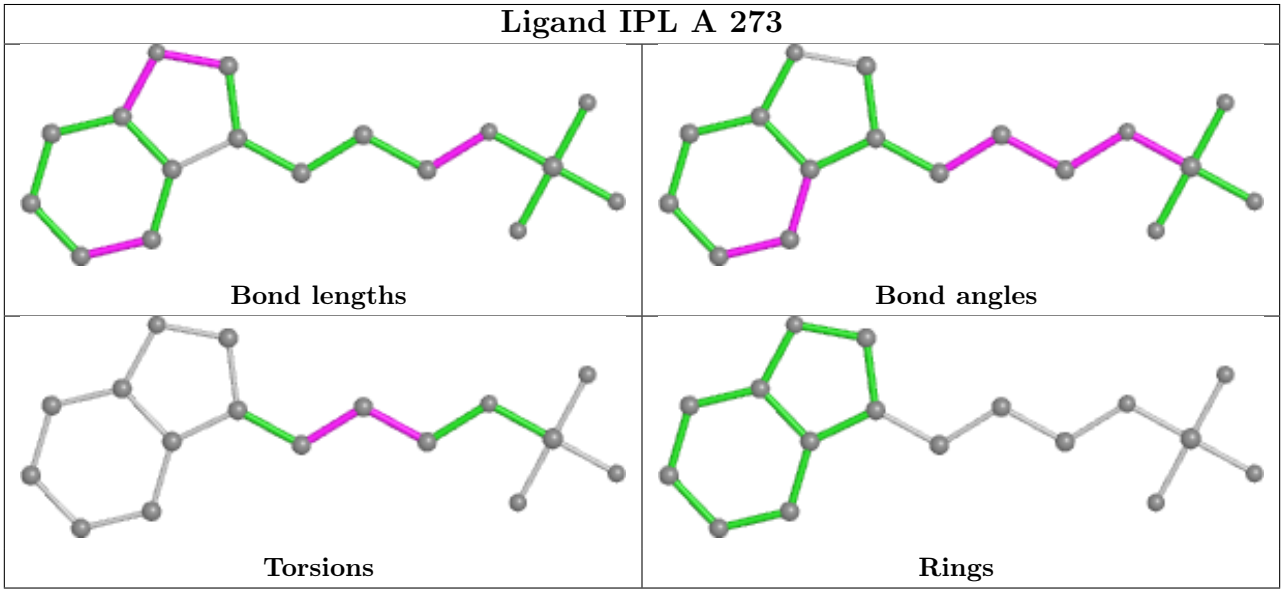
Mol	Chain	Res	Type	Atoms
5	B	398	PLS	N-CA-CB-OG
5	B	398	PLS	C6-C5-C5A-O4P

There are no ring outliers.

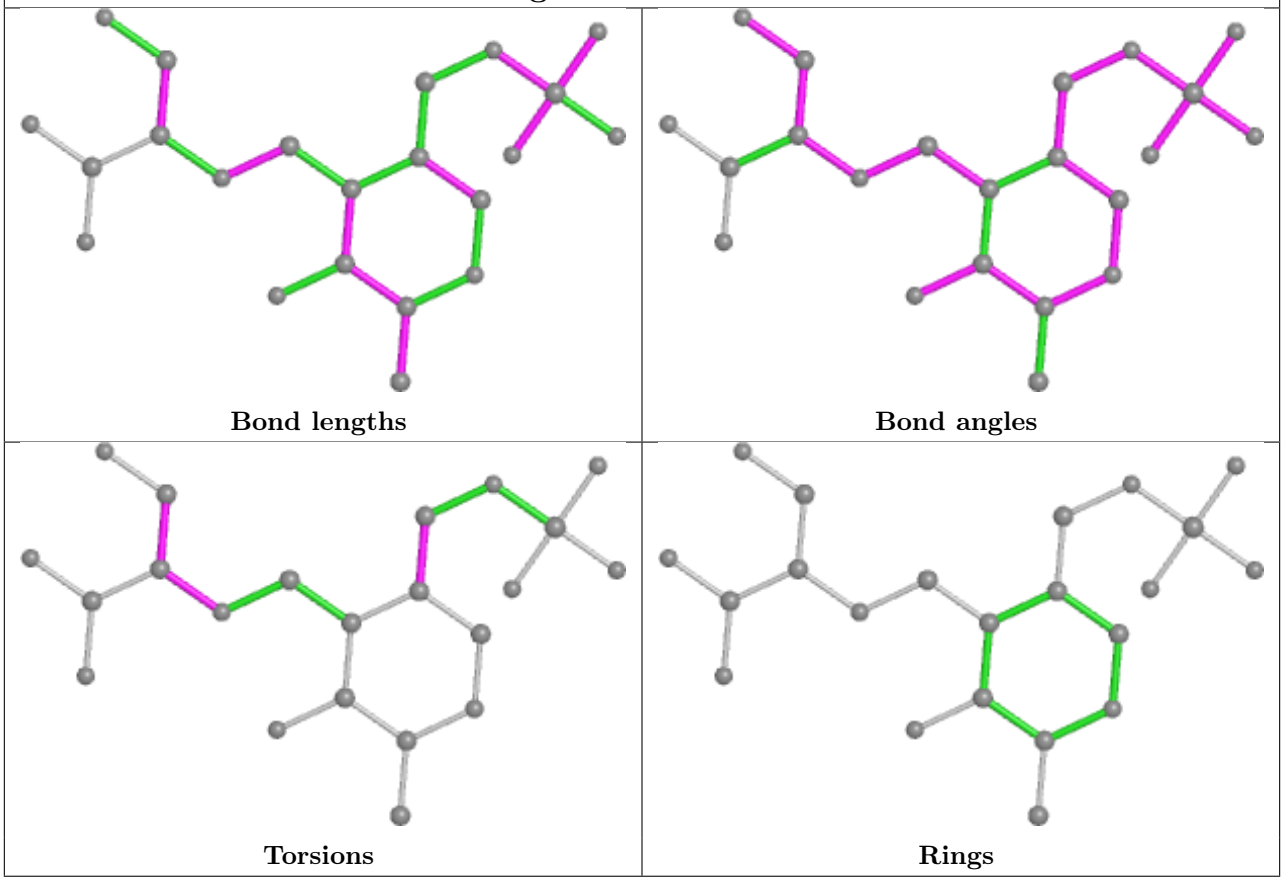
2 monomers are involved in 4 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	273	IPL	2	0
5	B	398	PLS	2	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 then 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.



Ligand PLS B 398



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, 95^{th} 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	262/268 (97%)	0.40	20 (7%) 13 14	19, 54, 98, 120	1 (0%)
2	B	389/397 (97%)	-0.29	5 (1%) 77 79	11, 28, 64, 106	2 (0%)
All	All	651/665 (97%)	-0.01	25 (3%) 40 44	11, 35, 91, 120	3 (0%)

All (25) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	268	ALA	15.7
1	A	185	ALA	5.7
1	A	224	VAL	5.0
1	A	267	ARG	4.2
1	A	11	LEU	3.6
1	A	184	GLY	3.6
1	A	182	VAL	3.5
2	B	138	ASP	3.5
1	A	246	ALA	3.3
1	A	225	ARG	3.2
1	A	228	ALA	3.2
1	A	194	HIS	2.9
1	A	221	SER	2.8
2	B	156	VAL	2.5
1	A	216	SER	2.4
1	A	264	ALA	2.4
2	B	163	SER	2.4
1	A	223	ALA	2.3
1	A	186	GLU	2.3
2	B	34	ARG	2.2
1	A	245	LEU	2.1
1	A	255	LEU	2.1
1	A	8	PHE	2.1
2	B	391	LEU	2.1

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
1	A	187	ASN	2.1

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 monosaccharides in this entry.

6.4 Ligands (i)

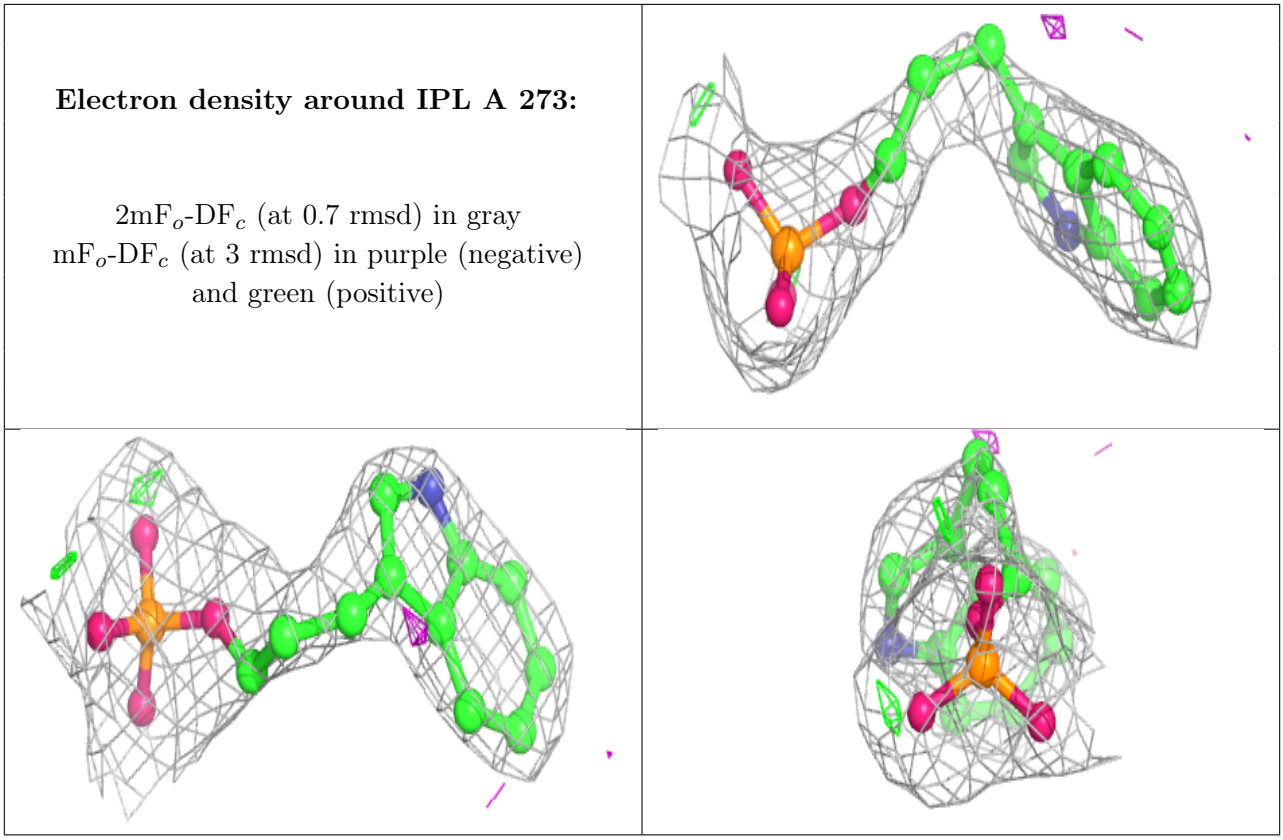
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' 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
3	IPL	A	273	17/17	0.91	0.20	42,52,67,68	0
4	NA	B	400	1/1	0.98	0.12	35,35,35,35	0
5	PLS	B	398	22/22	0.98	0.14	24,32,45,51	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.

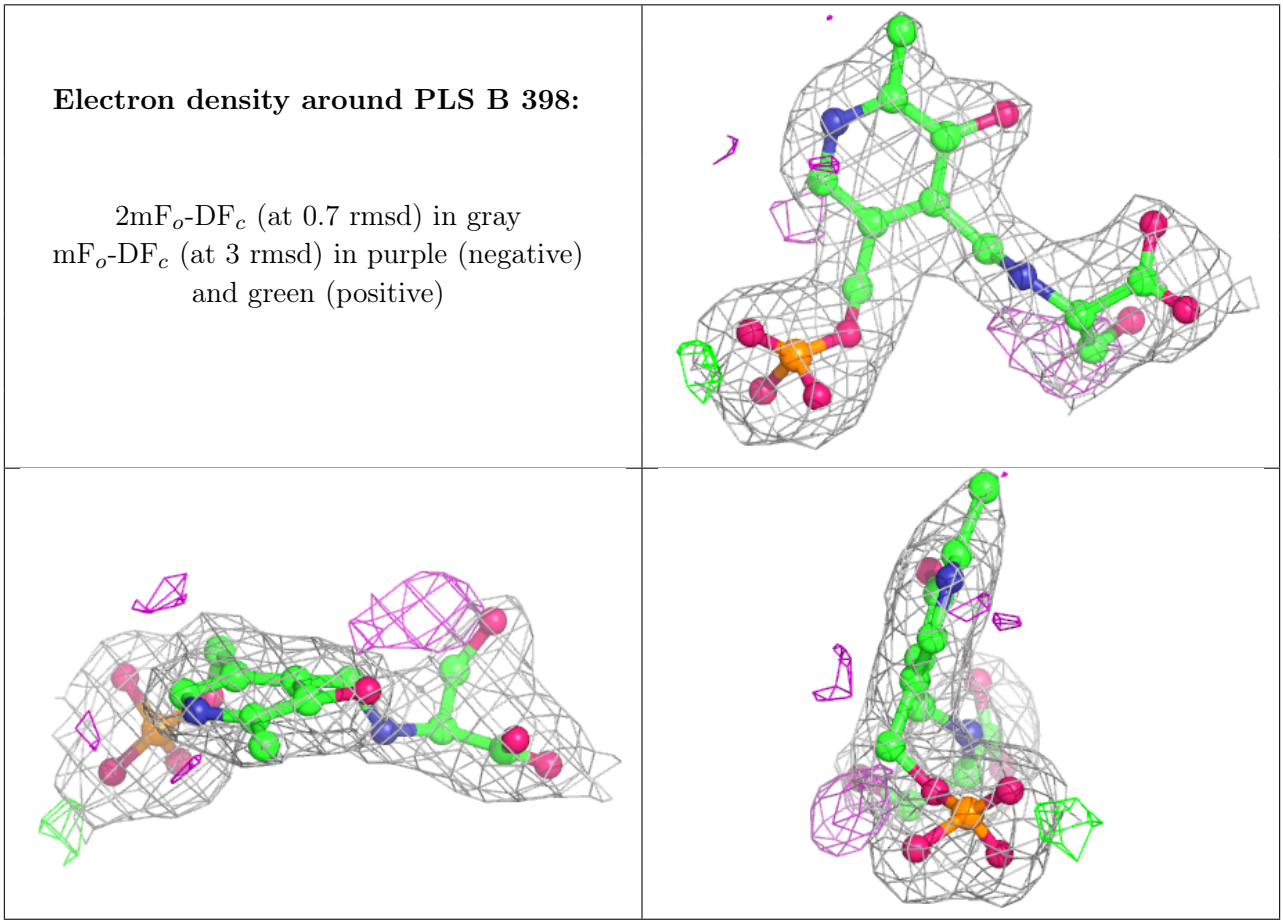
Electron density around IPL A 273:

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



Electron density around PLS B 398:

$2mF_o$-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.