Full wwPDB X-ray Structure Validation Report ⓘ

Nov 17, 2026 – 05:47 PM JST

PDB ID	:	22CX / pdb_000022cx
Title	:	Crystal structure of SARS-CoV-2 main protease in complex with Zevotrelvir
Authors	:	Li, W.W.; Guo, L.; Zeng, P.; Li, J.
Deposited on	:	2026-01-07
Resolution	:	2.46 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:

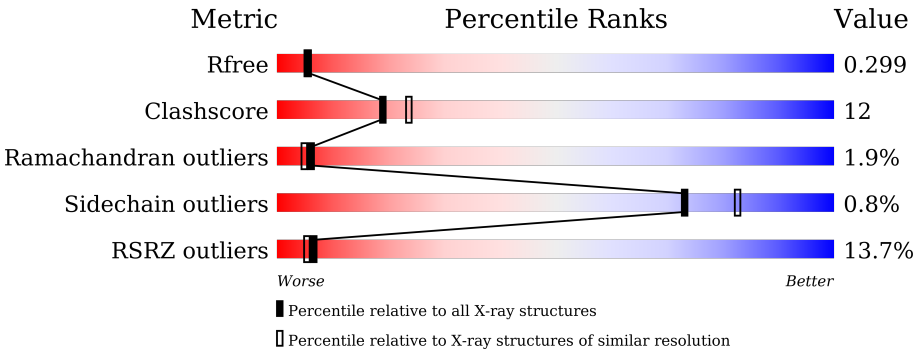
MolProbity	:	4-5-2 with Phenix2.2
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	2.2
EDS	:	3.0
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.015 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.51

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 2.46 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	1190 (2.46-2.46)
Clashscore	190562	1229 (2.46-2.46)
Ramachandran outliers	187476	1218 (2.46-2.46)
Sidechain outliers	187428	1218 (2.46-2.46)
RSRZ outliers	180081	1190 (2.46-2.46)

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	354	5% 68% 15% 16%
1	B	354	18% 60% 21% • 16%

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 4636 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 Replicase polyprotein 1ab.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	296	Total	C	N	O	S	0	0	0
			2256	1433	378	424	21			
1	B	296	Total	C	N	O	S	0	0	0
			2248	1426	378	423	21			

There are 94 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	308	GLY	-	expression tag	UNP P0DTD1
A	309	PHE	-	expression tag	UNP P0DTD1
A	310	ARG	-	expression tag	UNP P0DTD1
A	311	LYS	-	expression tag	UNP P0DTD1
A	312	MET	-	expression tag	UNP P0DTD1
A	313	ALA	-	expression tag	UNP P0DTD1
A	314	PHE	-	expression tag	UNP P0DTD1
A	315	PRO	-	expression tag	UNP P0DTD1
A	316	SER	-	expression tag	UNP P0DTD1
A	317	GLY	-	expression tag	UNP P0DTD1
A	318	LYS	-	expression tag	UNP P0DTD1
A	319	VAL	-	expression tag	UNP P0DTD1
A	320	GLU	-	expression tag	UNP P0DTD1
A	321	GLY	-	expression tag	UNP P0DTD1
A	322	CYS	-	expression tag	UNP P0DTD1
A	323	MET	-	expression tag	UNP P0DTD1
A	324	VAL	-	expression tag	UNP P0DTD1
A	325	GLN	-	expression tag	UNP P0DTD1
A	326	VAL	-	expression tag	UNP P0DTD1
A	327	THR	-	expression tag	UNP P0DTD1
A	328	CYS	-	expression tag	UNP P0DTD1
A	329	GLY	-	expression tag	UNP P0DTD1
A	330	THR	-	expression tag	UNP P0DTD1
A	331	THR	-	expression tag	UNP P0DTD1
A	332	THR	-	expression tag	UNP P0DTD1

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Chain	Residue	Modelled	Actual	Comment	Reference
A	333	LEU	-	expression tag	UNP P0DTD1
A	334	ASN	-	expression tag	UNP P0DTD1
A	335	GLY	-	expression tag	UNP P0DTD1
A	336	LEU	-	expression tag	UNP P0DTD1
A	337	TRP	-	expression tag	UNP P0DTD1
A	338	LEU	-	expression tag	UNP P0DTD1
A	339	ASP	-	expression tag	UNP P0DTD1
A	340	ASP	-	expression tag	UNP P0DTD1
A	341	VAL	-	expression tag	UNP P0DTD1
A	342	VAL	-	expression tag	UNP P0DTD1
A	343	TYR	-	expression tag	UNP P0DTD1
A	344	CYS	-	expression tag	UNP P0DTD1
A	345	PRO	-	expression tag	UNP P0DTD1
A	346	ARG	-	expression tag	UNP P0DTD1
A	347	HIS	-	expression tag	UNP P0DTD1
A	348	VAL	-	expression tag	UNP P0DTD1
A	349	ILE	-	expression tag	UNP P0DTD1
A	350	CYS	-	expression tag	UNP P0DTD1
A	351	THR	-	expression tag	UNP P0DTD1
A	352	SER	-	expression tag	UNP P0DTD1
A	353	GLU	-	expression tag	UNP P0DTD1
A	354	ASP	-	expression tag	UNP P0DTD1
B	308	GLY	-	expression tag	UNP P0DTD1
B	309	PHE	-	expression tag	UNP P0DTD1
B	310	ARG	-	expression tag	UNP P0DTD1
B	311	LYS	-	expression tag	UNP P0DTD1
B	312	MET	-	expression tag	UNP P0DTD1
B	313	ALA	-	expression tag	UNP P0DTD1
B	314	PHE	-	expression tag	UNP P0DTD1
B	315	PRO	-	expression tag	UNP P0DTD1
B	316	SER	-	expression tag	UNP P0DTD1
B	317	GLY	-	expression tag	UNP P0DTD1
B	318	LYS	-	expression tag	UNP P0DTD1
B	319	VAL	-	expression tag	UNP P0DTD1
B	320	GLU	-	expression tag	UNP P0DTD1
B	321	GLY	-	expression tag	UNP P0DTD1
B	322	CYS	-	expression tag	UNP P0DTD1
B	323	MET	-	expression tag	UNP P0DTD1
B	324	VAL	-	expression tag	UNP P0DTD1
B	325	GLN	-	expression tag	UNP P0DTD1
B	326	VAL	-	expression tag	UNP P0DTD1
B	327	THR	-	expression tag	UNP P0DTD1

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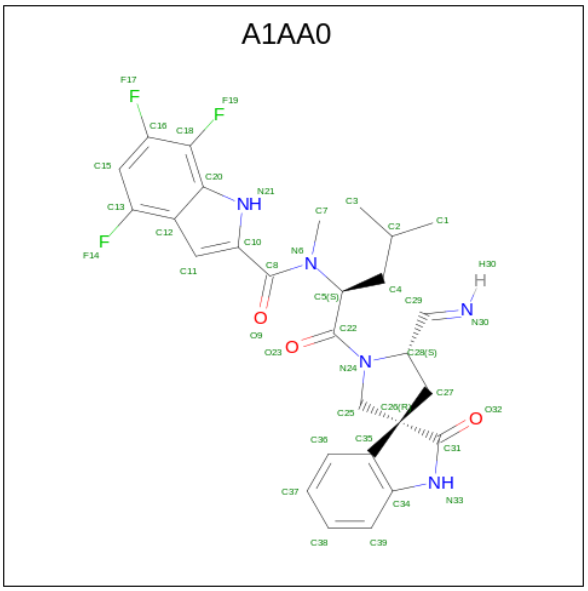
Chain	Residue	Modelled	Actual	Comment	Reference
B	328	CYS	-	expression tag	UNP P0DTD1
B	329	GLY	-	expression tag	UNP P0DTD1
B	330	THR	-	expression tag	UNP P0DTD1
B	331	THR	-	expression tag	UNP P0DTD1
B	332	THR	-	expression tag	UNP P0DTD1
B	333	LEU	-	expression tag	UNP P0DTD1
B	334	ASN	-	expression tag	UNP P0DTD1
B	335	GLY	-	expression tag	UNP P0DTD1
B	336	LEU	-	expression tag	UNP P0DTD1
B	337	TRP	-	expression tag	UNP P0DTD1
B	338	LEU	-	expression tag	UNP P0DTD1
B	339	ASP	-	expression tag	UNP P0DTD1
B	340	ASP	-	expression tag	UNP P0DTD1
B	341	VAL	-	expression tag	UNP P0DTD1
B	342	VAL	-	expression tag	UNP P0DTD1
B	343	TYR	-	expression tag	UNP P0DTD1
B	344	CYS	-	expression tag	UNP P0DTD1
B	345	PRO	-	expression tag	UNP P0DTD1
B	346	ARG	-	expression tag	UNP P0DTD1
B	347	HIS	-	expression tag	UNP P0DTD1
B	348	VAL	-	expression tag	UNP P0DTD1
B	349	ILE	-	expression tag	UNP P0DTD1
B	350	CYS	-	expression tag	UNP P0DTD1
B	351	THR	-	expression tag	UNP P0DTD1
B	352	SER	-	expression tag	UNP P0DTD1
B	353	GLU	-	expression tag	UNP P0DTD1
B	354	ASP	-	expression tag	UNP P0DTD1

- Molecule 2 is 4,6,7-trifluoro-N-{(2S)-1-[(3R,5'R)-5'-(iminomethyl)-2-oxo-1,2-dihydrospiro[indole-3,3'-pyrrolidin]-1'-yl]-4-methyl-1-oxopentan-2-yl}-N-methyl-1H-indole-2-carboxamide (CCD ID: A1AA0) (formula: $C_{28}H_{28}F_3N_5O_3$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	1	Total C F N O 39 28 3 5 3	0	0
2	B	1	Total C F N O 39 28 3 5 3	0	0

- Molecule 3 is water.

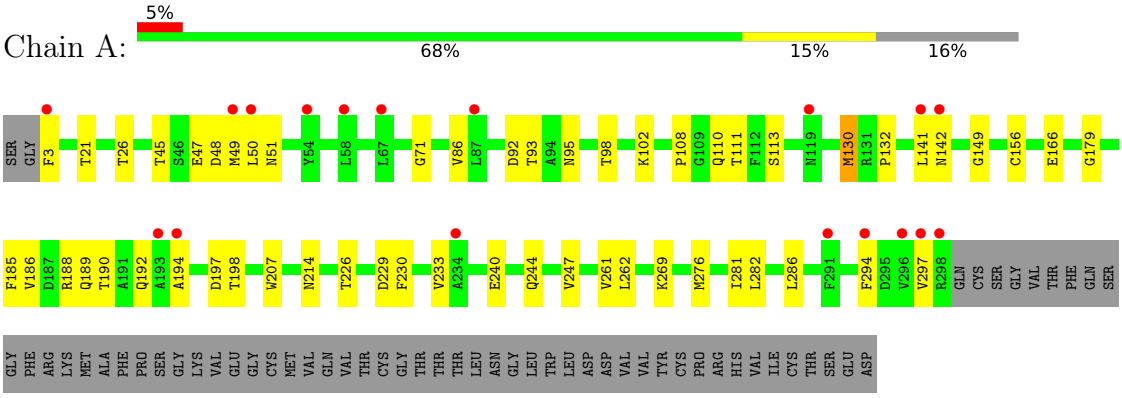
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	33	Total O 33 33	0	0
3	B	21	Total O 21 21	0	0

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.

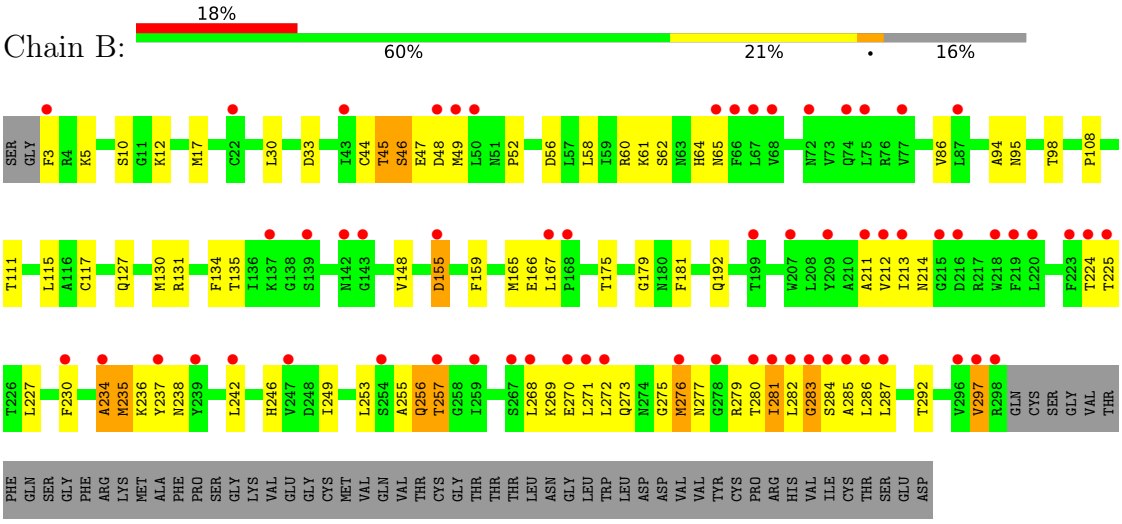
• Molecule 1: Replicase polyprotein 1ab

Chain A:



• Molecule 1: Replicase polyprotein 1ab

Chain B:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	67.89Å 102.79Å 103.39Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	33.95 – 2.46 33.95 – 2.46	Depositor EDS
% Data completeness (in resolution range)	98.4 (33.95-2.46) 98.3 (33.95-2.46)	Depositor EDS
R_{merge}	0.14	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.10 (at 2.45Å)	Xtriage
Refinement program	PHENIX 1.12_2829, PHENIX 1.12_2829	Depositor
R, R_{free}	0.243 , 0.297 0.243 , 0.299	Depositor DCC
R_{free} test set	1266 reflections (4.70%)	wwPDB-VP
Wilson B-factor (Å^2)	47.8	Xtriage
Anisotropy	0.648	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.32 , 35.3	EDS
L-test for twinning[2]	$< \|L\| > = 0.52$, $< L^2 > = 0.35$	Xtriage
Estimated twinning fraction	0.004 for -h,l,k	Xtriage
F_o,F_c correlation	0.92	EDS
Total number of atoms	4636	wwPDB-VP
Average B, all atoms (Å^2)	55.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.52% 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: A1AA0

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	0.40	0/2307	0.60	0/3142
1	B	0.37	0/2298	0.60	0/3130
All	All	0.38	0/4605	0.60	0/6272

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

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	2256	0	2172	38	0
1	B	2248	0	2163	68	0
2	A	39	0	0	1	0
2	B	39	0	0	2	0
3	A	33	0	0	2	0
3	B	21	0	0	0	0
All	All	4636	0	4335	105	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 12.

All (105) 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:276:MET:HE1	1:A:281:ILE:HG13	1.59	0.83
1:B:280:THR:HG23	1:B:284:SER:H	1.45	0.82
1:A:86:VAL:HG13	1:A:179:GLY:HA2	1.70	0.73
1:A:226:THR:HG23	1:A:229:ASP:H	1.54	0.73
1:A:108:PRO:HB3	1:A:132:PRO:HA	1.71	0.73
1:A:142:ASN:O	3:A:501:HOH:O	2.07	0.72
1:A:186:VAL:HG23	1:A:188:ARG:HB2	1.77	0.67
1:B:227:LEU:HD11	1:B:242:LEU:HD23	1.77	0.65
1:B:270:GLU:HG3	1:B:273:GLN:HE21	1.63	0.62
1:A:286:LEU:HD11	1:B:285:ALA:HB3	1.82	0.62
1:A:294:PHE:O	1:A:297:VAL:HG12	2.00	0.61
1:B:230:PHE:CZ	1:B:268:LEU:HD23	2.35	0.61
1:A:50:LEU:HG	1:A:51:ASN:N	2.17	0.60
1:B:234:ALA:O	1:B:236:LYS:N	2.35	0.59
1:A:188:ARG:NH2	1:A:190:THR:HG21	2.18	0.59
1:B:12:LYS:NZ	1:B:155:ASP:HA	2.18	0.59
1:B:212:VAL:HG12	1:B:257:THR:HG21	1.85	0.58
1:B:108:PRO:HG3	1:B:134:PHE:CE1	2.38	0.58
1:B:3:PHE:CB	1:B:282:LEU:HD22	2.34	0.58
1:B:5:LYS:HG2	1:B:127:GLN:HB3	1.85	0.58
1:B:211:ALA:HB2	1:B:281:ILE:HG22	1.85	0.58
1:A:207:TRP:CH2	1:A:281:ILE:HB	2.39	0.57
1:B:62:SER:HB2	1:B:64:HIS:CE1	2.40	0.56
1:B:12:LYS:HZ1	1:B:155:ASP:HA	1.71	0.55
1:A:45:THR:OG1	1:A:48:ASP:OD1	2.23	0.55
1:B:166:GLU:H	2:B:401:A1AA0:C7	2.19	0.55
1:B:275:GLY:O	1:B:277:ASN:N	2.40	0.55
1:B:268:LEU:HD12	1:B:271:LEU:HD11	1.87	0.55
1:B:62:SER:HB2	1:B:64:HIS:ND1	2.23	0.54
1:A:108:PRO:HA	1:A:130:MET:HG2	1.90	0.54
1:B:269:LYS:O	1:B:269:LYS:HD2	2.08	0.53
1:B:230:PHE:HZ	1:B:268:LEU:HD23	1.73	0.53
1:A:198:THR:OG1	1:A:240:GLU:HG2	2.09	0.52
1:A:113:SER:O	1:A:149:GLY:HA2	2.10	0.52
1:A:92:ASP:OD1	1:A:93:THR:N	2.43	0.52
1:B:246:HIS:O	1:B:249:ILE:HG22	2.11	0.52
1:B:282:LEU:HD12	1:B:283:GLY:N	2.24	0.52
1:A:102:LYS:HE2	1:A:156:CYS:SG	2.51	0.51
1:B:148:VAL:HG11	1:B:159:PHE:CD1	2.45	0.51
1:B:237:TYR:CE2	1:B:272:LEU:HB3	2.46	0.51
1:A:21:THR:HG23	1:A:26:THR:HB	1.92	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:108:PRO:HA	1:B:130:MET:HG3	1.93	0.51
1:B:61:LYS:HE3	1:B:65:ASN:ND2	2.25	0.51
1:A:45:THR:O	1:A:49:MET:SD	2.69	0.51
1:A:132:PRO:HD2	1:A:197:ASP:OD1	2.10	0.50
1:A:233:VAL:HG21	1:A:269:LYS:HE3	1.93	0.50
1:A:226:THR:CG2	1:A:229:ASP:H	2.21	0.49
1:A:230:PHE:HA	1:A:269:LYS:HD2	1.94	0.49
1:A:247:VAL:HG23	1:A:261:VAL:HG11	1.94	0.49
1:A:3:PHE:HB2	1:A:282:LEU:HD22	1.94	0.49
1:B:56:ASP:O	1:B:60:ARG:HG3	2.13	0.49
1:A:185:PHE:CZ	1:A:194:ALA:HA	2.47	0.49
1:B:167:LEU:HD22	1:B:192:GLN:O	2.13	0.49
1:B:271:LEU:HD13	1:B:287:LEU:HD21	1.95	0.48
1:B:30:LEU:HD13	1:B:148:VAL:HG21	1.96	0.48
1:B:235:MET:C	1:B:238:ASN:H	2.20	0.48
1:B:44:CYS:HB3	1:B:49:MET:HG3	1.95	0.48
1:A:141:LEU:HD23	1:A:141:LEU:HA	1.65	0.48
1:B:3:PHE:HB3	1:B:282:LEU:HD22	1.96	0.47
1:B:17:MET:HG3	1:B:117:CYS:SG	2.54	0.47
1:A:95:ASN:HB3	1:A:98:THR:OG1	2.14	0.47
1:A:185:PHE:HZ	1:A:194:ALA:HA	1.79	0.47
1:B:236:LYS:NZ	1:B:236:LYS:HB3	2.30	0.47
1:B:211:ALA:HB2	1:B:281:ILE:CG2	2.45	0.47
1:B:270:GLU:HG3	1:B:273:GLN:NE2	2.29	0.47
1:A:166:GLU:H	2:A:401:A1AA0:C7	2.27	0.47
1:B:175:THR:HG22	1:B:181:PHE:HA	1.97	0.47
1:B:111:THR:HG23	1:B:292:THR:HG23	1.97	0.46
1:B:276:MET:SD	1:B:285:ALA:HA	2.56	0.46
1:A:262:LEU:HA	1:A:262:LEU:HD23	1.71	0.46
1:B:255:ALA:C	1:B:257:THR:H	2.24	0.46
1:B:235:MET:HE3	1:B:235:MET:H	1.81	0.46
1:B:48:ASP:O	1:B:52:PRO:HB3	2.16	0.46
1:B:275:GLY:C	1:B:277:ASN:H	2.23	0.46
1:B:108:PRO:HA	1:B:130:MET:CG	2.46	0.45
1:B:95:ASN:HB3	1:B:98:THR:OG1	2.16	0.45
1:B:276:MET:HB3	1:B:279:ARG:O	2.17	0.45
1:A:244:GLN:HA	1:A:247:VAL:HG12	1.99	0.45
1:B:270:GLU:O	1:B:273:GLN:HG3	2.16	0.44
1:A:49:MET:HB3	1:A:189:GLN:HG3	2.00	0.44
1:B:86:VAL:HG13	1:B:179:GLY:HA2	1.99	0.44
1:B:256:GLN:O	1:B:256:GLN:HG2	2.17	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:213:ILE:HD11	1:B:253:LEU:HD22	1.99	0.44
1:A:102:LYS:HG2	1:A:156:CYS:SG	2.58	0.44
1:B:33:ASP:O	1:B:94:ALA:HA	2.18	0.44
1:B:269:LYS:HD2	1:B:269:LYS:C	2.42	0.44
1:B:45:THR:C	1:B:47:GLU:H	2.26	0.44
1:B:45:THR:O	1:B:47:GLU:N	2.50	0.44
1:B:255:ALA:O	1:B:257:THR:N	2.51	0.43
1:B:165:MET:HG3	2:B:401:A1AA0:C7	2.49	0.43
1:B:131:ARG:HG2	1:B:135:THR:O	2.19	0.43
1:B:286:LEU:HG	1:B:287:LEU:N	2.34	0.42
1:A:71:GLY:N	3:A:507:HOH:O	2.52	0.42
1:A:110:GLN:HE21	1:A:111:THR:H	1.68	0.42
1:B:234:ALA:C	1:B:236:LYS:N	2.77	0.42
1:A:130:MET:HE2	1:A:130:MET:HB2	1.86	0.41
1:B:235:MET:HA	1:B:238:ASN:HA	2.03	0.41
1:B:10:SER:HB2	1:B:115:LEU:HD13	2.03	0.41
1:B:297:VAL:O	1:B:297:VAL:HG23	2.21	0.41
1:B:46:SER:HA	1:B:49:MET:HE3	2.02	0.40
1:A:190:THR:O	1:A:192:GLN:HG3	2.21	0.40
1:B:58:LEU:O	1:B:61:LYS:HB2	2.21	0.40
1:B:234:ALA:O	1:B:237:TYR:N	2.54	0.40
1:B:224:THR:HG22	1:B:225:THR:H	1.85	0.40
1:B:235:MET:SD	1:B:235:MET:N	2.95	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	294/354 (83%)	281 (96%)	11 (4%)	2 (1%)	18 24
1	B	294/354 (83%)	264 (90%)	21 (7%)	9 (3%)	3 1

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
All	All	588/708 (83%)	545 (93%)	32 (5%)	11 (2%)	6 5

All (11) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	214	ASN
1	B	235	MET
1	B	281	ILE
1	B	46	SER
1	B	214	ASN
1	B	276	MET
1	B	283	GLY
1	B	234	ALA
1	B	256	GLN
1	A	47	GLU
1	B	297	VAL

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	245/305 (80%)	244 (100%)	1 (0%)	84 89
1	B	244/305 (80%)	241 (99%)	3 (1%)	63 74
All	All	489/610 (80%)	485 (99%)	4 (1%)	73 83

All (4) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	130	MET
1	B	45	THR
1	B	155	ASP
1	B	257	THR

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	53	ASN
1	A	69	GLN
1	A	83	GLN
1	A	110	GLN
1	A	256	GLN
1	A	273	GLN
1	A	277	ASN
1	B	221	ASN

5.3.3 RNA (i)

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates (i)

There are no oligosaccharides in this entry.

5.6 Ligand geometry (i)

2 ligands are modelled in this entry.

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	$\#\|Z\| > 2$
2	A1AA0	A	401	1	41,43,43	6.22	24 (58%)	54,66,66	2.76	17 (31%)
2	A1AA0	B	401	1	41,43,43	6.26	25 (60%)	54,66,66	2.59	18 (33%)

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
2	A1AA0	A	401	1	-	6/24/56/56	0/5/5/5
2	A1AA0	B	401	1	-	10/24/56/56	0/5/5/5

All (49) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	401	A1AA0	C27-C26	-16.02	1.32	1.55
2	B	401	A1AA0	C27-C26	-15.34	1.33	1.55
2	A	401	A1AA0	C12-C13	15.02	1.58	1.39
2	B	401	A1AA0	C12-C13	14.77	1.57	1.39
2	A	401	A1AA0	C36-C35	11.58	1.55	1.39
2	B	401	A1AA0	C36-C35	11.45	1.55	1.39
2	A	401	A1AA0	C31-N33	10.72	1.48	1.35
2	B	401	A1AA0	C20-C18	10.07	1.55	1.39
2	B	401	A1AA0	C31-N33	10.05	1.47	1.35
2	B	401	A1AA0	C28-N24	9.55	1.56	1.48
2	A	401	A1AA0	C20-C18	9.40	1.54	1.39
2	B	401	A1AA0	C34-C35	9.31	1.49	1.39
2	A	401	A1AA0	C39-C34	9.11	1.55	1.39
2	A	401	A1AA0	C34-C35	9.07	1.49	1.39
2	B	401	A1AA0	C39-C34	8.93	1.54	1.39
2	A	401	A1AA0	C28-N24	7.96	1.54	1.48
2	A	401	A1AA0	C8-N6	7.76	1.51	1.35
2	A	401	A1AA0	C38-C39	7.64	1.55	1.38
2	B	401	A1AA0	C37-C36	7.62	1.55	1.38
2	A	401	A1AA0	C15-C13	7.54	1.50	1.37
2	A	401	A1AA0	C37-C36	7.47	1.54	1.38
2	B	401	A1AA0	C15-C13	7.46	1.50	1.37
2	B	401	A1AA0	C25-C26	7.32	1.62	1.55
2	B	401	A1AA0	C38-C39	7.31	1.54	1.38
2	B	401	A1AA0	C15-C16	7.07	1.49	1.37
2	B	401	A1AA0	C8-N6	7.07	1.50	1.35
2	A	401	A1AA0	C16-C18	6.91	1.51	1.37
2	B	401	A1AA0	C34-N33	6.84	1.51	1.38
2	A	401	A1AA0	C34-N33	6.84	1.51	1.38
2	A	401	A1AA0	C25-C26	6.74	1.61	1.55
2	A	401	A1AA0	C15-C16	6.63	1.49	1.37
2	B	401	A1AA0	C16-C18	6.61	1.50	1.37
2	B	401	A1AA0	C22-N24	6.33	1.49	1.34
2	A	401	A1AA0	C38-C37	5.72	1.53	1.38
2	B	401	A1AA0	C38-C37	5.54	1.52	1.38

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	401	A1AA0	C22-N24	5.27	1.46	1.34
2	B	401	A1AA0	C10-C8	4.14	1.59	1.48
2	B	401	A1AA0	C27-C28	3.60	1.58	1.54
2	A	401	A1AA0	C25-N24	-3.60	1.33	1.47
2	A	401	A1AA0	C10-C8	3.47	1.57	1.48
2	B	401	A1AA0	C25-N24	-3.46	1.33	1.47
2	A	401	A1AA0	C27-C28	3.14	1.57	1.54
2	B	401	A1AA0	C11-C10	2.72	1.41	1.37
2	A	401	A1AA0	C12-C11	-2.45	1.36	1.44
2	A	401	A1AA0	O23-C22	-2.36	1.18	1.22
2	B	401	A1AA0	O9-C8	-2.35	1.18	1.23
2	B	401	A1AA0	O23-C22	-2.25	1.18	1.22
2	B	401	A1AA0	C5-C22	2.24	1.58	1.53
2	A	401	A1AA0	O9-C8	-2.18	1.18	1.23

All (35) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	A	401	A1AA0	C35-C26-C31	10.90	108.47	101.96
2	B	401	A1AA0	C35-C26-C31	8.46	107.01	101.96
2	B	401	A1AA0	C25-C26-C35	8.32	135.78	115.04
2	A	401	A1AA0	C25-C26-C35	7.06	132.63	115.04
2	B	401	A1AA0	C34-N33-C31	-6.39	108.03	111.86
2	A	401	A1AA0	C27-C26-C35	-6.06	102.22	113.99
2	B	401	A1AA0	C27-C26-C35	-5.35	103.59	113.99
2	A	401	A1AA0	C26-C25-N24	-5.24	98.38	103.73
2	A	401	A1AA0	C27-C26-C31	-5.09	99.02	111.41
2	B	401	A1AA0	C27-C26-C31	-5.06	99.11	111.41
2	A	401	A1AA0	C4-C5-N6	-4.61	104.00	112.48
2	A	401	A1AA0	C34-N33-C31	-4.43	109.20	111.86
2	B	401	A1AA0	C25-N24-C28	-4.02	104.01	112.50
2	A	401	A1AA0	O32-C31-C26	3.36	129.45	126.00
2	B	401	A1AA0	C22-C5-N6	3.14	116.13	109.67
2	B	401	A1AA0	O23-C22-N24	-3.12	115.82	121.38
2	A	401	A1AA0	C22-C5-N6	3.09	116.02	109.67
2	B	401	A1AA0	C2-C4-C5	-2.96	108.61	115.19
2	A	401	A1AA0	C35-C34-N33	-2.96	107.60	109.59
2	A	401	A1AA0	C27-C26-C25	2.87	104.00	100.37
2	B	401	A1AA0	O32-C31-N33	-2.86	123.49	126.31
2	A	401	A1AA0	C15-C13-C12	-2.72	119.36	124.23
2	A	401	A1AA0	C20-C12-C13	2.72	121.55	117.83
2	B	401	A1AA0	C7-N6-C5	2.63	122.43	117.75

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Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	A	401	A1AA0	O23-C22-N24	-2.57	116.80	121.38
2	A	401	A1AA0	C25-N24-C28	-2.55	107.11	112.50
2	B	401	A1AA0	C15-C13-C12	-2.33	120.06	124.23
2	A	401	A1AA0	O32-C31-N33	-2.28	124.06	126.31
2	B	401	A1AA0	C26-C25-N24	-2.27	101.42	103.73
2	A	401	A1AA0	C2-C4-C5	-2.26	110.17	115.19
2	B	401	A1AA0	C7-N6-C8	-2.21	113.77	121.22
2	B	401	A1AA0	C28-N24-C22	2.20	127.47	120.59
2	B	401	A1AA0	C4-C5-N6	-2.08	108.65	112.48
2	B	401	A1AA0	C35-C34-N33	-2.04	108.22	109.59
2	B	401	A1AA0	O32-C31-C26	2.01	128.07	126.00

There are no chirality outliers.

All (16) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	401	A1AA0	C2-C4-C5-C22
2	A	401	A1AA0	C11-C10-C8-N6
2	A	401	A1AA0	N21-C10-C8-N6
2	A	401	A1AA0	C11-C10-C8-O9
2	A	401	A1AA0	N21-C10-C8-O9
2	B	401	A1AA0	C2-C4-C5-C22
2	B	401	A1AA0	C11-C10-C8-N6
2	B	401	A1AA0	N21-C10-C8-N6
2	B	401	A1AA0	C11-C10-C8-O9
2	B	401	A1AA0	N21-C10-C8-O9
2	A	401	A1AA0	C2-C4-C5-N6
2	B	401	A1AA0	C2-C4-C5-N6
2	B	401	A1AA0	C4-C5-N6-C8
2	B	401	A1AA0	O23-C22-C5-N6
2	B	401	A1AA0	C4-C5-N6-C7
2	B	401	A1AA0	C22-C5-N6-C7

There are no ring outliers.

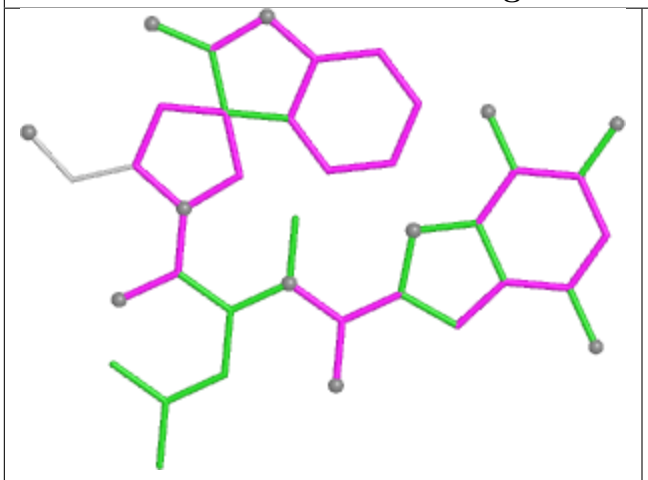
2 monomers are involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	401	A1AA0	1	0
2	B	401	A1AA0	2	0

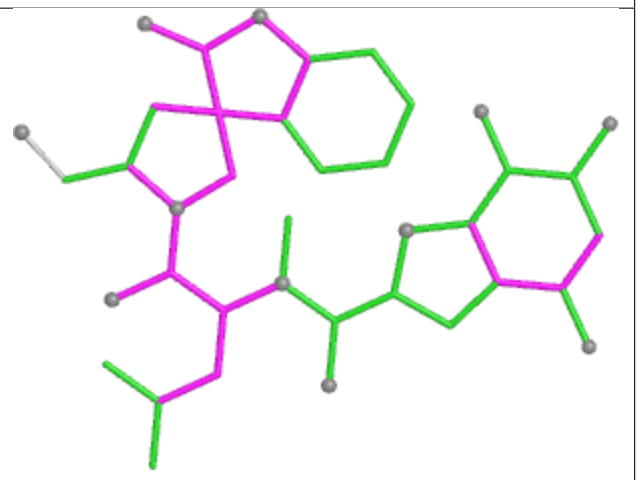
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths,

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.

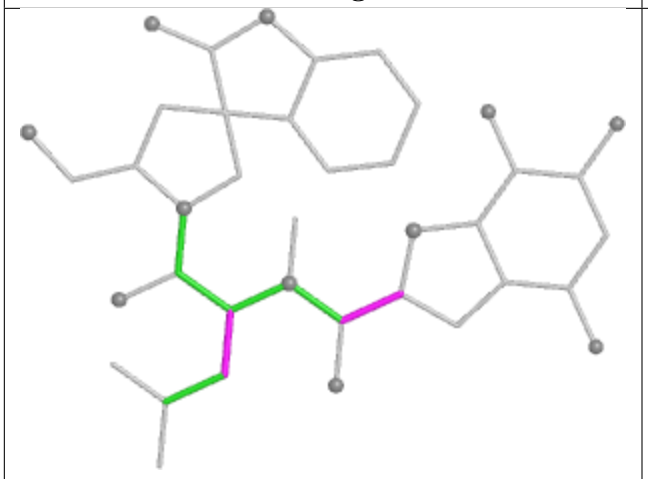
Ligand A1AA0 A 401



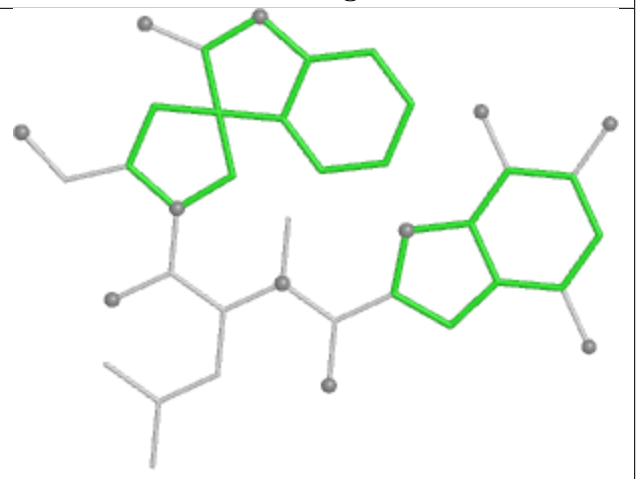
Bond lengths



Bond angles

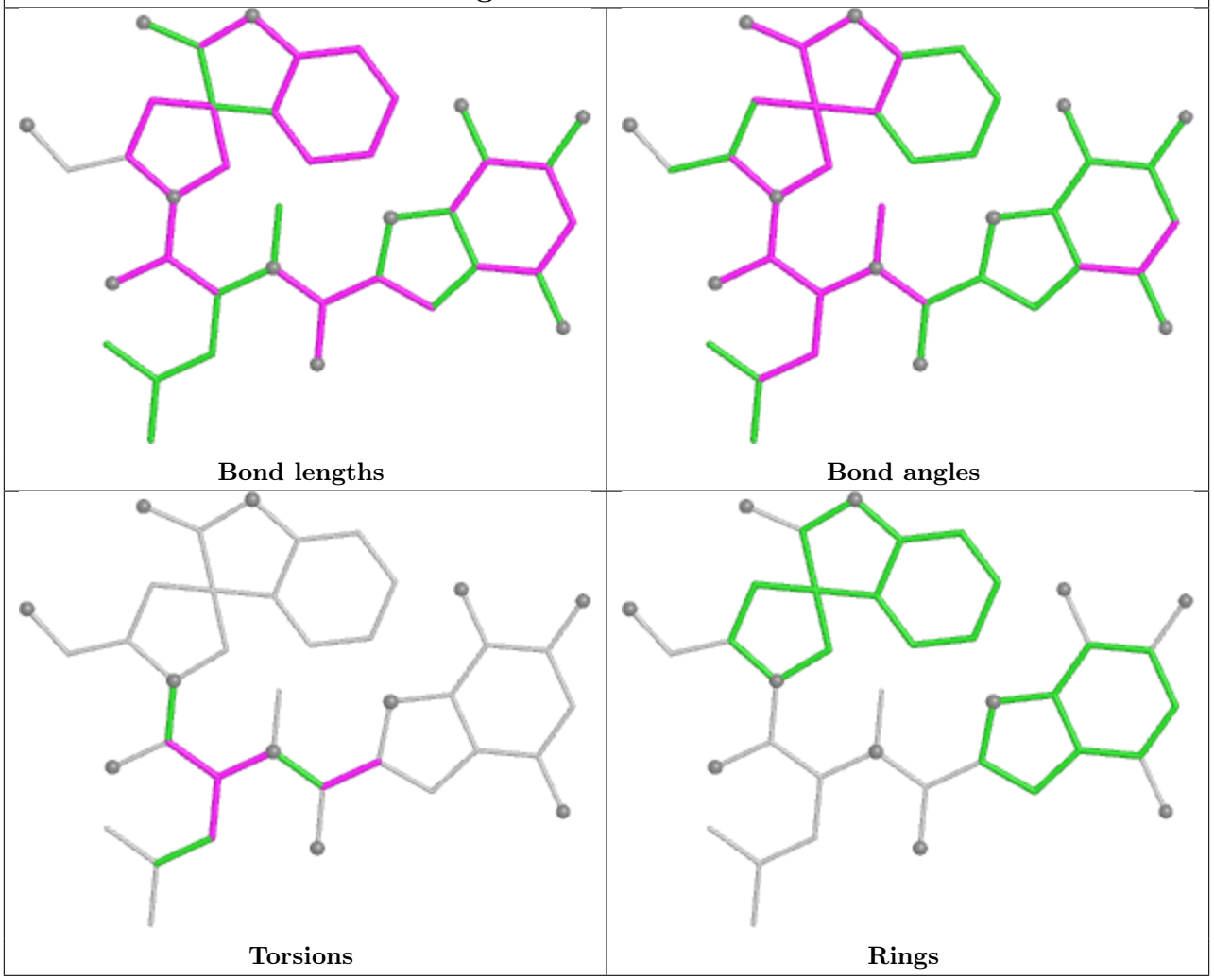


Torsions



Rings

Ligand A1AA0 B 401



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	296/354 (83%)	0.83	18 (6%) 27 24	33, 47, 63, 73	0
1	B	296/354 (83%)	1.39	63 (21%) 2 2	37, 60, 93, 104	0
All	All	592/708 (83%)	1.11	81 (13%) 6 5	33, 52, 84, 104	0

All (81) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	282	LEU	5.5
1	B	213	ILE	5.5
1	B	66	PHE	5.4
1	B	87	LEU	4.8
1	B	237	TYR	4.7
1	B	276	MET	4.5
1	B	271	LEU	4.4
1	B	223	PHE	3.9
1	B	284	SER	3.9
1	B	43	ILE	3.9
1	B	283	GLY	3.8
1	B	281	ILE	3.8
1	B	212	VAL	3.6
1	B	225	THR	3.5
1	B	272	LEU	3.5
1	B	285	ALA	3.5
1	B	287	LEU	3.5
1	B	49	MET	3.3
1	B	230	PHE	3.3
1	A	3	PHE	3.3
1	A	194	ALA	3.2
1	A	193	ALA	3.2
1	B	207	TRP	3.2
1	B	286	LEU	3.2

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Mol	Chain	Res	Type	RSRZ
1	B	298	ARG	3.1
1	A	142	ASN	3.0
1	B	211	ALA	3.0
1	B	3	PHE	3.0
1	B	50	LEU	2.9
1	B	142	ASN	2.8
1	B	48	ASP	2.8
1	B	239	TYR	2.8
1	A	49	MET	2.8
1	B	278	GLY	2.7
1	B	22	CYS	2.7
1	B	68	VAL	2.6
1	B	77	VAL	2.6
1	B	280	THR	2.6
1	A	58	LEU	2.6
1	B	67	LEU	2.6
1	B	220	LEU	2.5
1	B	74	GLN	2.5
1	B	65	ASN	2.5
1	B	234	ALA	2.5
1	B	168	PRO	2.5
1	B	216	ASP	2.5
1	B	199	THR	2.5
1	B	167	LEU	2.4
1	B	297	VAL	2.4
1	B	224	THR	2.4
1	B	259	ILE	2.4
1	A	291	PHE	2.4
1	A	234	ALA	2.4
1	A	294	PHE	2.4
1	A	87	LEU	2.4
1	B	218	TRP	2.4
1	B	247	VAL	2.3
1	A	119	ASN	2.3
1	B	257	THR	2.3
1	A	298	ARG	2.3
1	B	267	SER	2.2
1	B	155	ASP	2.2
1	B	137	LYS	2.2
1	B	268	LEU	2.2
1	B	72	ASN	2.2
1	A	67	LEU	2.2

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Mol	Chain	Res	Type	RSRZ
1	A	141	LEU	2.2
1	B	215	GLY	2.2
1	B	242	LEU	2.2
1	B	209	TYR	2.1
1	B	270	GLU	2.1
1	B	139	SER	2.1
1	B	143	GLY	2.1
1	B	219	PHE	2.1
1	A	50	LEU	2.1
1	A	296	VAL	2.0
1	A	297	VAL	2.0
1	B	75	LEU	2.0
1	B	296	VAL	2.0
1	A	54	TYR	2.0
1	B	254	SER	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 (i)

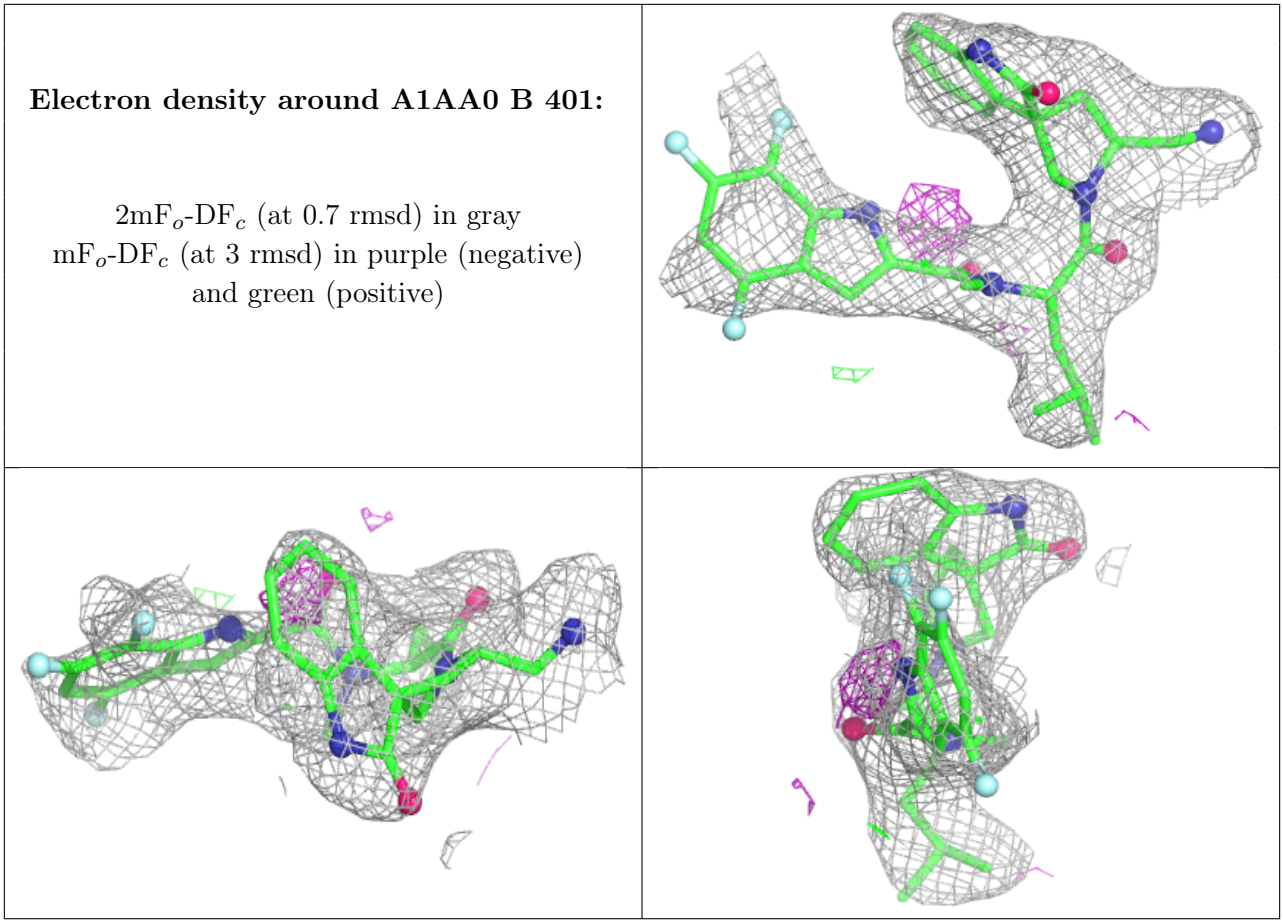
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
2	A1AA0	B	401	39/39	0.82	0.15	44,62,83,88	0
2	A1AA0	A	401	39/39	0.83	0.16	46,53,66,72	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.

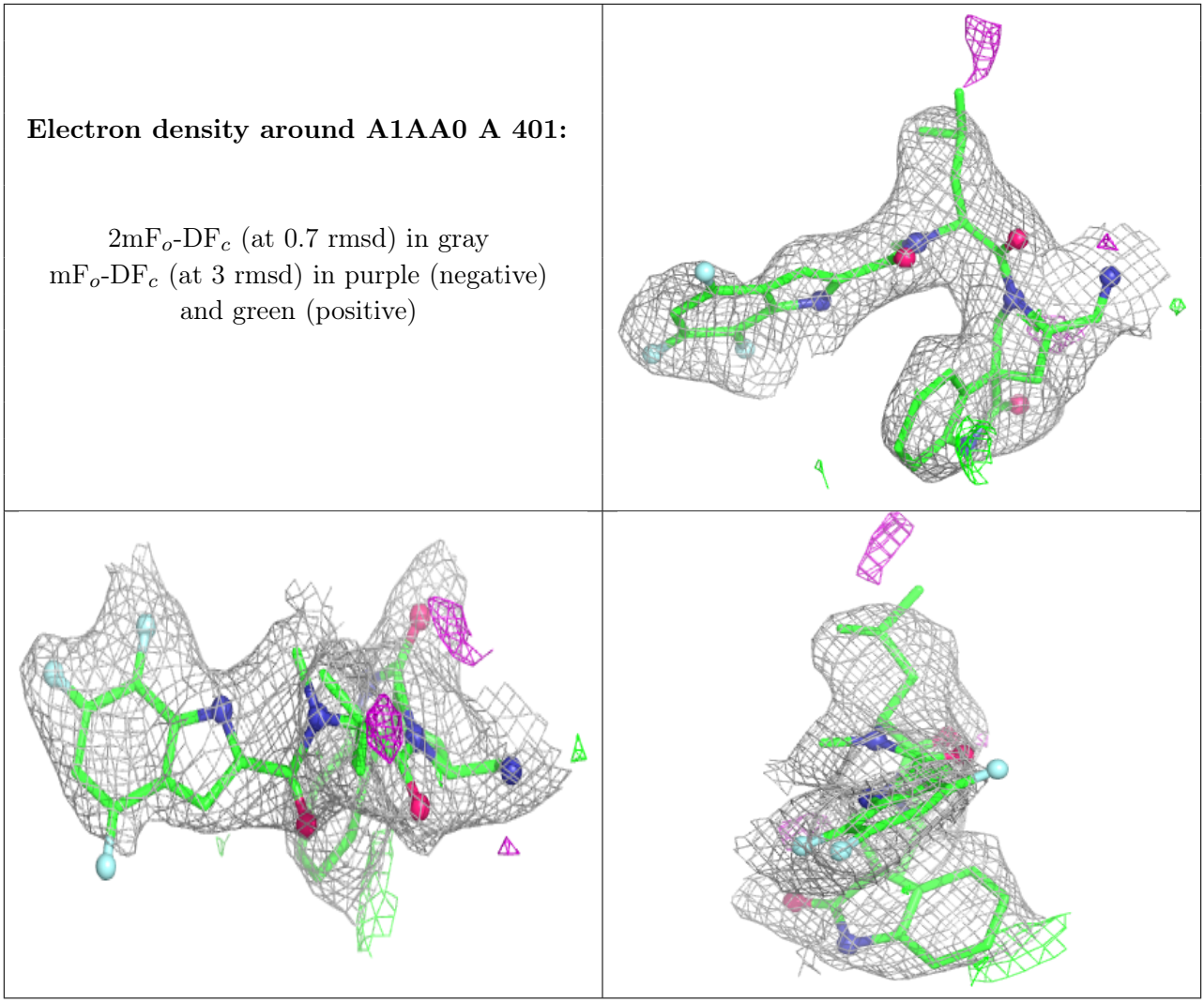
Electron density around A1AA0 B 401:

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



Electron density around A1AA0 A 401:

$2mF_o$-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

There are no such residues in this entry.