



Full wwPDB X-ray Structure Validation Report ⓘ

Feb 23, 2026 – 03:14 pm GMT

PDB ID : 28JN / pdb_000028jn
Title : CO-CRYSTAL STRUCTURE OF RAT PROTEIN FARNESYLTRANSFERASE COMPLEXED WITH A-176120
Authors : Cuesta, R.; Carion, M.; Park, H.W.; Ismail, S.
Deposited on : 2026-02-03
Resolution : 2.31 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)
Xtrriage (Phenix) : 2.0
EDS : 3.0
buster-report : 1.1.7 (2018)
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
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) : 2.48.1

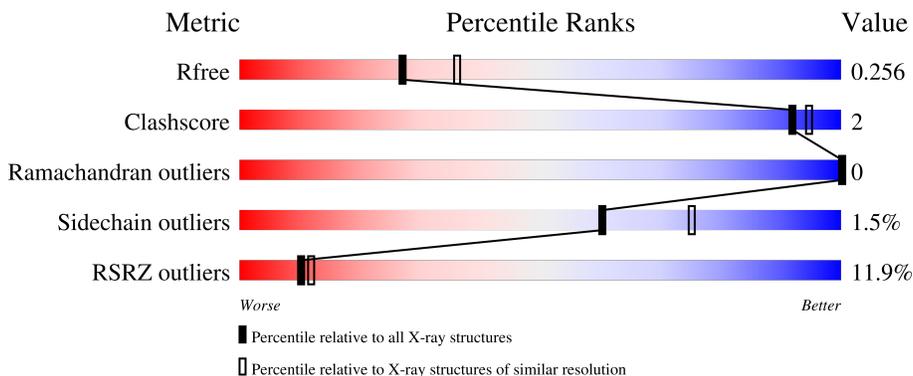
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.31 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}	164625	7250 (2.34-2.30)
Clashscore	180529	8063 (2.34-2.30)
Ramachandran outliers	177936	7993 (2.34-2.30)
Sidechain outliers	177891	7993 (2.34-2.30)
RSRZ outliers	164620	7250 (2.34-2.30)

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	377	 8% 80% 17%
2	B	437	 12% 81% 7% 12%

2 Entry composition [i](#)

There are 6 unique types of molecules in this entry. The entry contains 5812 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.

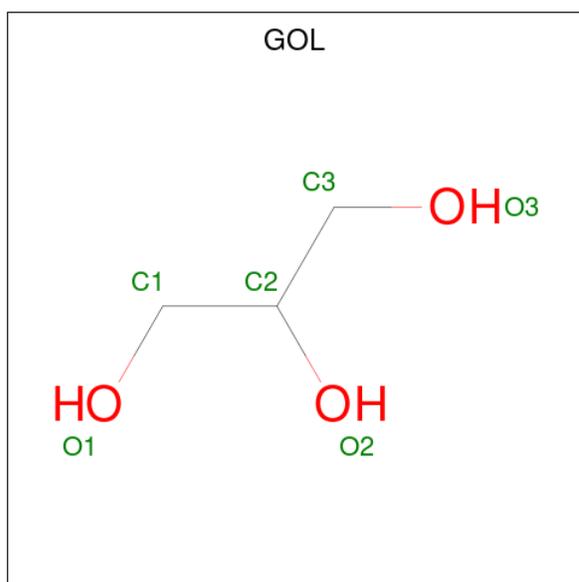
- Molecule 1 is a protein called Protein farnesyltransferase/geranylgeranyltransferase type-1 subunit alpha.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	312	2660	1694	467	494	5	0	0	0

- Molecule 2 is a protein called Protein farnesyltransferase subunit beta.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	386	3035	1936	521	555	23	0	1	0

- Molecule 3 is GLYCEROL (CCD ID: GOL) (formula: C₃H₈O₃).

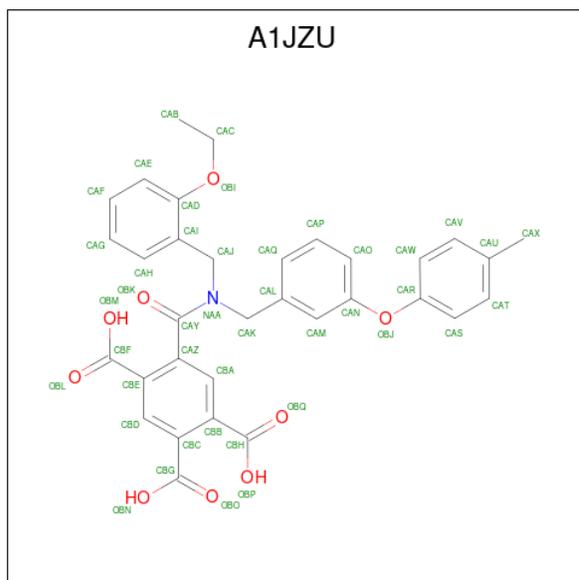


Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	C	O		
3	A	1	6	3	3	0	0

- Molecule 4 is ZINC ION (CCD ID: ZN) (formula: Zn).

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

- Molecule 5 is 5-[(2-ethoxyphenyl)methyl-[[3-(4-methylphenoxy)phenyl]methyl]carbamoyl]benzene-1,2,4-tricarboxylic acid (CCD ID: A1JZU) (formula: C₃₃H₂₉NO₉) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
5	B	1	Total	C	N	O	0	0
			43	33	1	9		

- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	35	Total	O	0	0
			35	35		
6	B	32	Total	O	0	0
			32	32		

4 Data and refinement statistics

Property	Value	Source
Space group	P 61	Depositor
Cell constants a, b, c, α , β , γ	172.78Å 172.78Å 70.49Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	44.15 – 2.31 44.15 – 2.31	Depositor EDS
% Data completeness (in resolution range)	100.0 (44.15-2.31) 100.0 (44.15-2.31)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.77 (at 2.32Å)	Xtrriage
Refinement program	REFMAC 5.8.0430	Depositor
R, R_{free}	0.228 , 0.251 0.234 , 0.256	Depositor DCC
R_{free} test set	2604 reflections (4.93%)	wwPDB-VP
Wilson B-factor (Å ²)	59.8	Xtrriage
Anisotropy	0.013	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 38.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	0.021 for h,-h-k,-l	Xtrriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	5812	wwPDB-VP
Average B, all atoms (Å ²)	69.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.83% 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: ZN, A1JZU, GOL

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	0.43	0/2725	0.87	0/3700
2	B	0.46	0/3115	0.87	0/4225
All	All	0.45	0/5840	0.87	0/7925

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	2660	0	2587	3	0
2	B	3035	0	2962	14	0
3	A	6	0	8	0	0
4	B	1	0	0	0	0
5	B	43	0	0	0	0
6	A	35	0	0	0	0
6	B	32	0	0	0	0
All	All	5812	0	5557	17	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 2.

All (17) 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:75:ARG:NH2	2:B:393:VAL:O	2.29	0.64
2:B:352:ASP:OD1	2:B:352:ASP:C	2.38	0.64
2:B:134:GLN:HE22	2:B:173:ASN:H	1.49	0.58
2:B:280:ARG:HE	2:B:289:GLN:HE21	1.58	0.50
2:B:253:PHE:HA	2:B:307:LEU:HD21	1.94	0.50
1:A:303:GLN:N	1:A:304:PRO:CD	2.75	0.49
2:B:78:HIS:HD1	2:B:349:GLY:H	1.59	0.48
2:B:74:GLN:H	2:B:344:GLN:HE22	1.62	0.48
2:B:239:ILE:HB	2:B:252:THR:HA	1.97	0.47
2:B:386:VAL:HG21	2:B:393:VAL:HG22	1.97	0.47
2:B:218:THR:HB	2:B:219:PRO:HD2	1.99	0.45
2:B:180:TYR:CZ	2:B:184:LEU:HD11	2.53	0.43
2:B:338:TYR:CE2	2:B:343:CYS:SG	3.11	0.43
2:B:381:MET:SD	2:B:381:MET:N	2.90	0.42
1:A:75:ILE:HD11	1:A:109:ARG:HD3	2.02	0.41
2:B:174:ARG:NH1	2:B:418:LYS:HD2	2.35	0.41
1:A:282:GLY:O	1:A:286:ASP:OD1	2.39	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	310/377 (82%)	297 (96%)	13 (4%)	0	100	100
2	B	381/437 (87%)	365 (96%)	16 (4%)	0	100	100
All	All	691/814 (85%)	662 (96%)	29 (4%)	0	100	100

There are no Ramachandran outliers to report.

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	291/338 (86%)	288 (99%)	3 (1%)	73 84
2	B	325/371 (88%)	319 (98%)	6 (2%)	54 70
All	All	616/709 (87%)	607 (98%)	9 (2%)	60 75

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

Mol	Chain	Res	Type
1	A	58	LEU
1	A	281	LYS
1	A	330	LYS
2	B	121	ILE
2	B	199	VAL
2	B	215	ASN
2	B	273	LEU
2	B	312	HIS
2	B	351	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (12) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	89	GLN
1	A	170	HIS
1	A	201	HIS
1	A	218	ASN
1	A	261	GLN
1	A	285	GLN
1	A	325	ASN
2	B	56	GLN
2	B	134	GLN
2	B	289	GLN
2	B	336	GLN
2	B	344	GLN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

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](#)

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	GOL	A	401	-	5,5,5	0.14	0	5,5,5	0.40	0
5	A1JZU	B	502	4	46,46,46	2.15	7 (15%)	64,64,64	1.04	5 (7%)

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	GOL	A	401	-	-	4/4/4/4	-
5	A1JZU	B	502	4	-	8/35/35/35	0/4/4/4

All (7) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	B	502	A1JZU	CAJ-CAI	-6.62	1.40	1.51

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	B	502	A1JZU	CAZ-CAY	-6.29	1.41	1.50
5	B	502	A1JZU	CAK-CAL	-6.22	1.40	1.51
5	B	502	A1JZU	CBB-CBH	-4.36	1.40	1.49
5	B	502	A1JZU	CBE-CBF	-4.28	1.40	1.49
5	B	502	A1JZU	CBC-CBG	-3.82	1.41	1.49
5	B	502	A1JZU	CAX-CAU	-3.00	1.40	1.51

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	B	502	A1JZU	CAL-CAK-NAA	2.81	117.64	113.13
5	B	502	A1JZU	OBN-CBG-OBO	-2.51	117.78	123.35
5	B	502	A1JZU	CBE-CAZ-CAY	2.12	127.06	122.17
5	B	502	A1JZU	OBM-CBF-OBL	-2.11	118.66	123.35
5	B	502	A1JZU	OBM-CBF-CBE	2.09	121.33	115.31

There are no chirality outliers.

All (12) torsion outliers are listed below:

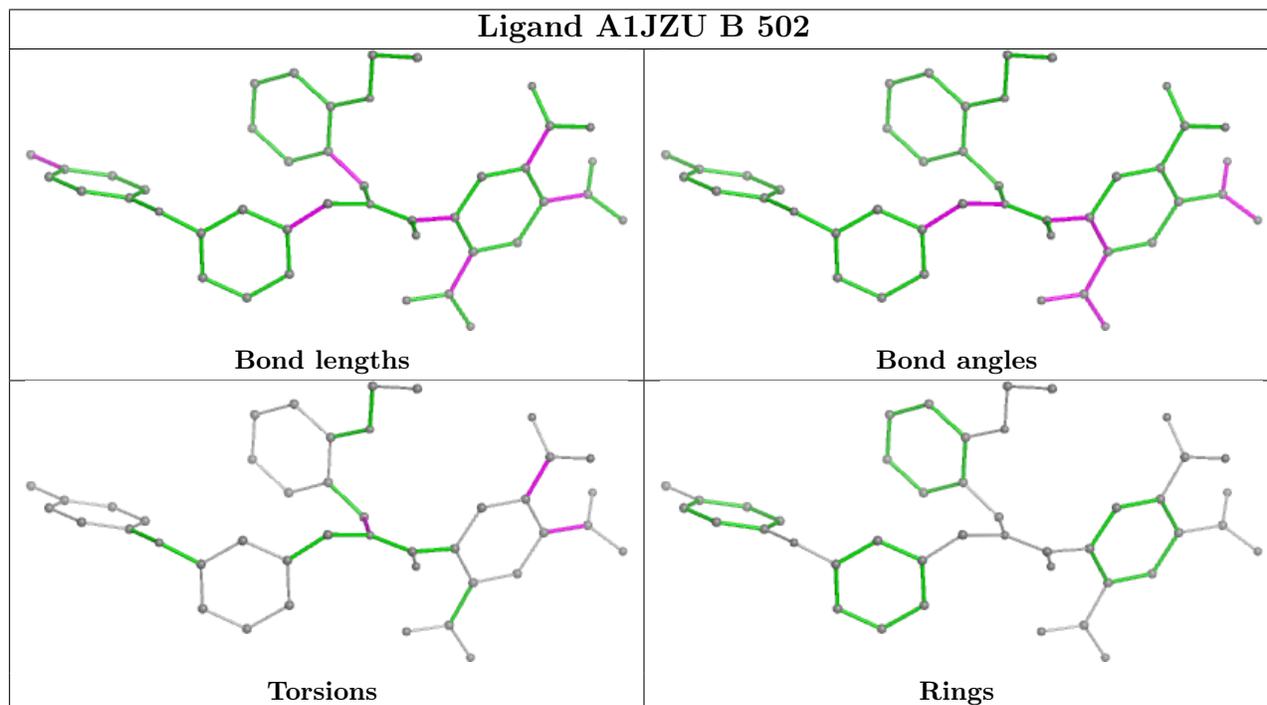
Mol	Chain	Res	Type	Atoms
3	A	401	GOL	O1-C1-C2-O2
3	A	401	GOL	O1-C1-C2-C3
3	A	401	GOL	C1-C2-C3-O3
5	B	502	A1JZU	CAI-CAJ-NAA-CAK
3	A	401	GOL	O2-C2-C3-O3
5	B	502	A1JZU	CAI-CAJ-NAA-CAY
5	B	502	A1JZU	CBD-CBC-CBG-OBO
5	B	502	A1JZU	CBA-CBB-CBH-OBP
5	B	502	A1JZU	CBD-CBC-CBG-OBN
5	B	502	A1JZU	CBA-CBB-CBH-OBQ
5	B	502	A1JZU	CBC-CBB-CBH-OBP
5	B	502	A1JZU	CBC-CBB-CBH-OBQ

There are no ring outliers.

No monomer is involved in short contacts.

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	312/377 (82%)	0.82	31 (9%) 14 16	43, 70, 106, 127	0
2	B	386/437 (88%)	0.86	52 (13%) 8 9	38, 65, 99, 124	1 (0%)
All	All	698/814 (85%)	0.84	83 (11%) 10 12	38, 67, 104, 127	1 (0%)

All (83) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	B	325	MET	5.0
2	B	23	LEU	4.8
2	B	327	HIS	4.5
2	B	416	LEU	4.4
2	B	418	LYS	4.1
2	B	26	LEU	4.1
2	B	80[A]	HIS	4.0
2	B	381	MET	4.0
2	B	379	GLY	3.9
2	B	376	PHE	3.8
2	B	71	LEU	3.6
2	B	417	GLN	3.4
2	B	62	TYR	3.3
2	B	384	ASP	3.3
1	A	291	ARG	3.3
2	B	389	VAL	3.2
2	B	313	ARG	3.2
1	A	345	ALA	3.2
2	B	121	ILE	3.2
1	A	348	LYS	3.1
2	B	324	SER	3.1
1	A	56	LEU	3.1
2	B	326	SER	3.1
2	B	380	ALA	3.1

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
2	B	266	ARG	3.0
1	A	334	LEU	3.0
1	A	338	LEU	3.0
2	B	386	VAL	3.0
2	B	219	PRO	2.9
1	A	366	LYS	2.9
2	B	388	GLY	2.9
1	A	287	ARG	2.9
1	A	296	LEU	2.9
2	B	375	HIS	2.8
1	A	367	HIS	2.7
2	B	323	LEU	2.7
2	B	378	SER	2.7
2	B	372	ILE	2.7
1	A	86	PRO	2.7
1	A	330	LYS	2.6
2	B	393	VAL	2.6
1	A	300	LEU	2.6
2	B	212	SER	2.6
1	A	364	GLN	2.6
2	B	72	VAL	2.6
2	B	415	PHE	2.6
2	B	352	ASP	2.6
2	B	377	GLY	2.5
2	B	24	TYR	2.5
2	B	385	VAL	2.5
2	B	319	GLY	2.5
1	A	346	LYS	2.4
1	A	357	ARG	2.4
1	A	365	SER	2.4
1	A	251	SER	2.3
2	B	390	PRO	2.2
1	A	285	GLN	2.2
1	A	344	LEU	2.2
2	B	351	LEU	2.2
2	B	394	LEU	2.2
2	B	332	GLN	2.2
1	A	329	ASN	2.2
2	B	264	LYS	2.2
2	B	28	PRO	2.2
2	B	32	ARG	2.1
1	A	356	TRP	2.1

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type	RSRZ
2	B	284	PHE	2.1
1	A	75	ILE	2.1
1	A	363	LEU	2.1
1	A	180	LYS	2.1
2	B	182	TYR	2.1
2	B	387	MET	2.1
1	A	361	ARG	2.1
1	A	164	LYS	2.1
1	A	336	LYS	2.1
1	A	302	LEU	2.1
2	B	392	ASN	2.1
2	B	412	THR	2.1
1	A	209	VAL	2.0
1	A	286	ASP	2.0
2	B	164	GLY	2.0
2	B	118	ILE	2.0
2	B	340	LEU	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.

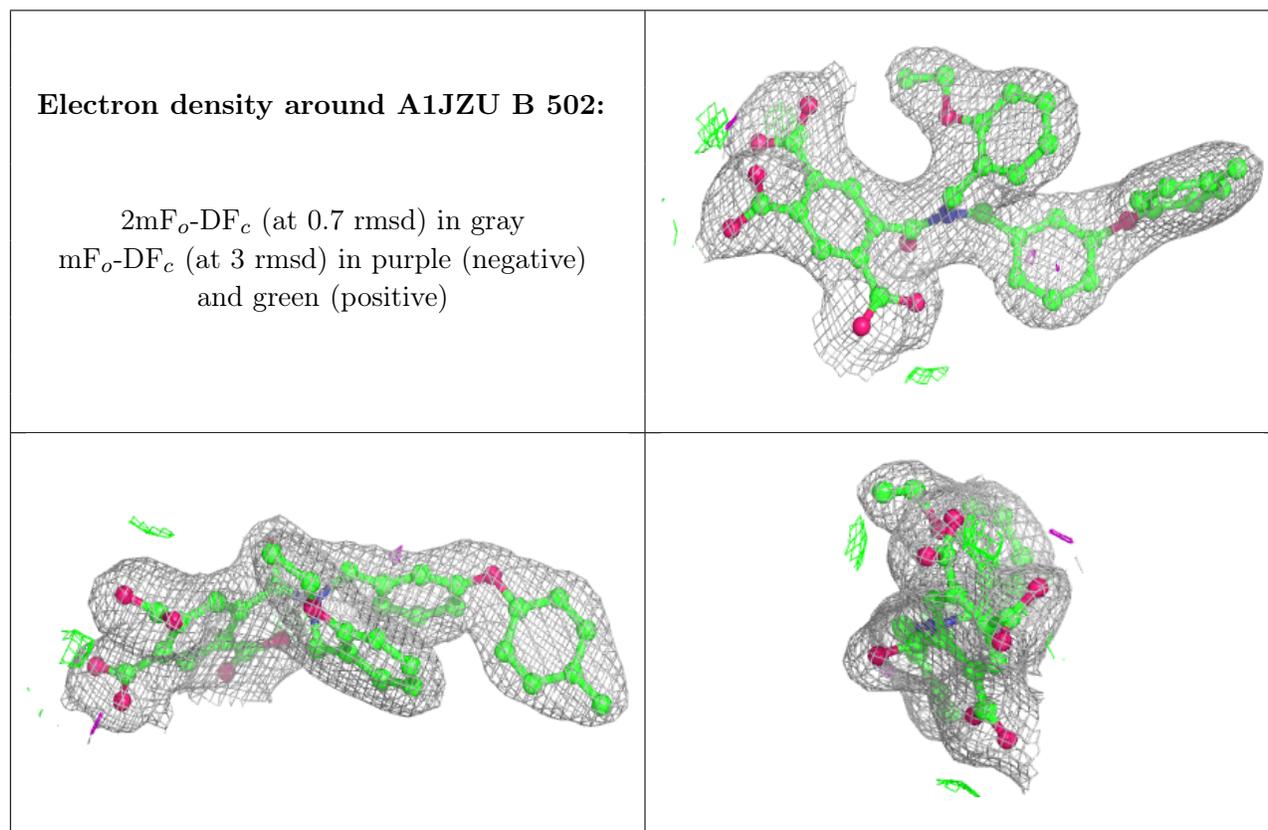
6.4 Ligands [i](#)

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
3	GOL	A	401	6/6	0.87	0.19	67,71,76,78	0
5	A1JZU	B	502	43/43	0.96	0.07	38,41,48,54	0
4	ZN	B	501	1/1	1.00	0.01	46,46,46,46	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.



6.5 Other polymers [i](#)

There are no such residues in this entry.