

wwPDB X-ray Structure Validation Summary Report (i)

Aug 11, 2025 – 10:07 AM EDT

PDB ID : 9D4B / pdb 00009d4b

Title: Discovery of SMD-3236, a Potent, Highly Selective and Efficacious SMARCA2

Degrader for the Treatment of SMARC4-Deficient Human Cancers

Authors : Strickland, C. Deposited on : 2024-08-12

Resolution : 3.30 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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 types of validation reports are described at http://www.wwpdb.org/validation/2017/FAQs#types.

The following versions of software and data (see references (1)) were used in the production of this report:

MolProbity : 4-5-2 with Phenix2.0rc1

Mogul : 2022.3.0, CSD as543be (2022)

Xtriage (Phenix) : 2.0rc1

EDS : 3.0

buster-report : 1.1.7 (2018)

Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)

CCP4 : 9.0.006 (Gargrove)

Density-Fitness : 1.0.12

Ideal geometry (proteins) : Engh & Huber (2001) Ideal geometry (DNA, RNA) : Parkinson et al. (1996)

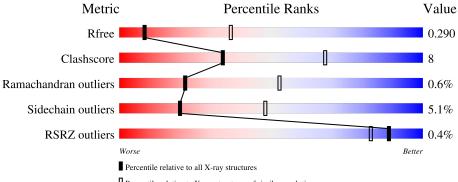
Validation Pipeline (wwPDB-VP) : 2.45.1

Overall quality at a glance (i) 1

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

The reported resolution of this entry is 3.30 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.



Percentile relative to X-ray structures of similar resolution

Metric	Whole archive $(\# \mathrm{Entries})$	$\begin{array}{c} {\rm Similar\ resolution} \\ (\#{\rm Entries,\ resolution\ range(\mathring{A})}) \end{array}$
R_{free}	164625	1085 (3.32-3.28)
Clashscore	180529	1128 (3.32-3.28)
Ramachandran outliers	177936	1125 (3.32-3.28)
Sidechain outliers	177891	1124 (3.32-3.28)
RSRZ outliers	164620	1085 (3.32-3.28)

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	161	73%	16% • 9%
1	D	161	% 64%	25% • 9%
2	В	104	74%	24% •
2	Е	104	70%	29%
3	С	96	75%	10% • 10%

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Mol	Chain	Length	Quality of chain		
3	F	96	75%	11% • 10%	
4	G	123	76%	15% • 8	%
4	Н	123	84%	8% 89	%



2 Entry composition (i)

There are 5 unique types of molecules in this entry. The entry contains 7428 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 von Hippel-Lindau disease tumor suppressor.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	Δ	147	Total	С	N	О	S	0	0	0
1	Λ	141	1202	764	220	216	2	0	U	U
1	D	147	Total	С	N	О	S	0	0	0
1	ע	141	1202	764	220	216	2	0	U	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	53	GLY	-	expression tag	UNP P40337
D	53	GLY	-	expression tag	UNP P40337

• Molecule 2 is a protein called Elongin-B.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace	
9	R	104	Total	С	N	О	S	n	0	0	
	Ъ	104	816	517	135	159	5		0	U	
2	E	104	Total	С	N	О	S	0	0	0	
	Ľ	104	822	520	138	159	5	0	0	U	

• Molecule 3 is a protein called Elongin-C.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
9	C	86	Total	С	N	О	S	0	0	0
3		00	688	444	110	128	6	U	U	U
2	Г	86	Total	С	N	О	S	0	0	0
3	Г	00	682	441	107	128	6		U	U

• Molecule 4 is a protein called Probable global transcription activator SNF2L2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
4	G	113	Total 930	C 592	N 164	O 171	S 3	0	0	0

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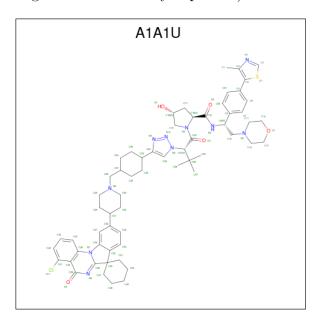
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Mol C	Chain	Residues		\mathbf{At}	oms			ZeroOcc	AltConf	Trace
4	Н	113	Total 930	C 592	N 164	O 171	S 3	0	0	0

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
G	1371	SER	-	expression tag	UNP B4DNT1
G	1372	MET	-	expression tag	UNP B4DNT1
Н	1371	SER	-	expression tag	UNP B4DNT1
Н	1372	MET	-	expression tag	UNP B4DNT1

• Molecule 5 is (4R)-1-[(2S)-2-{4-[(1S,4S)-4-({4-[(12'S)-4'-chloro-5'-oxo-5'H-spiro[cyclohexane -1,7'-indolo[1,2-a]quinazolin]-10'-yl]piperidin-1-yl}methyl)cyclohexyl]-1H-1,2,3-triazol-1-yl}-3,3-dimethylbutanoyl]-4-hydroxy-N-[(1R)-1-[4-(4-methyl-1,3-thiazol-5-yl)phenyl]-2-(morp holin-4-yl)ethyl]-L-prolinamide (CCD ID: A1A1U) (formula: $C_{61}H_{75}ClN_{10}O_5S$) (labeled as "Ligand of Interest" by depositor).



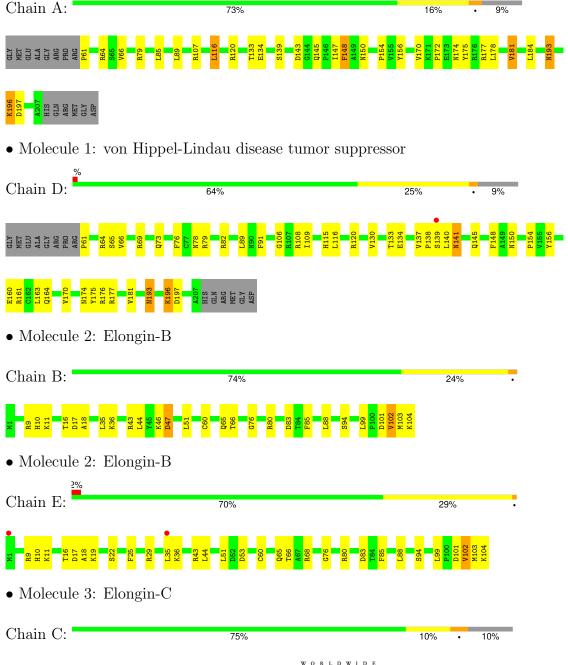
Mol	Chain	Residues	\mathbf{Atoms}					ZeroOcc	AltConf		
5	٨	1	Total	С	Cl	N	О	S	0	0	
9	A	1	78	61	1	10	5	1	0	0	
5	D	1	Total	С	Cl	N	О	S	0	0	
5	D	1	78	61	1	10	5	1	U	0	



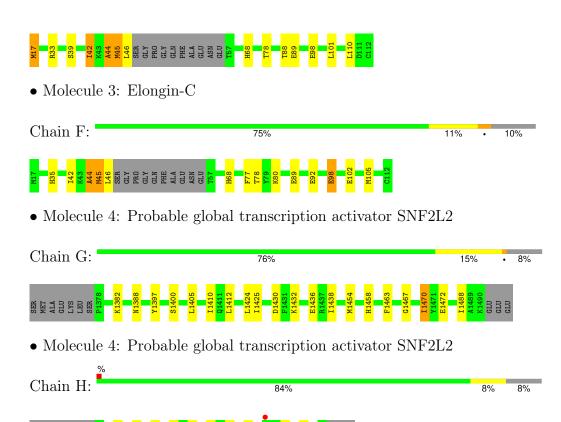
3 Residue-property plots (i)

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: von Hippel-Lindau disease tumor suppressor









4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants	93.13Å 132.01Å 210.70Å	Depositor
a, b, c, α , β , γ	90.00° 90.00° 90.00°	Depositor
Resolution (Å)	48.10 - 3.30	Depositor
Resolution (A)	48.10 - 3.30	EDS
% Data completeness	99.9 (48.10-3.30)	Depositor
(in resolution range)	99.9 (48.10-3.30)	EDS
R_{merge}	0.28	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) > 1$	3.25 (at 3.33Å)	Xtriage
Refinement program	REFMAC 5.8.0403	Depositor
P. P.	0.207 , 0.286	Depositor
R, R_{free}	0.210 , 0.290	DCC
R_{free} test set	1014 reflections (5.09%)	wwPDB-VP
Wilson B-factor (Å ²)	74.2	Xtriage
Anisotropy	0.055	Xtriage
Bulk solvent $k_{sol}(e/Å^3)$, $B_{sol}(Å^2)$	0.34, 50.0	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	0.93	EDS
Total number of atoms	7428	wwPDB-VP
Average B, all atoms (Å ²)	79.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: The largest off-origin peak in the Patterson function is 6.68% of the height of the origin peak. No significant pseudotranslation is detected.

²Theoretical 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.



¹Intensities estimated from amplitudes.

5 Model quality (i)

5.1 Standard geometry (i)

Bond lengths and bond angles in the following residue types are not validated in this section: A1A1U

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		
MIOI	Chain	RMSZ	# Z > 5	RMSZ	# Z > 5	
1	A	0.56	0/1233	1.05	2/1682~(0.1%)	
1	D	0.55	0/1233	1.08	0/1682	
2	В	0.50	0/832	1.00	0/1125	
2	Е	0.49	0/838	1.01	0/1132	
3	С	0.53	0/702	1.07	1/947 (0.1%)	
3	F	0.55	0/696	1.04	0/940	
4	G	0.49	0/946	1.03	0/1269	
4	Н	0.49	0/946	1.03	0/1269	
All	All	0.52	0/7426	1.04	3/10046 (0.0%)	

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
1	A	0	1
1	D	0	1
2	Ε	0	2
All	All	0	4

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	\mathbf{Z}	$\mathbf{Observed}(^{o})$	$\operatorname{Ideal}({}^{o})$
1	A	143	ASP	CA-CB-CG	5.25	117.85	112.60
1	A	150	ASN	CB-CA-C	-5.22	102.22	111.05
3	С	42	ILE	N-CA-C	-5.03	107.85	112.83

There are no chirality outliers.



All (4) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	177	ARG	Sidechain
1	D	69	ARG	Sidechain
2	Е	29	ARG	Sidechain
2	Е	68	ARG	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	1202	0	1205	23	0
1	D	1202	0	1205	34	0
2	В	816	0	813	15	0
2	Ε	822	0	824	18	0
3	С	688	0	690	10	0
3	F	682	0	679	12	0
4	G	930	0	964	10	2
4	Н	930	0	964	4	2
5	A	78	0	0	4	0
5	D	78	0	0	2	0
All	All	7428	0	7344	111	2

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.

The worst 5 of 111 close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	$\begin{array}{c} {\rm Interatomic} \\ {\rm distance} \ ({\rm \AA}) \end{array}$	$\begin{array}{c} \text{Clash} \\ \text{overlap } (\text{\AA}) \end{array}$
1:A:79:ARG:NH1	3:C:89:GLU:OE1	1.91	1.03
1:D:79:ARG:NH1	3:F:89:GLU:OE1	1.98	0.96
2:E:101:ASP:HA	2:E:104:LYS:HE2	1.60	0.81
2:B:101:ASP:HA	2:B:104:LYS:HE2	1.63	0.80
2:E:94:SER:HG	3:F:68:HIS:HD1	1.20	0.80

All (2) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.



Atom-1	Atom-2	$\begin{array}{c} {\rm Interatomic} \\ {\rm distance} \ ({\rm \AA}) \end{array}$	Clash overlap (Å)
4:G:1472:GLU:OE1	4:H:1397:TYR:OH[5_455]	2.08	0.12
4:G:1397:TYR:OH	4:H:1472:GLU:OE1[5_455]	2.19	0.01

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	145/161 (90%)	135 (93%)	10 (7%)	0	100 100
1	D	145/161 (90%)	136 (94%)	9 (6%)	0	100 100
2	В	102/104 (98%)	91 (89%)	10 (10%)	1 (1%)	13 42
2	E	102/104 (98%)	89 (87%)	13 (13%)	0	100 100
3	C	82/96 (85%)	77 (94%)	3 (4%)	2 (2%)	5 25
3	F	82/96 (85%)	76 (93%)	4 (5%)	2 (2%)	5 25
4	G	111/123 (90%)	105 (95%)	6 (5%)	0	100 100
4	Н	111/123 (90%)	106 (96%)	5 (4%)	0	100 100
All	All	880/968 (91%)	815 (93%)	60 (7%)	5 (1%)	22 53

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
3	С	44	ALA
3	F	44	ALA
2	В	47	ASP
3	С	45	MET
3	F	45	MET

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 o	of residues	for	which	the	${\rm sidechain}$	conformation	was
analysed, and the total number of	residues.							

Mol	Chain	Analysed	Rotameric	Outliers	Per	ce	$_{ m ntiles}$
1	A	137/147 (93%)	128 (93%)	9 (7%)	1	4	40
1	D	137/147 (93%)	129 (94%)	8 (6%)	1	7	44
2	В	91/92~(99%)	87 (96%)	4 (4%)	2	4	52
2	E	92/92 (100%)	88 (96%)	4 (4%)	2	5	53
3	\mathbf{C}	78/85 (92%)	74 (95%)	4 (5%)	2	О	48
3	F	77/85 (91%)	75 (97%)	2 (3%)	4	1	66
4	G	106/115 (92%)	99 (93%)	7 (7%)	1	4	40
4	Н	106/115 (92%)	102 (96%)	4 (4%)	2	8	56
All	All	824/878 (94%)	782 (95%)	42 (5%)	2	О	48

5 of 42 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	Е	102	VAL
4	G	1432	LYS
3	F	78	THR
4	G	1400	SER
4	G	1470	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 13 such sidechains are listed below:

Mol	Chain	Res	Type
3	F	35	HIS
3	F	58	ASN
4	Н	1478	GLN
4	G	1379	ASN
4	G	1478	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)

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).

Mal	Mol Type	Chain	Res	Link	Bond lengths			Bond angles		
MIOI	туре	Chain	nes	LIIIK	Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
5	A1A1U	D	301	-	83,89,89	0.66	1 (1%)	104,133,133	1.82	19 (18%)
5	A1A1U	A	301	-	83,89,89	0.49	1 (1%)	104,133,133	1.35	12 (11%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
5	A1A1U	D	301	-	-	4/46/116/116	0/12/12/12
5	A1A1U	A	301	-	-	8/46/116/116	0/12/12/12

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	$\operatorname{Observed}(\operatorname{\AA})$	$\operatorname{Ideal}(\text{\AA})$
5	D	301	A1A1U	C40-C41	2.52	1.43	1.39
5	A	301	A1A1U	C36-N7	2.04	1.43	1.40

The worst 5 of 31 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	\mathbf{Z}	$\mathbf{Observed}(^o)$	$\mathbf{Ideal}(^o)$
5	D	301	A1A1U	C22-N5-C21	9.23	135.81	125.62
5	D	301	A1A1U	C40-C41-CL1	5.88	127.20	119.62
5	D	301	A1A1U	C22-C23-C24	5.50	136.86	129.26
5	A	301	A1A1U	C40-C41-CL1	4.47	125.38	119.62

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Mol	Chain	Res	Type	Atoms	\mathbf{Z}	$\mathbf{Observed}(^o)$	$\operatorname{Ideal}({}^{o})$
5	D	301	A1A1U	C9-N3-C15	4.11	128.69	122.98

There are no chirality outliers.

5 of 12 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	A	301	A1A1U	C9-C10-N2-C14
5	A	301	A1A1U	C22-C23-C24-C25
5	A	301	A1A1U	N9-C23-C24-C25
5	A	301	A1A1U	C26-C27-C28-N6
5	A	301	A1A1U	C54-C27-C28-N6

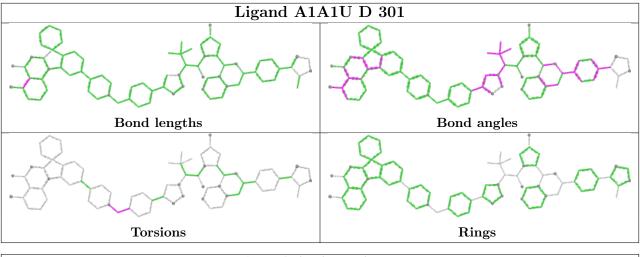
There are no ring outliers.

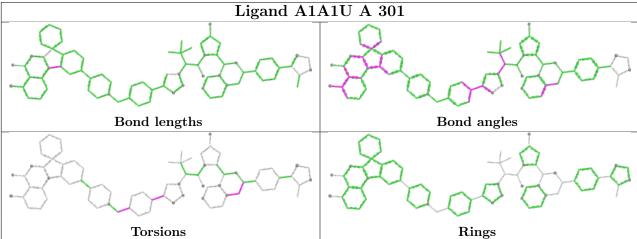
2 monomers are involved in 6 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	D	301	A1A1U	2	0
5	A	301	A1A1U	4	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less 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.







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 (i)

6.1 Protein, DNA and RNA chains (i)

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>	$\#\mathrm{RSRZ}{>}2$	$\mathbf{OWAB}(\mathrm{\AA}^2)$	Q < 0.9
1	A	147/161 (91%)	-0.58	0 100 100	32, 57, 89, 116	0
1	D	147/161 (91%)	-0.46	1 (0%) 84 75	35, 60, 104, 129	0
2	В	104/104 (100%)	-0.29	0 100 100	53, 82, 114, 145	0
2	E	104/104 (100%)	-0.01	2 (1%) 66 51	60, 92, 139, 157	0
3	С	86/96 (89%)	-0.45	0 100 100	33, 63, 100, 159	0
3	F	86/96 (89%)	-0.21	0 100 100	40, 71, 107, 139	0
4	G	113/123 (91%)	-0.19	0 100 100	50, 85, 124, 143	0
4	Н	113/123 (91%)	0.04	1 (0%) 81 70	55, 98, 168, 211	0
All	All	900/968 (92%)	-0.29	4 (0%) 89 83	32, 74, 130, 211	0

All (4) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	Е	35	LEU	2.8
2	Е	1	MET	2.1
4	Н	1465	LEU	2.1
1	D	139	SER	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 oligosaccharides in this entry.

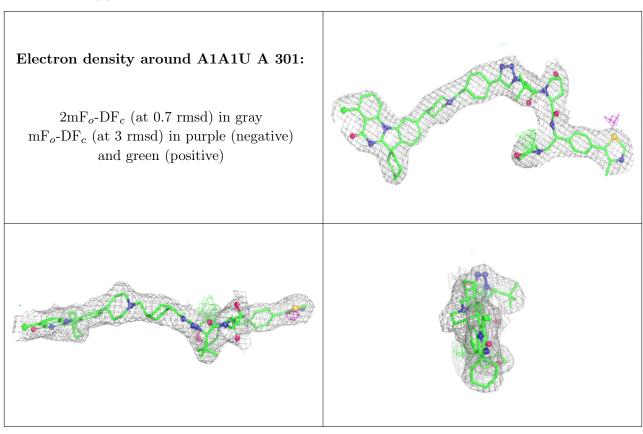


6.4 Ligands (i)

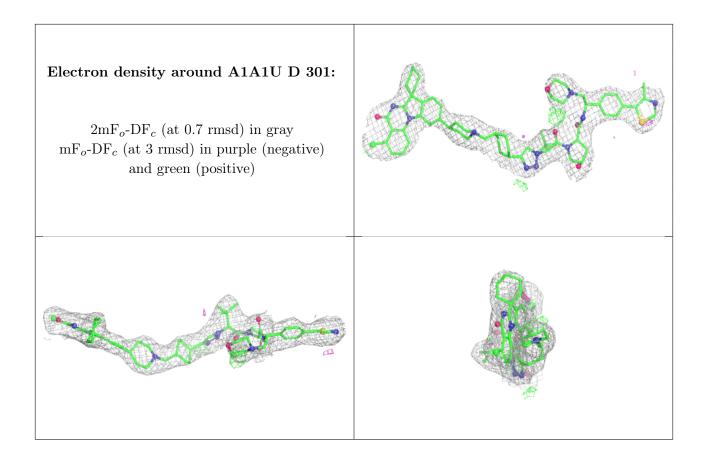
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9'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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	$\mathbf{B} ext{-}\mathbf{factors}(\mathbf{\mathring{A}}^2)$	Q<0.9
5	A1A1U	A	301	78/78	0.94	0.10	43,58,72,85	0
5	A1A1U	D	301	78/78	0.94	0.10	44,58,80,94	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.

