



# Full wwPDB X-ray Structure Validation Report ⓘ

Nov 25, 2024 – 09:05 pm GMT

PDB ID : 9ETQ  
Title : Crystal structure of PARP1 catalytic domain bound to AZD5305 (SARU-PARIB)  
Authors : Schimpl, M.  
Deposited on : 2024-03-26  
Resolution : 1.59 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](mailto: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>.

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

MolProbity : 4.02b-467  
Mogul : 1.8.4, CSD as541be (2020)  
Xtriage (Phenix) : 1.13  
EDS : 3.0  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)  
CCP4 : 9.0.003 (Gargrove)  
Density-Fitness : 1.0.11  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.40

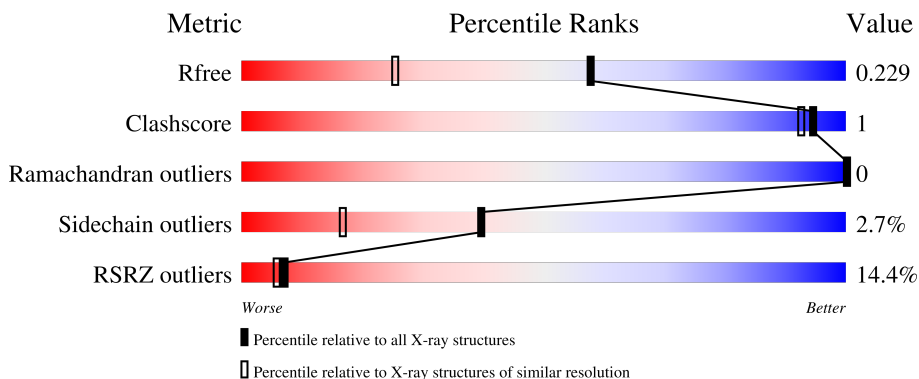
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.59 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	4274 (1.60-1.60)
Clashscore	180529	4682 (1.60-1.60)
Ramachandran outliers	177936	4583 (1.60-1.60)
Sidechain outliers	177891	4582 (1.60-1.60)
RSRZ outliers	164620	4272 (1.60-1.60)

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  $\geq 3$ , 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	352	 9% 94% 5%
1	B	352	 20% 93% 7%

## 2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 5955 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.

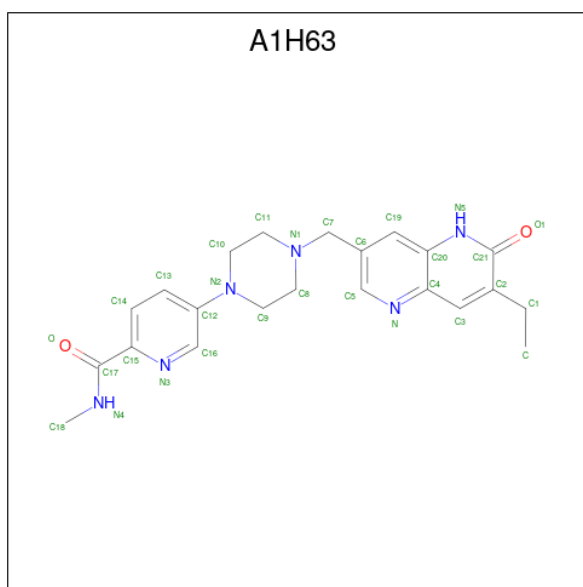
- Molecule 1 is a protein called Poly [ADP-ribose] polymerase 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	350	2743	1745	463	523	12	0	1	0
1	B	350	2729	1738	459	521	11	0	0	0

There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	660	GLY	-	expression tag	UNP P09874
A	661	SER	-	expression tag	UNP P09874
A	762	ALA	VAL	engineered mutation	UNP P09874
B	660	GLY	-	expression tag	UNP P09874
B	661	SER	-	expression tag	UNP P09874
B	762	ALA	VAL	engineered mutation	UNP P09874

- Molecule 2 is 5-[4-[(7-ethyl-6-oxidanylidene-5 {H}-1,5-naphthyridin-3-yl)methyl]piperazin-1-yl]- {N}-methyl-pyridine-2-carboxamide (three-letter code: A1H63) (formula: C<sub>22</sub>H<sub>26</sub>N<sub>6</sub>O<sub>2</sub>) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	N	O		
2	A	1	30	22	6	2	0	0
2	B	1	30	22	6	2	0	0

- Molecule 3 is SULFATE ION (three-letter code: SO4) (formula: O<sub>4</sub>S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
			Total	O	S		
3	A	1	5	4	1	0	0
3	A	1	5	4	1	0	0

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	O	S	0	0
			5	4	1		
3	A	1	Total	O	S	0	0
			5	4	1		
3	B	1	Total	O	S	0	0
			5	4	1		

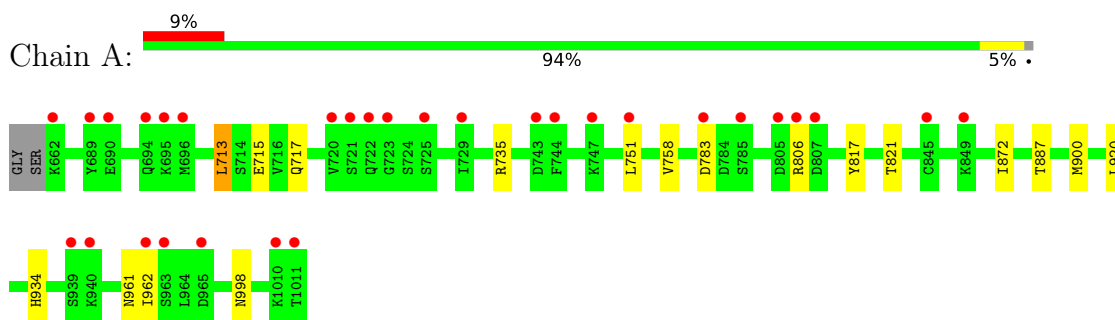
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	248	Total	O	0	0
			248	248		
4	B	150	Total	O	0	0
			150	150		

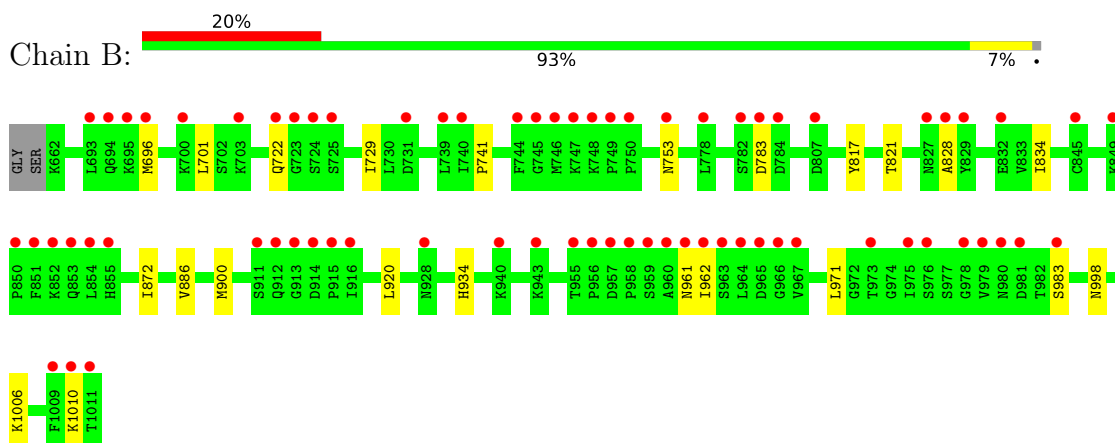
### 3 Residue-property plots [i](#)

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: Poly [ADP-ribose] polymerase 1



- Molecule 1: Poly [ADP-ribose] polymerase 1



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	48.23Å 92.53Å 163.54Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	81.77 – 1.59 81.77 – 1.59	Depositor EDS
% Data completeness (in resolution range)	70.3 (81.77-1.59) 70.3 (81.77-1.59)	Depositor EDS
$R_{merge}$	0.12	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.16 (at 1.59Å)	Xtrriage
Refinement program	BUSTER 2.11.7	Depositor
R, $R_{free}$	0.189 , 0.217 0.200 , 0.229	Depositor DCC
$R_{free}$ test set	3518 reflections (5.04%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	20.4	Xtrriage
Anisotropy	0.086	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.37 , 42.4	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.31$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	5955	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	29.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.26% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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 [i](#)

### 5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: A1H63, SO4

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	0.51	0/2795	0.63	0/3776
1	B	0.49	0/2781	0.62	0/3758
All	All	0.50	0/5576	0.63	0/7534

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 [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	2743	0	2768	5	0
1	B	2729	0	2743	9	0
2	A	30	0	0	0	0
2	B	30	0	0	0	0
3	A	20	0	0	0	0
3	B	5	0	0	0	0
4	A	248	0	0	0	0
4	B	150	0	0	0	0
All	All	5955	0	5511	13	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 1.



All (13) 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:872:ILE:HG21	1:A:920:LEU:HD11	1.85	0.57
1:B:872:ILE:HG21	1:B:920:LEU:HD11	1.88	0.54
1:A:717:GLN:HG2	1:A:887:THR:OG1	2.10	0.51
1:B:834:ILE:HD11	1:B:1006:LYS:HB2	1.93	0.50
1:B:729:ILE:HG21	1:B:753:ASN:HA	1.97	0.46
1:B:828:ALA:HA	1:B:1010:LYS:HB2	1.99	0.45
1:B:962:ILE:HG12	1:B:971:LEU:HD21	1.98	0.44
1:B:696:MET:HB2	1:B:741:PRO:HG2	2.01	0.42
1:A:934:HIS:CD2	1:B:886:VAL:HG11	2.55	0.42
1:B:934:HIS:CD2	1:B:983:SER:HB3	2.54	0.42
1:A:713:LEU:HG	1:A:758:VAL:HG13	2.00	0.42
1:B:821:THR:HB	1:B:900:MET:HA	2.03	0.40
1:A:821:THR:HB	1:A:900:MET:HA	2.04	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	349/352 (99%)	348 (100%)	1 (0%)	0	100	100
1	B	348/352 (99%)	347 (100%)	1 (0%)	0	100	100
All	All	697/704 (99%)	695 (100%)	2 (0%)	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	304/308 (99%)	294 (97%)	10 (3%)	33	12
1	B	300/308 (97%)	294 (98%)	6 (2%)	50	26
All	All	604/616 (98%)	588 (97%)	16 (3%)	40	17

All (16) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	713	LEU
1	A	715	GLU
1	A	735	ARG
1	A	751	LEU
1	A	783	ASP
1	A	806	ARG
1	A	817	TYR
1	A	961	ASN
1	A	962	ILE
1	A	998	ASN
1	B	701	LEU
1	B	722	GLN
1	B	783	ASP
1	B	817	TYR
1	B	961	ASN
1	B	998	ASN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (6) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	906	ASN
1	A	961	ASN
1	B	728	GLN
1	B	906	ASN
1	B	961	ASN
1	B	998	ASN

### 5.3.3 RNA

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](#)

7 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
3	SO4	A	1103	-	4,4,4	0.15	0	6,6,6	0.21	0
3	SO4	B	1102	-	4,4,4	0.45	0	6,6,6	0.27	0
3	SO4	A	1102	-	4,4,4	0.23	0	6,6,6	0.31	0
2	A1H63	B	1101	-	33,33,33	0.39	0	41,46,46	0.66	0
3	SO4	A	1105	-	4,4,4	0.31	0	6,6,6	0.30	0
3	SO4	A	1104	-	4,4,4	0.17	0	6,6,6	0.14	0
2	A1H63	A	1101	-	33,33,33	0.43	0	41,46,46	0.65	1 (2%)

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	A1H63	A	1101	-	-	0/16/26/26	0/4/4/4
2	A1H63	B	1101	-	-	0/16/26/26	0/4/4/4

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	1101	A1H63	C6-C7-N1	2.32	117.62	113.12

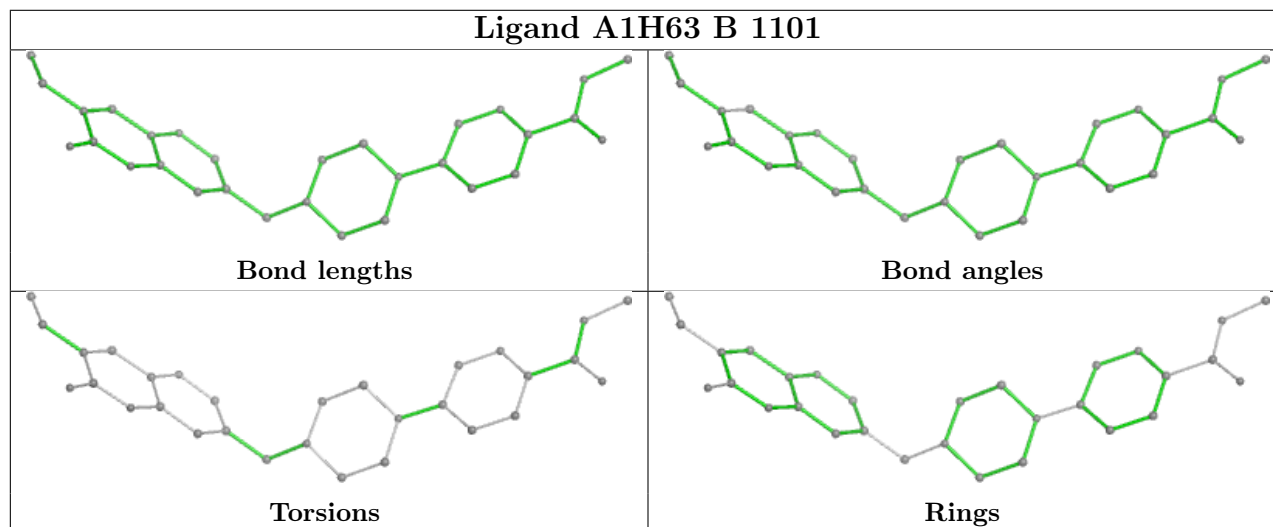
There are no chirality outliers.

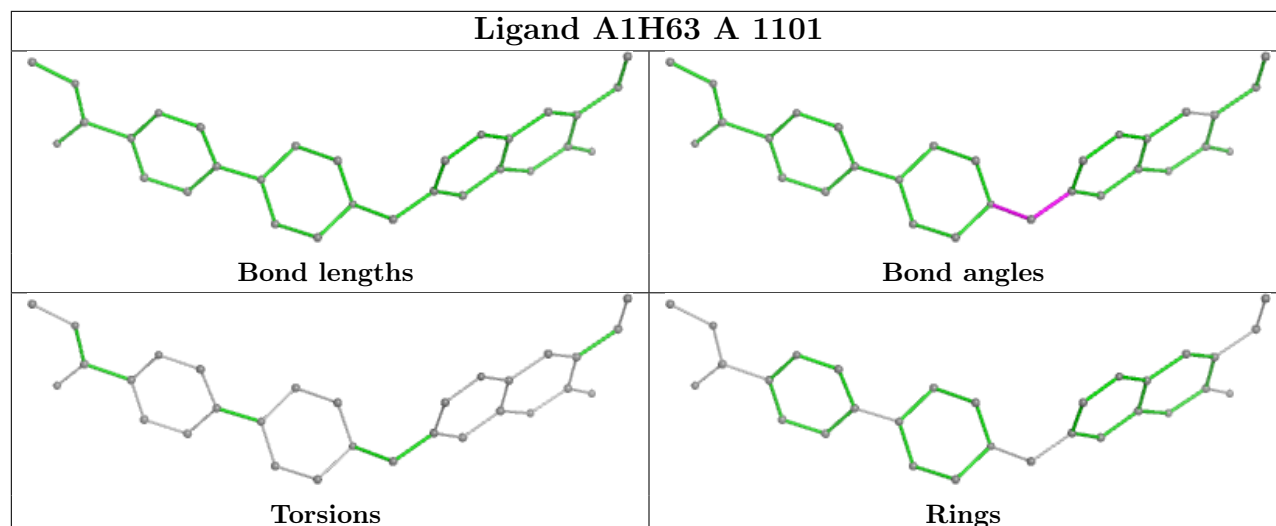
There are no torsion outliers.

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 [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<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	350/352 (99%)	0.34	30 (8%) 18 17	12, 22, 45, 64	1 (0%)
1	B	350/352 (99%)	1.03	71 (20%) 3 3	14, 30, 56, 95	0
All	All	700/704 (99%)	0.68	101 (14%) 7 6	12, 25, 53, 95	1 (0%)

All (101) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	854	LEU	8.5
1	B	1011	THR	7.5
1	B	828	ALA	7.3
1	B	851	PHE	6.4
1	B	979	VAL	5.0
1	B	980	ASN	4.9
1	B	694	GLN	4.8
1	B	853	GLN	4.8
1	B	981	ASP	4.5
1	B	914	ASP	4.2
1	B	978	GLY	4.1
1	A	1011	THR	4.1
1	B	967	VAL	4.0
1	B	975	ILE	3.9
1	A	689	TYR	3.9
1	A	720	VAL	3.7
1	A	962	ILE	3.6
1	B	747	LYS	3.5
1	B	845	CYS	3.5
1	A	807	ASP	3.5
1	B	723	GLY	3.5
1	B	913	GLY	3.4
1	A	845	CYS	3.4
1	B	827	ASN	3.3

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<b>Mol</b>	<b>Chain</b>	<b>Res</b>	<b>Type</b>	<b>RSRZ</b>
1	B	959	SER	3.2
1	B	783	ASP	3.2
1	B	964	LEU	3.2
1	B	956	PRO	3.2
1	B	696	MET	3.1
1	B	911	SER	3.1
1	A	729	ILE	3.1
1	B	912	GLN	3.1
1	B	849	LYS	3.1
1	B	963	SER	3.0
1	B	965	ASP	3.0
1	B	725	SER	2.9
1	B	983	SER	2.9
1	B	744	PHE	2.9
1	B	1009	PHE	2.9
1	B	724	SER	2.9
1	B	693	LEU	2.9
1	A	722	GLN	2.8
1	B	850	PRO	2.8
1	B	852	LYS	2.8
1	B	746	MET	2.8
1	A	785	SER	2.7
1	B	739	LEU	2.7
1	B	958	PRO	2.7
1	B	695	LYS	2.7
1	B	1010	LYS	2.7
1	A	747	LYS	2.6
1	A	696[A]	MET	2.6
1	A	694	GLN	2.6
1	B	722	GLN	2.6
1	B	966	GLY	2.6
1	B	749	PRO	2.6
1	A	805	ASP	2.6
1	A	662	LYS	2.5
1	A	940	LYS	2.5
1	B	829	TYR	2.5
1	B	915	PRO	2.5
1	A	849	LYS	2.4
1	A	743	ASP	2.4
1	B	784	ASP	2.4
1	B	745	GLY	2.4
1	B	807	ASP	2.4

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Mol	Chain	Res	Type	RSRZ
1	A	723	GLY	2.4
1	A	963	SER	2.4
1	B	750	PRO	2.4
1	A	783	ASP	2.4
1	B	916	ILE	2.3
1	B	940	LYS	2.3
1	A	695	LYS	2.3
1	B	957	ASP	2.3
1	B	753	ASN	2.3
1	B	778	LEU	2.3
1	B	960	ALA	2.3
1	A	690	GLU	2.2
1	A	721	SER	2.2
1	A	725	SER	2.2
1	B	782	SER	2.2
1	B	832	GLU	2.2
1	B	855	HIS	2.2
1	B	943	LYS	2.2
1	A	939	SER	2.2
1	A	751	LEU	2.1
1	B	962	ILE	2.1
1	B	703	LYS	2.1
1	B	955	THR	2.1
1	B	973	THR	2.1
1	B	976	SER	2.1
1	A	806	ARG	2.1
1	A	1010	LYS	2.1
1	A	965	ASP	2.1
1	A	744	PHE	2.1
1	B	740	ILE	2.1
1	B	700	LYS	2.0
1	B	748	LYS	2.0
1	B	731	ASP	2.0
1	B	928	ASN	2.0
1	B	961	ASN	2.0

## 6.2 Non-standard residues in protein, DNA, RNA chains

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



### 6.3 Carbohydrates

There are no monosaccharides in this entry.

### 6.4 Ligands

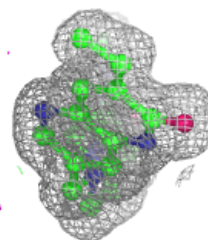
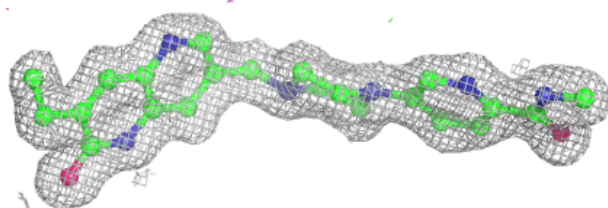
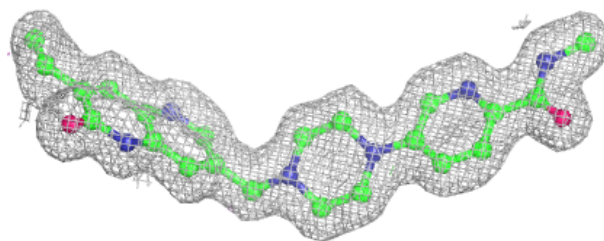
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors( $\text{\AA}^2$ )	Q<0.9
3	SO4	A	1103	5/5	0.86	0.12	46,49,50,52	0
3	SO4	A	1104	5/5	0.90	0.09	50,52,52,53	0
3	SO4	A	1105	5/5	0.90	0.10	41,44,46,47	0
2	A1H63	B	1101	30/30	0.96	0.05	11,15,20,20	0
3	SO4	B	1102	5/5	0.96	0.07	23,28,31,34	0
2	A1H63	A	1101	30/30	0.97	0.04	9,12,17,18	0
3	SO4	A	1102	5/5	0.99	0.07	15,23,26,27	0

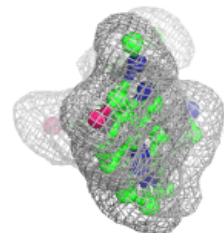
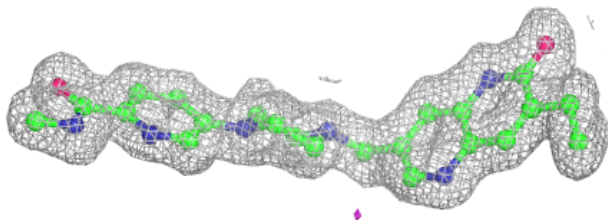
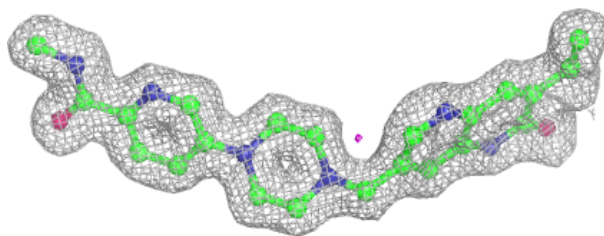
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.

**Electron density around A1H63 B 1101:**

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

**Electron density around A1H63 A 1101:**

$2mF_o-DF_c$  (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.