



# Full wwPDB X-ray Structure Validation Report ⓘ

Mar 12, 2026 – 06:55 AM UTC

PDB ID : 9H2Y / pdb\_00009h2y  
Title : Crystal structure of YTHDC1 in complex with AI\_056  
Authors : Bedi, R.K.; Caflisch, A.  
Deposited on : 2024-10-15  
Resolution : 1.24 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>.

---

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 : 2022.3.0, CSD as543be (2022)  
Xtriage (Phenix) : 2.0  
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 : 9.0.010 (Gargrove)  
Density-Fitness : 1.0.12  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.49

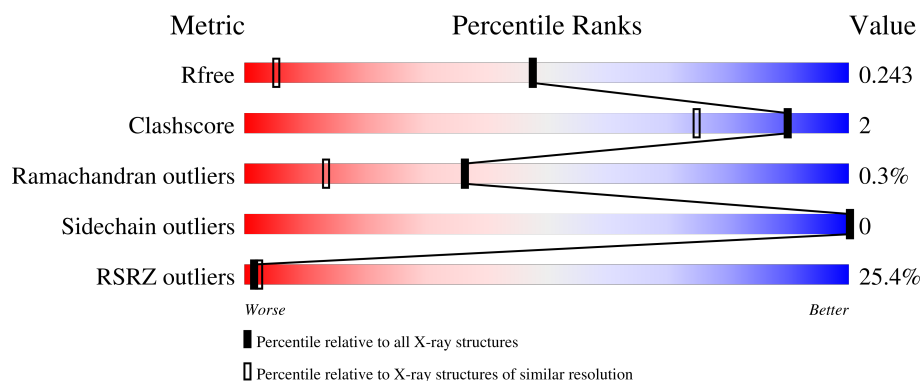
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.24 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	1630 (1.26-1.22)
Clashscore	190562	1668 (1.26-1.22)
Ramachandran outliers	187476	1635 (1.26-1.22)
Sidechain outliers	187428	1633 (1.26-1.22)
RSRZ outliers	180081	1630 (1.26-1.22)

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	166	<div> <div>25%</div> <div>93%</div> <div>5%</div> </div>
1	B	166	<div> <div>23%</div> <div>91%</div> <div>5%</div> </div>

## 2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 2850 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.

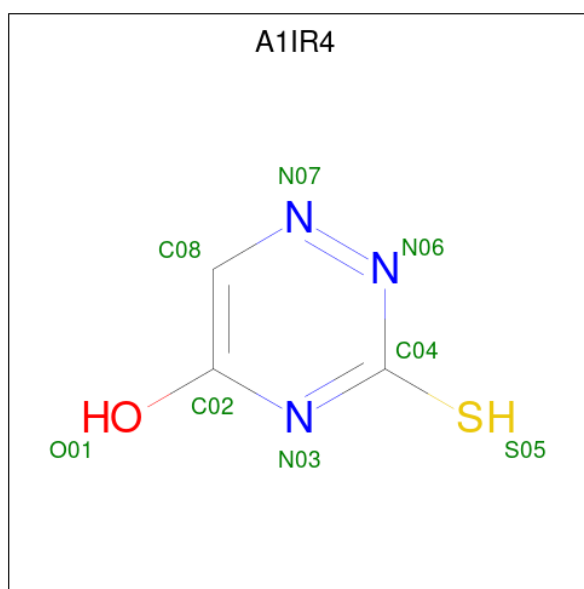
- Molecule 1 is a protein called YTH domain-containing protein 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	158	Total	C	N	O	S	0	2	0
			1239	804	218	213	4			
1	B	157	Total	C	N	O	S	0	4	0
			1241	805	214	218	4			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	344	GLY	-	expression tag	UNP Q96MU7
B	344	GLY	-	expression tag	UNP Q96MU7

- Molecule 2 is 3-sulfanyl-1,2,4-triazin-5-ol (CCD ID: A1IR4) (formula: C<sub>3</sub>H<sub>3</sub>N<sub>3</sub>OS) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	N	O	S	0	0
			8	3	3	1	1		

*Continued on next page...*

Continued from previous page...

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	A	1	Total	C	N	O	S	0	0
			8	3	3	1	1		
2	B	1	Total	C	N	O	S	0	0
			8	3	3	1	1		

- Molecule 3 is SULFATE ION (CCD ID: SO4) (formula: O<sub>4</sub>S).



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	A	1	Total	O	S	0	0
			5	4	1		
3	B	1	Total	O	S	0	0
			5	4	1		
3	B	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	137	Total	O	0	0
			137	137		

Continued on next page...

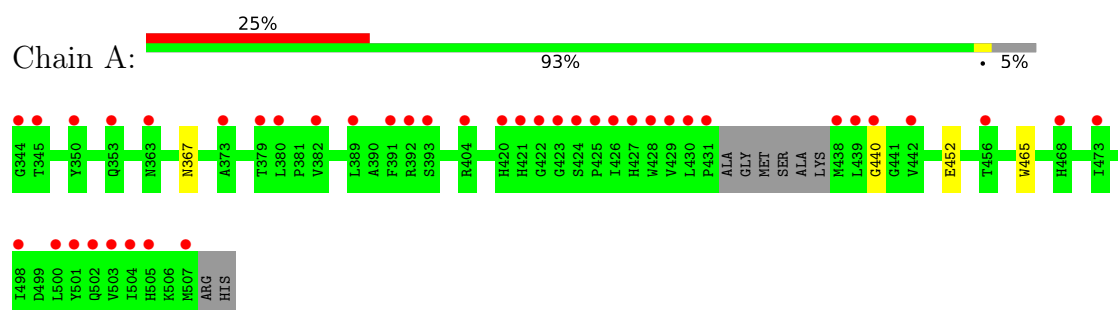
*Continued from previous page...*

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	B	179	Total	O	0	0
			179	179		

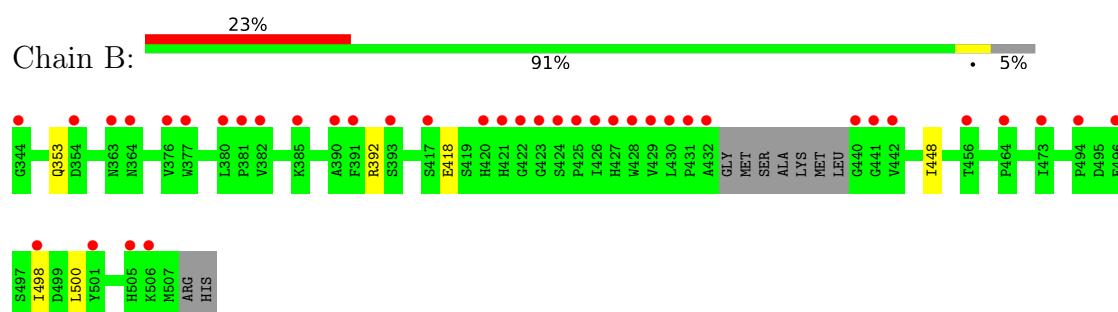
### 3 Residue-property plots [i](#)

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: YTH domain-containing protein 1



- Molecule 1: YTH domain-containing protein 1



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	39.85Å 104.01Å 41.99Å 90.00° 104.45° 90.00°	Depositor
Resolution (Å)	38.59 – 1.24 38.59 – 1.24	Depositor EDS
% Data completeness (in resolution range)	99.2 (38.59-1.24) 99.3 (38.59-1.24)	Depositor EDS
$R_{merge}$	(Not available)	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.31 (at 1.24Å)	Xtriage
Refinement program	PHENIX 1.21.1_5286	Depositor
R, $R_{free}$	0.216 , 0.243 0.215 , 0.243	Depositor DCC
$R_{free}$ test set	4667 reflections (4.96%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	21.1	Xtriage
Anisotropy	0.223	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.39 , 40.4	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	2850	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	28.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.08% 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

### 5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: A1IR4, 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	0.24	0/1277	0.45	0/1728
1	B	0.26	0/1285	0.44	0/1738
All	All	0.25	0/2562	0.44	0/3466

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	1239	0	1231	3	0
1	B	1241	0	1240	5	0
2	A	16	0	0	1	0
2	B	8	0	0	0	0
3	A	15	0	0	0	0
3	B	15	0	0	1	0
4	A	137	0	0	1	2
4	B	179	0	0	2	2
All	All	2850	0	2471	9	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 2.



All (9) 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:452:GLU:OE1	4:A:701:HOH:O	1.94	0.85
1:B:353:GLN:O	4:B:701:HOH:O	2.12	0.68
1:A:367:ASN:ND2	2:A:601:A1IR4:O01	2.32	0.52
3:B:603:SO4:O1	4:B:702:HOH:O	2.19	0.47
1:B:392:ARG:NE	1:B:418:GLU:OE2	2.48	0.45
1:B:392:ARG:NH2	1:B:418:GLU:OE1	2.54	0.41
1:B:448[B]:ILE:HG23	1:B:500:LEU:HD21	2.02	0.40
1:A:465:TRP:HA	1:A:465:TRP:CE3	2.56	0.40

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	Interatomic distance (Å)	Clash overlap (Å)
4:A:766:HOH:O	4:B:703:HOH:O[2_554]	2.16	0.04
4:A:756:HOH:O	4:B:719:HOH:O[1_455]	2.17	0.03

## 5.3 Torsion angles

### 5.3.1 Protein backbone

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	156/166 (94%)	152 (97%)	3 (2%)	1 (1%)	21	4
1	B	157/166 (95%)	155 (99%)	2 (1%)	0	100	100
All	All	313/332 (94%)	307 (98%)	5 (2%)	1 (0%)	36	13

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	440	GLY

### 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	131/145 (90%)	131 (100%)	0	100	100
1	B	134/145 (92%)	134 (100%)	0	100	100
All	All	265/290 (91%)	265 (100%)	0	100	100

There are no protein residues with a non-rotameric sidechain to report.

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	427	HIS
1	A	468	HIS

### 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](#)

9 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	A1IR4	B	601	-	7,8,8	0.95	0	8,10,10	3.19	4 (50%)
3	SO4	A	605	-	4,4,4	0.68	0	6,6,6	0.10	0
3	SO4	B	604	-	4,4,4	0.67	0	6,6,6	0.11	0
2	A1IR4	A	601	-	7,8,8	1.03	0	8,10,10	3.21	4 (50%)
3	SO4	B	602	-	4,4,4	0.60	0	6,6,6	0.31	0
3	SO4	A	604	-	4,4,4	0.59	0	6,6,6	0.15	0
3	SO4	A	603	-	4,4,4	0.60	0	6,6,6	0.21	0
3	SO4	B	603	-	4,4,4	0.60	0	6,6,6	0.26	0
2	A1IR4	A	602	-	7,8,8	0.93	0	8,10,10	3.03	4 (50%)

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	A1IR4	A	601	-	-	-	0/1/1/1
2	A1IR4	B	601	-	-	-	0/1/1/1
2	A1IR4	A	602	-	-	-	0/1/1/1

There are no bond length outliers.

All (12) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	601	A1IR4	N03-C04-N06	-5.81	120.32	126.78
2	B	601	A1IR4	N03-C04-N06	-5.70	120.44	126.78
2	A	602	A1IR4	C04-N06-N07	5.51	121.17	117.40
2	A	601	A1IR4	C04-N06-N07	5.23	120.98	117.40
2	A	602	A1IR4	N03-C04-N06	-4.97	121.26	126.78
2	B	601	A1IR4	C08-C02-N03	-4.26	120.02	122.99
2	B	601	A1IR4	C04-N06-N07	4.04	120.17	117.40
2	B	601	A1IR4	C04-N03-C02	3.58	119.41	115.00
2	A	602	A1IR4	C08-C02-N03	-3.34	120.66	122.99
2	A	601	A1IR4	C04-N03-C02	3.29	119.05	115.00
2	A	601	A1IR4	C08-C02-N03	-3.18	120.77	122.99
2	A	602	A1IR4	C04-N03-C02	2.01	117.48	115.00

There are no chirality outliers.

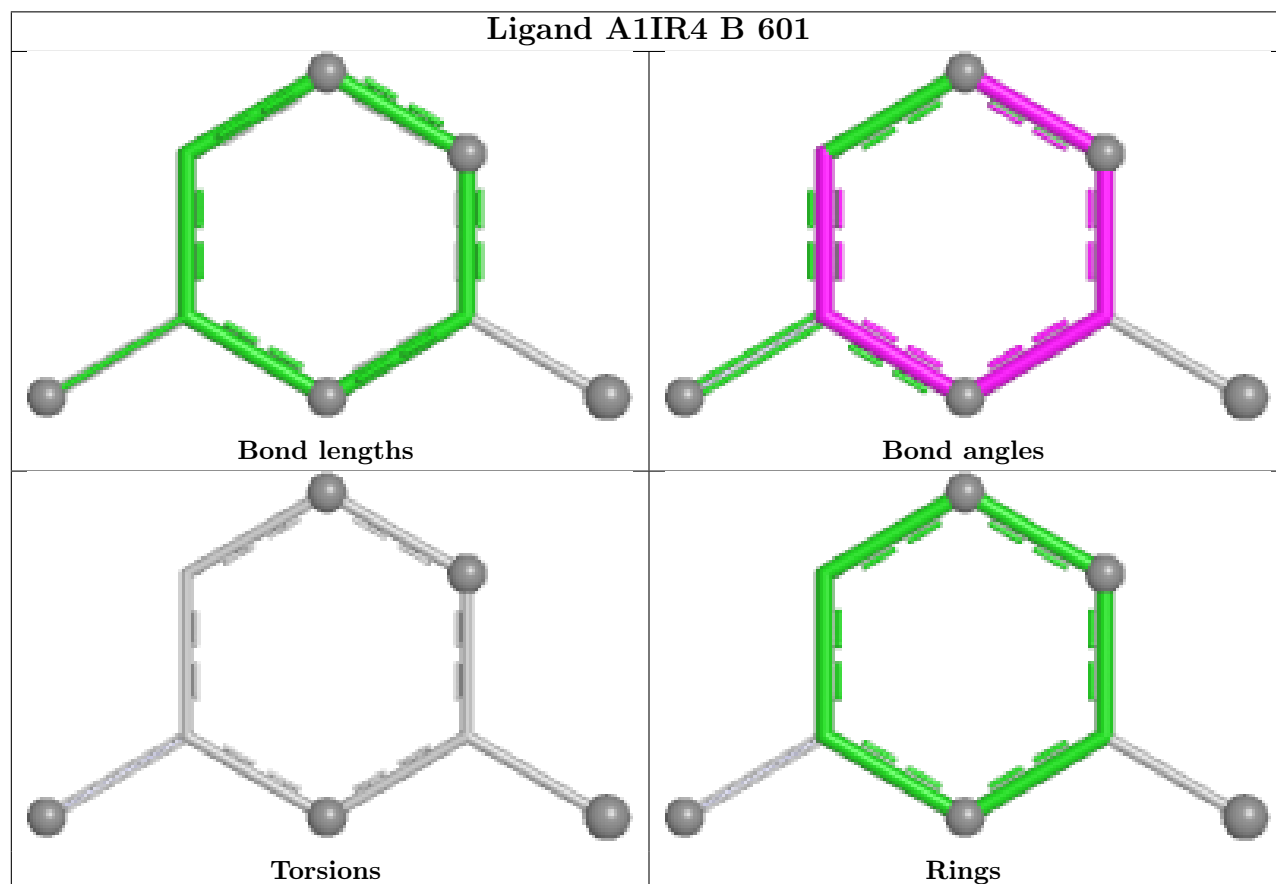
There are no torsion outliers.

There are no ring outliers.

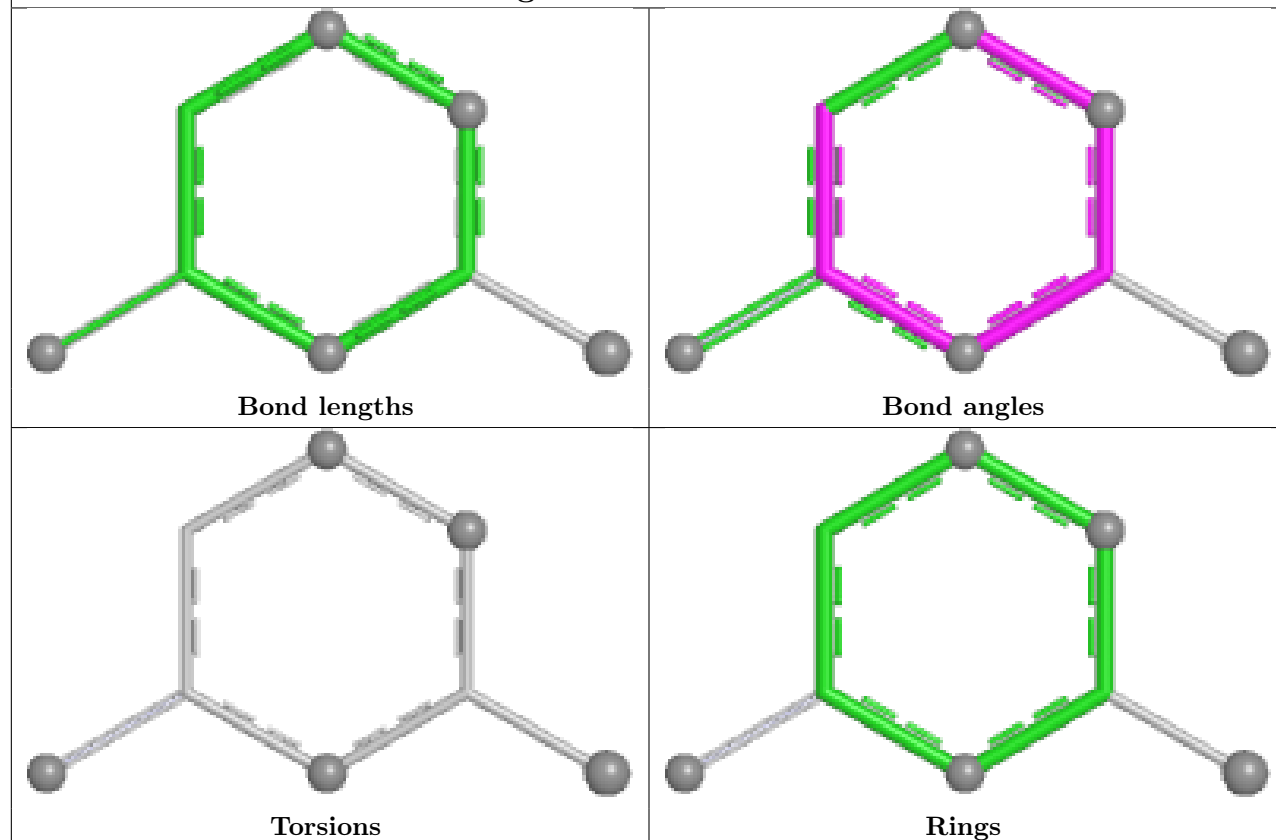
2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	601	A1IR4	1	0
3	B	603	SO4	1	0

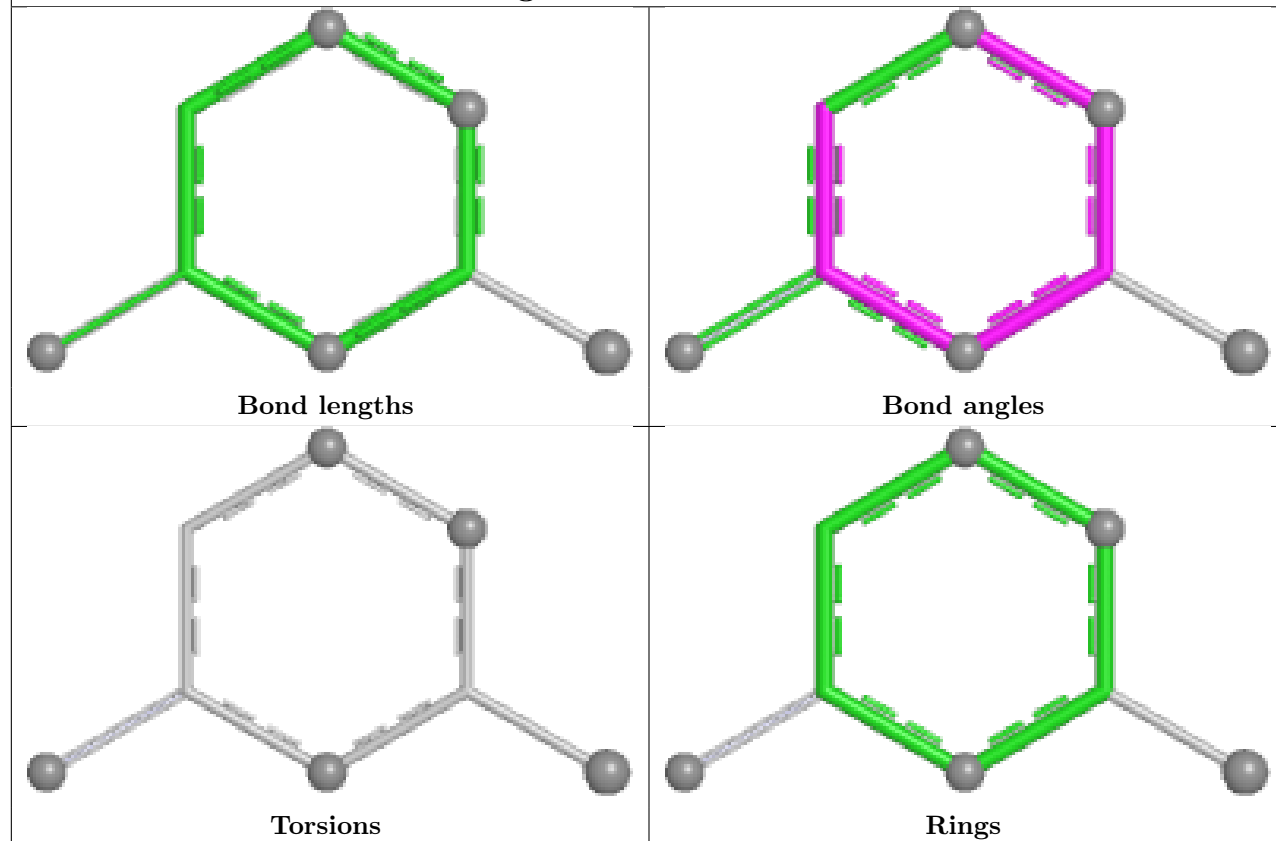
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included.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



## Ligand A1IR4 A 601



## Ligand A1IR4 A 602



## 5.7 Other polymers [i](#)

There are no such residues in this entry.

## 5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

## 6 Fit of model and data

### 6.1 Protein, DNA and RNA chains

In the following table, the column labelled ‘#RSRZ> 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95<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	158/166 (95%)	1.63	41 (25%)	<b>1</b> <b>2</b>	16, 25, 43, 67	2 (1%)
1	B	157/166 (94%)	1.59	39 (24%)	<b>2</b> <b>2</b>	12, 25, 48, 63	4 (2%)
All	All	315/332 (94%)	1.61	80 (25%)	<b>1</b> <b>2</b>	12, 25, 45, 67	6 (1%)

All (80) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	432	ALA	9.3
1	A	431	PRO	7.0
1	A	439	LEU	5.8
1	B	426	ILE	5.7
1	A	422	GLY	5.7
1	B	430	LEU	5.5
1	A	382	VAL	5.4
1	B	354	ASP	5.2
1	B	428	TRP	5.1
1	B	429	VAL	5.1
1	B	425	PRO	5.1
1	B	431	PRO	5.1
1	A	505	HIS	4.9
1	B	344	GLY	4.9
1	A	429	VAL	4.7
1	A	438	MET	4.7
1	A	440	GLY	4.4
1	A	344	GLY	4.3
1	B	380	LEU	4.2
1	A	430	LEU	4.1
1	A	421	HIS	4.1
1	B	505	HIS	4.0
1	A	425	PRO	4.0
1	A	503	VAL	3.8

*Continued on next page...*

*Continued from previous page...*

Mol	Chain	Res	Type	RSRZ
1	B	423	GLY	3.8
1	A	380	LEU	3.8
1	B	440	GLY	3.7
1	B	420	HIS	3.5
1	A	389	LEU	3.4
1	B	442	VAL	3.3
1	A	423	GLY	3.3
1	B	381	PRO	3.2
1	B	421	HIS	3.2
1	A	504	ILE	3.2
1	B	498	ILE	3.1
1	A	473	ILE	3.1
1	B	363	ASN	3.1
1	B	494	PRO	3.0
1	B	424	SER	3.0
1	A	345	THR	3.0
1	B	376	VAL	3.0
1	A	507	MET	2.9
1	B	427	HIS	2.9
1	B	441	GLY	2.8
1	A	420	HIS	2.8
1	B	422	GLY	2.8
1	A	363	ASN	2.8
1	A	501	TYR	2.7
1	B	456	THR	2.7
1	B	391	PHE	2.7
1	B	377	TRP	2.7
1	A	393	SER	2.7
1	A	424	SER	2.7
1	A	427	HIS	2.7
1	A	500	LEU	2.6
1	B	496	GLU	2.6
1	A	404	ARG	2.5
1	A	350	TYR	2.5
1	A	502	GLN	2.5
1	B	393	SER	2.5
1	B	501	TYR	2.5
1	B	390	ALA	2.5
1	A	428	TRP	2.5
1	A	426	ILE	2.4
1	A	456	THR	2.3
1	A	391	PHE	2.3

*Continued on next page...*



*Continued from previous page...*

Mol	Chain	Res	Type	RSRZ
1	B	506	LYS	2.3
1	A	373	ALA	2.2
1	B	364	ASN	2.2
1	B	473	ILE	2.2
1	B	417	SER	2.2
1	A	498	ILE	2.1
1	A	442	VAL	2.1
1	B	464	PRO	2.1
1	A	468	HIS	2.1
1	A	379	THR	2.1
1	B	382	VAL	2.1
1	B	385	LYS	2.1
1	A	353	GLN	2.0
1	A	392	ARG	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](#)

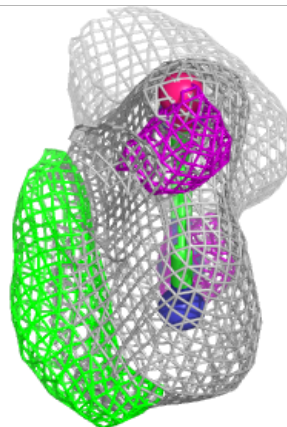
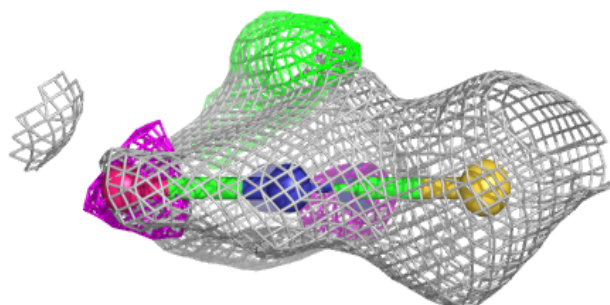
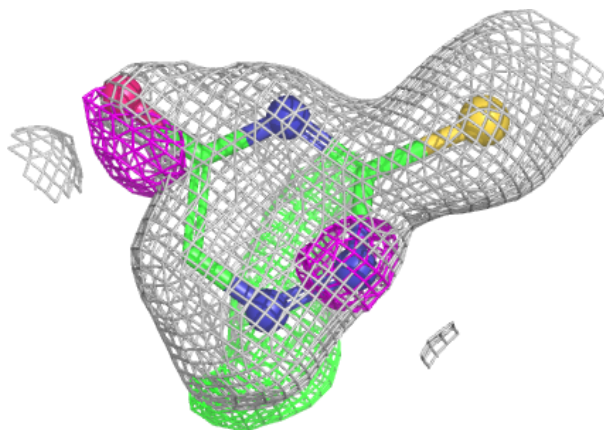
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q<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	605	5/5	0.70	0.18	48,48,51,52	0
3	SO4	B	604	5/5	0.76	0.15	47,49,52,55	0
2	A1IR4	A	601	8/8	0.83	0.13	31,35,39,41	0
2	A1IR4	A	602	8/8	0.85	0.15	42,45,51,54	0
3	SO4	A	603	5/5	0.87	0.19	28,33,36,40	0
2	A1IR4	B	601	8/8	0.90	0.12	28,31,32,33	0
3	SO4	A	604	5/5	0.91	0.10	36,41,50,51	0
3	SO4	B	603	5/5	0.94	0.12	28,30,36,39	0
3	SO4	B	602	5/5	0.96	0.09	28,28,32,32	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.

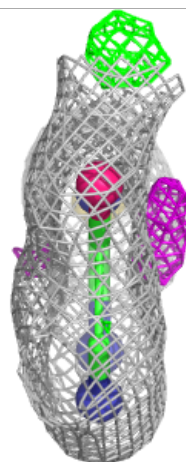
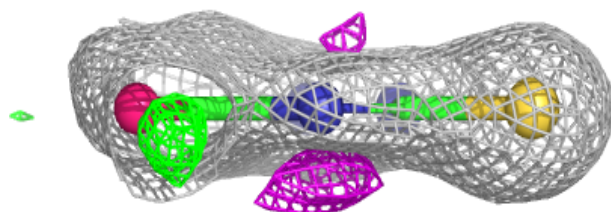
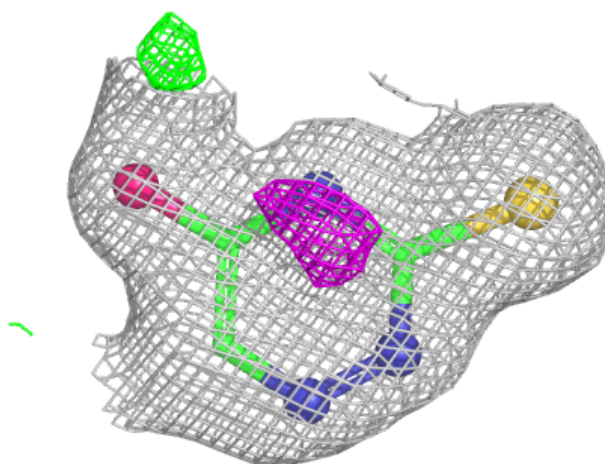
**Electron density around A1IR4 A 601:**

2mF<sub>o</sub>-DF<sub>c</sub> (at 0.7 rmsd) in gray  
mF<sub>o</sub>-DF<sub>c</sub> (at 3 rmsd) in purple (negative)  
and green (positive)



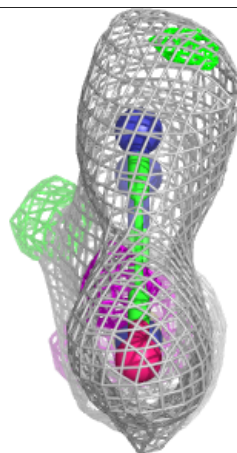
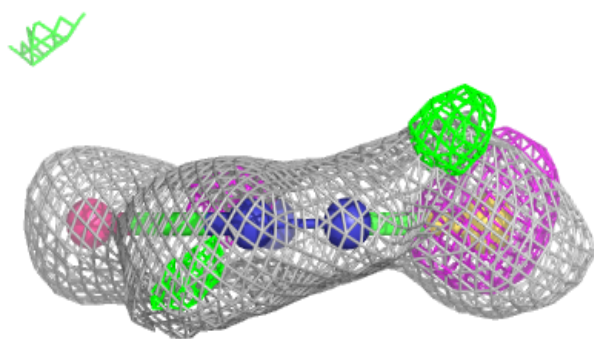
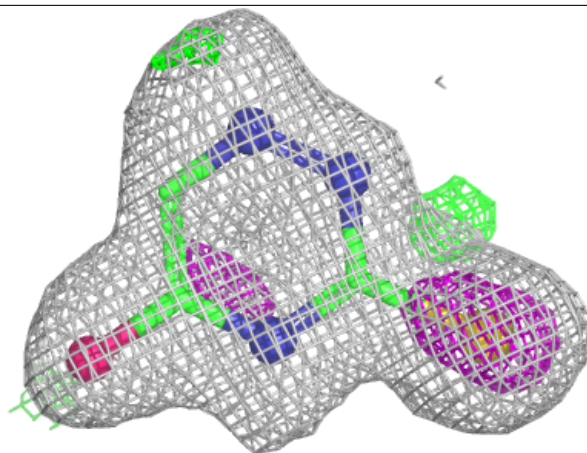
**Electron density around A1IR4 A 602:**

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



**Electron density around A1IR4 B 601:**

$2mF_o-DF_c$  (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.