



# Full wwPDB X-ray Structure Validation Report ⓘ

Oct 15, 2023 – 09:26 AM EDT

PDB ID : 8ECW  
Title : Co-crystal structure of Chaetomium glucosidase with compound 11  
Authors : Karade, S.S.; Mariuzza, R.A.  
Deposited on : 2022-09-02  
Resolution : 2.25 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 : 1.8.5 (274361), CSD as541be (2020)  
Xtriage (Phenix) : 1.13  
EDS : 2.36  
buster-report : 1.1.7 (2018)  
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)  
Refmac : 5.8.0158  
CCP4 : 7.0.044 (Gargrove)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.36

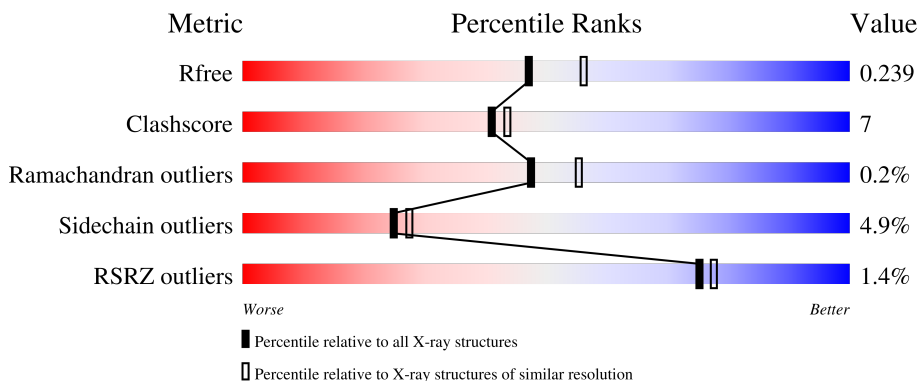
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.25 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))
$R_{free}$	130704	1377 (2.26-2.26)
Clashscore	141614	1487 (2.26-2.26)
Ramachandran outliers	138981	1449 (2.26-2.26)
Sidechain outliers	138945	1450 (2.26-2.26)
RSRZ outliers	127900	1356 (2.26-2.26)

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	819	 2% 79% 12% • 7%
1	B	819	 79% 13% • 7%

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
3	GOL	A	902	-	-	X	-
4	SO4	A	911	-	-	X	-

## 2 Entry composition [i](#)

There are 6 unique types of molecules in this entry. The entry contains 12771 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 Chaetomium alpha glucosidase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	765	6067	3899	1024	1131	13	0	0	0
1	B	764	6079	3901	1021	1144	13	0	0	0

There are 78 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-1	MET	-	initiating methionine	UNP G0SFD1
A	0	GLY	-	expression tag	UNP G0SFD1
A	1	ILE	-	expression tag	UNP G0SFD1
A	2	LEU	-	expression tag	UNP G0SFD1
A	3	PRO	-	expression tag	UNP G0SFD1
A	4	SER	-	expression tag	UNP G0SFD1
A	5	PRO	-	expression tag	UNP G0SFD1
A	6	GLY	-	expression tag	UNP G0SFD1
A	7	MET	-	expression tag	UNP G0SFD1
A	8	PRO	-	expression tag	UNP G0SFD1
A	9	ALA	-	expression tag	UNP G0SFD1
A	10	LEU	-	expression tag	UNP G0SFD1
A	11	LEU	-	expression tag	UNP G0SFD1
A	12	SER	-	expression tag	UNP G0SFD1
A	13	LEU	-	expression tag	UNP G0SFD1
A	14	VAL	-	expression tag	UNP G0SFD1
A	15	SER	-	expression tag	UNP G0SFD1
A	16	LEU	-	expression tag	UNP G0SFD1
A	17	LEU	-	expression tag	UNP G0SFD1
A	18	SER	-	expression tag	UNP G0SFD1
A	19	VAL	-	expression tag	UNP G0SFD1
A	20	LEU	-	expression tag	UNP G0SFD1
A	21	LEU	-	expression tag	UNP G0SFD1
A	22	MET	-	expression tag	UNP G0SFD1
A	23	GLY	-	expression tag	UNP G0SFD1

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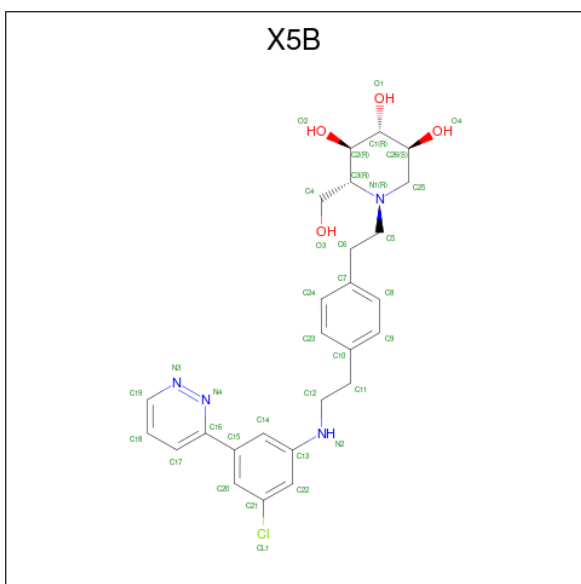
Chain	Residue	Modelled	Actual	Comment	Reference
A	24	CYS	-	expression tag	UNP G0SFD1
A	25	VAL	-	expression tag	UNP G0SFD1
A	26	ALA	-	expression tag	UNP G0SFD1
A	27	GLU	-	expression tag	UNP G0SFD1
A	28	THR	-	expression tag	UNP G0SFD1
A	29	GLY	-	expression tag	UNP G0SFD1
A	810	SER	-	expression tag	UNP G0SFD1
A	811	GLY	-	expression tag	UNP G0SFD1
A	812	HIS	-	expression tag	UNP G0SFD1
A	813	HIS	-	expression tag	UNP G0SFD1
A	814	HIS	-	expression tag	UNP G0SFD1
A	815	HIS	-	expression tag	UNP G0SFD1
A	816	HIS	-	expression tag	UNP G0SFD1
A	817	HIS	-	expression tag	UNP G0SFD1
B	-1	MET	-	initiating methionine	UNP G0SFD1
B	0	GLY	-	expression tag	UNP G0SFD1
B	1	ILE	-	expression tag	UNP G0SFD1
B	2	LEU	-	expression tag	UNP G0SFD1
B	3	PRO	-	expression tag	UNP G0SFD1
B	4	SER	-	expression tag	UNP G0SFD1
B	5	PRO	-	expression tag	UNP G0SFD1
B	6	GLY	-	expression tag	UNP G0SFD1
B	7	MET	-	expression tag	UNP G0SFD1
B	8	PRO	-	expression tag	UNP G0SFD1
B	9	ALA	-	expression tag	UNP G0SFD1
B	10	LEU	-	expression tag	UNP G0SFD1
B	11	LEU	-	expression tag	UNP G0SFD1
B	12	SER	-	expression tag	UNP G0SFD1
B	13	LEU	-	expression tag	UNP G0SFD1
B	14	VAL	-	expression tag	UNP G0SFD1
B	15	SER	-	expression tag	UNP G0SFD1
B	16	LEU	-	expression tag	UNP G0SFD1
B	17	LEU	-	expression tag	UNP G0SFD1
B	18	SER	-	expression tag	UNP G0SFD1
B	19	VAL	-	expression tag	UNP G0SFD1
B	20	LEU	-	expression tag	UNP G0SFD1
B	21	LEU	-	expression tag	UNP G0SFD1
B	22	MET	-	expression tag	UNP G0SFD1
B	23	GLY	-	expression tag	UNP G0SFD1
B	24	CYS	-	expression tag	UNP G0SFD1
B	25	VAL	-	expression tag	UNP G0SFD1
B	26	ALA	-	expression tag	UNP G0SFD1

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Chain	Residue	Modelled	Actual	Comment	Reference
B	27	GLU	-	expression tag	UNP G0SFD1
B	28	THR	-	expression tag	UNP G0SFD1
B	29	GLY	-	expression tag	UNP G0SFD1
B	810	SER	-	expression tag	UNP G0SFD1
B	811	GLY	-	expression tag	UNP G0SFD1
B	812	HIS	-	expression tag	UNP G0SFD1
B	813	HIS	-	expression tag	UNP G0SFD1
B	814	HIS	-	expression tag	UNP G0SFD1
B	815	HIS	-	expression tag	UNP G0SFD1
B	816	HIS	-	expression tag	UNP G0SFD1
B	817	HIS	-	expression tag	UNP G0SFD1

- Molecule 2 is (2R,3R,4R,5S)-1-{2-[4-(2-[(5M)-3-chloro-5-(pyridazin-3-yl)phenyl]amino)ethyl]phenyl]ethyl}-2-(hydroxymethyl)piperidine-3,4,5-triol (three-letter code: X5B) (formula: C<sub>26</sub>H<sub>31</sub>ClN<sub>4</sub>O<sub>4</sub>) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	
2	A	1	Total	C	Cl	N	O	0	0
				35	26	1	4		
2	B	1	Total	C	Cl	N	O	0	0
				35	26	1	4		

- Molecule 3 is GLYCEROL (three-letter code: GOL) (formula: C<sub>3</sub>H<sub>8</sub>O<sub>3</sub>).



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

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



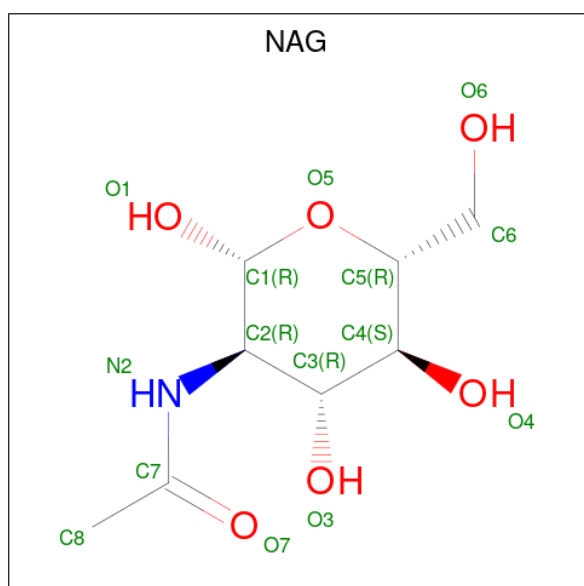
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	O	S	0	0
			5	4	1		
4	A	1	Total	O	S	0	0
			5	4	1		

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

- Molecule 5 is 2-acetamido-2-deoxy-beta-D-glucopyranose (three-letter code: NAG) (formula:  $C_8H_{15}NO_6$ ).





Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
5	B	1	Total	C	N	O	0	0
			14	8	1	5		

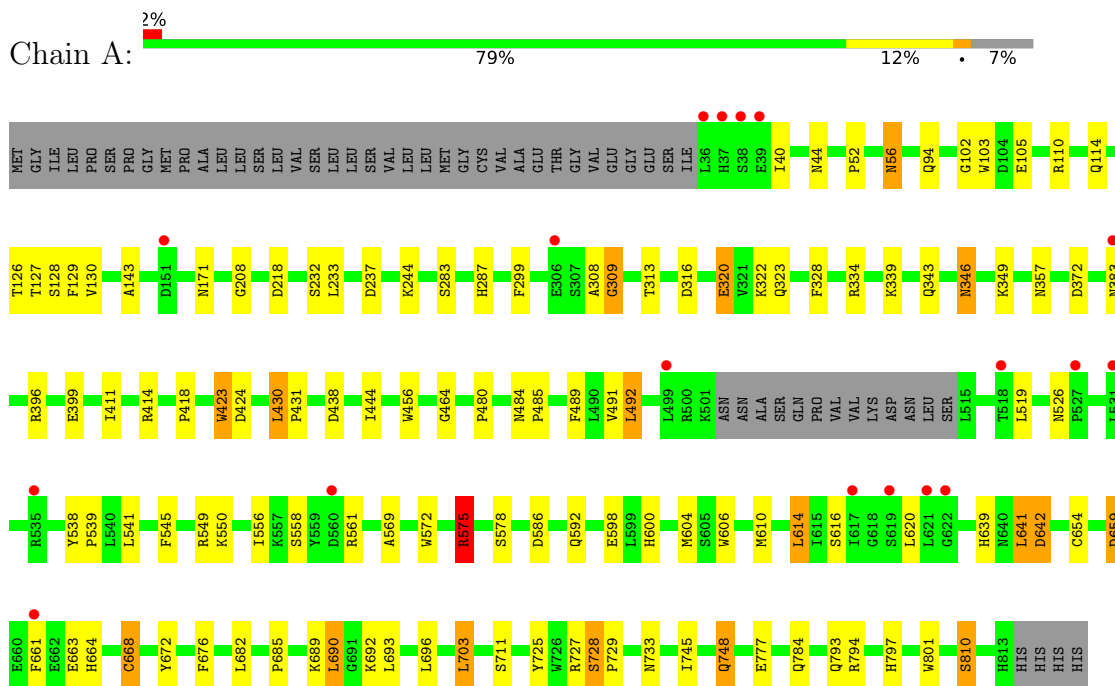
- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	223	Total	O	0	0
			223	223		
6	B	236	Total	O	0	0
			236	236		

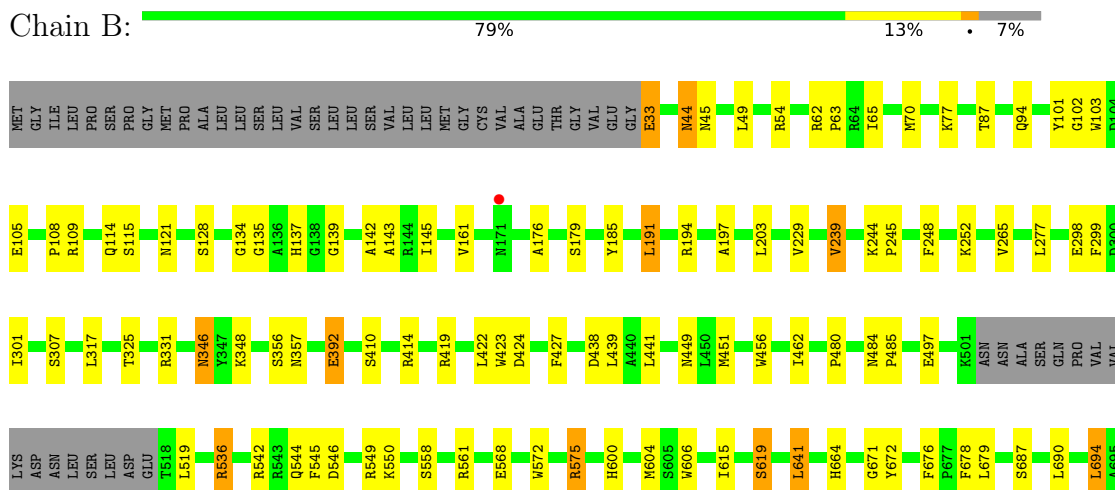
### 3 Residue-property plots

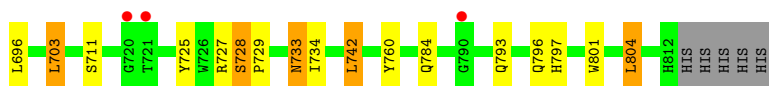
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. 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: Chaetomium alpha glucosidase



- Molecule 1: Chaetomium alpha glucosidase





## 4 Data and refinement statistics i

Property	Value	Source
Space group	I 2 2 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	136.30Å 178.68Å 179.67Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	46.77 – 2.25 46.73 – 2.25	Depositor EDS
% Data completeness (in resolution range)	99.2 (46.77-2.25) 99.3 (46.73-2.25)	Depositor EDS
$R_{merge}$	0.09	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.92 (at 2.24Å)	Xtrriage
Refinement program	REFMAC 5.8.0258	Depositor
R, $R_{free}$	0.190 , 0.238 0.190 , 0.239	Depositor DCC
$R_{free}$ test set	5087 reflections (4.92%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	39.2	Xtrriage
Anisotropy	0.323	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.34 , 27.9	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	0.009 for -h,-l,-k	Xtrriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	12771	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	41.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.78% 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: SO4, GOL, X5B, NAG

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	0.42	0/6243	0.80	5/8499 (0.1%)
1	B	0.44	0/6255	0.81	7/8513 (0.1%)
All	All	0.43	0/12498	0.81	12/17012 (0.1%)

There are no bond length outliers.

All (12) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	659	ASP	CB-CA-C	-9.38	91.64	110.40
1	B	575	ARG	CB-CA-C	7.14	124.68	110.40
1	B	239	VAL	CA-CB-CG1	7.14	121.60	110.90
1	A	575	ARG	CB-CA-C	6.73	123.85	110.40
1	B	45	ASN	CB-CA-C	6.43	123.26	110.40
1	B	536	ARG	CG-CD-NE	-6.43	98.29	111.80
1	B	733	ASN	N-CA-CB	-6.07	99.68	110.60
1	B	239	VAL	CA-CB-CG2	5.96	119.84	110.90
1	A	396	ARG	CG-CD-NE	-5.70	99.83	111.80
1	B	392	GLU	CB-CA-C	5.47	121.35	110.40
1	A	777	GLU	CB-CA-C	5.33	121.06	110.40
1	A	748	GLN	CB-CA-C	-5.30	99.80	110.40

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	6067	0	5740	84	0
1	B	6079	0	5739	85	0
2	A	35	0	0	1	0
2	B	35	0	0	0	0
3	A	6	0	8	4	0
3	B	6	0	8	0	0
4	A	50	0	0	4	0
4	B	20	0	0	0	0
5	B	14	0	13	0	0
6	A	223	0	0	2	0
6	B	236	0	0	2	0
All	All	12771	0	11508	168	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 7.

All (168) 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:654:CYS:SG	1:A:668:CYS:HB2	1.82	1.20
1:A:685:PRO:HG3	1:A:748:GLN:HE22	1.33	0.94
1:B:561:ARG:HE	1:B:664:HIS:HD2	1.17	0.91
1:B:572:TRP:H	1:B:600:HIS:HD2	1.18	0.91
1:A:383:ASN:HB2	6:A:1027:HOH:O	1.70	0.90
1:B:346:ASN:HD22	1:B:346:ASN:H	1.24	0.85
1:A:561:ARG:HE	1:A:664:HIS:HD2	1.27	0.82
1:A:550:LYS:HE3	6:B:1028:HOH:O	1.80	0.81
1:A:572:TRP:H	1:A:600:HIS:HD2	1.29	0.79
1:A:114:GLN:HE22	1:A:414:ARG:HH22	1.37	0.73
1:A:423:TRP:H	1:A:484:ASN:HD22	1.37	0.73
1:A:784:GLN:HE21	1:A:793:GLN:HE21	1.37	0.72
1:B:346:ASN:HD22	1:B:346:ASN:N	1.89	0.71
1:A:423:TRP:H	1:A:484:ASN:ND2	1.90	0.70
1:B:65:ILE:HD13	1:B:197:ALA:HB1	1.74	0.70
1:A:208:GLY:HA2	3:A:902:GOL:H12	1.71	0.70
1:B:572:TRP:H	1:B:600:HIS:CD2	2.06	0.69
1:B:135:GLY:HA3	1:B:307:SER:HB3	1.74	0.68
1:A:784:GLN:NE2	1:A:793:GLN:HE21	1.91	0.68
1:B:542:ARG:NH2	1:B:546:ASP:OD1	2.27	0.68

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:114:GLN:NE2	1:B:414:ARG:HH12	1.92	0.67
1:A:578:SER:N	4:A:911:SO4:O1	2.27	0.67
1:B:137:HIS:HD2	1:B:307:SER:OG	1.78	0.67
1:A:346:ASN:H	1:A:346:ASN:HD22	1.43	0.66
1:B:561:ARG:HE	1:B:664:HIS:CD2	2.08	0.66
1:A:561:ARG:HE	1:A:664:HIS:CD2	2.12	0.65
1:B:137:HIS:CD2	1:B:307:SER:OG	2.49	0.65
1:B:103:TRP:H	1:B:357:ASN:ND2	1.96	0.64
1:A:642:ASP:OD2	1:A:689:LYS:HE2	1.98	0.64
1:A:171:ASN:N	4:A:903:SO4:O3	2.26	0.62
1:A:456:TRP:CE2	1:A:480:PRO:HA	2.34	0.62
1:B:135:GLY:CA	1:B:307:SER:HB3	2.29	0.62
1:B:33:GLU:HB3	1:B:536:ARG:HH21	1.65	0.61
1:A:659:ASP:HB2	1:A:663:GLU:H	1.66	0.61
1:B:87:THR:HB	1:B:121:ASN:HD21	1.65	0.60
1:A:126:THR:HG22	6:A:1124:HOH:O	2.02	0.60
1:B:696:LEU:HG	1:B:703:LEU:HD22	1.82	0.60
1:A:299:PHE:HA	3:A:902:GOL:H11	1.84	0.60
1:B:671:GLY:HA2	1:B:703:LEU:HD11	1.85	0.58
1:A:604:MET:SD	1:A:641:LEU:HD13	2.44	0.57
1:B:561:ARG:NE	1:B:664:HIS:HD2	1.96	0.57
1:B:62:ARG:HD2	1:B:70:MET:HE3	1.85	0.57
1:B:105:GLU:OE2	1:B:325:THR:HG23	2.04	0.57
1:A:128:SER:O	1:A:143:ALA:HA	2.05	0.57
1:B:94:GLN:OE1	1:B:797:HIS:HE1	1.89	0.56
1:B:427:PHE:CE2	1:B:733:ASN:OD1	2.59	0.56
1:A:569:ALA:HA	1:A:604:MET:CE	2.37	0.54
1:B:728:SER:N	1:B:729:PRO:CD	2.70	0.54
1:A:208:GLY:HA2	3:A:902:GOL:C1	2.37	0.54
1:B:77:LYS:H	1:B:121:ASN:ND2	2.06	0.54
1:B:485:PRO:HB3	1:B:606:TRP:CE2	2.42	0.54
1:A:114:GLN:NE2	1:A:414:ARG:HH12	2.06	0.54
1:A:411:ILE:HD12	1:A:418:PRO:HA	1.89	0.54
1:B:728:SER:N	1:B:729:PRO:HD3	2.22	0.54
1:A:545:PHE:CZ	1:A:549:ARG:HD2	2.42	0.54
1:A:696:LEU:HG	1:A:703:LEU:HD22	1.90	0.54
1:B:77:LYS:HG2	1:B:121:ASN:HD22	1.72	0.54
1:A:103:TRP:H	1:A:357:ASN:ND2	2.05	0.53
1:B:456:TRP:CE2	1:B:480:PRO:HA	2.43	0.53
1:A:690:LEU:HD11	1:A:745:ILE:HD11	1.90	0.53
1:A:110:ARG:NH2	1:A:323:GLN:HG3	2.23	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:54:ARG:NE	1:B:70:MET:HE1	2.24	0.52
1:B:44:ASN:ND2	1:B:109:ARG:HH12	2.07	0.52
1:B:727:ARG:O	1:B:728:SER:HB3	2.09	0.52
1:B:114:GLN:HE22	1:B:414:ARG:HH22	1.58	0.52
1:B:44:ASN:HD21	1:B:109:ARG:HH22	1.58	0.51
1:B:456:TRP:CD2	1:B:480:PRO:HA	2.46	0.51
1:A:733:ASN:HB3	1:A:801:TRP:CG	2.45	0.51
1:B:33:GLU:CB	1:B:536:ARG:HH21	2.23	0.51
1:A:672:TYR:CZ	1:A:711:SER:HA	2.45	0.51
1:A:56:ASN:H	1:A:56:ASN:HD22	1.58	0.51
1:A:578:SER:HB2	4:A:911:SO4:O2	2.11	0.51
1:B:77:LYS:HG2	1:B:121:ASN:ND2	2.25	0.51
1:B:62:ARG:HB3	1:B:70:MET:HG2	1.93	0.50
1:B:451:MET:CE	1:B:544:GLN:HB2	2.41	0.50
1:A:654:CYS:SG	1:A:668:CYS:CB	2.77	0.50
1:B:179:SER:HB3	1:B:185:TYR:CD2	2.47	0.50
1:B:103:TRP:H	1:B:357:ASN:HD21	1.58	0.50
1:A:598:GLU:OE2	1:A:600:HIS:HE1	1.95	0.50
1:B:545:PHE:CZ	1:B:549:ARG:HD2	2.47	0.49
1:A:444:ILE:HD13	1:A:492:LEU:HD13	1.94	0.49
1:A:299:PHE:HA	3:A:902:GOL:C1	2.42	0.49
1:A:586:ASP:OD1	2:A:901:X5B:O4	2.30	0.49
1:B:128:SER:O	1:B:143:ALA:HA	2.13	0.49
1:A:456:TRP:CD2	1:A:480:PRO:HA	2.48	0.49
1:B:451:MET:HE2	1:B:544:GLN:HB2	1.93	0.49
1:B:728:SER:H	1:B:729:PRO:CD	2.26	0.49
1:B:346:ASN:H	1:B:346:ASN:ND2	2.02	0.48
1:B:248:PHE:O	1:B:252:LYS:HG3	2.14	0.48
1:B:575:ARG:HE	1:B:575:ARG:HB2	1.55	0.48
1:B:62:ARG:HD2	1:B:70:MET:CE	2.44	0.47
1:A:672:TYR:CE1	1:A:711:SER:HA	2.50	0.47
1:A:346:ASN:HD22	1:A:346:ASN:N	2.11	0.47
1:A:102:GLY:HA3	1:A:357:ASN:HD21	1.78	0.47
1:B:672:TYR:CE1	1:B:711:SER:HA	2.50	0.47
1:B:784:GLN:HE21	1:B:793:GLN:HE21	1.61	0.47
1:A:232:SER:OG	1:A:287:HIS:HD2	1.96	0.47
1:A:485:PRO:HB3	1:A:606:TRP:CE2	2.50	0.47
1:B:108:PRO:HG2	1:B:439:LEU:HD22	1.96	0.47
1:B:801:TRP:HB2	1:B:804:LEU:HD22	1.97	0.47
1:A:575:ARG:HH22	1:A:592:GLN:HE22	1.63	0.47
1:B:145:ILE:O	1:B:298:GLU:HA	2.15	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:233:LEU:HD22	1:B:265:VAL:HG23	1.97	0.46
1:A:430:LEU:HD13	1:A:491:VAL:HG22	1.98	0.46
1:A:94:GLN:OE1	1:A:797:HIS:HE1	1.98	0.46
1:A:339:LYS:HE3	1:A:810:SER:O	2.15	0.46
1:B:134:GLY:O	1:B:139:GLY:HA2	2.16	0.46
1:A:572:TRP:N	1:A:600:HIS:HD2	2.07	0.46
1:B:161:VAL:HG11	1:B:299:PHE:HE1	1.81	0.46
1:B:244:LYS:HB3	1:B:245:PRO:HD3	1.98	0.46
1:A:114:GLN:HE21	1:A:414:ARG:HH12	1.63	0.46
1:B:422:LEU:HB3	1:B:484:ASN:HD22	1.81	0.45
1:B:742:LEU:HB3	1:B:760:TYR:HB2	1.98	0.45
1:B:203:LEU:HD11	1:B:301:ILE:CG2	2.46	0.45
1:A:110:ARG:HH21	1:A:323:GLN:HG3	1.81	0.45
1:A:728:SER:N	1:A:729:PRO:CD	2.79	0.45
1:B:796:GLN:O	1:B:797:HIS:HB2	2.17	0.45
1:B:672:TYR:CG	1:B:734:ILE:HG21	2.51	0.45
1:B:801:TRP:O	1:B:804:LEU:HB2	2.17	0.45
1:A:130:VAL:HG21	1:A:320:GLU:HB3	1.98	0.45
1:A:654:CYS:HG	1:A:668:CYS:HB2	1.74	0.45
1:B:102:GLY:CA	1:B:357:ASN:HD21	2.30	0.45
1:B:542:ARG:HH21	1:B:546:ASP:CG	2.20	0.45
1:A:103:TRP:H	1:A:357:ASN:HD21	1.65	0.44
1:A:105:GLU:HG2	1:A:328:PHE:CD2	2.53	0.44
1:A:114:GLN:HB3	1:A:127:THR:OG1	2.18	0.44
1:B:346:ASN:N	1:B:346:ASN:ND2	2.60	0.44
1:B:687:SER:O	1:B:690:LEU:HB3	2.18	0.44
1:B:229:VAL:HG21	1:B:277:LEU:O	2.18	0.43
1:A:372:ASP:HA	1:A:399:GLU:HA	2.00	0.43
1:A:232:SER:OG	1:A:287:HIS:CD2	2.72	0.43
1:A:641:LEU:HD12	1:A:641:LEU:HA	1.91	0.43
1:A:639:HIS:O	1:A:642:ASP:HB2	2.17	0.43
1:A:572:TRP:H	1:A:600:HIS:CD2	2.20	0.43
1:A:659:ASP:HB3	1:A:661:PHE:H	1.83	0.43
1:B:419:ARG:HD2	1:B:462:ILE:HG12	2.00	0.43
1:A:614:LEU:HD12	1:A:614:LEU:HA	1.85	0.43
1:B:615:ILE:O	1:B:619:SER:HB3	2.18	0.42
1:A:464:GLY:HA2	4:A:908:SO4:O1	2.18	0.42
1:A:784:GLN:HE21	1:A:793:GLN:NE2	2.11	0.42
1:A:620:LEU:HD12	1:A:620:LEU:HA	1.91	0.42
1:A:52:PRO:HD3	1:A:129:PHE:CE2	2.55	0.42
1:A:423:TRP:N	1:A:484:ASN:HD22	2.12	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:101:TYR:HA	1:B:115:SER:O	2.19	0.42
1:B:604:MET:SD	1:B:641:LEU:HD13	2.59	0.42
1:A:40:ILE:HD13	1:A:40:ILE:HA	1.90	0.42
1:A:313:THR:O	1:A:316:ASP:HB2	2.20	0.42
1:A:492:LEU:HD12	1:A:492:LEU:HA	1.89	0.42
1:A:489:PHE:CZ	1:A:610:MET:HE2	2.54	0.41
1:A:561:ARG:NE	1:A:664:HIS:HD2	2.06	0.41
1:A:727:ARG:O	1:A:728:SER:HB3	2.20	0.41
1:A:538:TYR:HB3	1:A:539:PRO:HD3	2.03	0.41
1:B:672:TYR:CZ	1:B:711:SER:HA	2.55	0.41
1:B:550:LYS:NZ	6:B:1010:HOH:O	2.53	0.41
1:B:102:GLY:HA3	1:B:357:ASN:HD21	1.85	0.41
1:A:430:LEU:CB	1:A:431:PRO:HD3	2.51	0.41
1:A:569:ALA:HA	1:A:604:MET:HE1	2.02	0.41
1:B:105:GLU:HA	1:B:356:SER:OG	2.21	0.41
1:B:519:LEU:HD23	1:B:519:LEU:HA	1.91	0.41
1:B:694:LEU:HD12	1:B:694:LEU:HA	1.88	0.41
1:A:308:ALA:O	1:A:309:GLY:O	2.38	0.41
1:B:784:GLN:NE2	1:B:793:GLN:HE21	2.19	0.40
1:B:176:ALA:HA	1:B:191:LEU:HD12	2.03	0.40
1:B:678:PHE:HZ	1:B:742:LEU:HD13	1.86	0.40
1:A:556:ILE:HG23	1:A:561:ARG:HB3	2.02	0.40
1:B:49:LEU:O	1:B:63:PRO:HA	2.21	0.40
1:B:142:ALA:HB3	1:B:317:LEU:HD13	2.04	0.40
1:B:568:GLU:O	1:B:604:MET:HE1	2.22	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	761/819 (93%)	742 (98%)	17 (2%)	2 (0%)	41 46

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
1	B	760/819 (93%)	742 (98%)	17 (2%)	1 (0%)	51 60
All	All	1521/1638 (93%)	1484 (98%)	34 (2%)	3 (0%)	47 55

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	728	SER
1	B	728	SER
1	A	309	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	627/707 (89%)	591 (94%)	36 (6%)	20 20
1	B	632/707 (89%)	606 (96%)	26 (4%)	30 36
All	All	1259/1414 (89%)	1197 (95%)	62 (5%)	25 27

All (62) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	44	ASN
1	A	56	ASN
1	A	218	ASP
1	A	237	ASP
1	A	244	LYS
1	A	283	SER
1	A	320	GLU
1	A	322	LYS
1	A	334	ARG
1	A	343	GLN
1	A	346	ASN
1	A	349	LYS
1	A	423	TRP

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<b>Mol</b>	<b>Chain</b>	<b>Res</b>	<b>Type</b>
1	A	424	ASP
1	A	430	LEU
1	A	438	ASP
1	A	492	LEU
1	A	519	LEU
1	A	526	ASN
1	A	541	LEU
1	A	558	SER
1	A	575	ARG
1	A	614	LEU
1	A	616	SER
1	A	641	LEU
1	A	642	ASP
1	A	668	CYS
1	A	676	PHE
1	A	682	LEU
1	A	690	LEU
1	A	692	LYS
1	A	693	LEU
1	A	703	LEU
1	A	725	TYR
1	A	794	ARG
1	A	810	SER
1	B	33	GLU
1	B	44	ASN
1	B	191	LEU
1	B	194	ARG
1	B	239	VAL
1	B	331	ARG
1	B	346	ASN
1	B	348	LYS
1	B	392	GLU
1	B	410	SER
1	B	423	TRP
1	B	424	ASP
1	B	438	ASP
1	B	441	LEU
1	B	449	ASN
1	B	497	GLU
1	B	558	SER
1	B	619	SER
1	B	641	LEU

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Mol	Chain	Res	Type
1	B	676	PHE
1	B	679	LEU
1	B	694	LEU
1	B	703	LEU
1	B	725	TYR
1	B	742	LEU
1	B	804	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (46) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	44	ASN
1	A	45	ASN
1	A	56	ASN
1	A	85	GLN
1	A	114	GLN
1	A	137	HIS
1	A	157	GLN
1	A	167	GLN
1	A	214	GLN
1	A	287	HIS
1	A	346	ASN
1	A	357	ASN
1	A	368	HIS
1	A	383	ASN
1	A	398	GLN
1	A	484	ASN
1	A	494	ASN
1	A	526	ASN
1	A	544	GLN
1	A	592	GLN
1	A	600	HIS
1	A	664	HIS
1	A	741	GLN
1	A	748	GLN
1	A	784	GLN
1	A	797	HIS
1	B	44	ASN
1	B	46	GLN
1	B	94	GLN
1	B	114	GLN
1	B	121	ASN

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Mol	Chain	Res	Type
1	B	137	HIS
1	B	157	GLN
1	B	167	GLN
1	B	200	ASN
1	B	287	HIS
1	B	323	GLN
1	B	346	ASN
1	B	357	ASN
1	B	476	GLN
1	B	484	ASN
1	B	600	HIS
1	B	664	HIS
1	B	748	GLN
1	B	784	GLN
1	B	797	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 monosaccharides in this entry.

### 5.6 Ligand geometry [i](#)

19 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
4	SO4	A	908	-	4,4,4	0.52	0	6,6,6	0.27	0
4	SO4	A	905	-	4,4,4	0.26	0	6,6,6	0.10	0
4	SO4	A	904	-	4,4,4	0.34	0	6,6,6	0.06	0
4	SO4	B	906	-	4,4,4	0.37	0	6,6,6	0.18	0
2	X5B	B	901	-	38,38,38	3.07	10 (26%)	50,52,52	1.30	6 (12%)
4	SO4	A	903	-	4,4,4	0.36	0	6,6,6	0.13	0
4	SO4	B	905	-	4,4,4	0.32	0	6,6,6	0.07	0
4	SO4	A	912	-	4,4,4	0.29	0	6,6,6	0.09	0
4	SO4	B	907	-	4,4,4	0.27	0	6,6,6	0.11	0
3	GOL	A	902	-	5,5,5	0.24	0	5,5,5	0.77	0
4	SO4	B	904	-	4,4,4	0.45	0	6,6,6	0.23	0
4	SO4	A	906	-	4,4,4	0.38	0	6,6,6	0.10	0
4	SO4	A	907	-	4,4,4	0.29	0	6,6,6	0.06	0
2	X5B	A	901	-	38,38,38	2.89	7 (18%)	50,52,52	1.29	6 (12%)
4	SO4	A	911	-	4,4,4	0.36	0	6,6,6	0.10	0
4	SO4	A	910	-	4,4,4	0.32	0	6,6,6	0.17	0
4	SO4	A	909	-	4,4,4	0.34	0	6,6,6	0.08	0
5	NAG	B	902	1	14,14,15	1.10	1 (7%)	17,19,21	1.70	3 (17%)
3	GOL	B	903	-	5,5,5	0.44	0	5,5,5	0.58	0

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	X5B	A	901	-	-	1/17/37/37	0/4/4/4
3	GOL	A	902	-	-	4/4/4/4	-
2	X5B	B	901	-	-	0/17/37/37	0/4/4/4
5	NAG	B	902	1	-	0/6/23/26	0/1/1/1
3	GOL	B	903	-	-	2/4/4/4	-

All (18) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	901	X5B	C5-N1	-15.64	1.19	1.47
2	A	901	X5B	C5-N1	-14.71	1.21	1.47
2	B	901	X5B	C26-C1	-6.42	1.43	1.52
2	A	901	X5B	C26-C1	-5.05	1.45	1.52
2	A	901	X5B	C15-C16	3.70	1.54	1.48
2	A	901	X5B	C13-N2	3.16	1.47	1.38

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	901	X5B	O1-C1	2.96	1.50	1.43
2	B	901	X5B	C2-C1	-2.91	1.44	1.52
2	B	901	X5B	C16-N4	-2.74	1.29	1.34
2	A	901	X5B	C25-C26	2.70	1.56	1.52
2	B	901	X5B	C15-C16	2.66	1.53	1.48
2	B	901	X5B	C13-N2	2.65	1.46	1.38
2	B	901	X5B	C20-C15	-2.60	1.35	1.39
2	B	901	X5B	C3-N1	-2.58	1.42	1.48
2	B	901	X5B	C25-N1	-2.51	1.43	1.47
2	B	901	X5B	C22-C13	-2.19	1.35	1.39
2	A	901	X5B	C2-C1	-2.07	1.47	1.52
5	B	902	NAG	O7-C7	-2.06	1.18	1.23

All (15) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	B	902	NAG	C1-O5-C5	5.06	119.04	112.19
2	A	901	X5B	C19-N3-N4	4.32	122.48	118.99
2	B	901	X5B	C19-N3-N4	4.32	122.48	118.99
2	B	901	X5B	C16-N4-N3	2.92	123.19	119.11
5	B	902	NAG	C1-C2-N2	-2.68	105.91	110.49
2	A	901	X5B	C15-C16-N4	2.65	120.09	115.97
2	A	901	X5B	C4-C3-C2	-2.56	108.97	112.90
2	B	901	X5B	C18-C19-N3	-2.38	118.31	123.46
2	A	901	X5B	C25-C26-C1	2.36	112.93	110.24
2	B	901	X5B	C22-C21-CL1	2.33	122.06	119.15
2	B	901	X5B	C12-C11-C10	-2.31	107.52	112.87
5	B	902	NAG	O3-C3-C2	-2.27	104.76	109.47
2	B	901	X5B	C15-C16-N4	2.21	119.40	115.97
2	A	901	X5B	C16-N4-N3	2.07	122.00	119.11
2	A	901	X5B	C25-N1-C3	2.01	114.36	109.69

There are no chirality outliers.

All (7) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	902	GOL	O1-C1-C2-C3
3	B	903	GOL	O1-C1-C2-C3
3	A	902	GOL	O2-C2-C3-O3
3	A	902	GOL	C1-C2-C3-O3
3	A	902	GOL	O1-C1-C2-O2
3	B	903	GOL	O1-C1-C2-O2

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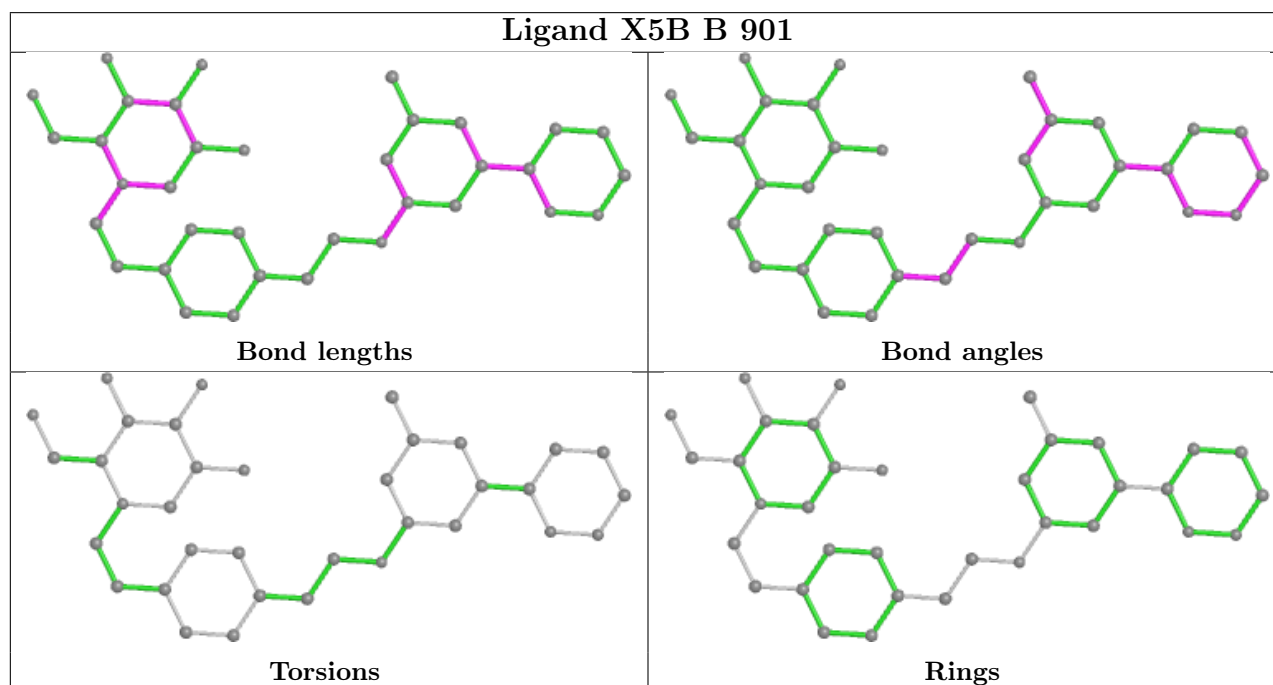
Mol	Chain	Res	Type	Atoms
2	A	901	X5B	C11-C12-N2-C13

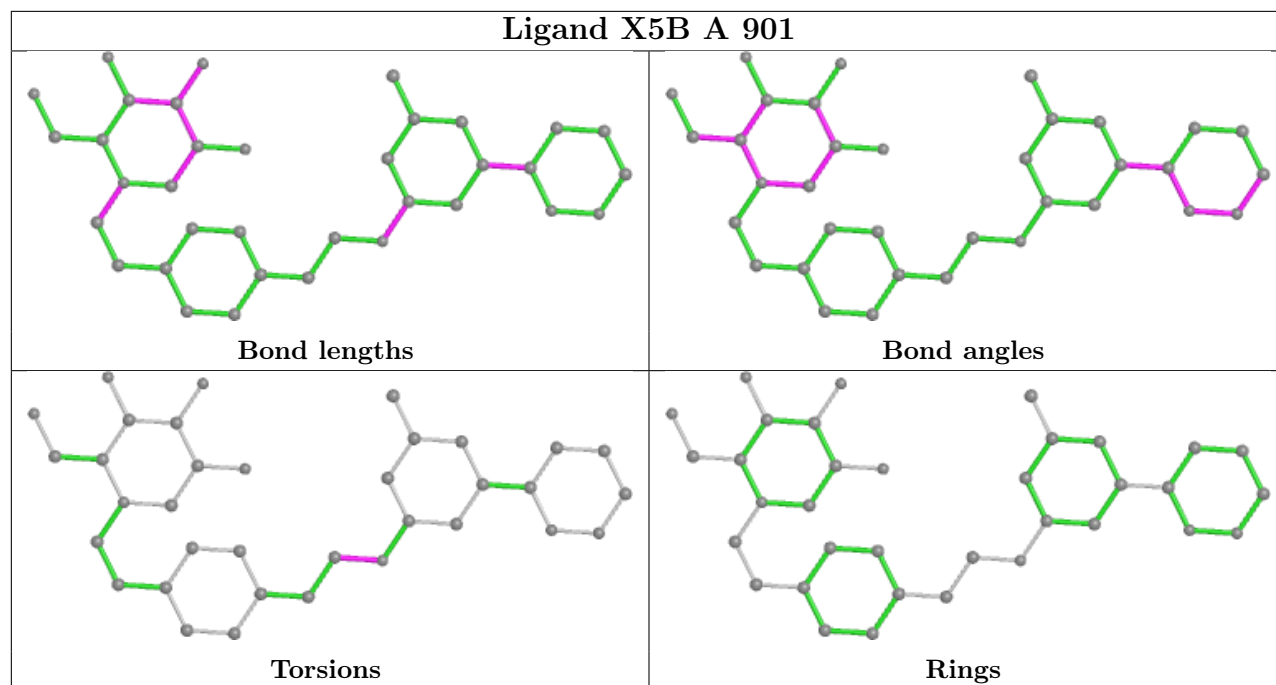
There are no ring outliers.

5 monomers are involved in 9 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	908	SO4	1	0
4	A	903	SO4	1	0
3	A	902	GOL	4	0
2	A	901	X5B	1	0
4	A	911	SO4	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 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, 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	765/819 (93%)	-0.23	18 (2%) 59 62	25, 38, 63, 92	0
1	B	764/819 (93%)	-0.38	4 (0%) 91 91	24, 38, 60, 82	0
All	All	1529/1638 (93%)	-0.31	22 (1%) 75 77	24, 38, 61, 92	0

All (22) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	36	LEU	3.8
1	A	560	ASP	3.8
1	A	37	HIS	3.5
1	A	621	LEU	3.4
1	A	531	LEU	3.2
1	A	535	ARG	2.7
1	B	171	ASN	2.6
1	A	617	ILE	2.6
1	A	38	SER	2.5
1	A	383	ASN	2.5
1	A	39	GLU	2.5
1	B	721	THR	2.3
1	A	661	PHE	2.3
1	A	151	ASP	2.2
1	A	518	THR	2.1
1	A	622	GLY	2.1
1	A	306	GLU	2.1
1	A	527	PRO	2.1
1	A	619	SER	2.1
1	B	720	GLY	2.1
1	A	499	LEU	2.0
1	B	790	GLY	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 monosaccharides in this entry.

## 6.4 Ligands [i](#)

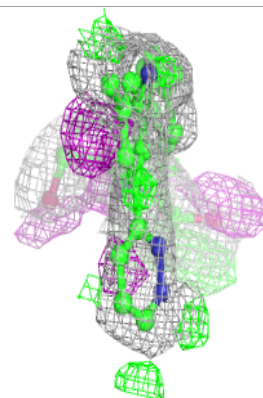
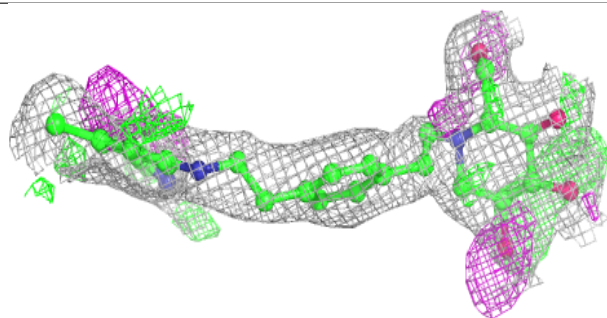
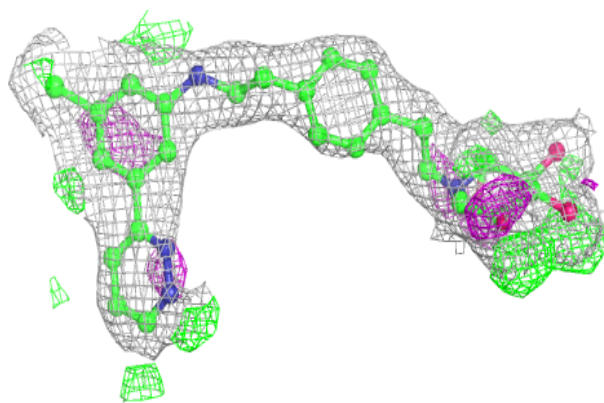
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95<sup>th</sup> percentile and maximum values of B factors of atoms in the group. The column labelled 'Q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

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å <sup>2</sup> )	Q<0.9
3	GOL	A	902	6/6	0.81	0.17	51,60,67,67	0
5	NAG	B	902	14/15	0.82	0.23	55,68,73,77	0
2	X5B	A	901	35/35	0.84	0.24	23,45,86,89	0
4	SO4	A	906	5/5	0.85	0.29	122,122,129,136	0
4	SO4	A	907	5/5	0.86	0.33	101,104,109,114	0
4	SO4	A	910	5/5	0.90	0.21	75,90,93,99	0
4	SO4	A	904	5/5	0.91	0.35	102,102,110,113	0
4	SO4	A	912	5/5	0.92	0.28	86,95,100,100	0
4	SO4	A	903	5/5	0.92	0.19	91,99,110,111	0
3	GOL	B	903	6/6	0.94	0.20	28,36,42,49	0
4	SO4	A	911	5/5	0.94	0.13	76,78,87,89	0
2	X5B	B	901	35/35	0.96	0.13	26,44,96,103	0
4	SO4	A	905	5/5	0.96	0.14	64,66,79,85	0
4	SO4	B	905	5/5	0.98	0.10	59,61,66,67	0
4	SO4	B	906	5/5	0.98	0.18	54,65,71,73	0
4	SO4	B	907	5/5	0.98	0.18	52,65,68,71	0
4	SO4	A	909	5/5	0.98	0.11	56,57,72,73	0
4	SO4	A	908	5/5	0.99	0.15	39,39,44,45	0
4	SO4	B	904	5/5	0.99	0.12	34,35,44,47	0

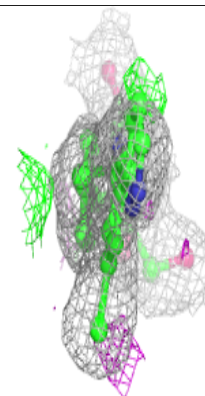
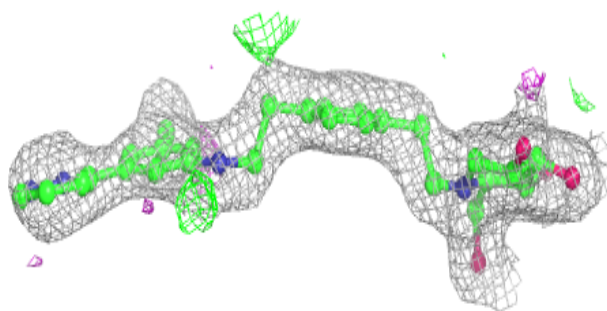
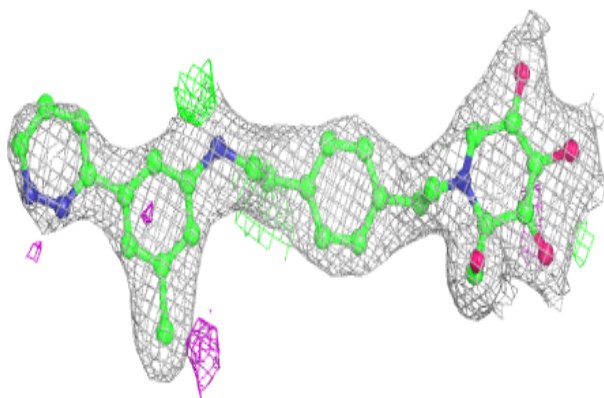
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

**Electron density around X5B A 901:**

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

**Electron density around X5B B 901:**

$2mF_o-DF_c$  (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.