



# wwPDB X-ray Structure Validation Summary Report ⓘ

Jul 3, 2023 – 10:28 pm BST

PDB ID : 8CJV  
Title : Structure of bovine CD46 ectodomain (SCR 1-4)  
Authors : Aitkenhead, H.; Stuart, D.I.; El Omari, K.  
Deposited on : 2023-02-13  
Resolution : 2.84 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](mailto:validation@mail.wwpdb.org)

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<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 : 2.33  
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) : 2.33

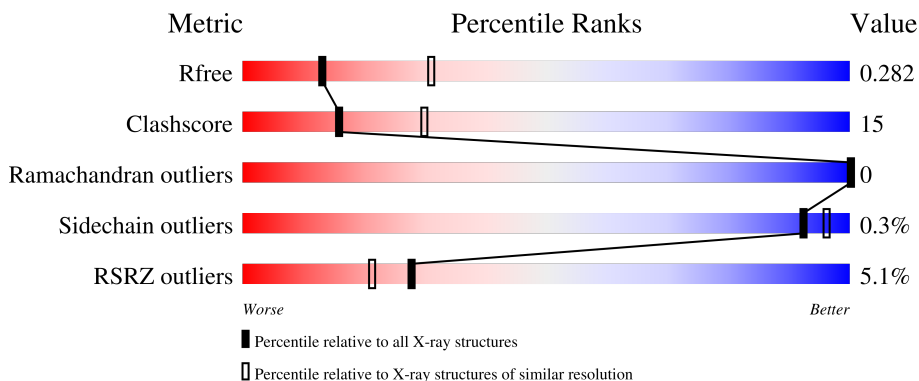
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.84 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	1031 (2.86-2.82)
Clashscore	141614	1078 (2.86-2.82)
Ramachandran outliers	138981	1050 (2.86-2.82)
Sidechain outliers	138945	1051 (2.86-2.82)
RSRZ outliers	127900	1019 (2.86-2.82)

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	289	 7% 64% 24% 12%
1	B	289	 7% 47% 19% 33%

## 2 Entry composition [i](#)

There are 2 unique types of molecules in this entry. The entry contains 3504 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 Membrane cofactor protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	254	1950	1227	321	385	17	0	0	0
1	B	194	1484	923	248	300	13	0	0	0

There are 78 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	40	GLU	-	expression tag	UNP Q6VE48
A	41	THR	-	expression tag	UNP Q6VE48
A	42	GLY	-	expression tag	UNP Q6VE48
A	73	ARG	HIS	conflict	UNP Q6VE48
A	126	ALA	GLU	conflict	UNP Q6VE48
A	185	ASN	SER	conflict	UNP Q6VE48
A	296	GLY	-	expression tag	UNP Q6VE48
A	297	THR	-	expression tag	UNP Q6VE48
A	298	GLY	-	expression tag	UNP Q6VE48
A	299	GLY	-	expression tag	UNP Q6VE48
A	300	SER	-	expression tag	UNP Q6VE48
A	301	GLY	-	expression tag	UNP Q6VE48
A	302	GLY	-	expression tag	UNP Q6VE48
A	303	SER	-	expression tag	UNP Q6VE48
A	304	GLY	-	expression tag	UNP Q6VE48
A	305	LEU	-	expression tag	UNP Q6VE48
A	306	ASN	-	expression tag	UNP Q6VE48
A	307	ASP	-	expression tag	UNP Q6VE48
A	308	ILE	-	expression tag	UNP Q6VE48
A	309	PHE	-	expression tag	UNP Q6VE48
A	310	GLU	-	expression tag	UNP Q6VE48
A	311	ALA	-	expression tag	UNP Q6VE48
A	312	GLN	-	expression tag	UNP Q6VE48
A	313	LYS	-	expression tag	UNP Q6VE48
A	314	ILE	-	expression tag	UNP Q6VE48

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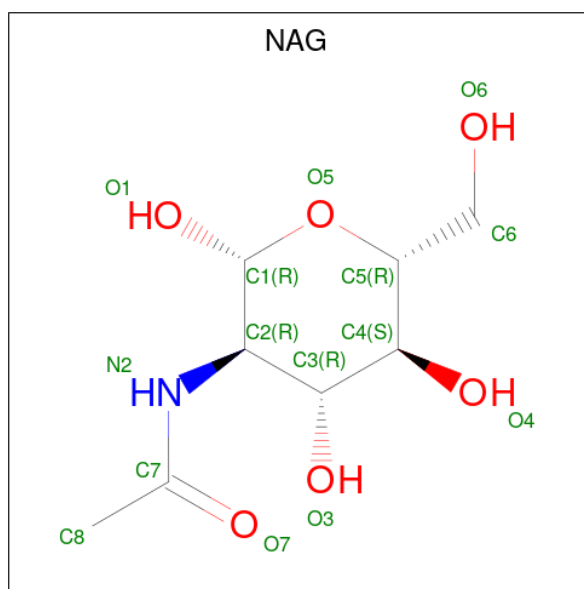
Chain	Residue	Modelled	Actual	Comment	Reference
A	315	GLU	-	expression tag	UNP Q6VE48
A	316	TRP	-	expression tag	UNP Q6VE48
A	317	HIS	-	expression tag	UNP Q6VE48
A	318	GLU	-	expression tag	UNP Q6VE48
A	319	GLY	-	expression tag	UNP Q6VE48
A	320	ARG	-	expression tag	UNP Q6VE48
A	321	THR	-	expression tag	UNP Q6VE48
A	322	LYS	-	expression tag	UNP Q6VE48
A	323	HIS	-	expression tag	UNP Q6VE48
A	324	HIS	-	expression tag	UNP Q6VE48
A	325	HIS	-	expression tag	UNP Q6VE48
A	326	HIS	-	expression tag	UNP Q6VE48
A	327	HIS	-	expression tag	UNP Q6VE48
A	328	HIS	-	expression tag	UNP Q6VE48
B	40	GLU	-	expression tag	UNP Q6VE48
B	41	THR	-	expression tag	UNP Q6VE48
B	42	GLY	-	expression tag	UNP Q6VE48
B	73	ARG	HIS	conflict	UNP Q6VE48
B	126	ALA	GLU	conflict	UNP Q6VE48
B	185	ASN	SER	conflict	UNP Q6VE48
B	296	GLY	-	expression tag	UNP Q6VE48
B	297	THR	-	expression tag	UNP Q6VE48
B	298	GLY	-	expression tag	UNP Q6VE48
B	299	GLY	-	expression tag	UNP Q6VE48
B	300	SER	-	expression tag	UNP Q6VE48
B	301	GLY	-	expression tag	UNP Q6VE48
B	302	GLY	-	expression tag	UNP Q6VE48
B	303	SER	-	expression tag	UNP Q6VE48
B	304	GLY	-	expression tag	UNP Q6VE48
B	305	LEU	-	expression tag	UNP Q6VE48
B	306	ASN	-	expression tag	UNP Q6VE48
B	307	ASP	-	expression tag	UNP Q6VE48
B	308	ILE	-	expression tag	UNP Q6VE48
B	309	PHE	-	expression tag	UNP Q6VE48
B	310	GLU	-	expression tag	UNP Q6VE48
B	311	ALA	-	expression tag	UNP Q6VE48
B	312	GLN	-	expression tag	UNP Q6VE48
B	313	LYS	-	expression tag	UNP Q6VE48
B	314	ILE	-	expression tag	UNP Q6VE48
B	315	GLU	-	expression tag	UNP Q6VE48
B	316	TRP	-	expression tag	UNP Q6VE48
B	317	HIS	-	expression tag	UNP Q6VE48

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Chain	Residue	Modelled	Actual	Comment	Reference
B	318	GLU	-	expression tag	UNP Q6VE48
B	319	GLY	-	expression tag	UNP Q6VE48
B	320	ARG	-	expression tag	UNP Q6VE48
B	321	THR	-	expression tag	UNP Q6VE48
B	322	LYS	-	expression tag	UNP Q6VE48
B	323	HIS	-	expression tag	UNP Q6VE48
B	324	HIS	-	expression tag	UNP Q6VE48
B	325	HIS	-	expression tag	UNP Q6VE48
B	326	HIS	-	expression tag	UNP Q6VE48
B	327	HIS	-	expression tag	UNP Q6VE48
B	328	HIS	-	expression tag	UNP Q6VE48

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

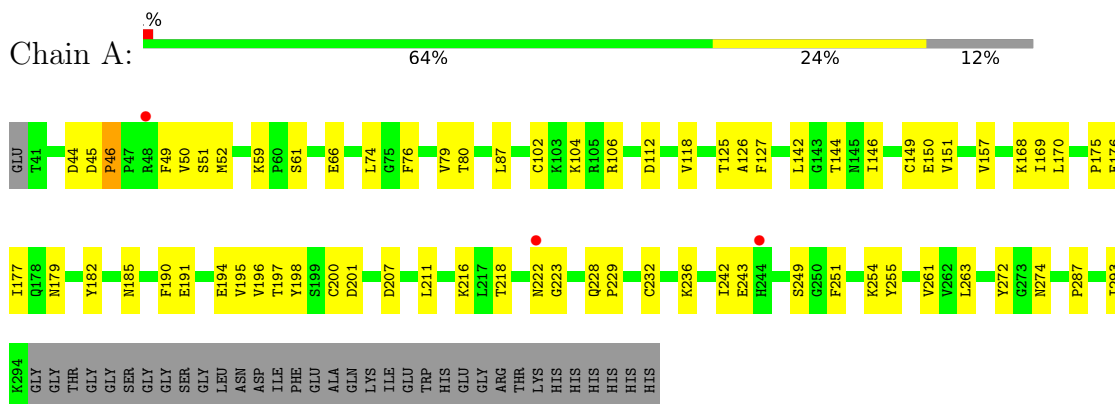


Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	A	1	Total	C	N	O	0	0
			14	8	1	5		
2	A	1	Total	C	N	O	0	0
			14	8	1	5		
2	B	1	Total	C	N	O	0	0
			14	8	1	5		
2	B	1	Total	C	N	O	0	0
			14	8	1	5		
2	B	1	Total	C	N	O	0	0
			14	8	1	5		

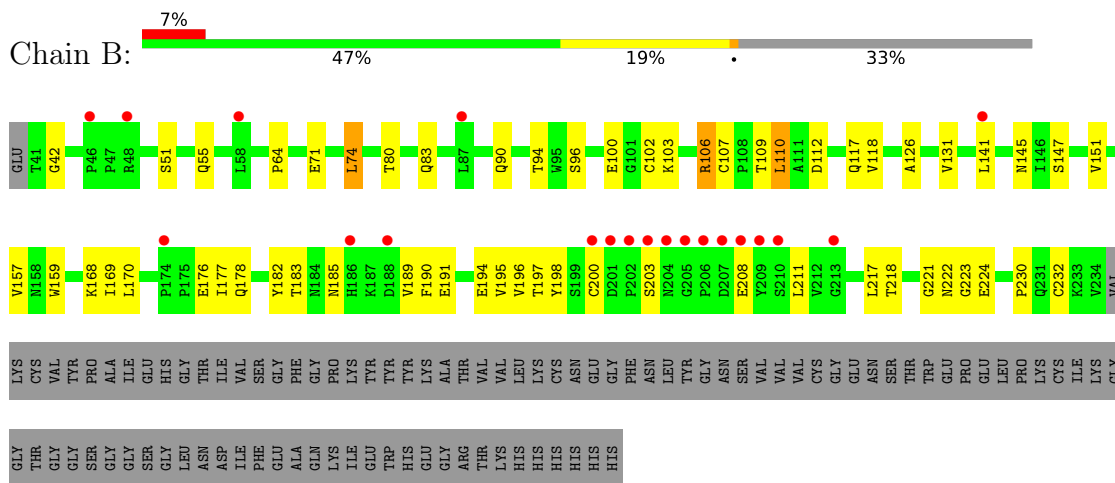
### 3 Residue-property plots [i](#)

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: Membrane cofactor protein



- Molecule 1: Membrane cofactor protein



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 41 21 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	129.73Å 129.73Å 120.19Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	88.17 – 2.84 91.73 – 2.84	Depositor EDS
% Data completeness (in resolution range)	43.9 (88.17-2.84) 44.0 (91.73-2.84)	Depositor EDS
$R_{merge}$	0.49	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.10 (at 2.86Å)	Xtrriage
Refinement program	PHENIX 1.18.2_3874	Depositor
R, $R_{free}$	0.253 , 0.285 0.251 , 0.282	Depositor DCC
$R_{free}$ test set	529 reflections (4.86%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	53.2	Xtrriage
Anisotropy	0.229	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.29 , 40.3	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.42$ , $\langle L^2 \rangle = 0.25$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.79	EDS
Total number of atoms	3504	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	87.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 8.36% 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: 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	0.75	0/2003	0.98	3/2735 (0.1%)
1	B	0.73	0/1523	0.96	3/2081 (0.1%)
All	All	0.74	0/3526	0.97	6/4816 (0.1%)

There are no bond length outliers.

The worst 5 of 6 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	110	LEU	CB-CG-CD2	-8.06	97.29	111.00
1	A	142	LEU	CA-CB-CG	-7.71	97.57	115.30
1	A	104	LYS	CB-CG-CD	6.53	128.57	111.60
1	B	106	ARG	NE-CZ-NH2	-5.42	117.59	120.30
1	B	74	LEU	CB-CG-CD2	-5.38	101.85	111.00

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	1950	0	1846	55	0
1	B	1484	0	1387	50	0
2	A	28	0	26	3	0
2	B	42	0	39	2	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
All	All	3504	0	3298	99	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 15.

The worst 5 of 99 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:B:169:ILE:HG23	1:B:222:ASN:HA	1.56	0.88
1:B:94:THR:HG21	2:B:402:NAG:H82	1.60	0.82
1:B:106:ARG:HG2	1:B:126:ALA:HA	1.63	0.79
1:B:42:GLY:HA2	1:B:64:PRO:HD3	1.69	0.74
1:A:50:VAL:HA	1:B:117:GLN:HE22	1.52	0.73

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	252/289 (87%)	242 (96%)	10 (4%)	0	100	100
1	B	192/289 (66%)	182 (95%)	10 (5%)	0	100	100
All	All	444/578 (77%)	424 (96%)	20 (4%)	0	100	100

There are no Ramachandran outliers to report.

### 5.3.2 Protein sidechains [i](#)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	225/251 (90%)	224 (100%)	1 (0%)	91	95
1	B	173/251 (69%)	173 (100%)	0	100	100
All	All	398/502 (79%)	397 (100%)	1 (0%)	92	96

All (1) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	46	PRO

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	117	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 monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

5 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	NAG	B	403	1	14,14,15	0.38	0	17,19,21	0.61	0
2	NAG	A	402	1	14,14,15	0.23	0	17,19,21	0.55	0
2	NAG	A	401	1	14,14,15	0.40	0	17,19,21	0.96	1 (5%)
2	NAG	B	402	1	14,14,15	0.50	0	17,19,21	0.38	0
2	NAG	B	401	1	14,14,15	0.47	0	17,19,21	0.68	1 (5%)

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	NAG	B	403	1	-	1/6/23/26	0/1/1/1
2	NAG	A	402	1	-	0/6/23/26	0/1/1/1
2	NAG	A	401	1	-	0/6/23/26	0/1/1/1
2	NAG	B	402	1	-	2/6/23/26	0/1/1/1
2	NAG	B	401	1	-	2/6/23/26	0/1/1/1

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	401	NAG	O4-C4-C5	-2.96	101.94	109.30
2	B	401	NAG	C1-O5-C5	2.23	115.21	112.19

There are no chirality outliers.

All (5) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	B	403	NAG	C3-C2-N2-C7
2	B	402	NAG	C4-C5-C6-O6
2	B	402	NAG	O5-C5-C6-O6
2	B	401	NAG	O5-C5-C6-O6
2	B	401	NAG	C4-C5-C6-O6

There are no ring outliers.

4 monomers are involved in 5 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	403	NAG	1	0
2	A	402	NAG	1	0
2	A	401	NAG	2	0
2	B	402	NAG	1	0

## 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	254/289 (87%)	0.10	3 (1%) 79 76	15, 86, 144, 186	0
1	B	194/289 (67%)	0.77	20 (10%) 6 4	17, 87, 196, 243	0
All	All	448/578 (77%)	0.39	23 (5%) 28 21	15, 87, 171, 243	0

The worst 5 of 23 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	205	GLY	17.1
1	B	203	SER	11.0
1	B	206	PRO	8.1
1	B	204	ASN	6.7
1	B	213	GLY	6.1

### 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 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( $\text{\AA}^2$ )	Q<0.9
2	NAG	B	402	14/15	0.92	0.18	96,109,113,113	0
2	NAG	A	402	14/15	0.95	0.16	40,44,56,56	0
2	NAG	B	403	14/15	0.96	0.21	49,52,56,58	0
2	NAG	A	401	14/15	0.98	0.21	19,21,24,26	0
2	NAG	B	401	14/15	0.98	0.21	18,19,22,23	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.