



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2026 – 05:11 AM UTC

PDB ID : 9BL5 / pdb_00009bl5
Title : KIR3DL1*001 in complex with HLA-A*24:02 presenting the TW9 peptide
Authors : Faoro, C.; Rossjohn, J.
Deposited on : 2024-04-29
Resolution : 2.00 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

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
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

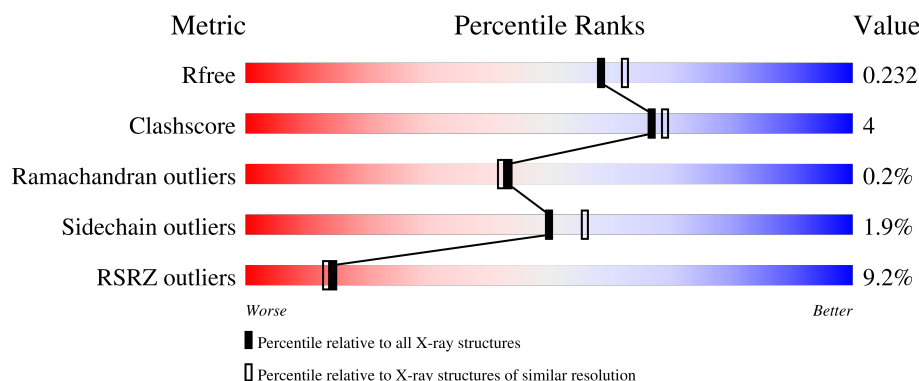
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.00 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	10052 (2.00-2.00)
Clashscore	190562	11152 (2.00-2.00)
Ramachandran outliers	187476	11031 (2.00-2.00)
Sidechain outliers	187428	11029 (2.00-2.00)
RSRZ outliers	180081	10067 (2.00-2.00)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions $\leq 5\%$. 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	276	<div> <div>4%</div> <div> <div></div> <div>93%</div> <div>7%</div> </div> </div>
2	B	100	<div> <div>6%</div> <div> <div></div> <div>91%</div> <div>6%</div> <div>..</div> </div> </div>
3	C	9	<div> <div></div> <div> <div>67%</div> <div>33%</div> </div> </div>
4	G	316	<div> <div>14%</div> <div> <div></div> <div>78%</div> <div>10%</div> <div>•</div> <div>11%</div> </div> </div>

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 5366 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 MHC class I antigen.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	276	Total	C	N	O	S	0	0	0
			2199	1372	395	422	10			

- Molecule 2 is a protein called Beta-2-microglobulin.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	98	Total	C	N	O	S	0	0	0
			771	496	133	139	3			

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	0	MET	-	initiating methionine	UNP P61769

- Molecule 3 is a protein called Polymerase basic protein 2 peptide.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
3	C	9	Total	C	N	O	0	1	0
			100	66	18	16			

- Molecule 4 is a protein called Killer cell immunoglobulin-like receptor 3DL1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
4	G	281	Total	C	N	O	S	0	0	0
			2086	1330	365	378	13			

There are 17 discrepancies between the modelled and reference sequences:

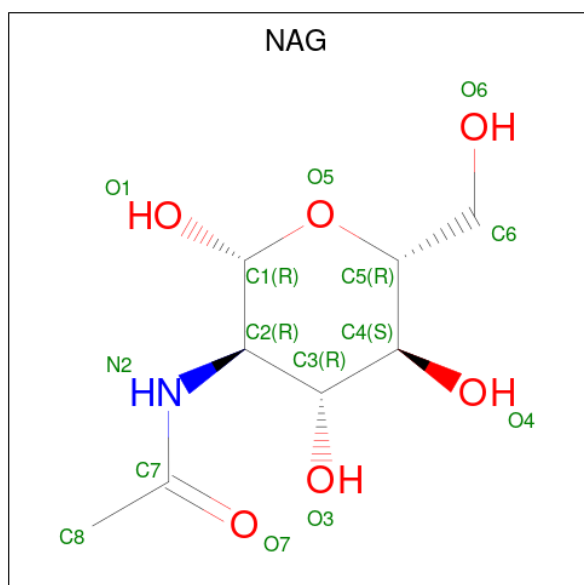
Chain	Residue	Modelled	Actual	Comment	Reference
G	-16	HIS	-	expression tag	UNP P43629
G	-15	HIS	-	expression tag	UNP P43629
G	-14	HIS	-	expression tag	UNP P43629

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Chain	Residue	Modelled	Actual	Comment	Reference
G	-13	HIS	-	expression tag	UNP P43629
G	-12	HIS	-	expression tag	UNP P43629
G	-11	HIS	-	expression tag	UNP P43629
G	-10	GLY	-	expression tag	UNP P43629
G	-9	SER	-	expression tag	UNP P43629
G	-8	GLY	-	expression tag	UNP P43629
G	-7	SER	-	expression tag	UNP P43629
G	-6	ASP	-	expression tag	UNP P43629
G	-5	ASP	-	expression tag	UNP P43629
G	-4	ASP	-	expression tag	UNP P43629
G	-3	ASP	-	expression tag	UNP P43629
G	-2	LYS	-	expression tag	UNP P43629
G	-1	GLY	-	expression tag	UNP P43629
G	0	SER	-	expression tag	UNP P43629

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



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

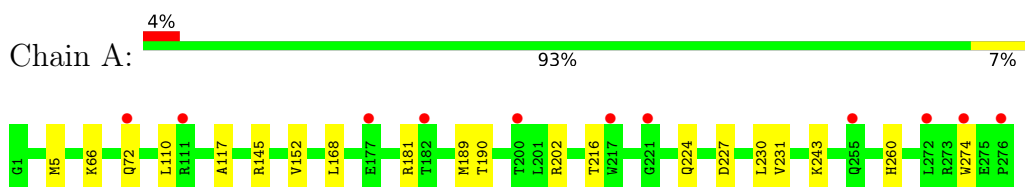
- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	94	Total 94	O 94	0	0
6	B	11	Total 11	O 11	0	0
6	C	6	Total 6	O 6	0	0
6	G	71	Total 71	O 71	0	0

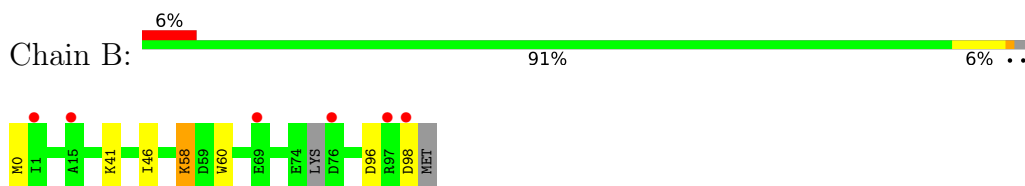
3 Residue-property plots

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.

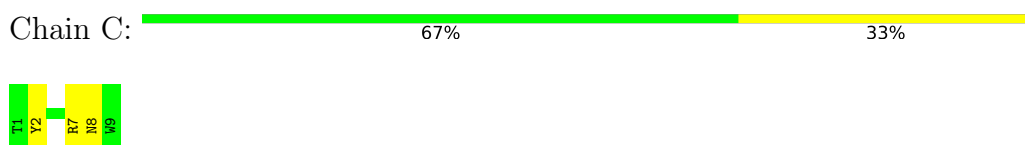
- Molecule 1: MHC class I antigen



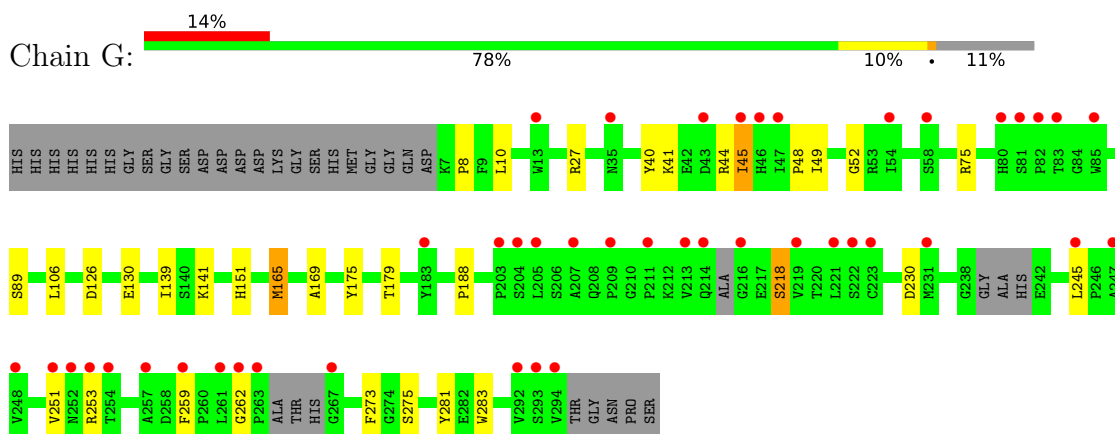
- Molecule 2: Beta-2-microglobulin



- Molecule 3: Polymerase basic protein 2 peptide



- Molecule 4: Killer cell immunoglobulin-like receptor 3DL1



4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α , β , γ	52.44Å 62.12Å 67.00Å 93.44° 100.67° 109.97°	Depositor
Resolution (Å)	35.88 – 2.00 35.88 – 2.00	Depositor EDS
% Data completeness (in resolution range)	97.3 (35.88-2.00) 97.3 (35.88-2.00)	Depositor EDS
R_{merge}	0.04	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.90 (at 2.00Å)	Xtriage
Refinement program	PHENIX 1.19.2_4158	Depositor
R, R_{free}	0.210 , 0.231 0.210 , 0.232	Depositor DCC
R_{free} test set	2512 reflections (4.81%)	wwPDB-VP
Wilson B-factor (Å ²)	41.7	Xtriage
Anisotropy	0.448	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 53.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	5366	wwPDB-VP
Average B, all atoms (Å ²)	60.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.51% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical 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	0.36	0/2259	0.54	0/3068
2	B	0.30	0/793	0.45	0/1080
3	C	0.36	0/104	0.41	0/141
4	G	0.31	0/2155	0.50	0/2940
All	All	0.33	0/5311	0.51	0/7229

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	2199	0	2036	14	0
2	B	771	0	707	6	0
3	C	100	0	92	3	0
4	G	2086	0	1891	21	0
5	G	28	0	26	0	0
6	A	94	0	0	1	0
6	B	11	0	0	0	0
6	C	6	0	0	0	0
6	G	71	0	0	0	0
All	All	5366	0	4752	37	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 4.

All (37) 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)
4:G:218:SER:HA	4:G:262:GLY:HA3	1.80	0.62
1:A:72:GLN:CD	4:G:165:MET:HE1	2.26	0.61
4:G:251:VAL:C	4:G:253:ARG:H	2.09	0.60
1:A:189:MET:CE	1:A:274:TRP:HB2	2.32	0.59
4:G:41:LYS:HG3	4:G:49:ILE:HG21	1.84	0.59
1:A:224:GLN:HB3	1:A:227:ASP:HB2	1.85	0.58
1:A:216:THR:HG23	1:A:260:HIS:HB2	1.88	0.55
2:B:96:ASP:OD1	2:B:98:ASP:CB	2.55	0.54
2:B:96:ASP:OD1	2:B:98:ASP:N	2.38	0.54
1:A:5:MET:HB2	1:A:168:LEU:HD13	1.92	0.51
4:G:48:PRO:HB2	4:G:52:GLY:HA2	1.94	0.50
1:A:152:VAL:HG21	3:C:7:ARG:HG3	1.93	0.49
1:A:145:ARG:HH22	4:G:230:ASP:CG	2.20	0.49
4:G:245:LEU:HD12	4:G:259:PHE:CD2	2.48	0.48
1:A:145:ARG:NH2	4:G:230:ASP:OD1	2.46	0.48
1:A:117:ALA:HB2	2:B:60:TRP:CE2	2.49	0.47
4:G:175:TYR:CE2	4:G:188:PRO:HB3	2.50	0.46
2:B:41:LYS:HB2	2:B:46:ILE:HD11	1.97	0.46
1:A:72:GLN:HG3	6:A:330:HOH:O	2.16	0.45
1:A:66:LYS:HE3	3:C:2:TYR:HB3	1.98	0.45
1:A:190:THR:OG1	1:A:202:ARG:HB3	2.17	0.45
4:G:251:VAL:C	4:G:253:ARG:N	2.75	0.44
3:C:8[B]:ASN:ND2	3:C:8[B]:ASN:H	2.14	0.44
4:G:40:TYR:CE1	4:G:75:ARG:HD2	2.52	0.44
4:G:273:PHE:HB3	4:G:283:TRP:HB3	2.00	0.44
2:B:0:MET:HE3	2:B:0:MET:HB2	1.73	0.44
1:A:230:LEU:HD22	1:A:243:LYS:HE3	2.00	0.43
4:G:10:LEU:HD12	4:G:27:ARG:O	2.18	0.43
4:G:139:ILE:HD13	4:G:139:ILE:HA	1.83	0.43
2:B:58:LYS:H	2:B:58:LYS:NZ	2.17	0.43
4:G:130:GLU:CD	4:G:179:THR:HG22	2.43	0.42
4:G:44:ARG:O	4:G:45:ILE:C	2.61	0.42
4:G:169:ALA:HB1	4:G:281:TYR:HB3	2.00	0.42
4:G:40:TYR:CZ	4:G:75:ARG:HD2	2.54	0.41
4:G:139:ILE:HG22	4:G:141:LYS:H	1.86	0.41
4:G:8:PRO:HB2	4:G:89:SER:HB3	2.02	0.41
1:A:145:ARG:NH2	4:G:230:ASP:CG	2.79	0.41

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	274/276 (99%)	267 (97%)	7 (3%)	0	100	100
2	B	94/100 (94%)	94 (100%)	0	0	100	100
3	C	8/9 (89%)	8 (100%)	0	0	100	100
4	G	273/316 (86%)	260 (95%)	12 (4%)	1 (0%)	30	27
All	All	649/701 (93%)	629 (97%)	19 (3%)	1 (0%)	43	42

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
4	G	45	ILE

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	223/232 (96%)	220 (99%)	3 (1%)	61	68
2	B	80/95 (84%)	79 (99%)	1 (1%)	61	68
3	C	10/9 (111%)	10 (100%)	0	100	100
4	G	212/270 (78%)	206 (97%)	6 (3%)	38	41
All	All	525/606 (87%)	515 (98%)	10 (2%)	50	56

All (10) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	110	LEU
1	A	181	ARG
1	A	231	VAL
2	B	58	LYS
4	G	106	LEU
4	G	126	ASP
4	G	151	HIS
4	G	165	MET
4	G	218	SER
4	G	275	SER

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

Mol	Chain	Res	Type
1	A	156	GLN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

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

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

2 ligands are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
5	NAG	G	302	4	14,14,15	0.38	0	17,19,21	0.39	0
5	NAG	G	301	4	14,14,15	0.55	0	17,19,21	0.84	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
5	NAG	G	302	4	-	0/6/23/26	0/1/1/1
5	NAG	G	301	4	-	0/6/23/26	0/1/1/1

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	G	301	NAG	C1-O5-C5	2.85	116.01	112.19

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

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, 95th 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 ²)	Q<0.9
1	A	276/276 (100%)	0.32	11 (3%) 42 41	29, 53, 92, 113	0
2	B	98/100 (98%)	0.68	6 (6%) 27 26	30, 69, 91, 102	0
3	C	9/9 (100%)	0.23	0 100 100	20, 41, 48, 51	1 (11%)
4	G	281/316 (88%)	0.88	44 (15%) 5 4	37, 60, 111, 136	0
All	All	664/701 (94%)	0.61	61 (9%) 14 13	20, 57, 101, 136	1 (0%)

All (61) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
4	G	223	CYS	4.5
4	G	253	ARG	4.4
4	G	251	VAL	4.2
2	B	1	ILE	4.1
4	G	211	PRO	4.0
4	G	205	LEU	3.8
4	G	252	ASN	3.8
4	G	292	VAL	3.7
2	B	98	ASP	3.6
4	G	83	THR	3.5
2	B	97	ARG	3.5
4	G	46	HIS	3.5
4	G	45	ILE	3.4
4	G	294	VAL	3.4
4	G	35	ASN	3.2
4	G	267	GLY	3.2
4	G	207	ALA	3.2
4	G	213	VAL	3.1
4	G	80	HIS	3.1
4	G	263	PRO	3.0
4	G	209	PRO	2.9

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Mol	Chain	Res	Type	RSRZ
4	G	262	GLY	2.9
2	B	76	ASP	2.9
4	G	293	SER	2.9
4	G	247	ALA	2.9
4	G	47	ILE	2.8
1	A	217	TRP	2.8
2	B	15	ALA	2.8
4	G	219	VAL	2.8
4	G	82	PRO	2.8
4	G	85	TRP	2.8
4	G	257	ALA	2.7
4	G	203	PRO	2.7
4	G	54	ILE	2.7
4	G	81	SER	2.7
4	G	221	LEU	2.7
4	G	259	PHE	2.6
1	A	255	GLN	2.6
4	G	261	LEU	2.6
4	G	248	VAL	2.5
4	G	231	MET	2.5
1	A	72	GLN	2.4
4	G	58	SER	2.4
1	A	111	ARG	2.4
4	G	214	GLN	2.3
4	G	254	THR	2.3
1	A	272	LEU	2.3
4	G	183	TYR	2.3
1	A	177	GLU	2.2
4	G	204	SER	2.2
4	G	222	SER	2.2
1	A	200	THR	2.2
1	A	182	THR	2.2
2	B	69	GLU	2.2
4	G	245	LEU	2.2
1	A	274	TRP	2.2
4	G	216	GLY	2.2
4	G	13	TRP	2.1
1	A	221	GLY	2.1
4	G	43	ASP	2.1
1	A	276	PRO	2.1

6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

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

6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

6.4 Ligands [i](#)

In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th 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(\AA^2)	Q<0.9
5	NAG	G	301	14/15	0.76	0.13	65,67,71,73	0
5	NAG	G	302	14/15	0.85	0.10	62,66,69,71	0

6.5 Other polymers [i](#)

There are no such residues in this entry.