



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 5, 2026 – 03:18 PM UTC

PDB ID : 9CYL / pdb_00009cyl
Title : Structure of LAG3 loop1 deletion bound to the MHC class II molecule I-A(b)
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Deposited on : 2024-08-02
Resolution : 4.66 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

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

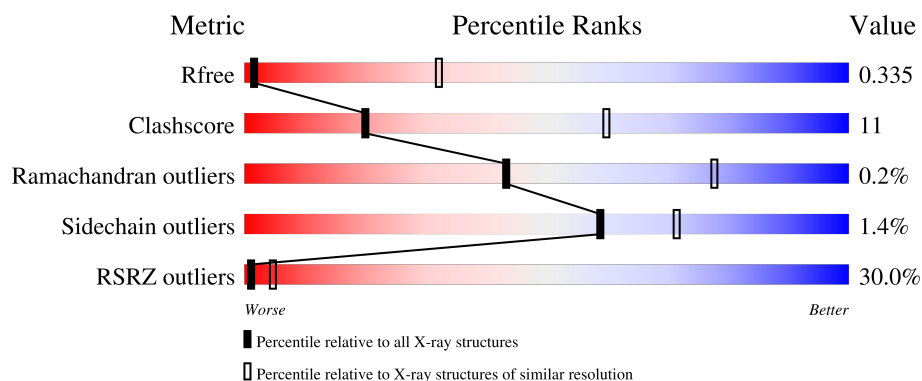
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 4.66 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	1016 (5.40-3.92)
Clashscore	190562	1000 (5.36-3.96)
Ramachandran outliers	187476	1075 (5.40-3.90)
Sidechain outliers	187428	1057 (5.40-3.90)
RSRZ outliers	180081	1011 (5.40-3.92)

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	195	25% 74% 20% • 5%
2	B	192	26% 66% 32% • •
3	P	15	20% 87% 13%
4	L	210	36% 69% 27% •

2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 4699 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 H-2 class II histocompatibility antigen, A-B alpha chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	185	Total	C	N	O	S	0	0	0
			1479	957	233	286	3			

- Molecule 2 is a protein called H-2 class II histocompatibility antigen, A beta chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	188	Total	C	N	O	S	0	0	0
			1557	975	283	292	7			

- Molecule 3 is a protein called Class-II-associated invariant chain peptide.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	P	15	Total	C	N	O	S	0	0	0
			113	72	20	18	3			

- Molecule 4 is a protein called Secreted lymphocyte activation gene 3 protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
4	L	202	Total	C	N	O	S	0	0	0
			1494	951	268	270	5			

There are 22 discrepancies between the modelled and reference sequences:

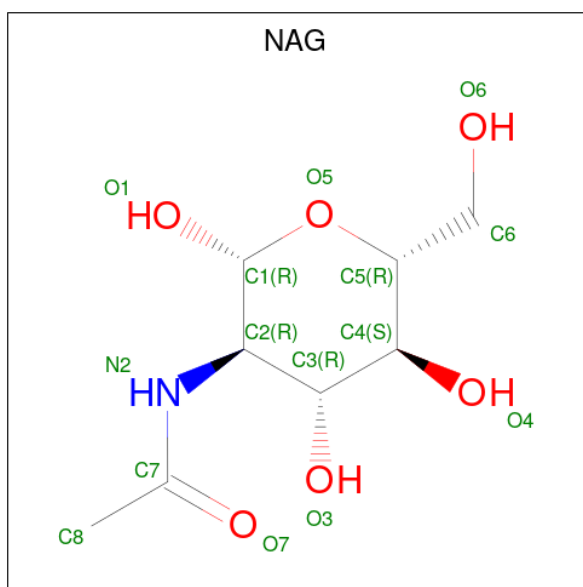
Chain	Residue	Modelled	Actual	Comment	Reference
L	?	-	GLN	deletion	UNP Q61790
L	?	-	PRO	deletion	UNP Q61790
L	?	-	THR	deletion	UNP Q61790
L	?	-	PRO	deletion	UNP Q61790
L	?	-	ILE	deletion	UNP Q61790
L	?	-	PRO	deletion	UNP Q61790
L	?	-	ALA	deletion	UNP Q61790
L	?	-	LEU	deletion	UNP Q61790

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Chain	Residue	Modelled	Actual	Comment	Reference
L	?	-	ASP	deletion	UNP Q61790
L	?	-	LEU	deletion	UNP Q61790
L	?	-	HIS	deletion	UNP Q61790
L	?	-	GLN	deletion	UNP Q61790
L	?	-	GLY	deletion	UNP Q61790
L	?	-	MET	deletion	UNP Q61790
L	?	-	PRO	deletion	UNP Q61790
L	?	-	SER	deletion	UNP Q61790
L	?	-	PRO	deletion	UNP Q61790
L	?	-	ARG	deletion	UNP Q61790
L	?	-	GLN	deletion	UNP Q61790
L	?	-	PRO	deletion	UNP Q61790
L	?	-	ALA	deletion	UNP Q61790
L	?	-	PRO	deletion	UNP Q61790

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

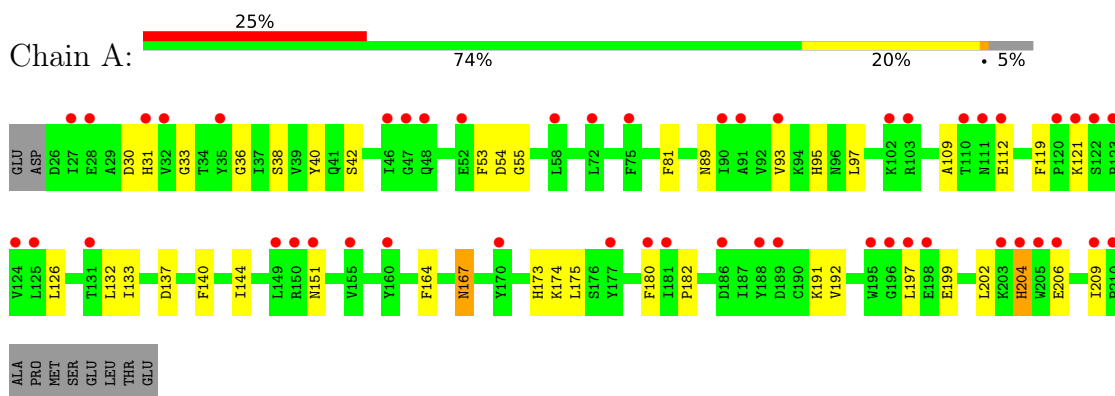


Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
5	A	1	Total	C	N	O	0	0
			14	8	1	5		
5	B	1	Total	C	N	O	0	0
			14	8	1	5		
5	L	1	Total	C	N	O	0	0
			14	8	1	5		
5	L	1	Total	C	N	O	0	0
			14	8	1	5		

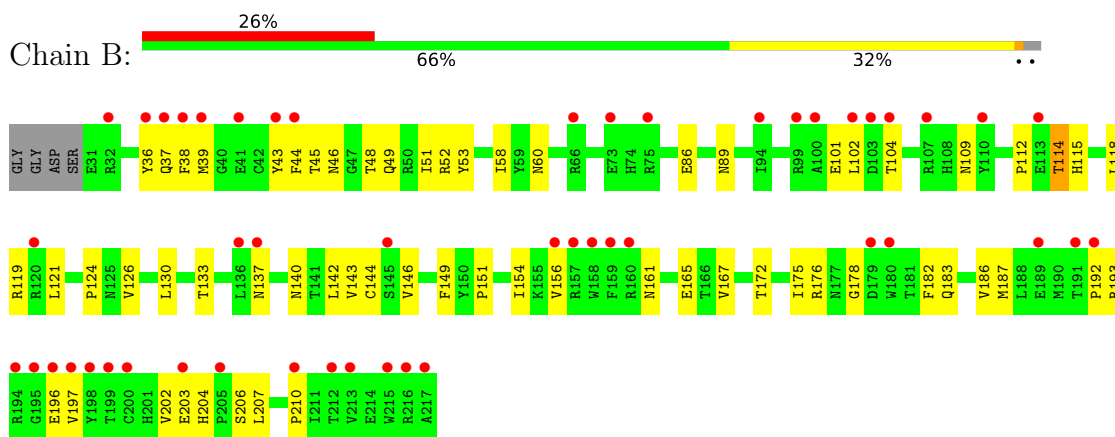
3 Residue-property plots [i](#)

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.

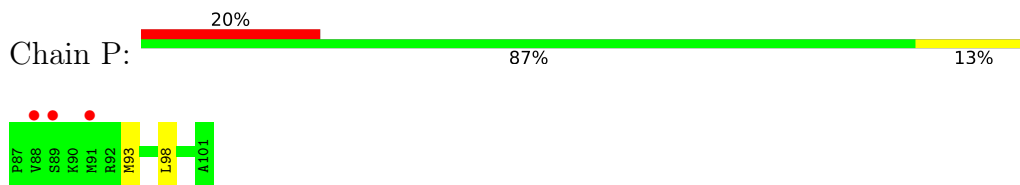
- Molecule 1: H-2 class II histocompatibility antigen, A-B alpha chain



- Molecule 2: H-2 class II histocompatibility antigen, A beta chain

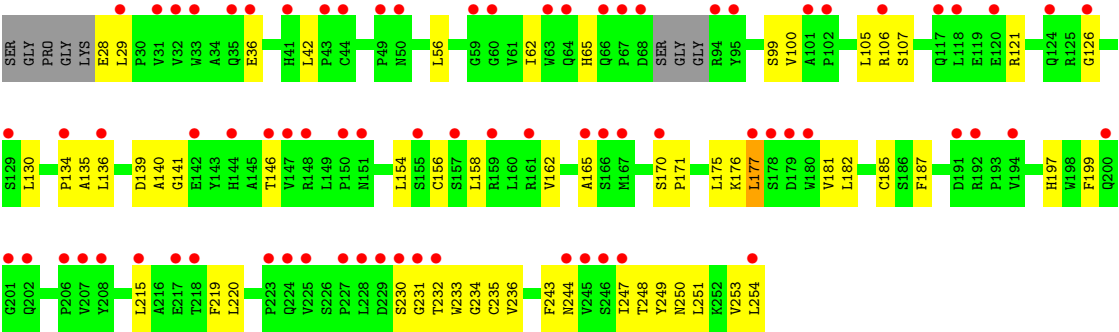


- Molecule 3: Class-II-associated invariant chain peptide



- Molecule 4: Secreted lymphocyte activation gene 3 protein





4 Data and refinement statistics

Property	Value	Source
Space group	P 65 2 2	Depositor
Cell constants a, b, c, α , β , γ	184.99Å 184.99Å 122.67Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	92.50 – 4.66 92.50 – 4.66	Depositor EDS
% Data completeness (in resolution range)	99.8 (92.50-4.66) 99.9 (92.50-4.66)	Depositor EDS
R_{merge}	0.19	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.32 (at 4.66Å)	Xtriage
Refinement program	PHENIX (1.21.1_5286: ???)	Depositor
R, R_{free}	0.268 , 0.326 0.274 , 0.335	Depositor DCC
R_{free} test set	351 reflections (5.01%)	wwPDB-VP
Wilson B-factor (Å ²)	232.6	Xtriage
Anisotropy	0.244	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.43 , 854.0	EDS
L-test for twinning ²	$\langle L \rangle = 0.41$, $\langle L^2 \rangle = 0.24$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.87	EDS
Total number of atoms	4699	wwPDB-VP
Average B, all atoms (Å ²)	246.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.44% 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

5.1 Standard geometry

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	0.13	0/1524	0.26	0/2083
2	B	0.25	0/1597	0.38	0/2173
3	P	0.10	0/114	0.21	0/151
4	L	0.41	0/1536	0.50	0/2111
All	All	0.29	0/4771	0.39	0/6518

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	1479	0	1398	33	0
2	B	1557	0	1470	46	0
3	P	113	0	128	2	0
4	L	1494	0	1401	38	0
5	A	14	0	13	0	0
5	B	14	0	13	0	0
5	L	28	0	26	1	0
All	All	4699	0	4449	104	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 11.

The worst 5 of 104 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:204:HIS:C	1:A:204:HIS:ND1	2.25	0.94
1:A:204:HIS:ND1	1:A:204:HIS:O	2.04	0.90
4:L:232:THR:HA	4:L:250:ASN:HA	1.54	0.90
2:B:48:THR:HA	2:B:51:ILE:HD11	1.68	0.75
2:B:109:ASN:HA	2:B:112:PRO:HD2	1.72	0.71

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	183/195 (94%)	179 (98%)	4 (2%)	0	100	100
2	B	186/192 (97%)	173 (93%)	13 (7%)	0	100	100
3	P	13/15 (87%)	13 (100%)	0	0	100	100
4	L	198/210 (94%)	178 (90%)	19 (10%)	1 (0%)	24	63
All	All	580/612 (95%)	543 (94%)	36 (6%)	1 (0%)	43	78

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
4	L	134	PRO

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	165/175 (94%)	162 (98%)	3 (2%)	51	67
2	B	170/175 (97%)	169 (99%)	1 (1%)	78	81
3	P	13/13 (100%)	13 (100%)	0	100	100
4	L	154/181 (85%)	151 (98%)	3 (2%)	50	66
All	All	502/544 (92%)	495 (99%)	7 (1%)	59	71

5 of 7 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	B	114	THR
4	L	156	CYS
4	L	235	CYS
4	L	177	LEU
1	A	204	HIS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 10 such sidechains are listed below:

Mol	Chain	Res	Type
4	L	35	GLN
4	L	197	HIS
4	L	250	ASN
1	A	204	HIS
2	B	49	GLN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

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

5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry

4 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	L	301	4	14,14,15	0.40	0	17,19,21	1.05	2 (11%)
5	NAG	B	301	2	14,14,15	0.72	0	17,19,21	0.92	0
5	NAG	A	301	1	14,14,15	0.72	0	17,19,21	0.95	1 (5%)
5	NAG	L	302	4	14,14,15	0.78	0	17,19,21	2.28	2 (11%)

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	L	301	4	-	1/6/23/26	0/1/1/1
5	NAG	B	301	2	-	2/6/23/26	0/1/1/1
5	NAG	A	301	1	-	4/6/23/26	0/1/1/1
5	NAG	L	302	4	-	6/6/23/26	0/1/1/1

There are no bond length outliers.

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	L	302	NAG	C2-N2-C7	8.08	133.73	122.90
5	L	301	NAG	O5-C1-C2	3.20	116.24	111.29
5	L	302	NAG	C8-C7-N2	2.87	120.88	116.12
5	L	301	NAG	C1-O5-C5	2.59	115.66	112.19
5	A	301	NAG	C1-O5-C5	2.06	114.94	112.19

There are no chirality outliers.

5 of 13 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	L	302	NAG	O5-C5-C6-O6
5	A	301	NAG	O5-C5-C6-O6
5	A	301	NAG	C4-C5-C6-O6
5	L	302	NAG	C4-C5-C6-O6
5	A	301	NAG	C8-C7-N2-C2

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	L	302	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, 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	185/195 (94%)	1.54	49 (26%) 1 5	111, 248, 278, 303	1 (0%)
2	B	188/192 (97%)	1.48	49 (26%) 1 5	214, 251, 295, 337	0
3	P	15/15 (100%)	1.37	3 (20%) 3 7	223, 238, 270, 274	0
4	L	202/210 (96%)	2.13	76 (37%) 1 3	202, 236, 262, 283	0
All	All	590/612 (96%)	1.72	177 (30%) 1 5	111, 245, 284, 337	1 (0%)

The worst 5 of 177 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
4	L	228	LEU	16.0
4	L	151	ASN	12.7
4	L	144	HIS	10.6
2	B	194	ARG	9.4
4	L	208	TYR	9.2

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($\text{\AA}^2$)	Q<0.9
5	NAG	L	301	14/15	0.44	0.18	215,262,269,279	0
5	NAG	B	301	14/15	0.57	0.10	249,269,280,282	0
5	NAG	L	302	14/15	0.71	0.21	232,254,266,267	0
5	NAG	A	301	14/15	0.78	0.18	206,208,215,217	14

6.5 Other polymers [i](#)

There are no such residues in this entry.