



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 14, 2026 – 11:40 AM UTC

PDB ID : 2YQ3 / pdb_00002yq3
Title : Structure of BVDV1 envelope glycoprotein E2, pH5
Authors : El Omari, K.; Iourin, O.; Harlos, K.; Grimes, J.M.; Stuart, D.I.
Deposited on : 2012-11-04
Resolution : 3.29 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

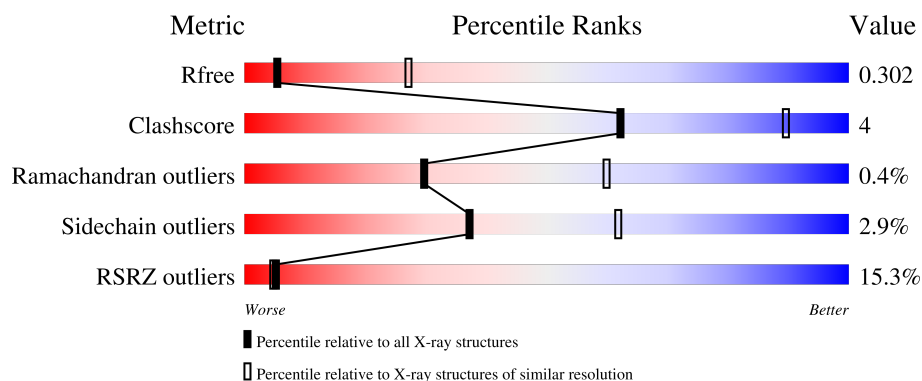
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 3.29 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	1169 (3.32-3.28)
Clashscore	190562	1209 (3.32-3.28)
Ramachandran outliers	187476	1188 (3.32-3.28)
Sidechain outliers	187428	1187 (3.32-3.28)
RSRZ outliers	180081	1169 (3.32-3.28)

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	337	
1	B	337	

2 Entry composition [i](#)

There are 2 unique types of molecules in this entry. The entry contains 4195 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 BVDV1 E2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	243	Total	C	N	O	S	0	0	0
			1928	1217	326	365	20			
1	B	272	Total	C	N	O	S	0	0	0
			2155	1363	361	410	21			

- Molecule 2 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: 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	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		

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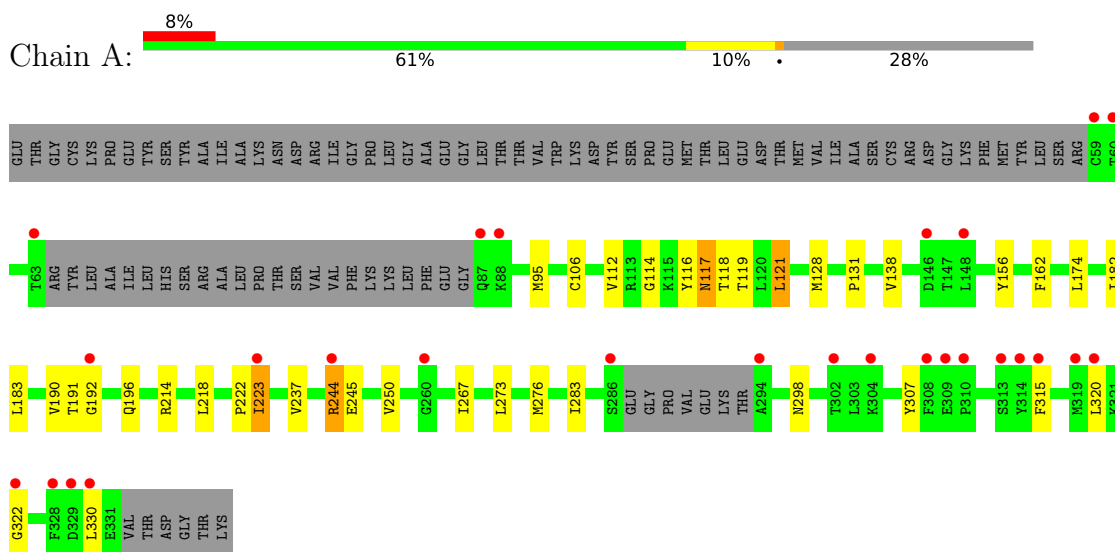
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Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	B	1	Total	C	N	O	0	0
			14	8	1	5		
2	B	1	Total	C	N	O	0	0
			14	8	1	5		
2	B	1	Total	C	N	O	0	0
			14	8	1	5		
2	B	1	Total	C	N	O	0	0
			14	8	1	5		

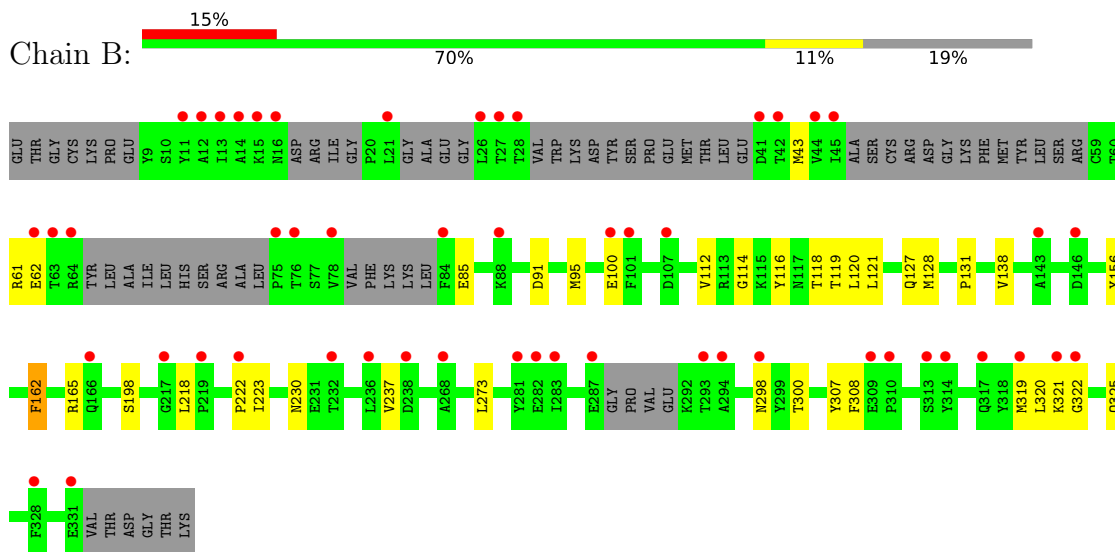
3 Residue-property plots [i](#)

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: BVDV1 E2



• Molecule 1: BVDV1 E2



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, α , β , γ	160.74Å 49.70Å 136.42Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	47.48 – 3.29 47.48 – 3.29	Depositor EDS
% Data completeness (in resolution range)	99.3 (47.48-3.29) 99.7 (47.48-3.29)	Depositor EDS
R_{merge}	0.24	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.54 (at 3.33Å)	Xtriage
Refinement program	BUSTER 2.11.2	Depositor
R, R_{free}	0.253 , 0.264 0.284 , 0.302	Depositor DCC
R_{free} test set	873 reflections (5.07%)	wwPDB-VP
Wilson B-factor (Å ²)	73.4	Xtriage
Anisotropy	0.301	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 46.8	EDS
L-test for twinning ²	$\langle L \rangle = 0.44$, $\langle L^2 \rangle = 0.26$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.84	EDS
Total number of atoms	4195	wwPDB-VP
Average B, all atoms (Å ²)	82.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.83% 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	0.70	0/1971	1.11	8/2665 (0.3%)
1	B	0.73	0/2198	1.09	6/2965 (0.2%)
All	All	0.71	0/4169	1.10	14/5630 (0.2%)

There are no bond length outliers.

All (14) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	117	ASN	CA-CB-CG	7.16	119.76	112.60
1	B	230	ASN	OD1-CG-ND2	-6.26	116.34	122.60
1	B	162	PHE	CA-CB-CG	6.16	119.96	113.80
1	B	230	ASN	CB-CG-ND2	6.14	125.61	116.40
1	B	298	ASN	CA-CB-CG	6.07	118.67	112.60
1	A	162	PHE	CA-CB-CG	6.06	119.86	113.80
1	A	298	ASN	CA-CB-CG	5.86	118.46	112.60
1	A	214	ARG	CA-C-N	5.83	129.93	120.60
1	A	214	ARG	C-N-CA	5.83	129.93	120.60
1	A	121	LEU	CD1-CG-CD2	5.73	123.42	110.80
1	A	114	GLY	CA-C-N	5.26	127.33	120.28
1	A	114	GLY	C-N-CA	5.26	127.33	120.28
1	B	114	GLY	CA-C-N	5.02	127.01	120.28
1	B	114	GLY	C-N-CA	5.02	127.01	120.28

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	1928	0	1858	17	0
1	B	2155	0	2086	21	0
2	A	56	0	52	0	0
2	B	56	0	52	0	0
All	All	4195	0	4048	34	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 (34) 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:308:PHE:H	1:B:325:GLN:HE22	1.22	0.87
1:A:128:MET:HB3	1:A:131:PRO:HG3	1.78	0.66
1:A:330:LEU:HD12	1:B:321:LYS:HZ1	1.70	0.57
1:A:283:ILE:HA	1:B:300:THR:HG22	1.87	0.56
1:A:174:LEU:HD11	1:A:191:THR:HG21	1.88	0.56
1:B:222:PRO:HG2	1:B:237:VAL:HG11	1.88	0.55
1:B:307:TYR:HB3	1:B:320:LEU:HD11	1.88	0.54
1:A:307:TYR:HB3	1:A:320:LEU:HD11	1.89	0.53
1:A:112:VAL:HG21	1:A:119:THR:HG21	1.91	0.53
1:B:131:PRO:O	1:B:162:PHE:HB2	2.08	0.53
1:B:95:MET:HE3	1:B:156:TYR:HB3	1.91	0.51
1:A:222:PRO:HG2	1:A:237:VAL:HG11	1.92	0.51
1:A:95:MET:HE3	1:A:156:TYR:HB3	1.91	0.51
1:B:128:MET:HB3	1:B:131:PRO:HG3	1.92	0.51
1:A:250:VAL:HG11	1:A:267:ILE:HD12	1.94	0.49
1:A:315:PHE:HE2	1:B:319:MET:HB3	1.79	0.46
1:B:112:VAL:HG21	1:B:119:THR:HG21	1.97	0.46
1:B:308:PHE:H	1:B:325:GLN:NE2	2.02	0.45
1:B:120:LEU:HD23	1:B:127:GLN:HE21	1.81	0.45
1:B:308:PHE:N	1:B:325:GLN:HE22	2.02	0.44
1:B:138:VAL:HB	1:B:156:TYR:HB2	2.00	0.44
1:B:131:PRO:HD2	1:B:165:ARG:HE	1.83	0.43
1:B:61:ARG:HG3	1:B:62:GLU:HG3	2.01	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:315:PHE:CE2	1:B:319:MET:HB3	2.54	0.43
1:A:138:VAL:HB	1:A:156:TYR:HB2	2.00	0.42
1:B:43:MET:SD	1:B:61:ARG:HB3	2.60	0.42
1:B:116:TYR:CE2	1:B:118:THR:HG23	2.55	0.42
1:A:244:ARG:HA	1:A:245:GLU:HA	1.85	0.42
1:B:100:GLU:HA	1:B:128:MET:HB2	2.02	0.42
1:A:116:TYR:CE2	1:A:118:THR:HG23	2.55	0.42
1:A:218:LEU:HD22	1:A:223:ILE:HD13	2.02	0.42
1:A:182:ILE:HG13	1:A:192:GLY:HA3	2.03	0.41
1:A:183:LEU:HB2	1:A:190:VAL:HB	2.03	0.41
1:B:218:LEU:HB3	1:B:223:ILE:HD11	2.02	0.40

There are no symmetry-related clashes.

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	237/337 (70%)	224 (94%)	12 (5%)	1 (0%)	30	60
1	B	256/337 (76%)	246 (96%)	9 (4%)	1 (0%)	30	60
All	All	493/674 (73%)	470 (95%)	21 (4%)	2 (0%)	30	60

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	322	GLY
1	B	322	GLY

5.3.2 Protein sidechains ⓘ

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	214/294 (73%)	206 (96%)	8 (4%)	30	58
1	B	240/294 (82%)	235 (98%)	5 (2%)	47	67
All	All	454/588 (77%)	441 (97%)	13 (3%)	37	62

All (13) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	106	CYS
1	A	117	ASN
1	A	121	LEU
1	A	196	GLN
1	A	223	ILE
1	A	244	ARG
1	A	273	LEU
1	A	276	MET
1	B	85	GLU
1	B	91	ASP
1	B	121	LEU
1	B	198	SER
1	B	273	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (6) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	171	GLN
1	B	16	ASN
1	B	127	GLN
1	B	144	ASN
1	B	220	HIS
1	B	325	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 ⓘ

8 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	A	1003	1	14,14,15	0.28	0	17,19,21	0.64	0
2	NAG	A	1000	1	14,14,15	0.28	0	17,19,21	0.52	0
2	NAG	A	1001	1	14,14,15	0.36	0	17,19,21	1.61	2 (11%)
2	NAG	B	1001	1	14,14,15	0.28	0	17,19,21	0.87	1 (5%)
2	NAG	B	1002	1	14,14,15	0.35	0	17,19,21	1.65	2 (11%)
2	NAG	B	1003	1	14,14,15	0.28	0	17,19,21	0.67	0
2	NAG	B	1000	1	14,14,15	0.38	0	17,19,21	0.81	1 (5%)
2	NAG	A	1002	1	14,14,15	0.28	0	17,19,21	0.68	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	NAG	A	1003	1	-	0/6/23/26	0/1/1/1

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	NAG	A	1000	1	-	0/6/23/26	0/1/1/1
2	NAG	A	1001	1	-	0/6/23/26	0/1/1/1
2	NAG	B	1001	1	-	0/6/23/26	0/1/1/1
2	NAG	B	1002	1	-	1/6/23/26	0/1/1/1
2	NAG	B	1003	1	-	0/6/23/26	0/1/1/1
2	NAG	B	1000	1	-	1/6/23/26	0/1/1/1
2	NAG	A	1002	1	-	0/6/23/26	0/1/1/1

There are no bond length outliers.

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	1002	NAG	C1-O5-C5	5.77	119.92	112.19
2	A	1001	NAG	C1-O5-C5	5.67	119.78	112.19
2	A	1001	NAG	O5-C1-C2	3.20	116.25	111.29
2	B	1002	NAG	O5-C1-C2	3.13	116.13	111.29
2	B	1001	NAG	C1-O5-C5	2.65	115.74	112.19
2	B	1000	NAG	O5-C1-C2	2.53	115.20	111.29

There are no chirality outliers.

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	B	1000	NAG	O5-C5-C6-O6
2	B	1002	NAG	O5-C5-C6-O6

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	243/337 (72%)	1.03	27 (11%) 10 9	47, 72, 116, 162	0
1	B	272/337 (80%)	1.27	52 (19%) 3 3	50, 82, 133, 161	0
All	All	515/674 (76%)	1.15	79 (15%) 5 5	47, 76, 125, 162	0

All (79) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	45	ILE	8.9
1	B	44	VAL	7.2
1	B	12	ALA	6.2
1	B	28	THR	5.5
1	A	63	THR	4.9
1	A	294	ALA	4.8
1	B	309	GLU	4.8
1	B	294	ALA	4.7
1	B	78	VAL	4.6
1	A	304	LYS	4.5
1	B	293	THR	4.3
1	A	286	SER	4.2
1	A	329	ASP	4.0
1	B	26	LEU	4.0
1	B	64	ARG	3.9
1	B	13	ILE	3.9
1	B	322	GLY	3.7
1	B	11	TYR	3.7
1	B	314	TYR	3.6
1	A	309	GLU	3.6
1	B	27	THR	3.5
1	B	146	ASP	3.5
1	A	88	LYS	3.3
1	A	244	ARG	3.2

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Mol	Chain	Res	Type	RSRZ
1	B	16	ASN	3.2
1	A	313	SER	3.2
1	B	14	ALA	3.2
1	A	319	MET	3.1
1	B	76	THR	3.1
1	B	319	MET	3.0
1	A	310	PRO	3.0
1	A	314	TYR	3.0
1	B	41	ASP	3.0
1	A	59	CYS	2.9
1	A	192	GLY	2.9
1	A	322	GLY	2.9
1	A	260	GLY	2.9
1	B	107	ASP	2.8
1	B	310	PRO	2.8
1	B	15	LYS	2.7
1	B	331	GLU	2.7
1	A	328	PHE	2.7
1	A	315	PHE	2.6
1	B	88	LYS	2.6
1	A	223	ILE	2.6
1	B	321	LYS	2.6
1	B	238	ASP	2.6
1	B	63	THR	2.6
1	B	328	PHE	2.5
1	B	21	LEU	2.5
1	B	298	ASN	2.5
1	A	60	THR	2.4
1	B	75	PRO	2.4
1	A	320	LEU	2.4
1	B	100	GLU	2.4
1	B	217	GLY	2.4
1	A	148	LEU	2.4
1	B	282	GLU	2.3
1	A	302	THR	2.3
1	B	62	GLU	2.3
1	B	283	ILE	2.3
1	A	87	GLN	2.3
1	A	308	PHE	2.2
1	B	268	ALA	2.2
1	B	232	THR	2.2
1	B	287	GLU	2.2

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Mol	Chain	Res	Type	RSRZ
1	B	166	GLN	2.1
1	B	317	GLN	2.1
1	B	42	THR	2.1
1	B	219	PRO	2.1
1	A	146	ASP	2.1
1	A	330	LEU	2.1
1	B	101	PHE	2.1
1	B	143	ALA	2.1
1	B	236	LEU	2.0
1	B	313	SER	2.0
1	B	281	TYR	2.0
1	B	84	PHE	2.0
1	B	222	PRO	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, 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
2	NAG	A	1003	14/15	0.64	0.18	143,145,149,151	0
2	NAG	B	1002	14/15	0.64	0.13	93,96,97,97	0
2	NAG	B	1003	14/15	0.70	0.23	135,139,143,143	0
2	NAG	A	1001	14/15	0.77	0.22	82,85,86,88	0
2	NAG	B	1000	14/15	0.79	0.20	107,109,113,115	0
2	NAG	A	1000	14/15	0.89	0.11	58,61,63,64	0
2	NAG	A	1002	14/15	0.89	0.14	66,68,70,71	0
2	NAG	B	1001	14/15	0.91	0.12	49,51,51,52	0

6.5 Other polymers [i](#)

There are no such residues in this entry.