



# Full wwPDB X-ray Structure Validation Report ⓘ

Nov 10, 2024 – 01:50 AM EST

PDB ID : 3RPM  
Title : Crystal structure of the first GH20 domain of a novel Beta-N-acetyl-hexosaminidase StrH from *Streptococcus pneumoniae* R6  
Authors : Jiang, Y.L.; Yu, W.L.; Zhang, J.W.  
Deposited on : 2011-04-27  
Resolution : 2.10 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	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	1.20.1
EDS	:	3.0
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.003 (Gargrove)
Density-Fitness	:	1.0.11
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.39

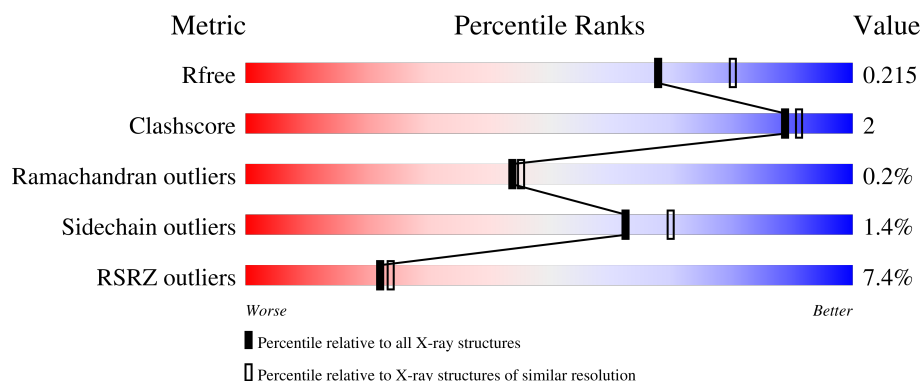
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.10 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))
$R_{free}$	164625	6234 (2.10-2.10)
Clashscore	180529	6893 (2.10-2.10)
Ramachandran outliers	177936	6839 (2.10-2.10)
Sidechain outliers	177891	6840 (2.10-2.10)
RSRZ outliers	164620	6234 (2.10-2.10)

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	467	
1	B	467	

## 2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 7523 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 Beta-N-acetyl-hexosaminidase.

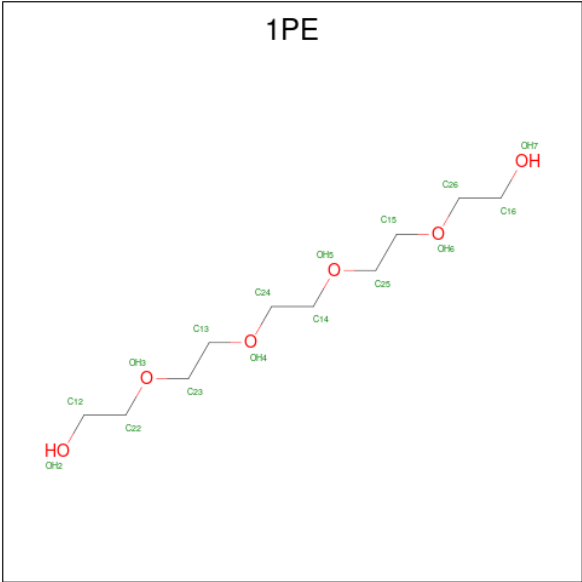
Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	450	Total	C	N	O	S	Se	0	1	0
			3528	2227	596	695	1	9			
1	B	422	Total	C	N	O	S	Se	0	1	0
			3297	2083	556	648	1	9			

- 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
			15	8	1	6		
2	B	1	Total	C	N	O	0	0
			15	8	1	6		

- Molecule 3 is PENTAETHYLENE GLYCOL (three-letter code: 1PE) (formula:  $C_{10}H_{22}O_6$ ).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	C	O	0	0
			16	10	6		
3	B	1	Total	C	O	0	0
			16	10	6		

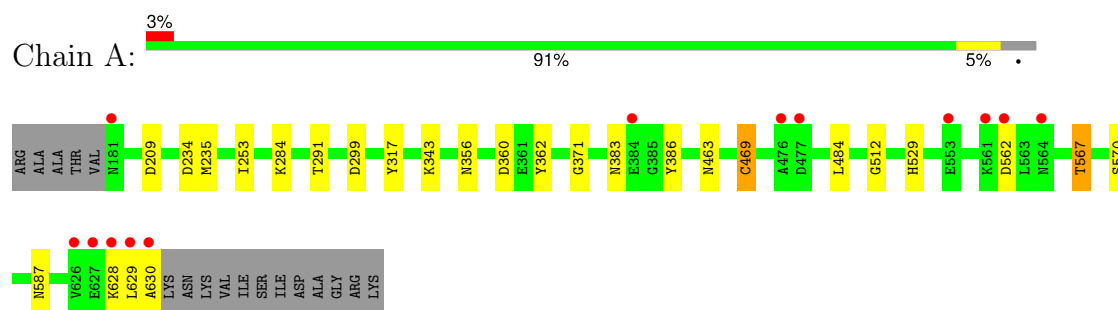
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	366	Total	O	0	0
			366	366		
4	B	270	Total	O	0	0
			270	270		

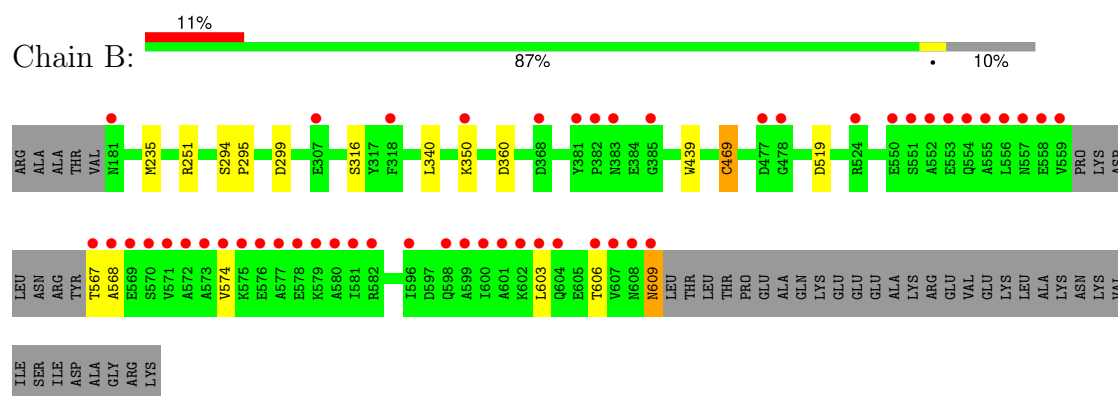
### 3 Residue-property plots [i](#)

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: Beta-N-acetyl-hexosaminidase



#### • Molecule 1: Beta-N-acetyl-hexosaminidase



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 31 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	173.98Å 173.98Å 108.20Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	45.56 – 2.10 45.56 – 2.10	Depositor EDS
% Data completeness (in resolution range)	97.4 (45.56-2.10) 98.3 (45.56-2.10)	Depositor EDS
$R_{merge}$	0.11	Depositor
$R_{sym}$	0.12	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	5.69 (at 2.10Å)	Xtriage
Refinement program	REFMAC 5.5.0109	Depositor
R, $R_{free}$	0.192 , 0.221 0.188 , 0.215	Depositor DCC
$R_{free}$ test set	5397 reflections (4.99%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	29.5	Xtriage
Anisotropy	0.730	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.35 , 34.6	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.51$ , $\langle L^2 \rangle = 0.35$	Xtriage
Estimated twinning fraction	0.012 for -h,-k,l	Xtriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	7523	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	36.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.09% 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

### 5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: NAG, 1PE

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	0.59	1/3595 (0.0%)	0.56	0/4850
1	B	0.58	1/3360 (0.0%)	0.56	0/4532
All	All	0.59	2/6955 (0.0%)	0.56	0/9382

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	469	CYS	CB-SG	-8.59	1.67	1.82
1	A	469	CYS	CB-SG	-7.92	1.68	1.82

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	3528	0	3433	13	0
1	B	3297	0	3195	11	0
2	A	15	0	15	1	0
2	B	15	0	15	4	0
3	A	16	0	20	0	0
3	B	16	0	20	0	0
4	A	366	0	0	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	B	270	0	0	0	0
All	All	7523	0	6698	24	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 2.

All (24) 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:567:THR:HG21	4:A:837:HOH:O	1.70	0.91
1:B:567:THR:HG22	1:B:568:ALA:H	1.43	0.83
1:A:567:THR:HG22	1:A:570:SER:H	1.43	0.82
1:B:360:ASP:HB2	2:B:1:NAG:H81	1.69	0.74
1:B:439:TRP:CZ3	2:B:1:NAG:O1	2.50	0.64
1:B:360:ASP:HB2	2:B:1:NAG:C8	2.28	0.63
1:B:574:VAL:HG22	1:B:606:THR:HG23	1.83	0.60
1:A:209:ASP:OD1	1:A:284:LYS:HE3	2.03	0.58
1:A:234:ASP:O	1:A:343:LYS:HE2	2.11	0.50
1:B:609:ASN:OD1	1:B:609:ASN:N	2.46	0.48
1:A:291:THR:OG1	1:A:356:ASN:HB3	2.14	0.47
1:A:463:ASN:O	1:A:512:GLY:HA2	2.15	0.47
1:B:235:MSE:HE1	1:B:340:LEU:HD11	1.95	0.47
1:A:562:ASP:OD1	1:A:562:ASP:N	2.47	0.44
1:A:484:LEU:HD22	1:A:529:HIS:HD2	1.82	0.44
1:A:362:TYR:O	1:A:371:GLY:HA3	2.19	0.43
1:A:628:LYS:C	1:A:630:ALA:H	2.22	0.43
1:B:567:THR:HG22	1:B:568:ALA:N	2.23	0.43
1:A:317:TYR:HH	1:A:386:TYR:HE1	1.67	0.42
1:B:519:ASP:OD1	2:B:1:NAG:O4	2.23	0.42
1:B:294:SER:HB2	1:B:295:PRO:HA	2.00	0.42
1:B:603:LEU:HA	1:B:606:THR:HG22	2.01	0.42
1:A:360:ASP:HB2	2:A:2:NAG:H83	2.02	0.42
1:A:235:MSE:CE	1:A:253:ILE:HD12	2.49	0.41

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	449/467 (96%)	438 (98%)	10 (2%)	1 (0%)	44	45
1	B	419/467 (90%)	407 (97%)	11 (3%)	1 (0%)	44	45
All	All	868/934 (93%)	845 (97%)	21 (2%)	2 (0%)	44	45

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	629	LEU
1	B	350	LYS

### 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	368/371 (99%)	363 (99%)	5 (1%)	62	70
1	B	343/371 (92%)	338 (98%)	5 (2%)	60	67
All	All	711/742 (96%)	701 (99%)	10 (1%)	62	70

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

Mol	Chain	Res	Type
1	A	299	ASP
1	A	383	ASN
1	A	469	CYS
1	A	567	THR

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Mol	Chain	Res	Type
1	A	587	ASN
1	B	251	ARG
1	B	299	ASP
1	B	316	SER
1	B	469	CYS
1	B	609	ASN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

### 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	$\# Z  > 2$
3	1PE	A	1	-	15,15,15	1.53	0	14,14,14	1.91	8 (57%)
2	NAG	B	1	-	15,15,15	0.47	0	21,21,21	0.55	0
3	1PE	B	2	-	15,15,15	1.60	0	14,14,14	1.78	7 (50%)
2	NAG	A	2	-	15,15,15	0.65	0	21,21,21	3.26	8 (38%)

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
3	1PE	A	1	-	-	7/13/13/13	-
2	NAG	B	1	-	-	0/6/26/26	0/1/1/1
3	1PE	B	2	-	-	9/13/13/13	-
2	NAG	A	2	-	-	0/6/26/26	0/1/1/1

There are no bond length outliers.

All (23) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	2	NAG	C1-C2-C3	-10.07	96.82	110.54
2	A	2	NAG	C1-O5-C5	-6.94	100.23	113.65
2	A	2	NAG	C1-C2-N2	3.86	115.20	110.73
2	A	2	NAG	C3-C2-N2	3.47	117.01	110.62
2	A	2	NAG	O7-C7-C8	-2.95	116.79	122.05
2	A	2	NAG	O1-C1-C2	2.83	115.09	109.22
3	A	1	1PE	OH5-C25-C15	2.76	122.92	110.35
3	A	1	1PE	OH5-C14-C24	2.63	122.32	110.35
3	A	1	1PE	OH4-C13-C23	2.58	122.13	110.35
2	A	2	NAG	O1-C1-O5	2.49	117.81	110.41
3	B	2	1PE	OH6-C15-C25	2.43	121.43	110.35
3	B	2	1PE	OH5-C14-C24	2.41	121.35	110.35
2	A	2	NAG	O5-C1-C2	-2.38	107.12	109.52
3	B	2	1PE	OH3-C22-C12	2.36	120.52	110.11
3	A	1	1PE	OH4-C24-C14	2.34	121.03	110.35
3	B	2	1PE	OH3-C23-C13	2.34	121.00	110.35
3	B	2	1PE	OH6-C26-C16	2.30	120.24	110.11
3	A	1	1PE	OH6-C26-C16	2.17	119.69	110.11
3	A	1	1PE	OH3-C23-C13	2.17	120.25	110.35
3	A	1	1PE	OH3-C22-C12	2.14	119.53	110.11
3	A	1	1PE	OH6-C15-C25	2.14	120.09	110.35
3	B	2	1PE	OH4-C13-C23	2.10	119.94	110.35
3	B	2	1PE	OH4-C24-C14	2.08	119.83	110.35

There are no chirality outliers.

All (16) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	1	1PE	OH5-C14-C24-OH4
3	A	1	1PE	OH7-C16-C26-OH6
3	B	2	1PE	OH5-C14-C24-OH4
3	A	1	1PE	C14-C24-OH4-C13
3	B	2	1PE	OH7-C16-C26-OH6
3	A	1	1PE	C15-C25-OH5-C14
3	B	2	1PE	C15-C25-OH5-C14
3	B	2	1PE	C14-C24-OH4-C13
3	A	1	1PE	C25-C15-OH6-C26
3	B	2	1PE	C24-C14-OH5-C25
3	B	2	1PE	C12-C22-OH3-C23
3	B	2	1PE	C23-C13-OH4-C24
3	B	2	1PE	OH6-C15-C25-OH5
3	B	2	1PE	OH4-C13-C23-OH3
3	A	1	1PE	OH6-C15-C25-OH5
3	A	1	1PE	OH4-C13-C23-OH3

There are no ring outliers.

2 monomers are involved in 5 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	1	NAG	4	0
2	A	2	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

### 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	441/467 (94%)	0.08	13 (2%)	54	55	16, 32, 47, 83	9 (2%)
1	B	413/467 (88%)	0.47	50 (12%)	10	10	16, 33, 82, 100	5 (1%)
All	All	854/934 (91%)	0.27	63 (7%)	22	24	16, 32, 64, 100	14 (1%)

All (63) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	559	VAL	9.8
1	A	630	ALA	6.9
1	B	572	ALA	6.1
1	A	629	LEU	6.0
1	B	571	VAL	5.9
1	B	553	GLU	5.9
1	A	628	LYS	5.8
1	B	556	LEU	5.7
1	B	574	VAL	5.5
1	B	607	VAL	5.4
1	B	568	ALA	5.3
1	B	555	ALA	5.1
1	B	567	THR	5.1
1	B	570	SER	4.8
1	B	600	ILE	4.4
1	B	181	ASN	4.1
1	B	573	ALA	4.0
1	B	606	THR	4.0
1	B	601	ALA	3.7
1	B	604	GLN	3.5
1	B	350	LYS	3.5
1	B	554	GLN	3.3
1	A	626	VAL	3.3
1	B	381	TYR	3.3

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Mol	Chain	Res	Type	RSRZ
1	B	575	LYS	3.2
1	B	576	GLU	3.2
1	B	602	LYS	3.2
1	B	551	SER	3.1
1	B	599	ALA	3.1
1	B	477	ASP	3.1
1	B	603	LEU	3.0
1	B	558	GLU	3.0
1	B	581	ILE	2.9
1	B	609	ASN	2.9
1	A	477	ASP	2.9
1	B	579	LYS	2.9
1	B	557	ASN	2.7
1	B	569	GLU	2.7
1	B	318	PHE	2.6
1	B	578	GLU	2.6
1	B	368	ASP	2.6
1	B	598	GLN	2.6
1	A	562	ASP	2.5
1	A	181	ASN	2.5
1	B	383	ASN	2.5
1	B	608	ASN	2.5
1	B	552	ALA	2.5
1	B	582	ARG	2.5
1	A	627	GLU	2.5
1	B	580	ALA	2.4
1	B	524	ARG	2.4
1	B	382	PRO	2.4
1	B	577	ALA	2.3
1	B	550	GLU	2.3
1	A	561	LYS	2.3
1	A	564	ASN	2.2
1	A	476	ALA	2.2
1	A	384	GLU	2.1
1	B	596	ILE	2.1
1	B	385	GLY	2.0
1	B	478	GLY	2.0
1	B	307	GLU	2.0
1	A	553	GLU	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( $\text{\AA}^2$ )	Q<0.9
3	1PE	B	2	16/16	0.78	0.24	71,72,75,75	0
3	1PE	A	1	16/16	0.83	0.18	57,62,66,66	0
2	NAG	B	1	15/15	0.83	0.17	31,38,49,53	0
2	NAG	A	2	15/15	0.90	0.11	29,35,43,45	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.