



# Full wwPDB X-ray Structure Validation Report ⓘ

Feb 26, 2014 – 04:22 PM GMT

PDB ID : 2V5Y  
Title : CRYSTAL STRUCTURE OF THE RECEPTOR PROTEIN TYROSINE PHOSPHATASE MU ECTODOMAIN  
Authors : Aricescu, A.R.; Siebold, C.; Choudhuri, K.; Chang, V.T.; Lu, W.; Davis, S.J.; Van Der Merwe, P.A.; Jones, E.Y.  
Deposited on : 2007-07-11  
Resolution : 3.10 Å(reported)

This is a full wwPDB 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 <http://wwpdb.org/ValidationPDFNotes.html>

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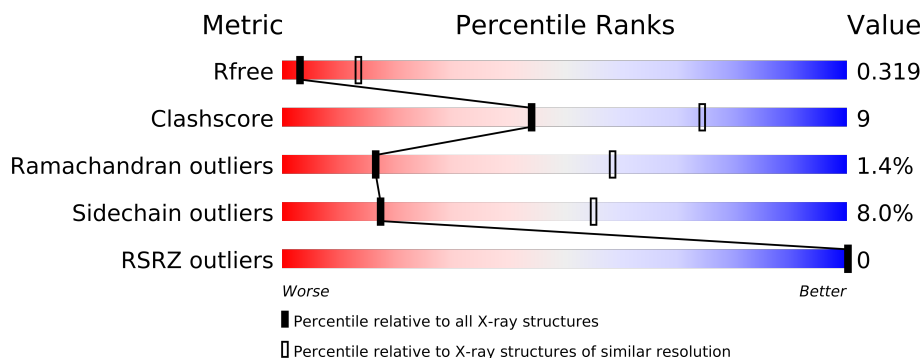
The following versions of software and data (see [references](#)) were used in the production of this report:

MolProbity : 4.02b-467  
Mogul : 1.15 2013  
Xtriage (Phenix) : dev-1323  
EDS : stable22639  
Percentile statistics : 21963  
Refmac : 5.8.0049  
CCP4 : 6.3.0 (Settle)  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et. al. (1996)  
Validation Pipeline (wwPDB-VP) : stable22683

# 1 Overall quality at a glance


The reported resolution of this entry is 3.10 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))
$R_{free}$	66092	1007 (3.18-3.02)
Clashscore	79885	1078 (3.16-3.04)
Ramachandran outliers	78287	1044 (3.16-3.04)
Sidechain outliers	78261	1044 (3.16-3.04)
RSRZ outliers	66119	1008 (3.18-3.02)

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 on the lower bar indicate the fraction of residues that contain outliers for  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density.

Mol	Chain	Length	Quality of chain
1	A	731	

The following table lists non-polymeric compounds that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Geometry	Electron density
2	NAG	A	1573	-	X
2	NAG	A	1574	-	X
3	NA	A	1577	-	X

## 2 Entry composition i

There are 3 unique types of molecules in this entry. The entry contains 4523 atoms, of which 0 are hydrogen and 0 are deuterium.

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.

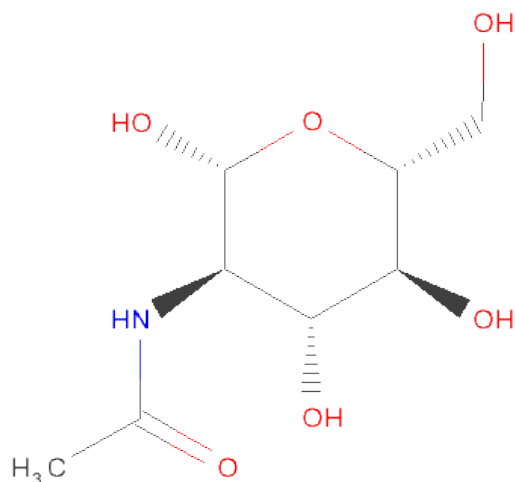
- Molecule 1 is a protein called RECEPTOR-TYPE TYROSINE-PROTEIN PHOSPHATASE MU.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	564	Total	C	N	O	S	0	0	0
			4423	2795	762	850	16			

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	48	PHE	LEU	CONFLICT	UNP P28827

- Molecule 2 is SUGAR (N-ACETYL-D-GLUCOSAMINE) (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		

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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		
2	A	1	Total	C	N	O	0	0
			14	8	1	5		

- Molecule 3 is SODIUM ION (three-letter code: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	2	Total	Na	0	0
			2	2		



## 4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	167.34Å 69.33Å 97.49Å 90.00° 113.52° 90.00°	Depositor
Resolution (Å)	20.00 – 3.10 29.80 – 2.99	Depositor EDS
% Data completeness (in resolution range)	100.0 (20.00-3.10) 99.1 (29.80-2.99)	Depositor EDS
$R_{merge}$	0.16	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.93 (at 3.00Å)	Xtriage
Refinement program	REFMAC 5.2.0019	Depositor
R, $R_{free}$	0.242 , 0.320 0.254 , 0.319	Depositor DCC
$R_{free}$ test set	1069 reflections (5.40%)	DCC
Wilson B-factor (Å <sup>2</sup> )	49.4	Xtriage
Anisotropy	0.920	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.32 , -0.3	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.33$	Xtriage
Outliers	0 of 20873 reflections	Xtriage
$F_o, F_c$ correlation	0.87	EDS
Total number of atoms	4523	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	31.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.51% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

## 5 Model quality

### 5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: NA, 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	0.39	0/4540	0.60	0/6188

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	1

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	530	PHE	Peptide

### 5.2 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 hydrogens added by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, and the number in parentheses is this value normalized per 1000 atoms of the molecule in the chain. The Symm-Clashes column gives symmetry related clashes, in the same way as for the Clashes column.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	4423	0	4261	76	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	A	98	0	91	3	0
3	A	2	0	0	0	0
All	All	4523	0	4352	76	0

Clashscore is defined as the number of clashes calculated for the entry per 1000 atoms (including hydrogens) of the entry. The overall clashscore for this entry is 9.

All (76) close contacts within the same asymmetric unit are listed below.

Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:A:282:LEU:HD11	1:A:313:VAL:HG21	1.54	0.89
1:A:112:ILE:HD12	1:A:114:GLY:HA3	1.57	0.87
1:A:519:VAL:HG21	1:A:528:PHE:CZ	2.14	0.81
1:A:396:THR:HG23	1:A:412:GLU:O	1.90	0.71
1:A:83:VAL:HG22	1:A:150:LEU:HD23	1.71	0.71
1:A:547:THR:HG22	1:A:549:LYS:H	1.60	0.66
1:A:192:THR:HG21	1:A:213:ILE:HD11	1.78	0.65
1:A:481:LEU:HD23	1:A:498:ILE:CD1	2.27	0.65
1:A:567:SER:HA	1:A:568:MET:HG2	1.79	0.63
1:A:265:ILE:HD12	1:A:286:SER:HB3	1.82	0.62
1:A:522:LEU:HD23	2:A:1575:NAG:H5	1.83	0.61
1:A:117:THR:O	1:A:119:THR:HG23	2.01	0.59
1:A:80:HIS:CE1	1:A:122:ARG:HG3	2.37	0.59
1:A:282:LEU:HD11	1:A:313:VAL:CG2	2.31	0.57
1:A:282:LEU:HD11	1:A:313:VAL:HG11	1.88	0.56
1:A:400:CYS:SG	1:A:409:VAL:HG22	2.45	0.56
1:A:200:LEU:HD11	1:A:238:TYR:HB3	1.89	0.54
1:A:85:SER:HA	1:A:86:LYS:CB	2.37	0.54
1:A:465:VAL:O	1:A:555:ALA:HB2	2.08	0.54
1:A:283:ASN:O	1:A:285:ASN:N	2.42	0.53
1:A:399:TYR:CE1	1:A:410:ARG:HB2	2.45	0.52
1:A:481:LEU:CD2	1:A:498:ILE:CD1	2.87	0.52
1:A:323:LEU:HD22	1:A:329:TYR:CZ	2.45	0.51
1:A:536:GLY:HA2	1:A:563:ILE:HG22	1.92	0.51
1:A:151:ALA:O	1:A:152:ILE:HD12	2.10	0.51
1:A:231:THR:HG22	1:A:232:LYS:H	1.76	0.50
1:A:525:GLU:HB3	2:A:1575:NAG:H82	1.91	0.50
1:A:378:ILE:HD13	1:A:437:VAL:HG11	1.94	0.50
1:A:274:GLY:HA3	1:A:277:TYR:CE2	2.46	0.50
1:A:180:GLN:HE21	1:A:340:GLU:HG3	1.76	0.49
1:A:269:GLN:HB2	1:A:281:GLN:HB3	1.92	0.49
1:A:538:THR:HG22	1:A:560:THR:HB	1.94	0.49
1:A:481:LEU:CD2	1:A:498:ILE:HD11	2.42	0.48

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Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:A:282:LEU:CD1	1:A:313:VAL:HG21	2.36	0.48
1:A:85:SER:HA	1:A:86:LYS:HB3	1.95	0.47
1:A:86:LYS:HG2	1:A:147:GLN:O	2.14	0.47
1:A:101:ASN:HA	1:A:134:PHE:CE2	2.50	0.47
1:A:546:SER:HB2	1:A:551:PHE:CD2	2.50	0.47
1:A:198:LEU:HD11	1:A:242:ILE:HD12	1.95	0.47
1:A:386:ASN:OD1	1:A:386:ASN:N	2.47	0.47
1:A:282:LEU:HD21	1:A:298:VAL:HG22	1.97	0.47
1:A:266:ALA:HB1	1:A:267:PRO:HD2	1.96	0.47
1:A:167:HIS:HB2	1:A:189:ILE:HG23	1.96	0.46
1:A:113:SER:N	1:A:114:GLY:HA2	2.29	0.46
1:A:547:THR:CG2	1:A:548:ALA:N	2.78	0.46
1:A:470:ILE:HD11	1:A:555:ALA:CB	2.46	0.46
1:A:291:GLY:HA3	1:A:337:ARG:HE	1.81	0.46
1:A:284:ALA:HB1	1:A:335:LEU:HD21	1.98	0.46
1:A:111:ASN:ND2	2:A:1571:NAG:H83	2.32	0.45
1:A:536:GLY:CA	1:A:563:ILE:HG22	2.47	0.45
1:A:301:CYS:HB3	1:A:308:ASN:HB2	1.99	0.45
1:A:521:LYS:HD3	1:A:525:GLU:HG3	1.98	0.45
1:A:85:SER:CA	1:A:86:LYS:CB	2.95	0.45
1:A:369:VAL:HG22	1:A:379:ARG:HG2	1.97	0.44
1:A:383:PHE:HB2	1:A:387:VAL:HB	1.99	0.44
1:A:367:GLU:HB2	1:A:379:ARG:HD2	2.00	0.44
1:A:427:THR:HG22	1:A:428:ASN:H	1.82	0.43
1:A:538:THR:CB	1:A:560:THR:HB	2.48	0.43
1:A:171:ILE:HD13	1:A:185:GLN:O	2.19	0.43
1:A:171:ILE:HG23	1:A:254:ALA:HB2	1.99	0.43
1:A:282:LEU:HD21	1:A:298:VAL:CG2	2.49	0.42
1:A:126:ALA:HB1	1:A:167:HIS:CE1	2.53	0.42
1:A:85:SER:CA	1:A:86:LYS:HB3	2.49	0.42
1:A:293:ILE:HD12	1:A:293:ILE:N	2.34	0.42
1:A:28:TRP:CE3	1:A:51:VAL:HG23	2.54	0.42
1:A:230:THR:HA	1:A:234:ASP:OD1	2.20	0.41
1:A:305:GLY:O	1:A:306:SER:C	2.58	0.41
1:A:496:TYR:CE1	1:A:526:THR:HG22	2.55	0.41
1:A:474:THR:HG21	1:A:560:THR:O	2.21	0.41
1:A:188:ALA:HB3	1:A:221:PHE:CE2	2.55	0.41
1:A:538:THR:HB	1:A:560:THR:HB	2.02	0.41
1:A:298:VAL:HG23	1:A:313:VAL:CG1	2.51	0.41
1:A:251:SER:OG	1:A:252:ASN:O	2.36	0.41
1:A:443:ASN:C	1:A:443:ASN:OD1	2.59	0.41
1:A:500:TYR:HA	1:A:540:SER:O	2.21	0.40

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Atom-1	Atom-2	Distance(Å)	Clash(Å)
1:A:184:PHE:CD2	1:A:200:LEU:HD21	2.57	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	560/731 (77%)	510 (91%)	42 (8%)	8 (1%)	16 58

All (8) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	86	LYS
1	A	87	SER
1	A	284	ALA
1	A	306	SER
1	A	325	PRO
1	A	403	VAL
1	A	470	ILE
1	A	405	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	490/637 (77%)	451 (92%)	39 (8%)	17 55

All (39) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	3	PHE
1	A	4	SER
1	A	14	SER
1	A	19	SER
1	A	25	ASP
1	A	33	THR
1	A	100	VAL
1	A	118	ARG
1	A	185	GLN
1	A	191	ARG
1	A	215	VAL
1	A	220	ARG
1	A	230	THR
1	A	269	GLN
1	A	308	ASN
1	A	328	GLU
1	A	345	SER
1	A	352	THR
1	A	354	THR
1	A	360	MET
1	A	370	GLU
1	A	379	ARG
1	A	383	PHE
1	A	386	ASN
1	A	400	CYS
1	A	406	GLN
1	A	407	GLU
1	A	438	LYS
1	A	487	THR
1	A	488	GLN
1	A	497	GLU
1	A	498	ILE
1	A	501	LYS
1	A	503	VAL
1	A	515	GLN
1	A	531	PHE
1	A	538	THR
1	A	547	THR
1	A	560	THR

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	147	GLN
1	A	269	GLN
1	A	406	GLN

### 5.3.3 RNA ⓘ

There are no RNA chains 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 carbohydrates in this entry.

## 5.6 Ligand geometry ⓘ

Of 9 ligands modelled in this entry, 2 are monoatomic - leaving 7 for Mogul analysis.

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	1569	1	12,14,15	0.71	0	15,19,21	1.33	2 (13%)
2	NAG	A	1570	1	12,14,15	0.62	0	15,19,21	1.26	1 (6%)
2	NAG	A	1571	1	12,14,15	0.72	1 (8%)	15,19,21	1.17	1 (6%)
2	NAG	A	1572	1	12,14,15	0.67	0	15,19,21	0.88	1 (6%)
2	NAG	A	1573	1	12,14,15	0.61	0	15,19,21	0.88	1 (6%)
2	NAG	A	1574	1	12,14,15	0.56	0	15,19,21	0.65	0
2	NAG	A	1575	1	12,14,15	0.59	0	15,19,21	1.05	2 (13%)

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	1569	1	-	1/6/23/26	0/1/1/1
2	NAG	A	1570	1	-	0/6/23/26	0/1/1/1
2	NAG	A	1571	1	-	0/6/23/26	0/1/1/1
2	NAG	A	1572	1	-	0/6/23/26	0/1/1/1
2	NAG	A	1573	1	-	0/6/23/26	0/1/1/1
2	NAG	A	1574	1	-	0/6/23/26	0/1/1/1
2	NAG	A	1575	1	-	0/6/23/26	0/1/1/1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	1571	NAG	O5-C5	-2.19	1.41	1.45

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	1569	NAG	O5-C5-C4	3.42	115.00	110.65
2	A	1571	NAG	C3-C2-N2	-2.89	107.36	111.76
2	A	1570	NAG	O5-C5-C6	2.82	109.94	106.98
2	A	1575	NAG	O5-C5-C4	2.62	113.98	110.65
2	A	1569	NAG	O5-C5-C6	2.11	109.20	106.98
2	A	1575	NAG	O4-C4-C3	-2.10	105.64	110.35
2	A	1572	NAG	C3-C2-N2	-2.02	108.69	111.76
2	A	1573	NAG	O5-C5-C6	2.01	109.08	106.98

There are no chirality outliers.

All (1) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	1569	NAG	O7-C7-N2-C2

There are no ring outliers.

## 5.7 Other polymers ⓘ

There are no such residues in this entry.

## 5.8 Polymer linkage issues

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	564/731 (77%)	-0.14	0 100 100	13, 29, 49, 59	0

There are no RSRZ outliers to report.

### 6.2 Non-standard residues in protein, DNA, RNA chains ⓘ

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

### 6.3 Carbohydrates ⓘ

There are no carbohydrates in this entry.

### 6.4 Ligands ⓘ

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. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. 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	RSR	LLDF	B-factors(Å <sup>2</sup> )	Q<0.9
2	NAG	A	1573	14/15	0.39	5.62	60,62,62,62	0
3	NA	A	1577	1/1	0.37	4.33	31,31,31,31	0
2	NAG	A	1574	14/15	0.32	2.06	53,54,56,56	0
2	NAG	A	1575	14/15	0.28	1.96	46,48,49,49	0
2	NAG	A	1572	14/15	0.30	1.81	51,52,53,53	0
2	NAG	A	1571	14/15	0.27	1.01	46,48,49,49	0
3	NA	A	1576	1/1	0.22	0.00	39,39,39,39	0

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Mol	Type	Chain	Res	Atoms	RSR	LLDF	B-factors( $\text{\AA}^2$ )	Q<0.9
2	NAG	A	1569	14/15	0.25	-0.13	56,57,58,58	0
2	NAG	A	1570	14/15	0.20	-0.47	40,41,42,42	0

## 6.5 Other polymers ⓘ

There are no such residues in this entry.