



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 07:14 AM UTC

PDB ID : 8WS0 / pdb_00008ws0
Title : Crystal structure of human NEK7 S195D mutant
Authors : Bijpuria, S.; Athresh, S.; Subbiah, R.; Mollard, A.; Bearss, D.
Deposited on : 2023-10-16
Resolution : 2.12 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
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

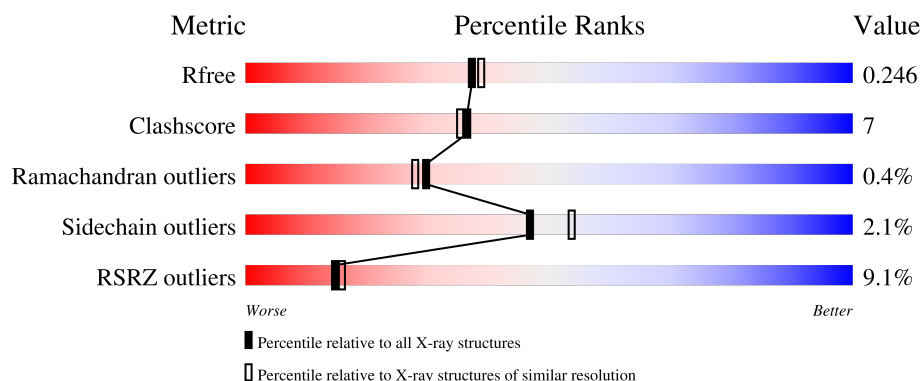
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.12 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	8290 (2.14-2.10)
Clashscore	190562	8817 (2.14-2.10)
Ramachandran outliers	187476	8738 (2.14-2.10)
Sidechain outliers	187428	8739 (2.14-2.10)
RSRZ outliers	180081	8294 (2.14-2.10)

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 ≥ 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	310	<div> <div>5%</div> <div>75%</div> <div>11%</div> <div>14%</div> </div>
1	B	310	<div> <div>11%</div> <div>60%</div> <div>22%</div> <div>5%</div> <div>13%</div> </div>

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 4540 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 Serine/threonine-protein kinase Nek7.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	267	Total	C	N	O	S	5	0	0
			2158	1381	373	386	18			
1	B	270	Total	C	N	O	S	0	5	0
			2192	1405	374	396	17			

There are 18 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	195	ASP	SER	engineered mutation	UNP Q8TDX7
A	303	LEU	-	expression tag	UNP Q8TDX7
A	304	GLU	-	expression tag	UNP Q8TDX7
A	305	HIS	-	expression tag	UNP Q8TDX7
A	306	HIS	-	expression tag	UNP Q8TDX7
A	307	HIS	-	expression tag	UNP Q8TDX7
A	308	HIS	-	expression tag	UNP Q8TDX7
A	309	HIS	-	expression tag	UNP Q8TDX7
A	310	HIS	-	expression tag	UNP Q8TDX7
B	195	ASP	SER	engineered mutation	UNP Q8TDX7
B	303	LEU	-	expression tag	UNP Q8TDX7
B	304	GLU	-	expression tag	UNP Q8TDX7
B	305	HIS	-	expression tag	UNP Q8TDX7
B	306	HIS	-	expression tag	UNP Q8TDX7
B	307	HIS	-	expression tag	UNP Q8TDX7
B	308	HIS	-	expression tag	UNP Q8TDX7
B	309	HIS	-	expression tag	UNP Q8TDX7
B	310	HIS	-	expression tag	UNP Q8TDX7

- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	99	Total	O	0	0
			99	99		

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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	B	91	Total	O	0	0
			91	91		

- Molecule 1: Serine/threonine-protein kinase Nek7



4 Data and refinement statistics

Property	Value	Source
Space group	P 31 2 1	Depositor
Cell constants a, b, c, α , β , γ	88.60Å 88.60Å 156.09Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	44.34 – 2.12 44.34 – 2.12	Depositor EDS
% Data completeness (in resolution range)	99.6 (44.34-2.12) 99.9 (44.34-2.12)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.76 (at 2.12Å)	Xtriage
Refinement program	REFMAC 5.8.0267	Depositor
R, R_{free}	0.191 , 0.242 0.197 , 0.246	Depositor DCC
R_{free} test set	1948 reflections (4.74%)	wwPDB-VP
Wilson B-factor (Å ²)	50.7	Xtriage
Anisotropy	0.078	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 44.5	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	0.025 for -h,-k,l	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	4540	wwPDB-VP
Average B, all atoms (Å ²)	61.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.39% 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

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	1.26	6/2207 (0.3%)	1.47	9/2978 (0.3%)
1	B	1.64	36/2251 (1.6%)	1.55	20/3042 (0.7%)
All	All	1.46	42/4458 (0.9%)	1.51	29/6020 (0.5%)

All (42) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	136	ARG	C-O	18.22	1.47	1.24
1	A	50	ARG	NE-CZ	-12.62	1.19	1.33
1	B	296	HIS	ND1-CE1	-11.33	1.21	1.32
1	B	146	CYS	C-O	10.95	1.36	1.24
1	B	56	ASP	CA-C	10.04	1.65	1.52
1	B	263	TYR	C-O	8.80	1.33	1.24
1	B	285	VAL	C-O	7.91	1.33	1.24
1	B	143	VAL	CA-C	7.68	1.64	1.52
1	A	124	LYS	CD-CE	7.53	1.75	1.52
1	B	89	LEU	C-O	-7.37	1.15	1.23
1	B	143	VAL	C-O	-7.12	1.15	1.24
1	B	125	HIS	C-O	6.84	1.32	1.24
1	B	280	GLU	C-O	-6.76	1.15	1.24
1	B	144	GLN	N-CA	6.36	1.54	1.46
1	B	139	TRP	C-O	6.33	1.31	1.24
1	B	56	ASP	CG-OD2	6.29	1.37	1.25
1	B	178	GLY	C-O	6.08	1.30	1.23
1	B	171	ALA	C-O	6.01	1.31	1.24
1	A	91	HIS	CE1-NE2	5.99	1.38	1.32
1	B	150	GLU	C-O	5.67	1.30	1.24
1	B	57	GLY	N-CA	5.63	1.53	1.45
1	B	263	TYR	CA-C	5.59	1.59	1.52
1	B	152	MET	C-O	5.54	1.30	1.24
1	B	215	PHE	C-O	5.50	1.30	1.24
1	A	86	LEU	C-O	5.49	1.30	1.24
1	B	116	ALA	C-O	5.47	1.30	1.23

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	160	ARG	C-O	-5.46	1.17	1.24
1	B	137	THR	C-O	5.45	1.30	1.24
1	B	286	THR	N-CA	5.31	1.52	1.46
1	B	263	TYR	CB-CG	5.29	1.63	1.51
1	B	168	PHE	C-N	5.29	1.40	1.33
1	B	145	LEU	N-CA	5.29	1.52	1.46
1	B	288	VAL	N-CA	5.22	1.52	1.46
1	B	32	ALA	C-O	-5.16	1.17	1.24
1	B	144	GLN	C-O	5.16	1.30	1.24
1	B	267	LEU	C-O	5.08	1.30	1.24
1	B	183	GLY	C-O	5.08	1.29	1.23
1	B	222	LEU	C-O	5.07	1.30	1.24
1	B	153	HIS	CE1-NE2	5.04	1.37	1.32
1	A	178	GLY	C-O	5.03	1.30	1.23
1	B	186	PHE	C-O	5.03	1.30	1.24
1	A	204	SER	CA-CB	-5.02	1.46	1.53

All (29) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	50	ARG	CD-NE-CZ	9.65	137.92	124.40
1	B	287	TYR	N-CA-C	-8.41	102.11	111.28
1	B	286	THR	CA-C-O	-8.37	111.68	120.55
1	B	90	ASN	CA-CB-CG	-7.57	105.03	112.60
1	A	50	ARG	NE-CZ-NH2	7.47	125.93	119.20
1	B	296	HIS	CA-CB-CG	-7.34	106.45	113.80
1	B	263	TYR	CB-CA-C	7.24	121.73	110.14
1	A	50	ARG	NE-CZ-NH1	-6.94	114.56	121.50
1	B	139	TRP	CA-C-O	-6.29	113.88	120.55
1	B	296	HIS	CG-CD2-NE2	-6.11	101.09	107.20
1	B	218	ASP	CA-CB-CG	6.00	118.60	112.60
1	B	118	ASP	CB-CA-C	-5.95	98.60	109.54
1	B	167	VAL	CA-C-O	-5.88	114.17	120.59
1	B	139	TRP	O-C-N	5.83	128.30	122.12
1	A	115	ASP	CA-CB-CG	5.80	118.40	112.60
1	B	142	PHE	N-CA-C	-5.66	105.19	111.36
1	B	118	ASP	CA-CB-CG	5.53	118.13	112.60
1	B	296	HIS	ND1-CG-CD2	5.45	111.55	106.10
1	B	289	TYR	CB-CA-C	-5.30	101.67	110.68
1	A	37	GLU	N-CA-C	-5.25	106.93	113.55
1	B	266	GLU	CA-C-O	-5.24	115.29	120.90
1	B	208	ILE	O-C-N	5.10	127.21	121.90

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	143	VAL	CA-C-N	5.03	127.28	120.44
1	B	143	VAL	C-N-CA	5.03	127.28	120.44
1	A	124	LYS	CG-CD-CE	-5.02	99.75	111.30
1	A	110	VAL	CA-C-O	-5.01	115.12	120.59
1	A	244	TYR	CA-C-N	5.01	127.00	120.28
1	A	244	TYR	C-N-CA	5.01	127.00	120.28
1	B	144	GLN	CA-C-O	-5.00	115.55	120.70

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	2158	0	2159	19	0
1	B	2192	0	2177	44	0
2	A	99	0	0	2	0
2	B	91	0	0	3	0
All	All	4540	0	4336	62	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 7.

All (62) 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:91:HIS:HD2	1:B:93:ASN:H	1.24	0.81
1:B:91:HIS:CD2	1:B:93:ASN:H	2.05	0.74
1:B:144:GLN:HE22	1:B:174:VAL:HA	1.59	0.66
1:B:23:ARG:NH1	1:B:26:MET:HE3	2.10	0.66
1:A:122:MET:HE1	1:A:141:TYR:CE2	2.34	0.63
1:B:267:LEU:HD23	1:B:267:LEU:C	2.26	0.61
1:B:170:THR:CG2	1:B:172:THR:HG22	2.31	0.60
1:B:23:ARG:HD2	2:B:461:HOH:O	2.02	0.60
1:A:205:PRO:HG2	1:A:277:PRO:HA	1.84	0.59

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:160:ARG:HA	1:A:213:TYR:CZ	2.39	0.57
1:B:170:THR:HG22	1:B:172:THR:HG22	1.86	0.56
1:A:160:ARG:NH1	2:A:404:HOH:O	2.37	0.56
1:A:48:VAL:HG22	1:A:63:LYS:HG2	1.89	0.55
1:A:203:MET:HB3	1:A:250:ILE:HD11	1.90	0.54
1:A:63:LYS:HE2	1:A:182:LEU:HG	1.89	0.54
1:B:296:HIS:ND1	2:B:403:HOH:O	2.33	0.54
1:B:133[B]:ILE:HG23	1:B:138:VAL:CG2	2.39	0.52
1:B:231:ALA:O	1:B:232:LEU:HB2	2.10	0.52
1:B:203:MET:HG2	1:B:208:ILE:HG13	1.91	0.51
1:A:159:HIS:O	1:A:160:ARG:HB2	2.10	0.51
1:B:66:GLN:HG3	1:B:70:LEU:HD12	1.93	0.50
1:B:269:GLN:HA	1:B:269:GLN:OE1	2.12	0.49
1:A:63:LYS:HD3	1:A:182:LEU:HD11	1.95	0.48
1:B:142:PHE:HB2	1:B:229:MET:HE1	1.94	0.48
1:A:90:ASN:OD1	1:B:96:LYS:NZ	2.45	0.47
1:A:21:ALA:O	1:A:23:ARG:HG2	2.14	0.47
1:A:161:ASP:OD1	2:A:401:HOH:O	2.20	0.47
1:B:91:HIS:HE1	1:B:147[B]:SER:OG	1.98	0.47
1:B:121:ARG:HH12	1:B:187:SER:C	2.23	0.47
1:A:184:ARG:O	1:A:185:PHE:HB2	2.14	0.46
1:B:147[A]:SER:HB3	1:B:289:TYR:CZ	2.50	0.46
1:B:116:ALA:HB1	1:B:169:ILE:O	2.15	0.46
1:A:237:TYR:CD1	1:A:237:TYR:C	2.94	0.46
1:B:160:ARG:HA	1:B:213:TYR:CZ	2.51	0.46
1:B:205:PRO:HG2	1:B:277:PRO:HA	1.98	0.46
1:A:100:SER:HA	1:A:108:ASN:O	2.16	0.45
1:B:129[B]:GLN:O	1:B:129[B]:GLN:CG	2.65	0.45
1:B:133[B]:ILE:HG23	1:B:138:VAL:HG23	1.99	0.45
1:B:213:TYR:CE1	1:B:217:SER:HB2	2.51	0.45
1:A:160:ARG:HA	1:A:213:TYR:CE1	2.51	0.45
1:B:91:HIS:CE1	1:B:147[B]:SER:OG	2.70	0.45
1:A:53:CYS:HB3	1:A:56:ASP:OD1	2.18	0.44
1:A:208:ILE:HD12	1:A:250:ILE:HG21	2.00	0.44
1:B:253:CYS:SG	1:B:277:PRO:HD3	2.57	0.44
1:B:147[A]:SER:HB3	1:B:289:TYR:OH	2.17	0.44
1:B:270:LEU:HA	1:B:273:MET:HE3	2.00	0.43
1:B:129[B]:GLN:O	1:B:129[B]:GLN:CD	2.62	0.43
1:B:204[B]:SER:OG	1:B:205:PRO:HD2	2.18	0.43
1:B:299:THR:HB	2:B:445:HOH:O	2.17	0.43
1:B:111:LEU:HD13	1:B:180:LEU:HD11	1.99	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:91:HIS:HB2	1:B:151:HIS:CD2	2.53	0.42
1:B:172:THR:HG23	1:B:174:VAL:HG23	2.00	0.42
1:B:249:LYS:HB3	1:B:249:LYS:HE3	1.59	0.42
1:B:170:THR:O	1:B:171:ALA:C	2.64	0.41
1:B:100:SER:HA	1:B:108:ASN:O	2.21	0.41
1:B:265:GLU:O	1:B:269:GLN:HB2	2.20	0.41
1:B:23:ARG:HH11	1:B:26:MET:HE3	1.81	0.41
1:B:133[B]:ILE:HG23	1:B:133[B]:ILE:O	2.21	0.41
1:A:63:LYS:HD3	1:A:182:LEU:CD1	2.51	0.41
1:B:144:GLN:NE2	1:B:175:VAL:H	2.18	0.41
1:B:170:THR:C	1:B:172:THR:N	2.77	0.41
1:B:203:MET:HG2	1:B:208:ILE:CG1	2.51	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	263/310 (85%)	250 (95%)	12 (5%)	1 (0%)	30	28
1	B	271/310 (87%)	260 (96%)	10 (4%)	1 (0%)	30	28
All	All	534/620 (86%)	510 (96%)	22 (4%)	2 (0%)	30	28

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	115	ASP
1	B	130	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	234/274 (85%)	232 (99%)	2 (1%)	70	78
1	B	238/274 (87%)	230 (97%)	8 (3%)	32	35
All	All	472/548 (86%)	462 (98%)	10 (2%)	47	54

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

Mol	Chain	Res	Type
1	A	124	LYS
1	A	180	LEU
1	B	39	LYS
1	B	47	GLU
1	B	96	LYS
1	B	105	ASN
1	B	169	ILE
1	B	203	MET
1	B	205	PRO
1	B	232	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	66	GLN
1	A	242	ASN
1	B	91	HIS
1	B	93	ASN
1	B	144	GLN
1	B	272	ASN

5.3.3 RNA ⓘ

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](#)

There are no ligands in this entry.

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	267/310 (86%)	0.32	15 (5%) 30 33	35, 56, 90, 112	4 (1%)
1	B	270/310 (87%)	0.78	34 (12%) 8 8	34, 61, 96, 123	6 (2%)
All	All	537/620 (86%)	0.55	49 (9%) 15 16	34, 58, 92, 123	10 (1%)

All (49) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	180	LEU	4.2
1	A	182	LEU	4.0
1	B	185	PHE	3.8
1	A	203	MET	3.7
1	A	70	LEU	3.4
1	B	182	LEU	3.4
1	B	186	PHE	3.3
1	B	22	LEU	3.3
1	B	292	ALA	3.2
1	A	180	LEU	3.2
1	B	133[A]	ILE	3.1
1	B	299	THR	3.0
1	A	185	PHE	2.9
1	B	169	ILE	2.9
1	B	129[A]	GLN	2.8
1	B	132	LEU	2.7
1	B	237	TYR	2.7
1	A	209	HIS	2.7
1	B	263	TYR	2.7
1	B	200	PRO	2.6
1	B	115	ASP	2.6
1	A	243	LEU	2.6
1	B	113	LEU	2.6
1	B	172	THR	2.5

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Mol	Chain	Res	Type	RSRZ
1	B	181	GLY	2.5
1	B	173	GLY	2.4
1	B	208	ILE	2.4
1	B	139	TRP	2.4
1	B	141	TYR	2.3
1	A	208	ILE	2.3
1	B	286	THR	2.3
1	B	116	ALA	2.3
1	A	237	TYR	2.3
1	B	38	LYS	2.3
1	A	241	MET	2.3
1	B	296	HIS	2.3
1	B	143	VAL	2.3
1	B	285	VAL	2.3
1	B	267	LEU	2.3
1	A	201	TYR	2.2
1	A	200	PRO	2.2
1	A	22	LEU	2.2
1	A	213	TYR	2.2
1	B	168	PHE	2.1
1	B	183	GLY	2.1
1	B	298	CYS	2.1
1	B	284	ASP	2.1
1	A	181	GLY	2.1
1	B	134	PRO	2.0

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 oligosaccharides in this entry.

6.4 Ligands ⓘ

There are no ligands in this entry.

6.5 Other polymers [i](#)

There are no such residues in this entry.