



# Full wwPDB X-ray Structure Validation Report ⓘ

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PDB ID : 3DBQ  
Title : Crystal structure of TTK kinase domain  
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Deposited on : 2008-06-02  
Resolution : 2.70 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  
<http://wwpdb.org/validation/2016/XrayValidationReportHelp>  
with specific help available everywhere you see the ⓘ symbol.

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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 : 1.7 (RC4), CSD as536be (2015)  
Xtriage (Phenix) : 1.9-1692  
EDS : rb-20026688  
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)  
Refmac : 5.8.0135  
CCP4 : 6.5.0  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : trunk26865

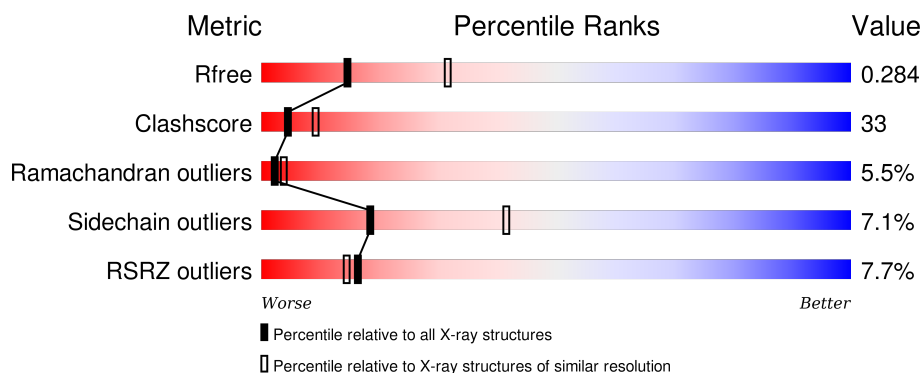
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 2.70 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))
$R_{free}$	91344	2103 (2.70-2.70)
Clashscore	102246	2422 (2.70-2.70)
Ramachandran outliers	100387	2382 (2.70-2.70)
Sidechain outliers	100360	2382 (2.70-2.70)
RSRZ outliers	91569	2107 (2.70-2.70)

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. 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	343	<div> <div>6%</div> <div>39%</div> <div>29%</div> <div>7%</div> <div>24%</div> </div>

## 2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 2133 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 Dual specificity protein kinase TTK.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	259	Total	C	N	O	S	0	0	0
			2114	1358	353	390	13			

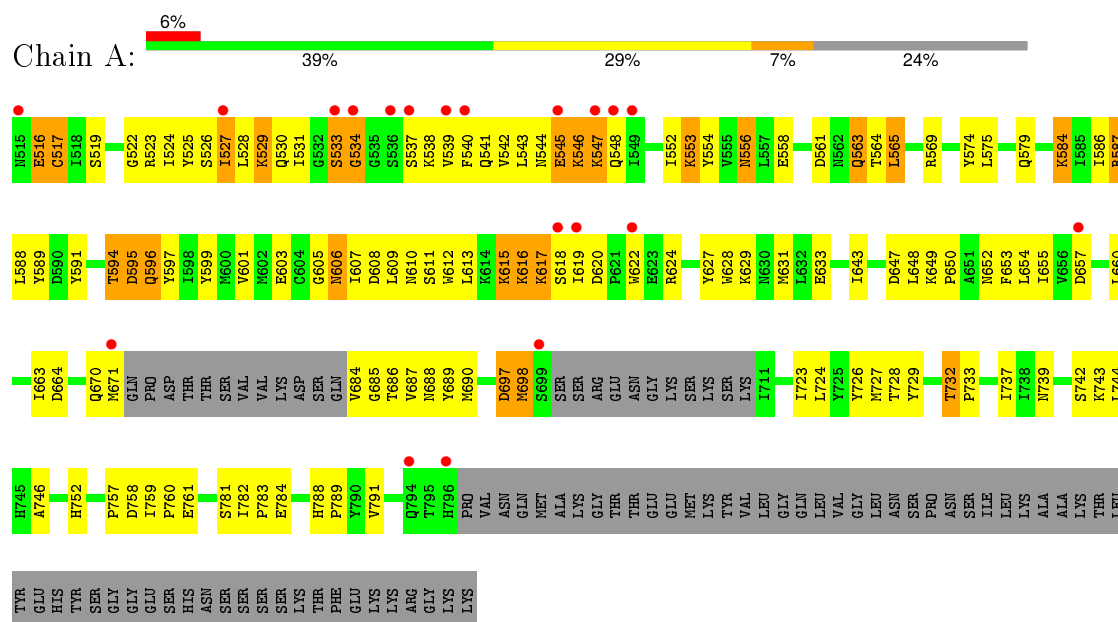
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	19	Total	O	0	0
			19	19		

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

These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors 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: Dual specificity protein kinase TTK



## 4 Data and refinement statistics

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	105.85Å 106.43Å 70.68Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	42.51 – 2.70 42.51 – 2.50	Depositor EDS
% Data completeness (in resolution range)	94.5 (42.51-2.70) 88.9 (42.51-2.50)	Depositor EDS
$R_{merge}$	0.04	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	4.43 (at 2.51Å)	Xtriage
Refinement program	CNS 1.1	Depositor
R, $R_{free}$	0.226 , 0.285 0.224 , 0.284	Depositor DCC
$R_{free}$ test set	1106 reflections (10.36%)	DCC
Wilson B-factor (Å <sup>2</sup> )	57.2	Xtriage
Anisotropy	0.758	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.34 , 65.8	EDS
Estimated twinning fraction	0.026 for -k,-h,-l	Xtriage
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.33$	Xtriage
Outliers	1 of 12581 reflections (0.008%)	Xtriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	2133	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	78.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.33% 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, 0.375 respectively for untwinned datasets, and 0.333, 0.2 for perfectly twinned datasets.

## 5 Model quality [i](#)

### 5.1 Standard geometry [i](#)

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	0.35	0/2160	0.58	0/2918

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 [i](#)

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	2114	0	2127	138	1
2	A	19	0	0	4	0
All	All	2133	0	2127	138	1

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 33.

All (138) 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:686:THR:HG22	1:A:688:ASN:H	1.22	1.02
1:A:687:VAL:HG11	1:A:744:LEU:HD21	1.47	0.93
1:A:594:THR:HG22	1:A:596:GLN:H	1.37	0.87
1:A:606:ASN:HB3	1:A:655:ILE:O	1.76	0.86

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:525:TYR:HB3	1:A:542:VAL:HG21	1.59	0.85
1:A:688:ASN:HB3	1:A:732:THR:HG21	1.58	0.83
1:A:649:LYS:H	1:A:652:ASN:HD22	1.23	0.83
1:A:619:ILE:HD11	1:A:727:MET:O	1.83	0.79
1:A:594:THR:CG2	1:A:596:GLN:H	1.98	0.76
1:A:594:THR:HG23	1:A:596:GLN:HE21	1.52	0.75
1:A:606:ASN:C	1:A:606:ASN:HD22	1.90	0.74
1:A:556:ASN:ND2	1:A:558:GLU:H	1.86	0.73
1:A:553:LYS:NZ	2:A:15:HOH:O	2.21	0.72
1:A:556:ASN:C	1:A:556:ASN:HD22	1.93	0.71
1:A:732:THR:HG23	1:A:733:PRO:HD2	1.72	0.71
1:A:664:ASP:HB2	1:A:670:GLN:NE2	2.05	0.71
1:A:530:GLN:NE2	1:A:534:GLY:HA2	2.06	0.70
1:A:519:SER:HA	1:A:523:ARG:O	1.91	0.70
1:A:649:LYS:H	1:A:652:ASN:ND2	1.89	0.69
1:A:616:LYS:O	1:A:617:LYS:HG2	1.93	0.68
1:A:586:ILE:HD11	1:A:603:GLU:HB2	1.76	0.67
1:A:565:LEU:HD22	1:A:569:ARG:CZ	2.26	0.66
1:A:737:ILE:O	1:A:743:LYS:HE3	1.97	0.65
1:A:528:LEU:HD11	1:A:543:LEU:HG	1.78	0.65
1:A:757:PRO:O	1:A:759:ILE:HG23	1.97	0.65
1:A:537:SER:HB3	1:A:671:MET:SD	2.36	0.65
1:A:664:ASP:HB2	1:A:670:GLN:HE22	1.62	0.65
1:A:594:THR:HG22	1:A:596:GLN:N	2.10	0.64
1:A:759:ILE:HB	1:A:760:PRO:HD2	1.80	0.64
1:A:542:VAL:HG22	1:A:543:LEU:N	2.15	0.62
1:A:528:LEU:O	1:A:529:LYS:HB3	2.00	0.61
1:A:517:CYS:SG	1:A:524:ILE:HG23	2.40	0.61
1:A:594:THR:CG2	1:A:595:ASP:N	2.65	0.60
1:A:584:LYS:HE3	1:A:633:GLU:OE2	2.01	0.60
1:A:729:TYR:CE1	1:A:757:PRO:HD2	2.37	0.60
1:A:594:THR:HG23	1:A:595:ASP:N	2.16	0.60
1:A:538:LYS:HB3	1:A:540:PHE:CE1	2.37	0.60
1:A:516:GLU:CG	1:A:527:ILE:HG23	2.32	0.60
1:A:594:THR:CG2	1:A:596:GLN:HE21	2.16	0.59
1:A:556:ASN:HD22	1:A:558:GLU:H	1.49	0.59
1:A:525:TYR:HB3	1:A:542:VAL:CG2	2.30	0.59
1:A:591:TYR:HA	1:A:599:TYR:O	2.04	0.58
1:A:528:LEU:HD21	1:A:543:LEU:HD12	1.85	0.58
1:A:686:THR:HG22	1:A:687:VAL:N	2.19	0.58
1:A:687:VAL:HG12	1:A:687:VAL:O	2.04	0.57

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:594:THR:HG23	1:A:596:GLN:NE2	2.18	0.57
1:A:605:GLY:HA2	1:A:654:LEU:HD21	1.87	0.57
1:A:609:LEU:O	1:A:613:LEU:HG	2.04	0.57
1:A:684:VAL:HG12	1:A:685:GLY:N	2.19	0.57
1:A:546:LYS:O	1:A:547:LYS:HG2	2.04	0.57
1:A:620:ASP:OD1	1:A:622:TRP:HB3	2.06	0.56
1:A:687:VAL:HG11	1:A:744:LEU:CD2	2.29	0.55
1:A:652:ASN:O	1:A:663:ILE:HG12	2.05	0.55
1:A:723:ILE:O	1:A:727:MET:HG3	2.06	0.55
1:A:782:ILE:HB	1:A:783:PRO:HD3	1.88	0.55
1:A:746:ALA:HB1	1:A:752:HIS:CD2	2.42	0.55
1:A:605:GLY:N	2:A:1:HOH:O	2.39	0.55
1:A:522:GLY:O	1:A:523:ARG:HG2	2.08	0.54
1:A:624:ARG:HB3	2:A:11:HOH:O	2.07	0.53
1:A:528:LEU:HD11	1:A:543:LEU:CD1	2.38	0.53
1:A:542:VAL:HG22	1:A:543:LEU:H	1.74	0.53
1:A:671:MET:SD	1:A:671:MET:N	2.75	0.53
1:A:528:LEU:HD11	1:A:543:LEU:CG	2.39	0.53
1:A:539:VAL:HG22	1:A:553:LYS:HG3	1.89	0.53
1:A:531:ILE:HD11	1:A:541:GLN:HB2	1.89	0.53
1:A:627:TYR:HB3	1:A:660:LEU:HD22	1.91	0.53
1:A:606:ASN:C	1:A:606:ASN:ND2	2.61	0.52
1:A:586:ILE:CD1	1:A:603:GLU:HB2	2.38	0.52
1:A:546:LYS:C	1:A:548:GLN:H	2.12	0.52
1:A:556:ASN:C	1:A:556:ASN:ND2	2.61	0.52
1:A:627:TYR:CD1	1:A:660:LEU:HD13	2.45	0.52
1:A:688:ASN:HD21	1:A:743:LYS:HE2	1.74	0.51
1:A:516:GLU:HG3	1:A:527:ILE:HG23	1.92	0.51
1:A:554:TYR:OH	1:A:556:ASN:HB2	2.11	0.51
1:A:739:ASN:O	1:A:742:SER:HB2	2.10	0.50
1:A:649:LYS:HE3	1:A:652:ASN:HD21	1.76	0.50
1:A:697:ASP:O	1:A:698:MET:C	2.50	0.50
1:A:544:ASN:OD1	1:A:548:GLN:HB2	2.11	0.50
1:A:605:GLY:CA	1:A:654:LEU:HD11	2.43	0.49
1:A:647:ASP:O	1:A:649:LYS:HE2	2.13	0.49
1:A:594:THR:HG23	1:A:595:ASP:H	1.76	0.49
1:A:687:VAL:CG1	1:A:744:LEU:HD21	2.32	0.49
1:A:732:THR:HG23	1:A:733:PRO:CD	2.42	0.49
1:A:537:SER:CB	1:A:671:MET:SD	3.01	0.49
1:A:613:LEU:HD13	1:A:726:TYR:CE2	2.48	0.49
1:A:608:ASP:OD2	1:A:610:ASN:HB3	2.12	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:788:HIS:CG	1:A:789:PRO:HD2	2.48	0.48
1:A:620:ASP:OD1	1:A:622:TRP:N	2.46	0.48
1:A:575:LEU:O	1:A:579:GLN:HG3	2.14	0.48
1:A:624:ARG:HG3	1:A:624:ARG:HH11	1.78	0.48
1:A:605:GLY:HA3	2:A:1:HOH:O	2.14	0.48
1:A:516:GLU:HG3	1:A:527:ILE:CG2	2.44	0.48
1:A:613:LEU:HD13	1:A:726:TYR:CD2	2.49	0.47
1:A:649:LYS:N	1:A:652:ASN:ND2	2.60	0.47
1:A:579:GLN:O	1:A:587:ARG:NH2	2.47	0.47
1:A:517:CYS:SG	1:A:524:ILE:HG12	2.54	0.47
1:A:684:VAL:HG12	1:A:685:GLY:H	1.80	0.47
1:A:728:THR:HG22	1:A:729:TYR:CD2	2.50	0.46
1:A:612:TRP:O	1:A:615:LYS:HB3	2.15	0.46
1:A:648:LEU:HA	1:A:652:ASN:ND2	2.31	0.46
1:A:556:ASN:HD21	1:A:558:GLU:HB2	1.80	0.46
1:A:579:GLN:HB3	1:A:587:ARG:HH21	1.81	0.46
1:A:686:THR:CG2	1:A:687:VAL:N	2.79	0.46
1:A:579:GLN:NE2	1:A:588:LEU:HB3	2.30	0.46
1:A:629:LYS:HE3	1:A:791:VAL:HG13	1.98	0.46
1:A:594:THR:CG2	1:A:596:GLN:HG2	2.45	0.45
1:A:552:ILE:CD1	1:A:601:VAL:HG22	2.45	0.45
1:A:594:THR:HG22	1:A:597:TYR:H	1.82	0.45
1:A:516:GLU:HG2	1:A:527:ILE:HG23	1.98	0.45
1:A:594:THR:HG21	1:A:596:GLN:HG2	1.99	0.45
1:A:587:ARG:HH11	1:A:587:ARG:HG2	1.82	0.45
1:A:650:PRO:HD3	1:A:689:TYR:CZ	2.52	0.45
1:A:729:TYR:CZ	1:A:757:PRO:HD2	2.52	0.44
1:A:628:TRP:CZ3	1:A:724:LEU:HB2	2.53	0.44
1:A:534:GLY:O	1:A:538:LYS:HE2	2.18	0.44
1:A:544:ASN:CG	1:A:545:GLU:N	2.71	0.43
1:A:533:SER:OG	1:A:534:GLY:N	2.51	0.43
1:A:728:THR:HG22	1:A:729:TYR:CE2	2.54	0.43
1:A:627:TYR:CE1	1:A:660:LEU:HD13	2.54	0.43
1:A:528:LEU:HD11	1:A:543:LEU:HD11	2.00	0.43
1:A:611:SER:O	1:A:615:LYS:HB2	2.18	0.42
1:A:587:ARG:HG3	1:A:603:GLU:OE2	2.19	0.42
1:A:545:GLU:C	1:A:547:LYS:H	2.21	0.42
1:A:752:HIS:ND1	1:A:752:HIS:O	2.48	0.42
1:A:589:TYR:OH	1:A:603:GLU:HG2	2.20	0.42
1:A:542:VAL:CG2	1:A:543:LEU:N	2.82	0.41
1:A:586:ILE:HD12	1:A:603:GLU:OE1	2.20	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:587:ARG:HG2	1:A:587:ARG:NH1	2.36	0.41
1:A:526:SER:C	1:A:542:VAL:HG23	2.41	0.41
1:A:579:GLN:HB3	1:A:587:ARG:NH2	2.36	0.41
1:A:563:GLN:CD	1:A:564:THR:N	2.75	0.41
1:A:687:VAL:HG13	1:A:690:MET:SD	2.62	0.40
1:A:631:MET:HG2	1:A:653:PHE:CE1	2.56	0.40
1:A:539:VAL:HG23	1:A:671:MET:HE3	2.02	0.40
1:A:554:TYR:CD1	1:A:599:TYR:CE2	3.10	0.40
1:A:540:PHE:CD1	1:A:540:PHE:N	2.90	0.40
1:A:574:TYR:CD2	1:A:643:ILE:HD11	2.57	0.40
1:A:781:SER:OG	1:A:784:GLU:HG3	2.21	0.40

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:517:CYS:O	1:A:517:CYS:O[4_546]	2.03	0.17

## 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	253/343 (74%)	219 (87%)	20 (8%)	14 (6%)	<b>2</b> <b>4</b>

All (14) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	698	MET
1	A	618	SER
1	A	761	GLU
1	A	516	GLU
1	A	529	LYS

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Mol	Chain	Res	Type
1	A	534	GLY
1	A	545	GLU
1	A	546	LYS
1	A	615	LYS
1	A	617	LYS
1	A	533	SER
1	A	616	LYS
1	A	547	LYS
1	A	607	ILE

### 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	239/313 (76%)	222 (93%)	17 (7%)	18	41

All (17) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	517	CYS
1	A	527	ILE
1	A	553	LYS
1	A	556	ASN
1	A	561	ASP
1	A	563	GLN
1	A	565	LEU
1	A	584	LYS
1	A	587	ARG
1	A	594	THR
1	A	595	ASP
1	A	596	GLN
1	A	606	ASN
1	A	657	ASP
1	A	697	ASP
1	A	732	THR
1	A	758	ASP

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (13) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	530	GLN
1	A	556	ASN
1	A	563	GLN
1	A	580	GLN
1	A	596	GLN
1	A	606	ASN
1	A	610	ASN
1	A	636	HIS
1	A	640	GLN
1	A	652	ASN
1	A	669	ASN
1	A	670	GLN
1	A	688	ASN

### 5.3.3 RNA [i](#)

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 carbohydrates 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, 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	259/343 (75%)	0.48	20 (7%) 16 14	41, 72, 130, 166	0

All (20) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	515	ASN	6.3
1	A	796	HIS	5.0
1	A	536	SER	4.3
1	A	618	SER	3.6
1	A	537	SER	3.4
1	A	540	PHE	3.2
1	A	548	GLN	3.1
1	A	545	GLU	2.8
1	A	547	LYS	2.7
1	A	539	VAL	2.6
1	A	622	TRP	2.5
1	A	527	ILE	2.5
1	A	671	MET	2.4
1	A	533	SER	2.4
1	A	794	GLN	2.3
1	A	534	GLY	2.2
1	A	699	SER	2.1
1	A	549	ILE	2.1
1	A	657	ASP	2.1
1	A	619	ILE	2.1

### 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 [i](#)

There are no carbohydrates in this entry.

### 6.4 Ligands [i](#)

There are no ligands in this entry.

### 6.5 Other polymers [i](#)

There are no such residues in this entry.