



# Full wwPDB X-ray Structure Validation Report ⓘ

May 21, 2020 – 09:21 pm BST

PDB ID : 5BK8  
Title : Cancer-associated SHP2/T507K mutant  
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Deposited on : 2019-06-01  
Resolution : 2.25 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.

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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
Xtriage (Phenix)	:	1.13
EDS	:	2.11
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.11

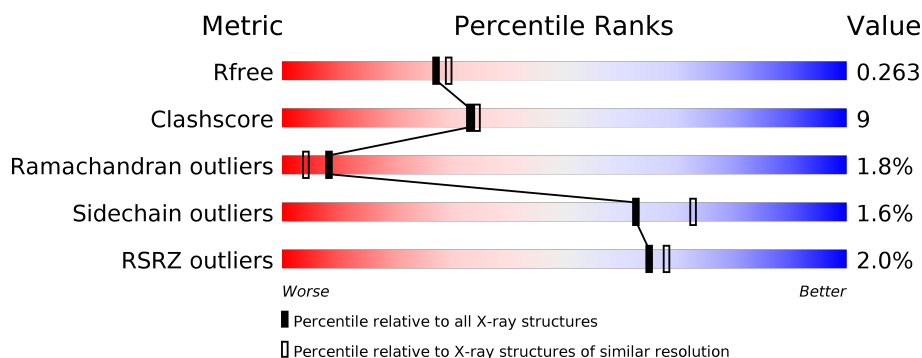
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 2.25 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))
$R_{free}$	130704	1377 (2.26-2.26)
Clashscore	141614	1487 (2.26-2.26)
Ramachandran outliers	138981	1449 (2.26-2.26)
Sidechain outliers	138945	1450 (2.26-2.26)
RSRZ outliers	127900	1356 (2.26-2.26)

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 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	536	<div> <div>2%</div> <div> <div></div> <div>73%</div> <div>19%</div> <div>• 7%</div> </div> </div>

## 2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 4259 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 Tyrosine-protein phosphatase non-receptor type 11.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	498	Total	C	N	O	S	0	0	0
			4028	2536	718	756	18			

There are 9 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	507	LYS	THR	engineered mutation	UNP Q06124
A	529	LEU	-	expression tag	UNP Q06124
A	530	GLU	-	expression tag	UNP Q06124
A	531	HIS	-	expression tag	UNP Q06124
A	532	HIS	-	expression tag	UNP Q06124
A	533	HIS	-	expression tag	UNP Q06124
A	534	HIS	-	expression tag	UNP Q06124
A	535	HIS	-	expression tag	UNP Q06124
A	536	HIS	-	expression tag	UNP Q06124

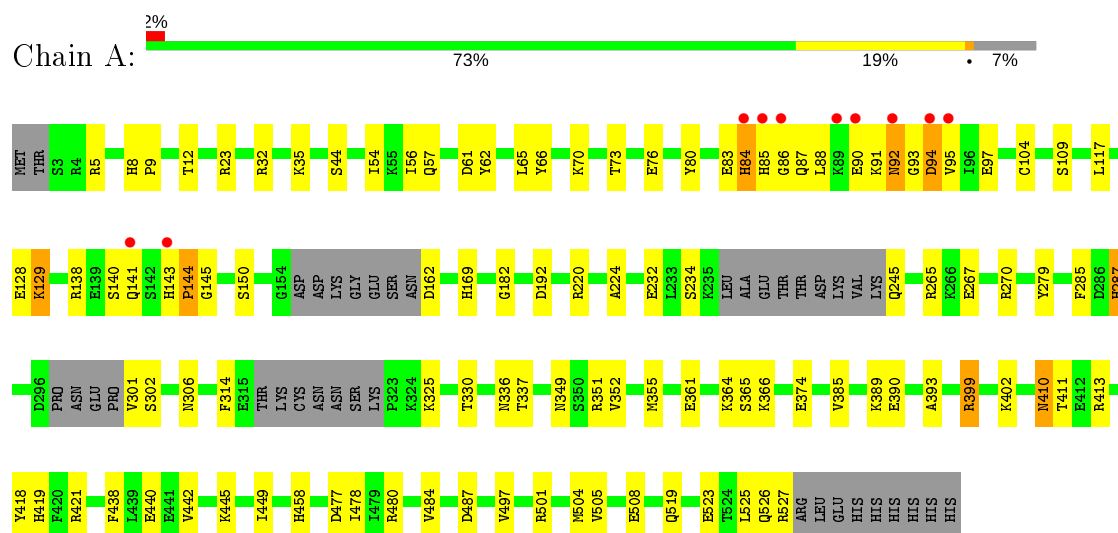
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	231	Total	O	0	0
			231	231		

### 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 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: Tyrosine-protein phosphatase non-receptor type 11



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 2 <sub>1</sub> 2 <sub>1</sub> 2	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	54.70 Å   203.18 Å   44.37 Å 90.00°   90.00°   90.00°	Depositor
Resolution (Å)	40.66 – 2.25 42.55 – 2.22	Depositor EDS
% Data completeness (in resolution range)	95.4 (40.66-2.25) 93.2 (42.55-2.22)	Depositor EDS
$R_{merge}$	0.14	Depositor
$R_{sym}$	0.14	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	3.91 (at 2.22 Å)	Xtriage
Refinement program	PHENIX 1.10.1 _2155	Depositor
R, $R_{free}$	0.198   ,   0.262 0.198   ,   0.263	Depositor DCC
$R_{free}$ test set	1190 reflections (5.04%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	27.4	Xtriage
Anisotropy	0.142	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.31 , 40.6	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.48$ , $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.94	EDS
Total number of atoms	4259	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 6.54% 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 [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	0.44	0/4111	0.61	1/5540 (0.0%)

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.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed( $^{\circ}$ )	Ideal( $^{\circ}$ )
1	A	399	ARG	NE-CZ-NH2	-5.54	117.53	120.30

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	140	SER	Peptide

### 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	4028	0	3960	69	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	A	231	0	0	14	0
All	All	4259	0	3960	69	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 9.

All (69) 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:220:ARG:HD3	1:A:487:ASP:HB3	1.58	0.83
1:A:306:ASN:OD1	1:A:501:ARG:NH2	2.20	0.73
1:A:301:VAL:HG23	1:A:302:SER:H	1.55	0.72
1:A:12:THR:HA	1:A:35:LYS:HE2	1.71	0.71
1:A:32:ARG:NH1	1:A:44:SER:OG	2.23	0.70
1:A:92:ASN:CG	1:A:93:GLY:H	1.95	0.69
1:A:9:PRO:O	2:A:601:HOH:O	2.11	0.69
1:A:138:ARG:HH21	1:A:141:GLN:HG2	1.56	0.68
1:A:390:GLU:HG2	1:A:399:ARG:HG2	1.74	0.68
1:A:162:ASP:N	2:A:610:HOH:O	2.28	0.66
1:A:5:ARG:NH1	1:A:192:ASP:OD1	2.29	0.65
1:A:83:GLU:O	2:A:602:HOH:O	2.15	0.63
1:A:232:GLU:HB3	1:A:245:GLN:HE21	1.64	0.63
1:A:519:GLN:O	1:A:523:GLU:HG2	1.98	0.62
1:A:245:GLN:N	2:A:616:HOH:O	2.32	0.62
1:A:80:TYR:CE2	1:A:86:GLY:HA2	2.35	0.61
1:A:330:THR:HG23	1:A:458:HIS:HB3	1.85	0.59
1:A:95:VAL:HG12	1:A:97:GLU:HG3	1.86	0.57
1:A:364:LYS:HD2	1:A:365:SER:H	1.71	0.56
1:A:480:ARG:NH2	2:A:607:HOH:O	2.38	0.56
1:A:285:PHE:HB3	1:A:287:HIS:CD2	2.42	0.55
1:A:355:MET:HG3	1:A:458:HIS:CE1	2.43	0.53
1:A:138:ARG:HH12	1:A:169:HIS:CE1	2.27	0.53
1:A:418:TYR:HB3	1:A:438:PHE:CE1	2.44	0.52
1:A:109:SER:HB2	2:A:699:HOH:O	2.10	0.51
1:A:301:VAL:N	2:A:628:HOH:O	2.43	0.50
1:A:525:LEU:C	1:A:527:ARG:H	2.14	0.50
1:A:361:GLU:N	2:A:627:HOH:O	2.42	0.50
1:A:410:ASN:OD1	1:A:411:THR:N	2.45	0.50
1:A:224:ALA:HB2	1:A:484:VAL:HG22	1.94	0.49
1:A:265:ARG:NH1	2:A:622:HOH:O	2.43	0.49
1:A:56:ILE:HG12	1:A:65:LEU:HD12	1.95	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:73:THR:OG1	1:A:76:GLU:HG3	2.13	0.48
1:A:84:HIS:O	1:A:85:HIS:HB3	2.14	0.48
1:A:128:GLU:HB3	1:A:129:LYS:HD3	1.96	0.48
1:A:440:GLU:OE1	2:A:603:HOH:O	2.20	0.47
1:A:65:LEU:HD23	2:A:723:HOH:O	2.13	0.47
1:A:364:LYS:HD2	1:A:365:SER:N	2.29	0.47
1:A:117:LEU:O	1:A:138:ARG:HD2	2.15	0.47
1:A:374:GLU:OE2	1:A:389:LYS:HD2	2.14	0.47
1:A:325:LYS:HE3	1:A:477:ASP:OD2	2.15	0.46
1:A:497:VAL:HG12	1:A:504:MET:HG3	1.97	0.46
1:A:35:LYS:HE3	2:A:758:HOH:O	2.15	0.46
1:A:314:PHE:CZ	1:A:478:ILE:HD11	2.52	0.45
1:A:232:GLU:O	1:A:245:GLN:NE2	2.49	0.45
1:A:90:GLU:HG3	1:A:91:LYS:H	1.81	0.45
1:A:385:VAL:HA	1:A:402:LYS:O	2.18	0.44
1:A:61:ASP:OD1	2:A:604:HOH:O	2.21	0.44
1:A:54:ILE:HD13	1:A:88:LEU:HD21	2.00	0.44
1:A:393:ALA:O	1:A:421:ARG:NH2	2.51	0.43
1:A:90:GLU:HB2	1:A:94:ASP:O	2.18	0.43
1:A:8:HIS:CG	1:A:104:CYS:HB2	2.53	0.43
1:A:138:ARG:NH1	1:A:150:SER:OG	2.51	0.43
1:A:62:TYR:CE1	1:A:70:LYS:HD3	2.54	0.42
1:A:364:LYS:HD3	1:A:364:LYS:HA	1.86	0.42
1:A:8:HIS:CE1	1:A:104:CYS:HB2	2.53	0.42
1:A:267:GLU:HA	1:A:270:ARG:HG3	2.01	0.42
1:A:92:ASN:CG	1:A:93:GLY:N	2.65	0.42
1:A:366:LYS:HE3	1:A:366:LYS:HB3	1.74	0.42
1:A:220:ARG:HD3	1:A:487:ASP:CB	2.39	0.42
1:A:352:VAL:HG11	1:A:442:VAL:HG13	2.00	0.42
1:A:399:ARG:NH2	1:A:419:HIS:ND1	2.63	0.42
1:A:245:GLN:HA	2:A:726:HOH:O	2.19	0.41
1:A:336:ASN:OD1	1:A:337:THR:HG23	2.19	0.41
1:A:144:PRO:HB2	1:A:145:GLY:H	1.28	0.41
1:A:57:GLN:OE1	1:A:66:TYR:HD1	2.03	0.41
1:A:70:LYS:HD2	1:A:279:TYR:CE1	2.56	0.41
1:A:445:LYS:O	1:A:449:ILE:HD12	2.21	0.40
1:A:349:ASN:OD1	1:A:351:ARG:NH1	2.55	0.40

There are no symmetry-related clashes.



## 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	488/536 (91%)	456 (93%)	23 (5%)	9 (2%)	8 4

All (9) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	84	HIS
1	A	144	PRO
1	A	410	ASN
1	A	92	ASN
1	A	182	GLY
1	A	526	GLN
1	A	87	GLN
1	A	143	HIS
1	A	505	VAL

### 5.3.2 Protein sidechains [i](#)

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	441/478 (92%)	434 (98%)	7 (2%)	62 73

All (7) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	23	ARG
1	A	94	ASP

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Mol	Chain	Res	Type
1	A	129	LYS
1	A	234	SER
1	A	287	HIS
1	A	413	ARG
1	A	508	GLU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (4) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	85	HIS
1	A	245	GLN
1	A	257	GLN
1	A	287	HIS

### 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 [i](#)

### 6.1 Protein, DNA and RNA chains [i](#)

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	498/536 (92%)	-0.24	10 (2%) 65 68	14, 29, 53, 86	0

All (10) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	85	HIS	4.6
1	A	90	GLU	3.5
1	A	94	ASP	2.7
1	A	143	HIS	2.6
1	A	84	HIS	2.5
1	A	89	LYS	2.3
1	A	86	GLY	2.3
1	A	141	GLN	2.3
1	A	92	ASN	2.1
1	A	95	VAL	2.1

### 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 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.