Full wwPDB X-ray Structure Validation Report ⓘ

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PDB ID	:	6UZT / pdb_00006uzt
Title	:	Crystal Structure of RPTP alpha
Authors	:	Santelli, E.; Wen, Y.; Yang, S.; Svensson, M.N.D.; Stanford, S.M.; Bottini, N.
Deposited on	:	2019-11-15
Resolution	:	1.80 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:

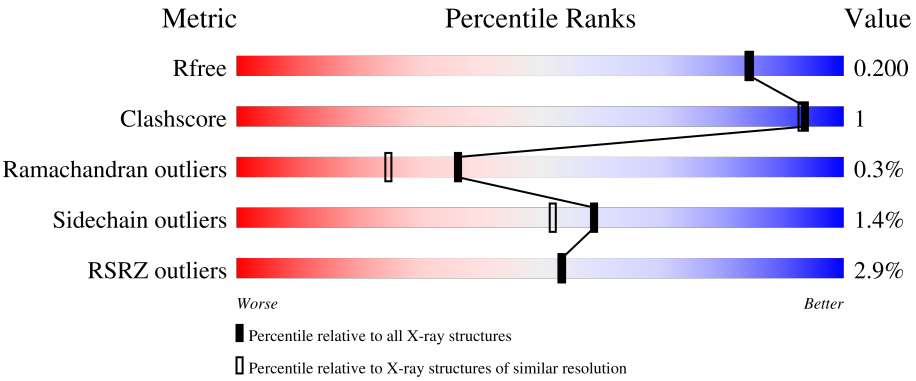
MolProbity	:	4-5-2 with Phenix2.0
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 1.80 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	7662 (1.80-1.80)
Clashscore	190562	8479 (1.80-1.80)
Ramachandran outliers	187476	8391 (1.80-1.80)
Sidechain outliers	187428	8390 (1.80-1.80)
RSRZ outliers	180081	7663 (1.80-1.80)

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 <=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	601	2% 93%
1	B	601	4% 90% 5%

2 Entry composition (i)

There are 2 unique types of molecules in this entry. The entry contains 11211 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 Receptor-type tyrosine-protein phosphatase alpha.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	587	Total	C	N	O	S	0	20	0
			4879	3098	841	906	34			
1	B	572	Total	C	N	O	S	0	21	0
			4803	3046	832	890	35			

There are 18 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	201	MET	-	initiating methionine	UNP P18433
A	794	LEU	-	expression tag	UNP P18433
A	795	GLU	-	expression tag	UNP P18433
A	796	HIS	-	expression tag	UNP P18433
A	797	HIS	-	expression tag	UNP P18433
A	798	HIS	-	expression tag	UNP P18433
A	799	HIS	-	expression tag	UNP P18433
A	800	HIS	-	expression tag	UNP P18433
A	801	HIS	-	expression tag	UNP P18433
B	201	MET	-	initiating methionine	UNP P18433
B	794	LEU	-	expression tag	UNP P18433
B	795	GLU	-	expression tag	UNP P18433
B	796	HIS	-	expression tag	UNP P18433
B	797	HIS	-	expression tag	UNP P18433
B	798	HIS	-	expression tag	UNP P18433
B	799	HIS	-	expression tag	UNP P18433
B	800	HIS	-	expression tag	UNP P18433
B	801	HIS	-	expression tag	UNP P18433

- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	825	Total	O	0	0
			825	825		

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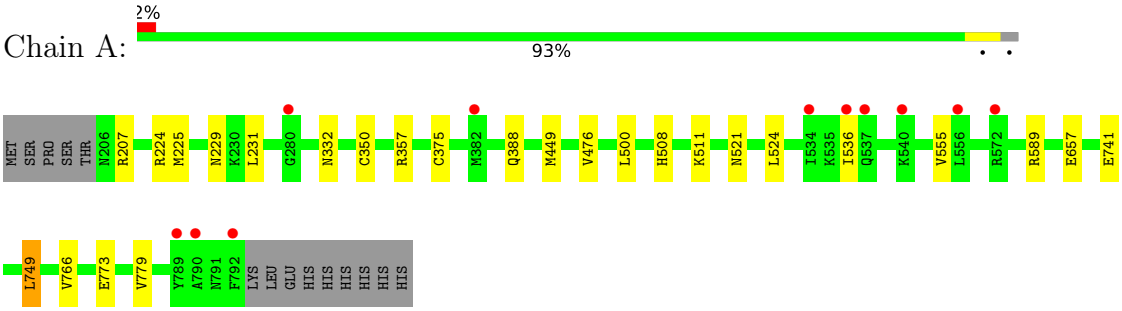
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	B	704	Total 704	O 704	0	2

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.

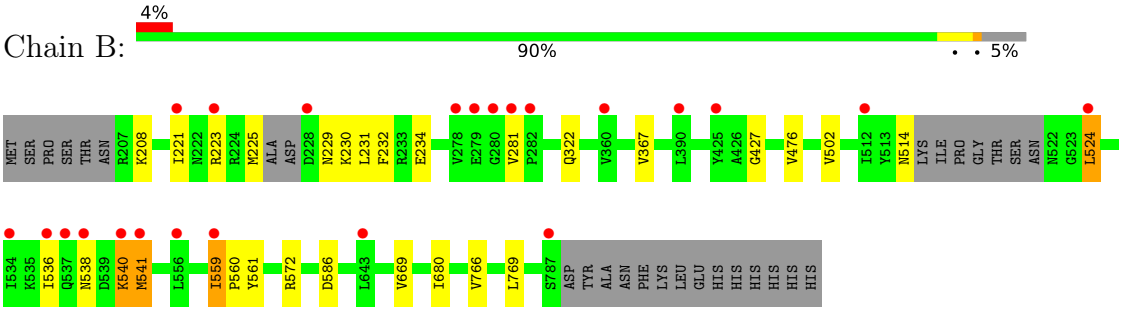
• Molecule 1: Receptor-type tyrosine-protein phosphatase alpha

Chain A:



• Molecule 1: Receptor-type tyrosine-protein phosphatase alpha

Chain B:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 2 21 21	Depositor
Cell constants a, b, c, α, β, γ	104.72Å 112.11Å 136.37Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	30.00 – 1.80 30.00 – 1.80	Depositor EDS
% Data completeness (in resolution range)	99.9 (30.00-1.80) 99.9 (30.00-1.80)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.03 (at 1.80Å)	Xtriage
Refinement program	REFMAC 5.8.0257	Depositor
R, R_{free}	0.155 , 0.191 0.166 , 0.200	Depositor DCC
R_{free} test set	7397 reflections (4.97%)	wwPDB-VP
Wilson B-factor (Å^2)	26.4	Xtriage
Anisotropy	0.453	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.33 , 43.6	EDS
L-test for twinning[2]	$< \|L\| > = 0.50$, $< L^2 > = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.97	EDS
Total number of atoms	11211	wwPDB-VP
Average B, all atoms (Å^2)	38.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.46% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ 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	0.95	0/5041	1.23	6/6817 (0.1%)
1	B	0.96	1/4920 (0.0%)	1.25	0/6645
All	All	0.96	1/9961 (0.0%)	1.24	6/13462 (0.0%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	281	VAL	N-CA	5.03	1.50	1.46

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	521	ASN	CA-CB-CG	5.41	118.01	112.60
1	A	511	LYS	CA-C-N	5.32	127.46	120.60
1	A	511	LYS	C-N-CA	5.32	127.46	120.60
1	A	657	GLU	CB-CA-C	5.18	119.60	109.35
1	A	555	VAL	CA-C-N	5.09	127.10	120.28
1	A	555	VAL	C-N-CA	5.09	127.10	120.28

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	4879	0	4852	10	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	B	4803	0	4753	17	0
2	A	825	0	0	1	0
2	B	704	0	0	1	0
All	All	11211	0	9605	27	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 1.

All (27) 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:541:MET:HE2	1:B:559:ILE:HG23	1.48	0.92
1:B:541:MET:HE2	1:B:559:ILE:CG2	2.22	0.68
1:B:225[B]:MET:HG3	1:B:229[B]:ASN:OD1	1.98	0.64
1:B:541:MET:HB3	1:B:560:PRO:O	2.03	0.59
1:A:749:LEU:HD13	1:A:779:VAL:HG11	1.85	0.59
1:A:589[A]:ARG:NH1	1:A:741:GLU:OE2	2.36	0.59
1:B:230[B]:LYS:HD2	1:B:231[B]:LEU:HD12	1.85	0.56
1:A:225:MET:HA	1:A:229:ASN:HD22	1.72	0.55
1:B:230[A]:LYS:HG2	1:B:231[A]:LEU:HD23	1.90	0.53
1:B:322:GLN:O	1:B:427:GLY:HA3	2.10	0.51
1:A:375[B]:CYS:SG	1:A:388:GLN:CD	2.94	0.50
1:B:541:MET:HG3	1:B:561:TYR:HD1	1.78	0.48
1:B:221[B]:ILE:O	1:B:225[B]:MET:HB2	2.14	0.47
1:A:350[B]:CYS:SG	1:A:357:ARG:CZ	3.04	0.46
1:B:540:LYS:HG2	2:B:1142:HOH:O	2.15	0.46
1:B:221[A]:ILE:O	1:B:225[A]:MET:HG3	2.16	0.44
1:A:224:ARG:HA	1:A:231:LEU:HB2	2.00	0.44
1:A:524:LEU:HD21	1:A:773:GLU:HB2	2.01	0.43
1:B:367:VAL:HG21	1:B:586:ASP:HB3	2.01	0.42
1:A:500:LEU:HD11	1:A:508:HIS:CG	2.55	0.42
1:B:230[A]:LYS:O	1:B:234:GLU:HB2	2.19	0.42
1:A:332:ASN:ND2	2:A:913:HOH:O	2.52	0.42
1:B:221[B]:ILE:O	1:B:225[B]:MET:N	2.46	0.42
1:B:541:MET:HG3	1:B:561:TYR:CD1	2.55	0.42
1:B:669:VAL:HG21	1:B:680:ILE:HD12	2.03	0.41
1:B:524:LEU:HD12	1:B:769:LEU:HD11	2.03	0.40
1:A:449:MET:HE2	1:A:449:MET:HA	2.03	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	605/601 (101%)	583 (96%)	20 (3%)	2 (0%)	36 25
1	B	585/601 (97%)	566 (97%)	17 (3%)	2 (0%)	36 25
All	All	1190/1202 (99%)	1149 (97%)	37 (3%)	4 (0%)	36 25

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	476	VAL
1	B	476	VAL
1	B	766	VAL
1	A	766	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	545/539 (101%)	542 (99%)	3 (1%)	78 77
1	B	533/539 (99%)	519 (97%)	14 (3%)	40 28
All	All	1078/1078 (100%)	1061 (98%)	17 (2%)	59 47

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

Mol	Chain	Res	Type
1	A	207	ARG
1	A	536	ILE

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Mol	Chain	Res	Type
1	A	749	LEU
1	B	208	LYS
1	B	223[A]	ARG
1	B	223[B]	ARG
1	B	232[A]	PHE
1	B	232[B]	PHE
1	B	502	VAL
1	B	514	ASN
1	B	524	LEU
1	B	536	ILE
1	B	538	ASN
1	B	540	LYS
1	B	541	MET
1	B	559	ILE
1	B	572	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (14) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	229	ASN
1	A	322	GLN
1	A	332	ASN
1	A	378	GLN
1	A	487	GLN
1	A	538	ASN
1	A	549	ASN
1	A	553	ASN
1	A	590	GLN
1	B	355	ASN
1	B	388	GLN
1	B	514	ASN
1	B	538	ASN
1	B	553	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, 95^{th} 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	587/601 (97%)	-0.18	11 (1%)	66	66	12, 29, 64, 142	20 (3%)
1	B	572/601 (95%)	-0.01	23 (4%)	42	41	13, 32, 76, 156	21 (3%)
All	All	1159/1202 (96%)	-0.10	34 (2%)	53	53	12, 31, 73, 156	41 (3%)

All (34) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	536	ILE	4.5
1	B	228[B]	ASP	4.2
1	B	540	LYS	4.1
1	B	556	LEU	3.9
1	A	536	ILE	3.8
1	B	278	VAL	3.7
1	A	540	LYS	3.6
1	B	281	VAL	3.5
1	A	556	LEU	3.5
1	B	282	PRO	3.4
1	B	541	MET	2.9
1	A	792	PHE	2.8
1	B	537	GLN	2.7
1	A	789	TYR	2.7
1	B	280	GLY	2.6
1	B	534	ILE	2.6
1	A	790	ALA	2.6
1	A	572	ARG	2.6
1	B	223[A]	ARG	2.5
1	B	524	LEU	2.5
1	B	221[A]	ILE	2.4
1	B	787	SER	2.4
1	B	559	ILE	2.4
1	B	425	TYR	2.3

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Mol	Chain	Res	Type	RSRZ
1	B	512	ILE	2.3
1	B	390	LEU	2.3
1	B	538	ASN	2.3
1	B	643	LEU	2.3
1	B	279	GLU	2.2
1	B	360	VAL	2.2
1	A	280	GLY	2.2
1	A	537	GLN	2.1
1	A	382	MET	2.1
1	A	534	ILE	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 oligosaccharides 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.