



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 6, 2026 – 06:05 PM UTC

PDB ID : 2YBX / pdb_00002ybx
Title : Crystal Structure of Human Phosphatidylinositol-5-phosphate 4-kinase type-2 alpha
Authors : Tresaugues, L.; Moche, M.; Arrowsmith, C.H.; Berglund, H.; Bountra, C.; Collins, R.; Edwards, A.M.; Ekblad, T.; Flodin, S.; Graslund, S.; Karlberg, T.; Kotenyova, T.; Kouznetsova, E.; Nyman, T.; Persson, C.; Schuler, H.; Siponen, M.I.; Thorsell, A.G.; Wahlberg, E.; Weigelt, J.; Nordlund, P.
Deposited on : 2011-03-30
Resolution : 2.56 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
Mogul	:	2022.3.0, CSD as543be (2022)
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)

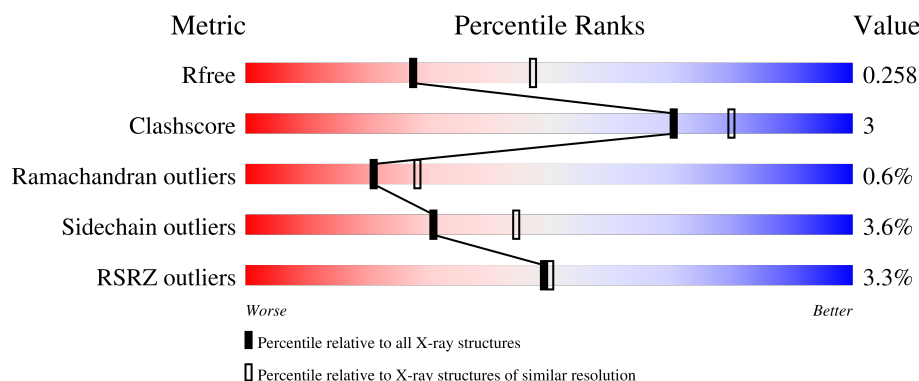
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

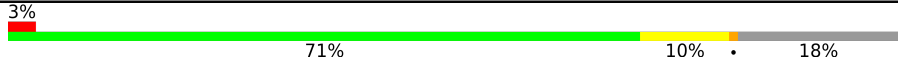
The reported resolution of this entry is 2.56 Å.

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	1853 (2.58-2.54)
Clashscore	190562	1897 (2.58-2.54)
Ramachandran outliers	187476	1875 (2.58-2.54)
Sidechain outliers	187428	1875 (2.58-2.54)
RSRZ outliers	180081	1853 (2.58-2.54)

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	394	
1	B	394	

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 5362 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 PHOSPHATIDYLINOSITOL-5-PHOSPHATE 4-KINASE TYPE-2 ALPHA.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	322	Total	C	N	O	P	S	0	2	0
			2671	1708	446	502	1	14			
1	B	312	Total	C	N	O	P	S	0	1	0
			2565	1648	432	471	1	13			

There are 46 discrepancies between the modelled and reference sequences:

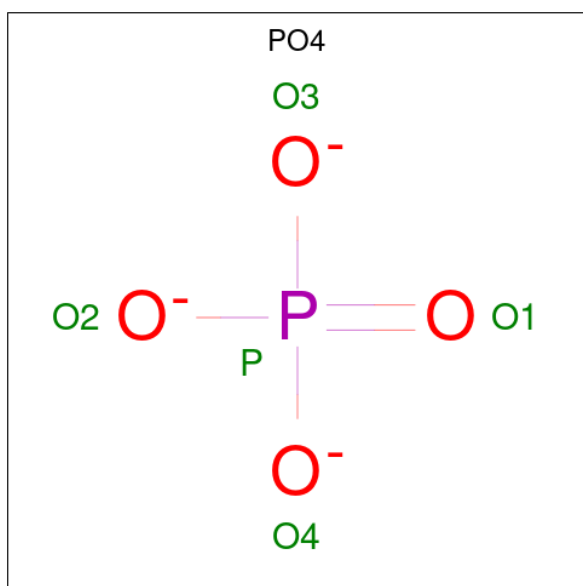
Chain	Residue	Modelled	Actual	Comment	Reference
A	12	MET	-	expression tag	UNP P48426
A	13	HIS	-	expression tag	UNP P48426
A	14	HIS	-	expression tag	UNP P48426
A	15	HIS	-	expression tag	UNP P48426
A	16	HIS	-	expression tag	UNP P48426
A	17	HIS	-	expression tag	UNP P48426
A	18	HIS	-	expression tag	UNP P48426
A	19	SER	-	expression tag	UNP P48426
A	20	SER	-	expression tag	UNP P48426
A	21	GLY	-	expression tag	UNP P48426
A	22	VAL	-	expression tag	UNP P48426
A	23	ASP	-	expression tag	UNP P48426
A	24	LEU	-	expression tag	UNP P48426
A	25	GLY	-	expression tag	UNP P48426
A	26	THR	-	expression tag	UNP P48426
A	27	GLU	-	expression tag	UNP P48426
A	28	ASN	-	expression tag	UNP P48426
A	29	LEU	-	expression tag	UNP P48426
A	30	TYR	-	expression tag	UNP P48426
A	31	PHE	-	expression tag	UNP P48426
A	32	GLN	-	expression tag	UNP P48426
A	33	SER	-	expression tag	UNP P48426
A	34	MET	-	expression tag	UNP P48426
B	12	MET	-	expression tag	UNP P48426

Continued on next page...

Continued from previous page...

Chain	Residue	Modelled	Actual	Comment	Reference
B	13	HIS	-	expression tag	UNP P48426
B	14	HIS	-	expression tag	UNP P48426
B	15	HIS	-	expression tag	UNP P48426
B	16	HIS	-	expression tag	UNP P48426
B	17	HIS	-	expression tag	UNP P48426
B	18	HIS	-	expression tag	UNP P48426
B	19	SER	-	expression tag	UNP P48426
B	20	SER	-	expression tag	UNP P48426
B	21	GLY	-	expression tag	UNP P48426
B	22	VAL	-	expression tag	UNP P48426
B	23	ASP	-	expression tag	UNP P48426
B	24	LEU	-	expression tag	UNP P48426
B	25	GLY	-	expression tag	UNP P48426
B	26	THR	-	expression tag	UNP P48426
B	27	GLU	-	expression tag	UNP P48426
B	28	ASN	-	expression tag	UNP P48426
B	29	LEU	-	expression tag	UNP P48426
B	30	TYR	-	expression tag	UNP P48426
B	31	PHE	-	expression tag	UNP P48426
B	32	GLN	-	expression tag	UNP P48426
B	33	SER	-	expression tag	UNP P48426
B	34	MET	-	expression tag	UNP P48426

- Molecule 2 is PHOSPHATE ION (CCD ID: PO4) (formula: O₄P).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total	O	P	0	0
			5	4	1		

- Molecule 3 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	69	Total	O	0	0
			69	69		
3	B	52	Total	O	0	0
			52	52		

4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	44.04Å 98.51Å 104.88Å 90.00° 93.43° 90.00°	Depositor
Resolution (Å)	28.37 – 2.56 28.37 – 2.56	Depositor EDS
% Data completeness (in resolution range)	97.9 (28.37-2.56) 97.9 (28.37-2.56)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.19 (at 2.57Å)	Xtriage
Refinement program	BUSTER 2.11.1	Depositor
R, R_{free}	0.188 , 0.238 0.202 , 0.258	Depositor DCC
R_{free} test set	1444 reflections (5.01%)	wwPDB-VP
Wilson B-factor (Å ²)	41.3	Xtriage
Anisotropy	0.735	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 52.5	EDS
L-test for twinning ²	$\langle L \rangle = 0.47$, $\langle L^2 \rangle = 0.29$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	5362	wwPDB-VP
Average B, all atoms (Å ²)	49.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 8.95% 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

Bond lengths and bond angles in the following residue types are not validated in this section: PO4, PHD

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	0.86	1/2718 (0.0%)	1.28	4/3664 (0.1%)
1	B	0.87	1/2611 (0.0%)	1.30	7/3520 (0.2%)
All	All	0.87	2/5329 (0.0%)	1.29	11/7184 (0.2%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	203	ARG	CA-C	5.25	1.58	1.53
1	B	155	MET	SD-CE	-5.04	1.67	1.79

All (11) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	364	TYR	CA-C-N	5.68	128.21	120.54
1	B	364	TYR	C-N-CA	5.68	128.21	120.54
1	A	43	TRP	CA-C-N	5.34	125.87	119.94
1	A	43	TRP	C-N-CA	5.34	125.87	119.94
1	B	333	ASP	CA-CB-CG	5.27	117.87	112.60
1	B	151	ASP	CA-CB-CG	5.26	117.86	112.60
1	B	389	ASN	CA-CB-CG	5.25	117.85	112.60
1	B	134	PHE	CA-CB-CG	5.22	119.02	113.80
1	A	101	LEU	CA-C-N	5.17	127.52	120.54
1	A	101	LEU	C-N-CA	5.17	127.52	120.54
1	B	187	ASP	CA-CB-CG	5.03	117.63	112.60

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	2671	0	2606	15	0
1	B	2565	0	2515	20	0
2	A	5	0	0	0	0
3	A	69	0	0	0	0
3	B	52	0	0	0	0
All	All	5362	0	5121	35	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 3.

All (35) 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:283:VAL:HB	1:B:350:LYS:HB3	1.81	0.63
1:B:155:MET:HE2	1:B:361:LEU:HD11	1.86	0.57
1:A:41:LEU:HB2	1:A:184:LEU:HD21	1.88	0.56
1:B:363:HIS:HD2	1:B:365:ASP:H	1.53	0.56
1:A:29:LEU:HD22	1:A:118:ARG:HA	1.88	0.55
1:A:245:ILE:HG21	1:A:355:MET:HE1	1.87	0.55
1:B:29:LEU:HD13	1:B:117:THR:HG22	1.91	0.53
1:B:225:GLU:O	1:B:231:PRO:HB3	2.09	0.52
1:B:41:LEU:HB2	1:B:184:LEU:HD21	1.91	0.52
1:A:219:ARG:HD3	1:A:235:ASP:OD2	2.10	0.51
1:A:217:VAL:HG13	1:A:218:ALA:H	1.76	0.51
1:A:215:SER:HB3	1:A:396:ARG:HB3	1.95	0.48
1:B:247:ILE:HD11	1:B:353:TYR:CD2	2.49	0.47
1:A:37:LEU:HD23	1:A:186:VAL:HG12	1.97	0.47
1:B:219:ARG:NH1	1:B:235:ASP:OD1	2.48	0.46
1:A:353:TYR:HB3	1:A:355:MET:HE3	1.99	0.45
1:A:49:ILE:HG21	1:A:113:GLN:HB2	1.98	0.45
1:B:57:ILE:HD13	1:B:99:ARG:CZ	2.46	0.45
1:B:41:LEU:HD13	1:B:193:VAL:HG21	1.97	0.45
1:B:44:GLY:O	1:B:48:SER:HB3	2.17	0.45
1:B:247:ILE:HD11	1:B:353:TYR:HD2	1.82	0.45
1:A:278:VAL:HG22	1:A:355:MET:HG2	1.99	0.44

Continued on next page...

Continued from previous page...

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:38:LEU:HD22	1:B:121:PRO:HD2	1.98	0.44
1:A:199:VAL:HA	1:A:339:TYR:CD2	2.53	0.44
1:B:36:PRO:O	1:B:40:VAL:HG23	2.18	0.43
1:B:252:LYS:HD2	1:B:405:LEU:HD12	2.00	0.43
1:A:213:LYS:HG2	1:A:275:SER:HB3	1.99	0.43
1:A:215:SER:HB2	1:A:396:ARG:HD2	2.00	0.43
1:B:89:LYS:HB2	1:B:185:ASN:HB3	2.02	0.42
1:A:391:GLU:O	1:A:395:LYS:HG2	2.19	0.42
1:B:46:ASN:HA	1:B:113:GLN:HE21	1.84	0.42
1:B:91:LYS:HB3	1:B:183:ARG:HB3	2.02	0.42
1:A:181:MET:HB2	1:A:194:ILE:HD12	2.03	0.40
1:B:104:ARG:CZ	1:B:167:VAL:HG22	2.51	0.40
1:B:69:TYR:CE1	1:B:71:LYS:HD3	2.57	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	315/394 (80%)	305 (97%)	8 (2%)	2 (1%)	21	28
1	B	304/394 (77%)	290 (95%)	12 (4%)	2 (1%)	18	25
All	All	619/788 (79%)	595 (96%)	20 (3%)	4 (1%)	21	28

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	217	VAL
1	B	329	PRO
1	A	138	TYR
1	B	217	VAL

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	297/353 (84%)	282 (95%)	15 (5%)	21	32
1	B	282/353 (80%)	275 (98%)	7 (2%)	42	58
All	All	579/706 (82%)	557 (96%)	22 (4%)	31	42

All (22) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	29	LEU
1	A	51[A]	GLU
1	A	51[B]	GLU
1	A	109	ASP
1	A	133	ARG
1	A	137	SER
1	A	144	ILE
1	A	161	LYS
1	A	194	ILE
1	A	264	GLU
1	A	284	GLU
1	A	335	ASN
1	A	345	GLU
1	A	365	ASP
1	A	389	ASN
1	B	39	SER
1	B	48	SER
1	B	154	GLU
1	B	216	THR
1	B	239	ILE
1	B	349	ARG
1	B	350	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (9) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	47	HIS
1	A	240	ASN
1	A	288	GLN
1	A	389	ASN
1	B	113	GLN
1	B	164	GLN
1	B	240	ASN
1	B	335	ASN
1	B	363	HIS

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

2 non-standard protein/DNA/RNA residues are modelled in this entry.

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	$\# Z > 2$
1	PHD	A	359	1	9,11,12	1.04	1 (11%)	9,15,17	2.08	3 (33%)
1	PHD	B	359	1	9,11,12	0.83	1 (11%)	9,15,17	1.82	3 (33%)

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
1	PHD	A	359	1	-	0/8/11/13	-
1	PHD	B	359	1	-	1/8/11/13	-

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	359	PHD	P-OD1	2.82	1.64	1.59
1	B	359	PHD	P-OD1	2.09	1.63	1.59

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	359	PHD	OD1-CG-CB	4.35	121.16	110.95
1	B	359	PHD	OD1-CG-CB	3.53	119.23	110.95
1	A	359	PHD	CA-CB-CG	2.82	118.82	112.78
1	A	359	PHD	OD2-CG-CB	-2.72	118.34	124.65
1	B	359	PHD	CA-CB-CG	2.39	117.90	112.78
1	B	359	PHD	OD1-P-OP1	-2.05	102.90	109.47

There are no chirality outliers.

All (1) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	B	359	PHD	CG-OD1-P-OP2

There are no ring outliers.

No monomer is involved in short contacts.

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

1 ligand is modelled in this entry.

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	PO4	A	1406	-	4,4,4	2.44	1 (25%)	6,6,6	0.49	0

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	1406	PO4	P-O1	3.88	1.59	1.50

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

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	321/394 (81%)	0.14	12 (3%) 45 46	20, 45, 74, 111	2 (0%)
1	B	311/394 (78%)	0.10	9 (2%) 53 55	22, 46, 75, 105	1 (0%)
All	All	632/788 (80%)	0.12	21 (3%) 49 50	20, 46, 75, 111	3 (0%)

All (21) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	216	THR	4.6
1	A	131	GLY	4.5
1	A	217	VAL	3.6
1	B	286	ALA	3.6
1	A	405	LEU	3.4
1	B	126	SER	3.3
1	A	132	ALA	2.8
1	B	328	ALA	2.7
1	A	291	VAL	2.6
1	A	218	ALA	2.4
1	B	405	LEU	2.4
1	B	216	THR	2.3
1	A	387	THR	2.3
1	A	366	ALA	2.3
1	B	366	ALA	2.1
1	B	125	ASP	2.1
1	B	132	ALA	2.1
1	A	215	SER	2.1
1	A	293	CYS	2.1
1	B	29	LEU	2.0
1	A	81	LYS	2.0

6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

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. The B-factors column lists the minimum, median, 95th 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	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
1	PHD	B	359	12/13	0.88	0.11	39,47,69,70	0
1	PHD	A	359	12/13	0.92	0.08	35,41,59,61	0

6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

6.4 Ligands [i](#)

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. The B-factors column lists the minimum, median, 95th 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	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
2	PO4	A	1406	5/5	0.87	0.09	78,82,85,85	0

6.5 Other polymers [i](#)

There are no such residues in this entry.