



# Full wwPDB X-ray Structure Validation Report ⓘ

May 30, 2017 – 02:24 PM EDT

PDB ID : 5MO5  
Title : Crystal Structure of CK2alpha with N-(3-(((2-chloro-[1,1'-biphenyl]-4-yl)methyl)amino)propyl)methanesulfonamide bound  
Authors : Brear, P.; De Fusco, C.; Georgiou, K.; Iegre, J.; Sore, H.; Hyvonen, M.; Spring, D.  
Deposited on : 2016-12-13  
Resolution : 2.04 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	:	1.7.2 (RC1), CSD as538be (2017)
Xtriage (Phenix)	:	1.9-1692
EDS	:	rb-20029077
Percentile statistics	:	20161228.v01 (using entries in the PDB archive December 28th 2016)
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)	:	rb-20029077

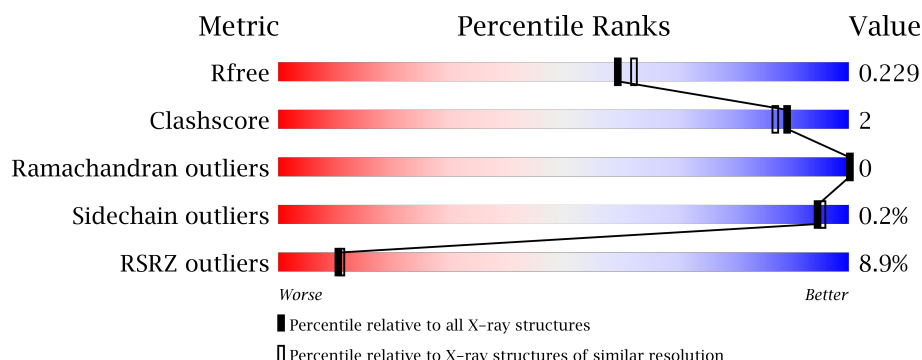
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

## *X-RAY DIFFRACTION*

The reported resolution of this entry is 2.04 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))
$R_{free}$	100719	1316 (2.04-2.04)
Clashscore	112137	1394 (2.04-2.04)
Ramachandran outliers	110173	1383 (2.04-2.04)
Sidechain outliers	110143	1383 (2.04-2.04)
RSRZ outliers	101464	1319 (2.04-2.04)

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	352	<div> <div>4%</div> <div>86%</div> <div>6%</div> <div>7%</div> </div>
1	B	352	<div> <div>13%</div> <div>87%</div> <div>5%</div> <div>8%</div> </div>

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
2	ACT	A	401	-	-	-	X
4	PO4	A	405	-	-	-	X

## 2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 5750 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 Casein kinase II subunit alpha.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	326	Total	C	N	O	S	0	3	0
			2773	1775	487	500	11			
1	B	325	Total	C	N	O	S	0	4	0
			2774	1777	488	498	11			

There are 50 discrepancies between the modelled and reference sequences:

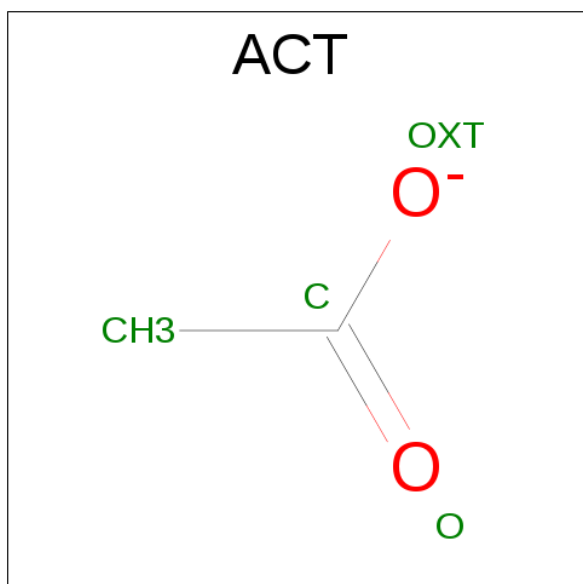
Chain	Residue	Modelled	Actual	Comment	Reference
A	-22	GLY	-	expression tag	UNP P68400
A	-21	SER	-	expression tag	UNP P68400
A	-20	MET	-	expression tag	UNP P68400
A	-19	ASP	-	expression tag	UNP P68400
A	-18	ILE	-	expression tag	UNP P68400
A	-17	GLU	-	expression tag	UNP P68400
A	-16	PHE	-	expression tag	UNP P68400
A	-15	ASP	-	expression tag	UNP P68400
A	-14	ASP	-	expression tag	UNP P68400
A	-13	ASP	-	expression tag	UNP P68400
A	-12	ALA	-	expression tag	UNP P68400
A	-11	ASP	-	expression tag	UNP P68400
A	-10	ASP	-	expression tag	UNP P68400
A	-9	ASP	-	expression tag	UNP P68400
A	-8	GLY	-	expression tag	UNP P68400
A	-7	SER	-	expression tag	UNP P68400
A	-6	GLY	-	expression tag	UNP P68400
A	-5	SER	-	expression tag	UNP P68400
A	-4	GLY	-	expression tag	UNP P68400
A	-3	SER	-	expression tag	UNP P68400
A	-2	GLY	-	expression tag	UNP P68400
A	-1	SER	-	expression tag	UNP P68400
A	0	GLY	-	expression tag	UNP P68400
A	1	SER	-	expression tag	UNP P68400
A	21	SER	ARG	engineered mutation	UNP P68400

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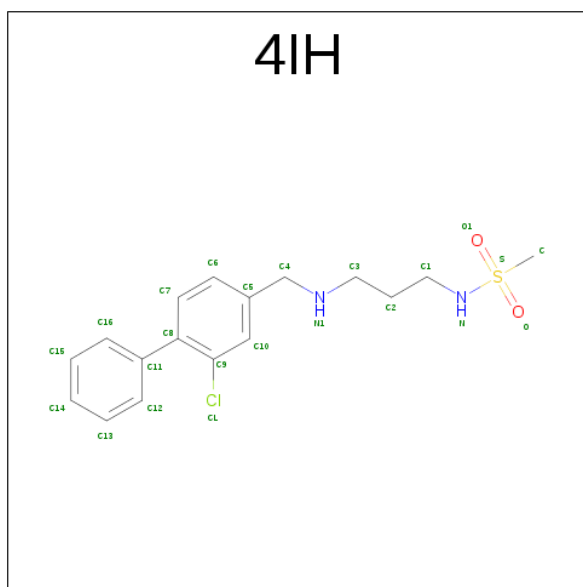
Chain	Residue	Modelled	Actual	Comment	Reference
B	-22	GLY	-	expression tag	UNP P68400
B	-21	SER	-	expression tag	UNP P68400
B	-20	MET	-	expression tag	UNP P68400
B	-19	ASP	-	expression tag	UNP P68400
B	-18	ILE	-	expression tag	UNP P68400
B	-17	GLU	-	expression tag	UNP P68400
B	-16	PHE	-	expression tag	UNP P68400
B	-15	ASP	-	expression tag	UNP P68400
B	-14	ASP	-	expression tag	UNP P68400
B	-13	ASP	-	expression tag	UNP P68400
B	-12	ALA	-	expression tag	UNP P68400
B	-11	ASP	-	expression tag	UNP P68400
B	-10	ASP	-	expression tag	UNP P68400
B	-9	ASP	-	expression tag	UNP P68400
B	-8	GLY	-	expression tag	UNP P68400
B	-7	SER	-	expression tag	UNP P68400
B	-6	GLY	-	expression tag	UNP P68400
B	-5	SER	-	expression tag	UNP P68400
B	-4	GLY	-	expression tag	UNP P68400
B	-3	SER	-	expression tag	UNP P68400
B	-2	GLY	-	expression tag	UNP P68400
B	-1	SER	-	expression tag	UNP P68400
B	0	GLY	-	expression tag	UNP P68400
B	1	SER	-	expression tag	UNP P68400
B	21	SER	ARG	engineered mutation	UNP P68400

- Molecule 2 is ACETATE ION (three-letter code: ACT) (formula:  $C_2H_3O_2$ ).



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

- Molecule 3 is {N}-[3-[(3-chloranyl-4-phenyl-phenyl)methylamino]propyl]methanesulfonamide (three-letter code: 4IH) (formula: C<sub>17</sub>H<sub>21</sub>ClN<sub>2</sub>O<sub>2</sub>S).



Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
3	A	1	Total	C	Cl	N	O	S	0	0
			23	17	1	2	2	1		

- Molecule 4 is PHOSPHATE ION (three-letter code: PO4) (formula: O<sub>4</sub>P).



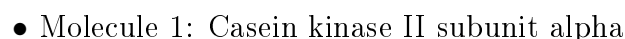
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	O	P	0	0
			5	4	1		
4	A	1	Total	O	P	0	0
			5	4	1		
4	B	1	Total	O	P	0	0
			5	4	1		

- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	120	Total	O	0	0
			120	120		
5	B	37	Total	O	0	0
			37	37		



- Molecule 1: Casein kinase II subunit alpha





## 4 Data and refinement statistics

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	64.66 Å 68.29 Å 334.50 Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	46.95 – 2.04 46.95 – 2.04	Depositor EDS
% Data completeness (in resolution range)	99.3 (46.95-2.04) 99.8 (46.95-2.04)	Depositor EDS
$R_{merge}$	0.11	Depositor
$R_{sym}$	0.11	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.43 (at 2.03 Å)	Xtriage
Refinement program	BUSTER	Depositor
R, $R_{free}$	0.196 , 0.213 0.208 , 0.229	Depositor DCC
$R_{free}$ test set	2426 reflections (5.36%)	DCC
Wilson B-factor (Å <sup>2</sup> )	37.3	Xtriage
Anisotropy	0.507	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.34 , 52.5	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.47$ , $\langle L^2 \rangle = 0.30$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	5750	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	55.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.67% 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](#)

Bond lengths and bond angles in the following residue types are not validated in this section: PO4, 4IH, ACT

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	0.64	0/2848	0.68	1/3853 (0.0%)
1	B	0.53	0/2853	0.65	0/3860
All	All	0.59	0/5701	0.67	1/7713 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	2	SER	N-CA-C	5.50	125.85	111.00

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	2773	0	2709	14	0
1	B	2774	0	2711	10	0
2	A	8	0	6	0	0
3	A	23	0	0	0	0
4	A	10	0	0	0	0
4	B	5	0	0	0	0
5	A	120	0	0	0	0
5	B	37	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
All	All	5750	0	5426	24	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 2.

All (24) 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:163:MET:HE1	1:A:174:ILE:HG21	1.73	0.68
1:A:163:MET:CE	1:A:174:ILE:HG21	2.26	0.65
1:A:168:HIS:HB3	1:A:170:LYS:HE3	1.83	0.60
1:B:50:TYR:CD1	1:B:73:VAL:HG21	2.39	0.58
1:A:33:TRP:CZ3	1:A:100:ILE:HG22	2.39	0.57
1:A:33:TRP:CE3	1:A:100:ILE:HG22	2.40	0.56
1:A:50:TYR:CD1	1:A:73:VAL:HG21	2.41	0.55
1:B:258:ILE:HA	1:B:263:ILE:HD12	1.91	0.53
1:A:165:ASP:HB3	1:A:170:LYS:HB2	1.91	0.52
1:A:70:LEU:HD13	1:A:78:ILE:HG12	1.90	0.52
1:B:224:SER:HB2	1:B:230:GLU:HG2	1.94	0.49
1:B:128:LEU:HD22	1:B:132:ASP:HB3	1.95	0.49
1:A:33:TRP:CH2	1:A:109:PRO:HB3	2.48	0.49
1:B:22:GLU:H	1:B:22:GLU:CD	2.17	0.47
1:A:303:LYS:HB3	1:A:313:LEU:HG	1.99	0.45
1:B:119:THR:CG2	1:B:124:LEU:HD13	2.48	0.44
1:B:303:LYS:HB3	1:B:313:LEU:HG	2.00	0.44
1:B:5:VAL:HB	1:B:261:TYR:HA	2.00	0.44
1:A:124:LEU:HG	1:A:128:LEU:HD11	1.99	0.43
1:A:126:GLN:HG2	1:A:126:GLN:O	2.19	0.42
1:A:285:VAL:HG22	1:A:293:VAL:HG11	2.00	0.42
1:A:5:VAL:HB	1:A:261:TYR:HA	2.01	0.42
1:B:119:THR:HG21	1:B:124:LEU:HD13	2.01	0.41
1:B:33:TRP:CD1	1:B:100:ILE:HG22	2.56	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	327/352 (93%)	315 (96%)	12 (4%)	0	100	100
1	B	327/352 (93%)	315 (96%)	12 (4%)	0	100	100
All	All	654/704 (93%)	630 (96%)	24 (4%)	0	100	100

There are no Ramachandran outliers to report.

### 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	303/319 (95%)	303 (100%)	0	100	100
1	B	303/319 (95%)	302 (100%)	1 (0%)	94	94
All	All	606/638 (95%)	605 (100%)	1 (0%)	94	95

All (1) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	21	SER

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	118	ASN
1	A	262	ASN

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Mol	Chain	Res	Type
1	A	270	ASN
1	B	262	ASN

### 5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

There are no non-standard protein/DNA/RNA residues in this entry.

## 5.5 Carbohydrates ⓘ

There are no carbohydrates in this entry.

## 5.6 Ligand geometry ⓘ

6 ligands 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	$\# Z  > 2$
2	ACT	A	401	-	1,3,3	7.83	1 (100%)	0,3,3	0.00	-
2	ACT	A	402	-	1,3,3	4.61	1 (100%)	0,3,3	0.00	-
3	4IH	A	403	-	24,24,24	0.22	0	32,32,32	0.30	0
4	PO4	A	404	-	4,4,4	2.63	1 (25%)	6,6,6	0.63	0
4	PO4	A	405	-	4,4,4	2.32	1 (25%)	6,6,6	0.72	0
4	PO4	B	401	-	4,4,4	2.68	1 (25%)	6,6,6	0.66	0

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
2	ACT	A	401	-	-	0/0/0/0	0/0/0/0
2	ACT	A	402	-	-	0/0/0/0	0/0/0/0
3	4IH	A	403	-	-	0/14/14/14	0/2/2/2
4	PO4	A	404	-	-	0/0/0/0	0/0/0/0
4	PO4	A	405	-	-	0/0/0/0	0/0/0/0
4	PO4	B	401	-	-	0/0/0/0	0/0/0/0

All (5) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	A	405	PO4	P-O1	3.49	1.58	1.50
2	A	402	ACT	CH3-C	4.61	1.54	1.48
4	A	404	PO4	P-O1	4.63	1.60	1.50
4	B	401	PO4	P-O1	4.71	1.60	1.50
2	A	401	ACT	CH3-C	7.83	1.58	1.48

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

There are no such residues in this entry.

## 5.8 Polymer linkage issues

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	326/352 (92%)	0.27	13 (3%) 39 43	19, 37, 73, 116	0
1	B	325/352 (92%)	0.79	45 (13%) 3 3	31, 67, 111, 128	0
All	All	651/704 (92%)	0.53	58 (8%) 10 11	19, 51, 100, 128	0

All (58) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	125	TYR	9.3
1	B	123	GLN	7.6
1	A	122	LYS	6.9
1	A	121	PHE	6.8
1	B	50	TYR	6.4
1	A	124	LEU	6.1
1	B	271	ASP	5.2
1	A	125	TYR	5.0
1	B	270	ASN	4.7
1	A	50	TYR	4.7
1	B	126	GLN	4.3
1	B	121	PHE	4.2
1	B	265	LEU	4.0
1	B	120	ASP	4.0
1	B	124	LEU	4.0
1	B	257	TYR	4.0
1	B	122	LYS	3.9
1	B	128	LEU	3.9
1	B	105	VAL	3.7
1	B	166	HIS	3.4
1	A	126	GLN	3.4
1	B	33	TRP	3.4
1	B	49	LYS	3.3
1	A	120	ASP	3.3

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Mol	Chain	Res	Type	RSRZ
1	B	281	TRP	3.1
1	B	104	PRO	3.1
1	B	225	MET	3.0
1	B	258	ILE	3.0
1	A	128	LEU	3.0
1	A	2	SER	2.9
1	A	107	ARG	2.9
1	B	327	VAL	2.8
1	B	272	ILE	2.8
1	B	283	ARG	2.8
1	B	167	GLU	2.8
1	A	271	ASP	2.8
1	B	22	GLU	2.7
1	B	254	LEU	2.6
1	B	268	ARG	2.6
1	A	104	PRO	2.6
1	B	267	PRO	2.6
1	B	252	GLU	2.6
1	B	132	ASP	2.5
1	B	298	LEU	2.5
1	B	284	PHE	2.4
1	B	107	ARG	2.4
1	B	223	ALA	2.3
1	B	292	LEU	2.3
1	B	36	GLN	2.2
1	B	239	TYR	2.2
1	B	299	ASP	2.2
1	B	282	GLU	2.2
1	B	301	LEU	2.2
1	B	255	TYR	2.2
1	B	307	TYR	2.1
1	B	288	GLU	2.0
1	B	264	GLU	2.0
1	A	33	TRP	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 [i](#)

There are no carbohydrates 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. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. The B-factors column lists the minimum, median, 95<sup>th</sup> 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	LLDF	B-factors( $\text{\AA}^2$ )	Q<0.9
2	ACT	A	401	4/4	0.86	0.20	4.16	39,45,46,46	0
4	PO4	A	405	5/5	0.84	0.18	3.36	66,67,68,70	0
3	4IH	A	403	23/23	0.66	0.29	1.12	60,67,100,103	0
2	ACT	A	402	4/4	0.97	0.13	0.18	44,48,49,52	0
4	PO4	B	401	5/5	0.91	0.13	-0.28	74,74,76,78	0
4	PO4	A	404	5/5	0.92	0.13	-	56,59,65,66	0

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

There are no such residues in this entry.