



Full wwPDB X-ray Structure Validation Report ⓘ

May 14, 2020 – 10:55 am BST

PDB ID : 3T4T
Title : Arabidopsis histidine kinase 4 sensor domain in complex with thiadiazuron
Authors : Hothorn, M.
Deposited on : 2011-07-26
Resolution : 1.70 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

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 1.8.5 (274361), CSD as541be (2020)
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

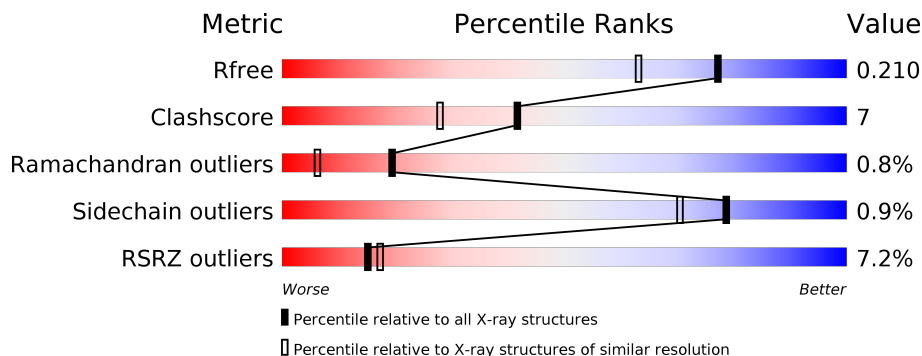
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.70 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}	130704	4298 (1.70-1.70)
Clashscore	141614	4695 (1.70-1.70)
Ramachandran outliers	138981	4610 (1.70-1.70)
Sidechain outliers	138945	4610 (1.70-1.70)
RSRZ outliers	127900	4222 (1.70-1.70)

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 ≥ 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	270	
1	B	270	

2 Entry composition [i](#)

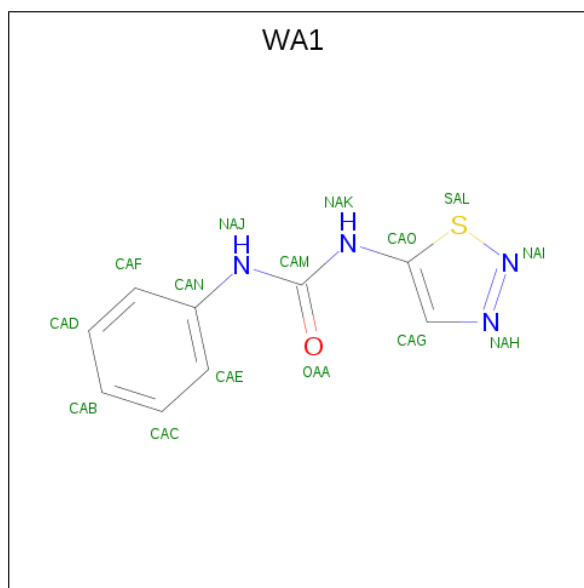
There are 4 unique types of molecules in this entry. The entry contains 4987 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 Histidine kinase 4.

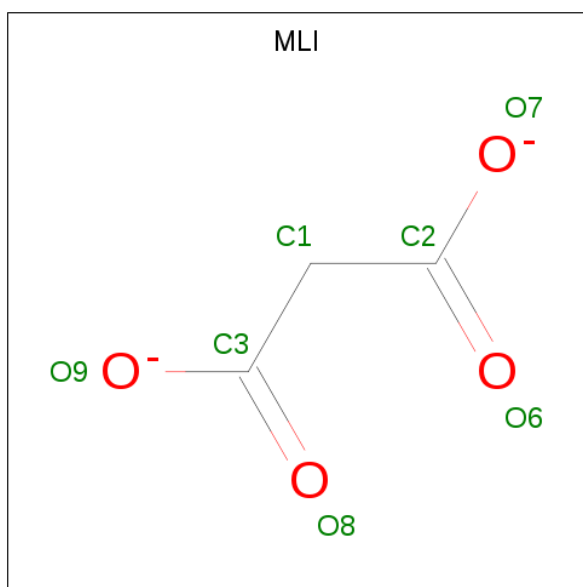
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	268	Total	C	N	O	S	0	20	0
			2250	1430	386	422	12			
1	B	263	Total	C	N	O	S	0	16	0
			2188	1382	381	414	11			

- Molecule 2 is 1-phenyl-3-(1,2,3-thiadiazol-5-yl)urea (three-letter code: WA1) (formula: C₉H₈N₄OS).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	S		
2	A	1	Total	C	N	O	S	0	0
			15	9	4	1	1		
2	B	1	Total	C	N	O	S	0	0
			15	9	4	1	1		

- Molecule 3 is MALONATE ION (three-letter code: MLI) (formula: C₃H₂O₄).



Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	B	1	Total	C O	0	0
			7	3 4		

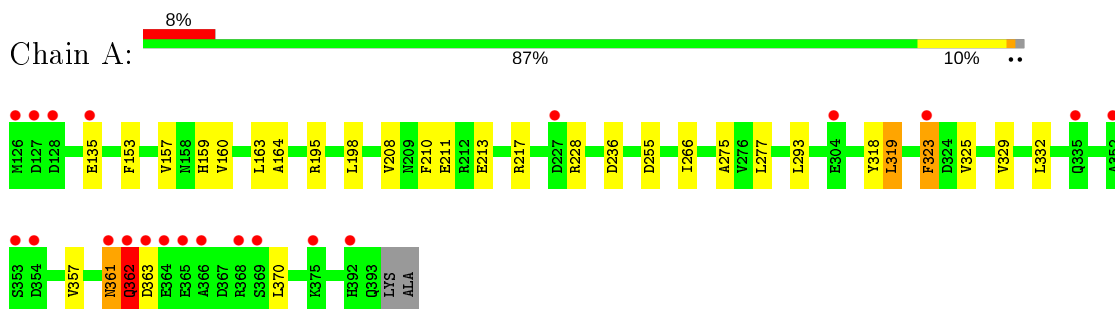
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	243	Total	O	0	0
			243	243		
4	B	269	Total	O	0	0
			269	269		

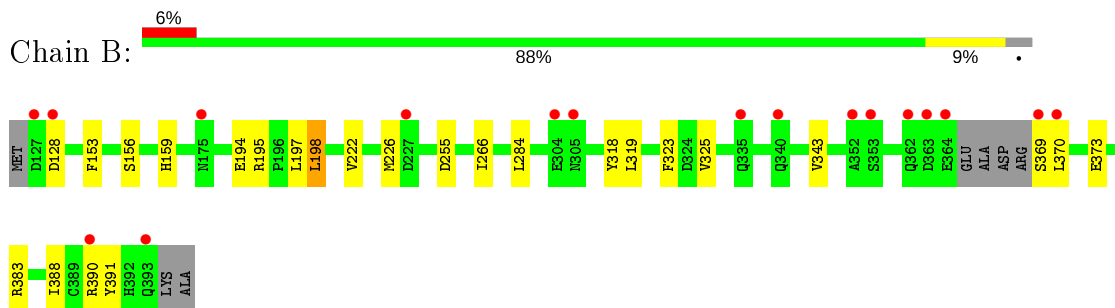
3 Residue-property plots [i](#)

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: Histidine kinase 4



- Molecule 1: Histidine kinase 4



4 Data and refinement statistics

Property	Value	Source
Space group	P 32 2 1	Depositor
Cell constants a, b, c, α , β , γ	60.09Å 60.09Å 297.58Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	19.68 – 1.70 19.68 – 1.70	Depositor EDS
% Data completeness (in resolution range)	96.4 (19.68-1.70) 96.5 (19.68-1.70)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.05	Depositor
$\langle I/\sigma(I) \rangle$ ¹	3.09 (at 1.70Å)	Xtrriage
Refinement program	REFMAC 5.5.0109	Depositor
R, R_{free}	0.182 , 0.208 0.184 , 0.210	Depositor DCC
R_{free} test set	3381 reflections (4.99%)	wwPDB-VP
Wilson B-factor (Å ²)	22.2	Xtrriage
Anisotropy	0.042	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 39.8	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtrriage
Estimated twinning fraction	0.033 for -h,-k,l	Xtrriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	4987	wwPDB-VP
Average B, all atoms (Å ²)	31.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.13% 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 [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: MLI, WA1

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	0.69	2/2358 (0.1%)	0.75	2/3191 (0.1%)
1	B	0.71	0/2280	0.76	3/3082 (0.1%)
All	All	0.70	2/4638 (0.0%)	0.75	5/6273 (0.1%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	211	GLU	CB-CG	-5.31	1.42	1.52
1	A	211	GLU	CD-OE1	5.30	1.31	1.25

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	255	ASP	CB-CG-OD2	-7.14	111.87	118.30
1	B	255	ASP	CB-CG-OD1	6.70	124.33	118.30
1	B	198	LEU	CA-CB-CG	-6.33	100.73	115.30
1	B	383	ARG	NE-CZ-NH1	5.24	122.92	120.30
1	A	236	ASP	CB-CG-OD1	5.23	123.01	118.30

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	2250	0	2226	35	0
1	B	2188	0	2154	29	0
2	A	15	0	8	1	0
2	B	15	0	8	1	0
3	B	7	0	2	0	0
4	A	243	0	0	3	0
4	B	269	0	0	3	0
All	All	4987	0	4398	62	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 7.

All (62) 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:198:LEU:HD21	1:B:323[A]:PHE:CE2	1.86	1.09
1:B:198:LEU:HD21	1:B:323[A]:PHE:CD2	1.95	1.01
1:A:198:LEU:HD21	1:A:323[B]:PHE:CE2	1.97	0.99
1:A:195:ARG:HB3	1:A:198:LEU:HD12	1.48	0.92
1:A:213[B]:GLU:HG2	1:A:217[B]:ARG:HE	1.38	0.87
1:B:323[B]:PHE:CE2	1:B:325:VAL:HG22	2.11	0.86
1:A:208[A]:VAL:HG21	1:A:210[A]:PHE:CE1	2.18	0.78
1:B:323[B]:PHE:CD2	1:B:325:VAL:HG22	2.18	0.78
1:A:159:HIS:NE2	1:B:159:HIS:CE1	2.51	0.77
1:A:159:HIS:CD2	1:B:159:HIS:NE2	2.53	0.77
1:A:361:ASN:O	1:A:362:GLN:HB2	1.84	0.76
1:B:198:LEU:CD2	1:B:323[A]:PHE:CD2	2.70	0.75
1:A:217[B]:ARG:HG3	4:A:548:HOH:O	1.88	0.73
1:B:197:LEU:HD13	1:B:323[B]:PHE:CZ	2.25	0.71
1:A:213[B]:GLU:OE2	1:A:217[B]:ARG:NH2	2.24	0.70
1:A:208[A]:VAL:CG2	1:A:210[A]:PHE:CE1	2.75	0.69
1:B:159:HIS:CD2	1:B:194:GLU:HB3	2.28	0.67
1:A:163:LEU:HB2	1:A:319[B]:LEU:HD21	1.75	0.67
1:A:323[A]:PHE:CE2	1:A:325:VAL:HG22	2.30	0.67
1:B:323[B]:PHE:CD2	1:B:325:VAL:CG2	2.79	0.65
1:A:208[A]:VAL:HG21	1:A:210[A]:PHE:HE1	1.62	0.63
1:A:159:HIS:HE1	4:A:447:HOH:O	1.83	0.62
1:B:197:LEU:HD13	1:B:323[B]:PHE:HZ	1.65	0.62
1:B:156:SER:HB3	1:B:198:LEU:HD11	1.81	0.62
1:A:153[A]:PHE:HZ	1:A:277:LEU:HD21	1.64	0.61
1:A:323[A]:PHE:CZ	1:A:325:VAL:HG22	2.35	0.61
1:A:198:LEU:HD21	1:A:323[B]:PHE:CD2	2.36	0.61

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:159:HIS:NE2	1:B:194:GLU:OE1	2.34	0.60
1:B:159:HIS:CE1	4:B:450:HOH:O	2.56	0.59
1:A:228[A]:ARG:HG3	1:A:228[A]:ARG:HH11	1.68	0.58
1:B:153:PHE:CD2	1:B:323[B]:PHE:CE1	2.95	0.55
1:B:373[A]:GLU:HG2	1:B:388:ILE:CD1	2.36	0.55
1:A:135:GLU:HG3	1:A:370:LEU:HD11	1.88	0.55
1:A:159:HIS:NE2	1:B:159:HIS:NE2	2.54	0.55
1:A:153[A]:PHE:CZ	1:A:277:LEU:HD21	2.42	0.54
1:A:164:ALA:N	1:A:319[B]:LEU:HD22	2.23	0.53
1:A:208[A]:VAL:HG23	1:A:210[A]:PHE:CD1	2.44	0.52
2:A:400:WA1:OAA	2:A:400:WA1:SAL	2.67	0.52
1:B:195:ARG:HB3	1:B:198:LEU:HD12	1.90	0.51
2:B:400:WA1:SAL	2:B:400:WA1:OAA	2.67	0.51
1:B:153:PHE:CE2	1:B:323[B]:PHE:CE1	3.00	0.50
1:A:208[A]:VAL:CG2	1:A:210[A]:PHE:CD1	2.96	0.49
1:B:156:SER:HB3	1:B:198:LEU:CD1	2.42	0.49
1:B:197:LEU:HB3	1:B:323[B]:PHE:CE1	2.48	0.48
1:A:325:VAL:HG13	1:A:329:VAL:HG21	1.96	0.48
1:B:369:SER:OG	1:B:370:LEU:N	2.48	0.47
1:A:357[B]:VAL:HG12	4:A:452:HOH:O	2.15	0.46
1:A:160:VAL:HG13	1:A:319[A]:LEU:HD12	1.98	0.45
1:B:343:VAL:HG13	4:B:598:HOH:O	2.16	0.45
1:B:226[B]:MET:HG3	1:B:284:LEU:HD11	1.98	0.44
1:A:160:VAL:HG12	1:A:319[B]:LEU:HD23	1.99	0.44
1:A:332:LEU:C	1:A:332:LEU:HD23	2.38	0.43
1:A:153[A]:PHE:CE1	1:A:157:VAL:CG2	3.01	0.43
1:A:275:ALA:HB1	1:A:293:LEU:HD11	1.99	0.43
1:A:198:LEU:CD2	1:A:323[B]:PHE:CD2	3.01	0.43
1:B:390[B]:ARG:HG2	1:B:391:TYR:O	2.19	0.42
1:B:226[B]:MET:HG2	1:B:284:LEU:HD21	2.00	0.42
1:A:266:ILE:HG23	1:A:318:TYR:CE1	2.55	0.42
1:B:266:ILE:HG23	1:B:318:TYR:CE1	2.55	0.42
1:A:160:VAL:O	1:A:319[B]:LEU:CD2	2.69	0.41
1:A:159:HIS:HD2	1:B:159:HIS:NE2	2.14	0.40
1:B:222[A]:VAL:HG13	4:B:534:HOH:O	2.22	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	286/270 (106%)	279 (98%)	4 (1%)	3 (1%)	15	4
1	B	274/270 (102%)	268 (98%)	5 (2%)	1 (0%)	34	18
All	All	560/540 (104%)	547 (98%)	9 (2%)	4 (1%)	19	8

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	362	GLN
1	A	363	ASP
1	A	361	ASN
1	B	128	ASP

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	251/236 (106%)	246 (98%)	5 (2%)	55	38
1	B	244/236 (103%)	243 (100%)	1 (0%)	91	87
All	All	495/472 (105%)	489 (99%)	6 (1%)	78	59

All (6) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	319[A]	LEU
1	A	319[B]	LEU

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Mol	Chain	Res	Type
1	A	323[A]	PHE
1	A	323[B]	PHE
1	A	362	GLN
1	B	319	LEU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

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](#)

3 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	WA1	A	400	-	11,16,16	1.17	0	13,20,20	1.85	2 (15%)
3	MLI	B	1	-	0,6,6	0.00	-	0,7,7	0.00	-
2	WA1	B	400	-	11,16,16	0.76	0	13,20,20	2.58	2 (15%)

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	WA1	A	400	-	-	0/6/8/8	0/2/2/2
3	MLI	B	1	-	-	0/0/4/4	-
2	WA1	B	400	-	-	0/6/8/8	0/2/2/2

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	400	WA1	CAO-NAK-CAM	-8.46	118.53	130.41
2	A	400	WA1	CAO-NAK-CAM	-5.68	122.44	130.41
2	A	400	WA1	CAD-CAF-CAN	2.38	122.57	119.72
2	B	400	WA1	OAA-CAM-NAK	2.00	127.01	123.62

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	400	WA1	1	0
2	B	400	WA1	1	0

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, 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	268/270 (99%)	0.19	21 (7%) 13 15	13, 27, 97, 168	0
1	B	263/270 (97%)	0.12	17 (6%) 18 21	14, 26, 54, 80	0
All	All	531/540 (98%)	0.16	38 (7%) 15 17	13, 26, 60, 168	0

All (38) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	126	MET	11.7
1	A	362	GLN	8.3
1	B	369	SER	7.9
1	A	363	ASP	7.0
1	B	370	LEU	6.2
1	A	127	ASP	5.9
1	B	364	GLU	5.7
1	B	304	GLU	5.0
1	B	362	GLN	4.9
1	A	128	ASP	4.6
1	B	335	GLN	4.4
1	B	127	ASP	4.3
1	A	323[A]	PHE	4.2
1	A	361	ASN	4.2
1	B	390[A]	ARG	3.6
1	B	305	ASN	3.2
1	B	363	ASP	3.2
1	A	368	ARG	3.2
1	B	128	ASP	3.0
1	A	392	HIS	2.8
1	B	175	ASN	2.8
1	B	353	SER	2.8
1	B	393[A]	GLN	2.8
1	A	227	ASP	2.7

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Mol	Chain	Res	Type	RSRZ
1	B	352	ALA	2.7
1	A	353	SER	2.7
1	A	365	GLU	2.6
1	A	354	ASP	2.6
1	A	352	ALA	2.5
1	B	227	ASP	2.5
1	A	369	SER	2.4
1	A	335	GLN	2.3
1	A	366	ALA	2.3
1	A	135	GLU	2.3
1	B	340	GLN	2.2
1	A	375	LYS	2.2
1	A	304	GLU	2.1
1	A	364	GLU	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 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. 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(Å ²)	Q<0.9
3	MLI	B	1	7/7	0.92	0.24	22,24,27,31	0
2	WA1	B	400	15/15	0.94	0.14	23,25,29,32	0
2	WA1	A	400	15/15	0.97	0.06	14,17,24,24	0

6.5 Other polymers [i](#)

There are no such residues in this entry.