



wwPDB X-ray Structure Validation Summary Report ⓘ

Aug 20, 2023 – 10:48 AM EDT

PDB ID : 2ONL
Title : Crystal Structure of the p38a-MAPKAP kinase 2 Heterodimer
Authors : Ter Haar, E.
Deposited on : 2007-01-24
Resolution : 4.00 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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 : 4.02b-467
Xtriage (Phenix) : 1.13
EDS : 2.35
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) : 2.35

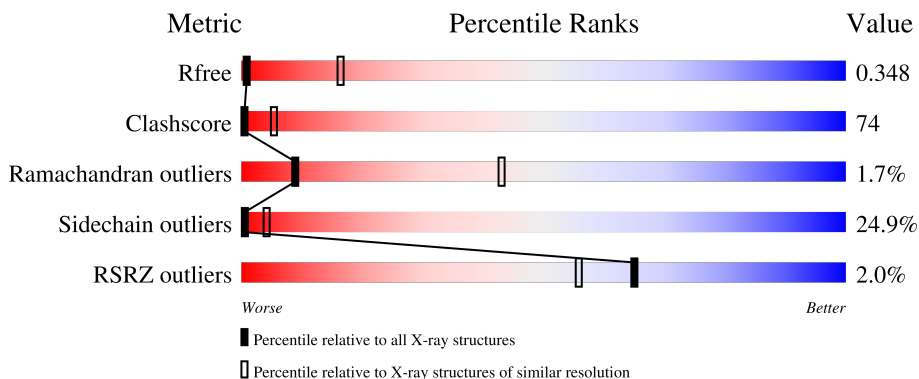
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 4.00 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	1087 (4.30-3.70)
Clashscore	141614	1148 (4.30-3.70)
Ramachandran outliers	138981	1108 (4.30-3.70)
Sidechain outliers	138945	1099 (4.30-3.70)
RSRZ outliers	127900	1028 (4.34-3.66)

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	366	 2% 36% 45% 11% 8%
1	B	366	 % 33% 48% 11% 7%
2	C	406	 2% 10% 43% 23% 22%
2	D	406	 % 14% 42% 19% 23%

2 Entry composition [i](#)

There are 2 unique types of molecules in this entry. The entry contains 10466 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 Mitogen-activated protein kinase 14.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	338	Total	C	N	O	S	0	0	0
			2709	1737	466	494	12			
1	B	339	Total	C	N	O	S	0	0	0
			2714	1740	467	495	12			

There are 14 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-5	GLY	-	cloning artifact	UNP Q16539
A	-4	SER	-	cloning artifact	UNP Q16539
A	-3	HIS	-	cloning artifact	UNP Q16539
A	-2	MET	-	cloning artifact	UNP Q16539
A	-1	LEU	-	cloning artifact	UNP Q16539
A	0	GLU	-	cloning artifact	UNP Q16539
A	1	MET	-	cloning artifact	UNP Q16539
B	-5	GLY	-	cloning artifact	UNP Q16539
B	-4	SER	-	cloning artifact	UNP Q16539
B	-3	HIS	-	cloning artifact	UNP Q16539
B	-2	MET	-	cloning artifact	UNP Q16539
B	-1	LEU	-	cloning artifact	UNP Q16539
B	0	GLU	-	cloning artifact	UNP Q16539
B	1	MET	-	cloning artifact	UNP Q16539

- Molecule 2 is a protein called MAP kinase-activated protein kinase 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	C	317	Total	C	N	O	S	0	0	0
			2531	1611	440	462	18			
2	D	313	Total	C	N	O	S	0	0	0
			2512	1597	437	460	18			

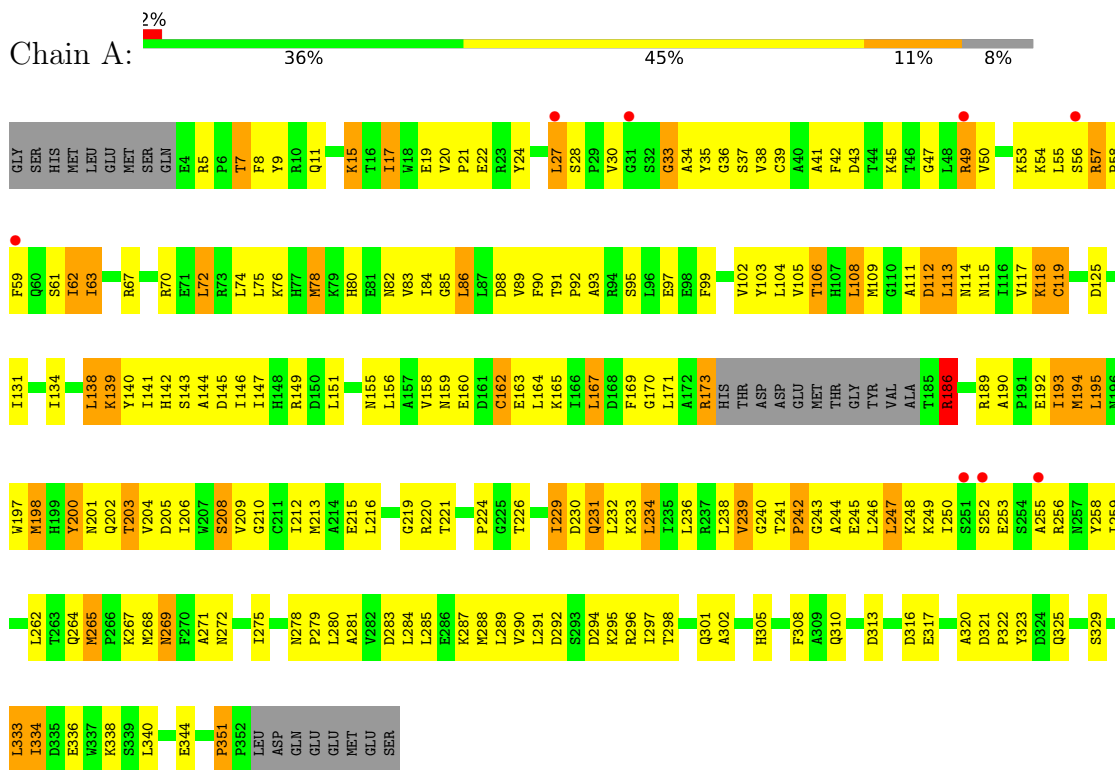
There are 12 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
C	-5	GLY	-	cloning artifact	UNP P49137
C	-4	SER	-	cloning artifact	UNP P49137
C	-3	HIS	-	cloning artifact	UNP P49137
C	-2	MET	-	cloning artifact	UNP P49137
C	-1	LEU	-	cloning artifact	UNP P49137
C	0	GLU	-	cloning artifact	UNP P49137
D	-5	GLY	-	cloning artifact	UNP P49137
D	-4	SER	-	cloning artifact	UNP P49137
D	-3	HIS	-	cloning artifact	UNP P49137
D	-2	MET	-	cloning artifact	UNP P49137
D	-1	LEU	-	cloning artifact	UNP P49137
D	0	GLU	-	cloning artifact	UNP P49137

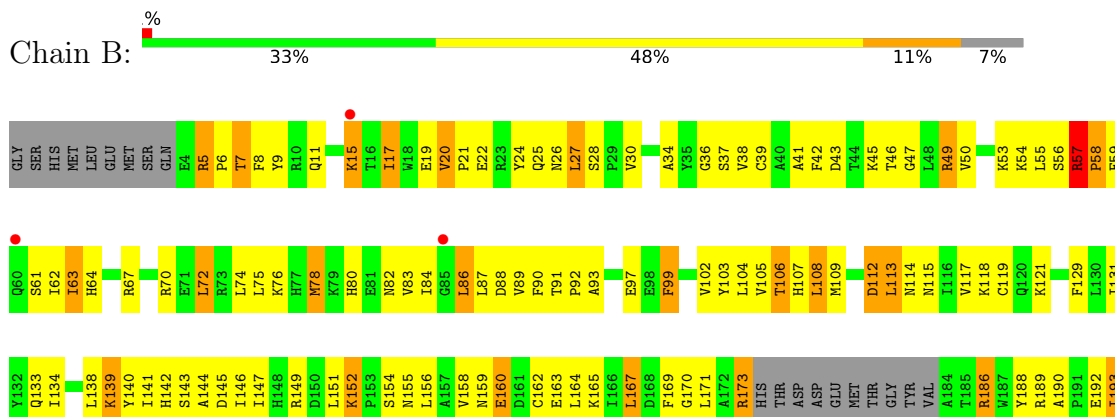
3 Residue-property plots

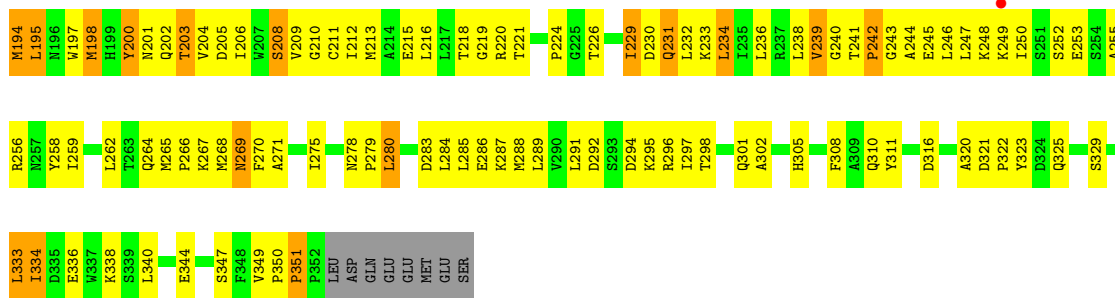
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. 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: Mitogen-activated protein kinase 14

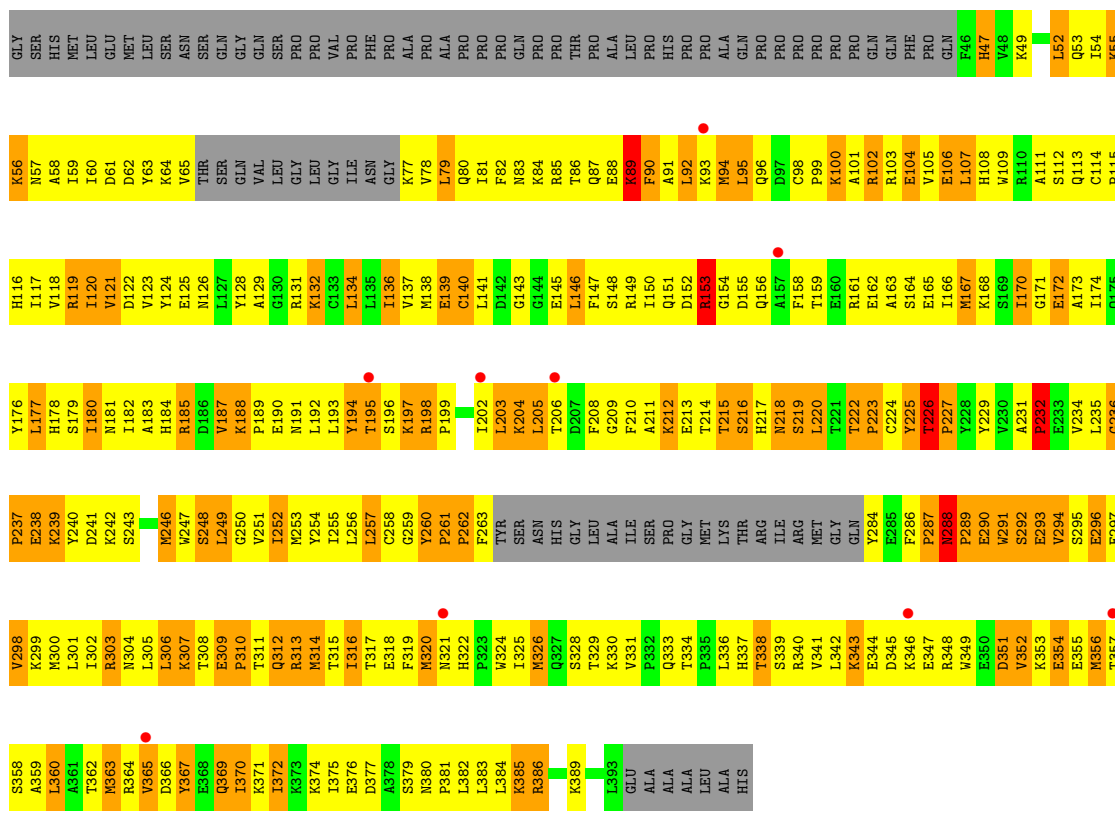


- Molecule 1: Mitogen-activated protein kinase 14

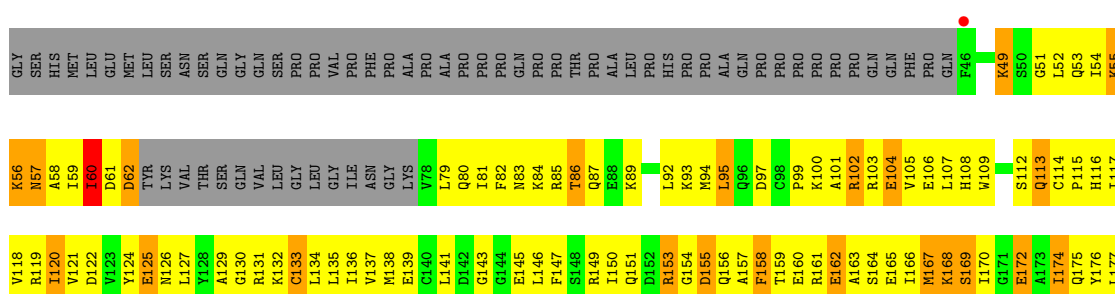




• Molecule 2: MAP kinase-activated protein kinase 2



• Molecule 2: MAP kinase-activated protein kinase 2



H178	E238	V298	A359
S179	K239	K299	L360
I180	Y240	M300	A361
H181	D241	L301	T362
I182	K242	I302	M363
A183	S243	R303	R364
H184	C244	M304	V365
R185	D245	L305	D366
D186	M246	L306	Q369
V187	W247	K307	I370
K188	S248	T308	K371
P189	L249	E309	L372
E190	G250	P310	K373
M191	V251	T311	D377
L192	I252	Q312	D378
L193	M253	R313	S379
Y194	Y254	M314	N380
T195	I255	T315	P381
S196	L256	I316	L382
K197	L257	T317	L383
R198	C258	E318	L384
P199	G259	F319	K385
M200	Y260	K320	R386
A201	P261	N321	R387
I202	P262	H322	K388
L203	F263	P323	K389
K204	TYR	W324	L393
L205	SER	I325	GLU
T206	ASN	M326	ALA
D207	HIS	S328	ALA
F208	GLY	T329	ALA
G209	LEU	K330	LEU
F210	ALA	V331	ALA
A211	ILE	T334	HIS
K212	SER	P335	
E213	PRO	L336	
T214	GLY	H337	
T215	WET	T338	
S216	LYS	S339	
H217	THR	R340	
N218	ARG	V341	
S219	ILE	L342	
L220	ARG	K343	
T221	WET	E344	
T222	GLY	D345	
P223	GLN	K346	
C224	Y284	E347	
Y225	F285	R348	
T226	P287	W349	
P227	M288	E350	
Y228	P289	D351	
Y229	E290	V352	
V230	W291	K353	
A231	S292	E354	
P232	F293	E355	
F233	V294	K356	
V234	S295	T357	
L235	E296	S358	
G236	E297		
P237			

4 Data and refinement statistics i

Property	Value	Source
Space group	P 41	Depositor
Cell constants a, b, c, α , β , γ	103.15Å 103.15Å 231.55Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	45.34 – 4.00 45.34 – 4.00	Depositor EDS
% Data completeness (in resolution range)	95.6 (45.34-4.00) 95.9 (45.34-4.00)	Depositor EDS
R_{merge}	0.15	Depositor
R_{sym}	0.15	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.84 (at 4.00Å)	Xtrriage
Refinement program	BUSTER-TNT V. 1.1.0	Depositor
R, R_{free}	0.314 , 0.331 0.340 , 0.348	Depositor DCC
R_{free} test set	984 reflections (5.03%)	wwPDB-VP
Wilson B-factor (Å ²)	106.4	Xtrriage
Anisotropy	0.546	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.27 , 61.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.42$, $\langle L^2 \rangle = 0.25$	Xtrriage
Estimated twinning fraction	0.219 for h,-k,-l	Xtrriage
F_o, F_c correlation	0.76	EDS
Total number of atoms	10466	wwPDB-VP
Average B, all atoms (Å ²)	99.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.01% 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](#)

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	0.27	0/2770	0.51	2/3758 (0.1%)
1	B	0.26	0/2775	0.48	2/3765 (0.1%)
2	C	0.25	0/2583	0.59	3/3480 (0.1%)
2	D	0.32	2/2563 (0.1%)	0.57	4/3453 (0.1%)
All	All	0.28	2/10691 (0.0%)	0.54	11/14456 (0.1%)

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	2
1	B	0	1
2	C	0	24
2	D	0	25
All	All	0	52

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	354	GLU	CD-OE2	6.41	1.32	1.25
2	D	354	GLU	CD-OE1	5.65	1.31	1.25

The worst 5 of 11 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	231	ALA	C-N-CD	-7.96	103.09	120.60
2	C	194	TYR	CB-CA-C	-7.67	95.06	110.40
1	A	265	MET	N-CA-C	7.67	131.71	111.00
2	C	234	VAL	N-CA-C	6.29	128.00	111.00
2	D	237	PRO	N-CA-CB	5.93	110.41	103.30

There are no chirality outliers.

5 of 52 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	186	ARG	Peptide
1	A	33	GLY	Peptide
2	C	153	ARG	Peptide
2	C	154	GLY	Peptide
2	C	89	LYS	Peptide

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	2709	0	2701	298	0
1	B	2714	0	2706	325	0
2	C	2531	0	2509	517	6
2	D	2512	0	2500	495	2
All	All	10466	0	10416	1540	8

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 74.

The worst 5 of 1540 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:159:ASN:C	2:D:370:ILE:HD13	1.35	1.42
2:D:214:THR:HG23	2:D:237:PRO:O	1.24	1.37
2:C:315:THR:CG2	2:C:318:GLU:CB	2.02	1.36
2:D:214:THR:CG2	2:D:238:GLU:HA	1.58	1.33
2:D:99:PRO:O	2:D:103:ARG:HG3	1.22	1.32

The worst 5 of 8 symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:C:58:ALA:CB	2:C:226:THR:OG1[4_574]	1.62	0.58

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:C:58:ALA:CA	2:C:226:THR:OG1[4_574]	1.75	0.45
2:D:58:ALA:CA	2:D:226:THR:O[3_745]	1.87	0.33
2:D:58:ALA:N	2:D:226:THR:O[3_745]	1.87	0.33
2:C:58:ALA:N	2:C:226:THR:CG2[4_574]	1.90	0.30

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	334/366 (91%)	307 (92%)	25 (8%)	2 (1%)	25	63
1	B	335/366 (92%)	309 (92%)	23 (7%)	3 (1%)	17	55
2	C	311/406 (77%)	262 (84%)	40 (13%)	9 (3%)	4	32
2	D	307/406 (76%)	247 (80%)	52 (17%)	8 (3%)	5	34
All	All	1287/1544 (83%)	1125 (87%)	140 (11%)	22 (2%)	9	43

5 of 22 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	C	237	PRO
2	D	232	PRO
2	D	237	PRO
2	C	222	THR
2	C	232	PRO

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	294/325 (90%)	240 (82%)	54 (18%)	1	10
1	B	294/325 (90%)	243 (83%)	51 (17%)	2	13
2	C	272/362 (75%)	182 (67%)	90 (33%)	0	2
2	D	273/362 (75%)	186 (68%)	87 (32%)	0	2
All	All	1133/1374 (82%)	851 (75%)	282 (25%)	0	4

5 of 282 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	D	205	LEU
2	D	238	GLU
2	D	313	ARG
2	C	203	LEU
2	C	195	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 45 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	257	ASN
2	D	113	GLN
1	B	310	GLN
2	D	87	GLN
2	D	151	GLN

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 monosaccharides 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, 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	338/366 (92%)	0.08	8 (2%) 59 49	100, 100, 100, 100	0
1	B	339/366 (92%)	-0.04	4 (1%) 79 70	100, 100, 100, 100	0
2	C	317/406 (78%)	0.09	9 (2%) 53 42	20, 100, 100, 100	0
2	D	313/406 (77%)	0.00	5 (1%) 72 62	100, 100, 100, 100	0
All	All	1307/1544 (84%)	0.03	26 (1%) 65 56	20, 100, 100, 100	0

The worst 5 of 26 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	251	SER	6.0
1	A	252	SER	4.1
1	A	56	SER	3.9
2	C	202	ILE	3.7
1	B	85	GLY	2.9

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 monosaccharides 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.