



wwPDB X-ray Structure Validation Summary Report

Oct 3, 2023 – 10:22 AM EDT

PDB ID : 6PIS
Title : Mouse two pore domain K⁺ channel TRAAK (K2P4.1) - Fab complex structure
Authors : Brohawn, S.G.
Deposited on : 2019-06-27
Resolution : 2.77 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 : 2.35.1
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

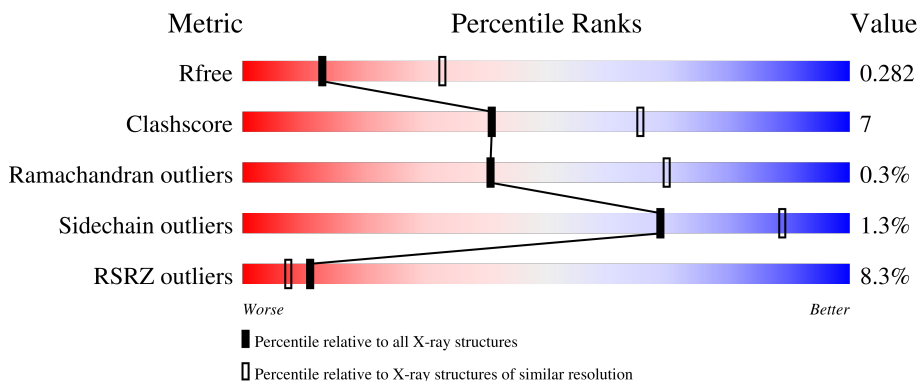
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.77 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.



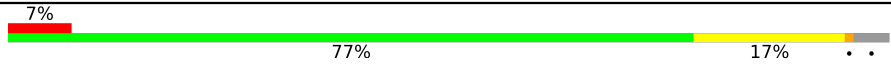
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	4107 (2.80-2.76)
Clashscore	141614	4575 (2.80-2.76)
Ramachandran outliers	138981	4487 (2.80-2.76)
Sidechain outliers	138945	4489 (2.80-2.76)
RSRZ outliers	127900	4027 (2.80-2.76)

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	310	 11% 66% 9% 24%
1	B	310	 12% 67% 9% 23%
2	L	213	 4% 78% 20%
2	M	213	 3% 82% 17%
3	H	224	 4% 79% 15%

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Mol	Chain	Length	Quality of chain
3	I	224	 <p>7% 77% 17% . .</p>

2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 10250 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 Potassium channel subfamily K member 4.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	235	1838	1227	295	310	6	0	0	0
1	B	239	1868	1247	299	316	6	0	0	0

There are 74 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	MET	-	expression tag	UNP O88454
A	2	THR	-	expression tag	UNP O88454
A	3	THR	-	expression tag	UNP O88454
A	4	ALA	-	expression tag	UNP O88454
A	5	PRO	-	expression tag	UNP O88454
A	6	GLN	-	expression tag	UNP O88454
A	7	GLU	-	expression tag	UNP O88454
A	8	PRO	-	expression tag	UNP O88454
A	9	PRO	-	expression tag	UNP O88454
A	10	ALA	-	expression tag	UNP O88454
A	11	ARG	-	expression tag	UNP O88454
A	12	PRO	-	expression tag	UNP O88454
A	13	LEU	-	expression tag	UNP O88454
A	14	GLN	-	expression tag	UNP O88454
A	15	ALA	-	expression tag	UNP O88454
A	16	GLY	-	expression tag	UNP O88454
A	17	SER	-	expression tag	UNP O88454
A	18	GLY	-	expression tag	UNP O88454
A	19	ALA	-	expression tag	UNP O88454
A	20	GLY	-	expression tag	UNP O88454
A	21	PRO	-	expression tag	UNP O88454
A	22	ALA	-	expression tag	UNP O88454
A	23	PRO	-	expression tag	UNP O88454
A	24	GLY	-	expression tag	UNP O88454
A	25	ARG	-	expression tag	UNP O88454

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Chain	Residue	Modelled	Actual	Comment	Reference
A	26	ALA	-	expression tag	UNP O88454
A	107	GLN	ASN	engineered mutation	UNP O88454
A	110	GLN	ASN	engineered mutation	UNP O88454
A	302	SER	-	expression tag	UNP O88454
A	303	ASN	-	expression tag	UNP O88454
A	304	SER	-	expression tag	UNP O88454
A	305	LEU	-	expression tag	UNP O88454
A	306	GLU	-	expression tag	UNP O88454
A	307	VAL	-	expression tag	UNP O88454
A	308	LEU	-	expression tag	UNP O88454
A	309	PHE	-	expression tag	UNP O88454
A	310	GLN	-	expression tag	UNP O88454
B	1	MET	-	expression tag	UNP O88454
B	2	THR	-	expression tag	UNP O88454
B	3	THR	-	expression tag	UNP O88454
B	4	ALA	-	expression tag	UNP O88454
B	5	PRO	-	expression tag	UNP O88454
B	6	GLN	-	expression tag	UNP O88454
B	7	GLU	-	expression tag	UNP O88454
B	8	PRO	-	expression tag	UNP O88454
B	9	PRO	-	expression tag	UNP O88454
B	10	ALA	-	expression tag	UNP O88454
B	11	ARG	-	expression tag	UNP O88454
B	12	PRO	-	expression tag	UNP O88454
B	13	LEU	-	expression tag	UNP O88454
B	14	GLN	-	expression tag	UNP O88454
B	15	ALA	-	expression tag	UNP O88454
B	16	GLY	-	expression tag	UNP O88454
B	17	SER	-	expression tag	UNP O88454
B	18	GLY	-	expression tag	UNP O88454
B	19	ALA	-	expression tag	UNP O88454
B	20	GLY	-	expression tag	UNP O88454
B	21	PRO	-	expression tag	UNP O88454
B	22	ALA	-	expression tag	UNP O88454
B	23	PRO	-	expression tag	UNP O88454
B	24	GLY	-	expression tag	UNP O88454
B	25	ARG	-	expression tag	UNP O88454
B	26	ALA	-	expression tag	UNP O88454
B	107	GLN	ASN	engineered mutation	UNP O88454
B	110	GLN	ASN	engineered mutation	UNP O88454
B	302	SER	-	expression tag	UNP O88454
B	303	ASN	-	expression tag	UNP O88454

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Chain	Residue	Modelled	Actual	Comment	Reference
B	304	SER	-	expression tag	UNP O88454
B	305	LEU	-	expression tag	UNP O88454
B	306	GLU	-	expression tag	UNP O88454
B	307	VAL	-	expression tag	UNP O88454
B	308	LEU	-	expression tag	UNP O88454
B	309	PHE	-	expression tag	UNP O88454
B	310	GLN	-	expression tag	UNP O88454

- Molecule 2 is a protein called ANTIBODY FAB FRAGMENT LIGHT CHAIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	L	211	Total	C	N	O	S	0	0	0
			1639	1030	274	331	4			
2	M	211	Total	C	N	O	S	0	0	0
			1639	1030	274	331	4			

- Molecule 3 is a protein called ANTIBODY FAB FRAGMENT HEAVY CHAIN.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	H	215	Total	C	N	O	S	0	0	0
			1634	1044	269	316	5			
3	I	214	Total	C	N	O	S	0	0	0
			1626	1040	267	314	5			

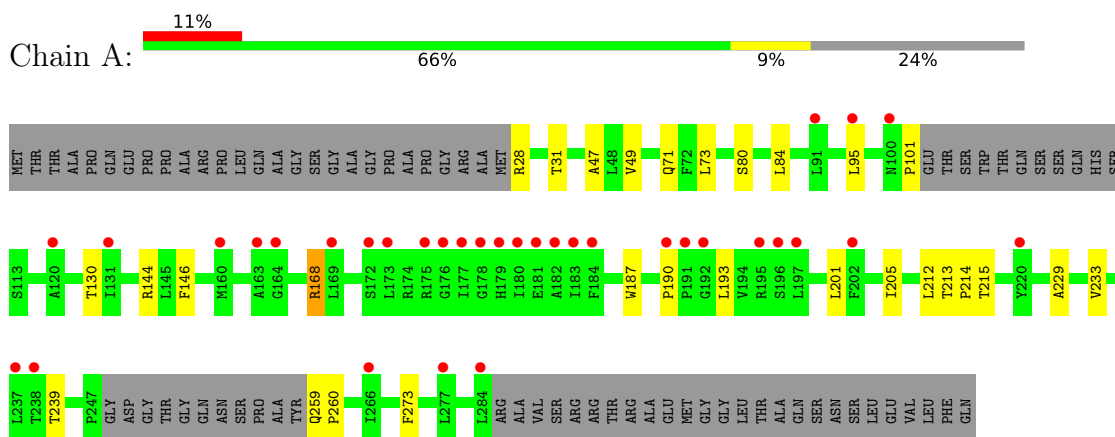
- Molecule 4 is POTASSIUM ION (three-letter code: K) (formula: K).

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

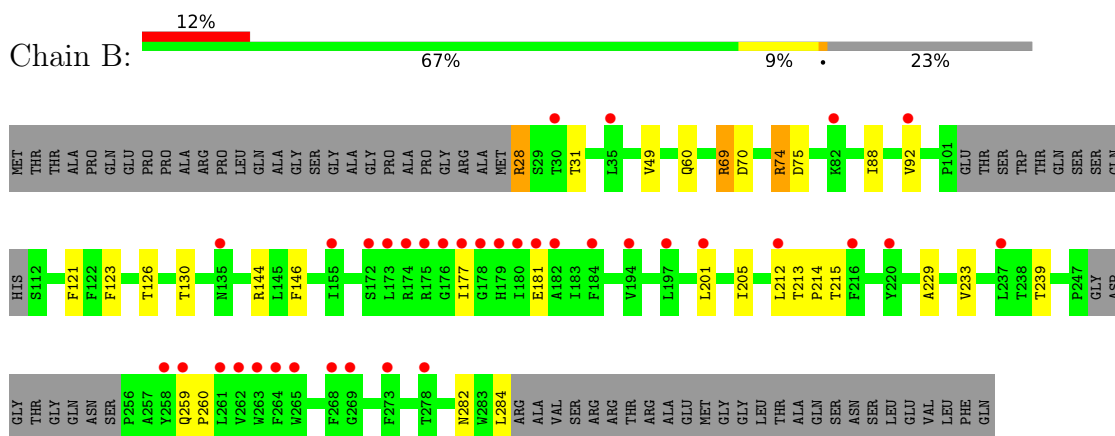
3 Residue-property plots [i](#)

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.

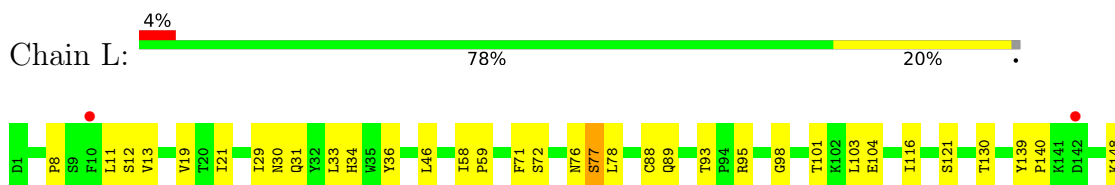
- Molecule 1: Potassium channel subfamily K member 4

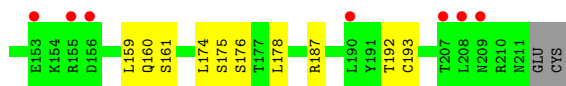


- Molecule 1: Potassium channel subfamily K member 4

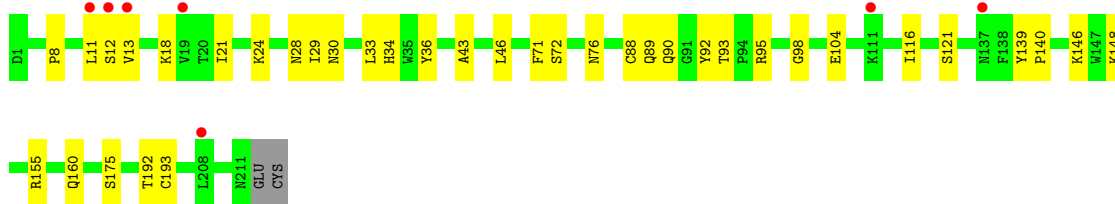
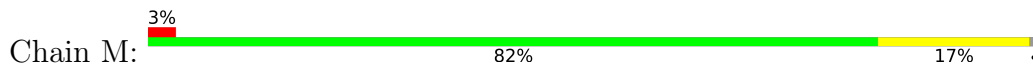


- Molecule 2: ANTIBODY FAB FRAGMENT LIGHT CHAIN

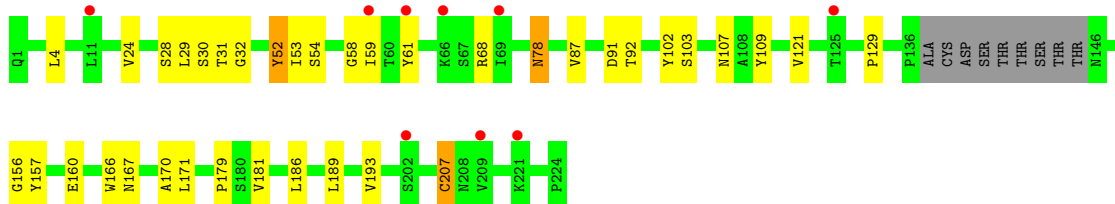
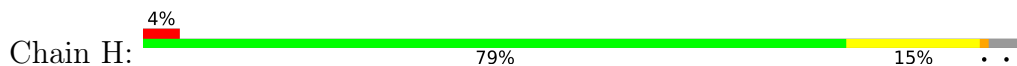




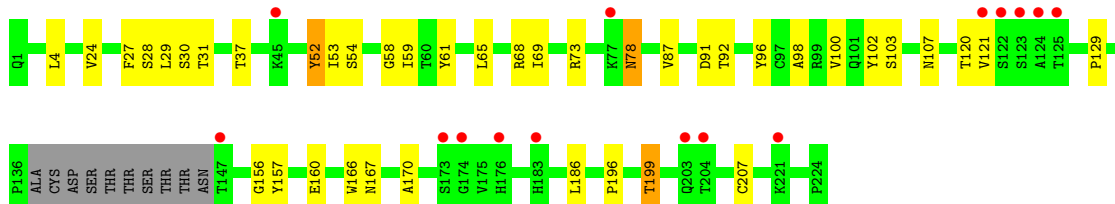
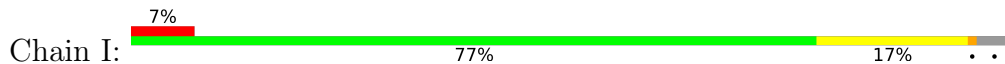
● Molecule 2: ANTIBODY FAB FRAGMENT LIGHT CHAIN



● Molecule 3: ANTIBODY FAB FRAGMENT HEAVY CHAIN



● Molecule 3: ANTIBODY FAB FRAGMENT HEAVY CHAIN



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	72.45Å 154.51Å 202.85Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	122.91 – 2.77 122.91 – 2.77	Depositor EDS
% Data completeness (in resolution range)	44.6 (122.91-2.77) 44.6 (122.91-2.77)	Depositor EDS
R_{merge}	0.48	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.22 (at 2.77Å)	Xtrriage
Refinement program	REFMAC 5.8.0230	Depositor
R, R_{free}	0.248 , 0.286 0.252 , 0.282	Depositor DCC
R_{free} test set	1287 reflections (4.93%)	wwPDB-VP
Wilson B-factor (Å ²)	65.7	Xtrriage
Anisotropy	0.138	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.29 , 36.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.42$, $\langle L^2 \rangle = 0.25$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.84	EDS
Total number of atoms	10250	wwPDB-VP
Average B, all atoms (Å ²)	84.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.63% 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:
K

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	0.36	0/1888	0.49	0/2569
1	B	0.36	0/1920	0.50	0/2613
2	L	0.37	0/1674	0.58	0/2275
2	M	0.39	0/1674	0.58	0/2275
3	H	0.41	0/1680	0.62	0/2301
3	I	0.40	0/1672	0.61	0/2290
All	All	0.38	0/10508	0.56	0/14323

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	5
2	L	0	1
3	H	0	2
3	I	0	3
All	All	0	13

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

5 of 13 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	144	ARG	Sidechain
1	A	168	ARG	Sidechain

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Mol	Chain	Res	Type	Group
1	B	28	ARG	Peptide,Sidechain
1	B	69	ARG	Sidechain
1	B	74	ARG	Sidechain

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	1838	0	1871	20	0
1	B	1868	0	1898	25	0
2	L	1639	0	1604	36	0
2	M	1639	0	1604	27	0
3	H	1634	0	1599	29	0
3	I	1626	0	1593	27	0
4	A	5	0	0	0	0
4	B	1	0	0	0	0
All	All	10250	0	10169	145	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.

The worst 5 of 145 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)
3:H:92:THR:HG22	3:H:121:VAL:H	1.43	0.81
1:B:60:GLN:HE21	2:L:30:ASN:HD22	1.29	0.81
3:H:103:SER:OG	3:H:107:ASN:ND2	2.19	0.74
2:L:33:LEU:HD23	2:L:71:PHE:CD2	2.26	0.70
3:I:28:SER:O	3:I:31:THR:HG22	1.94	0.68

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	229/310 (74%)	219 (96%)	10 (4%)	0	100	100
1	B	233/310 (75%)	225 (97%)	8 (3%)	0	100	100
2	L	209/213 (98%)	200 (96%)	7 (3%)	2 (1%)	15	41
2	M	209/213 (98%)	200 (96%)	9 (4%)	0	100	100
3	H	211/224 (94%)	202 (96%)	8 (4%)	1 (0%)	29	58
3	I	210/224 (94%)	199 (95%)	10 (5%)	1 (0%)	29	58
All	All	1301/1494 (87%)	1245 (96%)	52 (4%)	4 (0%)	41	70

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
3	H	78	ASN
3	I	78	ASN
2	L	77	SER
2	L	31	GLN

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	195/251 (78%)	192 (98%)	3 (2%)	65	87
1	B	198/251 (79%)	196 (99%)	2 (1%)	76	91
2	L	188/190 (99%)	186 (99%)	2 (1%)	73	90

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
2	M	188/190 (99%)	185 (98%)	3 (2%)	62	86
3	H	186/194 (96%)	183 (98%)	3 (2%)	62	86
3	I	185/194 (95%)	183 (99%)	2 (1%)	73	90
All	All	1140/1270 (90%)	1125 (99%)	15 (1%)	69	89

5 of 15 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
3	H	30	SER
2	M	90	GLN
3	H	52	TYR
2	M	121	SER
3	I	199	THR

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 9 such sidechains are listed below:

Mol	Chain	Res	Type
2	M	137	ASN
2	M	188	HIS
3	H	5	GLN
3	I	3	GLN
3	I	176	HIS

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](#)

Of 6 ligands modelled in this entry, 6 are monoatomic - leaving 0 for Mogul analysis.

There are no bond length outliers.

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 [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	235/310 (75%)	0.97	34 (14%) 2 1	40, 97, 218, 254	0
1	B	239/310 (77%)	0.96	36 (15%) 2 1	41, 94, 185, 220	0
2	L	211/213 (99%)	0.09	9 (4%) 35 30	47, 72, 99, 118	0
2	M	211/213 (99%)	0.19	7 (3%) 46 41	42, 70, 91, 106	0
3	H	215/224 (95%)	0.14	9 (4%) 36 30	39, 65, 102, 128	0
3	I	214/224 (95%)	0.46	15 (7%) 16 11	34, 68, 134, 172	0
All	All	1325/1494 (88%)	0.49	110 (8%) 11 7	34, 77, 158, 254	0

The worst 5 of 110 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	173	LEU	17.7
1	B	176	GLY	13.3
1	A	180	ILE	12.5
1	A	179	HIS	12.0
1	B	177	ILE	11.5

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](#)

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
4	K	A	402	1/1	0.94	0.10	67,67,67,67	0
4	K	A	404	1/1	0.94	0.06	89,89,89,89	0
4	K	B	401	1/1	0.94	0.14	87,87,87,87	0
4	K	A	403	1/1	0.97	0.11	72,72,72,72	0
4	K	A	405	1/1	0.98	0.05	67,67,67,67	0
4	K	A	401	1/1	0.98	0.12	60,60,60,60	0

6.5 Other polymers [i](#)

There are no such residues in this entry.