



wwPDB X-ray Structure Validation Summary Report ⓘ

Aug 31, 2026 – 03:18 PM EDT

PDB ID : 9O18 / pdb_00009o18
Title : Fab1504 in complex with the C-terminal alpha-TSR domain of the P. falciparum circumsporozoite protein
Authors : Moskovitz, R.; Wilson, I.A.
Deposited on : 2025-04-03
Resolution : 2.20 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	:	4-5-2 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	:	9.0.015 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.50

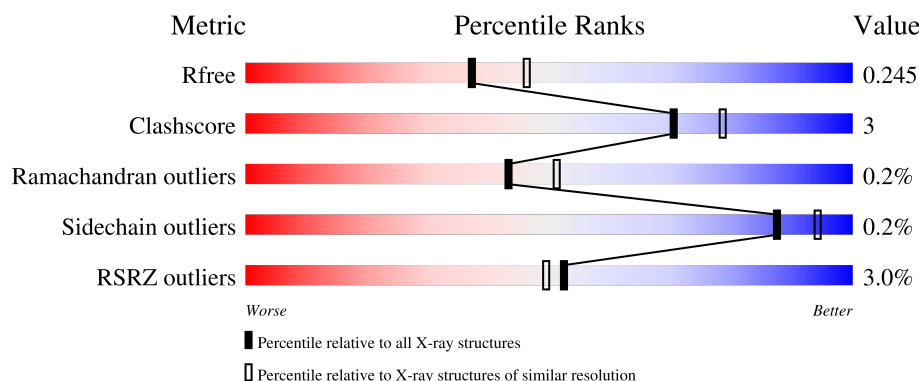
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.20 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	6164 (2.20-2.20)
Clashscore	190562	6851 (2.20-2.20)
Ramachandran outliers	187476	6768 (2.20-2.20)
Sidechain outliers	187428	6769 (2.20-2.20)
RSRZ outliers	180081	6166 (2.20-2.20)

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	230	% 95% ..
1	D	230	2% 92% 7% .
1	H	230	7% 92% 7% .
1	I	230	% 93% 7%
2	B	214	% 89% 9% .

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Mol	Chain	Length	Quality of chain
2	E	214	2% 93% 7%
2	J	214	2% 92% 7%
2	L	214	3% 91% 8%
3	C	73	85% 7% 8%
3	F	73	7% 77% 12% 10%
3	G	73	79% 12% 8%
3	K	73	16% 77% 14% 8%

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 30937 atoms, of which 15031 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 Fab1504 Heavy Chain.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	H	227	Total	C	H	N	O	S	0	0	0
			3345	1077	1652	277	335	4			
1	A	227	Total	C	H	N	O	S	0	0	0
			3345	1077	1652	277	335	4			
1	D	230	Total	C	H	N	O	S	0	0	0
			3375	1086	1665	280	339	5			
1	I	230	Total	C	H	N	O	S	0	4	0
			3406	1093	1685	282	341	5			

- Molecule 2 is a protein called Fab1504 Light Chain.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
2	L	211	Total	C	H	N	O	S	0	0	0
			3191	1011	1576	274	325	5			
2	B	211	Total	C	H	N	O	S	0	0	0
			3181	1009	1570	273	324	5			
2	E	214	Total	C	H	N	O	S	0	1	0
			3225	1021	1591	277	330	6			
2	J	214	Total	C	H	N	O	S	0	0	0
			3224	1021	1590	277	330	6			

- Molecule 3 is a protein called Circumsporozoite protein.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
3	G	67	Total	C	H	N	O	S	0	0	0
			1036	322	513	90	106	5			
3	C	67	Total	C	H	N	O	S	0	0	0
			1041	322	518	90	106	5			
3	F	66	Total	C	H	N	O	S	0	0	0
			1024	317	510	89	103	5			
3	K	67	Total	C	H	N	O	S	0	0	0
			1028	319	509	89	106	5			

There are 24 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
G	377	HIS	-	expression tag	UNP Q7K740
G	378	HIS	-	expression tag	UNP Q7K740
G	379	HIS	-	expression tag	UNP Q7K740
G	380	HIS	-	expression tag	UNP Q7K740
G	381	HIS	-	expression tag	UNP Q7K740
G	382	HIS	-	expression tag	UNP Q7K740
C	377	HIS	-	expression tag	UNP Q7K740
C	378	HIS	-	expression tag	UNP Q7K740
C	379	HIS	-	expression tag	UNP Q7K740
C	380	HIS	-	expression tag	UNP Q7K740
C	381	HIS	-	expression tag	UNP Q7K740
C	382	HIS	-	expression tag	UNP Q7K740
F	377	HIS	-	expression tag	UNP Q7K740
F	378	HIS	-	expression tag	UNP Q7K740
F	379	HIS	-	expression tag	UNP Q7K740
F	380	HIS	-	expression tag	UNP Q7K740
F	381	HIS	-	expression tag	UNP Q7K740
F	382	HIS	-	expression tag	UNP Q7K740
K	377	HIS	-	expression tag	UNP Q7K740
K	378	HIS	-	expression tag	UNP Q7K740
K	379	HIS	-	expression tag	UNP Q7K740
K	380	HIS	-	expression tag	UNP Q7K740
K	381	HIS	-	expression tag	UNP Q7K740
K	382	HIS	-	expression tag	UNP Q7K740

- Molecule 4 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	H	45	Total O 45 45	0	0
4	L	43	Total O 43 43	0	0
4	G	20	Total O 20 20	0	0
4	A	58	Total O 58 58	0	0
4	B	57	Total O 57 57	0	0
4	C	23	Total O 23 23	0	0
4	D	67	Total O 67 67	0	0

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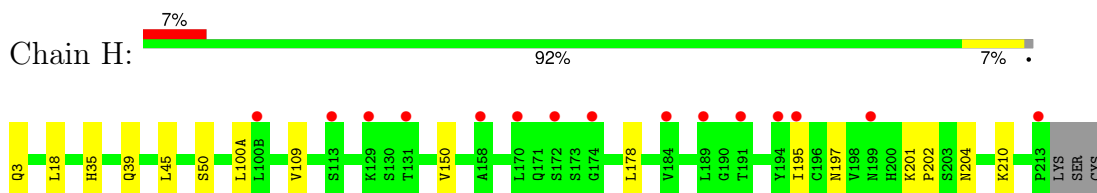
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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	E	47	Total 47	O 47	0	0
4	F	6	Total 6	O 6	0	0
4	I	77	Total 77	O 77	0	0
4	J	68	Total 68	O 68	0	0
4	K	5	Total 5	O 5	0	0

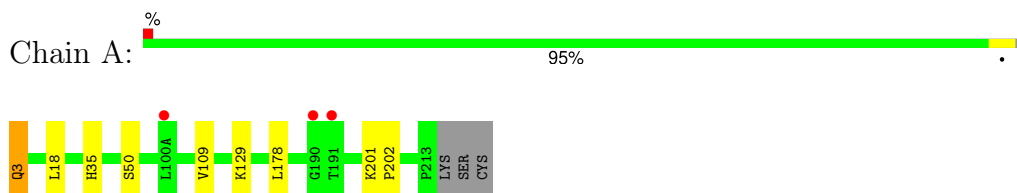
3 Residue-property plots [i](#)

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.

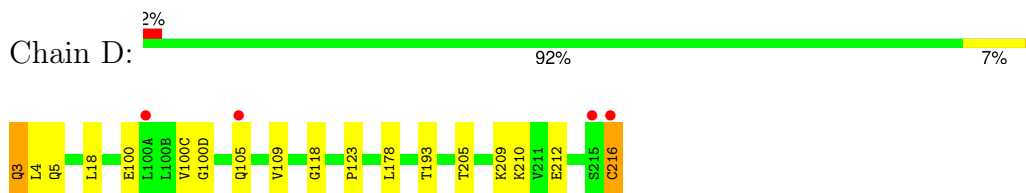
- Molecule 1: Fab1504 Heavy Chain



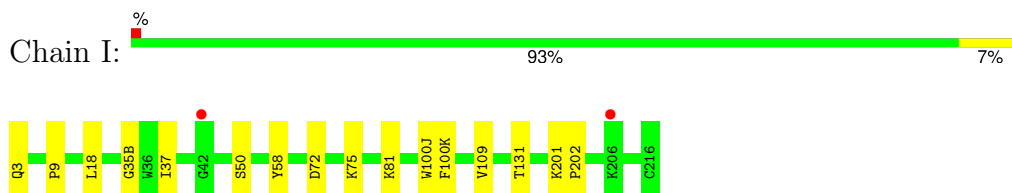
- Molecule 1: Fab1504 Heavy Chain



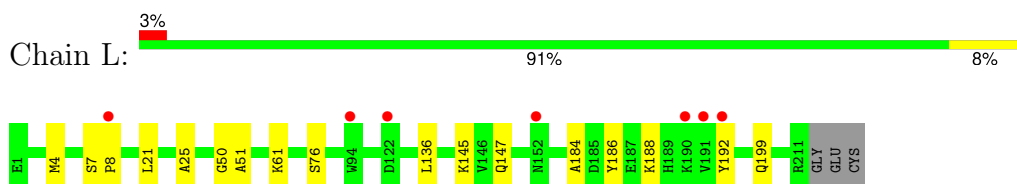
- Molecule 1: Fab1504 Heavy Chain



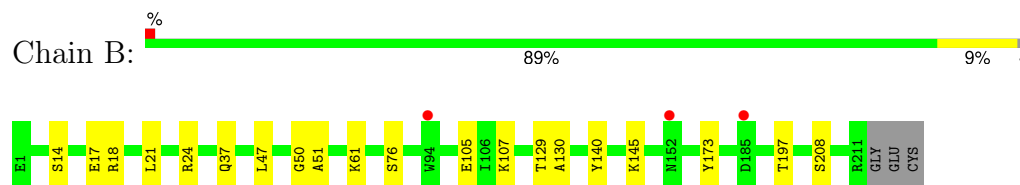
- Molecule 1: Fab1504 Heavy Chain



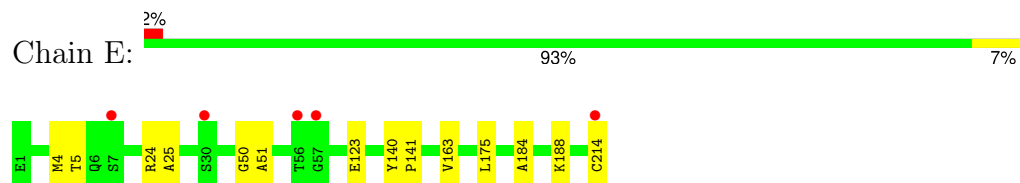
- Molecule 2: Fab1504 Light Chain



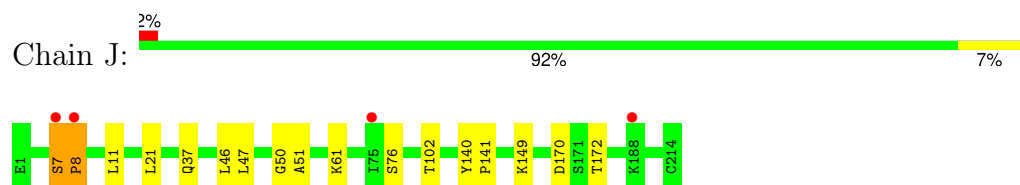
- Molecule 2: Fab1504 Light Chain



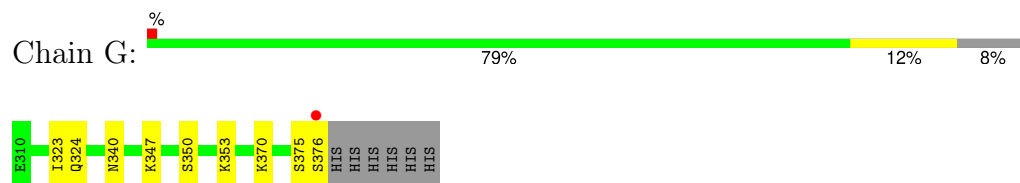
- Molecule 2: Fab1504 Light Chain



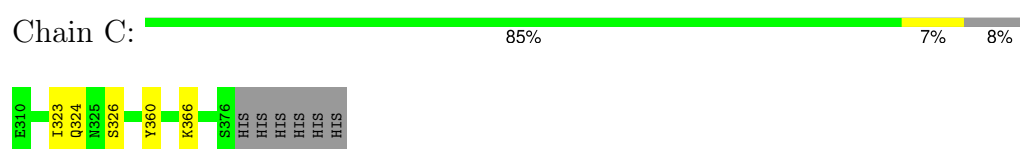
- Molecule 2: Fab1504 Light Chain



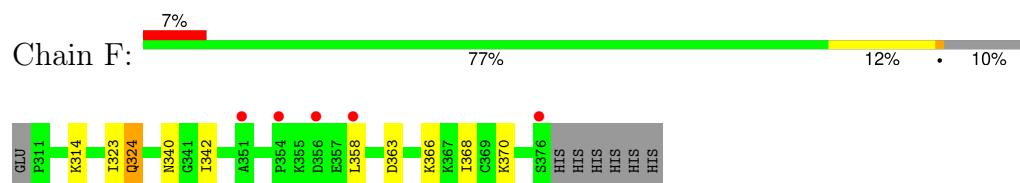
- Molecule 3: Circumsporozoite protein



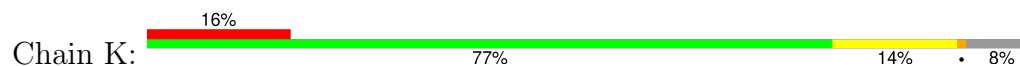
- Molecule 3: Circumsporozoite protein

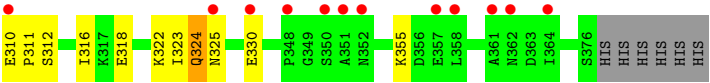


- Molecule 3: Circumsporozoite protein



- Molecule 3: Circumsporozoite protein





4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α , β , γ	72.75Å 85.32Å 104.31Å 66.78° 70.27° 65.54°	Depositor
Resolution (Å)	46.88 – 2.20 46.88 – 2.20	Depositor EDS
% Data completeness (in resolution range)	92.8 (46.88-2.20) 94.0 (46.88-2.20)	Depositor EDS
R_{merge}	0.12	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.54 (at 2.20Å)	Xtriage
Refinement program	PHENIX (1.21.2_5419: ???)	Depositor
R, R_{free}	0.213 , 0.246 0.212 , 0.245	Depositor DCC
R_{free} test set	4816 reflections (4.57%)	wwPDB-VP
Wilson B-factor (Å ²)	27.5	Xtriage
Anisotropy	0.522	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.37 , 26.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	0.010 for h,h-k,h-l	Xtriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	30937	wwPDB-VP
Average B, all atoms (Å ²)	37.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.20% 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: PCA

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	0.10	0/1732	0.29	0/2370
1	D	0.11	0/1749	0.30	0/2393
1	H	0.12	0/1732	0.30	0/2370
1	I	0.11	0/1782	0.30	0/2437
2	B	0.11	0/1645	0.29	0/2234
2	E	0.10	0/1677	0.28	0/2276
2	J	0.10	0/1668	0.30	0/2264
2	L	0.12	0/1649	0.29	0/2239
3	C	0.10	0/531	0.30	0/712
3	F	0.14	0/522	0.32	0/699
3	G	0.12	0/531	0.32	0/712
3	K	0.11	0/527	0.29	0/708
All	All	0.11	0/15745	0.29	0/21414

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
2	J	0	1
2	L	0	1
All	All	0	2

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
2	J	7	SER	Peptide
2	L	7	SER	Peptide

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	1693	1652	1657	9	0
1	D	1710	1665	1669	12	0
1	H	1693	1652	1657	10	0
1	I	1721	1685	1657	9	0
2	B	1611	1570	1570	15	1
2	E	1634	1591	1582	9	0
2	J	1634	1590	1589	10	0
2	L	1615	1576	1576	9	1
3	C	523	518	518	3	0
3	F	514	510	513	10	0
3	G	523	513	518	5	0
3	K	519	509	507	8	0
4	A	58	0	0	1	0
4	B	57	0	0	0	0
4	C	23	0	0	0	0
4	D	67	0	0	0	0
4	E	47	0	0	0	0
4	F	6	0	0	0	0
4	G	20	0	0	0	0
4	H	45	0	0	0	0
4	I	77	0	0	0	0
4	J	68	0	0	1	0
4	K	5	0	0	0	0
4	L	43	0	0	0	0
All	All	15906	15031	15013	103	1

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.

The worst 5 of 103 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:18:LEU:HD12	1:A:109:VAL:HG11	1.72	0.72
1:D:210:LYS:HD3	1:D:212:GLU:OE2	1.92	0.70
1:A:129:LYS:HD2	2:B:208:SER:O	1.95	0.67
3:F:368:ILE:HG21	3:F:370:LYS:HE2	1.78	0.64
1:D:18:LEU:HD12	1:D:109:VAL:HG11	1.82	0.62

All (1) 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:L:199:GLN:O	2:B:107:LYS:HZ2[1_545]	1.57	0.03

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	225/230 (98%)	219 (97%)	6 (3%)	0	100	100
1	D	228/230 (99%)	222 (97%)	6 (3%)	0	100	100
1	H	225/230 (98%)	218 (97%)	7 (3%)	0	100	100
1	I	232/230 (101%)	225 (97%)	7 (3%)	0	100	100
2	B	209/214 (98%)	204 (98%)	5 (2%)	0	100	100
2	E	213/214 (100%)	207 (97%)	6 (3%)	0	100	100
2	J	212/214 (99%)	204 (96%)	6 (3%)	2 (1%)	14	14
2	L	209/214 (98%)	201 (96%)	7 (3%)	1 (0%)	24	27
3	C	65/73 (89%)	62 (95%)	3 (5%)	0	100	100
3	F	64/73 (88%)	61 (95%)	2 (3%)	1 (2%)	7	6
3	G	65/73 (89%)	64 (98%)	1 (2%)	0	100	100
3	K	65/73 (89%)	63 (97%)	1 (2%)	1 (2%)	8	6
All	All	2012/2068 (97%)	1950 (97%)	57 (3%)	5 (0%)	43	51

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	L	8	PRO
2	J	7	SER
3	F	324	GLN
2	J	8	PRO
3	K	324	GLN

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	194/197 (98%)	194 (100%)	0	100	100
1	D	196/197 (100%)	195 (100%)	1 (0%)	81	90
1	H	194/197 (98%)	194 (100%)	0	100	100
1	I	200/197 (102%)	199 (100%)	1 (0%)	81	90
2	B	181/184 (98%)	181 (100%)	0	100	100
2	E	185/184 (100%)	185 (100%)	0	100	100
2	J	184/184 (100%)	184 (100%)	0	100	100
2	L	182/184 (99%)	182 (100%)	0	100	100
3	C	62/68 (91%)	62 (100%)	0	100	100
3	F	61/68 (90%)	61 (100%)	0	100	100
3	G	62/68 (91%)	62 (100%)	0	100	100
3	K	61/68 (90%)	59 (97%)	2 (3%)	33	45
All	All	1762/1796 (98%)	1758 (100%)	4 (0%)	87	94

All (4) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	D	216	CYS
1	I	131	THR
3	K	318	GLU
3	K	355	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 29 such sidechains are listed below:

Mol	Chain	Res	Type
3	F	340	ASN
2	J	189	HIS
1	I	5	GLN
2	J	137	ASN
3	F	352	ASN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

4 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	PCA	I	3	1	7,8,9	0.61	0	9,10,12	1.29	2 (22%)
1	PCA	D	3	1	7,8,9	0.60	0	9,10,12	1.31	2 (22%)
1	PCA	A	3	1	7,8,9	0.63	0	9,10,12	1.30	2 (22%)
1	PCA	H	3	1	7,8,9	0.61	0	9,10,12	1.28	1 (11%)

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	PCA	I	3	1	-	0/0/11/13	0/1/1/1
1	PCA	D	3	1	-	0/0/11/13	0/1/1/1
1	PCA	A	3	1	-	0/0/11/13	0/1/1/1
1	PCA	H	3	1	-	0/0/11/13	0/1/1/1

There are no bond length outliers.

The worst 5 of 7 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	3	PCA	CB-CA-N	2.25	109.44	103.24
1	H	3	PCA	CB-CA-N	2.21	109.33	103.24
1	I	3	PCA	CB-CA-N	2.21	109.33	103.24
1	D	3	PCA	CB-CA-N	2.21	109.31	103.24
1	A	3	PCA	CB-CG-CD	2.05	107.58	104.41

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
1	D	3	PCA	1	0
1	A	3	PCA	1	0

5.5 Carbohydrates [i](#)

There are no oligosaccharides 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	226/230 (98%)	0.25	3 (1%) 75 73	25, 34, 62, 73	0
1	D	229/230 (99%)	0.02	4 (1%) 69 66	21, 29, 49, 59	0
1	H	226/230 (98%)	0.63	15 (6%) 24 21	25, 45, 71, 80	0
1	I	229/230 (99%)	0.03	2 (0%) 81 79	22, 30, 44, 61	1 (0%)
2	B	211/214 (98%)	0.13	3 (1%) 73 71	25, 34, 49, 61	0
2	E	214/214 (100%)	0.42	5 (2%) 61 58	22, 37, 54, 64	0
2	J	214/214 (100%)	0.13	4 (1%) 66 63	23, 33, 47, 62	0
2	L	211/214 (98%)	0.27	7 (3%) 49 46	27, 36, 63, 75	0
3	C	67/73 (91%)	0.08	0 100 100	24, 32, 46, 53	0
3	F	66/73 (90%)	0.84	5 (7%) 20 17	35, 47, 79, 84	0
3	G	67/73 (91%)	0.15	1 (1%) 72 69	25, 32, 52, 66	0
3	K	67/73 (91%)	1.15	12 (17%) 3 3	37, 54, 89, 94	0
All	All	2027/2068 (98%)	0.28	61 (3%) 52 49	21, 35, 62, 94	1 (0%)

The worst 5 of 61 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
3	K	348	PRO	4.9
3	K	352	ASN	4.3
2	B	94	TRP	4.0
3	F	356	ASP	3.6
1	H	100(B)	LEU	3.6

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(Å ²)	Q<0.9
1	PCA	I	3	8/9	0.82	0.13	34,38,42,44	0
1	PCA	A	3	8/9	0.88	0.11	28,30,34,35	0
1	PCA	D	3	8/9	0.91	0.09	34,36,39,39	0
1	PCA	H	3	8/9	0.91	0.09	29,30,32,32	0

6.3 Carbohydrates [i](#)

There are no oligosaccharides 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.