



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 09:53 PM UTC

PDB ID : 7N4K / pdb_00007n4k
Title : 6218 TCR in complex with H2-Db PA 224
Authors : Szeto, C.; Gras, S.
Deposited on : 2021-06-04
Resolution : 1.85 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 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
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

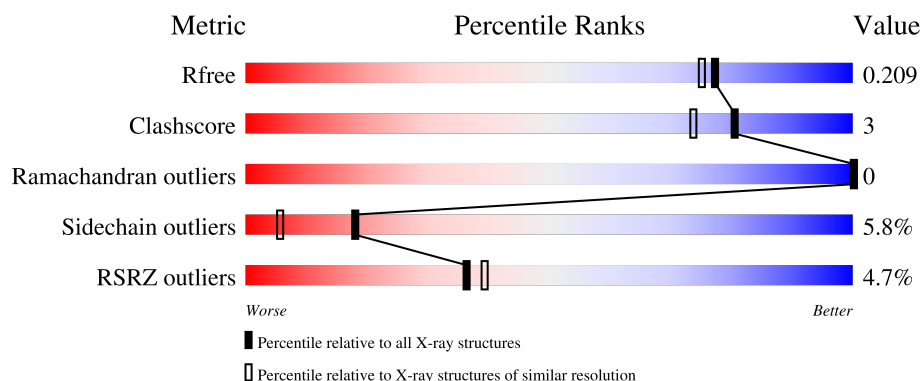
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.85 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	3428 (1.86-1.86)
Clashscore	190562	3579 (1.86-1.86)
Ramachandran outliers	187476	3553 (1.86-1.86)
Sidechain outliers	187428	3553 (1.86-1.86)
RSRZ outliers	180081	3429 (1.86-1.86)

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	277	5% 85% 11% ..
2	B	100	5% 88% 11% .
3	C	10	80% 20%
4	D	199	5% 89% 10% ..
5	E	240	5% 90% 9% .

2 Entry composition

There are 7 unique types of molecules in this entry. The entry contains 7131 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 H-2 class I histocompatibility antigen, D-B alpha chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	273	Total	C	N	O	S	0	4	0
			2275	1435	405	426	9			

- Molecule 2 is a protein called Beta-2-microglobulin.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	100	Total	C	N	O	S	0	0	0
			837	533	141	159	4			

There is a discrepancy between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	0	MET	-	initiating methionine	UNP P61769

- Molecule 3 is a protein called Peptide from Polymerase acidic protein.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
3	C	10	Total	C	N	O	0	1	0
			92	58	17	17			

- Molecule 4 is a protein called Fusion protein of T cell receptor alpha variable 21-DV12 and T-cell receptor, sp3.4 alpha chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
4	D	199	Total	C	N	O	S	0	2	0
			1559	973	259	318	9			

There are 21 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
D	107	SER	-	linker	UNP A0A075B6C4
D	108	GLY	-	linker	UNP A0A075B6C4

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Chain	Residue	Modelled	Actual	Comment	Reference
D	109	GLY	-	linker	UNP A0A075B6C4
D	110	SER	-	linker	UNP A0A075B6C4
D	111	ASN	-	linker	UNP A0A075B6C4
D	112	TYR	-	linker	UNP A0A075B6C4
D	113	LYS	-	linker	UNP A0A075B6C4
D	114	LEU	-	linker	UNP A0A075B6C4
D	115	THR	-	linker	UNP A0A075B6C4
D	116	PHE	-	linker	UNP A0A075B6C4
D	117	GLY	-	linker	UNP A0A075B6C4
D	118	LYS	-	linker	UNP A0A075B6C4
D	119	GLY	-	linker	UNP A0A075B6C4
D	120	THR	-	linker	UNP A0A075B6C4
D	121	LEU	-	linker	UNP A0A075B6C4
D	122	LEU	-	linker	UNP A0A075B6C4
D	123	THR	-	linker	UNP A0A075B6C4
D	124	VAL	-	linker	UNP A0A075B6C4
D	125	THR	-	linker	UNP A0A075B6C4
D	126	PRO	-	linker	UNP A0A075B6C4
D	127	ASN	-	linker	UNP A0A075B6C4

- Molecule 5 is a protein called Fusion protein of T cell receptor beta, variable 29 and Human nkt tcr beta chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
5	E	240	Total	C	N	O	S	0	4	0
			1966	1242	341	371	12			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
E	108	PHE	-	linker	UNP A0A0G2LB96
E	109	GLY	-	linker	UNP A0A0G2LB96
E	110	ARG	-	linker	UNP A0A0G2LB96
E	123	LEU	THR	conflict	UNP K7N5M4

- Molecule 6 is SODIUM ION (CCD ID: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	D	2	Total	Na	0	0
			2	2		
6	E	2	Total	Na	0	0
			2	2		

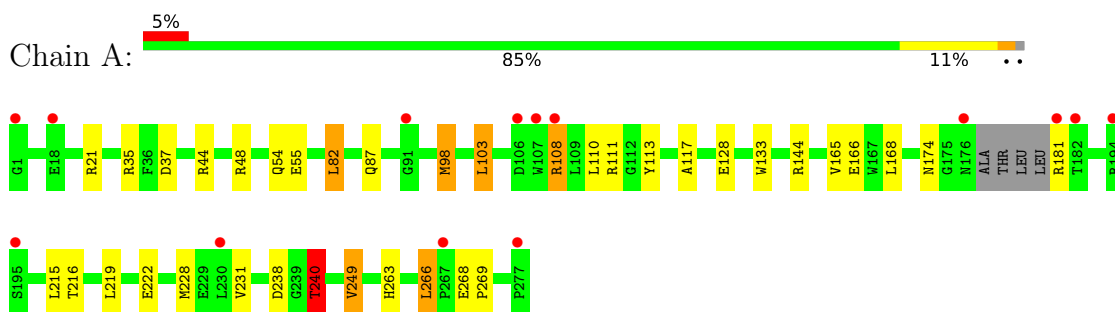
- Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	107	Total 107	O 107	0	0
7	B	77	Total 77	O 77	0	0
7	C	6	Total 6	O 6	0	0
7	D	90	Total 90	O 90	0	0
7	E	118	Total 118	O 118	0	0

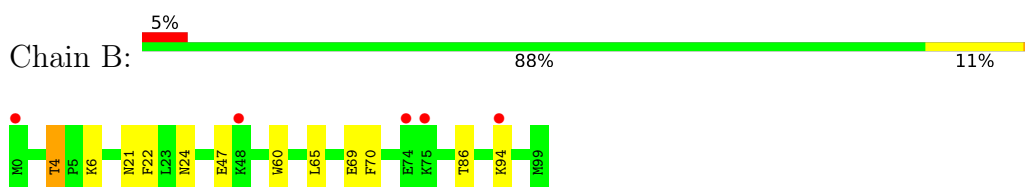
3 Residue-property plots [i](#)

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.

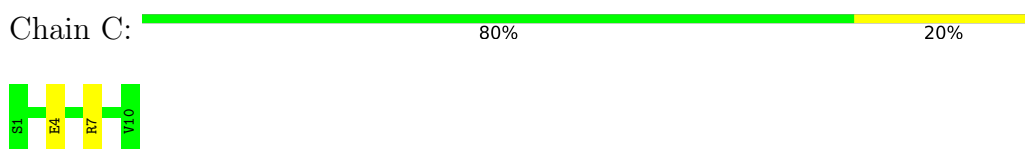
- Molecule 1: H-2 class I histocompatibility antigen, D-B alpha chain



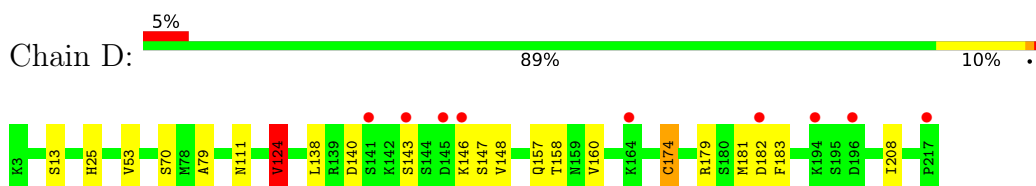
- Molecule 2: Beta-2-microglobulin



- Molecule 3: Peptide from Polymerase acidic protein



- Molecule 4: Fusion protein of T cell receptor alpha variable 21-DV12 and T-cell receptor, sp3.4 alpha chain



- Molecule 5: Fusion protein of T cell receptor beta, variable 29 and Human nkt tcr beta chain





4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	54.14Å 72.53Å 107.72Å 90.00° 101.36° 90.00°	Depositor
Resolution (Å)	44.07 – 1.85 44.07 – 1.85	Depositor EDS
% Data completeness (in resolution range)	100.0 (44.07-1.85) 100.0 (44.07-1.85)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.01 (at 1.86Å)	Xtriage
Refinement program	BUSTER 2.10.3	Depositor
R, R_{free}	0.186 , 0.214 (Not available) , 0.209	Depositor DCC
R_{free} test set	3484 reflections (4.99%)	wwPDB-VP
Wilson B-factor (Å ²)	20.4	Xtriage
Anisotropy	0.352	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.33 , 41.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.95	EDS
Total number of atoms	7131	wwPDB-VP
Average B, all atoms (Å ²)	26.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.69% 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: NA

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	0.81	0/2348	1.14	7/3186 (0.2%)
2	B	0.81	0/860	1.06	3/1162 (0.3%)
3	C	0.89	0/96	1.19	1/126 (0.8%)
4	D	0.88	1/1595 (0.1%)	1.18	8/2172 (0.4%)
5	E	0.80	0/2027	1.02	1/2748 (0.0%)
All	All	0.83	1/6926 (0.0%)	1.11	20/9394 (0.2%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	D	25	HIS	CA-CB	5.47	1.57	1.53

All (20) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	249	VAL	N-CA-CB	-10.09	100.77	111.87
1	A	174	ASN	CA-CB-CG	7.05	119.65	112.60
4	D	181	MET	CA-C-N	-6.63	112.55	122.24
4	D	181	MET	C-N-CA	-6.63	112.55	122.24
1	A	37	ASP	CA-CB-CG	6.42	119.02	112.60
4	D	182	ASP	N-CA-C	-6.10	102.97	110.65
2	B	6	LYS	N-CA-C	-6.04	100.71	110.32
1	A	21	ARG	N-CA-C	-5.79	101.27	109.96
4	D	124	VAL	N-CA-CB	5.75	119.64	111.82
1	A	249	VAL	CB-CA-C	5.55	115.89	109.89
1	A	55	GLU	N-CA-C	5.44	117.29	111.36
4	D	183	PHE	N-CA-C	5.42	117.92	108.76
2	B	21	ASN	CA-CB-CG	5.33	117.93	112.60
5	E	133	GLU	N-CA-C	-5.29	101.08	109.76
2	B	70	PHE	CA-CB-CG	5.14	118.94	113.80

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	240	THR	N-CA-CB	-5.06	103.01	111.20
4	D	79	ALA	N-CA-C	5.05	115.20	108.38
4	D	53	VAL	N-CA-C	-5.05	106.73	111.48
3	C	4	GLU	CB-CG-CD	5.00	121.11	112.60
4	D	111	ASN	CA-CB-CG	5.00	117.60	112.60

There are no chirality outliers.

There are no planarity outliers.

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	2275	0	2147	17	0
2	B	837	0	803	5	0
3	C	92	0	93	1	0
4	D	1559	0	1481	4	0
5	E	1966	0	1888	10	0
6	D	2	0	0	0	0
6	E	2	0	0	0	0
7	A	107	0	0	0	0
7	B	77	0	0	0	0
7	C	6	0	0	0	0
7	D	90	0	0	0	0
7	E	118	0	0	0	0
All	All	7131	0	6412	33	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 3.

All (33) 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:108:ARG:HD3	1:A:108:ARG:H	1.36	0.90
1:A:108:ARG:HG3	1:A:108:ARG:HH11	1.51	0.74
1:A:133:TRP:HB2	1:A:144[B]:ARG:HG3	1.80	0.64

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:D:174:CYS:HB3	5:E:180[B]:CYS:SG	2.40	0.61
5:E:136:VAL:HG23	5:E:246:ALA:HB3	1.87	0.55
1:A:111:ARG:HG2	1:A:113:TYR:CZ	2.44	0.52
1:A:103:LEU:HD12	1:A:165:VAL:HG22	1.93	0.50
1:A:117:ALA:HB2	2:B:60:TRP:CE2	2.48	0.49
1:A:268:GLU:HG3	1:A:269:PRO:HD2	1.95	0.48
5:E:15:MET:HE2	5:E:96:THR:HG23	1.96	0.48
5:E:9:ARG:NH2	5:E:116:PRO:HG2	2.29	0.48
1:A:108:ARG:H	1:A:108:ARG:CD	2.16	0.48
1:A:117:ALA:HB2	2:B:60:TRP:CD2	2.49	0.47
2:B:22:PHE:CE2	2:B:69:GLU:HG2	2.49	0.47
1:A:238:ASP:OD1	1:A:240:THR:HG22	2.15	0.46
2:B:4:THR:HB	2:B:86:THR:OG1	2.17	0.45
5:E:12:ILE:HD12	5:E:225:GLY:HA2	1.98	0.45
2:B:24:ASN:HB3	2:B:65:LEU:HD11	1.99	0.44
5:E:29:HIS:CD2	5:E:108[B]:PHE:HB3	2.52	0.44
1:A:82:LEU:HD22	1:A:87:GLN:HA	1.99	0.44
1:A:103:LEU:HD13	1:A:168:LEU:HD23	1.99	0.44
3:C:7[A]:ARG:HG3	5:E:109:GLY:HA2	2.01	0.43
1:A:108:ARG:HG3	1:A:108:ARG:NH1	2.26	0.42
4:D:13:SER:O	4:D:124:VAL:HA	2.20	0.42
1:A:263:HIS:HB3	1:A:266:LEU:HD22	2.02	0.42
5:E:43:ARG:HB3	5:E:53:ILE:HD11	2.01	0.41
5:E:189:GLN:HG3	5:E:192:LEU:HD12	2.03	0.41
4:D:140:ASP:HB2	4:D:146:LYS:HB3	2.02	0.41
4:D:140:ASP:HB3	4:D:143:SER:O	2.21	0.41
1:A:111:ARG:HD2	1:A:128:GLU:HG3	2.03	0.41
5:E:220:GLN:HG3	5:E:243:ILE:HG23	2.04	0.41
1:A:98:MET:HE2	1:A:98:MET:HB3	1.91	0.40
1:A:48:ARG:HD3	1:A:48:ARG:HA	1.93	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	273/277 (99%)	270 (99%)	3 (1%)	0	100	100
2	B	98/100 (98%)	98 (100%)	0	0	100	100
3	C	9/10 (90%)	9 (100%)	0	0	100	100
4	D	199/199 (100%)	195 (98%)	4 (2%)	0	100	100
5	E	242/240 (101%)	237 (98%)	5 (2%)	0	100	100
All	All	821/826 (99%)	809 (98%)	12 (2%)	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	236/235 (100%)	217 (92%)	19 (8%)	11	2
2	B	95/95 (100%)	92 (97%)	3 (3%)	34	19
3	C	10/9 (111%)	10 (100%)	0	100	100
4	D	181/179 (101%)	170 (94%)	11 (6%)	17	5
5	E	217/213 (102%)	207 (95%)	10 (5%)	24	9
All	All	739/731 (101%)	696 (94%)	43 (6%)	18	6

All (43) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	35	ARG
1	A	44	ARG
1	A	54	GLN
1	A	82	LEU
1	A	98	MET
1	A	103	LEU
1	A	108	ARG

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Mol	Chain	Res	Type
1	A	110	LEU
1	A	166	GLU
1	A	181	ARG
1	A	215	LEU
1	A	216	THR
1	A	219	LEU
1	A	222	GLU
1	A	228	MET
1	A	231	VAL
1	A	240	THR
1	A	249	VAL
1	A	266	LEU
2	B	4	THR
2	B	47	GLU
2	B	94	LYS
4	D	70	SER
4	D	124	VAL
4	D	138	LEU
4	D	147	SER
4	D	148	VAL
4	D	157	GLN
4	D	158	THR
4	D	160	VAL
4	D	174	CYS
4	D	179	ARG
4	D	208	ILE
5	E	9	ARG
5	E	27	MET
5	E	50	LEU
5	E	108[A]	PHE
5	E	108[B]	PHE
5	E	119	ARG
5	E	173	LYS
5	E	189	GLN
5	E	227	SER
5	E	251	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (7) such sidechains are listed below:

Mol	Chain	Res	Type
2	B	2	GLN
2	B	13	HIS

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Mol	Chain	Res	Type
2	B	89	GLN
4	D	48	GLN
5	E	86	HIS
5	E	222	GLN
5	E	242	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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 4 ligands modelled in this entry, 4 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 ⓘ

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, 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	273/277 (98%)	0.15	14 (5%) 33 36	7, 24, 49, 72	10 (3%)
2	B	100/100 (100%)	-0.18	5 (5%) 34 37	12, 21, 45, 56	0
3	C	10/10 (100%)	-0.60	0 100 100	11, 14, 23, 26	1 (10%)
4	D	199/199 (100%)	0.29	9 (4%) 38 41	13, 26, 55, 66	3 (1%)
5	E	240/240 (100%)	-0.01	11 (4%) 37 40	9, 22, 47, 64	4 (1%)
All	All	822/826 (99%)	0.09	39 (4%) 36 39	7, 23, 49, 72	18 (2%)

All (39) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
4	D	217	PRO	4.8
4	D	145	ASP	4.6
1	A	277	PRO	4.4
4	D	182	ASP	3.5
2	B	75	LYS	3.5
1	A	106	ASP	3.4
4	D	196	ASP	3.3
2	B	48	LYS	3.1
1	A	1	GLY	3.0
4	D	143	SER	2.9
5	E	232	TRP	2.8
4	D	141	SER	2.7
5	E	236	ARG	2.7
1	A	107	TRP	2.6
4	D	194	LYS	2.6
1	A	176	ASN	2.6
1	A	181	ARG	2.6
5	E	234	GLN	2.6
4	D	164	LYS	2.6
1	A	194[A]	ARG	2.5

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Mol	Chain	Res	Type	RSRZ
1	A	230	LEU	2.3
5	E	192	LEU	2.3
5	E	48	LEU	2.3
1	A	195	SER	2.2
5	E	235	ASP	2.2
2	B	0	MET	2.2
2	B	94	LYS	2.2
5	E	193	ASN	2.2
4	D	146	LYS	2.2
5	E	233	THR	2.1
1	A	18	GLU	2.1
5	E	189	GLN	2.1
5	E	230	ASP	2.1
1	A	182	THR	2.1
2	B	74	GLU	2.1
5	E	237	ALA	2.1
1	A	91	GLY	2.0
1	A	267	PRO	2.0
1	A	108	ARG	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 oligosaccharides 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($\text{\AA}^2$)	Q<0.9
6	NA	D	301	1/1	0.81	0.17	50,50,50,50	0
6	NA	E	302	1/1	0.91	0.28	40,40,40,40	0
6	NA	D	302	1/1	0.94	0.06	39,39,39,39	0
6	NA	E	301	1/1	0.96	0.04	24,24,24,24	0

6.5 Other polymers [i](#)

There are no such residues in this entry.