



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 05:49 AM UTC

PDB ID : 5IXD / pdb_00005ixd
Title : Structure of human JAK1 FERM/SH2 in complex with IFN lambda receptor
Authors : Ferrao, R.; Wallweber, H.J.A.; Lupardus, P.J.
Deposited on : 2016-03-23
Resolution : 2.85 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
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	:	9.0.010 (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

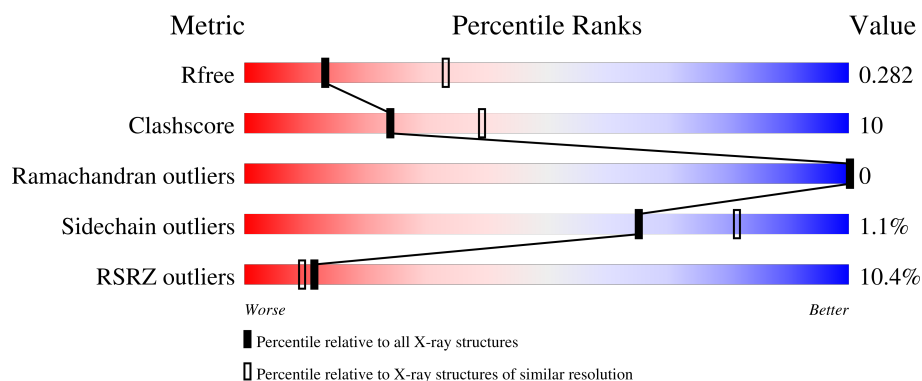
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.85 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	1407 (2.88-2.84)
Clashscore	190562	1446 (2.88-2.84)
Ramachandran outliers	187476	1406 (2.88-2.84)
Sidechain outliers	187428	1407 (2.88-2.84)
RSRZ outliers	180081	1408 (2.88-2.84)

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	544	8% 67% 10% 23%
2	B	55	7% 36% 62%

2 Entry composition

There are 3 unique types of molecules in this entry. The entry contains 3466 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 Tyrosine-protein kinase JAK1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	420	Total	C	N	O	S	0	0	0
			3292	2106	558	605	23			

There are 21 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	19	MET	-	initiating methionine	UNP P23458
A	20	HIS	-	expression tag	UNP P23458
A	21	HIS	-	expression tag	UNP P23458
A	22	HIS	-	expression tag	UNP P23458
A	23	HIS	-	expression tag	UNP P23458
A	24	HIS	-	expression tag	UNP P23458
A	25	HIS	-	expression tag	UNP P23458
A	26	GLY	-	expression tag	UNP P23458
A	27	GLU	-	expression tag	UNP P23458
A	28	ASN	-	expression tag	UNP P23458
A	29	LEU	-	expression tag	UNP P23458
A	30	TYR	-	expression tag	UNP P23458
A	31	PHE	-	expression tag	UNP P23458
A	32	GLN	-	expression tag	UNP P23458
A	33	GLY	-	expression tag	UNP P23458
A	34	SER	-	expression tag	UNP P23458
A	350	ASP	HIS	conflict	UNP P23458
A	368	PHE	TYR	conflict	UNP P23458
A	560	GLY	-	expression tag	UNP P23458
A	561	ASN	-	expression tag	UNP P23458
A	562	SER	-	expression tag	UNP P23458

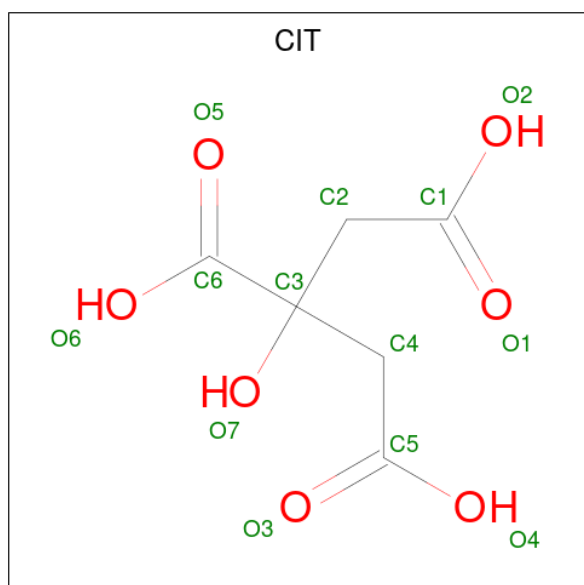
- Molecule 2 is a protein called Interferon lambda receptor 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	21	Total	C	N	O	S	0	0	0
			161	105	27	27	2			

There are 5 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	248	GLY	-	expression tag	UNP Q8IU57
B	249	SER	-	expression tag	UNP Q8IU57
B	300	GLY	-	expression tag	UNP Q8IU57
B	301	ASN	-	expression tag	UNP Q8IU57
B	302	SER	-	expression tag	UNP Q8IU57

- Molecule 3 is CITRIC ACID (CCD ID: CIT) (formula: $C_6H_8O_7$).

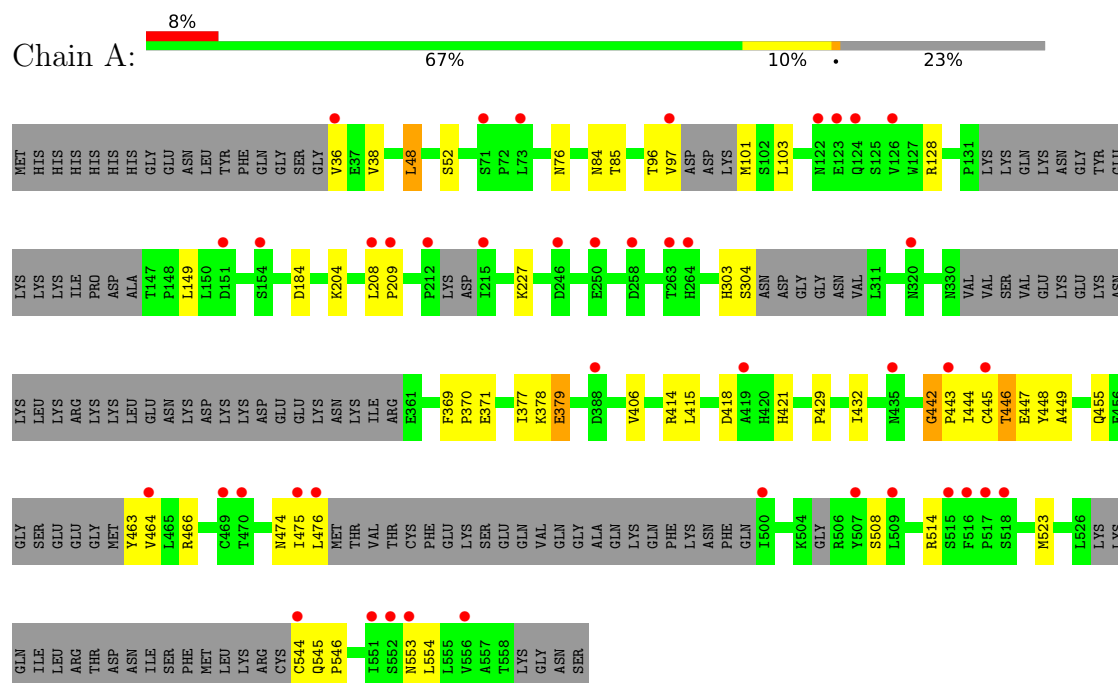


Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total	C	O	0	0
			13	6	7		

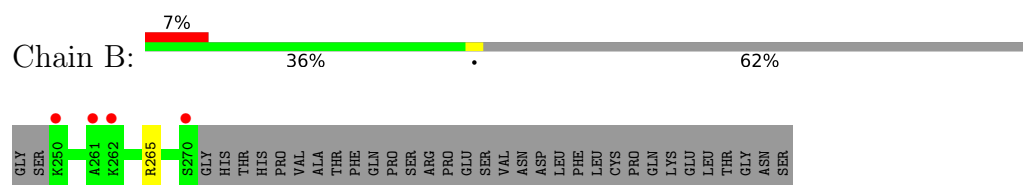
3 Residue-property plots [i](#)

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: Tyrosine-protein kinase JAK1



• Molecule 2: Interferon lambda receptor 1



4 Data and refinement statistics

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, α , β , γ	111.17Å 193.20Å 72.98Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	44.29 – 2.85 44.29 – 2.85	Depositor EDS
% Data completeness (in resolution range)	99.3 (44.29-2.85) 94.3 (44.29-2.85)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.06 (at 2.86Å)	Xtriage
Refinement program	PHENIX 1.10_2155	Depositor
R, R_{free}	0.249 , 0.282 0.248 , 0.282	Depositor DCC
R_{free} test set	1867 reflections (9.97%)	wwPDB-VP
Wilson B-factor (Å ²)	76.0	Xtriage
Anisotropy	0.480	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.29 , 79.5	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.010 for 1/2*h-1/2*k,-3/2*h-1/2*k,-l 0.025 for 1/2*h+1/2*k,3/2*h-1/2*k,-l	Xtriage
F_o, F_c correlation	0.92	EDS
Total number of atoms	3466	wwPDB-VP
Average B, all atoms (Å ²)	97.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.31% 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: CIT

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	0.40	1/3368 (0.0%)	0.70	5/4575 (0.1%)
2	B	0.29	0/166	0.61	0/225
All	All	0.40	1/3534 (0.0%)	0.70	5/4800 (0.1%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	442	GLY	C-N	5.06	1.39	1.33

All (5) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	379	GLU	CB-CA-C	-5.88	109.23	117.23
1	A	442	GLY	CA-C-N	-5.42	113.69	119.98
1	A	442	GLY	C-N-CA	-5.42	113.69	119.98
1	A	474	ASN	N-CA-C	5.20	117.29	109.23
1	A	446	THR	N-CA-C	5.05	116.48	111.07

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	3292	0	3103	66	0
2	B	161	0	145	1	0
3	A	13	0	5	1	0
All	All	3466	0	3253	67	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 10.

All (67) 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:97:VAL:HA	1:A:101:MET:CE	1.78	1.14
1:A:97:VAL:HA	1:A:101:MET:HE2	1.42	1.00
1:A:445:CYS:SG	1:A:553:ASN:ND2	2.38	0.97
1:A:38:VAL:HB	1:A:48:LEU:HD21	1.48	0.93
1:A:444:ILE:HD12	1:A:448:TYR:HB2	1.51	0.92
1:A:48:LEU:H	1:A:48:LEU:HD23	1.33	0.92
1:A:466:ARG:HG2	1:A:476:LEU:O	1.73	0.88
1:A:466:ARG:CG	1:A:476:LEU:O	2.23	0.86
1:A:36:VAL:N	1:A:103:LEU:O	2.13	0.81
1:A:444:ILE:HD12	1:A:448:TYR:CB	2.10	0.81
1:A:442:GLY:O	1:A:444:ILE:HG23	1.82	0.79
1:A:97:VAL:HG23	1:A:101:MET:HE3	1.68	0.74
1:A:466:ARG:O	1:A:475:ILE:CG2	2.39	0.71
1:A:466:ARG:O	1:A:475:ILE:HG23	1.91	0.71
1:A:76:ASN:HD21	1:A:415:LEU:CD2	2.06	0.68
1:A:443:PRO:O	1:A:554:LEU:HD21	1.94	0.68
3:A:601:CIT:O3	3:A:601:CIT:O7	2.13	0.66
1:A:128:ARG:NH1	1:A:149:LEU:O	2.29	0.65
1:A:466:ARG:HG3	1:A:476:LEU:O	1.95	0.65
1:A:184:ASP:OD2	2:B:265:ARG:NH2	2.30	0.64
1:A:429:PRO:O	1:A:432:ILE:HG22	1.98	0.63
1:A:97:VAL:HG23	1:A:101:MET:CE	2.31	0.61
1:A:97:VAL:CA	1:A:101:MET:CE	2.69	0.60
1:A:48:LEU:H	1:A:48:LEU:CD2	2.13	0.60
1:A:544:CYS:SG	1:A:545:GLN:N	2.75	0.59
1:A:48:LEU:HD23	1:A:48:LEU:N	2.11	0.59
1:A:76:ASN:HD21	1:A:415:LEU:HD23	1.67	0.59
1:A:463:TYR:HE1	1:A:523:MET:HE1	1.68	0.58
1:A:38:VAL:HB	1:A:48:LEU:CD2	2.26	0.58
1:A:371:GLU:N	1:A:371:GLU:OE1	2.37	0.56
1:A:378:LYS:O	1:A:379:GLU:HB2	2.05	0.56

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:36:VAL:N	1:A:103:LEU:H	2.04	0.56
1:A:446:THR:O	1:A:447:GLU:C	2.50	0.55
1:A:545:GLN:HB3	1:A:546:PRO:HD2	1.89	0.55
1:A:414:ARG:HD3	1:A:432:ILE:HD13	1.88	0.54
1:A:444:ILE:CD1	1:A:448:TYR:HB2	2.31	0.54
1:A:414:ARG:HD3	1:A:432:ILE:CD1	2.38	0.54
1:A:377:ILE:HD11	1:A:406:VAL:HG21	1.91	0.53
1:A:446:THR:O	1:A:449:ALA:N	2.42	0.53
1:A:443:PRO:O	1:A:443:PRO:HG2	2.09	0.51
1:A:464:VAL:HG13	1:A:464:VAL:O	2.10	0.51
1:A:418:ASP:OD2	1:A:421:HIS:N	2.44	0.50
1:A:96:THR:O	1:A:101:MET:HE1	2.10	0.50
1:A:52:SER:HA	1:A:97:VAL:HG13	1.94	0.50
1:A:97:VAL:CG2	1:A:101:MET:HE3	2.41	0.49
1:A:466:ARG:HH21	1:A:476:LEU:HD23	1.76	0.49
1:A:379:GLU:HA	1:A:379:GLU:OE1	2.13	0.48
1:A:444:ILE:HD12	1:A:448:TYR:HB3	1.95	0.48
1:A:76:ASN:HD21	1:A:415:LEU:HD21	1.76	0.47
1:A:544:CYS:O	1:A:545:GLN:HG3	2.13	0.47
1:A:97:VAL:CA	1:A:101:MET:HE2	2.29	0.47
1:A:508:SER:OG	1:A:514:ARG:O	2.31	0.46
1:A:466:ARG:O	1:A:475:ILE:HG22	2.14	0.46
1:A:303:HIS:O	1:A:304:SER:OG	2.25	0.46
1:A:48:LEU:CD2	1:A:48:LEU:N	2.76	0.46
1:A:463:TYR:CG	1:A:463:TYR:O	2.69	0.45
1:A:463:TYR:CE1	1:A:523:MET:HE1	2.49	0.45
1:A:429:PRO:HG2	1:A:432:ILE:CG2	2.47	0.45
1:A:476:LEU:HA	1:A:476:LEU:HD12	1.76	0.45
1:A:377:ILE:HD11	1:A:406:VAL:HG11	2.00	0.43
1:A:84:ASN:OD1	1:A:85:THR:N	2.50	0.42
1:A:208:LEU:N	1:A:209:PRO:HD2	2.34	0.42
1:A:444:ILE:CD1	1:A:448:TYR:CB	2.91	0.41
1:A:445:CYS:SG	1:A:553:ASN:CG	3.02	0.41
1:A:97:VAL:HA	1:A:101:MET:HE1	1.86	0.40
1:A:369:PHE:N	1:A:370:PRO:CD	2.84	0.40
1:A:544:CYS:O	1:A:545:GLN:CG	2.69	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	400/544 (74%)	387 (97%)	13 (3%)	0	100	100
2	B	19/55 (34%)	18 (95%)	1 (5%)	0	100	100
All	All	419/599 (70%)	405 (97%)	14 (3%)	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	348/497 (70%)	344 (99%)	4 (1%)	65	81
2	B	15/48 (31%)	15 (100%)	0	100	100
All	All	363/545 (67%)	359 (99%)	4 (1%)	65	81

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

Mol	Chain	Res	Type
1	A	48	LEU
1	A	204	LYS
1	A	227	LYS
1	A	455	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (5) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	76	ASN
1	A	129	HIS
1	A	183	HIS
1	A	545	GLN
1	A	553	ASN

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](#)

1 ligand is 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	$\# Z > 2$
3	CIT	A	601	-	12,12,12	1.04	0	17,17,17	1.48	2 (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
3	CIT	A	601	-	-	7/16/16/16	-

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed($^{\circ}$)	Ideal($^{\circ}$)
3	A	601	CIT	O6-C6-C3	3.46	119.78	113.14
3	A	601	CIT	O2-C1-C2	2.30	121.62	114.35

There are no chirality outliers.

All (7) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	601	CIT	O7-C3-C4-C5
3	A	601	CIT	C2-C3-C6-O5
3	A	601	CIT	C2-C3-C6-O6
3	A	601	CIT	O7-C3-C6-O5
3	A	601	CIT	O7-C3-C6-O6
3	A	601	CIT	C2-C3-C4-C5
3	A	601	CIT	C6-C3-C4-C5

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	601	CIT	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 ⓘ

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	420/544 (77%)	0.69	42 (10%)	12 10	53, 95, 157, 209	0
2	B	21/55 (38%)	0.89	4 (19%)	3 3	67, 81, 108, 122	0
All	All	441/599 (73%)	0.70	46 (10%)	11 9	53, 94, 156, 209	0

All (46) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	215	ILE	4.6
1	A	445	CYS	4.4
1	A	246	ASP	4.4
2	B	250	LYS	4.3
1	A	469	CYS	3.9
2	B	262	LYS	3.6
1	A	515	SER	3.6
1	A	552	SER	3.5
1	A	464	VAL	3.5
1	A	388	ASP	3.5
2	B	270	SER	3.2
1	A	553	ASN	3.1
1	A	320	ASN	3.1
1	A	36	VAL	3.1
1	A	208	LEU	2.9
1	A	516	PHE	2.9
1	A	544	CYS	2.7
1	A	73	LEU	2.7
1	A	263	THR	2.7
1	A	151	ASP	2.7
1	A	509	LEU	2.6
1	A	517	PRO	2.6
1	A	500	ILE	2.5
1	A	258	ASP	2.5

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Mol	Chain	Res	Type	RSRZ
1	A	250	GLU	2.4
1	A	126	VAL	2.4
1	A	212	PRO	2.4
1	A	71	SER	2.3
1	A	507	TYR	2.3
1	A	476	LEU	2.3
1	A	556	VAL	2.3
1	A	419	ALA	2.2
1	A	443	PRO	2.2
1	A	470	THR	2.2
1	A	518	SER	2.2
1	A	123	GLU	2.2
1	A	122	ASN	2.1
1	A	264	HIS	2.1
1	A	435	ASN	2.1
1	A	209	PRO	2.1
1	A	551	ILE	2.1
1	A	124	GLN	2.1
1	A	97	VAL	2.1
1	A	154	SER	2.0
2	B	261	ALA	2.0
1	A	475	ILE	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(Å ²)	Q<0.9
3	CIT	A	601	13/13	0.86	0.14	84,95,112,119	0

6.5 Other polymers [i](#)

There are no such residues in this entry.