



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2026 – 02:38 PM UTC

PDB ID : 1VG4 / pdb_00001vg4
Title : Crystal Structure Of Octaprenyl Pyrophosphate Synthase From Hyperthermophilic Thermotoga Maritima F132A/L128A mutant
Authors : Guo, R.T.; Kuo, C.J.; Ko, T.P.; Chou, C.C.; Liang, P.H.; Wang, A.H.-J.
Deposited on : 2004-04-23
Resolution : 3.30 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

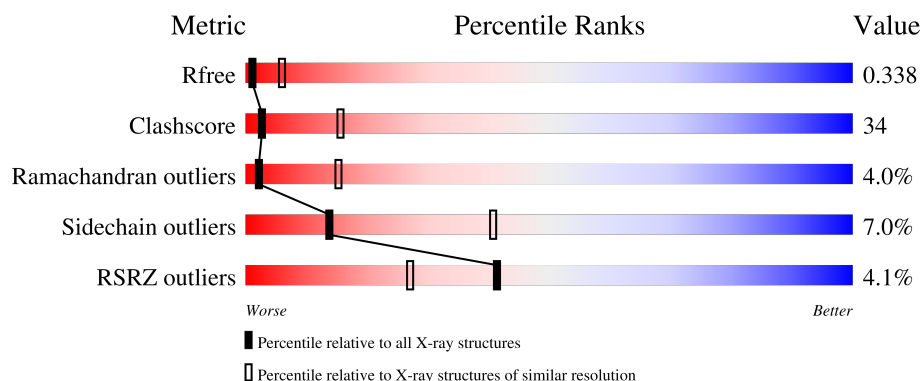
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

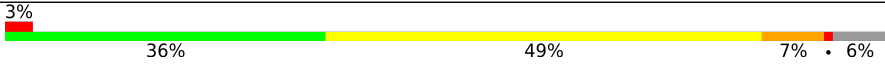
The reported resolution of this entry is 3.30 Å.

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	1169 (3.32-3.28)
Clashscore	190562	1209 (3.32-3.28)
Ramachandran outliers	187476	1188 (3.32-3.28)
Sidechain outliers	187428	1187 (3.32-3.28)
RSRZ outliers	180081	1169 (3.32-3.28)

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	299	
1	B	299	

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 4816 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 octoprenyl-diphosphate synthase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	280	Total	C	N	O	S	0	0	0
			2219	1421	371	415	12			
1	B	280	Total	C	N	O	S	0	0	0
			2219	1421	371	415	12			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	128	ALA	LEU	engineered mutation	UNP Q9X1M1
A	132	ALA	PHE	engineered mutation	UNP Q9X1M1
B	128	ALA	LEU	engineered mutation	UNP Q9X1M1
B	132	ALA	PHE	engineered mutation	UNP Q9X1M1

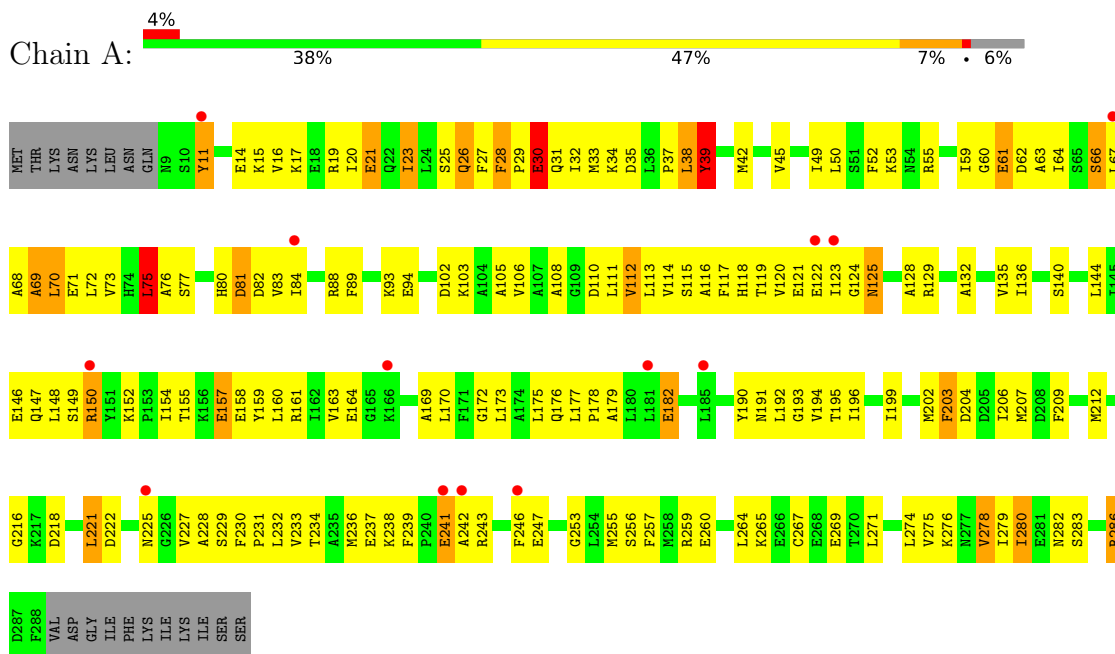
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	194	Total	O	0	0
			194	194		
2	B	184	Total	O	0	0
			184	184		

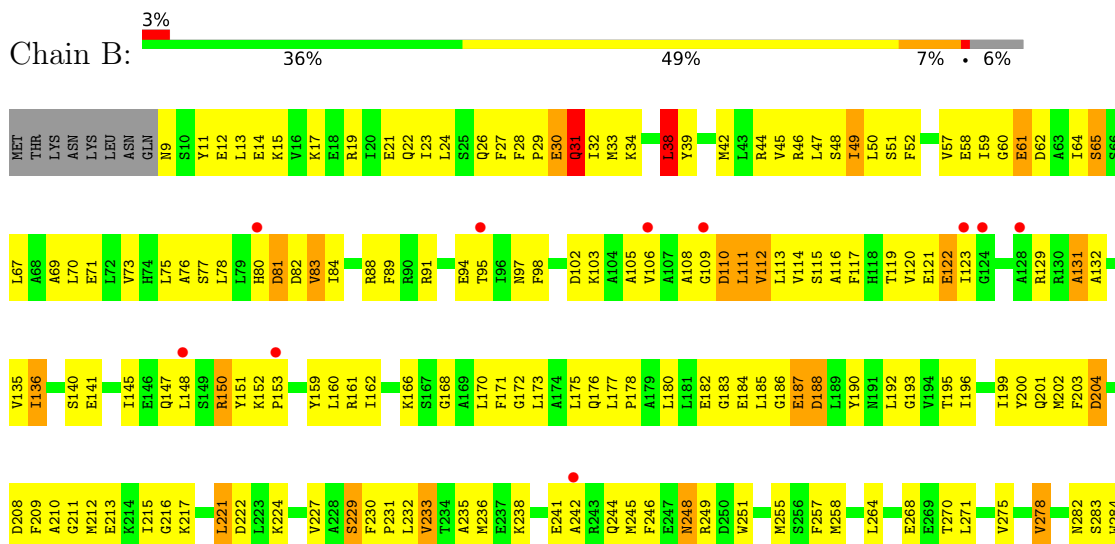
3 Residue-property plots

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: octoprenyl-diphosphate synthase



- Molecule 1: octoprenyl-diphosphate synthase



L285	R286	D287	F288	VAL	ASP	GLY	ILE	PHE	LYS	ILE	LYS	ILE	SER	SER
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4 Data and refinement statistics

Property	Value	Source
Space group	P 4 21 2	Depositor
Cell constants a, b, c, α , β , γ	151.43Å 151.43Å 67.04Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	47.89 – 3.30 47.89 – 3.30	Depositor EDS
% Data completeness (in resolution range)	73.7 (47.89-3.30) 90.3 (47.89-3.30)	Depositor EDS
R_{merge}	0.10	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	4.16 (at 3.33Å)	Xtriage
Refinement program	CNS	Depositor
R, R_{free}	0.277 , 0.321 0.295 , 0.338	Depositor DCC
R_{free} test set	600 reflections (5.15%)	wwPDB-VP
Wilson B-factor (Å ²)	73.0	Xtriage
Anisotropy	0.569	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 78.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.46$, $\langle L^2 \rangle = 0.29$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.89	EDS
Total number of atoms	4816	wwPDB-VP
Average B, all atoms (Å ²)	64.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 10.24% 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

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	0.33	0/2253	0.99	14/3025 (0.5%)
1	B	0.32	0/2253	0.97	11/3025 (0.4%)
All	All	0.33	0/4506	0.98	25/6050 (0.4%)

There are no bond length outliers.

All (25) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	71	GLU	N-CA-C	-9.07	101.48	112.54
1	B	71	GLU	N-CA-C	-9.01	102.80	113.88
1	B	111	LEU	N-CA-C	-7.04	102.81	111.33
1	A	259	ARG	N-CA-C	-7.00	104.55	113.23
1	A	278	VAL	N-CA-C	-6.45	104.46	110.53
1	B	38	LEU	N-CA-C	6.35	124.33	110.80
1	A	21	GLU	N-CA-C	-6.20	104.59	111.71
1	A	128	ALA	N-CA-C	-6.03	104.67	112.68
1	B	39	TYR	N-CA-C	5.96	118.44	108.73
1	B	168	GLY	N-CA-C	5.93	119.85	112.73
1	B	131	ALA	N-CA-C	-5.85	103.61	112.04
1	B	241	GLU	N-CA-C	-5.80	105.04	111.36
1	B	112	VAL	N-CA-C	-5.71	104.76	110.30
1	A	75	LEU	N-CA-C	-5.60	105.27	111.71
1	B	32	ILE	N-CA-C	-5.59	106.35	113.22
1	A	203	PHE	N-CA-C	-5.57	105.11	111.07
1	B	248	ASN	N-CA-C	-5.54	106.50	113.20
1	B	31	GLN	N-CA-C	5.51	119.27	112.54
1	A	152	LYS	CA-C-N	5.43	126.62	119.84
1	A	152	LYS	C-N-CA	5.43	126.62	119.84
1	A	30	GLU	N-CA-C	-5.27	105.43	111.07
1	A	236	MET	N-CA-C	5.23	117.66	111.33
1	A	28	PHE	N-CA-C	-5.11	98.52	109.81
1	A	69	ALA	N-CA-C	5.09	117.57	111.71
1	A	286	ARG	N-CA-C	-5.07	107.16	113.19

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	2219	0	2259	157	0
1	B	2219	0	2259	155	0
2	A	194	0	0	0	2
2	B	184	0	0	1	0
All	All	4816	0	4518	301	2

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 34.

All (301) 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:70:LEU:HD11	1:B:170:LEU:HD11	1.40	1.02
1:B:44:ARG:HE	1:B:170:LEU:HD23	1.26	0.97
1:B:244:GLN:HG2	1:B:248:ASN:HD21	1.29	0.96
1:A:15:LYS:HG2	1:A:64:ILE:HG21	1.52	0.91
1:A:77:SER:O	1:A:81:ASP:HB2	1.73	0.87
1:B:217:LYS:H	1:B:217:LYS:HD2	1.40	0.84
1:B:120:VAL:HG12	1:B:129:ARG:HG2	1.59	0.84
1:A:120:VAL:HG12	1:A:129:ARG:HG3	1.61	0.83
1:B:244:GLN:HG2	1:B:248:ASN:ND2	1.96	0.80
1:A:118:HIS:O	1:A:122:GLU:HG2	1.82	0.79
1:A:73:VAL:O	1:A:76:ALA:HB3	1.82	0.79
1:B:70:LEU:HD11	1:B:170:LEU:CD1	2.12	0.79
1:B:9:ASN:N	1:B:49:ILE:HG21	1.99	0.77
1:B:116:ALA:O	1:B:120:VAL:HG23	1.88	0.74
1:A:202:MET:HE3	1:A:230:PHE:CZ	2.22	0.73
1:B:19:ARG:HG2	1:B:64:ILE:HG22	1.71	0.73
1:A:111:LEU:HD13	1:B:140:SER:HB2	1.69	0.72
1:A:276:LYS:O	1:A:280:ILE:HG12	1.89	0.72
1:B:102:ASP:O	1:B:106:VAL:HG23	1.90	0.71

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:217:LYS:HD2	1:B:217:LYS:N	2.06	0.71
1:A:175:LEU:HD11	1:A:196:ILE:HD12	1.73	0.69
1:A:238:LYS:HE2	1:A:239:PHE:HE1	1.56	0.69
1:A:160:LEU:O	1:A:164:GLU:HG3	1.94	0.68
1:A:216:GLY:H	1:A:222:ASP:HB2	1.58	0.68
1:A:238:LYS:HE2	1:A:239:PHE:CE1	2.28	0.68
1:A:75:LEU:HD12	1:A:75:LEU:H	1.58	0.68
1:A:88:ARG:O	1:A:94:GLU:HA	1.94	0.68
1:B:12:GLU:HG2	1:B:59:ILE:HD12	1.76	0.67
1:B:44:ARG:NE	1:B:170:LEU:HD23	2.06	0.67
1:A:110:ASP:O	1:A:114:VAL:HG23	1.95	0.66
1:A:135:VAL:HG21	1:A:173:LEU:HD22	1.75	0.66
1:A:216:GLY:N	1:A:222:ASP:HB2	2.11	0.66
1:A:62:ASP:O	1:A:66:SER:HB2	1.96	0.66
1:A:116:ALA:O	1:A:120:VAL:HG23	1.96	0.66
1:A:108:ALA:O	1:A:112:VAL:HG23	1.94	0.66
1:A:172:GLY:HA2	1:A:193:GLY:HA3	1.79	0.65
1:A:61:GLU:C	1:A:63:ALA:H	2.03	0.65
1:A:21:GLU:HG3	1:A:33:MET:HE1	1.79	0.65
1:B:147:GLN:O	1:B:150:ARG:HB2	1.97	0.65
1:B:120:VAL:CG1	1:B:129:ARG:HG2	2.27	0.64
1:B:242:ALA:HA	1:B:245:MET:HE3	1.79	0.64
1:A:227:VAL:C	1:A:229:SER:H	2.06	0.64
1:B:227:VAL:HG22	1:B:246:PHE:HZ	1.62	0.64
1:B:47:LEU:HD12	1:B:171:PHE:CD1	2.34	0.63
1:A:271:LEU:O	1:A:275:VAL:HG23	1.98	0.63
1:B:208:ASP:OD1	1:B:224:LYS:HG3	1.99	0.63
1:A:192:LEU:O	1:A:196:ILE:HG13	1.99	0.62
1:B:230:PHE:HB3	1:B:231:PRO:HD3	1.81	0.62
1:A:19:ARG:O	1:A:23:ILE:HG22	2.00	0.62
1:B:175:LEU:HD11	1:B:196:ILE:HD12	1.81	0.62
1:B:49:ILE:HG22	1:B:50:LEU:N	2.14	0.62
1:A:243:ARG:O	1:A:247:GLU:HG3	2.00	0.62
1:B:11:TYR:O	1:B:15:LYS:HG3	2.00	0.62
1:B:108:ALA:O	1:B:112:VAL:HG23	1.99	0.62
1:A:160:LEU:HA	1:A:163:VAL:HG22	1.81	0.61
1:A:84:ILE:HD13	1:B:103:LYS:HG3	1.81	0.61
1:B:69:ALA:HB2	1:B:119:THR:HG21	1.82	0.61
1:B:245:MET:HE1	1:B:257:PHE:CG	2.35	0.61
1:A:177:LEU:HB2	1:A:178:PRO:HD3	1.81	0.61
1:A:29:PRO:HG2	1:B:148:LEU:HD11	1.83	0.61

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:70:LEU:HD22	1:B:173:LEU:HD23	1.83	0.61
1:A:61:GLU:C	1:A:63:ALA:N	2.58	0.61
1:A:11:TYR:CD1	1:A:11:TYR:C	2.78	0.61
1:B:217:LYS:H	1:B:217:LYS:CD	2.14	0.60
1:B:175:LEU:O	1:B:178:PRO:HD2	2.02	0.60
1:B:182:GLU:HG3	2:B:385:HOH:O	2.01	0.60
1:A:69:ALA:HB2	1:A:119:THR:CG2	2.31	0.60
1:A:15:LYS:HG2	1:A:64:ILE:CG2	2.29	0.60
1:A:23:ILE:HD11	1:A:115:SER:O	2.02	0.60
1:B:12:GLU:O	1:B:15:LYS:HB2	2.02	0.60
1:A:212:MET:HE1	1:A:221:LEU:HD22	1.84	0.59
1:B:113:LEU:O	1:B:116:ALA:HB3	2.02	0.59
1:A:111:LEU:HD13	1:B:140:SER:CB	2.33	0.59
1:B:131:ALA:O	1:B:135:VAL:HG23	2.02	0.59
1:B:30:GLU:O	1:B:33:MET:HB3	2.02	0.59
1:B:186:GLY:O	1:B:188:ASP:N	2.35	0.59
1:A:62:ASP:O	1:A:62:ASP:OD2	2.20	0.59
1:A:69:ALA:O	1:A:72:LEU:HB2	2.03	0.59
1:B:69:ALA:HB2	1:B:119:THR:CG2	2.33	0.58
1:B:264:LEU:O	1:B:268:GLU:HG3	2.03	0.58
1:A:132:ALA:O	1:A:136:ILE:HG13	2.04	0.58
1:A:27:PHE:HZ	1:A:115:SER:HA	1.68	0.58
1:A:106:VAL:HG21	1:B:84:ILE:HD11	1.85	0.58
1:B:69:ALA:O	1:B:73:VAL:HG23	2.03	0.58
1:B:47:LEU:HD12	1:B:171:PHE:HD1	1.69	0.57
1:A:20:ILE:HG12	1:A:68:ALA:HB1	1.85	0.57
1:B:97:ASN:HA	1:B:105:ALA:HB2	1.86	0.57
1:B:202:MET:HE2	1:B:271:LEU:HD13	1.85	0.57
1:A:62:ASP:CG	1:A:123:ILE:HG23	2.30	0.57
1:B:49:ILE:O	1:B:52:PHE:HB2	2.04	0.57
1:A:117:PHE:C	1:A:119:THR:N	2.62	0.56
1:A:112:VAL:O	1:A:115:SER:N	2.28	0.56
1:B:119:THR:O	1:B:122:GLU:HB2	2.06	0.56
1:B:42:MET:O	1:B:46:ARG:HG3	2.05	0.56
1:B:110:ASP:O	1:B:114:VAL:HG23	2.06	0.56
1:A:113:LEU:HD23	1:B:113:LEU:HD23	1.86	0.56
1:B:227:VAL:HG22	1:B:246:PHE:CZ	2.41	0.56
1:B:244:GLN:CG	1:B:248:ASN:HD21	2.08	0.56
1:A:154:ILE:HD11	1:A:228:ALA:HA	1.89	0.55
1:A:275:VAL:O	1:A:279:ILE:HG12	2.06	0.55
1:A:69:ALA:HB2	1:A:119:THR:HG21	1.86	0.55

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:147:GLN:C	1:A:149:SER:H	2.13	0.55
1:A:80:HIS:HE1	1:B:110:ASP:OD1	1.90	0.55
1:B:159:TYR:O	1:B:162:ILE:HB	2.06	0.55
1:A:242:ALA:HB2	1:A:257:PHE:CD2	2.42	0.55
1:A:253:GLY:O	1:A:256:SER:HB3	2.07	0.55
1:B:232:LEU:HB3	1:B:236:MET:HE2	1.87	0.55
1:A:70:LEU:HD23	1:A:170:LEU:CD1	2.38	0.54
1:B:110:ASP:O	1:B:114:VAL:N	2.35	0.54
1:B:286:ARG:O	1:B:287:ASP:C	2.50	0.54
1:A:60:GLY:O	1:A:62:ASP:N	2.41	0.54
1:B:270:THR:O	1:B:270:THR:HG22	2.06	0.54
1:A:16:VAL:O	1:A:20:ILE:HG13	2.08	0.53
1:B:60:GLY:O	1:B:61:GLU:C	2.51	0.53
1:B:141:GLU:HG2	1:B:145:ILE:CD1	2.39	0.53
1:B:176:GLN:HG2	1:B:180:LEU:HG	1.90	0.53
1:A:195:THR:O	1:A:199:ILE:HG13	2.09	0.53
1:B:88:ARG:HG3	1:B:98:PHE:CG	2.43	0.53
1:A:63:ALA:O	1:A:67:LEU:HG	2.09	0.53
1:A:117:PHE:C	1:A:119:THR:H	2.16	0.53
1:B:76:ALA:HB1	1:B:109:GLY:O	2.08	0.53
1:A:227:VAL:C	1:A:229:SER:N	2.67	0.53
1:A:23:ILE:O	1:A:26:GLN:HB2	2.09	0.53
1:A:206:ILE:HG23	1:A:264:LEU:HD11	1.90	0.52
1:B:65:SER:HB3	1:B:123:ILE:HD11	1.90	0.52
1:B:233:VAL:HA	1:B:236:MET:HE3	1.92	0.52
1:B:51:SER:HA	1:B:284:TRP:CZ3	2.45	0.52
1:B:178:PRO:O	1:B:182:GLU:HG2	2.09	0.52
1:B:192:LEU:O	1:B:196:ILE:HG13	2.10	0.52
1:A:82:ASP:C	1:A:84:ILE:N	2.63	0.51
1:A:120:VAL:HG12	1:A:120:VAL:O	2.10	0.51
1:A:227:VAL:O	1:A:229:SER:N	2.37	0.51
1:A:140:SER:CB	1:B:111:LEU:HD13	2.40	0.51
1:A:140:SER:HB2	1:B:111:LEU:HD13	1.93	0.51
1:A:229:SER:HB3	1:A:232:LEU:CB	2.40	0.51
1:A:238:LYS:HB3	1:A:239:PHE:CD1	2.46	0.51
1:A:82:ASP:O	1:A:83:VAL:C	2.53	0.51
1:A:229:SER:O	1:A:233:VAL:HG23	2.11	0.51
1:B:12:GLU:HG2	1:B:59:ILE:CD1	2.40	0.50
1:A:170:LEU:O	1:A:170:LEU:HD12	2.12	0.50
1:A:155:THR:OG1	1:A:157:GLU:HG3	2.11	0.50
1:A:233:VAL:O	1:A:234:THR:C	2.55	0.50

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:185:LEU:HD13	1:B:187:GLU:OE1	2.13	0.49
1:A:178:PRO:O	1:A:182:GLU:HB2	2.12	0.49
1:A:192:LEU:HG	1:A:196:ILE:HD11	1.93	0.49
1:A:147:GLN:C	1:A:149:SER:N	2.71	0.49
1:B:166:LYS:HE3	1:B:201:GLN:NE2	2.27	0.49
1:A:62:ASP:OD1	1:A:123:ILE:HG23	2.13	0.49
1:A:278:VAL:O	1:A:282:ASN:HB2	2.12	0.49
1:B:44:ARG:HG3	1:B:44:ARG:HH11	1.78	0.49
1:A:19:ARG:NH1	1:A:23:ILE:HG22	2.27	0.49
1:A:190:TYR:O	1:A:194:VAL:HG23	2.13	0.49
1:A:242:ALA:HB2	1:A:257:PHE:CE2	2.47	0.49
1:B:141:GLU:HG2	1:B:145:ILE:HD11	1.93	0.49
1:B:80:HIS:C	1:B:82:ASP:N	2.71	0.48
1:B:221:LEU:O	1:B:222:ASP:HB3	2.12	0.48
1:A:256:SER:O	1:A:260:GLU:HB2	2.13	0.48
1:A:89:PHE:HA	1:A:93:LYS:O	2.13	0.48
1:A:117:PHE:O	1:A:120:VAL:N	2.47	0.48
1:B:65:SER:HB3	1:B:123:ILE:CD1	2.44	0.48
1:B:77:SER:O	1:B:81:ASP:HB2	2.13	0.48
1:B:24:LEU:HB2	1:B:33:MET:HE1	1.96	0.48
1:B:80:HIS:O	1:B:83:VAL:HG23	2.14	0.48
1:A:276:LYS:C	1:A:280:ILE:HG12	2.38	0.48
1:B:89:PHE:CE2	1:B:94:GLU:HG2	2.49	0.47
1:B:249:ARG:NE	1:B:251:TRP:CH2	2.79	0.47
1:B:19:ARG:O	1:B:23:ILE:HG13	2.15	0.47
1:B:132:ALA:O	1:B:136:ILE:HG12	2.14	0.47
1:A:112:VAL:O	1:A:113:LEU:C	2.57	0.47
1:A:42:MET:HE2	1:A:45:VAL:HG21	1.97	0.47
1:A:49:ILE:O	1:A:53:LYS:HG2	2.15	0.47
1:B:45:VAL:HG13	1:B:67:LEU:HD13	1.95	0.47
1:B:57:VAL:HG12	1:B:58:GLU:N	2.30	0.47
1:B:288:PHE:CD1	1:B:288:PHE:C	2.92	0.47
1:B:208:ASP:HB2	1:B:224:LYS:HE2	1.97	0.47
1:B:14:GLU:HA	1:B:17:LYS:HB2	1.97	0.47
1:B:31:GLN:HE21	1:B:31:GLN:HB3	1.60	0.47
1:B:141:GLU:O	1:B:145:ILE:HG13	2.15	0.47
1:A:160:LEU:HA	1:A:163:VAL:CG2	2.45	0.46
1:B:172:GLY:HA2	1:B:193:GLY:HA3	1.96	0.46
1:A:15:LYS:CD	1:A:64:ILE:HG13	2.46	0.46
1:A:227:VAL:O	1:A:227:VAL:HG12	2.16	0.46
1:B:132:ALA:O	1:B:135:VAL:HB	2.15	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:169:ALA:HA	1:A:190:TYR:OH	2.15	0.46
1:B:177:LEU:N	1:B:178:PRO:HD2	2.30	0.46
1:B:212:MET:CE	1:B:255:MET:HE1	2.46	0.46
1:A:37:PRO:HA	1:A:93:LYS:HD3	1.96	0.46
1:B:153:PRO:HG3	1:B:246:PHE:CD2	2.50	0.46
1:A:124:GLY:O	1:A:125:ASN:O	2.33	0.46
1:A:31:GLN:O	1:A:34:LYS:NZ	2.48	0.46
1:A:221:LEU:O	1:A:222:ASP:HB3	2.15	0.46
1:A:52:PHE:CG	1:A:178:PRO:HG3	2.51	0.46
1:A:70:LEU:HA	1:A:70:LEU:HD12	1.64	0.46
1:A:20:ILE:HA	1:A:23:ILE:HG23	1.97	0.46
1:A:30:GLU:O	1:A:33:MET:HB2	2.16	0.46
1:A:61:GLU:O	1:A:63:ALA:N	2.49	0.46
1:A:154:ILE:HD12	1:A:159:TYR:HB2	1.98	0.46
1:B:150:ARG:O	1:B:227:VAL:HG23	2.15	0.46
1:A:149:SER:O	1:A:150:ARG:C	2.59	0.45
1:B:245:MET:HE1	1:B:257:PHE:CD1	2.51	0.45
1:B:22:GLN:O	1:B:26:GLN:HG2	2.15	0.45
1:A:274:LEU:O	1:A:278:VAL:HG23	2.16	0.45
1:A:70:LEU:HD23	1:A:170:LEU:HD13	1.99	0.45
1:A:227:VAL:HG21	1:A:246:PHE:CZ	2.50	0.45
1:A:35:ASP:O	1:A:93:LYS:HE3	2.17	0.45
1:A:29:PRO:HG2	1:B:148:LEU:CD1	2.46	0.45
1:B:102:ASP:O	1:B:105:ALA:HB3	2.16	0.45
1:A:119:THR:C	1:A:121:GLU:H	2.24	0.45
1:B:192:LEU:HD13	1:B:282:ASN:HD21	1.82	0.45
1:B:82:ASP:HB3	1:B:97:ASN:ND2	2.32	0.44
1:B:201:GLN:O	1:B:204:ASP:HB2	2.17	0.44
1:B:88:ARG:O	1:B:88:ARG:HG2	2.16	0.44
1:A:105:ALA:O	1:A:108:ALA:HB3	2.18	0.44
1:A:230:PHE:N	1:A:231:PRO:HD2	2.32	0.44
1:B:83:VAL:HG13	1:B:97:ASN:HB2	2.00	0.44
1:A:203:PHE:O	1:A:207:MET:HG2	2.18	0.44
1:B:28:PHE:HA	1:B:29:PRO:HD3	1.88	0.44
1:A:29:PRO:O	1:A:32:ILE:HG22	2.18	0.44
1:A:102:ASP:O	1:A:106:VAL:HG23	2.18	0.44
1:A:157:GLU:O	1:A:161:ARG:HG3	2.18	0.43
1:A:202:MET:HB3	1:A:271:LEU:HD13	2.00	0.43
1:A:14:GLU:HA	1:A:17:LYS:HB2	1.99	0.43
1:B:160:LEU:O	1:B:161:ARG:C	2.60	0.43
1:B:195:THR:O	1:B:199:ILE:HG13	2.18	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:176:GLN:HG3	1:B:186:GLY:HA3	2.01	0.43
1:A:116:ALA:O	1:A:119:THR:HB	2.19	0.43
1:B:27:PHE:CD2	1:B:115:SER:HB3	2.53	0.43
1:B:235:ALA:HB2	1:B:258:MET:HE3	1.99	0.43
1:A:108:ALA:O	1:A:112:VAL:N	2.46	0.43
1:A:229:SER:HB3	1:A:232:LEU:HB3	1.99	0.43
1:A:230:PHE:CE2	1:A:267:CYS:HB3	2.54	0.43
1:B:13:LEU:C	1:B:15:LYS:N	2.75	0.43
1:B:119:THR:O	1:B:120:VAL:C	2.62	0.43
1:A:209:PHE:CZ	1:A:255:MET:HE1	2.53	0.43
1:A:279:ILE:O	1:A:280:ILE:C	2.60	0.43
1:B:78:LEU:HD23	1:B:78:LEU:HA	1.85	0.43
1:B:103:LYS:C	1:B:105:ALA:N	2.77	0.43
1:B:186:GLY:O	1:B:187:GLU:C	2.61	0.43
1:A:158:GLU:O	1:A:159:TYR:C	2.61	0.43
1:A:103:LYS:NZ	1:B:81:ASP:OD1	2.49	0.43
1:A:209:PHE:O	1:A:212:MET:HG2	2.19	0.43
1:B:47:LEU:O	1:B:48:SER:C	2.61	0.43
1:A:229:SER:HB3	1:A:232:LEU:HB2	2.01	0.42
1:B:13:LEU:C	1:B:15:LYS:H	2.27	0.42
1:B:111:LEU:O	1:B:114:VAL:HB	2.18	0.42
1:A:19:ARG:O	1:A:23:ILE:CG2	2.66	0.42
1:A:21:GLU:HG3	1:A:33:MET:CE	2.48	0.42
1:B:212:MET:HE1	1:B:255:MET:HE1	2.01	0.42
1:A:38:LEU:O	1:A:39:TYR:O	2.38	0.42
1:B:21:GLU:OE2	1:B:21:GLU:C	2.62	0.42
1:B:287:ASP:O	1:B:288:PHE:C	2.62	0.42
1:B:170:LEU:HA	1:B:170:LEU:HD12	1.82	0.42
1:B:73:VAL:HG11	1:B:136:ILE:HD12	2.01	0.42
1:B:113:LEU:HG	1:B:117:PHE:HE1	1.84	0.42
1:B:213:GLU:OE2	1:B:213:GLU:HA	2.19	0.42
1:A:52:PHE:CD2	1:A:178:PRO:HG3	2.54	0.42
1:A:276:LYS:O	1:A:279:ILE:N	2.53	0.42
1:B:180:LEU:O	1:B:183:GLY:N	2.49	0.42
1:A:241:GLU:HG3	1:A:242:ALA:N	2.34	0.42
1:B:48:SER:O	1:B:52:PHE:HD2	2.03	0.42
1:B:78:LEU:C	1:B:80:HIS:N	2.77	0.42
1:A:21:GLU:O	1:A:25:SER:HB3	2.19	0.42
1:A:82:ASP:O	1:A:84:ILE:N	2.53	0.42
1:A:125:ASN:OD1	1:A:125:ASN:C	2.63	0.42
1:B:123:ILE:O	1:B:123:ILE:HG22	2.19	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:172:GLY:HA3	1:B:190:TYR:CD1	2.55	0.42
1:B:200:TYR:O	1:B:203:PHE:HB3	2.20	0.41
1:B:227:VAL:C	1:B:229:SER:H	2.28	0.41
1:B:75:LEU:O	1:B:78:LEU:HB2	2.20	0.41
1:B:192:LEU:CD1	1:B:282:ASN:ND2	2.83	0.41
1:B:80:HIS:C	1:B:82:ASP:H	2.28	0.41
1:B:110:ASP:C	1:B:112:VAL:N	2.76	0.41
1:B:209:PHE:C	1:B:211:GLY:H	2.28	0.41
1:A:160:LEU:O	1:A:161:ARG:C	2.63	0.41
1:A:227:VAL:HG13	1:A:232:LEU:HD23	2.01	0.41
1:A:239:PHE:CD1	1:A:239:PHE:N	2.89	0.41
1:A:265:LYS:O	1:A:269:GLU:HG2	2.20	0.41
1:A:113:LEU:O	1:A:116:ALA:HB3	2.20	0.41
1:A:176:GLN:O	1:A:179:ALA:HB3	2.20	0.41
1:A:191:ASN:O	1:A:194:VAL:HB	2.20	0.41
1:B:215:ILE:HG22	1:B:216:GLY:N	2.35	0.41
1:A:114:VAL:O	1:A:114:VAL:HG12	2.21	0.41
1:B:97:ASN:CA	1:B:105:ALA:HB2	2.49	0.41
1:B:286:ARG:O	1:B:288:PHE:N	2.54	0.41
1:B:38:LEU:HA	1:B:38:LEU:HD23	1.87	0.41
1:B:229:SER:O	1:B:233:VAL:HG13	2.21	0.41
1:B:249:ARG:NE	1:B:251:TRP:HH2	2.19	0.40
1:A:69:ALA:HA	1:A:72:LEU:HD12	2.02	0.40
1:A:70:LEU:C	1:A:72:LEU:N	2.78	0.40
1:A:176:GLN:NE2	1:A:190:TYR:HB2	2.35	0.40
1:A:55:ARG:NE	1:A:179:ALA:HA	2.36	0.40
1:A:146:GLU:OE2	1:A:225:ASN:HB3	2.22	0.40
1:B:88:ARG:HG3	1:B:98:PHE:CD2	2.56	0.40
1:B:110:ASP:O	1:B:111:LEU:C	2.62	0.40
1:B:151:TYR:C	1:B:152:LYS:HD2	2.45	0.40
1:A:175:LEU:O	1:A:178:PRO:HD2	2.21	0.40
1:A:283:SER:HA	1:A:286:ARG:NH2	2.35	0.40
1:B:180:LEU:C	1:B:182:GLU:N	2.80	0.40
1:B:275:VAL:O	1:B:278:VAL:HB	2.21	0.40
1:A:144:LEU:O	1:A:148:LEU:HG	2.22	0.40
1:B:57:VAL:CG1	1:B:58:GLU:N	2.85	0.40

All (2) 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:A:476:HOH:O	2:A:476:HOH:O[7_556]	0.98	1.22
2:A:409:HOH:O	2:A:410:HOH:O[2_555]	1.99	0.21

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	278/299 (93%)	228 (82%)	41 (15%)	9 (3%)	3	19
1	B	278/299 (93%)	231 (83%)	34 (12%)	13 (5%)	2	12
All	All	556/598 (93%)	459 (83%)	75 (14%)	22 (4%)	2	15

All (22) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	39	TYR
1	A	61	GLU
1	B	38	LEU
1	B	187	GLU
1	B	238	LYS
1	A	125	ASN
1	B	61	GLU
1	B	221	LEU
1	A	59	ILE
1	A	150	ARG
1	A	280	ILE
1	B	121	GLU
1	B	81	ASP
1	B	95	THR
1	B	150	ARG
1	B	283	SER
1	A	38	LEU
1	A	221	LEU
1	B	91	ARG

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Mol	Chain	Res	Type
1	B	210	ALA
1	B	287	ASP
1	A	112	VAL

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	237/255 (93%)	220 (93%)	17 (7%)	13	40
1	B	237/255 (93%)	221 (93%)	16 (7%)	14	42
All	All	474/510 (93%)	441 (93%)	33 (7%)	14	41

All (33) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	11	TYR
1	A	23	ILE
1	A	26	GLN
1	A	28	PHE
1	A	30	GLU
1	A	39	TYR
1	A	50	LEU
1	A	66	SER
1	A	70	LEU
1	A	75	LEU
1	A	81	ASP
1	A	157	GLU
1	A	182	GLU
1	A	204	ASP
1	A	218	ASP
1	A	237	GLU
1	A	241	GLU
1	B	30	GLU
1	B	31	GLN
1	B	34	LYS

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Mol	Chain	Res	Type
1	B	49	ILE
1	B	62	ASP
1	B	65	SER
1	B	83	VAL
1	B	110	ASP
1	B	122	GLU
1	B	136	ILE
1	B	184	GLU
1	B	188	ASP
1	B	204	ASP
1	B	229	SER
1	B	233	VAL
1	B	278	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (16) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	31	GLN
1	A	54	ASN
1	A	80	HIS
1	A	147	GLN
1	A	176	GLN
1	A	191	ASN
1	A	225	ASN
1	A	282	ASN
1	B	31	GLN
1	B	74	HIS
1	B	80	HIS
1	B	147	GLN
1	B	191	ASN
1	B	225	ASN
1	B	248	ASN
1	B	282	ASN

5.3.3 RNA ⓘ

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](#)

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

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	280/299 (93%)	0.43	13 (4%) 37 25	41, 67, 94, 106	0
1	B	280/299 (93%)	0.26	10 (3%) 46 31	27, 62, 88, 106	0
All	All	560/598 (93%)	0.34	23 (4%) 41 27	27, 64, 91, 106	0

All (23) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	106	VAL	3.2
1	A	166	LYS	3.1
1	A	67	LEU	3.1
1	B	123	ILE	3.1
1	B	153	PRO	3.1
1	B	109	GLY	2.9
1	A	123	ILE	2.9
1	A	181	LEU	2.8
1	A	185	LEU	2.7
1	A	241	GLU	2.6
1	B	148	LEU	2.5
1	B	124	GLY	2.3
1	B	95	THR	2.3
1	A	242	ALA	2.3
1	A	246	PHE	2.2
1	A	11	TYR	2.2
1	A	122	GLU	2.2
1	A	225	ASN	2.2
1	B	128	ALA	2.1
1	A	84	ILE	2.0
1	B	80	HIS	2.0
1	B	242	ALA	2.0
1	A	150	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](#)

There are no ligands in this entry.

6.5 Other polymers [i](#)

There are no such residues in this entry.