



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 5, 2026 – 04:38 AM UTC

PDB ID : 1IV1 / pdb_00001iv1
Title : Structure of 2C-Methyl-D-erythritol-2,4-cyclodiphosphate Synthase
Authors : Kishida, H.; Wada, T.; Unzai, S.; Kuzuyama, T.; Terada, T.; Sirouzu, M.; Yokoyama, S.; Tame, J.R.H.; Park, S.-Y.; RIKEN Structural Genomics/Proteomics Initiative (RSGI)
Deposited on : 2002-03-11
Resolution : 1.65 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)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

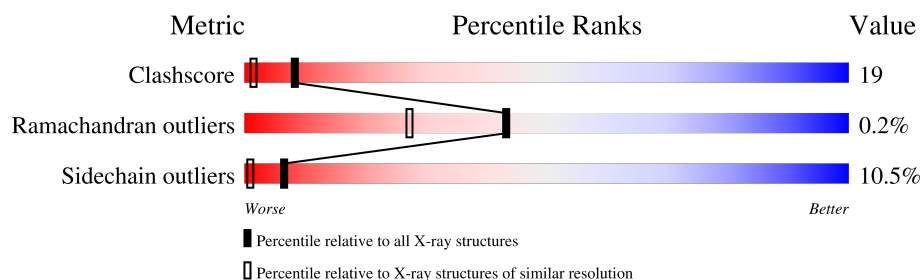
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.65 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))
Clashscore	190562	2662 (1.66-1.66)
Ramachandran outliers	187476	2621 (1.66-1.66)
Sidechain outliers	187428	2621 (1.66-1.66)

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 $\leq 5\%$.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	152	70% 23% 5% .
1	B	152	71% 24% . .
1	C	152	72% 22% . .
1	D	152	53% 35% 9% . .
1	E	152	47% 41% 11% .
1	F	152	54% 33% 12% .

2 Entry composition

There are 2 unique types of molecules in this entry. The entry contains 7264 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 2-C-methyl-D-erythritol 2,4-cyclodiphosphate synthase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	150	Total	C	N	O	S	0	0	0
			1152	729	213	209	1			
1	C	150	Total	C	N	O	S	0	0	0
			1152	729	213	209	1			
1	D	150	Total	C	N	O	S	0	0	0
			1152	729	213	209	1			
1	B	150	Total	C	N	O	S	0	0	0
			1152	729	213	209	1			
1	E	150	Total	C	N	O	S	0	0	0
			1152	729	213	209	1			
1	F	150	Total	C	N	O	S	0	0	0
			1152	729	213	209	1			

- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	72	Total	O	0	0
			72	72		
2	C	82	Total	O	0	0
			82	82		
2	D	36	Total	O	0	0
			36	36		
2	B	73	Total	O	0	0
			73	73		
2	E	31	Total	O	0	0
			31	31		
2	F	58	Total	O	0	0
			58	58		

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. 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. 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.

Note EDS was not executed.

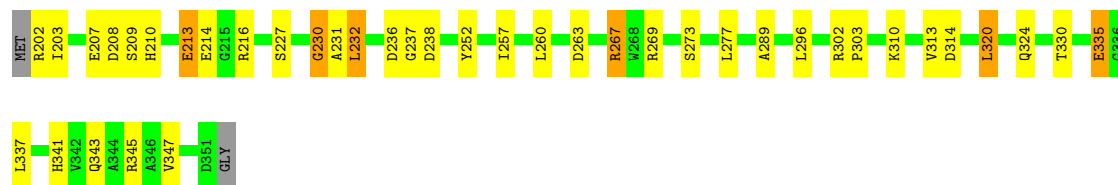
• Molecule 1: 2-C-methyl-D-erythritol 2,4-cyclodiphosphate synthase

Chain A: 



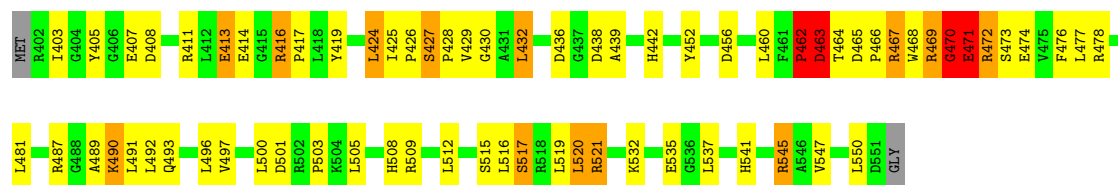
• Molecule 1: 2-C-methyl-D-erythritol 2,4-cyclodiphosphate synthase

Chain C: 



• Molecule 1: 2-C-methyl-D-erythritol 2,4-cyclodiphosphate synthase

Chain D: 



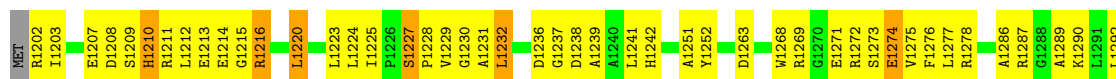
• Molecule 1: 2-C-methyl-D-erythritol 2,4-cyclodiphosphate synthase

Chain B: 

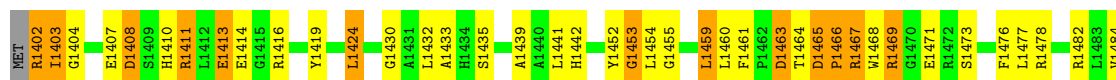




- Molecule 1: 2-C-methyl-D-erythritol 2,4-cyclodiphosphate synthase



- Molecule 1: 2-C-methyl-D-erythritol 2,4-cyclodiphosphate synthase



4 Data and refinement statistics

Xtriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	P 41 21 2	Depositor
Cell constants a, b, c, α , β , γ	105.83Å 105.83Å 148.67Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	20.00 – 1.65	Depositor
% Data completeness (in resolution range)	91.3 (20.00-1.65)	Depositor
R_{merge}	0.05	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	SHELXL-97	Depositor
R, R_{free}	0.228 , 0.314	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	7264	wwPDB-VP
Average B, all atoms (Å ²)	25.0	wwPDB-VP

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	0.44	0/1173	1.39	2/1590 (0.1%)
1	B	0.45	0/1173	1.35	2/1590 (0.1%)
1	C	0.49	0/1173	1.37	5/1590 (0.3%)
1	D	0.67	3/1173 (0.3%)	1.47	16/1590 (1.0%)
1	E	0.41	0/1173	1.39	6/1590 (0.4%)
1	F	0.47	0/1173	1.48	12/1590 (0.8%)
All	All	0.49	3/7038 (0.0%)	1.41	43/9540 (0.5%)

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	D	0	4

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	D	470	GLY	C-N	-12.24	1.16	1.33
1	D	471	GLU	C-N	7.76	1.44	1.33
1	D	463	ASP	N-CA	7.52	1.55	1.46

All (43) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	463	ASP	N-CA-CB	-12.33	91.17	110.28
1	F	1550	LEU	CA-C-N	9.35	138.52	121.70
1	F	1550	LEU	C-N-CA	9.35	138.52	121.70
1	D	462	PRO	O-C-N	-8.78	110.78	122.64
1	F	1466	PRO	CA-C-N	7.85	133.16	120.60
1	F	1466	PRO	C-N-CA	7.85	133.16	120.60
1	D	492	LEU	CA-C-O	7.29	127.47	119.24

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	1150	LEU	CA-C-N	7.09	134.46	121.70
1	B	1150	LEU	C-N-CA	7.09	134.46	121.70
1	D	470	GLY	CA-C-N	6.80	134.54	121.54
1	D	470	GLY	C-N-CA	6.80	134.54	121.54
1	E	1210	HIS	CA-CB-CG	-6.76	107.04	113.80
1	F	1465	ASP	O-C-N	6.33	127.06	121.18
1	D	416	ARG	O-C-N	6.07	126.67	121.20
1	D	427	SER	N-CA-C	6.07	113.68	108.22
1	A	65	ASP	CA-CB-CG	6.05	118.65	112.60
1	D	545	ARG	CA-C-O	-5.78	114.02	120.66
1	C	230	GLY	CA-C-N	-5.75	112.71	120.87
1	C	230	GLY	C-N-CA	-5.75	112.71	120.87
1	C	238	ASP	CA-C-N	5.52	128.00	120.54
1	C	238	ASP	C-N-CA	5.52	128.00	120.54
1	F	1551	ASP	CA-CB-CG	5.51	118.11	112.60
1	E	1286	ALA	CA-C-N	-5.46	113.94	122.73
1	E	1286	ALA	C-N-CA	-5.46	113.94	122.73
1	D	550	LEU	CA-C-N	5.44	131.49	121.70
1	D	550	LEU	C-N-CA	5.44	131.49	121.70
1	D	463	ASP	N-CA-C	-5.36	105.61	111.82
1	F	1404	GLY	O-C-N	5.26	128.46	123.56
1	E	1287	ARG	N-CA-C	-5.25	106.73	112.72
1	F	1541	HIS	CA-C-O	5.24	127.57	121.44
1	D	517	SER	CA-C-N	5.24	128.07	120.79
1	D	517	SER	C-N-CA	5.24	128.07	120.79
1	F	1408	ASP	CA-CB-CG	-5.23	107.37	112.60
1	A	81	LEU	O-C-N	5.23	127.67	122.12
1	F	1404	GLY	CA-C-O	-5.22	115.67	121.37
1	C	267	ARG	CD-NE-CZ	-5.21	117.11	124.40
1	E	1301	ASP	CA-CB-CG	-5.19	107.41	112.60
1	F	1435	SER	CA-C-N	-5.08	113.82	122.56
1	F	1435	SER	C-N-CA	-5.08	113.82	122.56
1	D	471	GLU	CA-C-N	-5.03	113.04	121.39
1	D	471	GLU	C-N-CA	-5.03	113.04	121.39
1	E	1329	LEU	CA-C-O	5.02	125.67	120.30
1	D	545	ARG	O-C-N	5.01	129.38	123.27

There are no chirality outliers.

All (4) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	D	462	PRO	Mainchain,Peptide

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Mol	Chain	Res	Type	Group
1	D	470	GLY	Mainchain,Peptide

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	1152	0	1188	35	0
1	B	1152	0	1188	40	0
1	C	1152	0	1188	39	0
1	D	1152	0	1187	58	0
1	E	1152	0	1188	69	0
1	F	1152	0	1188	60	0
2	A	72	0	0	1	0
2	B	73	0	0	5	0
2	C	82	0	0	3	0
2	D	36	0	0	3	0
2	E	31	0	0	2	0
2	F	58	0	0	4	0
All	All	7264	0	7127	270	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 19.

All (270) 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:C:207:GLU:HG2	1:C:345:ARG:HG2	1.45	0.98
1:B:1007:GLU:HG2	1:B:1145:ARG:HG2	1.44	0.97
1:F:1469:ARG:HH11	1:F:1469:ARG:HB3	1.37	0.90
1:F:1459:LEU:HG	1:F:1460:LEU:HD23	1.55	0.88
1:F:1407:GLU:HG2	1:F:1545:ARG:HG2	1.59	0.85
1:A:7:GLU:HG3	1:D:497:VAL:HG21	1.59	0.84
1:E:1310:LYS:HE2	1:E:1314:ASP:OD2	1.78	0.83
1:E:1213:GLU:HB3	1:E:1216:ARG:HG3	1.62	0.81
1:E:1300:LEU:HD11	1:E:1303:PRO:HD2	1.65	0.79
1:F:1504:LYS:HD3	2:F:303:HOH:O	1.83	0.79

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:481:LEU:HD13	1:D:521:ARG:HH21	1.48	0.78
1:B:1143:GLN:HE21	1:B:1145:ARG:HH22	1.28	0.78
1:D:416:ARG:HB2	1:D:430:GLY:H	1.48	0.78
1:B:1090:LYS:HB2	1:B:1151:ASP:HA	1.66	0.78
1:D:427:SER:HB3	1:D:503:PRO:HG3	1.68	0.76
1:B:1092:LEU:O	1:B:1126:ARG:HD2	1.86	0.75
1:B:1007:GLU:OE2	1:F:1545:ARG:HD2	1.87	0.74
1:D:407:GLU:HG2	1:D:545:ARG:HG2	1.69	0.74
1:E:1274:GLU:O	1:E:1278:ARG:HG3	1.88	0.73
1:E:1272:ARG:HG3	2:E:141:HOH:O	1.88	0.72
1:A:65:ASP:OD1	1:A:67:ARG:HB2	1.89	0.71
1:A:132:LYS:HE3	1:C:207:GLU:O	1.91	0.71
1:A:7:GLU:OE2	1:D:545:ARG:HD2	1.90	0.70
1:E:1305:LEU:HD22	1:E:1312:LEU:HD11	1.74	0.69
1:E:1263:ASP:O	1:E:1269:ARG:HD3	1.92	0.68
1:B:1027:SER:HB2	1:B:1103:PRO:HG3	1.74	0.68
1:C:213:GLU:OE1	1:C:232:LEU:HB2	1.94	0.68
1:E:1310:LYS:HG2	1:E:1314:ASP:OD2	1.95	0.67
1:F:1453:GLY:O	1:F:1454:LEU:HD23	1.93	0.67
1:D:515:SER:O	1:D:519:LEU:HD13	1.94	0.67
1:B:1143:GLN:NE2	1:B:1145:ARG:HH22	1.91	0.67
1:D:481:LEU:HD13	1:D:521:ARG:NH2	2.08	0.67
1:E:1214:GLU:OE2	1:E:1228:PRO:HB2	1.94	0.67
1:F:1441:LEU:HD22	1:F:1477:LEU:HD22	1.76	0.66
1:A:3:ILE:H	1:D:493:GLN:NE2	1.93	0.66
1:A:27:SER:HB2	1:A:103:PRO:HG3	1.77	0.66
1:A:13:GLU:OE1	1:A:32:LEU:HD22	1.95	0.65
1:A:5:TYR:OH	1:A:145:ARG:HG2	1.97	0.65
1:B:1135:GLU:HG3	1:E:1209:SER:O	1.97	0.65
1:E:1316:LEU:O	1:E:1320:LEU:HB2	1.97	0.65
1:E:1305:LEU:HD13	1:E:1312:LEU:HD13	1.77	0.65
1:E:1220:LEU:HD13	1:E:1305:LEU:HD11	1.80	0.64
1:C:267:ARG:HG3	2:C:382:HOH:O	1.97	0.64
1:D:478:ARG:NH2	1:D:519:LEU:HA	2.12	0.63
1:F:1543:GLN:HE21	1:F:1545:ARG:HH22	1.44	0.63
1:D:452:TYR:OH	1:D:489:ALA:HB2	1.98	0.63
1:B:1136:GLY:HA3	1:E:1211:ARG:HH21	1.63	0.63
1:D:465:ASP:OD1	1:D:467:ARG:HD3	1.99	0.63
1:B:1013:GLU:OE1	1:B:1032:LEU:HD13	1.98	0.63
1:F:1543:GLN:NE2	1:F:1545:ARG:HH22	1.96	0.62
1:D:465:ASP:HB3	1:D:468:TRP:CD1	2.34	0.62

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:252:TYR:OH	1:C:289:ALA:HB2	2.00	0.62
1:A:88:GLY:O	1:A:90:LYS:HE2	2.00	0.62
1:F:1452:TYR:CE1	1:F:1489:ALA:HB2	2.35	0.61
1:B:1143:GLN:HE21	1:B:1145:ARG:NH2	1.97	0.61
1:F:1531:PHE:O	1:F:1532:LYS:HD2	2.00	0.61
1:E:1304:LYS:O	1:E:1307:PRO:HD2	2.01	0.61
1:B:1145:ARG:HD2	1:E:1207:GLU:OE2	2.00	0.60
1:E:1223:LEU:HD11	1:E:1315:SER:OG	2.01	0.60
1:C:252:TYR:CZ	1:C:289:ALA:HB2	2.36	0.59
1:E:1300:LEU:HD12	1:E:1302:ARG:O	2.03	0.59
1:D:419:TYR:CE1	1:D:424:LEU:HD23	2.37	0.59
1:D:413:GLU:OE1	1:D:432:LEU:HD13	2.03	0.59
1:F:1500:LEU:HD21	1:F:1505:LEU:HD11	1.85	0.59
1:F:1452:TYR:HE1	1:F:1489:ALA:HB2	1.68	0.58
1:D:470:GLY:O	1:D:471:GLU:O	2.21	0.58
1:D:414:GLU:HA	1:D:428:PRO:O	2.04	0.57
1:F:1463:ASP:O	1:F:1469:ARG:HD3	2.04	0.57
1:F:1466:PRO:HA	1:F:1469:ARG:NH2	2.19	0.57
1:F:1490:LYS:O	1:F:1490:LYS:HG3	2.03	0.57
1:E:1225:ILE:HD11	1:E:1312:LEU:HD21	1.86	0.57
1:F:1416:ARG:HG2	1:F:1416:ARG:HH11	1.69	0.56
1:A:3:ILE:H	1:D:493:GLN:HE22	1.51	0.56
1:D:452:TYR:CZ	1:D:489:ALA:HB2	2.40	0.56
1:E:1214:GLU:HG3	1:E:1215:GLY:N	2.19	0.56
1:F:1496:LEU:HD21	1:F:1529:LEU:HD13	1.87	0.56
1:B:1031:ALA:CB	1:B:1037:GLY:HA3	2.36	0.55
1:A:79:GLU:OE1	1:A:79:GLU:HA	2.06	0.55
1:B:1011:ARG:HG3	1:B:1011:ARG:HH11	1.72	0.54
1:B:1116:LEU:O	1:B:1120:LEU:HB2	2.06	0.54
1:D:436:ASP:OD2	1:D:438:ASP:HB2	2.07	0.54
1:C:277:LEU:HD21	1:C:320:LEU:CD1	2.38	0.54
1:C:330:THR:HG22	1:D:456:ASP:HB3	1.89	0.54
1:D:508:HIS:O	1:D:512:LEU:HG	2.08	0.54
1:E:1293:GLN:HE22	1:F:1402:ARG:HG2	1.73	0.54
1:A:93:GLN:NE2	1:C:203:ILE:H	2.06	0.53
1:D:474:GLU:O	1:D:478:ARG:HG3	2.07	0.53
1:D:432:LEU:O	1:D:432:LEU:HD23	2.09	0.53
1:F:1455:GLY:HA3	1:F:1459:LEU:HD23	1.90	0.53
1:E:1231:ALA:HB1	1:E:1237:GLY:HA3	1.91	0.52
1:A:143:GLN:NE2	1:A:145:ARG:HH22	2.08	0.52
1:E:1293:GLN:HE22	1:F:1402:ARG:CG	2.22	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:343:GLN:NE2	1:C:345:ARG:HH22	2.08	0.51
1:E:1210:HIS:HE1	1:E:1242:HIS:ND1	2.08	0.51
1:A:74:GLU:O	1:A:78:ARG:HG2	2.10	0.51
1:E:1208:ASP:OD2	1:E:1242:HIS:HB2	2.10	0.51
1:D:473:SER:HA	1:D:476:PHE:CD2	2.45	0.51
1:A:141:HIS:HE1	1:D:535:GLU:O	1.94	0.51
1:E:1213:GLU:O	1:E:1229:VAL:HA	2.11	0.51
1:F:1469:ARG:HH11	1:F:1469:ARG:CB	2.17	0.51
1:D:509:ARG:HD3	2:D:94:HOH:O	2.10	0.51
1:D:501:ASP:HB3	2:D:112:HOH:O	2.11	0.50
1:B:1141:HIS:HE1	1:F:1535:GLU:O	1.94	0.50
1:B:1090:LYS:CB	1:B:1151:ASP:HA	2.39	0.50
1:E:1227:SER:OG	1:E:1303:PRO:HD3	2.12	0.50
1:F:1482:ARG:HD2	2:F:251:HOH:O	2.11	0.50
1:A:135:GLU:O	1:C:341:HIS:HE1	1.94	0.50
1:A:77:LEU:HD21	1:A:120:LEU:CD1	2.41	0.50
1:A:124:GLN:HB3	2:A:211:HOH:O	2.10	0.50
1:E:1305:LEU:HD12	1:E:1331:PHE:CD1	2.47	0.50
1:F:1414:GLU:N	1:F:1414:GLU:OE2	2.44	0.50
1:E:1220:LEU:CD1	1:E:1305:LEU:HD11	2.40	0.50
1:D:463:ASP:O	1:D:465:ASP:O	2.30	0.50
1:D:417:PRO:HB2	1:D:419:TYR:CE2	2.47	0.49
1:E:1202:ARG:HD3	1:E:1251:ALA:O	2.12	0.49
1:A:31:ALA:CB	1:A:37:GLY:HA3	2.42	0.49
1:C:267:ARG:NH1	2:C:428:HOH:O	2.43	0.49
1:F:1500:LEU:HD21	1:F:1505:LEU:CD1	2.43	0.49
1:D:405:TYR:HD1	1:D:547:VAL:HG22	1.77	0.49
1:E:1236:ASP:OD2	1:E:1273:SER:OG	2.30	0.49
1:F:1411:ARG:NH1	1:F:1540:SER:OG	2.46	0.49
1:E:1208:ASP:OD2	1:E:1239:ALA:HA	2.13	0.49
1:E:1216:ARG:HG2	1:E:1216:ARG:HH11	1.76	0.49
1:E:1350:LEU:O	1:E:1351:ASP:O	2.30	0.49
1:F:1465:ASP:C	1:F:1469:ARG:HH12	2.20	0.49
1:D:413:GLU:O	1:D:429:VAL:HA	2.12	0.48
1:D:452:TYR:CE1	1:D:489:ALA:HB2	2.48	0.48
1:D:419:TYR:CZ	1:D:424:LEU:HD23	2.48	0.48
1:B:1003:ILE:HD13	1:F:1547:VAL:HG11	1.95	0.48
1:E:1216:ARG:HE	1:E:1232:LEU:HD12	1.78	0.48
1:E:1335:GLU:O	1:F:1541:HIS:HE1	1.96	0.48
1:C:335:GLU:O	1:D:541:HIS:HE1	1.97	0.48
1:B:1136:GLY:HA3	1:E:1211:ARG:NH2	2.27	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:E:1213:GLU:OE1	1:E:1232:LEU:HD13	2.13	0.48
1:E:1293:GLN:HB2	1:E:1326:ARG:HH11	1.79	0.48
1:E:1305:LEU:HD13	1:E:1312:LEU:CD1	2.42	0.48
1:D:491:LEU:HD21	1:D:520:LEU:HG	1.96	0.47
1:E:1302:ARG:O	1:E:1302:ARG:HG2	2.07	0.47
1:A:135:GLU:OE1	1:C:210:HIS:ND1	2.47	0.47
1:C:267:ARG:HG2	1:B:1087:ARG:NH2	2.30	0.47
1:E:1297:VAL:HG22	1:E:1330:THR:OG1	2.15	0.47
1:B:1019:TYR:HA	1:B:1023:LEU:O	2.14	0.47
1:B:1097:VAL:HG22	1:B:1130:THR:OG1	2.15	0.47
1:B:1132:LYS:HE3	2:B:179:HOH:O	2.14	0.47
1:F:1516:LEU:O	1:F:1520:LEU:HB2	2.14	0.47
1:E:1317:SER:OG	1:E:1322:LEU:O	2.25	0.47
1:F:1491:LEU:CD2	1:F:1520:LEU:HG	2.45	0.47
1:B:1020:LEU:HD21	2:B:352:HOH:O	2.14	0.47
1:F:1465:ASP:OD1	1:F:1467:ARG:NE	2.48	0.47
1:C:252:TYR:CE1	1:C:289:ALA:HB2	2.50	0.47
1:B:1031:ALA:HB1	1:B:1037:GLY:HA3	1.97	0.46
1:F:1478:ARG:HH11	1:F:1478:ARG:HG2	1.80	0.46
1:F:1484:VAL:O	1:F:1487:ARG:HB2	2.15	0.46
1:B:1132:LYS:HD2	1:B:1132:LYS:HA	1.62	0.46
1:E:1293:GLN:NE2	1:F:1403:ILE:H	2.14	0.46
1:E:1263:ASP:HB2	1:E:1269:ARG:HG3	1.98	0.46
1:A:74:GLU:OE2	1:A:78:ARG:NH2	2.49	0.46
1:B:1074:GLU:OE2	1:B:1078:ARG:NE	2.49	0.46
1:F:1491:LEU:HD21	1:F:1520:LEU:HG	1.97	0.46
1:C:296:LEU:N	1:C:296:LEU:HD23	2.31	0.46
1:E:1231:ALA:CB	1:E:1237:GLY:HA3	2.46	0.46
1:E:1212:LEU:HD13	1:E:1229:VAL:HG21	1.98	0.46
1:C:208:ASP:OD2	1:C:210:HIS:NE2	2.49	0.45
1:D:467:ARG:O	1:D:467:ARG:HG2	2.16	0.45
1:B:1131:PHE:O	1:B:1132:LYS:HD2	2.16	0.45
1:F:1464:THR:O	1:F:1469:ARG:NH2	2.49	0.45
1:A:143:GLN:HE21	1:A:145:ARG:HH22	1.64	0.45
1:D:413:GLU:HB3	1:D:416:ARG:HG3	1.98	0.45
1:D:462:PRO:O	1:D:464:THR:N	2.49	0.45
1:E:1252:TYR:CE1	1:E:1289:ALA:HB2	2.51	0.45
1:F:1463:ASP:OD1	1:F:1463:ASP:N	2.50	0.45
1:D:408:ASP:OD2	1:D:442:HIS:HB2	2.16	0.45
1:F:1432:LEU:O	1:F:1433:ALA:HB2	2.16	0.45
1:C:313:VAL:HG12	1:C:324:GLN:NE2	2.32	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:19:TYR:HA	1:A:23:LEU:O	2.16	0.45
1:C:269:ARG:HH11	1:C:269:ARG:HB3	1.81	0.45
1:F:1487:ARG:HG2	1:F:1487:ARG:HH11	1.81	0.45
1:C:232:LEU:HA	2:C:425:HOH:O	2.18	0.44
1:D:500:LEU:HD21	1:D:505:LEU:CD1	2.46	0.44
1:C:213:GLU:OE2	1:C:232:LEU:HD13	2.17	0.44
1:C:227:SER:HB2	1:C:303:PRO:HG3	1.99	0.44
1:B:1062:PRO:HA	2:B:287:HOH:O	2.18	0.44
1:E:1271:GLU:HB3	1:E:1275:VAL:HG21	1.98	0.44
1:E:1278:ARG:NH1	2:E:187:HOH:O	2.50	0.44
1:E:1299:THR:HB	1:E:1343:GLN:HB2	2.00	0.44
1:D:472:ARG:NH1	2:D:96:HOH:O	2.49	0.44
1:E:1238:ASP:OD1	1:E:1241:LEU:HG	2.17	0.44
1:D:427:SER:HB3	1:D:503:PRO:CG	2.44	0.44
1:D:477:LEU:HD21	1:D:520:LEU:HD13	1.99	0.44
1:F:1461:PHE:CE2	1:F:1476:PHE:HB3	2.52	0.44
1:A:36:ASP:OD2	1:A:73:SER:OG	2.30	0.44
1:D:425:ILE:HA	1:D:426:PRO:HD3	1.84	0.44
1:B:1003:ILE:CD1	1:F:1547:VAL:HG11	2.48	0.44
1:F:1410:HIS:HE1	1:F:1439:ALA:HA	1.83	0.44
1:F:1534:SER:O	1:F:1535:GLU:HB2	2.17	0.44
1:C:314:ASP:OD1	1:C:324:GLN:NE2	2.50	0.44
1:E:1320:LEU:O	1:E:1321:ARG:NE	2.51	0.44
1:F:1465:ASP:O	1:F:1469:ARG:NH1	2.50	0.44
1:E:1216:ARG:HD2	1:E:1232:LEU:HB2	1.99	0.44
1:A:16:ARG:NH1	1:A:31:ALA:O	2.51	0.44
1:E:1317:SER:OG	1:E:1324:GLN:NE2	2.38	0.43
1:F:1487:ARG:HD3	1:F:1487:ARG:HA	1.82	0.43
1:C:310:LYS:NZ	1:C:314:ASP:OD2	2.51	0.43
1:B:1010:HIS:HD2	1:F:1535:GLU:OE2	2.02	0.43
1:C:202:ARG:HD2	1:C:252:TYR:CE1	2.53	0.43
1:B:1027:SER:HB2	1:B:1103:PRO:CG	2.45	0.43
1:E:1295:SER:HA	1:E:1328:GLY:O	2.19	0.43
1:D:496:LEU:HD23	1:D:496:LEU:H	1.83	0.43
1:A:7:GLU:HG3	1:D:497:VAL:CG2	2.40	0.43
1:D:490:LYS:HE3	1:D:490:LYS:HB2	1.74	0.43
1:E:1301:ASP:N	1:E:1301:ASP:OD1	2.50	0.43
1:F:1461:PHE:CD2	1:F:1476:PHE:HB3	2.54	0.43
1:C:216:ARG:O	1:C:230:GLY:HA3	2.18	0.43
1:B:1079:GLU:O	1:B:1083:LEU:HG	2.19	0.43
1:E:1277:LEU:HD21	1:E:1320:LEU:CD1	2.49	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:496:LEU:HD23	1:D:496:LEU:N	2.34	0.42
1:B:1141:HIS:HD2	2:B:146:HOH:O	2.02	0.42
1:E:1351:ASP:OD1	1:E:1351:ASP:N	2.52	0.42
1:A:74:GLU:OE2	1:A:119:LEU:HG	2.18	0.42
1:C:257:ILE:HD13	1:C:257:ILE:HG21	1.88	0.42
1:A:67:ARG:HG2	1:A:67:ARG:HH11	1.83	0.42
1:B:1097:VAL:HG21	1:E:1207:GLU:HG3	2.01	0.42
1:F:1514:ASP:HA	1:F:1524:GLN:HE22	1.84	0.42
1:B:1040:ALA:HB2	1:B:1098:LEU:HD21	2.01	0.42
1:F:1419:TYR:CE1	1:F:1424:LEU:HG	2.54	0.42
1:F:1465:ASP:HB3	1:F:1468:TRP:HD1	1.84	0.42
1:D:516:LEU:O	1:D:520:LEU:HB2	2.19	0.42
1:E:1331:PHE:O	1:E:1332:LYS:HD2	2.19	0.42
1:C:260:LEU:HD22	1:B:1067:ARG:HH21	1.85	0.42
1:E:1216:ARG:HG2	1:E:1216:ARG:NH1	2.33	0.42
1:F:1478:ARG:HG2	1:F:1478:ARG:NH1	2.34	0.42
1:A:83:LEU:O	1:A:87:ARG:HD2	2.19	0.42
1:C:202:ARG:HD2	1:C:252:TYR:CZ	2.54	0.42
1:C:260:LEU:HD22	1:B:1067:ARG:NH2	2.35	0.42
1:B:1104:LYS:HD2	1:B:1104:LYS:HA	1.85	0.42
1:F:1452:TYR:CE2	1:F:1487:ARG:HB3	2.55	0.42
1:F:1413:GLU:N	1:F:1430:GLY:O	2.50	0.41
1:C:337:LEU:HD12	1:C:337:LEU:O	2.20	0.41
1:A:61:PHE:N	1:A:62:PRO:HD3	2.36	0.41
1:E:1319:LEU:HD12	1:E:1319:LEU:HA	1.90	0.41
1:C:231:ALA:HB3	1:C:237:GLY:HA3	2.02	0.41
1:C:347:VAL:HG11	1:D:403:ILE:CD1	2.51	0.41
1:E:1211:ARG:NH1	1:E:1211:ARG:HG3	2.35	0.41
1:E:1293:GLN:NE2	1:E:1326:ARG:HH11	2.18	0.41
1:C:213:GLU:OE1	1:C:232:LEU:HD13	2.20	0.41
1:F:1473:SER:HB3	2:F:118:HOH:O	2.20	0.41
1:F:1549:LEU:HG	2:F:289:HOH:O	2.20	0.41
1:C:236:ASP:OD2	1:C:273:SER:OG	2.37	0.41
1:C:296:LEU:HD23	1:C:296:LEU:H	1.85	0.41
1:D:408:ASP:OD2	1:D:439:ALA:HA	2.21	0.41
1:F:1468:TRP:O	1:F:1471:GLU:HG2	2.20	0.41
1:A:102:ARG:HB2	1:A:103:PRO:HA	2.03	0.41
1:D:478:ARG:HH22	1:D:519:LEU:HA	1.82	0.41
1:F:1487:ARG:HG2	1:F:1487:ARG:NH1	2.36	0.41
1:D:466:PRO:HA	1:D:469:ARG:HH21	1.86	0.41
1:D:532:LYS:HE3	1:D:532:LYS:HB3	1.84	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:537:LEU:HD12	1:D:537:LEU:HA	1.88	0.41
1:B:1118:ARG:HD3	2:B:328:HOH:O	2.20	0.41
1:A:85:GLU:OE2	1:A:121:ARG:NH2	2.49	0.40
1:C:267:ARG:NH1	1:C:267:ARG:HB2	2.36	0.40
1:D:481:LEU:HD23	1:D:481:LEU:HA	1.93	0.40
1:F:1408:ASP:OD2	1:F:1442:HIS:ND1	2.55	0.40
1:A:14:GLU:OE1	1:A:102:ARG:NH2	2.50	0.40
1:E:1229:VAL:HG21	1:E:1302:ARG:HD3	2.03	0.40
1:E:1268:TRP:HB3	1:E:1276:PHE:CE1	2.57	0.40
1:A:3:ILE:HD11	1:C:203:ILE:CD1	2.52	0.40
1:A:19:TYR:CE1	1:A:24:LEU:HD23	2.56	0.40
1:D:413:GLU:O	1:D:416:ARG:HB2	2.21	0.40
1:E:1216:ARG:C	1:E:1230:GLY:HA3	2.46	0.40
1:E:1293:GLN:NE2	1:E:1326:ARG:NH1	2.69	0.40

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	148/152 (97%)	146 (99%)	2 (1%)	0	100	100
1	B	148/152 (97%)	145 (98%)	3 (2%)	0	100	100
1	C	148/152 (97%)	146 (99%)	2 (1%)	0	100	100
1	D	148/152 (97%)	139 (94%)	8 (5%)	1 (1%)	18	6
1	E	148/152 (97%)	140 (95%)	8 (5%)	0	100	100
1	F	148/152 (97%)	139 (94%)	8 (5%)	1 (1%)	18	6
All	All	888/912 (97%)	855 (96%)	31 (4%)	2 (0%)	43	27

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	D	471	GLU
1	F	1453	GLY

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	121/122 (99%)	112 (93%)	9 (7%)	13	2
1	B	121/122 (99%)	113 (93%)	8 (7%)	15	2
1	C	121/122 (99%)	113 (93%)	8 (7%)	15	2
1	D	121/122 (99%)	106 (88%)	15 (12%)	4	1
1	E	121/122 (99%)	101 (84%)	20 (16%)	2	0
1	F	121/122 (99%)	105 (87%)	16 (13%)	4	0
All	All	726/732 (99%)	650 (90%)	76 (10%)	6	1

All (76) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	13	GLU
1	A	14	GLU
1	A	67	ARG
1	A	90	LYS
1	A	104	LYS
1	A	120	LEU
1	A	132	LYS
1	A	145	ARG
1	A	151	ASP
1	C	209	SER
1	C	213	GLU
1	C	214	GLU
1	C	232	LEU
1	C	263	ASP
1	C	302	ARG
1	C	320	LEU
1	C	335	GLU

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Mol	Chain	Res	Type
1	D	411	ARG
1	D	413	GLU
1	D	424	LEU
1	D	432	LEU
1	D	460	LEU
1	D	463	ASP
1	D	467	ARG
1	D	469	ARG
1	D	471	GLU
1	D	472	ARG
1	D	487	ARG
1	D	490	LYS
1	D	517	SER
1	D	520	LEU
1	D	521	ARG
1	B	1013	GLU
1	B	1027	SER
1	B	1032	LEU
1	B	1063	ASP
1	B	1090	LYS
1	B	1120	LEU
1	B	1132	LYS
1	B	1134	SER
1	E	1203	ILE
1	E	1216	ARG
1	E	1220	LEU
1	E	1224	LEU
1	E	1227	SER
1	E	1232	LEU
1	E	1274	GLU
1	E	1290	LYS
1	E	1292	LEU
1	E	1302	ARG
1	E	1304	LYS
1	E	1315	SER
1	E	1317	SER
1	E	1318	ARG
1	E	1319	LEU
1	E	1320	LEU
1	E	1321	ARG
1	E	1324	GLN
1	E	1335	GLU

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Mol	Chain	Res	Type
1	E	1351	ASP
1	F	1402	ARG
1	F	1403	ILE
1	F	1411	ARG
1	F	1413	GLU
1	F	1424	LEU
1	F	1459	LEU
1	F	1463	ASP
1	F	1467	ARG
1	F	1469	ARG
1	F	1490	LYS
1	F	1502	ARG
1	F	1510	LYS
1	F	1520	LEU
1	F	1521	ARG
1	F	1524	GLN
1	F	1551	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (24) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	10	HIS
1	A	93	GLN
1	A	141	HIS
1	A	143	GLN
1	C	293	GLN
1	C	308	HIS
1	C	324	GLN
1	C	341	HIS
1	C	343	GLN
1	D	410	HIS
1	D	493	GLN
1	D	541	HIS
1	D	543	GLN
1	B	1010	HIS
1	B	1093	GLN
1	B	1108	HIS
1	B	1141	HIS
1	B	1143	GLN
1	E	1210	HIS
1	E	1293	GLN
1	E	1341	HIS

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Mol	Chain	Res	Type
1	F	1493	GLN
1	F	1524	GLN
1	F	1543	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](#)

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](#)

The following chains have linkage breaks:

Mol	Chain	Number of breaks
1	D	1

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	D	470:GLY	C	471:GLU	N	1.16

6 Fit of model and data

6.1 Protein, DNA and RNA chains

EDS was not executed - this section is therefore empty.

6.2 Non-standard residues in protein, DNA, RNA chains

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates

EDS was not executed - this section is therefore empty.

6.4 Ligands

EDS was not executed - this section is therefore empty.

6.5 Other polymers

EDS was not executed - this section is therefore empty.