



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 4, 2026 – 10:09 PM UTC

PDB ID : 4DSL / pdb_00004dsl
Title : Crystal structure of fragment DNA polymerase I from *Bacillus stearothermophilus* with duplex DNA and Calcium
Authors : Gan, J.H.; Abdur, R.; Liu, H.H.; Sheng, J.; Caton-Williams, J.; Soares, A.S.; Huang, Z.
Deposited on : 2012-02-19
Resolution : 2.45 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

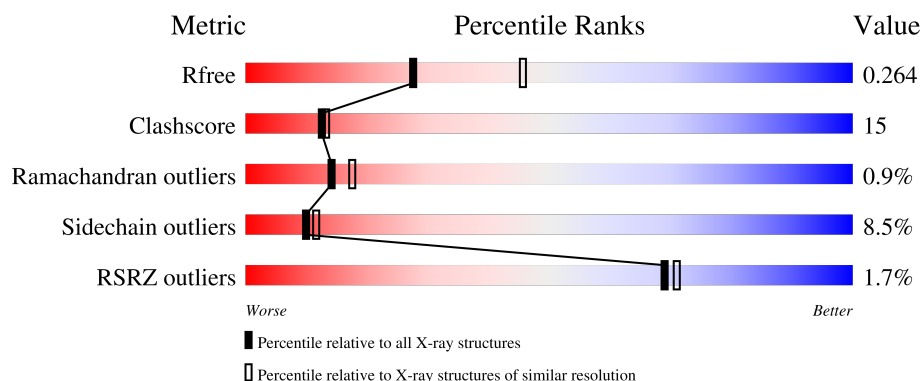
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.45 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	1190 (2.46-2.46)
Clashscore	190562	1229 (2.46-2.46)
Ramachandran outliers	187476	1218 (2.46-2.46)
Sidechain outliers	187428	1218 (2.46-2.46)
RSRZ outliers	180081	1190 (2.46-2.46)

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	579	
2	B	13	
3	C	17	

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 5213 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 DNA polymerase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	579	Total	C	N	O	S	0	0	0
			4649	2956	807	869	17			

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	598	ASP	ALA	engineered mutation	UNP D9N168
A	713	VAL	PRO	engineered mutation	UNP D9N168

- Molecule 2 is a DNA chain called DNA (5'-D(*G*GP*CP*TP*AP*CP*AP*GP*GP*AP*C P*TP*C)-3').

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	12	Total	C	N	O	P	0	0	0
			242	116	46	69	11			

- Molecule 3 is a DNA chain called DNA (5'-D(*TP*CP*AP*CP*GP*AP*GP*TP*CP*CP*TP*GP*TP*AP*GP*CP*C)-3').

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
3	C	12	Total	C	N	O	P	0	0	0
			247	117	45	73	12			

- Molecule 4 is SULFATE ION (CCD ID: SO4) (formula: O₄S).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	O	S	0	0
			5	4	1		
4	A	1	Total	O	S	0	0
			5	4	1		

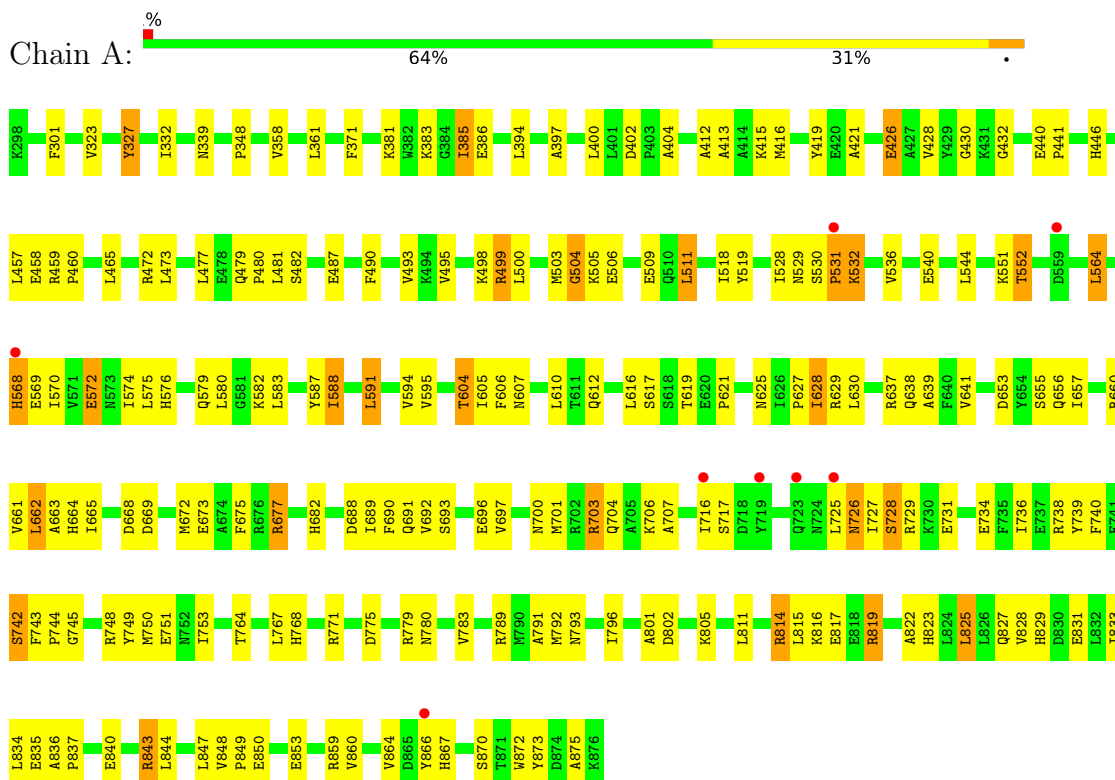
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	58	Total	O	0	0
			58	58		
5	B	2	Total	O	0	0
			2	2		
5	C	5	Total	O	0	0
			5	5		

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.

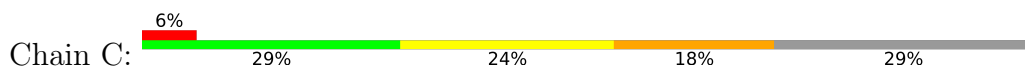
• Molecule 1: DNA polymerase

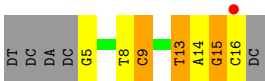


• Molecule 2: DNA (5'-D(*G*GP*CP*TP*AP*CP*AP*GP*GP*AP*CP*TP*C)-3')



• Molecule 3: DNA (5'-D(*TP*CP*AP*CP*GP*AP*GP*TP*CP*CP*TP*GP*TP*AP*GP*CP*C)-3')





4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	88.34Å 93.59Å 104.62Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	30.00 – 2.45 30.00 – 2.45	Depositor EDS
% Data completeness (in resolution range)	91.5 (30.00-2.45) 91.7 (30.00-2.45)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.11	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.98 (at 2.45Å)	Xtriage
Refinement program	REFMAC 5.5.0109	Depositor
R, R_{free}	0.222 , 0.286 (Not available) , 0.264	Depositor DCC
R_{free} test set	3037 reflections (9.28%)	wwPDB-VP
Wilson B-factor (Å ²)	32.8	Xtriage
Anisotropy	0.754	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 40.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.45$, $\langle L^2 \rangle = 0.28$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.93	EDS
Total number of atoms	5213	wwPDB-VP
Average B, all atoms (Å ²)	39.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.49% 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: SO4

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	0.97	0/4733	1.13	10/6395 (0.2%)
2	B	0.50	0/271	1.37	3/416 (0.7%)
3	C	0.59	0/276	1.36	4/424 (0.9%)
All	All	0.93	0/5280	1.16	17/7235 (0.2%)

There are no bond length outliers.

All (17) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	641	VAL	CA-C-N	-7.85	112.26	120.03
1	A	641	VAL	C-N-CA	-7.85	112.26	120.03
3	C	13	DT	P-O3'-C3'	6.98	130.66	120.20
1	A	323	VAL	CB-CA-C	-6.64	104.92	111.30
2	B	3	DC	P-O3'-C3'	6.33	129.69	120.20
1	A	385	ILE	N-CA-C	6.08	116.77	107.77
1	A	327	TYR	N-CA-C	5.98	119.84	112.54
1	A	665	ILE	CB-CA-C	-5.62	104.77	111.97
1	A	506	GLU	N-CA-C	-5.47	105.40	111.36
2	B	13	DC	O4'-C1'-N1	5.44	116.56	108.40
2	B	10	DA	O5'-C5'-C4'	-5.42	102.67	110.80
3	C	15	DG	P-O3'-C3'	5.34	128.22	120.20
3	C	8	DT	C5'-C4'-C3'	-5.18	107.13	114.90
1	A	697	VAL	N-CA-C	5.18	115.80	107.98
1	A	413	ALA	N-CA-C	-5.10	105.72	111.28
3	C	9	DC	O5'-C5'-C4'	-5.09	103.16	110.80
1	A	827	GLN	N-CA-C	-5.07	101.14	109.40

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	4649	0	4704	151	0
2	B	242	0	136	7	0
3	C	247	0	136	6	0
4	A	10	0	0	0	0
5	A	58	0	0	19	0
5	B	2	0	0	0	0
5	C	5	0	0	0	0
All	All	5213	0	4976	155	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 15.

All (155) 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:727:ILE:HB	5:A:1020:HOH:O	1.54	1.07
1:A:536:VAL:O	1:A:540:GLU:HB2	1.59	1.02
1:A:725:LEU:O	1:A:726:ASN:HB2	1.64	0.94
2:B:9:DG:H1	3:C:9:DC:H42	1.20	0.89
1:A:339:ASN:HB2	5:A:1035:HOH:O	1.73	0.89
1:A:673:GLU:OE1	1:A:677:ARG:HD2	1.74	0.88
1:A:569:GLU:HB2	5:A:1046:HOH:O	1.76	0.85
1:A:725:LEU:O	1:A:726:ASN:CB	2.32	0.77
1:A:789:ARG:HG3	1:A:789:ARG:HH11	1.53	0.73
1:A:848:VAL:HB	1:A:849:PRO:HD3	1.71	0.73
1:A:688:ASP:HA	5:A:1039:HOH:O	1.90	0.70
1:A:843:ARG:HH11	1:A:843:ARG:HB3	1.56	0.69
1:A:727:ILE:HG22	1:A:728:SER:H	1.57	0.69
1:A:866:TYR:O	1:A:867:HIS:CG	2.46	0.68
1:A:853:GLU:HG3	1:A:864:VAL:HG23	1.74	0.68
1:A:301:PHE:HA	5:A:1009:HOH:O	1.94	0.66
1:A:682:HIS:ND1	1:A:706:LYS:HA	2.11	0.66
1:A:607:ASN:ND2	1:A:617:SER:OG	2.28	0.65
1:A:572:GLU:HA	1:A:575:LEU:HD12	1.77	0.65
1:A:419:TYR:CE2	1:A:421:ALA:HB3	2.30	0.65

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:789:ARG:HG3	1:A:789:ARG:NH1	2.09	0.64
1:A:588:ILE:N	1:A:588:ILE:HD13	2.12	0.64
1:A:693:SER:H	1:A:696:GLU:HG3	1.63	0.64
1:A:472:ARG:HB2	5:A:1004:HOH:O	1.98	0.63
1:A:836:ALA:HB1	1:A:837:PRO:HD2	1.80	0.63
1:A:767:LEU:O	1:A:768:HIS:HB2	1.98	0.63
1:A:530:SER:C	1:A:532:LYS:H	2.07	0.62
1:A:628:ILE:HG22	2:B:12:DT:H5''	1.81	0.62
1:A:664:HIS:O	1:A:859:ARG:NH1	2.34	0.61
1:A:544:LEU:HD23	1:A:564:LEU:HD22	1.82	0.60
1:A:371:PHE:HD1	1:A:394:LEU:HB3	1.66	0.60
1:A:493:VAL:HG22	1:A:825:LEU:HD13	1.83	0.60
1:A:753:ILE:HG12	1:A:791:ALA:O	2.01	0.60
2:B:3:DC:H42	3:C:15:DG:H1	1.50	0.59
1:A:689:ILE:O	1:A:738:ARG:HD2	2.03	0.59
1:A:504:GLY:HA2	1:A:588:ILE:HG21	1.84	0.59
1:A:814:ARG:HE	1:A:847:LEU:HD11	1.69	0.58
1:A:383:LYS:HD3	5:A:1013:HOH:O	2.03	0.57
1:A:638:GLN:HG2	1:A:873:TYR:CG	2.39	0.57
1:A:750:MET:HG2	1:A:792:MET:SD	2.44	0.57
1:A:499:ARG:HG3	1:A:503:MET:HE2	1.87	0.57
1:A:481:LEU:CD2	1:A:805:LYS:HD3	2.35	0.56
1:A:625:ASN:CG	1:A:625:ASN:O	2.47	0.56
1:A:529:ASN:O	1:A:531:PRO:HD3	2.05	0.56
1:A:582:LYS:HG2	2:B:11:DC:H5'	1.87	0.56
1:A:745:GLY:HA2	1:A:748:ARG:CZ	2.34	0.56
1:A:815:LEU:HD22	1:A:822:ALA:HB3	1.88	0.56
1:A:745:GLY:HA2	1:A:748:ARG:NH1	2.21	0.55
1:A:616:LEU:HG	5:A:1022:HOH:O	2.06	0.55
2:B:5:DA:H61	3:C:13:DT:H3	1.53	0.54
1:A:386:GLU:HG3	5:A:1040:HOH:O	2.07	0.54
1:A:727:ILE:HG22	1:A:728:SER:N	2.21	0.54
1:A:662:LEU:O	1:A:663:ALA:C	2.46	0.54
1:A:726:ASN:O	1:A:727:ILE:HD13	2.07	0.54
1:A:653:ASP:HB3	1:A:831:GLU:HB3	1.90	0.54
1:A:693:SER:OG	1:A:696:GLU:HG2	2.07	0.54
1:A:519:TYR:CE1	1:A:528:ILE:HD11	2.42	0.54
1:A:568:HIS:ND1	5:A:1046:HOH:O	2.29	0.53
1:A:793:ASN:ND2	3:C:5:DG:H1'	2.23	0.53
1:A:690:PHE:CD2	1:A:701:MET:HE3	2.44	0.53
1:A:610:LEU:HD23	1:A:610:LEU:C	2.33	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:837:PRO:HG2	1:A:840:GLU:HG3	1.91	0.52
1:A:688:ASP:HB3	1:A:742:SER:OG	2.09	0.52
1:A:693:SER:O	1:A:696:GLU:HB2	2.09	0.52
1:A:657:ILE:O	1:A:661:VAL:HG23	2.10	0.52
1:A:397:ALA:HB1	1:A:465:LEU:HD11	1.91	0.51
1:A:583:LEU:O	1:A:587:TYR:HB2	2.11	0.50
1:A:569:GLU:CB	5:A:1046:HOH:O	2.47	0.50
1:A:692:VAL:HG21	1:A:701:MET:HE1	1.93	0.50
1:A:767:LEU:O	1:A:768:HIS:CB	2.60	0.50
1:A:853:GLU:HG3	1:A:864:VAL:CG2	2.41	0.50
1:A:700:ASN:HA	1:A:703:ARG:HE	1.75	0.50
1:A:728:SER:HB2	5:A:1007:HOH:O	2.11	0.50
1:A:426:GLU:O	1:A:430:GLY:N	2.42	0.50
1:A:739:TYR:C	1:A:739:TYR:CD2	2.90	0.49
1:A:588:ILE:N	1:A:588:ILE:CD1	2.76	0.49
1:A:700:ASN:O	1:A:704:GLN:HG2	2.12	0.49
1:A:518:ILE:HD11	1:A:574:ILE:HA	1.94	0.49
1:A:744:PRO:HB2	1:A:748:ARG:HH21	1.77	0.49
1:A:848:VAL:HB	1:A:849:PRO:CD	2.41	0.49
1:A:576:HIS:O	1:A:579:GLN:HB3	2.13	0.48
1:A:607:ASN:HB2	1:A:617:SER:HG	1.78	0.48
1:A:867:HIS:HB3	1:A:875:ALA:C	2.38	0.48
1:A:530:SER:C	1:A:532:LYS:N	2.71	0.48
1:A:381:LYS:HD3	1:A:490:PHE:CD2	2.49	0.48
1:A:569:GLU:N	5:A:1046:HOH:O	2.46	0.48
1:A:823:HIS:CE1	1:A:835:GLU:OE2	2.67	0.48
1:A:402:ASP:C	1:A:404:ALA:H	2.22	0.48
1:A:669:ASP:N	5:A:1037:HOH:O	2.46	0.48
1:A:690:PHE:C	1:A:691:GLN:HG3	2.38	0.47
1:A:691:GLN:HA	5:A:1039:HOH:O	2.13	0.47
1:A:412:ALA:N	5:A:1045:HOH:O	2.47	0.47
1:A:811:LEU:HD21	1:A:834:LEU:HD21	1.97	0.47
1:A:495:VAL:HA	1:A:639:ALA:O	2.14	0.47
1:A:552:THR:OG1	2:B:8:DG:OP1	2.30	0.47
1:A:655:SER:HB3	5:A:1049:HOH:O	2.14	0.46
1:A:692:VAL:HB	1:A:696:GLU:CB	2.45	0.46
1:A:457:LEU:O	1:A:460:PRO:HD2	2.15	0.46
1:A:637:ARG:O	1:A:872:TRP:HB3	2.16	0.46
1:A:693:SER:N	1:A:696:GLU:HG3	2.28	0.46
3:C:15:DG:H2"	3:C:16:DC:OP2	2.15	0.46
1:A:481:LEU:HD23	1:A:805:LYS:HD3	1.97	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:853:GLU:CG	1:A:864:VAL:HG23	2.43	0.46
1:A:327:TYR:CZ	1:A:605:ILE:HG12	2.51	0.46
1:A:801:ALA:O	1:A:805:LYS:HG3	2.15	0.45
1:A:669:ASP:HA	1:A:672:MET:HE3	1.97	0.45
1:A:332:ILE:O	1:A:348:PRO:HG3	2.16	0.45
1:A:428:VAL:HG11	1:A:446:HIS:CD2	2.52	0.45
1:A:481:LEU:HD12	1:A:481:LEU:O	2.16	0.45
1:A:828:VAL:O	1:A:829:HIS:HB2	2.16	0.45
1:A:428:VAL:HG21	1:A:446:HIS:CE1	2.52	0.44
1:A:833:ILE:C	1:A:834:LEU:HD12	2.43	0.43
1:A:660:ARG:NH1	1:A:675:PHE:CD2	2.86	0.43
1:A:828:VAL:O	1:A:828:VAL:HG12	2.18	0.43
1:A:606:PHE:HA	1:A:617:SER:O	2.18	0.43
1:A:479:GLN:O	1:A:482:SER:HB3	2.19	0.43
1:A:498:LYS:O	1:A:499:ARG:C	2.61	0.43
1:A:749:TYR:O	1:A:753:ILE:HG22	2.18	0.43
1:A:736:ILE:CG2	1:A:740:PHE:CE2	3.02	0.43
1:A:327:TYR:CE1	1:A:605:ILE:HG12	2.54	0.43
1:A:402:ASP:C	1:A:404:ALA:N	2.76	0.42
1:A:789:ARG:HH11	1:A:789:ARG:CG	2.26	0.42
1:A:415:LYS:O	1:A:416:MET:C	2.61	0.42
1:A:587:TYR:O	1:A:591:LEU:HD22	2.19	0.42
1:A:383:LYS:HB2	1:A:385:ILE:HD12	2.00	0.42
1:A:604:THR:OG1	1:A:621:PRO:O	2.35	0.42
1:A:358:VAL:HA	1:A:361:LEU:HD12	2.02	0.42
1:A:780:ASN:HB3	1:A:783:VAL:HB	2.00	0.42
1:A:457:LEU:C	1:A:460:PRO:HD2	2.44	0.42
1:A:500:LEU:HA	1:A:503:MET:HE3	2.00	0.42
1:A:707:ALA:HB3	1:A:725:LEU:HD21	2.00	0.42
1:A:668:ASP:OD1	1:A:743:PHE:HD1	2.03	0.42
1:A:500:LEU:HA	1:A:500:LEU:HD12	1.81	0.42
1:A:532:LYS:NZ	3:C:14:DA:OP1	2.44	0.42
1:A:660:ARG:NH1	5:A:1049:HOH:O	2.53	0.42
1:A:734:GLU:O	1:A:738:ARG:N	2.45	0.42
1:A:511:LEU:HD12	1:A:580:LEU:HB3	2.02	0.41
1:A:579:GLN:NE2	1:A:630:LEU:HD13	2.34	0.41
1:A:440:GLU:N	1:A:441:PRO:CD	2.83	0.41
1:A:607:ASN:HB2	1:A:617:SER:OG	2.21	0.41
1:A:628:ILE:HG23	1:A:629:ARG:N	2.35	0.41
1:A:371:PHE:CD1	1:A:394:LEU:HB3	2.51	0.41
1:A:457:LEU:O	1:A:458:GLU:C	2.60	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:767:LEU:HB2	1:A:802:ASP:OD1	2.20	0.41
1:A:816:LYS:O	1:A:819:ARG:N	2.44	0.41
1:A:400:LEU:HD22	1:A:473:LEU:HD21	2.01	0.41
1:A:479:GLN:O	1:A:480:PRO:C	2.63	0.41
1:A:459:ARG:HB3	1:A:460:PRO:HD3	2.01	0.41
1:A:551:LYS:HD3	5:A:1016:HOH:O	2.20	0.41
1:A:692:VAL:HB	1:A:696:GLU:HB3	2.02	0.41
1:A:816:LYS:O	1:A:817:GLU:C	2.64	0.41
1:A:587:TYR:CE2	1:A:627:PRO:HD3	2.56	0.41
1:A:530:SER:O	1:A:532:LYS:N	2.54	0.40
1:A:612:GLN:O	1:A:771:ARG:HD2	2.21	0.40
1:A:829:HIS:HD2	2:B:13:DC:O4'	2.05	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	577/579 (100%)	527 (91%)	45 (8%)	5 (1%)	14 17

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	726	ASN
1	A	432	GLY
1	A	504	GLY
1	A	775	ASP
1	A	531	PRO

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	496/496 (100%)	454 (92%)	42 (8%)	10	11

All (42) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	426	GLU
1	A	477	LEU
1	A	487	GLU
1	A	499	ARG
1	A	505	LYS
1	A	509	GLU
1	A	511	LEU
1	A	532	LYS
1	A	552	THR
1	A	564	LEU
1	A	568	HIS
1	A	570	ILE
1	A	572	GLU
1	A	588	ILE
1	A	591	LEU
1	A	594	VAL
1	A	595	VAL
1	A	604	THR
1	A	619	THR
1	A	628	ILE
1	A	656	GLN
1	A	662	LEU
1	A	677	ARG
1	A	703	ARG
1	A	716	ILE
1	A	717	SER
1	A	728	SER
1	A	729	ARG
1	A	731	GLU
1	A	742	SER

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Mol	Chain	Res	Type
1	A	751	GLU
1	A	764	THR
1	A	779	ARG
1	A	796	ILE
1	A	814	ARG
1	A	819	ARG
1	A	825	LEU
1	A	843	ARG
1	A	844	LEU
1	A	850	GLU
1	A	860	VAL
1	A	870	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (11) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	543	GLN
1	A	579	GLN
1	A	607	ASN
1	A	608	GLN
1	A	724	ASN
1	A	755	GLN
1	A	759	GLN
1	A	780	ASN
1	A	797	GLN
1	A	823	HIS
1	A	829	HIS

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates ⓘ

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

2 ligands are modelled in this entry.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
4	SO4	A	902	-	4,4,4	0.30	0	6,6,6	0.46	0
4	SO4	A	901	-	4,4,4	0.28	0	6,6,6	0.36	0

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 [i](#)

6.1 Protein, DNA and RNA chains [i](#)

In the following table, the column labelled ‘#RSRZ > 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q < 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	579/579 (100%)	-0.08	8 (1%) 73 75	14, 35, 58, 72	0
2	B	12/13 (92%)	0.24	1 (8%) 17 15	35, 48, 109, 119	0
3	C	12/17 (70%)	0.20	1 (8%) 17 15	36, 49, 104, 129	0
All	All	603/609 (99%)	-0.07	10 (1%) 69 71	14, 36, 60, 129	0

All (10) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	B	2	DG	3.4
3	C	16	DC	3.0
1	A	719	TYR	3.0
1	A	725	LEU	3.0
1	A	531	PRO	2.4
1	A	568	HIS	2.4
1	A	716	ILE	2.4
1	A	559	ASP	2.3
1	A	723	GLN	2.2
1	A	866	TYR	2.1

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
4	SO4	A	902	5/5	0.90	0.15	58,58,59,59	0
4	SO4	A	901	5/5	0.93	0.07	54,54,56,56	0

6.5 Other polymers [i](#)

There are no such residues in this entry.