



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 2, 2026 – 03:59 AM UTC

PDB ID : 1F7U / pdb_00001f7u
Title : CRYSTAL STRUCTURE OF THE ARGINYL-TRNA SYNTHETASE COM-
PLEXED WITH THE TRNA(ARG) AND L-ARG
Authors : Delagoutte, B.; Moras, D.; Cavarelli, J.
Deposited on : 2000-06-28
Resolution : 2.20 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

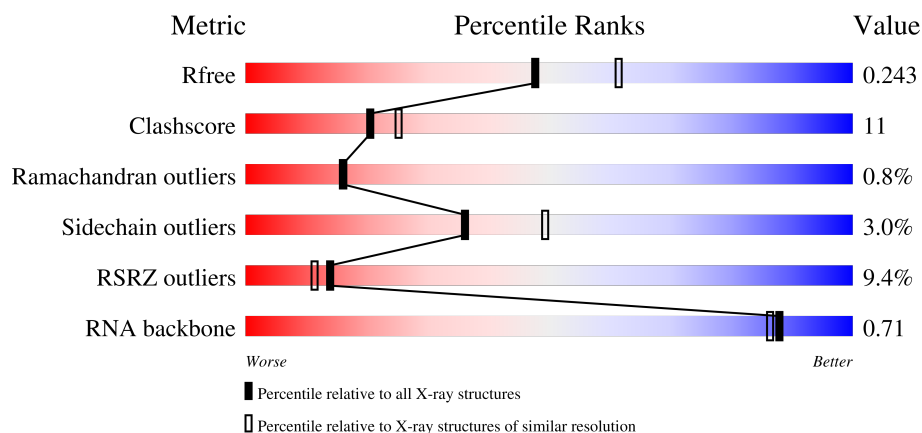
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.20 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	6164 (2.20-2.20)
Clashscore	190562	6851 (2.20-2.20)
Ramachandran outliers	187476	6768 (2.20-2.20)
Sidechain outliers	187428	6769 (2.20-2.20)
RSRZ outliers	180081	6166 (2.20-2.20)
RNA backbone	3983	1052 (2.50-1.90)

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	B	76	4% 61% 33% 7%
2	A	607	10% 72% 26% .

2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 7126 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.

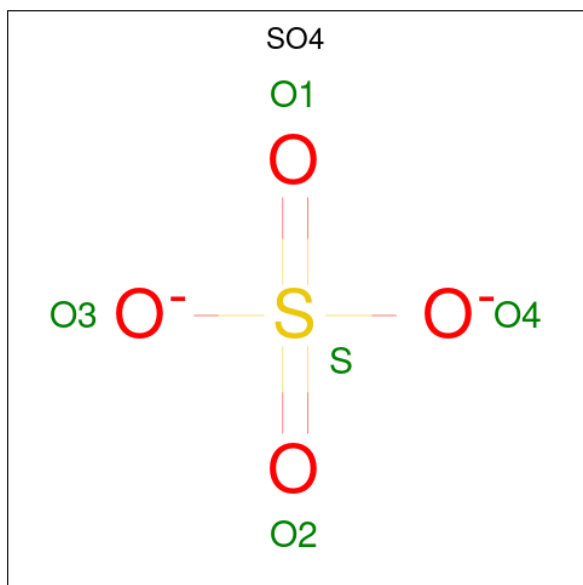
- Molecule 1 is a RNA chain called TRNA(ARG).

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	B	76	Total	C	N	O	P	0	0	0
			1629	730	290	533	76			

- Molecule 2 is a protein called ARGINYL-TRNA SYNTHETASE.

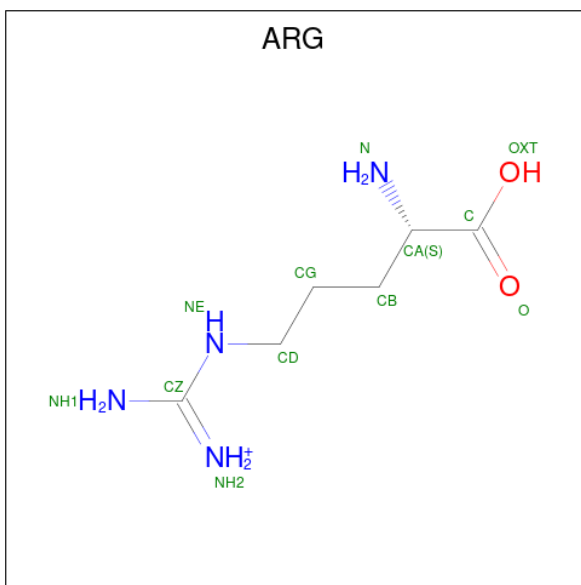
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	A	606	Total	C	N	O	S	0	0	0
			4892	3138	828	905	21			

- Molecule 3 is SULFATE ION (CCD ID: SO4) (formula: O₄S).



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

- Molecule 4 is ARGinine (CCD ID: ARG) (formula: C₆H₁₅N₄O₂).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	A	1	Total	C	N	O	0	0
			12	6	4	2		

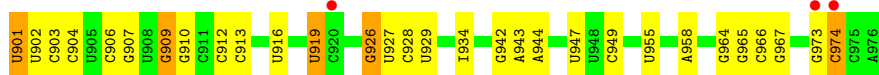
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	B	240	Total	O	0	0
			240	240		
5	A	348	Total	O	0	0
			348	348		

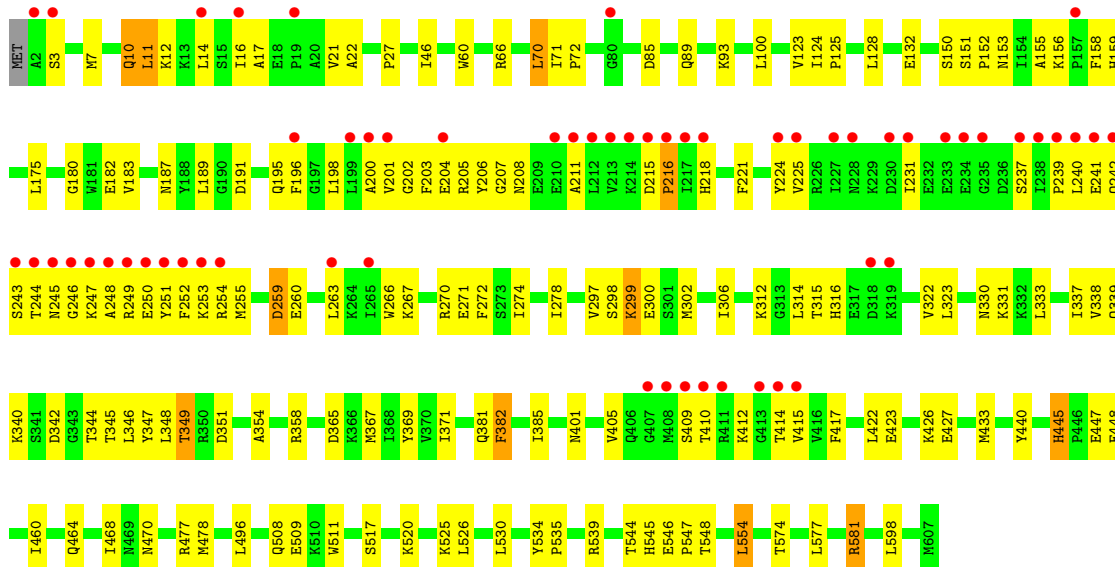
3 Residue-property plots [i](#)

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: TRNA(ARG)



• Molecule 2: ARGINYL-TRNA SYNTHETASE



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 2	Depositor
Cell constants a, b, c, α , β , γ	129.65Å 107.47Å 71.38Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	14.98 – 2.20 14.98 – 2.20	Depositor EDS
% Data completeness (in resolution range)	99.7 (14.98-2.20) 99.4 (14.98-2.20)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	8.71 (at 2.19Å)	Xtriage
Refinement program	CNS 1.0	Depositor
R, R_{free}	0.190 , 0.233 0.204 , 0.243	Depositor DCC
R_{free} test set	2562 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å ²)	20.7	Xtriage
Anisotropy	0.725	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.41 , 66.5	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	7126	wwPDB-VP
Average B, all atoms (Å ²)	30.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.56% 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: H2U, 1MG, 5MC, SO4, M2G, PSU, 2MG, 5MU, 1MA

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	B	0.37	1/1532 (0.1%)	0.55	0/2387
2	A	0.35	0/4996	0.86	13/6736 (0.2%)
All	All	0.35	1/6528 (0.0%)	0.79	13/9123 (0.1%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	934	I	O3'-P	5.54	1.61	1.56

All (13) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	3	SER	N-CA-C	-7.62	103.05	111.36
2	A	180	GLY	N-CA-C	6.82	122.81	114.69
2	A	182	GLU	N-CA-C	-6.25	99.08	109.46
2	A	123	VAL	N-CA-C	6.16	116.33	110.42
2	A	60	TRP	N-CA-C	-5.64	102.93	110.55
2	A	470	ASN	N-CA-C	-5.61	102.22	110.52
2	A	496	LEU	N-CA-C	-5.48	105.39	111.36
2	A	365	ASP	N-CA-C	-5.36	106.59	113.23
2	A	445	HIS	CA-C-N	5.35	124.80	119.24
2	A	445	HIS	C-N-CA	5.35	124.80	119.24
2	A	405	VAL	N-CA-C	-5.23	99.58	107.73
2	A	183	VAL	N-CA-C	5.12	115.86	108.48
2	A	574	THR	N-CA-C	-5.07	103.84	110.53

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	B	1629	0	834	17	0
2	A	4892	0	4906	125	0
3	B	5	0	0	0	0
4	A	12	0	12	1	0
5	A	348	0	0	3	0
5	B	240	0	0	2	0
All	All	7126	0	5752	138	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 11.

All (138) 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)
2:A:299:LYS:HE3	2:A:299:LYS:H	1.11	1.15
2:A:331:LYS:HD2	2:A:331:LYS:H	1.24	1.00
2:A:323:LEU:HB3	2:A:337:ILE:HD13	1.53	0.90
2:A:299:LYS:HE3	2:A:299:LYS:N	1.94	0.83
2:A:331:LYS:HD2	2:A:331:LYS:N	1.97	0.79
2:A:252:PHE:HA	2:A:255:MET:HE3	1.64	0.79
2:A:299:LYS:H	2:A:299:LYS:CE	1.96	0.76
2:A:409:SER:HB2	2:A:414:THR:HG22	1.69	0.73
2:A:331:LYS:H	2:A:331:LYS:CD	2.02	0.72
2:A:322:VAL:HG12	2:A:339:GLN:HB3	1.71	0.72
2:A:520:LYS:O	2:A:525:LYS:HE3	1.91	0.71
2:A:153:ASN:HB3	2:A:195:GLN:OE1	1.93	0.69
2:A:246:GLY:O	2:A:249:ARG:HG2	1.93	0.69
2:A:241:GLU:HA	2:A:246:GLY:HA3	1.74	0.68
2:A:244:THR:HA	2:A:247:LYS:HE2	1.76	0.68
2:A:17:ALA:HB1	2:A:21:VAL:HG13	1.76	0.67
2:A:300:GLU:H	2:A:300:GLU:CD	2.02	0.67
1:B:974:C:H2'	2:A:340:LYS:HG3	1.78	0.66
2:A:231:ILE:HD12	2:A:245:ASN:HD22	1.61	0.66
2:A:155:ALA:C	2:A:156:LYS:HD2	2.21	0.65
2:A:460:ILE:O	2:A:464:GLN:HG3	1.97	0.64

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:A:581:ARG:HD3	5:A:1043:HOH:O	1.98	0.63
1:B:942:G:O2'	1:B:943:A:H5'	2.00	0.62
2:A:525:LYS:HE2	5:A:1072:HOH:O	2.00	0.62
2:A:70:LEU:C	2:A:70:LEU:HD12	2.25	0.61
2:A:322:VAL:CG1	2:A:339:GLN:HB3	2.30	0.60
2:A:322:VAL:HG13	2:A:338:VAL:HG23	1.84	0.60
2:A:316:HIS:NE2	2:A:323:LEU:HD11	2.17	0.60
2:A:198:LEU:HD23	2:A:224:TYR:CE1	2.38	0.59
2:A:348:LEU:CD1	2:A:382:PHE:HB3	2.32	0.59
2:A:205:ARG:HG2	2:A:206:TYR:CE1	2.36	0.59
2:A:371:ILE:O	2:A:401:ASN:HA	2.03	0.59
2:A:251:TYR:O	2:A:255:MET:HG3	2.03	0.59
1:B:928:C:O2'	1:B:929:U:H5'	2.03	0.58
2:A:445:HIS:HB3	2:A:448:GLU:OE1	2.03	0.58
2:A:196:PHE:CZ	2:A:266:TRP:HA	2.39	0.58
2:A:208:ASN:HB3	2:A:211:ALA:HB3	1.84	0.58
2:A:200:ALA:O	2:A:204:GLU:HG3	2.03	0.57
2:A:239:PRO:HB2	2:A:242:GLN:HB3	1.86	0.57
2:A:259:ASP:O	2:A:263:LEU:HD23	2.04	0.57
2:A:241:GLU:CA	2:A:246:GLY:HA3	2.34	0.56
2:A:196:PHE:HZ	2:A:266:TRP:HA	1.71	0.56
2:A:338:VAL:O	2:A:349:THR:HG21	2.06	0.56
2:A:346:LEU:H	2:A:349:THR:CG2	2.20	0.55
2:A:267:LYS:O	2:A:271:GLU:HB2	2.07	0.55
2:A:348:LEU:HD12	2:A:382:PHE:HB3	1.89	0.55
2:A:254:ARG:HE	2:A:259:ASP:CG	2.14	0.54
2:A:10:GLN:HE21	2:A:10:GLN:N	2.06	0.54
2:A:477:ARG:HB2	2:A:478:MET:HE2	1.90	0.54
1:B:926:M2G:HM22	5:B:1244:HOH:O	2.08	0.53
2:A:17:ALA:HB1	2:A:21:VAL:CG1	2.38	0.53
2:A:221:PHE:O	2:A:225:VAL:HG23	2.09	0.53
2:A:323:LEU:C	2:A:323:LEU:HD12	2.34	0.52
1:B:974:C:O2	2:A:340:LYS:HG3	2.10	0.52
2:A:539:ARG:O	2:A:539:ARG:HD3	2.10	0.52
2:A:517:SER:O	2:A:520:LYS:HE3	2.11	0.51
2:A:156:LYS:HE3	2:A:224:TYR:CE2	2.45	0.51
2:A:246:GLY:C	2:A:248:ALA:H	2.18	0.51
2:A:345:THR:HB	2:A:349:THR:OG1	2.11	0.51
2:A:132:GLU:H	2:A:132:GLU:CD	2.18	0.51
2:A:330:ASN:HB3	2:A:333:LEU:HG	1.93	0.51
2:A:300:GLU:CD	2:A:300:GLU:N	2.68	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:A:156:LYS:HD2	2:A:156:LYS:N	2.25	0.50
2:A:577:LEU:O	2:A:581:ARG:HG3	2.12	0.50
2:A:367:MET:HE3	2:A:369:TYR:OH	2.12	0.50
2:A:546:GLU:HB3	2:A:548:THR:HG22	1.93	0.50
2:A:342:ASP:OD1	2:A:344:THR:HG23	2.12	0.49
2:A:423:GLU:O	2:A:427:GLU:HG3	2.13	0.49
2:A:315:THR:HB	2:A:322:VAL:CG2	2.43	0.49
1:B:964:G:O2'	1:B:965:G:H5'	2.14	0.48
2:A:534:TYR:HB3	2:A:535:PRO:HD3	1.96	0.48
2:A:12:LYS:HA	2:A:27:PRO:HB2	1.96	0.48
2:A:302:MET:O	2:A:306:ILE:HG12	2.13	0.48
2:A:14:LEU:HG	2:A:16:ILE:HG23	1.96	0.48
1:B:973:G:O2'	2:A:337:ILE:HG13	2.13	0.48
2:A:347:TYR:OH	4:A:800:ARG:HG2	2.13	0.48
2:A:203:PHE:O	2:A:207:GLY:HA3	2.13	0.48
2:A:241:GLU:N	2:A:246:GLY:HA3	2.29	0.48
2:A:539:ARG:HD3	2:A:539:ARG:C	2.38	0.48
2:A:253:LYS:HD2	2:A:253:LYS:C	2.39	0.47
2:A:508:GLN:HA	2:A:511:TRP:CD2	2.50	0.47
1:B:901:PSU:H2'	1:B:902:U:C6	2.50	0.47
2:A:409:SER:HB2	2:A:414:THR:CG2	2.44	0.46
2:A:85:ASP:O	2:A:89:GLN:HG3	2.16	0.46
2:A:152:PRO:HG3	2:A:158:PHE:CZ	2.51	0.46
2:A:70:LEU:HD12	2:A:70:LEU:O	2.15	0.46
2:A:191:ASP:OD2	2:A:270:ARG:NH1	2.49	0.46
2:A:215:ASP:OD2	2:A:218:HIS:HB2	2.15	0.46
2:A:274:ILE:O	2:A:278:ILE:HG13	2.16	0.46
2:A:433:MET:HG2	2:A:440:TYR:HD1	1.80	0.46
2:A:250:GLU:O	2:A:253:LYS:HG3	2.16	0.46
2:A:410:THR:C	2:A:412:LYS:H	2.24	0.45
2:A:70:LEU:C	2:A:70:LEU:CD1	2.89	0.45
2:A:348:LEU:HD11	2:A:382:PHE:HB3	1.99	0.45
1:B:919:H2U:H52	2:A:66:ARG:HD3	1.99	0.44
2:A:159:HIS:HA	2:A:417:PHE:HA	1.99	0.44
1:B:903:C:H2'	1:B:904:C:H6	1.83	0.44
2:A:151:SER:HA	2:A:187:ASN:OD1	2.18	0.44
2:A:448:GLU:N	2:A:448:GLU:CD	2.76	0.44
2:A:205:ARG:HH21	2:A:244:THR:HG23	1.82	0.44
2:A:312:LYS:HB2	2:A:314:LEU:HG	1.99	0.44
2:A:381:GLN:O	2:A:385:ILE:HG13	2.18	0.43
2:A:201:VAL:HG13	2:A:202:GLY:N	2.32	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:A:253:LYS:HD2	2:A:254:ARG:N	2.33	0.43
2:A:298:SER:HB2	2:A:300:GLU:OE1	2.17	0.43
2:A:7:MET:O	2:A:11:LEU:HD22	2.18	0.43
2:A:547:PRO:HD2	5:A:1002:HOH:O	2.18	0.43
2:A:189:LEU:HD12	2:A:270:ARG:NH1	2.32	0.43
2:A:409:SER:C	2:A:415:VAL:HG13	2.44	0.43
2:A:124:ILE:HB	2:A:125:PRO:HD3	2.01	0.43
2:A:17:ALA:O	2:A:22:ALA:HB2	2.19	0.42
2:A:175:LEU:HA	2:A:598:LEU:HD11	2.01	0.42
2:A:71:ILE:HA	2:A:72:PRO:HD3	1.85	0.42
2:A:241:GLU:HA	2:A:246:GLY:CA	2.45	0.42
2:A:346:LEU:H	2:A:349:THR:HG23	1.83	0.42
2:A:409:SER:O	2:A:415:VAL:HG13	2.19	0.42
2:A:426:LYS:CE	2:A:447:GLU:HG3	2.48	0.42
2:A:247:LYS:HA	2:A:250:GLU:CD	2.44	0.42
1:B:902:U:H2'	1:B:903:C:C6	2.54	0.42
1:B:903:C:H2'	1:B:904:C:C6	2.55	0.42
2:A:297:VAL:HG13	2:A:297:VAL:O	2.20	0.42
1:B:943:A:O2'	1:B:944:A:H5'	2.19	0.42
1:B:912:C:H2'	1:B:913:C:O4'	2.19	0.41
5:B:1192:HOH:O	2:A:468:ILE:HD11	2.20	0.41
1:B:966:C:H2'	1:B:967:G:C8	2.55	0.41
2:A:46:ILE:HG23	2:A:93:LYS:HD2	2.02	0.41
1:B:906:C:O2'	1:B:907:G:H5'	2.20	0.41
2:A:298:SER:O	2:A:302:MET:HG2	2.20	0.41
2:A:354:ALA:O	2:A:358:ARG:HG3	2.21	0.41
2:A:243:SER:O	2:A:247:LYS:HE2	2.21	0.41
2:A:433:MET:HE3	2:A:433:MET:HB2	1.94	0.41
1:B:903:C:O2'	1:B:904:C:H5'	2.21	0.41
2:A:205:ARG:NH2	2:A:244:THR:HG23	2.35	0.41
2:A:554:LEU:HD12	2:A:554:LEU:HA	1.89	0.41
2:A:299:LYS:N	2:A:299:LYS:CE	2.70	0.40
2:A:10:GLN:HE21	2:A:10:GLN:H	1.69	0.40
2:A:544:THR:O	2:A:545:HIS:HB2	2.22	0.40
2:A:216:PRO:HG2	2:A:272:PHE:HB3	2.03	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
2	A	604/607 (100%)	576 (95%)	23 (4%)	5 (1%)	16 16

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	A	237	SER
2	A	259	ASP
2	A	240	LEU
2	A	150	SER
2	A	216	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
2	A	525/526 (100%)	509 (97%)	16 (3%)	36 49

All (16) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	A	10	GLN
2	A	11	LEU
2	A	70	LEU
2	A	100	LEU
2	A	128	LEU
2	A	260	GLU

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Mol	Chain	Res	Type
2	A	299	LYS
2	A	349	THR
2	A	351	ASP
2	A	382	PHE
2	A	422	LEU
2	A	509	GLU
2	A	526	LEU
2	A	530	LEU
2	A	554	LEU
2	A	581	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (10) such sidechains are listed below:

Mol	Chain	Res	Type
2	A	10	GLN
2	A	62	ASN
2	A	89	GLN
2	A	245	ASN
2	A	363	HIS
2	A	374	GLN
2	A	406	GLN
2	A	420	ASN
2	A	442	GLN
2	A	508	GLN

5.3.3 RNA ⓘ

Mol	Chain	Analysed	Backbone Outliers	Pucker Outliers
1	B	73/76 (96%)	2 (2%)	0

All (2) RNA backbone outliers are listed below:

Mol	Chain	Res	Type
1	B	909	1MG
1	B	974	C

There are no RNA pucker outliers to report.

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

12 non-standard protein/DNA/RNA residues 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
1	5MU	B	954	1	19,22,23	0.31	0	27,32,35	0.33	0
1	PSU	B	901	1	22,22,22	1.65	1 (4%)	28,33,33	0.74	1 (3%)
1	PSU	B	927	1	18,21,22	1.85	1 (5%)	21,30,33	0.71	1 (4%)
1	PSU	B	955	1	18,21,22	1.80	1 (5%)	21,30,33	0.78	1 (4%)
1	H2U	B	947	1	18,21,22	0.77	1 (5%)	19,30,33	0.73	0
1	H2U	B	916	1	18,21,22	0.68	1 (5%)	19,30,33	0.72	0
1	2MG	B	910	1	23,26,27	0.59	0	33,38,41	1.29	1 (3%)
1	M2G	B	926	1	24,27,28	0.36	0	33,40,43	1.54	3 (9%)
1	1MA	B	958	1	21,25,26	0.77	1 (4%)	30,37,40	0.68	1 (3%)
1	H2U	B	919	1	18,21,22	0.61	1 (5%)	19,30,33	0.72	0
1	1MG	B	909	1	23,26,27	0.57	0	33,39,42	1.30	3 (9%)
1	5MC	B	949	1	19,22,23	0.45	0	26,32,35	0.83	2 (7%)

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
1	5MU	B	954	1	-	0/7/25/26	0/2/2/2
1	PSU	B	901	1	-	0/10/26/26	0/2/2/2
1	PSU	B	927	1	-	1/7/25/26	0/2/2/2
1	PSU	B	955	1	-	1/7/25/26	0/2/2/2
1	H2U	B	947	1	-	0/7/38/39	0/2/2/2
1	H2U	B	916	1	-	1/7/38/39	0/2/2/2
1	2MG	B	910	1	-	0/9/27/28	0/3/3/3
1	M2G	B	926	1	-	0/11/29/30	0/3/3/3
1	1MA	B	958	1	-	0/7/25/26	0/3/3/3
1	H2U	B	919	1	-	0/7/38/39	0/2/2/2

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
1	1MG	B	909	1	-	0/7/25/26	0/3/3/3
1	5MC	B	949	1	-	0/7/25/26	0/2/2/2

All (7) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	927	PSU	C6-N1	-7.40	1.24	1.36
1	B	955	PSU	C6-N1	-7.34	1.24	1.36
1	B	901	PSU	C6-N1	-7.24	1.24	1.36
1	B	947	H2U	C2-N1	2.74	1.39	1.35
1	B	958	1MA	C6-N6	2.44	1.33	1.28
1	B	916	H2U	C2-N1	2.30	1.38	1.35
1	B	919	H2U	C2-N1	2.06	1.38	1.35

All (13) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	910	2MG	CM2-N2-C2	-7.20	108.19	123.65
1	B	926	M2G	CM2-N2-CM1	6.26	135.88	115.87
1	B	909	1MG	C2-N1-C6	4.46	124.71	120.99
1	B	926	M2G	CM1-N2-C2	-4.42	111.56	120.61
1	B	926	M2G	CM2-N2-C2	-3.94	112.56	120.61
1	B	909	1MG	CM1-N1-C2	-3.19	117.40	120.70
1	B	909	1MG	N2-C2-N1	-3.17	116.23	118.79
1	B	949	5MC	C5-C6-N1	-2.75	120.33	123.31
1	B	955	PSU	C5-C6-N1	2.48	125.58	122.14
1	B	958	1MA	N1-C2-N3	2.42	128.87	126.00
1	B	901	PSU	C5-C6-N1	2.31	125.35	122.14
1	B	927	PSU	C5-C6-N1	2.22	125.22	122.14
1	B	949	5MC	CM5-C5-C6	-2.04	120.09	122.85

There are no chirality outliers.

All (3) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	B	955	PSU	O4'-C1'-C5-C4
1	B	916	H2U	C3'-C4'-C5'-O5'
1	B	927	PSU	O4'-C1'-C5-C6

There are no ring outliers.

3 monomers are involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
1	B	901	PSU	1	0
1	B	926	M2G	1	0
1	B	919	H2U	1	0

5.5 Carbohydrates [i](#)

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	ARG	A	800	-	10,11,11	0.68	0	9,13,13	0.33	0
3	SO4	B	900	-	4,4,4	0.34	0	6,6,6	0.05	0

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
4	ARG	A	800	-	-	0/11/11/11	-

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.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	800	ARG	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	B	63/76 (82%)	-0.76	3 (4%) 35 32	7, 17, 43, 75	0
2	A	606/607 (99%)	0.23	60 (9%) 13 10	5, 26, 83, 120	0
All	All	669/683 (97%)	0.14	63 (9%) 14 11	5, 25, 82, 120	0

All (63) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	A	240	LEU	7.0
2	A	238	ILE	6.5
2	A	410	THR	4.8
2	A	2	ALA	4.7
2	A	248	ALA	4.4
2	A	239	PRO	4.4
2	A	246	GLY	4.2
2	A	212	LEU	4.2
2	A	251	TYR	4.2
2	A	235	GLY	4.1
2	A	217	ILE	4.0
2	A	227	ILE	3.8
2	A	16	ILE	3.6
1	B	974	C	3.6
2	A	3	SER	3.5
2	A	80	GLY	3.5
2	A	211	ALA	3.4
2	A	409	SER	3.4
2	A	231	ILE	3.4
1	B	973	G	3.4
2	A	215	ASP	3.3
2	A	263	LEU	3.2
2	A	414	THR	3.2
2	A	213	VAL	3.0

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Mol	Chain	Res	Type	RSRZ
2	A	201	VAL	2.9
2	A	241	GLU	2.9
2	A	413	GLY	2.9
2	A	252	PHE	2.9
2	A	196	PHE	2.8
2	A	245	ASN	2.8
2	A	247	LYS	2.8
2	A	249	ARG	2.8
2	A	237	SER	2.7
2	A	244	THR	2.7
2	A	253	LYS	2.6
2	A	243	SER	2.6
2	A	234	GLU	2.5
2	A	216	PRO	2.5
2	A	254	ARG	2.5
2	A	199	LEU	2.3
2	A	407	GLY	2.3
2	A	218	HIS	2.3
2	A	265	ILE	2.3
2	A	415	VAL	2.3
1	B	920	C	2.3
2	A	242	GLN	2.3
2	A	14	LEU	2.2
2	A	19	PRO	2.2
2	A	214	LYS	2.2
2	A	204	GLU	2.2
2	A	319	LYS	2.2
2	A	230	ASP	2.2
2	A	233	GLU	2.2
2	A	411	ARG	2.1
2	A	228	ASN	2.1
2	A	157	PRO	2.1
2	A	225	VAL	2.1
2	A	210	GLU	2.1
2	A	250	GLU	2.1
2	A	318	ASP	2.1
2	A	408	MET	2.1
2	A	224	TYR	2.1
2	A	200	ALA	2.0

6.2 Non-standard residues in protein, DNA, RNA chains [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
1	PSU	B	901	21/21	0.68	0.15	56,58,68,69	0
1	H2U	B	947	20/21	0.87	0.14	34,44,57,57	0
1	PSU	B	927	20/21	0.94	0.08	14,21,25,30	0
1	H2U	B	919	20/21	0.94	0.08	22,25,30,38	0
1	H2U	B	916	20/21	0.96	0.06	11,14,18,19	0
1	1MG	B	909	24/25	0.96	0.06	8,12,17,21	0
1	PSU	B	955	20/21	0.96	0.06	15,19,22,24	0
1	M2G	B	926	25/26	0.97	0.06	10,15,20,22	0
1	5MU	B	954	21/22	0.97	0.06	8,14,17,21	0
1	2MG	B	910	24/25	0.97	0.06	4,11,17,18	0
1	5MC	B	949	21/22	0.98	0.04	3,12,14,14	0
1	1MA	B	958	23/24	0.98	0.05	8,11,15,15	0

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	ARG	A	800	12/12	0.89	0.10	23,25,30,32	0
3	SO4	B	900	5/5	0.97	0.10	30,33,35,36	0

6.5 Other polymers [i](#)

There are no such residues in this entry.