



Full wwPDB X-ray Structure Validation Report ⓘ

Feb 1, 2016 – 01:15 AM GMT

PDB ID : 2C9B
Title : LUMAZINE SYNTHASE FROM MYCOBACTERIUM TUBERCULOSIS
BOUND TO 3-(1,3,7-TRIHYDRO-9-D-RIBITYL-2,6,8-PURINETRION
E-7-YL)
Authors : Morgunova, E.; Illarionov, B.; Jin, G.; Haase, I.; Fischer, M.; Cushman, M.;
Bacher, A.; Ladenstein, R.
Deposited on : 2005-12-09
Resolution : 2.75 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
<http://wwpdb.org/validation/2016/XrayValidationReportHelp>
with specific help available everywhere you see the ⓘ symbol.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 1.7 (RC4), CSD as536be (2015)
Xtriage (Phenix) : 1.9-1692
EDS : rb-20026688
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)
Refmac : 5.8.0135
CCP4 : 6.5.0
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : trunk26865

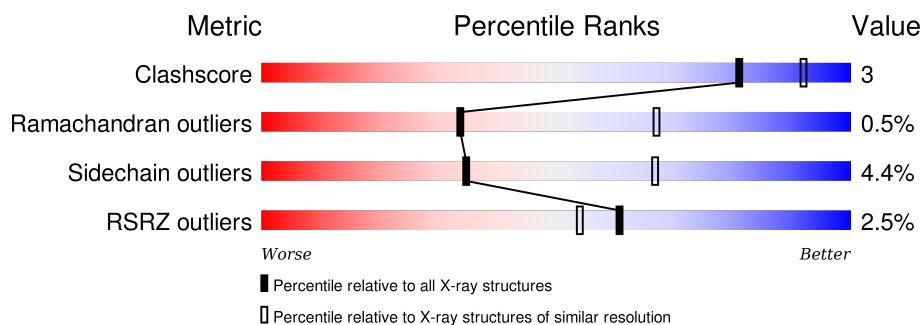
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.75 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	102246	3829 (2.80-2.72)
Ramachandran outliers	100387	3767 (2.80-2.72)
Sidechain outliers	100360	3770 (2.80-2.72)
RSRZ outliers	91569	3352 (2.80-2.72)

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 on the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria. 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	160	<div> <div>4%</div> <div>80% 11% 8%</div> </div>
1	B	160	<div> <div>3%</div> <div>82% 9% 8%</div> </div>
1	C	160	<div> <div>%</div> <div>86% 6% 9%</div> </div>
1	D	160	<div> <div></div> <div>82% 9% 8%</div> </div>
1	E	160	<div> <div>5%</div> <div>83% 9% 9%</div> </div>
1	F	160	<div> <div>%</div> <div>77% 14% 8%</div> </div>
1	G	160	<div> <div>2%</div> <div>84% 6% 8%</div> </div>

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Mol	Chain	Length	Quality of chain
1	H	160	
1	I	160	
1	J	160	

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
4	PO4	D	1163	-	-	-	X
4	PO4	I	1162	-	-	-	X

2 Entry composition

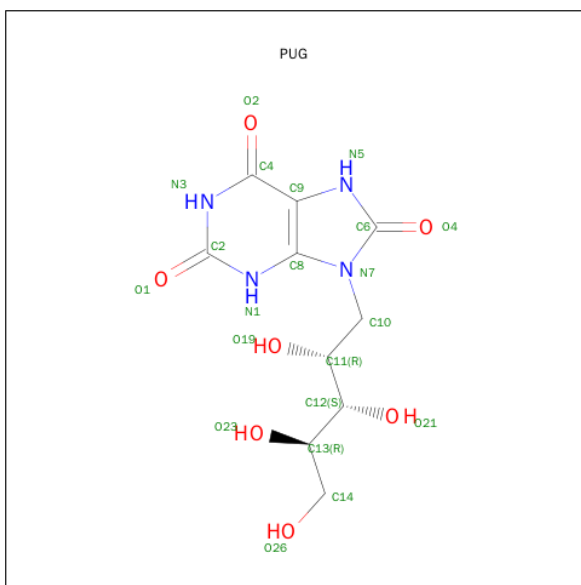
There are 6 unique types of molecules in this entry. The entry contains 11543 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 6,7-DIMETHYL-8-RIBITYLLUMAZINE SYNTHASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	147	Total	C	N	O	S	0	0	0
			1063	655	194	211	3			
1	B	147	Total	C	N	O	S	0	0	0
			1063	655	194	211	3			
1	C	146	Total	C	N	O	S	0	0	0
			1055	651	193	208	3			
1	D	147	Total	C	N	O	S	0	0	0
			1063	655	194	211	3			
1	E	146	Total	C	N	O	S	0	0	0
			1055	651	193	208	3			
1	F	147	Total	C	N	O	S	0	0	0
			1063	655	194	211	3			
1	G	147	Total	C	N	O	S	0	0	0
			1063	655	194	211	3			
1	H	146	Total	C	N	O	S	0	0	0
			1055	651	193	208	3			
1	I	147	Total	C	N	O	S	0	0	0
			1063	655	194	211	3			
1	J	146	Total	C	N	O	S	0	0	0
			1055	651	193	208	3			

- Molecule 2 is 3-(1,3,7-TRIHYDRO-9-D-RIBITYL-2,6,8-PURINETRIONE-7-YL) (three-letter code: PUG) (formula: C₁₀H₁₄N₄O₇).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	A	1	Total	C	N	O	0	0
			21	10	4	7		
2	B	1	Total	C	N	O	0	0
			21	10	4	7		
2	C	1	Total	C	N	O	0	0
			21	10	4	7		
2	D	1	Total	C	N	O	0	0
			21	10	4	7		
2	E	1	Total	C	N	O	0	0
			21	10	4	7		
2	F	1	Total	C	N	O	0	0
			21	10	4	7		
2	G	1	Total	C	N	O	0	0
			21	10	4	7		
2	H	1	Total	C	N	O	0	0
			21	10	4	7		
2	I	1	Total	C	N	O	0	0
			21	10	4	7		
2	J	1	Total	C	N	O	0	0
			21	10	4	7		

- Molecule 3 is POTASSIUM ION (three-letter code: K) (formula: K).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	G	2	Total	K	0	0
			2	2		
3	J	1	Total	K	0	0
			1	1		

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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	D	2	Total	K	0	0
			2	2		
3	E	2	Total	K	0	0
			2	2		
3	H	1	Total	K	0	0
			1	1		
3	B	1	Total	K	0	0
			1	1		
3	I	1	Total	K	0	0
			1	1		
3	C	2	Total	K	0	0
			2	2		
3	A	2	Total	K	0	0
			2	2		
3	F	1	Total	K	0	0
			1	1		

- Molecule 4 is PHOSPHATE ION (three-letter code: PO4) (formula: O₄P).



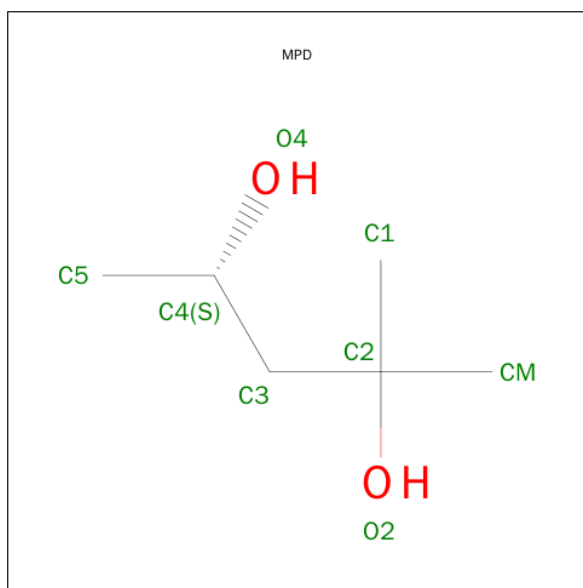
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total	O	P	0	0
			5	4	1		
4	B	1	Total	O	P	0	0
			5	4	1		
4	C	1	Total	O	P	0	0
			5	4	1		

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	D	1	Total	O	P	0	0
			5	4	1		
4	E	1	Total	O	P	0	0
			5	4	1		
4	F	1	Total	O	P	0	0
			5	4	1		
4	G	1	Total	O	P	0	0
			5	4	1		
4	H	1	Total	O	P	0	0
			5	4	1		
4	I	1	Total	O	P	0	0
			5	4	1		
4	J	1	Total	O	P	0	0
			5	4	1		

- Molecule 5 is (4S)-2-METHYL-2,4-PENTANEDIOL (three-letter code: MPD) (formula: $C_6H_{14}O_2$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	C	1	Total	C	O	0	0
			8	6	2		
5	J	1	Total	C	O	0	0
			8	6	2		


- Molecule 6 is water.

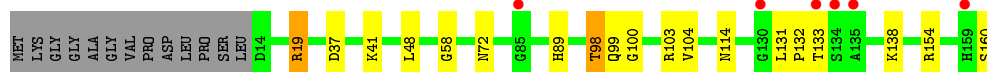
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	64	Total 64	O 64	0	0
6	B	66	Total 66	O 66	0	0
6	C	75	Total 75	O 75	0	0
6	D	55	Total 55	O 55	0	0
6	E	66	Total 66	O 66	0	0
6	F	74	Total 74	O 74	0	0
6	G	81	Total 81	O 81	0	0
6	H	55	Total 55	O 55	0	0
6	I	60	Total 60	O 60	0	0
6	J	58	Total 58	O 58	0	0

3 Residue-property plots [i](#)


These plots are drawn for all protein, RNA and DNA chains in the entry. The first graphic for a chain summarises the proportions of errors 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.

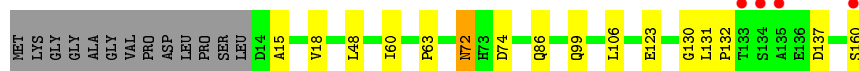
- Molecule 1: 6,7-DIMETHYL-8-RIBITYLLUMAZINE SYNTHASE

Chain A: 




- Molecule 1: 6,7-DIMETHYL-8-RIBITYLLUMAZINE SYNTHASE

Chain B: 




- Molecule 1: 6,7-DIMETHYL-8-RIBITYLLUMAZINE SYNTHASE

Chain C: 




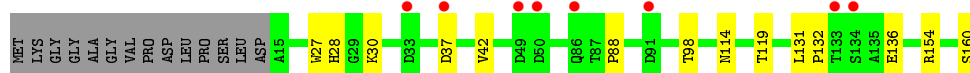
- Molecule 1: 6,7-DIMETHYL-8-RIBITYLLUMAZINE SYNTHASE

Chain D: 



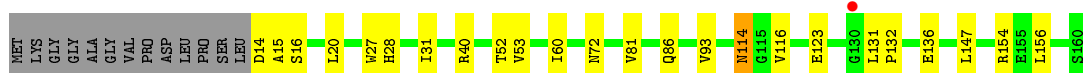
- Molecule 1: 6,7-DIMETHYL-8-RIBITYLLUMAZINE SYNTHASE

Chain E: 

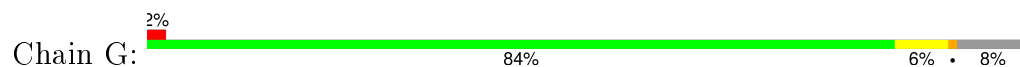


- Molecule 1: 6,7-DIMETHYL-8-RIBITYLLUMAZINE SYNTHASE

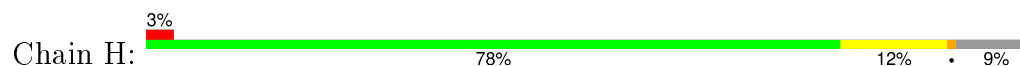
Chain F: 



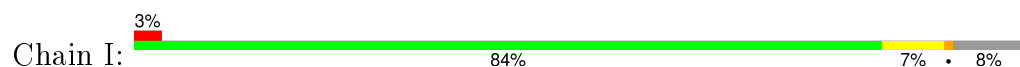
- Molecule 1: 6,7-DIMETHYL-8-RIBITYLLUMAZINE SYNTHASE



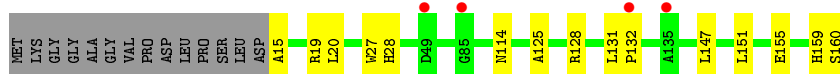
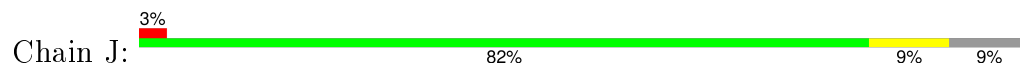
- Molecule 1: 6,7-DIMETHYL-8-RIBITYLLUMAZINE SYNTHASE



- Molecule 1: 6,7-DIMETHYL-8-RIBITYLLUMAZINE SYNTHASE



- Molecule 1: 6,7-DIMETHYL-8-RIBITYLLUMAZINE SYNTHASE



4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, α , β , γ	78.05Å 78.36Å 88.84Å 64.39° 64.69° 65.03°	Depositor
Resolution (Å)	10.00 – 2.75 44.42 – 2.45	Depositor EDS
% Data completeness (in resolution range)	89.5 (10.00-2.75) 65.0 (44.42-2.45)	Depositor EDS
R_{merge}	0.15	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.29 (at 2.45Å)	Xtriage
Refinement program	REFMAC 5.2.0005	Depositor
R, R_{free}	0.250 , 0.324 0.246 , (Not available)	Depositor DCC
R_{free} test set	No test flags present.	DCC
Wilson B-factor (Å ²)	35.0	Xtriage
Anisotropy	0.076	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.40 , 55.3	EDS
Estimated twinning fraction	0.410 for -k,-h,-l	Xtriage
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Outliers	0 of 50448 reflections	Xtriage
F_o, F_c correlation	0.88	EDS
Total number of atoms	11543	wwPDB-VP
Average B, all atoms (Å ²)	32.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 11.80% 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, 0.375 respectively for untwinned datasets, and 0.333, 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: PO4, MPD, PUG, K

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	0.35	0/1075	0.50	0/1467
1	B	0.34	0/1075	0.51	0/1467
1	C	0.35	0/1067	0.51	0/1456
1	D	0.33	0/1075	0.49	0/1467
1	E	0.35	0/1067	0.50	0/1456
1	F	0.33	0/1075	0.49	0/1467
1	G	0.33	0/1075	0.50	0/1467
1	H	0.36	0/1067	0.52	0/1456
1	I	0.34	0/1075	0.50	0/1467
1	J	0.35	0/1067	0.52	0/1456
All	All	0.34	0/10718	0.50	0/14626

There are no bond length outliers.

There are no bond angle outliers.

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	1063	0	1074	10	0
1	B	1063	0	1074	11	0
1	C	1055	0	1070	4	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	D	1063	0	1074	11	0
1	E	1055	0	1070	5	0
1	F	1063	0	1074	11	0
1	G	1063	0	1074	7	0
1	H	1055	0	1070	10	0
1	I	1063	0	1074	7	0
1	J	1055	0	1070	7	0
2	A	21	0	14	1	0
2	B	21	0	14	1	0
2	C	21	0	14	1	0
2	D	21	0	14	1	0
2	E	21	0	14	1	0
2	F	21	0	14	0	0
2	G	21	0	14	0	0
2	H	21	0	14	0	0
2	I	21	0	14	1	0
2	J	21	0	14	0	0
3	A	2	0	0	0	0
3	B	1	0	0	0	0
3	C	2	0	0	0	0
3	D	2	0	0	0	0
3	E	2	0	0	0	0
3	F	1	0	0	0	0
3	G	2	0	0	0	0
3	H	1	0	0	0	0
3	I	1	0	0	0	0
3	J	1	0	0	0	0
4	A	5	0	0	0	0
4	B	5	0	0	0	0
4	C	5	0	0	0	0
4	D	5	0	0	0	0
4	E	5	0	0	0	0
4	F	5	0	0	0	0
4	G	5	0	0	0	0
4	H	5	0	0	0	0
4	I	5	0	0	0	0
4	J	5	0	0	0	0
5	C	8	0	14	0	0
5	J	8	0	14	0	0
6	A	64	0	0	1	0
6	B	66	0	0	0	0
6	C	75	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
6	D	55	0	0	1	0
6	E	66	0	0	1	0
6	F	74	0	0	1	0
6	G	81	0	0	0	0
6	H	55	0	0	2	0
6	I	60	0	0	1	0
6	J	58	0	0	1	0
All	All	11543	0	10892	72	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 3.

All (72) 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:H:131:LEU:HB2	1:H:132:PRO:HD2	1.61	0.81
1:I:131:LEU:HB3	1:I:132:PRO:HD2	1.66	0.75
1:H:22:ILE:HG22	1:H:77:VAL:HB	1.71	0.72
1:G:103:ARG:NH2	1:H:107:ASP:OD2	2.30	0.65
1:D:32:CYS:HB3	6:D:2004:HOH:O	2.01	0.60
1:A:160:SER:HB2	1:G:52:THR:HA	1.84	0.60
1:B:18:VAL:HG23	1:B:74:ASP:HB2	1.84	0.59
1:H:131:LEU:CB	1:H:132:PRO:HD2	2.32	0.59
1:J:20:LEU:HD22	1:J:147:LEU:HD21	1.87	0.55
1:B:131:LEU:HB3	1:B:132:PRO:HD2	1.88	0.55
1:D:131:LEU:HB3	1:D:132:PRO:HD2	1.89	0.54
1:A:103:ARG:HD3	1:B:106:LEU:HD12	1.89	0.54
1:F:20:LEU:HD22	1:F:147:LEU:HD21	1.88	0.53
1:C:87:THR:HG23	1:D:128:ARG:HH21	1.73	0.53
1:I:83:ILE:HD13	1:I:122:GLU:HG2	1.91	0.53
1:F:86:GLN:HG2	6:F:2039:HOH:O	2.08	0.53
1:F:31:ILE:HB	1:F:81:VAL:HG21	1.92	0.52
1:B:130:GLY:HA3	1:B:137:ASP:OD1	2.10	0.52
1:J:125:ALA:HB3	6:J:2047:HOH:O	2.10	0.51
1:F:14:ASP:O	1:F:16:SER:N	2.44	0.51
1:G:87:THR:HG21	1:H:119:THR:HG22	1.93	0.51
1:B:18:VAL:HG13	1:B:48:LEU:HD11	1.93	0.50
1:J:131:LEU:HB3	1:J:132:PRO:HD2	1.93	0.50
1:A:100:GLY:O	1:A:104:VAL:HG23	2.11	0.50
1:A:19:ARG:HH11	1:G:154:ARG:HH21	1.61	0.49
1:F:27:TRP:HD1	1:F:28:HIS:CD2	2.31	0.49

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:H:15:ALA:O	1:H:18:VAL:HG12	2.13	0.48
1:A:98:THR:HG21	6:E:2035:HOH:O	2.13	0.48
1:I:18:VAL:HG23	1:I:74:ASP:HB2	1.96	0.48
1:D:81:VAL:HG12	1:D:117:LEU:HB2	1.96	0.47
1:B:160:SER:HB3	1:F:52:THR:HA	1.96	0.47
1:B:99:GLN:HE22	1:C:99:GLN:HA	1.79	0.47
1:I:131:LEU:HB3	1:I:132:PRO:CD	2.42	0.46
1:F:114:ASN:HD22	1:F:116:VAL:H	1.63	0.46
1:H:131:LEU:HB2	1:H:132:PRO:CD	2.39	0.46
1:A:99:GLN:HB3	6:A:2031:HOH:O	2.16	0.46
1:D:138:LYS:HD2	1:D:141:GLN:OE1	2.15	0.46
1:B:15:ALA:O	1:B:18:VAL:HG12	2.16	0.45
1:J:155:GLU:O	1:J:159:HIS:HE1	1.98	0.45
1:I:83:ILE:HG12	6:I:2042:HOH:O	2.15	0.45
2:B:701:PUG:H102	2:B:701:PUG:O23	2.16	0.45
1:E:27:TRP:HD1	1:E:28:HIS:CD2	2.34	0.44
1:I:58:GLY:HA3	2:I:701:PUG:H11	1.99	0.44
1:D:87:THR:HG21	1:E:119:THR:HG22	1.99	0.44
1:H:40:ARG:NH2	1:H:53:VAL:HG21	2.32	0.44
1:A:138:LYS:NZ	2:E:701:PUG:O4	2.51	0.44
1:D:87:THR:C	1:D:89:HIS:H	2.21	0.44
1:G:31:ILE:HB	1:G:81:VAL:HG21	1.98	0.44
1:F:131:LEU:HB3	1:F:132:PRO:HD2	2.00	0.43
1:G:28:HIS:CE1	1:G:83:ILE:HD12	2.53	0.43
1:D:31:ILE:HG21	1:D:81:VAL:HG11	2.01	0.43
1:F:40:ARG:HH21	1:F:53:VAL:HG21	1.84	0.43
1:A:37:ASP:O	1:A:41:LYS:HG2	2.18	0.43
1:J:27:TRP:HD1	1:J:28:HIS:CD2	2.37	0.43
1:J:15:ALA:HB2	1:J:151:LEU:HD11	1.99	0.43
1:A:58:GLY:HA3	2:A:701:PUG:H11	2.00	0.43
2:C:701:PUG:O4	1:D:138:LYS:NZ	2.52	0.42
1:E:154:ARG:HG3	6:H:2016:HOH:O	2.19	0.42
1:E:131:LEU:HB3	1:E:132:PRO:HD2	2.01	0.42
1:B:131:LEU:HB3	1:B:132:PRO:CD	2.50	0.42
1:D:58:GLY:HA3	2:D:701:PUG:H11	2.02	0.42
1:H:138:LYS:HE3	6:H:2046:HOH:O	2.19	0.42
1:D:52:THR:HA	1:I:160:SER:OG	2.20	0.42
1:F:60:ILE:HD11	1:F:93:VAL:HA	2.02	0.42
1:A:131:LEU:HB3	1:A:132:PRO:HD2	2.02	0.41
1:G:87:THR:C	1:G:89:HIS:H	2.24	0.41
1:E:160:SER:HA	1:H:52:THR:HG23	2.02	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:60:ILE:O	1:B:63:PRO:HD2	2.21	0.41
1:C:27:TRP:HD1	1:C:28:HIS:CD2	2.39	0.40
1:B:72:ASN:HD22	1:B:72:ASN:HA	1.75	0.40
1:J:159:HIS:HB2	1:J:160:SER:HB3	2.03	0.40
1:C:158:ALA:HB1	1:F:156:LEU:HD22	2.03	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	145/160 (91%)	140 (97%)	5 (3%)	0	100	100
1	B	145/160 (91%)	142 (98%)	3 (2%)	0	100	100
1	C	144/160 (90%)	140 (97%)	3 (2%)	1 (1%)	26	59
1	D	145/160 (91%)	139 (96%)	6 (4%)	0	100	100
1	E	144/160 (90%)	138 (96%)	5 (4%)	1 (1%)	26	59
1	F	145/160 (91%)	139 (96%)	5 (3%)	1 (1%)	26	59
1	G	145/160 (91%)	142 (98%)	2 (1%)	1 (1%)	26	59
1	H	144/160 (90%)	140 (97%)	1 (1%)	3 (2%)	9	25
1	I	145/160 (91%)	137 (94%)	8 (6%)	0	100	100
1	J	144/160 (90%)	140 (97%)	4 (3%)	0	100	100
All	All	1446/1600 (90%)	1397 (97%)	42 (3%)	7 (0%)	34	67

All (7) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	F	15	ALA
1	H	29	GLY

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Mol	Chain	Res	Type
1	G	88	PRO
1	C	50	ASP
1	H	132	PRO
1	H	88	PRO
1	E	88	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	111/120 (92%)	103 (93%)	8 (7%)	18	42
1	B	111/120 (92%)	108 (97%)	3 (3%)	52	83
1	C	110/120 (92%)	107 (97%)	3 (3%)	52	83
1	D	111/120 (92%)	107 (96%)	4 (4%)	42	75
1	E	110/120 (92%)	104 (94%)	6 (6%)	27	56
1	F	111/120 (92%)	106 (96%)	5 (4%)	34	66
1	G	111/120 (92%)	107 (96%)	4 (4%)	42	75
1	H	110/120 (92%)	102 (93%)	8 (7%)	17	41
1	I	111/120 (92%)	106 (96%)	5 (4%)	34	66
1	J	110/120 (92%)	107 (97%)	3 (3%)	52	83
All	All	1106/1200 (92%)	1057 (96%)	49 (4%)	35	67

All (49) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	19	ARG
1	A	48	LEU
1	A	72	ASN
1	A	89	HIS
1	A	98	THR
1	A	114	ASN
1	A	133	THR
1	A	154	ARG

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Mol	Chain	Res	Type
1	B	72	ASN
1	B	86	GLN
1	B	123	GLU
1	C	18	VAL
1	C	114	ASN
1	C	122	GLU
1	D	57	LEU
1	D	81	VAL
1	D	114	ASN
1	D	160	SER
1	E	30	LYS
1	E	37	ASP
1	E	42	VAL
1	E	98	THR
1	E	114	ASN
1	E	136	GLU
1	F	72	ASN
1	F	114	ASN
1	F	123	GLU
1	F	136	GLU
1	F	154	ARG
1	G	61	GLU
1	G	72	ASN
1	G	103	ARG
1	G	154	ARG
1	H	41	LYS
1	H	57	LEU
1	H	74	ASP
1	H	91	ASP
1	H	109	SER
1	H	114	ASN
1	H	131	LEU
1	H	155	GLU
1	I	18	VAL
1	I	57	LEU
1	I	72	ASN
1	I	114	ASN
1	I	154	ARG
1	J	19	ARG
1	J	114	ASN
1	J	128	ARG

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (26) such

sidechains are listed below:

Mol	Chain	Res	Type
1	A	28	HIS
1	A	72	ASN
1	B	72	ASN
1	B	89	HIS
1	B	99	GLN
1	D	72	ASN
1	D	99	GLN
1	D	114	ASN
1	E	99	GLN
1	E	114	ASN
1	F	28	HIS
1	F	72	ASN
1	F	114	ASN
1	G	28	HIS
1	G	72	ASN
1	G	99	GLN
1	H	114	ASN
1	H	159	HIS
1	I	72	ASN
1	I	86	GLN
1	I	99	GLN
1	I	114	ASN
1	I	120	ASN
1	J	28	HIS
1	J	114	ASN
1	J	159	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 carbohydrates in this entry.

5.6 Ligand geometry ⓘ

Of 37 ligands modelled in this entry, 15 are monoatomic - leaving 22 for Mogul analysis.

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	PO4	A	1163	-	4,4,4	0.40	0	6,6,6	0.28	0
2	PUG	A	701	-	20,22,22	2.45	3 (15%)	21,32,32	4.24	7 (33%)
4	PO4	B	1162	-	4,4,4	0.40	0	6,6,6	0.28	0
2	PUG	B	701	-	20,22,22	2.44	4 (20%)	21,32,32	4.36	7 (33%)
4	PO4	C	1163	-	4,4,4	0.39	0	6,6,6	0.27	0
5	MPD	C	1164	-	6,7,7	0.32	0	7,10,10	0.27	0
2	PUG	C	701	-	20,22,22	2.44	4 (20%)	21,32,32	4.42	7 (33%)
4	PO4	D	1163	-	4,4,4	0.43	0	6,6,6	0.28	0
2	PUG	D	701	-	20,22,22	2.49	4 (20%)	21,32,32	4.16	7 (33%)
4	PO4	E	1163	-	4,4,4	0.36	0	6,6,6	0.28	0
2	PUG	E	701	-	20,22,22	2.39	4 (20%)	21,32,32	4.41	7 (33%)
4	PO4	F	1162	-	4,4,4	0.40	0	6,6,6	0.27	0
2	PUG	F	701	-	20,22,22	2.36	3 (15%)	21,32,32	4.43	7 (33%)
4	PO4	G	1163	-	4,4,4	0.39	0	6,6,6	0.27	0
2	PUG	G	701	-	20,22,22	2.43	4 (20%)	21,32,32	4.22	7 (33%)
4	PO4	H	1162	-	4,4,4	0.42	0	6,6,6	0.27	0
2	PUG	H	701	-	20,22,22	2.43	4 (20%)	21,32,32	4.24	7 (33%)
4	PO4	I	1162	-	4,4,4	0.37	0	6,6,6	0.28	0
2	PUG	I	701	-	20,22,22	2.45	3 (15%)	21,32,32	4.22	7 (33%)
4	PO4	J	1162	-	4,4,4	0.43	0	6,6,6	0.26	0
5	MPD	J	1163	-	6,7,7	0.35	0	7,10,10	0.28	0
2	PUG	J	701	-	20,22,22	2.47	4 (20%)	21,32,32	4.17	7 (33%)

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	PO4	A	1163	-	-	0/0/0/0	0/0/0/0
2	PUG	A	701	-	-	0/14/42/42	0/2/2/2
4	PO4	B	1162	-	-	0/0/0/0	0/0/0/0
2	PUG	B	701	-	-	0/14/42/42	0/2/2/2
4	PO4	C	1163	-	-	0/0/0/0	0/0/0/0
5	MPD	C	1164	-	-	0/5/5/5	0/0/0/0
2	PUG	C	701	-	-	0/14/42/42	0/2/2/2
4	PO4	D	1163	-	-	0/0/0/0	0/0/0/0
2	PUG	D	701	-	-	0/14/42/42	0/2/2/2
4	PO4	E	1163	-	-	0/0/0/0	0/0/0/0
2	PUG	E	701	-	-	0/14/42/42	0/2/2/2
4	PO4	F	1162	-	-	0/0/0/0	0/0/0/0
2	PUG	F	701	-	-	0/14/42/42	0/2/2/2
4	PO4	G	1163	-	-	0/0/0/0	0/0/0/0
2	PUG	G	701	-	-	0/14/42/42	0/2/2/2
4	PO4	H	1162	-	-	0/0/0/0	0/0/0/0
2	PUG	H	701	-	-	0/14/42/42	0/2/2/2
4	PO4	I	1162	-	-	0/0/0/0	0/0/0/0
2	PUG	I	701	-	-	0/14/42/42	0/2/2/2
4	PO4	J	1162	-	-	0/0/0/0	0/0/0/0
5	MPD	J	1163	-	-	0/5/5/5	0/0/0/0
2	PUG	J	701	-	-	0/14/42/42	0/2/2/2

All (37) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	701	PUG	C8-N7	-8.84	1.35	1.45
2	J	701	PUG	C8-N7	-8.79	1.35	1.45
2	I	701	PUG	C8-N7	-8.74	1.35	1.45
2	B	701	PUG	C8-N7	-8.73	1.35	1.45
2	A	701	PUG	C8-N7	-8.59	1.35	1.45
2	G	701	PUG	C8-N7	-8.56	1.35	1.45
2	C	701	PUG	C8-N7	-8.55	1.35	1.45
2	H	701	PUG	C8-N7	-8.45	1.35	1.45
2	F	701	PUG	C8-N7	-8.32	1.35	1.45
2	E	701	PUG	C8-N7	-8.26	1.35	1.45
2	C	701	PUG	C9-N5	-4.67	1.35	1.45
2	E	701	PUG	C9-N5	-4.65	1.35	1.45
2	D	701	PUG	C9-N5	-4.62	1.35	1.45
2	H	701	PUG	C9-N5	-4.61	1.35	1.45
2	G	701	PUG	C9-N5	-4.59	1.35	1.45
2	B	701	PUG	C9-N5	-4.52	1.35	1.45
2	A	701	PUG	C9-N5	-4.51	1.35	1.45

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	F	701	PUG	C9-N5	-4.50	1.35	1.45
2	I	701	PUG	C9-N5	-4.45	1.35	1.45
2	J	701	PUG	C9-N5	-4.42	1.35	1.45
2	C	701	PUG	C9-C4	-2.36	1.48	1.53
2	H	701	PUG	C9-C4	-2.21	1.49	1.53
2	E	701	PUG	C9-C4	-2.20	1.49	1.53
2	D	701	PUG	C9-C4	-2.18	1.49	1.53
2	B	701	PUG	C9-C4	-2.17	1.49	1.53
2	J	701	PUG	C9-C4	-2.17	1.49	1.53
2	G	701	PUG	C9-C4	-2.12	1.49	1.53
2	B	701	PUG	O4-C6	2.93	1.28	1.23
2	C	701	PUG	O4-C6	2.98	1.28	1.23
2	E	701	PUG	O4-C6	3.03	1.28	1.23
2	D	701	PUG	O4-C6	3.09	1.29	1.23
2	F	701	PUG	O4-C6	3.11	1.29	1.23
2	J	701	PUG	O4-C6	3.24	1.29	1.23
2	G	701	PUG	O4-C6	3.27	1.29	1.23
2	I	701	PUG	O4-C6	3.28	1.29	1.23
2	A	701	PUG	O4-C6	3.36	1.29	1.23
2	H	701	PUG	O4-C6	3.36	1.29	1.23

All (70) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	701	PUG	C8-N7-C6	-13.20	103.66	112.03
2	F	701	PUG	C8-N7-C6	-13.16	103.69	112.03
2	E	701	PUG	C8-N7-C6	-13.11	103.72	112.03
2	B	701	PUG	C8-N7-C6	-12.88	103.87	112.03
2	H	701	PUG	C8-N7-C6	-12.54	104.08	112.03
2	I	701	PUG	C8-N7-C6	-12.37	104.19	112.03
2	G	701	PUG	C8-N7-C6	-12.37	104.19	112.03
2	A	701	PUG	C8-N7-C6	-12.35	104.20	112.03
2	D	701	PUG	C8-N7-C6	-12.28	104.25	112.03
2	J	701	PUG	C8-N7-C6	-12.09	104.37	112.03
2	E	701	PUG	O4-C6-N5	-2.99	120.83	126.77
2	I	701	PUG	O4-C6-N5	-2.80	121.22	126.77
2	F	701	PUG	O4-C6-N5	-2.75	121.31	126.77
2	C	701	PUG	O4-C6-N5	-2.75	121.32	126.77
2	H	701	PUG	O4-C6-N5	-2.68	121.44	126.77
2	D	701	PUG	O4-C6-N5	-2.68	121.45	126.77
2	G	701	PUG	O4-C6-N5	-2.59	121.63	126.77
2	B	701	PUG	O4-C6-N5	-2.50	121.81	126.77

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	A	701	PUG	O4-C6-N5	-2.40	122.01	126.77
2	J	701	PUG	O4-C6-N5	-2.29	122.23	126.77
2	I	701	PUG	C10-N7-C8	2.96	128.67	124.10
2	D	701	PUG	C10-N7-C8	3.16	128.99	124.10
2	G	701	PUG	C10-N7-C8	3.36	129.30	124.10
2	C	701	PUG	C10-N7-C8	3.65	129.75	124.10
2	H	701	PUG	C10-N7-C8	3.66	129.76	124.10
2	A	701	PUG	C10-N7-C8	3.67	129.77	124.10
2	B	701	PUG	C10-N7-C8	3.71	129.84	124.10
2	F	701	PUG	C10-N7-C8	3.73	129.86	124.10
2	J	701	PUG	C10-N7-C8	3.92	130.16	124.10
2	E	701	PUG	C10-N7-C8	4.31	130.77	124.10
2	B	701	PUG	N3-C2-N1	4.62	121.19	116.14
2	J	701	PUG	N3-C2-N1	4.65	121.23	116.14
2	C	701	PUG	N3-C2-N1	4.91	121.52	116.14
2	A	701	PUG	N3-C2-N1	4.92	121.53	116.14
2	H	701	PUG	N3-C2-N1	4.96	121.57	116.14
2	D	701	PUG	N3-C2-N1	4.99	121.61	116.14
2	G	701	PUG	N3-C2-N1	5.05	121.67	116.14
2	F	701	PUG	N3-C2-N1	5.06	121.68	116.14
2	I	701	PUG	N3-C2-N1	5.11	121.73	116.14
2	A	701	PUG	C8-C9-N5	5.12	108.71	102.09
2	F	701	PUG	C8-C9-N5	5.21	108.82	102.09
2	I	701	PUG	C8-C9-N5	5.22	108.83	102.09
2	J	701	PUG	C8-C9-N5	5.22	108.84	102.09
2	E	701	PUG	N3-C2-N1	5.29	121.94	116.14
2	G	701	PUG	C8-C9-N5	5.34	108.99	102.09
2	C	701	PUG	C8-C9-N5	5.38	109.05	102.09
2	H	701	PUG	C8-C9-N5	5.45	109.14	102.09
2	E	701	PUG	C8-C9-N5	5.50	109.19	102.09
2	B	701	PUG	C8-C9-N5	5.51	109.21	102.09
2	D	701	PUG	C8-C9-N5	5.54	109.25	102.09
2	I	701	PUG	N5-C6-N7	5.57	115.10	108.39
2	A	701	PUG	N5-C6-N7	5.61	115.14	108.39
2	G	701	PUG	N5-C6-N7	5.63	115.17	108.39
2	J	701	PUG	N5-C6-N7	5.73	115.29	108.39
2	H	701	PUG	N5-C6-N7	5.78	115.35	108.39
2	D	701	PUG	N5-C6-N7	5.81	115.38	108.39
2	F	701	PUG	N5-C6-N7	6.10	115.73	108.39
2	B	701	PUG	N5-C6-N7	6.17	115.82	108.39
2	C	701	PUG	N5-C6-N7	6.18	115.83	108.39
2	E	701	PUG	N5-C6-N7	6.18	115.83	108.39

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	701	PUG	C9-C8-N7	9.84	108.03	102.75
2	H	701	PUG	C9-C8-N7	10.06	108.14	102.75
2	E	701	PUG	C9-C8-N7	10.10	108.17	102.75
2	G	701	PUG	C9-C8-N7	10.22	108.23	102.75
2	J	701	PUG	C9-C8-N7	10.22	108.23	102.75
2	B	701	PUG	C9-C8-N7	10.33	108.29	102.75
2	I	701	PUG	C9-C8-N7	10.53	108.40	102.75
2	A	701	PUG	C9-C8-N7	10.55	108.41	102.75
2	C	701	PUG	C9-C8-N7	10.59	108.43	102.75
2	F	701	PUG	C9-C8-N7	10.74	108.51	102.75

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

6 monomers are involved in 6 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	701	PUG	1	0
2	B	701	PUG	1	0
2	C	701	PUG	1	0
2	D	701	PUG	1	0
2	E	701	PUG	1	0
2	I	701	PUG	1	0

5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data ⓘ

6.1 Protein, DNA and RNA chains ⓘ

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

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	147/160 (91%)	-0.01	6 (4%) 41 34	33, 33, 33, 33	0
1	B	147/160 (91%)	-0.25	4 (2%) 58 51	33, 33, 33, 33	0
1	C	146/160 (91%)	-0.26	1 (0%) 89 86	33, 33, 33, 33	0
1	D	147/160 (91%)	-0.30	0 100 100	33, 33, 33, 33	0
1	E	146/160 (91%)	0.02	8 (5%) 29 22	33, 33, 33, 33	0
1	F	147/160 (91%)	-0.18	1 (0%) 89 86	33, 33, 33, 33	0
1	G	147/160 (91%)	-0.19	3 (2%) 68 63	33, 33, 33, 33	0
1	H	146/160 (91%)	-0.09	5 (3%) 49 42	33, 33, 33, 33	0
1	I	147/160 (91%)	-0.19	4 (2%) 58 51	33, 33, 33, 33	0
1	J	146/160 (91%)	-0.20	4 (2%) 58 51	33, 33, 33, 33	0
All	All	1466/1600 (91%)	-0.16	36 (2%) 61 54	33, 33, 33, 33	0

All (36) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	E	133	THR	6.3
1	E	134	SER	6.1
1	A	134	SER	5.6
1	H	134	SER	5.3
1	H	133	THR	4.8
1	A	133	THR	4.8
1	J	132	PRO	4.2
1	A	130	GLY	3.7
1	I	133	THR	3.5
1	A	135	ALA	3.4
1	I	134	SER	3.4
1	E	50	ASP	3.2
1	E	37	ASP	3.1

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Mol	Chain	Res	Type	RSRZ
1	H	132	PRO	3.0
1	E	86	GLN	3.0
1	A	159	HIS	2.8
1	J	85	GLY	2.7
1	H	136	GLU	2.7
1	E	91	ASP	2.5
1	G	135	ALA	2.4
1	I	87	THR	2.4
1	J	135	ALA	2.4
1	B	134	SER	2.4
1	B	133	THR	2.4
1	F	130	GLY	2.4
1	H	50	ASP	2.4
1	I	121	THR	2.3
1	A	85	GLY	2.3
1	C	87	THR	2.3
1	G	45	GLY	2.2
1	G	123	GLU	2.2
1	B	160	SER	2.2
1	E	33	ASP	2.1
1	E	49	ASP	2.1
1	J	49	ASP	2.1
1	B	135	ALA	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 carbohydrates 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. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. 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	LLDF	B-factors(\AA^2)	Q<0.9
4	PO4	I	1162	5/5	0.90	0.35	2.38	33,33,33,33	0
4	PO4	D	1163	5/5	0.92	0.28	2.24	32,32,33,33	0
4	PO4	G	1163	5/5	0.93	0.29	1.78	32,32,33,33	0
4	PO4	E	1163	5/5	0.91	0.37	1.33	33,33,33,33	0
4	PO4	B	1162	5/5	0.94	0.22	0.76	32,32,33,33	0
4	PO4	H	1162	5/5	0.96	0.24	0.74	32,32,32,33	0
4	PO4	F	1162	5/5	0.93	0.25	0.37	32,33,33,33	0
3	K	G	1161	1/1	0.99	0.17	0.15	33,33,33,33	0
4	PO4	C	1163	5/5	0.95	0.20	0.06	32,32,33,33	0
3	K	E	1162	1/1	0.99	0.18	0.03	34,34,34,34	0
2	PUG	C	701	21/21	0.92	0.14	0.02	32,32,32,33	0
4	PO4	A	1163	5/5	0.95	0.23	-0.05	33,33,33,33	0
2	PUG	F	701	21/21	0.90	0.15	-0.14	32,32,32,32	0
2	PUG	H	701	21/21	0.93	0.13	-0.41	32,32,33,33	0
2	PUG	D	701	21/21	0.89	0.13	-0.59	32,32,32,32	0
2	PUG	E	701	21/21	0.92	0.14	-0.67	32,32,32,32	0
3	K	A	1162	1/1	0.98	0.14	-0.70	33,33,33,33	0
2	PUG	I	701	21/21	0.94	0.12	-0.70	32,32,32,32	0
3	K	D	1162	1/1	0.99	0.12	-0.86	33,33,33,33	0
2	PUG	A	701	21/21	0.93	0.13	-0.88	32,32,32,33	0
2	PUG	B	701	21/21	0.92	0.12	-0.94	32,32,32,33	0
2	PUG	G	701	21/21	0.95	0.12	-1.16	32,32,32,32	0
2	PUG	J	701	21/21	0.95	0.08	-1.57	32,32,32,33	0
3	K	C	1162	1/1	0.96	0.11	-1.58	33,33,33,33	0
3	K	D	1161	1/1	0.99	0.04	-3.22	32,32,32,32	0
3	K	E	1161	1/1	0.99	0.05	-4.09	32,32,32,32	0
3	K	B	1161	1/1	0.99	0.04	-4.82	32,32,32,32	0
3	K	F	1161	1/1	0.99	0.04	-6.42	32,32,32,32	0
3	K	H	1161	1/1	0.97	0.08	-	33,33,33,33	0
3	K	I	1161	1/1	0.99	0.06	-	32,32,32,32	0
3	K	C	1161	1/1	0.99	0.04	-	32,32,32,32	0
3	K	G	1162	1/1	0.99	0.05	-	32,32,32,32	0
3	K	J	1161	1/1	0.99	0.02	-	32,32,32,32	0
5	MPD	C	1164	8/8	0.97	0.11	-	32,32,32,32	0
5	MPD	J	1163	8/8	0.92	0.14	-	33,33,33,33	0
4	PO4	J	1162	5/5	0.91	0.23	-	32,32,33,33	0
3	K	A	1161	1/1	0.98	0.05	-	32,32,32,32	0

6.5 Other polymers ⓘ

There are no such residues in this entry.