



Full wwPDB X-ray Structure Validation Report ⓘ

Feb 1, 2016 – 06:02 PM GMT

PDB ID : 4K9O
Title : Crystal Structure of the Phe397Ala mutant of Benzoylformate Decarboxylase from *Pseudomonas putida*
Authors : Brodtkin, H.R.; McLeish, M.J.
Deposited on : 2013-04-20
Resolution : 1.89 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

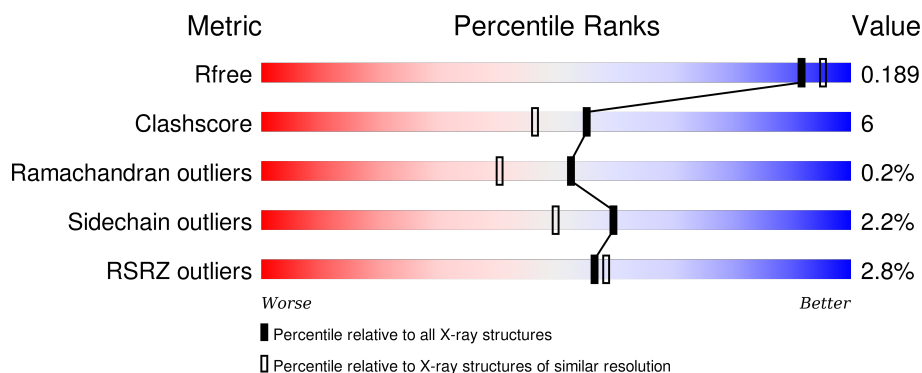
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION




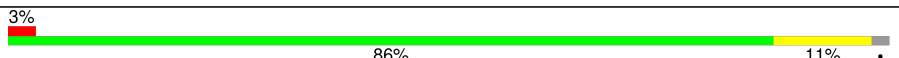
The reported resolution of this entry is 1.89 Å.

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}	91344	6965 (1.90-1.86)
Clashscore	102246	7778 (1.90-1.86)
Ramachandran outliers	100387	7691 (1.90-1.86)
Sidechain outliers	100360	7692 (1.90-1.86)
RSRZ outliers	91569	6979 (1.90-1.86)

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	533	
1	B	533	
1	C	533	
1	D	533	

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
3	TPP	D	602	-	-	X	-
5	GOL	B	604	-	-	-	X
5	GOL	B	605	-	-	-	X
5	GOL	B	607	-	-	-	X
5	GOL	D	603	-	-	-	X

2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 17289 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 Benzoylformate decarboxylase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	525	Total	C	N	O	S	0	5	0
			3963	2510	684	748	21			
1	B	525	Total	C	N	O	S	0	6	0
			3962	2505	683	753	21			
1	C	524	Total	C	N	O	S	0	6	0
			3953	2499	682	751	21			
1	D	524	Total	C	N	O	S	0	5	0
			3956	2504	683	748	21			

There are 28 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	397	ALA	PHE	ENGINEERED MUTATION	UNP P20906
A	529	HIS	-	EXPRESSION TAG	UNP P20906
A	530	HIS	-	EXPRESSION TAG	UNP P20906
A	531	HIS	-	EXPRESSION TAG	UNP P20906
A	532	HIS	-	EXPRESSION TAG	UNP P20906
A	533	HIS	-	EXPRESSION TAG	UNP P20906
A	534	HIS	-	EXPRESSION TAG	UNP P20906
B	397	ALA	PHE	ENGINEERED MUTATION	UNP P20906
B	529	HIS	-	EXPRESSION TAG	UNP P20906
B	530	HIS	-	EXPRESSION TAG	UNP P20906
B	531	HIS	-	EXPRESSION TAG	UNP P20906
B	532	HIS	-	EXPRESSION TAG	UNP P20906
B	533	HIS	-	EXPRESSION TAG	UNP P20906
B	534	HIS	-	EXPRESSION TAG	UNP P20906
C	397	ALA	PHE	ENGINEERED MUTATION	UNP P20906
C	529	HIS	-	EXPRESSION TAG	UNP P20906
C	530	HIS	-	EXPRESSION TAG	UNP P20906
C	531	HIS	-	EXPRESSION TAG	UNP P20906
C	532	HIS	-	EXPRESSION TAG	UNP P20906
C	533	HIS	-	EXPRESSION TAG	UNP P20906
C	534	HIS	-	EXPRESSION TAG	UNP P20906

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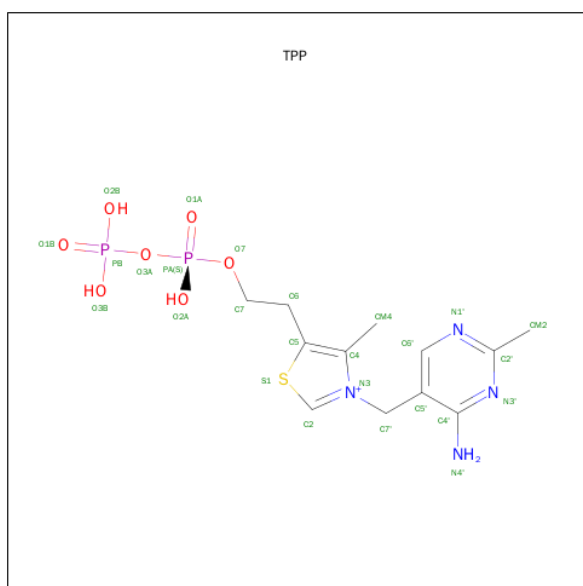
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Chain	Residue	Modelled	Actual	Comment	Reference
D	397	ALA	PHE	ENGINEERED MUTATION	UNP P20906
D	529	HIS	-	EXPRESSION TAG	UNP P20906
D	530	HIS	-	EXPRESSION TAG	UNP P20906
D	531	HIS	-	EXPRESSION TAG	UNP P20906
D	532	HIS	-	EXPRESSION TAG	UNP P20906
D	533	HIS	-	EXPRESSION TAG	UNP P20906
D	534	HIS	-	EXPRESSION TAG	UNP P20906

- Molecule 2 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	B	1	Total Mg 1 1	0	0
2	A	1	Total Mg 1 1	0	0

- Molecule 3 is THIAMINE DIPHOSPHATE (three-letter code: TPP) (formula: C₁₂H₁₉N₄O₇P₂S).



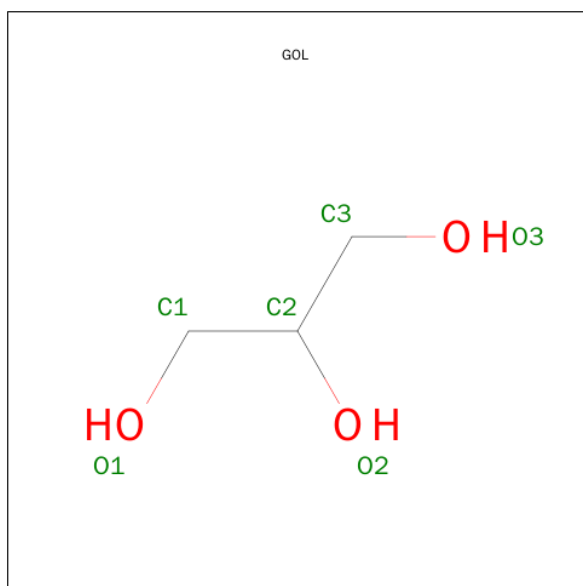
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Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
3	D	1	Total	C	N	O	P	S	0	0
			26	12	4	7	2	1		

- Molecule 4 is CALCIUM ION (three-letter code: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	B	1	Total	Ca	0	0
			1	1		
4	A	1	Total	Ca	0	0
			1	1		
4	D	1	Total	Ca	0	0
			1	1		
4	C	1	Total	Ca	0	0
			1	1		

- Molecule 5 is GLYCEROL (three-letter code: GOL) (formula: C₃H₈O₃).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	B	1	Total	C	O	0	0
			6	3	3		
5	B	1	Total	C	O	0	0
			6	3	3		
5	B	1	Total	C	O	0	0
			6	3	3		
5	B	1	Total	C	O	0	0
			6	3	3		

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	C	1	Total	C	O	0	0
			6	3	3		
5	D	1	Total	C	O	0	0
			6	3	3		

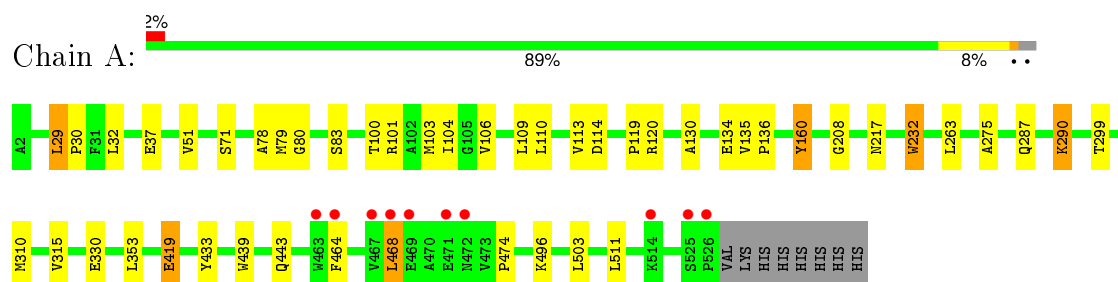
- Molecule 6 is water.

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	A	358	Total	O		0	0
			358	358			
6	B	328	Total	O		0	0
			328	328			
6	C	322	Total	O		0	0
			322	322			
6	D	301	Total	O		0	0
			301	301			

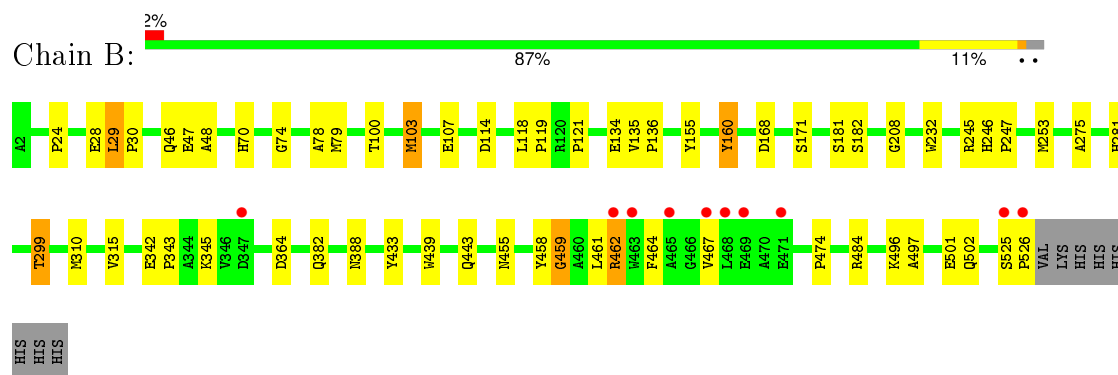
3 Residue-property plots

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.

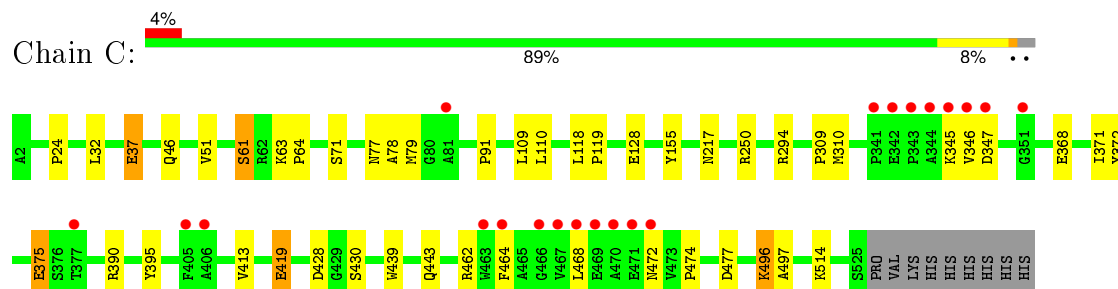
• Molecule 1: Benzoylformate decarboxylase



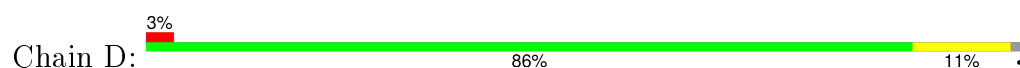
• Molecule 1: Benzoylformate decarboxylase

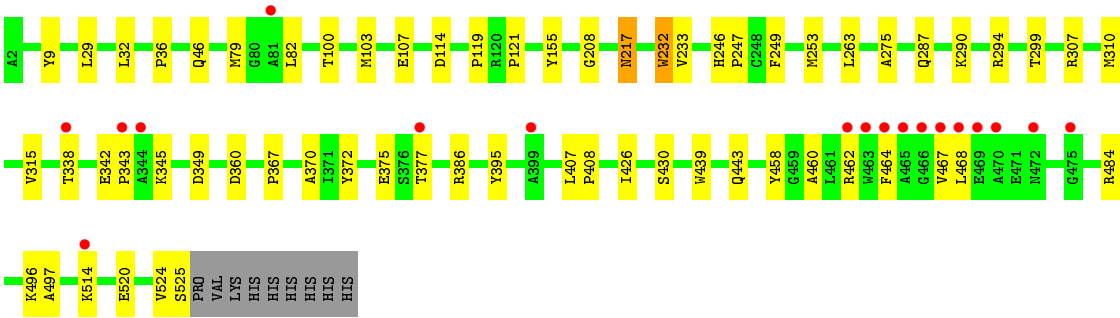


• Molecule 1: Benzoylformate decarboxylase



• Molecule 1: Benzoylformate decarboxylase





4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	70.18Å 161.22Å 175.20Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	38.49 – 1.89 38.49 – 1.89	Depositor EDS
% Data completeness (in resolution range)	93.5 (38.49-1.89) 93.5 (38.49-1.89)	Depositor EDS
R_{merge}	0.11	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.15 (at 1.89Å)	Xtriage
Refinement program	PHENIX (phenix.refine: 1.7.1_743)	Depositor
R, R_{free}	0.167 , 0.192 0.162 , 0.189	Depositor DCC
R_{free} test set	1987 reflections (1.33%)	DCC
Wilson B-factor (Å ²)	27.1	Xtriage
Anisotropy	0.081	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 45.9	EDS
Estimated twinning fraction	No twinning to report.	Xtriage
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Outliers	0 of 149435 reflections	Xtriage
F_o, F_c correlation	0.97	EDS
Total number of atoms	17289	wwPDB-VP
Average B, all atoms (Å ²)	31.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.70% 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: GOL, CA, MG, TPP

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	0.50	0/4075	0.59	0/5572
1	B	0.54	0/4075	0.60	0/5570
1	C	0.51	0/4065	0.60	1/5555 (0.0%)
1	D	0.51	0/4067	0.61	0/5560
All	All	0.52	0/16282	0.60	1/22257 (0.0%)

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	A	0	2
1	B	0	2
1	C	0	1
1	D	0	2
All	All	0	7

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	C	428	ASP	CB-CG-OD1	5.03	122.83	118.30

There are no chirality outliers.

All (7) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	232[A]	TRP	Mainchain

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Mol	Chain	Res	Type	Group
1	A	232[B]	TRP	Mainchain
1	B	103[A]	MET	Mainchain
1	B	181	SER	Mainchain
1	C	61[B]	SER	Mainchain
1	D	232[A]	TRP	Mainchain
1	D	232[B]	TRP	Mainchain

5.2 Too-close contacts [i](#)

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	3963	0	3908	46	0
1	B	3962	0	3904	61	1
1	C	3953	0	3898	48	1
1	D	3956	0	3899	58	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
3	A	26	0	16	4	0
3	B	26	0	16	5	0
3	C	26	0	16	5	0
3	D	26	0	16	10	0
4	A	1	0	0	0	0
4	B	1	0	0	0	0
4	C	1	0	0	0	0
4	D	1	0	0	0	0
5	B	24	0	32	5	0
5	C	6	0	8	0	0
5	D	6	0	8	1	0
6	A	358	0	0	3	0
6	B	328	0	0	4	0
6	C	322	0	0	8	0
6	D	301	0	0	10	0
All	All	17289	0	15721	199	1

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 6.

All (199) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:79[B]:MET:CE	1:D:79[B]:MET:HE1	1.78	1.11
1:D:524:VAL:HG12	1:D:525:SER:H	1.10	1.06
1:B:79[B]:MET:HE1	1:D:79[B]:MET:HE1	1.07	1.05
1:B:342:GLU:HG3	1:B:343:PRO:HD2	1.31	1.05
1:B:364:ASP:OD1	5:B:606:GOL:H31	1.56	1.03
1:D:524:VAL:HG12	1:D:525:SER:N	1.71	1.00
1:B:79[B]:MET:HE1	1:D:79[B]:MET:CE	1.93	0.98
1:D:524:VAL:CG1	1:D:525:SER:H	1.76	0.97
1:A:464:PHE:CZ	1:A:468:LEU:HD11	2.04	0.93
1:A:79[B]:MET:HE2	1:C:79[B]:MET:SD	2.10	0.92
1:B:79[B]:MET:SD	1:D:79[B]:MET:CE	2.64	0.86
1:B:79[B]:MET:CE	1:D:79[B]:MET:CE	2.51	0.84
1:A:79[B]:MET:CE	1:C:79[B]:MET:SD	2.67	0.82
1:C:375:GLU:HG2	1:C:430:SER:HB3	1.64	0.80
1:B:364:ASP:OD1	5:B:606:GOL:C3	2.32	0.77
1:A:464:PHE:CE2	1:A:468:LEU:HD11	2.21	0.76
1:D:107:GLU:OE2	6:D:916:HOH:O	2.06	0.74
3:C:602:TPP:HN42	3:C:602:TPP:H2	1.53	0.74
1:C:61[B]:SER:HB3	1:C:63:LYS:HG2	1.70	0.73
1:C:375:GLU:HG2	1:C:430:SER:CB	2.17	0.73
1:D:107:GLU:OE1	6:D:914:HOH:O	2.07	0.73
1:B:100:THR:CG2	1:B:103[B]:MET:HG3	2.19	0.72
1:B:281:HIS:CE1	5:B:604:GOL:H2	2.25	0.72
1:D:100:THR:CG2	1:D:103[B]:MET:HG3	2.19	0.71
1:C:464:PHE:CZ	1:C:468:LEU:HD11	2.25	0.70
1:B:439:TRP:CZ2	1:B:443:GLN:HG3	2.26	0.70
1:D:464:PHE:CE2	1:D:468:LEU:HD11	2.27	0.69
1:A:79[B]:MET:SD	1:C:79[B]:MET:SD	2.91	0.69
1:D:496:LYS:HD2	1:D:520:GLU:O	1.92	0.69
1:B:79[B]:MET:SD	1:D:79[B]:MET:HE2	2.33	0.68
1:D:458:TYR:CD1	3:D:602:TPP:H61	2.28	0.68
1:C:464:PHE:CE2	1:C:468:LEU:HD11	2.28	0.68
1:C:419:GLU:OE1	6:C:1000:HOH:O	2.11	0.68
1:A:511:LEU:O	6:A:850:HOH:O	2.11	0.68
1:B:135:VAL:HB	1:B:136:PRO:HD3	1.76	0.66
1:C:439:TRP:CZ2	1:C:443:GLN:HG3	2.30	0.66
1:D:484:ARG:HD3	6:D:996:HOH:O	1.96	0.65
3:A:602:TPP:H2	3:A:602:TPP:HN42	1.62	0.65
1:C:514:LYS:NZ	6:C:886:HOH:O	2.29	0.65
1:B:79[B]:MET:SD	1:D:79[B]:MET:HE1	2.31	0.64
1:B:29:LEU:HB2	1:B:30:PRO:HD3	1.81	0.63
1:B:107:GLU:HG3	1:D:307:ARG:HD2	1.81	0.63

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:29:LEU:HD23	1:C:464:PHE:CD2	2.34	0.63
1:C:439:TRP:CE2	1:C:443:GLN:HG3	2.34	0.63
1:A:29:LEU:CD2	1:C:464:PHE:HD2	2.12	0.63
1:C:109:LEU:O	1:C:110:LEU:HB2	1.98	0.63
1:D:375:GLU:HG2	1:D:430:SER:CB	2.31	0.60
1:B:79[B]:MET:CE	1:D:79[B]:MET:SD	2.90	0.60
1:A:135:VAL:HB	1:A:136:PRO:HD3	1.83	0.60
3:B:603:TPP:H2	3:B:603:TPP:HN42	1.67	0.60
1:B:208:GLY:HA3	1:B:275:ALA:HB2	1.83	0.59
1:A:79[B]:MET:SD	1:C:79[B]:MET:CE	2.90	0.59
1:A:464:PHE:CE2	1:A:468:LEU:CD1	2.85	0.59
1:A:330:GLU:HG2	6:A:1045:HOH:O	2.02	0.59
1:D:524:VAL:CG1	1:D:525:SER:N	2.41	0.59
3:D:602:TPP:H2	3:D:602:TPP:HN42	1.68	0.58
1:D:360:ASP:OD1	1:D:386:ARG:HG2	2.02	0.58
3:C:602:TPP:C2	3:C:602:TPP:HN42	2.15	0.58
1:A:232[A]:TRP:CH2	1:A:263:LEU:HD22	2.38	0.58
1:B:484:ARG:HD3	6:B:839:HOH:O	2.03	0.58
1:D:439:TRP:CZ2	1:D:443:GLN:HG3	2.39	0.57
1:A:79[B]:MET:SD	1:C:79[B]:MET:HE2	2.45	0.57
1:A:109:LEU:O	1:A:110:LEU:HB2	2.04	0.57
1:D:287:GLN:OE1	1:D:290:LYS:NZ	2.37	0.57
1:B:455:ASN:HB2	1:B:525:SER:HB3	1.86	0.57
1:A:29:LEU:CD2	1:C:464:PHE:CD2	2.88	0.56
1:A:100:THR:CG2	1:A:103[A]:MET:HG3	2.35	0.56
1:D:496:LYS:HG3	1:D:497:ALA:N	2.21	0.56
3:D:602:TPP:H7'2	6:D:1000:HOH:O	2.04	0.56
1:A:79[B]:MET:HE1	1:C:79[B]:MET:HE1	1.90	0.54
1:B:458:TYR:CD1	3:B:603:TPP:H61	2.43	0.54
1:D:100:THR:HG23	1:D:103[B]:MET:HG3	1.87	0.54
1:A:106[B]:VAL:HG12	1:C:309:PRO:HG3	1.89	0.54
1:D:375:GLU:HG2	1:D:430:SER:HB3	1.90	0.54
1:B:462:ARG:HH21	1:B:462:ARG:CG	2.21	0.54
1:C:79[A]:MET:CE	1:C:119:PRO:HA	2.38	0.53
1:B:160:TYR:CD1	1:B:160:TYR:C	2.81	0.53
1:D:79[A]:MET:CE	1:D:119:PRO:HA	2.38	0.53
1:D:342:GLU:HG3	1:D:343:PRO:HD2	1.91	0.53
1:A:79[B]:MET:CE	1:C:79[B]:MET:CE	2.86	0.53
1:C:496:LYS:HG3	1:C:497:ALA:N	2.23	0.53
1:B:439:TRP:CH2	1:B:443:GLN:HG3	2.44	0.52
1:D:246:HIS:CG	1:D:247:PRO:HD2	2.44	0.52

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:208:GLY:HA3	1:A:275:ALA:HB2	1.90	0.52
1:A:29:LEU:HD22	1:C:464:PHE:HD2	1.74	0.52
5:B:607:GOL:H11	1:C:128:GLU:OE2	2.10	0.52
1:A:464:PHE:CZ	1:A:468:LEU:CD1	2.87	0.52
1:C:472:ASN:ND2	6:C:1015:HOH:O	2.34	0.52
1:B:525:SER:HB2	1:B:526:PRO:HD2	1.90	0.52
3:A:602:TPP:C2	3:A:602:TPP:HN42	2.21	0.52
1:A:439:TRP:CZ2	1:A:443:GLN:HG3	2.45	0.52
1:C:419:GLU:HB2	6:C:785:HOH:O	2.10	0.51
1:B:525:SER:O	1:B:526:PRO:C	2.48	0.51
1:C:375:GLU:CG	1:C:430:SER:HB3	2.37	0.51
3:D:602:TPP:C2	6:D:1000:HOH:O	2.57	0.51
1:D:338[B]:THR:HG22	6:D:937:HOH:O	2.10	0.51
1:C:462:ARG:HH11	1:C:477:ASP:CG	2.13	0.51
1:B:246:HIS:CG	1:B:247:PRO:HD2	2.45	0.51
1:D:119:PRO:HG3	1:D:155:TYR:CG	2.44	0.51
1:B:46:GLN:OE1	1:B:48:ALA:HB3	2.10	0.51
1:B:134:GLU:HG2	1:B:134:GLU:O	2.11	0.50
1:B:497:ALA:HA	1:B:502:GLN:HB3	1.93	0.50
1:A:134:GLU:HG2	1:A:134:GLU:O	2.11	0.50
1:B:246:HIS:ND1	1:B:247:PRO:HD2	2.27	0.50
1:B:299:THR:O	1:B:315:VAL:HA	2.12	0.50
1:A:120:ARG:NH1	6:D:863:HOH:O	2.34	0.49
1:C:474:PRO:HB3	6:C:1019:HOH:O	2.12	0.49
1:B:245:ARG:HG2	1:B:388:ASN:CG	2.32	0.49
3:C:602:TPP:C2	6:C:1022:HOH:O	2.61	0.49
1:B:100:THR:HG23	1:B:103[B]:MET:HG3	1.95	0.49
1:B:47:GLU:HG2	1:B:74:GLY:O	2.13	0.49
1:C:368:GLU:HG2	1:C:390:ARG:CZ	2.43	0.49
1:C:372:TYR:O	1:C:395:TYR:HA	2.13	0.48
3:B:603:TPP:HN42	3:B:603:TPP:C2	2.27	0.47
1:A:32:LEU:HB3	1:C:474:PRO:HD2	1.95	0.47
1:B:433:TYR:HA	1:D:46:GLN:HG3	1.97	0.47
1:B:24:PRO:O	3:D:602:TPP:HM43	2.13	0.47
3:D:602:TPP:C7'	6:D:1000:HOH:O	2.63	0.47
3:B:603:TPP:H7'2	6:D:997:HOH:O	2.13	0.47
1:B:168:ASP:O	1:B:171:SER:HB2	2.14	0.47
1:D:430:SER:OG	3:D:602:TPP:O1A	2.17	0.47
1:B:114:ASP:HB3	1:D:121:PRO:HG3	1.96	0.47
1:A:287:GLN:OE1	1:A:290:LYS:HE2	2.15	0.47
1:A:80:GLY:O	1:A:83[B]:SER:HB3	2.15	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:D:349:ASP:OD1	1:D:349:ASP:C	2.54	0.46
1:B:30:PRO:HG2	1:B:160:TYR:HB2	1.97	0.46
1:B:245:ARG:NH1	6:B:824:HOH:O	2.48	0.46
1:B:79[A]:MET:SD	1:B:119:PRO:HA	2.55	0.46
1:D:377:THR:OG1	1:D:460:ALA:HB2	2.16	0.46
1:A:79[A]:MET:CE	1:A:119:PRO:HA	2.46	0.46
3:D:602:TPP:HN42	3:D:602:TPP:C2	2.27	0.46
1:D:407:LEU:HB3	1:D:408:PRO:HD3	1.97	0.46
1:D:372:TYR:O	1:D:395:TYR:HA	2.16	0.46
1:D:407:LEU:HB3	1:D:408:PRO:CD	2.46	0.46
1:C:79[A]:MET:HE2	1:C:119:PRO:HA	1.98	0.45
1:C:118:LEU:HB3	1:C:119:PRO:HD3	1.98	0.45
1:A:419:GLU:HB2	6:A:739:HOH:O	2.16	0.45
1:C:462:ARG:NH1	1:C:477:ASP:OD2	2.48	0.45
1:C:109:LEU:O	1:C:110:LEU:CB	2.63	0.45
1:B:439:TRP:CE2	1:B:443:GLN:HG3	2.51	0.45
1:A:130:ALA:HA	5:D:603:GOL:H12	1.99	0.45
1:B:119:PRO:HG3	1:B:155:TYR:CD2	2.52	0.44
1:D:233:VAL:HG23	1:D:249:PHE:CE1	2.52	0.44
1:C:368:GLU:HG2	1:C:390:ARG:NH1	2.32	0.44
1:A:51:VAL:HG21	1:A:78:ALA:HB1	1.99	0.44
1:B:118:LEU:HB3	1:B:119:PRO:HD3	1.99	0.44
1:C:118:LEU:HB3	1:C:119:PRO:CD	2.47	0.44
3:D:602:TPP:O2B	6:D:981:HOH:O	2.21	0.44
1:C:119:PRO:HG3	1:C:155:TYR:CG	2.53	0.44
1:B:462:ARG:NH2	1:B:462:ARG:CG	2.78	0.44
1:D:9:TYR:CD1	1:D:36:PRO:HG2	2.53	0.43
1:D:367:PRO:HG2	1:D:370:ALA:HB2	2.00	0.43
1:A:160:TYR:C	1:A:160:TYR:CD1	2.91	0.43
1:D:439:TRP:CE2	1:D:443:GLN:HG3	2.53	0.43
1:D:208:GLY:HA3	1:D:275:ALA:HB2	1.99	0.43
1:D:439:TRP:CH2	1:D:443:GLN:HG3	2.53	0.43
5:B:605:GOL:C1	6:B:997:HOH:O	2.67	0.43
1:A:29:LEU:HD12	1:A:29:LEU:HA	1.75	0.43
1:C:371:ILE:HG21	1:C:413:VAL:HG11	2.01	0.43
1:B:29:LEU:CB	1:B:30:PRO:HD3	2.48	0.42
1:A:29:LEU:N	1:A:30:PRO:CD	2.82	0.42
1:B:461:LEU:HD11	3:B:603:TPP:HM43	2.01	0.42
1:A:439:TRP:CE2	1:A:443:GLN:HG3	2.55	0.42
1:A:433:TYR:HA	1:C:46:GLN:HG3	2.01	0.42
1:A:299:THR:O	1:A:315:VAL:HA	2.19	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:101:ARG:HA	1:A:104:ILE:HD12	2.01	0.42
1:B:79[B]:MET:HE2	1:D:79[B]:MET:SD	2.59	0.42
1:B:29:LEU:N	1:B:30:PRO:CD	2.82	0.42
1:A:29:LEU:CB	1:A:30:PRO:HD3	2.49	0.42
1:D:232[B]:TRP:HB3	1:D:253:MET:HG3	2.01	0.42
3:C:602:TPP:C2	3:C:602:TPP:N4'	2.82	0.42
3:A:602:TPP:H7'2	6:C:1016:HOH:O	2.19	0.42
1:A:113:VAL:O	1:A:114:ASP:C	2.58	0.42
1:D:79[A]:MET:HE2	1:D:119:PRO:HA	2.00	0.41
1:D:375:GLU:HB3	1:D:426:ILE:HG23	2.01	0.41
3:A:602:TPP:H7'1	1:C:24:PRO:O	2.19	0.41
1:B:461:LEU:HD23	1:B:461:LEU:HA	1.86	0.41
1:B:464:PHE:HD2	1:D:29:LEU:HD12	1.85	0.41
1:B:458:TYR:O	1:B:459:GLY:C	2.58	0.41
1:D:217:ASN:OD1	1:D:217:ASN:N	2.53	0.41
1:B:107:GLU:HG3	1:D:307:ARG:CD	2.49	0.41
1:A:474:PRO:HD2	1:C:32:LEU:HB3	2.03	0.41
1:C:250:ARG:HA	1:C:250:ARG:HD3	1.92	0.41
1:B:47:GLU:HB3	1:B:78:ALA:HB2	2.03	0.41
1:D:299:THR:O	1:D:315:VAL:HA	2.21	0.41
1:C:64:PRO:HA	1:C:91:PRO:O	2.21	0.41
1:B:474:PRO:HD2	1:D:32:LEU:HB3	2.03	0.41
1:D:79[A]:MET:SD	1:D:82:LEU:HD12	2.61	0.41
1:A:80:GLY:HA3	1:C:77:ASN:OD1	2.21	0.41
1:C:51:VAL:HG21	1:C:78:ALA:HB1	2.02	0.41
1:B:28:GLU:OE2	1:B:70:HIS:HA	2.21	0.41
3:C:602:TPP:H7'2	6:C:1022:HOH:O	2.21	0.40
1:B:136:PRO:HG2	6:B:767:HOH:O	2.22	0.40
1:B:121:PRO:HG3	1:D:114:ASP:HB3	2.03	0.40
1:D:377:THR:HG21	3:D:602:TPP:S1	2.62	0.40
1:B:246:HIS:CE1	1:B:247:PRO:HD2	2.57	0.40
1:A:353:LEU:HD13	1:A:503:LEU:HD22	2.04	0.40
1:B:232:TRP:HB3	1:B:253:MET:HG3	2.02	0.40

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:345:LYS:NZ	1:C:37:GLU:OE1[2_455]	2.03	0.17

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	528/533 (99%)	522 (99%)	5 (1%)	1 (0%)	52	40
1	B	529/533 (99%)	521 (98%)	6 (1%)	2 (0%)	39	25
1	C	528/533 (99%)	519 (98%)	8 (2%)	1 (0%)	52	40
1	D	527/533 (99%)	517 (98%)	10 (2%)	0	100	100
All	All	2112/2132 (99%)	2079 (98%)	29 (1%)	4 (0%)	52	40

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	182	SER
1	C	71	SER
1	A	71	SER
1	B	459	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	415/418 (99%)	406 (98%)	9 (2%)	60	50
1	B	416/418 (100%)	406 (98%)	10 (2%)	57	46
1	C	415/418 (99%)	405 (98%)	10 (2%)	57	46
1	D	414/418 (99%)	406 (98%)	8 (2%)	65	56
All	All	1660/1672 (99%)	1623 (98%)	37 (2%)	60	50

All (37) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	29	LEU
1	A	37	GLU
1	A	160	TYR
1	A	217	ASN
1	A	290	LYS
1	A	310	MET
1	A	419	GLU
1	A	468	LEU
1	A	496	LYS
1	B	29	LEU
1	B	160	TYR
1	B	299	THR
1	B	310	MET
1	B	382	GLN
1	B	462	ARG
1	B	467	VAL
1	B	496	LYS
1	B	501[A]	GLU
1	B	501[B]	GLU
1	C	37	GLU
1	C	217	ASN
1	C	294	ARG
1	C	310	MET
1	C	345	LYS
1	C	346	VAL
1	C	347	ASP
1	C	375	GLU
1	C	419	GLU
1	C	496	LYS
1	D	217	ASN
1	D	263	LEU
1	D	294	ARG
1	D	310	MET
1	D	345	LYS
1	D	462	ARG
1	D	467	VAL
1	D	514	LYS

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	281	HIS

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 carbohydrates in this entry.

5.6 Ligand geometry [i](#)

Of 16 ligands modelled in this entry, 6 are monoatomic - leaving 10 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	$\# Z > 2$
3	TPP	A	602	4	20,27,27	1.49	2 (10%)	31,40,40	1.91	7 (22%)
3	TPP	B	603	4	20,27,27	1.46	2 (10%)	31,40,40	1.92	7 (22%)
5	GOL	B	604	-	5,5,5	0.21	0	5,5,5	0.23	0
5	GOL	B	605	-	5,5,5	0.20	0	5,5,5	0.25	0
5	GOL	B	606	-	5,5,5	0.20	0	5,5,5	0.25	0
5	GOL	B	607	-	5,5,5	0.20	0	5,5,5	0.22	0
3	TPP	C	602	4	20,27,27	1.48	2 (10%)	31,40,40	1.96	7 (22%)
5	GOL	C	603	-	5,5,5	0.19	0	5,5,5	0.24	0
3	TPP	D	602	4	20,27,27	1.49	2 (10%)	31,40,40	1.91	7 (22%)
5	GOL	D	603	-	5,5,5	0.20	0	5,5,5	0.22	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
3	TPP	A	602	4	-	0/16/17/17	0/2/2/2
3	TPP	B	603	4	-	0/16/17/17	0/2/2/2
5	GOL	B	604	-	-	0/4/4/4	0/0/0/0
5	GOL	B	605	-	-	0/4/4/4	0/0/0/0
5	GOL	B	606	-	-	0/4/4/4	0/0/0/0
5	GOL	B	607	-	-	0/4/4/4	0/0/0/0
3	TPP	C	602	4	-	0/16/17/17	0/2/2/2
5	GOL	C	603	-	-	0/4/4/4	0/0/0/0
3	TPP	D	602	4	-	0/16/17/17	0/2/2/2
5	GOL	D	603	-	-	0/4/4/4	0/0/0/0

All (8) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	D	602	TPP	C4-N3	-5.59	1.34	1.39
3	A	602	TPP	C4-N3	-5.57	1.34	1.39
3	C	602	TPP	C4-N3	-5.52	1.34	1.39
3	B	603	TPP	C4-N3	-5.36	1.35	1.39
3	D	602	TPP	C5'-C4'	2.31	1.48	1.42
3	B	603	TPP	C5'-C4'	2.38	1.48	1.42
3	A	602	TPP	C5'-C4'	2.38	1.48	1.42
3	C	602	TPP	C5'-C4'	2.39	1.48	1.42

All (28) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	C	602	TPP	C6-C5-S1	-3.48	115.36	120.24
3	D	602	TPP	PA-O3A-PB	-3.46	121.08	132.67
3	B	603	TPP	PA-O3A-PB	-3.45	121.10	132.67
3	B	603	TPP	C6-C5-S1	-3.36	115.54	120.24
3	A	602	TPP	C6-C5-S1	-3.34	115.56	120.24
3	C	602	TPP	PA-O3A-PB	-3.30	121.61	132.67
3	A	602	TPP	PA-O3A-PB	-3.20	121.94	132.67
3	D	602	TPP	C6-C5-S1	-3.15	115.83	120.24
3	D	602	TPP	C5'-C6'-N1'	-2.57	119.40	123.86
3	C	602	TPP	C5'-C6'-N1'	-2.54	119.45	123.86
3	B	603	TPP	C5'-C6'-N1'	-2.54	119.45	123.86
3	A	602	TPP	C5'-C6'-N1'	-2.52	119.48	123.86
3	A	602	TPP	N1'-C2'-N3'	-2.12	121.68	125.60
3	D	602	TPP	N1'-C2'-N3'	-2.11	121.69	125.60

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	C	602	TPP	N1'-C2'-N3'	-2.11	121.70	125.60
3	B	603	TPP	N1'-C2'-N3'	-2.10	121.72	125.60
3	B	603	TPP	N4'-C4'-N3'	2.64	120.77	116.95
3	C	602	TPP	N4'-C4'-N3'	2.64	120.78	116.95
3	A	602	TPP	N4'-C4'-N3'	2.72	120.88	116.95
3	D	602	TPP	N4'-C4'-N3'	2.76	120.94	116.95
3	B	603	TPP	C6'-N1'-C2'	3.55	121.97	115.77
3	A	602	TPP	C6'-N1'-C2'	3.57	122.02	115.77
3	C	602	TPP	C6'-N1'-C2'	3.58	122.02	115.77
3	D	602	TPP	C6'-N1'-C2'	3.59	122.04	115.77
3	D	602	TPP	C6-C5-C4	5.23	132.25	127.56
3	B	603	TPP	C6-C5-C4	5.53	132.52	127.56
3	A	602	TPP	C6-C5-C4	5.59	132.57	127.56
3	C	602	TPP	C6-C5-C4	5.90	132.85	127.56

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

9 monomers are involved in 30 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	602	TPP	4	0
3	B	603	TPP	5	0
5	B	604	GOL	1	0
5	B	605	GOL	1	0
5	B	606	GOL	2	0
5	B	607	GOL	1	0
3	C	602	TPP	5	0
3	D	602	TPP	10	0
5	D	603	GOL	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	525/533 (98%)	-0.21	10 (1%) 70 72	20, 27, 41, 74	4 (0%)
1	B	525/533 (98%)	-0.20	10 (1%) 70 72	21, 29, 47, 81	2 (0%)
1	C	524/533 (98%)	-0.06	21 (4%) 42 44	19, 28, 44, 69	4 (0%)
1	D	524/533 (98%)	-0.00	18 (3%) 49 50	22, 31, 52, 74	4 (0%)
All	All	2098/2132 (98%)	-0.12	59 (2%) 56 58	19, 29, 47, 81	14 (0%)

All (59) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	467	VAL	6.1
1	D	463	TRP	5.4
1	D	468	LEU	5.2
1	C	468	LEU	5.0
1	B	526	PRO	4.7
1	D	469	GLU	4.5
1	A	463	TRP	4.4
1	A	525	SER	4.4
1	C	463	TRP	4.3
1	C	471	GLU	4.3
1	B	347[A]	ASP	4.2
1	C	464	PHE	4.0
1	C	470	ALA	4.0
1	C	341	PRO	3.9
1	D	470	ALA	3.8
1	C	469	GLU	3.8
1	C	466	GLY	3.8
1	B	525	SER	3.7
1	C	467	VAL	3.6
1	D	466	GLY	3.6
1	D	472	ASN	3.6

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Mol	Chain	Res	Type	RSRZ
1	A	467	VAL	3.5
1	B	465	ALA	3.2
1	C	346	VAL	3.2
1	B	463	TRP	3.2
1	A	464	PHE	3.2
1	D	81	ALA	3.1
1	C	347	ASP	3.1
1	C	343	PRO	3.1
1	D	344	ALA	3.0
1	A	468	LEU	2.8
1	B	462	ARG	2.8
1	C	405	PHE	2.8
1	D	475	GLY	2.7
1	B	467	VAL	2.7
1	C	472	ASN	2.7
1	D	464	PHE	2.7
1	A	526	PRO	2.7
1	C	342	GLU	2.6
1	B	471	GLU	2.6
1	D	465	ALA	2.6
1	C	344	ALA	2.6
1	D	399	ALA	2.5
1	D	462	ARG	2.5
1	B	468	LEU	2.5
1	B	469	GLU	2.5
1	A	469	GLU	2.4
1	D	343	PRO	2.4
1	C	351	GLY	2.3
1	A	472	ASN	2.3
1	C	406	ALA	2.2
1	A	514	LYS	2.1
1	D	514	LYS	2.1
1	C	81	ALA	2.1
1	C	345	LYS	2.1
1	D	338[A]	THR	2.1
1	D	377	THR	2.1
1	A	471	GLU	2.0
1	C	377	THR	2.0

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

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

6.3 Carbohydrates ⓘ

There are no carbohydrates in this entry.

6.4 Ligands ⓘ

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(Å ²)	Q<0.9
5	GOL	B	605	6/6	0.86	0.48	39.89	43,45,51,54	1
5	GOL	D	603	6/6	0.86	0.20	13.59	34,38,43,46	0
5	GOL	B	604	6/6	0.78	0.28	2.91	53,58,60,60	0
5	GOL	B	607	6/6	0.88	0.12	2.63	35,40,45,49	0
3	TPP	A	602	26/26	0.95	0.11	1.05	21,31,34,40	7
3	TPP	C	602	26/26	0.92	0.14	0.80	27,31,40,41	25
5	GOL	B	606	6/6	0.86	0.15	0.74	48,54,56,60	0
2	MG	B	602	1/1	0.99	0.12	0.59	19,19,19,19	0
2	MG	A	601	1/1	0.99	0.10	0.37	16,16,16,16	0
3	TPP	B	603	26/26	0.95	0.10	-0.14	29,35,42,43	7
3	TPP	D	602	26/26	0.94	0.11	-0.26	29,38,47,49	4
4	CA	B	601	1/1	0.96	0.06	-2.14	30,30,30,30	1
4	CA	C	601	1/1	0.99	0.03	-2.84	27,27,27,27	1
4	CA	D	601	1/1	0.96	0.04	-3.60	41,41,41,41	0
4	CA	A	603	1/1	0.99	0.02	-5.40	26,26,26,26	1
5	GOL	C	603	6/6	0.84	0.17	-	54,60,60,61	0

6.5 Other polymers ⓘ

There are no such residues in this entry.