



wwPDB X-ray Structure Validation Summary Report ⓘ

May 22, 2020 – 03:25 am BST

PDB ID : 1W3N
Title : Sulfolobus solfataricus 2-keto-3-deoxygluconate (KDG) aldolase complex with D-KDG
Authors : Theodossis, A.; Walden, H.; Westwick, E.J.; Connaris, H.; Lambale, H.J.; Hough, D.W.; Danson, M.J.; Taylor, G.L.
Deposited on : 2004-07-17
Resolution : 2.10 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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 following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467
Mogul : 1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix) : 1.13
EDS : 2.11
Percentile statistics : 20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac : 5.8.0158
CCP4 : 7.0.044 (Gargrove)
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.11

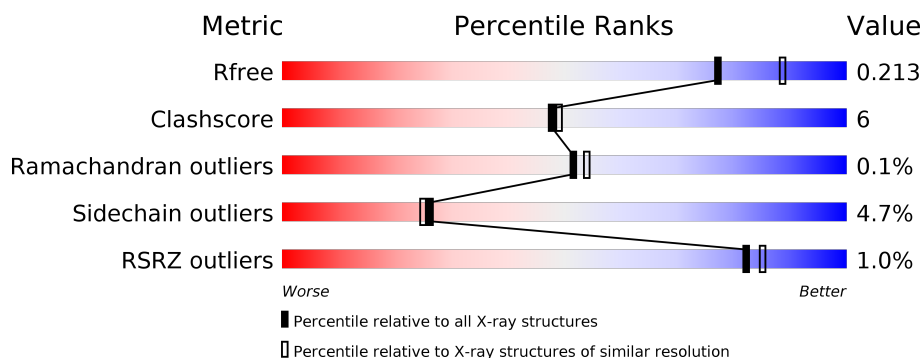
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.10 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}	130704	5197 (2.10-2.10)
Clashscore	141614	5710 (2.10-2.10)
Ramachandran outliers	138981	5647 (2.10-2.10)
Sidechain outliers	138945	5648 (2.10-2.10)
RSRZ outliers	127900	5083 (2.10-2.10)

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 respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions $\leq 5\%$. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	294	<div> <div style="width: 100%; height: 10px; background-color: red;"></div> <div style="width: 80%; height: 10px; background-color: green;"></div> <div style="width: 17%; height: 10px; background-color: yellow;"></div> <div style="width: 3%; height: 10px; background-color: orange;"></div> <div style="width: 4%; height: 10px; background-color: red;"></div> <div style="width: 100%; height: 10px; background-color: grey;"></div> <div style="display: flex; justify-content: space-between; width: 100%;"> 80% 17% • </div> </div>
1	B	294	<div> <div style="width: 80%; height: 10px; background-color: green;"></div> <div style="width: 17%; height: 10px; background-color: yellow;"></div> <div style="width: 3%; height: 10px; background-color: orange;"></div> <div style="width: 4%; height: 10px; background-color: red;"></div> <div style="width: 100%; height: 10px; background-color: grey;"></div> <div style="display: flex; justify-content: space-between; width: 100%;"> 80% 17% • </div> </div>
1	C	294	<div> <div style="width: 100%; height: 10px; background-color: red;"></div> <div style="width: 85%; height: 10px; background-color: green;"></div> <div style="width: 12%; height: 10px; background-color: yellow;"></div> <div style="width: 3%; height: 10px; background-color: orange;"></div> <div style="width: 2%; height: 10px; background-color: red;"></div> <div style="width: 100%; height: 10px; background-color: grey;"></div> <div style="display: flex; justify-content: space-between; width: 100%;"> 85% 12% • </div> </div>
1	D	294	<div> <div style="width: 85%; height: 10px; background-color: green;"></div> <div style="width: 12%; height: 10px; background-color: yellow;"></div> <div style="width: 3%; height: 10px; background-color: orange;"></div> <div style="width: 4%; height: 10px; background-color: red;"></div> <div style="width: 100%; height: 10px; background-color: grey;"></div> <div style="display: flex; justify-content: space-between; width: 100%;"> 85% 12% • </div> </div>

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 crite-

ria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
2	SSH	A	1295	X	-	-	-
2	SSH	C	1295	X	-	-	-
3	GOL	D	1296	-	-	X	-

2 Entry composition [i](#)

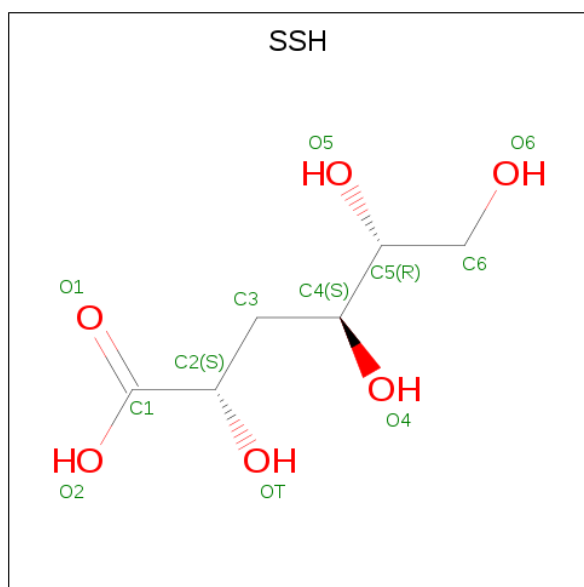
There are 4 unique types of molecules in this entry. The entry contains 10314 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called 2-KETO-3-DEOXY GLUCONATE ALDOLASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	293	Total	C	N	O	S	0	3	0
			2349	1516	382	444	7			
1	B	293	Total	C	N	O	S	0	4	0
			2359	1522	386	444	7			
1	C	293	Total	C	N	O	S	0	6	0
			2376	1533	390	446	7			
1	D	293	Total	C	N	O	S	0	4	0
			2356	1521	384	444	7			

- Molecule 2 is 3-DEOXY-D-ARABINO-HEXONIC ACID (three-letter code: SSH) (formula: $C_6H_{12}O_6$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total	C	O	0	0
			11	6	5		
2	B	1	Total	C	O	0	0
			11	6	5		

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	C	1	Total	C	O	0	0
			11	6	5		
2	D	1	Total	C	O	0	0
			11	6	5		

- Molecule 3 is GLYCEROL (three-letter code: GOL) (formula: C₃H₈O₃).



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

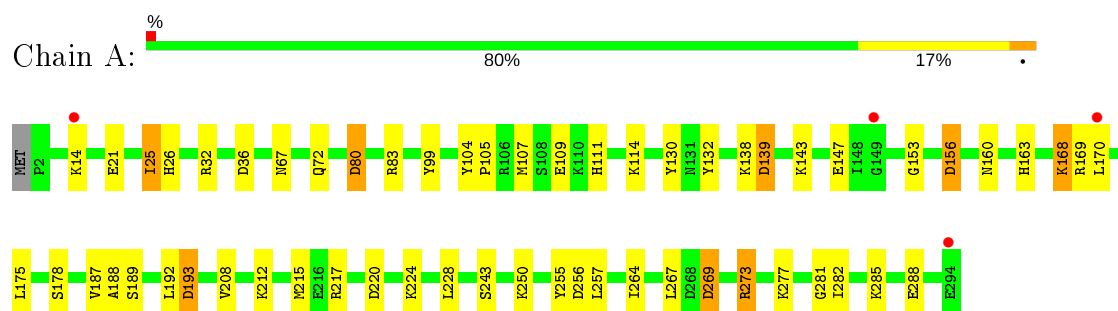
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	182	Total	O	0	0
			182	182		
4	B	226	Total	O	0	0
			226	226		
4	C	195	Total	O	0	0
			195	195		
4	D	209	Total	O	0	0
			209	209		

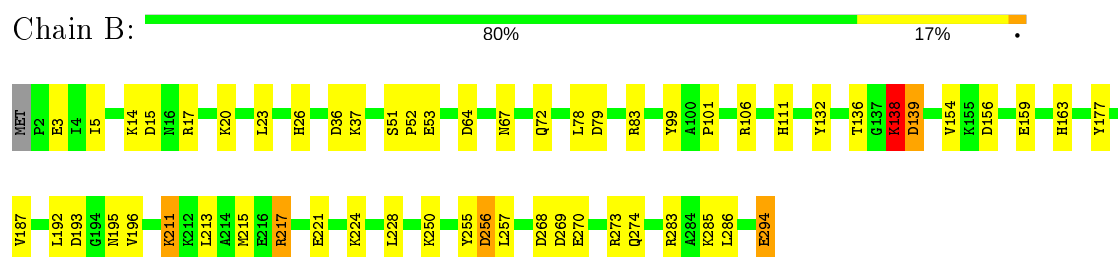
3 Residue-property plots [i](#)

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

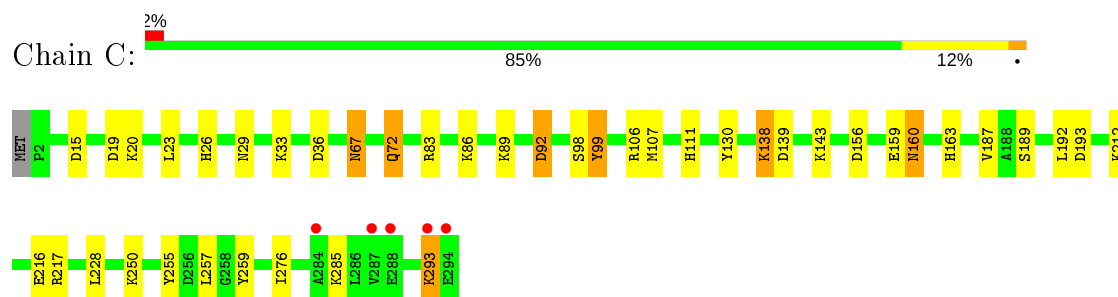
• Molecule 1: 2-KETO-3-DEOXY GLUCONATE ALDOLASE



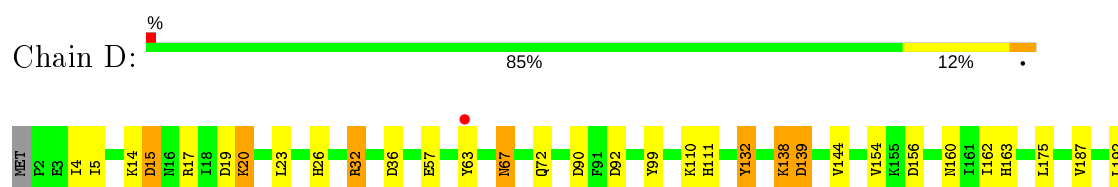
• Molecule 1: 2-KETO-3-DEOXY GLUCONATE ALDOLASE



• Molecule 1: 2-KETO-3-DEOXY GLUCONATE ALDOLASE



• Molecule 1: 2-KETO-3-DEOXY GLUCONATE ALDOLASE





4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	83.80Å 131.27Å 132.76Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	40.00 – 2.10 39.13 – 2.10	Depositor EDS
% Data completeness (in resolution range)	96.8 (40.00-2.10) 96.8 (39.13-2.10)	Depositor EDS
R_{merge}	0.08	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	4.81 (at 2.10Å)	Xtriage
Refinement program	REFMAC 5.1.24	Depositor
R, R_{free}	0.151 , 0.213 0.156 , 0.213	Depositor DCC
R_{free} test set	8347 reflections (10.03%)	wwPDB-VP
Wilson B-factor (Å ²)	21.1	Xtriage
Anisotropy	0.058	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 55.8	EDS
L-test for twinning ²	$\langle L \rangle = 0.47$, $\langle L^2 \rangle = 0.30$	Xtriage
Estimated twinning fraction	0.019 for -h,l,k	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	10314	wwPDB-VP
Average B, all atoms (Å ²)	23.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.05% 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 [i](#)

5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: GOL, SSH

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	1.02	0/2395	0.96	11/3238 (0.3%)
1	B	1.11	5/2405 (0.2%)	1.03	12/3252 (0.4%)
1	C	1.03	1/2422 (0.0%)	0.96	5/3273 (0.2%)
1	D	1.10	4/2402 (0.2%)	1.02	11/3248 (0.3%)
All	All	1.07	10/9624 (0.1%)	0.99	39/13011 (0.3%)

The worst 5 of 10 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	138	LYS	CD-CE	8.08	1.71	1.51
1	B	177	TYR	CD2-CE2	7.75	1.50	1.39
1	B	3	GLU	CD-OE2	7.43	1.33	1.25
1	B	154	VAL	CB-CG1	6.18	1.65	1.52
1	D	154	VAL	CB-CG1	5.90	1.65	1.52

The worst 5 of 39 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	138	LYS	CD-CE-NZ	-12.13	83.80	111.70
1	C	36	ASP	CB-CG-OD2	10.57	127.81	118.30
1	D	15	ASP	CB-CG-OD2	10.40	127.66	118.30
1	B	36	ASP	CB-CG-OD2	8.22	125.69	118.30
1	B	15	ASP	CB-CG-OD2	8.21	125.69	118.30

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	2349	0	2407	38	0
1	B	2359	0	2420	32	0
1	C	2376	0	2441	27	0
1	D	2356	0	2416	27	0
2	A	11	0	9	0	0
2	B	11	0	9	1	0
2	C	11	0	9	0	0
2	D	11	0	9	1	0
3	A	6	0	8	2	0
3	B	6	0	8	1	0
3	D	6	0	8	4	0
4	A	182	0	0	6	0
4	B	226	0	0	8	0
4	C	195	0	0	7	0
4	D	209	0	0	8	0
All	All	10314	0	9744	117	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 6.

The worst 5 of 117 close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:107:MET:SD	1:C:107:MET:CE	2.02	1.47
1:B:217:ARG:HD2	1:D:217:ARG:HD2	1.10	1.09
1:A:217:ARG:HD2	1:C:217:ARG:HD2	1.39	1.02
1:A:188:ALA:O	1:A:215[B]:MET:HE1	1.65	0.95
3:A:1296:GOL:H11	4:A:2159:HOH:O	1.69	0.91

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	294/294 (100%)	287 (98%)	7 (2%)	0	100	100
1	B	295/294 (100%)	290 (98%)	5 (2%)	0	100	100
1	C	297/294 (101%)	293 (99%)	3 (1%)	1 (0%)	41	41
1	D	295/294 (100%)	288 (98%)	7 (2%)	0	100	100
All	All	1181/1176 (100%)	1158 (98%)	22 (2%)	1 (0%)	51	54

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	160	ASN

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	261/259 (101%)	248 (95%)	13 (5%)	24	23
1	B	262/259 (101%)	249 (95%)	13 (5%)	24	23
1	C	264/259 (102%)	252 (96%)	12 (4%)	27	27
1	D	262/259 (101%)	250 (95%)	12 (5%)	27	26
All	All	1049/1036 (101%)	999 (95%)	50 (5%)	26	24

5 of 50 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	211	LYS
1	C	67[A]	ASN
1	D	132	TYR
1	B	224	LYS
1	B	294	GLU

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 17 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	195	ASN
1	B	274	GLN
1	D	111	HIS
1	B	163	HIS
1	D	163	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](#)

7 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
2	SSH	B	1295	1	7,10,11	1.74	1 (14%)	9,12,14	5.13	3 (33%)
2	SSH	A	1295	1	7,10,11	1.44	1 (14%)	9,12,14	3.01	3 (33%)
2	SSH	D	1295	1	7,10,11	1.82	1 (14%)	9,12,14	6.43	6 (66%)
3	GOL	D	1296	-	5,5,5	1.46	1 (20%)	5,5,5	0.93	0
2	SSH	C	1295	1	7,10,11	1.01	1 (14%)	9,12,14	3.79	5 (55%)
3	GOL	B	1296	-	5,5,5	1.43	1 (20%)	5,5,5	1.42	1 (20%)
3	GOL	A	1296	-	5,5,5	1.69	1 (20%)	5,5,5	1.35	1 (20%)

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
2	SSH	B	1295	1	-	6/9/11/14	-
2	SSH	A	1295	1	1/1/3/4	4/9/11/14	-
2	SSH	D	1295	1	-	5/9/11/14	-
3	GOL	D	1296	-	-	1/4/4/4	-
2	SSH	C	1295	1	1/1/3/4	4/9/11/14	-
3	GOL	B	1296	-	-	0/4/4/4	-
3	GOL	A	1296	-	-	2/4/4/4	-

The worst 5 of 7 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	1295	SSH	C3-C4	4.41	1.60	1.52
2	B	1295	SSH	C3-C4	4.13	1.60	1.52
2	A	1295	SSH	C3-C4	3.52	1.58	1.52
3	A	1296	GOL	O2-C2	2.69	1.51	1.43
2	C	1295	SSH	O5-C5	2.42	1.48	1.43

The worst 5 of 19 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	1295	SSH	C2-C3-C4	-14.08	100.59	113.43
2	D	1295	SSH	C2-C3-C4	-13.54	101.09	113.43
2	D	1295	SSH	O5-C5-C6	-9.72	86.33	109.14
2	C	1295	SSH	O6-C6-C5	-9.22	90.98	111.07
2	A	1295	SSH	C2-C3-C4	-7.77	106.35	113.43

All (2) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
2	A	1295	SSH	C2
2	C	1295	SSH	C2

5 of 22 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	B	1295	SSH	C1-C2-C3-C4
2	B	1295	SSH	C2-C3-C4-O4
2	B	1295	SSH	O5-C5-C6-O6
2	A	1295	SSH	C2-C3-C4-O4
2	D	1295	SSH	C1-C2-C3-C4

There are no ring outliers.

5 monomers are involved in 9 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	B	1295	SSH	1	0
2	D	1295	SSH	1	0
3	D	1296	GOL	4	0
3	B	1296	GOL	1	0
3	A	1296	GOL	2	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 [i](#)

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

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

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	293/294 (99%)	-0.14	4 (1%) 75 78	13, 22, 38, 64	0
1	B	293/294 (99%)	-0.45	0 100 100	11, 18, 31, 53	0
1	C	293/294 (99%)	-0.17	5 (1%) 70 74	13, 21, 38, 65	0
1	D	293/294 (99%)	-0.35	3 (1%) 82 85	11, 18, 34, 64	0
All	All	1172/1176 (99%)	-0.28	12 (1%) 82 85	11, 20, 36, 65	0

The worst 5 of 12 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	294	GLU	4.5
1	C	294	GLU	3.2
1	D	288	GLU	2.9
1	A	149	GLY	2.8
1	C	293	LYS	2.6

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. 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(\AA^2)	Q<0.9
3	GOL	D	1296	6/6	0.81	0.21	25,31,33,37	0
2	SSH	D	1295	11/12	0.85	0.16	2,16,23,33	0
3	GOL	A	1296	6/6	0.89	0.17	28,31,33,36	0
2	SSH	C	1295	11/12	0.90	0.15	2,2,15,33	0
2	SSH	A	1295	11/12	0.93	0.16	2,24,43,44	0
3	GOL	B	1296	6/6	0.94	0.13	23,26,28,30	0
2	SSH	B	1295	11/12	0.95	0.12	2,16,43,43	0

6.5 Other polymers [i](#)

There are no such residues in this entry.