Full wwPDB X-ray Structure Validation Report ⓘ

Jun 29, 2025 – 02:21 PM JST

PDB ID	:	9IX7 / pdb_00009ix7
Title	:	Crystal structure of homolog of dihydroxyacid dehydratase(AstD) from Aspergillus terreus
Authors	:	Huang, W.X.; Zhang, P.X.; Zhou, J.H.
Deposited on	:	2024-07-26
Resolution	:	2.29 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:

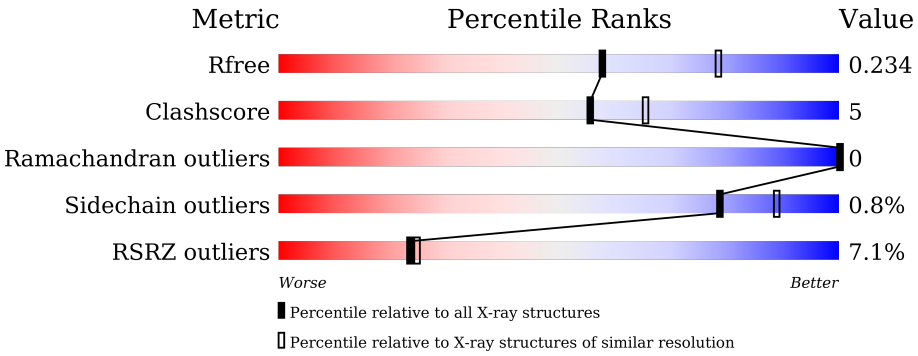
MolProbity	:	4-5-2 with Phenix2.0rc1
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	2.0rc1
EDS	:	3.0
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.006 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.44

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 2.29 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}	164625	5963 (2.30-2.30)
Clashscore	180529	6698 (2.30-2.30)
Ramachandran outliers	177936	6640 (2.30-2.30)
Sidechain outliers	177891	6640 (2.30-2.30)
RSRZ outliers	164620	5963 (2.30-2.30)

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 <=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	560	4% 74% 9% 17%
1	B	560	7% 73% 9% 17%

2 Entry composition (i)

There are 4 unique types of molecules in this entry. The entry contains 7320 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.

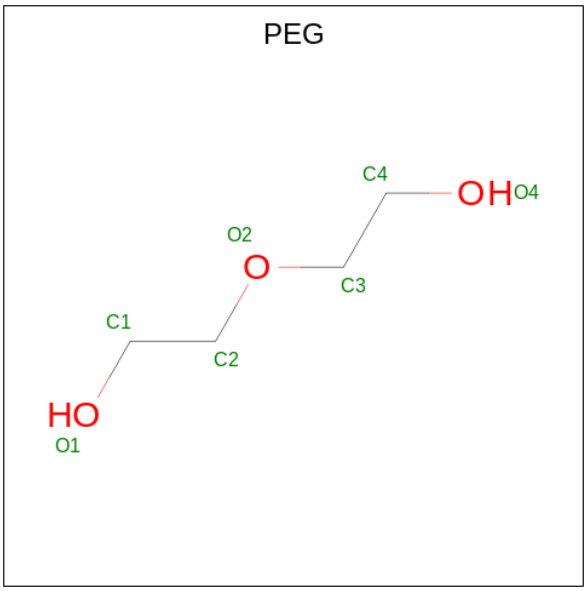
- Molecule 1 is a protein called dihydroxy-acid dehydratase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	464	Total	C	N	O	S	0	1	0
			3479	2189	596	670	24			
1	B	464	Total	C	N	O	S	0	0	0
			3475	2185	594	672	24			

There are 8 discrepancies between the modelled and reference sequences:

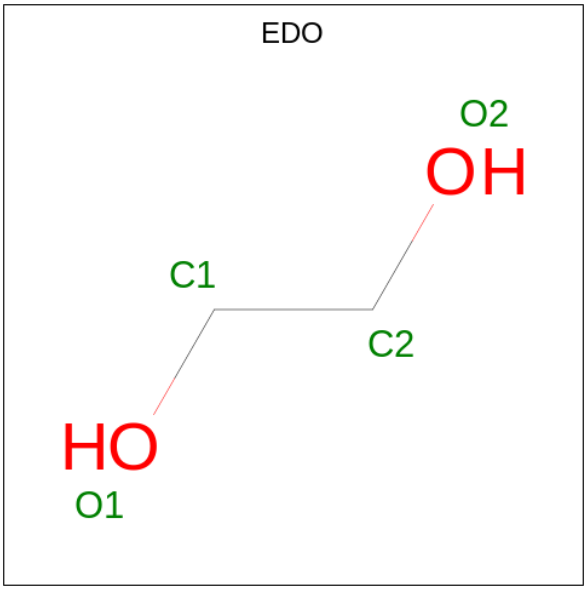
Chain	Residue	Modelled	Actual	Comment	Reference
A	39	GLY	-	expression tag	UNP A0A5M3YPM6
A	40	SER	-	expression tag	UNP A0A5M3YPM6
A	41	GLU	-	expression tag	UNP A0A5M3YPM6
A	42	PHE	-	expression tag	UNP A0A5M3YPM6
B	39	GLY	-	expression tag	UNP A0A5M3YPM6
B	40	SER	-	expression tag	UNP A0A5M3YPM6
B	41	GLU	-	expression tag	UNP A0A5M3YPM6
B	42	PHE	-	expression tag	UNP A0A5M3YPM6

- Molecule 2 is DI(HYDROXYETHYL)ETHER (CCD ID: PEG) (formula: $C_4H_{10}O_3$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	1	Total C O 7 4 3	0	0

- Molecule 3 is 1,2-ETHANEDIOL (CCD ID: EDO) (formula: $C_2H_6O_2$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total C O 4 2 2	0	0
3	B	1	Total C O 4 2 2	0	0
3	B	1	Total C O 4 2 2	0	0

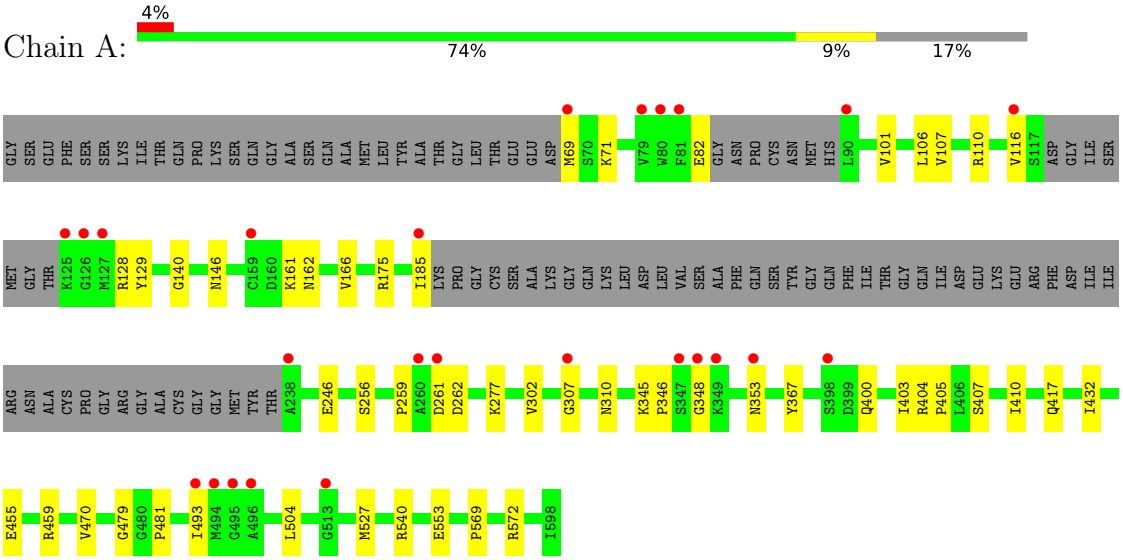
- Molecule 4 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	160	Total O 160 160	0	0
4	B	187	Total O 187 187	0	0

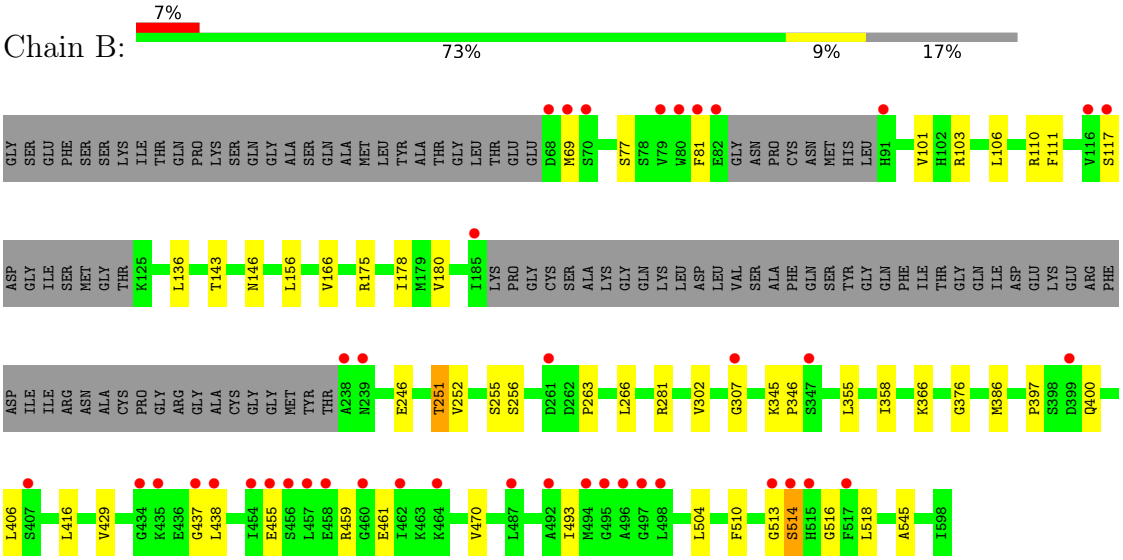
3 Residue-property plots (i)

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: dihydroxy-acid dehydratase



• Molecule 1: dihydroxy-acid dehydratase



4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	56.61Å 66.28Å 268.95Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	47.20 – 2.29 47.20 – 2.29	Depositor EDS
% Data completeness (in resolution range)	97.0 (47.20-2.29) 97.0 (47.20-2.29)	Depositor EDS
R_{merge}	0.18	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.15 (at 2.29Å)	Xtriage
Refinement program	PHENIX 1.16_3549	Depositor
R, R_{free}	0.201 , 0.232 0.202 , 0.234	Depositor DCC
R_{free} test set	2355 reflections (5.06%)	wwPDB-VP
Wilson B-factor (Å^2)	31.8	Xtriage
Anisotropy	0.119	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.35 , 38.6	EDS
L-test for twinning[2]	$< \|L\| > = 0.47$, $< L^2 > = 0.30$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.94	EDS
Total number of atoms	7320	wwPDB-VP
Average B, all atoms (Å^2)	38.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 7.35% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ 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: PEG, EDO

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	0.11	0/3538	0.34	0/4784
1	B	0.12	0/3532	0.35	0/4770
All	All	0.12	0/7070	0.35	0/9554

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	3479	0	3494	32	0
1	B	3475	0	3509	36	0
2	A	7	0	10	1	0
3	A	4	0	6	0	0
3	B	8	0	12	0	0
4	A	160	0	0	3	0
4	B	187	0	0	3	0
All	All	7320	0	7031	64	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 5.

All (64) 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:376:GLY:HA2	1:B:386:MET:HE2	1.74	0.68
1:A:146:ASN:OD1	1:A:175:ARG:NH2	2.27	0.68
1:B:263:PRO:HA	1:B:266:LEU:HD23	1.76	0.68
1:A:572:ARG:NH2	4:A:702:HOH:O	2.27	0.67
1:A:259:PRO:HB2	1:A:261:ASP:OD1	2.00	0.61
1:A:400:GLN:NE2	1:A:403:ILE:O	2.34	0.60
1:A:310:ASN:HD22	2:A:601:PEG:H32	1.67	0.59
1:A:110:ARG:O	1:B:81:PHE:HB2	2.02	0.58
1:B:355:LEU:HD23	1:B:358:ILE:HD11	1.85	0.58
1:B:366:LYS:NZ	4:B:705:HOH:O	2.35	0.58
1:A:261:ASP:OD1	1:A:262:ASP:N	2.38	0.57
1:A:185:ILE:O	1:A:353:ASN:ND2	2.38	0.56
1:B:416:LEU:HD11	1:B:429:VAL:HG13	1.89	0.55
1:A:455:GLU:O	1:A:459:ARG:HG3	2.08	0.53
1:A:302:VAL:HG12	1:A:307:GLY:HA2	1.91	0.53
1:B:455:GLU:O	1:B:459:ARG:HG3	2.10	0.52
1:B:459:ARG:NH2	1:B:461:GLU:OE1	2.39	0.52
1:A:367:TYR:OH	1:A:405:PRO:HA	2.10	0.51
1:B:156:LEU:HD13	1:B:180:VAL:HB	1.94	0.50
1:A:69:MET:SD	1:A:71:LYS:HE3	2.53	0.49
1:A:540:ARG:HB3	1:A:553:GLU:HB2	1.93	0.49
1:B:504:LEU:HB2	1:B:518:LEU:HD23	1.95	0.49
1:B:514:SER:C	1:B:516:GLY:H	2.19	0.49
1:A:404:ARG:HG3	1:A:410:ILE:HG13	1.95	0.48
1:B:146:ASN:OD1	1:B:175:ARG:NH2	2.46	0.48
1:B:103:ARG:NH1	4:B:714:HOH:O	2.45	0.48
1:B:81:PHE:CZ	1:B:117:SER:HB2	2.48	0.47
1:A:479:GLY:HA2	1:A:527:MET:HE3	1.97	0.46
1:A:101:VAL:HG13	1:A:106:LEU:HB2	1.97	0.46
1:B:101:VAL:HG13	1:B:106:LEU:HB2	1.98	0.46
1:A:277:LYS:NZ	4:A:710:HOH:O	2.50	0.45
1:B:438:LEU:HD23	1:B:438:LEU:HA	1.68	0.45
1:B:77:SER:HB3	1:B:111:PHE:CZ	2.52	0.44
1:B:470:VAL:HB	1:B:504:LEU:HD23	1.98	0.44
1:B:178:ILE:HD11	1:B:252:VAL:HG13	2.00	0.44
1:B:281:ARG:NH2	4:B:720:HOH:O	2.49	0.44
1:A:470:VAL:HB	1:A:504:LEU:HD23	1.99	0.43
1:A:71:LYS:NZ	4:A:706:HOH:O	2.47	0.43
1:A:82:GLU:OE1	1:B:110:ARG:NH1	2.52	0.43
1:A:116:VAL:HG21	1:A:161:LYS:CB	2.49	0.42

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:129:TYR:HB3	1:B:143:THR:HG23	1.99	0.42
1:B:302:VAL:HG12	1:B:307:GLY:HA2	2.00	0.42
1:A:345:LYS:HB3	1:A:346:PRO:HA	2.02	0.42
1:A:493:ILE:HD12	1:A:504:LEU:HD11	2.00	0.42
1:A:140:GLY:HA2	1:B:136:LEU:HD13	2.02	0.42
1:B:246:GLU:HA	1:B:251:THR:HB	2.01	0.42
1:B:397:PRO:HG2	1:B:400:GLN:HB3	2.02	0.42
1:B:251:THR:HG23	1:B:255:SER:HB3	2.00	0.42
1:B:437:GLY:O	1:B:438:LEU:HD23	2.20	0.42
1:A:527:MET:SD	1:A:569:PRO:HG2	2.60	0.41
1:B:345:LYS:HB3	1:B:346:PRO:HA	2.01	0.41
1:B:493:ILE:HD12	1:B:504:LEU:HD11	2.01	0.41
1:A:71:LYS:HB2	1:A:107:VAL:HG23	2.01	0.41
1:A:116:VAL:HG22	1:A:162:ASN:OD1	2.20	0.41
1:A:246:GLU:OE1	1:A:256:SER:OG	2.29	0.41
1:A:417:GLN:HG3	1:A:432:ILE:HD12	2.02	0.41
1:B:510:PHE:CD2	1:B:518:LEU:HD22	2.55	0.41
1:A:128:ARG:HD2	1:A:481:PRO:HD2	2.03	0.41
1:A:345:LYS:HA	1:A:348:GLY:H	1.85	0.41
1:B:246:GLU:OE1	1:B:256:SER:OG	2.31	0.41
1:B:438:LEU:HB3	1:B:545:ALA:HB3	2.03	0.41
1:B:513:GLY:HA2	1:B:518:LEU:HD12	2.02	0.40
1:B:406:LEU:HD12	1:B:406:LEU:HA	1.96	0.40
1:B:263:PRO:HA	1:B:266:LEU:CD2	2.49	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	457/560 (82%)	450 (98%)	7 (2%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
1	B	456/560 (81%)	448 (98%)	8 (2%)	0	100 100
All	All	913/1120 (82%)	898 (98%)	15 (2%)	0	100 100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains (i)

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	375/456 (82%)	373 (100%)	2 (0%)	86 93
1	B	377/456 (83%)	373 (99%)	4 (1%)	70 83
All	All	752/912 (82%)	746 (99%)	6 (1%)	79 89

All (6) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	166	VAL
1	A	407	SER
1	B	69	MET
1	B	166	VAL
1	B	251	THR
1	B	514	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	91	HIS
1	B	153	ASN

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 oligosaccharides in this entry.

5.6 Ligand geometry (i)

4 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	PEG	A	601	-	6,6,6	0.49	0	5,5,5	0.26	0
3	EDO	B	601	-	3,3,3	0.45	0	2,2,2	0.33	0
3	EDO	A	602	-	3,3,3	0.46	0	2,2,2	0.29	0
3	EDO	B	602	-	3,3,3	0.46	0	2,2,2	0.34	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
2	PEG	A	601	-	-	1/4/4/4	-
3	EDO	B	601	-	-	0/1/1/1	-
3	EDO	A	602	-	-	1/1/1/1	-
3	EDO	B	602	-	-	1/1/1/1	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (3) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	602	EDO	O1-C1-C2-O2
3	B	602	EDO	O1-C1-C2-O2
2	A	601	PEG	O2-C3-C4-O4

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	601	PEG	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, 95^{th} 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	464/560 (82%)	0.25	25 (5%)	32	34	13, 34, 64, 97	1 (0%)
1	B	464/560 (82%)	0.29	41 (8%)	17	19	20, 35, 74, 102	0
All	All	928/1120 (82%)	0.27	66 (7%)	23	25	13, 34, 69, 102	1 (0%)

All (66) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	437	GLY	5.7
1	B	438	LEU	5.6
1	B	513	GLY	5.0
1	A	90	LEU	4.9
1	B	80	TRP	4.7
1	A	307	GLY	4.7
1	B	81	PHE	4.6
1	A	261	ASP	4.5
1	B	91	HIS	4.1
1	B	82	GLU	3.9
1	A	80	TRP	3.8
1	A	69	MET	3.7
1	A	81	PHE	3.5
1	B	117	SER	3.4
1	B	454	ILE	3.4
1	B	261	ASP	3.4
1	B	68	ASP	3.3
1	B	238	ALA	3.3
1	A	126	GLY	3.3
1	B	69	MET	3.2
1	B	455	GLU	3.2
1	B	495	GLY	3.0
1	A	260	ALA	3.0
1	B	407	SER	3.0

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Mol	Chain	Res	Type	RSRZ
1	B	515	HIS	2.9
1	A	513	GLY	2.8
1	B	185	ILE	2.7
1	A	238	ALA	2.7
1	B	79	VAL	2.7
1	B	514	SER	2.7
1	A	79	VAL	2.7
1	B	116	VAL	2.6
1	A	496	ALA	2.6
1	B	307	GLY	2.5
1	B	496	ALA	2.5
1	B	498	LEU	2.5
1	A	127	MET	2.5
1	B	517	PHE	2.5
1	B	347	SER	2.4
1	A	348	GLY	2.4
1	A	495	GLY	2.4
1	B	434	GLY	2.4
1	A	494	MET	2.3
1	A	398	SER	2.3
1	A	493	ILE	2.3
1	A	353	ASN	2.3
1	B	462	ILE	2.3
1	B	494	MET	2.3
1	B	70	SER	2.3
1	B	399	ASP	2.3
1	A	125	LYS	2.3
1	B	464	LYS	2.3
1	B	435	LYS	2.2
1	B	460	GLY	2.2
1	B	487	LEU	2.2
1	A	349	LYS	2.2
1	A	347	SER	2.1
1	A	159	CYS	2.1
1	B	458	GLU	2.1
1	B	456	SER	2.1
1	B	239	ASN	2.1
1	B	492	ALA	2.1
1	A	116	VAL	2.1
1	B	497	GLY	2.0
1	B	457	LEU	2.0
1	A	185	ILE	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 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, 95^{th} 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(Å^2)	Q<0.9
2	PEG	A	601	7/7	0.63	0.23	67,67,68,68	0
3	EDO	B	602	4/4	0.75	0.21	65,65,65,66	0
3	EDO	A	602	4/4	0.77	0.20	72,72,72,72	0
3	EDO	B	601	4/4	0.91	0.10	32,33,34,34	0

6.5 Other polymers (i)

There are no such residues in this entry.