



# Full wwPDB X-ray Structure Validation Report ⓘ

Feb 28, 2024 – 02:50 AM EST

PDB ID : 5QKB  
Title : Ground-state model of NUDT5 and corresponding apo datasets for PanDDA analysis  
Authors : Dubianok, Y.; Collins, P.; Krojer, T.; Wright, N.; Strain-Damerell, C.; Burgess-Brown, N.; Bountra, C.; Arrowsmith, C.H.; Edwards, A.; Huber, K.; von Delft, F.  
Deposited on : 2018-12-07  
Resolution : 1.58 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](mailto: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>.

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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 : 2.36  
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) : 2.36

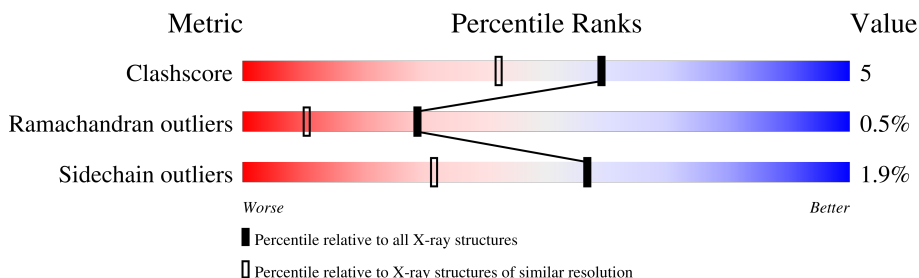
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.58 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	141614	5861 (1.60-1.56)
Ramachandran outliers	138981	5708 (1.60-1.56)
Sidechain outliers	138945	5703 (1.60-1.56)

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  $\geq 3$ , 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  $\leq 5\%$ .

Mol	Chain	Length	Quality of chain
1	A	209	
1	B	209	
1	C	209	
1	D	209	

## 2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 5953 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 ADP-sugar pyrophosphatase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	194	1450	917	242	283	8	0	0	0
1	B	194	1464	924	244	288	8	0	0	0
1	C	192	1402	884	234	277	7	0	0	0
1	D	189	1395	882	234	271	8	0	1	0

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	0	SER	-	expression tag	UNP Q9UKK9
B	0	SER	-	expression tag	UNP Q9UKK9
C	0	SER	-	expression tag	UNP Q9UKK9
D	0	SER	-	expression tag	UNP Q9UKK9

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

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

- Molecule 3 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total Cl 1 1	0	0

- Molecule 4 is 1,2-ETHANEDIOL (three-letter code: EDO) (formula: C<sub>2</sub>H<sub>6</sub>O<sub>2</sub>).



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

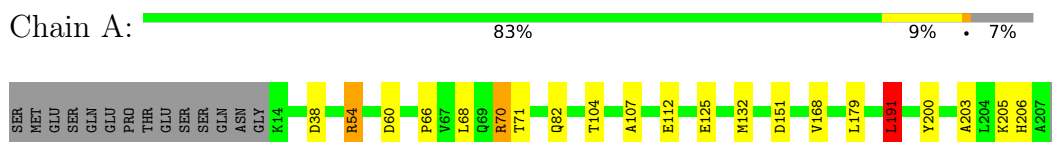
- Molecule 5 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	66	Total O 66 66	0	0
5	B	69	Total O 69 69	0	0
5	C	66	Total O 66 66	0	0
5	D	24	Total O 24 24	0	0

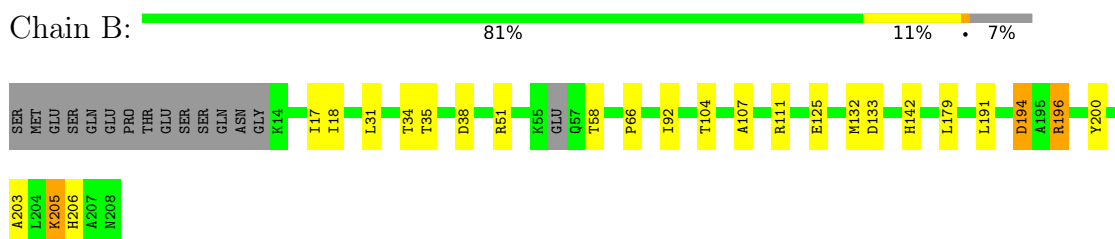
### 3 Residue-property plots [i](#)

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. 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. 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.

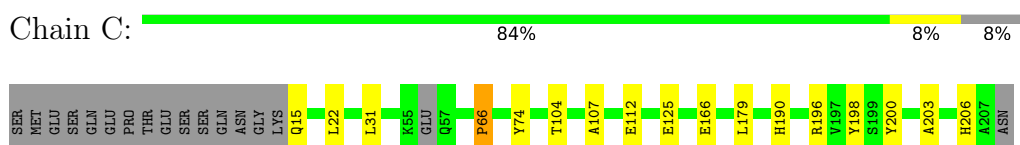
- Molecule 1: ADP-sugar pyrophosphatase



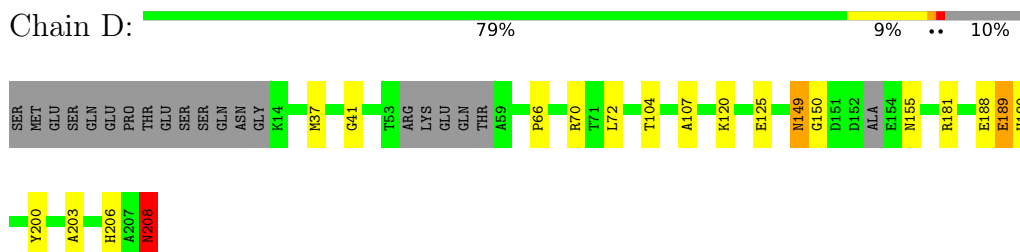
- Molecule 1: ADP-sugar pyrophosphatase



- Molecule 1: ADP-sugar pyrophosphatase



- Molecule 1: ADP-sugar pyrophosphatase



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	49.07Å 59.68Å 80.32Å 79.44° 81.82° 75.93°	Depositor
Resolution (Å)	78.54 – 1.58 78.54 – 1.58	Depositor EDS
% Data completeness (in resolution range)	95.5 (78.54-1.58) 100.0 (78.54-1.58)	Depositor EDS
$R_{merge}$	0.03	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	262.85 (at 1.58Å)	Xtrriage
Refinement program	REFMAC 5.8.0189	Depositor
R, $R_{free}$	0.219 , 0.250 (Not available) , (Not available)	Depositor DCC
$R_{free}$ test set	2000 reflections (1.69%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	34.8	Xtrriage
Anisotropy	0.081	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.34 , 35.8	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.55$ , $\langle L^2 \rangle = 0.39$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.93	EDS
Total number of atoms	5953	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	32.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 7.40% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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: EDO, MG, CL

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	1.01	1/1478 (0.1%)	1.09	5/2019 (0.2%)
1	B	0.93	0/1492	1.01	7/2035 (0.3%)
1	C	0.95	0/1429	0.97	2/1958 (0.1%)
1	D	0.97	1/1420 (0.1%)	1.27	10/1939 (0.5%)
All	All	0.96	2/5819 (0.0%)	1.09	24/7951 (0.3%)

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	112	GLU	CD-OE2	-5.75	1.19	1.25
1	D	208	ASN	CG-ND2	5.46	1.46	1.32

All (24) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	196[A]	ARG	NE-CZ-NH2	-18.30	111.15	120.30
1	D	196[B]	ARG	NE-CZ-NH2	-18.30	111.15	120.30
1	D	196[A]	ARG	NE-CZ-NH1	14.73	127.67	120.30
1	D	196[B]	ARG	NE-CZ-NH1	14.73	127.67	120.30
1	A	70	ARG	NE-CZ-NH2	-10.99	114.80	120.30
1	A	70	ARG	NE-CZ-NH1	8.64	124.62	120.30
1	D	189	GLU	N-CA-C	8.43	133.76	111.00
1	A	54	ARG	NE-CZ-NH2	-8.40	116.10	120.30
1	C	196	ARG	NE-CZ-NH1	8.09	124.35	120.30
1	A	54	ARG	NE-CZ-NH1	8.00	124.30	120.30
1	B	111	ARG	NE-CZ-NH1	7.00	123.80	120.30
1	B	196	ARG	NE-CZ-NH1	6.88	123.74	120.30
1	D	196[A]	ARG	CD-NE-CZ	6.72	133.01	123.60
1	D	196[B]	ARG	CD-NE-CZ	6.72	133.01	123.60
1	B	51	ARG	NE-CZ-NH2	-5.91	117.34	120.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	191	LEU	CA-CB-CG	5.74	128.50	115.30
1	B	133	ASP	CB-CG-OD1	5.66	123.39	118.30
1	C	190	HIS	N-CA-CB	5.60	120.69	110.60
1	B	132	MET	CG-SD-CE	-5.32	91.69	100.20
1	B	194	ASP	CB-CG-OD2	-5.29	113.54	118.30
1	D	181	ARG	NE-CZ-NH2	-5.23	117.69	120.30
1	D	189	GLU	CB-CA-C	-5.20	100.01	110.40
1	B	111	ARG	NE-CZ-NH2	-5.15	117.72	120.30
1	D	181	ARG	NE-CZ-NH1	5.02	122.81	120.30

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	1450	0	1405	16	0
1	B	1464	0	1414	14	0
1	C	1402	0	1298	14	0
1	D	1395	0	1328	20	0
2	A	2	0	0	0	0
2	B	2	0	0	0	0
2	C	2	0	0	0	0
2	D	2	0	0	0	0
3	A	1	0	0	0	0
4	B	4	0	6	2	0
4	C	4	0	6	0	0
5	A	66	0	0	1	0
5	B	69	0	0	2	0
5	C	66	0	0	6	0
5	D	24	0	0	3	0
All	All	5953	0	5457	53	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 (53) 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:D:194:ASP:OD1	1:D:196[A]:ARG:HD3	1.82	0.79
1:C:104:THR:HG23	1:C:107:ALA:H	1.49	0.77
1:A:104:THR:HG23	1:A:107:ALA:H	1.49	0.77
1:C:125:GLU:OE1	5:C:401:HOH:O	2.03	0.76
1:D:120:LYS:H	1:D:155:ASN:HD21	1.34	0.73
1:A:203:ALA:HB3	1:B:203:ALA:HB3	1.71	0.72
5:C:401:HOH:O	1:D:206:HIS:HE1	1.74	0.69
1:D:196[B]:ARG:NH2	1:D:196[B]:ARG:HG3	2.07	0.69
1:D:104:THR:HG23	1:D:107:ALA:H	1.57	0.68
1:C:203:ALA:HB3	1:D:203:ALA:HB3	1.80	0.63
1:C:206:HIS:HD2	1:D:200:TYR:OH	1.82	0.61
1:B:92:ILE:HD11	1:B:191:LEU:HD13	1.82	0.60
1:B:104:THR:HG23	1:B:107:ALA:H	1.67	0.60
1:C:112:GLU:OE2	5:C:402:HOH:O	2.16	0.60
4:B:301:EDO:H22	5:B:406:HOH:O	2.01	0.60
1:D:196[B]:ARG:HG3	1:D:196[B]:ARG:HH21	1.67	0.59
4:B:301:EDO:C2	5:B:406:HOH:O	2.51	0.58
1:D:189:GLU:O	1:D:190:HIS:C	2.41	0.58
1:A:206:HIS:HD2	1:B:200:TYR:OH	1.86	0.58
1:D:188:GLU:HG3	1:D:189:GLU:HG3	1.86	0.56
1:C:206:HIS:HE1	1:D:125:GLU:OE1	1.90	0.54
1:C:203:ALA:HB2	1:D:200:TYR:CD1	2.45	0.51
1:A:104:THR:CG2	1:A:107:ALA:H	2.22	0.51
1:C:179:LEU:HD11	1:C:198:TYR:CZ	2.46	0.51
1:D:150:GLY:O	5:D:401:HOH:O	2.19	0.49
1:A:71:THR:HG23	1:A:151:ASP:OD2	2.12	0.49
1:A:82:GLN:HG2	1:A:168:VAL:HG22	1.94	0.49
1:C:166:GLU:OE2	5:C:402:HOH:O	2.19	0.49
1:A:54:ARG:HD3	1:A:60:ASP:OD1	2.13	0.49
1:A:132:MET:O	1:B:196:ARG:NH2	2.46	0.49
1:B:194:ASP:OD2	1:B:196:ARG:NH2	2.41	0.48
1:C:15:GLN:N	5:C:405:HOH:O	2.45	0.48
1:A:200:TYR:OH	1:B:206:HIS:HD2	1.95	0.48
1:D:37:MET:SD	1:D:41:GLY:O	2.72	0.47
1:B:58:THR:CB	1:B:142:HIS:NE2	2.78	0.47
1:A:125:GLU:OE1	1:B:206:HIS:HE1	1.99	0.46
1:D:208:ASN:CG	5:D:402:HOH:O	2.54	0.46
1:B:18:ILE:HD12	1:B:35:THR:HG22	1.96	0.46
1:A:179:LEU:HD23	1:A:205:LYS:HD2	1.98	0.45
1:C:200:TYR:CD1	1:D:203:ALA:HB2	2.52	0.45
1:A:70:ARG:HD3	5:A:419:HOH:O	2.16	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:191:LEU:C	1:A:191:LEU:HD23	2.38	0.44
1:A:206:HIS:HE1	1:B:125:GLU:OE1	2.01	0.44
1:B:179:LEU:CD2	1:B:205:LYS:HE2	2.48	0.42
1:A:203:ALA:HB2	1:B:200:TYR:CD1	2.55	0.42
1:D:191:LEU:C	1:D:191:LEU:HD12	2.40	0.41
1:C:200:TYR:OH	1:D:206:HIS:HD2	2.03	0.41
1:A:68:LEU:HG	1:A:70:ARG:HD2	2.02	0.41
1:B:17:ILE:HD12	1:B:34:THR:CG2	2.51	0.41
1:C:22:LEU:C	1:C:22:LEU:HD13	2.40	0.41
1:C:74:TYR:HB3	5:C:426:HOH:O	2.22	0.40
1:D:149:ASN:C	1:D:149:ASN:HD22	2.23	0.40
1:D:70:ARG:HD3	5:D:409:HOH:O	2.22	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	192/209 (92%)	184 (96%)	7 (4%)	1 (0%)	29	10
1	B	190/209 (91%)	188 (99%)	1 (0%)	1 (0%)	29	10
1	C	188/209 (90%)	185 (98%)	2 (1%)	1 (0%)	29	10
1	D	184/209 (88%)	180 (98%)	3 (2%)	1 (0%)	29	10
All	All	754/836 (90%)	737 (98%)	13 (2%)	4 (0%)	29	10

All (4) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	66	PRO
1	B	66	PRO
1	C	66	PRO

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Mol	Chain	Res	Type
1	D	66	PRO

### 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	151/179 (84%)	149 (99%)	2 (1%)	69	48
1	B	154/179 (86%)	151 (98%)	3 (2%)	57	31
1	C	139/179 (78%)	137 (99%)	2 (1%)	67	45
1	D	142/179 (79%)	137 (96%)	5 (4%)	36	11
All	All	586/716 (82%)	574 (98%)	12 (2%)	57	29

All (12) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	38	ASP
1	A	191	LEU
1	B	31	LEU
1	B	38	ASP
1	B	205	LYS
1	C	31	LEU
1	C	66	PRO
1	D	72	LEU
1	D	149	ASN
1	D	196[A]	ARG
1	D	196[B]	ARG
1	D	208	ASN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (9) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	73	HIS
1	A	206	HIS
1	B	73	HIS

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Mol	Chain	Res	Type
1	B	206	HIS
1	C	206	HIS
1	D	149	ASN
1	D	155	ASN
1	D	190	HIS
1	D	206	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 monosaccharides in this entry.

### 5.6 Ligand geometry [i](#)

Of 11 ligands modelled in this entry, 9 are monoatomic - leaving 2 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	EDO	C	301	-	3,3,3	0.64	0	2,2,2	0.38	0
4	EDO	B	301	-	3,3,3	0.88	0	2,2,2	0.27	0

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
4	EDO	C	301	-	-	0/1/1/1	-
4	EDO	B	301	-	-	0/1/1/1	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

1 monomer is involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	B	301	EDO	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

### 6.1 Protein, DNA and RNA chains

Unable to reproduce the depositors R factor - this section is therefore empty.

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

Unable to reproduce the depositors R factor - this section is therefore empty.

### 6.3 Carbohydrates

Unable to reproduce the depositors R factor - this section is therefore empty.

### 6.4 Ligands

Unable to reproduce the depositors R factor - this section is therefore empty.

### 6.5 Other polymers

Unable to reproduce the depositors R factor - this section is therefore empty.