



# wwPDB X-ray Structure Validation Summary Report ⓘ

May 21, 2020 – 11:43 pm BST

PDB ID : 3QH3  
Title : The crystal structure of TCR A6  
Authors : Borbulevych, O.Y.; Baker, B.M.  
Deposited on : 2011-01-25  
Resolution : 2.19 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](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.

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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 : 2.11  
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

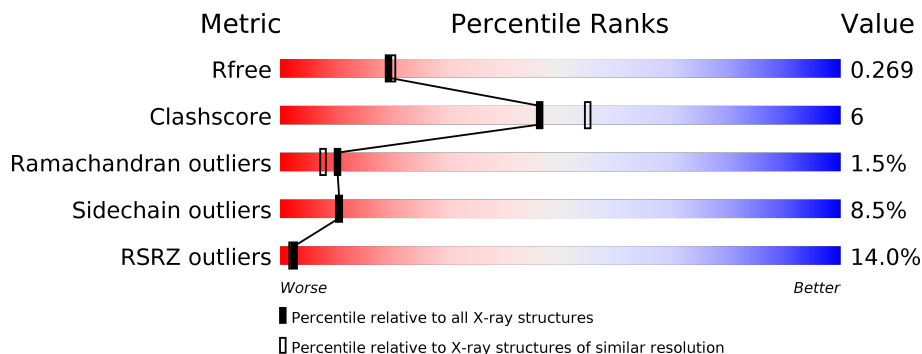
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.19 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	4898 (2.20-2.20)
Clashscore	141614	5594 (2.20-2.20)
Ramachandran outliers	138981	5503 (2.20-2.20)
Sidechain outliers	138945	5504 (2.20-2.20)
RSRZ outliers	127900	4800 (2.20-2.20)

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  $\geq 3$ , 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  $\leq 5\%$ . 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	194	 18% 76% 21% •
1	C	194	 22% 79% 14% 6% •
2	B	245	 9% 80% 18% •
2	D	245	 9% 81% 16% ••

## 2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 7190 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.

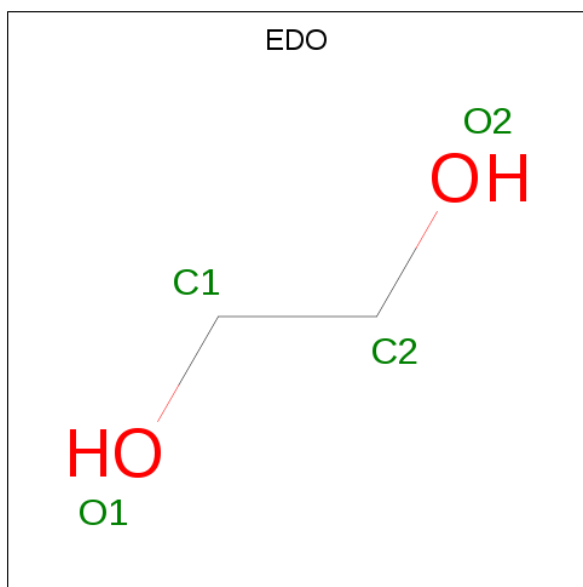
- Molecule 1 is a protein called A6 alpha chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	194	1512	937	250	317	8	0	2	0
1	C	194	1506	933	250	315	8	0	1	0

- Molecule 2 is a protein called A6 beta chain.

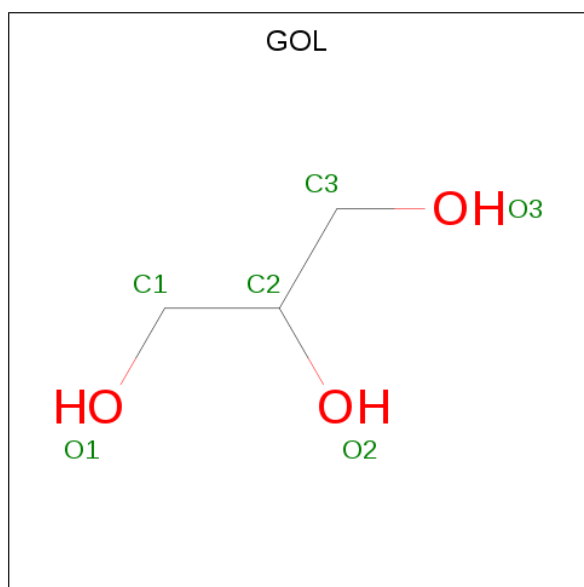
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	245	1928	1209	338	372	9	0	0	0
2	D	241	1918	1208	331	369	10	0	3	0

- Molecule 3 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
3	A	1	Total C O 4 2 2	0	0
3	A	1	Total C O 4 2 2	0	0
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
3	B	1	Total C O 4 2 2	0	0
3	C	1	Total C O 4 2 2	0	0
3	C	1	Total C O 4 2 2	0	0
3	D	1	Total C O 4 2 2	0	0
3	D	1	Total C O 4 2 2	0	0

- Molecule 4 is GLYCEROL (three-letter code: GOL) (formula: C<sub>3</sub>H<sub>8</sub>O<sub>3</sub>).



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

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

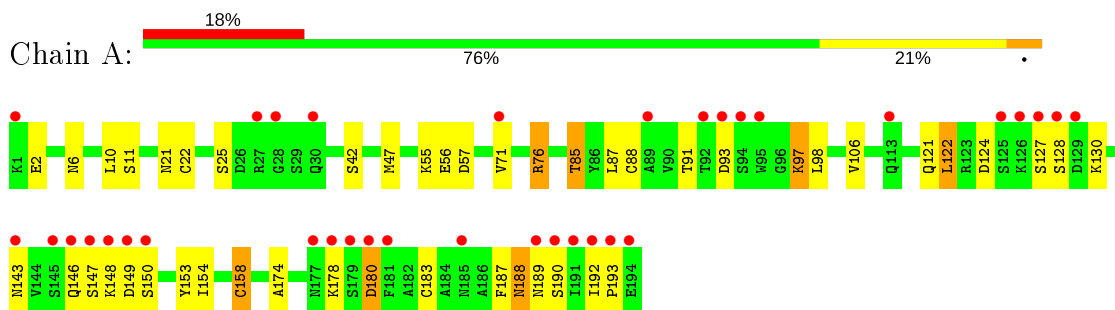
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	52	Total	O	0	0
			52	52		
5	B	63	Total	O	0	0
			63	63		
5	C	51	Total	O	0	0
			51	51		
5	D	90	Total	O	0	0
			90	90		

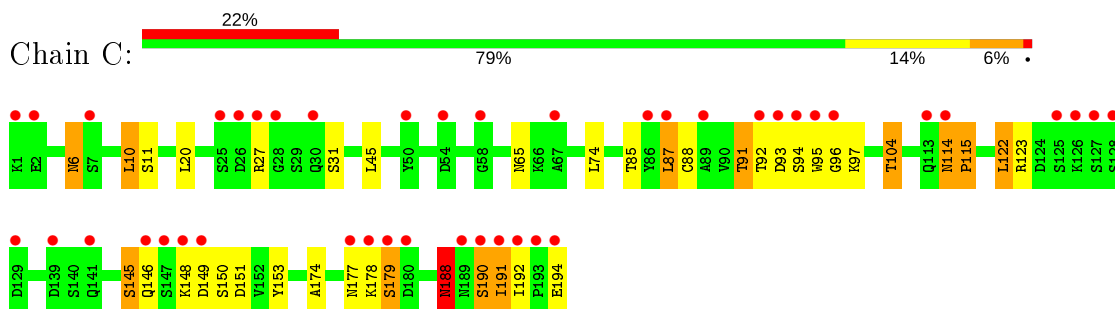
### 3 Residue-property plots [i](#)

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.

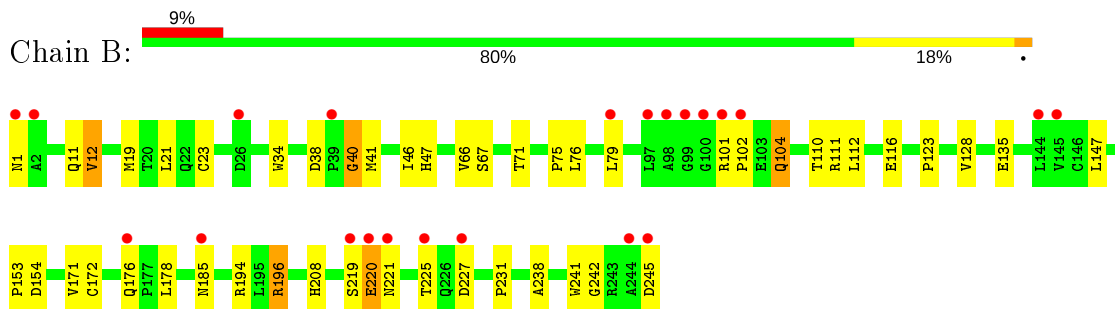
- Molecule 1: A6 alpha chain



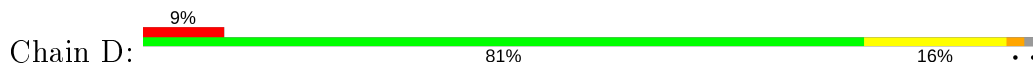
- Molecule 1: A6 alpha chain

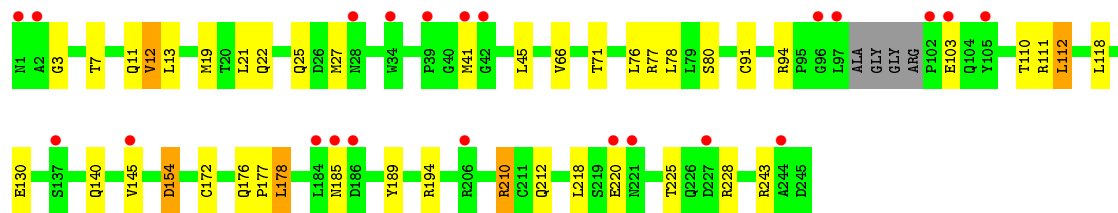


- Molecule 2: A6 beta chain



- Molecule 2: A6 beta chain





## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	91.25Å 51.73Å 96.34Å 90.00° 105.05° 90.00°	Depositor
Resolution (Å)	19.86 – 2.19 19.86 – 2.19	Depositor EDS
% Data completeness (in resolution range)	100.0 (19.86-2.19) 98.7 (19.86-2.19)	Depositor EDS
$R_{merge}$	0.07	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.53 (at 2.19Å)	Xtrriage
Refinement program	REFMAC	Depositor
R, $R_{free}$	0.202 , 0.274 0.197 , 0.269	Depositor DCC
$R_{free}$ test set	2254 reflections (5.04%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	37.0	Xtrriage
Anisotropy	0.211	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.35 , 48.7	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.50$ , $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	7190	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	44.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 30.31 % of the origin peak, indicating pseudo-translational symmetry. The chance of finding a peak of this or larger height randomly in a structure without pseudo-translational symmetry is equal to 1.3372e-03. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

<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: GOL, 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	0.93	3/1548 (0.2%)	0.93	4/2098 (0.2%)
1	C	0.84	2/1539 (0.1%)	0.87	1/2086 (0.0%)
2	B	0.85	1/1981 (0.1%)	0.87	1/2699 (0.0%)
2	D	0.97	1/1979 (0.1%)	0.97	5/2695 (0.2%)
All	All	0.90	7/7047 (0.1%)	0.91	11/9578 (0.1%)

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	C	0	4
2	B	0	1
All	All	0	5

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

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	22	CYS	CB-SG	-7.02	1.70	1.82
1	A	88	CYS	CB-SG	-6.70	1.70	1.82
2	B	172	CYS	CB-SG	-6.20	1.71	1.82
1	C	88	CYS	CB-SG	-5.48	1.72	1.81
2	D	91	CYS	CB-SG	-5.46	1.73	1.81

The worst 5 of 11 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	158	CYS	CA-CB-SG	9.09	130.36	114.00
2	D	210	ARG	NE-CZ-NH2	-8.87	115.86	120.30

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	178	LEU	CA-CB-CG	7.88	133.42	115.30
1	A	87	LEU	CA-CB-CG	6.70	130.71	115.30
1	C	122	LEU	CA-CB-CG	6.68	130.66	115.30

There are no chirality outliers.

All (5) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
2	B	171	VAL	Peptide
1	C	115	PRO	Peptide
1	C	188	ASN	Peptide
1	C	91	THR	Peptide
1	C	96	GLY	Peptide

## 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	1512	0	1429	17	0
1	C	1506	0	1423	24	0
2	B	1928	0	1829	18	0
2	D	1918	0	1832	32	0
3	A	12	0	18	2	0
3	B	12	0	18	0	0
3	C	8	0	12	1	0
3	D	8	0	12	3	0
4	A	6	0	8	0	0
4	B	6	0	8	0	0
4	C	6	0	8	0	0
4	D	12	0	16	0	0
5	A	52	0	0	1	0
5	B	63	0	0	0	0
5	C	51	0	0	2	0
5	D	90	0	0	1	0
All	All	7190	0	6613	85	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 85 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)
2:D:19[A]:MET:HE2	2:D:21[A]:LEU:HD23	1.50	0.92
2:D:19[A]:MET:CE	2:D:21[A]:LEU:HD23	2.01	0.89
2:D:19[A]:MET:CE	2:D:21[A]:LEU:CD2	2.53	0.87
2:D:228:ARG:HE	3:D:249:EDO:H11	1.43	0.83
2:D:3:GLY:HA2	2:D:27:MET:CE	2.11	0.81

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	194/194 (100%)	175 (90%)	12 (6%)	7 (4%)	3	1
1	C	193/194 (100%)	172 (89%)	17 (9%)	4 (2%)	7	4
2	B	243/245 (99%)	233 (96%)	7 (3%)	3 (1%)	13	10
2	D	240/245 (98%)	234 (98%)	6 (2%)	0	100	100
All	All	870/878 (99%)	814 (94%)	42 (5%)	14 (2%)	10	7

5 of 14 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	188	ASN
2	B	220	GLU
1	A	146	GLN
1	A	148	LYS
1	A	180	ASP

### 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	174/172 (101%)	160 (92%)	14 (8%)	12	12
1	C	173/172 (101%)	154 (89%)	19 (11%)	6	5
2	B	209/209 (100%)	193 (92%)	16 (8%)	13	13
2	D	211/209 (101%)	194 (92%)	17 (8%)	11	12
All	All	767/762 (101%)	701 (91%)	66 (9%)	10	10

5 of 66 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	B	245	ASP
1	C	87	LEU
2	D	172	CYS
1	C	10	LEU
1	C	65	ASN

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 10 such sidechains are listed below:

Mol	Chain	Res	Type
1	C	105	GLN
1	C	114	ASN
1	C	188	ASN
2	B	185	ASN
1	C	146	GLN

### 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](#)

15 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
3	EDO	B	249	-	3,3,3	0.80	0	2,2,2	0.46	0
3	EDO	A	197	-	3,3,3	0.49	0	2,2,2	0.85	0
3	EDO	C	197	-	3,3,3	0.76	0	2,2,2	0.36	0
3	EDO	B	247	-	3,3,3	0.37	0	2,2,2	0.55	0
4	GOL	B	246	-	5,5,5	0.70	0	5,5,5	1.65	2 (40%)
4	GOL	D	246	-	5,5,5	0.28	0	5,5,5	0.49	0
3	EDO	A	196	-	3,3,3	0.49	0	2,2,2	0.63	0
3	EDO	C	195	-	3,3,3	0.57	0	2,2,2	0.19	0
4	GOL	C	196	-	5,5,5	0.44	0	5,5,5	0.40	0
3	EDO	A	195	-	3,3,3	0.45	0	2,2,2	0.66	0
4	GOL	D	247	-	5,5,5	0.46	0	5,5,5	0.29	0
3	EDO	B	248	-	3,3,3	0.55	0	2,2,2	0.41	0
4	GOL	A	198	-	5,5,5	0.33	0	5,5,5	0.47	0
3	EDO	D	248	-	3,3,3	0.66	0	2,2,2	0.23	0
3	EDO	D	249	-	3,3,3	0.55	0	2,2,2	0.59	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	EDO	B	249	-	-	1/1/1/1	-
3	EDO	A	197	-	-	0/1/1/1	-
3	EDO	C	197	-	-	1/1/1/1	-
3	EDO	B	247	-	-	1/1/1/1	-

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
4	GOL	B	246	-	-	2/4/4/4	-
4	GOL	D	246	-	-	0/4/4/4	-
3	EDO	A	196	-	-	0/1/1/1	-
3	EDO	C	195	-	-	0/1/1/1	-
4	GOL	C	196	-	-	0/4/4/4	-
3	EDO	A	195	-	-	0/1/1/1	-
4	GOL	D	247	-	-	2/4/4/4	-
3	EDO	B	248	-	-	0/1/1/1	-
4	GOL	A	198	-	-	0/4/4/4	-
3	EDO	D	248	-	-	1/1/1/1	-
3	EDO	D	249	-	-	1/1/1/1	-

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
4	B	246	GOL	O3-C3-C2	-2.98	95.93	110.20
4	B	246	GOL	O2-C2-C3	-2.07	99.99	109.12

There are no chirality outliers.

5 of 9 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	B	246	GOL	C1-C2-C3-O3
4	D	247	GOL	O1-C1-C2-C3
3	B	249	EDO	O1-C1-C2-O2
3	C	197	EDO	O1-C1-C2-O2
3	B	247	EDO	O1-C1-C2-O2

There are no ring outliers.

5 monomers are involved in 6 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	197	EDO	1	0
3	C	197	EDO	1	0
3	A	196	EDO	1	0
3	D	248	EDO	1	0
3	D	249	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 [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, 95<sup>th</sup> 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 <sup>2</sup> )	Q < 0.9
1	A	194/194 (100%)	0.99	35 (18%) <b>1</b> <b>1</b>	19, 38, 100, 113	0
1	C	194/194 (100%)	1.28	43 (22%) <b>0</b> <b>0</b>	25, 50, 97, 118	0
2	B	245/245 (100%)	0.58	22 (8%) <b>9</b> <b>8</b>	23, 40, 74, 88	0
2	D	241/245 (98%)	0.38	22 (9%) <b>9</b> <b>8</b>	17, 32, 55, 81	0
All	All	874/878 (99%)	0.77	122 (13%) <b>2</b> <b>2</b>	17, 38, 87, 118	0

The worst 5 of 122 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	192	ILE	12.7
1	A	191	ILE	11.7
1	C	193	PRO	11.5
1	C	147	SER	10.7
1	C	191	ILE	9.2

### 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, 95<sup>th</sup> 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( $\text{\AA}^2$ )	Q<0.9
4	GOL	A	198	6/6	0.54	0.28	52,61,63,65	0
3	EDO	C	195	4/4	0.64	0.24	58,61,62,62	0
3	EDO	B	249	4/4	0.68	0.37	40,41,42,45	0
4	GOL	C	196	6/6	0.73	0.17	66,68,69,69	0
3	EDO	D	248	4/4	0.73	0.30	50,55,56,56	0
3	EDO	A	197	4/4	0.78	0.15	48,53,54,55	0
3	EDO	D	249	4/4	0.82	0.17	48,49,49,50	0
3	EDO	A	196	4/4	0.83	0.62	42,45,47,50	0
3	EDO	A	195	4/4	0.83	0.18	56,60,61,61	0
3	EDO	B	248	4/4	0.83	0.34	39,46,47,49	0
3	EDO	B	247	4/4	0.87	0.21	55,56,57,57	0
4	GOL	D	246	6/6	0.87	0.16	55,56,58,58	0
4	GOL	B	246	6/6	0.88	0.18	39,43,45,48	0
3	EDO	C	197	4/4	0.91	0.20	34,40,42,50	0
4	GOL	D	247	6/6	0.92	0.17	46,49,54,56	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.