wwPDB X-ray Structure Validation Summary Report (i)

May 25, 2020 – 10:33 am BST

PDB ID	:	3Q5Y
Title	:	V beta/V beta homodimerization-based pre-TCR model suggested by TCR beta crystal structures
Authors	:	Chen, Q.; Zhang, H.; Wang, J.-H.
Deposited on	:	2010-12-30
Resolution	:	1.90 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 (i) symbol.

The following versions of software and data (see references (1)) were used in the production of this report:

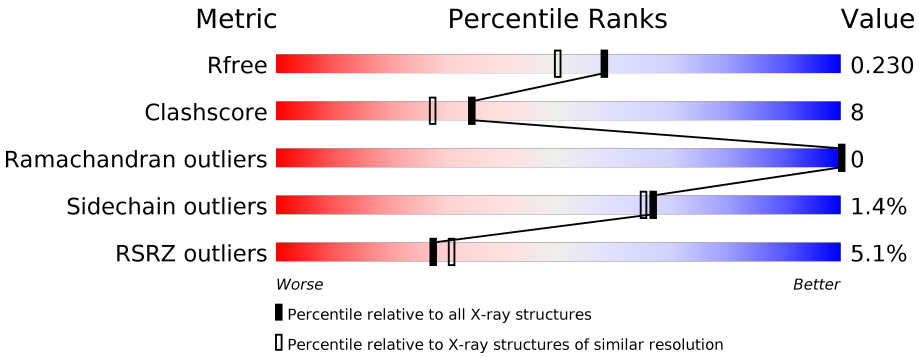
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.11
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA,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

1 Overall quality at a glance (i)

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

The reported resolution of this entry is 1.90 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	6207 (1.90-1.90)
Clashscore	141614	6847 (1.90-1.90)
Ramachandran outliers	138981	6760 (1.90-1.90)
Sidechain outliers	138945	6760 (1.90-1.90)
RSRZ outliers	127900	6082 (1.90-1.90)

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 <=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	240	4% 90% 10%
1	B	240	5% 85% 15%
1	C	240	5% 86% 13%
1	D	240	6% 88% 11%

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	GOL	A	248	-	-	X	-
3	PEG	B	249	-	-	X	-

2 Entry composition

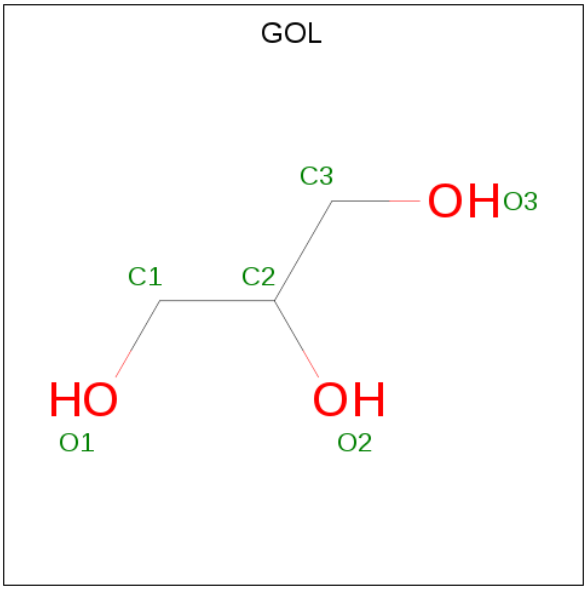
There are 5 unique types of molecules in this entry. The entry contains 8761 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 TCR N15 beta.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	240	Total	C	N	O	S	0	4	0
			1959	1240	344	367	8			
1	B	238	Total	C	N	O	S	0	0	0
			1919	1215	337	360	7			
1	C	239	Total	C	N	O	S	0	2	0
			1936	1226	339	364	7			
1	D	238	Total	C	N	O	S	0	2	0
			1928	1221	337	363	7			

- Molecule 2 is GLYCEROL (three-letter code: GOL) (formula: $C_3H_8O_3$).



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

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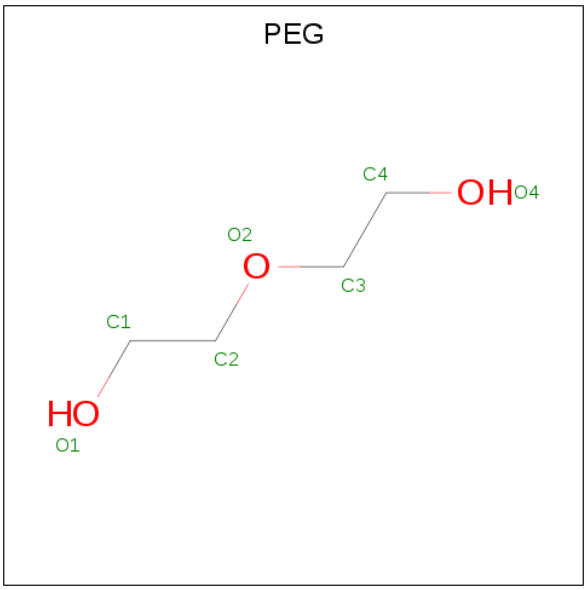
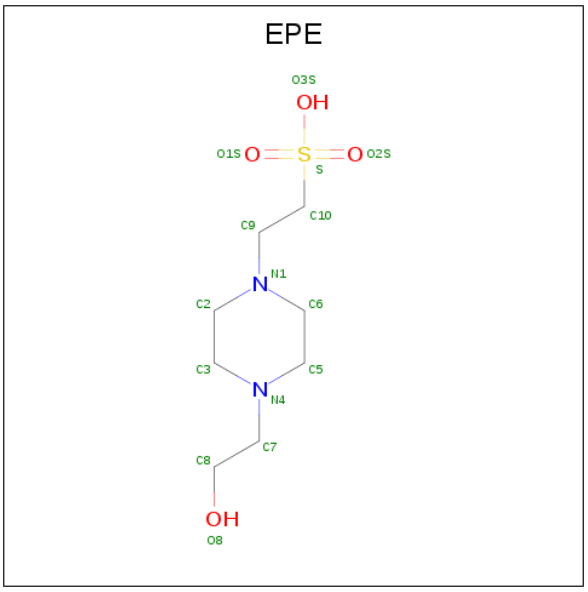
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	C	1	Total C O 6 3 3	0	0
2	D	1	Total C O 6 3 3	0	0
2	D	1	Total C O 6 3 3	0	0
2	D	1	Total C O 6 3 3	0	0

- Molecule 3 is DI(HYDROXYETHYL)ETHER (three-letter code: PEG) (formula: $C_4H_{10}O_3$).



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

- Molecule 4 is 4-(2-HYDROXYETHYL)-1-PIPERAZINE ETHANESULFONIC ACID (three-letter code: EPE) (formula: $C_8H_{18}N_2O_4S$).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	B	1	Total C N O S 15 8 2 4 1	0	0
4	C	1	Total C N O S 15 8 2 4 1	0	0

- Molecule 5 is water.

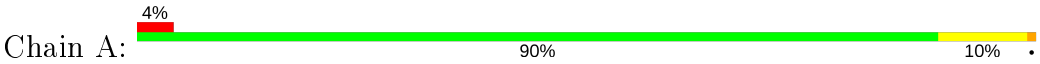
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
5	A	250	Total O 250 250	0	0
5	B	222	Total O 222 222	0	0
5	C	230	Total O 230 230	0	0
5	D	237	Total O 237 237	0	0

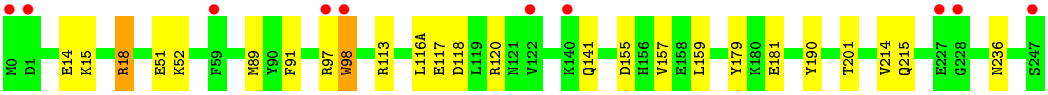
3 Residue-property plots (i)

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: TCR N15 beta

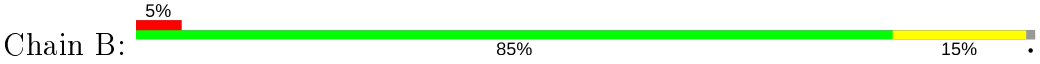
Chain A:

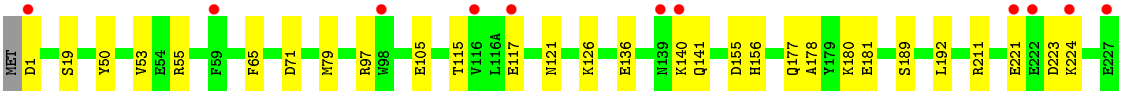


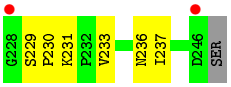


- Molecule 1: TCR N15 beta

Chain B:

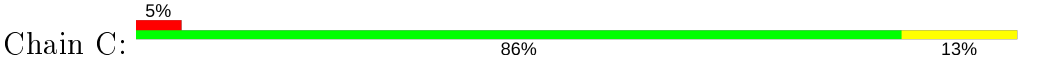


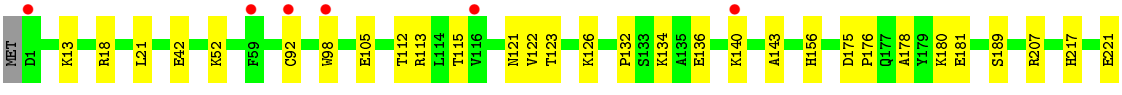


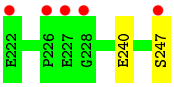


- Molecule 1: TCR N15 beta

Chain C:

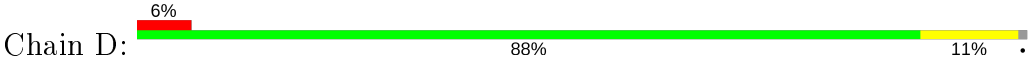


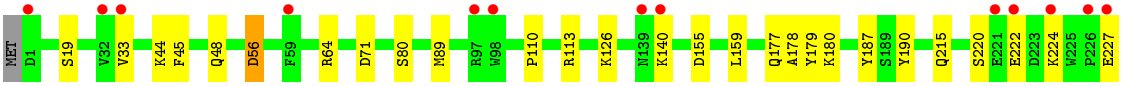


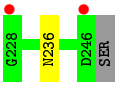


- Molecule 1: TCR N15 beta

Chain D:






G228
N236
D246
SER

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	78.18Å 129.56Å 129.70Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	20.00 – 1.90 19.83 – 1.90	Depositor EDS
% Data completeness (in resolution range)	99.4 (20.00-1.90) 99.3 (19.83-1.90)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.16 (at 1.90Å)	Xtriage
Refinement program	REFMAC 5.5.0066	Depositor
R, R_{free}	0.178 , 0.218 0.193 , 0.230	Depositor DCC
R_{free} test set	5146 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å^2)	22.3	Xtriage
Anisotropy	0.118	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.36 , 45.4	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.33$	Xtriage
Estimated twinning fraction	0.012 for -h,l,k	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	8761	wwPDB-VP
Average B, all atoms (Å^2)	25.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 24.57 % 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 3.7405e-03. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

[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: EPE, GOL, PEG

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	0.46	0/2023	0.55	0/2738
1	B	0.45	0/1974	0.55	0/2675
1	C	0.46	1/1997 (0.1%)	0.56	0/2705
1	D	0.45	0/1989	0.56	0/2695
All	All	0.45	1/7983 (0.0%)	0.55	0/10813

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	92	CYS	CB-SG	-5.29	1.73	1.81

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	1959	0	1887	34	2
1	B	1919	0	1837	41	1
1	C	1936	0	1859	33	2
1	D	1928	0	1848	29	2
2	A	6	0	8	10	0
2	B	6	0	8	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
2	C	6	0	8	2	0
2	D	18	0	24	2	0
3	A	7	0	10	0	0
3	B	7	0	10	7	0
4	B	15	0	17	2	0
4	C	15	0	17	3	0
5	A	250	0	0	5	2
5	B	222	0	0	9	0
5	C	230	0	0	7	1
5	D	237	0	0	7	0
All	All	8761	0	7533	128	5

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 8.

The worst 5 of 128 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:220:SER:OG	1:D:222:GLU:CG	1.76	1.33
1:D:220:SER:OG	1:D:222:GLU:HG3	1.11	1.27
1:B:211:ARG:HH12	1:C:207:ARG:NH2	1.30	1.25
1:A:141:GLN:HG2	5:A:788:HOH:O	1.35	1.22
1:C:156:HIS:HB2	5:C:683:HOH:O	1.56	1.04

All (5) 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:A:179:TYR:OH	5:C:551:HOH:O[3_545]	2.04	0.16
1:A:52:LYS:NZ	1:B:71:ASP:OD2[4_545]	2.11	0.09
1:C:180:LYS:O	5:A:447:HOH:O[4_445]	2.11	0.09
1:C:52:LYS:NZ	1:D:71:ASP:OD2[4_455]	2.12	0.08
1:D:179:TYR:OH	5:A:384:HOH:O[4_445]	2.18	0.02

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	242/240 (101%)	236 (98%)	6 (2%)	0	100	100
1	B	236/240 (98%)	226 (96%)	10 (4%)	0	100	100
1	C	239/240 (100%)	231 (97%)	8 (3%)	0	100	100
1	D	238/240 (99%)	232 (98%)	6 (2%)	0	100	100
All	All	955/960 (100%)	925 (97%)	30 (3%)	0	100	100

There are no Ramachandran outliers to report.

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	217/213 (102%)	215 (99%)	2 (1%)	78	79
1	B	211/213 (99%)	209 (99%)	2 (1%)	78	79
1	C	214/213 (100%)	210 (98%)	4 (2%)	57	53
1	D	213/213 (100%)	209 (98%)	4 (2%)	57	53
All	All	855/852 (100%)	843 (99%)	12 (1%)	67	65

5 of 12 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	C	134	LYS
1	C	176	PRO
1	D	56	ASP

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Mol	Chain	Res	Type
1	C	98	TRP
1	D	19	SER

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

5.3.3 RNA

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains

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

5.5 Carbohydrates

There are no carbohydrates in this entry.

5.6 Ligand geometry

10 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	$\#\|Z\| > 2$
4	EPE	C	249	-	15,15,15	1.02	1 (6%)	18,20,20	0.98	1 (5%)
3	PEG	B	249	-	6,6,6	0.56	0	5,5,5	0.17	0
2	GOL	D	249	-	5,5,5	0.41	0	5,5,5	0.33	0
4	EPE	B	250	-	15,15,15	0.86	1 (6%)	18,20,20	0.95	1 (5%)
2	GOL	C	248	-	5,5,5	0.29	0	5,5,5	0.45	0
2	GOL	D	248	-	5,5,5	0.46	0	5,5,5	0.59	0
2	GOL	A	248	-	5,5,5	0.46	0	5,5,5	1.02	0
2	GOL	B	248	-	5,5,5	0.40	0	5,5,5	0.22	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\#\|Z\|>2$	Counts	RMSZ	$\#\|Z\|>2$
3	PEG	A	249	-	6,6,6	0.44	0	5,5,5	0.30	0
2	GOL	D	250	-	5,5,5	0.42	0	5,5,5	0.19	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	EPE	C	249	-	-	8/9/19/19	0/1/1/1
3	PEG	B	249	-	-	3/4/4/4	-
2	GOL	D	249	-	-	0/4/4/4	-
4	EPE	B	250	-	-	4/9/19/19	0/1/1/1
2	GOL	C	248	-	-	4/4/4/4	-
2	GOL	D	248	-	-	2/4/4/4	-
2	GOL	A	248	-	-	2/4/4/4	-
2	GOL	B	248	-	-	0/4/4/4	-
3	PEG	A	249	-	-	3/4/4/4	-
2	GOL	D	250	-	-	0/4/4/4	-

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
4	C	249	EPE	C10-S	3.41	1.82	1.77
4	B	250	EPE	C10-S	2.77	1.81	1.77

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
4	C	249	EPE	O3S-S-C10	2.90	110.46	105.77
4	B	250	EPE	O2S-S-C10	2.88	110.39	106.92

There are no chirality outliers.

5 of 26 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	C	249	EPE	C10-C9-N1-C2
4	B	250	EPE	C10-C9-N1-C6
4	B	250	EPE	C8-C7-N4-C3
4	B	250	EPE	N4-C7-C8-O8

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Mol	Chain	Res	Type	Atoms
2	C	248	GOL	C1-C2-C3-O3

There are no ring outliers.

6 monomers are involved in 26 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	C	249	EPE	3	0
3	B	249	PEG	7	0
4	B	250	EPE	2	0
2	C	248	GOL	2	0
2	D	248	GOL	2	0
2	A	248	GOL	10	0

5.7 Other polymers

There are no such residues in this entry.

5.8 Polymer linkage issues

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	240/240 (100%)	0.28	10 (4%)	36	39	9, 22, 41, 58	0
1	B	238/240 (99%)	0.39	13 (5%)	25	28	12, 24, 44, 66	0
1	C	239/240 (99%)	0.34	11 (4%)	32	35	9, 23, 45, 74	0
1	D	238/240 (99%)	0.34	15 (6%)	20	22	11, 23, 42, 64	0
All	All	955/960 (99%)	0.34	49 (5%)	28	31	9, 23, 43, 74	0

The worst 5 of 49 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	59	PHE	7.0
1	C	59	PHE	6.4
1	D	59	PHE	6.4
1	C	247	SER	6.3
1	B	1	ASP	5.7

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. 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
3	PEG	A	249	7/7	0.56	0.20	66,66,67,67	0
4	EPE	B	250	15/15	0.66	0.22	56,57,63,63	0
2	GOL	C	248	6/6	0.80	0.22	44,48,49,50	0
2	GOL	A	248	6/6	0.84	0.22	34,37,37,38	0
4	EPE	C	249	15/15	0.84	0.17	47,48,54,55	0
3	PEG	B	249	7/7	0.85	0.23	28,36,39,39	0
2	GOL	B	248	6/6	0.87	0.17	29,34,36,39	0
2	GOL	D	250	6/6	0.87	0.21	31,36,37,38	0
2	GOL	D	248	6/6	0.89	0.15	36,37,38,38	0
2	GOL	D	249	6/6	0.90	0.16	32,34,36,37	0

6.5 Other polymers (i)

There are no such residues in this entry.