Full wwPDB X-ray Structure Validation Report ⓘ

Oct 29, 2024 – 02:06 pm GMT

PDB ID	:	9ETO
Title	:	PsiK from Psilocybe cubensis
Authors	:	Werten, S.; Rupp, B.
Deposited on	:	2024-03-26
Resolution	:	2.54 Å(reported)

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

|		
MolProbity	:	4.02b-467
Mogul	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	3.0
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.003 (Gargrove)
Density-Fitness	:	1.0.11
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.39

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 2.54 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.

Percentile relative to all X-ray structures
Percentile relative to X-ray structures of similar resolution
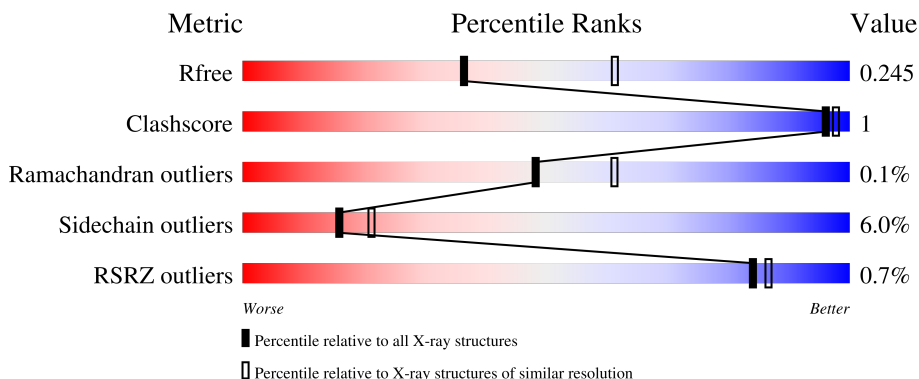
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	164625	1004 (2.54-2.54)
Clashscore	180529	1055 (2.54-2.54)
Ramachandran outliers	177936	1048 (2.54-2.54)
Sidechain outliers	177891	1048 (2.54-2.54)
RSRZ outliers	164620	1004 (2.54-2.54)

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	364	94% 5% ·
1	B	364	91% 8% ·

2 Entry composition ⓘ

There are 6 unique types of molecules in this entry. The entry contains 5797 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 4-hydroxytryptamine kinase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	363	Total	C	N	O	S	0	0	0
			2842	1804	481	544	13			
1	B	363	Total	C	N	O	S	0	0	0
			2842	1804	481	544	13			

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-1	GLY	-	expression tag	UNP P0DPA8
A	0	HIS	-	expression tag	UNP P0DPA8
B	-1	GLY	-	expression tag	UNP P0DPA8
B	0	HIS	-	expression tag	UNP P0DPA8

- Molecule 2 is DI(HYDROXYETHYL)ETHER (three-letter code: PEG) (formula: $C_4H_{10}O_3$) (labeled as "Ligand of Interest" by depositor).
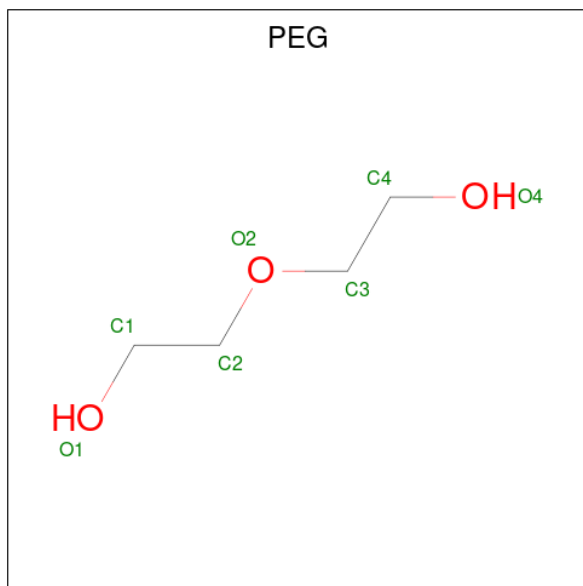
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total 7	C 4	O 3	0	0
2	B	1	Total 7	C 4	O 3	0	0

- Molecule 3 is SULFATE ION (three-letter code: SO4) (formula: O_4S).

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total 5	O 4	S 1	0	0
3	A	1	Total 5	O 4	S 1	0	0
3	A	1	Total 5	O 4	S 1	0	0
3	A	1	Total 5	O 4	S 1	0	0
3	A	1	Total 5	O 4	S 1	0	0
3	B	1	Total 5	O 4	S 1	0	0
3	B	1	Total 5	O 4	S 1	0	0
3	B	1	Total 5	O 4	S 1	0	0
3	B	1	Total 5	O 4	S 1	0	0
3	B	1	Total 5	O 4	S 1	0	0

- Molecule 4 is CHLORIDE ION (three-letter code: CL) (formula: Cl).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	3	Total 3	Cl 3	0	0
4	B	2	Total 2	Cl 2	0	0

- Molecule 5 is dodecaethylene glycol monomethyl ether (three-letter code: RWB) (formula: $C_{25}H_{52}O_{13}$).
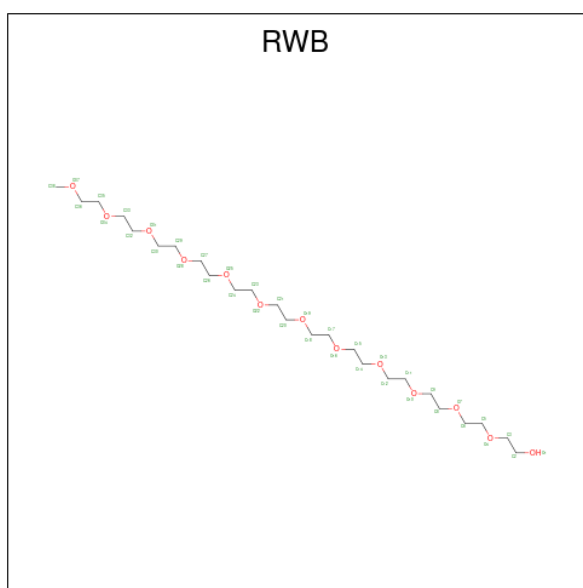
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	A	1	Total 32	C 21	O 11	0	0
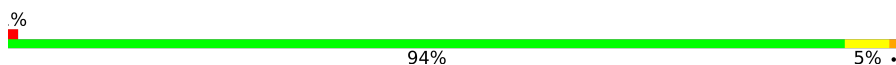
- Molecule 6 is water.

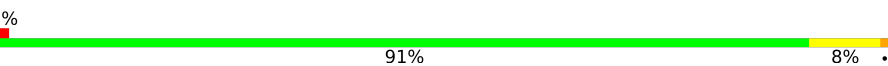| Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	9	Total 9	O 9	0	0
6	B	3	Total 3	O 3	0	0

3 Residue-property plots ⓘ

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.
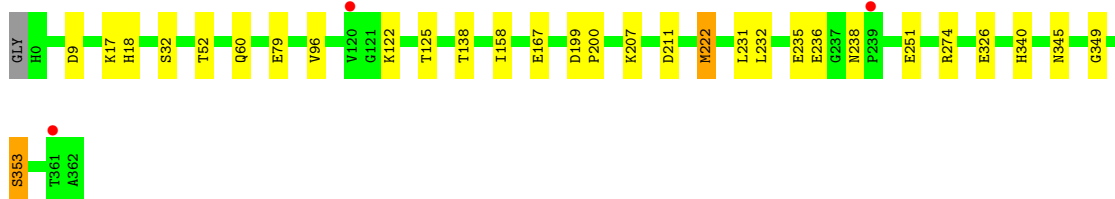
• Molecule 1: 4-hydroxytryptamine kinase

• Molecule 1: 4-hydroxytryptamine kinase

4 Data and refinement statistics (i)

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α, β, γ	111.82Å 70.14Å 118.90Å 90.00° 95.84° 90.00°	Depositor
Resolution (Å)	43.11 – 2.54 43.11 – 2.54	Depositor EDS
% Data completeness (in resolution range)	99.9 (43.11-2.54) 99.9 (43.11-2.54)	Depositor EDS
R_{merge}	0.28	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.14 (at 2.54Å)	Xtriage
Refinement program	REFMAC 5.8.0419	Depositor
R, R_{free}	0.197 , 0.243 0.204 , 0.245	Depositor DCC
R_{free} test set	1485 reflections (4.88%)	wwPDB-VP
Wilson B-factor (Å^2)	59.1	Xtriage
Anisotropy	0.339	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.33 , 42.8	EDS
L-test for twinning[2]	$< \|L\| > = 0.50, < L^2 > = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	5797	wwPDB-VP
Average B, all atoms (Å^2)	64.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.68% 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, SO4, RWB, 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	0.41	0/2899	0.87	1/3928 (0.0%)
1	B	0.40	0/2899	0.87	2/3928 (0.1%)
All	All	0.41	0/5798	0.87	3/7856 (0.0%)

There are no bond length outliers.

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	251	GLU	CB-CA-C	-7.25	95.90	110.40
1	A	251	GLU	CB-CA-C	-6.93	96.53	110.40
1	B	222	MET	CG-SD-CE	-5.06	92.10	100.20

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	2842	0	2806	4	0
1	B	2842	0	2806	7	0
2	A	7	0	10	0	0
2	B	7	0	10	0	0
3	A	25	0	0	0	0
3	B	25	0	0	2	0

Continued on next page...

W O R L D W I D E
wwPDB
PROTEIN DATA BANK

Continued from previous page...

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
4	A	3	0	0	0	0
4	B	2	0	0	0	0
5	A	32	0	0	0	0
6	A	9	0	0	0	0
6	B	3	0	0	0	0
All	All	5797	0	5632	11	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 1.

All (11) 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:A:321:GLN:HE21	1:A:321:GLN:HA	1.50	0.75
1:A:349:GLY:O	1:A:353:SER:HB3	2.02	0.59
1:B:349:GLY:O	1:B:353:SER:HB3	2.05	0.56
1:B:235:GLU:OE1	1:B:238:ASN:CB	2.58	0.52
1:B:199:ASP:OD2	1:B:340:HIS:NE2	2.43	0.50
1:B:199:ASP:OD1	1:B:200:PRO:HD2	2.12	0.50
1:B:18:HIS:ND1	3:B:402:SO4:O3	2.41	0.49
1:A:199:ASP:OD1	1:A:200:PRO:HD2	2.14	0.48
1:A:321:GLN:HA	1:A:321:GLN:NE2	2.27	0.46
1:B:340:HIS:ND1	3:B:404:SO4:O2	2.43	0.45
1:B:125:THR:HG22	1:B:231:LEU:HD23	2.03	0.41

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	361/364 (99%)	347 (96%)	14 (4%)	0	100	100

Continued on next page...

Continued from previous page...

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	B	361/364 (99%)	345 (96%)	15 (4%)	1 (0%)	37	46
All	All	722/728 (99%)	692 (96%)	29 (4%)	1 (0%)	48	61

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	236	GLU

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	306/310 (99%)	288 (94%)	18 (6%)	16	21
1	B	306/310 (99%)	287 (94%)	19 (6%)	15	20
All	All	612/620 (99%)	575 (94%)	37 (6%)	16	21

All (37) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	9	ASP
1	A	30	ARG
1	A	32	SER
1	A	60	GLN
1	A	79	GLU
1	A	84	LYS
1	A	96	VAL
1	A	138	THR
1	A	142	ARG
1	A	158	ILE
1	A	167	GLU
1	A	183	GLN
1	A	211	ASP
1	A	222	MET
1	A	232	LEU

Continued on next page...

Continued from previous page...

Mol	Chain	Res	Type
1	A	274	ARG
1	A	321	GLN
1	A	353	SER
1	B	9	ASP
1	B	17	LYS
1	B	32	SER
1	B	52	THR
1	B	60	GLN
1	B	79	GLU
1	B	96	VAL
1	B	122	LYS
1	B	138	THR
1	B	158	ILE
1	B	167	GLU
1	B	207	LYS
1	B	211	ASP
1	B	222	MET
1	B	232	LEU
1	B	274	ARG
1	B	326	GLU
1	B	345	ASN
1	B	353	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (3) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	186	GLN
1	A	321	GLN
1	B	186	GLN

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 oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 18 ligands modelled in this entry, 5 are monoatomic - leaving 13 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	#$|Z| > 2$
3	SO4	B	403	-	4,4,4	0.36	0	6,6,6	0.25	0
2	PEG	A	401	-	6,6,6	0.21	0	5,5,5	0.14	0
3	SO4	B	406	-	4,4,4	0.34	0	6,6,6	0.18	0
3	SO4	B	404	-	4,4,4	0.40	0	6,6,6	0.11	0
3	SO4	A	402	-	4,4,4	0.38	0	6,6,6	0.16	0
3	SO4	A	404	-	4,4,4	0.35	0	6,6,6	0.07	0
3	SO4	B	405	-	4,4,4	0.33	0	6,6,6	0.06	0
3	SO4	A	405	-	4,4,4	0.32	0	6,6,6	0.15	0
5	RWB	A	410	-	31,31,37	0.28	0	30,30,36	0.38	0
3	SO4	B	402	-	4,4,4	0.37	0	6,6,6	0.10	0
3	SO4	A	403	-	4,4,4	0.36	0	6,6,6	0.11	0
2	PEG	B	401	-	6,6,6	0.43	0	5,5,5	0.25	0
3	SO4	A	409	-	4,4,4	0.26	0	6,6,6	0.16	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
5	RWB	A	410	-	-	14/29/29/35	-
2	PEG	B	401	-	-	1/4/4/4	-
2	PEG	A	401	-	-	2/4/4/4	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.
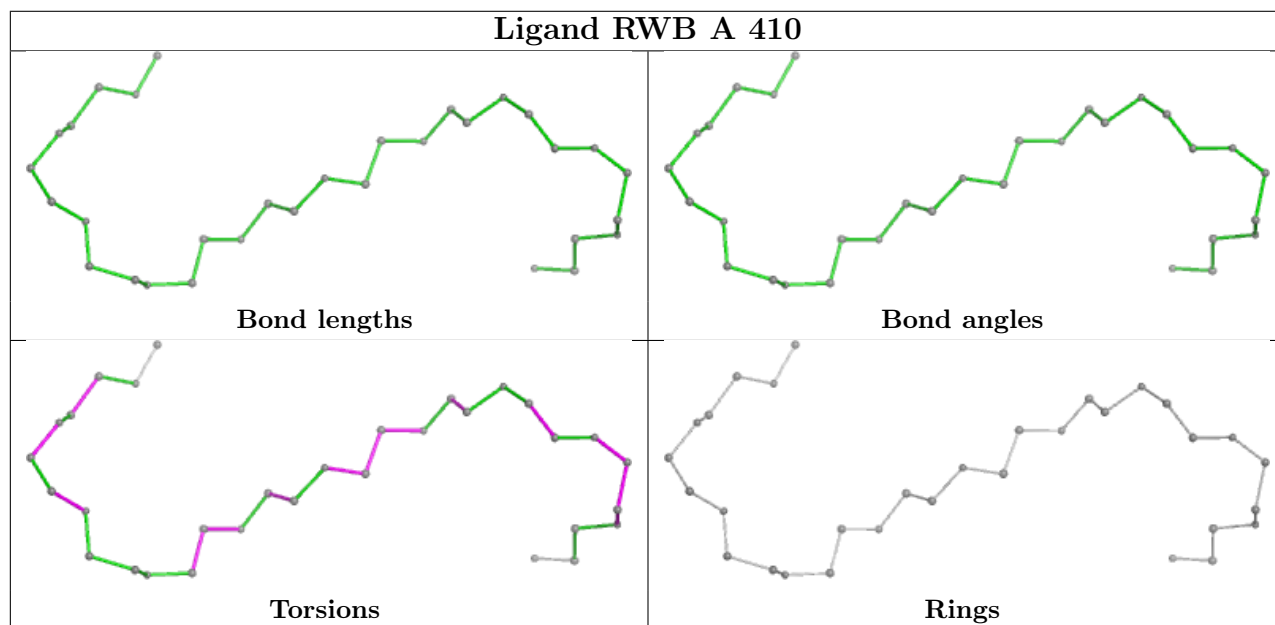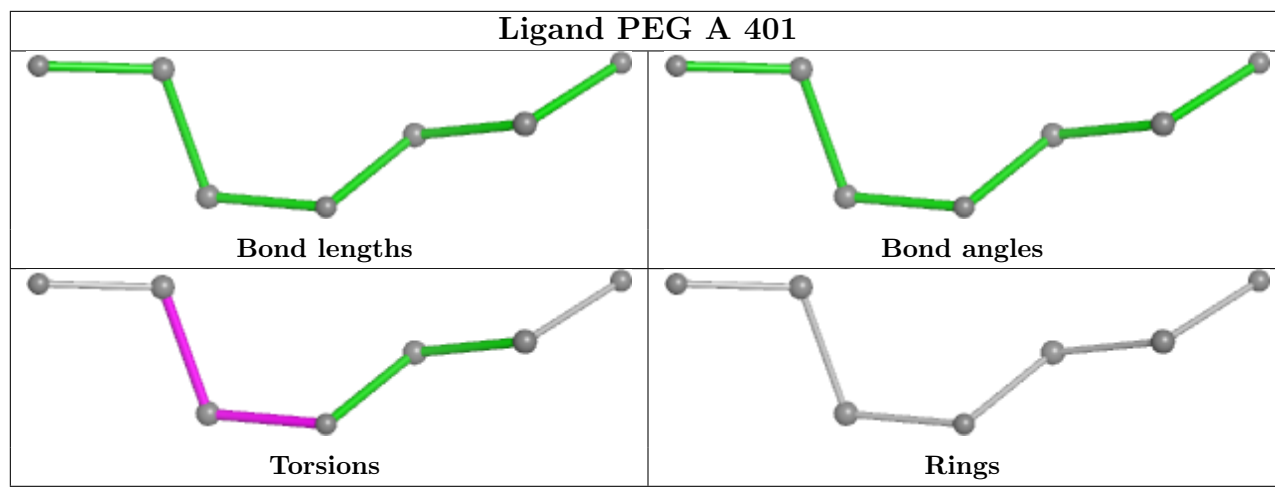
All (17) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
5	A	410	RWB	O34-C35-C36-O37
5	A	410	RWB	O10-C11-C12-O13
5	A	410	RWB	O13-C14-C15-O16
2	B	401	PEG	O1-C1-C2-O2
5	A	410	RWB	O25-C26-C27-O28
2	A	401	PEG	O1-C1-C2-O2
5	A	410	RWB	O16-C17-C18-O19
5	A	410	RWB	C32-C33-O34-C35
5	A	410	RWB	C21-C20-O19-C18
5	A	410	RWB	C27-C26-O25-C24
5	A	410	RWB	C11-C12-O13-C14
2	A	401	PEG	C1-C2-O2-C3
5	A	410	RWB	C33-C32-O31-C30
5	A	410	RWB	C20-C21-O22-C23
5	A	410	RWB	C12-C11-O10-C9
5	A	410	RWB	O22-C23-C24-O25
5	A	410	RWB	O19-C20-C21-O22

There are no ring outliers.

2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	B	404	SO4	1	0
3	B	402	SO4	1	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less then 5% of the Mogul distribution of torsion angles is within 10 degrees of the torsion angle in question, then that torsion angle is considered an outlier. Any bond that is central to one or more torsion angles identified as an outlier by Mogul will be highlighted in the graph. For rings, the root-mean-square deviation (RMSD) between the ring in question and similar rings identified by Mogul is calculated over all ring torsion angles. If the average RMSD is greater than 60 degrees and the minimal RMSD between the ring in question and any Mogul-identified rings is also greater than 60 degrees, then that ring is considered an outlier. The outliers are highlighted in purple. The color gray indicates Mogul did not find sufficient equivalents in the CSD to analyse the geometry.

Ligand PEG A 401	
Bond lengths	Bond angles
Torsions	Rings

Ligand RWB A 410	
Bond lengths	Bond angles
Torsions	Rings

Ligand PEG B 401
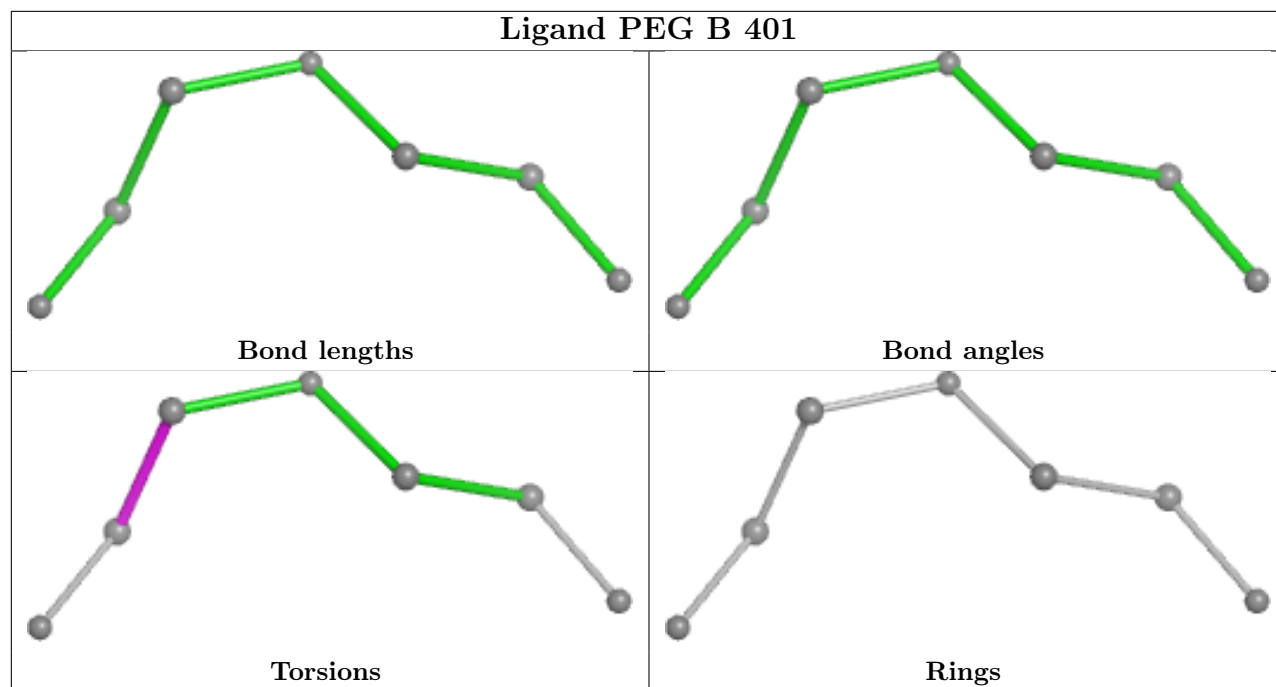
5.7 Other polymers ⓘ

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, 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	363/364 (99%)	-0.35	2 (0%)	85	88	39, 58, 96, 133	0
1	B	363/364 (99%)	-0.22	3 (0%)	82	85	39, 61, 108, 143	0
All	All	726/728 (99%)	-0.28	5 (0%)	84	86	39, 60, 102, 143	0

All (5) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	120	VAL	2.9
1	B	361	THR	2.5
1	A	120	VAL	2.4
1	A	97	ASP	2.1
1	B	239	PRO	2.0

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

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

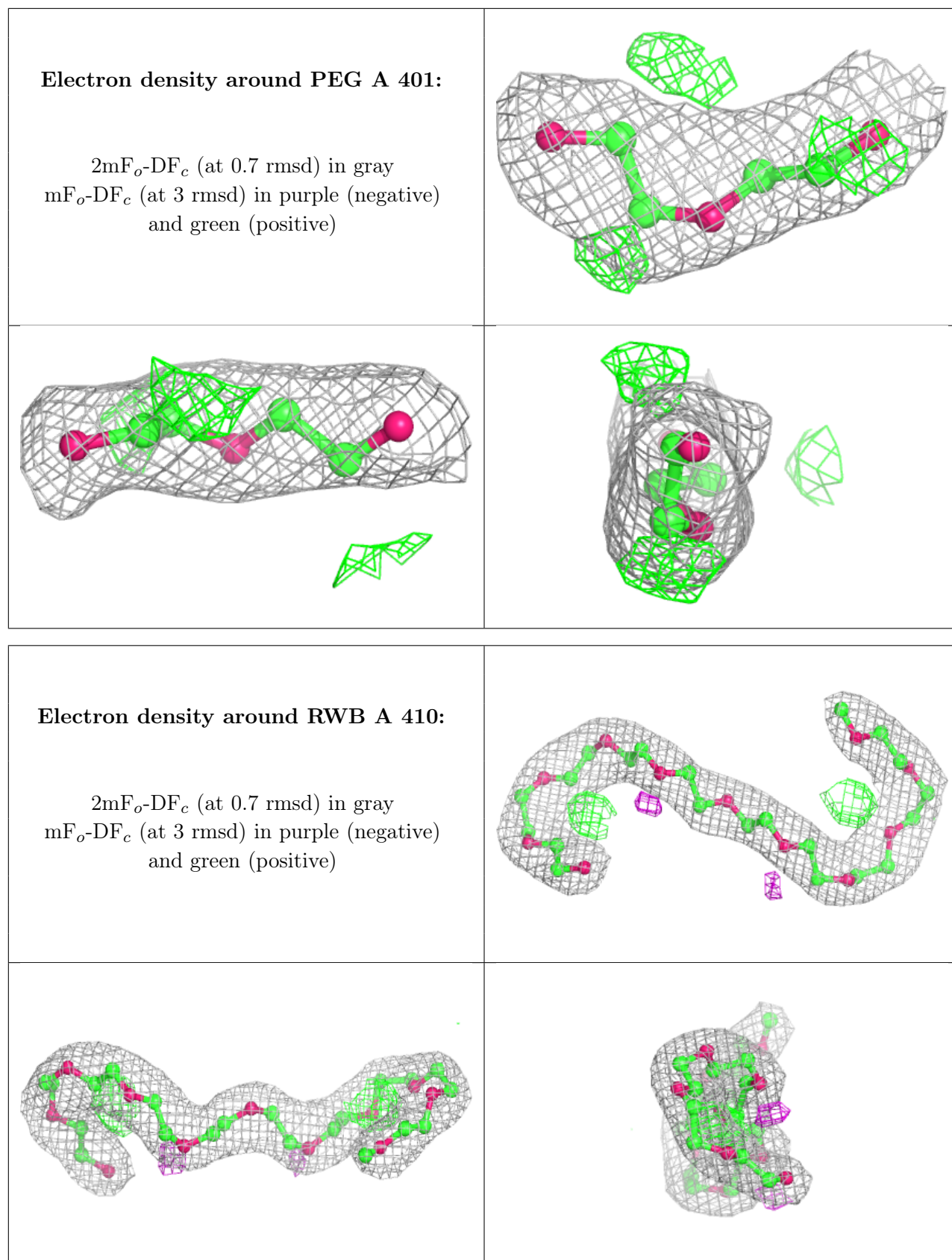## 6.3 Carbohydrates ⓘ

There are no monosaccharides in this entry.
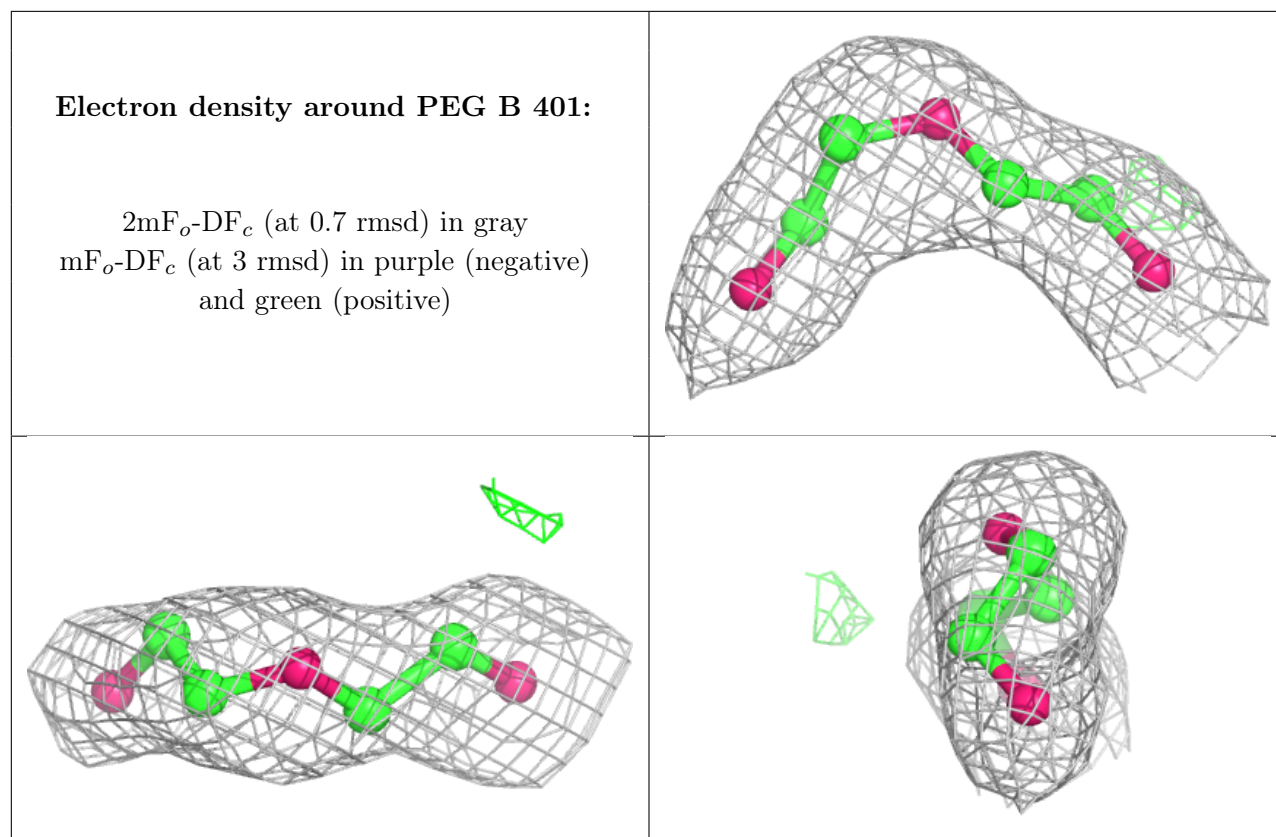
6.4 Ligands ⓘ

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, 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(Å^2)	Q<0.9
3	SO4	A	404	5/5	0.69	0.10	122,141,145,149	0
3	SO4	B	406	5/5	0.70	0.13	123,135,138,138	0
3	SO4	A	409	5/5	0.79	0.12	103,105,118,121	0
3	SO4	B	404	5/5	0.83	0.12	107,108,110,110	5
3	SO4	B	405	5/5	0.85	0.08	111,113,118,125	0
3	SO4	B	402	5/5	0.86	0.12	120,121,126,130	0
3	SO4	A	405	5/5	0.87	0.09	116,124,128,134	0
3	SO4	B	403	5/5	0.89	0.15	78,90,94,95	0
4	CL	A	407	1/1	0.89	0.08	85,85,85,85	0
2	PEG	A	401	7/7	0.92	0.11	70,76,79,80	0
3	SO4	A	402	5/5	0.92	0.12	76,79,88,97	0
3	SO4	A	403	5/5	0.92	0.09	114,119,125,127	0
5	RWB	A	410	32/38	0.94	0.10	46,57,65,66	0
4	CL	A	408	1/1	0.95	0.06	74,74,74,74	0
2	PEG	B	401	7/7	0.95	0.09	62,71,74,78	0
4	CL	B	408	1/1	0.96	0.05	84,84,84,84	0
4	CL	B	407	1/1	0.96	0.05	74,74,74,74	0
4	CL	A	406	1/1	0.99	0.06	54,54,54,54	0

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.

WORLDWIDE
PDB
PROTEIN DATA BANK

Electron density around PEG A 401:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative) and green (positive)

Electron density around RWB A 410:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative) and green (positive)

Electron density around PEG B 401:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

6.5 Other polymers ⓘ

There are no such residues in this entry.