



wwPDB X-ray Structure Validation Summary Report ⓘ

Sep 7, 2023 – 07:17 AM EDT

PDB ID : 4FT4
Title : crystal structure of Zea mays ZMET2 in complex H3(1-32)K9me2 peptide and SAH
Authors : Du, J.; Patel, D.J.
Deposited on : 2012-06-27
Resolution : 2.70 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 ⓘ 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 : 4.02b-467
Mogul : 1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix) : 1.13
EDS : 2.35
buster-report : 1.1.7 (2018)
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) : 2.35

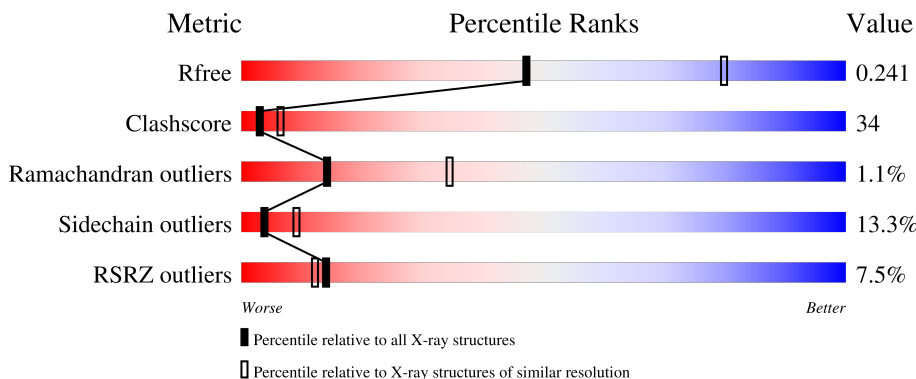
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.70 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	2808 (2.70-2.70)
Clashscore	141614	3122 (2.70-2.70)
Ramachandran outliers	138981	3069 (2.70-2.70)
Sidechain outliers	138945	3069 (2.70-2.70)
RSRZ outliers	127900	2737 (2.70-2.70)

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 $\leq 5\%$. 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	784	
1	B	784	
2	P	32	
2	Q	32	

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 criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
2	MLY	P	9	-	-	X	-

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 11265 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 DNA (cytosine-5)-methyltransferase 1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	B	693	5514	3521	939	1021	33	0	0	0
1	A	688	5443	3476	931	1003	33	0	0	0

There are 2 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	129	SER	-	expression tag	UNP Q9AXT8
A	129	SER	-	expression tag	UNP Q9AXT8

- Molecule 2 is a protein called H3(1-32)K9me2 peptide.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
2	P	7	56	33	12	11	0	0	0
2	Q	5	40	24	9	7	0	0	0

- Molecule 3 is S-ADENOSYL-L-HOMOCYSTEINE (three-letter code: SAH) (formula: C₁₄H₂₀N₆O₅S).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	N	O	S		
3	B	1	26	14	6	5	1	0	0
3	A	1	26	14	6	5	1	0	0

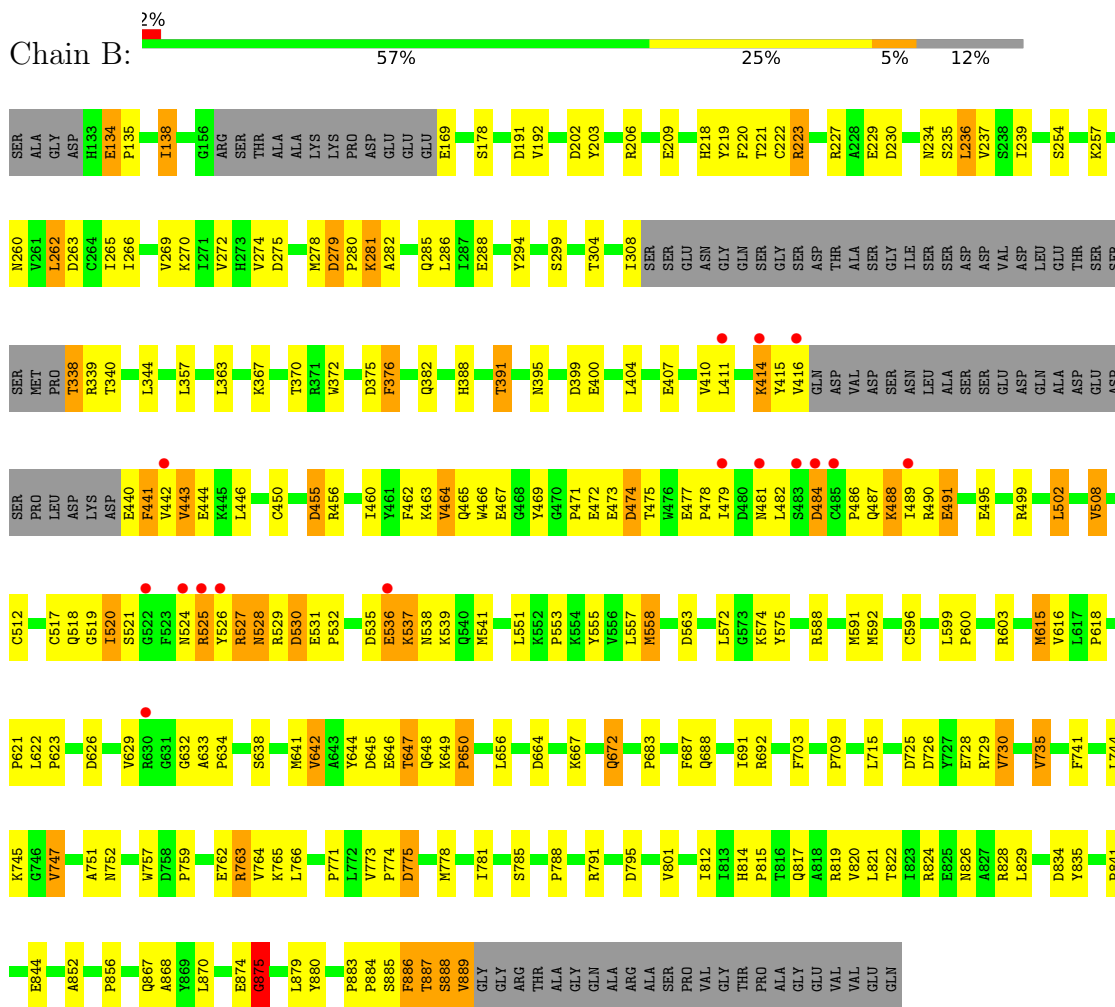
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
4	B	132	132	132	0	0
4	A	27	27	27	0	0
4	Q	1	1	1	0	0

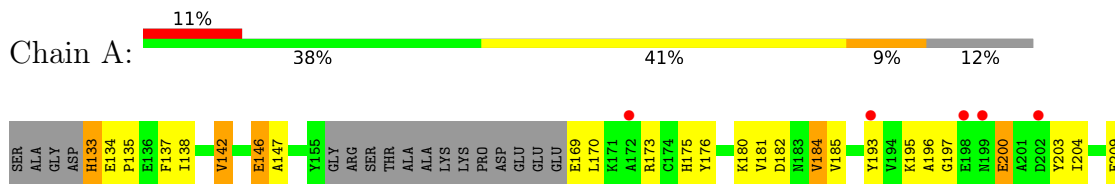
3 Residue-property plots

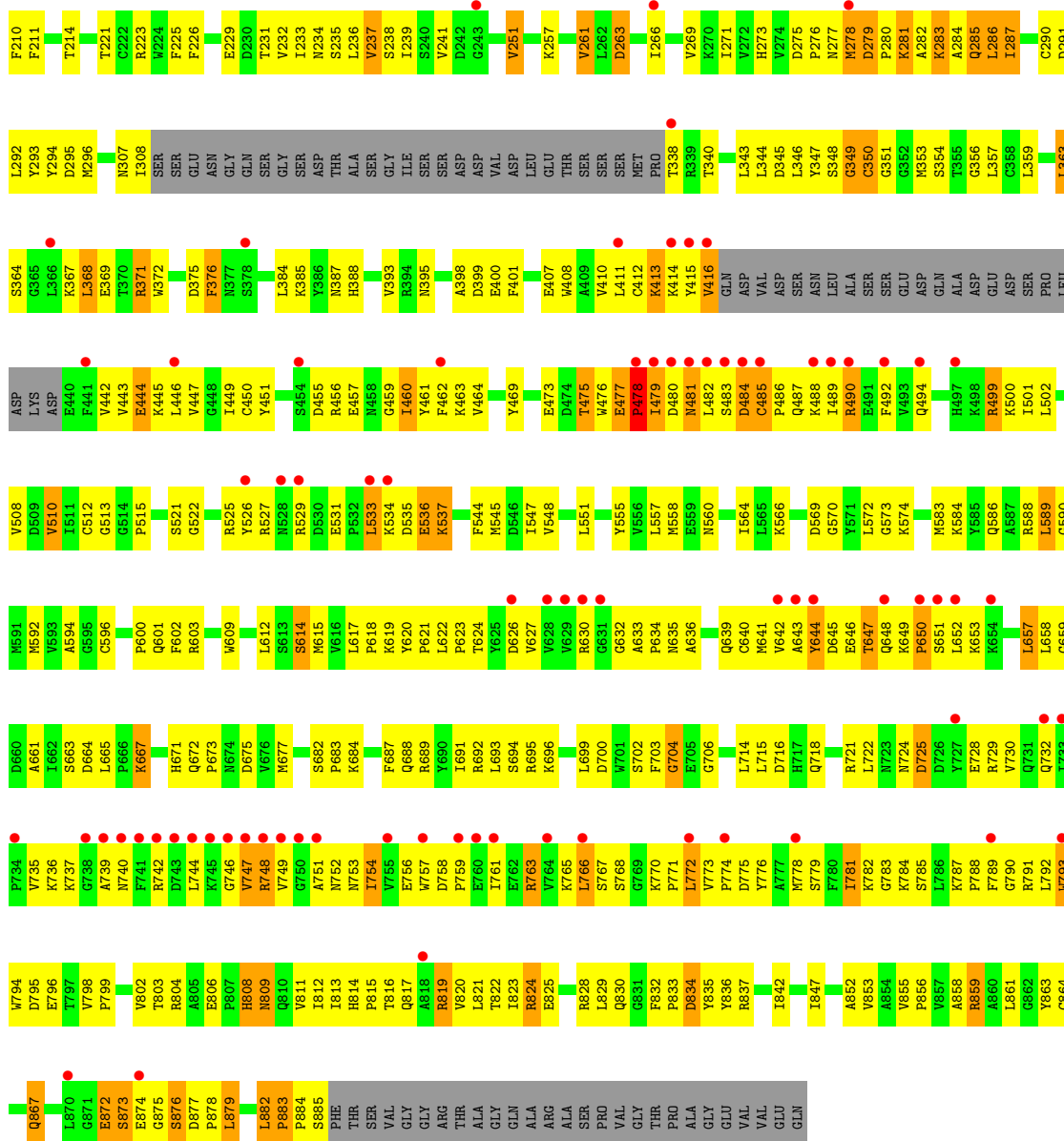
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. 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: DNA (cytosine-5)-methyltransferase 1



● Molecule 1: DNA (cytosine-5)-methyltransferase 1





• Molecule 2: H3(1-32)K9me2 peptide



ALA	THR	LYS	Q5	T6	A7	R8	G874	S875	R876	D877	P878	L879	L882	P883	P884	S885	PHE	THR	SER	VAL	GLY	GLY	ARG	THR	ALA	ALA	ARG	LYS	SER	ALA	ALA	THR
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• Molecule 2: H3(1-32)K9me2 peptide



ALA	ARG	THR	LYS	T6	T6	A7	R8	S10	K9	S10	GLY	GLY	LYS	ALA	ALA	ARG	LYS	SER	ALA	ALA	ALA	THR
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4 Data and refinement statistics i

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	64.64Å 111.56Å 151.48Å 90.00° 101.98° 90.00°	Depositor
Resolution (Å)	43.82 – 2.70 49.39 – 2.69	Depositor EDS
% Data completeness (in resolution range)	98.4 (43.82-2.70) 97.8 (49.39-2.69)	Depositor EDS
R_{merge}	0.09	Depositor
R_{sym}	0.09	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.41 (at 2.69Å)	Xtrriage
Refinement program	PHENIX (phenix.refine: 1.7.1_743)	Depositor
R, R_{free}	0.206 , 0.248 0.199 , 0.241	Depositor DCC
R_{free} test set	2894 reflections (5.06%)	wwPDB-VP
Wilson B-factor (Å ²)	52.0	Xtrriage
Anisotropy	0.512	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.32 , 62.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	0.022 for h,-k,-h-l	Xtrriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	11265	wwPDB-VP
Average B, all atoms (Å ²)	73.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.18% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical 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: SAH, MLY

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	0.40	0/5577	0.56	2/7555 (0.0%)
1	B	0.47	1/5649 (0.0%)	0.50	0/7650
2	P	0.25	0/44	0.56	0/58
2	Q	0.27	0/28	0.66	0/36
All	All	0.44	1/11298 (0.0%)	0.53	2/15299 (0.0%)

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	B	0	1

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	517	CYS	CB-SG	-5.43	1.73	1.81

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	478	PRO	N-CA-C	5.31	125.90	112.10
1	A	477	GLU	C-N-CD	-5.29	108.96	120.60

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	B	875	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	5443	0	5326	513	0
1	B	5514	0	5427	229	0
2	P	56	0	59	11	0
2	Q	40	0	45	9	0
3	A	26	0	19	5	0
3	B	26	0	19	5	0
4	A	27	0	0	2	0
4	B	132	0	0	5	0
4	Q	1	0	0	0	0
All	All	11265	0	10895	753	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 34.

The worst 5 of 753 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:483:SER:O	1:A:486:PRO:HD3	1.31	1.26
1:A:533:LEU:HD12	1:A:534:LYS:N	1.52	1.22
1:A:589:LEU:HD12	1:A:589:LEU:O	1.34	1.20
1:A:285:GLN:CA	1:A:285:GLN:HE21	1.56	1.18
1:A:589:LEU:HD12	1:A:589:LEU:C	1.64	1.17

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	680/784 (87%)	631 (93%)	38 (6%)	11 (2%)	9	24
1	B	685/784 (87%)	660 (96%)	22 (3%)	3 (0%)	34	60
2	P	4/32 (12%)	4 (100%)	0	0	100	100
2	Q	2/32 (6%)	1 (50%)	0	1 (50%)	0	0
All	All	1371/1632 (84%)	1296 (94%)	60 (4%)	15 (1%)	14	34

5 of 15 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	883	PRO
1	B	650	PRO
1	B	875	GLY
1	A	704	GLY
1	A	748	ARG

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	580/668 (87%)	492 (85%)	88 (15%)	3	7
1	B	596/668 (89%)	530 (89%)	66 (11%)	6	14
2	P	5/21 (24%)	3 (60%)	2 (40%)	0	0
2	Q	3/21 (14%)	1 (33%)	2 (67%)	0	0
All	All	1184/1378 (86%)	1026 (87%)	158 (13%)	4	9

5 of 158 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	589	LEU
1	A	821	LEU

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Mol	Chain	Res	Type
1	A	647	THR
1	A	754	ILE
1	A	874	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 9 such sidechains are listed below:

Mol	Chain	Res	Type
1	A	487	GLN
1	A	867	GLN
1	B	752	ASN
1	B	810	GLN
1	A	285	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](#)

2 non-standard protein/DNA/RNA residues 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	MLY	Q	9	2	9,10,11	0.78	0	6,11,13	1.57	1 (16%)
2	MLY	P	9	2	9,10,11	0.68	0	6,11,13	0.69	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	MLY	Q	9	2	-	4/8/9/11	-
2	MLY	P	9	2	-	3/8/9/11	-

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	Q	9	MLY	CD-CE-NZ	-3.73	103.70	113.79

There are no chirality outliers.

5 of 7 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	P	9	MLY	C-CA-CB-CG
2	Q	9	MLY	C-CA-CB-CG
2	P	9	MLY	CD-CE-NZ-CH2
2	Q	9	MLY	CD-CE-NZ-CH2
2	P	9	MLY	CD-CE-NZ-CH1

There are no ring outliers.

1 monomer is involved in 7 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	P	9	MLY	7	0

5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

5.6 Ligand geometry [i](#)

2 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	SAH	A	1000	-	24,28,28	1.04	1 (4%)	25,40,40	1.46	3 (12%)
3	SAH	B	1000	-	24,28,28	1.79	7 (29%)	25,40,40	6.07	12 (48%)

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	SAH	A	1000	-	-	3/11/31/31	0/3/3/3
3	SAH	B	1000	-	-	1/11/31/31	0/3/3/3

The worst 5 of 8 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	1000	SAH	C2-N3	4.96	1.40	1.32
3	B	1000	SAH	C2-N1	3.10	1.39	1.33
3	B	1000	SAH	C5-C4	-2.80	1.33	1.40
3	B	1000	SAH	O4'-C4'	2.61	1.50	1.45
3	B	1000	SAH	C6-C5	-2.60	1.33	1.43

The worst 5 of 15 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	1000	SAH	O4'-C1'-C2'	-22.71	73.74	106.93
3	B	1000	SAH	O4'-C4'-C5'	-12.34	77.06	108.83
3	B	1000	SAH	O4'-C4'-C3'	-7.46	90.36	105.11
3	B	1000	SAH	C5'-C4'-C3'	7.33	133.37	115.06
3	B	1000	SAH	N3-C2-N1	-6.63	118.31	128.68

There are no chirality outliers.

All (4) torsion outliers are listed below:

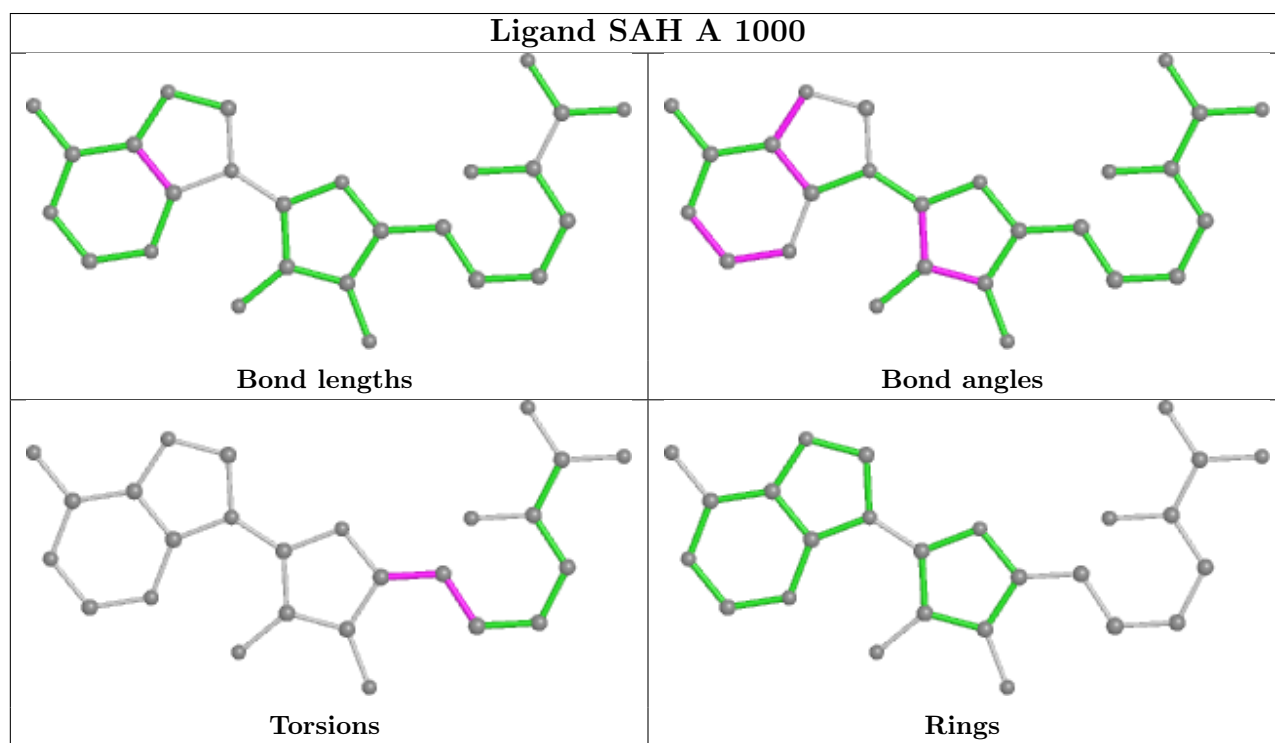
Mol	Chain	Res	Type	Atoms
3	B	1000	SAH	O4'-C4'-C5'-SD
3	A	1000	SAH	O4'-C4'-C5'-SD
3	A	1000	SAH	C3'-C4'-C5'-SD
3	A	1000	SAH	C4'-C5'-SD-CG

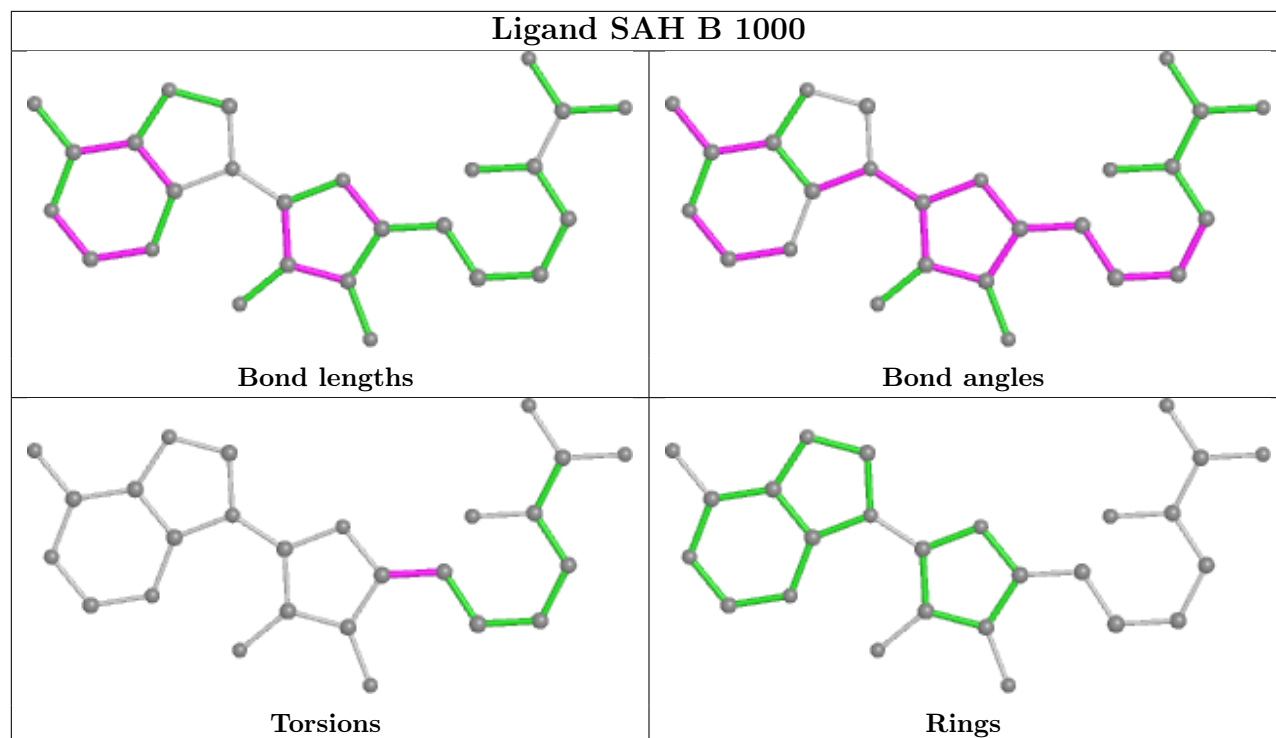
There are no ring outliers.

2 monomers are involved in 10 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	A	1000	SAH	5	0
3	B	1000	SAH	5	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 than 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.





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, 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	688/784 (87%)	0.57	84 (12%) 4 3	56, 88, 149, 228	0
1	B	693/784 (88%)	0.00	16 (2%) 60 62	24, 45, 106, 159	0
2	P	6/32 (18%)	0.60	0 100 100	105, 130, 135, 135	0
2	Q	4/32 (12%)	4.43	4 (100%) 0 0	119, 128, 143, 164	0
All	All	1391/1632 (85%)	0.30	104 (7%) 14 12	24, 71, 137, 228	0

The worst 5 of 104 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	628	VAL	10.3
1	A	629	VAL	9.5
1	A	479	ILE	8.4
1	A	748	ARG	7.7
1	A	416	VAL	7.7

6.2 Non-standard residues in protein, DNA, RNA chains [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, 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
2	MLY	Q	9	11/12	0.85	0.26	76,96,108,114	0
2	MLY	P	9	11/12	0.88	0.29	81,87,108,112	0

6.3 Carbohydrates [i](#)

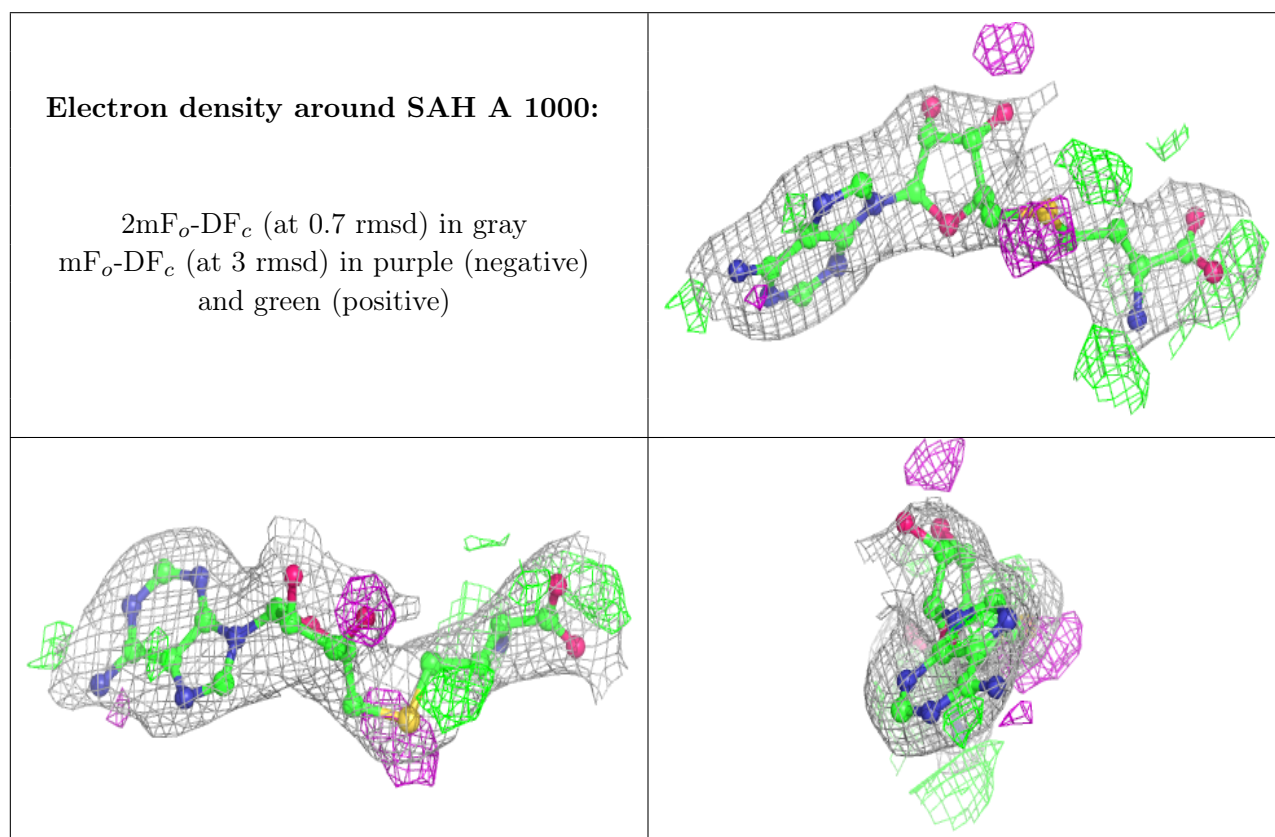
There are no monosaccharides in this entry.

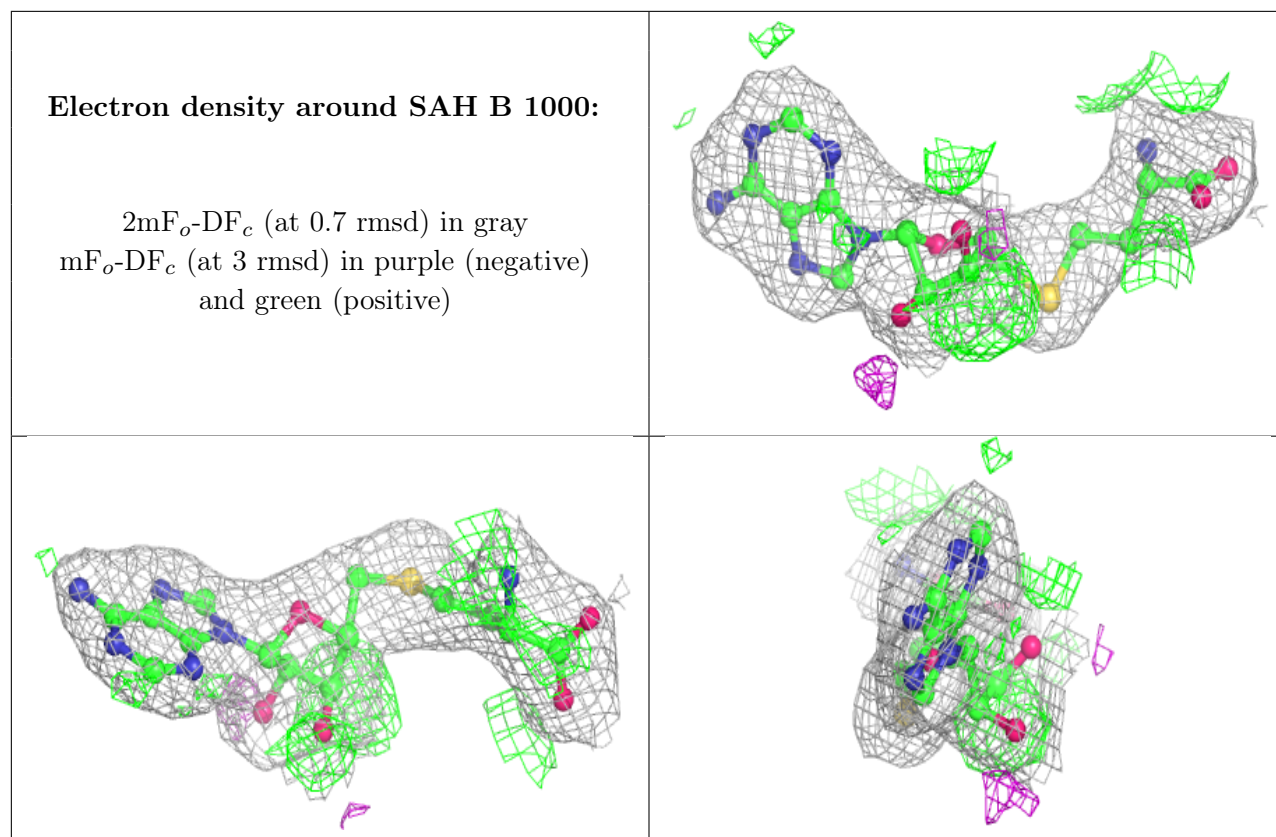
6.4 Ligands [i](#)

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, 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	SAH	A	1000	26/26	0.90	0.24	36,63,83,93	0
3	SAH	B	1000	26/26	0.96	0.24	11,36,55,67	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.





6.5 Other polymers [i](#)

There are no such residues in this entry.