wwPDB X-ray Structure Validation Summary Report (i)

Jan 19, 2026 – 02:15 PM JST

PDB ID	:	9LPL / pdb_00009lpl
Title	:	E. coli FabF mutant -C163Q
Authors	:	Chen, L.; Huang, Y.
Deposited on	:	2025-01-25
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 (i) 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 (i)) were used in the production of this report:

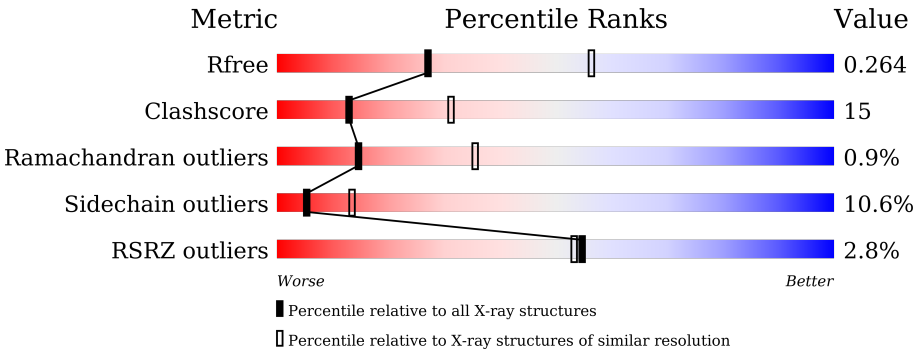
MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.47

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 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}	164625	3333 (2.70-2.70)
Clashscore	180529	3684 (2.70-2.70)
Ramachandran outliers	177936	3633 (2.70-2.70)
Sidechain outliers	177891	3633 (2.70-2.70)
RSRZ outliers	164620	3333 (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 <=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	443	2% 60% 24% 7% • 8%
1	B	443	3% 56% 28% 6% • 7%

2 Entry composition (i)

There are 3 unique types of molecules in this entry. The entry contains 6120 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 3-oxoacyl-[acyl-carrier-protein] synthase 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	409	Total	C	N	O	S	0	0	0
			2990	1865	525	584	16			
1	B	410	Total	C	N	O	S	0	0	0
			2999	1871	527	585	16			

There are 64 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-17	HIS	-	expression tag	UNP P0AAI5
A	-16	HIS	-	expression tag	UNP P0AAI5
A	-15	HIS	-	expression tag	UNP P0AAI5
A	-14	HIS	-	expression tag	UNP P0AAI5
A	-13	HIS	-	expression tag	UNP P0AAI5
A	-12	HIS	-	expression tag	UNP P0AAI5
A	-11	SER	-	expression tag	UNP P0AAI5
A	-10	SER	-	expression tag	UNP P0AAI5
A	-9	GLY	-	expression tag	UNP P0AAI5
A	-8	LEU	-	expression tag	UNP P0AAI5
A	-7	VAL	-	expression tag	UNP P0AAI5
A	-6	PRO	-	expression tag	UNP P0AAI5
A	-5	ARG	-	expression tag	UNP P0AAI5
A	-4	GLY	-	expression tag	UNP P0AAI5
A	-3	SER	-	expression tag	UNP P0AAI5
A	-2	HIS	-	expression tag	UNP P0AAI5
A	-1	MET	-	expression tag	UNP P0AAI5
A	0	VAL	-	expression tag	UNP P0AAI5
A	163	GLN	CYS	engineered mutation	UNP P0AAI5
A	413	LYS	-	expression tag	UNP P0AAI5
A	414	LEU	-	expression tag	UNP P0AAI5
A	415	ALA	-	expression tag	UNP P0AAI5
A	416	ALA	-	expression tag	UNP P0AAI5
A	417	ALA	-	expression tag	UNP P0AAI5
A	418	LEU	-	expression tag	UNP P0AAI5

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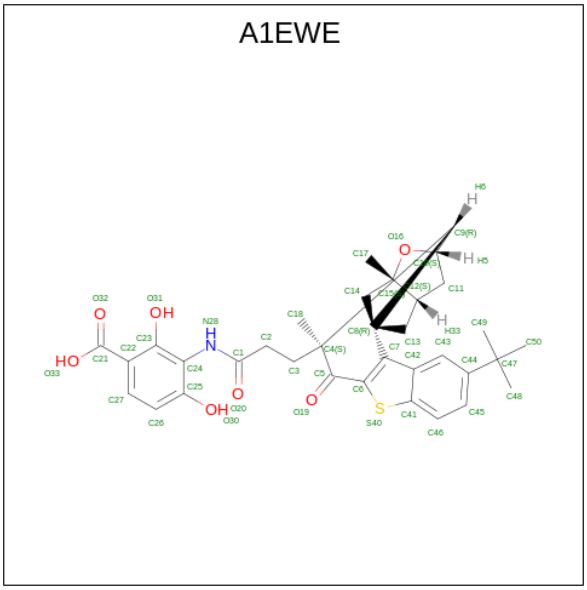
Chain	Residue	Modelled	Actual	Comment	Reference
A	419	GLU	-	expression tag	UNP P0AAI5
A	420	HIS	-	expression tag	UNP P0AAI5
A	421	HIS	-	expression tag	UNP P0AAI5
A	422	HIS	-	expression tag	UNP P0AAI5
A	423	HIS	-	expression tag	UNP P0AAI5
A	424	HIS	-	expression tag	UNP P0AAI5
A	425	HIS	-	expression tag	UNP P0AAI5
B	-17	HIS	-	expression tag	UNP P0AAI5
B	-16	HIS	-	expression tag	UNP P0AAI5
B	-15	HIS	-	expression tag	UNP P0AAI5
B	-14	HIS	-	expression tag	UNP P0AAI5
B	-13	HIS	-	expression tag	UNP P0AAI5
B	-12	HIS	-	expression tag	UNP P0AAI5
B	-11	SER	-	expression tag	UNP P0AAI5
B	-10	SER	-	expression tag	UNP P0AAI5
B	-9	GLY	-	expression tag	UNP P0AAI5
B	-8	LEU	-	expression tag	UNP P0AAI5
B	-7	VAL	-	expression tag	UNP P0AAI5
B	-6	PRO	-	expression tag	UNP P0AAI5
B	-5	ARG	-	expression tag	UNP P0AAI5
B	-4	GLY	-	expression tag	UNP P0AAI5
B	-3	SER	-	expression tag	UNP P0AAI5
B	-2	HIS	-	expression tag	UNP P0AAI5
B	-1	MET	-	expression tag	UNP P0AAI5
B	0	VAL	-	expression tag	UNP P0AAI5
B	163	GLN	CYS	engineered mutation	UNP P0AAI5
B	413	LYS	-	expression tag	UNP P0AAI5
B	414	LEU	-	expression tag	UNP P0AAI5
B	415	ALA	-	expression tag	UNP P0AAI5
B	416	ALA	-	expression tag	UNP P0AAI5
B	417	ALA	-	expression tag	UNP P0AAI5
B	418	LEU	-	expression tag	UNP P0AAI5
B	419	GLU	-	expression tag	UNP P0AAI5
B	420	HIS	-	expression tag	UNP P0AAI5
B	421	HIS	-	expression tag	UNP P0AAI5
B	422	HIS	-	expression tag	UNP P0AAI5
B	423	HIS	-	expression tag	UNP P0AAI5
B	424	HIS	-	expression tag	UNP P0AAI5
B	425	HIS	-	expression tag	UNP P0AAI5

- Molecule 2 is 3-(3-((2S,3S,5S,5aR,6S,12cR)-11-(tert-butyl)-2,6-dimethyl-7-oxo-1,2,3,4,5,5a,6,7-octahydro-2,5-epoxy-3,12c-methanobenzo[b]cyclohepta[5,6]benzo[1,2-d]thiophen-6-yl)propanamido)-2,4-dihydroxybenzoic acid (CCD ID: A1EWE) (formula: $C_{34}H_{37}NO_7S$) (labeled

as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	1	Total C N O S 43 34 1 7 1	0	0
2	B	1	Total C N O S 43 34 1 7 1	0	0

- Molecule 3 is water.

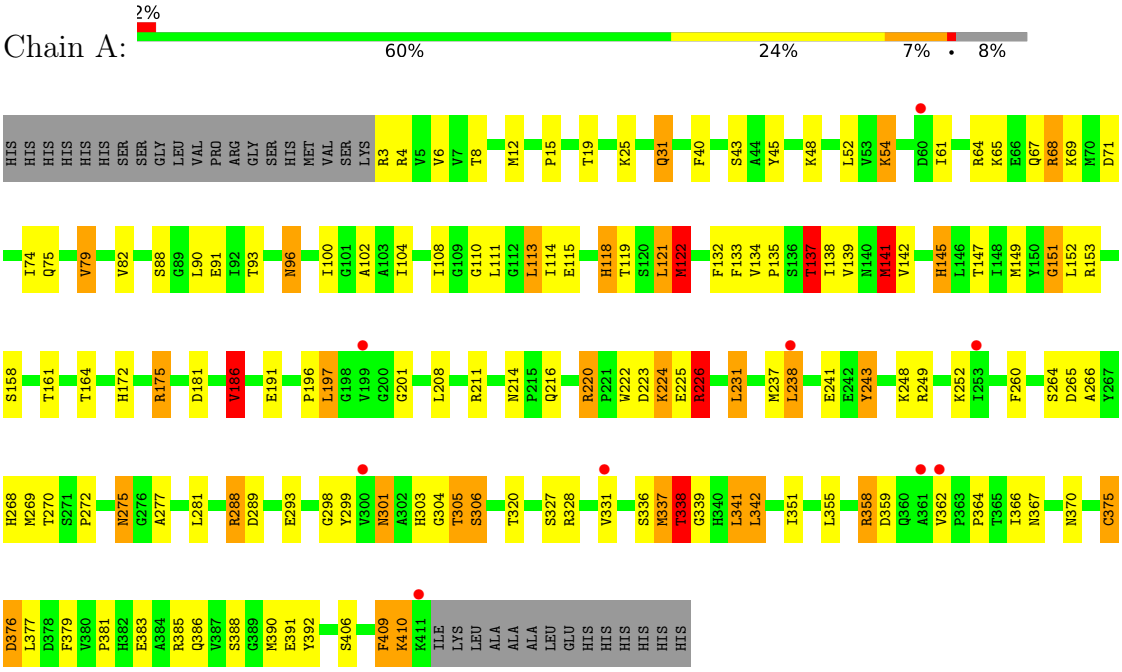
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	24	Total O 24 24	0	0
3	B	21	Total O 21 21	0	0

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 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.

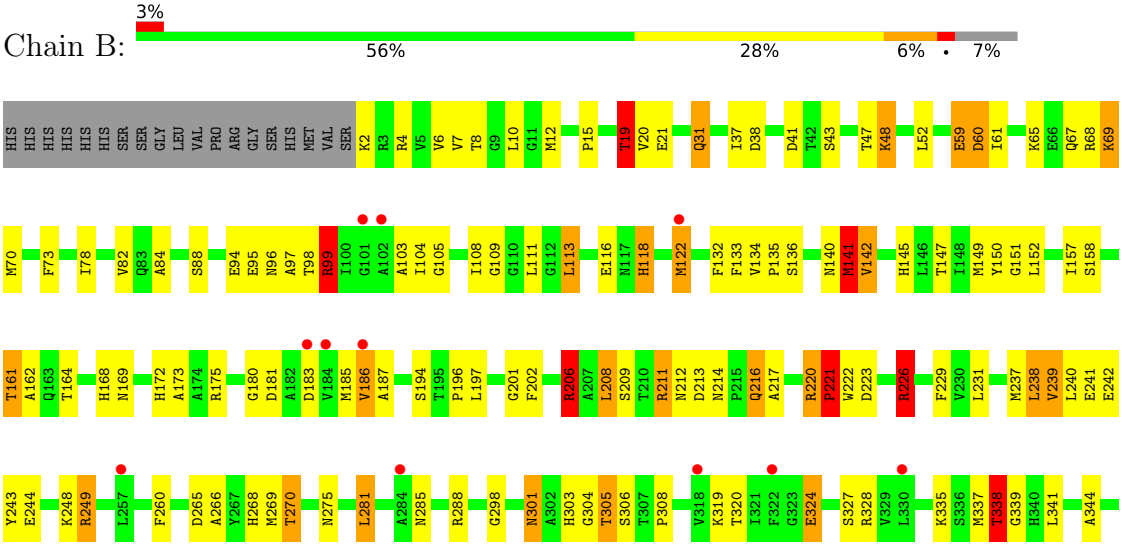
• Molecule 1: 3-oxoacyl-[acyl-carrier-protein] synthase 2

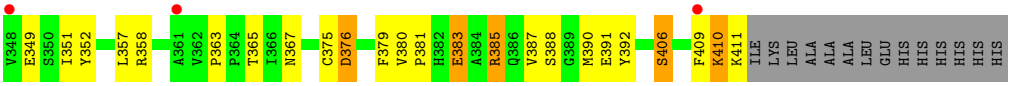
Chain A:



• Molecule 1: 3-oxoacyl-[acyl-carrier-protein] synthase 2

Chain B:




V348
E349
S350
T351
Y352
L357
R358
A361
V362
P363
P364
T365
I366
N367
C375
D376
F379
V380
P381
H382
E383
A384
R385
Q386
V387
S388
G389
M390
E391
Y392
S406
F409
K410
K411
ILE
LYS
LEU
ALA
ALA
ALA
LEU
GLU
HIS
HIS
HIS
HIS
HIS

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 32 2 1	Depositor
Cell constants a, b, c, α, β, γ	79.76Å 79.76Å 299.19Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	33.27 – 2.70 33.27 – 2.70	Depositor EDS
% Data completeness (in resolution range)	98.9 (33.27-2.70) 98.9 (33.27-2.70)	Depositor EDS
R_{merge}	0.19	Depositor
R_{sym}	0.19	Depositor
$< I/\sigma(I) >$ [1]	2.03 (at 2.68Å)	Xtriage
Refinement program	REFMAC 5.8.0430	Depositor
R, R_{free}	0.204 , 0.263 0.209 , 0.264	Depositor DCC
R_{free} test set	1503 reflections (4.80%)	wwPDB-VP
Wilson B-factor (Å^2)	56.1	Xtriage
Anisotropy	0.100	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.28 , 31.9	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	0.043 for -h,-k,l	Xtriage
F_o,F_c correlation	0.94	EDS
Total number of atoms	6120	wwPDB-VP
Average B, all atoms (Å^2)	59.0	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 64.48 % 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 8.2306e-06. 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: A1EWE

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	0/3042	1.79	55/4115 (1.3%)
1	B	1.03	1/3051 (0.0%)	1.85	69/4126 (1.7%)
All	All	1.02	1/6093 (0.0%)	1.82	124/8241 (1.5%)

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	A	0	5
1	B	0	5
All	All	0	10

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	168	HIS	CG-CD2	-5.16	1.30	1.35

The worst 5 of 124 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	A	137	THR	CA-CB-OG1	-15.52	86.33	109.60
1	B	19	THR	CA-CB-OG1	-12.95	90.17	109.60
1	B	226	ARG	CB-CA-C	-12.35	85.84	110.42
1	A	226	ARG	CB-CA-C	-12.25	86.05	110.42
1	B	376	ASP	CA-CB-CG	11.30	123.90	112.60

There are no chirality outliers.

5 of 10 planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	211	ARG	Sidechain
1	A	220	ARG	Sidechain
1	A	226	ARG	Sidechain
1	A	288	ARG	Sidechain
1	A	4	ARG	Sidechain

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	2990	0	2949	86	0
1	B	2999	0	2962	104	0
2	A	43	0	0	0	0
2	B	43	0	0	0	0
3	A	24	0	0	3	0
3	B	21	0	0	4	0
All	All	6120	0	5911	177	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 15.

The worst 5 of 177 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:B:135:PRO:HA	1:B:141:MET:CE	1.99	0.93
1:A:135:PRO:HA	1:A:141:MET:CE	2.02	0.89
1:A:135:PRO:HA	1:A:141:MET:HE3	1.58	0.86
1:B:387:VAL:HG22	1:B:388:SER:H	1.40	0.84
1:B:349:GLU:OE1	3:B:601:HOH:O	1.95	0.84

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	407/443 (92%)	374 (92%)	28 (7%)	5 (1%)	11 28
1	B	408/443 (92%)	377 (92%)	29 (7%)	2 (0%)	25 49
All	All	815/886 (92%)	751 (92%)	57 (7%)	7 (1%)	14 35

5 of 7 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	226	ARG
1	A	304	GLY
1	A	306	SER
1	A	375	CYS
1	B	304	GLY

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	305/334 (91%)	268 (88%)	37 (12%)	4 10
1	B	306/334 (92%)	278 (91%)	28 (9%)	7 18
All	All	611/668 (92%)	546 (89%)	65 (11%)	5 13

5 of 65 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	327	SER

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Mol	Chain	Res	Type
1	B	375	CYS
1	A	301	ASN
1	A	293	GLU
1	B	383	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 16 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	301	ASN
1	B	268	HIS
1	A	382	HIS
1	B	214	ASN
1	A	301	ASN

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 oligosaccharides 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	$\#\|Z\|>2$
2	A1EWE	B	501	-	44,49,49	1.82	8 (18%)	48,82,82	2.24	15 (31%)
2	A1EWE	A	501	-	44,49,49	2.24	11 (25%)	48,82,82	2.74	22 (45%)

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	A1EWE	B	501	-	-	5/20/78/78	0/1/7/7
2	A1EWE	A	501	-	-	6/20/78/78	0/1/7/7

The worst 5 of 19 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	A	501	A1EWE	C7-C42	7.15	1.53	1.40
2	B	501	A1EWE	C4-C5	-5.81	1.46	1.53
2	A	501	A1EWE	C13-C8	5.44	1.61	1.54
2	A	501	A1EWE	C27-C22	-4.93	1.32	1.39
2	A	501	A1EWE	C24-N28	-4.80	1.34	1.43

The worst 5 of 37 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	A	501	A1EWE	C11-C12-C13	-9.07	100.72	107.91
2	B	501	A1EWE	C3-C2-C1	-6.20	97.70	111.23
2	A	501	A1EWE	C23-C22-C21	6.05	126.50	119.83
2	B	501	A1EWE	C11-C12-C13	-5.88	103.25	107.91
2	A	501	A1EWE	C27-C26-C25	5.53	126.19	120.50

There are no chirality outliers.

5 of 11 torsion outliers are listed below:

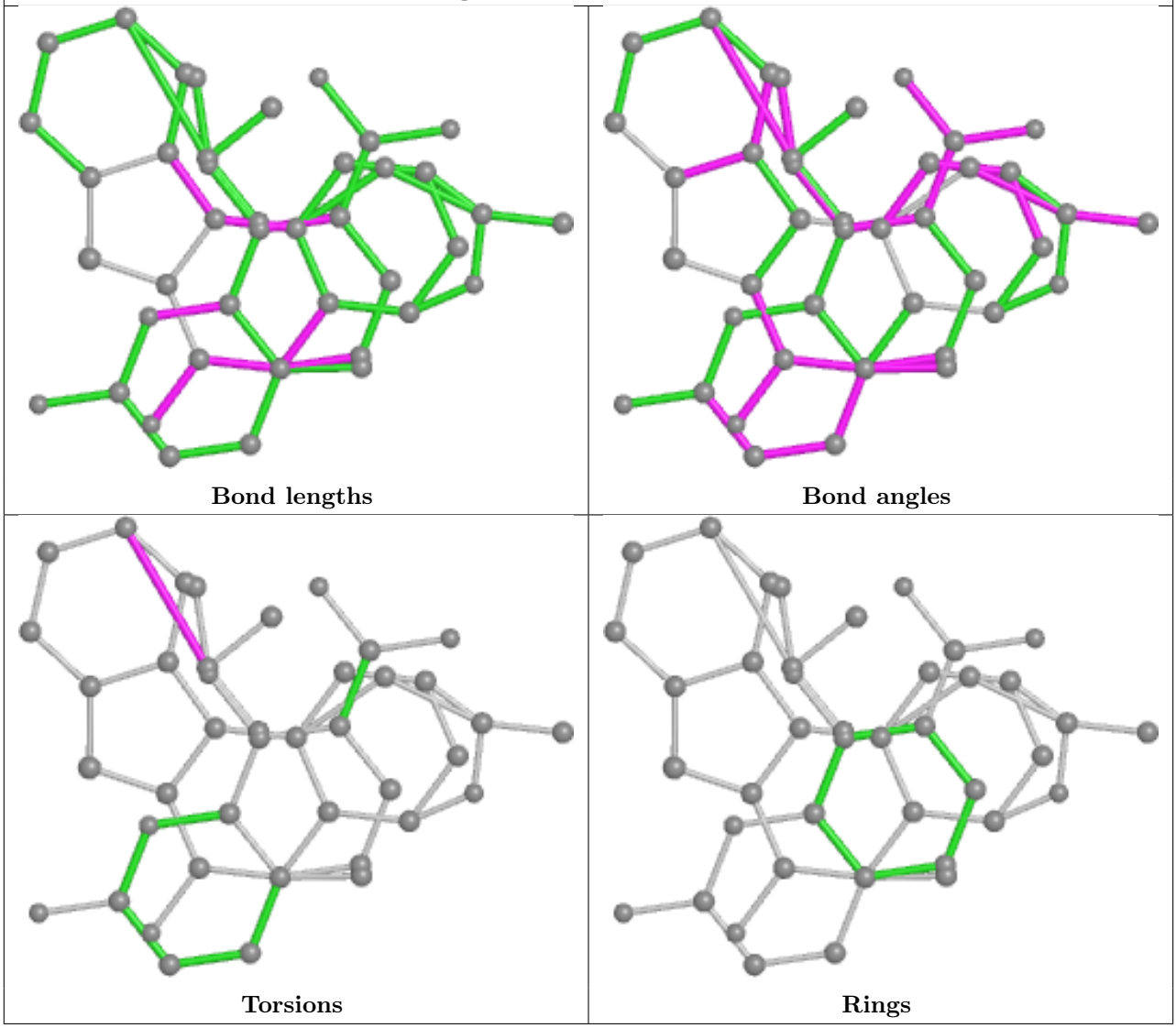
Mol	Chain	Res	Type	Atoms
2	A	501	A1EWE	C2-C3-C4-C5
2	A	501	A1EWE	C45-C44-C47-C48
2	B	501	A1EWE	C43-C44-C47-C49
2	B	501	A1EWE	C45-C44-C47-C49
2	B	501	A1EWE	C43-C44-C47-C48

There are no ring outliers.

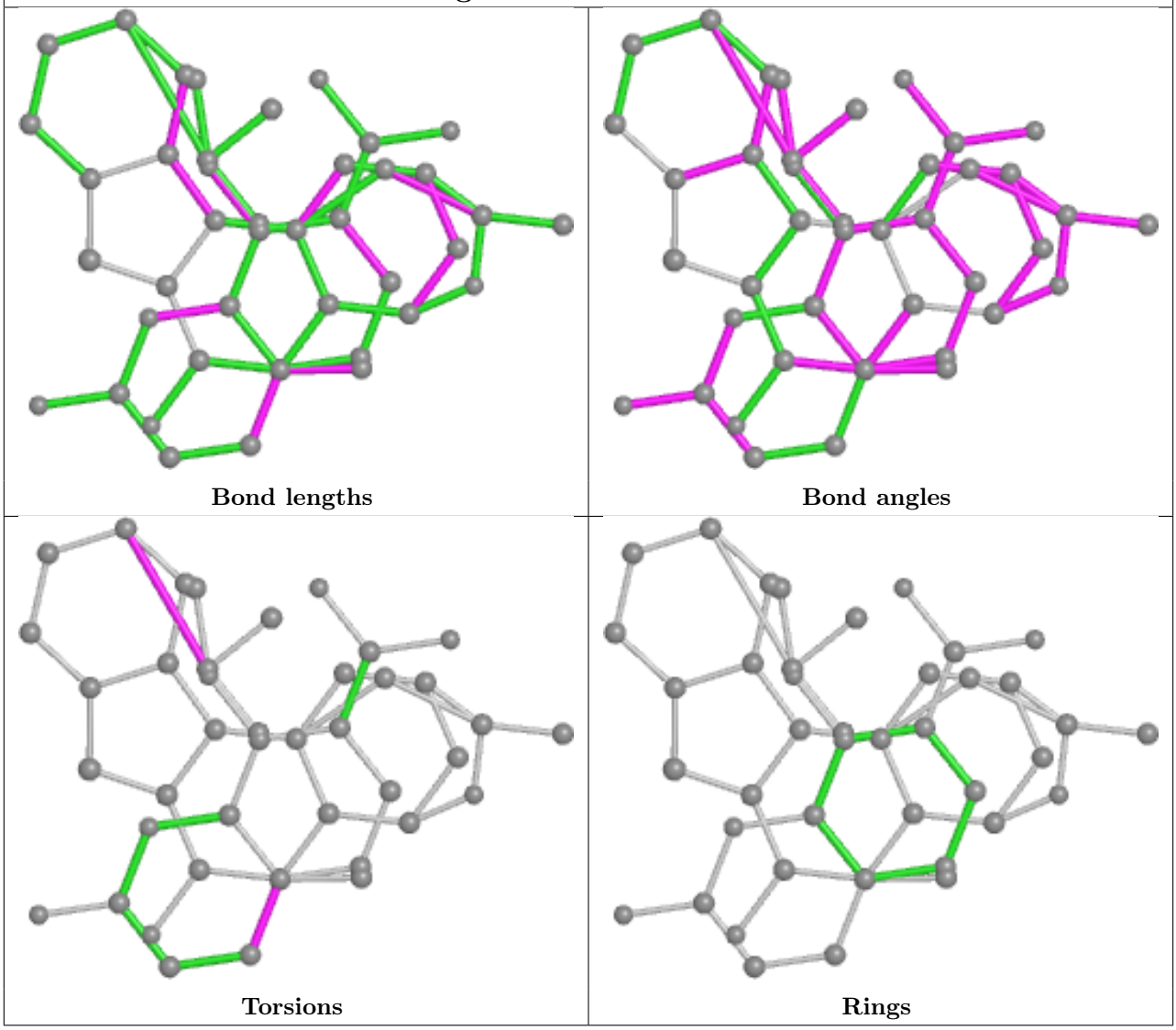
No monomer is involved in short contacts.

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 A1EWE B 501



Ligand A1EWE A 501



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

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	409/443 (92%)	0.12	9 (2%)	62	61	34, 54, 89, 113	0
1	B	410/443 (92%)	0.34	14 (3%)	48	46	36, 56, 85, 116	0
All	All	819/886 (92%)	0.23	23 (2%)	55	53	34, 55, 88, 116	0

The worst 5 of 23 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	184	VAL	8.3
1	B	361	ALA	6.8
1	B	101	GLY	6.5
1	B	257	LEU	4.6
1	B	318	VAL	4.4

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 oligosaccharides in this entry.

6.4 Ligands

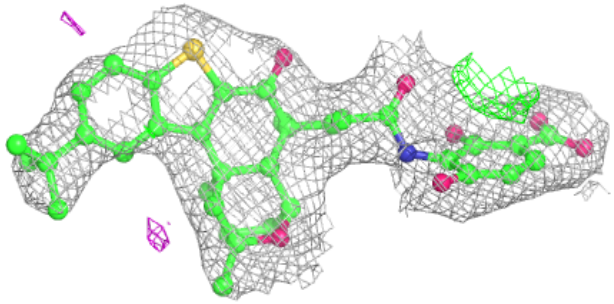
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95^{th} percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

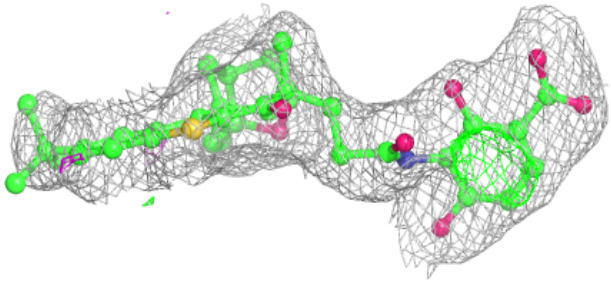
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
2	A1EWE	B	501	43/43	0.93	0.09	32,47,83,95	0
2	A1EWE	A	501	43/43	0.94	0.08	32,47,69,74	0

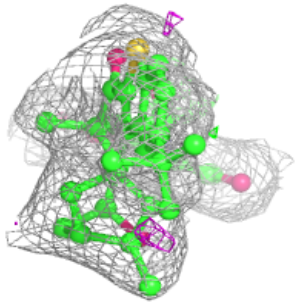
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around A1EWE B 501:

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

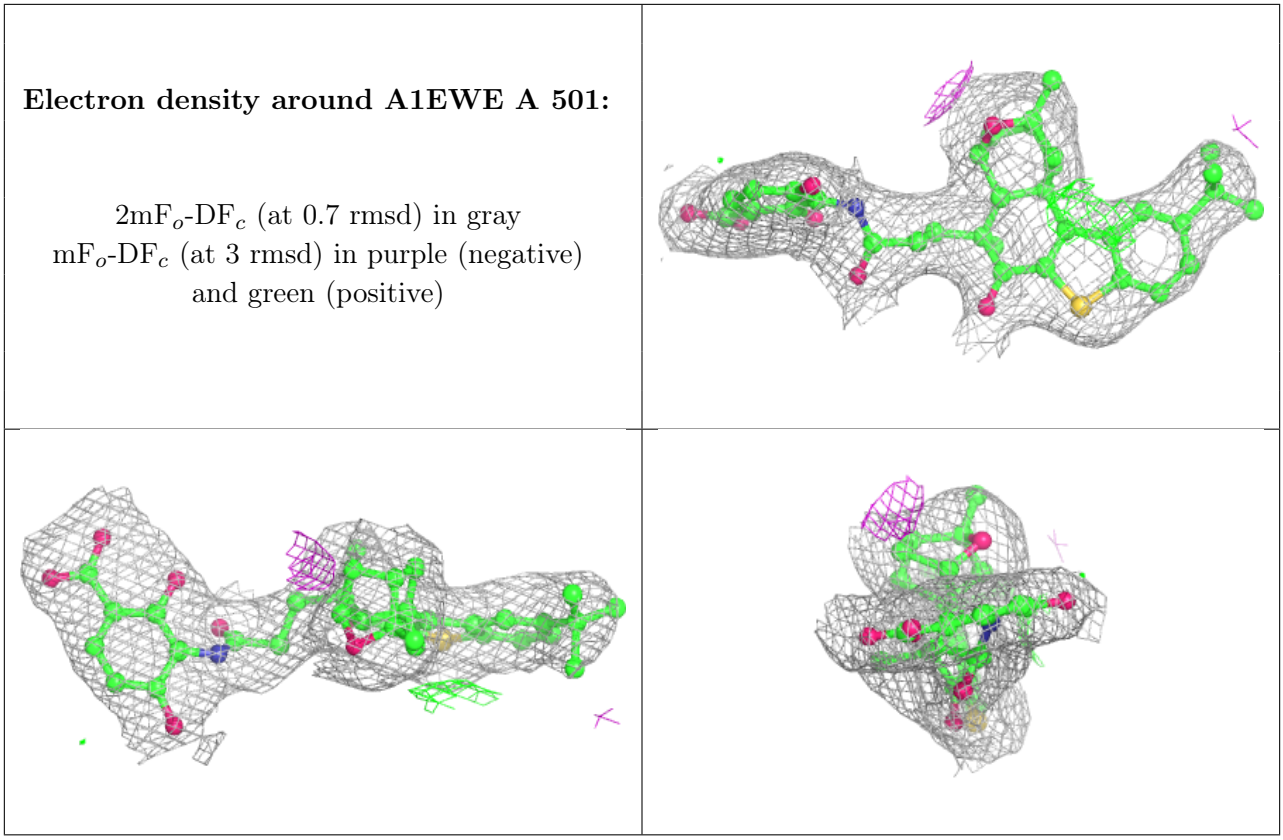






Electron density around A1EWE A 501:

$2mF_o$-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 (i)

There are no such residues in this entry.