Full wwPDB X-ray Structure Validation Report (i)

Mar 3, 2024 – 09:16 AM EST

PDB ID	:	6BLF
Title	:	PDE2 complexed with 2-[6-fluoro-8-methylsulfonyl-9-[(1R)-1-[4-(trifluoromethyl)phenyl]ethyl]-1,2,3,4-tetrahydrocarbazol-1-yl]acetic acid
Authors	:	Su, H.P.
Deposited on	:	2017-11-10
Resolution	:	2.11 Å(reported)

This is a Full wwPDB X-ray Structure Validation 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:

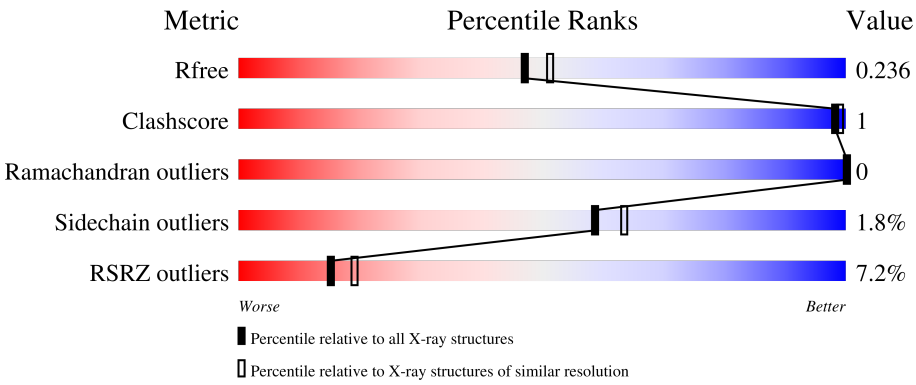
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.36
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36

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 2.11 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	6241 (2.14-2.10)
Clashscore	141614	6778 (2.14-2.10)
Ramachandran outliers	138981	6705 (2.14-2.10)
Sidechain outliers	138945	6706 (2.14-2.10)
RSRZ outliers	127900	6112 (2.14-2.10)

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	373	10% 89% • 7%
1	B	373	4% 91% • 6%

2 Entry composition (i)

There are 5 unique types of molecules in this entry. The entry contains 5973 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 cGMP-dependent 3',5'-cyclic phosphodiesterase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	348	2825	1797	479	523	26	0	4	0
1	B	349	2864	1822	491	524	27	0	5	0

There are 62 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	547	MET	-	expression tag	UNP O00408
A	548	HIS	-	expression tag	UNP O00408
A	549	HIS	-	expression tag	UNP O00408
A	550	HIS	-	expression tag	UNP O00408
A	551	HIS	-	expression tag	UNP O00408
A	552	HIS	-	expression tag	UNP O00408
A	553	HIS	-	expression tag	UNP O00408
A	554	GLU	-	expression tag	UNP O00408
A	555	ASN	-	expression tag	UNP O00408
A	556	LEU	-	expression tag	UNP O00408
A	557	TYR	-	expression tag	UNP O00408
A	558	PHE	-	expression tag	UNP O00408
A	559	GLN	-	expression tag	UNP O00408
A	560	GLY	-	expression tag	UNP O00408
A	561	GLU	-	expression tag	UNP O00408
A	562	LEU	-	expression tag	UNP O00408
A	563	SER	-	expression tag	UNP O00408
A	564	THR	-	expression tag	UNP O00408
A	565	SER	-	expression tag	UNP O00408
A	566	LEU	-	expression tag	UNP O00408
A	567	TYR	-	expression tag	UNP O00408
A	568	LYS	-	expression tag	UNP O00408
A	569	LYS	-	expression tag	UNP O00408
A	570	ALA	-	expression tag	UNP O00408
A	571	GLY	-	expression tag	UNP O00408

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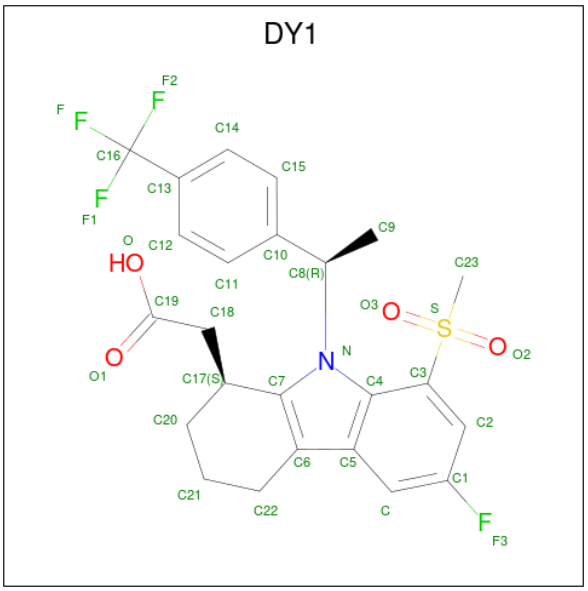
Chain	Residue	Modelled	Actual	Comment	Reference
A	572	PHE	-	expression tag	UNP O00408
A	573	ASP	-	expression tag	UNP O00408
A	574	ASP	-	expression tag	UNP O00408
A	575	ASP	-	expression tag	UNP O00408
A	576	ASP	-	expression tag	UNP O00408
A	577	LYS	-	expression tag	UNP O00408
B	547	MET	-	expression tag	UNP O00408
B	548	HIS	-	expression tag	UNP O00408
B	549	HIS	-	expression tag	UNP O00408
B	550	HIS	-	expression tag	UNP O00408
B	551	HIS	-	expression tag	UNP O00408
B	552	HIS	-	expression tag	UNP O00408
B	553	HIS	-	expression tag	UNP O00408
B	554	GLU	-	expression tag	UNP O00408
B	555	ASN	-	expression tag	UNP O00408
B	556	LEU	-	expression tag	UNP O00408
B	557	TYR	-	expression tag	UNP O00408
B	558	PHE	-	expression tag	UNP O00408
B	559	GLN	-	expression tag	UNP O00408
B	560	GLY	-	expression tag	UNP O00408
B	561	GLU	-	expression tag	UNP O00408
B	562	LEU	-	expression tag	UNP O00408
B	563	SER	-	expression tag	UNP O00408
B	564	THR	-	expression tag	UNP O00408
B	565	SER	-	expression tag	UNP O00408
B	566	LEU	-	expression tag	UNP O00408
B	567	TYR	-	expression tag	UNP O00408
B	568	LYS	-	expression tag	UNP O00408
B	569	LYS	-	expression tag	UNP O00408
B	570	ALA	-	expression tag	UNP O00408
B	571	GLY	-	expression tag	UNP O00408
B	572	PHE	-	expression tag	UNP O00408
B	573	ASP	-	expression tag	UNP O00408
B	574	ASP	-	expression tag	UNP O00408
B	575	ASP	-	expression tag	UNP O00408
B	576	ASP	-	expression tag	UNP O00408
B	577	LYS	-	expression tag	UNP O00408

- Molecule 2 is [(1S)-6-fluoro-8-(methylsulfonyl)-9-{(1R)-1-[4-(trifluoromethyl)phenyl]ethyl}-2,3,4,9-tetrahydro-1H-carbazol-1-yl]acetic acid (three-letter code: DY1) (formula: $C_{24}H_{23}F_4NO_4S$).



Mol	Chain	Residues	Atoms						ZeroOcc	AltConf
			Total	C	F	N	O	S		
2	A	1	34	24	4	1	4	1	0	0
			Total	C	F	N	O	S		
2	B	1	34	24	4	1	4	1	0	0

- Molecule 3 is ZINC ION (three-letter code: ZN) (formula: Zn).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Zn		
3	A	1	1	1	0	0
			Total	Zn		
3	B	1	1	1	0	0

- Molecule 4 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Mg		
4	A	1	1	1	0	0
			Total	Mg		
4	B	1	1	1	0	0

- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
5	A	95	95	95	0	0

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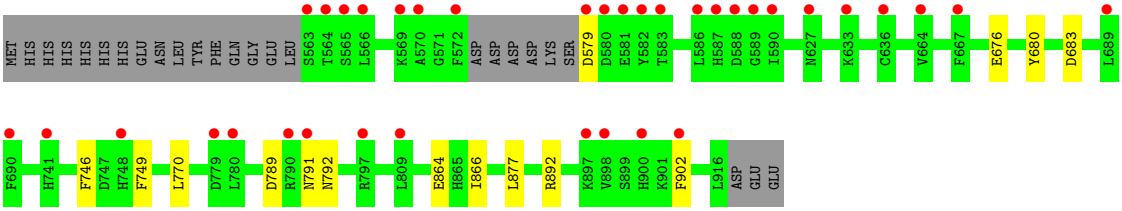
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
5	B	117	117	117	0	0

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.

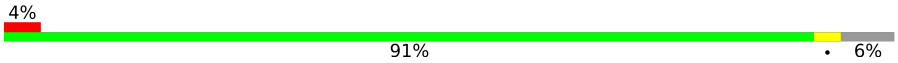
- Molecule 1: cGMP-dependent 3',5'-cyclic phosphodiesterase

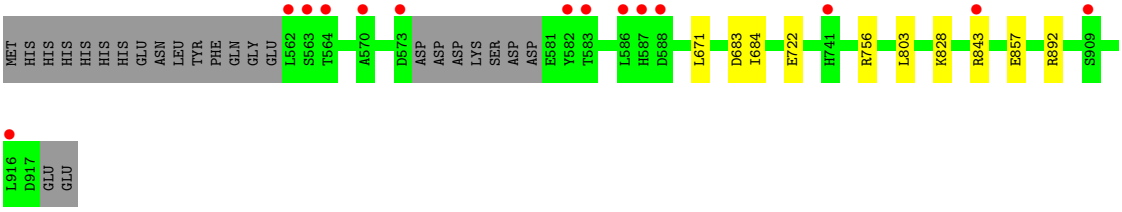
Chain A:



- Molecule 1: cGMP-dependent 3',5'-cyclic phosphodiesterase

Chain B:





4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	72.03Å 95.83Å 104.13Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	29.72 – 2.11 29.62 – 2.11	Depositor EDS
% Data completeness (in resolution range)	99.9 (29.72-2.11) 99.9 (29.62-2.11)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	4.01 (at 2.12Å)	Xtriage
Refinement program	BUSTER 2.11.7	Depositor
R, R_{free}	0.185 , 0.228 0.188 , 0.236	Depositor DCC
R_{free} test set	2125 reflections (5.05%)	wwPDB-VP
Wilson B-factor (Å^2)	27.8	Xtriage
Anisotropy	0.099	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.35 , 56.6	EDS
L-test for twinning[2]	$< \|L\| > = 0.48$, $< L^2 > = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.96	EDS
Total number of atoms	5973	wwPDB-VP
Average B, all atoms (Å^2)	36.0	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 24.40 % 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 3.8617e-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 (i)

5.1 Standard geometry (i)

Bond lengths and bond angles in the following residue types are not validated in this section: ZN, MG, DY1

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	0.50	0/2892	0.62	0/3908
1	B	0.52	0/2932	0.60	0/3957
All	All	0.51	0/5824	0.61	0/7865

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no planarity outliers.

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	2825	0	2706	5	0
1	B	2864	0	2769	2	0
2	A	34	0	0	0	0
2	B	34	0	0	0	0
3	A	1	0	0	0	0
3	B	1	0	0	0	0
4	A	1	0	0	0	0
4	B	1	0	0	0	0
5	A	95	0	0	0	0
5	B	117	0	0	0	0
All	All	5973	0	5475	7	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 (7) 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:864:GLU:HG3	1:A:892:ARG:HD2	1.93	0.51
1:B:684:ILE:HD13	1:B:756[A]:ARG:HG2	1.93	0.50
1:B:671:LEU:HD13	1:B:803:LEU:HD22	1.95	0.48
1:A:770:LEU:HD11	1:A:866:ILE:HD12	1.98	0.45
1:A:676:GLU:O	1:A:680:TYR:HD1	2.02	0.43
1:A:746:PHE:O	1:A:749:PHE:HB2	2.18	0.42
1:A:789:ASP:HB3	1:A:792:ASN:HB3	2.03	0.41

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	348/373 (93%)	338 (97%)	10 (3%)	0	100	100
1	B	350/373 (94%)	344 (98%)	6 (2%)	0	100	100
All	All	698/746 (94%)	682 (98%)	16 (2%)	0	100	100

There are no Ramachandran outliers to report.

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	306/337 (91%)	301 (98%)	5 (2%)	62	68
1	B	312/337 (93%)	306 (98%)	6 (2%)	57	61
All	All	618/674 (92%)	607 (98%)	11 (2%)	59	63

All (11) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	579	ASP
1	A	683	ASP
1	A	791	ASN
1	A	877	LEU
1	A	902	PHE
1	B	683	ASP
1	B	722	GLU
1	B	828	LYS
1	B	843	ARG
1	B	857	GLU
1	B	892	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	708	GLN
1	B	794	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 monosaccharides in this entry.

5.6 Ligand geometry (i)

Of 6 ligands modelled in this entry, 4 are monoatomic - leaving 2 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	$\#\|Z\| > 2$
2	DY1	A	1000	-	31,37,37	0.57	0	45,58,58	1.24	3 (6%)
2	DY1	B	1000	-	31,37,37	0.54	0	45,58,58	1.24	1 (2%)

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	DY1	A	1000	-	-	9/22/34/34	0/4/4/4
2	DY1	B	1000	-	-	6/22/34/34	0/4/4/4

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	B	1000	DY1	C6-C7-N	6.34	110.69	106.66
2	A	1000	DY1	C6-C7-N	6.10	110.54	106.66
2	A	1000	DY1	C17-C18-C19	-2.55	110.77	113.50
2	A	1000	DY1	C-C5-C4	2.12	121.67	117.07

There are no chirality outliers.

All (15) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	1000	DY1	C2-C3-S-C23
2	A	1000	DY1	C4-C3-S-O2
2	A	1000	DY1	C4-C3-S-C23
2	B	1000	DY1	C2-C3-S-C23

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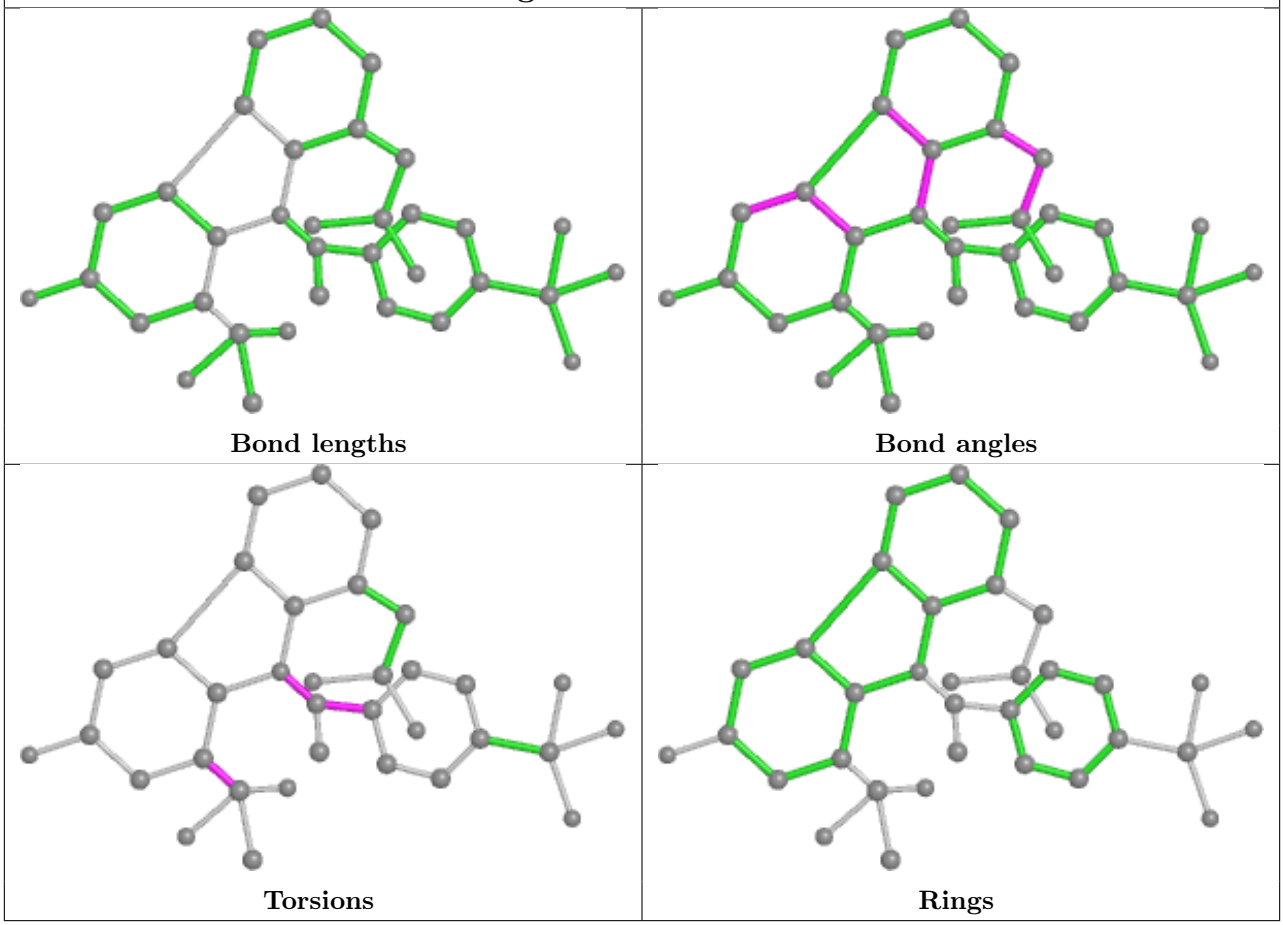
Mol	Chain	Res	Type	Atoms
2	B	1000	DY1	C4-C3-S-O2
2	B	1000	DY1	C4-C3-S-C23
2	A	1000	DY1	C11-C10-C8-N
2	A	1000	DY1	C2-C3-S-O2
2	B	1000	DY1	C2-C3-S-O2
2	A	1000	DY1	C11-C10-C8-C9
2	A	1000	DY1	C15-C10-C8-C9
2	B	1000	DY1	C11-C10-C8-C9
2	A	1000	DY1	C15-C10-C8-N
2	A	1000	DY1	C9-C8-N-C4
2	B	1000	DY1	C9-C8-N-C4

There are no ring outliers.

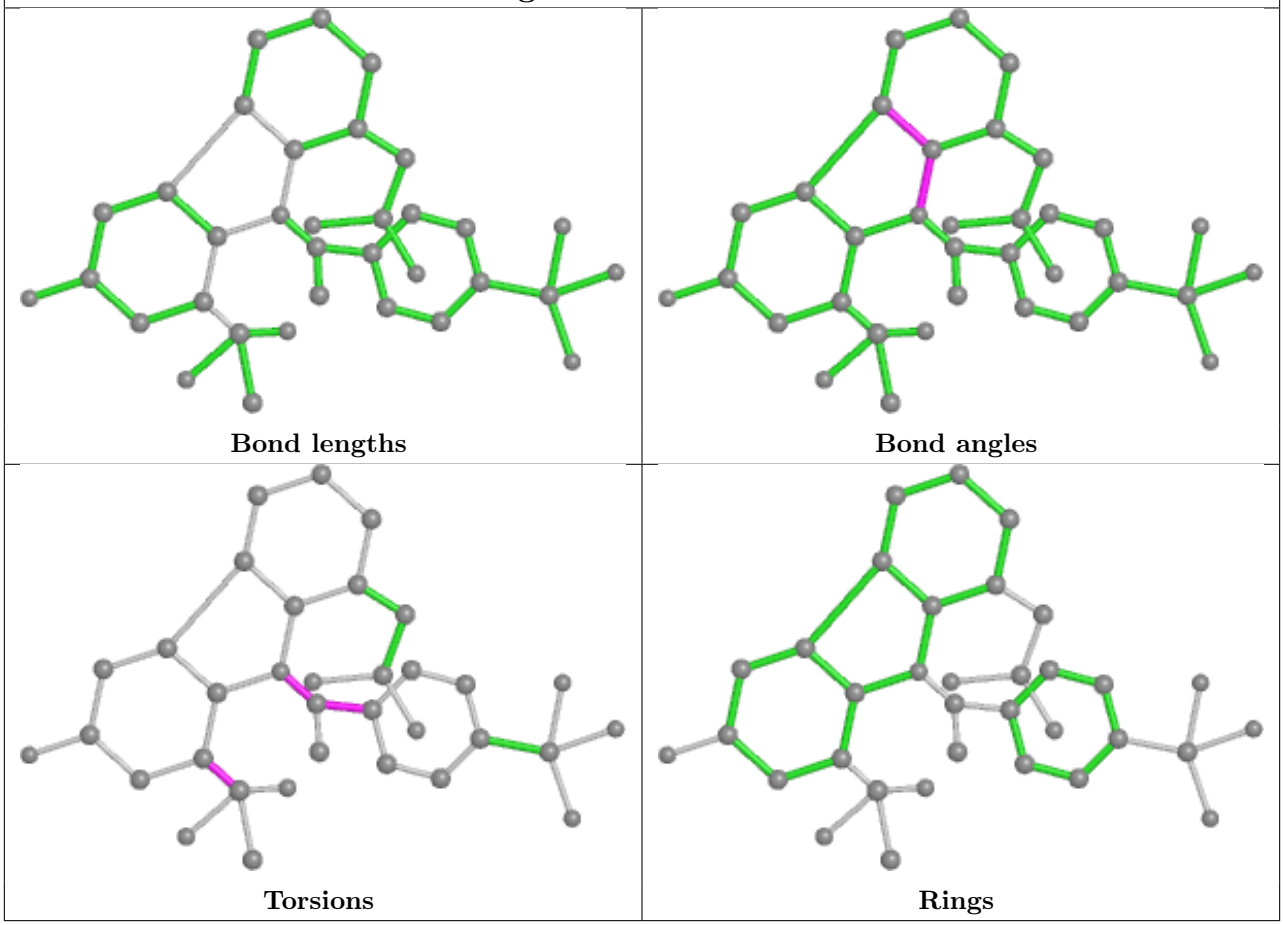
No monomer is involved in short contacts.

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 DY1 A 1000



Ligand DY1 B 1000



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	348/373 (93%)	0.46	36 (10%)	6	8	15, 34, 70, 104	0
1	B	349/373 (93%)	0.01	14 (4%)	38	44	14, 30, 59, 100	0
All	All	697/746 (93%)	0.24	50 (7%)	15	19	14, 32, 66, 104	0

All (50) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	589	GLY	10.1
1	A	570	ALA	9.5
1	A	588	ASP	6.0
1	A	580	ASP	5.7
1	B	586	LEU	5.2
1	A	563	SER	5.0
1	B	563	SER	5.0
1	A	572	PHE	4.9
1	B	562	LEU	4.5
1	B	587	HIS	4.5
1	A	564	THR	4.3
1	B	583	THR	4.2
1	A	633	LYS	4.2
1	A	897	LYS	3.7
1	A	590	ILE	3.7
1	B	564	THR	3.6
1	A	748	HIS	3.5
1	A	741	HIS	3.5
1	A	900	HIS	3.3
1	B	582	TYR	3.3
1	A	582	TYR	3.3
1	A	586	LEU	3.2
1	A	791	ASN	3.0
1	A	587	HIS	3.0

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Mol	Chain	Res	Type	RSRZ
1	A	583	THR	2.8
1	B	573	ASP	2.8
1	B	588	ASP	2.7
1	A	664	VAL	2.7
1	A	779	ASP	2.6
1	A	690	PHE	2.6
1	A	902	PHE	2.5
1	A	636	CYS	2.5
1	A	581	GLU	2.4
1	A	780	LEU	2.4
1	A	566	LEU	2.3
1	A	579	ASP	2.3
1	B	843	ARG	2.3
1	A	797	ARG	2.3
1	B	916	LEU	2.3
1	A	898	VAL	2.3
1	A	790	ARG	2.2
1	A	689	LEU	2.2
1	B	570	ALA	2.2
1	A	667	PHE	2.1
1	A	565	SER	2.1
1	A	627	ASN	2.1
1	A	569	LYS	2.1
1	B	741	HIS	2.1
1	B	909	SER	2.0
1	A	809	LEU	2.0

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 monosaccharides in this entry.

6.4 Ligands (i)

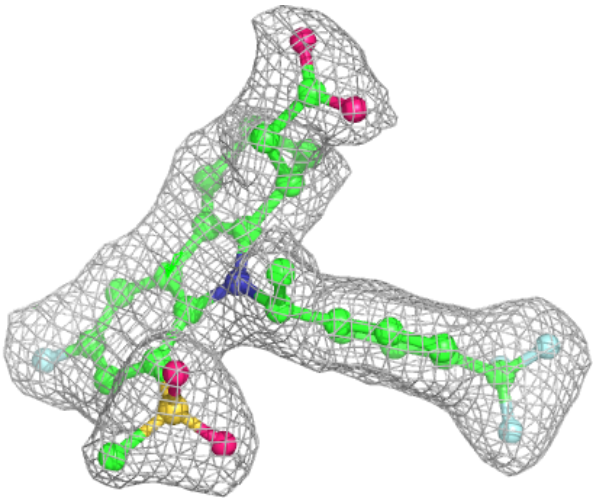
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

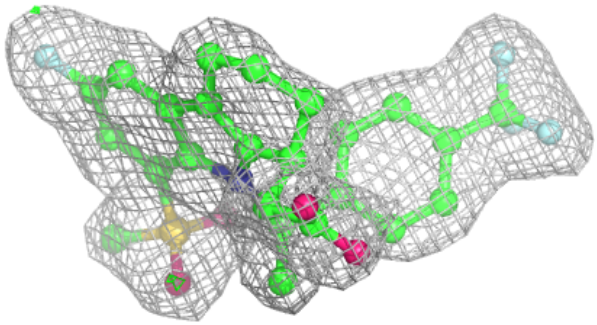
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
2	DY1	A	1000	34/34	0.97	0.13	23,28,40,44	0
2	DY1	B	1000	34/34	0.97	0.10	24,27,36,40	0
3	ZN	A	1001	1/1	1.00	0.08	21,21,21,21	0
3	ZN	B	1001	1/1	1.00	0.08	22,22,22,22	0
4	MG	A	1002	1/1	1.00	0.11	17,17,17,17	0
4	MG	B	1002	1/1	1.00	0.08	18,18,18,18	0

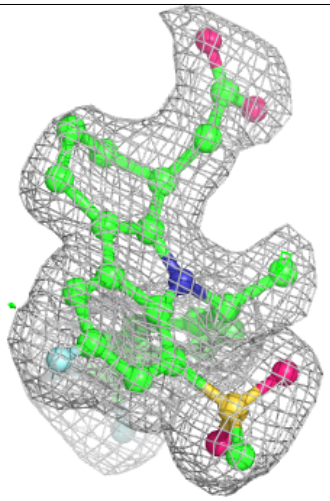
The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation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

Electron density around DY1 A 1000:

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

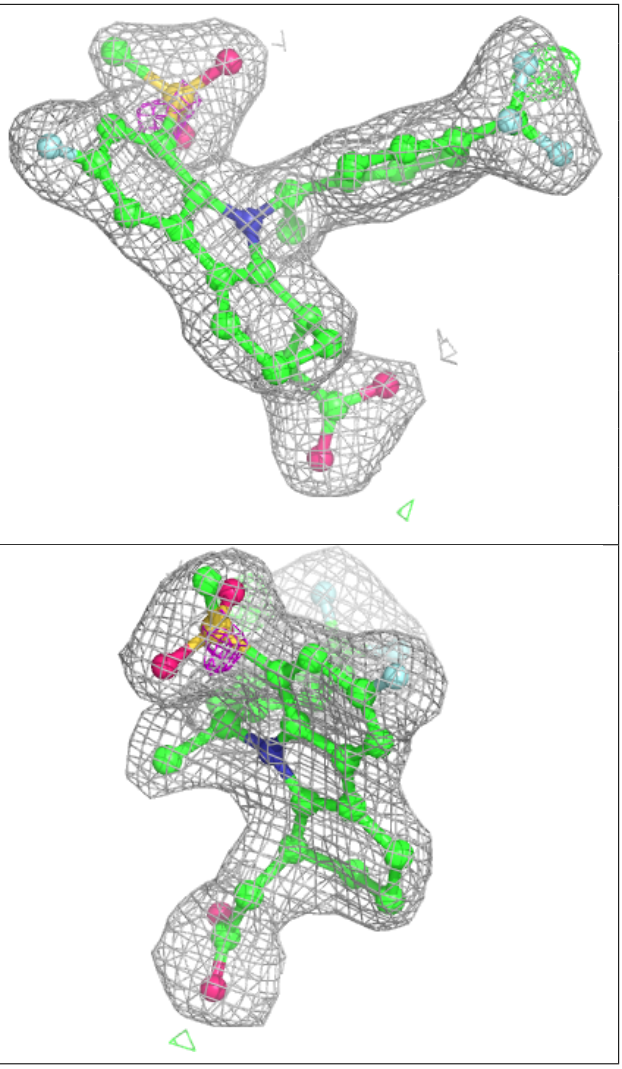


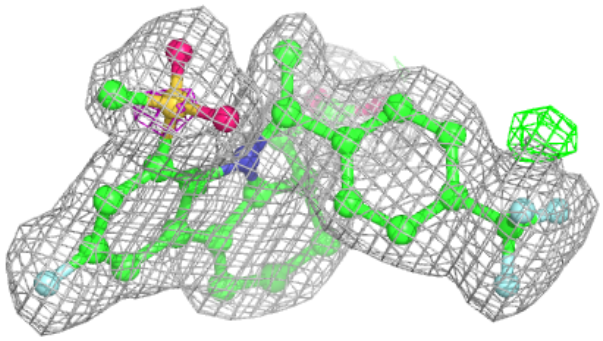




Electron density around DY1 B 1000:

$2mF_o$-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.