Full wwPDB X-ray Structure Validation Report (i)

Jan 11, 2021 – 07:12 PM GMT

PDB ID	:	6QGV
Title	:	HIF prolyl hydroxylase 2 (PHD2/ EGLN1) in complex with a Spiro[4.5]decanone inhibitor (JPHM-2-167)
Authors	:	Chowdhury, R.; Holt-Martyn, J.P.; Rahman, M.Z.; Schofield, C.J.
Deposited on	:	2019-01-13
Resolution	:	1.40 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 following versions of software and data (see references (i)) were used in the production of this report:

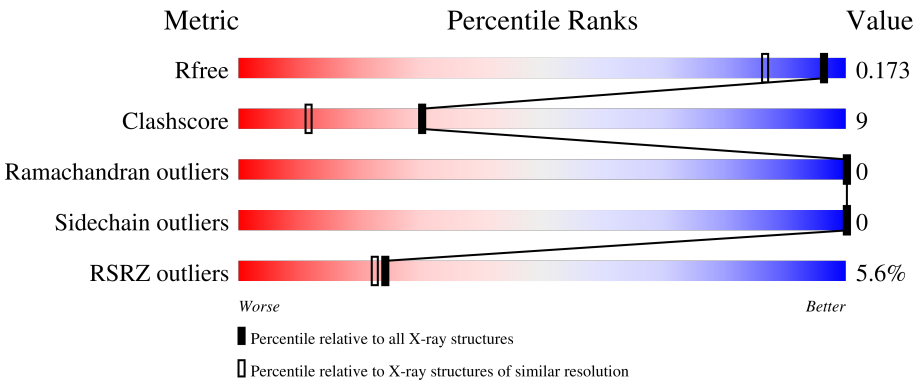
MolProbity	:	4.02b-467
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.16
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.16

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 1.40 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	1714 (1.40-1.40)
Clashscore	141614	1812 (1.40-1.40)
Ramachandran outliers	138981	1763 (1.40-1.40)
Sidechain outliers	138945	1762 (1.40-1.40)
RSRZ outliers	127900	1674 (1.40-1.40)

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	233	5% 74% 11% 15%

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
4	GOL	A	503	-	-	X	-

2 Entry composition (i)

There are 7 unique types of molecules in this entry. The entry contains 3452 atoms, of which 1568 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 Egl nine homolog 1.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	H	N	O	S			
1	A	198	3143	1025	1524	279	301	14	0	22	0

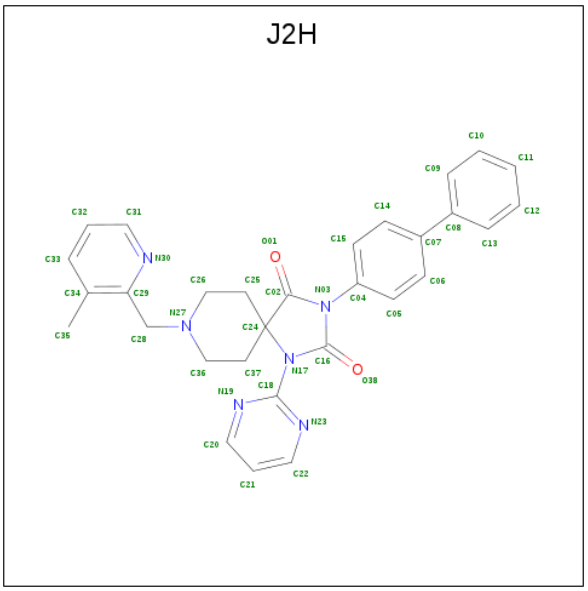
There are 6 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	175	GLY	-	expression tag	UNP Q9GZT9
A	176	SER	-	expression tag	UNP Q9GZT9
A	177	HIS	-	expression tag	UNP Q9GZT9
A	178	MET	-	expression tag	UNP Q9GZT9
A	179	ALA	-	expression tag	UNP Q9GZT9
A	180	SER	-	expression tag	UNP Q9GZT9

- Molecule 2 is MANGANESE (II) ION (three-letter code: MN) (formula: Mn).

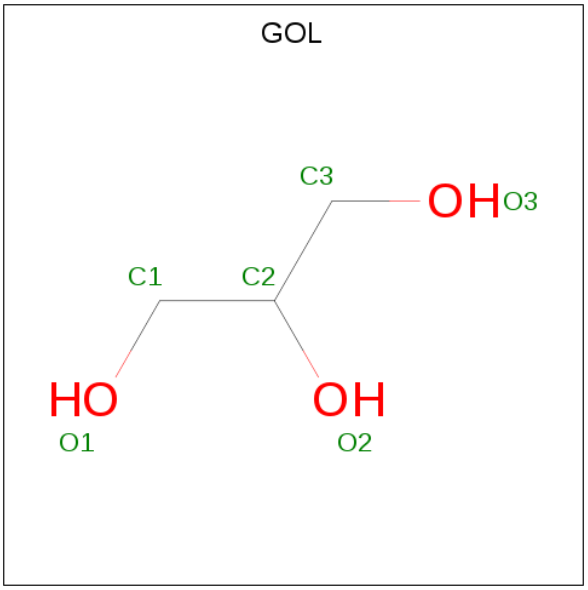
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Mn		
2	A	1	1	1	0	0

- Molecule 3 is 8-[(3-methylpyridin-2-yl)methyl]-3-(4-phenylphenyl)-1-pyrimidin-2-yl-1,3,8-triazaspiro[4.5]decane-2,4-dione (three-letter code: J2H) (formula: $C_{30}H_{28}N_6O_2$).



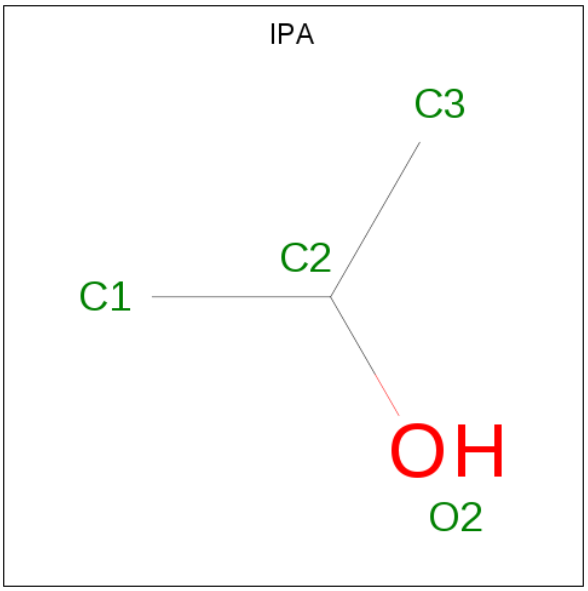
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
			Total	C	H	N	O		
3	A	1	66	30	28	6	2	0	0

- Molecule 4 is GLYCEROL (three-letter code: GOL) (formula: $C_3H_8O_3$).



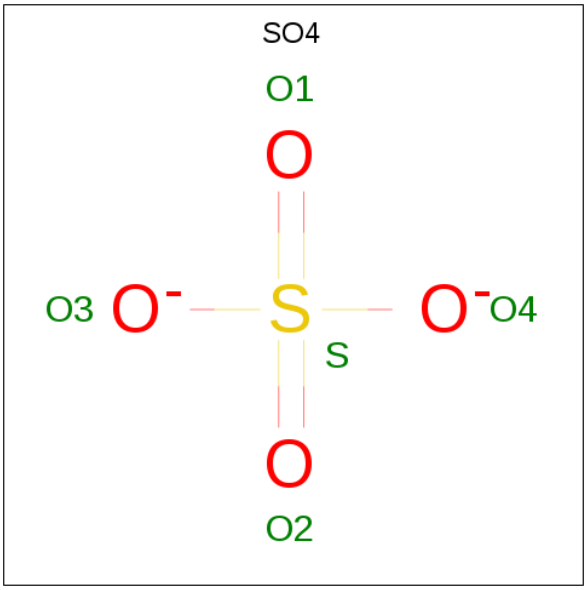
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	H	O		
4	A	1	14	3	8	3	0	0

- Molecule 5 is ISOPROPYL ALCOHOL (three-letter code: IPA) (formula: C_3H_8O).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
			Total	C	H	O		
5	A	1	12	3	8	1	0	0

- Molecule 6 is SULFATE ION (three-letter code: SO4) (formula: O_4S).



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

- Molecule 7 is water.

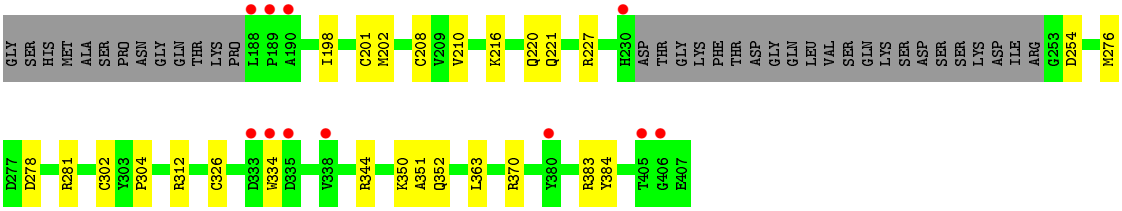
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
7	A	180	206	206	0	27

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: Egl nine homolog 1

Chain A:



4 Data and refinement statistics (i)

Property	Value	Source
Space group	H 3 2	Depositor
Cell constants a, b, c, α, β, γ	120.06Å 120.06Å 86.56Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	60.03 – 1.40 60.03 – 1.40	Depositor EDS
% Data completeness (in resolution range)	99.9 (60.03-1.40) 99.9 (60.03-1.40)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.14 (at 1.40Å)	Xtriage
Refinement program	PHENIX (1.14_3260: ???)	Depositor
R, R_{free}	0.157 , 0.172 0.157 , 0.173	Depositor DCC
R_{free} test set	2361 reflections (5.02%)	wwPDB-VP
Wilson B-factor (Å^2)	20.7	Xtriage
Anisotropy	0.141	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.40 , 60.9	EDS
L-test for twinning[2]	$< \|L\| > = 0.52$, $< L^2 > = 0.36$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.98	EDS
Total number of atoms	3452	wwPDB-VP
Average B, all atoms (Å^2)	36.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.64% 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 (i)

5.1 Standard geometry (i)

Bond lengths and bond angles in the following residue types are not validated in this section: J2H, GOL, IPA, SO4, MN

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	0.69	0/1736	0.77	0/2355

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	1619	1524	1439	29	0
2	A	1	0	0	0	0
3	A	38	28	0	0	0
4	A	6	8	8	5	0
5	A	4	8	8	0	0
6	A	10	0	0	1	0
7	A	206	0	0	10	0
All	All	1884	1568	1455	29	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 9.

All (29) 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:350:LYS:HB3	4:A:503:GOL:H11	1.61	0.81
1:A:351:ALA:H	4:A:503:GOL:H32	1.49	0.76
1:A:326[A]:CYS:SG	1:A:363:LEU:HD11	2.25	0.76
1:A:344:ARG:NH2	6:A:506:SO4:O3	2.21	0.74
1:A:351:ALA:H	4:A:503:GOL:C3	2.03	0.70
1:A:227:ARG:NH1	7:A:753[B]:HOH:O	2.26	0.68
1:A:227:ARG:NH2	7:A:601[A]:HOH:O	2.26	0.67
1:A:276:MET:SD	1:A:326[A]:CYS:SG	2.93	0.67
1:A:227:ARG:NE	7:A:601[B]:HOH:O	2.29	0.65
1:A:216:LYS:O	1:A:220:GLN:HG3	1.98	0.63
1:A:221[B]:GLN:CG	7:A:603:HOH:O	2.45	0.63
1:A:278[B]:ASP:OD1	1:A:281[B]:ARG:NH2	2.36	0.59
1:A:278[A]:ASP:OD1	1:A:281[A]:ARG:NH2	2.21	0.57
1:A:202:MET:HG2	1:A:208[B]:CYS:SG	2.44	0.57
1:A:221[B]:GLN:NE2	7:A:603:HOH:O	2.32	0.56
1:A:198[B]:ILE:HD11	1:A:210:VAL:CG2	2.37	0.55
1:A:221[B]:GLN:HG3	7:A:603:HOH:O	2.05	0.55
1:A:334:TRP:CH2	1:A:383:ARG:HG2	2.43	0.53
1:A:201:CYS:HB3	1:A:208[B]:CYS:SG	2.53	0.49
1:A:254:ASP:OD1	1:A:304:PRO:HD2	2.12	0.49
1:A:198[B]:ILE:HD11	1:A:210:VAL:HG21	1.96	0.48
1:A:370:ARG:HG3	7:A:719:HOH:O	2.14	0.47
1:A:201:CYS:SG	1:A:208[B]:CYS:SG	3.13	0.46
1:A:312[B]:ARG:HD3	7:A:730[B]:HOH:O	2.16	0.46
1:A:312[B]:ARG:CD	7:A:730[B]:HOH:O	2.64	0.45
1:A:352:GLN:N	4:A:503:GOL:H12	2.32	0.43
1:A:302[B]:CYS:HG	1:A:384:TYR:HD1	1.63	0.43
1:A:352:GLN:H	4:A:503:GOL:H12	1.84	0.43
1:A:383:ARG:NH1	7:A:604:HOH:O	2.36	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	216/233 (93%)	213 (99%)	3 (1%)	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	167/194 (86%)	167 (100%)	0	100	100

There are no protein residues with a non-rotameric sidechain to report.

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	372	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 monosaccharides in this entry.

5.6 Ligand geometry (i)

Of 6 ligands modelled in this entry, 1 is monoatomic - leaving 5 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	$\#\|Z\| > 2$
4	GOL	A	503	-	5,5,5	0.89	0	5,5,5	1.04	0
5	IPA	A	504	-	3,3,3	0.15	0	3,3,3	0.13	0
6	SO4	A	505	-	4,4,4	0.27	0	6,6,6	0.30	0
6	SO4	A	506	-	4,4,4	0.47	0	6,6,6	0.12	0
3	J2H	A	502	2	42,43,43	2.67	15 (35%)	55,62,62	4.74	17 (30%)

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	GOL	A	503	-	-	0/4/4/4	-
3	J2H	A	502	2	-	0/16/52/52	0/6/6/6

All (15) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	502	J2H	C16-N17	6.84	1.48	1.38
3	A	502	J2H	C28-N27	-5.93	1.36	1.47
3	A	502	J2H	C26-N27	-5.66	1.31	1.46
3	A	502	J2H	O01-C02	-5.59	1.13	1.22
3	A	502	J2H	C16-N03	4.99	1.50	1.40
3	A	502	J2H	C36-N27	-4.79	1.33	1.46
3	A	502	J2H	O38-C16	-4.67	1.13	1.22
3	A	502	J2H	C28-C29	4.66	1.57	1.51
3	A	502	J2H	C02-N03	3.19	1.46	1.40
3	A	502	J2H	C32-C33	-2.52	1.33	1.38
3	A	502	J2H	C33-C34	-2.40	1.34	1.39
3	A	502	J2H	C29-N30	-2.07	1.31	1.34
3	A	502	J2H	C37-C36	2.05	1.57	1.52
3	A	502	J2H	C18-N23	-2.04	1.30	1.34
3	A	502	J2H	C18-N17	2.00	1.41	1.36

All (17) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
3	A	502	J2H	C02-C24-N17	30.45	110.65	100.77
3	A	502	J2H	C25-C26-N27	8.65	119.77	111.23
3	A	502	J2H	C37-C36-N27	6.28	117.43	111.23
3	A	502	J2H	C34-C29-N30	-5.38	117.93	122.95
3	A	502	J2H	C22-N23-C18	4.70	120.27	115.08
3	A	502	J2H	C20-N19-C18	3.87	119.35	115.08
3	A	502	J2H	C31-N30-C29	3.59	122.33	117.81
3	A	502	J2H	N23-C18-N19	-3.46	121.22	127.06
3	A	502	J2H	O38-C16-N17	3.09	131.63	127.13
3	A	502	J2H	C28-C29-N30	2.74	119.20	115.72
3	A	502	J2H	O01-C02-N03	-2.72	121.51	125.88
3	A	502	J2H	N23-C18-N17	2.67	119.96	116.85
3	A	502	J2H	C18-N17-C16	-2.58	120.83	125.45
3	A	502	J2H	O01-C02-C24	2.50	133.12	125.78
3	A	502	J2H	C32-C31-N30	-2.41	119.49	123.43
3	A	502	J2H	C21-C20-N19	-2.15	119.92	123.43
3	A	502	J2H	C04-N03-C02	2.15	127.65	123.41

There are no chirality outliers.

There are no torsion outliers.

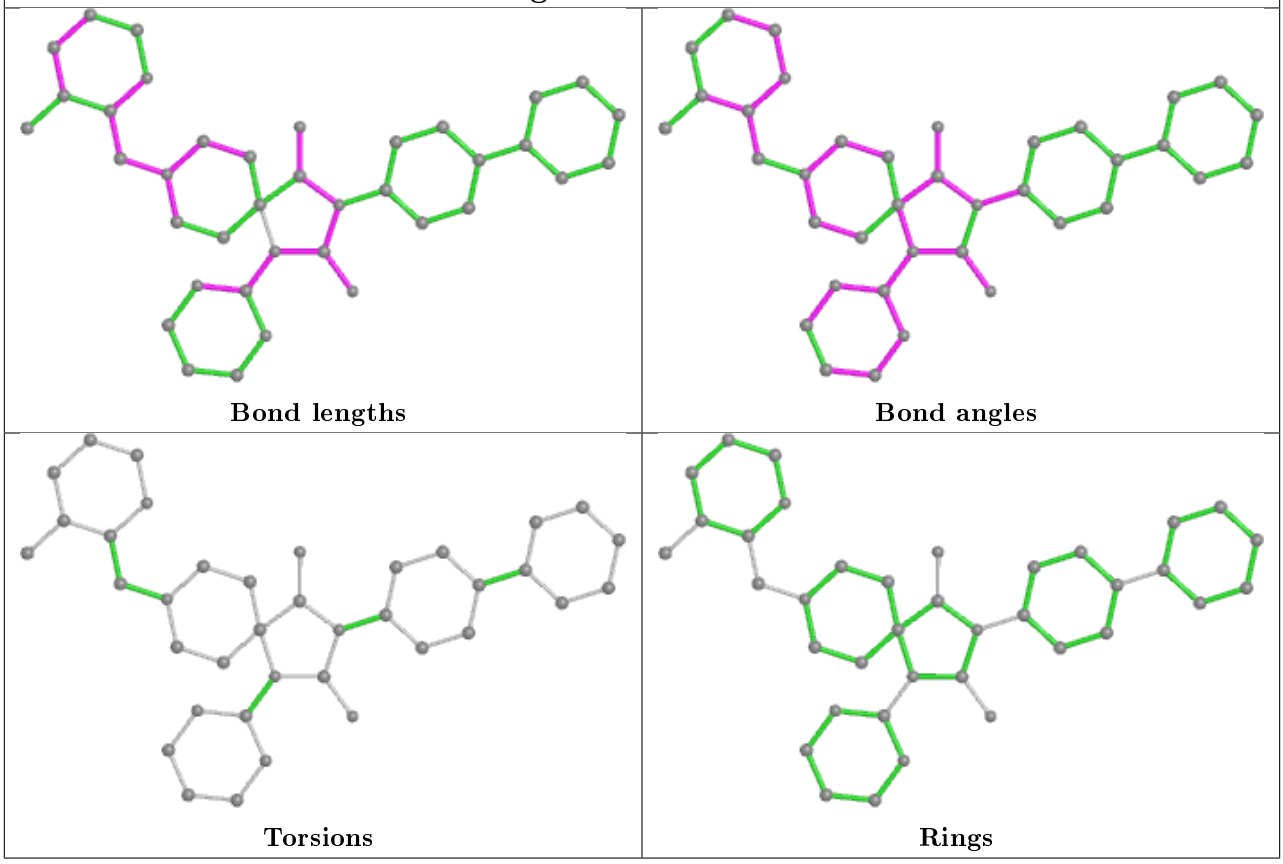
There are no ring outliers.

2 monomers are involved in 6 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	503	GOL	5	0
6	A	506	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 J2H A 502



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	198/233 (84%)	0.40	11 (5%)	24	22	17, 28, 61, 91	3 (1%)

All (11) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	188	LEU	8.9
1	A	189	PRO	8.5
1	A	333	ASP	5.4
1	A	406	GLY	3.2
1	A	190	ALA	3.0
1	A	338	VAL	3.0
1	A	334	TRP	2.8
1	A	380	TYR	2.6
1	A	335	ASP	2.5
1	A	230	HIS	2.2
1	A	405	THR	2.1

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,

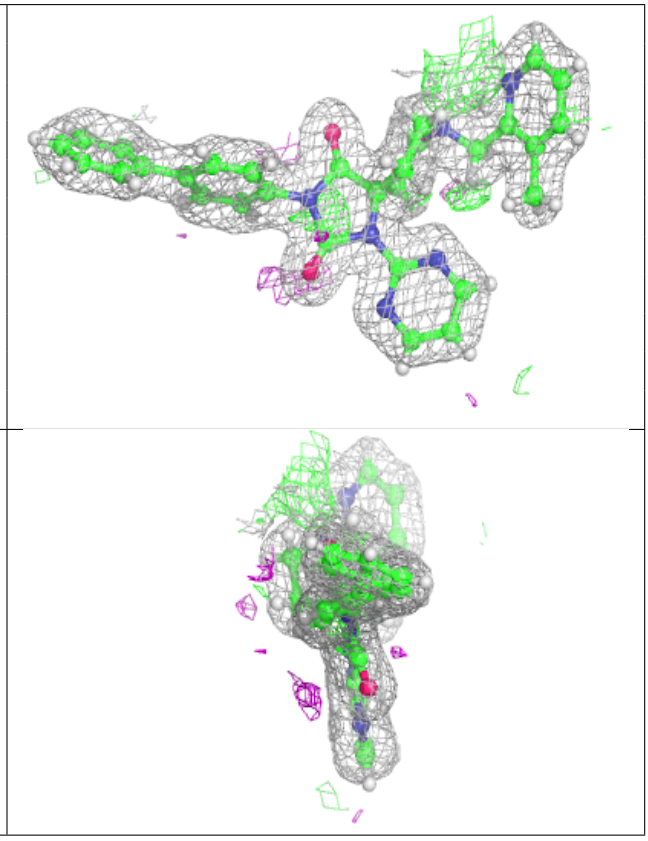
median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å^2)	Q<0.9
6	SO4	A	506	5/5	0.65	0.27	36,42,45,49	5
4	GOL	A	503	6/6	0.88	0.14	30,43,88,99	0
5	IPA	A	504	4/4	0.88	0.14	47,56,75,91	0
3	J2H	A	502	38/38	0.96	0.10	15,19,25,36	0
6	SO4	A	505	5/5	0.98	0.08	25,25,35,36	5
2	MN	A	501	1/1	0.99	0.20	14,14,14,14	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 J2H A 502:

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.