wwPDB X-ray Structure Validation Summary Report (i)

May 16, 2020 – 12:40 am BST

PDB ID	:	6B5Y
Title	:	Beta-lactamase, mixed with Ceftriaxone, 30ms time point, Shards crystal form
Authors	:	Pandey, S.; Schmidt, M.
Deposited on	:	2017-09-29
Resolution	:	2.75 Å(reported)

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	:	2.11
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)	:	2.11

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 2.75 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.
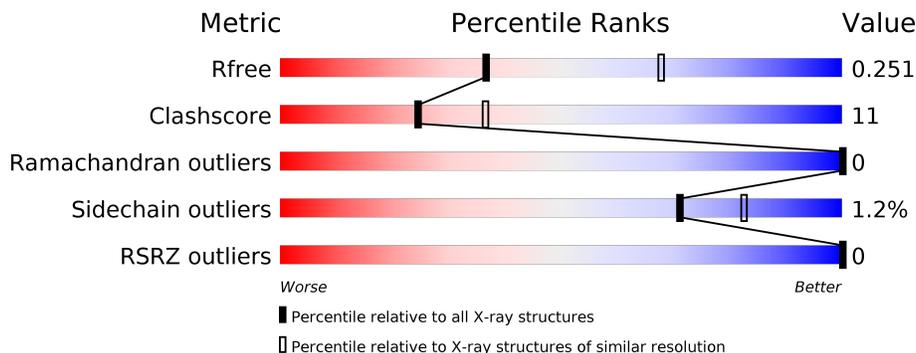
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	1235 (2.78-2.74)
Clashscore	141614	1277 (2.78-2.74)
Ramachandran outliers	138981	1257 (2.78-2.74)
Sidechain outliers	138945	1257 (2.78-2.74)
RSRZ outliers	127900	1207 (2.78-2.74)

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 on 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	267	75% 　 24% ・
1	B	267	79% 　 20% ・
1	C	267	76% 　 22% ・
1	D	267	75% 　 23% ・・

2 Entry composition (i)

There are 4 unique types of molecules in this entry. The entry contains 8249 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 Beta-lactamase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	265	Total	C	N	O	S	0	0	0
			1988	1243	352	387	6			
1	B	265	Total	C	N	O	S	0	0	0
			1988	1243	352	387	6			
1	C	265	Total	C	N	O	S	0	0	0
			1988	1243	352	387	6			
1	D	265	Total	C	N	O	S	0	0	0
			1988	1243	352	387	6			

- Molecule 2 is PHOSPHATE ION (three-letter code: PO4) (formula: O_4P).
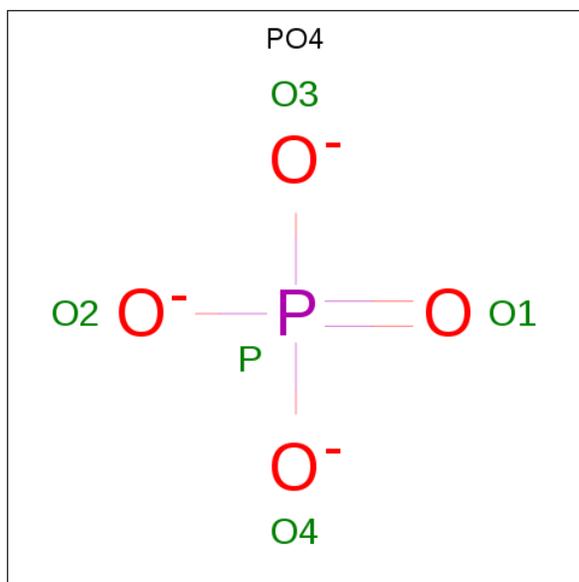
PO4

O3

O^-

O2 O^- — P $=$ O O1

P

O^-

O4

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total	O	P	0	0
			5	4	1		
2	C	1	Total	O	P	0	0
			5	4	1		

- Molecule 3 is Ceftriaxone (three-letter code: 9F2) (formula: $C_{18}H_{18}N_8O_7S_3$) (labeled as "Ligand of Interest" by author).
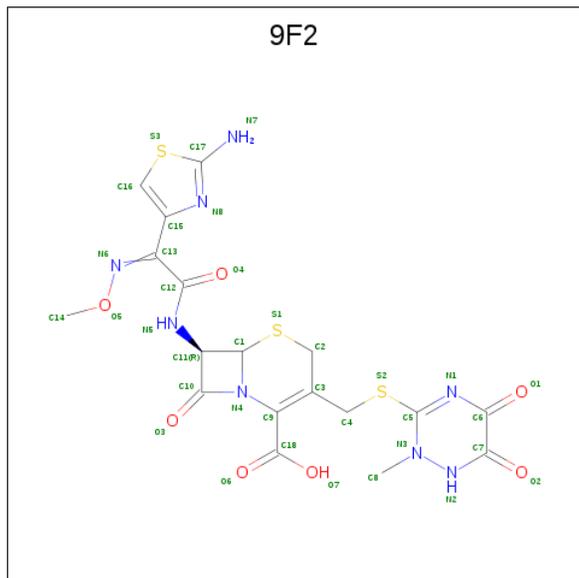
9F2

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	A	1	Total	C	N	O	S	0	0
			36	18	8	7	3		
3	B	1	Total	C	N	O	S	0	1
			36	18	8	7	3		
3	C	1	Total	C	N	O	S	0	0
			36	18	8	7	3		
3	D	1	Total	C	N	O	S	0	1
			36	18	8	7	3		

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	32	Total	O	0	0
			32	32		
4	B	31	Total	O	0	0
			31	31		
4	C	49	Total	O	0	0
			49	49		
4	D	31	Total	O	0	0
			31	31		

3 Residue-property plots ⓘ

These plots are drawn for all protein, RNA and DNA 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: Beta-lactamase
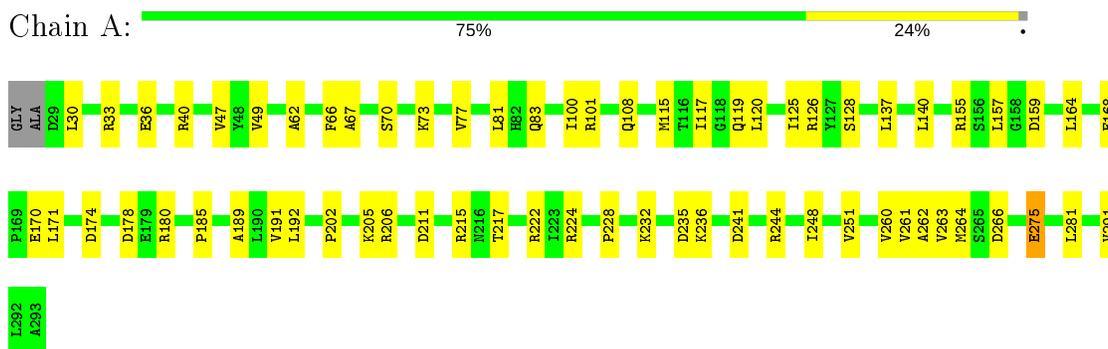
Chain A:

• Molecule 1: Beta-lactamase

Chain B:

• Molecule 1: Beta-lactamase

Chain C:

• Molecule 1: Beta-lactamase

Chain D:

P176 R180 T183 T184 P185 H186 V191 L195 V196 P202 K205 R206 T217 R222 W231 K232 V233 K236 D241 Y242 G243 R244 V251 W252 S253 P258 V263 A268 G271 Y272 D273 R277 L281 A284 V288 A293
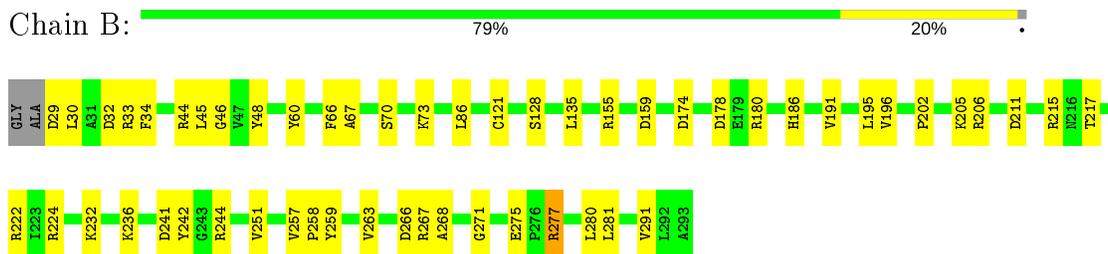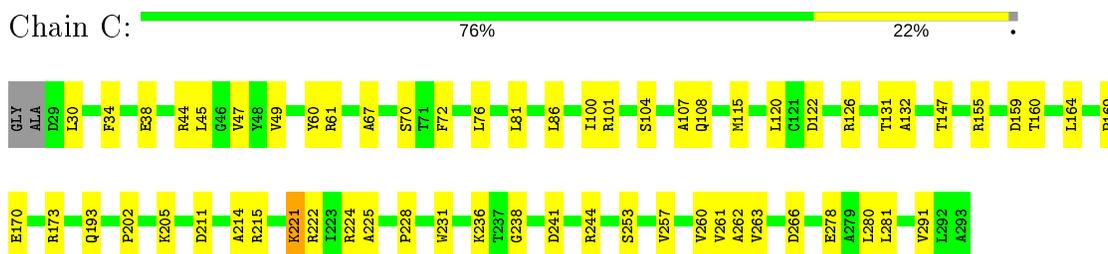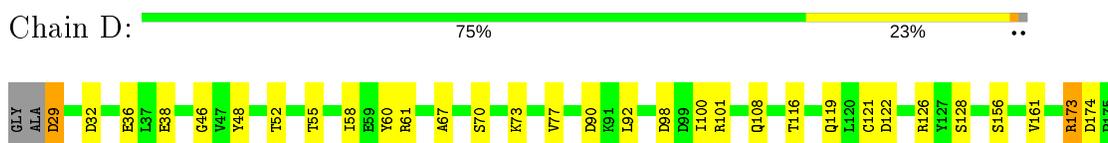
4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	78.53Å 96.03Å 112.58Å 90.00° 109.68° 90.00°	Depositor
Resolution (Å)	19.34 – 2.75 19.35 – 2.60	Depositor EDS
% Data completeness (in resolution range)	94.1 (19.34-2.75) 85.7 (19.35-2.60)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$<I/\sigma(I)>$ [1]	0.76 (at 2.59Å)	Xtriage
Refinement program	PHENIX (1.12_2829: ???)	Depositor
R, R_{free}	0.193 , 0.251 0.193 , 0.251	Depositor DCC
R_{free} test set	2414 reflections (4.98%)	wwPDB-VP
Wilson B-factor (Å^2)	48.0	Xtriage
Anisotropy	0.116	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.32 , 25.7	EDS
L-test for twinning[2]	$<|L|> = 0.44$, $<L^2> = 0.27$	Xtriage
Estimated twinning fraction	0.106 for h,-k,-h-l	Xtriage
F_o,F_c correlation	0.95	EDS
Total number of atoms	8249	wwPDB-VP
Average B, all atoms (Å^2)	51.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 11.42% of the height of the origin peak. No significant pseudotranslation is detected.*

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[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: PO4, 9F2

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	0.54	1/2027 (0.0%)	0.74	0/2767
1	B	0.49	1/2027 (0.0%)	0.70	1/2767 (0.0%)
1	C	0.51	0/2027	0.71	1/2767 (0.0%)
1	D	0.47	0/2027	0.71	1/2767 (0.0%)
All	All	0.50	2/8108 (0.0%)	0.72	3/11068 (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	D	0	1

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	275	GLU	CG-CD	6.58	1.61	1.51
1	B	121	CYS	CB-SG	-5.53	1.72	1.81

All (3) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	173	ARG	NE-CZ-NH1	5.96	123.28	120.30
1	B	277	ARG	CB-CG-CD	5.65	126.29	111.60
1	C	221	LYS	CG-CD-CE	-5.35	95.85	111.90

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	D	29	ASP	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	1988	0	1956	51	0
1	B	1988	0	1956	39	0
1	C	1988	0	1956	42	0
1	D	1988	0	1956	42	0
2	A	5	0	0	0	0
2	C	5	0	0	0	0
3	A	36	0	0	3	0
3	B	36	0	0	0	0
3	C	36	0	0	2	0
3	D	36	0	0	0	0
4	A	32	0	0	5	0
4	B	31	0	0	6	1
4	C	49	0	0	4	1
4	D	31	0	0	5	0
All	All	8249	0	7824	173	1

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 11.

The worst 5 of 173 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:D:222:ARG:HD3	1:D:281:LEU:HD12	1.58	0.86
1:B:202:PRO:HG2	1:B:205:LYS:HD2	1.60	0.84
1:C:107:ALA:HA	1:C:115:MET:HE2	1.61	0.83
1:A:83:GLN:NE2	4:A:401:HOH:O	1.96	0.76
1:C:202:PRO:HG2	1:C:205:LYS:HD2	1.68	0.75

All (1) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:B:529:HOH:O	4:C:427:HOH:O[2_656]	2.05	0.15

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	263/267 (98%)	256 (97%)	7 (3%)	0	100	100
1	B	263/267 (98%)	257 (98%)	6 (2%)	0	100	100
1	C	263/267 (98%)	257 (98%)	6 (2%)	0	100	100
1	D	263/267 (98%)	258 (98%)	5 (2%)	0	100	100
All	All	1052/1068 (98%)	1028 (98%)	24 (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	202/202 (100%)	198 (98%)	4 (2%)	55	72
1	B	202/202 (100%)	200 (99%)	2 (1%)	76	85
1	C	202/202 (100%)	200 (99%)	2 (1%)	76	85
1	D	202/202 (100%)	200 (99%)	2 (1%)	76	85
All	All	808/808 (100%)	798 (99%)	10 (1%)	71	82

5 of 10 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	128	SER
1	B	236	LYS
1	C	236	LYS
1	A	236	LYS
1	C	101	ARG

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

Mol	Chain	Res	Type
1	D	108	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 carbohydrates in this entry.

5.6 Ligand geometry (i)

6 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	9F2	B	400[A]	-	31,39,39	1.73	6 (19%)	29,57,57	4.13	12 (41%)
2	PO4	A	301	-	4,4,4	0.75	0	6,6,6	0.93	0
3	9F2	C	302	-	31,39,39	1.56	3 (9%)	29,57,57	4.13	13 (44%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	#|Z| > 2	Counts	RMSZ	#|Z| > 2
2	PO4	C	301	-	4,4,4	1.04	0	6,6,6	0.64	0
3	9F2	A	302	-	31,39,39	1.62	7 (22%)	29,57,57	4.52	13 (44%)
3	9F2	D	400[A]	-	31,39,39	1.78	5 (16%)	29,57,57	3.85	17 (58%)

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	9F2	C	302	-	-	4/15/53/53	0/4/4/4
3	9F2	A	302	-	-	6/15/53/53	0/4/4/4
3	9F2	B	400[A]	-	-	5/15/53/53	0/4/4/4
3	9F2	D	400[A]	-	-	8/15/53/53	0/4/4/4

The worst 5 of 21 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	D	400[A]	9F2	O5-N6	-6.28	1.26	1.40
3	B	400[A]	9F2	O5-N6	-6.11	1.26	1.40
3	C	302	9F2	O5-N6	-5.91	1.27	1.40
3	A	302	9F2	O5-N6	-5.07	1.28	1.40
3	D	400[A]	9F2	C18-C9	-3.73	1.46	1.52

The worst 5 of 55 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(º)	Ideal(º)
3	A	302	9F2	O5-N6-C13	16.90	129.88	111.28
3	B	400[A]	9F2	O5-N6-C13	12.29	124.81	111.28
3	D	400[A]	9F2	O5-N6-C13	12.27	124.79	111.28
3	C	302	9F2	O5-N6-C13	12.12	124.62	111.28
3	B	400[A]	9F2	C14-O5-N6	11.11	121.31	108.40

There are no chirality outliers.

5 of 23 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	B	400[A]	9F2	N5-C12-C13-N6
3	B	400[A]	9F2	O4-C12-C13-N6
3	B	400[A]	9F2	O4-C12-C13-C15

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| Mol	Chain	Res	Type	Atoms
3	A	302	9F2	O4-C12-N5-C11
3	A	302	9F2	C13-C12-N5-C11

There are no ring outliers.

2 monomers are involved in 5 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	C	302	9F2	2	0
3	A	302	9F2	3	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 9F2 B 400 (A)

Bond lengths   Bond angles

Torsions   Rings

Ligand 9F2 C 302

Bond lengths

Bond angles

Torsions

Rings

Ligand 9F2 A 302

Bond lengths

Bond angles

Torsions

Rings

Ligand 9F2 D 400 (A)

Bond lengths

Bond angles

Torsions

Rings
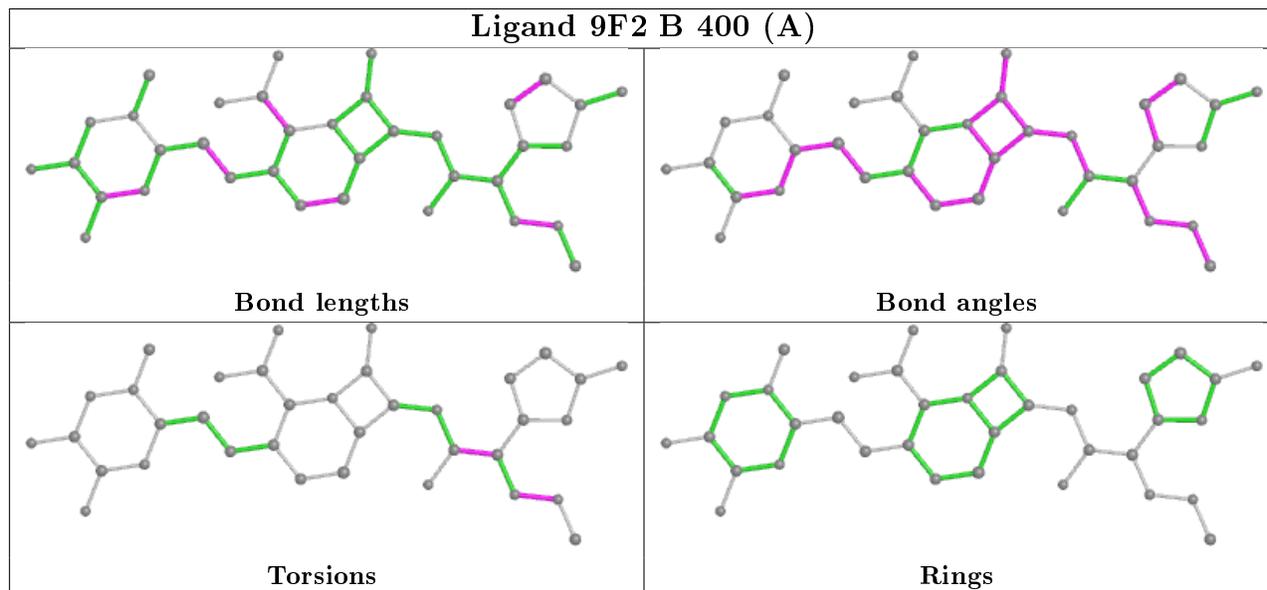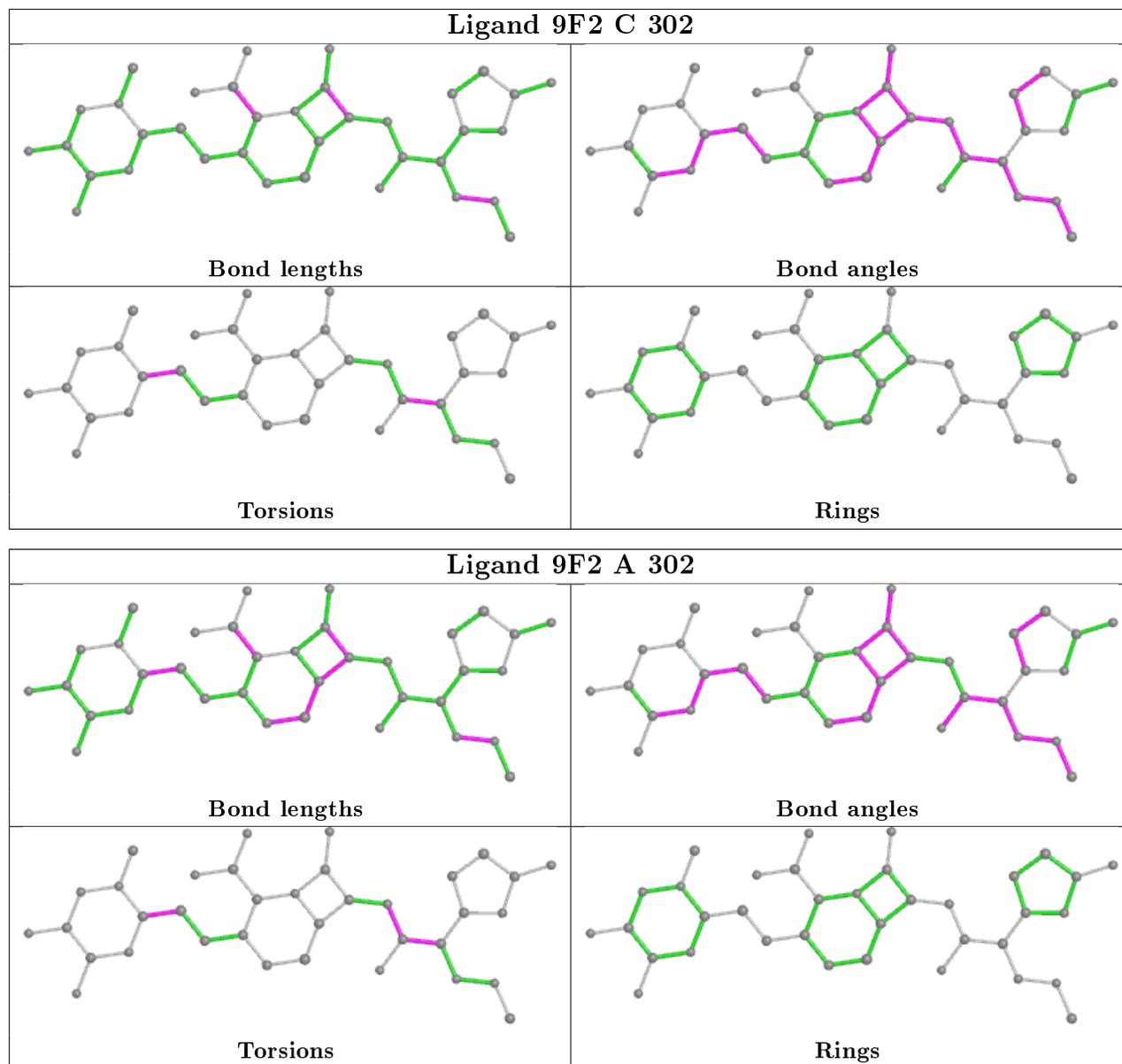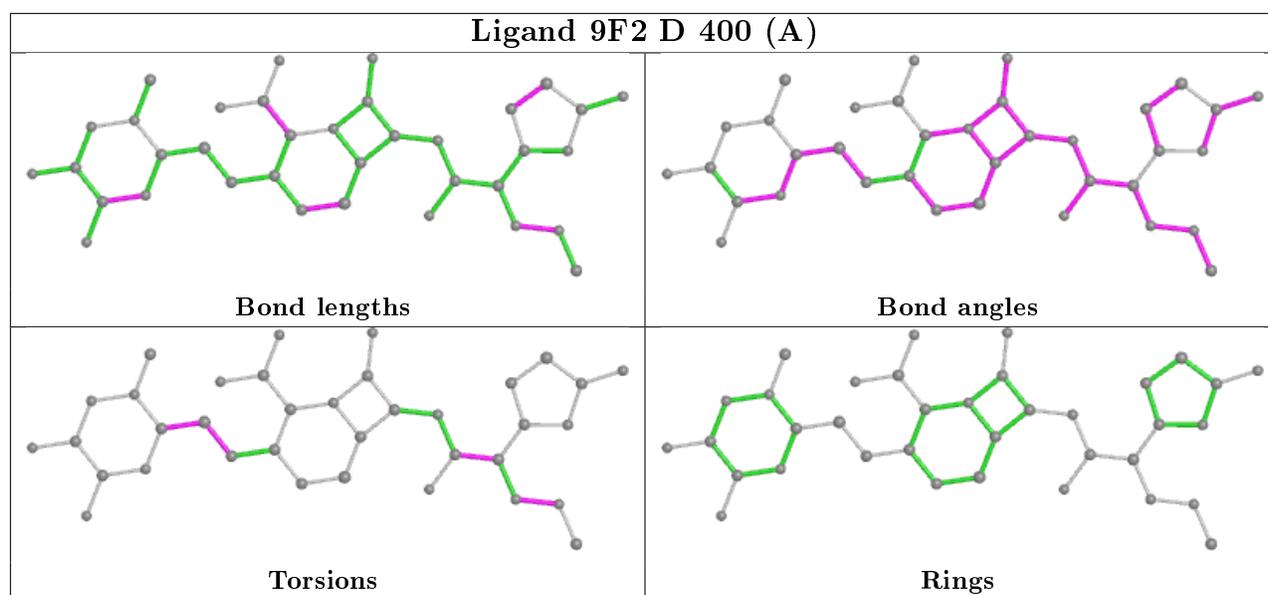
5.7 Other polymers (i)

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(Å²)	Q<0.9
1	A	265/267 (99%)	-0.12	0	100	100	35, 47, 68, 89	0
1	B	265/267 (99%)	-0.17	0	100	100	34, 49, 68, 85	0
1	C	265/267 (99%)	-0.12	0	100	100	35, 51, 71, 93	0
1	D	265/267 (99%)	-0.17	0	100	100	34, 49, 68, 80	0
All	All	1060/1068 (99%)	-0.14	0	100	100	34, 49, 69, 93	0

There are no RSRZ outliers to report.

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 carbohydrates 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(Å²)	Q<0.9
3	9F2	C	302	36/36	0.86	0.27	77,98,108,111	0
3	9F2	A	302	36/36	0.88	0.27	58,93,102,107	0
3	9F2	B	400[A]	36/36	0.94	0.17	45,68,107,110	0
3	9F2	D	400[A]	36/36	0.95	0.15	47,65,99,103	0

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| Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å²)	Q<0.9
2	PO4	C	301	5/5	0.98	0.12	55,55,62,67	0
2	PO4	A	301	5/5	0.99	0.15	38,43,52,53	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 9F2 C 302:

$2mF_o\text{-}DF_c$ (at 0.7 rmsd) in gray
$mF_o\text{-}DF_c$ (at 3 rmsd) in purple (negative)
and green (positive)
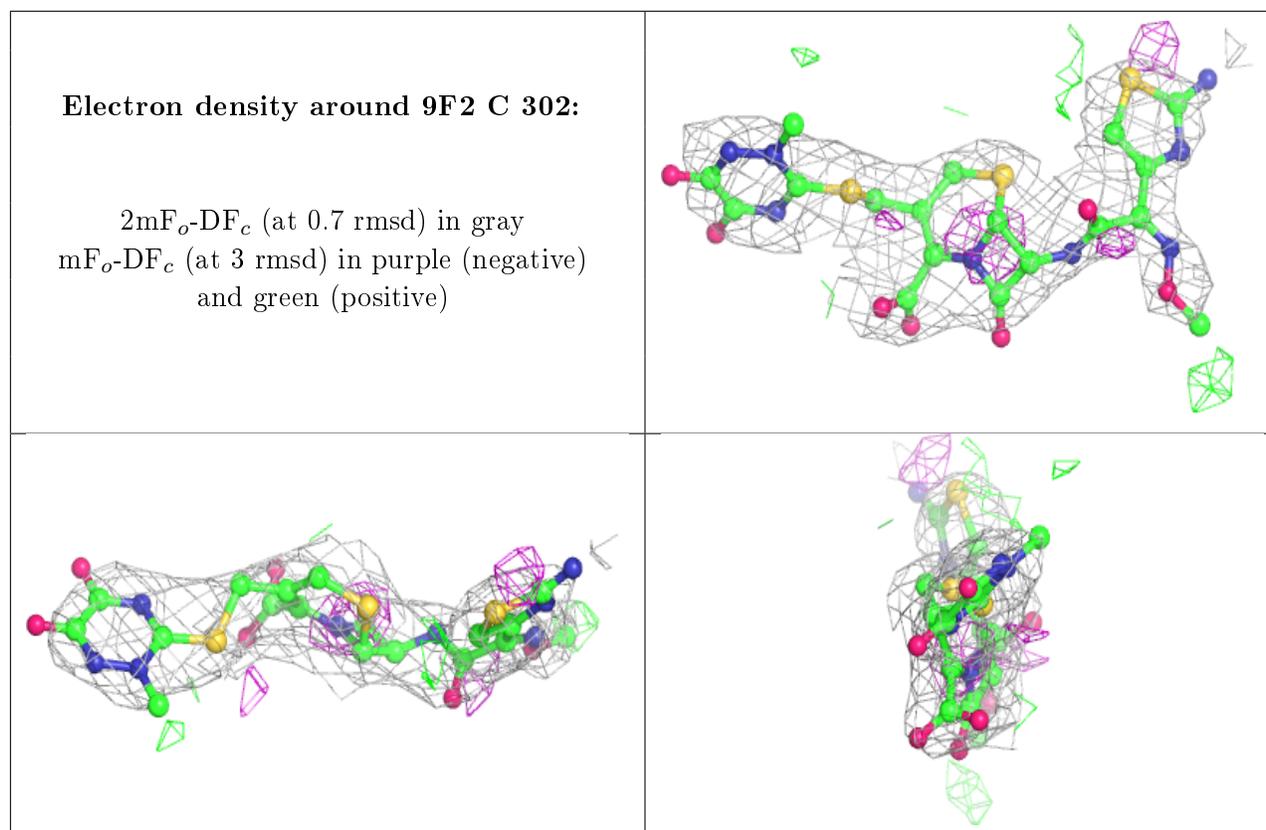
Electron density around 9F2 A 302:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)
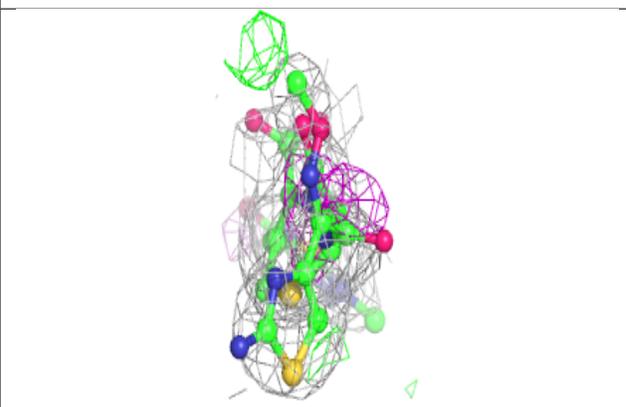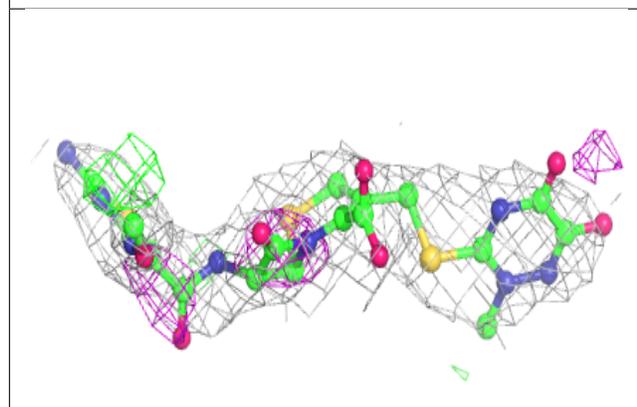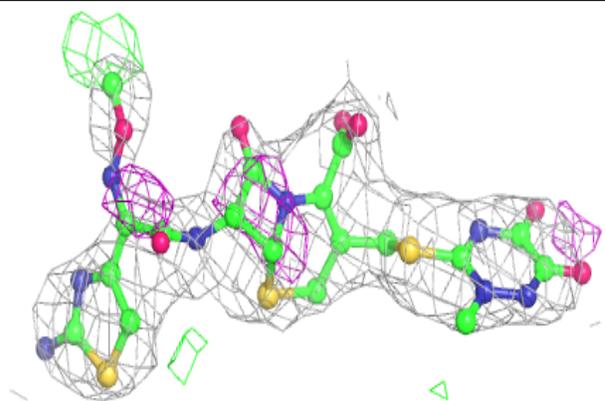
Electron density around 9F2 B 400 (A):

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

Electron density around 9F2 D 400 (A):

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

6.5 Other polymers (i)

There are no such residues in this entry.