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Full wwPDB X-ray Structure Validation Report (i)

Jan 20, 2024 – 07:31 pm GMT

PDB ID	:	7OZY
Title	:	FGFR2 kinase domain (residues 461-763) in complex with 38.
Authors	:	Trinh, C.H.; Turner, L.D.; Fishwick, C.W.G.
Deposited on	:	2021-06-29
Resolution	:	2.28 Å(reported)

The following versions of software and data (see references (i)) were used in the production of this report:

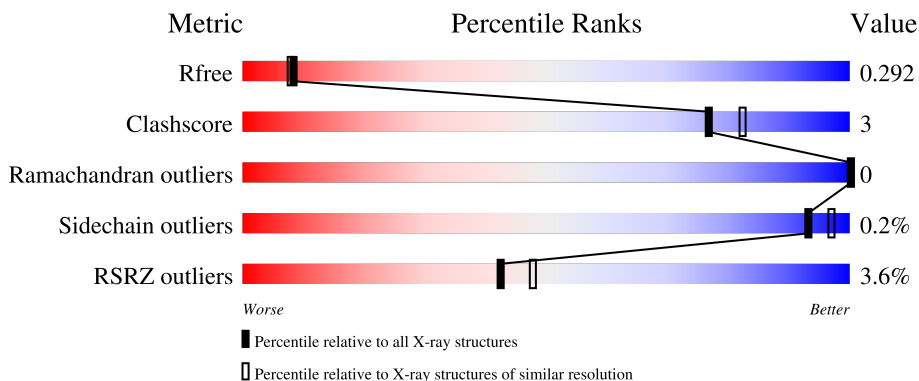|		
MolProbity	:	4.02b-467
Mogul	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.36
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36

1 Overall quality at a glance ⓘ

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 2.28 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	Percentile Ranks	Value
Rfree		0.292
Clashscore		3
Ramachandran outliers		0
Sidechain outliers		0.2%
RSRZ outliers		3.6%

Worse   *Better*

▮ Percentile relative to all X-ray structures

▯ Percentile relative to X-ray structures of similar resolution

Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	130704	6980 (2.30-2.26)
Clashscore	141614	7711 (2.30-2.26)
Ramachandran outliers	138981	7597 (2.30-2.26)
Sidechain outliers	138945	7598 (2.30-2.26)
RSRZ outliers	127900	6849 (2.30-2.26)

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	AAA	303	3% / 85% / 7% · 7%
1	BBB	303	4% / 86% / 6% 8%

2 Entry composition (i)

There are 5 unique types of molecules in this entry. The entry contains 8976 atoms, of which 4435 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 Fibroblast growth factor receptor 2.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	AAA	281	Total	C	H	N	O	S	97	1	0
			4429	1409	2216	377	405	22			
1	BBB	278	Total	C	H	N	O	S	92	0	0
			4351	1392	2169	366	405	19			

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
AAA	461	GLY	-	expression tag	UNP P21802
AAA	462	SER	-	expression tag	UNP P21802
AAA	463	HIS	-	expression tag	UNP P21802
AAA	464	MET	-	expression tag	UNP P21802
BBB	461	GLY	-	expression tag	UNP P21802
BBB	462	SER	-	expression tag	UNP P21802
BBB	463	HIS	-	expression tag	UNP P21802
BBB	464	MET	-	expression tag	UNP P21802

- Molecule 2 is 4-[3-(4-piperazin-4-ium-1-ylphenyl)-1H-indazol-6-yl]phenol (three-letter code: 47I) (formula: $C_{23}H_{23}N_4O$) (labeled as "Ligand of Interest" by depositor).
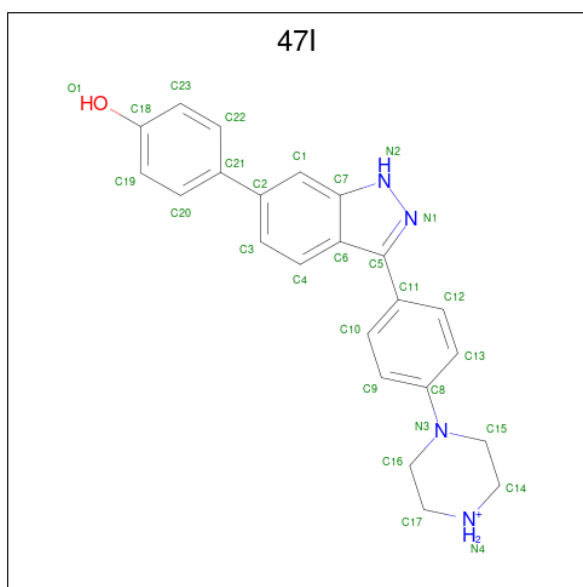
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
2	AAA	1	Total	C	H	N	O	0	0
			50	23	22	4	1		
2	BBB	1	Total	C	H	N	O	0	0
			50	23	22	4	1		

• Molecule 3 is SULFATE ION (three-letter code: SO4) (formula: O_4S).

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	AAA	1	Total	O	S	0	0
			5	4	1		
3	BBB	1	Total	O	S	0	0
			5	4	1		

- Molecule 4 is 1,2-ETHANEDIOL (three-letter code: EDO) (formula: $C_2H_6O_2$).

EDO

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	BBB	1	Total	C	H	O	1	0
			10	2	6	2		

- Molecule 5 is water.

| Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	AAA	49	Total	O	0	0
			49	49		
5	BBB	27	Total	O	0	0
			27	27		

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: Fibroblast growth factor receptor 2

Chain AAA:

• Molecule 1: Fibroblast growth factor receptor 2

Chain BBB:
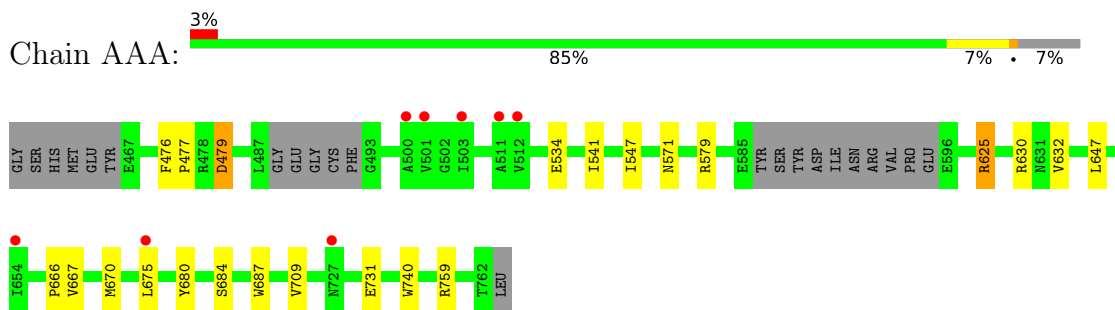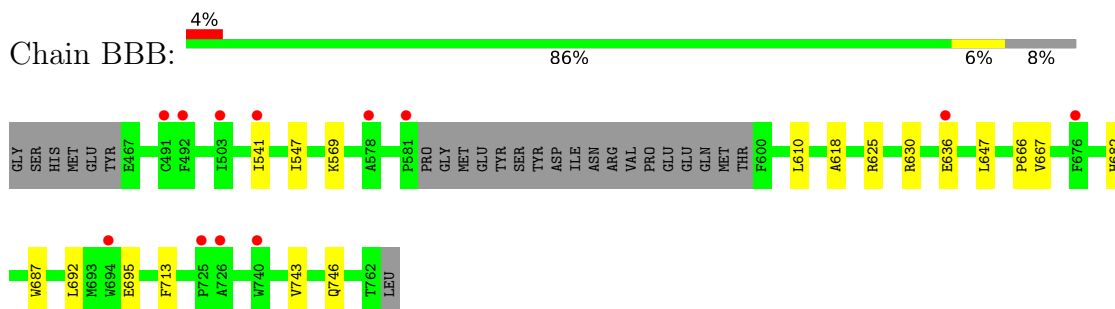
4 Data and refinement statistics ⓘ

Property	Value	Source
Space group	P 43 21 2	Depositor
Cell constants a, b, c, α, β, γ	113.84Å 113.84Å 117.41Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	80.50 – 2.28 80.50 – 2.28	Depositor EDS
% Data completeness (in resolution range)	98.3 (80.50-2.28) 98.3 (80.50-2.28)	Depositor EDS
R_{merge}	0.14	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	1.78 (at 2.27Å)	Xtriage
Refinement program	REFMAC 5.8.0258	Depositor
R, R_{free}	0.240 , 0.296 0.243 , 0.292	Depositor DCC
R_{free} test set	1691 reflections (4.80%)	wwPDB-VP
Wilson B-factor (Å^2)	45.5	Xtriage
Anisotropy	0.300	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.37 , 33.2	EDS
L-test for twinning [2]	$< |L| > = 0.50, < L^2 > = 0.34$	Xtriage
Estimated twinning fraction	0.012 for -h,l,k 0.002 for -l,-k,-h	Xtriage
F_o,F_c correlation	0.93	EDS
Total number of atoms	8976	wwPDB-VP
Average B, all atoms (Å^2)	55.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.22% 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: SO4, EDO, 47I

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	AAA	0.68	0/2259	0.81	1/3058 (0.0%)
1	BBB	0.66	0/2229	0.78	0/3020
All	All	0.67	0/4488	0.80	1/6078 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	AAA	625	ARG	NE-CZ-NH2	-5.63	117.48	120.30

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts ⓘ

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	AAA	2213	2216	2183	16	0
1	BBB	2182	2169	2140	10	0
2	AAA	28	22	0	1	0
2	BBB	28	22	0	0	0
3	AAA	5	0	0	0	0
3	BBB	5	0	0	0	0
4	BBB	4	6	6	0	0
5	AAA	49	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
5	BBB	27	0	0	0	0
All	All	4541	4435	4329	26	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 3.

All (26) 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:AAA:670:MET:SD	1:AAA:675:LEU:HD23	2.27	0.75
1:BBB:692:LEU:O	1:BBB:695:GLU:HB2	2.04	0.57
1:AAA:579:ARG:HH11	1:AAA:579:ARG:HG3	1.74	0.52
1:BBB:630:ARG:HH22	1:BBB:666:PRO:HG2	1.75	0.52
1:BBB:687:TRP:C	1:BBB:687:TRP:CD1	2.84	0.50
1:BBB:667:VAL:HG13	1:BBB:713:PHE:CE2	2.47	0.49
1:BBB:625:ARG:HD3	1:BBB:647:LEU:O	2.12	0.49
1:AAA:670:MET:SD	1:AAA:675:LEU:CD2	2.99	0.49
1:AAA:731:GLU:OE2	1:AAA:759:ARG:NH2	2.41	0.49
1:BBB:618:ALA:HA	1:BBB:682:HIS:CD2	2.48	0.48
1:AAA:630:ARG:HH22	1:AAA:666:PRO:HG2	1.80	0.47
1:AAA:630:ARG:NH2	1:AAA:666:PRO:HG2	2.30	0.47
1:AAA:667:VAL:HG21	1:AAA:709:VAL:HB	1.96	0.46
1:AAA:534:GLU:OE2	2:AAA:801:47I:O1	2.32	0.46
1:BBB:610:LEU:HD13	1:BBB:692:LEU:HD21	1.97	0.45
1:AAA:687:TRP:CE3	1:AAA:740:TRP:HA	2.52	0.45
1:BBB:541:ILE:HD12	1:BBB:547:ILE:HD12	2.00	0.44
1:AAA:579:ARG:HG3	1:AAA:579:ARG:NH1	2.33	0.43
1:AAA:680:TYR:CE1	1:AAA:684:SER:HB2	2.54	0.42
1:AAA:571:ASN:HA	1:AAA:632:VAL:O	2.20	0.42
1:BBB:569:LYS:NZ	1:BBB:636:GLU:O	2.53	0.42
1:AAA:541:ILE:HD12	1:AAA:547:ILE:HD12	2.02	0.41
1:AAA:479:ASP:OD1	1:AAA:479:ASP:N	2.48	0.41
1:BBB:743:VAL:HB	1:BBB:746:GLN:HG3	2.03	0.41
1:AAA:476:PHE:HA	1:AAA:477:PRO:HD3	1.95	0.40
1:AAA:625:ARG:HD3	1:AAA:647:LEU:O	2.21	0.40

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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	AAA	276/303 (91%)	269 (98%)	7 (2%)	0	100	100
1	BBB	274/303 (90%)	265 (97%)	9 (3%)	0	100	100
All	All	550/606 (91%)	534 (97%)	16 (3%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains ⓘ

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	AAA	236/266 (89%)	235 (100%)	1 (0%)	91	95
1	BBB	232/266 (87%)	232 (100%)	0	100	100
All	All	468/532 (88%)	467 (100%)	1 (0%)	93	97

All (1) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	AAA	479	ASP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates ⓘ

There are no monosaccharides in this entry.

5.6 Ligand geometry ⓘ

5 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	47I	BBB	801	-	30,32,32	1.55	2 (6%)	38,45,45	1.04	4 (10%)
4	EDO	BBB	803	-	3,3,3	0.18	0	2,2,2	0.16	0
3	SO4	AAA	802	-	4,4,4	0.40	0	6,6,6	0.12	0
3	SO4	BBB	802	-	4,4,4	0.37	0	6,6,6	0.10	0
2	47I	AAA	801	-	30,32,32	1.54	2 (6%)	38,45,45	1.21	4 (10%)

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	47I	AAA	801	-	-	2/12/20/20	0/5/5/5
4	EDO	BBB	803	-	-	0/1/1/1	-
2	47I	BBB	801	-	-	2/12/20/20	0/5/5/5

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	AAA	801	47I	C11-C5	-5.54	1.41	1.49
2	BBB	801	47I	C11-C5	-5.49	1.41	1.49

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	BBB	801	47I	O1-C18	-5.16	1.25	1.37
2	AAA	801	47I	O1-C18	-5.01	1.25	1.37

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	AAA	801	47I	C16-N3-C15	4.19	120.78	111.52
2	BBB	801	47I	C16-N3-C15	2.96	118.04	111.52
2	AAA	801	47I	C12-C11-C5	2.63	124.95	120.65
2	BBB	801	47I	C12-C11-C5	2.35	124.50	120.65
2	AAA	801	47I	C17-C16-N3	-2.32	105.47	110.48
2	AAA	801	47I	C10-C11-C5	-2.24	116.99	120.65
2	BBB	801	47I	C1-C7-N2	2.12	133.96	130.51
2	BBB	801	47I	C14-C15-N3	-2.02	106.12	110.48

There are no chirality outliers.

All (4) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	AAA	801	47I	C12-C11-C5-C6
2	BBB	801	47I	C10-C11-C5-C6
2	BBB	801	47I	C12-C11-C5-C6
2	AAA	801	47I	C10-C11-C5-C6

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	AAA	801	47I	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 47I BBB 801 — Bond lengths, Bond angles, Torsions, Rings

Ligand 47I AAA 801 — Bond lengths, Bond angles, Torsions, Rings
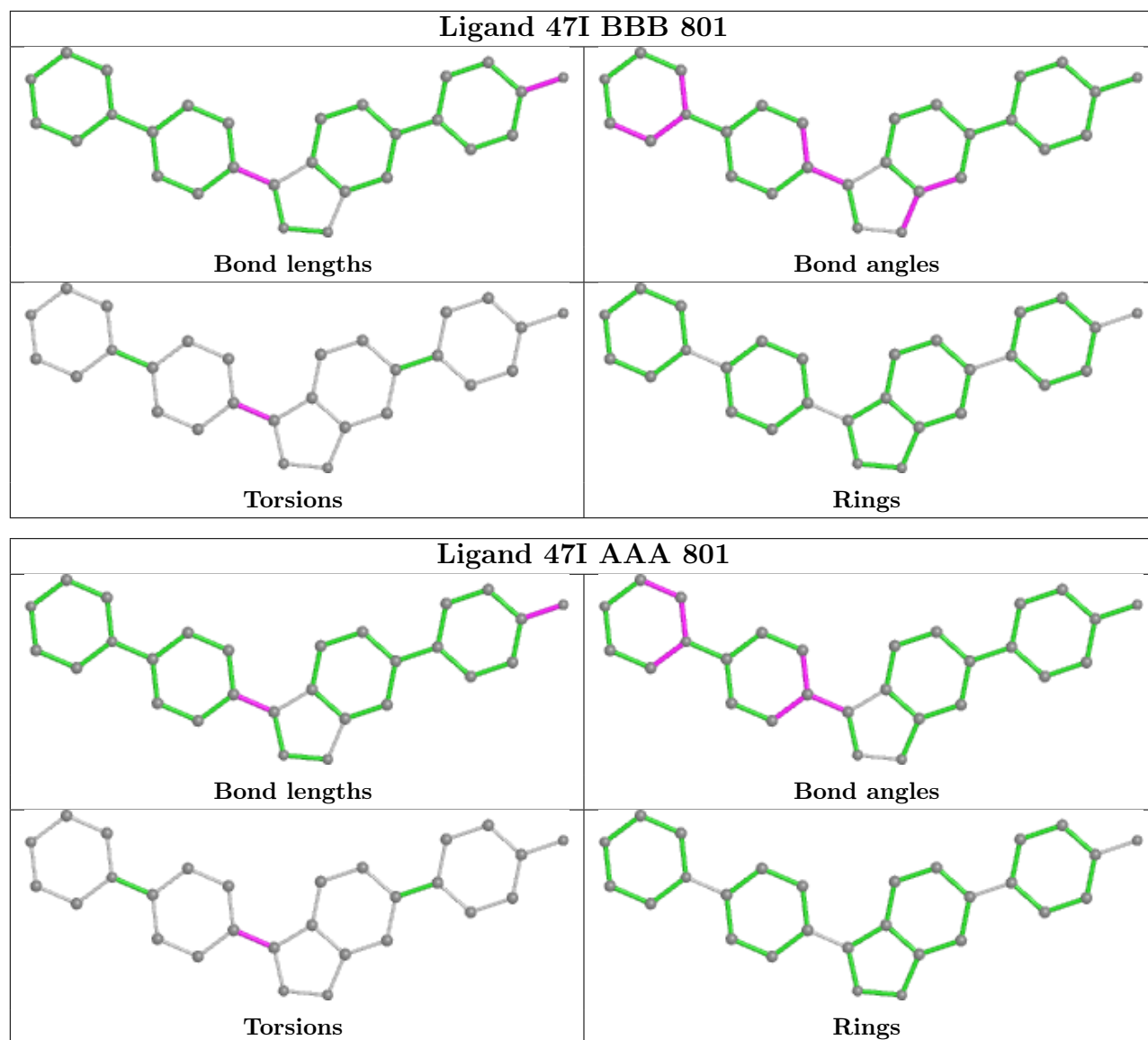
5.7 Other polymers ⓘ

There are no such residues in this entry.

5.8 Polymer linkage issues ⓘ

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, 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	AAA	281/303 (92%)	0.31	8 (2%)	53	59	27, 48, 86, 101	0
1	BBB	278/303 (91%)	0.38	12 (4%)	35	40	35, 57, 92, 129	0
All	All	559/606 (92%)	0.35	20 (3%)	42	48	27, 53, 90, 129	0

All (20) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	BBB	492	PHE	3.9
1	AAA	675	LEU	3.4
1	BBB	578	ALA	3.4
1	AAA	500	ALA	3.3
1	BBB	636	GLU	3.2
1	AAA	727	ASN	3.2
1	AAA	512	VAL	3.0
1	BBB	581	PRO	2.9
1	BBB	694	TRP	2.8
1	BBB	725	PRO	2.7
1	BBB	740	TRP	2.7
1	AAA	511	ALA	2.6
1	BBB	726	ALA	2.4
1	BBB	491	CYS	2.4
1	BBB	541	ILE	2.3
1	AAA	503	ILE	2.2
1	BBB	676	PHE	2.1
1	BBB	503	ILE	2.1
1	AAA	501	VAL	2.1
1	AAA	654	ILE	2.0

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 monosaccharides 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, 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	47I	BBB	801	28/28	0.89	0.22	41,47,64,64	50
2	47I	AAA	801	28/28	0.91	0.17	43,53,67,72	3
4	EDO	BBB	803	4/4	0.95	0.16	43,52,57,58	1
3	SO4	AAA	802	5/5	0.96	0.17	73,81,85,85	0
3	SO4	BBB	802	5/5	0.98	0.16	50,51,58,59	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.

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Electron density around 47I BBB 801:

$2mF_o-DF_c$ (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)
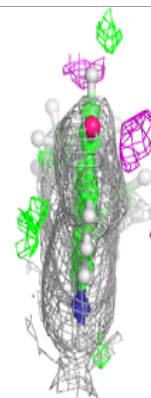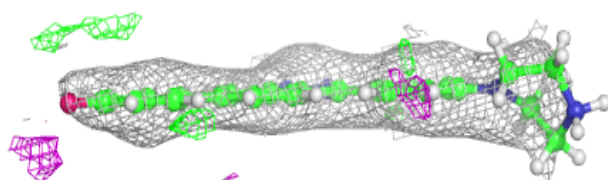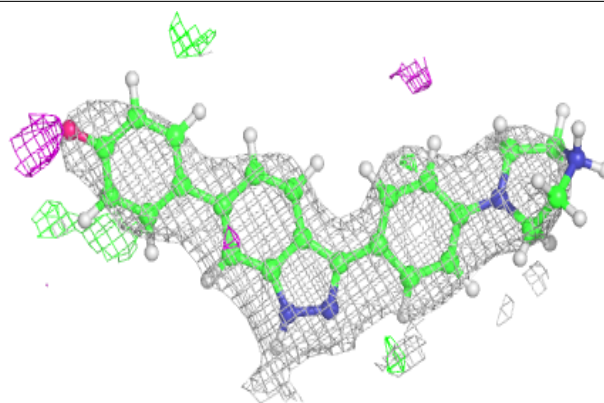
Electron density around 47I AAA 801:

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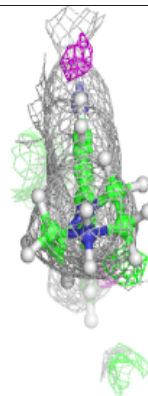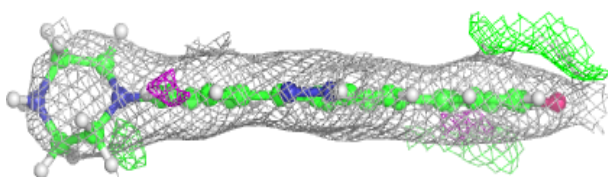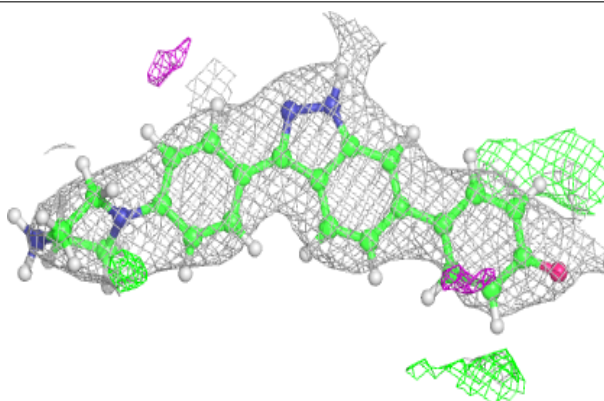
6.5 Other polymers (i)

There are no such residues in this entry.