Full wwPDB X-ray Structure Validation Report (i)

Jun 24, 2024 – 08:01 PM EDT

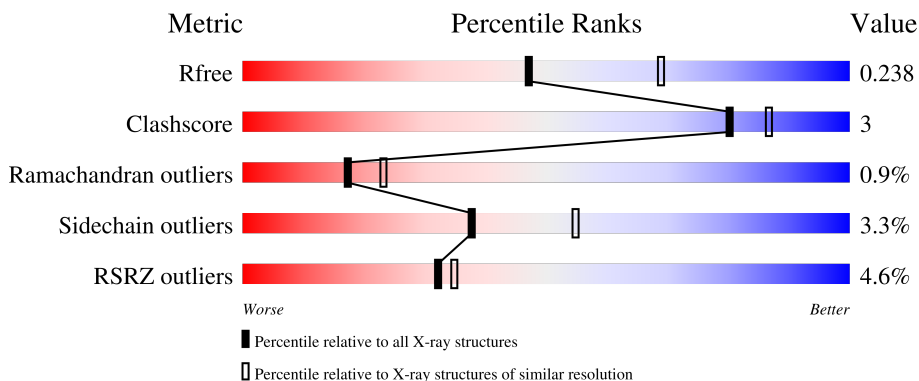|		
PDB ID	:	6F3D
Title	:	IRAK4 IN COMPLEX WITH inhibitor
Authors	:	Xue, Y.; Degorce, S.L.; Robb, G.R.; Ferguson, A.D.
Deposited on	:	2017-11-28
Resolution	:	2.38 Å(reported)

1   Overall quality at a glance   ⓘ

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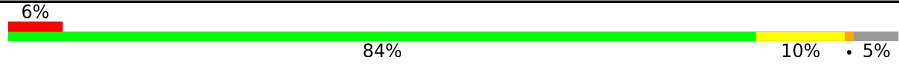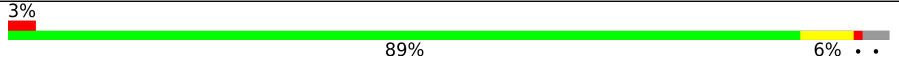*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.38 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		0.238
Clashscore		3
Ramachandran outliers		0.9%
Sidechain outliers		3.3%
RSRZ outliers		4.6%

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	5509 (2.40-2.36)
Clashscore	141614	6082 (2.40-2.36)
Ramachandran outliers	138981	5973 (2.40-2.36)
Sidechain outliers	138945	5975 (2.40-2.36)
RSRZ outliers	127900	5397 (2.40-2.36)

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	295	6% 84% 10% · 5%
1	B	295	3% 89% 6% · ·

2 Entry composition ⓘ

There are 4 unique types of molecules in this entry. The entry contains 4633 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 Interleukin-1 receptor-associated kinase 4.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
1	A	279	Total 2205	C 1386	N 373	O 430	P 2	S 14	0	0	0
1	B	285	Total 2249	C 1411	N 379	O 443	P 2	S 14	0	0	0

- Molecule 2 is SULFATE ION (three-letter code: SO4) (formula: O_4S).

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

- Molecule 3 is 4-[4-[[4-(dimethylamino)cyclohexyl]amino]-7 {H}-pyrrolo[2,3-d]pyrimidin-5-yl] cyclohexane-1-carboxamide (three-letter code: CJT) (formula: $C_{21}H_{32}N_6O$).
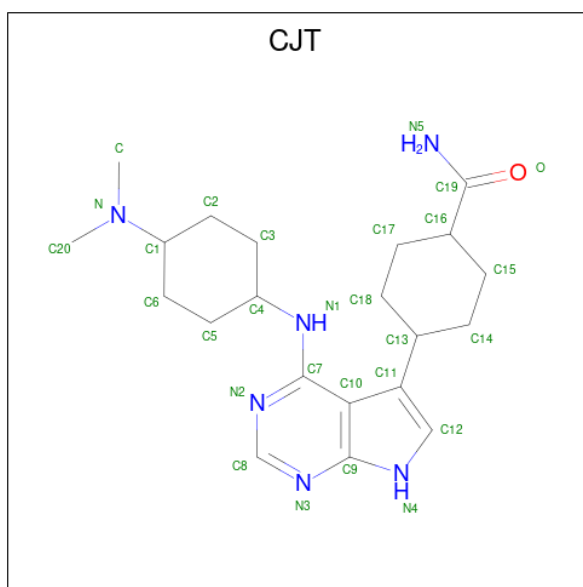
Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total 28	C 21	N 6	O 1	0	0
3	B	1	Total 28	C 21	N 6	O 1	0	0

• Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	42	Total 42	O 42	0	0
4	B	71	Total 71	O 71	0	0

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: Interleukin-1 receptor-associated kinase 4

Chain A:

• Molecule 1: Interleukin-1 receptor-associated kinase 4

Chain B:
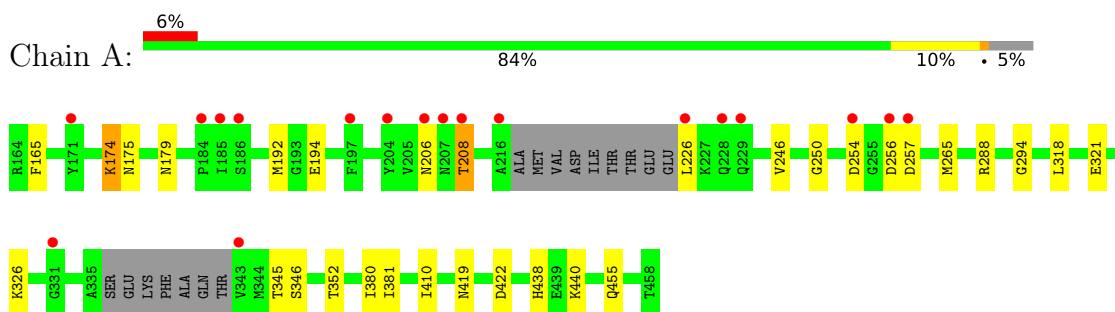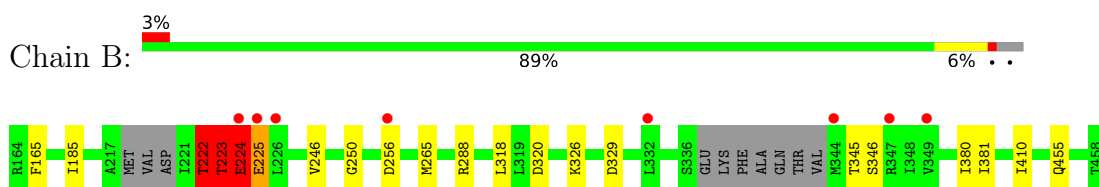
4 Data and refinement statistics (i)

Property	Value	Source
Space group	I 2 2 2	Depositor
Cell constants a, b, c, α, β, γ	86.57Å 125.28Å 142.60Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	94.12 – 2.38 94.12 – 2.38	Depositor EDS
% Data completeness (in resolution range)	99.2 (94.12-2.38) 99.2 (94.12-2.38)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	2.14 (at 2.37Å)	Xtriage
Refinement program	BUSTER 2.11.5 PACIOREK	Depositor
R, R_{free}	0.198 , 0.227 0.202 , 0.238	Depositor DCC
R_{free} test set	1531 reflections (4.90%)	wwPDB-VP
Wilson B-factor (Å^2)	47.2	Xtriage
Anisotropy	0.551	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.35 , 50.5	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	0.95	EDS
Total number of atoms	4633	wwPDB-VP
Average B, all atoms (Å^2)	63.0	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 24.75 % 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 3.6117e-03. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

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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 (i)

5.1 Standard geometry (i)

Bond lengths and bond angles in the following residue types are not validated in this section: TPO, SEP, SO4, CJT

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	0.49	0/2220	0.68	0/2989
1	B	0.51	0/2264	0.86	4/3049 (0.1%)
All	All	0.50	0/4484	0.77	4/6038 (0.1%)

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	B	1	0

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	224	GLU	N-CA-C	-14.62	71.53	111.00
1	B	225	GLU	N-CA-CB	13.54	134.98	110.60
1	B	222	THR	N-CA-C	13.31	146.93	111.00
1	B	223	THR	N-CA-CB	12.34	133.75	110.30

All (1) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
1	B	222	THR	CA

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	A	2205	0	2176	12	0
1	B	2249	0	2214	12	0
2	A	5	0	0	0	0
2	B	5	0	0	0	0
3	A	28	0	0	0	0
3	B	28	0	0	0	0
4	A	42	0	0	2	0
4	B	71	0	0	0	0
All	All	4633	0	4390	24	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 (24) 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:265:MET:HE1	1:A:326:LYS:HG3	1.63	0.81
1:A:265:MET:CE	1:A:326:LYS:HG3	2.11	0.80
1:B:265:MET:CE	1:B:326:LYS:HG3	2.14	0.78
1:B:222:THR:HB	1:B:224:GLU:O	1.86	0.75
1:B:265:MET:HE1	1:B:326:LYS:HG3	1.74	0.70
1:B:265:MET:HE2	1:B:326:LYS:HG3	1.79	0.64
1:B:381:ILE:HG21	1:B:410:ILE:HD11	1.81	0.62
1:A:381:ILE:HG21	1:A:410:ILE:HD11	1.82	0.60
1:A:438:HIS:HE1	1:A:440:LYS:HD2	1.69	0.56
1:A:265:MET:HE2	1:A:326:LYS:HG3	1.85	0.56
1:A:321:GLU:HG3	4:A:640:HOH:O	2.07	0.53
1:A:246:VAL:HG11	1:A:318:LEU:HD12	1.91	0.51
1:B:246:VAL:HG11	1:B:318:LEU:HD12	1.92	0.51
1:B:222:THR:O	1:B:222:THR:CG2	2.59	0.50
1:A:165:PHE:HB3	1:A:250:GLY:HA2	1.95	0.49
1:B:222:THR:O	1:B:222:THR:HG22	2.11	0.49
1:B:165:PHE:HB3	1:B:250:GLY:HA2	1.97	0.47
1:A:206:ASN:C	1:A:208:THR:H	2.20	0.46
1:A:174:LYS:HG2	1:A:179:ASN:HA	1.99	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:288:ARG:HB3	1:A:380:ILE:HG23	1.99	0.44
1:B:223:THR:N	1:B:224:GLU:O	2.51	0.44
1:B:265:MET:HE1	1:B:320:ASP:HB3	2.01	0.43
1:A:294:GLY:HA3	4:A:617:HOH:O	2.20	0.42
1:B:288:ARG:HB3	1:B:380:ILE:HG23	2.02	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	A	271/295 (92%)	262 (97%)	8 (3%)	1 (0%)	34	46
1	B	277/295 (94%)	264 (95%)	9 (3%)	4 (1%)	11	14
All	All	548/590 (93%)	526 (96%)	17 (3%)	5 (1%)	17	23

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	257	ASP
1	B	223	THR
1	B	225	GLU
1	B	224	GLU
1	B	329	ASP

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	A	241/255 (94%)	229 (95%)	12 (5%)	24	37
1	B	246/255 (96%)	242 (98%)	4 (2%)	62	78
All	All	487/510 (96%)	471 (97%)	16 (3%)	38	55

All (16) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	174	LYS
1	A	175	ASN
1	A	192	MET
1	A	194	GLU
1	A	208	THR
1	A	226	LEU
1	A	254	ASP
1	A	256	ASP
1	A	352	THR
1	A	419	ASN
1	A	422	ASP
1	A	455	GLN
1	B	185	ILE
1	B	222	THR
1	B	256	ASP
1	B	455	GLN

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	229	GLN
1	A	419	ASN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

4 non-standard protein/DNA/RNA residues 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	$\#|Z| > 2$
1	TPO	B	345	1	8,10,11	1.22	1 (12%)	10,14,16	0.83	0
1	SEP	B	346	1	8,9,10	0.76	0	8,12,14	2.49	2 (25%)
1	TPO	A	345	1	8,10,11	1.36	1 (12%)	10,14,16	0.95	0
1	SEP	A	346	1	8,9,10	0.75	0	8,12,14	2.46	2 (25%)

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
1	TPO	B	345	1	-	3/9/11/13	-
1	SEP	B	346	1	-	1/5/8/10	-
1	TPO	A	345	1	-	3/9/11/13	-
1	SEP	A	346	1	-	1/5/8/10	-

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	345	TPO	CB-CA	2.88	1.60	1.53
1	B	345	TPO	CB-CA	2.31	1.59	1.53

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	B	346	SEP	OG-CB-CA	5.38	113.38	108.14
1	A	346	SEP	OG-CB-CA	5.24	113.25	108.14
1	B	346	SEP	O3P-P-OG	4.14	117.75	106.73
1	A	346	SEP	O3P-P-OG	3.88	117.07	106.73

There are no chirality outliers.

All (8) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	A	345	TPO	N-CA-CB-OG1
1	A	346	SEP	N-CA-CB-OG
1	B	345	TPO	N-CA-CB-OG1
1	B	345	TPO	CB-OG1-P-O1P
1	B	346	SEP	N-CA-CB-OG
1	A	345	TPO	CB-OG1-P-O2P
1	A	345	TPO	O-C-CA-CB
1	B	345	TPO	O-C-CA-CB

There are no ring outliers.

No monomer is involved in short contacts.

5.5 Carbohydrates ⓘ

There are no monosaccharides in this entry.

5.6 Ligand geometry ⓘ

4 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	SO4	A	501	-	4,4,4	0.08	0	6,6,6	0.11	0
3	CJT	B	502	-	29,31,31	0.87	1 (3%)	34,44,44	0.79	0
3	CJT	A	502	-	29,31,31	0.83	1 (3%)	34,44,44	0.62	0
2	SO4	B	501	-	4,4,4	0.19	0	6,6,6	0.06	0

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	CJT	B	502	-	-	3/14/36/36	0/4/4/4
3	CJT	A	502	-	-	3/14/36/36	0/4/4/4

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	502	CJT	C11-C10	3.64	1.44	1.40
3	B	502	CJT	C11-C10	3.63	1.44	1.40

There are no bond angle outliers.

There are no chirality outliers.
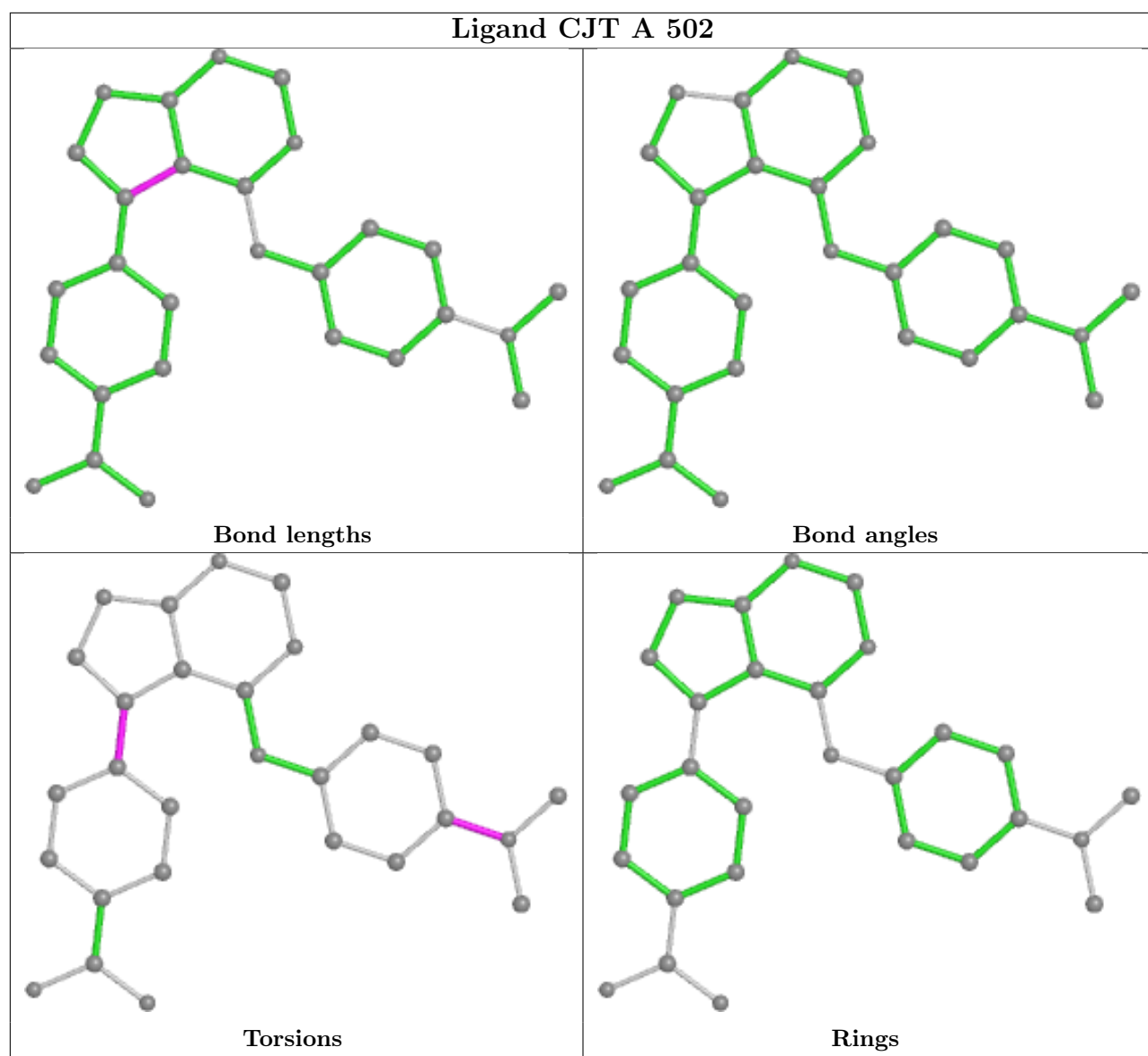
All (6) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	502	CJT	C6-C1-N-C
3	B	502	CJT	C17-C16-C19-O
3	B	502	CJT	C17-C16-C19-N5
3	B	502	CJT	C6-C1-N-C
3	A	502	CJT	C2-C1-N-C
3	A	502	CJT	C12-C11-C13-C18

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 CJT B 502

Bond lengths

Bond angles

Torsions

Rings

Ligand CJT A 502

Bond lengths

Bond angles

Torsions

Rings
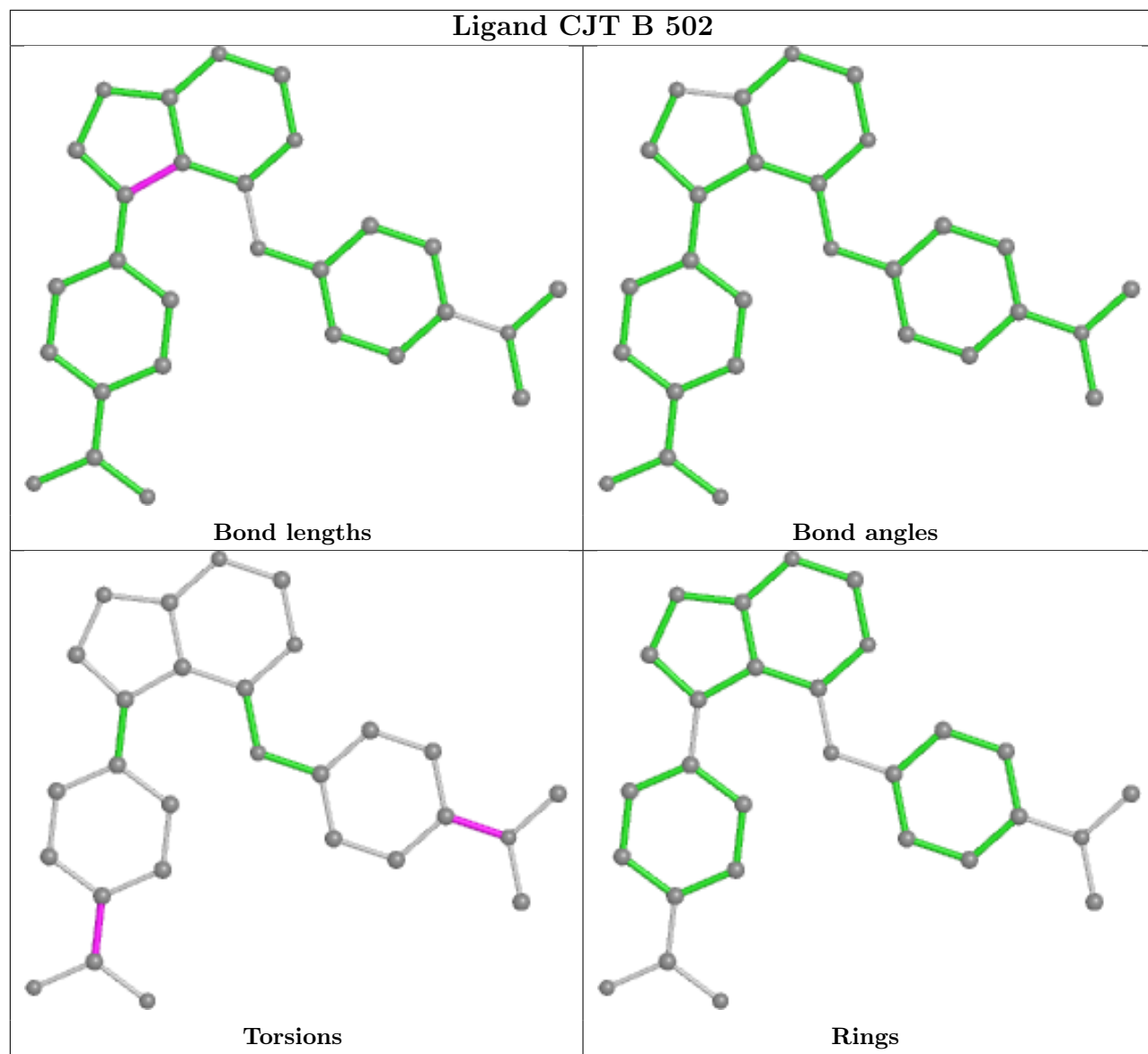
5.7 Other polymers ⓘ

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(Å²)	Q<0.9
1	A	277/295 (93%)	0.61	18 (6%) 18	20	39, 61, 105, 123	0
1	B	283/295 (95%)	0.42	8 (2%) 53	55	33, 55, 98, 135	0
All	All	560/590 (94%)	0.51	26 (4%) 32	35	33, 57, 103, 135	0

All (26) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	226	LEU	4.8
1	A	229	GLN	4.7
1	A	206	ASN	3.8
1	A	204	TYR	3.7
1	B	225	GLU	3.6
1	B	226	LEU	3.5
1	A	216	ALA	3.5
1	A	185	ILE	3.2
1	B	256	ASP	3.2
1	A	197	PHE	3.1
1	A	186	SER	3.0
1	A	207	ASN	2.8
1	A	343	VAL	2.7
1	A	254	ASP	2.7
1	B	332	LEU	2.7
1	A	257	ASP	2.6
1	B	224	GLU	2.6
1	A	331	GLY	2.6
1	A	256	ASP	2.5
1	A	184	PRO	2.5
1	B	347	ARG	2.4
1	A	228	GLN	2.3
1	B	349	VAL	2.3
1	B	344	MET	2.2

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Mol	Chain	Res	Type	RSRZ
1	A	171	TYR	2.0
1	A	208	THR	2.0

## 6.2 Non-standard residues in protein, DNA, RNA chains ⓘ

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
1	SEP	A	346	10/11	0.74	0.15	106,115,127,127	0
1	SEP	B	346	10/11	0.78	0.22	115,122,132,134	0
1	TPO	B	345	11/12	0.83	0.19	107,113,117,119	0
1	TPO	A	345	11/12	0.88	0.14	102,107,111,114	0

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	SO4	A	501	5/5	0.75	0.19	149,149,149,150	0
2	SO4	B	501	5/5	0.87	0.28	135,135,135,136	0
3	CJT	A	502	28/28	0.97	0.16	41,46,58,62	0
3	CJT	B	502	28/28	0.97	0.17	29,37,43,47	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 CJT 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)

Electron density around CJT B 502:

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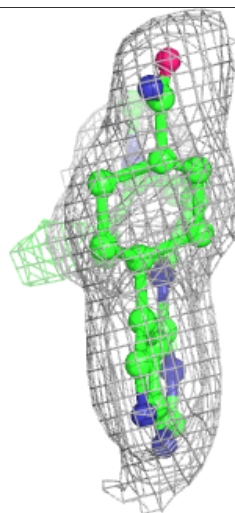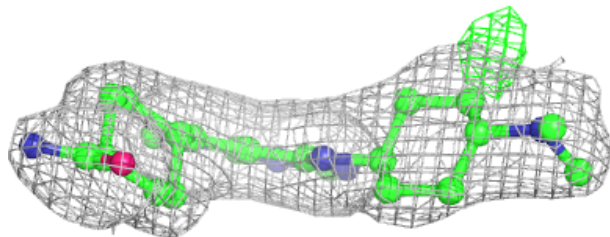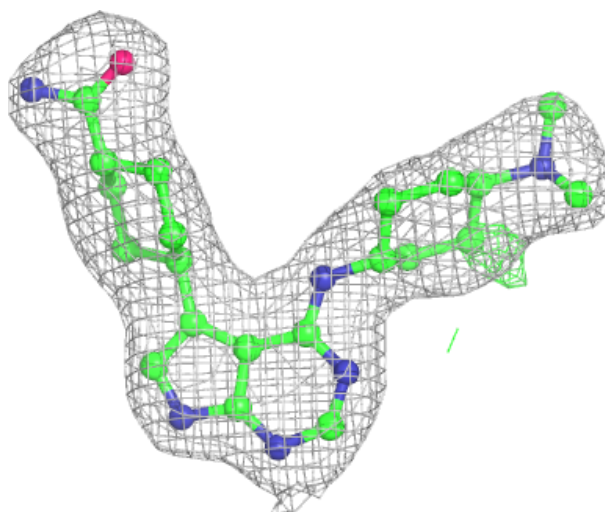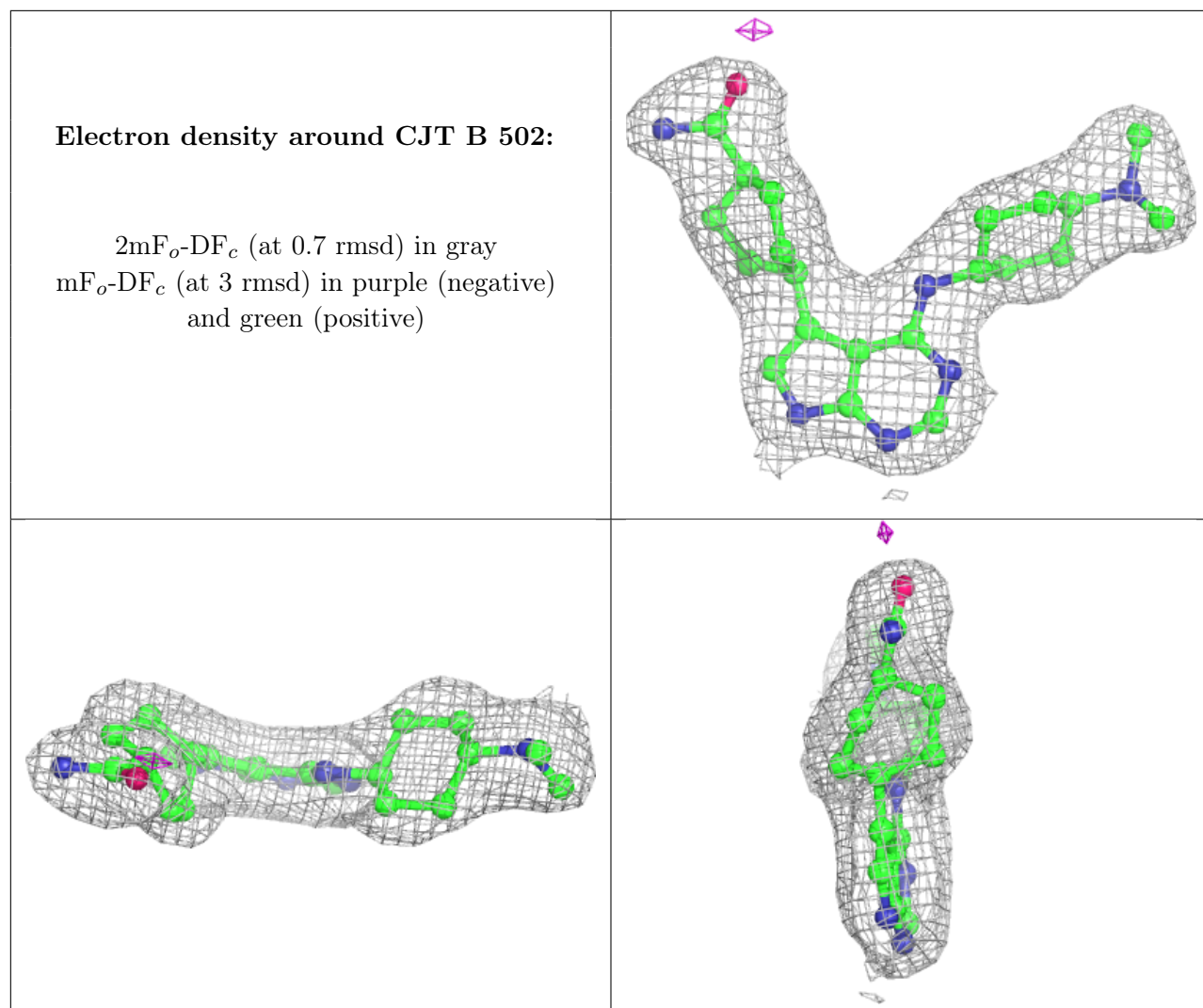
6.5 Other polymers (i)

There are no such residues in this entry.