



Full wwPDB X-ray Structure Validation Report ⓘ

May 13, 2020 – 09:52 pm BST

PDB ID : 6NFO
Title : CYCLIC GMP-AMP SYNTHASE in complex with compound 20 inhibitor: 7-hydroxy-N-[(2S)-1-hydroxypropan-2-yl]-5-phenylpyrazolo[1,5-a]pyrimidine-3-carboxamide
Authors : Hall, J.
Deposited on : 2018-12-20
Resolution : 2.93 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 ⓘ symbol.

The following versions of software and data (see [references ⓘ](#)) 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

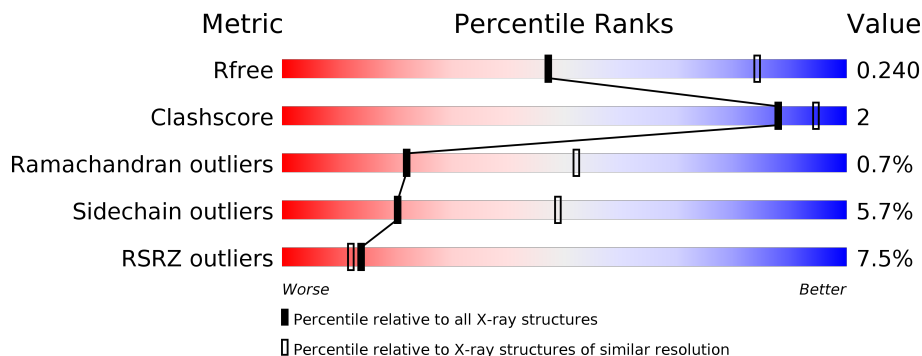
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.93 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	2969 (2.98-2.90)
Clashscore	141614	3218 (2.98-2.90)
Ramachandran outliers	138981	3122 (2.98-2.90)
Sidechain outliers	138945	3124 (2.98-2.90)
RSRZ outliers	127900	2902 (2.98-2.90)

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 $\leq 5\%$. 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	362	 6% 87% 8% . .
1	B	362	 9% 89% 9% . .

2 Entry composition i

There are 4 unique types of molecules in this entry. The entry contains 5479 atoms, of which 32 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.

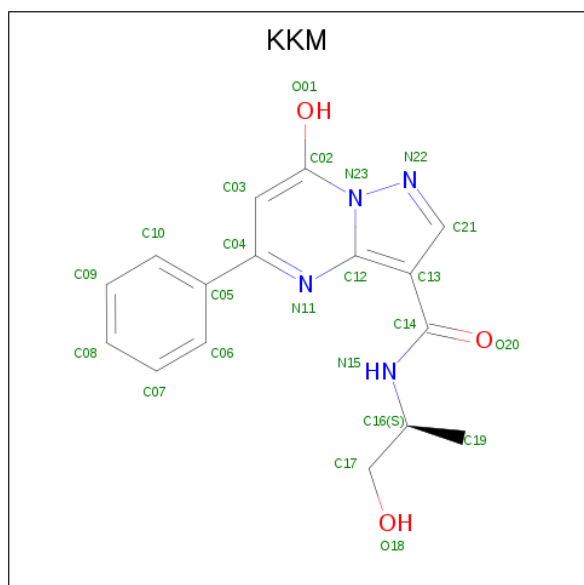
- Molecule 1 is a protein called CYCLIC GMP-AMP SYNTHASE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	347	Total 2666	C 1709	N 451	O 492	S 14	0	0	0
1	B	356	Total 2706	C 1737	N 458	O 497	S 14	0	0	0

- Molecule 2 is ZINC ION (three-letter code: ZN) (formula: Zn).

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

- Molecule 3 is 7-hydroxy-N-[(2S)-1-hydroxypropan-2-yl]-5-phenylpyrazolo[1,5-a]pyrimidine-3-carboxamide (three-letter code: KKM) (formula: C₁₆H₁₆N₄O₃) (labeled as "Ligand of Interest" by author).



Mol	Chain	Residues	Atoms					ZeroOcc	AltConf
3	A	1	Total	C	H	N	O	0	0
			39	16	16	4	3		
3	B	1	Total	C	H	N	O	0	0
			39	16	16	4	3		

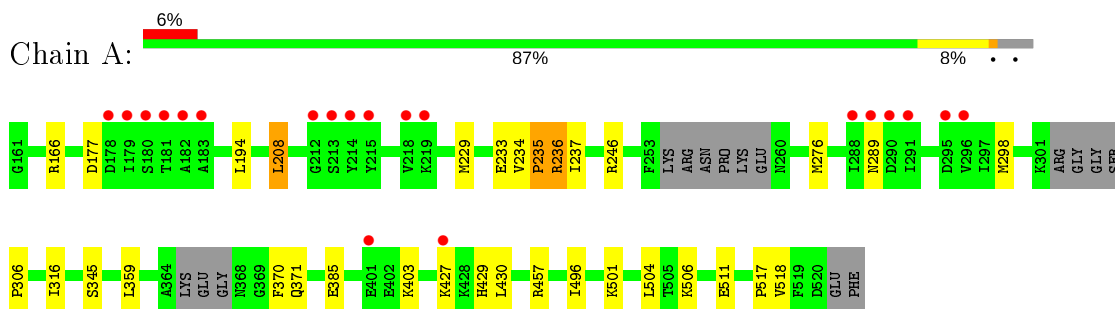
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	18	Total	O	0	0
			18	18		
4	B	9	Total	O	0	0
			9	9		

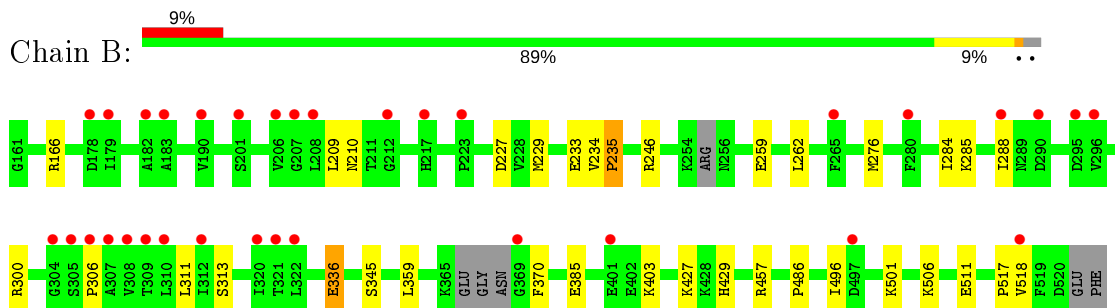
3 Residue-property plots [i](#)

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: CYCLIC GMP-AMP SYNTHASE



- Molecule 1: CYCLIC GMP-AMP SYNTHASE



4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	218.80Å 46.00Å 90.34Å 90.00° 111.64° 90.00°	Depositor
Resolution (Å)	83.97 – 2.93 83.97 – 2.93	Depositor EDS
% Data completeness (in resolution range)	100.0 (83.97-2.93) 100.0 (83.97-2.93)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.16 (at 2.91Å)	Xtrriage
Refinement program	BUSTER 2.11.7	Depositor
R, R_{free}	0.210 , 0.231 0.223 , 0.240	Depositor DCC
R_{free} test set	942 reflections (5.11%)	wwPDB-VP
Wilson B-factor (Å ²)	61.2	Xtrriage
Anisotropy	0.289	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.30 , 52.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	0.012 for -h-2*1,-k,l	Xtrriage
F_o, F_c correlation	0.92	EDS
Total number of atoms	5479	wwPDB-VP
Average B, all atoms (Å ²)	71.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 9.17% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ 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: KKM, ZN

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	0/2717	0.68	1/3672 (0.0%)
1	B	0.50	0/2762	0.70	3/3741 (0.1%)
All	All	0.50	0/5479	0.69	4/7413 (0.1%)

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	313	SER	N-CA-C	-6.35	93.85	111.00
1	B	306	PRO	C-N-CA	6.04	136.80	121.70
1	A	306	PRO	C-N-CA	5.25	134.84	121.70
1	B	235	PRO	N-CA-C	5.17	125.55	112.10

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	2666	0	2527	11	0
1	B	2706	0	2524	10	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
3	A	23	16	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	B	23	16	0	0	0
4	A	18	0	0	0	0
4	B	9	0	0	0	0
All	All	5447	32	5051	21	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 2.

All (21) 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:B:336:GLU:HG2	1:B:486:PRO:HG2	1.75	0.68
1:A:427:LYS:HB3	1:A:429:HIS:CD2	2.41	0.56
1:B:284:ILE:O	1:B:288:ILE:HG23	2.04	0.55
1:A:430:LEU:HD22	1:A:504:LEU:HD13	1.90	0.54
1:A:403:LYS:HB3	1:A:457:ARG:HD2	1.92	0.51
1:B:403:LYS:HB3	1:B:457:ARG:HD2	1.93	0.51
1:A:235:PRO:HB2	1:A:236:ARG:HD3	1.94	0.50
1:A:234:VAL:CG2	1:A:237:ILE:HG21	2.44	0.48
1:A:234:VAL:HG23	1:A:237:ILE:HG21	1.96	0.47
1:A:166:ARG:NH2	1:A:457:ARG:HG2	2.30	0.47
1:B:166:ARG:NH2	1:B:457:ARG:HG2	2.30	0.47
1:A:194:LEU:HD11	1:A:208:LEU:HD13	1.97	0.46
1:B:427:LYS:HB3	1:B:429:HIS:CD2	2.51	0.46
1:A:496:ILE:HB	1:A:501:LYS:HE3	1.99	0.43
1:B:511:GLU:OE1	1:B:517:PRO:HD2	2.18	0.43
1:A:427:LYS:HB3	1:A:429:HIS:HD2	1.80	0.43
1:B:234:VAL:HG12	1:B:262:LEU:HD11	1.99	0.43
1:B:496:ILE:HB	1:B:501:LYS:HE3	1.99	0.43
1:B:429:HIS:H	1:B:429:HIS:CD2	2.37	0.43
1:A:511:GLU:OE1	1:A:517:PRO:HD2	2.20	0.42
1:B:285:LYS:O	1:B:288:ILE:HG13	2.20	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	339/362 (94%)	319 (94%)	18 (5%)	2 (1%)	25	56
1	B	350/362 (97%)	329 (94%)	18 (5%)	3 (1%)	17	46
All	All	689/724 (95%)	648 (94%)	36 (5%)	5 (1%)	22	52

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	235	PRO
1	A	345	SER
1	B	300	ARG
1	B	345	SER
1	B	235	PRO

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	274/334 (82%)	258 (94%)	16 (6%)	20	48
1	B	271/334 (81%)	256 (94%)	15 (6%)	21	50
All	All	545/668 (82%)	514 (94%)	31 (6%)	20	49

All (31) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	177	ASP

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Mol	Chain	Res	Type
1	A	208	LEU
1	A	229	MET
1	A	233	GLU
1	A	236	ARG
1	A	246	ARG
1	A	276	MET
1	A	289	ASN
1	A	298	MET
1	A	316	ILE
1	A	359	LEU
1	A	370	PHE
1	A	371	GLN
1	A	385	GLU
1	A	506	LYS
1	A	518	VAL
1	B	209	LEU
1	B	210	ASN
1	B	227	ASP
1	B	229	MET
1	B	233	GLU
1	B	246	ARG
1	B	259	GLU
1	B	276	MET
1	B	311	LEU
1	B	336	GLU
1	B	359	LEU
1	B	370	PHE
1	B	385	GLU
1	B	506	LYS
1	B	518	VAL

Some sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (6) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	224	ASN
1	A	371	GLN
1	A	448	GLN
1	B	210	ASN
1	B	429	HIS
1	B	448	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](#)

Of 4 ligands modelled in this entry, 2 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
3	KKM	B	602	-	20,25,25	1.85	5 (25%)	25,35,35	1.57	4 (16%)
3	KKM	A	602	-	20,25,25	1.79	4 (20%)	25,35,35	1.48	3 (12%)

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	KKM	B	602	-	-	0/12/14/14	0/3/3/3
3	KKM	A	602	-	-	1/12/14/14	0/3/3/3

All (9) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	B	602	KKM	C14-N15	5.82	1.46	1.34

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	A	602	KKM	C14-N15	5.33	1.45	1.34
3	B	602	KKM	O01-C02	2.95	1.41	1.32
3	B	602	KKM	C05-C04	2.89	1.53	1.48
3	A	602	KKM	C05-C04	2.65	1.53	1.48
3	A	602	KKM	O01-C02	2.49	1.39	1.32
3	A	602	KKM	O20-C14	-2.38	1.18	1.23
3	B	602	KKM	O20-C14	-2.03	1.19	1.23
3	B	602	KKM	C21-N22	2.01	1.39	1.33

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	602	KKM	C04-C03-C02	4.59	119.89	116.80
3	B	602	KKM	C03-C04-N11	-3.68	118.87	122.23
3	A	602	KKM	C04-C03-C02	3.40	119.09	116.80
3	A	602	KKM	C03-C04-N11	-3.21	119.30	122.23
3	A	602	KKM	C21-N22-N23	2.45	107.81	103.94
3	B	602	KKM	O20-C14-C13	-2.25	118.61	121.72
3	B	602	KKM	C21-N22-N23	2.11	107.27	103.94

There are no chirality outliers.

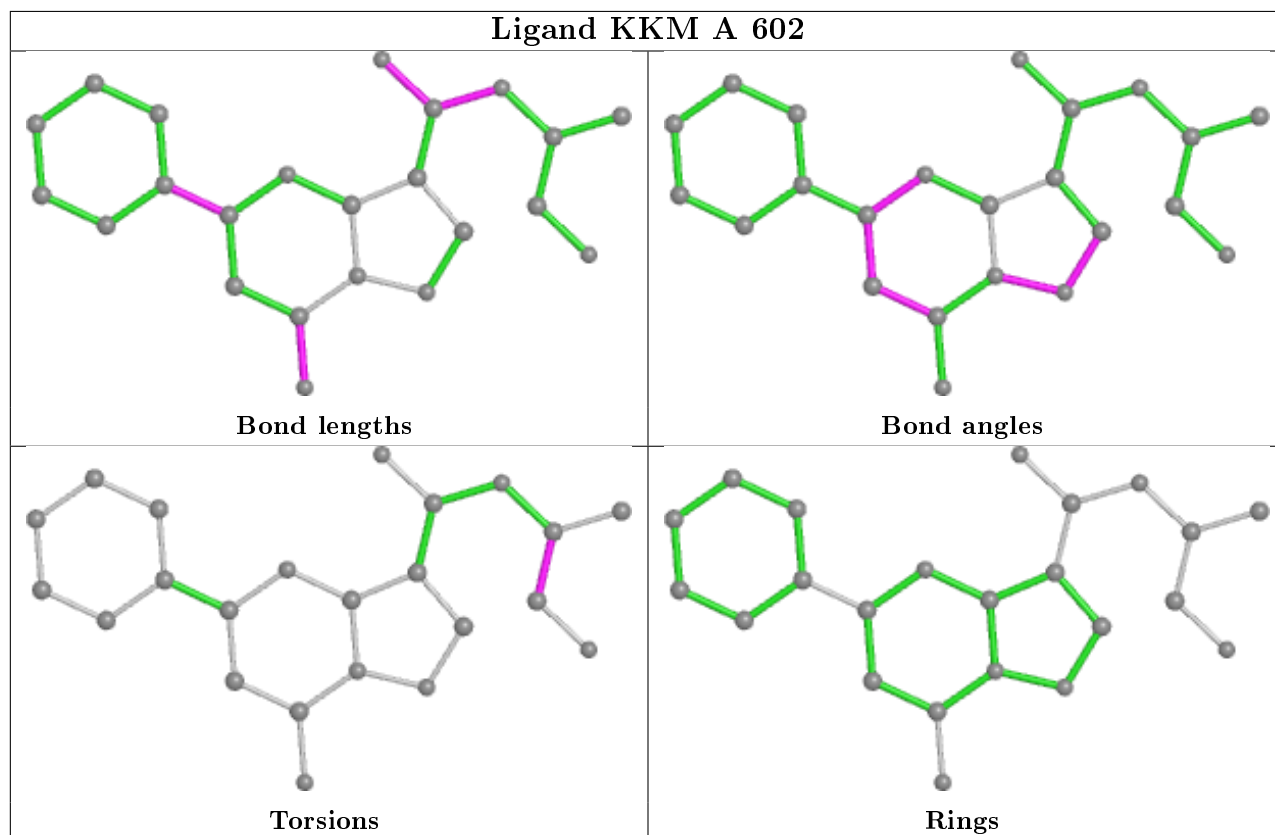
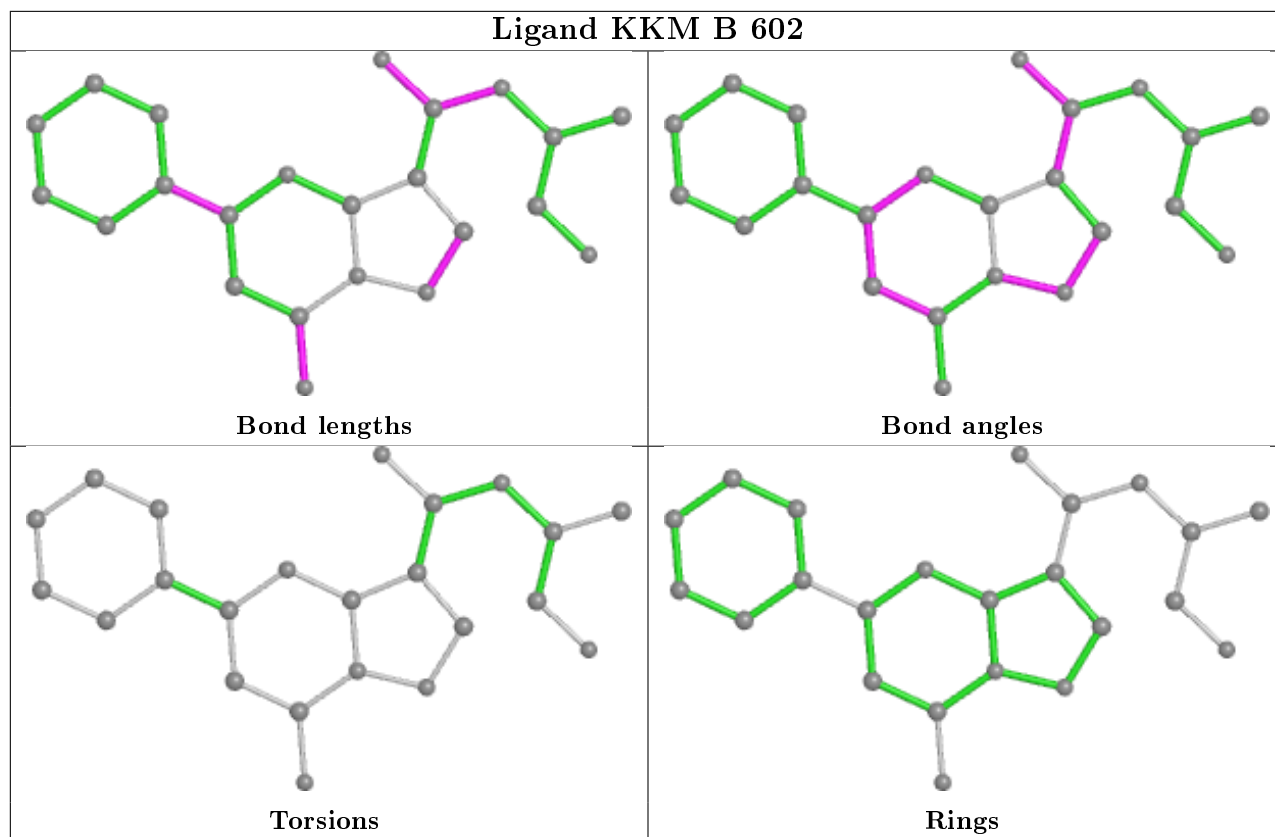
All (1) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	A	602	KKM	C19-C16-C17-O18

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 than 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.



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

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	A	347/362 (95%)	0.29	20 (5%) 23 21	35, 69, 115, 136	0
1	B	356/362 (98%)	0.43	33 (9%) 8 7	34, 73, 126, 153	0
All	All	703/724 (97%)	0.36	53 (7%) 14 12	34, 70, 123, 153	0

All (53) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	212	GLY	7.6
1	A	182	ALA	7.3
1	B	305	SER	7.0
1	A	178	ASP	6.1
1	A	213	SER	6.1
1	A	183	ALA	4.9
1	A	179	ILE	4.7
1	A	290	ASP	4.6
1	A	181	THR	4.5
1	A	180	SER	4.5
1	A	295	ASP	4.3
1	B	179	ILE	4.2
1	A	219	LYS	4.1
1	B	304	GLY	3.9
1	B	212	GLY	3.9
1	B	182	ALA	3.8
1	B	321	THR	3.8
1	B	178	ASP	3.6
1	A	291	ILE	3.4
1	B	306	PRO	3.4
1	B	369	GLY	3.4
1	B	207	GLY	3.2
1	B	497	ASP	3.2
1	B	208	LEU	3.2

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Mol	Chain	Res	Type	RSRZ
1	A	215	TYR	3.2
1	A	214	TYR	3.2
1	B	288	ILE	3.1
1	B	206	VAL	3.0
1	A	218	VAL	3.0
1	B	322	LEU	2.8
1	A	288	ILE	2.7
1	B	290	ASP	2.7
1	A	296	VAL	2.6
1	B	312	ILE	2.6
1	B	190	VAL	2.5
1	B	308	VAL	2.5
1	B	307	ALA	2.4
1	B	401	GLU	2.4
1	B	296	VAL	2.4
1	A	427	LYS	2.4
1	B	223	PRO	2.4
1	B	310	LEU	2.3
1	B	183	ALA	2.3
1	A	289	ASN	2.3
1	B	265	PHE	2.3
1	A	401	GLU	2.3
1	B	201	SER	2.2
1	B	320	ILE	2.1
1	B	295	ASP	2.1
1	B	309	THR	2.1
1	B	280	PHE	2.1
1	B	217	HIS	2.1
1	B	518	VAL	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 carbohydrates in this entry.

6.4 Ligands [i](#)

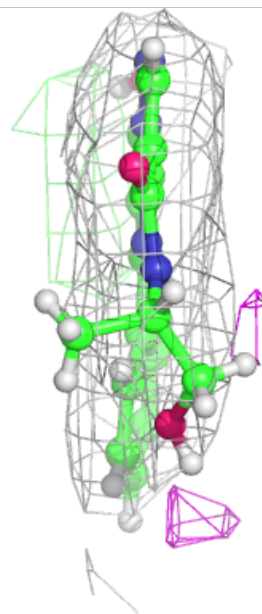
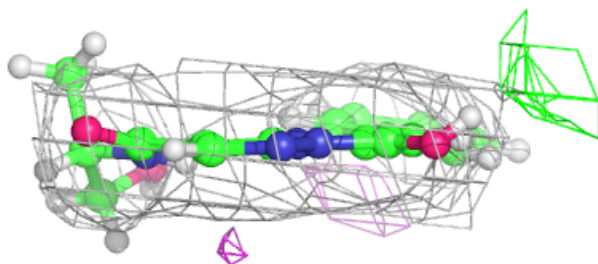
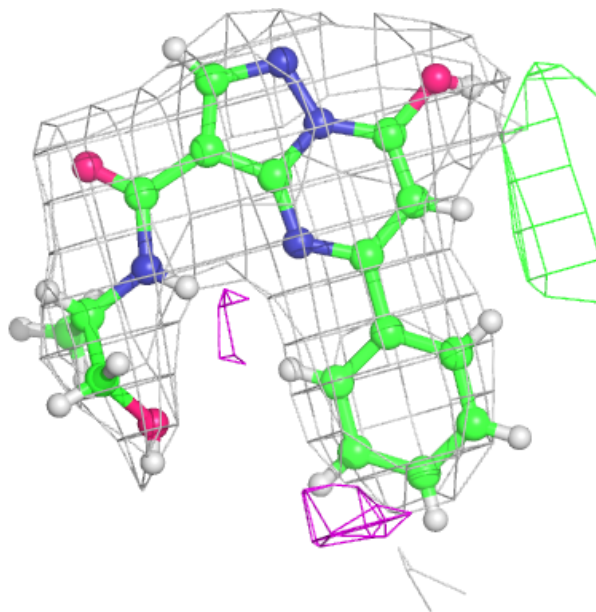
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

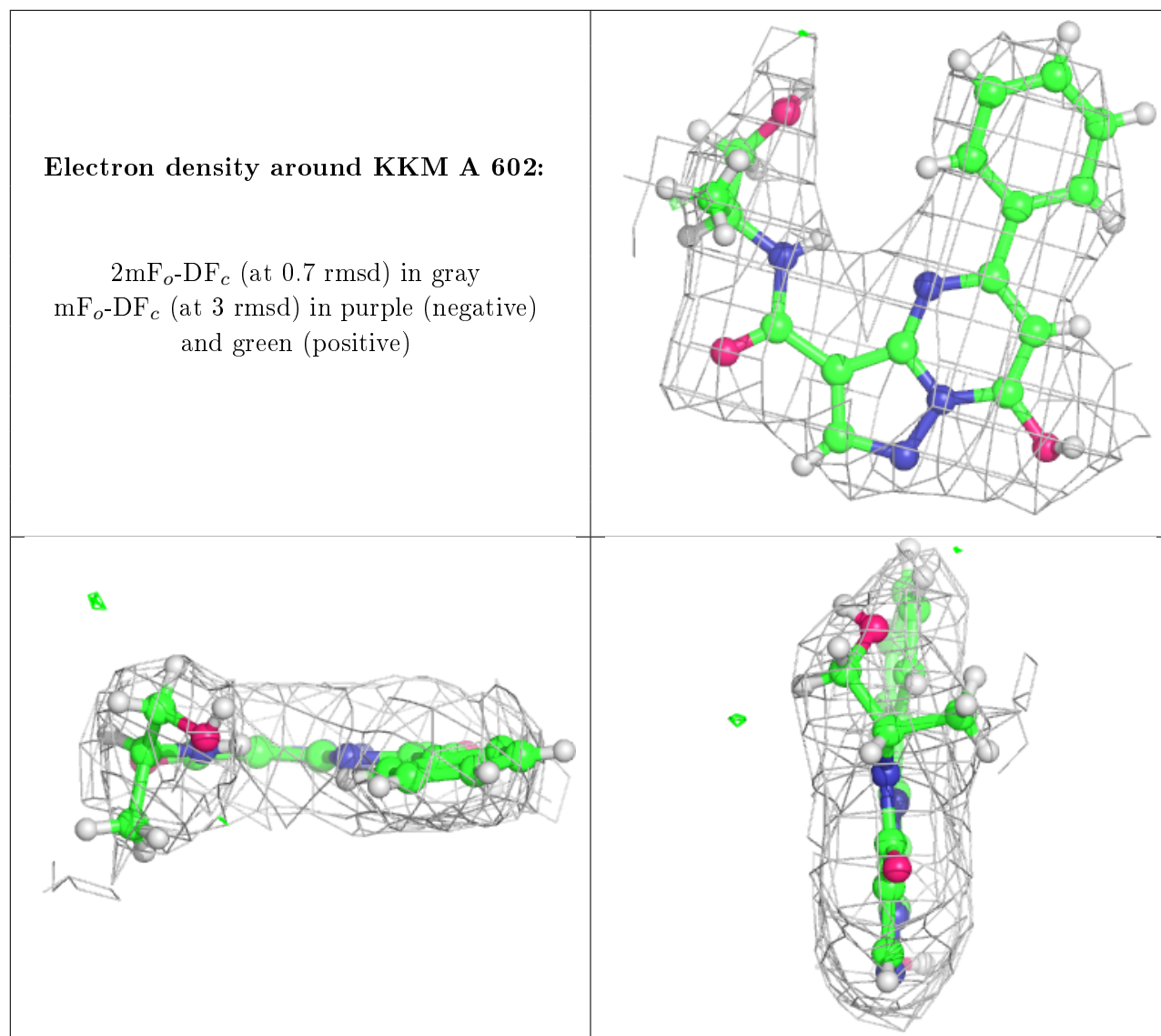
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
3	KKM	B	602	23/23	0.94	0.24	44,51,58,59	0
3	KKM	A	602	23/23	0.96	0.17	47,53,63,64	0
2	ZN	B	601	1/1	0.99	0.17	58,58,58,58	0
2	ZN	A	601	1/1	1.00	0.14	63,63,63,63	0

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 KKM B 602:

$2mF_o-DF_c$ (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.