Full wwPDB X-ray Structure Validation Report (i)

Mar 2, 2026 – 03:11 PM JST

PDB ID	:	9UAC / pdb_00009uac
Title	:	Crystal structure of the OkaE-M64A mutant with a-ketoglutarate
Authors	:	Yu, J.J.; Yan, W.P.; Wang, X.Y.
Deposited on	:	2025-03-31
Resolution	:	2.72 Å(reported)

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

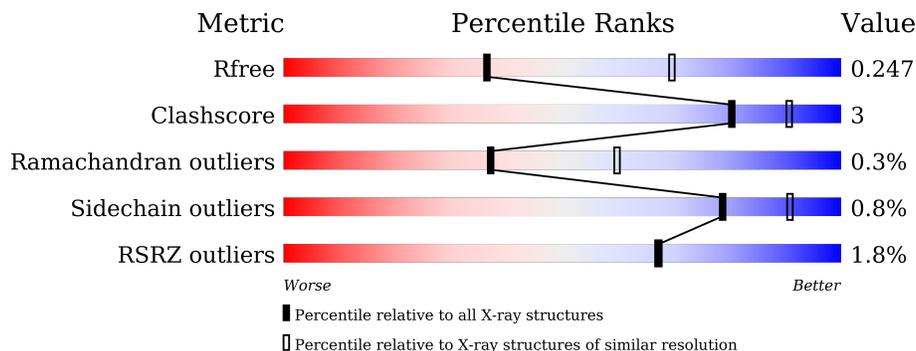|		
MolProbity	:	4-5-2 with Phenix2.0
Mogul	:	1.8.5 (274361), CSD as541be (2020)
Xtriage (Phenix)	:	2.0
EDS	:	3.0
buster-report	:	1.1.7 (2018)
Percentile statistics	:	20231227.v01 (using entries in the PDB archive December 27th 2023)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.48.1

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 2.72 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		0.247
Clashscore		3
Ramachandran outliers		0.3%
Sidechain outliers		0.8%
RSRZ outliers		1.8%

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}	164625	4050 (2.74-2.70)
Clashscore	180529	4439 (2.74-2.70)
Ramachandran outliers	177936	4374 (2.74-2.70)
Sidechain outliers	177891	4375 (2.74-2.70)
RSRZ outliers	164620	4050 (2.74-2.70)

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	315	2% · 84% · 8% · 8%
1	B	315	2% · 87% · 5% · 8%
1	C	315	% · 85% · 6% · 9%
1	D	315	% · 88% · 9% · •

2 Entry composition ⓘ

There are 5 unique types of molecules in this entry. The entry contains 9513 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 Iron/alpha-ketoglutarate-dependent dioxygenase okaE.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	291	Total	C	N	O	S	0	0	0
			2238	1405	403	414	16			
1	B	290	Total	C	N	O	S	0	0	0
			2255	1417	409	412	17			
1	C	287	Total	C	N	O	S	0	0	0
			2233	1403	403	411	16			
1	D	305	Total	C	N	O	S	0	0	0
			2368	1483	425	443	17			

There are 68 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-6	MET	-	initiating methionine	UNP A0A2Z5U507
A	-5	GLY	-	expression tag	UNP A0A2Z5U507
A	-4	ASP	-	expression tag	UNP A0A2Z5U507
A	-3	ARG	-	expression tag	UNP A0A2Z5U507
A	-2	GLY	-	expression tag	UNP A0A2Z5U507
A	-1	PRO	-	expression tag	UNP A0A2Z5U507
A	0	GLU	-	expression tag	UNP A0A2Z5U507
A	1	PHE	-	expression tag	UNP A0A2Z5U507
A	64	ALA	MET	engineered mutation	UNP A0A2Z5U507
A	301	TRP	-	expression tag	UNP A0A2Z5U507
A	302	SER	-	expression tag	UNP A0A2Z5U507
A	303	HIS	-	expression tag	UNP A0A2Z5U507
A	304	PRO	-	expression tag	UNP A0A2Z5U507
A	305	GLN	-	expression tag	UNP A0A2Z5U507
A	306	PHE	-	expression tag	UNP A0A2Z5U507
A	307	GLU	-	expression tag	UNP A0A2Z5U507
A	308	LYS	-	expression tag	UNP A0A2Z5U507
B	-6	MET	-	initiating methionine	UNP A0A2Z5U507
B	-5	GLY	-	expression tag	UNP A0A2Z5U507
B	-4	ASP	-	expression tag	UNP A0A2Z5U507
B	-3	ARG	-	expression tag	UNP A0A2Z5U507

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Chain	Residue	Modelled	Actual	Comment	Reference
B	-2	GLY	-	expression tag	UNP A0A2Z5U507
B	-1	PRO	-	expression tag	UNP A0A2Z5U507
B	0	GLU	-	expression tag	UNP A0A2Z5U507
B	1	PHE	-	expression tag	UNP A0A2Z5U507
B	64	ALA	MET	engineered mutation	UNP A0A2Z5U507
B	301	TRP	-	expression tag	UNP A0A2Z5U507
B	302	SER	-	expression tag	UNP A0A2Z5U507
B	303	HIS	-	expression tag	UNP A0A2Z5U507
B	304	PRO	-	expression tag	UNP A0A2Z5U507
B	305	GLN	-	expression tag	UNP A0A2Z5U507
B	306	PHE	-	expression tag	UNP A0A2Z5U507
B	307	GLU	-	expression tag	UNP A0A2Z5U507
B	308	LYS	-	expression tag	UNP A0A2Z5U507
C	-6	MET	-	initiating methionine	UNP A0A2Z5U507
C	-5	GLY	-	expression tag	UNP A0A2Z5U507
C	-4	ASP	-	expression tag	UNP A0A2Z5U507
C	-3	ARG	-	expression tag	UNP A0A2Z5U507
C	-2	GLY	-	expression tag	UNP A0A2Z5U507
C	-1	PRO	-	expression tag	UNP A0A2Z5U507
C	0	GLU	-	expression tag	UNP A0A2Z5U507
C	1	PHE	-	expression tag	UNP A0A2Z5U507
C	64	ALA	MET	engineered mutation	UNP A0A2Z5U507
C	301	TRP	-	expression tag	UNP A0A2Z5U507
C	302	SER	-	expression tag	UNP A0A2Z5U507
C	303	HIS	-	expression tag	UNP A0A2Z5U507
C	304	PRO	-	expression tag	UNP A0A2Z5U507
C	305	GLN	-	expression tag	UNP A0A2Z5U507
C	306	PHE	-	expression tag	UNP A0A2Z5U507
C	307	GLU	-	expression tag	UNP A0A2Z5U507
C	308	LYS	-	expression tag	UNP A0A2Z5U507
D	-6	MET	-	initiating methionine	UNP A0A2Z5U507
D	-5	GLY	-	expression tag	UNP A0A2Z5U507
D	-4	ASP	-	expression tag	UNP A0A2Z5U507
D	-3	ARG	-	expression tag	UNP A0A2Z5U507
D	-2	GLY	-	expression tag	UNP A0A2Z5U507
D	-1	PRO	-	expression tag	UNP A0A2Z5U507
D	0	GLU	-	expression tag	UNP A0A2Z5U507
D	1	PHE	-	expression tag	UNP A0A2Z5U507
D	64	ALA	MET	engineered mutation	UNP A0A2Z5U507
D	301	TRP	-	expression tag	UNP A0A2Z5U507
D	302	SER	-	expression tag	UNP A0A2Z5U507
D	303	HIS	-	expression tag	UNP A0A2Z5U507

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Chain	Residue	Modelled	Actual	Comment	Reference
D	304	PRO	-	expression tag	UNP A0A2Z5U507
D	305	GLN	-	expression tag	UNP A0A2Z5U507
D	306	PHE	-	expression tag	UNP A0A2Z5U507
D	307	GLU	-	expression tag	UNP A0A2Z5U507
D	308	LYS	-	expression tag	UNP A0A2Z5U507

- Molecule 2 is COBALT (II) ION (CCD ID: CO) (formula: Co).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	1	Total 1	Co 1	0	0
2	B	1	Total 1	Co 1	0	0
2	C	1	Total 1	Co 1	0	0
2	D	1	Total 1	Co 1	0	0

- Molecule 3 is 2-OXOGLUTARIC ACID (CCD ID: AKG) (formula: $C_5H_6O_5$) (labeled as "Ligand of Interest" by depositor).
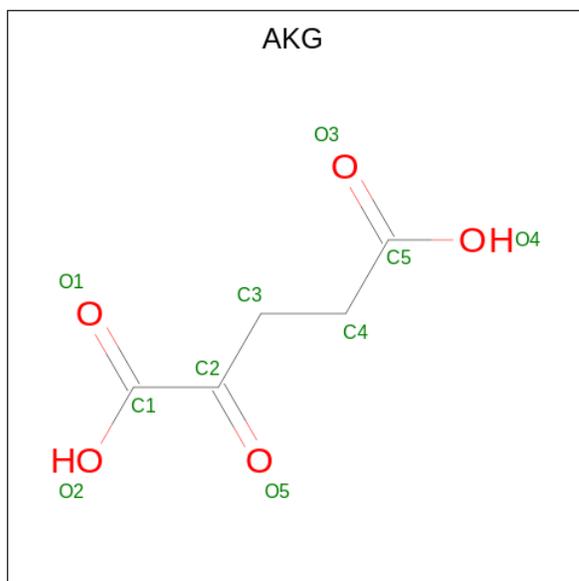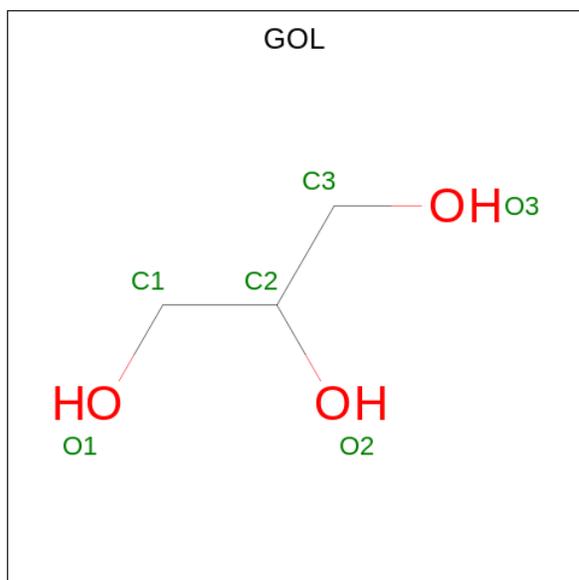

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	A	1	Total 10	C 5	O 5	0	0
3	B	1	Total 10	C 5	O 5	0	0

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
3	C	1	Total 10	C 5	O 5	0	0
3	D	1	Total 10	C 5	O 5	0	0

• Molecule 4 is GLYCEROL (CCD ID: GOL) (formula: $C_3H_8O_3$).

Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	A	1	Total 6	C 3	O 3	0	0
4	A	1	Total 6	C 3	O 3	0	0
4	A	1	Total 6	C 3	O 3	0	0
4	A	1	Total 6	C 3	O 3	0	0
4	B	1	Total 6	C 3	O 3	0	0
4	B	1	Total 6	C 3	O 3	0	0
4	B	1	Total 6	C 3	O 3	0	0
4	B	1	Total 6	C 3	O 3	0	0
4	B	1	Total 6	C 3	O 3	0	0

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
4	C	1	Total 6	C 3	O 3	0	0
4	C	1	Total 6	C 3	O 3	0	0
4	C	1	Total 6	C 3	O 3	0	0
4	D	1	Total 6	C 3	O 3	0	0
4	D	1	Total 6	C 3	O 3	0	0

- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	61	Total 61	O 61	0	0
5	B	80	Total 80	O 80	0	0
5	C	78	Total 78	O 78	0	0
5	D	72	Total 72	O 72	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.
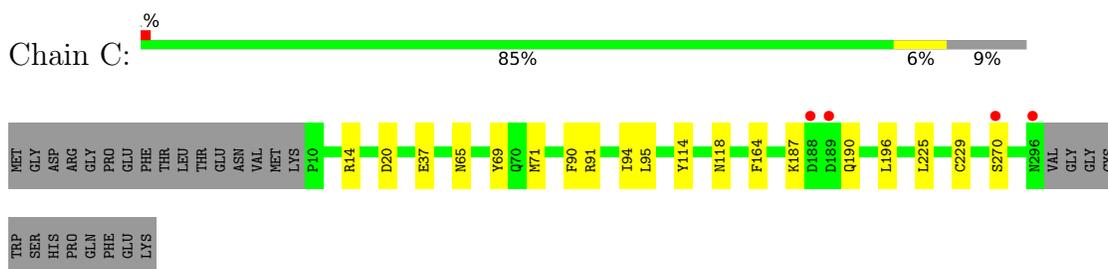
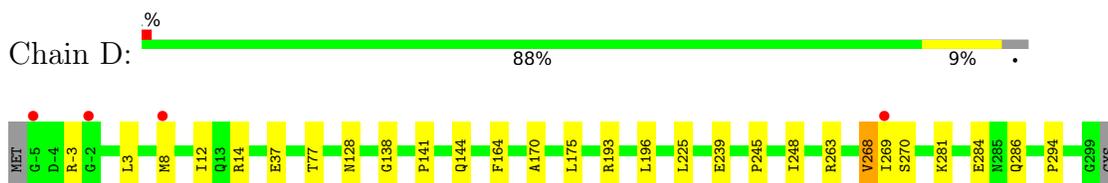• Molecule 1: Iron/alpha-ketoglutarate-dependent dioxygenase okaE
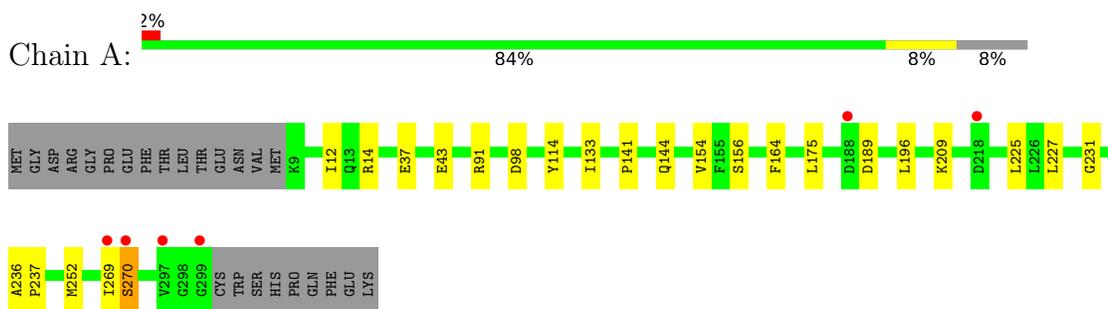
Chain A:

• Molecule 1: Iron/alpha-ketoglutarate-dependent dioxygenase okaE

Chain B:

• Molecule 1: Iron/alpha-ketoglutarate-dependent dioxygenase okaE

Chain C:

• Molecule 1: Iron/alpha-ketoglutarate-dependent dioxygenase okaE

Chain D:
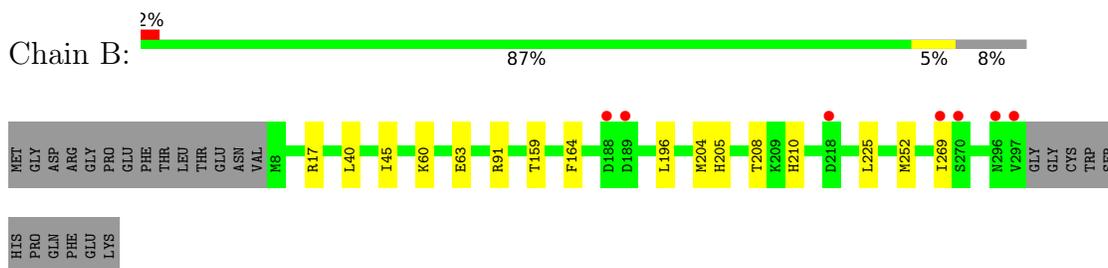
TRP SER HIS PRO GLN PHE GLU LYS

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α, β, γ	76.23Å 107.84Å 134.73Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	38.69 – 2.72 38.69 – 2.72	Depositor EDS
% Data completeness (in resolution range)	99.9 (38.69-2.72) 99.8 (38.69-2.72)	Depositor EDS
R_{merge}	0.17	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	3.91 (at 2.73Å)	Xtriage
Refinement program	PHENIX 1.20.1_4487	Depositor
R, R_{free}	0.194 , 0.248 0.194 , 0.247	Depositor DCC
R_{free} test set	1527 reflections (4.99%)	wwPDB-VP
Wilson B-factor (Å^2)	34.2	Xtriage
Anisotropy	0.488	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.39 , 42.2	EDS
L-test for twinning[2]	$< |L| > = 0.50, < L^2 > = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o,F_c correlation	0.93	EDS
Total number of atoms	9513	wwPDB-VP
Average B, all atoms (Å^2)	31.0	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 25.28 % 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 3.2664e-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 ⓘ

5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: GOL, CO, AKG

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	0.08	0/2293	0.25	0/3129
1	B	0.08	0/2311	0.26	0/3148
1	C	0.08	0/2288	0.27	0/3117
1	D	0.08	0/2425	0.27	0/3305
All	All	0.08	0/9317	0.26	0/12699

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	A	0	1
1	B	0	1
All	All	0	2

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (2) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	269	ILE	Peptide
1	B	269	ILE	Peptide

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	2238	0	2165	15	0
1	B	2255	0	2208	8	0
1	C	2233	0	2186	12	0
1	D	2368	0	2300	14	0
2	A	1	0	0	0	0
2	B	1	0	0	0	0
2	C	1	0	0	0	0
2	D	1	0	0	0	0
3	A	10	0	4	0	0
3	B	10	0	4	0	0
3	C	10	0	4	0	0
3	D	10	0	4	0	0
4	A	24	0	32	1	0
4	B	30	0	40	0	0
4	C	18	0	24	1	0
4	D	12	0	16	0	0
5	A	61	0	0	0	0
5	B	80	0	0	0	0
5	C	78	0	0	0	0
5	D	72	0	0	1	0
All	All	9513	0	8987	46	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 (46) 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:C:164:PHE:HB2	1:C:196:LEU:H	1.61	0.65
1:C:65:ASN:HD21	1:C:71:MET:HE3	1.62	0.65
1:B:204:MET:HE1	1:B:210:HIS:HB3	1.79	0.64
1:A:14:ARG:NH1	1:A:37:GLU:OE2	2.32	0.62
1:A:164:PHE:HZ	1:A:225:LEU:HB3	1.67	0.59
1:C:20:ASP:HB2	1:D:294:PRO:HG2	1.85	0.58
1:A:164:PHE:HB2	1:A:196:LEU:H	1.69	0.58

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:164:PHE:HZ	1:C:225:LEU:HB3	1.71	0.55
1:A:12:ILE:HG12	1:A:175:LEU:HD21	1.90	0.54
1:D:164:PHE:HB2	1:D:196:LEU:H	1.73	0.54
1:D:14:ARG:NH1	1:D:37:GLU:OE2	2.41	0.54
1:C:91:ARG:HA	1:C:95:LEU:HD12	1.92	0.51
1:B:164:PHE:HB2	1:B:196:LEU:H	1.74	0.51
1:B:164:PHE:HZ	1:B:225:LEU:HB3	1.76	0.50
1:B:40:LEU:HD12	1:B:159:THR:HG21	1.92	0.50
1:D:164:PHE:HZ	1:D:225:LEU:HB3	1.78	0.48
1:A:133:ILE:HG22	1:A:209:LYS:HE3	1.96	0.48
1:B:60:LYS:HE2	1:B:63:GLU:HB2	1.96	0.47
1:C:14:ARG:NH1	1:C:37:GLU:OE2	2.47	0.47
1:D:77:THR:OG1	1:D:128:ASN:OD1	2.32	0.46
1:A:114:TYR:CE2	4:A:403:GOL:H11	2.51	0.46
1:D:245:PRO:HD2	1:D:248:ILE:HD12	1.99	0.44
1:A:156:SER:HB2	1:A:227:LEU:HD11	1.99	0.44
1:B:45:ILE:HD13	1:B:45:ILE:HA	1.89	0.44
1:D:141:PRO:O	1:D:144:GLN:HG2	2.18	0.44
1:D:263:ARG:HG2	1:D:284:GLU:HB3	2.00	0.44
1:A:154:VAL:HG12	1:A:231:GLY:HA3	2.00	0.44
1:A:43:GLU:H	1:A:43:GLU:CD	2.26	0.43
1:D:239:GLU:OE1	5:D:501:HOH:O	2.21	0.43
1:C:90:PHE:HA	1:C:94:ILE:HB	2.00	0.42
1:C:118:ASN:HB3	1:C:229:CYS:HB2	2.02	0.42
1:D:170:ALA:N	1:D:193:ARG:HH21	2.17	0.42
1:C:114:TYR:CE2	4:C:405:GOL:H12	2.54	0.42
1:A:91:ARG:HB2	1:A:252:MET:HE3	2.01	0.42
1:C:69:TYR:HD2	1:C:71:MET:HE2	1.84	0.42
1:C:69:TYR:CD2	1:C:71:MET:HE2	2.54	0.42
1:A:270:SER:HB3	1:D:141:PRO:HB3	2.01	0.41
1:A:236:ALA:HA	1:A:237:PRO:HD3	1.96	0.41
1:B:91:ARG:HB2	1:B:252:MET:HE3	2.03	0.41
1:A:98:ASP:OD1	1:A:98:ASP:N	2.53	0.41
1:D:12:ILE:HG12	1:D:175:LEU:HD21	2.02	0.41
1:D:281:LYS:HD2	1:D:286:GLN:NE2	2.35	0.41
1:A:141:PRO:O	1:A:144:GLN:HG2	2.22	0.41
1:A:270:SER:OG	1:D:138:GLY:O	2.39	0.41
1:B:205:HIS:HB3	1:B:208:THR:OG1	2.21	0.40
1:C:187:LYS:HB2	1:C:190:GLN:HG3	2.03	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	289/315 (92%)	276 (96%)	13 (4%)	0	100	100
1	B	288/315 (91%)	276 (96%)	12 (4%)	0	100	100
1	C	285/315 (90%)	274 (96%)	10 (4%)	1 (0%)	30	53
1	D	303/315 (96%)	288 (95%)	13 (4%)	2 (1%)	19	40
All	All	1165/1260 (92%)	1114 (96%)	48 (4%)	3 (0%)	37	60

All (3) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	270	SER
1	D	268	VAL
1	D	270	SER

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	239/274 (87%)	237 (99%)	2 (1%)	79	91
1	B	244/274 (89%)	243 (100%)	1 (0%)	89	96
1	C	242/274 (88%)	242 (100%)	0	100	100
1	D	256/274 (93%)	251 (98%)	5 (2%)	50	76
All	All	981/1096 (90%)	973 (99%)	8 (1%)	79	91

All (8) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	189	ASP
1	A	270	SER
1	B	17	ARG
1	D	-3	ARG
1	D	3	LEU
1	D	8	MET
1	D	268	VAL
1	D	269	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (8) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	144	GLN
1	B	234	GLN
1	C	11	GLN
1	C	13	GLN
1	C	92	HIS
1	C	144	GLN
1	D	92	HIS
1	D	105	ASN

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 oligosaccharides in this entry.

5.6 Ligand geometry ⓘ

Of 22 ligands modelled in this entry, 4 are monoatomic - leaving 18 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	D	404	-	5,5,5	0.93	0	5,5,5	0.98	0
4	GOL	A	404	-	5,5,5	0.90	0	5,5,5	0.99	0
4	GOL	C	404	-	5,5,5	0.89	0	5,5,5	0.97	0
3	AKG	B	402	2	9,9,9	0.21	0	11,11,11	0.41	0
4	GOL	B	406	-	5,5,5	0.89	0	5,5,5	0.97	0
4	GOL	D	403	-	5,5,5	0.92	0	5,5,5	1.02	0
4	GOL	B	405	-	5,5,5	0.88	0	5,5,5	1.01	0
4	GOL	C	403	-	5,5,5	0.92	0	5,5,5	1.00	0
3	AKG	D	402	2	9,9,9	0.21	0	11,11,11	0.42	0
4	GOL	A	403	-	5,5,5	0.92	0	5,5,5	0.99	0
3	AKG	A	402	2	9,9,9	0.18	0	11,11,11	0.42	0
4	GOL	A	406	-	5,5,5	0.86	0	5,5,5	1.02	0
4	GOL	B	407	-	5,5,5	0.90	0	5,5,5	1.00	0
3	AKG	C	402	2	9,9,9	0.21	0	11,11,11	0.41	0
4	GOL	C	405	-	5,5,5	0.87	0	5,5,5	1.00	0
4	GOL	A	405	-	5,5,5	0.84	0	5,5,5	1.00	0
4	GOL	B	403	-	5,5,5	0.90	0	5,5,5	0.99	0
4	GOL	B	404	-	5,5,5	0.92	0	5,5,5	0.98	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
4	GOL	D	404	-	-	0/4/4/4	-
4	GOL	A	404	-	-	2/4/4/4	-
4	GOL	C	404	-	-	0/4/4/4	-
3	AKG	B	402	2	-	2/9/9/9	-
4	GOL	B	406	-	-	3/4/4/4	-
4	GOL	D	403	-	-	0/4/4/4	-
4	GOL	B	405	-	-	2/4/4/4	-
4	GOL	C	403	-	-	0/4/4/4	-
3	AKG	D	402	2	-	3/9/9/9	-
4	GOL	A	403	-	-	0/4/4/4	-
3	AKG	A	402	2	-	0/9/9/9	-
4	GOL	A	406	-	-	0/4/4/4	-

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
4	GOL	B	407	-	-	0/4/4/4	-
3	AKG	C	402	2	-	3/9/9/9	-
4	GOL	C	405	-	-	3/4/4/4	-
4	GOL	A	405	-	-	2/4/4/4	-
4	GOL	B	403	-	-	0/4/4/4	-
4	GOL	B	404	-	-	2/4/4/4	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (22) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	B	402	AKG	O2-C1-C2-C3
3	C	402	AKG	O2-C1-C2-C3
3	D	402	AKG	O2-C1-C2-C3
4	A	404	GOL	O1-C1-C2-C3
4	A	405	GOL	O1-C1-C2-C3
4	B	405	GOL	O1-C1-C2-O2
4	B	405	GOL	O1-C1-C2-C3
4	A	404	GOL	O1-C1-C2-O2
4	B	404	GOL	C1-C2-C3-O3
4	B	406	GOL	O1-C1-C2-C3
4	C	405	GOL	O1-C1-C2-C3
4	A	405	GOL	O1-C1-C2-O2
4	B	404	GOL	O2-C2-C3-O3
4	B	406	GOL	O1-C1-C2-O2
3	D	402	AKG	C3-C4-C5-O3
4	C	405	GOL	O1-C1-C2-O2
3	C	402	AKG	C3-C4-C5-O3
3	C	402	AKG	C3-C4-C5-O4
3	D	402	AKG	C3-C4-C5-O4
4	B	406	GOL	C1-C2-C3-O3
4	C	405	GOL	C1-C2-C3-O3
3	B	402	AKG	C3-C4-C5-O3

There are no ring outliers.

2 monomers are involved in 2 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	403	GOL	1	0
4	C	405	GOL	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 AKG B 402

Bond lengths

Bond angles

Torsions

Rings

Ligand AKG D 402

Bond lengths

Bond angles

Torsions

Rings

Ligand AKG A 402

Bond lengths

Bond angles

Torsions

Rings

Ligand AKG C 402
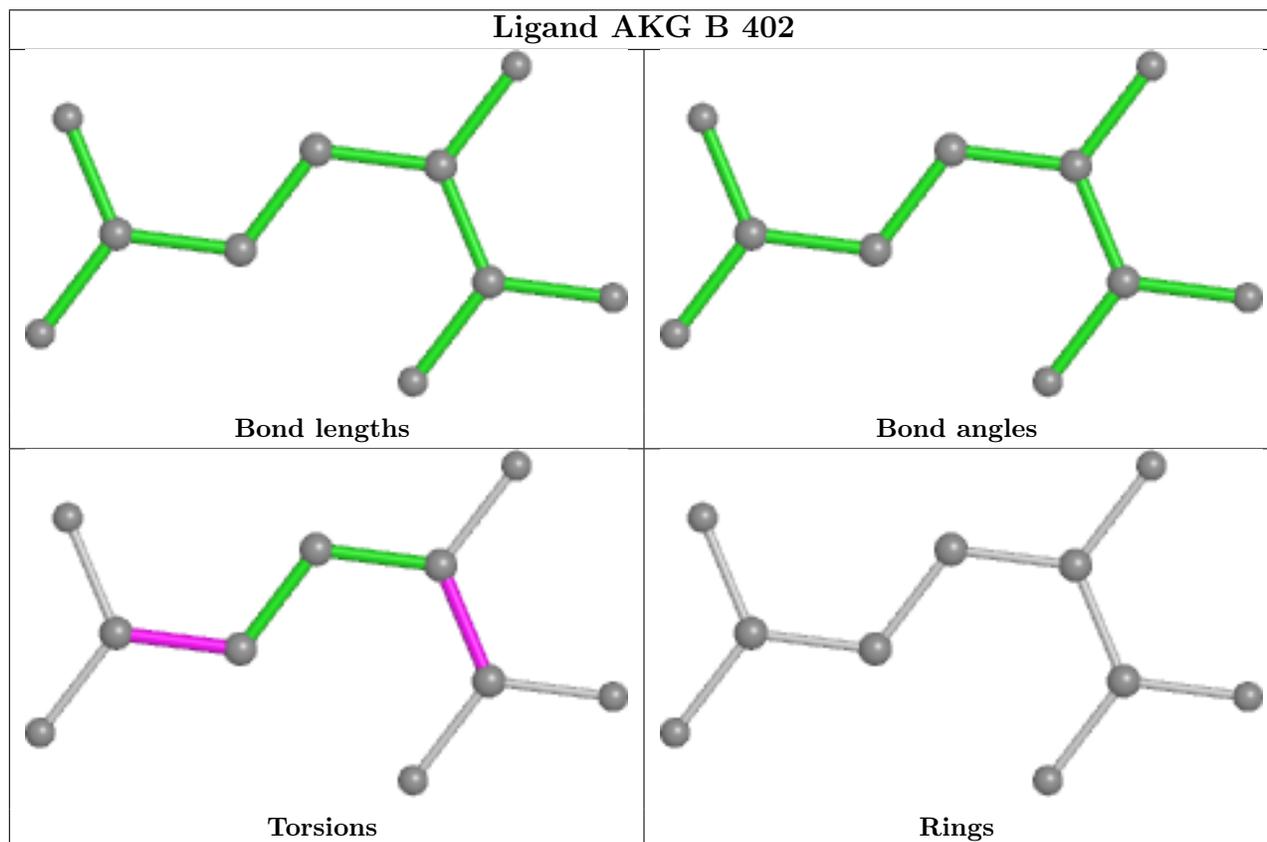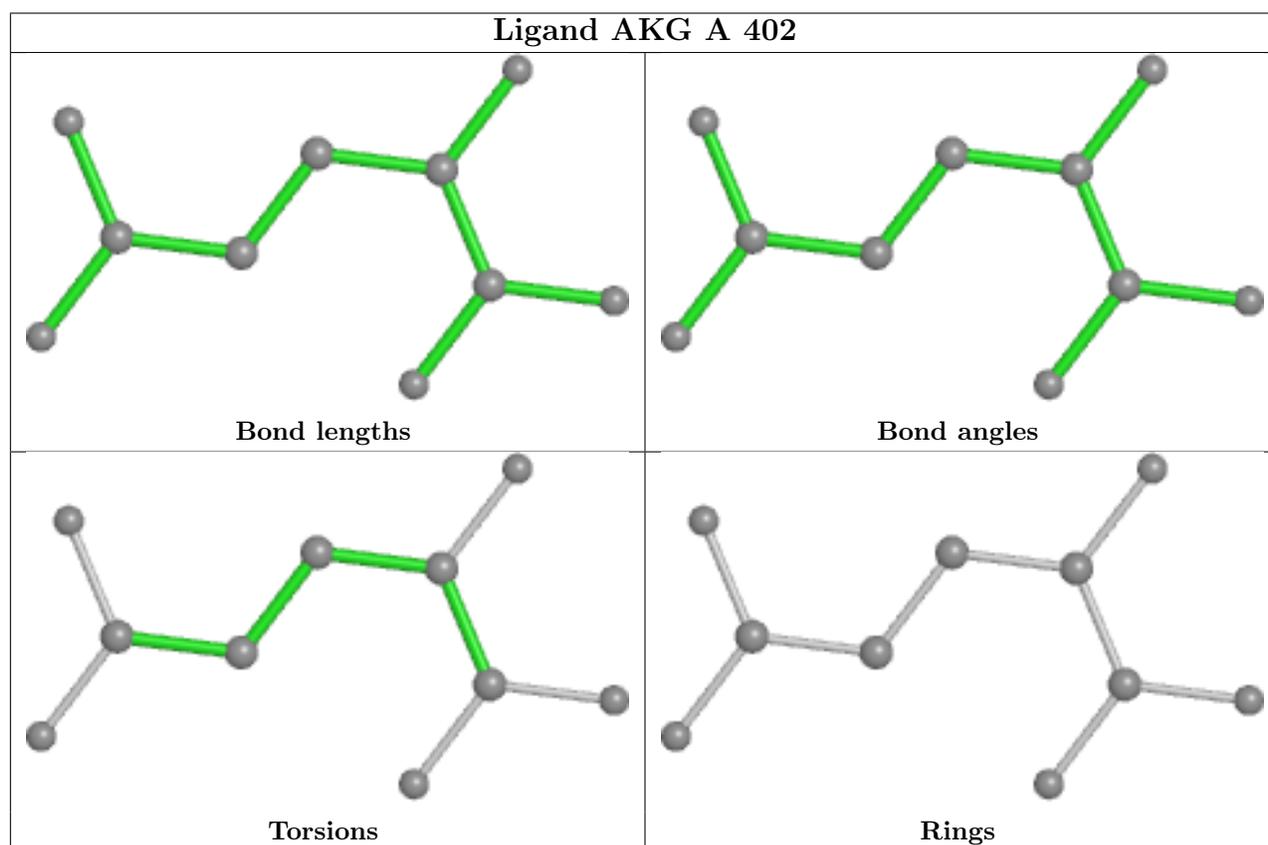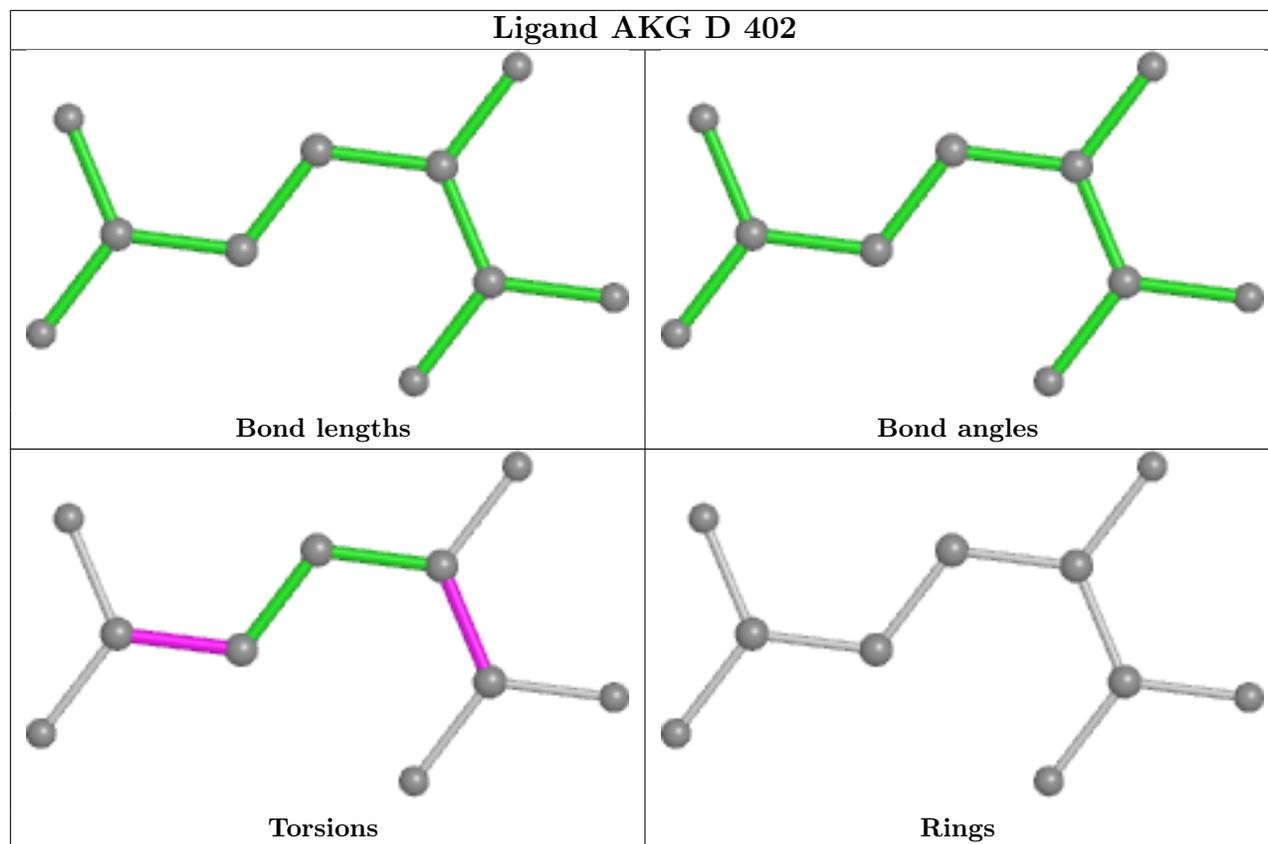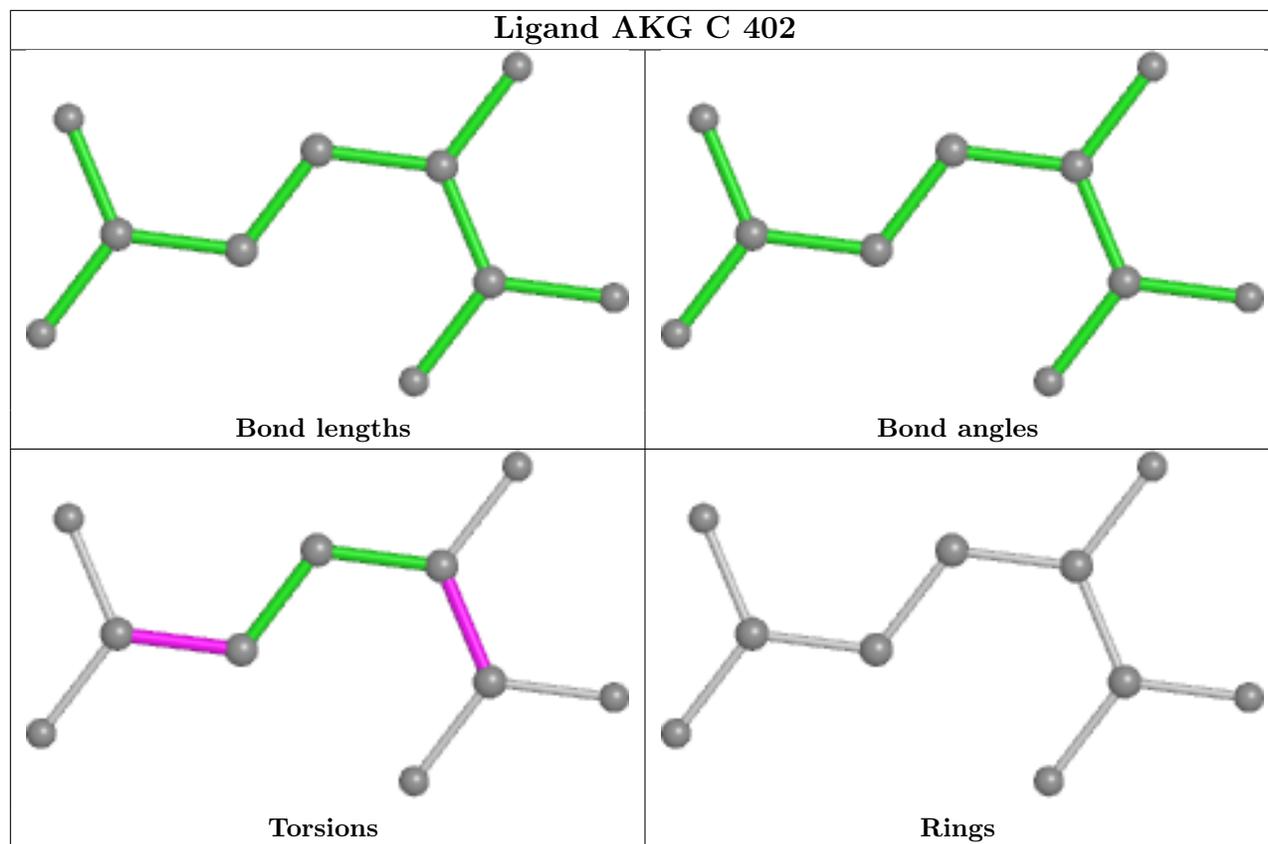
5.7 Other polymers ⓘ

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	291/315 (92%)	-0.12	6 (2%)	63	63	23, 34, 49, 70	0
1	B	290/315 (92%)	-0.21	7 (2%)	59	59	22, 30, 40, 67	0
1	C	287/315 (91%)	-0.32	4 (1%)	73	73	21, 29, 41, 58	0
1	D	305/315 (96%)	-0.24	4 (1%)	74	75	22, 29, 52, 75	0
All	All	1173/1260 (93%)	-0.22	21 (1%)	67	67	21, 30, 48, 75	0

All (21) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	269	ILE	4.7
1	D	269	ILE	4.4
1	A	297	VAL	4.0
1	C	188	ASP	3.3
1	B	218	ASP	3.0
1	A	188	ASP	2.8
1	B	270	SER	2.8
1	A	299	GLY	2.7
1	B	189	ASP	2.7
1	D	8	MET	2.6
1	B	269	ILE	2.6
1	A	270	SER	2.6
1	B	188	ASP	2.5
1	D	-5	GLY	2.5
1	B	296	ASN	2.5
1	B	297	VAL	2.2
1	A	218	ASP	2.2
1	C	189	ASP	2.2
1	D	-2	GLY	2.2
1	C	270	SER	2.1
1	C	296	ASN	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 oligosaccharides 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
4	GOL	A	404	6/6	0.76	0.18	41,45,50,50	0
4	GOL	B	405	6/6	0.76	0.19	33,40,45,58	0
4	GOL	D	404	6/6	0.78	0.18	26,32,35,36	0
4	GOL	A	406	6/6	0.79	0.13	35,38,43,46	0
4	GOL	C	405	6/6	0.81	0.14	31,38,38,40	0
4	GOL	D	403	6/6	0.82	0.15	32,33,37,40	0
4	GOL	A	403	6/6	0.82	0.14	27,31,34,39	0
4	GOL	C	404	6/6	0.83	0.16	29,30,33,38	0
4	GOL	B	407	6/6	0.84	0.11	36,43,48,49	0
4	GOL	B	403	6/6	0.85	0.12	28,29,36,38	0
4	GOL	B	404	6/6	0.86	0.17	25,30,35,37	0
4	GOL	B	406	6/6	0.87	0.11	30,31,35,36	0
4	GOL	A	405	6/6	0.87	0.16	29,32,36,37	0
4	GOL	C	403	6/6	0.88	0.13	24,27,28,32	0
3	AKG	A	402	10/10	0.95	0.07	32,34,37,37	0
3	AKG	B	402	10/10	0.95	0.07	23,26,28,30	0
3	AKG	C	402	10/10	0.96	0.07	27,29,31,32	0
3	AKG	D	402	10/10	0.96	0.06	24,26,29,30	0
2	CO	A	401	1/1	0.99	0.02	33,33,33,33	0
2	CO	B	401	1/1	0.99	0.02	28,28,28,28	0
2	CO	C	401	1/1	1.00	0.02	22,22,22,22	0
2	CO	D	401	1/1	1.00	0.02	22,22,22,22	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 AKG A 402:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
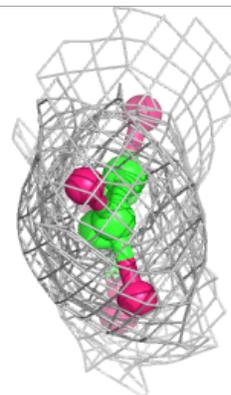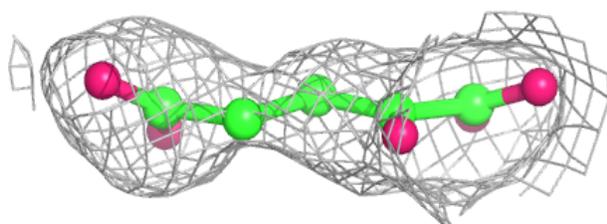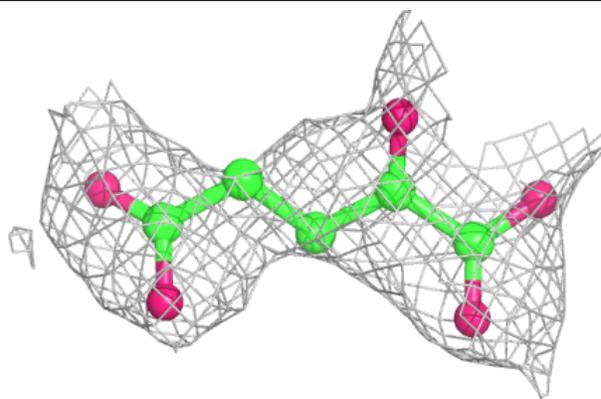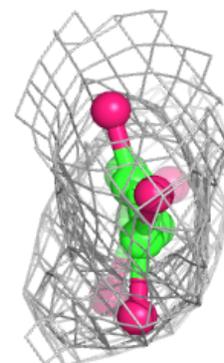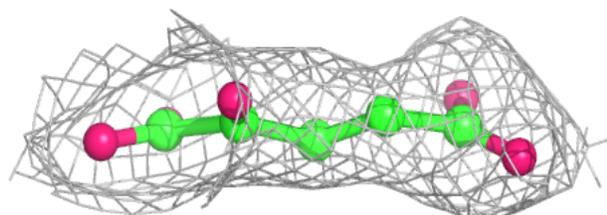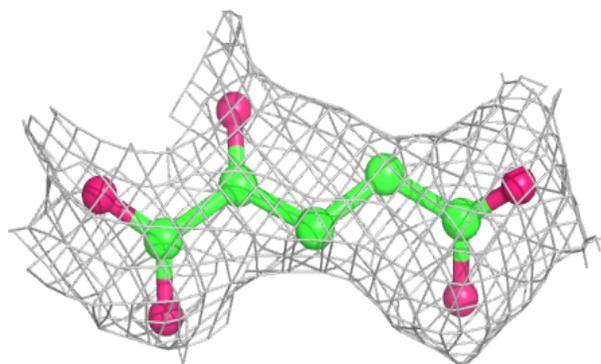mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)
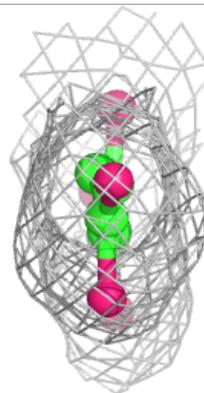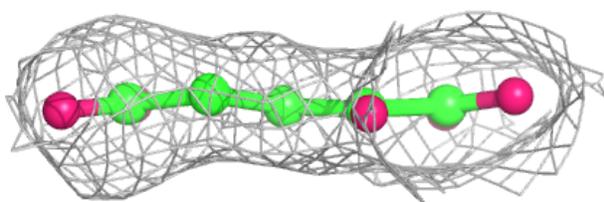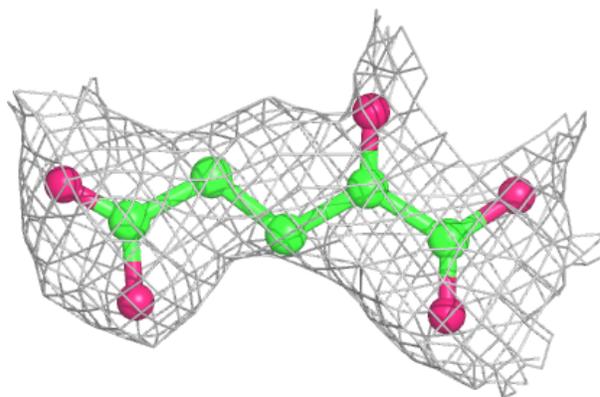
Electron density around AKG B 402:

$2mF_o$-DF_c (at 0.7 rmsd) in gray
mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)
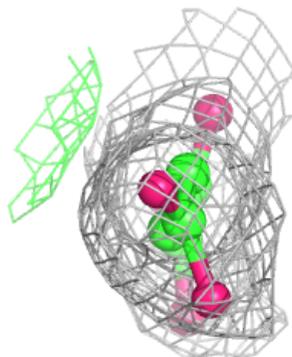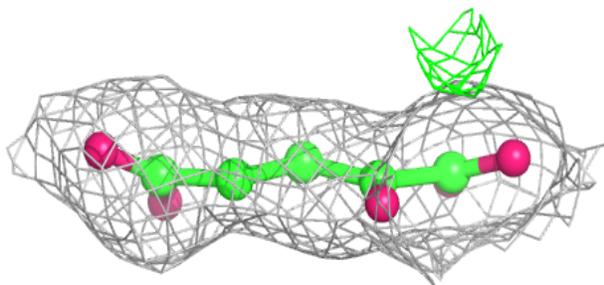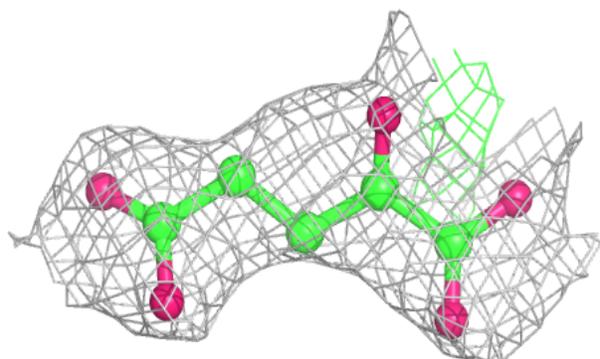
Electron density around AKG C 402:

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

Electron density around AKG D 402:

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

6.5 Other polymers ⓘ

There are no such residues in this entry.