



Full wwPDB X-ray Structure Validation Report ⓘ

Jun 12, 2024 – 11:05 am BST

PDB ID : 9F99
Title : Crystal structure of MUS81-EME1 bound by compound 10.
Authors : Collie, G.W.
Deposited on : 2024-05-07
Resolution : 2.80 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 types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

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

MolProbity : 4.02b-467
Mogul : 1.8.4, CSD as541be (2020)
Xtriage (Phenix) : 1.13
EDS : 2.36.2
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) : 2.36.2

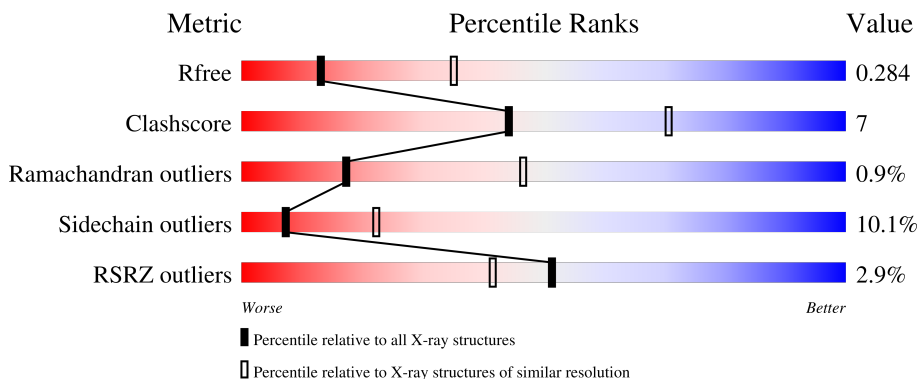
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.80 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	3140 (2.80-2.80)
Clashscore	141614	3569 (2.80-2.80)
Ramachandran outliers	138981	3498 (2.80-2.80)
Sidechain outliers	138945	3500 (2.80-2.80)
RSRZ outliers	127900	3078 (2.80-2.80)

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 $\leq 5\%$. 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	308	 2% 50% 9% 40%
1	C	308	 46% 13% 40%
1	E	308	 2% 44% 14% 40%
1	G	308	 3% 46% 13% 40%
2	B	326	 2% 36% 7% 57%

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Mol	Chain	Length	Quality of chain
2	D	326	
2	F	326	
2	H	326	

2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 10145 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 Crossover junction endonuclease MUS81.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	185	1465	928	266	267	4	0	0	0
1	C	186	1467	928	267	268	4	0	0	0
1	E	187	1474	933	268	269	4	0	0	0
1	G	187	1469	931	264	270	4	0	0	0

There are 8 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	244	GLY	-	expression tag	UNP Q96NY9
A	245	SER	-	expression tag	UNP Q96NY9
C	244	GLY	-	expression tag	UNP Q96NY9
C	245	SER	-	expression tag	UNP Q96NY9
E	244	GLY	-	expression tag	UNP Q96NY9
E	245	SER	-	expression tag	UNP Q96NY9
G	244	GLY	-	expression tag	UNP Q96NY9
G	245	SER	-	expression tag	UNP Q96NY9

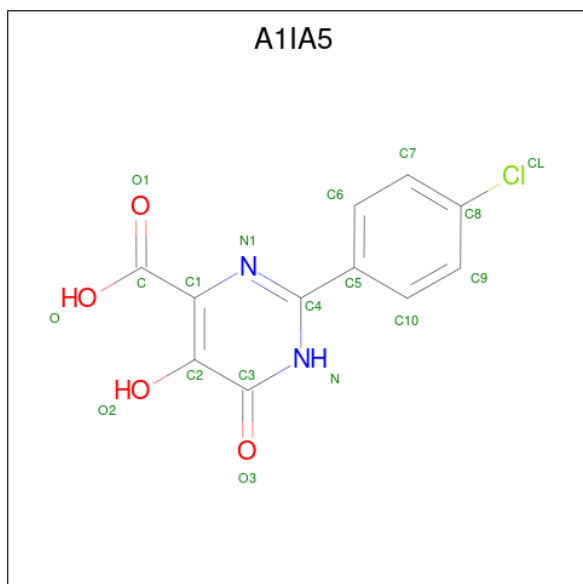
- Molecule 2 is a protein called Crossover junction endonuclease EME1.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	139	1048	666	173	201	8	0	0	0
2	D	139	1048	666	173	201	8	0	0	0
2	F	139	1050	666	175	201	8	0	0	0
2	H	139	1044	663	172	201	8	0	0	0

There are 4 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	245	GLY	-	expression tag	UNP Q96AY2
D	245	GLY	-	expression tag	UNP Q96AY2
F	245	GLY	-	expression tag	UNP Q96AY2
H	245	GLY	-	expression tag	UNP Q96AY2

- Molecule 3 is 2-(4-chlorophenyl)-5-oxidanyl-6-oxidanylidene-1H-pyrimidine-4-carboxylic acid (three-letter code: A1IA5) (formula: $C_{11}H_7ClN_2O_4$) (labeled as "Ligand of Interest" by depositor).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	
			Total	C	Cl	N			O
3	A	1	Total	C	Cl	N	O	0	0
			18	11	1	2	4		
3	C	1	Total	C	Cl	N	O	0	0
			18	11	1	2	4		
3	E	1	Total	C	Cl	N	O	0	0
			18	11	1	2	4		
3	G	1	Total	C	Cl	N	O	0	0
			18	11	1	2	4		

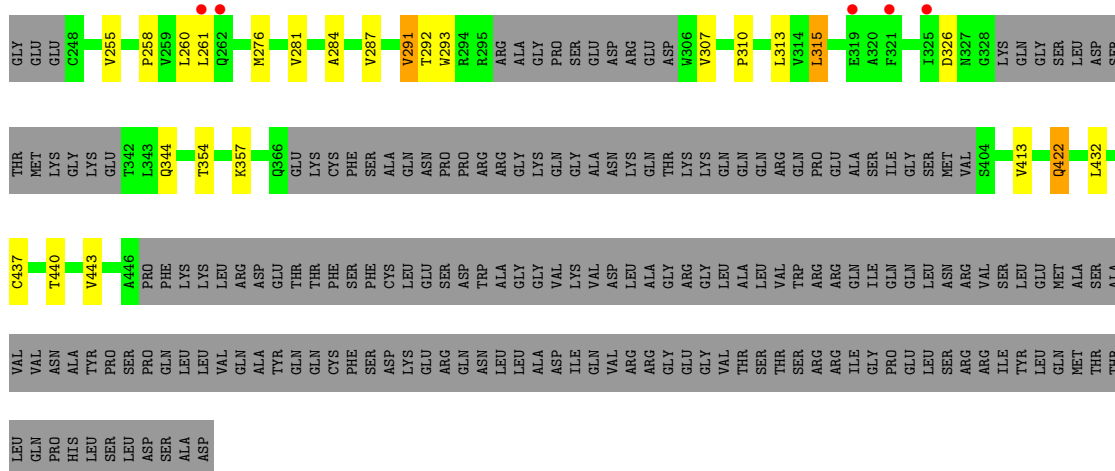
- Molecule 4 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	Mg		
4	A	2	Total	Mg	0	0
			2	2		
4	C	2	Total	Mg	0	0
			2	2		

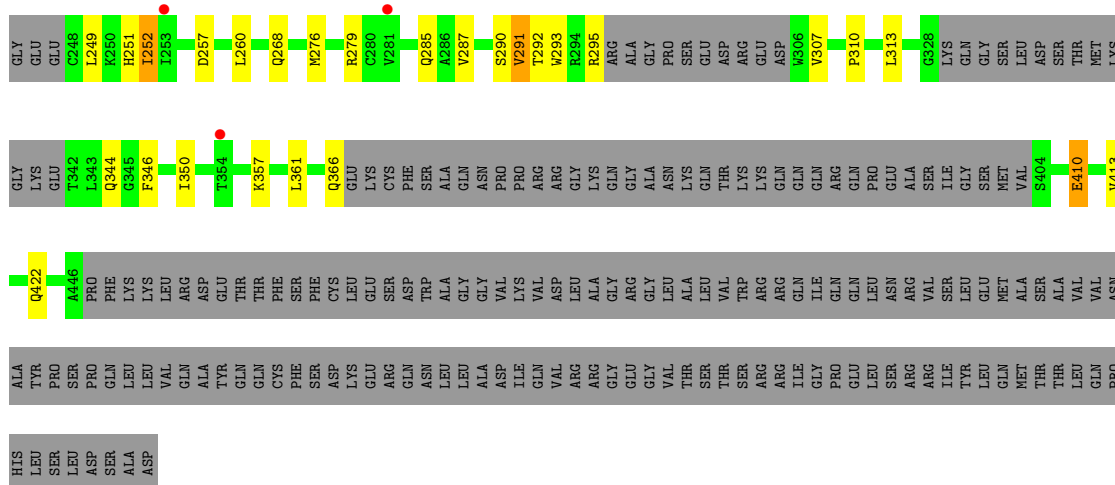
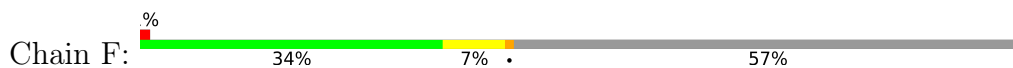
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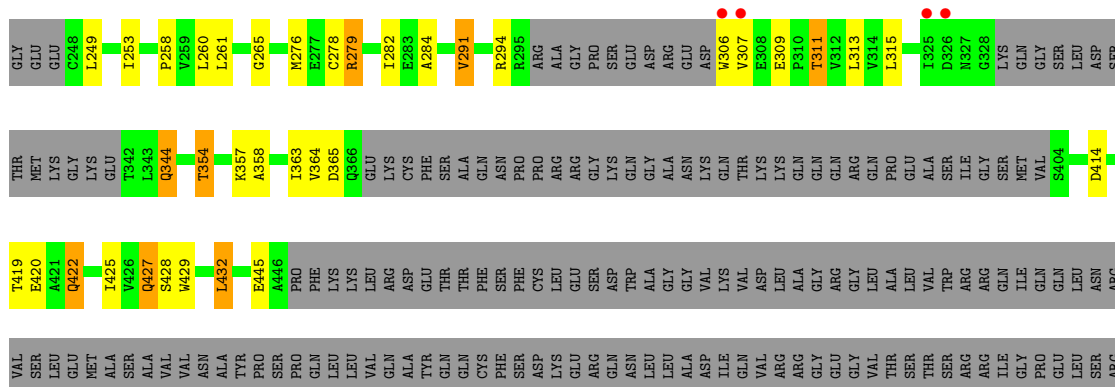
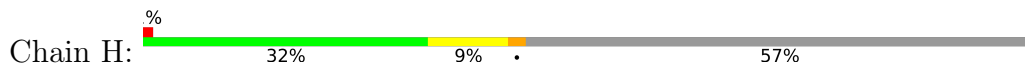
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	E	2	Total 2	Mg 2	0	0
4	G	2	Total 2	Mg 2	0	0



• Molecule 2: Crossover junction endonuclease EME1



• Molecule 2: Crossover junction endonuclease EME1



ARG
ILE
TYR
LEU
GLN
MET
THR
THR
LEU
GLN
PRO
HIS
LEU
SER
LEU
ASP
SER
ALA
ASP

4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	111.35Å 125.10Å 218.00Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	38.95 – 2.80 38.95 – 2.80	Depositor EDS
% Data completeness (in resolution range)	51.1 (38.95-2.80) 51.2 (38.95-2.80)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.66 (at 2.81Å)	Xtrriage
Refinement program	BUSTER 2.11.8	Depositor
R, R_{free}	0.240 , 0.280 0.240 , 0.284	Depositor DCC
R_{free} test set	1932 reflections (5.01%)	wwPDB-VP
Wilson B-factor (Å ²)	78.0	Xtrriage
Anisotropy	0.111	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.30 , 43.6	EDS
L-test for twinning ²	$\langle L \rangle = 0.46$, $\langle L^2 \rangle = 0.29$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.90	EDS
Total number of atoms	10145	wwPDB-VP
Average B, all atoms (Å ²)	84.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.78% 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: A1IA5, MG

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	0.38	0/1493	0.62	1/2022 (0.0%)
1	C	0.40	0/1495	0.63	0/2027
1	E	0.36	0/1503	0.60	0/2039
1	G	0.36	0/1498	0.57	0/2033
2	B	0.31	0/1059	0.50	0/1439
2	D	0.33	0/1059	0.53	0/1439
2	F	0.32	0/1061	0.50	0/1442
2	H	0.32	0/1055	0.48	0/1435
All	All	0.35	0/10223	0.57	1/13876 (0.0%)

There are no bond length outliers.

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	369	GLU	C-N-CA	5.35	135.09	121.70

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	1465	0	1459	15	0
1	C	1467	0	1455	20	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	E	1474	0	1462	30	0
1	G	1469	0	1451	26	0
2	B	1048	0	1055	9	0
2	D	1048	0	1055	15	0
2	F	1050	0	1055	10	0
2	H	1044	0	1044	16	0
3	A	18	0	0	0	0
3	C	18	0	0	0	0
3	E	18	0	0	0	0
3	G	18	0	0	0	0
4	A	2	0	0	0	0
4	C	2	0	0	0	0
4	E	2	0	0	0	0
4	G	2	0	0	0	0
All	All	10145	0	10036	133	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 7.

All (133) 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:335:LYS:NZ	1:A:352:GLN:HE22	1.58	1.00
1:A:335:LYS:HZ1	1:A:352:GLN:HE22	1.02	0.96
1:E:431:ARG:HD3	1:E:435:THR:HA	1.56	0.86
1:A:335:LYS:HZ1	1:A:352:GLN:NE2	1.71	0.86
2:D:258:PRO:HD2	2:D:284:ALA:HA	1.60	0.83
1:G:304:HIS:CD2	1:G:305:VAL:HG12	2.18	0.78
1:A:335:LYS:NZ	1:A:352:GLN:NE2	2.30	0.75
1:G:304:HIS:NE2	1:G:305:VAL:HG12	2.01	0.74
1:G:308:PHE:HB2	1:G:332:VAL:HB	1.68	0.74
2:B:291:VAL:HG13	2:B:313:LEU:HB3	1.69	0.73
1:E:304:HIS:CD2	1:E:305:VAL:HG12	2.26	0.70
2:H:291:VAL:HG13	2:H:313:LEU:HB3	1.73	0.69
1:G:335:LYS:NZ	1:G:352:GLN:NE2	2.43	0.67
2:H:249:LEU:HD22	2:H:278:CYS:HB3	1.77	0.67
2:D:292:THR:HG22	2:D:293:TRP:H	1.60	0.67
2:B:252:ILE:HG13	2:B:295:ARG:HG2	1.78	0.65
1:E:369:GLU:HA	1:E:402:THR:HG23	1.79	0.64
2:F:291:VAL:HG13	2:F:313:LEU:HB3	1.79	0.64
1:G:335:LYS:NZ	1:G:352:GLN:HE22	1.95	0.64

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:282:GLY:HA2	1:G:362:GLU:HG2	1.79	0.63
1:E:335:LYS:NZ	1:E:352:GLN:HE22	1.97	0.63
1:G:335:LYS:HZ1	1:G:352:GLN:NE2	1.97	0.62
1:E:348:ARG:O	1:E:352:GLN:HG3	2.00	0.61
2:D:310:PRO:HA	2:D:357:LYS:HG2	1.82	0.61
1:E:308:PHE:HB2	1:E:332:VAL:HB	1.81	0.61
2:D:292:THR:HG21	2:D:357:LYS:NZ	2.17	0.60
1:E:335:LYS:NZ	1:E:352:GLN:NE2	2.50	0.60
1:G:369:GLU:HA	1:G:402:THR:HG23	1.83	0.60
1:C:333:GLU:HB2	1:C:356:LEU:HD21	1.84	0.60
2:D:315:LEU:HD11	2:D:432:LEU:HD21	1.84	0.59
1:G:335:LYS:HZ1	1:G:352:GLN:HE22	1.50	0.59
2:F:310:PRO:HA	2:F:357:LYS:HD3	1.84	0.59
1:C:332:VAL:HG22	1:C:365:VAL:HB	1.84	0.58
1:E:269:VAL:HG13	1:E:420:GLN:HG2	1.85	0.57
2:B:261:LEU:HD11	2:B:282:ILE:HD12	1.86	0.57
1:A:297:THR:H	1:C:316:ASN:HD21	1.52	0.57
1:A:341:CYS:O	1:A:345:ILE:HG12	2.04	0.57
1:E:335:LYS:HZ3	1:E:352:GLN:NE2	2.03	0.56
1:E:327:VAL:HG11	1:E:459:PHE:HB2	1.88	0.56
1:E:414:LEU:HB3	2:F:413:VAL:HG21	1.87	0.56
1:C:422:LEU:HD13	1:C:449:PRO:HB3	1.88	0.56
1:A:364:ARG:NH1	1:A:395:ASP:O	2.39	0.56
1:E:400:LYS:HG3	1:E:411:TYR:CE1	2.41	0.56
2:H:294:ARG:HG2	2:H:306:TRP:HB3	1.88	0.55
2:B:260:LEU:HB2	2:B:289:CYS:HA	1.88	0.55
2:D:258:PRO:CD	2:D:284:ALA:HA	2.33	0.55
1:G:354:PHE:HE2	1:G:355:ARG:NH2	2.05	0.54
2:B:263:MET:HE3	2:B:317:ARG:HG2	1.90	0.54
1:C:333:GLU:CB	1:C:356:LEU:HD21	2.38	0.54
2:H:260:LEU:HD11	2:H:315:LEU:HD13	1.90	0.53
1:A:283:HIS:HE1	1:G:329:ASP:OD1	1.91	0.52
2:F:252:ILE:HG13	2:F:295:ARG:HG2	1.91	0.52
2:D:354:THR:HG23	2:D:357:LYS:H	1.75	0.52
1:G:354:PHE:HE2	1:G:355:ARG:HH21	1.58	0.52
1:C:335:LYS:HG3	1:C:366:TYR:OH	2.09	0.52
1:G:405:ILE:HD12	1:G:405:ILE:H	1.74	0.52
1:E:317:PRO:HG3	1:E:323:PRO:HB3	1.92	0.51
1:G:450:LEU:HD23	1:G:453:LEU:HD23	1.91	0.51
1:G:428:LEU:HD12	1:G:451:CYS:HA	1.93	0.50
1:E:281:GLY:O	1:E:282:GLY:O	2.29	0.50

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:414:LEU:HB3	2:D:413:VAL:HG21	1.93	0.50
2:H:261:LEU:HD11	2:H:282:ILE:HD12	1.94	0.49
2:H:258:PRO:HD2	2:H:284:ALA:HA	1.94	0.49
1:C:331:ILE:HB	1:C:361:LEU:HD23	1.94	0.49
1:G:262:LEU:HD22	1:G:267:TYR:HB3	1.95	0.49
1:A:348:ARG:O	1:A:352:GLN:HG3	2.13	0.49
1:E:422:LEU:HD22	1:E:449:PRO:HB3	1.94	0.49
1:C:287:LEU:HD12	1:C:409:ALA:HB2	1.94	0.48
1:E:335:LYS:HG3	1:E:366:TYR:OH	2.14	0.48
1:E:400:LYS:HG3	1:E:411:TYR:CZ	2.49	0.48
2:H:311:THR:HG23	2:H:358:ALA:HB3	1.95	0.48
1:E:271:LEU:HD13	1:E:310:TRP:CE2	2.48	0.48
1:G:369:GLU:O	1:G:370:GLU:HB2	2.13	0.48
1:C:379:LEU:HG	1:C:380:PRO:HD2	1.94	0.47
1:G:400:LYS:HG3	1:G:411:TYR:CE1	2.49	0.47
2:D:276:MET:HE1	2:D:437:CYS:HA	1.96	0.47
1:E:262:LEU:HB2	1:E:428:LEU:HB2	1.96	0.47
2:D:292:THR:HG21	2:D:357:LYS:HZ3	1.78	0.47
2:F:346:PHE:O	2:F:350:ILE:HG13	2.15	0.47
1:G:335:LYS:HZ3	1:G:352:GLN:NE2	2.13	0.47
1:C:283:HIS:HD2	1:E:436:PRO:HD2	1.79	0.47
1:G:269:VAL:HG13	1:G:420:GLN:HG2	1.96	0.47
1:G:328:LEU:HD23	1:G:419:LEU:HD22	1.97	0.47
2:H:365:ASP:HB3	2:H:427:GLN:HG3	1.97	0.47
1:G:354:PHE:CE2	1:G:355:ARG:NH2	2.83	0.46
1:C:269:VAL:HG13	1:C:420:GLN:HG2	1.97	0.46
1:C:308:PHE:HB2	1:C:332:VAL:HB	1.98	0.46
2:H:363:ILE:HB	2:H:425:ILE:HG12	1.97	0.46
1:A:305:VAL:HG11	1:A:359:CYS:HB2	1.97	0.46
1:C:341:CYS:O	1:C:345:ILE:HG12	2.16	0.46
2:H:315:LEU:HD21	2:H:432:LEU:HD21	1.98	0.46
1:A:345:ILE:HD11	1:A:379:LEU:HD13	1.98	0.45
1:E:304:HIS:NE2	1:E:305:VAL:HG12	2.30	0.45
1:E:271:LEU:HD11	1:E:308:PHE:HB3	1.97	0.45
2:B:310:PRO:HA	2:B:357:LYS:HG2	1.97	0.45
2:H:344:GLN:HE21	2:H:419:THR:HG23	1.83	0.44
1:E:367:LEU:HD21	1:E:408:SER:HB3	1.99	0.44
1:C:283:HIS:CD2	1:E:436:PRO:HD2	2.52	0.44
2:H:422:GLN:HE21	2:H:422:GLN:HB2	1.66	0.44
1:E:352:GLN:O	1:E:356:LEU:HB2	2.18	0.44
2:H:265:GLY:HA3	2:H:429:TRP:CD2	2.53	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:313:LEU:HD11	2:B:435:PHE:HE2	1.82	0.44
1:C:299:THR:HG21	1:C:301:ARG:HE	1.83	0.44
2:F:292:THR:HG22	2:F:293:TRP:H	1.83	0.44
1:E:305:VAL:HG11	1:E:359:CYS:HB2	2.00	0.44
1:A:423:TYR:CZ	1:A:449:PRO:HB2	2.53	0.43
2:H:354:THR:HG23	2:H:357:LYS:HB2	2.01	0.43
1:E:336:ARG:HG2	1:E:369:GLU:HB3	2.00	0.43
2:F:292:THR:HG21	2:F:357:LYS:HZ3	1.84	0.43
2:H:354:THR:CG2	2:H:357:LYS:HB2	2.49	0.42
1:G:271:LEU:HD13	1:G:310:TRP:NE1	2.33	0.42
2:D:440:THR:HA	2:D:443:VAL:HG22	2.01	0.42
2:D:291:VAL:HG13	2:D:313:LEU:HB3	2.01	0.42
1:E:417:ARG:NH2	2:F:410:GLU:OE2	2.53	0.42
1:C:271:LEU:O	1:C:298:HIS:HA	2.20	0.41
2:D:422:GLN:HE21	2:D:422:GLN:HB2	1.69	0.41
2:F:257:ASP:O	2:F:260:LEU:HB2	2.21	0.41
1:G:357:LYS:HA	1:G:364:ARG:HE	1.85	0.41
1:E:263:ARG:HA	1:E:427:THR:HG23	2.02	0.41
2:D:310:PRO:CA	2:D:357:LYS:HG2	2.48	0.41
2:B:322:VAL:O	2:B:325:ILE:HG13	2.21	0.41
1:E:337:LEU:HD12	1:E:384:LEU:HG	2.01	0.41
1:A:332:VAL:HG22	1:A:365:VAL:HB	2.03	0.41
1:C:405:ILE:HA	1:C:408:SER:HB2	2.03	0.41
1:C:400:LYS:HG3	1:C:411:TYR:CZ	2.56	0.41
1:C:422:LEU:HD22	1:C:449:PRO:HG3	2.03	0.41
1:G:267:TYR:HA	1:G:314:GLU:HA	2.01	0.41
1:A:335:LYS:HG3	1:A:366:TYR:OH	2.20	0.40
2:D:255:VAL:HG13	2:D:281:VAL:HG23	2.03	0.40
2:B:261:LEU:CD1	2:B:282:ILE:HD12	2.51	0.40
1:G:273:VAL:HG22	1:G:308:PHE:HE1	1.86	0.40
2:F:257:ASP:HB2	2:F:285:GLN:HB2	2.04	0.40
2:H:253:ILE:HG23	2:H:279:ARG:HB3	2.03	0.40

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	179/308 (58%)	172 (96%)	6 (3%)	1 (1%)	25	56
1	C	180/308 (58%)	172 (96%)	7 (4%)	1 (1%)	25	56
1	E	181/308 (59%)	176 (97%)	3 (2%)	2 (1%)	14	41
1	G	181/308 (59%)	170 (94%)	9 (5%)	2 (1%)	14	41
2	B	131/326 (40%)	127 (97%)	2 (2%)	2 (2%)	10	33
2	D	131/326 (40%)	120 (92%)	10 (8%)	1 (1%)	19	49
2	F	131/326 (40%)	122 (93%)	8 (6%)	1 (1%)	19	49
2	H	131/326 (40%)	122 (93%)	8 (6%)	1 (1%)	19	49
All	All	1245/2536 (49%)	1181 (95%)	53 (4%)	11 (1%)	17	46

All (11) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	432	PRO
2	D	307	VAL
1	E	282	GLY
1	E	432	PRO
1	G	282	GLY
1	A	432	PRO
2	B	307	VAL
2	F	307	VAL
2	B	355	ALA
1	G	432	PRO
2	H	307	VAL

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	158/260 (61%)	147 (93%)	11 (7%)	15	40

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	C	158/260 (61%)	138 (87%)	20 (13%)	4	14
1	E	159/260 (61%)	142 (89%)	17 (11%)	6	20
1	G	158/260 (61%)	141 (89%)	17 (11%)	6	19
2	B	113/275 (41%)	106 (94%)	7 (6%)	18	47
2	D	113/275 (41%)	105 (93%)	8 (7%)	14	39
2	F	113/275 (41%)	99 (88%)	14 (12%)	4	14
2	H	112/275 (41%)	97 (87%)	15 (13%)	4	12
All	All	1084/2140 (51%)	975 (90%)	109 (10%)	7	22

All (109) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	275	ILE
1	A	279	ARG
1	A	288	LEU
1	A	337	LEU
1	A	362	GLU
1	A	370	GLU
1	A	379	LEU
1	A	381	GLU
1	A	384	LEU
1	A	422	LEU
1	A	424	GLN
2	B	262	GLN
2	B	285	GLN
2	B	291	VAL
2	B	344	GLN
2	B	354	THR
2	B	422	GLN
2	B	424	GLN
1	C	269	VAL
1	C	275	ILE
1	C	279	ARG
1	C	299	THR
1	C	300	VAL
1	C	304	HIS
1	C	315	THR
1	C	335	LYS
1	C	361	LEU
1	C	362	GLU

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Mol	Chain	Res	Type
1	C	384	LEU
1	C	402	THR
1	C	408	SER
1	C	415	LEU
1	C	417	ARG
1	C	421	ARG
1	C	422	LEU
1	C	426	HIS
1	C	429	ARG
1	C	455	THR
2	D	260	LEU
2	D	261	LEU
2	D	287	VAL
2	D	291	VAL
2	D	315	LEU
2	D	326	ASP
2	D	344	GLN
2	D	422	GLN
1	E	275	ILE
1	E	287	LEU
1	E	292	GLN
1	E	294	LEU
1	E	299	THR
1	E	304	HIS
1	E	316	ASN
1	E	337	LEU
1	E	356	LEU
1	E	364	ARG
1	E	366	TYR
1	E	379	LEU
1	E	384	LEU
1	E	400	LYS
1	E	421	ARG
1	E	422	LEU
1	E	454	LEU
2	F	249	LEU
2	F	251	HIS
2	F	252	ILE
2	F	268	GLN
2	F	276	MET
2	F	279	ARG
2	F	287	VAL

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Mol	Chain	Res	Type
2	F	290	SER
2	F	291	VAL
2	F	344	GLN
2	F	361	LEU
2	F	366	GLN
2	F	410	GLU
2	F	422	GLN
1	G	260	LEU
1	G	269	VAL
1	G	290	GLU
1	G	304	HIS
1	G	338	ASP
1	G	358	ARG
1	G	362	GLU
1	G	364	ARG
1	G	377	LEU
1	G	379	LEU
1	G	384	LEU
1	G	405	ILE
1	G	422	LEU
1	G	429	ARG
1	G	435	THR
1	G	447	PRO
1	G	455	THR
2	H	276	MET
2	H	279	ARG
2	H	291	VAL
2	H	309	GLU
2	H	311	THR
2	H	344	GLN
2	H	354	THR
2	H	364	VAL
2	H	414	ASP
2	H	420	GLU
2	H	422	GLN
2	H	427	GLN
2	H	428	SER
2	H	432	LEU
2	H	445	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (16) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	283	HIS
1	A	304	HIS
1	A	352	GLN
1	A	392	GLN
1	A	448	ASN
1	C	283	HIS
1	C	316	ASN
1	C	352	GLN
1	E	352	GLN
1	E	448	ASN
2	F	422	GLN
1	G	292	GLN
1	G	352	GLN
2	H	251	HIS
2	H	327	ASN
2	H	344	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 monosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 12 ligands modelled in this entry, 8 are monoatomic - leaving 4 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	A1IA5	E	601	4	17,19,19	0.25	0	20,27,27	0.44	0
3	A1IA5	C	601	4	17,19,19	0.22	0	20,27,27	0.50	0
3	A1IA5	A	601	4	17,19,19	0.45	0	20,27,27	0.50	0
3	A1IA5	G	601	4	17,19,19	0.33	0	20,27,27	0.45	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	A1IA5	E	601	4	-	0/8/8/8	0/2/2/2
3	A1IA5	C	601	4	-	6/8/8/8	0/2/2/2
3	A1IA5	A	601	4	-	3/8/8/8	0/2/2/2
3	A1IA5	G	601	4	-	4/8/8/8	0/2/2/2

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (13) torsion outliers are listed below:

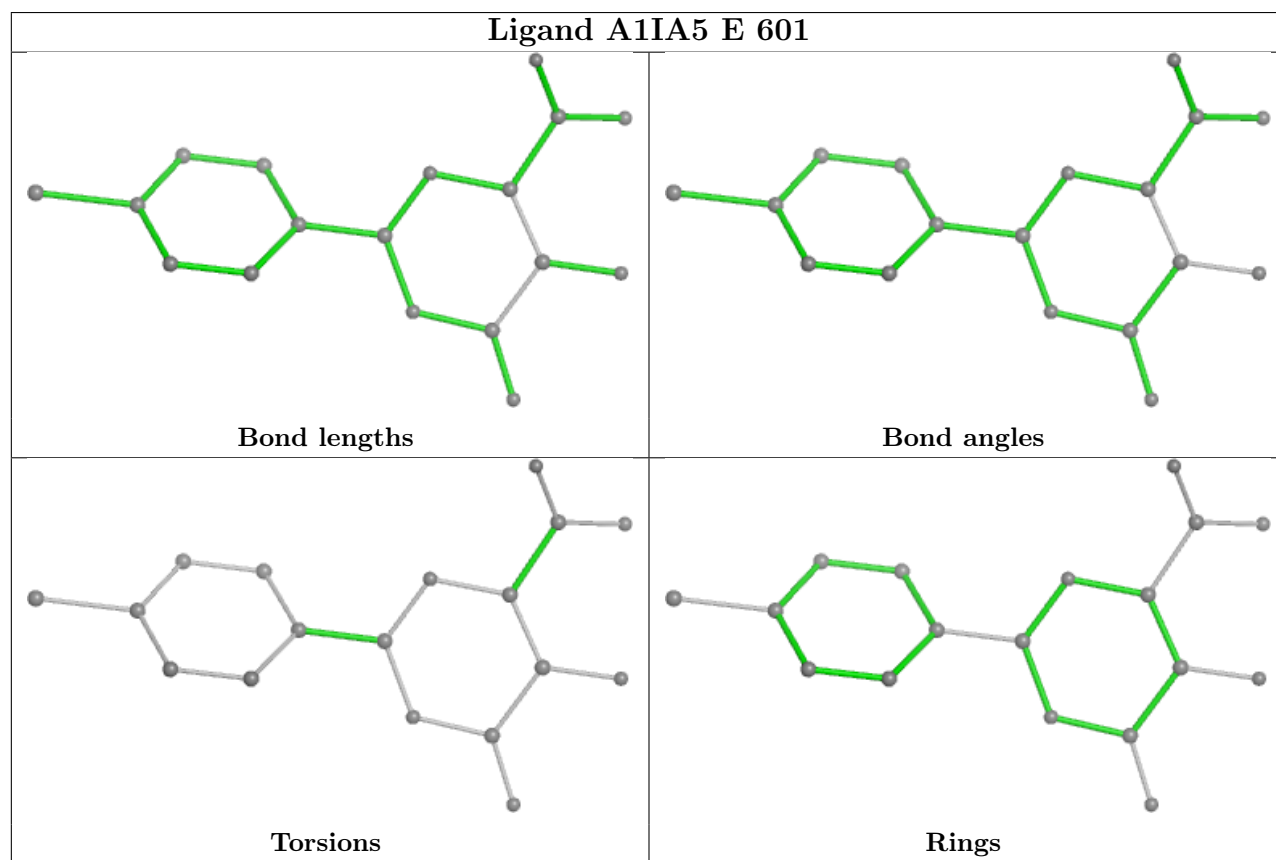
Mol	Chain	Res	Type	Atoms
3	A	601	A1IA5	O-C-C1-C2
3	A	601	A1IA5	O-C-C1-N1
3	C	601	A1IA5	O-C-C1-C2
3	C	601	A1IA5	O-C-C1-N1
3	C	601	A1IA5	O1-C-C1-C2
3	C	601	A1IA5	N-C4-C5-C6
3	G	601	A1IA5	N-C4-C5-C6
3	C	601	A1IA5	N-C4-C5-C10
3	G	601	A1IA5	N-C4-C5-C10
3	A	601	A1IA5	O1-C-C1-C2
3	G	601	A1IA5	N1-C4-C5-C10
3	G	601	A1IA5	N1-C4-C5-C6
3	C	601	A1IA5	N1-C4-C5-C6

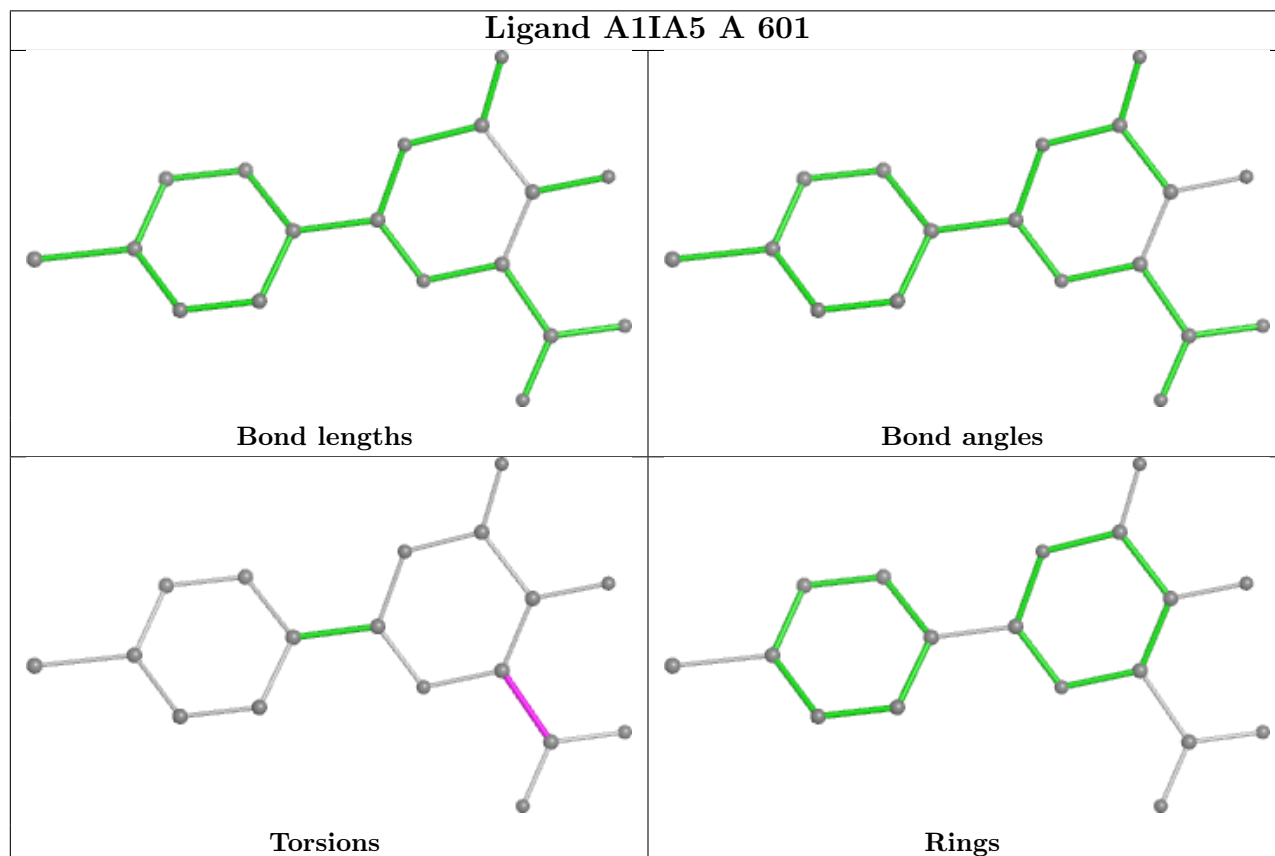
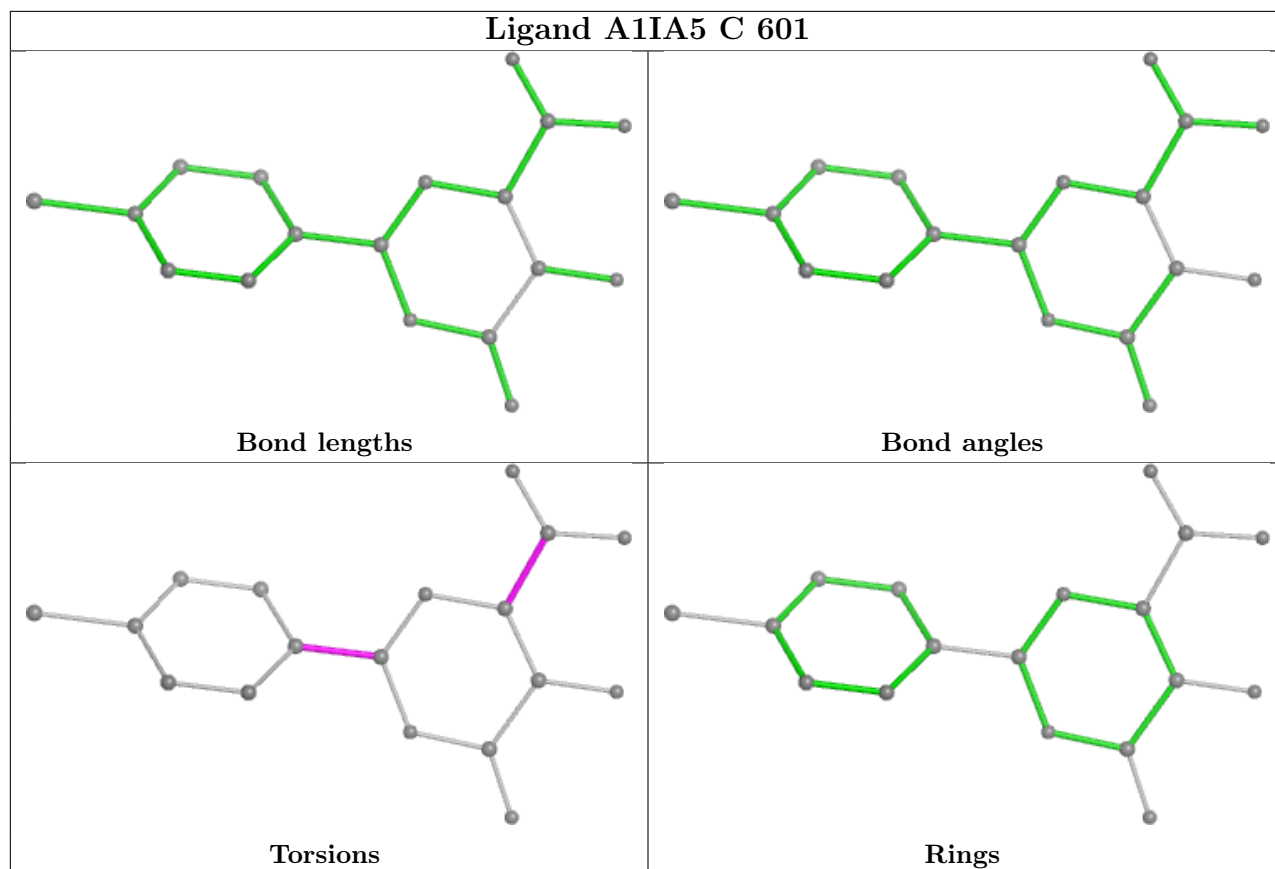
There are no ring outliers.

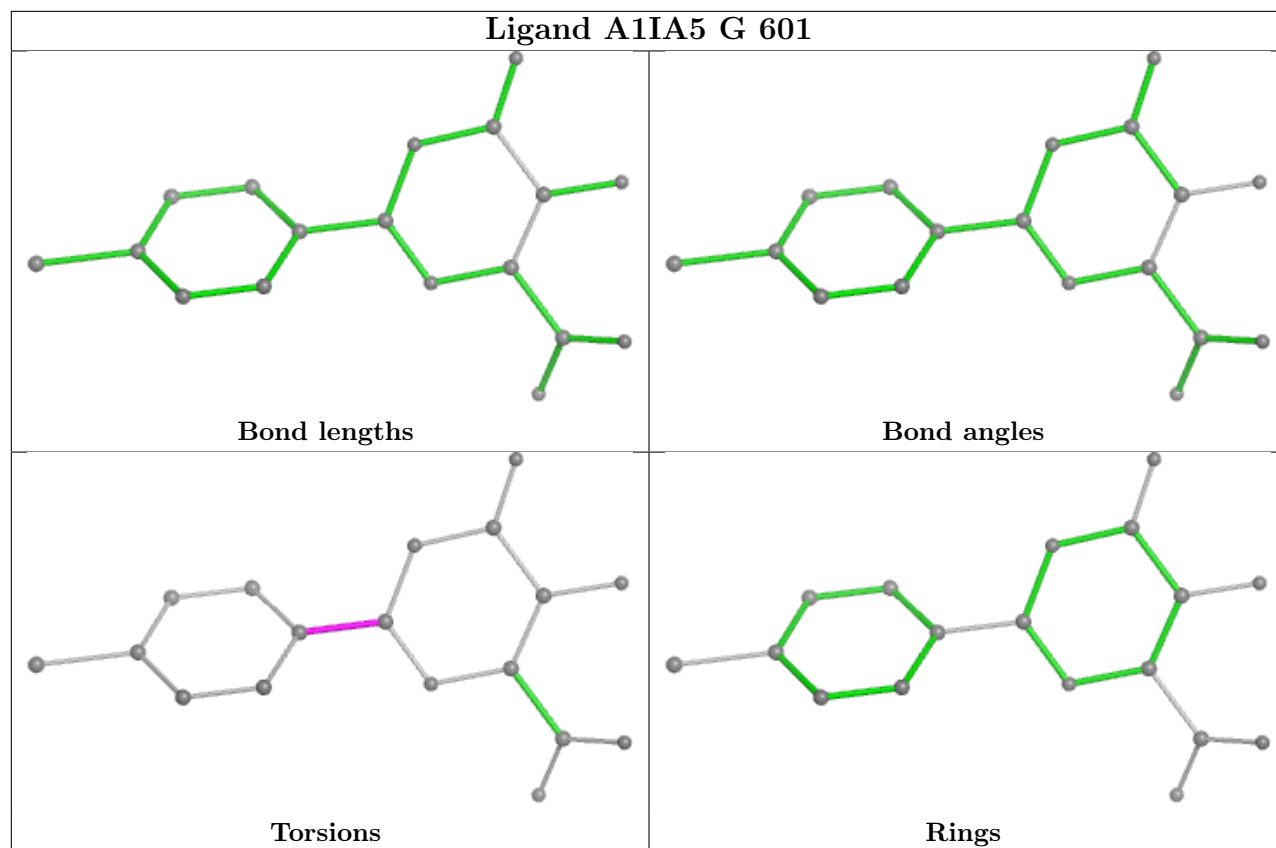
No monomer is involved in short contacts.

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	185/308 (60%)	-0.28	2 (1%) 80 75	46, 68, 88, 97	0
1	C	186/308 (60%)	-0.41	0 100 100	49, 66, 88, 100	0
1	E	187/308 (60%)	-0.00	6 (3%) 47 37	54, 79, 104, 113	0
1	G	187/308 (60%)	0.08	10 (5%) 26 17	53, 82, 105, 111	0
2	B	139/326 (42%)	0.39	8 (5%) 23 15	74, 99, 125, 130	0
2	D	139/326 (42%)	0.22	5 (3%) 42 32	70, 97, 118, 121	0
2	F	139/326 (42%)	0.07	3 (2%) 62 52	70, 95, 112, 116	0
2	H	139/326 (42%)	-0.01	4 (2%) 51 41	75, 97, 117, 125	0
All	All	1301/2536 (51%)	-0.02	38 (2%) 51 41	46, 85, 114, 130	0

All (38) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	G	320	PRO	4.2
1	G	319	ASP	3.9
1	G	321	ALA	3.7
2	B	260	LEU	3.6
1	G	314	GLU	3.4
1	G	313	GLN	3.4
2	D	325	ILE	3.3
1	E	321	ALA	3.2
1	G	326	LEU	3.2
1	G	317	PRO	3.1
1	G	322	ASN	2.9
2	D	261	LEU	2.9
1	G	315	THR	2.8
2	H	306	TRP	2.7
2	F	253	ILE	2.7
2	B	325	ILE	2.6

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Mol	Chain	Res	Type	RSRZ
2	H	326	ASP	2.6
2	D	319	GLU	2.5
1	E	260	LEU	2.5
2	B	249	LEU	2.5
2	B	252	ILE	2.5
1	E	428	LEU	2.5
2	H	325	ILE	2.4
1	A	262	LEU	2.4
1	A	429	ARG	2.3
2	F	281	VAL	2.3
2	D	262	GLN	2.3
2	B	343	LEU	2.2
1	G	268	ARG	2.1
2	H	307	VAL	2.1
2	B	319	GLU	2.1
2	B	356	GLY	2.1
2	F	354	THR	2.0
1	E	326	LEU	2.0
2	D	321	PHE	2.0
1	E	451	CYS	2.0
1	E	262	LEU	2.0
2	B	344	GLN	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 monosaccharides 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.

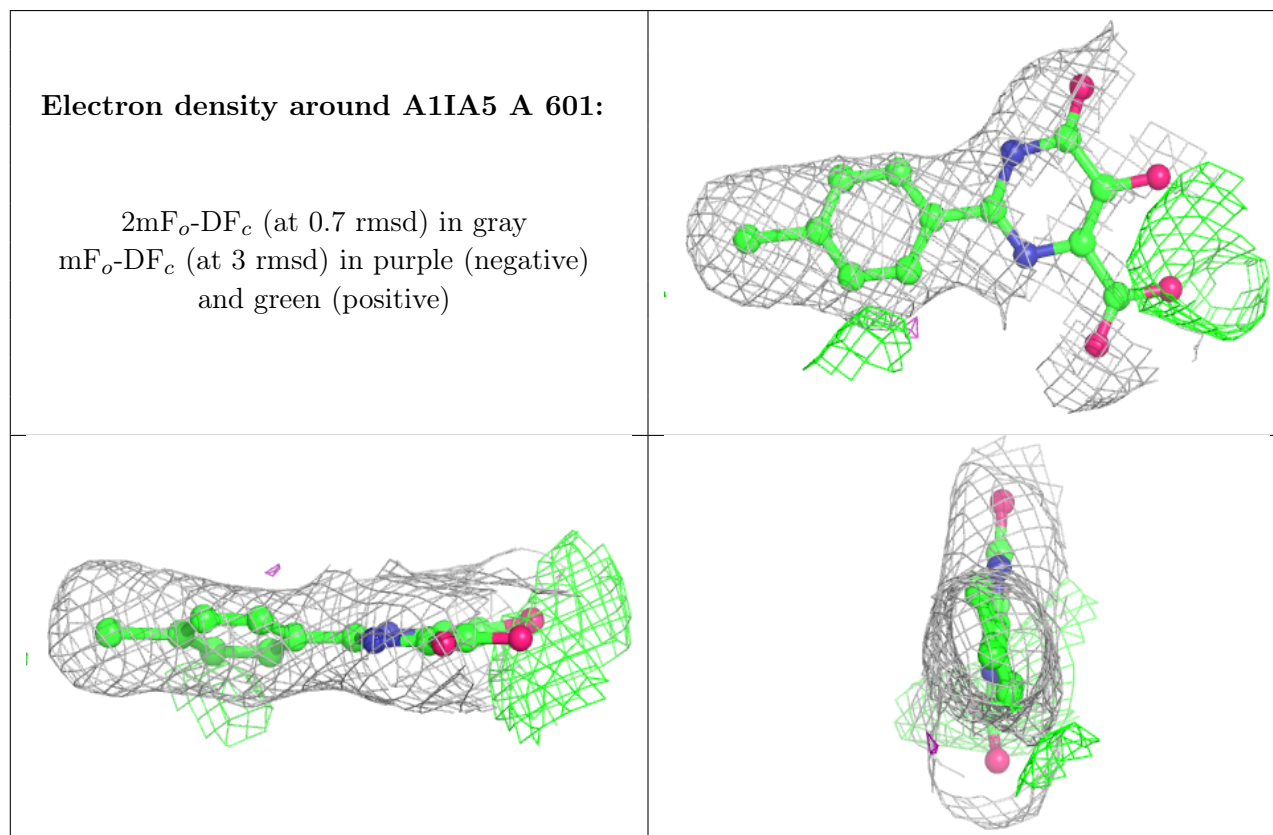
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
3	A1IA5	A	601	18/18	0.93	0.20	66,67,67,67	0

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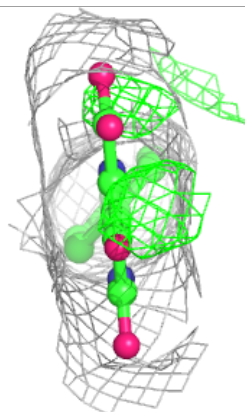
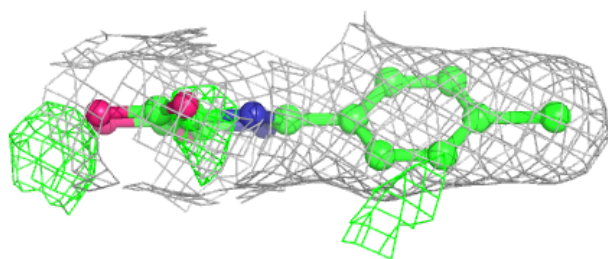
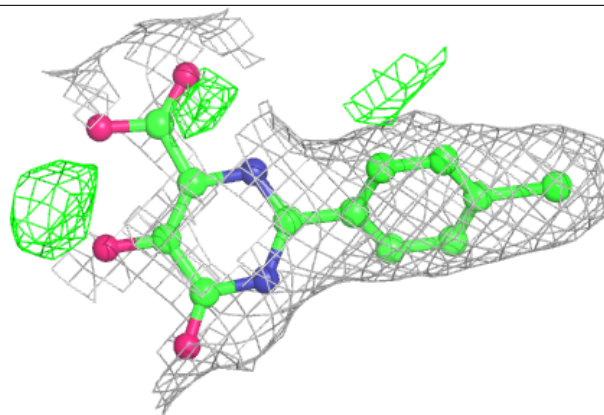
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
3	A1IA5	C	601	18/18	0.93	0.19	72,73,74,74	0
4	MG	E	603	1/1	0.93	0.18	51,51,51,51	0
4	MG	E	602	1/1	0.94	0.25	54,54,54,54	0
3	A1IA5	G	601	18/18	0.94	0.15	73,75,76,76	0
3	A1IA5	E	601	18/18	0.95	0.17	63,64,64,65	0
4	MG	C	602	1/1	0.95	0.24	57,57,57,57	0
4	MG	G	603	1/1	0.96	0.12	49,49,49,49	0
4	MG	A	602	1/1	0.97	0.35	57,57,57,57	0
4	MG	A	603	1/1	0.98	0.14	34,34,34,34	0
4	MG	G	602	1/1	0.99	0.16	43,43,43,43	0
4	MG	C	603	1/1	0.99	0.16	35,35,35,35	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.

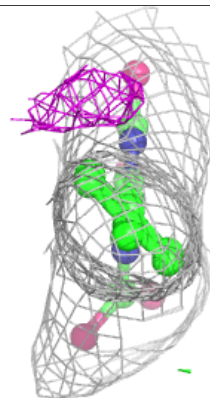
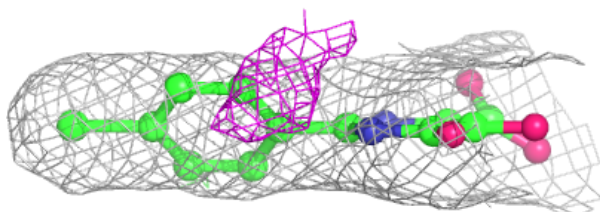
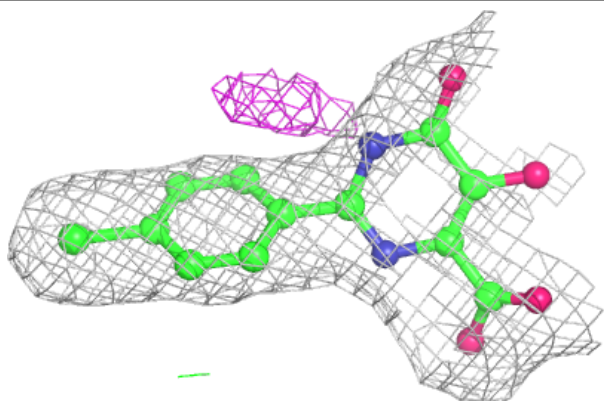


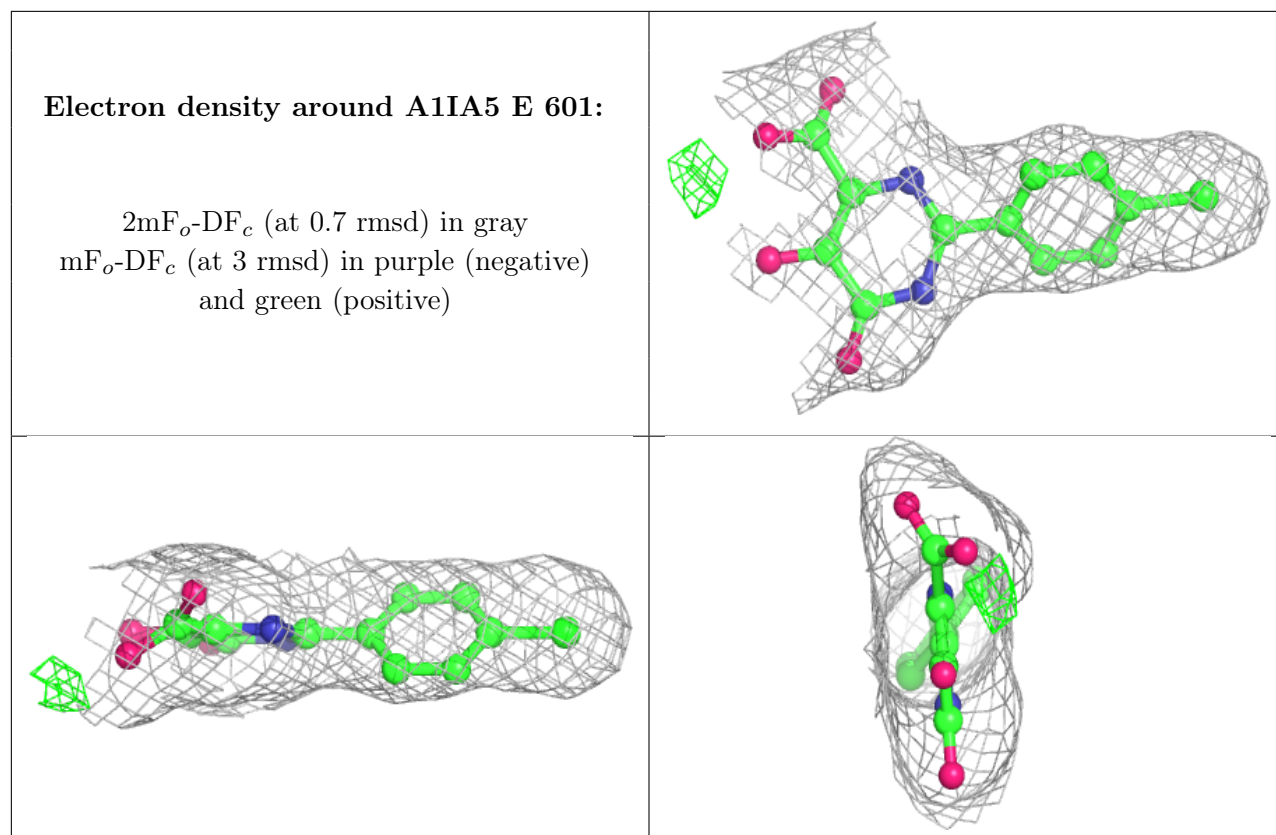
Electron density around A1IA5 C 601:

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

**Electron density around A1IA5 G 601:**

$2mF_o-DF_c$ (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.