



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 12, 2026 – 08:14 PM UTC

PDB ID : 1KYV / pdb_00001kyv
Title : Lumazine Synthase from *S.pombe* bound to riboflavin
Authors : Gerhardt, S.; Haase, I.; Steinbacher, S.; Kaiser, J.T.; Cushman, M.; Bacher, A.; Huber, R.; Fischer, M.
Deposited on : 2002-02-06
Resolution : 2.40 Å(reported)

This is a Full wwPDB X-ray Structure Validation Report for a publicly released PDB entry.

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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	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (Phenix)	:	NOT EXECUTED
EDS	:	NOT EXECUTED
Buster-report	:	wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

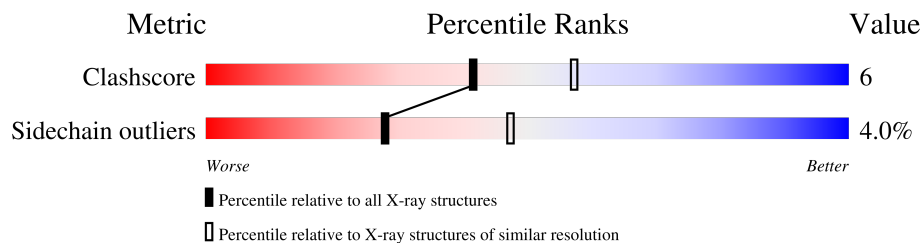
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.40 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))
Clashscore	190562	5391 (2.40-2.40)
Sidechain outliers	187428	5321 (2.40-2.40)

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 $\leq 5\%$.

Note EDS was not executed.

Mol	Chain	Length	Quality of chain
1	A	159	 81% 10% • 8%
1	B	159	 76% 13% • 8%
1	C	159	 84% 8% •• 6%
1	D	159	 82% 9% • 8%
1	E	159	 83% 11% ••

2 Entry composition [i](#)

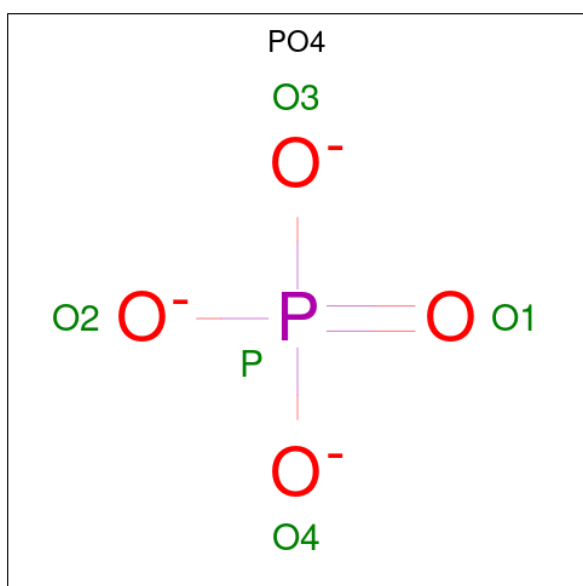
There are 4 unique types of molecules in this entry. The entry contains 5949 atoms, of which 0 are hydrogens and 0 are deuteriums.

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 6,7-Dimethyl-8-ribityllumazine Synthase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	147	Total	C	N	O	S	11	1	0
			1129	718	199	208	4			
1	B	147	Total	C	N	O	S	20	1	0
			1129	718	199	208	4			
1	C	149	Total	C	N	O	S	10	1	0
			1147	730	201	212	4			
1	D	147	Total	C	N	O	S	11	1	0
			1129	718	199	208	4			
1	E	152	Total	C	N	O	S	16	1	0
			1161	737	205	215	4			

- Molecule 2 is PHOSPHATE ION (CCD ID: PO4) (formula: O₄P).



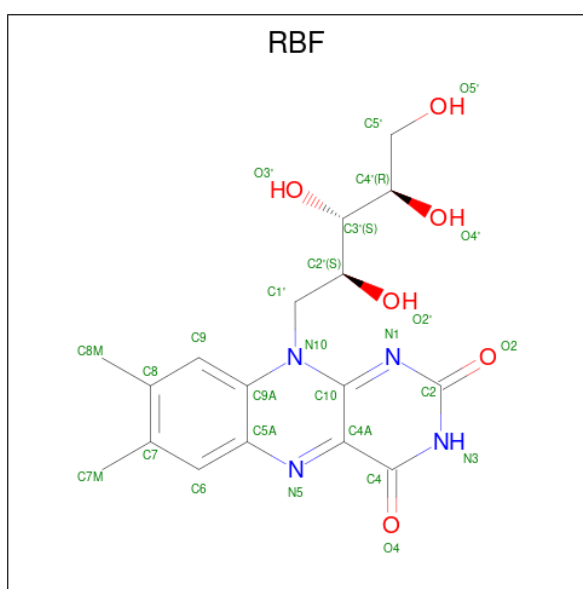
Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	A	1	Total	O	P	0	0
			5	4	1		

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Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
2	B	1	Total	O	P	0	0
			5	4	1		
2	C	1	Total	O	P	0	0
			5	4	1		
2	D	1	Total	O	P	0	0
			5	4	1		
2	E	1	Total	O	P	0	0
			5	4	1		

- Molecule 3 is RIBOFLAVIN (CCD ID: RBF) (formula: $C_{17}H_{20}N_4O_6$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	A	1	Total	C	N	O	0	0
			27	17	4	6		
3	B	1	Total	C	N	O	0	0
			27	17	4	6		
3	C	1	Total	C	N	O	0	0
			27	17	4	6		
3	D	1	Total	C	N	O	0	0
			27	17	4	6		
3	E	1	Total	C	N	O	0	0
			27	17	4	6		

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	23	Total 23	O 23	0	0
4	B	16	Total 16	O 16	0	0
4	C	21	Total 21	O 21	0	0
4	D	16	Total 16	O 16	0	0
4	E	18	Total 18	O 18	0	0

3 Residue-property plots [i](#)

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. 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. 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.

Note EDS was not executed.

• Molecule 1: 6,7-Dimethyl-8-ribityllumazine Synthase

Chain A: 



• Molecule 1: 6,7-Dimethyl-8-ribityllumazine Synthase

Chain B: 



• Molecule 1: 6,7-Dimethyl-8-ribityllumazine Synthase

Chain C: 



• Molecule 1: 6,7-Dimethyl-8-ribityllumazine Synthase

Chain D: 



• Molecule 1: 6,7-Dimethyl-8-ribityllumazine Synthase

Chain E: 



4 Data and refinement statistics

Xtriage (Phenix) and EDS were not executed - this section is therefore incomplete.

Property	Value	Source
Space group	C 2 2 21	Depositor
Cell constants a, b, c, α , β , γ	111.50Å 145.52Å 128.70Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	16.03 – 2.40	Depositor
% Data completeness (in resolution range)	(Not available) (16.03-2.40)	Depositor
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
Refinement program	CNS	Depositor
R, R_{free}	0.180 , 0.213	Depositor
Estimated twinning fraction	No twinning to report.	Xtriage
Total number of atoms	5949	wwPDB-VP
Average B, all atoms (Å ²)	44.0	wwPDB-VP

5 Model quality

5.1 Standard geometry

Bond lengths and bond angles in the following residue types are not validated in this section: PO4, RBF

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	0.67	0/1150	0.98	0/1560
1	B	0.70	0/1150	0.97	1/1560 (0.1%)
1	C	0.69	0/1169	1.05	6/1586 (0.4%)
1	D	0.61	0/1150	0.97	3/1560 (0.2%)
1	E	0.64	0/1184	0.99	1/1608 (0.1%)
All	All	0.66	0/5803	0.99	11/7874 (0.1%)

There are no bond length outliers.

All (11) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed($^{\circ}$)	Ideal($^{\circ}$)
1	C	157	ALA	N-CA-C	-8.10	102.45	111.28
1	C	158	LEU	CA-C-N	5.78	132.10	121.70
1	C	158	LEU	C-N-CA	5.78	132.10	121.70
1	D	49	VAL	N-CA-C	-5.61	101.81	109.55
1	C	158	LEU	N-CA-C	5.50	122.51	110.80
1	C	158	LEU	O-C-N	5.49	129.89	122.59
1	B	157	ALA	N-CA-C	-5.48	106.55	113.18
1	C	49	VAL	N-CA-C	-5.45	102.03	109.55
1	D	45	GLU	N-CA-C	5.45	117.98	111.71
1	E	97	TYR	N-CA-C	5.33	117.17	111.36
1	D	124	VAL	N-CA-C	5.12	116.98	108.99

There are no chirality outliers.

There are no planarity outliers.

5.2 Too-close contacts ⓘ

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	1129	0	1143	14	0
1	B	1129	0	1143	23	0
1	C	1147	0	1157	16	0
1	D	1129	0	1143	9	0
1	E	1161	0	1171	13	0
2	A	5	0	0	1	0
2	B	5	0	0	0	0
2	C	5	0	0	1	0
2	D	5	0	0	1	0
2	E	5	0	0	0	0
3	A	27	0	20	2	0
3	B	27	0	19	4	0
3	C	27	0	19	3	0
3	D	27	0	19	2	0
3	E	27	0	19	1	0
4	A	23	0	0	0	0
4	B	16	0	0	1	0
4	C	21	0	0	0	0
4	D	16	0	0	0	0
4	E	18	0	0	1	0
All	All	5949	0	5853	74	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 6.

All (74) 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:158:LEU:HD22	1:C:159:TYR:H	1.05	1.10
1:C:158:LEU:HD22	1:C:159:TYR:N	1.72	1.01
1:C:158:LEU:C	1:C:158:LEU:HD13	1.91	0.95
1:B:67:GLN:HG3	4:B:1015:HOH:O	1.65	0.95
1:D:157:ALA:O	1:D:158:LEU:HB2	1.74	0.87
1:B:15:GLY:HA3	1:B:18:LEU:HD12	1.61	0.81
1:B:157:ALA:O	1:B:158:LEU:HB2	1.80	0.80

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:E:157:ALA:O	1:E:158:LEU:HB2	1.80	0.79
1:A:152:GLU:OE2	1:B:26:ARG:NH2	2.16	0.77
1:A:157:ALA:O	1:A:158:LEU:HB2	1.84	0.76
1:C:158:LEU:C	1:C:158:LEU:CD1	2.62	0.71
1:C:158:LEU:HD13	1:C:159:TYR:N	2.09	0.68
1:C:158:LEU:CD2	1:C:159:TYR:N	2.53	0.68
1:B:15:GLY:CA	1:B:18:LEU:HD12	2.24	0.68
1:B:15:GLY:HA3	1:B:18:LEU:CD1	2.25	0.66
1:A:152:GLU:CD	1:B:26:ARG:HH22	2.04	0.64
1:B:63:TRP:HB3	3:B:502:RBF:HC3'	1.80	0.62
1:D:12:ASP:OD2	1:D:12:ASP:N	2.34	0.61
1:E:94:HIS:ND1	4:E:1008:HOH:O	2.32	0.57
1:A:157:ALA:O	1:A:158:LEU:CB	2.52	0.57
1:C:157:ALA:O	1:C:158:LEU:HB2	2.05	0.57
1:E:33:GLU:HB2	1:E:34:PRO:HD3	1.88	0.55
1:C:87:LEU:HD21	1:C:98:ILE:HD11	1.89	0.55
1:D:51:LEU:HD23	1:D:51:LEU:O	2.07	0.55
1:D:89:LYS:HE3	1:D:90:GLY:O	2.07	0.54
1:B:157:ALA:O	1:B:158:LEU:CB	2.53	0.54
1:D:157:ALA:O	1:D:158:LEU:CB	2.51	0.53
1:B:31:ALA:O	1:B:34:PRO:HD2	2.08	0.53
1:C:31:ALA:O	1:C:34:PRO:HD2	2.09	0.53
1:E:11:SER:OG	1:E:13:LEU:HD12	2.09	0.53
1:C:33:GLU:HB2	1:C:34:PRO:HD3	1.91	0.52
1:E:157:ALA:O	1:E:158:LEU:CB	2.53	0.52
1:A:31:ALA:O	1:A:34:PRO:HD2	2.09	0.52
1:A:63:TRP:HB3	3:A:501:RBF:HC3'	1.92	0.52
1:B:18:LEU:HD11	1:B:155:LEU:CD2	2.41	0.51
1:B:12:ASP:OD2	1:B:12:ASP:N	2.43	0.51
1:B:119:LEU:O	3:C:503:RBF:HC51	2.11	0.51
1:D:33:GLU:HB2	1:D:34:PRO:HD3	1.92	0.50
1:C:89:LYS:HE3	1:C:90:GLY:O	2.12	0.50
1:B:33:GLU:HB2	1:B:34:PRO:HD3	1.92	0.50
2:D:1005:PO4:O2	3:D:504:RBF:HC71	2.12	0.50
1:C:158:LEU:HD13	1:C:158:LEU:O	2.11	0.49
1:E:51:LEU:HD23	1:E:51:LEU:O	2.13	0.48
1:E:89:LYS:HE3	1:E:90:GLY:O	2.12	0.48
1:E:87:LEU:HD21	1:E:98:ILE:HD11	1.95	0.47
1:C:24:HIS:O	1:C:58:SER:HA	2.14	0.47
1:C:158:LEU:CD1	1:C:159:TYR:N	2.78	0.46
1:A:84:ILE:HA	1:A:120:GLY:O	2.15	0.46

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:119:LEU:HB3	3:C:503:RBF:HC52	1.98	0.46
1:C:158:LEU:O	1:C:159:TYR:CD2	2.70	0.45
1:D:103:VAL:HG12	1:E:101:ALA:HB2	1.98	0.45
1:D:87:LEU:HD21	1:D:98:ILE:HD11	1.99	0.44
1:A:12:ASP:OD2	1:A:12:ASP:N	2.51	0.44
1:A:33:GLU:HB2	1:A:34:PRO:HD3	1.99	0.44
2:C:1003:PO4:O2	3:C:503:RBF:HC73	2.18	0.44
1:A:89:LYS:HE3	1:A:90:GLY:O	2.18	0.44
1:B:66:PRO:HG3	1:B:106:LEU:HD13	1.99	0.44
1:B:24:HIS:HA	1:B:84:ILE:O	2.17	0.43
3:D:504:RBF:HC81	3:D:504:RBF:HC73	1.84	0.43
1:A:142:HIS:CD2	3:B:502:RBF:HC81	2.53	0.43
1:A:119:LEU:O	3:B:502:RBF:HC52	2.19	0.42
2:A:1004:PO4:O1	3:A:501:RBF:HC6	2.19	0.42
1:B:18:LEU:HD23	1:B:79:ASP:CB	2.50	0.42
1:B:37:LYS:HG2	1:B:41:GLU:OE2	2.19	0.41
1:C:158:LEU:O	1:C:159:TYR:CG	2.73	0.41
1:B:87:LEU:HD23	3:B:502:RBF:N3	2.36	0.41
1:E:31:ALA:O	1:E:34:PRO:HD2	2.20	0.41
1:A:103:VAL:HG12	1:B:101:ALA:HB2	2.03	0.41
1:B:18:LEU:HD11	1:B:155:LEU:HD21	2.03	0.41
1:B:24:HIS:O	1:B:58:SER:HA	2.21	0.41
1:D:152:GLU:CD	1:E:26:ARG:HH12	2.29	0.41
1:E:87:LEU:HD23	3:E:505:RBF:C4	2.51	0.40
1:E:37:LYS:HG2	1:E:41:GLU:OE2	2.21	0.40
1:A:87:LEU:HD21	1:A:98:ILE:HD11	2.02	0.40

There are no symmetry-related clashes.

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

There are no protein backbone outliers to report in this entry.

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	119/128 (93%)	114 (96%)	5 (4%)	26	45
1	B	119/128 (93%)	112 (94%)	7 (6%)	18	31
1	C	121/128 (94%)	117 (97%)	4 (3%)	33	55
1	D	119/128 (93%)	115 (97%)	4 (3%)	32	54
1	E	123/128 (96%)	119 (97%)	4 (3%)	33	55
All	All	601/640 (94%)	577 (96%)	24 (4%)	28	47

All (24) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	12	ASP
1	A	51	LEU
1	A	98	ILE
1	A	136	LEU
1	A	158	LEU
1	B	12	ASP
1	B	18	LEU
1	B	51	LEU
1	B	65	LEU
1	B	106	LEU
1	B	136	LEU
1	B	158	LEU
1	C	65	LEU
1	C	98	ILE
1	C	127	GLU
1	C	158	LEU
1	D	12	ASP
1	D	65	LEU
1	D	136	LEU
1	D	158	LEU
1	E	9	ASN
1	E	51	LEU
1	E	136	LEU
1	E	158	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (14) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	28	ASN
1	A	142	HIS
1	A	144	ASN
1	B	28	ASN
1	B	53	ASN
1	B	142	HIS
1	B	144	ASN
1	C	47	HIS
1	C	142	HIS
1	D	28	ASN
1	D	30	GLN
1	D	47	HIS
1	D	53	ASN
1	E	30	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 oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

10 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	PO4	E	1002	-	4,4,4	1.81	2 (50%)	6,6,6	0.47	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
3	RBF	E	505	-	29,29,29	2.32	13 (44%)	42,43,43	2.37	17 (40%)
3	RBF	D	504	-	29,29,29	2.17	10 (34%)	42,43,43	2.29	17 (40%)
3	RBF	B	502	-	29,29,29	2.16	12 (41%)	42,43,43	2.46	16 (38%)
3	RBF	C	503	-	29,29,29	2.24	10 (34%)	42,43,43	2.70	16 (38%)
2	PO4	B	1001	-	4,4,4	1.87	2 (50%)	6,6,6	0.46	0
2	PO4	A	1004	-	4,4,4	1.73	1 (25%)	6,6,6	0.49	0
2	PO4	D	1005	-	4,4,4	1.78	2 (50%)	6,6,6	0.44	0
2	PO4	C	1003	-	4,4,4	1.80	2 (50%)	6,6,6	0.47	0
3	RBF	A	501	-	29,29,29	2.16	11 (37%)	42,43,43	2.00	15 (35%)

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	RBF	E	505	-	-	3/14/14/14	0/3/3/3
3	RBF	D	504	-	-	1/14/14/14	0/3/3/3
3	RBF	B	502	-	-	3/14/14/14	0/3/3/3
3	RBF	C	503	-	-	4/14/14/14	0/3/3/3
3	RBF	A	501	-	-	0/14/14/14	0/3/3/3

All (65) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	E	505	RBF	C6-C5A	4.78	1.47	1.40
3	A	501	RBF	C6-C5A	4.76	1.47	1.40
3	C	503	RBF	C6-C5A	4.75	1.47	1.40
3	D	504	RBF	C6-C5A	4.66	1.47	1.40
3	B	502	RBF	C6-C5A	4.65	1.47	1.40
3	E	505	RBF	C9A-N10	4.45	1.48	1.41
3	D	504	RBF	C9A-N10	4.28	1.48	1.41
3	B	502	RBF	C9A-N10	4.15	1.48	1.41
3	C	503	RBF	C9A-N10	4.08	1.48	1.41
3	C	503	RBF	C9-C9A	4.01	1.46	1.39
3	A	501	RBF	C9A-N10	3.97	1.48	1.41
3	E	505	RBF	C8M-C8	3.93	1.58	1.51
3	E	505	RBF	C9-C9A	3.82	1.45	1.39
3	D	504	RBF	C9-C9A	3.80	1.45	1.39

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	E	505	RBF	C8-C7	3.71	1.49	1.40
3	B	502	RBF	C9-C9A	3.68	1.45	1.39
3	D	504	RBF	C10-N1	3.64	1.40	1.33
3	A	501	RBF	C10-N1	3.64	1.40	1.33
3	C	503	RBF	C8M-C8	3.62	1.57	1.51
3	E	505	RBF	C10-N1	3.58	1.40	1.33
3	D	504	RBF	C8M-C8	3.55	1.57	1.51
3	B	502	RBF	C8-C7	3.54	1.49	1.40
3	C	503	RBF	C10-N1	3.53	1.40	1.33
3	A	501	RBF	C8-C7	3.49	1.49	1.40
3	A	501	RBF	C9-C9A	3.41	1.45	1.39
3	B	502	RBF	C10-N1	3.38	1.40	1.33
3	B	502	RBF	C8M-C8	3.33	1.57	1.51
3	A	501	RBF	C8M-C8	3.26	1.57	1.51
3	D	504	RBF	C8-C7	3.19	1.48	1.40
3	C	503	RBF	C8-C7	3.02	1.48	1.40
3	C	503	RBF	C4A-C4	2.93	1.55	1.44
3	D	504	RBF	C5'-C4'	2.90	1.59	1.52
3	C	503	RBF	C5'-C4'	2.78	1.59	1.52
3	E	505	RBF	C5'-C4'	2.74	1.58	1.52
3	A	501	RBF	C5'-C4'	2.74	1.58	1.52
3	E	505	RBF	C7M-C7	2.67	1.56	1.51
3	C	503	RBF	C5A-N5	2.62	1.44	1.39
3	C	503	RBF	C7M-C7	2.55	1.55	1.51
3	A	501	RBF	C7M-C7	2.54	1.55	1.51
3	A	501	RBF	C4'-C3'	-2.51	1.49	1.53
3	E	505	RBF	C4A-C4	2.51	1.53	1.44
3	B	502	RBF	C9A-C5A	2.44	1.45	1.41
3	A	501	RBF	C4A-C4	2.41	1.53	1.44
3	B	502	RBF	C4A-C4	2.40	1.53	1.44
3	D	504	RBF	C4A-C4	2.40	1.53	1.44
3	E	505	RBF	C9A-C5A	2.39	1.45	1.41
3	B	502	RBF	C5'-C4'	2.36	1.58	1.52
3	B	502	RBF	C7M-C7	2.34	1.55	1.51
2	B	1001	PO4	P-O4	-2.32	1.47	1.54
2	C	1003	PO4	P-O2	-2.30	1.47	1.54
3	E	505	RBF	C5A-N5	2.24	1.43	1.39
3	A	501	RBF	C2'-C3'	-2.20	1.49	1.53
2	B	1001	PO4	P-O3	-2.17	1.48	1.54
2	A	1004	PO4	P-O3	-2.13	1.48	1.54
2	D	1005	PO4	P-O2	-2.12	1.48	1.54
3	B	502	RBF	C4'-C3'	-2.11	1.49	1.53

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	C	1003	PO4	P-O3	-2.11	1.48	1.54
2	E	1002	PO4	P-O4	-2.09	1.48	1.54
3	D	504	RBF	C7M-C7	2.09	1.54	1.51
2	E	1002	PO4	P-O2	-2.09	1.48	1.54
3	E	505	RBF	C4-N3	2.06	1.42	1.38
3	D	504	RBF	C9A-C5A	2.06	1.44	1.41
3	E	505	RBF	C4'-C3'	-2.05	1.49	1.53
3	B	502	RBF	C5A-N5	2.05	1.43	1.39
2	D	1005	PO4	P-O4	-2.03	1.48	1.54

All (81) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	C	503	RBF	O5'-C5'-C4'	-7.69	95.02	111.16
3	B	502	RBF	O4'-C4'-C5'	-5.96	95.48	109.03
3	B	502	RBF	C5'-C4'-C3'	5.95	124.29	112.17
3	C	503	RBF	O4'-C4'-C5'	-5.62	96.24	109.03
3	E	505	RBF	O3'-C3'-C2'	5.58	121.61	108.93
3	C	503	RBF	C5'-C4'-C3'	5.43	123.24	112.17
3	D	504	RBF	O3'-C3'-C2'	5.31	121.00	108.93
3	C	503	RBF	O3'-C3'-C2'	5.26	120.88	108.93
3	D	504	RBF	O3'-C3'-C4'	-4.82	97.97	108.93
3	B	502	RBF	O2-C2-N3	4.71	127.62	118.58
3	D	504	RBF	O2-C2-N3	4.62	127.45	118.58
3	E	505	RBF	O3'-C3'-C4'	-4.60	98.48	108.93
3	E	505	RBF	O2-C2-N3	4.56	127.33	118.58
3	C	503	RBF	O2-C2-N3	4.49	127.20	118.58
3	C	503	RBF	O3'-C3'-C4'	-4.45	98.82	108.93
3	A	501	RBF	O2-C2-N3	4.37	126.97	118.58
3	A	501	RBF	C9-C8-C7	4.33	126.04	119.69
3	E	505	RBF	C5'-C4'-C3'	4.32	120.97	112.17
3	E	505	RBF	O4'-C4'-C5'	-4.22	99.44	109.03
3	B	502	RBF	C9-C8-C7	4.20	125.86	119.69
3	D	504	RBF	C9-C8-C7	4.12	125.74	119.69
3	E	505	RBF	C9-C8-C7	3.93	125.45	119.69
3	C	503	RBF	C9-C8-C7	3.90	125.41	119.69
3	B	502	RBF	O3'-C3'-C4'	-3.87	100.15	108.93
3	B	502	RBF	O3'-C3'-C2'	3.85	117.67	108.93
3	D	504	RBF	C5'-C4'-C3'	3.57	119.45	112.17
3	B	502	RBF	C10-N1-C2	3.36	124.12	116.85
3	C	503	RBF	C10-N1-C2	3.31	124.02	116.85
3	E	505	RBF	C10-N1-C2	3.18	123.74	116.85

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	D	504	RBF	C10-N1-C2	3.17	123.71	116.85
3	D	504	RBF	C4'-C3'-C2'	3.12	118.76	113.57
3	C	503	RBF	C4'-C3'-C2'	3.11	118.75	113.57
3	A	501	RBF	C5A-C6-C7	-2.98	115.30	120.83
3	D	504	RBF	C5A-C6-C7	-2.96	115.34	120.83
3	A	501	RBF	C10-N1-C2	2.95	123.24	116.85
3	A	501	RBF	C9A-C9-C8	-2.94	113.31	119.22
3	E	505	RBF	C4'-C3'-C2'	2.94	118.46	113.57
3	D	504	RBF	O2'-C2'-C3'	2.92	116.08	109.25
3	B	502	RBF	C9A-C9-C8	-2.91	113.37	119.22
3	A	501	RBF	C6-C5A-C9A	2.87	122.99	119.05
3	E	505	RBF	O2'-C2'-C3'	2.87	115.96	109.25
3	B	502	RBF	O2-C2-N1	-2.84	117.08	121.80
3	B	502	RBF	C5A-C6-C7	-2.84	115.57	120.83
3	B	502	RBF	C4'-C3'-C2'	2.83	118.29	113.57
3	E	505	RBF	C5A-C6-C7	-2.83	115.58	120.83
3	A	501	RBF	O3'-C3'-C4'	-2.82	102.53	108.93
3	E	505	RBF	O2-C2-N1	-2.79	117.16	121.80
3	C	503	RBF	C4A-C10-N10	2.78	120.47	116.48
3	B	502	RBF	O5'-C5'-C4'	-2.78	105.31	111.16
3	D	504	RBF	C9A-C9-C8	-2.77	113.64	119.22
3	D	504	RBF	O2-C2-N1	-2.74	117.24	121.80
3	B	502	RBF	C4A-C10-N10	2.74	120.41	116.48
3	A	501	RBF	C5'-C4'-C3'	2.71	117.69	112.17
3	A	501	RBF	O3'-C3'-C2'	2.71	115.08	108.93
3	C	503	RBF	O2-C2-N1	-2.69	117.33	121.80
3	D	504	RBF	C4A-C10-N10	2.68	120.32	116.48
3	B	502	RBF	C6-C5A-C9A	2.68	122.72	119.05
3	D	504	RBF	C6-C5A-C9A	2.67	122.72	119.05
3	A	501	RBF	O2-C2-N1	-2.65	117.39	121.80
3	E	505	RBF	C9A-C9-C8	-2.65	113.90	119.22
3	E	505	RBF	C4A-C10-N10	2.62	120.24	116.48
3	E	505	RBF	C6-C5A-C9A	2.61	122.63	119.05
3	C	503	RBF	C9A-C9-C8	-2.60	114.00	119.22
3	A	501	RBF	C4'-C3'-C2'	2.57	117.85	113.57
3	C	503	RBF	C5A-C6-C7	-2.50	116.20	120.83
3	D	504	RBF	C2'-C1'-N10	2.50	122.00	110.20
3	A	501	RBF	C4A-C10-N10	2.40	119.92	116.48
3	C	503	RBF	C4-N3-C2	2.40	129.91	125.64
3	D	504	RBF	O4'-C4'-C5'	-2.40	103.58	109.03
3	E	505	RBF	C2'-C1'-N10	2.38	121.45	110.20
3	C	503	RBF	O2'-C2'-C3'	2.36	114.76	109.25

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	A	501	RBF	C8M-C8-C9	-2.35	115.43	119.57
3	B	502	RBF	C8M-C8-C9	-2.35	115.43	119.57
3	E	505	RBF	C8M-C8-C9	-2.33	115.47	119.57
3	A	501	RBF	O4'-C4'-C5'	-2.31	103.76	109.03
3	C	503	RBF	C6-C5A-C9A	2.28	122.17	119.05
3	D	504	RBF	C8M-C8-C9	-2.23	115.64	119.57
3	A	501	RBF	C4-N3-C2	2.20	129.54	125.64
3	E	505	RBF	C4-N3-C2	2.07	129.32	125.64
3	D	504	RBF	C4-N3-C2	2.06	129.30	125.64
3	B	502	RBF	O2'-C2'-C3'	2.04	114.01	109.25

There are no chirality outliers.

All (11) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
3	C	503	RBF	C2'-C3'-C4'-O4'
3	C	503	RBF	O3'-C3'-C4'-C5'
3	E	505	RBF	C1'-C2'-C3'-C4'
3	C	503	RBF	C2'-C3'-C4'-C5'
3	E	505	RBF	O4'-C4'-C5'-O5'
3	E	505	RBF	C3'-C4'-C5'-O5'
3	B	502	RBF	C3'-C4'-C5'-O5'
3	C	503	RBF	O3'-C3'-C4'-O4'
3	B	502	RBF	O4'-C4'-C5'-O5'
3	B	502	RBF	C2'-C3'-C4'-C5'
3	D	504	RBF	C3'-C4'-C5'-O5'

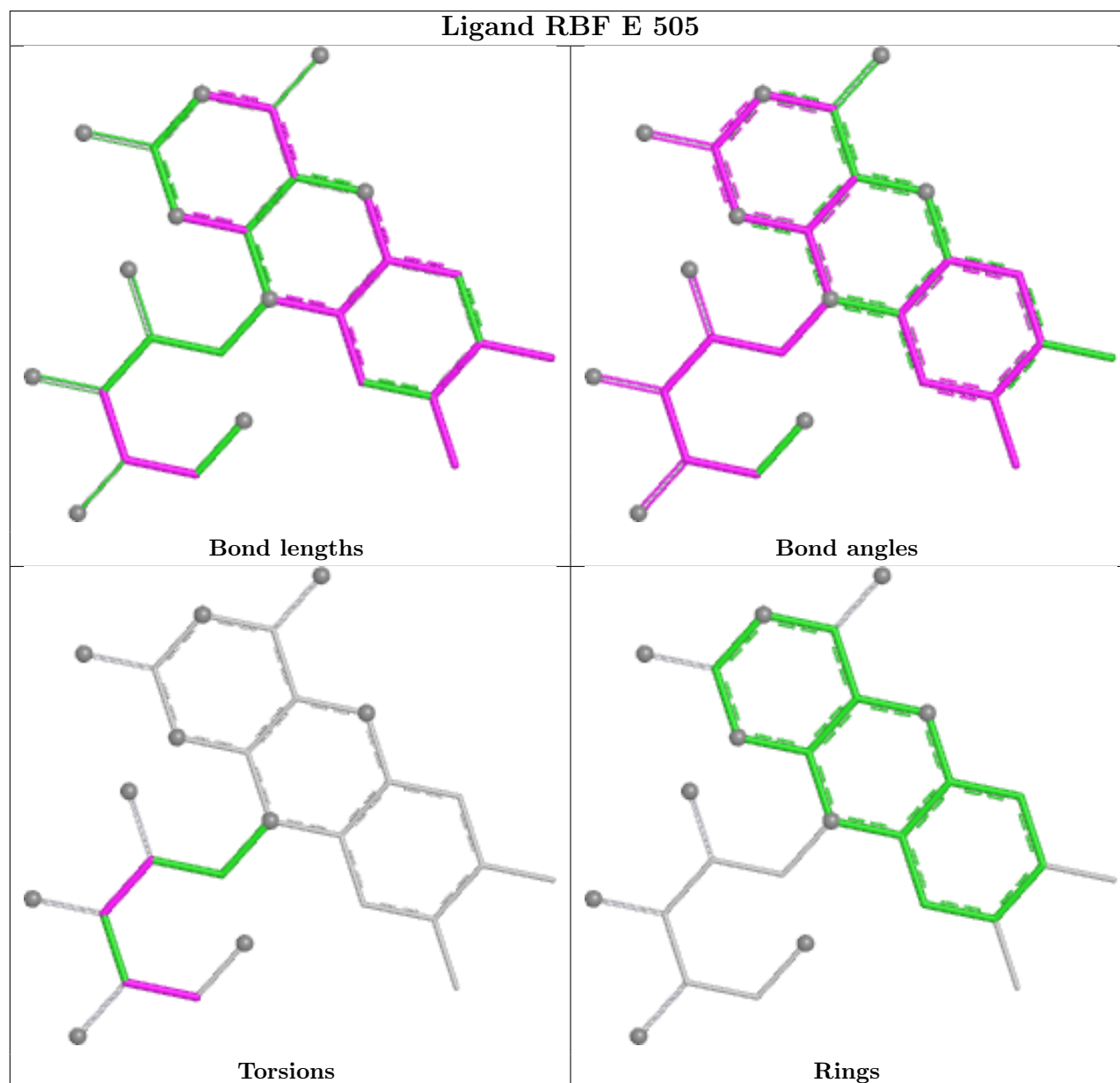
There are no ring outliers.

8 monomers are involved in 12 short contacts:

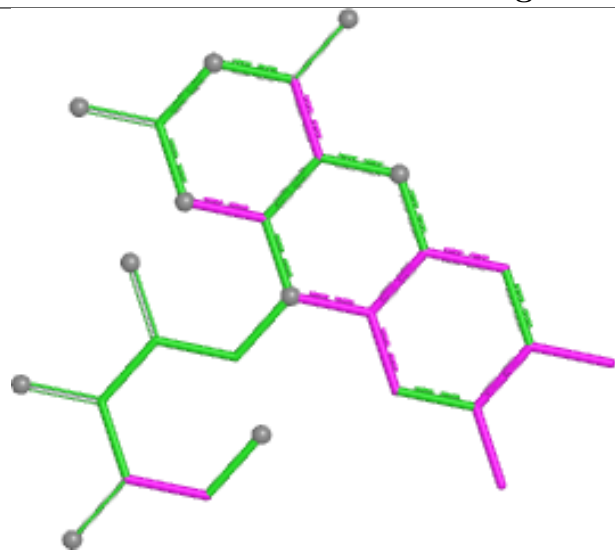
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	E	505	RBF	1	0
3	D	504	RBF	2	0
3	B	502	RBF	4	0
3	C	503	RBF	3	0
2	A	1004	PO4	1	0
2	D	1005	PO4	1	0
2	C	1003	PO4	1	0
3	A	501	RBF	2	0

The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths,

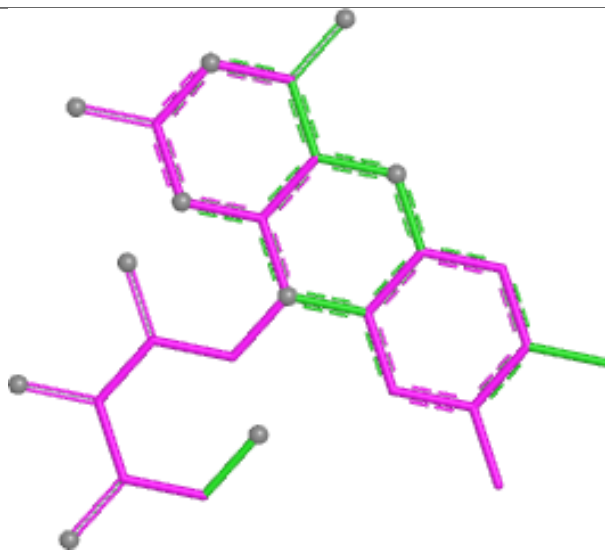
bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less than 5% of the Mogul distribution of torsion angles is within 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.



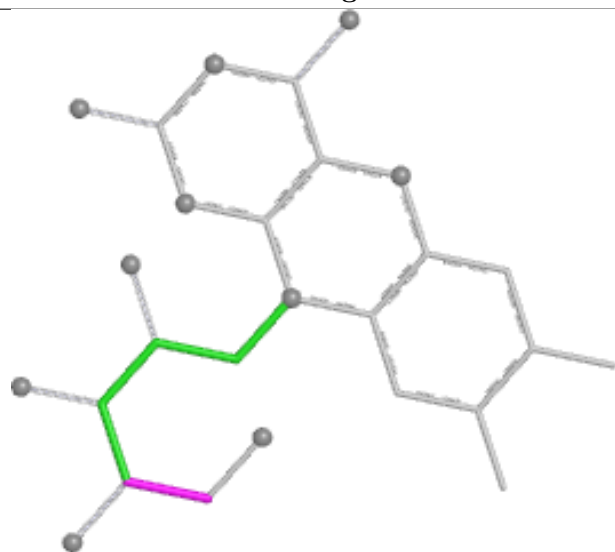
Ligand RBF D 504



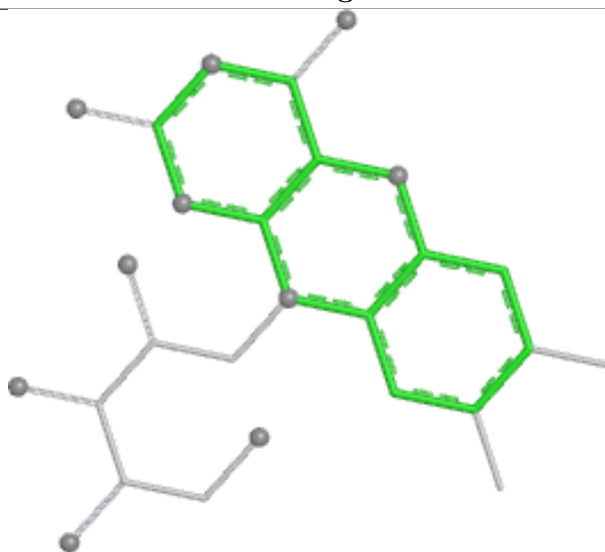
Bond lengths



Bond angles

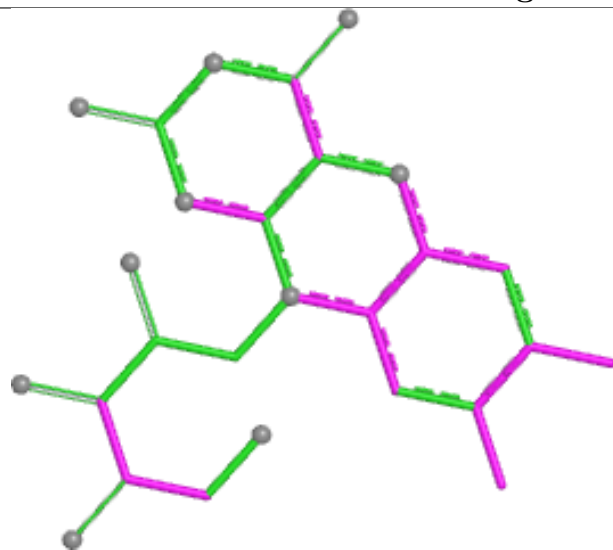


Torsions

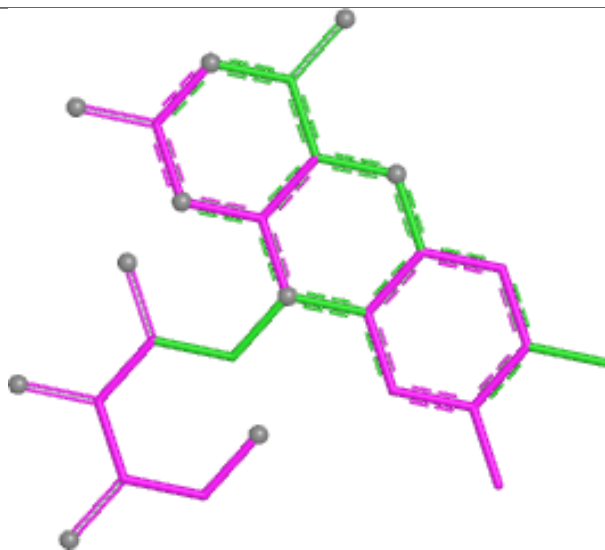


Rings

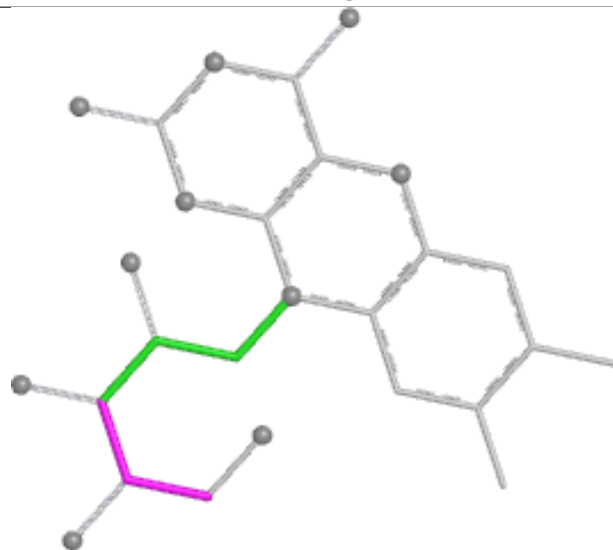
Ligand RBF B 502



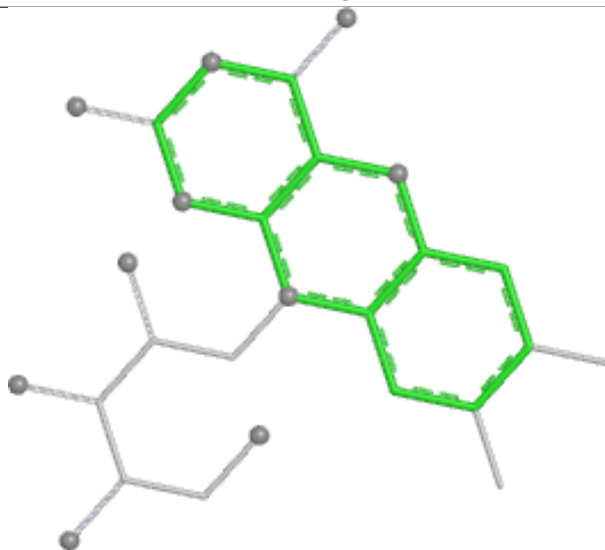
Bond lengths



Bond angles

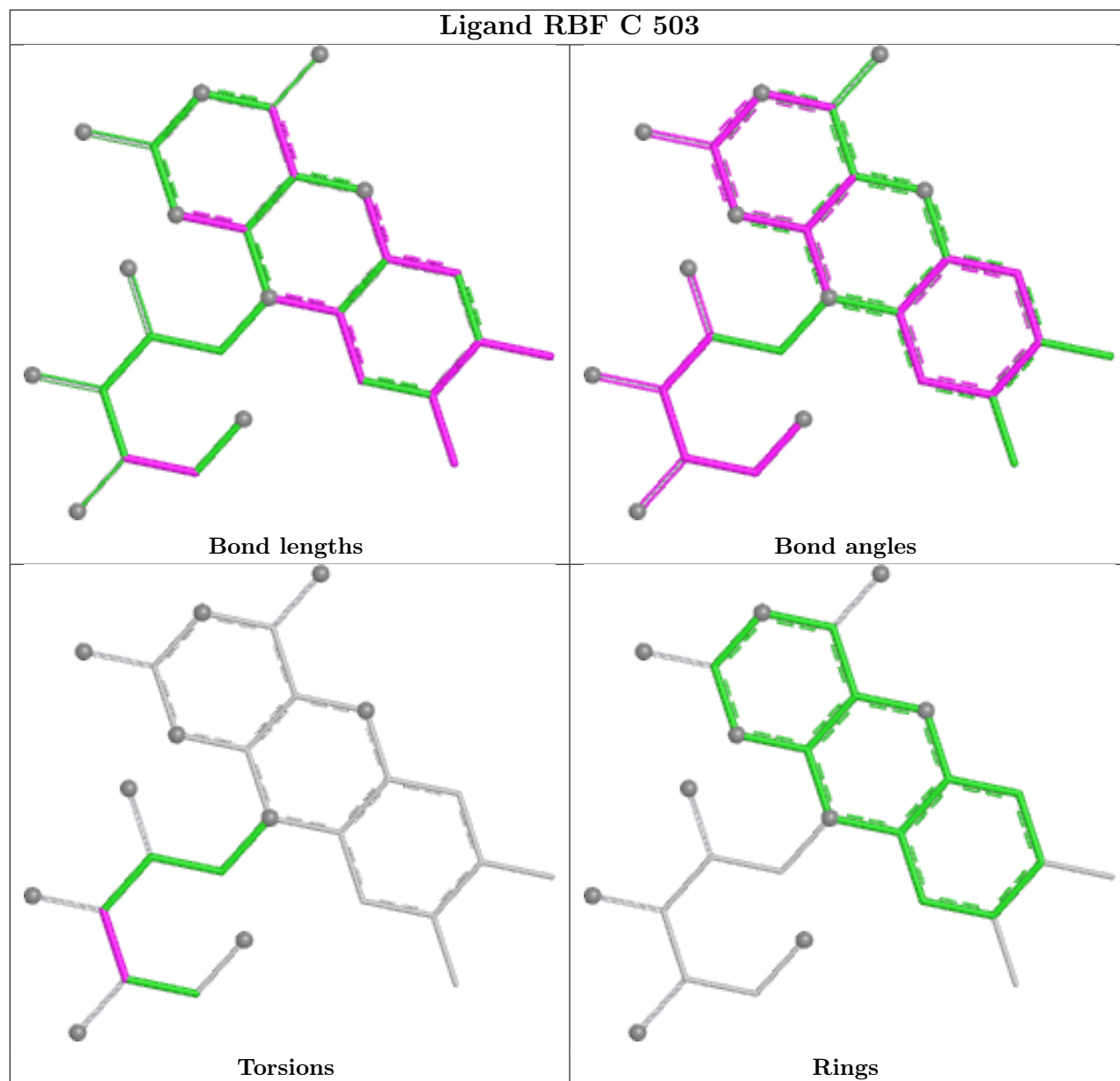


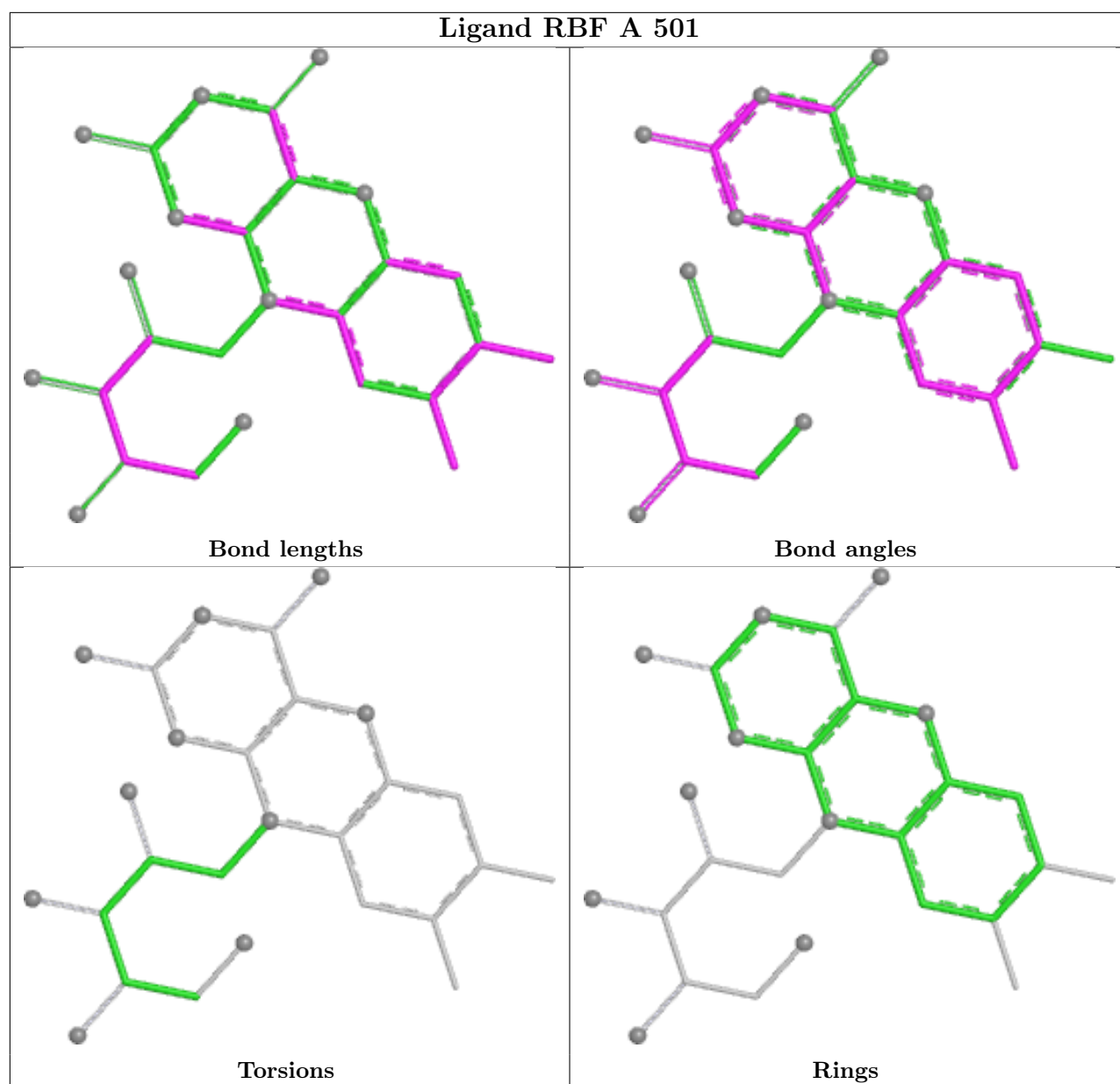
Torsions



Rings

Ligand RBF C 503





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

EDS was not executed - this section is therefore empty.

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

EDS was not executed - this section is therefore empty.

6.3 Carbohydrates

EDS was not executed - this section is therefore empty.

6.4 Ligands

EDS was not executed - this section is therefore empty.

6.5 Other polymers

EDS was not executed - this section is therefore empty.