



Full wwPDB EM Validation Report ⓘ

Jul 16, 2025 – 10:45 AM JST

PDB ID : 8IFF / pdb_00008iff
EMDB ID : EMD-35415
Title : Cryo-EM structure of Arabidopsis phytochrome A.
Authors : Ma, L.; Zhou, C.; Wang, J.; Guan, Z.; Yin, P.
Deposited on : 2023-02-17
Resolution : 3.10 Å(reported)

This is a Full wwPDB EM 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/EMValidationReportHelp>

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:

EMDB validation analysis : **FAILED**
Mogul : 1.8.5 (274361), CSD as541be (2020)
MolProbity : 4-5-2 with Phenix2.0rc1
buster-report : 1.1.7 (2018)
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)
MapQ : **FAILED**
Ideal geometry (proteins) : Engh & Huber (2001)
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP) : 2.44

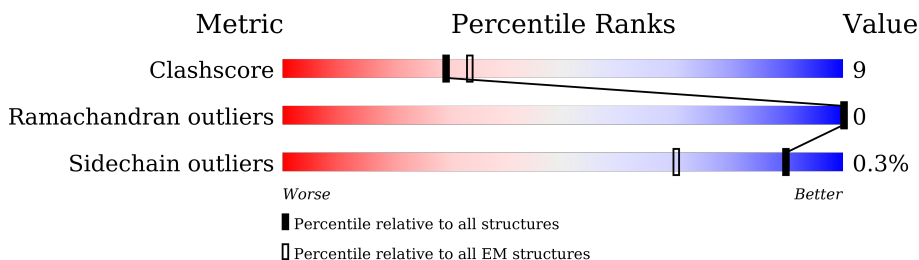
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

ELECTRON MICROSCOPY

The reported resolution of this entry is 3.10 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)	EM structures (#Entries)
Clashscore	210492	15764
Ramachandran outliers	207382	16835
Sidechain outliers	206894	16415

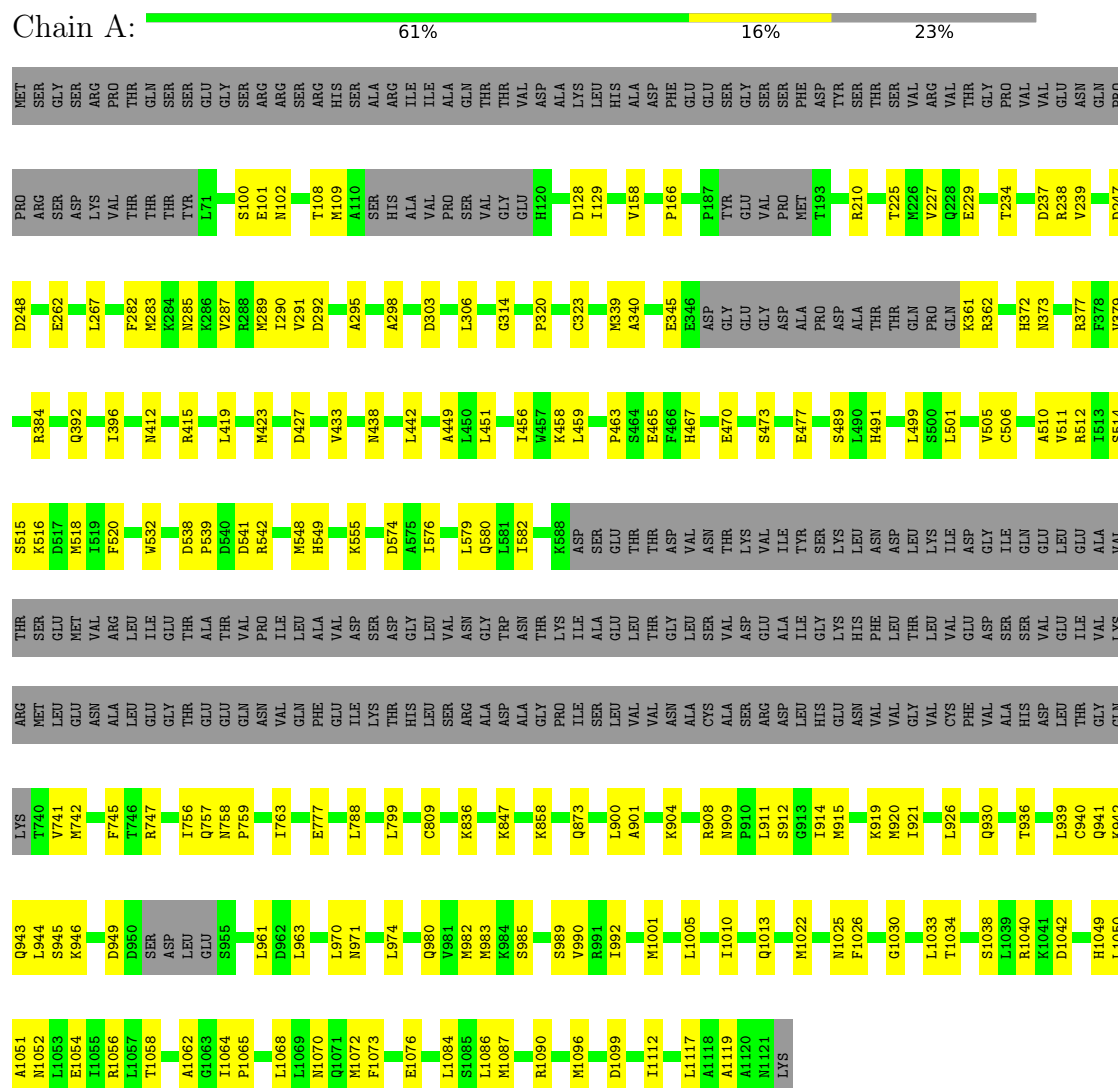
The table below summarises the geometric issues observed across the polymeric chains and their fit to the map. The red, orange, yellow and green segments of the bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment 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 $\leq 5\%$.

Mol	Chain	Length	Quality of chain
1	A	1122	
1	B	1122	

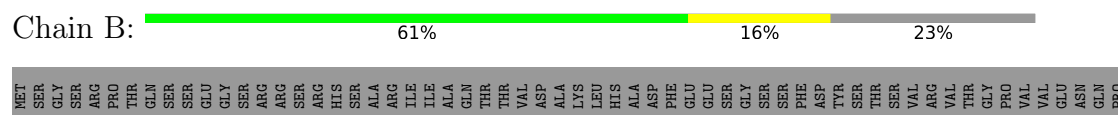
3 Residue-property plots

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. 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.

• Molecule 1: Phytochrome A



• Molecule 1: Phytochrome A



E1054	F916	THR	ILE	GLU	F520	C323	K165	PRO
I1055	T917	GLY	VAL	ALA	W521	H324	K165	ARG
R1056	K918	GLN	LYS	VAL	F522	L325	I171	SER
L1057	K919	LYS	ARG	THR	H525	Q326	L180	ASP
T1058	M920	MET	LYS	SER	H526	Y327	L180	LYS
H1059	I921	LEU	LEU	SER	W532	N330	K186	VAL
P1065	E922	GLU	GLU	MET	K536	V343	P187	THR
L1068	I933	ASN	ASN	VAL	H537	N344	Y188	THR
L1069	L934	ALA	ARG	ALA	D538	E345	GLU	THR
L1070	L948	GLY	GLY	THR	P539	E346	VAL	THR
Q1071	D949	THR	THR	THR	R542	ASP	PRO	THR
V1079	D950	GLU	GLU	ALA	R547	GLY	PRO	THR
S1080	SER	GLU	GLU	THR	M548	GLY	MET	THR
E1081	ASP	GLN	GLN	VAL	H549	ASP	ALA	THR
K1090	LEU	ASN	ASN	PRO	P550	ALA	A195	THR
R1091	GLU	VAL	VAL	ILE	F557	PRO	A204	THR
L1092	S955	GLN	PHE	ALA	K562	ASP	I208	THR
G1098	L961	GLU	GLU	VAL	T563	ALA	T209	THR
D1099	L970	LYS	ILE	ASP	K564	THR	R210	THR
V1100	N971	THR	THR	ASP	S565	GLN	V227	THR
Q1101	F972	HIS	HIS	GLY	L566	PRO	Q228	THR
Y1102	V973	LEU	LEU	LEU	D570	GLN	E229	THR
L1103	L974	SER	SER	VAL	L579	K361	D237	THR
R1104	S977	ARG	ARG	ASN	K588	H372	R238	THR
S1109	V981	ALA	ALA	ASP	ASP	T374	V239	THR
S1110	M1001	GLY	GLY	THR	GLU	T375	D247	THR
F1111	L1005	PRO	PRO	LYS	SER	L420	D248	THR
T1112	L1005	ILE	ILE	ILE	GLU	L424	T257	THR
T1114	L1012	LEU	LEU	LEU	THR	A428	E262	THR
A1119	L1016	VAL	VAL	THR	THR	P429	L265	THR
A1120	A1017	ASN	ASN	GLY	ASP	L430	G266	THR
M1121	M1020	CYS	CYS	SER	ASN	I432	L267	THR
LYS	M1021	ALA	ALA	VAL	LYS	L442	D273	THR
	M1022	SER	SER	ASP	VAL	P463	I274	THR
	T1034	ARG	ARG	GLU	ILE	L475	P275	THR
	V1035	ASP	ASP	ALA	TYR	S489	I290	THR
	S1036	HIS	HIS	ALA	LYS	D503	C293	THR
	A1037	GLU	GLU	LYS	LEU	S504	R299	THR
	S1038	ASN	ASN	PHE	ASN	V505	Q302	THR
	L1039	VAL	VAL	LEU	ASP	C506	L306	THR
	D1042	VAL	VAL	GLY	ILE	G507	P320	THR
	Q1043	VAL	VAL	THR	GLN	M508	H321	THR
	L1044	CYS	CYS	LEU	ILE	M518	S322	THR
	L1044	PHE	PHE	VAL	GLY	I519		THR
	L1049	VAL	VAL	ASP	ASP			THR
	L1050	ALA	ALA	SER	ASP			THR
	A1051	HIS	HIS	SER	GLN			THR
		T914	ASP	SER	GLU			THR
		M915	LEU	LEU	LEU			THR

4 Experimental information

Property	Value	Source
EM reconstruction method	SINGLE PARTICLE	Depositor
Imposed symmetry	POINT, Not provided	
Number of particles used	498817	Depositor
Resolution determination method	FSC 0.143 CUT-OFF	Depositor
CTF correction method	NONE	Depositor
Microscope	FEI TITAN KRIOS	Depositor
Voltage (kV)	300	Depositor
Electron dose ($e^-/\text{\AA}^2$)	50	Depositor
Minimum defocus (nm)	1200	Depositor
Maximum defocus (nm)	2200	Depositor
Magnification	Not provided	
Image detector	GATAN K3 (6k x 4k)	Depositor

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: O6E

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	0.15	0/6923	0.34	0/9343
1	B	0.15	0/6937	0.32	0/9362
All	All	0.15	0/13860	0.33	0/18705

There are no bond length outliers.

There are no bond angle outliers.

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	6800	0	6893	125	0
1	B	6812	0	6899	128	0
2	A	43	0	0	1	0
2	B	43	0	0	2	0
All	All	13698	0	13792	250	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 9.

All (250) 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:323:CYS:SG	2:A:1201:O6E:CAC	2.20	1.28
1:B:323:CYS:SG	2:B:1201:O6E:CAC	2.21	1.28
1:B:911:LEU:HG	1:B:915:MET:HE3	1.57	0.87
1:A:345:GLU:O	1:A:362:ARG:HB3	1.76	0.86
1:B:919:LYS:HB3	1:B:920:MET:HE2	1.62	0.80
1:A:920:MET:HE2	1:B:933:ILE:HG12	1.67	0.77
1:B:150:VAL:HG21	1:B:171:ILE:HD11	1.68	0.75
1:A:1073:PHE:HA	1:A:1090:ARG:HH12	1.51	0.73
1:B:532:TRP:HA	1:B:557:PHE:HB3	1.72	0.72
1:A:901:ALA:HA	1:A:904:LYS:HE2	1.72	0.71
1:A:942:LYS:HG3	1:A:1010:ILE:HD11	1.72	0.71
1:A:961:LEU:HG	1:A:963:LEU:H	1.56	0.69
1:B:858:LYS:HD2	1:B:869:PHE:HE2	1.57	0.69
1:B:1049:HIS:HB2	1:B:1119:ALA:HB3	1.72	0.69
1:B:204:ALA:O	1:B:208:ILE:HG13	1.95	0.67
1:A:741:VAL:HG12	1:A:742:MET:H	1.57	0.67
1:B:977:SER:HB2	1:B:1017:ALA:HB2	1.75	0.67
1:A:946:LYS:HA	1:A:949:ASP:HB2	1.76	0.66
1:B:538:ASP:HB2	1:B:542:ARG:HG3	1.77	0.66
1:A:227:VAL:HG22	1:A:239:VAL:HG23	1.77	0.66
1:A:1049:HIS:HB2	1:A:1119:ALA:HB3	1.77	0.66
1:B:330:ASN:OD1	1:B:549:HIS:NE2	2.26	0.66
1:B:322:SER:HA	1:B:325:LEU:HD23	1.78	0.65
1:A:262:GLU:OE2	1:A:262:GLU:N	2.30	0.65
1:B:1100:VAL:HG22	1:B:1113:ILE:HG23	1.78	0.65
1:A:539:PRO:O	1:A:542:ARG:NH2	2.31	0.64
1:A:463:PRO:HD3	1:A:505:VAL:HG21	1.78	0.64
1:B:227:VAL:HG13	1:B:239:VAL:HG23	1.80	0.64
1:B:1090:ARG:NH1	1:B:1100:VAL:O	2.31	0.63
1:A:745:PHE:HE1	1:A:747:ARG:HE	1.47	0.63
1:A:788:LEU:HD21	1:A:809:CYS:HB3	1.80	0.63
1:B:267:LEU:HD22	1:B:532:TRP:HD1	1.62	0.63
1:A:282:PHE:HD2	1:A:340:ALA:HB2	1.64	0.62
1:B:267:LEU:HD22	1:B:532:TRP:CD1	2.34	0.62
1:B:489:SER:HB2	1:B:563:THR:HG22	1.82	0.62
1:B:475:LEU:HD23	1:B:518:MET:HE1	1.82	0.62
1:A:210:ARG:NH1	1:A:229:GLU:OE1	2.33	0.61
1:B:88:ALA:HB3	1:B:98:ALA:HB3	1.82	0.61
1:A:777:GLU:OE2	1:A:858:LYS:NZ	2.31	0.61
1:A:100:SER:OG	1:A:102:ASN:OD1	2.15	0.61
1:A:574:ASP:OD1	1:A:758:ASN:ND2	2.34	0.61
1:A:1005:LEU:HD11	1:A:1117:LEU:HD23	1.83	0.60

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:982:MET:SD	1:A:992:ILE:HD11	2.42	0.60
1:B:93:THR:HG22	1:B:95:LYS:HG2	1.83	0.60
1:B:503:ASP:OD1	1:B:503:ASP:N	2.36	0.59
1:B:210:ARG:NH1	1:B:229:GLU:OE1	2.37	0.58
1:B:128:ASP:HB2	1:B:130:ARG:HH21	1.68	0.58
1:B:1100:VAL:HG13	1:B:1113:ILE:HG12	1.85	0.58
1:B:916:PHE:O	1:B:920:MET:HG2	2.04	0.58
1:A:943:GLN:OE1	1:A:1013:GLN:NE2	2.36	0.58
1:B:463:PRO:HD3	1:B:505:VAL:HG11	1.84	0.58
1:A:1040:ARG:HB2	1:A:1052:ASN:HB2	1.86	0.58
1:A:982:MET:HA	1:A:982:MET:HE2	1.84	0.57
1:A:237:ASP:HB2	1:A:373:ASN:HA	1.86	0.57
1:B:131:SER:O	1:B:161:ARG:NH2	2.38	0.56
1:B:908:ARG:NH2	1:B:948:LEU:O	2.37	0.56
1:B:916:PHE:CD1	1:B:920:MET:HE3	2.40	0.56
1:A:1026:PHE:HB3	1:A:1062:ALA:HB3	1.87	0.56
1:A:944:LEU:HD13	1:B:910:PRO:HB2	1.87	0.56
1:A:289:MET:HE3	1:A:291:VAL:HG23	1.86	0.56
1:A:419:LEU:O	1:A:423:MET:HG3	2.06	0.56
1:B:171:ILE:HG22	1:B:180:ILE:HG23	1.87	0.56
1:A:582:ILE:HD11	1:A:763:ILE:HD11	1.88	0.55
1:A:756:ILE:HG23	1:A:758:ASN:H	1.70	0.55
1:A:511:VAL:HG21	1:A:576:ILE:HG22	1.89	0.55
1:B:238:ARG:HB2	1:B:257:THR:HG22	1.87	0.55
1:A:985:SER:HB3	1:A:990:VAL:HB	1.88	0.55
1:A:1084:LEU:HA	1:A:1087:MET:HE1	1.89	0.55
1:B:1051:ALA:HB2	1:B:1119:ALA:HB2	1.87	0.55
1:A:1072:MET:HG2	1:A:1086:LEU:HG	1.87	0.55
1:B:237:ASP:HB2	1:B:373:ASN:HA	1.87	0.55
1:B:537:HIS:CE1	1:B:539:PRO:HG3	2.42	0.55
1:B:832:GLN:HA	1:B:857:LYS:HB3	1.89	0.55
1:A:1033:LEU:HA	1:A:1058:THR:HG21	1.88	0.55
1:B:916:PHE:HD1	1:B:920:MET:HE3	1.72	0.54
1:B:1038:SER:HB3	1:B:1054:GLU:HB2	1.89	0.54
1:A:756:ILE:HG23	1:A:759:PRO:HD3	1.89	0.54
1:A:1042:ASP:HB3	1:A:1050:LEU:HB2	1.88	0.54
1:A:456:ILE:HD12	1:A:465:GLU:HG2	1.90	0.54
1:B:1022:MET:HE1	1:B:1111:PHE:CZ	2.42	0.54
1:A:912:SER:HA	1:A:915:MET:HE2	1.90	0.54
1:A:510:ALA:HA	1:A:520:PHE:HB3	1.90	0.53
1:B:1081:GLU:CD	1:B:1081:GLU:H	2.16	0.53

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:922:GLU:HG3	1:B:934:LEU:HD13	1.89	0.53
1:B:1044:LEU:HB2	1:B:1050:LEU:HD12	1.91	0.53
1:A:158:VAL:O	1:A:166:PRO:HA	2.09	0.53
1:B:262:GLU:OE1	1:B:262:GLU:N	2.39	0.52
1:B:1071:GLN:HB3	1:B:1079:VAL:HG13	1.92	0.52
1:B:877:HIS:O	1:B:881:GLN:HG2	2.10	0.51
1:A:433:VAL:HG23	1:A:459:LEU:HD11	1.92	0.51
1:B:911:LEU:O	1:B:914:ILE:HG22	2.11	0.51
1:A:1034:THR:H	1:A:1058:THR:HB	1.76	0.51
1:B:1005:LEU:HD22	1:B:1039:LEU:HD21	1.92	0.51
1:A:915:MET:HG3	1:A:941:GLN:NE2	2.26	0.51
1:B:238:ARG:HG2	1:B:372:HIS:HB2	1.92	0.51
1:A:971:ASN:ND2	1:A:1001:MET:HG2	2.26	0.51
1:B:911:LEU:O	1:B:915:MET:HG3	2.11	0.51
1:B:532:TRP:HZ3	1:B:536:LYS:HZ3	1.59	0.50
1:B:562:LYS:NZ	1:B:563:THR:H	2.09	0.50
1:A:379:VAL:O	1:A:384:ARG:NH1	2.45	0.50
1:A:467:HIS:HA	1:A:470:GLU:OE2	2.11	0.50
1:A:1051:ALA:HB2	1:A:1119:ALA:HB2	1.93	0.50
1:A:1070:ASN:ND2	1:A:1076:GLU:OE2	2.45	0.50
1:B:538:ASP:OD1	1:B:538:ASP:N	2.44	0.50
1:B:971:ASN:HB2	1:B:1001:MET:HG3	1.94	0.49
1:A:225:THR:O	1:A:229:GLU:HG2	2.12	0.49
1:B:1036:SER:OG	1:B:1056:ARG:NH1	2.45	0.49
1:A:290:ILE:HD13	1:A:320:PRO:HG3	1.95	0.49
1:A:908:ARG:CZ	1:A:908:ARG:HA	2.42	0.49
1:A:909:ASN:O	1:A:912:SER:OG	2.22	0.49
1:B:1098:GLY:HA2	1:B:1114:THR:O	2.11	0.49
1:B:343:VAL:HG12	1:B:345:GLU:HG2	1.93	0.49
1:B:1059:HIS:HB3	1:B:1109:SER:HB3	1.95	0.49
1:B:918:ARG:NH1	1:B:922:GLU:OE2	2.45	0.49
1:A:926:LEU:HB3	1:A:930:GLN:HG3	1.95	0.49
1:B:813:LYS:HG3	1:B:814:ASN:HD22	1.78	0.49
1:B:746:THR:O	1:B:746:THR:OG1	2.30	0.48
1:A:467:HIS:NE2	1:A:501:LEU:HB3	2.28	0.48
1:A:756:ILE:C	1:A:758:ASN:H	2.21	0.48
1:A:989:SER:HB2	1:A:1030:GLY:H	1.78	0.48
1:B:961:LEU:HD22	1:B:1092:LEU:HD21	1.96	0.48
1:B:788:LEU:HD21	1:B:809:CYS:HB3	1.95	0.48
1:B:824:VAL:HG22	1:B:855:VAL:HG11	1.95	0.48
1:B:1104:ARG:HA	1:B:1109:SER:HB2	1.95	0.48

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:467:HIS:CD2	1:A:501:LEU:HB3	2.49	0.47
1:A:512:ARG:HG2	1:A:518:MET:HG2	1.96	0.47
1:A:438:ASN:HD22	1:A:459:LEU:HD22	1.79	0.47
1:B:171:ILE:HG22	1:B:180:ILE:HG12	1.95	0.47
1:B:518:MET:HE2	1:B:520:PHE:CE1	2.50	0.47
1:B:970:LEU:O	1:B:974:LEU:HB2	2.14	0.47
1:A:900:LEU:O	1:A:904:LYS:HG3	2.14	0.47
1:B:97:ILE:HA	1:B:125:ILE:HG23	1.96	0.47
1:B:1042:ASP:OD1	1:B:1042:ASP:N	2.46	0.47
1:A:427:ASP:N	1:A:427:ASP:OD1	2.44	0.47
1:B:267:LEU:HD22	1:B:532:TRP:HB2	1.95	0.47
1:A:756:ILE:HG13	1:A:757:GLN:H	1.78	0.47
1:A:1064:ILE:HG23	1:A:1068:LEU:HB2	1.96	0.47
1:B:290:ILE:HD13	1:B:320:PRO:HG3	1.97	0.47
1:B:758:ASN:O	1:B:760:ASN:N	2.38	0.47
1:B:858:LYS:HD3	1:B:866:THR:HB	1.97	0.47
1:A:491:HIS:CE1	1:A:499:LEU:HD23	2.51	0.46
1:B:275:PRO:HD2	2:B:1201:O6E:NAN	2.30	0.46
1:A:109:MET:HE2	1:A:109:MET:HA	1.98	0.46
1:A:451:LEU:HD12	1:A:456:ILE:HG12	1.96	0.46
1:A:238:ARG:HG2	1:A:372:HIS:HB2	1.98	0.46
1:A:836:LYS:HD3	1:A:873:GLN:NE2	2.30	0.46
1:A:548:MET:SD	1:A:549:HIS:N	2.89	0.46
1:A:303:ASP:HB3	1:A:306:LEU:HG	1.98	0.46
1:B:1049:HIS:O	1:B:1119:ALA:N	2.49	0.46
1:B:373:ASN:ND2	1:B:375:THR:O	2.41	0.45
1:B:110:ALA:O	1:B:120:HIS:NE2	2.49	0.45
1:B:1054:GLU:HB3	1:B:1056:ARG:HH21	1.81	0.45
1:A:128:ASP:OD1	1:A:129:ILE:N	2.49	0.45
1:A:532:TRP:NE1	1:A:555:LYS:O	2.49	0.45
1:A:1065:PRO:HD2	1:A:1068:LEU:HD12	1.98	0.45
1:B:95:LYS:HD2	1:B:126:GLY:O	2.16	0.45
1:B:508:MET:HG3	1:B:522:PHE:CE1	2.51	0.45
1:B:1055:ILE:HB	1:B:1113:ILE:HB	1.97	0.45
1:A:345:GLU:O	1:A:362:ARG:CB	2.56	0.45
1:A:491:HIS:HE1	1:A:499:LEU:HD23	1.81	0.45
1:A:936:THR:O	1:A:939:LEU:HD23	2.16	0.45
1:A:514:SER:OG	1:A:515:SER:N	2.49	0.45
1:B:918:ARG:O	1:B:921:ILE:HG22	2.16	0.45
1:B:1034:THR:H	1:B:1058:THR:HG22	1.82	0.45
1:B:1090:ARG:HH12	1:B:1101:GLN:HA	1.81	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:392:GLN:O	1:A:396:ILE:HG23	2.16	0.45
1:B:97:ILE:HD12	1:B:306:LEU:HD11	1.98	0.45
1:B:128:ASP:OD1	1:B:131:SER:N	2.49	0.45
1:B:429:PRO:HD2	1:B:430:LEU:HD22	1.98	0.45
1:A:283:MET:HE3	1:A:283:MET:HB3	1.85	0.45
1:B:302:GLN:HE21	1:B:306:LEU:HD12	1.81	0.45
1:B:565:SER:OG	1:B:566:LEU:N	2.50	0.45
1:B:768:GLY:HA3	1:B:869:PHE:CD1	2.51	0.45
1:B:547:ARG:HE	1:B:550:PRO:HG2	1.82	0.45
1:B:909:ASN:HB2	1:B:910:PRO:HD3	1.98	0.45
1:A:919:LYS:HA	1:A:919:LYS:HD3	1.83	0.44
1:A:921:ILE:HB	1:B:933:ILE:HG21	1.99	0.44
1:B:420:LEU:HD12	1:B:420:LEU:O	2.17	0.44
1:B:1065:PRO:HD2	1:B:1068:LEU:HD12	1.98	0.44
1:A:438:ASN:OD1	1:A:438:ASN:N	2.47	0.44
1:A:267:LEU:HD22	1:A:532:TRP:CD1	2.53	0.44
1:B:748:ILE:HG23	1:B:749:GLU:H	1.82	0.44
1:A:489:SER:HA	1:A:506:CYS:SG	2.58	0.44
1:A:412:ASN:OD1	1:A:415:ARG:NH2	2.44	0.44
1:B:73:HIS:HA	1:B:76:LYS:HZ2	1.83	0.44
1:B:442:LEU:HD22	1:B:579:LEU:HD13	2.00	0.44
1:A:473:SER:O	1:A:477:GLU:HG3	2.18	0.44
1:A:974:LEU:HD22	1:A:1001:MET:HE1	1.99	0.43
1:B:834:PRO:HA	1:B:855:VAL:O	2.18	0.43
1:A:1099:ASP:OD1	1:A:1099:ASP:N	2.51	0.43
1:B:109:MET:HG2	1:B:165:LYS:HE2	2.00	0.43
1:B:293:CYS:HB2	1:B:325:LEU:HD12	2.00	0.43
1:A:292:ASP:HB3	1:A:295:ALA:HB2	2.01	0.43
1:A:516:LYS:HE2	1:A:516:LYS:HB2	1.84	0.43
1:A:908:ARG:HH12	1:A:911:LEU:HD23	1.83	0.43
1:A:1022:MET:O	1:A:1025:ASN:HB2	2.18	0.43
1:A:511:VAL:HG11	1:A:580:GLN:HB2	1.99	0.43
1:A:970:LEU:HB2	1:A:1005:LEU:HD22	2.01	0.43
1:B:981:VAL:HG11	1:B:1020:MET:SD	2.58	0.43
1:A:908:ARG:HA	1:A:908:ARG:NH1	2.33	0.43
1:B:78:LYS:HB2	1:B:78:LYS:HE2	1.71	0.43
1:B:273:ASP:OD2	1:B:327:TYR:OH	2.31	0.43
1:B:840:ALA:HA	1:B:849:VAL:O	2.19	0.43
1:B:912:SER:HA	1:B:915:MET:SD	2.58	0.43
1:A:234:THR:O	1:A:377:ARG:NH2	2.47	0.43
1:A:285:ASN:HD21	1:A:314:GLY:HA2	1.84	0.43

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:423:MET:HE2	1:A:423:MET:HB3	1.82	0.43
1:B:506:CYS:SG	1:B:525:HIS:HB2	2.59	0.43
1:A:102:ASN:OD1	1:A:102:ASN:N	2.49	0.42
1:B:429:PRO:O	1:B:432:ILE:HG12	2.19	0.42
1:A:361:LYS:HB3	1:A:362:ARG:H	1.57	0.42
1:B:1069:LEU:HD13	1:B:1102:TYR:CE1	2.54	0.42
1:A:940:CYS:SG	1:A:980:GLN:NE2	2.92	0.42
1:A:945:SER:O	1:A:949:ASP:N	2.53	0.42
1:A:1056:ARG:NH1	1:A:1112:ILE:HG23	2.35	0.42
1:B:247:ASP:O	1:B:248:ASP:HB2	2.20	0.42
1:B:562:LYS:HZ2	1:B:563:THR:H	1.68	0.42
1:B:1012:LEU:O	1:B:1016:LEU:HG	2.20	0.42
1:A:449:ALA:HB3	1:A:520:PHE:CE1	2.54	0.42
1:A:799:LEU:HD12	1:A:799:LEU:HA	1.84	0.42
1:B:562:LYS:HD2	1:B:562:LYS:HA	1.82	0.42
1:A:538:ASP:HB2	1:A:542:ARG:NH1	2.35	0.41
1:A:911:LEU:HA	1:A:914:ILE:HD12	2.01	0.41
1:A:247:ASP:O	1:A:248:ASP:HB2	2.20	0.41
1:A:971:ASN:HD22	1:A:1001:MET:HG2	1.85	0.41
1:B:265:LEU:HD23	1:B:266:GLY:N	2.36	0.41
1:A:101:GLU:HG2	1:A:298:ALA:HB1	2.01	0.41
1:A:108:THR:OG1	1:A:109:MET:N	2.54	0.41
1:A:847:LYS:HE3	1:A:847:LYS:HB3	1.84	0.41
1:B:81:GLN:HA	1:B:82:PRO:HD3	1.90	0.41
1:B:90:ASP:OD1	1:B:90:ASP:N	2.47	0.41
1:B:424:LEU:O	1:B:428:ALA:HB2	2.20	0.41
1:B:570:ASP:OD1	1:B:570:ASP:N	2.49	0.41
1:A:458:LYS:NZ	1:A:465:GLU:HB2	2.35	0.41
1:A:1096:MET:HE3	1:A:1096:MET:HB2	1.86	0.41
1:A:442:LEU:HD22	1:A:579:LEU:HD13	2.02	0.41
1:A:1038:SER:HB3	1:A:1054:GLU:OE1	2.20	0.41
1:B:836:LYS:N	1:B:836:LYS:HD2	2.35	0.41
1:A:1087:MET:SD	1:A:1087:MET:N	2.88	0.41
1:B:104:SER:O	1:B:108:THR:OG1	2.38	0.41
1:A:512:ARG:HD3	1:A:518:MET:HE2	2.03	0.41
1:B:878:GLU:H	1:B:878:GLU:HG2	1.71	0.41
1:B:186:LYS:HA	1:B:186:LYS:HD3	1.93	0.40
1:A:287:VAL:HG22	1:A:339:MET:HG2	2.03	0.40
1:B:101:GLU:HG2	1:B:299:ARG:O	2.21	0.40
1:A:541:ASP:OD1	1:A:541:ASP:N	2.53	0.40
1:B:973:VAL:HG21	1:B:1012:LEU:HB3	2.04	0.40

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:983:MET:HA	1:A:983:MET:HE3	2.04	0.40
1:B:420:LEU:O	1:B:424:LEU:HD23	2.21	0.40
1:B:1098:GLY:CA	1:B:1114:THR:O	2.70	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 PDB entries followed by that with respect to all EM entries.

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	856/1122 (76%)	809 (94%)	47 (6%)	0	100	100
1	B	856/1122 (76%)	814 (95%)	42 (5%)	0	100	100
All	All	1712/2244 (76%)	1623 (95%)	89 (5%)	0	100	100

There are no Ramachandran outliers to report.

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 PDB entries followed by that with respect to all EM entries.

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	750/970 (77%)	750 (100%)	0	100	100
1	B	751/970 (77%)	747 (100%)	4 (0%)	86	92
All	All	1501/1940 (77%)	1497 (100%)	4 (0%)	90	95

All (4) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	97	ILE
1	B	475	LEU
1	B	532	TRP
1	B	861	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (13) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	392	GLN
1	A	760	ASN
1	A	909	ASN
1	A	980	GLN
1	A	1014	GLN
1	A	1105	GLN
1	B	81	GLN
1	B	297	HIS
1	B	525	HIS
1	B	537	HIS
1	B	881	GLN
1	B	1025	ASN
1	B	1105	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](#)

2 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	O6E	A	1201	-	42,46,46	1.11	4 (9%)	50,67,67	1.05	3 (6%)
2	O6E	B	1201	-	42,46,46	1.08	2 (4%)	50,67,67	1.18	4 (8%)

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
2	O6E	A	1201	-	-	17/25/74/74	0/4/4/4
2	O6E	B	1201	-	-	14/25/74/74	0/4/4/4

All (6) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	B	1201	O6E	CAB-CBI	-3.59	1.37	1.47
2	A	1201	O6E	CAO-CAV	3.58	1.38	1.35
2	A	1201	O6E	CAB-CBI	-3.17	1.38	1.47
2	B	1201	O6E	CAO-CAV	2.72	1.37	1.35
2	A	1201	O6E	CBI-CBC	2.06	1.41	1.37
2	A	1201	O6E	OAZ-CAL	-2.05	1.23	1.30

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	1201	O6E	CAS-CBC-CAW	3.19	128.15	124.17
2	B	1201	O6E	CAO-CAV-NAE	-2.74	125.03	128.83
2	A	1201	O6E	CAS-CBC-CAW	2.54	127.34	124.17
2	B	1201	O6E	CAC-CBJ-CBD	-2.49	108.04	114.26
2	B	1201	O6E	CAQ-CBN-NBP	2.47	128.14	125.20
2	A	1201	O6E	CAO-CAV-NAE	-2.19	125.79	128.83
2	A	1201	O6E	CBD-CBJ-CBN	2.14	104.54	101.34

There are no chirality outliers.

All (31) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
2	A	1201	O6E	CAH-CAC-CBJ-CBD
2	A	1201	O6E	CAH-CAC-CBJ-CBN
2	A	1201	O6E	CAY-CAQ-CBN-NBP
2	A	1201	O6E	CBK-CAD-CAI-CAM
2	A	1201	O6E	CAV-CAO-CBO-NAN
2	A	1201	O6E	CAV-CAO-CBO-CBK
2	A	1201	O6E	CAW-CAP-CBL-NAE
2	A	1201	O6E	CAW-CAP-CBL-CBH
2	B	1201	O6E	CAH-CAC-CBJ-CBD
2	B	1201	O6E	CAH-CAC-CBJ-CBN
2	B	1201	O6E	CBN-CAQ-CAY-NAN
2	B	1201	O6E	CBN-CAQ-CAY-CBE
2	B	1201	O6E	CAV-CAO-CBO-NAN
2	B	1201	O6E	CAV-CAO-CBO-CBK
2	B	1201	O6E	CAW-CAP-CBL-NAE
2	B	1201	O6E	CAW-CAP-CBL-CBH
2	A	1201	O6E	CBL-CAP-CAW-NAJ
2	B	1201	O6E	CBL-CAP-CAW-NAJ
2	A	1201	O6E	CBL-CAP-CAW-CBC
2	B	1201	O6E	CBL-CAP-CAW-CBC
2	B	1201	O6E	CBB-CAA-CAF-CAL
2	A	1201	O6E	CAF-CAA-CBB-CAV
2	A	1201	O6E	CAF-CAA-CBB-CBH
2	B	1201	O6E	CBK-CAD-CAI-CAM
2	A	1201	O6E	CAI-CAD-CBK-CBE
2	A	1201	O6E	CAI-CAD-CBK-CBO
2	A	1201	O6E	CAA-CAF-CAL-OFB
2	A	1201	O6E	CAA-CAF-CAL-OAZ
2	B	1201	O6E	CAD-CAI-CAM-OBG
2	A	1201	O6E	CBB-CAA-CAF-CAL
2	B	1201	O6E	CAD-CAI-CAM-OBA

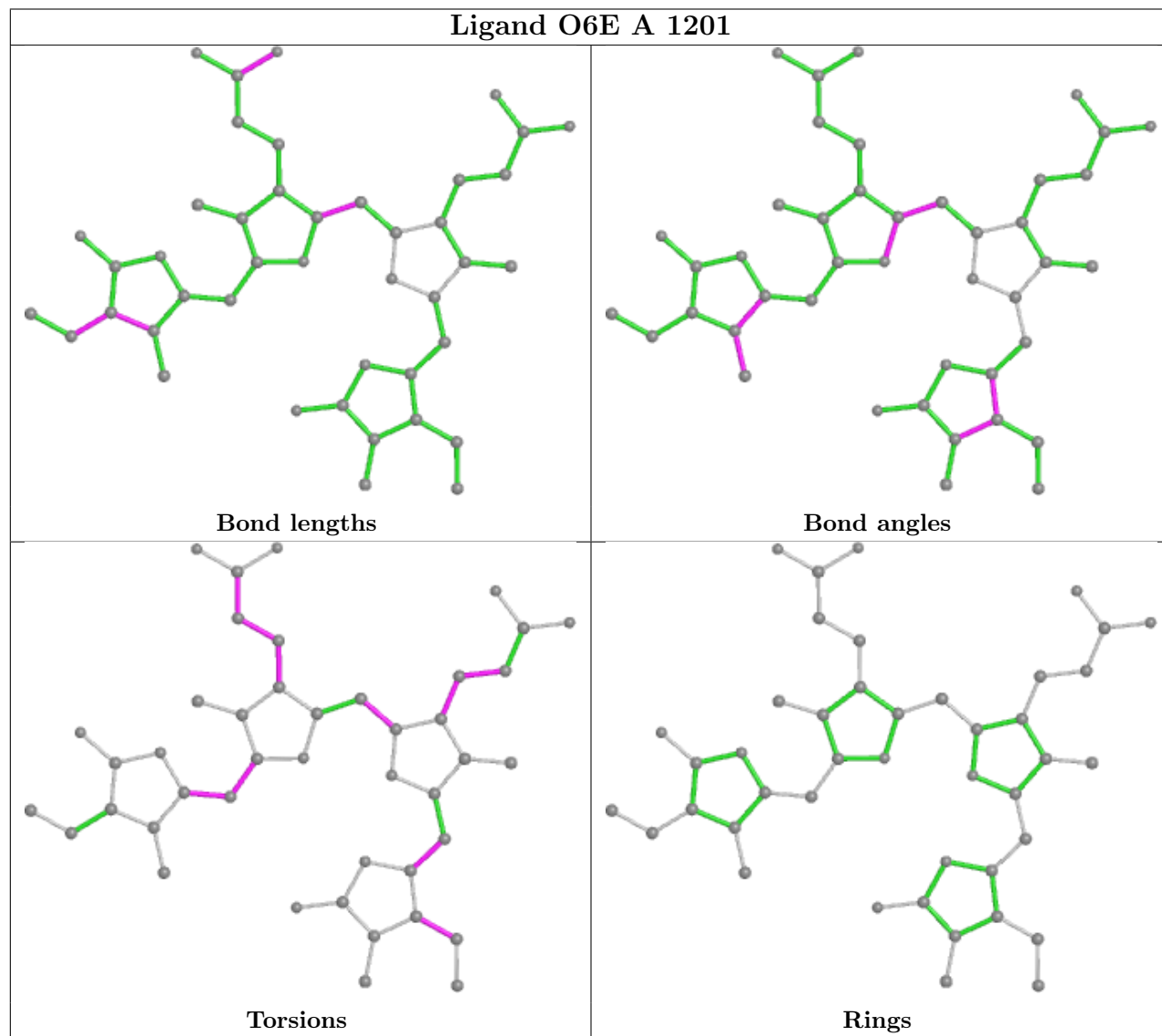
There are no ring outliers.

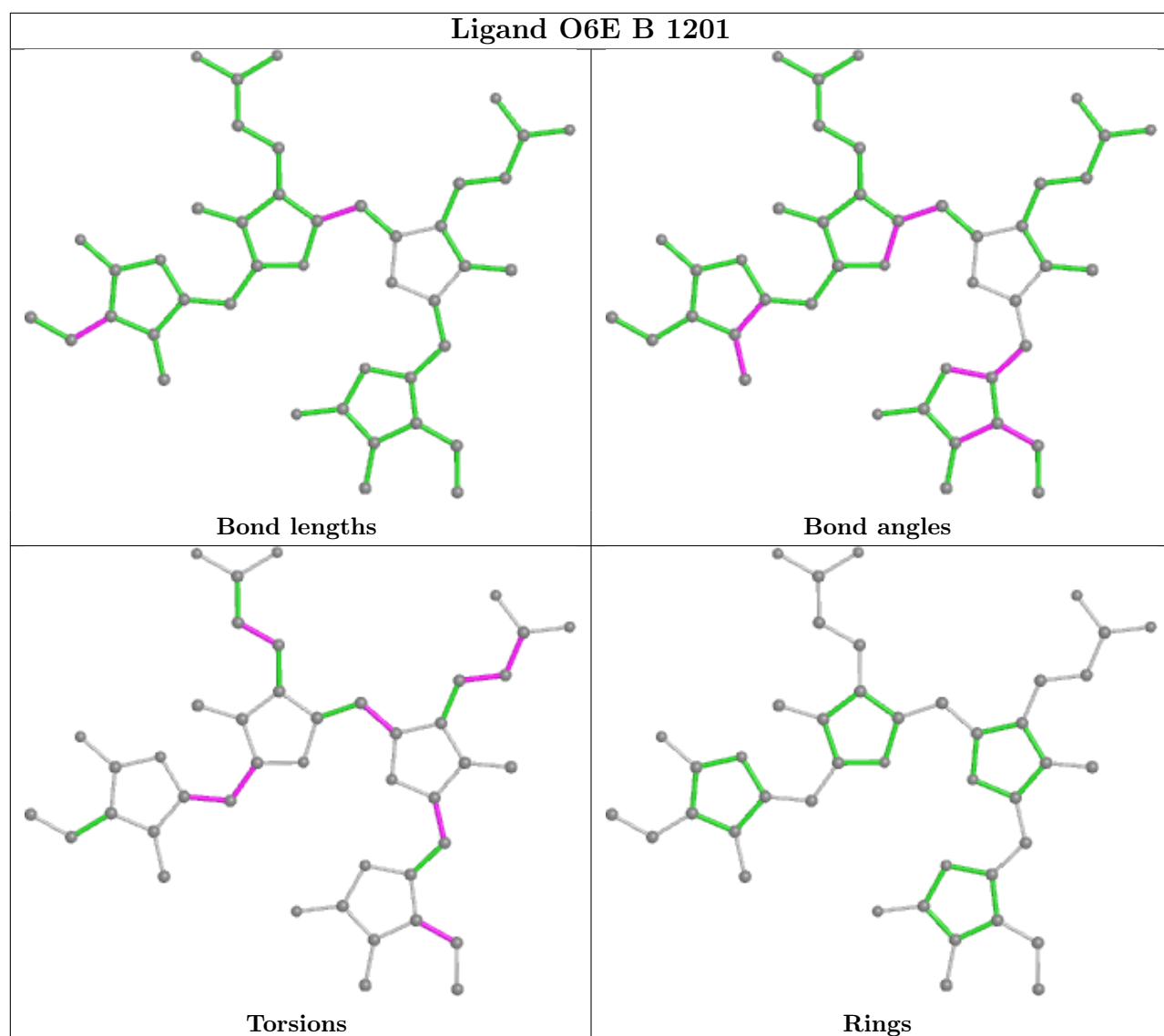
2 monomers are involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	A	1201	O6E	1	0
2	B	1201	O6E	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.





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.