



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 6, 2026 – 05:29 AM UTC

PDB ID : 2VFX / pdb_00002vfx
Title : Structure of the Symmetric Mad2 Dimer
Authors : Yang, M.; Li, B.; Liu, C.-J.; Tomchick, D.R.; Machius, M.; Rizo, J.; Yu, H.;
Luo, X.
Deposited on : 2007-11-05
Resolution : 1.95 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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)
Xtrriage (Phenix) : 2.0
EDS : 3.0
Buster-report : wwPDB partial adaption of 1.1.7 (2018)
Percentile statistics : 20250101.v01 (using entries in the PDB archive January 1st 2025)
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) : 2.49

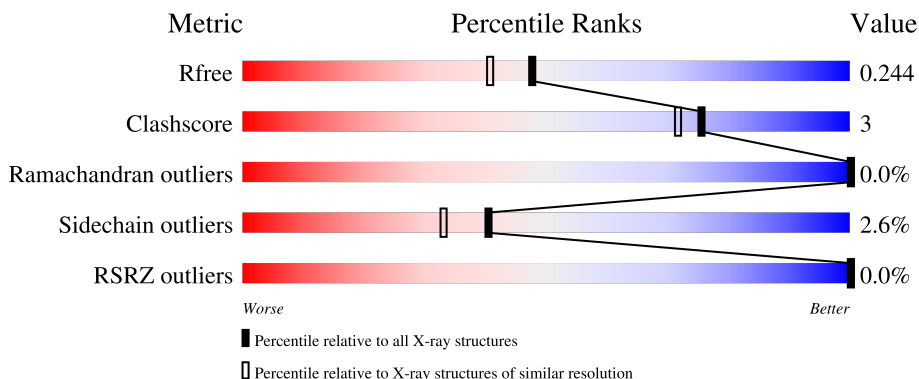
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.95 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}	180053	3494 (1.96-1.96)
Clashscore	190562	3612 (1.96-1.96)
Ramachandran outliers	187476	3587 (1.96-1.96)
Sidechain outliers	187428	3587 (1.96-1.96)
RSRZ outliers	180081	3495 (1.96-1.96)

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	206	
1	B	206	
1	C	206	
1	D	206	
1	E	206	

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Mol	Chain	Length	Quality of chain
1	F	206	 86% 11% ..
1	G	206	 89% 8% ..
1	H	206	 89% 9% ..
1	I	206	 88% 9% ..
1	J	206	 87% 9% ..
1	K	206	 91% 9%
1	L	206	 89% 9% ..

2 Entry composition [i](#)

There are 7 unique types of molecules in this entry. The entry contains 21651 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 MITOTIC SPINDLE ASSEMBLY CHECKPOINT PROTEIN MAD2A.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	203	Total 1652	C 1055	N 271	O 322	S 4	0	3	0
1	B	203	Total 1652	C 1054	N 272	O 323	S 3	0	3	0
1	C	203	Total 1652	C 1055	N 271	O 322	S 4	0	3	0
1	D	202	Total 1681	C 1075	N 275	O 327	S 4	0	7	0
1	E	206	Total 1685	C 1073	N 277	O 331	S 4	0	4	0
1	F	203	Total 1640	C 1049	N 269	O 318	S 4	0	1	0
1	G	203	Total 1663	C 1065	N 273	O 322	S 3	0	4	0
1	H	203	Total 1638	C 1047	N 269	O 319	S 3	0	1	0
1	I	202	Total 1647	C 1053	N 270	O 320	S 4	0	3	0
1	J	201	Total 1667	C 1065	N 277	O 322	S 3	0	5	0
1	K	206	Total 1685	C 1074	N 276	O 332	S 3	0	4	0
1	L	203	Total 1647	C 1053	N 271	O 320	S 3	0	2	0

There are 36 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	13	ALA	LEU	engineered mutation	UNP Q13257
A	79	SER	CYS	engineered mutation	UNP Q13257
A	106	SER	CYS	engineered mutation	UNP Q13257
B	13	ALA	LEU	engineered mutation	UNP Q13257

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Chain	Residue	Modelled	Actual	Comment	Reference
B	79	SER	CYS	engineered mutation	UNP Q13257
B	106	SER	CYS	engineered mutation	UNP Q13257
C	13	ALA	LEU	engineered mutation	UNP Q13257
C	79	SER	CYS	engineered mutation	UNP Q13257
C	106	SER	CYS	engineered mutation	UNP Q13257
D	13	ALA	LEU	engineered mutation	UNP Q13257
D	79	SER	CYS	engineered mutation	UNP Q13257
D	106	SER	CYS	engineered mutation	UNP Q13257
E	13	ALA	LEU	engineered mutation	UNP Q13257
E	79	SER	CYS	engineered mutation	UNP Q13257
E	106	SER	CYS	engineered mutation	UNP Q13257
F	13	ALA	LEU	engineered mutation	UNP Q13257
F	79	SER	CYS	engineered mutation	UNP Q13257
F	106	SER	CYS	engineered mutation	UNP Q13257
G	13	ALA	LEU	engineered mutation	UNP Q13257
G	79	SER	CYS	engineered mutation	UNP Q13257
G	106	SER	CYS	engineered mutation	UNP Q13257
H	13	ALA	LEU	engineered mutation	UNP Q13257
H	79	SER	CYS	engineered mutation	UNP Q13257
H	106	SER	CYS	engineered mutation	UNP Q13257
I	13	ALA	LEU	engineered mutation	UNP Q13257
I	79	SER	CYS	engineered mutation	UNP Q13257
I	106	SER	CYS	engineered mutation	UNP Q13257
J	13	ALA	LEU	engineered mutation	UNP Q13257
J	79	SER	CYS	engineered mutation	UNP Q13257
J	106	SER	CYS	engineered mutation	UNP Q13257
K	13	ALA	LEU	engineered mutation	UNP Q13257
K	79	SER	CYS	engineered mutation	UNP Q13257
K	106	SER	CYS	engineered mutation	UNP Q13257
L	13	ALA	LEU	engineered mutation	UNP Q13257
L	79	SER	CYS	engineered mutation	UNP Q13257
L	106	SER	CYS	engineered mutation	UNP Q13257

- Molecule 2 is MAGNESIUM ION (CCD ID: MG) (formula: Mg).

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

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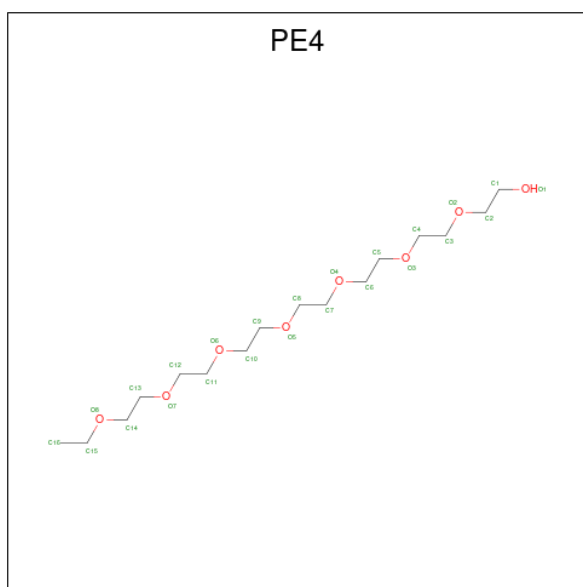
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Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	E	1	Total Mg 1 1	0	0
2	F	1	Total Mg 1 1	0	0
2	G	1	Total Mg 1 1	0	0
2	K	1	Total Mg 1 1	0	0
2	L	1	Total Mg 1 1	0	0

- Molecule 3 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

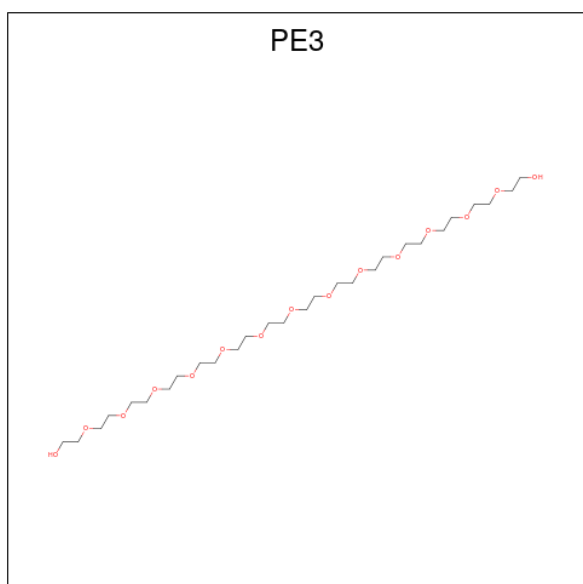
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	3	Total Cl 3 3	0	0
3	B	4	Total Cl 4 4	0	0
3	C	3	Total Cl 3 3	0	0
3	D	5	Total Cl 5 5	0	0
3	E	5	Total Cl 5 5	0	0
3	F	2	Total Cl 2 2	0	0
3	G	1	Total Cl 1 1	0	0
3	I	4	Total Cl 4 4	0	0
3	J	5	Total Cl 5 5	0	0
3	K	2	Total Cl 2 2	0	0
3	L	3	Total Cl 3 3	0	0

- Molecule 4 is 2-{2-[2-(2-{2-[2-(2-ETHOXY-ETHOXY)-ETHOXY]-ETHOXY}-ETHOXY)-ETHOXY]-ETHOXY}-ETHANOL (CCD ID: PE4) (formula: C₁₆H₃₄O₈).



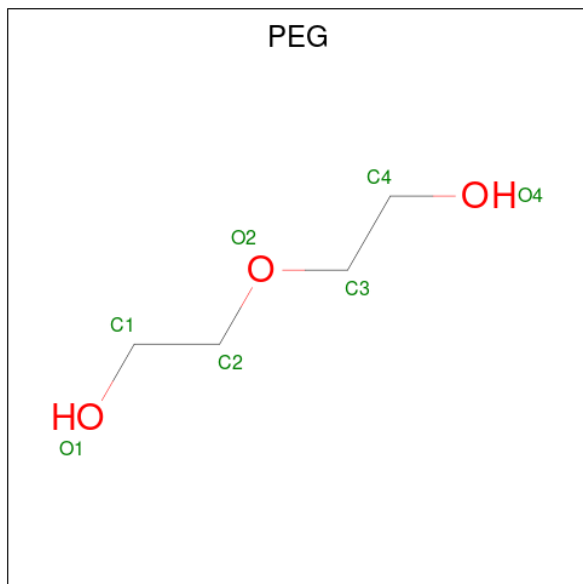
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	A	1	Total C O 13 8 5	0	0
4	E	1	Total C O 13 8 5	0	0
4	L	1	Total C O 13 8 5	0	0

- Molecule 5 is 3,6,9,12,15,18,21,24,27,30,33,36,39-TRIDECAXAHENTETRACONTANE-1,41-DIOL (CCD ID: PE3) (formula: $C_{28}H_{58}O_{15}$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
5	B	1	Total	C	O	0	0
			10	6	4		
5	C	1	Total	C	O	0	0
			10	6	4		
5	F	1	Total	C	O	0	0
			10	6	4		
5	G	1	Total	C	O	0	0
			10	6	4		
5	H	1	Total	C	O	0	0
			10	6	4		
5	K	1	Total	C	O	0	0
			10	6	4		

- Molecule 6 is DI(HYDROXYETHYL)ETHER (CCD ID: PEG) (formula: $C_4H_{10}O_3$).



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf
6	I	1	Total	C	O	0	0
			7	4	3		

- Molecule 7 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	A	145	Total	O	0	0
			145	145		
7	B	133	Total	O	0	0
			133	133		
7	C	121	Total	O	0	0
			121	121		

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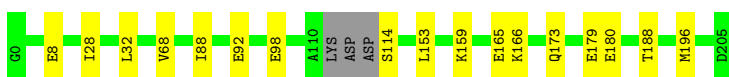
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
7	D	140	Total 140	O 140	0	0
7	E	131	Total 131	O 131	0	0
7	F	131	Total 131	O 131	0	0
7	G	130	Total 130	O 130	0	0
7	H	118	Total 118	O 118	0	0
7	I	138	Total 138	O 138	0	0
7	J	136	Total 136	O 136	0	0
7	K	140	Total 140	O 140	0	0
7	L	128	Total 128	O 128	0	0

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 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: MITOTIC SPINDLE ASSEMBLY CHECKPOINT PROTEIN MAD2A

Chain A: 



- Molecule 1: MITOTIC SPINDLE ASSEMBLY CHECKPOINT PROTEIN MAD2A

Chain B: 




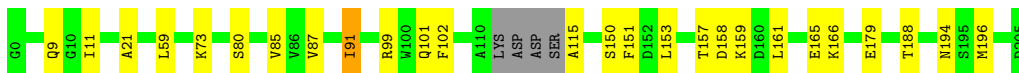
- Molecule 1: MITOTIC SPINDLE ASSEMBLY CHECKPOINT PROTEIN MAD2A

Chain C: 



- Molecule 1: MITOTIC SPINDLE ASSEMBLY CHECKPOINT PROTEIN MAD2A

Chain D: 



- Molecule 1: MITOTIC SPINDLE ASSEMBLY CHECKPOINT PROTEIN MAD2A

Chain E: 

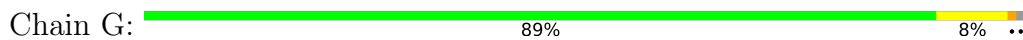


- Molecule 1: MITOTIC SPINDLE ASSEMBLY CHECKPOINT PROTEIN MAD2A

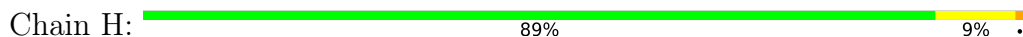
Chain F: 



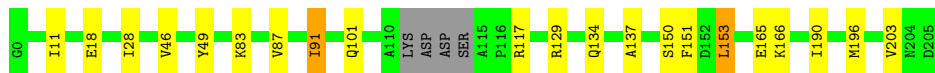
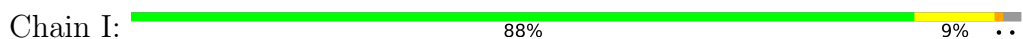
- Molecule 1: MITOTIC SPINDLE ASSEMBLY CHECKPOINT PROTEIN MAD2A



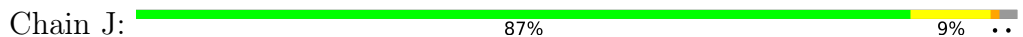
- Molecule 1: MITOTIC SPINDLE ASSEMBLY CHECKPOINT PROTEIN MAD2A



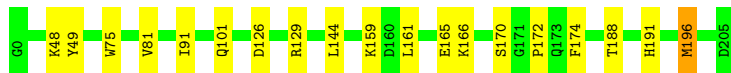
- Molecule 1: MITOTIC SPINDLE ASSEMBLY CHECKPOINT PROTEIN MAD2A



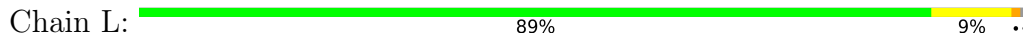
- Molecule 1: MITOTIC SPINDLE ASSEMBLY CHECKPOINT PROTEIN MAD2A



- Molecule 1: MITOTIC SPINDLE ASSEMBLY CHECKPOINT PROTEIN MAD2A



- Molecule 1: MITOTIC SPINDLE ASSEMBLY CHECKPOINT PROTEIN MAD2A



4 Data and refinement statistics i

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	109.34Å 191.41Å 154.31Å 90.00° 90.02° 90.00°	Depositor
Resolution (Å)	45.00 – 1.95 45.00 – 1.95	Depositor EDS
% Data completeness (in resolution range)	97.3 (45.00-1.95) 97.2 (45.00-1.95)	Depositor EDS
R_{merge}	0.07	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.93 (at 1.95Å)	Xtrriage
Refinement program	REFMAC 5.2.0005	Depositor
R, R_{free}	0.208 , 0.247 0.207 , 0.244	Depositor DCC
R_{free} test set	2700 reflections (1.19%)	wwPDB-VP
Wilson B-factor (Å ²)	23.1	Xtrriage
Anisotropy	0.324	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.36 , 25.2	EDS
L-test for twinning ²	$\langle L \rangle = 0.50$, $\langle L^2 \rangle = 0.33$	Xtrriage
Estimated twinning fraction	0.000 for -1/2*h-1/2*k,-3/2*h+1/2*k,-l 0.000 for -1/2*h+1/2*k,3/2*h+1/2*k,-l 0.000 for 1/2*h-1/2*k,-3/2*h-1/2*k,-l 0.000 for 1/2*h+1/2*k,3/2*h-1/2*k,-l 0.478 for h,-k,-l	Xtrriage
F_o, F_c correlation	0.97	EDS
Total number of atoms	21651	wwPDB-VP
Average B, all atoms (Å ²)	25.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The analyses of the Patterson function reveals a significant off-origin peak that is 51.06 % 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 5.9210e-05. The detected translational NCS is most likely also responsible for the elevated intensity ratio.*

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: MG, CL, PE4, PEG, PE3

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	0.61	0/1679	0.95	2/2272 (0.1%)
1	B	0.63	0/1679	0.97	3/2273 (0.1%)
1	C	0.62	0/1679	0.96	3/2272 (0.1%)
1	D	0.62	0/1709	0.97	5/2314 (0.2%)
1	E	0.62	0/1713	0.96	2/2319 (0.1%)
1	F	0.63	0/1667	0.98	3/2256 (0.1%)
1	G	0.63	0/1690	0.97	3/2287 (0.1%)
1	H	0.63	0/1665	0.93	3/2254 (0.1%)
1	I	0.62	0/1674	0.97	1/2266 (0.0%)
1	J	0.62	0/1694	0.98	4/2292 (0.2%)
1	K	0.64	0/1713	0.96	2/2320 (0.1%)
1	L	0.64	0/1674	0.98	2/2265 (0.1%)
All	All	0.63	0/20236	0.97	33/27390 (0.1%)

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	H	1	0

There are no bond length outliers.

The worst 5 of 33 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	G	171	GLY	N-CA-C	-7.46	102.93	112.10
1	D	158	ASP	N-CA-C	7.43	120.84	112.00
1	B	9	GLN	N-CA-C	-6.67	98.47	109.80
1	D	9	GLN	N-CA-C	-6.59	99.80	109.63

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	F	188	THR	N-CA-C	-6.40	105.11	113.17

All (1) chirality outliers are listed below:

Mol	Chain	Res	Type	Atom
1	H	115	ALA	CA

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	1652	0	1670	5	0
1	B	1652	0	1667	10	0
1	C	1652	0	1670	3	0
1	D	1681	0	1695	20	0
1	E	1685	0	1697	7	0
1	F	1640	0	1662	9	0
1	G	1663	0	1690	13	0
1	H	1638	0	1658	11	0
1	I	1647	0	1667	12	0
1	J	1667	0	1681	13	1
1	K	1685	0	1697	11	0
1	L	1647	0	1670	13	1
2	A	1	0	0	0	0
2	B	1	0	0	0	1
2	C	1	0	0	0	0
2	E	1	0	0	0	0
2	F	1	0	0	0	0
2	G	1	0	0	0	0
2	K	1	0	0	0	0
2	L	1	0	0	0	0
3	A	3	0	0	0	0
3	B	4	0	0	0	0
3	C	3	0	0	1	0
3	D	5	0	0	0	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
3	E	5	0	0	0	0
3	F	2	0	0	0	0
3	G	1	0	0	0	0
3	I	4	0	0	0	0
3	J	5	0	0	0	0
3	K	2	0	0	0	0
3	L	3	0	0	0	0
4	A	13	0	17	0	0
4	E	13	0	17	0	0
4	L	13	0	17	0	0
5	B	10	0	13	0	0
5	C	10	0	13	0	0
5	F	10	0	13	0	0
5	G	10	0	13	0	0
5	H	10	0	13	0	0
5	K	10	0	13	0	0
6	I	7	0	10	0	0
7	A	145	0	0	0	0
7	B	133	0	0	0	0
7	C	121	0	0	1	0
7	D	140	0	0	7	0
7	E	131	0	0	1	0
7	F	131	0	0	1	0
7	G	130	0	0	3	0
7	H	118	0	0	1	0
7	I	138	0	0	0	0
7	J	136	0	0	1	0
7	K	140	0	0	2	0
7	L	128	0	0	1	0
All	All	21651	0	20263	120	2

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.

The worst 5 of 120 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:G:101:GLN:HB3	1:G:196:MET:HE2	1.53	0.90
1:K:101:GLN:HB3	1:K:196:MET:HE2	1.55	0.89
1:H:115:ALA:HB1	1:H:116:PRO:CD	2.07	0.85
1:D:101[A]:GLN:NE2	7:D:2071:HOH:O	2.11	0.83

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:J:157[B]:THR:HG21	1:J:161:LEU:HD13	1.61	0.82

All (2) symmetry-related close contacts are listed below. The label for Atom-2 includes the symmetry operator and encoded unit-cell translations to be applied.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
2:B:1206:MG:MG	2:B:1206:MG:MG[2_656]	1.48	0.72
1:J:7[A]:ARG:NH2	1:L:38:TYR:OH[4_645]	2.16	0.04

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	202/206 (98%)	199 (98%)	3 (2%)	0	100	100
1	B	202/206 (98%)	198 (98%)	4 (2%)	0	100	100
1	C	202/206 (98%)	197 (98%)	4 (2%)	1 (0%)	24	16
1	D	205/206 (100%)	200 (98%)	5 (2%)	0	100	100
1	E	208/206 (101%)	206 (99%)	2 (1%)	0	100	100
1	F	200/206 (97%)	197 (98%)	3 (2%)	0	100	100
1	G	203/206 (98%)	200 (98%)	3 (2%)	0	100	100
1	H	200/206 (97%)	197 (98%)	3 (2%)	0	100	100
1	I	201/206 (98%)	198 (98%)	3 (2%)	0	100	100
1	J	200/206 (97%)	198 (99%)	2 (1%)	0	100	100
1	K	208/206 (101%)	206 (99%)	2 (1%)	0	100	100
1	L	201/206 (98%)	198 (98%)	3 (2%)	0	100	100
All	All	2432/2472 (98%)	2394 (98%)	37 (2%)	1 (0%)	100	100

All (1) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	C	115	ALA

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	189/189 (100%)	184 (97%)	5 (3%)	40	33
1	B	189/189 (100%)	185 (98%)	4 (2%)	47	41
1	C	189/189 (100%)	187 (99%)	2 (1%)	65	64
1	D	192/189 (102%)	187 (97%)	5 (3%)	40	33
1	E	193/189 (102%)	189 (98%)	4 (2%)	47	41
1	F	187/189 (99%)	177 (95%)	10 (5%)	20	9
1	G	190/189 (100%)	186 (98%)	4 (2%)	47	41
1	H	187/189 (99%)	179 (96%)	8 (4%)	26	15
1	I	188/189 (100%)	182 (97%)	6 (3%)	34	25
1	J	189/189 (100%)	185 (98%)	4 (2%)	47	41
1	K	193/189 (102%)	189 (98%)	4 (2%)	47	41
1	L	188/189 (100%)	184 (98%)	4 (2%)	47	41
All	All	2274/2268 (100%)	2214 (97%)	60 (3%)	40	33

5 of 60 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	F	196[A]	MET
1	K	196	MET
1	H	45	ARG
1	K	170	SER
1	L	203	VAL

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 16 such sidechains are listed below:

Mol	Chain	Res	Type
1	K	71	GLN
1	K	9	GLN
1	G	71	GLN
1	J	71	GLN
1	F	173	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](#)

Of 55 ligands modelled in this entry, 45 are monoatomic - leaving 10 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	PE4	A	1210	-	12,12,23	0.55	0	11,11,22	0.44	0
5	PE3	H	3104	-	9,9,42	1.07	1 (11%)	8,8,41	1.04	0
4	PE4	L	1209	-	12,12,23	0.68	0	11,11,22	0.32	0
4	PE4	E	1210	-	12,12,23	0.63	0	11,11,22	0.54	0
5	PE3	F	1208	-	9,9,42	0.46	0	8,8,41	0.52	0
6	PEG	I	1209	-	6,6,6	0.62	0	5,5,5	0.41	0
5	PE3	C	1210	-	9,9,42	0.50	0	8,8,41	0.59	0
5	PE3	K	1209	-	9,9,42	0.64	0	8,8,41	0.44	0
5	PE3	G	1208	-	9,9,42	0.72	0	8,8,41	0.56	0
5	PE3	B	1210	-	9,9,42	0.63	0	8,8,41	0.50	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	PE4	A	1210	-	-	6/10/10/21	-
5	PE3	H	3104	-	-	5/7/7/40	-
4	PE4	L	1209	-	-	5/10/10/21	-
4	PE4	E	1210	-	-	9/10/10/21	-
5	PE3	F	1208	-	-	5/7/7/40	-
6	PEG	I	1209	-	-	4/4/4/4	-
5	PE3	C	1210	-	-	0/7/7/40	-
5	PE3	K	1209	-	-	5/7/7/40	-
5	PE3	G	1208	-	-	6/7/7/40	-
5	PE3	B	1210	-	-	4/7/7/40	-

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	H	3104	PE3	O34-C35	2.24	1.53	1.42

There are no bond angle outliers.

There are no chirality outliers.

5 of 49 torsion outliers are listed below:

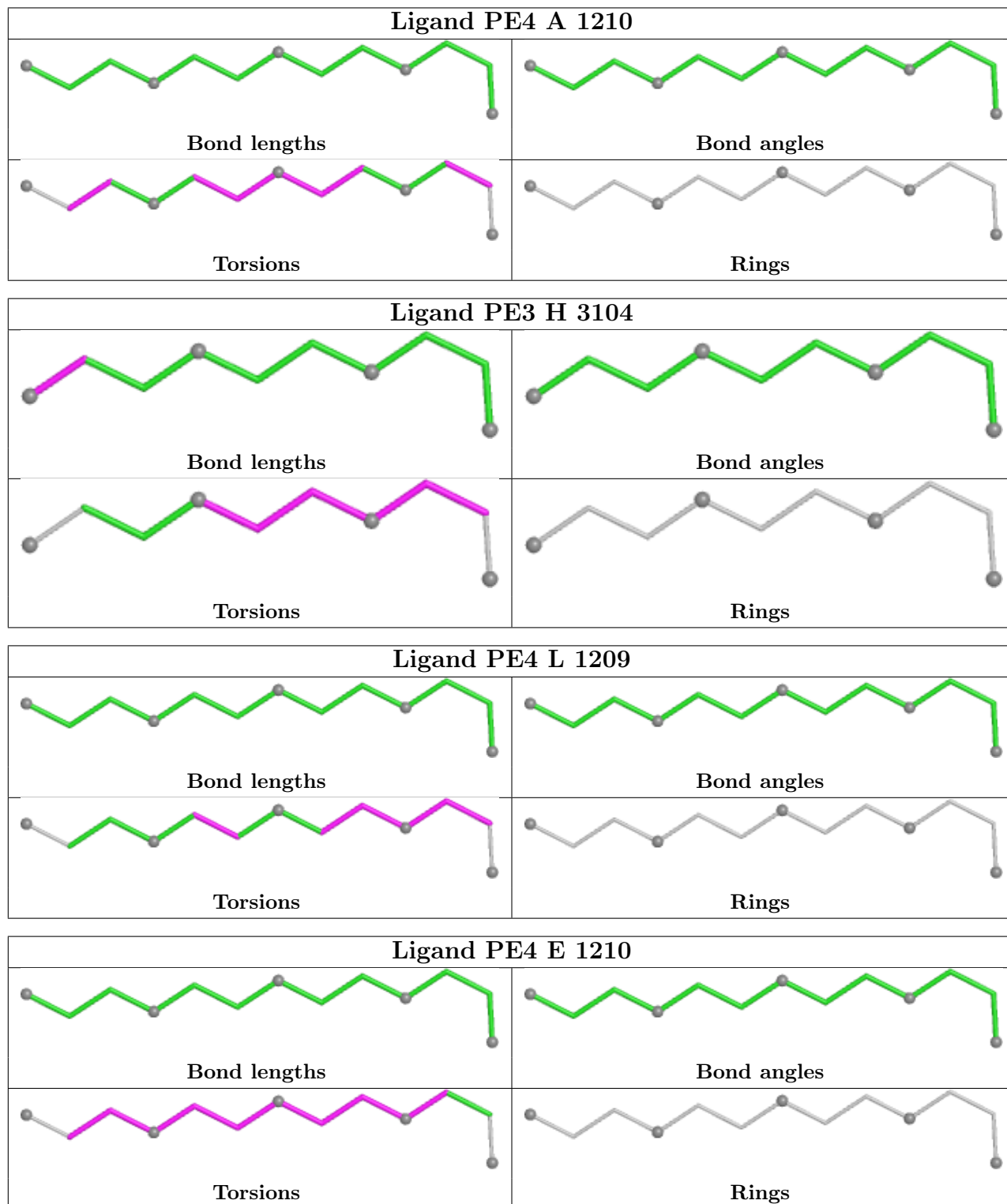
Mol	Chain	Res	Type	Atoms
4	E	1210	PE4	O2-C3-C4-O3
5	F	1208	PE3	O34-C35-C36-O37
5	G	1208	PE3	O34-C35-C36-O37
6	I	1209	PEG	O1-C1-C2-O2
5	G	1208	PE3	O37-C38-C39-O40

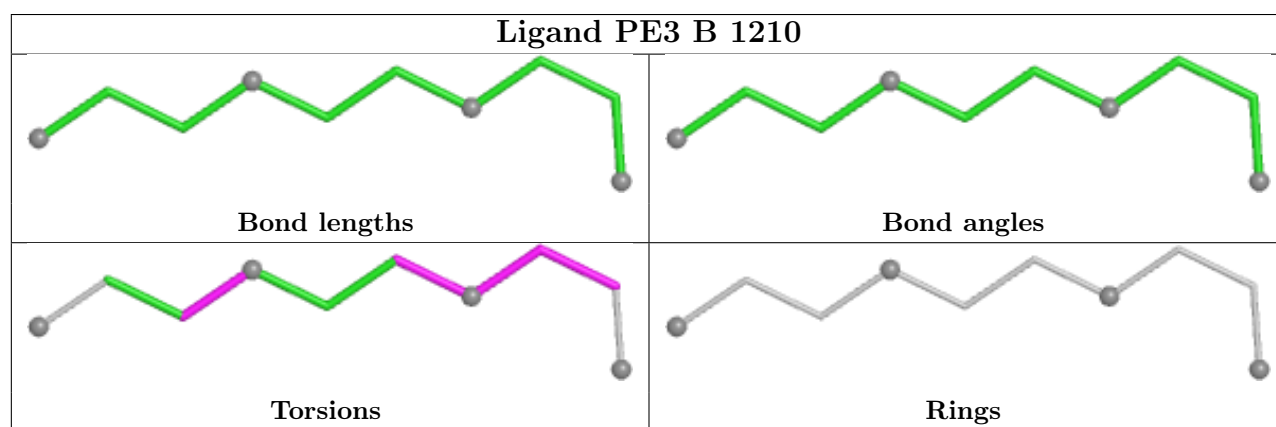
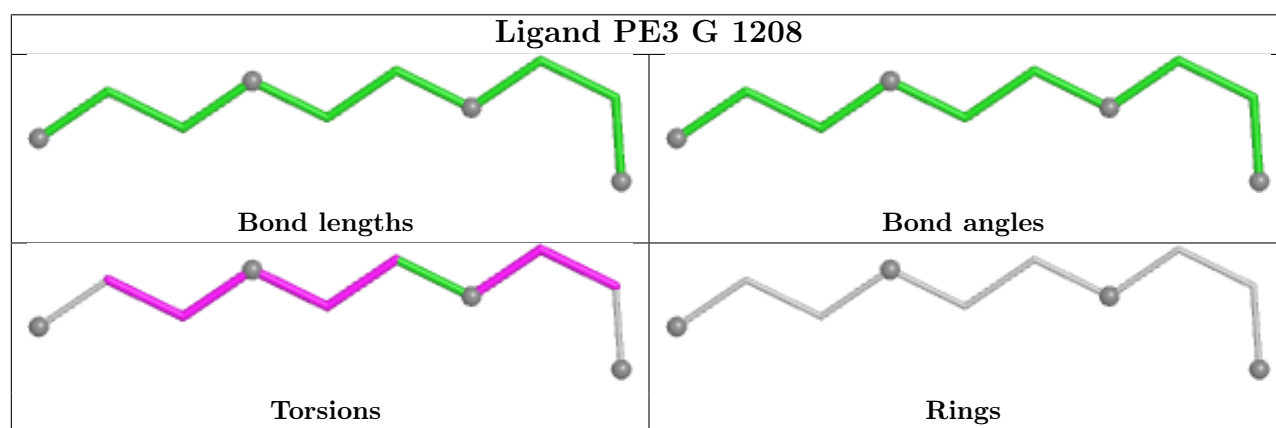
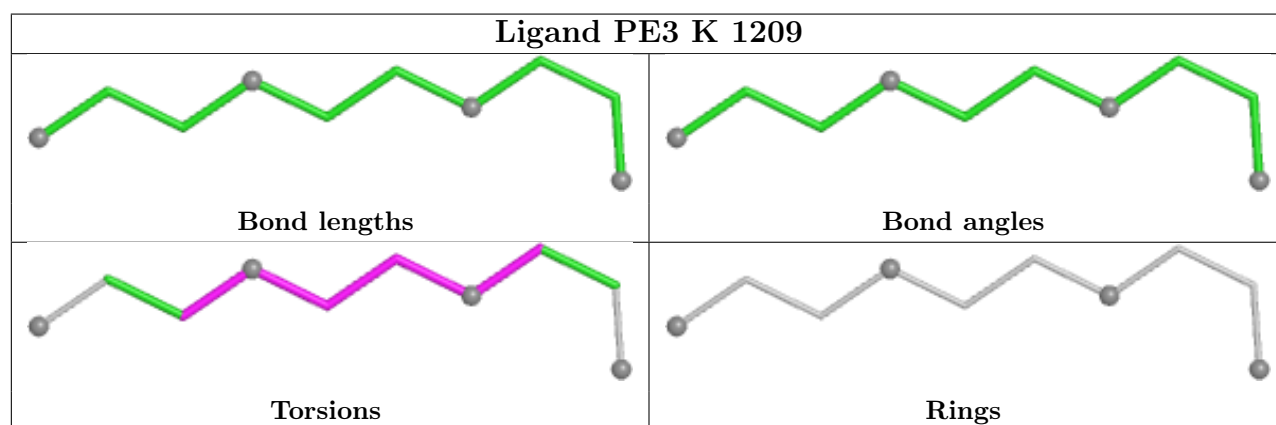
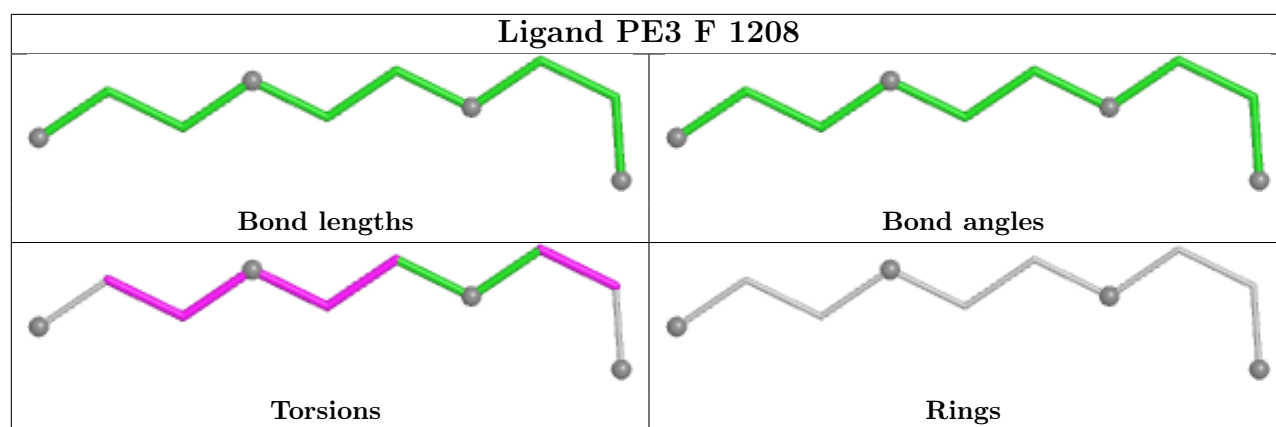
There are no ring outliers.

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 [i](#)

6.1 Protein, DNA and RNA chains [i](#)

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	203/206 (98%)	-1.26	0 100 100	8, 20, 31, 46	3 (1%)
1	B	203/206 (98%)	-1.22	0 100 100	10, 24, 35, 46	3 (1%)
1	C	203/206 (98%)	-1.20	0 100 100	11, 24, 37, 46	3 (1%)
1	D	202/206 (98%)	-1.22	0 100 100	11, 24, 34, 43	7 (3%)
1	E	206/206 (100%)	-1.20	0 100 100	10, 24, 35, 44	4 (1%)
1	F	203/206 (98%)	-1.20	0 100 100	12, 25, 35, 45	1 (0%)
1	G	203/206 (98%)	-1.19	1 (0%) 87 90	10, 24, 35, 48	4 (1%)
1	H	203/206 (98%)	-1.20	0 100 100	10, 25, 37, 47	1 (0%)
1	I	202/206 (98%)	-1.21	0 100 100	11, 25, 34, 45	3 (1%)
1	J	201/206 (97%)	-1.17	0 100 100	11, 24, 33, 41	5 (2%)
1	K	206/206 (100%)	-1.27	0 100 100	9, 21, 34, 46	4 (1%)
1	L	203/206 (98%)	-1.28	0 100 100	8, 20, 31, 44	2 (0%)
All	All	2438/2472 (98%)	-1.22	1 (0%) 100 100	8, 24, 35, 48	40 (1%)

All (1) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	G	0	GLY	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 oligosaccharides 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.

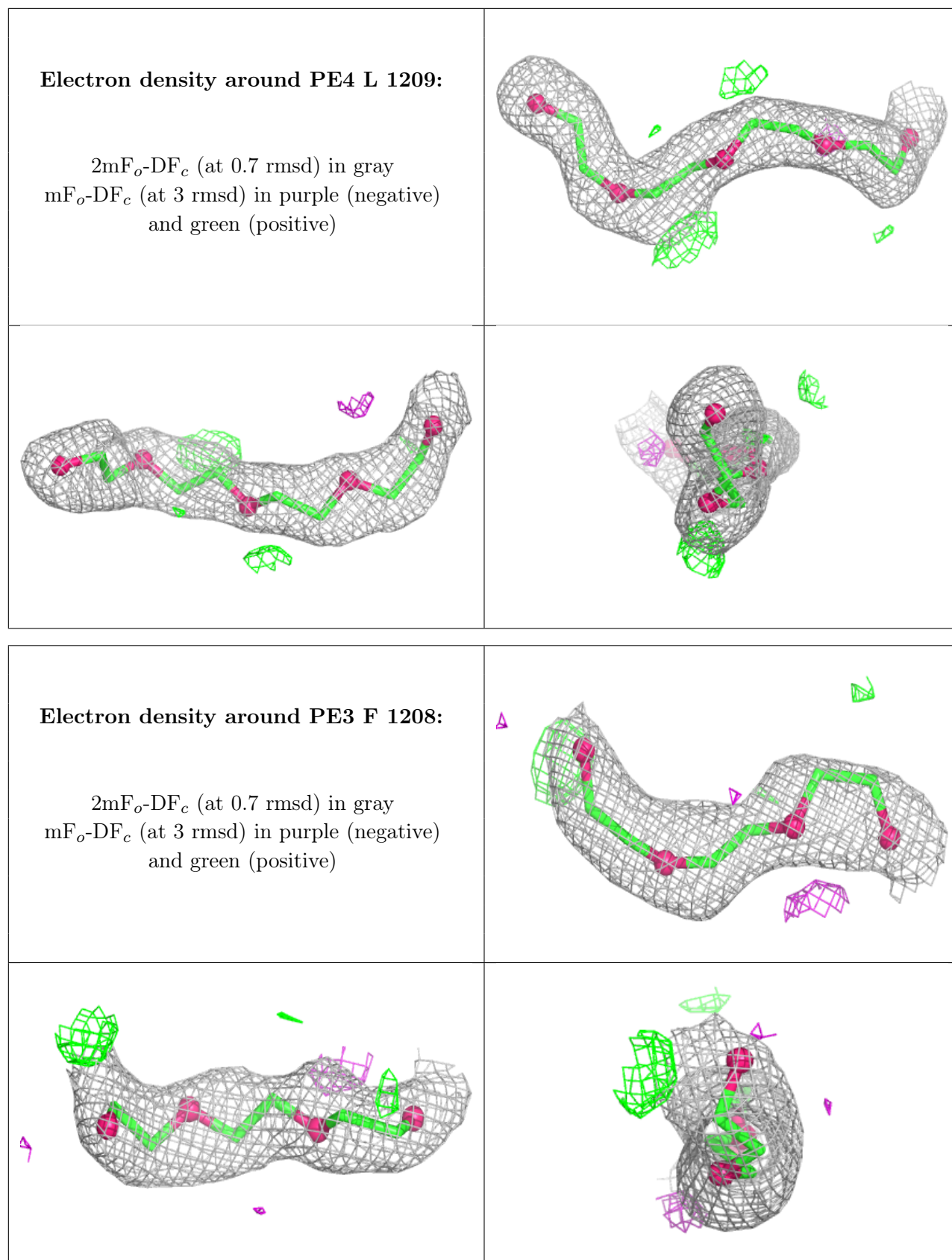
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
3	CL	A	1208	1/1	0.97	0.05	68,68,68,68	0
3	CL	C	1209	1/1	0.97	0.08	52,52,52,52	0
3	CL	L	3127	1/1	0.97	0.08	67,67,67,67	0
4	PE4	L	1209	13/24	0.97	0.07	52,53,55,55	0
5	PE3	F	1208	10/43	0.97	0.07	51,52,53,53	0
4	PE4	A	1210	13/24	0.98	0.06	54,55,59,59	0
4	PE4	E	1210	13/24	0.98	0.06	55,57,65,66	0
3	CL	J	3128	1/1	0.98	0.08	61,61,61,61	0
5	PE3	B	1210	10/43	0.98	0.06	55,56,56,56	0
5	PE3	C	1210	10/43	0.98	0.05	49,49,51,52	0
2	MG	B	1206	1/1	0.98	0.04	39,39,39,39	0
5	PE3	G	1208	10/43	0.98	0.06	52,53,53,54	0
5	PE3	K	1209	10/43	0.98	0.05	50,53,54,55	0
3	CL	A	1209	1/1	0.99	0.04	27,27,27,27	1
3	CL	B	1208	1/1	0.99	0.07	24,24,24,24	0
2	MG	F	1206	1/1	0.99	0.05	29,29,29,29	0
3	CL	E	1209	1/1	0.99	0.06	59,59,59,59	0
3	CL	E	3129	1/1	0.99	0.08	62,62,62,62	0
2	MG	G	1206	1/1	0.99	0.06	24,24,24,24	1
3	CL	K	1207	1/1	0.99	0.04	25,25,25,25	0
5	PE3	H	3104	10/43	0.99	0.05	47,47,48,48	0
2	MG	C	1206	1/1	0.99	0.02	27,27,27,27	0
6	PEG	I	1209	7/7	0.99	0.05	44,45,45,46	0
3	CL	E	1207	1/1	1.00	0.03	18,18,18,18	0
3	CL	E	1208	1/1	1.00	0.04	25,25,25,25	0
3	CL	A	1207	1/1	1.00	0.03	18,18,18,18	0
3	CL	E	3102	1/1	1.00	0.04	17,17,17,17	0
2	MG	A	1206	1/1	1.00	0.02	28,28,28,28	0
3	CL	F	1207	1/1	1.00	0.04	18,18,18,18	0
3	CL	F	3132	1/1	1.00	0.10	40,40,40,40	1
3	CL	G	1207	1/1	1.00	0.03	26,26,26,26	0
3	CL	I	1206	1/1	1.00	0.03	18,18,18,18	0
3	CL	I	1207	1/1	1.00	0.05	25,25,25,25	0
3	CL	I	1208	1/1	1.00	0.04	26,26,26,26	0
3	CL	I	3103	1/1	1.00	0.04	17,17,17,17	0
3	CL	J	1206	1/1	1.00	0.05	17,17,17,17	0
3	CL	J	1207	1/1	1.00	0.05	23,23,23,23	0

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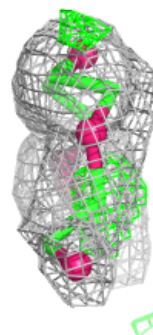
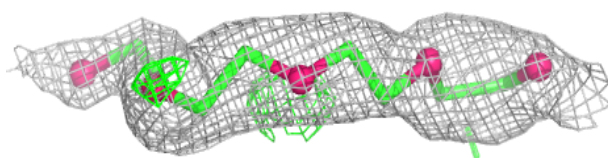
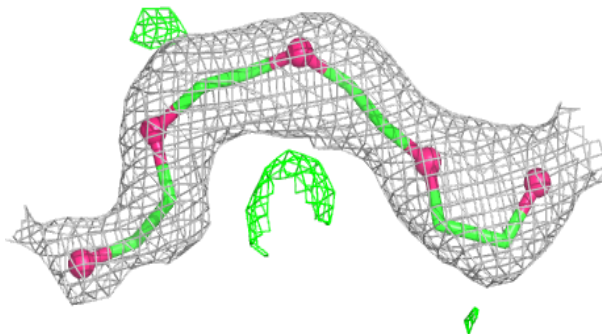
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(\AA^2)	Q<0.9
3	CL	J	1208	1/1	1.00	0.05	23,23,23,23	0
3	CL	J	3104	1/1	1.00	0.05	16,16,16,16	0
2	MG	E	1206	1/1	1.00	0.03	27,27,27,27	0
3	CL	B	1207	1/1	1.00	0.04	24,24,24,24	0
3	CL	K	1208	1/1	1.00	0.05	23,23,23,23	0
3	CL	L	1207	1/1	1.00	0.05	19,19,19,19	0
3	CL	L	1208	1/1	1.00	0.07	24,24,24,24	0
2	MG	K	1206	1/1	1.00	0.01	22,22,22,22	1
3	CL	B	1209	1/1	1.00	0.02	26,26,26,26	0
3	CL	B	3111	1/1	1.00	0.04	19,19,19,19	0
3	CL	C	1207	1/1	1.00	0.01	20,20,20,20	1
3	CL	C	1208	1/1	1.00	0.09	24,24,24,24	0
2	MG	L	1206	1/1	1.00	0.05	15,15,15,15	1
3	CL	D	1206	1/1	1.00	0.05	17,17,17,17	0
3	CL	D	1207	1/1	1.00	0.04	18,18,18,18	0
3	CL	D	1208	1/1	1.00	0.04	24,24,24,24	0
3	CL	D	1209	1/1	1.00	0.09	23,23,23,23	0
3	CL	D	1210	1/1	1.00	0.04	23,23,23,23	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.

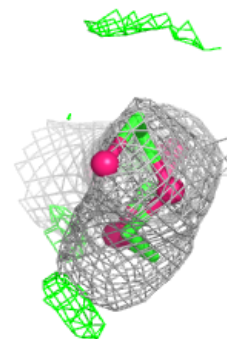
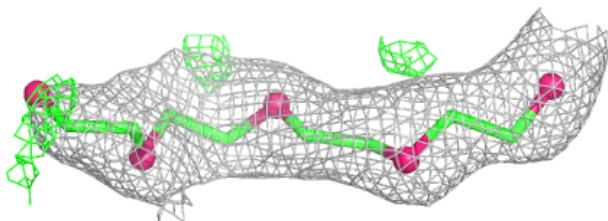
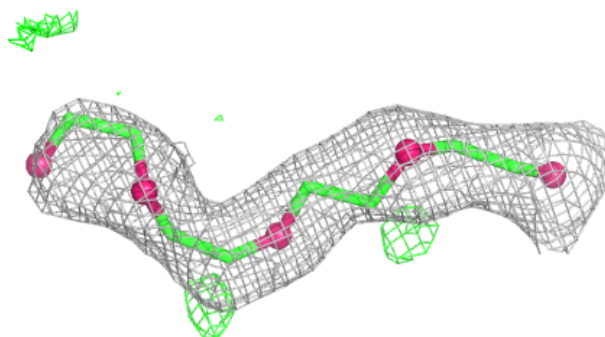


Electron density around PE4 A 1210:

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

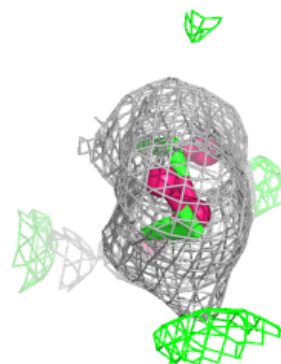
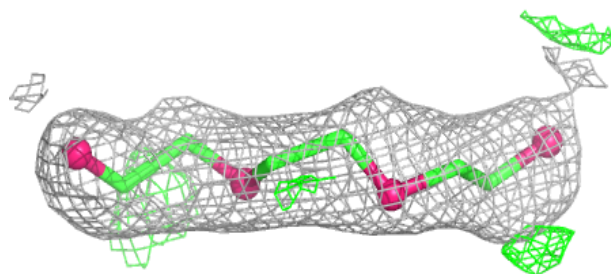
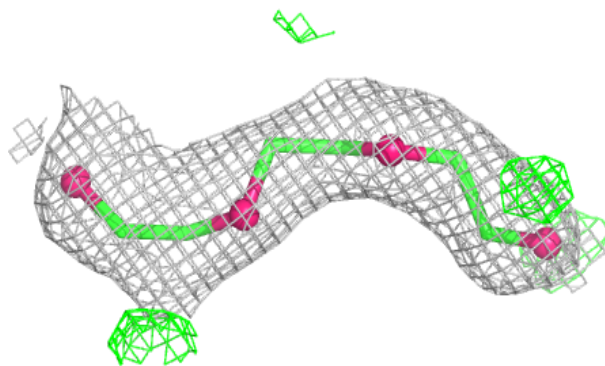
**Electron density around PE4 E 1210:**

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 mF_o-DF_c (at 3 rmsd) in purple (negative)
and green (positive)

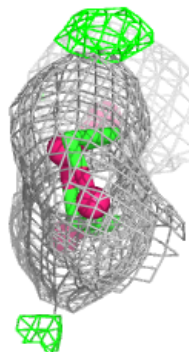
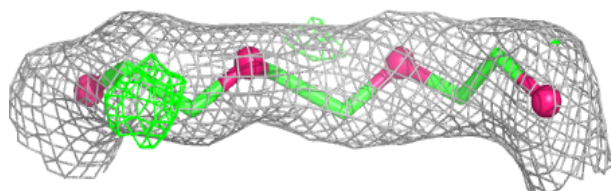
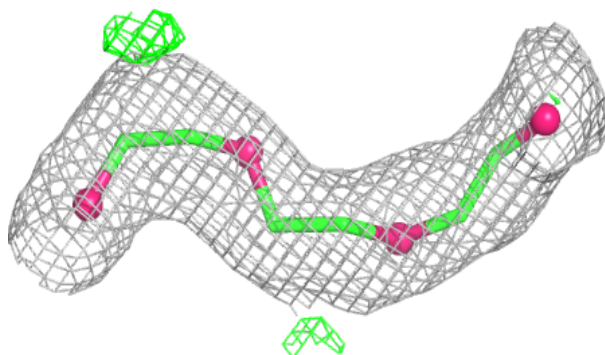


Electron density around PE3 B 1210:

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

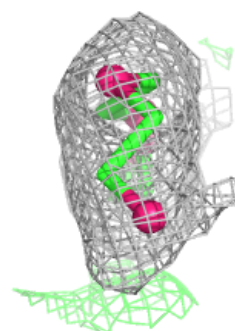
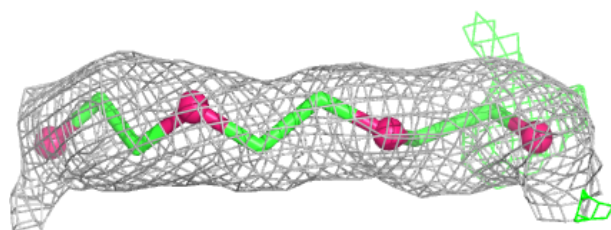
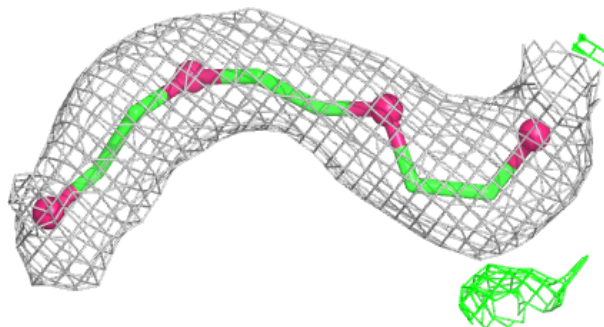
**Electron density around PE3 G 1208:**

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

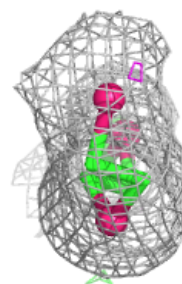
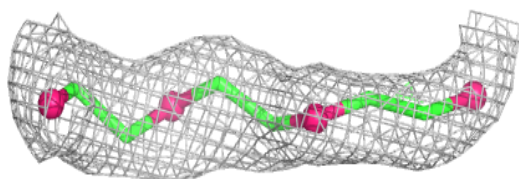


Electron density around PE3 K 1209:

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

**Electron density around PE3 H 3104:**

$2mF_o-DF_c$ (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.