



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 17, 2026 – 08:53 PM UTC

PDB ID : 4JPG / pdb_00004jpg
Title : 2-((1H-benzo[d]imidazol-1-yl)methyl)-4H-pyrido[1,2-a]pyrimidin-4-ones as Novel PKM2 Activators
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Deposited on : 2013-03-19
Resolution : 2.33 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	:	4-5-2 with Phenix2.0
Mogul	:	2022.3.0, CSD as543be (2022)
Xtriage (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

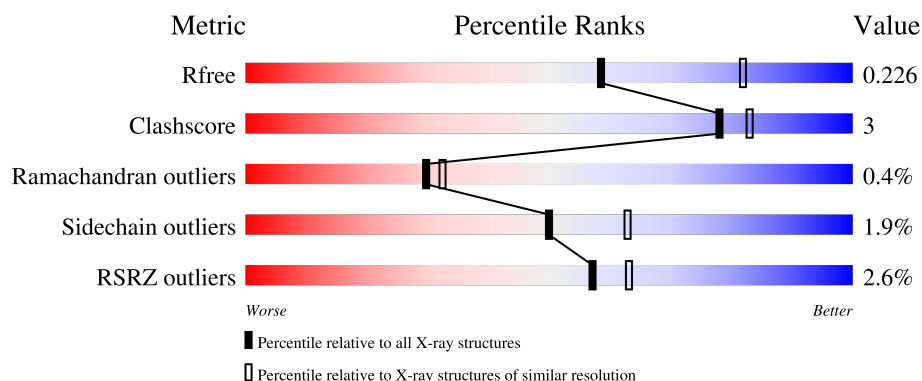
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.33 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	3031 (2.36-2.32)
Clashscore	190562	3127 (2.36-2.32)
Ramachandran outliers	187476	3095 (2.36-2.32)
Sidechain outliers	187428	3095 (2.36-2.32)
RSRZ outliers	180081	3033 (2.36-2.32)

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	556	85% 8% • 7%
1	B	556	3% 80% 11% 8%
1	C	556	85% 8% • 7%
1	D	556	5% 84% 7% • 8%

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 16344 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 Pyruvate kinase isozymes M1/M2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	519	Total	C	N	O	S	0	1	0
			3905	2459	682	739	25			
1	B	510	Total	C	N	O	S	11	3	0
			3816	2403	672	716	25			
1	C	518	Total	C	N	O	S	0	3	0
			3921	2470	683	743	25			
1	D	512	Total	C	N	O	S	0	2	0
			3844	2412	684	723	25			

There are 100 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	-24	GLY	-	expression tag	UNP P14618
A	-23	SER	-	expression tag	UNP P14618
A	-22	MET	-	expression tag	UNP P14618
A	-21	LYS	-	expression tag	UNP P14618
A	-20	HIS	-	expression tag	UNP P14618
A	-19	HIS	-	expression tag	UNP P14618
A	-18	HIS	-	expression tag	UNP P14618
A	-17	HIS	-	expression tag	UNP P14618
A	-16	HIS	-	expression tag	UNP P14618
A	-15	HIS	-	expression tag	UNP P14618
A	-14	ASP	-	expression tag	UNP P14618
A	-13	TYR	-	expression tag	UNP P14618
A	-12	GLY	-	expression tag	UNP P14618
A	-11	ILE	-	expression tag	UNP P14618
A	-10	LEU	-	expression tag	UNP P14618
A	-9	THR	-	expression tag	UNP P14618
A	-8	THR	-	expression tag	UNP P14618
A	-7	GLU	-	expression tag	UNP P14618
A	-6	ASN	-	expression tag	UNP P14618
A	-5	LEU	-	expression tag	UNP P14618
A	-4	TYR	-	expression tag	UNP P14618

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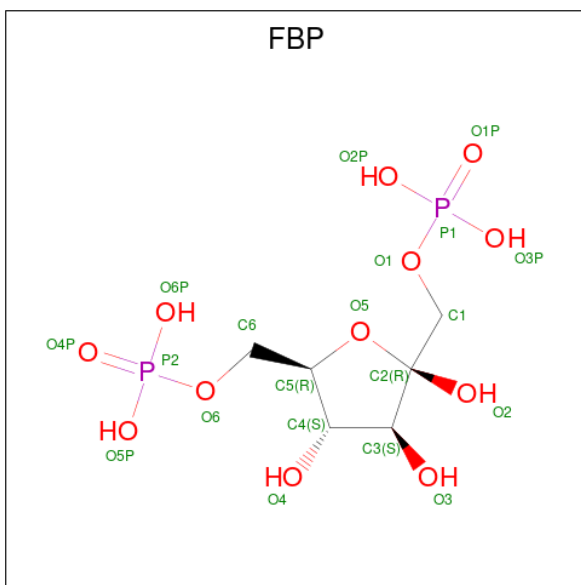
Chain	Residue	Modelled	Actual	Comment	Reference
A	-3	PHE	-	expression tag	UNP P14618
A	-2	GLN	-	expression tag	UNP P14618
A	-1	GLY	-	expression tag	UNP P14618
A	0	SER	-	expression tag	UNP P14618
B	-24	GLY	-	expression tag	UNP P14618
B	-23	SER	-	expression tag	UNP P14618
B	-22	MET	-	expression tag	UNP P14618
B	-21	LYS	-	expression tag	UNP P14618
B	-20	HIS	-	expression tag	UNP P14618
B	-19	HIS	-	expression tag	UNP P14618
B	-18	HIS	-	expression tag	UNP P14618
B	-17	HIS	-	expression tag	UNP P14618
B	-16	HIS	-	expression tag	UNP P14618
B	-15	HIS	-	expression tag	UNP P14618
B	-14	ASP	-	expression tag	UNP P14618
B	-13	TYR	-	expression tag	UNP P14618
B	-12	GLY	-	expression tag	UNP P14618
B	-11	ILE	-	expression tag	UNP P14618
B	-10	LEU	-	expression tag	UNP P14618
B	-9	THR	-	expression tag	UNP P14618
B	-8	THR	-	expression tag	UNP P14618
B	-7	GLU	-	expression tag	UNP P14618
B	-6	ASN	-	expression tag	UNP P14618
B	-5	LEU	-	expression tag	UNP P14618
B	-4	TYR	-	expression tag	UNP P14618
B	-3	PHE	-	expression tag	UNP P14618
B	-2	GLN	-	expression tag	UNP P14618
B	-1	GLY	-	expression tag	UNP P14618
B	0	SER	-	expression tag	UNP P14618
C	-24	GLY	-	expression tag	UNP P14618
C	-23	SER	-	expression tag	UNP P14618
C	-22	MET	-	expression tag	UNP P14618
C	-21	LYS	-	expression tag	UNP P14618
C	-20	HIS	-	expression tag	UNP P14618
C	-19	HIS	-	expression tag	UNP P14618
C	-18	HIS	-	expression tag	UNP P14618
C	-17	HIS	-	expression tag	UNP P14618
C	-16	HIS	-	expression tag	UNP P14618
C	-15	HIS	-	expression tag	UNP P14618
C	-14	ASP	-	expression tag	UNP P14618
C	-13	TYR	-	expression tag	UNP P14618
C	-12	GLY	-	expression tag	UNP P14618

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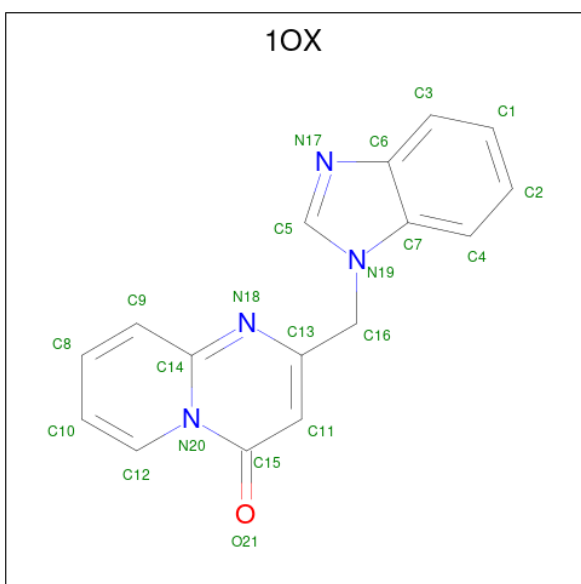
Chain	Residue	Modelled	Actual	Comment	Reference
C	-11	ILE	-	expression tag	UNP P14618
C	-10	LEU	-	expression tag	UNP P14618
C	-9	THR	-	expression tag	UNP P14618
C	-8	THR	-	expression tag	UNP P14618
C	-7	GLU	-	expression tag	UNP P14618
C	-6	ASN	-	expression tag	UNP P14618
C	-5	LEU	-	expression tag	UNP P14618
C	-4	TYR	-	expression tag	UNP P14618
C	-3	PHE	-	expression tag	UNP P14618
C	-2	GLN	-	expression tag	UNP P14618
C	-1	GLY	-	expression tag	UNP P14618
C	0	SER	-	expression tag	UNP P14618
D	-24	GLY	-	expression tag	UNP P14618
D	-23	SER	-	expression tag	UNP P14618
D	-22	MET	-	expression tag	UNP P14618
D	-21	LYS	-	expression tag	UNP P14618
D	-20	HIS	-	expression tag	UNP P14618
D	-19	HIS	-	expression tag	UNP P14618
D	-18	HIS	-	expression tag	UNP P14618
D	-17	HIS	-	expression tag	UNP P14618
D	-16	HIS	-	expression tag	UNP P14618
D	-15	HIS	-	expression tag	UNP P14618
D	-14	ASP	-	expression tag	UNP P14618
D	-13	TYR	-	expression tag	UNP P14618
D	-12	GLY	-	expression tag	UNP P14618
D	-11	ILE	-	expression tag	UNP P14618
D	-10	LEU	-	expression tag	UNP P14618
D	-9	THR	-	expression tag	UNP P14618
D	-8	THR	-	expression tag	UNP P14618
D	-7	GLU	-	expression tag	UNP P14618
D	-6	ASN	-	expression tag	UNP P14618
D	-5	LEU	-	expression tag	UNP P14618
D	-4	TYR	-	expression tag	UNP P14618
D	-3	PHE	-	expression tag	UNP P14618
D	-2	GLN	-	expression tag	UNP P14618
D	-1	GLY	-	expression tag	UNP P14618
D	0	SER	-	expression tag	UNP P14618

- Molecule 2 is 1,6-di-O-phosphono-beta-D-fructofuranose (CCD ID: FBP) (formula: $C_6H_{14}O_{12}P_2$).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
2	A	1	Total	C	O	P	0	0
			20	6	12	2		
2	B	1	Total	C	O	P	0	0
			20	6	12	2		
2	C	1	Total	C	O	P	0	0
			20	6	12	2		
2	D	1	Total	C	O	P	0	0
			20	6	12	2		

- Molecule 3 is 2-(1H-benzimidazol-1-ylmethyl)-4H-pyrido[1,2-a]pyrimidin-4-one (CCD ID: 10X) (formula: C₁₆H₁₂N₄O).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
3	B	1	Total	C	N	O	0	1
			42	32	8	2		
3	D	1	Total	C	N	O	0	1
			42	32	8	2		

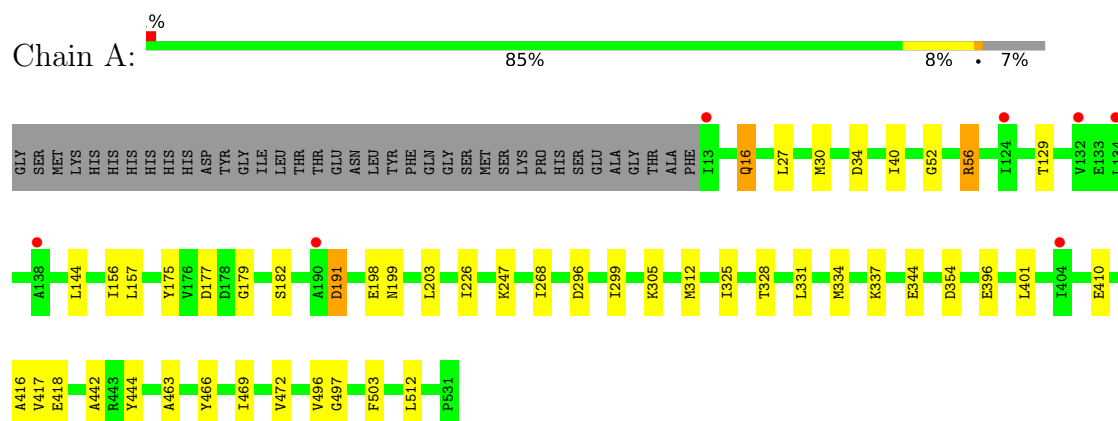
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	194	Total	O	0	0
			194	194		
4	B	184	Total	O	0	0
			184	184		
4	C	165	Total	O	0	0
			165	165		
4	D	151	Total	O	0	0
			151	151		

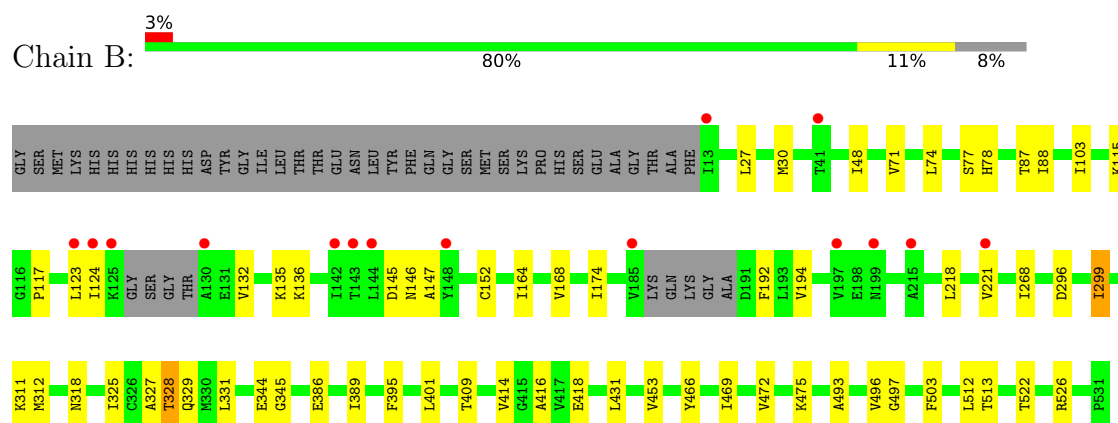
3 Residue-property plots [i](#)

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.

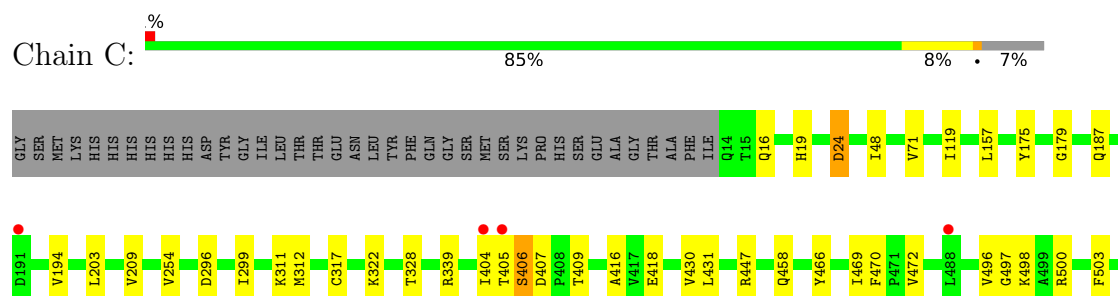
• Molecule 1: Pyruvate kinase isozymes M1/M2



• Molecule 1: Pyruvate kinase isozymes M1/M2

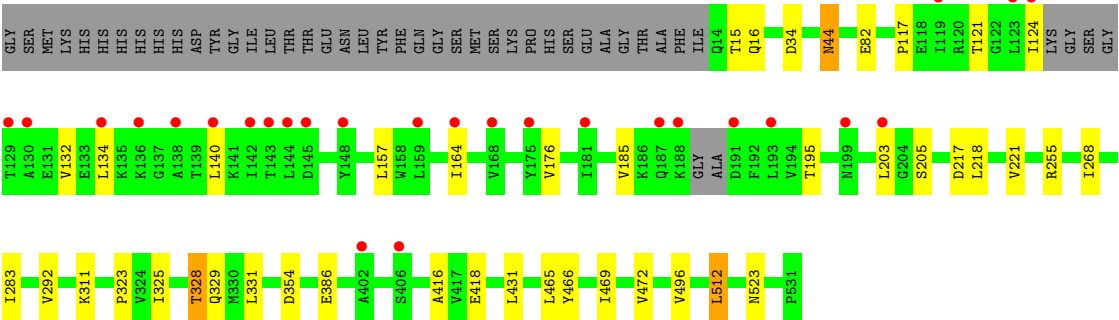
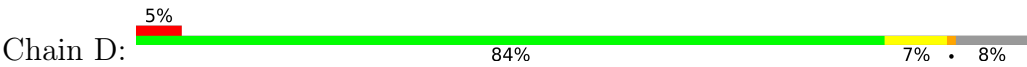


• Molecule 1: Pyruvate kinase isozymes M1/M2





● Molecule 1: Pyruvate kinase isozymes M1/M2



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	80.97Å 153.61Å 93.48Å 90.00° 103.45° 90.00°	Depositor
Resolution (Å)	45.46 – 2.33 45.46 – 2.33	Depositor EDS
% Data completeness (in resolution range)	99.6 (45.46-2.33) 99.7 (45.46-2.33)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	0.08	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.84 (at 2.34Å)	Xtriage
Refinement program	BUSTER 2.11.4	Depositor
R, R_{free}	0.177 , 0.219 0.180 , 0.226	Depositor DCC
R_{free} test set	4734 reflections (5.02%)	wwPDB-VP
Wilson B-factor (Å ²)	43.7	Xtriage
Anisotropy	0.144	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.31 , 44.5	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	16344	wwPDB-VP
Average B, all atoms (Å ²)	53.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.00% 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 ⓘ

5.1 Standard geometry ⓘ

Bond lengths and bond angles in the following residue types are not validated in this section: 1OX, FBP

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	0.90	0/3978	1.29	8/5389 (0.1%)
1	B	0.89	0/3883	1.30	10/5264 (0.2%)
1	C	0.87	0/3994	1.27	5/5410 (0.1%)
1	D	0.85	0/3906	1.29	11/5292 (0.2%)
All	All	0.88	0/15761	1.29	34/21355 (0.2%)

There are no bond length outliers.

All (34) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	299	ILE	N-CA-C	-6.30	105.68	111.67
1	C	406	SER	N-CA-C	-6.07	105.17	113.30
1	A	56	ARG	N-CA-C	5.94	118.71	111.82
1	B	318	ASN	CA-C-N	5.93	128.23	120.28
1	B	318	ASN	C-N-CA	5.93	128.23	120.28
1	A	354	ASP	CA-CB-CG	5.87	118.47	112.60
1	D	34	ASP	CA-CB-CG	5.81	118.41	112.60
1	C	299	ILE	N-CA-C	-5.79	107.21	111.90
1	B	135	LYS	CA-C-N	5.75	132.51	121.54
1	B	135	LYS	C-N-CA	5.75	132.51	121.54
1	B	299	ILE	N-CA-C	-5.71	105.53	111.58
1	B	135	LYS	N-CA-C	5.53	117.48	109.07
1	A	442	ALA	CA-C-N	5.36	127.72	120.38
1	A	442	ALA	C-N-CA	5.36	127.72	120.38
1	A	191	ASP	CA-CB-CG	5.32	117.92	112.60
1	D	354	ASP	CA-CB-CG	5.32	117.92	112.60
1	D	44	ASN	CA-CB-CG	5.27	117.87	112.60
1	B	327	ALA	CA-C-N	5.22	131.52	121.54
1	B	327	ALA	C-N-CA	5.22	131.52	121.54
1	D	255	ARG	CA-C-N	5.22	127.23	120.44

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	255	ARG	C-N-CA	5.22	127.23	120.44
1	C	254	VAL	CA-C-N	5.21	127.22	120.44
1	C	254	VAL	C-N-CA	5.21	127.22	120.44
1	A	396	GLU	CB-CG-CD	5.20	121.44	112.60
1	B	345	GLY	CA-C-N	5.15	127.14	120.44
1	B	345	GLY	C-N-CA	5.15	127.14	120.44
1	D	217	ASP	CA-CB-CG	5.15	117.75	112.60
1	D	292	VAL	N-CA-C	-5.14	100.07	107.37
1	D	331	LEU	CA-C-N	5.11	128.48	120.82
1	D	331	LEU	C-N-CA	5.11	128.48	120.82
1	D	283	ILE	CA-C-N	5.09	127.06	120.44
1	D	283	ILE	C-N-CA	5.09	127.06	120.44
1	C	24	ASP	CA-CB-CG	5.09	117.69	112.60
1	A	34	ASP	CA-CB-CG	5.03	117.63	112.60

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	3905	0	3900	21	0
1	B	3816	0	3770	33	0
1	C	3921	0	3920	22	0
1	D	3844	0	3778	18	0
2	A	20	0	10	0	0
2	B	20	0	10	0	0
2	C	20	0	10	0	0
2	D	20	0	10	0	0
3	B	42	0	24	3	0
3	D	42	0	24	3	0
4	A	194	0	0	1	0
4	B	184	0	0	3	0
4	C	165	0	0	3	0
4	D	151	0	0	1	0
All	All	16344	0	15456	88	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 3.

All (88) 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:B:418[B]:GLU:HG3	1:D:418:GLU:HG2	1.37	1.06
1:B:466:TYR:HB2	1:B:469:ILE:HD12	1.65	0.79
1:B:418[B]:GLU:HG3	1:D:418:GLU:CG	2.21	0.69
1:D:472:VAL:HG11	1:D:496:VAL:HG11	1.80	0.64
1:B:497:GLY:HA3	1:B:503:PHE:CZ	2.37	0.60
1:C:187:GLN:HB2	1:C:194:VAL:HB	1.84	0.60
1:B:472:VAL:HG11	1:B:496:VAL:HG11	1.84	0.59
1:D:82:GLU:HG2	4:D:845:HOH:O	2.01	0.58
1:A:401:LEU:HD12	1:B:27:LEU:HD23	1.86	0.58
1:C:497:GLY:HA3	1:C:503:PHE:CZ	2.40	0.56
1:A:182:SER:HB3	1:A:199:ASN:HB2	1.86	0.56
1:A:466:TYR:HB2	1:A:469:ILE:HD12	1.87	0.56
1:A:175:TYR:HB3	1:A:179:GLY:HA2	1.88	0.56
4:C:865:HOH:O	3:D:602[B]:1OX:H6	2.06	0.56
1:B:311:LYS:HD3	3:B:602[A]:1OX:H3	1.88	0.56
1:C:175:TYR:HB3	1:C:179:GLY:HA2	1.88	0.54
1:A:157:LEU:HD13	1:A:203:LEU:HD21	1.91	0.53
1:A:52:GLY:O	1:A:56:ARG:HG3	2.09	0.53
1:A:305:LYS:NZ	4:A:892:HOH:O	2.42	0.52
1:D:466:TYR:HB2	1:D:469:ILE:HD12	1.91	0.52
1:C:416:ALA:HB2	1:C:512:LEU:HD21	1.93	0.51
1:C:510:ILE:HG23	1:C:525:MET:HE3	1.92	0.51
1:B:453:VAL:HG21	1:B:493:ALA:HB2	1.93	0.50
1:B:74:LEU:HD11	1:B:88:ILE:HG13	1.93	0.50
1:A:463:ALA:HB1	1:A:469:ILE:HG21	1.94	0.50
1:D:121:THR:HB	1:D:157:LEU:HD11	1.94	0.49
1:B:416:ALA:HB2	1:B:512:LEU:HD21	1.94	0.49
1:D:311:LYS:HD3	3:D:602[A]:1OX:H3	1.95	0.49
1:C:19:HIS:HD2	4:C:712:HOH:O	1.95	0.48
1:B:77:SER:HA	1:B:115:LYS:HG3	1.95	0.48
1:B:192:PHE:HE1	1:B:194:VAL:HG23	1.77	0.48
1:B:328:THR:HG22	1:B:329:GLN:HG3	1.96	0.48
1:C:430:VAL:HG22	1:C:512:LEU:HD12	1.96	0.48
1:C:472:VAL:HG11	1:C:496:VAL:HG11	1.95	0.48
1:B:453:VAL:CG2	1:B:493:ALA:HB2	2.43	0.47
1:C:466:TYR:HB2	1:C:469:ILE:HD12	1.97	0.47
1:A:331:LEU:HD23	1:A:344:GLU:HB3	1.97	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:458:GLN:HG3	4:C:864:HOH:O	2.14	0.47
1:C:157:LEU:HD13	1:C:203:LEU:HD21	1.95	0.47
1:B:117:PRO:HB2	1:B:218:LEU:HD13	1.96	0.47
1:B:475:LYS:NZ	4:B:879:HOH:O	2.48	0.47
1:A:472:VAL:HG11	1:A:496:VAL:HG11	1.97	0.46
1:C:312:MET:C	1:C:312:MET:SD	2.98	0.46
1:D:268:ILE:HG21	1:D:325:ILE:HD12	1.97	0.46
1:D:328:THR:HG22	1:D:329:GLN:HG3	1.98	0.46
1:B:74:LEU:HD22	1:B:87:THR:HG21	1.98	0.46
1:B:124:ILE:HG12	1:B:152:CYS:HB2	1.98	0.46
1:B:431:LEU:HD22	1:B:513:THR:HG22	1.98	0.46
3:B:602[B]:1OX:H6	4:B:702:HOH:O	2.16	0.45
1:D:117:PRO:HB2	1:D:218:LEU:HD13	1.99	0.45
1:A:417:VAL:HG21	1:A:444:TYR:HB2	1.99	0.45
1:C:16:GLN:NE2	1:C:447[A]:ARG:HD3	2.31	0.45
3:B:602[A]:1OX:H6	4:B:701:HOH:O	2.16	0.45
1:D:124:ILE:H	1:D:205:SER:HB2	1.82	0.44
1:A:268:ILE:HG21	1:A:325:ILE:HD12	1.99	0.44
1:C:470:PHE:CZ	1:C:500:ARG:HD2	2.53	0.44
1:A:334:MET:HA	1:A:337:LYS:O	2.17	0.44
1:A:144:LEU:HD12	1:A:191:ASP:HA	2.00	0.44
1:A:312:MET:HA	1:B:30:MET:O	2.18	0.44
1:D:185:VAL:HA	1:D:195:THR:HG22	2.00	0.43
1:A:16:GLN:HG2	1:A:40:ILE:HG23	2.00	0.43
1:D:134:LEU:HD11	1:D:203:LEU:HD22	2.00	0.43
1:D:323:PRO:HB3	1:D:465:LEU:O	2.18	0.43
1:C:48:ILE:HG12	1:C:71:VAL:HB	2.00	0.43
1:A:497:GLY:HA3	1:A:503:PHE:CZ	2.53	0.43
1:B:268:ILE:HG21	1:B:325:ILE:HD12	2.00	0.43
1:A:30:MET:O	1:B:312:MET:HA	2.19	0.42
1:B:414:VAL:HG13	1:D:418:GLU:HG3	2.01	0.42
1:C:311:LYS:HD3	3:D:602[B]:1OX:H3	2.01	0.42
1:C:317:CYS:HB3	1:C:322:LYS:O	2.20	0.42
1:C:119:ILE:HG22	1:C:209:VAL:HB	2.01	0.42
1:C:405:THR:HB	1:C:407:ASP:H	1.84	0.42
1:D:416:ALA:HB2	1:D:512:LEU:HD21	2.01	0.42
1:A:27:LEU:HD23	1:B:401:LEU:HD12	2.02	0.42
1:B:526:ARG:HA	1:D:523:ASN:O	2.19	0.42
1:A:416:ALA:HB2	1:A:512:LEU:HD21	2.02	0.42
1:B:48:ILE:HG12	1:B:71:VAL:HB	2.02	0.42
1:B:192:PHE:CE1	1:B:194:VAL:HG23	2.54	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:395:PHE:CZ	1:B:418[B]:GLU:HG2	2.55	0.41
1:B:386:GLU:HA	1:B:389:ILE:HD12	2.03	0.41
1:B:409[A]:THR:HG23	1:B:522:THR:HB	2.01	0.41
1:A:418:GLU:HB2	1:C:418:GLU:HG2	2.03	0.41
1:B:331:LEU:HD23	1:B:344:GLU:HB3	2.01	0.41
1:B:145:ASP:C	1:B:147:ALA:H	2.29	0.41
1:C:409:THR:HG22	1:C:522:THR:O	2.21	0.41
1:C:431:LEU:HG	1:C:513:THR:HG22	2.04	0.40
1:B:296:ASP:HA	1:B:299:ILE:HD12	2.03	0.40
1:D:44:ASN:H	1:D:386:GLU:CD	2.29	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	518/556 (93%)	508 (98%)	8 (2%)	2 (0%)	30	32
1	B	507/556 (91%)	496 (98%)	8 (2%)	3 (1%)	21	22
1	C	519/556 (93%)	507 (98%)	11 (2%)	1 (0%)	43	50
1	D	508/556 (91%)	493 (97%)	12 (2%)	3 (1%)	21	22
All	All	2052/2224 (92%)	2004 (98%)	39 (2%)	9 (0%)	30	32

All (9) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	136	LYS
1	B	146	ASN
1	D	15	THR
1	D	16	GLN
1	A	328	THR

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Mol	Chain	Res	Type
1	B	328	THR
1	C	328	THR
1	A	177	ASP
1	D	328	THR

5.3.2 Protein sidechains ⓘ

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	409/458 (89%)	401 (98%)	8 (2%)	48	61
1	B	390/458 (85%)	382 (98%)	8 (2%)	47	60
1	C	410/458 (90%)	402 (98%)	8 (2%)	48	61
1	D	392/458 (86%)	385 (98%)	7 (2%)	51	64
All	All	1601/1832 (87%)	1570 (98%)	31 (2%)	50	63

All (31) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	16	GLN
1	A	129	THR
1	A	156	ILE
1	A	198	GLU
1	A	226	ILE
1	A	247	LYS
1	A	296	ASP
1	A	410	GLU
1	B	78	HIS
1	B	103	ILE
1	B	123	LEU
1	B	132	VAL
1	B	164	ILE
1	B	168	VAL
1	B	174	ILE
1	B	221	VAL
1	C	24	ASP

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Mol	Chain	Res	Type
1	C	296	ASP
1	C	339	ARG
1	C	404	ILE
1	C	406	SER
1	C	498	LYS
1	C	516	ARG
1	C	525	MET
1	D	132	VAL
1	D	140	LEU
1	D	164	ILE
1	D	176	VAL
1	D	221	VAL
1	D	431	LEU
1	D	512	LEU

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	146	ASN
1	A	210	ASN
1	A	458	GLN
1	B	210	ASN
1	B	440	GLN
1	B	458	GLN
1	C	44	ASN
1	C	458	GLN
1	D	44	ASN
1	D	155	ASN
1	D	235	GLN
1	D	252	HIS
1	D	495	ASN

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains ⓘ

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

8 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	FBP	C	601	-	18,20,20	0.82	1 (5%)	21,32,32	0.88	0
3	1OX	B	602[A]	-	24,24,24	1.51	3 (12%)	31,34,34	2.60	12 (38%)
3	1OX	B	602[B]	-	24,24,24	1.49	4 (16%)	31,34,34	2.70	13 (41%)
2	FBP	A	601	-	18,20,20	0.68	0	21,32,32	0.92	0
2	FBP	B	601	-	18,20,20	0.69	0	21,32,32	1.07	0
3	1OX	D	602[B]	-	24,24,24	1.51	3 (12%)	31,34,34	2.60	10 (32%)
3	1OX	D	602[A]	-	24,24,24	1.48	4 (16%)	31,34,34	2.51	10 (32%)
2	FBP	D	601	-	18,20,20	0.71	0	21,32,32	1.11	1 (4%)

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	FBP	C	601	-	-	2/13/32/32	0/1/1/1
3	1OX	B	602[A]	-	-	0/3/4/4	0/4/4/4
3	1OX	B	602[B]	-	-	0/3/4/4	0/4/4/4
2	FBP	A	601	-	-	2/13/32/32	0/1/1/1
2	FBP	B	601	-	-	2/13/32/32	0/1/1/1
3	1OX	D	602[B]	-	-	0/3/4/4	0/4/4/4
3	1OX	D	602[A]	-	-	1/3/4/4	0/4/4/4
2	FBP	D	601	-	-	2/13/32/32	0/1/1/1

All (15) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	D	602[B]	1OX	C14-N18	4.21	1.41	1.33
3	B	602[B]	1OX	C14-N18	4.12	1.41	1.33
3	B	602[A]	1OX	C14-N18	3.91	1.40	1.33
3	D	602[A]	1OX	C14-N18	3.87	1.40	1.33
3	D	602[B]	1OX	C14-N20	-3.46	1.34	1.38
3	D	602[A]	1OX	C14-N20	-3.39	1.34	1.38
3	B	602[B]	1OX	C14-N20	-3.37	1.34	1.38
3	B	602[A]	1OX	C14-N20	-3.33	1.34	1.38
3	D	602[A]	1OX	C12-N20	-2.46	1.34	1.38
3	D	602[B]	1OX	C12-N20	-2.38	1.34	1.38
2	C	601	FBP	O2-C2	2.37	1.44	1.40
3	B	602[A]	1OX	C12-N20	-2.26	1.34	1.38
3	B	602[B]	1OX	C12-N20	-2.23	1.34	1.38
3	D	602[A]	1OX	C11-C15	2.21	1.48	1.43
3	B	602[B]	1OX	C11-C13	-2.18	1.33	1.36

All (46) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	B	602[B]	1OX	C11-C15-N20	7.29	121.89	113.63
3	B	602[B]	1OX	C15-C11-C13	-7.11	113.79	120.82
3	D	602[B]	1OX	C11-C15-N20	6.92	121.47	113.63
3	B	602[A]	1OX	C15-C11-C13	-6.91	113.99	120.82
3	D	602[B]	1OX	C15-C11-C13	-6.81	114.08	120.82
3	D	602[A]	1OX	C15-C11-C13	-6.74	114.16	120.82
3	B	602[A]	1OX	C11-C15-N20	6.52	121.02	113.63
3	D	602[A]	1OX	C11-C15-N20	6.14	120.59	113.63
3	B	602[B]	1OX	C13-C16-N19	-4.75	105.42	112.00
3	B	602[A]	1OX	C9-C14-N20	4.29	121.06	116.87
3	D	602[B]	1OX	C13-C16-N19	-4.26	106.10	112.00
3	D	602[A]	1OX	C13-C16-N19	-4.21	106.17	112.00
3	D	602[A]	1OX	C9-C14-N20	4.03	120.80	116.87
3	B	602[A]	1OX	C7-N19-C5	3.98	108.83	106.19
3	B	602[A]	1OX	N19-C5-N17	-3.97	110.49	114.16
3	B	602[B]	1OX	C7-N19-C5	3.73	108.67	106.19
3	D	602[B]	1OX	C7-N19-C5	3.72	108.66	106.19
3	B	602[A]	1OX	C13-C16-N19	-3.65	106.93	112.00
3	D	602[A]	1OX	C7-N19-C5	3.55	108.55	106.19
3	B	602[B]	1OX	C9-C14-N20	3.52	120.31	116.87
3	D	602[B]	1OX	N19-C5-N17	-3.48	110.94	114.16
3	B	602[B]	1OX	N19-C5-N17	-3.36	111.05	114.16
3	D	602[B]	1OX	C9-C14-N20	3.36	120.15	116.87

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	D	602[B]	1OX	C16-N19-C5	-3.34	123.96	127.27
3	D	602[A]	1OX	N19-C5-N17	-3.29	111.12	114.16
3	B	602[B]	1OX	C16-N19-C5	-3.18	124.12	127.27
3	D	602[A]	1OX	C16-N19-C5	-2.87	124.43	127.27
3	B	602[B]	1OX	N20-C14-N18	-2.78	119.84	122.94
3	D	602[B]	1OX	C6-C7-N19	-2.69	103.79	105.40
3	B	602[A]	1OX	N20-C14-N18	-2.68	119.94	122.94
3	B	602[A]	1OX	C16-N19-C5	-2.57	124.72	127.27
2	D	601	FBP	O3P-P1-O1	-2.57	99.98	106.67
3	B	602[A]	1OX	C1-C2-C4	2.54	123.38	120.24
3	B	602[B]	1OX	C6-C7-N19	-2.46	103.92	105.40
3	D	602[B]	1OX	N20-C14-N18	-2.39	120.27	122.94
3	D	602[A]	1OX	N20-C14-N18	-2.31	120.36	122.94
3	D	602[A]	1OX	C6-C7-N19	-2.27	104.03	105.40
3	B	602[B]	1OX	O21-C15-C11	-2.27	120.01	125.61
3	B	602[B]	1OX	C1-C2-C4	2.25	123.01	120.24
3	B	602[A]	1OX	C14-N18-C13	2.22	119.96	118.05
3	D	602[B]	1OX	C2-C1-C3	2.19	122.95	120.24
3	D	602[A]	1OX	C11-C13-N18	2.18	125.67	122.23
3	B	602[B]	1OX	C14-N18-C13	2.16	119.92	118.05
3	B	602[A]	1OX	C11-C13-N18	2.10	125.55	122.23
3	B	602[A]	1OX	C6-C7-N19	-2.01	104.19	105.40
3	B	602[B]	1OX	C11-C13-N18	2.01	125.41	122.23

There are no chirality outliers.

All (9) torsion outliers are listed below:

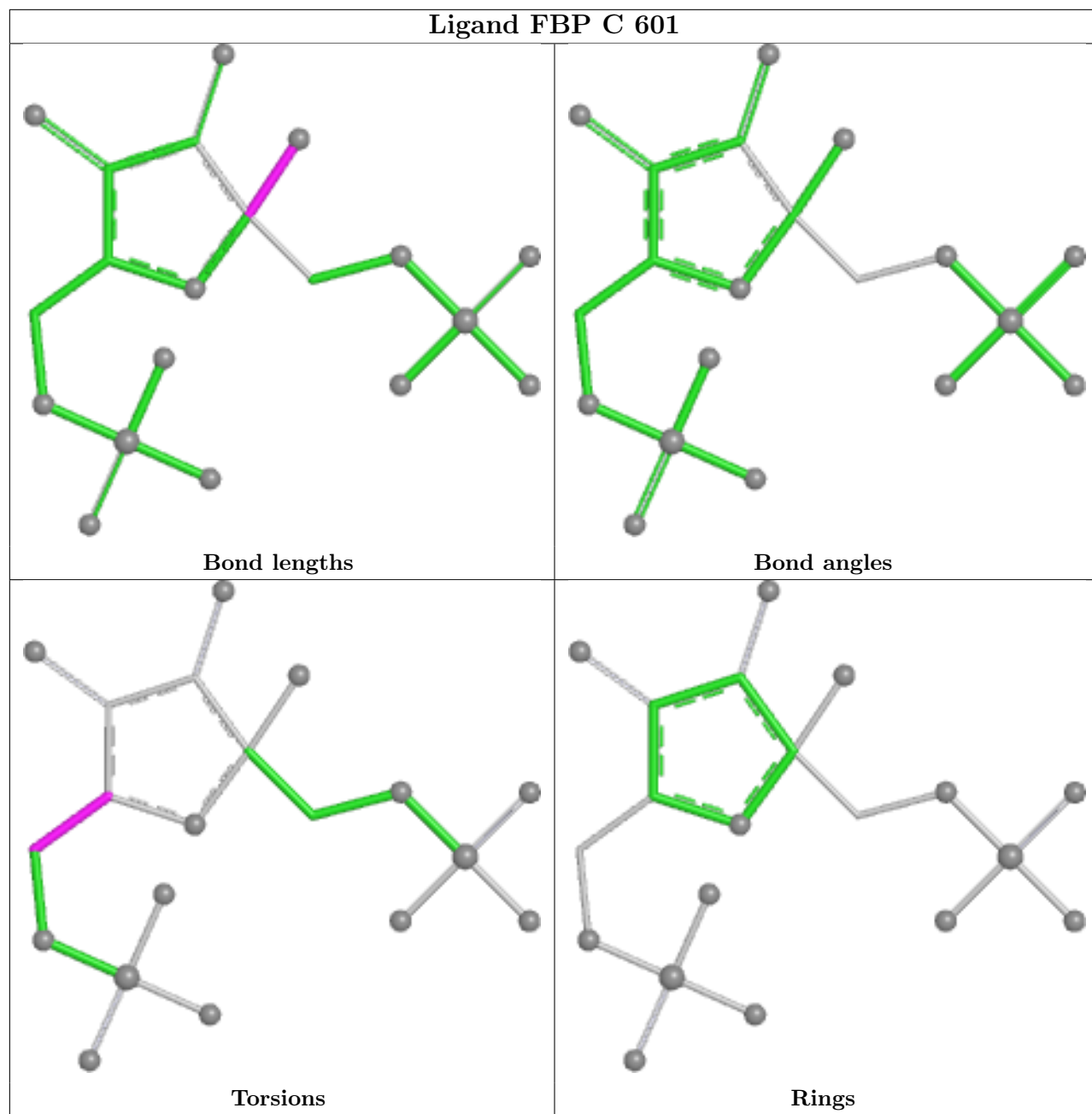
Mol	Chain	Res	Type	Atoms
2	A	601	FBP	C4-C5-C6-O6
2	B	601	FBP	C4-C5-C6-O6
2	C	601	FBP	C4-C5-C6-O6
2	D	601	FBP	C4-C5-C6-O6
2	C	601	FBP	O5-C5-C6-O6
2	B	601	FBP	O5-C5-C6-O6
2	D	601	FBP	O5-C5-C6-O6
2	A	601	FBP	O5-C5-C6-O6
3	D	602[A]	1OX	C11-C13-C16-N19

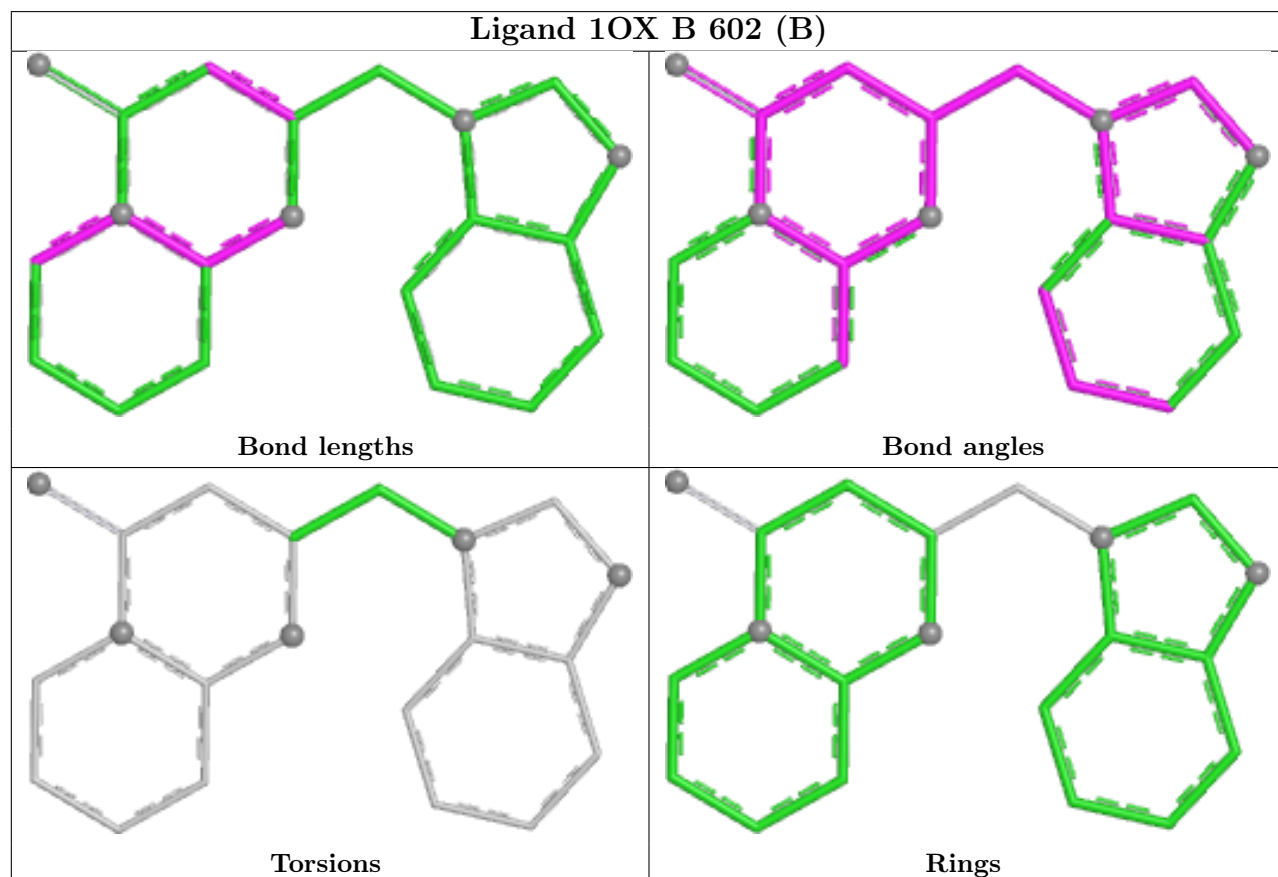
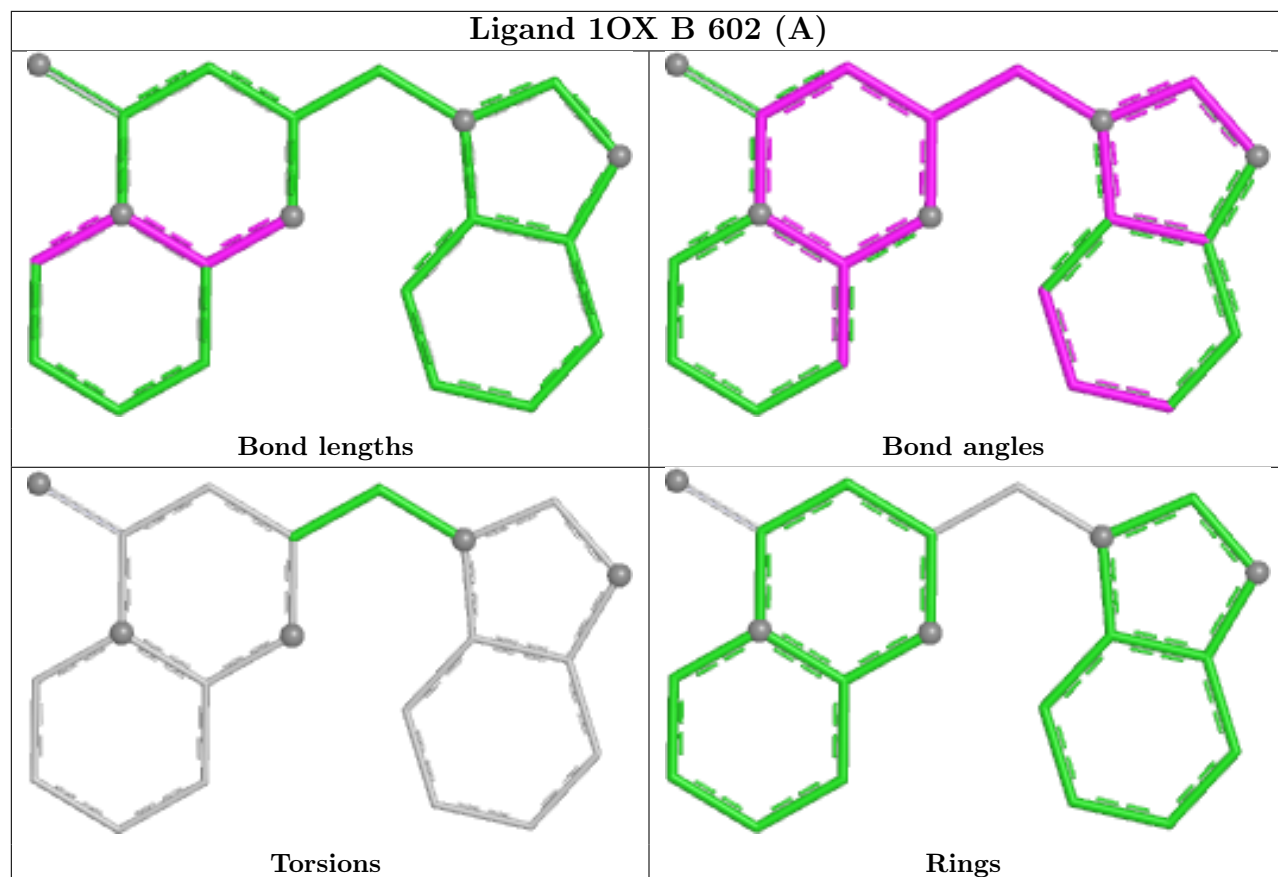
There are no ring outliers.

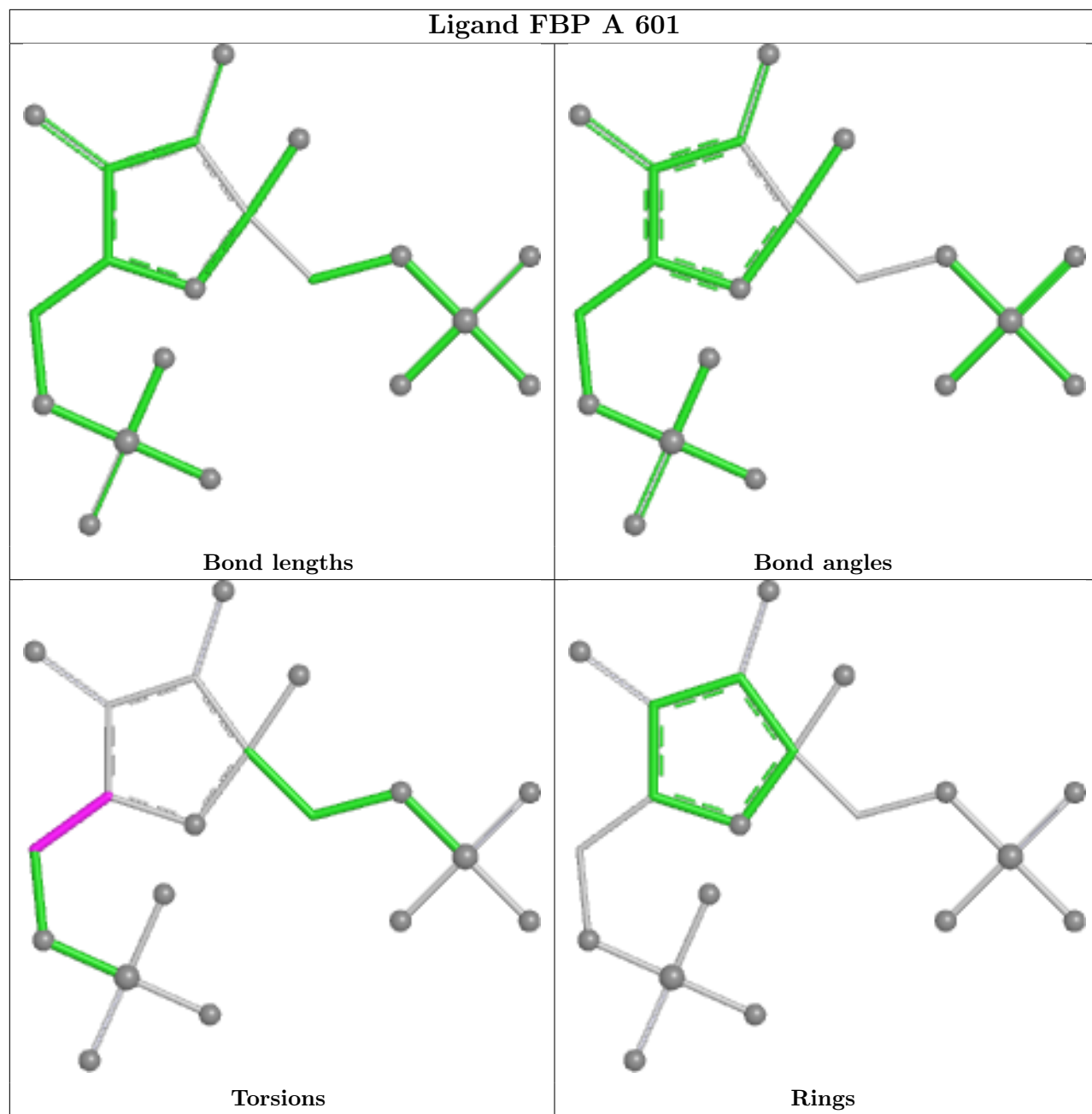
4 monomers are involved in 6 short contacts:

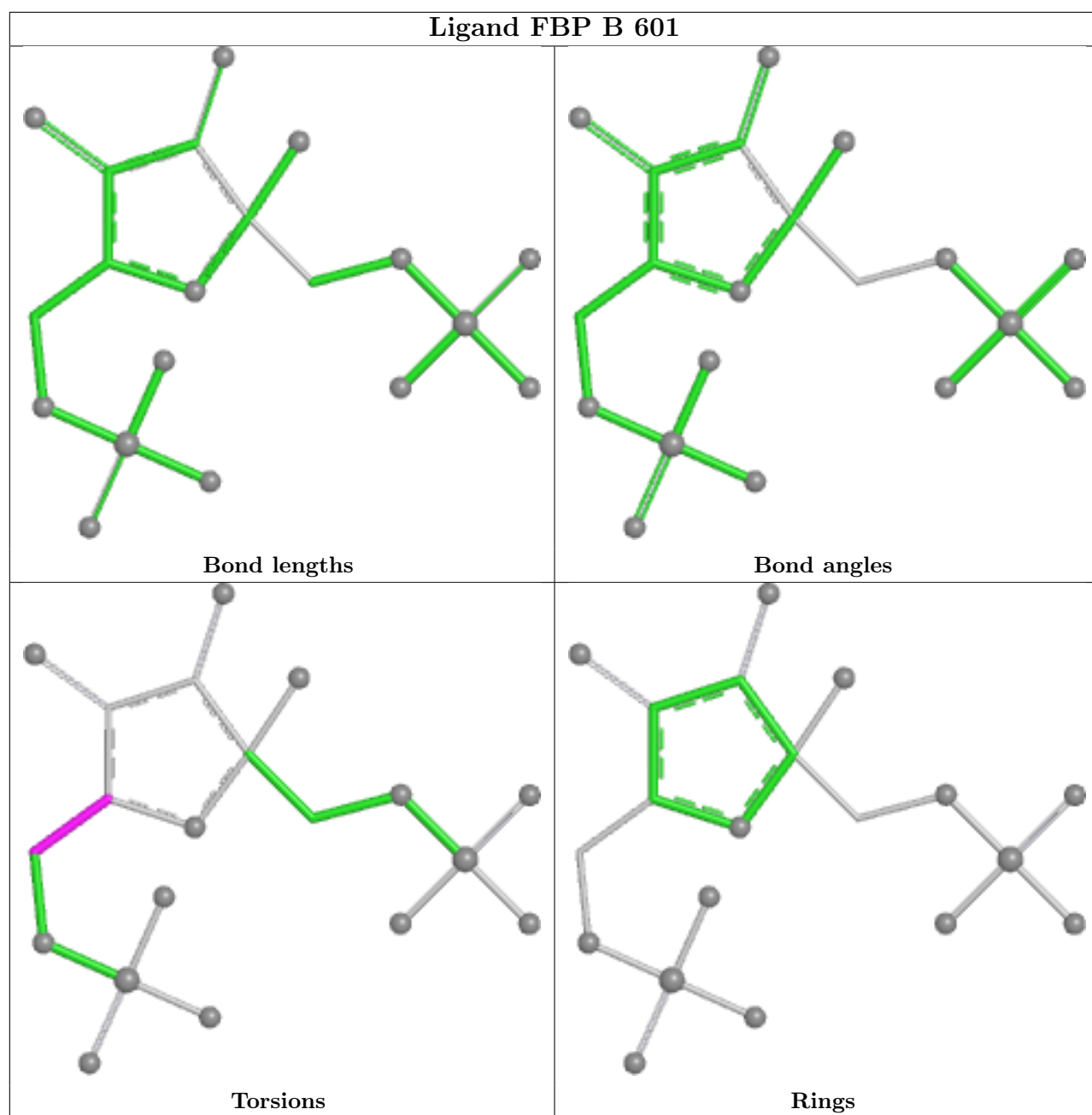
Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	B	602[A]	1OX	2	0
3	B	602[B]	1OX	1	0
3	D	602[B]	1OX	2	0
3	D	602[A]	1OX	1	0

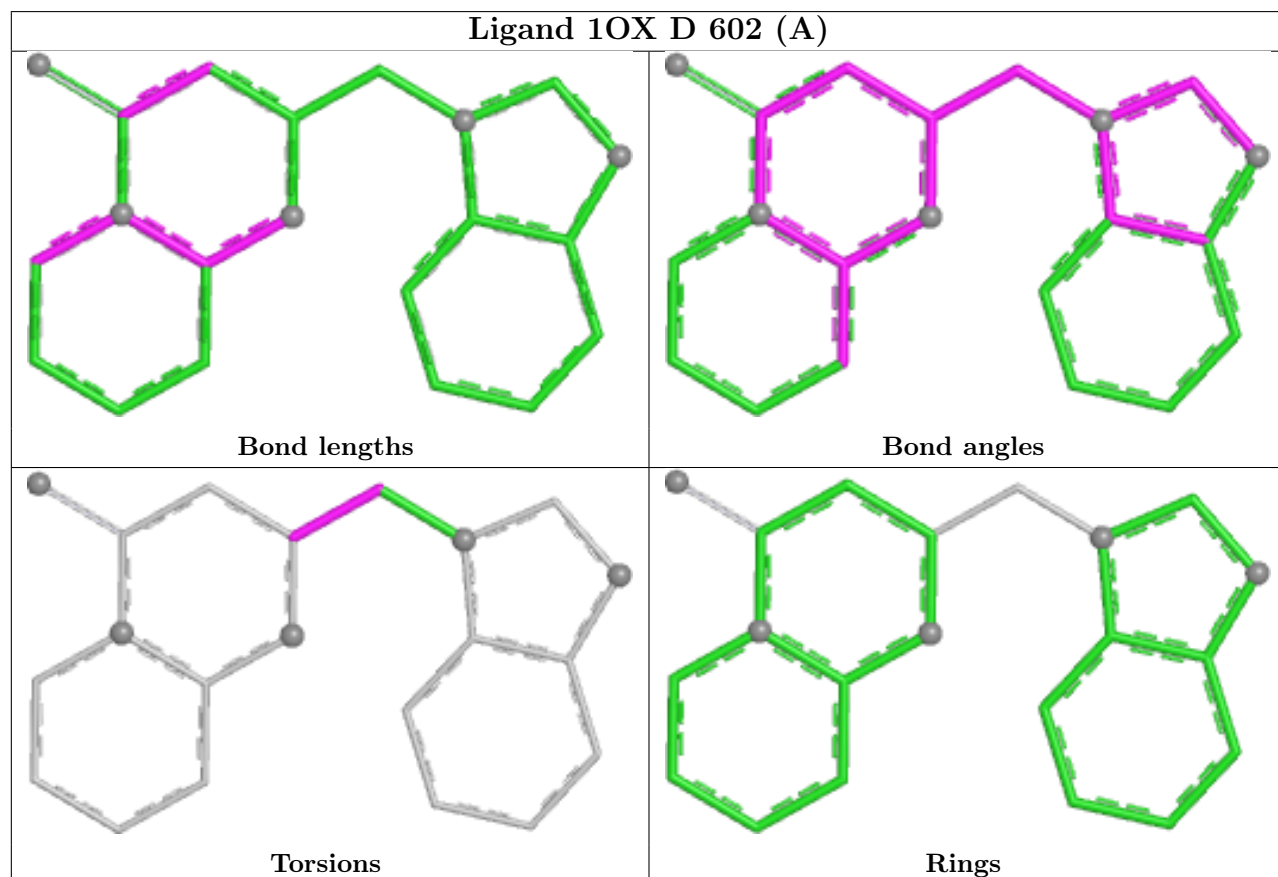
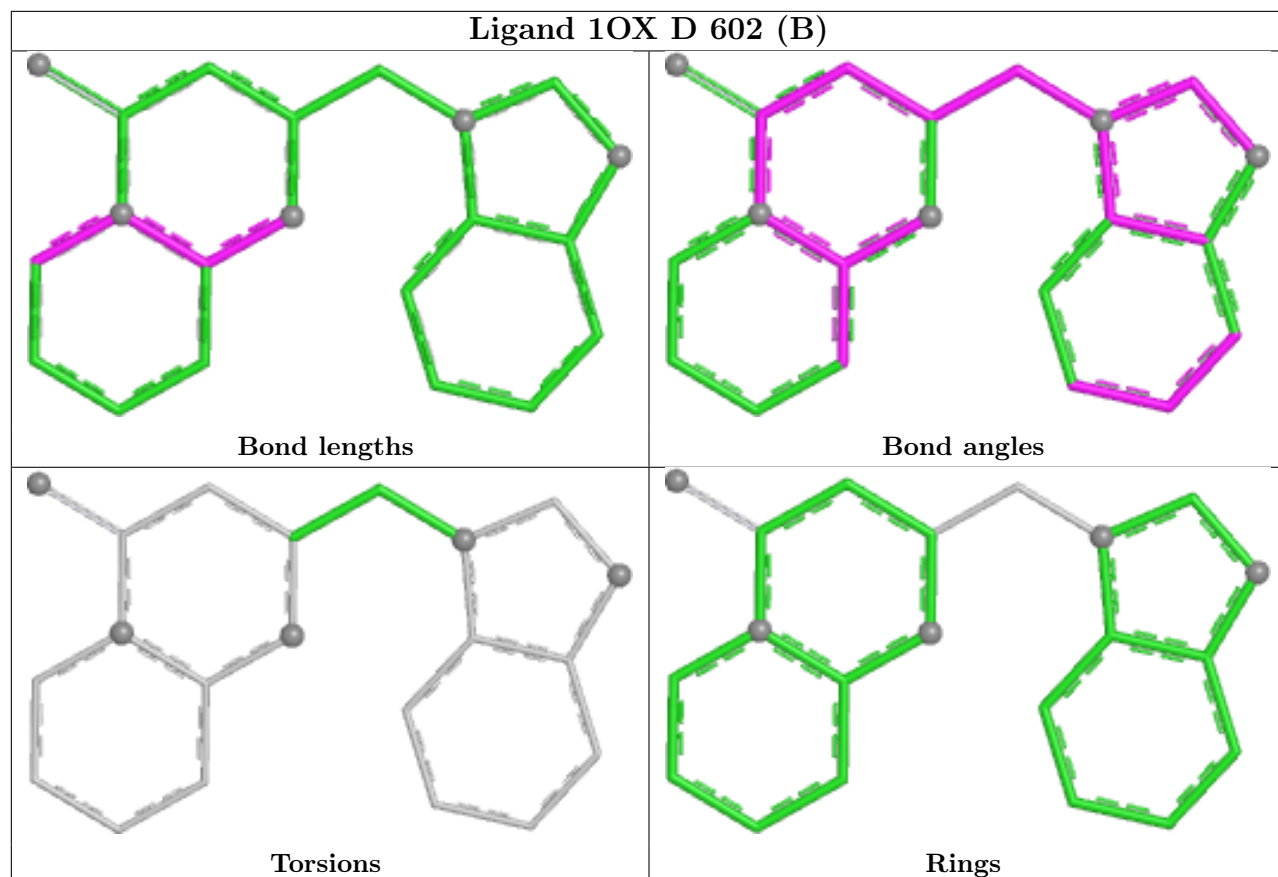
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the validation Tables will also be included. For torsion angles, if less 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.

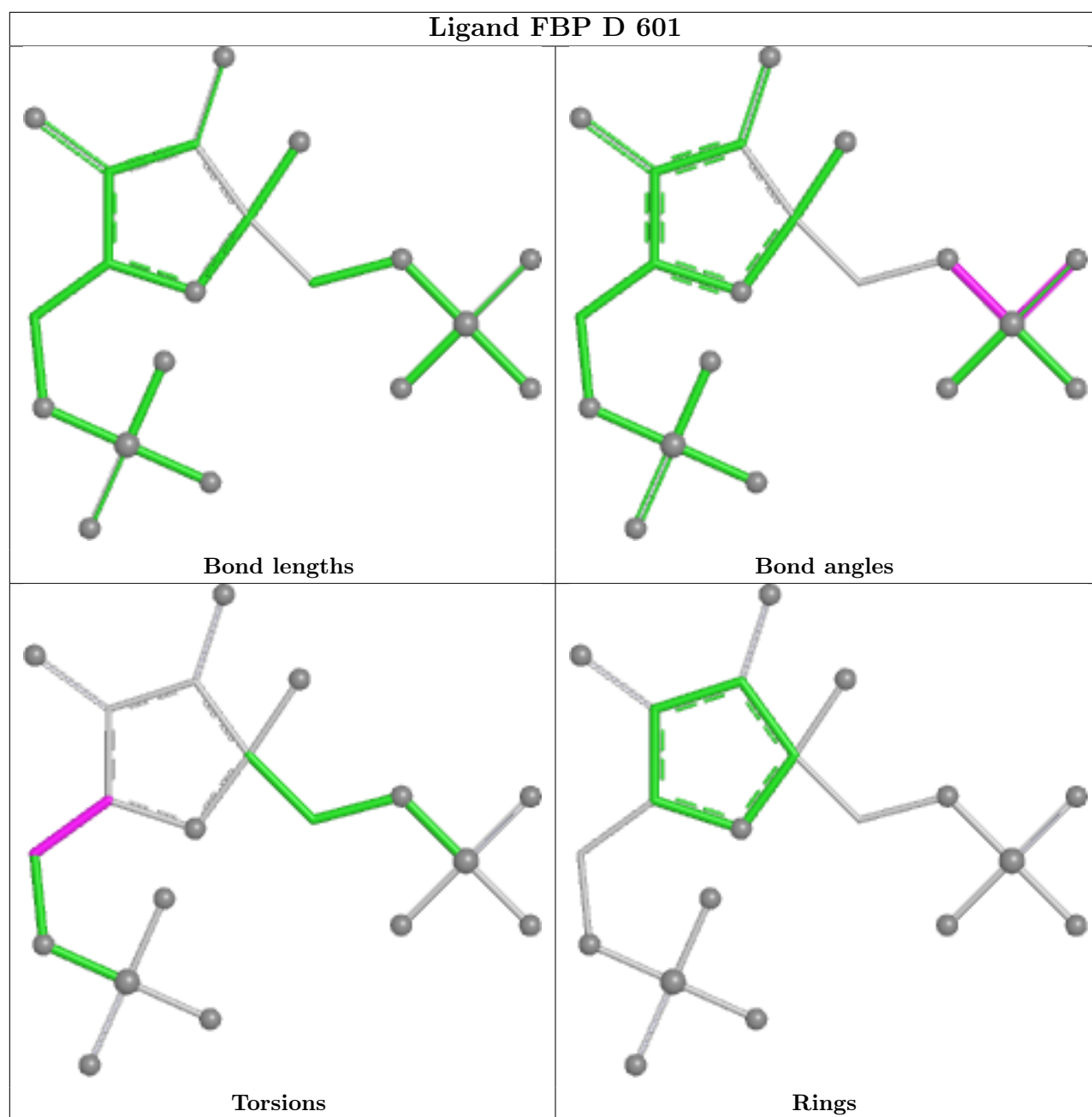












5.7 Other polymers [i](#)

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	519/556 (93%)	-0.12	7 (1%) 75 79	33, 46, 85, 106	1 (0%)
1	B	509/556 (91%)	0.11	15 (2%) 53 60	27, 48, 100, 113	2 (0%)
1	C	518/556 (93%)	-0.02	4 (0%) 82 85	23, 50, 74, 94	3 (0%)
1	D	512/556 (92%)	0.18	27 (5%) 32 37	20, 50, 107, 125	2 (0%)
All	All	2058/2224 (92%)	0.04	53 (2%) 57 63	20, 49, 92, 125	8 (0%)

All (53) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	130	ALA	4.6
1	D	124	ILE	3.6
1	D	191	ASP	3.4
1	D	145	ASP	3.4
1	B	148	TYR	3.2
1	B	197	VAL	3.2
1	D	143	THR	3.2
1	D	188	LYS	3.2
1	D	168	VAL	3.1
1	B	13	ILE	3.0
1	B	124	ILE	3.0
1	B	142	ILE	3.0
1	A	404	ILE	3.0
1	A	134	LEU	2.9
1	D	129	THR	2.9
1	B	215	ALA	2.9
1	D	148	TYR	2.8
1	D	144	LEU	2.8
1	D	142	ILE	2.8
1	B	199	ASN	2.8
1	A	13	ILE	2.7

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Mol	Chain	Res	Type	RSRZ
1	D	159	LEU	2.7
1	A	132	VAL	2.7
1	D	199	ASN	2.6
1	D	164	ILE	2.6
1	B	125	LYS	2.6
1	C	488	LEU	2.5
1	D	134	LEU	2.5
1	C	404	ILE	2.5
1	D	181	ILE	2.4
1	B	185	VAL	2.4
1	D	119	ILE	2.4
1	C	405	THR	2.4
1	D	175	TYR	2.3
1	D	130	ALA	2.3
1	D	193	LEU	2.3
1	B	123	LEU	2.2
1	D	203	LEU	2.2
1	A	124	ILE	2.2
1	B	221	VAL	2.2
1	D	123	LEU	2.2
1	B	41	THR	2.2
1	D	138	ALA	2.2
1	D	406	SER	2.2
1	D	136	LYS	2.2
1	A	138	ALA	2.2
1	C	191	ASP	2.1
1	D	402	ALA	2.1
1	D	140	LEU	2.1
1	A	190	ALA	2.0
1	D	187	GLN	2.0
1	B	143	THR	2.0
1	B	144	LEU	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](#)

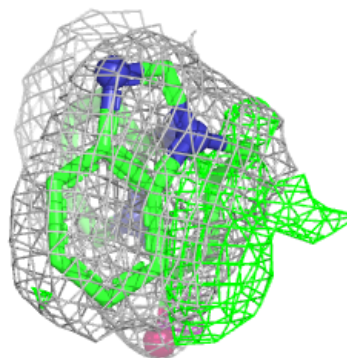
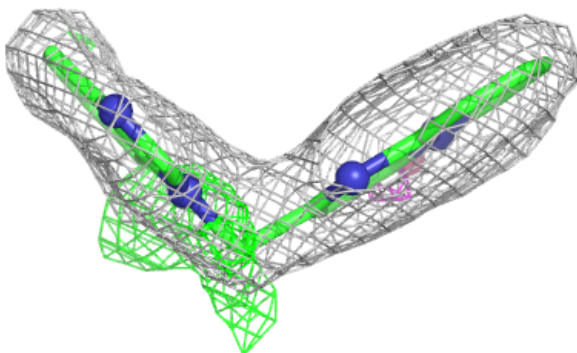
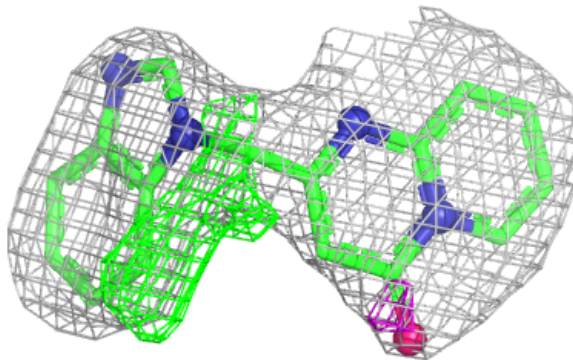
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists 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	1OX	D	602[A]	21/21	0.82	0.17	22,30,37,40	21
3	1OX	D	602[B]	21/21	0.82	0.17	21,40,51,52	21
3	1OX	B	602[A]	21/21	0.91	0.12	23,29,39,41	21
3	1OX	B	602[B]	21/21	0.91	0.12	20,30,43,44	21
2	FBP	C	601	20/20	0.96	0.06	45,53,61,62	0
2	FBP	A	601	20/20	0.97	0.06	41,49,52,54	0
2	FBP	D	601	20/20	0.97	0.06	41,44,52,54	0
2	FBP	B	601	20/20	0.97	0.06	36,40,54,56	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.

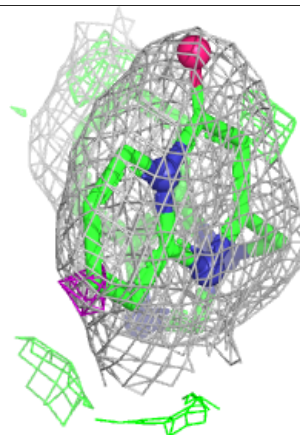
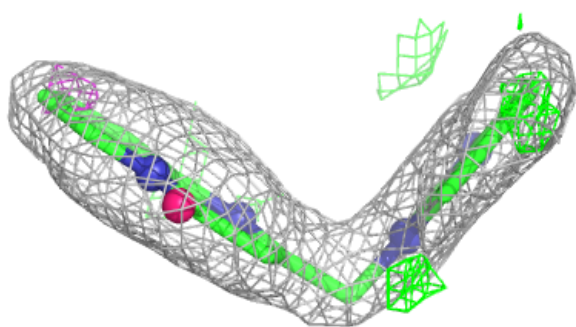
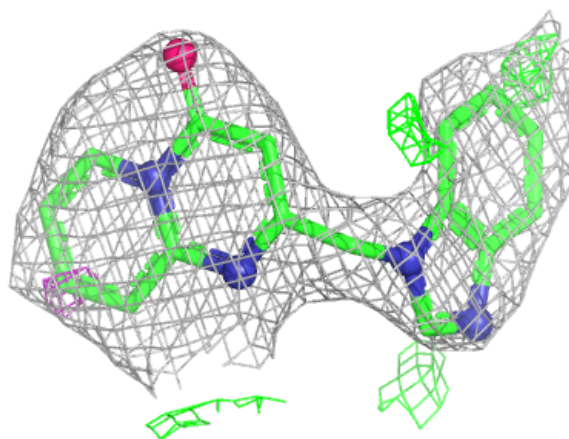
Electron density around 1OX D 602 (A):

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



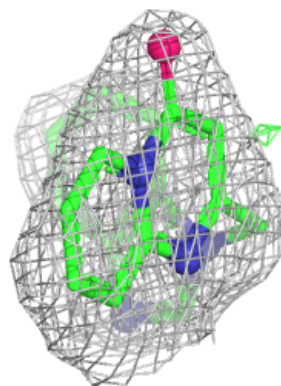
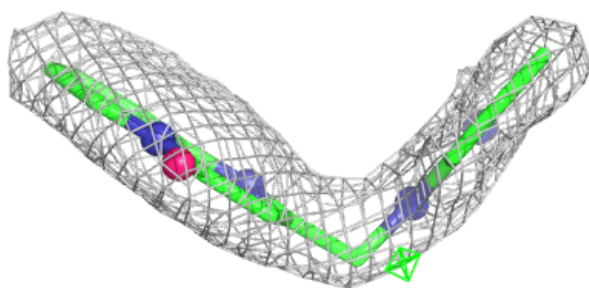
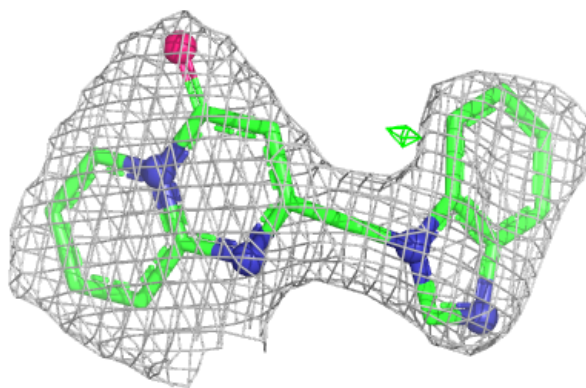
Electron density around 1OX D 602 (B):

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



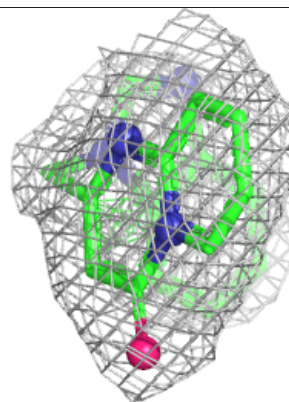
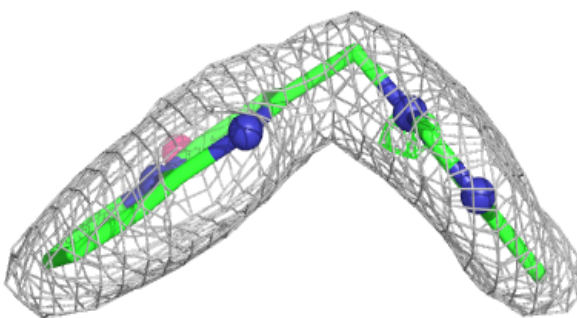
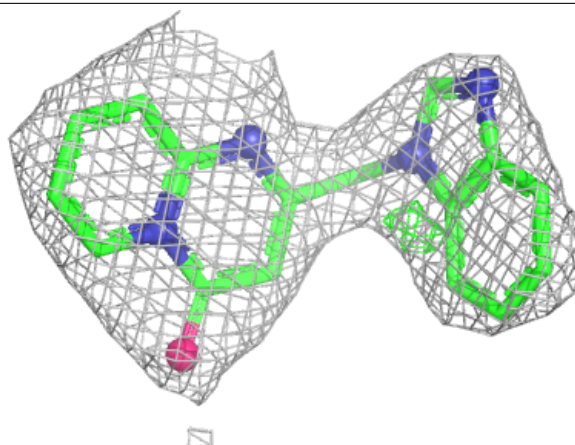
Electron density around 1OX B 602 (A):

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

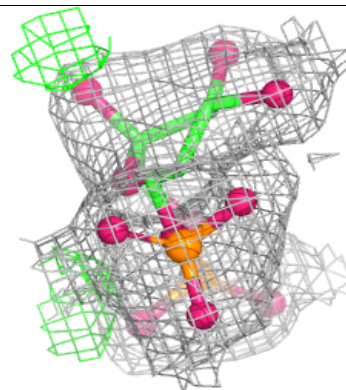
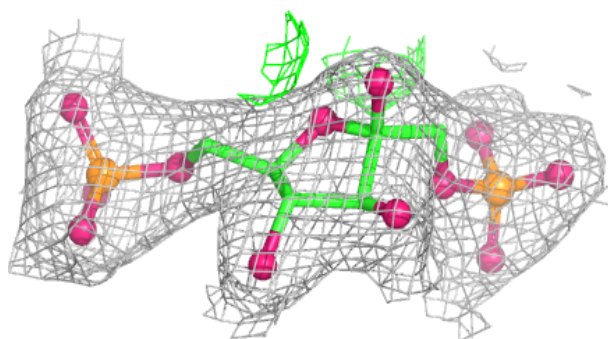
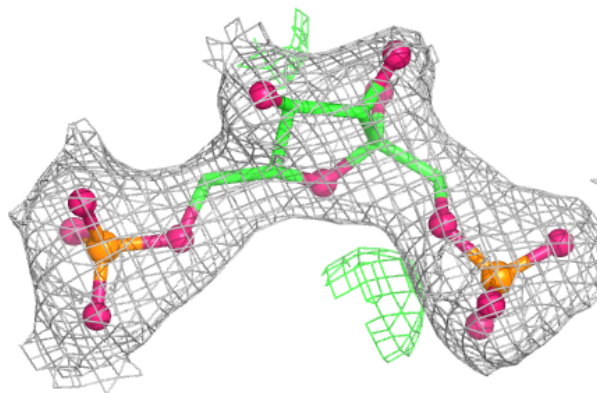


Electron density around 1OX B 602 (B):

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

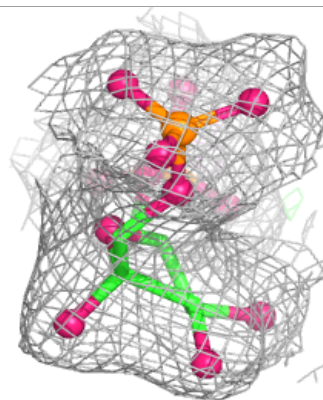
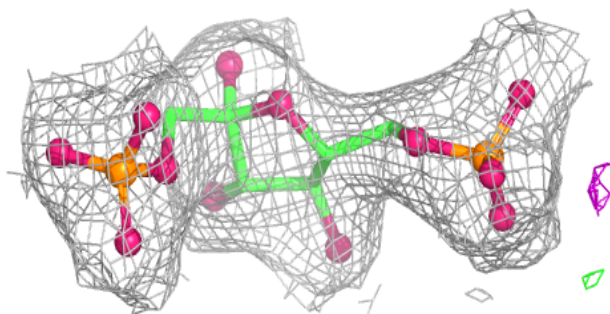
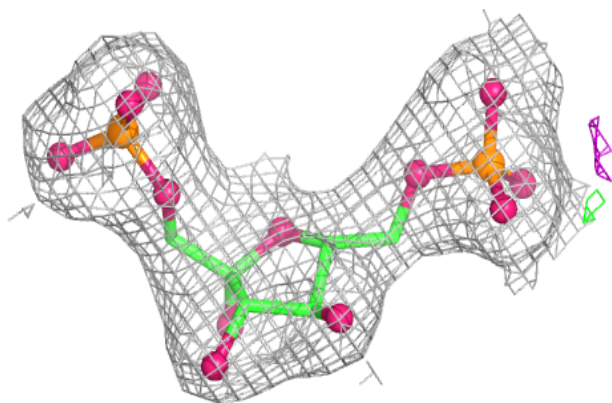
**Electron density around FBP C 601:**

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

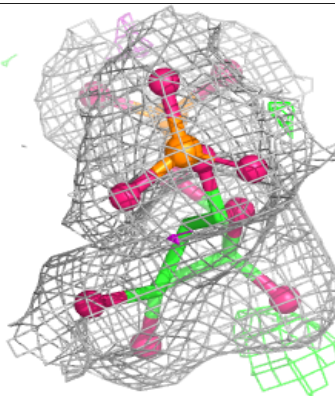
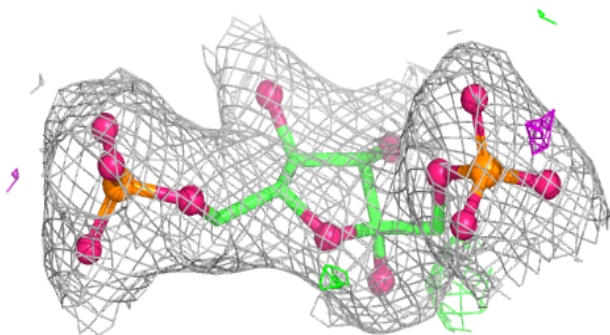
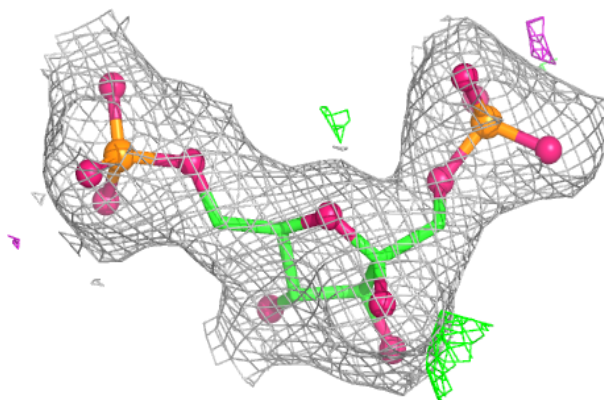


Electron density around FBP A 601:

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

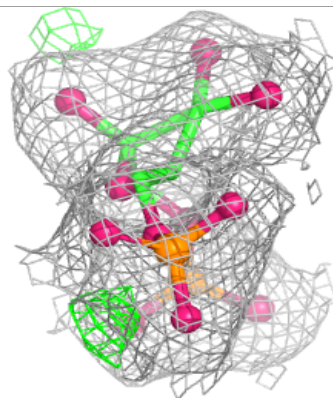
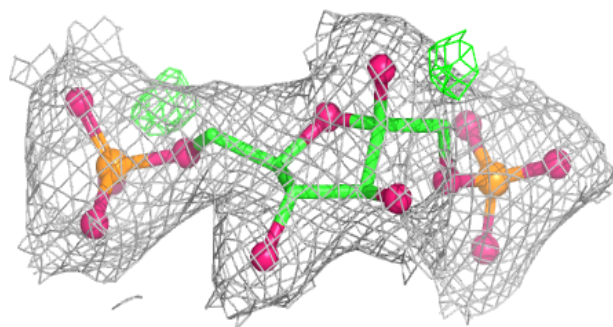
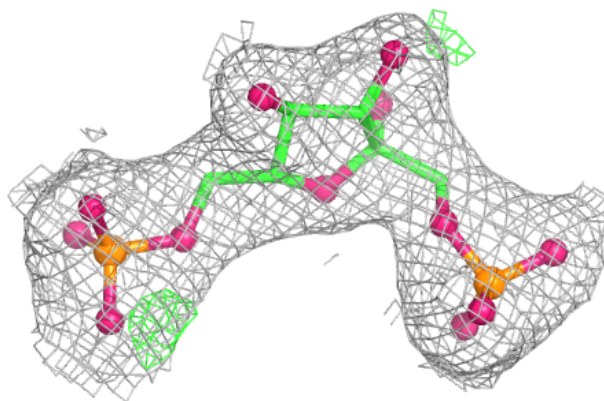
**Electron density around FBP D 601:**

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



Electron density around FBP B 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.