



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 12, 2026 – 07:58 PM UTC

PDB ID : 5AYE / pdb_00005aye
Title : Crystal structure of Ruminococcus albus beta-(1,4)-mannooligosaccharide phosphorylase (RaMP2) in complexes with phosphate and beta-(1,4)-mannobiose
Authors : Ye, Y.; Saburi, W.; Kato, K.; Yao, M.
Deposited on : 2015-08-13
Resolution : 2.20 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
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

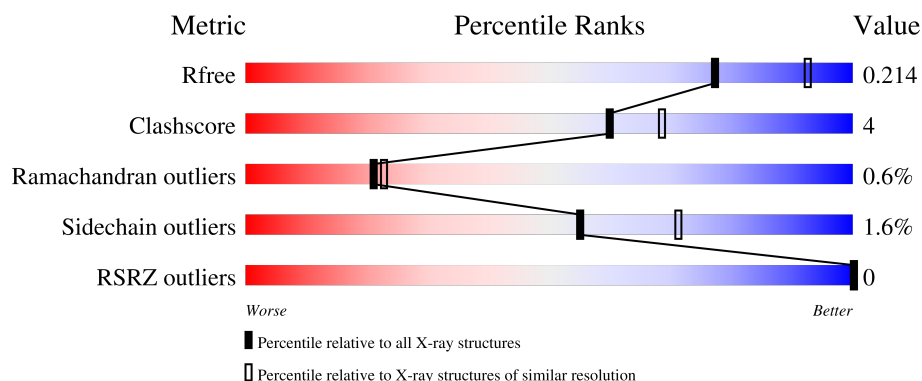
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.20 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.



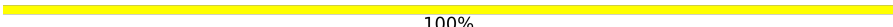
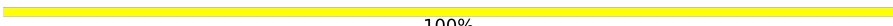
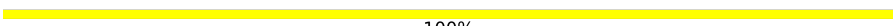
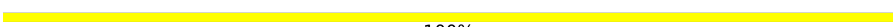
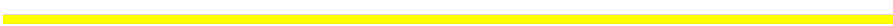
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	180053	6164 (2.20-2.20)
Clashscore	190562	6851 (2.20-2.20)
Ramachandran outliers	187476	6768 (2.20-2.20)
Sidechain outliers	187428	6769 (2.20-2.20)
RSRZ outliers	180081	6166 (2.20-2.20)

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	335	 89% 10% .
1	B	335	 89% 10%
1	C	335	 87% 12% .
1	D	335	 89% 11%
1	E	335	 88% 11% .

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Mol	Chain	Length	Quality of chain
1	F	335	 91% 9%
2	G	2	 100%
2	H	2	 100%
2	I	2	 100%
2	J	2	 100%
2	K	2	 100%
2	L	2	 100%

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
3	PO4	C	401	-	X	-	-

2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 17797 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 Beta-1,4-mannooligosaccharide phosphorylase.

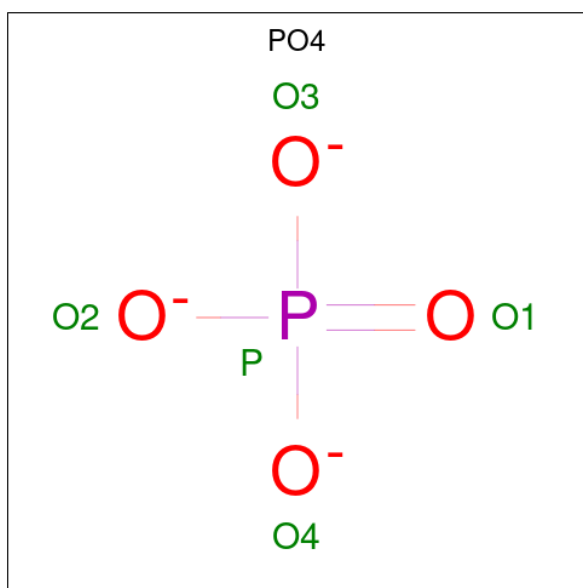
Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	335	Total	C	N	O	S	0	0	0
			2700	1737	446	497	20			
1	B	335	Total	C	N	O	S	0	0	0
			2700	1737	446	497	20			
1	C	335	Total	C	N	O	S	0	0	0
			2700	1737	446	497	20			
1	D	335	Total	C	N	O	S	0	0	0
			2700	1737	446	497	20			
1	E	335	Total	C	N	O	S	0	0	0
			2700	1737	446	497	20			
1	F	335	Total	C	N	O	S	0	0	0
			2700	1737	446	497	20			

- Molecule 2 is an oligosaccharide called beta-D-mannopyranose-(1-4)-beta-D-mannopyranose.



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf	Trace
2	G	2	Total	C	O	0	0	0
			23	12	11			
2	H	2	Total	C	O	0	0	0
			23	12	11			
2	I	2	Total	C	O	0	0	0
			23	12	11			
2	J	2	Total	C	O	0	0	0
			23	12	11			
2	K	2	Total	C	O	0	0	0
			23	12	11			
2	L	2	Total	C	O	0	0	0
			23	12	11			

- Molecule 3 is PHOSPHATE ION (CCD ID: PO4) (formula: O_4P).



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

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	220	Total	O	0	0
			220	220		
4	B	224	Total	O	0	0
			224	224		
4	C	251	Total	O	0	0
			251	251		
4	D	226	Total	O	0	0
			226	226		
4	E	222	Total	O	0	0
			222	222		

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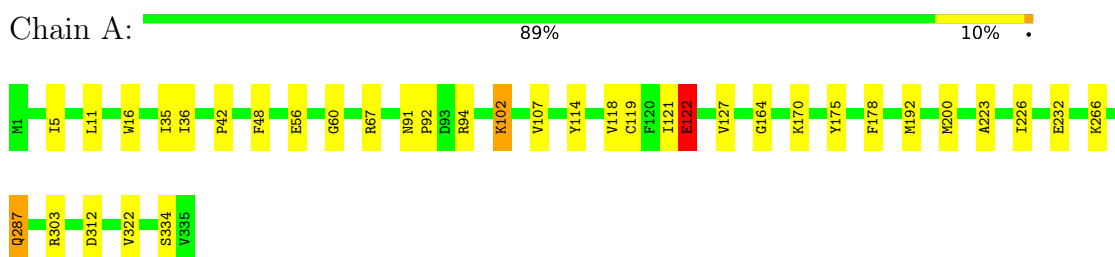
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Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	F	286	Total 286	O 286	0	0

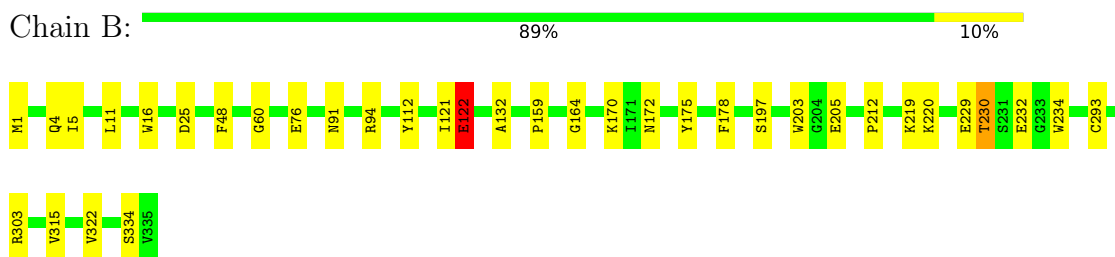
3 Residue-property plots

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 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.

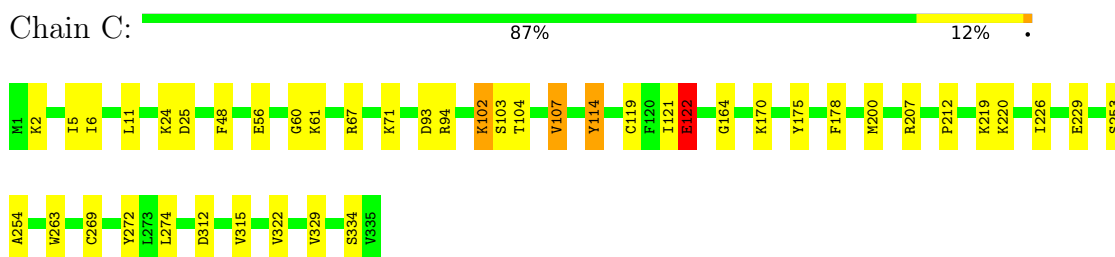
- Molecule 1: Beta-1,4-mannooligosaccharide phosphorylase



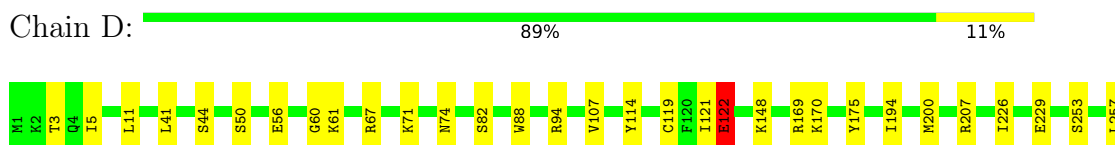
- Molecule 1: Beta-1,4-mannooligosaccharide phosphorylase



- Molecule 1: Beta-1,4-mannooligosaccharide phosphorylase



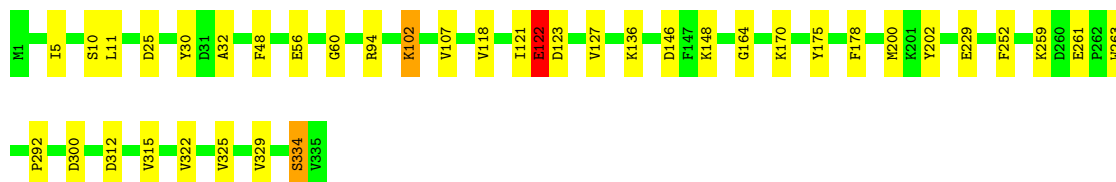
- Molecule 1: Beta-1,4-mannooligosaccharide phosphorylase





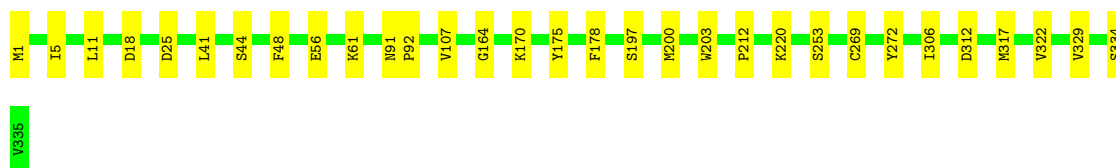
- Molecule 1: Beta-1,4-mannooligosaccharide phosphorylase

Chain E: 88% 11%



- Molecule 1: Beta-1,4-mannooligosaccharide phosphorylase

Chain F: 91% 9%



- Molecule 2: beta-D-mannopyranose-(1-4)-beta-D-mannopyranose

Chain G: 100%



- Molecule 2: beta-D-mannopyranose-(1-4)-beta-D-mannopyranose

Chain H: 100%



- Molecule 2: beta-D-mannopyranose-(1-4)-beta-D-mannopyranose

Chain I: 100%

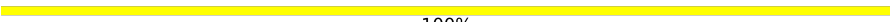


- Molecule 2: beta-D-mannopyranose-(1-4)-beta-D-mannopyranose

Chain J: 100%

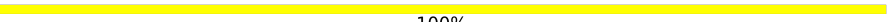


- Molecule 2: beta-D-mannopyranose-(1-4)-beta-D-mannopyranose

Chain K:  100%

BMA1
BMA2

- Molecule 2: beta-D-mannopyranose-(1-4)-beta-D-mannopyranose

Chain L:  100%

BMA1
BMA2

4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	92.47Å 166.15Å 92.72Å 90.00° 118.87° 90.00°	Depositor
Resolution (Å)	47.09 – 2.20 47.09 – 2.20	Depositor EDS
% Data completeness (in resolution range)	99.9 (47.09-2.20) 99.1 (47.09-2.20)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.01 (at 2.20Å)	Xtriage
Refinement program	PHENIX (phenix.refine: 1.9_1692), Coot	Depositor
R, R_{free}	0.166 , 0.213 0.170 , 0.214	Depositor DCC
R_{free} test set	6182 reflections (4.99%)	wwPDB-VP
Wilson B-factor (Å ²)	23.6	Xtriage
Anisotropy	0.374	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.34 , 19.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.45$, $\langle L^2 \rangle = 0.27$	Xtriage
Estimated twinning fraction	0.034 for -h-l,k,h 0.034 for l,k,-h-l 0.044 for h,-k,-h-l 0.039 for -h-l,-k,l 0.196 for l,-k,h	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	17797	wwPDB-VP
Average B, all atoms (Å ²)	25.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.35% 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: PO4, BMA

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	0.49	0/2787	0.77	1/3791 (0.0%)
1	B	0.51	0/2787	0.77	1/3791 (0.0%)
1	C	0.52	1/2787 (0.0%)	0.79	1/3791 (0.0%)
1	D	0.50	0/2787	0.77	2/3791 (0.1%)
1	E	0.49	0/2787	0.79	1/3791 (0.0%)
1	F	0.50	0/2787	0.77	0/3791
All	All	0.50	1/16722 (0.0%)	0.78	6/22746 (0.0%)

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	C	114	TYR	C-O	-6.58	1.15	1.23

All (6) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	D	50	SER	N-CA-C	5.87	119.12	109.85
1	B	60	GLY	N-CA-C	5.75	117.74	110.38
1	A	60	GLY	N-CA-C	5.59	117.71	110.45
1	C	60	GLY	N-CA-C	5.42	117.32	110.38
1	E	60	GLY	N-CA-C	5.23	117.07	110.38
1	D	60	GLY	N-CA-C	5.11	117.47	110.58

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	2700	0	2564	22	0
1	B	2700	0	2564	25	0
1	C	2700	0	2564	31	0
1	D	2700	0	2564	21	0
1	E	2700	0	2564	25	0
1	F	2700	0	2564	18	0
2	G	23	0	21	0	0
2	H	23	0	21	0	0
2	I	23	0	21	0	0
2	J	23	0	21	0	0
2	K	23	0	21	0	0
2	L	23	0	21	0	0
3	A	5	0	0	0	0
3	B	5	0	0	0	0
3	C	5	0	0	0	0
3	D	5	0	0	0	0
3	E	5	0	0	0	0
3	F	5	0	0	0	0
4	A	220	0	0	1	0
4	B	224	0	0	8	0
4	C	251	0	0	6	0
4	D	226	0	0	6	0
4	E	222	0	0	4	0
4	F	286	0	0	4	0
All	All	17797	0	15510	136	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 4.

All (136) 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:E:146:ASP:OD2	4:E:501:HOH:O	1.88	0.92
1:C:263:TRP:O	4:C:501:HOH:O	1.89	0.89
1:D:5:ILE:HD11	1:D:322:VAL:HG21	1.56	0.88

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:E:122:GLU:OE2	4:E:502:HOH:O	2.00	0.80
1:C:5:ILE:HD11	1:C:322:VAL:HG21	1.69	0.74
1:F:5:ILE:HD11	1:F:322:VAL:HG21	1.68	0.74
1:C:207:ARG:CZ	1:F:107:VAL:HG21	2.21	0.71
1:B:5:ILE:HD11	1:B:322:VAL:HG21	1.73	0.70
1:D:327:ASP:OD1	4:D:502:HOH:O	2.09	0.69
1:A:5:ILE:HD11	1:A:322:VAL:HG21	1.74	0.69
1:C:93:ASP:OD1	4:C:502:HOH:O	2.13	0.66
1:B:76:GLU:OE2	4:B:501:HOH:O	2.14	0.66
1:E:5:ILE:HD11	1:E:322:VAL:HG21	1.77	0.66
1:A:35:ILE:HG13	1:A:36:ILE:HG13	1.78	0.65
1:D:67:ARG:HD2	1:D:114:TYR:HB2	1.80	0.64
1:F:18:ASP:OD1	4:F:501:HOH:O	2.15	0.62
1:D:169:ARG:NH1	4:D:501:HOH:O	1.92	0.61
1:A:102:LYS:H	1:A:102:LYS:NZ	2.03	0.57
1:F:175:TYR:CD1	1:F:200:MET:HE2	2.39	0.57
1:F:56:GLU:OE2	1:F:61:LYS:NZ	2.25	0.57
1:B:4:GLN:OE1	4:B:502:HOH:O	2.18	0.56
1:C:25:ASP:HB3	4:C:583:HOH:O	2.05	0.56
1:E:102:LYS:H	1:E:102:LYS:NZ	2.03	0.56
1:C:253:SER:HB2	1:C:272:TYR:HA	1.88	0.56
1:E:94:ARG:NH2	4:E:506:HOH:O	2.35	0.56
1:D:170:LYS:HE2	1:D:175:TYR:CZ	2.40	0.56
1:C:103:SER:HB2	4:F:532:HOH:O	2.06	0.55
1:C:6:ILE:HB	1:C:229:GLU:HG2	1.89	0.55
1:C:56:GLU:OE2	1:C:61:LYS:NZ	2.26	0.55
1:C:119:CYS:HB3	1:C:226:ILE:HG13	1.88	0.54
1:F:107:VAL:HG23	4:F:504:HOH:O	2.06	0.54
1:C:170:LYS:HE2	1:C:175:TYR:CZ	2.43	0.54
1:E:170:LYS:HE2	1:E:175:TYR:CZ	2.43	0.53
1:E:175:TYR:CD1	1:E:200:MET:HE2	2.43	0.53
1:D:121:ILE:O	1:D:122:GLU:HG2	2.08	0.53
1:C:102:LYS:H	1:C:102:LYS:CD	2.22	0.53
1:E:118:VAL:HG22	1:E:127:VAL:HG22	1.90	0.53
1:E:48:PHE:HA	1:E:315:VAL:HG22	1.91	0.52
1:A:175:TYR:CD2	1:A:200:MET:HG2	2.45	0.52
1:A:94:ARG:NH2	4:A:517:HOH:O	2.42	0.52
1:B:25:ASP:HB3	4:B:566:HOH:O	2.10	0.52
1:B:94:ARG:NH2	4:B:508:HOH:O	2.42	0.52
1:D:94:ARG:HD3	4:D:681:HOH:O	2.09	0.51
1:A:42:PRO:HA	1:C:24:LYS:HD2	1.93	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:170:LYS:HE2	1:B:175:TYR:CZ	2.45	0.51
1:B:121:ILE:O	1:B:122:GLU:HG2	2.11	0.50
1:D:119:CYS:HB3	1:D:226:ILE:HG13	1.92	0.50
1:F:170:LYS:HE2	1:F:175:TYR:CZ	2.46	0.50
1:D:56:GLU:OE2	1:D:61:LYS:NZ	2.26	0.49
1:B:230:THR:HG22	1:B:232:GLU:H	1.76	0.49
1:C:269:CYS:HB2	1:C:329:VAL:HG22	1.94	0.49
1:C:175:TYR:CD1	1:C:200:MET:HE2	2.48	0.49
1:D:194:ILE:HG13	1:D:207:ARG:HB2	1.94	0.49
1:F:41:LEU:HB2	1:F:44:SER:HB3	1.95	0.48
1:E:175:TYR:CD2	1:E:200:MET:HG2	2.47	0.48
1:D:74:ASN:HB3	4:D:644:HOH:O	2.13	0.48
1:D:229:GLU:OE2	1:D:259:LYS:NZ	2.41	0.48
1:A:175:TYR:CD1	1:A:200:MET:HE2	2.48	0.48
1:B:121:ILE:C	1:B:122:GLU:HG2	2.39	0.48
1:D:121:ILE:C	1:D:122:GLU:HG2	2.38	0.47
1:C:175:TYR:CD2	1:C:200:MET:HG2	2.48	0.47
1:B:230:THR:CG2	1:B:232:GLU:H	2.26	0.47
1:C:48:PHE:HA	1:C:315:VAL:HG22	1.95	0.47
1:E:121:ILE:O	1:E:123:ASP:N	2.42	0.47
1:A:170:LYS:HE2	1:A:175:TYR:CZ	2.50	0.47
1:C:2:LYS:NZ	4:C:515:HOH:O	2.47	0.47
1:C:121:ILE:O	1:C:122:GLU:HG2	2.15	0.47
1:B:159:PRO:HD3	4:B:542:HOH:O	2.15	0.46
1:E:121:ILE:O	1:E:122:GLU:HG2	2.15	0.46
1:A:102:LYS:H	1:A:102:LYS:HZ3	1.63	0.46
1:C:94:ARG:NH2	4:C:518:HOH:O	2.48	0.46
1:D:3:THR:OG1	4:D:503:HOH:O	2.20	0.46
1:D:175:TYR:CD2	1:D:200:MET:HG2	2.51	0.46
1:A:119:CYS:HB3	1:A:226:ILE:HG13	1.96	0.46
1:A:232:GLU:O	1:A:266:LYS:NZ	2.38	0.46
1:B:197:SER:HB2	1:B:203:TRP:CE3	2.51	0.45
1:B:212:PRO:HG3	1:B:220:LYS:HA	1.97	0.45
1:D:82:SER:HB2	1:D:88:TRP:CD2	2.51	0.45
1:B:25:ASP:OD1	1:C:71:LYS:NZ	2.49	0.45
1:F:253:SER:HB2	1:F:272:TYR:HA	1.98	0.45
1:E:10:SER:OG	1:E:300:ASP:OD2	2.17	0.45
1:A:192:MET:HE3	1:A:223:ALA:HB2	1.99	0.44
1:C:175:TYR:CG	1:C:200:MET:HE2	2.53	0.44
1:E:252:PHE:CG	1:E:292:PRO:HG3	2.53	0.44
1:C:219:LYS:HA	1:C:219:LYS:HD3	1.88	0.44

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:F:25:ASP:HB3	4:F:528:HOH:O	2.17	0.44
1:A:91:ASN:HA	1:A:92:PRO:HD3	1.87	0.44
1:C:207:ARG:NE	1:F:107:VAL:HG21	2.32	0.44
1:C:212:PRO:HG3	1:C:220:LYS:HA	1.98	0.44
1:E:229:GLU:OE2	1:E:259:LYS:NZ	2.37	0.43
1:E:325:VAL:O	1:E:329:VAL:HG23	2.18	0.43
1:B:164:GLY:HA2	1:B:178:PHE:O	2.18	0.43
1:C:67:ARG:HD2	1:C:114:TYR:HB2	2.01	0.43
1:D:257:LEU:HD13	1:D:262:PRO:O	2.19	0.43
1:D:41:LEU:HB2	1:D:44:SER:HB3	2.00	0.43
1:B:112:TYR:CZ	1:B:132:ALA:HB2	2.54	0.43
1:C:48:PHE:CD2	1:C:312:ASP:HA	2.52	0.43
1:E:136:LYS:NZ	4:E:509:HOH:O	2.39	0.43
1:B:91:ASN:HB3	4:B:642:HOH:O	2.17	0.43
1:E:164:GLY:HA2	1:E:178:PHE:O	2.18	0.43
1:A:164:GLY:HA2	1:A:178:PHE:O	2.18	0.42
1:D:71:LYS:NZ	1:E:25:ASP:OD1	2.51	0.42
1:D:253:SER:HB2	1:D:272:TYR:HA	2.01	0.42
1:E:48:PHE:CD2	1:E:312:ASP:HA	2.54	0.42
1:C:104:THR:HA	1:C:107:VAL:HG23	2.01	0.42
1:B:197:SER:HB2	1:B:203:TRP:CD2	2.55	0.42
1:E:30:TYR:CE2	1:E:32:ALA:HB3	2.53	0.42
1:F:91:ASN:HA	1:F:92:PRO:HD3	1.89	0.42
1:A:67:ARG:HD2	1:A:114:TYR:HB2	2.01	0.42
1:B:205:GLU:OE2	1:E:202:TYR:OH	2.32	0.42
1:C:164:GLY:HA2	1:C:178:PHE:O	2.19	0.42
1:F:269:CYS:HB2	1:F:329:VAL:HG22	2.00	0.42
1:B:16:TRP:CH2	1:B:303:ARG:HG2	2.55	0.42
1:B:293:CYS:HB2	4:B:582:HOH:O	2.20	0.42
1:E:261:GLU:HB3	1:E:263:TRP:CZ2	2.55	0.42
1:F:212:PRO:HG3	1:F:220:LYS:HA	2.01	0.42
1:A:102:LYS:H	1:A:102:LYS:CE	2.33	0.41
1:C:102:LYS:NZ	4:C:523:HOH:O	2.53	0.41
1:A:16:TRP:CD2	1:A:303:ARG:HD2	2.55	0.41
1:F:197:SER:HB2	1:F:203:TRP:CD2	2.55	0.41
1:A:48:PHE:CD2	1:A:312:ASP:HA	2.55	0.41
1:A:118:VAL:HG22	1:A:127:VAL:HG22	2.03	0.41
1:E:121:ILE:C	1:E:122:GLU:HG2	2.46	0.41
1:A:121:ILE:C	1:A:122:GLU:HG2	2.45	0.41
1:B:112:TYR:CE1	1:B:132:ALA:HB2	2.55	0.41
1:F:164:GLY:HA2	1:F:178:PHE:O	2.20	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:229:GLU:HB2	1:B:234:TRP:CZ3	2.56	0.41
1:C:253:SER:OG	1:C:254:ALA:N	2.53	0.41
1:F:306:ILE:O	1:F:317:MET:HA	2.20	0.41
1:F:48:PHE:CD2	1:F:312:ASP:HA	2.56	0.40
1:B:76:GLU:HG3	4:B:563:HOH:O	2.21	0.40
1:A:287:GLN:H	1:A:287:GLN:CD	2.29	0.40
1:D:148:LYS:NZ	4:D:525:HOH:O	2.54	0.40
1:E:148:LYS:HB2	1:E:148:LYS:HE3	1.76	0.40
1:A:5:ILE:CD1	1:A:322:VAL:HG21	2.47	0.40
1:B:48:PHE:HA	1:B:315:VAL:HG22	2.03	0.40

There are no symmetry-related clashes.

5.3 Torsion angles ⓘ

5.3.1 Protein backbone ⓘ

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	333/335 (99%)	314 (94%)	17 (5%)	2 (1%)	21	23
1	B	333/335 (99%)	316 (95%)	15 (4%)	2 (1%)	21	23
1	C	333/335 (99%)	319 (96%)	12 (4%)	2 (1%)	21	23
1	D	333/335 (99%)	313 (94%)	18 (5%)	2 (1%)	21	23
1	E	333/335 (99%)	314 (94%)	17 (5%)	2 (1%)	21	23
1	F	333/335 (99%)	309 (93%)	23 (7%)	1 (0%)	36	42
All	All	1998/2010 (99%)	1885 (94%)	102 (5%)	11 (1%)	21	23

All (11) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	A	122	GLU
1	B	122	GLU

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Mol	Chain	Res	Type
1	C	122	GLU
1	D	122	GLU
1	D	334	SER
1	E	122	GLU
1	B	334	SER
1	E	334	SER
1	F	334	SER
1	A	334	SER
1	C	334	SER

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	294/294 (100%)	288 (98%)	6 (2%)	48	64
1	B	294/294 (100%)	288 (98%)	6 (2%)	48	64
1	C	294/294 (100%)	289 (98%)	5 (2%)	53	69
1	D	294/294 (100%)	291 (99%)	3 (1%)	68	81
1	E	294/294 (100%)	288 (98%)	6 (2%)	48	64
1	F	294/294 (100%)	292 (99%)	2 (1%)	76	87
All	All	1764/1764 (100%)	1736 (98%)	28 (2%)	55	71

All (28) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	11	LEU
1	A	56	GLU
1	A	102	LYS
1	A	107	VAL
1	A	122	GLU
1	A	287	GLN
1	B	1	MET
1	B	11	LEU
1	B	122	GLU

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Mol	Chain	Res	Type
1	B	172	ASN
1	B	219	LYS
1	B	230	THR
1	C	11	LEU
1	C	102	LYS
1	C	107	VAL
1	C	122	GLU
1	C	274	LEU
1	D	11	LEU
1	D	107	VAL
1	D	122	GLU
1	E	11	LEU
1	E	56	GLU
1	E	102	LYS
1	E	107	VAL
1	E	122	GLU
1	E	334	SER
1	F	1	MET
1	F	11	LEU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (17) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	45	ASN
1	B	99	GLN
1	B	108	ASN
1	B	152	GLN
1	B	186	HIS
1	B	277	GLN
1	C	45	ASN
1	C	99	GLN
1	C	108	ASN
1	C	288	ASN
1	D	45	ASN
1	D	277	GLN
1	E	4	GLN
1	E	7	ASN
1	F	99	GLN
1	F	108	ASN
1	F	332	HIS

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 ⓘ

12 monosaccharides 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	BMA	G	1	2	12,12,12	0.79	0	17,17,17	1.72	4 (23%)
2	BMA	G	2	2	11,11,12	1.04	0	15,15,17	3.64	7 (46%)
2	BMA	H	1	2	12,12,12	1.04	1 (8%)	17,17,17	0.98	1 (5%)
2	BMA	H	2	2	11,11,12	0.99	0	15,15,17	3.34	8 (53%)
2	BMA	I	1	2	12,12,12	0.93	0	17,17,17	2.27	4 (23%)
2	BMA	I	2	2	11,11,12	1.15	1 (9%)	15,15,17	3.21	7 (46%)
2	BMA	J	1	2	12,12,12	0.97	1 (8%)	17,17,17	1.68	4 (23%)
2	BMA	J	2	2	11,11,12	0.76	0	15,15,17	3.55	9 (60%)
2	BMA	K	1	2	12,12,12	0.82	0	17,17,17	1.67	5 (29%)
2	BMA	K	2	2	11,11,12	1.15	2 (18%)	15,15,17	3.26	7 (46%)
2	BMA	L	1	2	12,12,12	1.02	1 (8%)	17,17,17	1.50	5 (29%)
2	BMA	L	2	2	11,11,12	0.74	0	15,15,17	3.32	6 (40%)

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	BMA	G	1	2	-	0/2/22/22	0/1/1/1
2	BMA	G	2	2	-	2/2/19/22	0/1/1/1
2	BMA	H	1	2	-	0/2/22/22	0/1/1/1
2	BMA	H	2	2	-	2/2/19/22	0/1/1/1
2	BMA	I	1	2	-	1/2/22/22	0/1/1/1
2	BMA	I	2	2	-	2/2/19/22	0/1/1/1
2	BMA	J	1	2	-	1/2/22/22	0/1/1/1
2	BMA	J	2	2	-	2/2/19/22	0/1/1/1
2	BMA	K	1	2	-	0/2/22/22	0/1/1/1
2	BMA	K	2	2	-	2/2/19/22	1/1/1/1
2	BMA	L	1	2	-	0/2/22/22	0/1/1/1
2	BMA	L	2	2	-	2/2/19/22	0/1/1/1

All (6) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	I	2	BMA	C2-C3	2.91	1.56	1.52
2	L	1	BMA	O5-C1	-2.45	1.36	1.42
2	K	2	BMA	C4-C3	2.27	1.58	1.52
2	H	1	BMA	O5-C1	-2.10	1.37	1.42
2	J	1	BMA	O5-C1	-2.09	1.37	1.42
2	K	2	BMA	C1-C2	2.00	1.57	1.52

All (67) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	G	2	BMA	C1-O5-C5	10.37	126.09	112.19
2	J	2	BMA	C1-O5-C5	9.32	124.68	112.19
2	L	2	BMA	C1-O5-C5	8.86	124.06	112.19
2	H	2	BMA	C1-O5-C5	8.53	123.61	112.19
2	K	2	BMA	C1-O5-C5	8.17	123.13	112.19
2	I	2	BMA	C1-O5-C5	7.88	122.75	112.19
2	L	2	BMA	C1-C2-C3	-5.61	101.47	109.64
2	G	2	BMA	O2-C2-C3	5.49	121.52	110.15
2	H	2	BMA	C1-C2-C3	-5.45	101.71	109.64
2	J	2	BMA	C1-C2-C3	-5.39	101.80	109.64
2	I	2	BMA	O2-C2-C3	5.33	121.19	110.15
2	I	1	BMA	O6-C6-C5	-5.02	94.24	111.33
2	G	2	BMA	C1-C2-C3	-4.91	102.50	109.64
2	K	2	BMA	C1-C2-C3	-4.81	102.63	109.64
2	K	2	BMA	O2-C2-C1	4.57	119.69	109.22
2	H	2	BMA	O2-C2-C3	4.48	119.44	110.15

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	I	1	BMA	O5-C5-C4	4.36	117.56	109.70
2	I	2	BMA	C1-C2-C3	-4.30	103.38	109.64
2	J	2	BMA	O2-C2-C3	4.23	118.92	110.15
2	I	1	BMA	C6-C5-C4	-4.09	102.97	113.02
2	J	2	BMA	O5-C5-C6	-4.06	99.76	107.66
2	K	2	BMA	O2-C2-C3	3.88	118.19	110.15
2	L	2	BMA	O6-C6-C5	-3.71	98.72	111.33
2	J	1	BMA	O2-C2-C3	-3.58	101.93	110.38
2	I	2	BMA	C6-C5-C4	-3.43	104.60	113.02
2	K	1	BMA	O2-C2-C3	-3.35	102.47	110.38
2	G	1	BMA	O4-C4-C5	3.28	117.41	109.32
2	J	2	BMA	O5-C1-C2	-3.24	103.05	110.79
2	G	2	BMA	O5-C1-C2	-3.21	103.13	110.79
2	H	2	BMA	O2-C2-C1	3.21	116.58	109.22
2	L	2	BMA	O2-C2-C3	3.21	116.79	110.15
2	G	1	BMA	O5-C5-C6	-3.19	98.54	106.44
2	G	2	BMA	O2-C2-C1	3.18	116.50	109.22
2	J	2	BMA	O6-C6-C5	-3.14	100.63	111.33
2	L	2	BMA	O2-C2-C1	3.14	116.41	109.22
2	H	2	BMA	O5-C1-C2	-3.10	103.40	110.79
2	K	1	BMA	C1-O5-C5	-3.00	107.86	113.65
2	K	2	BMA	O6-C6-C5	-2.99	101.16	111.33
2	L	2	BMA	C2-C3-C4	2.89	115.94	110.86
2	K	1	BMA	O1-C1-C2	2.87	117.30	108.98
2	I	2	BMA	C3-C4-C5	2.83	115.37	110.23
2	L	1	BMA	O4-C4-C3	2.79	116.95	110.38
2	H	2	BMA	O6-C6-C5	-2.72	102.06	111.33
2	G	1	BMA	O1-C1-C2	2.68	116.75	108.98
2	K	2	BMA	C3-C4-C5	2.62	114.98	110.23
2	I	2	BMA	O2-C2-C1	2.49	114.93	109.22
2	H	2	BMA	C2-C3-C4	2.45	115.17	110.86
2	J	1	BMA	O5-C5-C6	-2.44	100.39	106.44
2	I	1	BMA	C1-O5-C5	2.44	118.37	113.65
2	H	1	BMA	O1-C1-C2	2.42	116.01	108.98
2	L	1	BMA	C1-C2-C3	-2.38	105.50	110.36
2	J	2	BMA	O2-C2-C1	2.38	114.67	109.22
2	J	1	BMA	O3-C3-C2	-2.38	104.77	110.38
2	J	2	BMA	C2-C3-C4	2.28	114.86	110.86
2	I	2	BMA	O5-C1-C2	-2.25	105.42	110.79
2	K	2	BMA	O4-C4-C5	-2.24	103.82	109.32
2	K	1	BMA	O4-C4-C5	2.19	114.72	109.32
2	J	2	BMA	C3-C4-C5	2.18	114.19	110.23

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	H	2	BMA	C3-C4-C5	2.14	114.12	110.23
2	G	1	BMA	O1-C1-O5	-2.14	104.06	110.41
2	L	1	BMA	O3-C3-C4	2.12	115.38	110.38
2	K	1	BMA	C6-C5-C4	2.11	118.19	113.02
2	J	1	BMA	O5-C1-C2	-2.04	106.71	110.30
2	L	1	BMA	O5-C1-C2	-2.02	106.75	110.30
2	G	2	BMA	O6-C6-C5	-2.02	104.47	111.33
2	G	2	BMA	C3-C4-C5	2.01	113.88	110.23
2	L	1	BMA	O1-C1-C2	2.00	114.80	108.98

There are no chirality outliers.

All (14) torsion outliers are listed below:

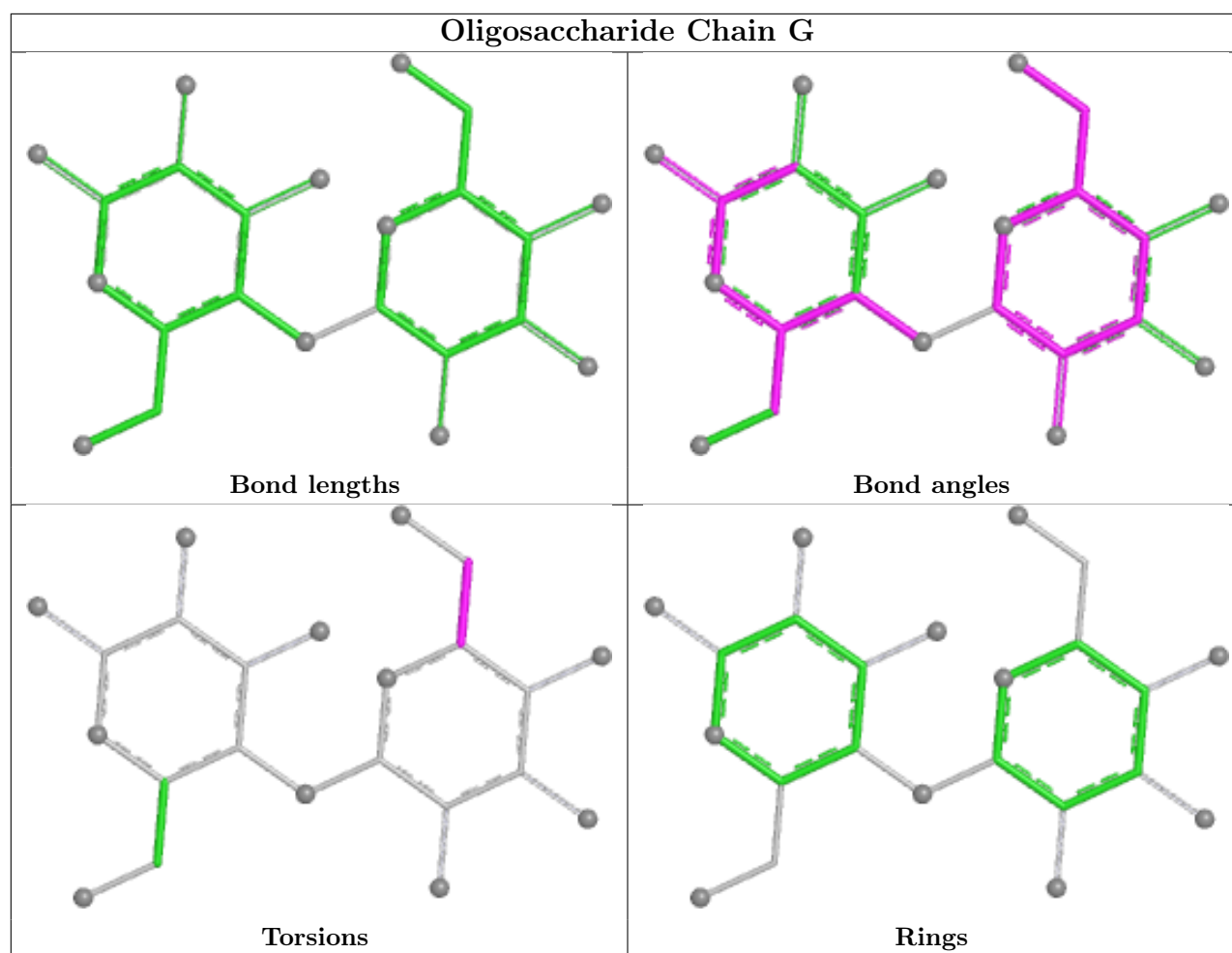
Mol	Chain	Res	Type	Atoms
2	G	2	BMA	O5-C5-C6-O6
2	G	2	BMA	C4-C5-C6-O6
2	L	2	BMA	O5-C5-C6-O6
2	J	2	BMA	O5-C5-C6-O6
2	H	2	BMA	O5-C5-C6-O6
2	L	2	BMA	C4-C5-C6-O6
2	K	2	BMA	O5-C5-C6-O6
2	I	2	BMA	O5-C5-C6-O6
2	J	2	BMA	C4-C5-C6-O6
2	H	2	BMA	C4-C5-C6-O6
2	K	2	BMA	C4-C5-C6-O6
2	J	1	BMA	O5-C5-C6-O6
2	I	1	BMA	C4-C5-C6-O6
2	I	2	BMA	C4-C5-C6-O6

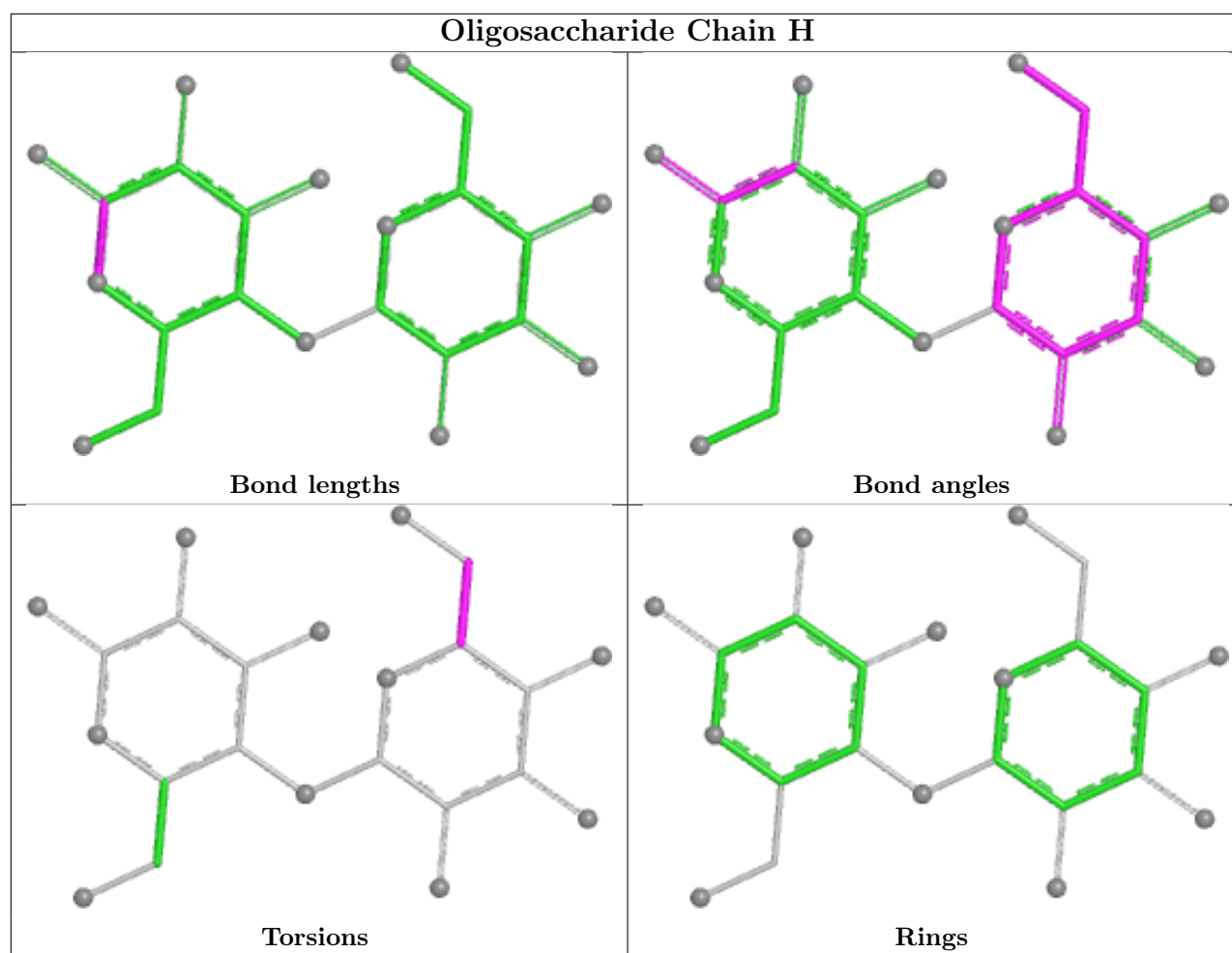
All (1) ring outliers are listed below:

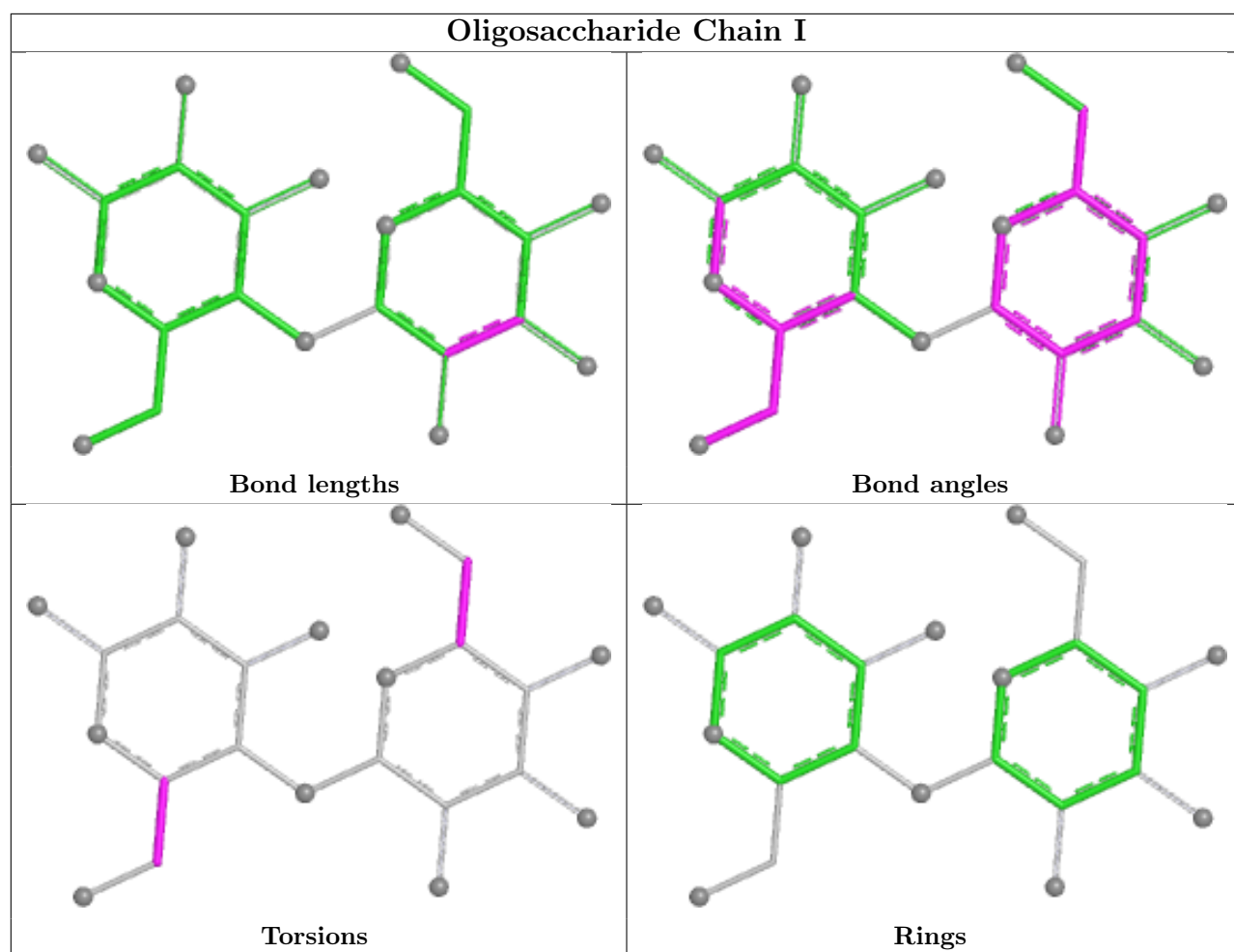
Mol	Chain	Res	Type	Atoms
2	K	2	BMA	C1-C2-C3-C4-C5-O5

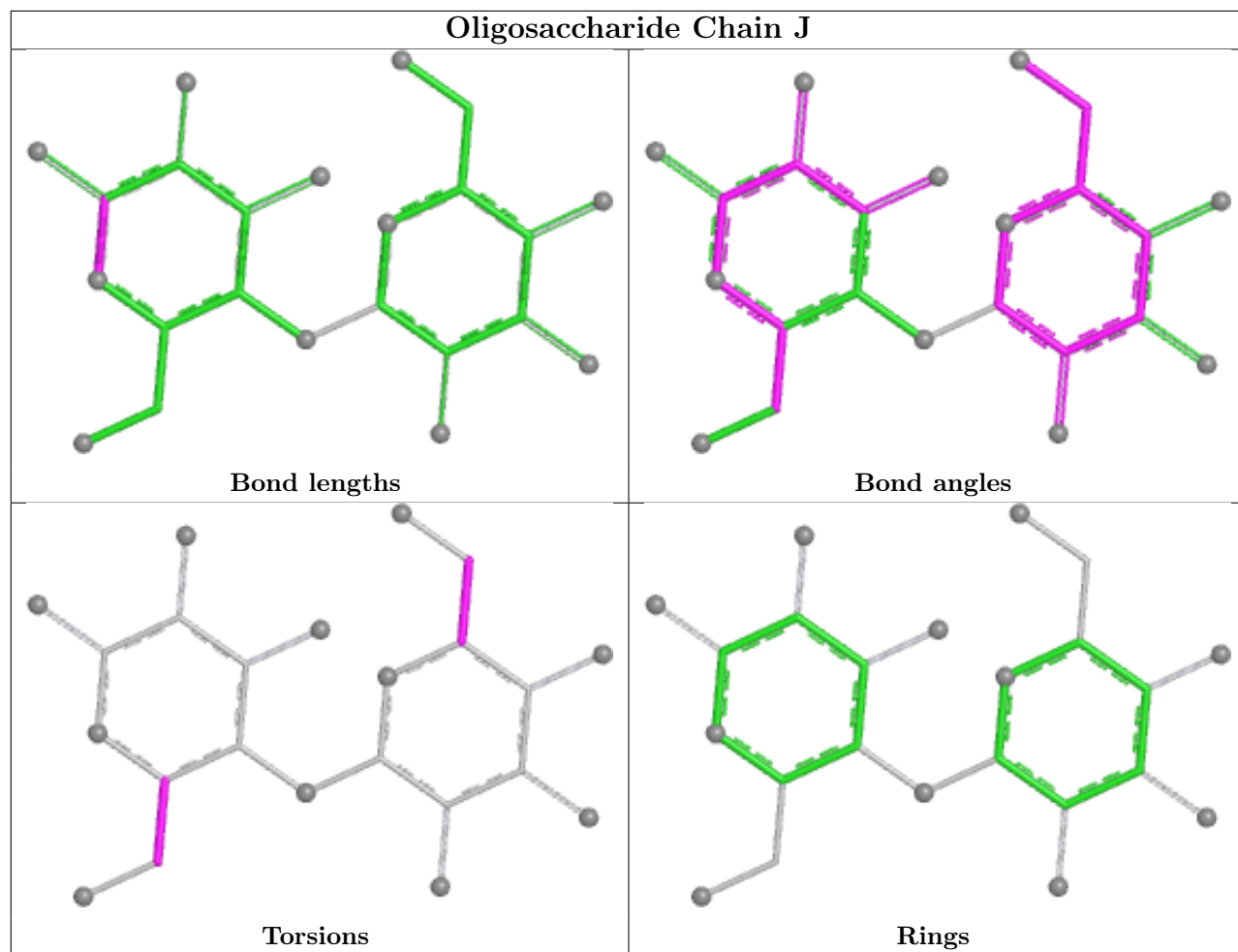
No monomer is involved in short contacts.

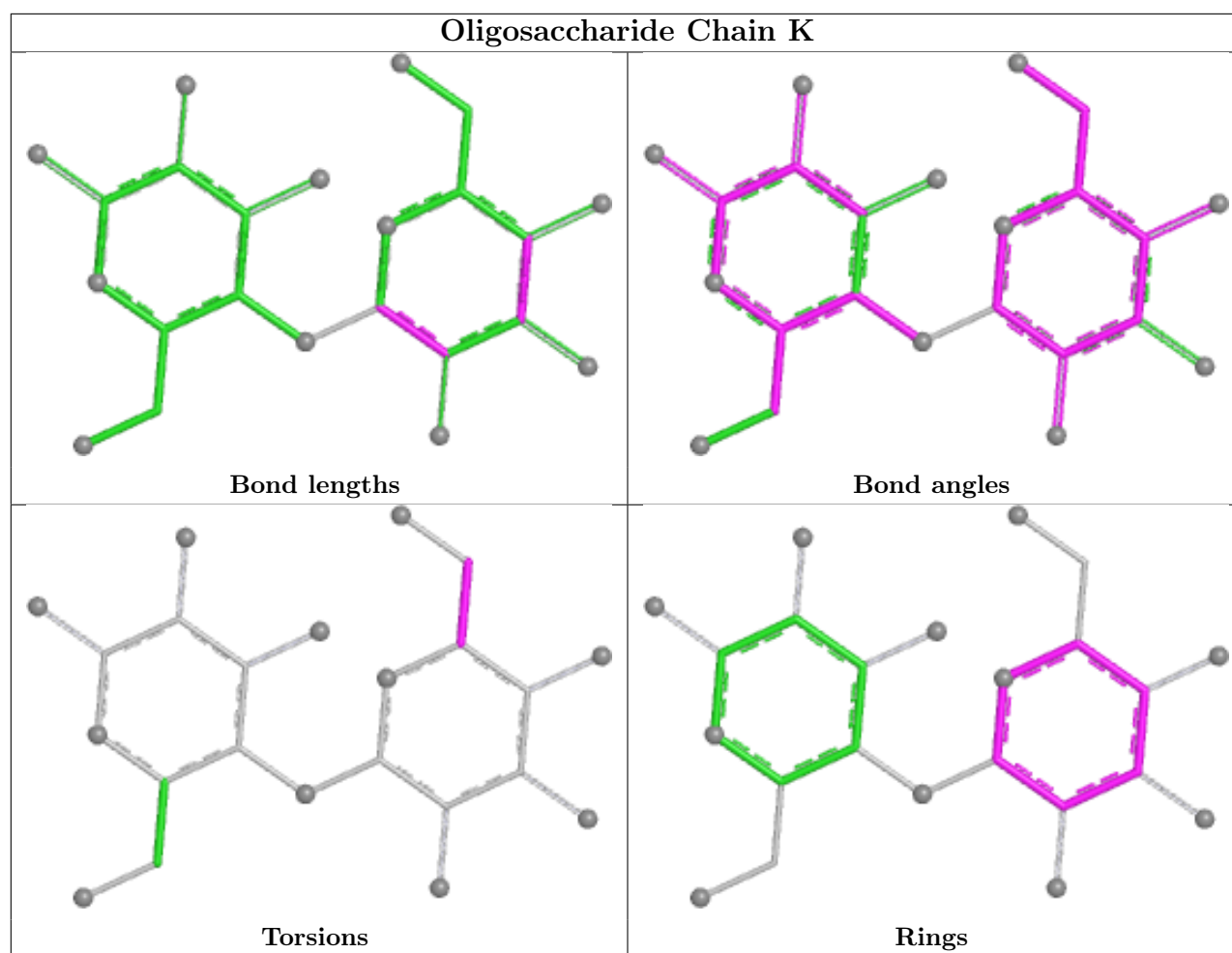
The following is a two-dimensional graphical depiction of Mogul quality analysis of bond lengths, bond angles, torsion angles, and ring geometry for oligosaccharide.

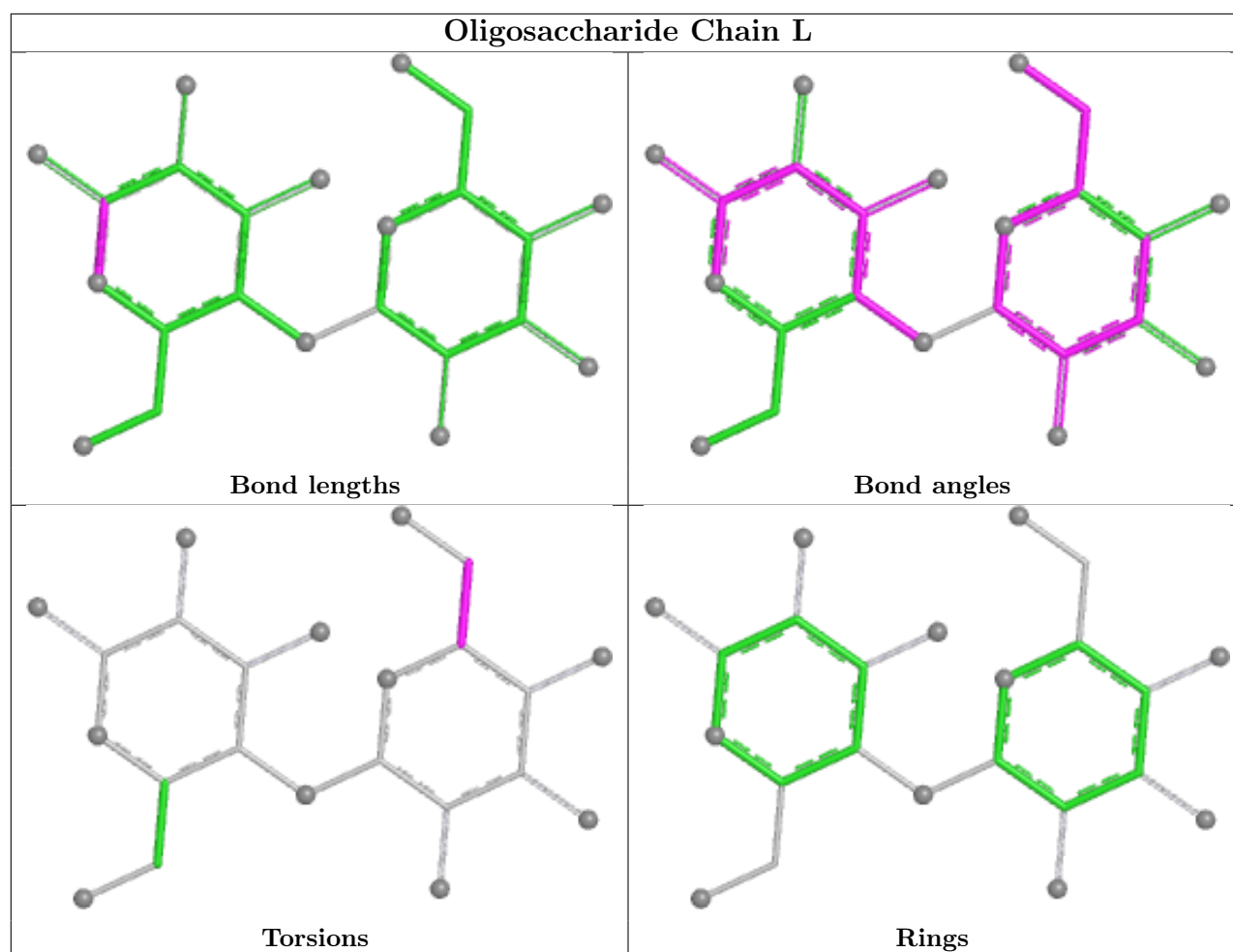












5.6 Ligand geometry [i](#)

6 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	$\# Z > 2$
3	PO4	E	401	-	4,4,4	1.07	0	6,6,6	0.66	0
3	PO4	A	401	-	4,4,4	0.79	0	6,6,6	0.46	0
3	PO4	C	401	-	4,4,4	4.16	4 (100%)	6,6,6	0.76	0
3	PO4	F	401	-	4,4,4	0.93	0	6,6,6	0.59	0
3	PO4	B	401	-	4,4,4	0.89	0	6,6,6	1.01	0
3	PO4	D	401	-	4,4,4	0.84	0	6,6,6	0.66	0

All (4) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	C	401	PO4	P-O3	-4.75	1.40	1.54
3	C	401	PO4	P-O1	-4.30	1.40	1.50
3	C	401	PO4	P-O4	-3.84	1.43	1.54
3	C	401	PO4	P-O2	-3.66	1.44	1.54

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

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	335/335 (100%)	-1.64	0 100 100	15, 24, 38, 52	0
1	B	335/335 (100%)	-1.67	0 100 100	13, 21, 37, 58	0
1	C	335/335 (100%)	-1.68	0 100 100	13, 22, 36, 54	0
1	D	335/335 (100%)	-1.62	0 100 100	14, 24, 41, 56	0
1	E	335/335 (100%)	-1.63	0 100 100	15, 25, 42, 56	0
1	F	335/335 (100%)	-1.69	0 100 100	14, 21, 36, 58	0
All	All	2010/2010 (100%)	-1.65	0 100 100	13, 23, 40, 58	0

There are no RSRZ outliers to report.

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

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

6.3 Carbohydrates ⓘ

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.

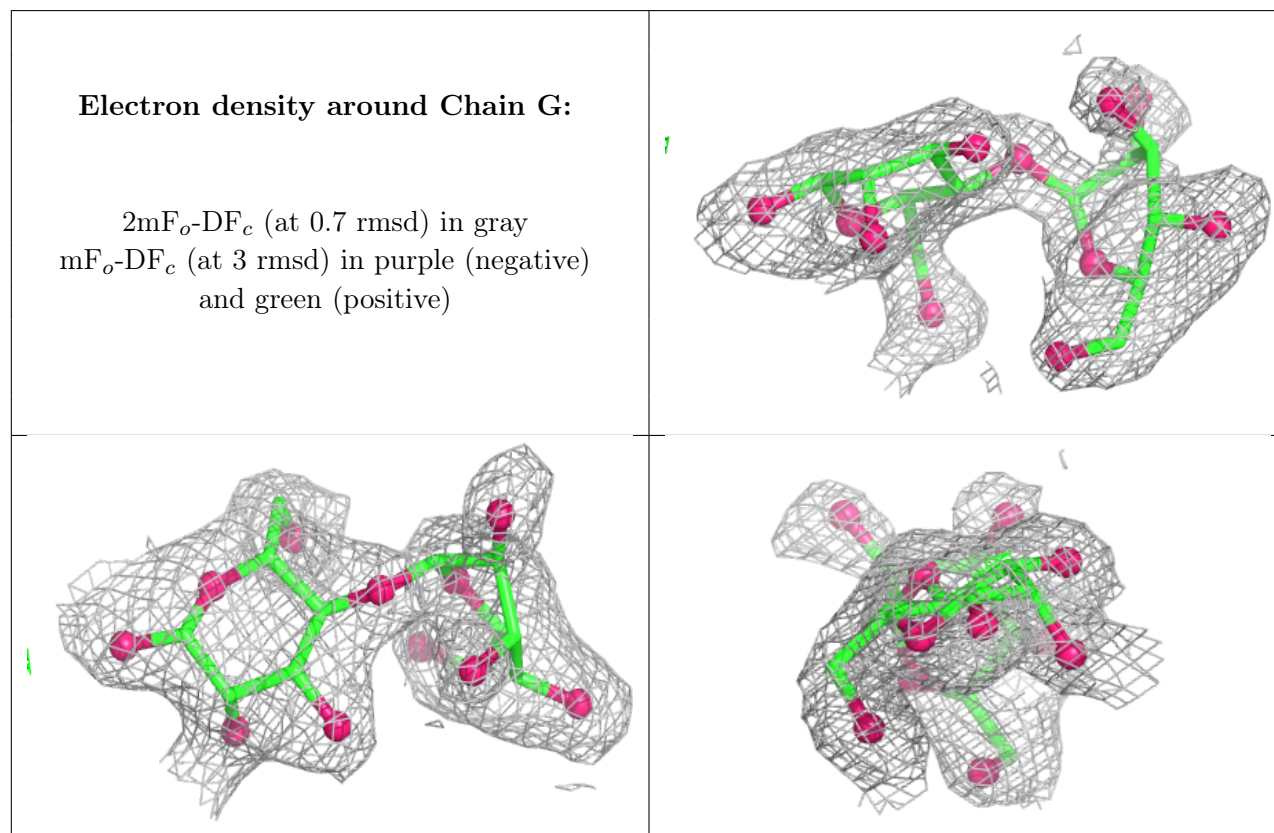
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
2	BMA	G	1	12/12	0.99	0.03	30,34,37,39	0
2	BMA	G	2	11/12	0.99	0.04	29,34,37,39	0
2	BMA	H	1	12/12	0.99	0.02	25,29,34,41	0
2	BMA	H	2	11/12	0.99	0.03	27,32,37,38	0
2	BMA	I	1	12/12	0.99	0.03	29,35,38,38	0
2	BMA	I	2	11/12	0.99	0.04	25,30,37,39	0

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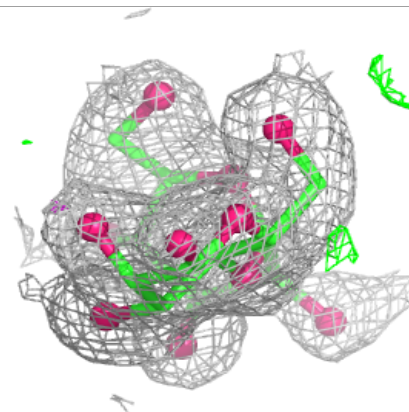
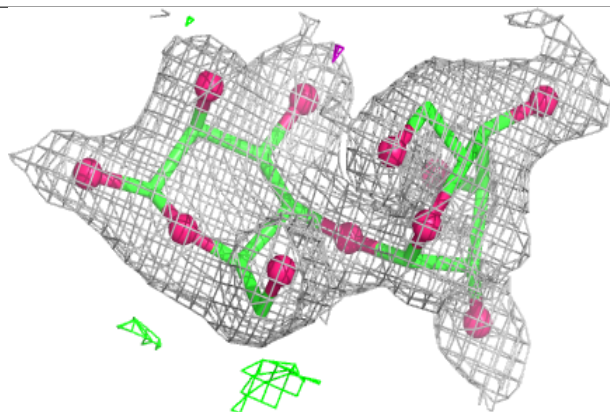
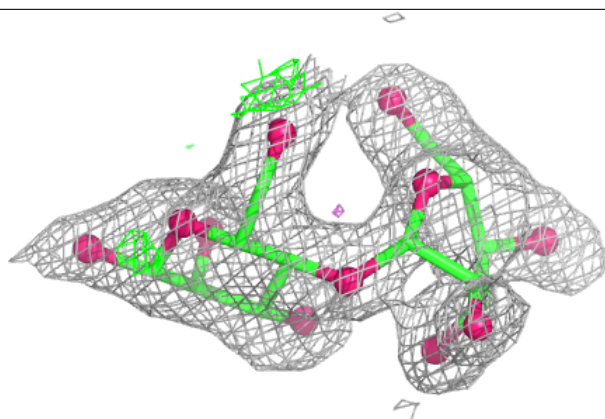
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
2	BMA	J	1	12/12	0.99	0.03	30,33,40,40	0
2	BMA	J	2	11/12	0.99	0.04	33,34,41,43	0
2	BMA	K	1	12/12	0.99	0.03	30,36,42,43	0
2	BMA	K	2	11/12	0.99	0.04	27,34,40,40	0
2	BMA	L	1	12/12	0.99	0.03	24,31,33,42	0
2	BMA	L	2	11/12	0.99	0.04	28,30,37,38	0

The following is a graphical depiction of the model fit to experimental electron density for oligosaccharide. Each fit is shown from different orientation to approximate a three-dimensional view.

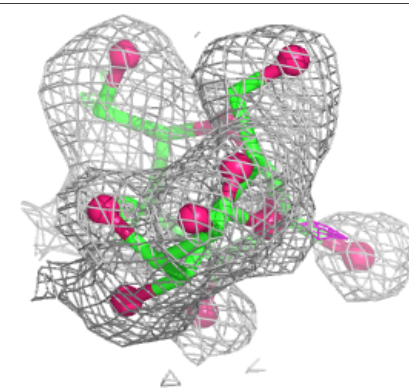
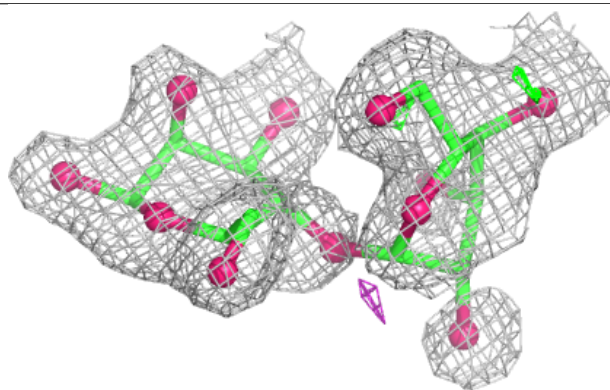
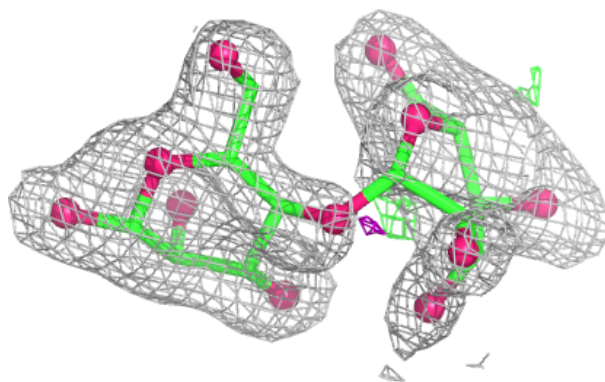


Electron density around Chain H:

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

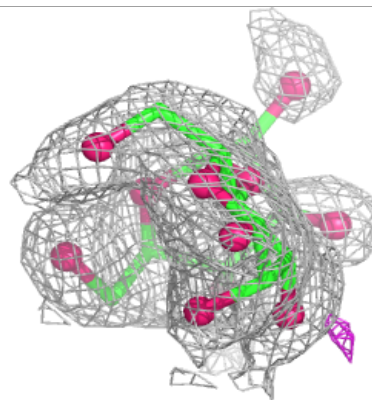
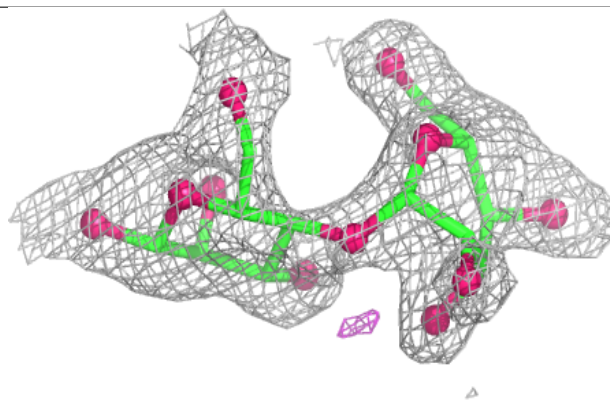
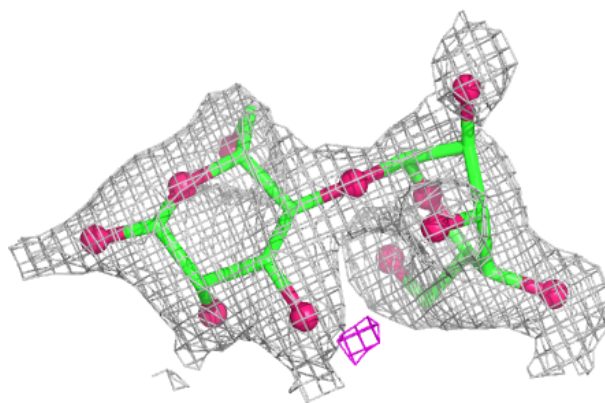
**Electron density around Chain I:**

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

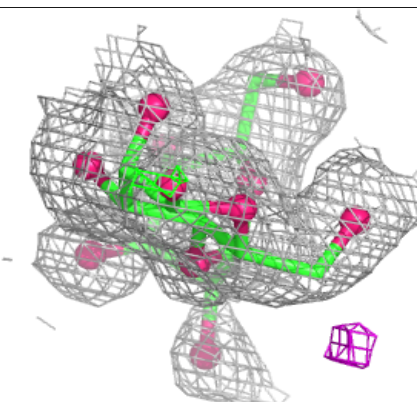
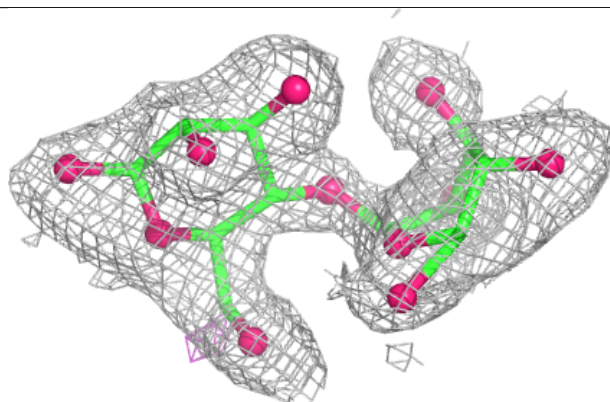
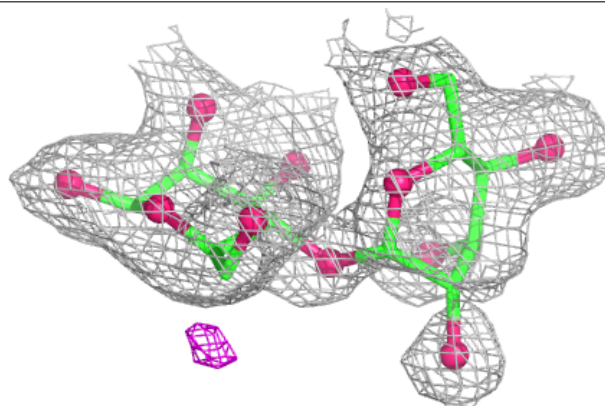


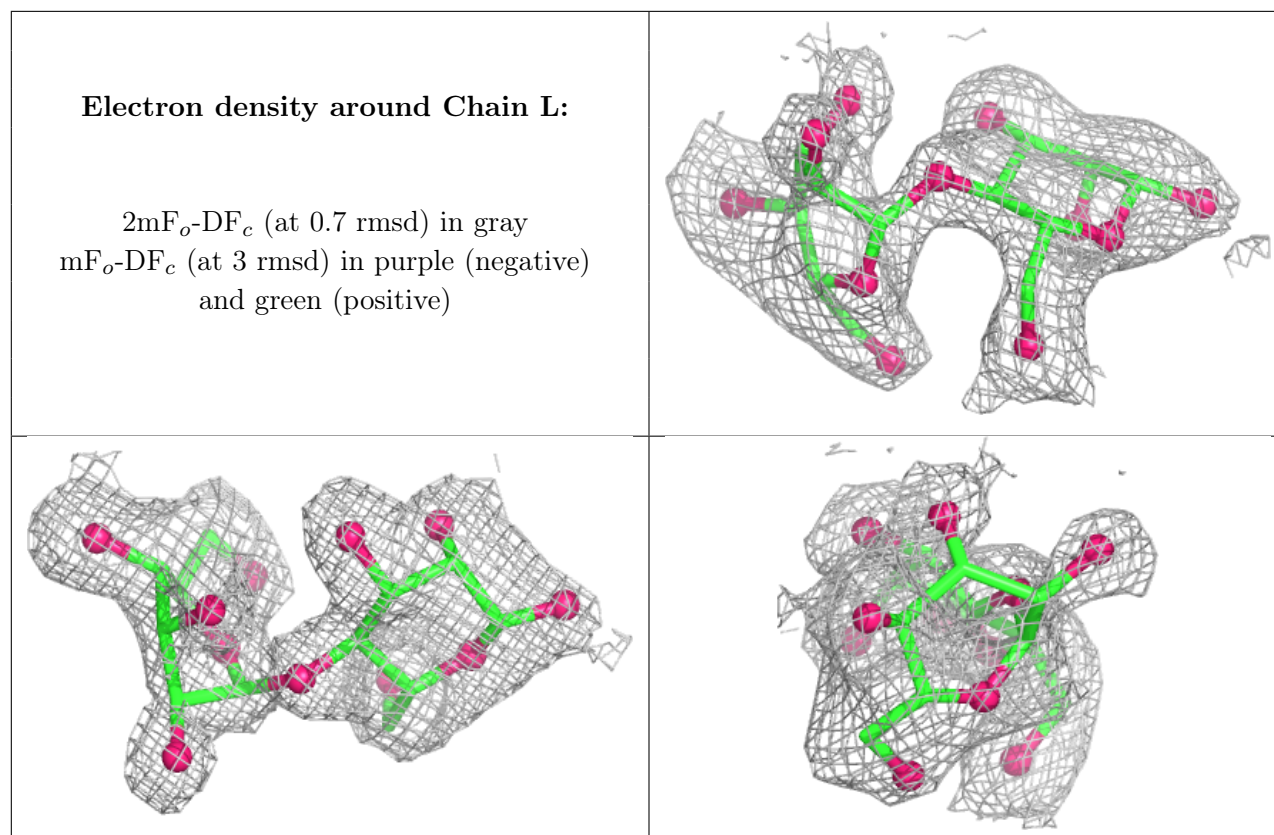
Electron density around Chain J:

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

**Electron density around Chain K:**

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





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	PO4	A	401	5/5	1.00	0.02	14,18,19,22	0
3	PO4	B	401	5/5	1.00	0.02	15,17,18,19	0
3	PO4	C	401	5/5	1.00	0.02	14,14,21,21	0
3	PO4	D	401	5/5	1.00	0.02	17,18,20,21	0
3	PO4	E	401	5/5	1.00	0.01	18,19,22,23	0
3	PO4	F	401	5/5	1.00	0.02	16,18,20,21	0

6.5 Other polymers [i](#)

There are no such residues in this entry.