



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 14, 2026 – 08:57 PM UTC

PDB ID : 3QHO / pdb_00003qho
Title : Crystal analysis of the complex structure, Y299F-cellotetraose, of endocellulase from pyrococcus horikoshii
Authors : Kim, H.-W.; Ishikawa, K.
Deposited on : 2011-01-26
Resolution : 1.65 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

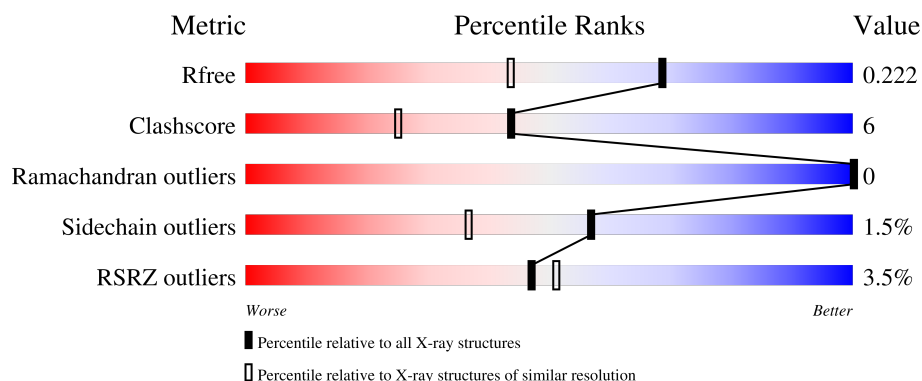
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 1.65 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	2563 (1.66-1.66)
Clashscore	190562	2662 (1.66-1.66)
Ramachandran outliers	187476	2621 (1.66-1.66)
Sidechain outliers	187428	2621 (1.66-1.66)
RSRZ outliers	180081	2564 (1.66-1.66)

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	458	 3% 69% 12% 18%
1	B	458	 2% 71% 11% 18%
1	C	458	 3% 69% 13% 18%
2	D	4	 100%
2	E	4	 75% 25%

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Mol	Chain	Length	Quality of chain
2	F	4	 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	462	-	-	X	-

2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 9884 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 458aa long hypothetical endo-1,4-beta-glucanase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	377	Total	C	N	O	S	0	0	0
			3070	2002	502	556	10			
1	B	377	Total	C	N	O	S	0	2	0
			3089	2013	506	560	10			
1	C	377	Total	C	N	O	S	0	2	0
			3085	2010	504	560	11			

There are 3 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	299	PHE	TYR	engineered mutation	UNP O58925
B	299	PHE	TYR	engineered mutation	UNP O58925
C	299	PHE	TYR	engineered mutation	UNP O58925

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



Mol	Chain	Residues	Atoms			ZeroOcc	AltConf	Trace
2	D	4	Total	C	O	0	0	0
			45	24	21			
2	E	4	Total	C	O	0	0	0
			45	24	21			
2	F	4	Total	C	O	0	0	0
			45	24	21			

- Molecule 3 is PHOSPHATE ION (CCD ID: PO4) (formula: O₄P).



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

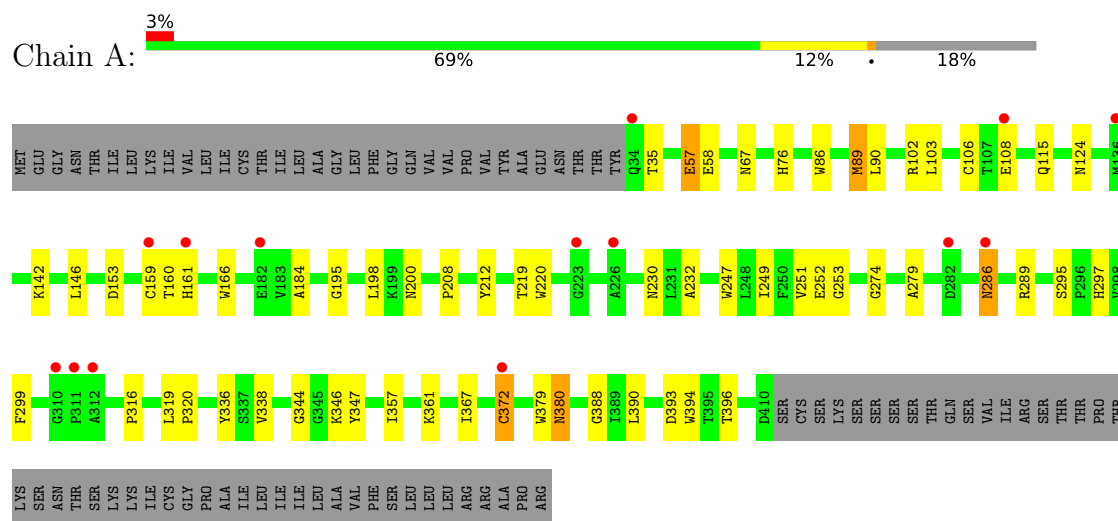
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	190	Total	O	0	0
			190	190		
4	B	160	Total	O	0	0
			160	160		
4	C	130	Total	O	0	0
			130	130		

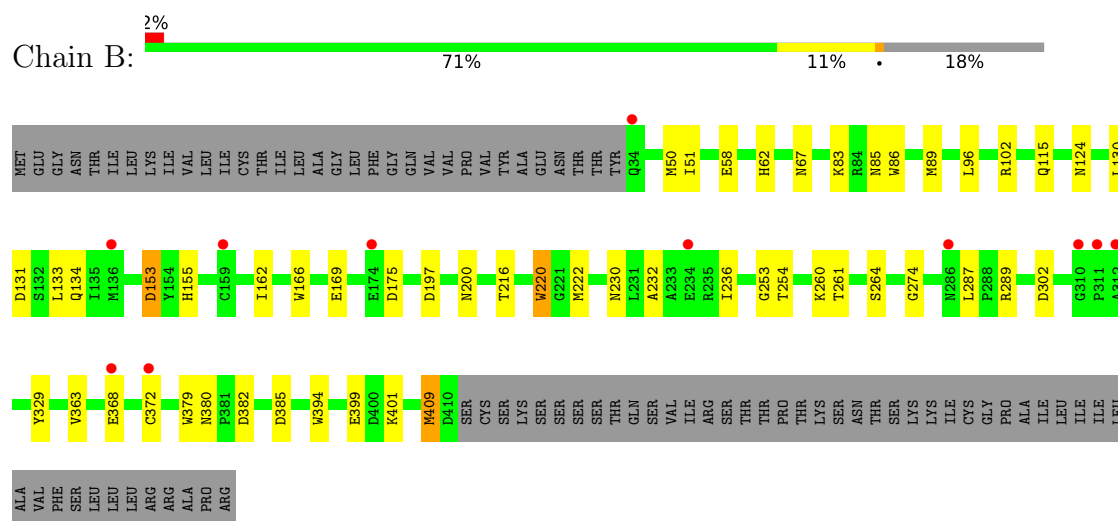
3 Residue-property plots

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: 458aa long hypothetical endo-1,4-beta-glucanase

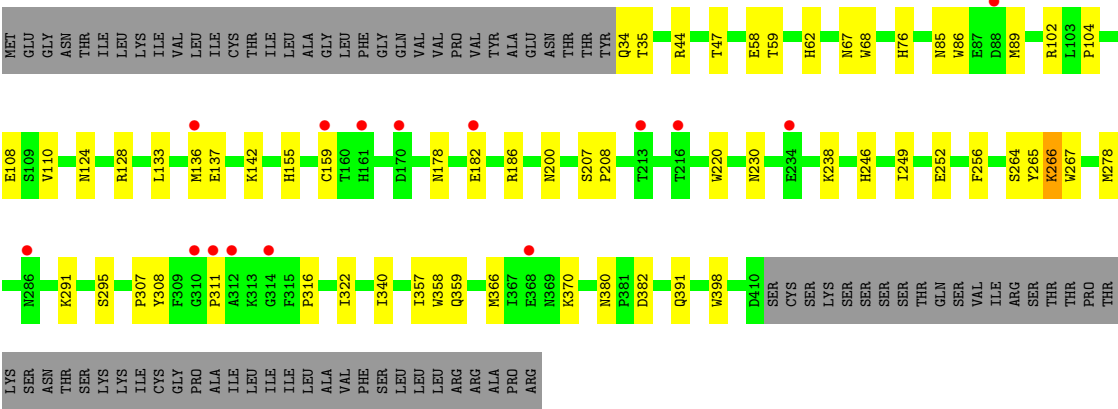


- Molecule 1: 458aa long hypothetical endo-1,4-beta-glucanase



- Molecule 1: 458aa long hypothetical endo-1,4-beta-glucanase

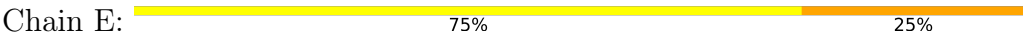




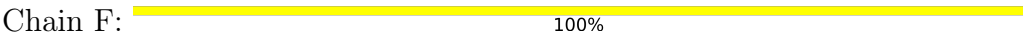
● Molecule 2: beta-D-glucopyranose-(1-4)-beta-D-glucopyranose-(1-4)-beta-D-glucopyranose-(1-4)-beta-D-glucopyranose



● Molecule 2: beta-D-glucopyranose-(1-4)-beta-D-glucopyranose-(1-4)-beta-D-glucopyranose-(1-4)-beta-D-glucopyranose



● Molecule 2: beta-D-glucopyranose-(1-4)-beta-D-glucopyranose-(1-4)-beta-D-glucopyranose-(1-4)-beta-D-glucopyranose



4 Data and refinement statistics

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, α , β , γ	161.16Å 58.53Å 138.32Å 90.00° 109.24° 90.00°	Depositor
Resolution (Å)	33.67 – 1.65 33.67 – 1.65	Depositor EDS
% Data completeness (in resolution range)	94.8 (33.67-1.65) 94.7 (33.67-1.65)	Depositor EDS
R_{merge}	0.06	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.57 (at 1.63Å)	Xtriage
Refinement program	REFMAC 5.5.0072	Depositor
R, R_{free}	0.187 , 0.227 0.184 , 0.222	Depositor DCC
R_{free} test set	7002 reflections (5.01%)	wwPDB-VP
Wilson B-factor (Å ²)	18.8	Xtriage
Anisotropy	0.537	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.40 , 40.3	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	9884	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 4.45% 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 [i](#)

5.1 Standard geometry [i](#)

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

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	1.51	9/3181 (0.3%)	1.33	15/4342 (0.3%)
1	B	1.44	9/3201 (0.3%)	1.28	15/4369 (0.3%)
1	C	1.19	3/3196 (0.1%)	1.09	1/4362 (0.0%)
All	All	1.39	21/9578 (0.2%)	1.24	31/13073 (0.2%)

All (21) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	319	LEU	N-CA	6.90	1.55	1.46
1	A	344	GLY	N-CA	6.63	1.51	1.45
1	B	409	MET	N-CA	-6.59	1.37	1.46
1	A	208	PRO	CA-C	6.54	1.56	1.52
1	B	175	ASP	CA-C	6.51	1.61	1.52
1	A	379	TRP	C-O	6.40	1.31	1.24
1	C	142	LYS	C-O	6.40	1.31	1.24
1	B	254	THR	N-CA	6.26	1.54	1.45
1	A	89	MET	N-CA	6.13	1.53	1.46
1	B	220	TRP	N-CA	6.10	1.53	1.46
1	A	219	THR	CA-CB	6.07	1.63	1.53
1	A	390	LEU	N-CA	5.96	1.53	1.46
1	A	338	VAL	C-O	5.67	1.30	1.24
1	B	289	ARG	CB-CG	-5.62	1.35	1.52
1	B	379	TRP	CA-C	5.60	1.59	1.52
1	B	222	MET	N-CA	5.53	1.53	1.46
1	B	329	TYR	N-CA	5.41	1.53	1.46
1	C	249	ILE	CA-CB	5.38	1.60	1.53
1	C	104	PRO	CA-C	-5.38	1.45	1.52
1	A	336	TYR	N-CA	5.26	1.52	1.45
1	B	287	LEU	N-CA	5.25	1.50	1.45

All (31) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	115	GLN	CA-C-N	-8.03	112.44	120.31
1	B	115	GLN	C-N-CA	-8.03	112.44	120.31
1	B	409	MET	N-CA-C	-6.95	103.80	112.90
1	B	216	THR	CA-C-N	-6.41	113.83	122.03
1	B	216	THR	C-N-CA	-6.41	113.83	122.03
1	B	363	VAL	N-CA-C	-6.34	104.32	110.72
1	B	401	LYS	N-CA-C	-6.14	104.67	111.36
1	A	286	ASN	N-CA-C	6.00	118.62	109.62
1	C	59	THR	CB-CA-C	-5.90	102.31	110.16
1	B	236	ILE	CA-C-N	5.89	126.52	119.98
1	B	236	ILE	C-N-CA	5.89	126.52	119.98
1	B	287	LEU	O-C-N	5.76	125.39	121.71
1	A	89	MET	CG-SD-CE	-5.72	88.33	100.90
1	A	195	GLY	N-CA-C	5.66	117.63	110.38
1	A	347	TYR	N-CA-C	-5.58	104.20	111.74
1	B	368	GLU	CB-CG-CD	-5.55	103.17	112.60
1	A	103	LEU	CA-C-N	5.51	125.43	119.76
1	A	103	LEU	C-N-CA	5.51	125.43	119.76
1	A	142	LYS	N-CA-C	5.50	117.28	111.28
1	A	146	LEU	N-CA-C	5.42	119.75	113.20
1	B	409	MET	CB-CA-C	5.42	120.56	109.67
1	B	254	THR	N-CA-C	-5.38	101.62	109.63
1	B	133	LEU	N-CA-C	5.36	116.93	111.14
1	A	279	ALA	N-CA-C	5.28	119.56	113.18
1	A	212	TYR	N-CA-C	5.19	117.84	111.82
1	A	380	ASN	CB-CA-C	-5.18	101.33	109.52
1	B	289	ARG	CG-CD-NE	-5.18	100.60	112.00
1	A	299	PHE	CA-C-N	5.17	129.99	121.87
1	A	299	PHE	C-N-CA	5.17	129.99	121.87
1	A	90	LEU	N-CA-C	5.15	117.29	111.11
1	A	251	VAL	N-CA-C	5.07	115.16	107.75

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	3070	0	2910	35	0
1	B	3089	0	2919	33	0
1	C	3085	0	2919	44	0
2	D	45	0	39	0	0
2	E	45	0	39	1	0
2	F	45	0	39	0	0
3	A	5	0	0	0	0
3	C	20	0	0	3	0
4	A	190	0	0	7	1
4	B	160	0	0	0	0
4	C	130	0	0	5	1
All	All	9884	0	8865	111	1

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 6.

All (111) close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:266:LYS:H	1:C:266:LYS:HD2	0.91	1.04
1:C:266:LYS:HD2	1:C:266:LYS:N	1.74	0.97
1:B:62[A]:HIS:ND1	1:B:372:CYS:SG	2.41	0.94
1:C:266:LYS:H	1:C:266:LYS:CD	1.77	0.93
1:A:367:ILE:HD13	4:A:650:HOH:O	1.67	0.92
1:C:238:LYS:HE2	4:C:580:HOH:O	1.70	0.90
1:A:67:ASN:HD21	1:A:102:ARG:HH11	1.23	0.86
1:C:67:ASN:HD21	1:C:102:ARG:HH11	1.21	0.84
1:A:361:LYS:HD2	4:A:632:HOH:O	1.81	0.80
1:C:34:GLN:HB2	4:C:559:HOH:O	1.89	0.72
1:A:289:ARG:HH11	1:A:289:ARG:HG3	1.55	0.72
1:C:67:ASN:ND2	1:C:102:ARG:HH11	1.89	0.70
1:B:67:ASN:HD21	1:B:102:ARG:HH11	1.37	0.70
1:A:86:TRP:HD1	1:A:124:ASN:HD22	1.42	0.68
1:A:67:ASN:ND2	1:A:102:ARG:HH11	1.91	0.68
1:A:106:CYS:HG	1:A:159:CYS:HG	0.69	0.68
1:C:62:HIS:HE1	3:C:462:PO4:O4	1.77	0.67
1:B:62[A]:HIS:CE1	1:B:372:CYS:SG	2.89	0.66
1:C:102:ARG:HH22	1:C:200:ASN:HD22	1.42	0.65
1:B:86:TRP:H	1:B:124:ASN:ND2	1.97	0.61
1:C:76:HIS:HE1	1:C:159:CYS:SG	2.23	0.61
1:A:86:TRP:H	1:A:124:ASN:HD21	1.46	0.61
1:B:86:TRP:H	1:B:124:ASN:HD21	1.49	0.60

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:C:110:VAL:HA	1:C:133:LEU:HD13	1.84	0.58
1:A:102:ARG:HH22	1:A:200:ASN:HD22	1.51	0.58
1:C:340:ILE:HD12	1:C:366:MET:HE3	1.86	0.58
1:A:160:THR:CG2	1:B:169[B]:GLU:HG3	2.35	0.57
1:A:316:PRO:HG3	1:A:357:ILE:CG2	2.35	0.57
1:B:67:ASN:ND2	1:B:102:ARG:HH11	2.02	0.56
1:A:160:THR:HG23	1:B:169[B]:GLU:HG3	1.87	0.55
1:B:102:ARG:HH22	1:B:200:ASN:HD22	1.52	0.55
1:A:76:HIS:HE1	1:A:159:CYS:SG	2.29	0.55
1:A:393:ASP:OD1	1:A:396:THR:HG23	2.06	0.55
1:B:131:ASP:H	1:B:134:GLN:HE21	1.54	0.55
1:A:108:GLU:HG3	4:A:571:HOH:O	2.07	0.55
1:A:372:CYS:SG	4:A:636:HOH:O	2.57	0.54
1:A:253:GLY:O	1:A:274:GLY:HA2	2.07	0.54
3:C:460:PO4:O2	3:C:461:PO4:O4	2.26	0.53
1:B:67:ASN:HD21	1:B:102:ARG:HD3	1.73	0.52
1:B:62[A]:HIS:CG	1:B:372:CYS:HG	2.27	0.52
1:C:128:ARG:HD2	4:C:644:HOH:O	2.08	0.51
1:A:220:TRP:CE2	1:A:230:ASN:HB3	2.46	0.51
1:B:51:ILE:HG12	1:B:58:GLU:HG2	1.93	0.51
1:C:291:LYS:HA	1:C:291:LYS:HE2	1.93	0.50
1:C:137:GLU:OE2	1:C:186:ARG:HD3	2.11	0.50
1:B:153:ASP:HA	1:B:197:ASP:HB3	1.92	0.50
1:C:178:ASN:O	1:C:182:GLU:HG3	2.11	0.50
1:A:86:TRP:H	1:A:124:ASN:ND2	2.09	0.50
1:C:108:GLU:HG3	4:C:561:HOH:O	2.11	0.50
1:A:198:LEU:HD21	1:A:249:ILE:HG23	1.94	0.49
1:A:160:THR:OG1	1:A:161:HIS:HD2	1.95	0.49
1:B:86:TRP:HD1	1:B:124:ASN:HD22	1.59	0.49
1:C:44:ARG:NH2	1:C:58[A]:GLU:OE2	2.47	0.48
1:C:85:ASN:HA	1:C:124:ASN:HD21	1.78	0.48
1:B:166:TRP:CZ2	1:B:232:ALA:HB2	2.49	0.48
1:A:289:ARG:HG3	1:A:289:ARG:NH1	2.27	0.48
1:B:96:LEU:O	1:B:409:MET:HE1	2.12	0.48
1:A:346:LYS:NZ	4:A:637:HOH:O	2.32	0.48
1:B:86:TRP:N	1:B:124:ASN:HD21	2.11	0.48
1:B:260:LYS:HB2	1:B:260:LYS:HE2	1.48	0.48
1:C:311:PRO:HD3	4:C:476:HOH:O	2.14	0.48
1:C:62:HIS:CE1	3:C:462:PO4:O4	2.63	0.47
1:C:86:TRP:H	1:C:124:ASN:HD21	1.61	0.47
1:C:265:TYR:HB3	1:C:278:MET:HE1	1.96	0.47

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:102:ARG:HH22	1:B:200:ASN:ND2	2.12	0.47
1:B:131:ASP:H	1:B:134:GLN:NE2	2.13	0.47
1:C:358:TRP:CE3	1:C:359:GLN:HG2	2.50	0.47
1:C:67:ASN:HD21	1:C:102:ARG:HD3	1.79	0.47
1:B:302:ASP:HB3	1:B:385:ASP:O	2.15	0.46
1:A:89:MET:HE1	1:A:394:TRP:CE3	2.51	0.46
1:A:102:ARG:HH22	1:A:200:ASN:ND2	2.13	0.46
1:A:76:HIS:CE1	1:A:159:CYS:SG	3.08	0.46
1:C:68:TRP:CZ2	1:C:89:MET:HE3	2.51	0.46
1:A:86:TRP:CD1	1:A:124:ASN:HD22	2.30	0.45
1:A:372:CYS:HA	4:A:594:HOH:O	2.15	0.45
1:C:110:VAL:HG12	1:C:136:MET:HE1	1.99	0.45
1:A:108:GLU:CG	4:A:571:HOH:O	2.63	0.45
1:C:267:TRP:CZ3	1:C:307:PRO:HB2	2.51	0.45
1:B:62[A]:HIS:CG	1:B:372:CYS:SG	3.09	0.45
1:C:86:TRP:HD1	1:C:124:ASN:HD22	1.64	0.44
1:A:57:GLU:HG3	1:A:58:GLU:N	2.31	0.44
1:A:166:TRP:CZ2	1:A:232:ALA:HB2	2.53	0.44
1:C:316:PRO:HG3	1:C:357:ILE:HG21	2.00	0.43
1:C:102:ARG:HH22	1:C:200:ASN:ND2	2.11	0.43
1:C:220:TRP:CE2	1:C:230:ASN:HB3	2.54	0.42
1:B:261:THR:O	1:B:264:SER:OG	2.35	0.42
1:B:130:LEU:HA	1:B:134:GLN:NE2	2.35	0.42
1:C:86:TRP:H	1:C:124:ASN:ND2	2.16	0.42
1:C:391:GLN:HG2	1:C:398:TRP:CE2	2.55	0.42
1:A:184:ALA:HA	1:A:247:TRP:CH2	2.55	0.42
1:C:35:THR:HB	1:C:246:HIS:HB3	2.02	0.42
1:B:253:GLY:O	1:B:274:GLY:HA2	2.20	0.41
1:C:252:GLU:HG2	1:C:295:SER:O	2.20	0.41
1:C:155:HIS:HA	1:C:200:ASN:HB3	2.02	0.41
1:B:50:MET:HE2	1:B:50:MET:HB3	1.86	0.41
1:B:162:ILE:HD11	2:E:3:BGC:H2	2.01	0.41
1:C:34:GLN:HE21	1:C:34:GLN:HA	1.86	0.41
1:C:380:ASN:HB3	1:C:382:ASP:OD1	2.20	0.41
1:B:89:MET:HE1	1:B:394:TRP:CE3	2.56	0.41
1:C:155:HIS:HA	1:C:200:ASN:CB	2.51	0.41
1:C:208:PRO:HD3	1:C:256:PHE:CZ	2.55	0.41
1:B:155:HIS:HA	1:B:200:ASN:CB	2.51	0.41
1:B:220:TRP:CE2	1:B:230:ASN:HB3	2.55	0.41
1:A:200:ASN:ND2	1:A:297:HIS:HE1	2.19	0.41
1:C:34:GLN:HA	1:C:34:GLN:NE2	2.35	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:85:ASN:HA	1:B:124:ASN:HD21	1.86	0.41
1:A:380:ASN:O	1:A:388:GLY:HA3	2.21	0.40
1:B:380:ASN:HB3	1:B:382:ASP:OD1	2.21	0.40
1:C:308:TYR:CG	1:C:322:ILE:HD13	2.56	0.40
1:C:265:TYR:CB	1:C:278:MET:HE1	2.50	0.40
1:A:252:GLU:HG2	1:A:295:SER:O	2.21	0.40

All (1) 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)
4:A:609:HOH:O	4:C:481:HOH:O[4_545]	1.59	0.61

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	375/458 (82%)	366 (98%)	9 (2%)	0	100	100
1	B	377/458 (82%)	368 (98%)	9 (2%)	0	100	100
1	C	377/458 (82%)	363 (96%)	14 (4%)	0	100	100
All	All	1129/1374 (82%)	1097 (97%)	32 (3%)	0	100	100

There are no Ramachandran outliers to report.

5.3.2 Protein sidechains [i](#)

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all 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	324/396 (82%)	317 (98%)	7 (2%)	45	23
1	B	326/396 (82%)	323 (99%)	3 (1%)	70	56
1	C	326/396 (82%)	321 (98%)	5 (2%)	57	37
All	All	976/1188 (82%)	961 (98%)	15 (2%)	57	37

All (15) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	35	THR
1	A	57	GLU
1	A	115	GLN
1	A	153	ASP
1	A	286	ASN
1	A	320	PRO
1	A	372	CYS
1	B	83	LYS
1	B	153	ASP
1	B	399	GLU
1	C	47	THR
1	C	207	SER
1	C	264	SER
1	C	266	LYS
1	C	370	LYS

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (26) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	67	ASN
1	A	76	HIS
1	A	115	GLN
1	A	124	ASN
1	A	161	HIS
1	A	178	ASN
1	A	200	ASN
1	A	359	GLN
1	A	360	ASN
1	B	34	GLN
1	B	67	ASN
1	B	115	GLN

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Mol	Chain	Res	Type
1	B	124	ASN
1	B	134	GLN
1	B	200	ASN
1	B	359	GLN
1	C	34	GLN
1	C	62	HIS
1	C	67	ASN
1	C	75	ASN
1	C	76	HIS
1	C	124	ASN
1	C	161	HIS
1	C	200	ASN
1	C	359	GLN
1	C	360	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 ⓘ

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	BGC	D	1	2	12,12,12	1.65	3 (25%)	17,17,17	1.89	4 (23%)
2	BGC	D	2	2	11,11,12	1.50	3 (27%)	15,15,17	2.13	6 (40%)
2	BGC	D	3	2	11,11,12	1.59	1 (9%)	15,15,17	3.15	6 (40%)
2	BGC	D	4	2	11,11,12	1.27	1 (9%)	15,15,17	1.12	1 (6%)

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
2	BGC	E	1	2	12,12,12	1.10	1 (8%)	17,17,17	1.50	4 (23%)
2	BGC	E	2	2	11,11,12	1.23	1 (9%)	15,15,17	2.01	3 (20%)
2	BGC	E	3	2	11,11,12	1.55	3 (27%)	15,15,17	2.76	6 (40%)
2	BGC	E	4	2	11,11,12	1.28	1 (9%)	15,15,17	1.57	4 (26%)
2	BGC	F	1	2	12,12,12	1.18	1 (8%)	17,17,17	1.48	3 (17%)
2	BGC	F	2	2	11,11,12	1.15	2 (18%)	15,15,17	1.99	6 (40%)
2	BGC	F	3	2	11,11,12	0.85	1 (9%)	15,15,17	2.65	8 (53%)
2	BGC	F	4	2	11,11,12	1.45	1 (9%)	15,15,17	1.07	1 (6%)

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	BGC	D	1	2	-	2/2/22/22	0/1/1/1
2	BGC	D	2	2	-	0/2/19/22	0/1/1/1
2	BGC	D	3	2	-	0/2/19/22	0/1/1/1
2	BGC	D	4	2	-	0/2/19/22	0/1/1/1
2	BGC	E	1	2	-	2/2/22/22	0/1/1/1
2	BGC	E	2	2	-	1/2/19/22	0/1/1/1
2	BGC	E	3	2	-	1/2/19/22	0/1/1/1
2	BGC	E	4	2	-	0/2/19/22	0/1/1/1
2	BGC	F	1	2	-	2/2/22/22	0/1/1/1
2	BGC	F	2	2	-	0/2/19/22	0/1/1/1
2	BGC	F	3	2	-	0/2/19/22	0/1/1/1
2	BGC	F	4	2	-	1/2/19/22	0/1/1/1

All (19) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	3	BGC	O3-C3	4.58	1.54	1.43
2	D	4	BGC	O5-C5	3.21	1.49	1.43
2	E	3	BGC	C4-C5	-2.90	1.46	1.53
2	D	2	BGC	O3-C3	2.88	1.50	1.43
2	E	3	BGC	O4-C4	-2.72	1.36	1.43
2	D	1	BGC	C4-C3	2.72	1.59	1.52
2	F	1	BGC	O4-C4	2.67	1.49	1.43
2	D	1	BGC	C6-C5	2.57	1.60	1.51
2	F	4	BGC	O5-C5	2.57	1.48	1.43

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Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	D	1	BGC	C1-C2	2.43	1.57	1.52
2	E	1	BGC	O5-C1	-2.42	1.37	1.42
2	E	2	BGC	O4-C4	2.30	1.48	1.43
2	D	2	BGC	C4-C5	2.30	1.57	1.53
2	F	3	BGC	O3-C3	2.29	1.48	1.43
2	E	4	BGC	C1-C2	2.28	1.57	1.52
2	F	2	BGC	O4-C4	2.15	1.48	1.43
2	E	3	BGC	O3-C3	2.13	1.48	1.43
2	F	2	BGC	O5-C5	2.03	1.47	1.43
2	D	2	BGC	C1-C2	2.01	1.57	1.52

All (52) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	E	3	BGC	C1-O5-C5	8.30	123.31	112.19
2	D	3	BGC	C1-O5-C5	7.40	122.10	112.19
2	D	3	BGC	O5-C5-C6	-5.62	96.73	107.66
2	F	3	BGC	O5-C5-C6	-4.66	98.59	107.66
2	E	2	BGC	O5-C1-C2	-4.65	99.69	110.79
2	F	3	BGC	C3-C4-C5	-4.46	102.15	110.23
2	D	1	BGC	O5-C1-C2	-4.44	102.49	110.30
2	D	3	BGC	C3-C4-C5	-4.29	102.46	110.23
2	D	2	BGC	O4-C4-C3	-4.27	100.31	110.38
2	F	2	BGC	C3-C4-C5	-4.22	102.58	110.23
2	E	2	BGC	O4-C4-C5	4.08	119.37	109.32
2	F	2	BGC	O4-C4-C5	3.94	119.04	109.32
2	E	3	BGC	O4-C4-C5	-3.69	100.25	109.32
2	D	2	BGC	O2-C2-C3	-3.54	102.83	110.15
2	D	3	BGC	O4-C4-C5	-3.51	100.67	109.32
2	D	1	BGC	O4-C4-C5	-3.43	100.87	109.32
2	F	3	BGC	O5-C1-C2	3.27	118.58	110.79
2	E	4	BGC	C6-C5-C4	-3.25	105.03	113.02
2	F	3	BGC	O4-C4-C5	-3.25	101.31	109.32
2	F	1	BGC	O5-C5-C4	3.06	115.22	109.70
2	D	3	BGC	O3-C3-C4	2.98	117.41	110.38
2	F	3	BGC	C1-O5-C5	2.97	116.17	112.19
2	D	3	BGC	C1-C2-C3	2.91	113.89	109.64
2	D	1	BGC	O4-C4-C3	2.87	117.14	110.38
2	D	2	BGC	O5-C1-C2	-2.84	104.02	110.79
2	F	3	BGC	C1-C2-C3	2.80	113.72	109.64
2	D	2	BGC	O4-C4-C5	2.74	116.06	109.32
2	D	2	BGC	C6-C5-C4	-2.68	106.44	113.02

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Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	D	1	BGC	O5-C5-C4	-2.66	104.90	109.70
2	E	4	BGC	C2-C3-C4	-2.65	106.20	110.86
2	E	3	BGC	O3-C3-C4	2.64	116.59	110.38
2	E	3	BGC	O3-C3-C2	-2.61	104.72	110.05
2	E	1	BGC	C4-C3-C2	2.61	115.41	110.83
2	E	1	BGC	O6-C6-C5	-2.57	102.58	111.33
2	F	2	BGC	O4-C4-C3	-2.54	104.38	110.38
2	E	4	BGC	O3-C3-C2	2.54	115.23	110.05
2	E	3	BGC	C3-C4-C5	-2.51	105.68	110.23
2	F	3	BGC	O5-C5-C4	2.48	116.87	110.83
2	F	3	BGC	O2-C2-C1	2.42	114.75	109.22
2	F	2	BGC	O5-C5-C6	-2.38	103.04	107.66
2	F	2	BGC	O5-C1-C2	-2.36	105.17	110.79
2	E	1	BGC	O5-C1-C2	-2.34	106.19	110.30
2	F	4	BGC	O5-C5-C6	2.24	112.02	107.66
2	E	1	BGC	O1-C1-O5	-2.22	103.82	110.41
2	D	2	BGC	C3-C4-C5	-2.19	106.27	110.23
2	F	1	BGC	C4-C3-C2	2.13	114.58	110.83
2	E	2	BGC	C3-C4-C5	-2.12	106.38	110.23
2	F	1	BGC	O6-C6-C5	-2.10	104.17	111.33
2	D	4	BGC	C1-O5-C5	2.08	114.97	112.19
2	E	3	BGC	C1-C2-C3	2.06	112.65	109.64
2	F	2	BGC	O5-C5-C4	2.02	115.74	110.83
2	E	4	BGC	O5-C5-C6	2.00	111.56	107.66

There are no chirality outliers.

All (9) torsion outliers are listed below:

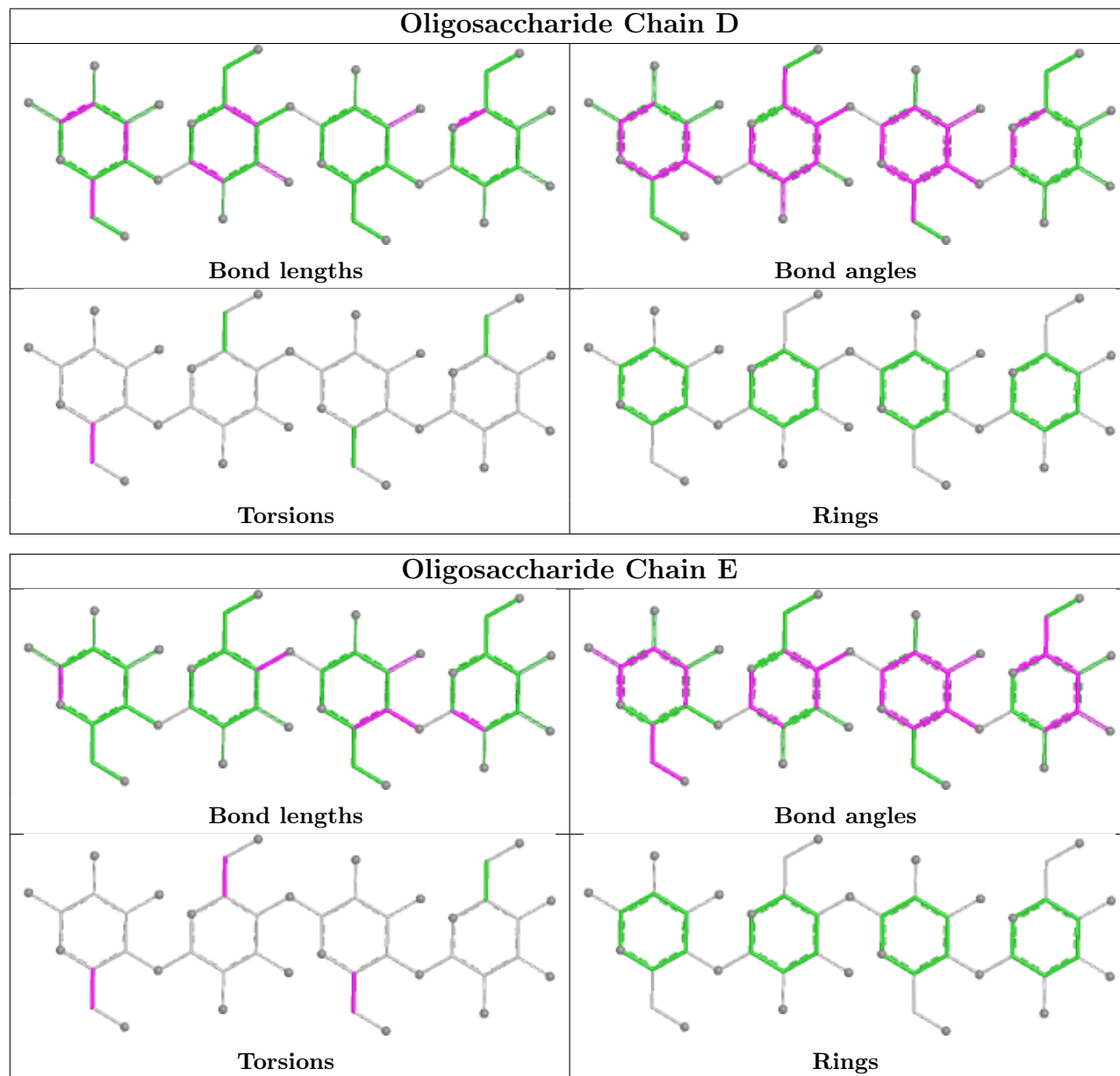
Mol	Chain	Res	Type	Atoms
2	D	1	BGC	O5-C5-C6-O6
2	F	1	BGC	O5-C5-C6-O6
2	D	1	BGC	C4-C5-C6-O6
2	F	1	BGC	C4-C5-C6-O6
2	E	1	BGC	C4-C5-C6-O6
2	E	1	BGC	O5-C5-C6-O6
2	F	4	BGC	O5-C5-C6-O6
2	E	2	BGC	O5-C5-C6-O6
2	E	3	BGC	C4-C5-C6-O6

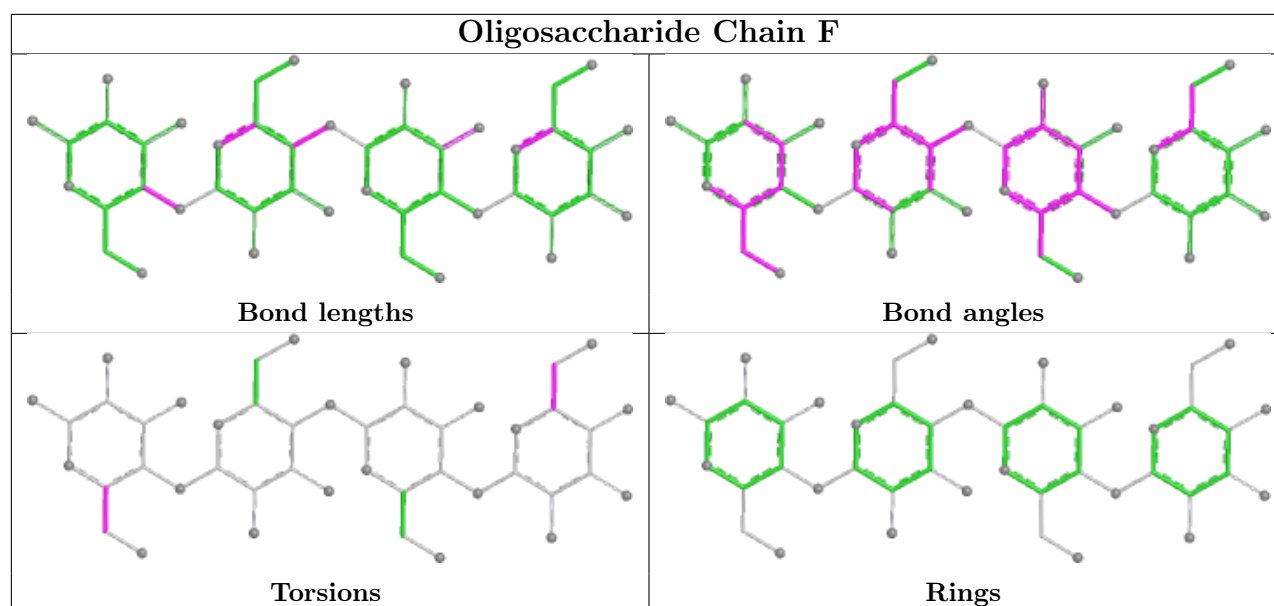
There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	E	3	BGC	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 oligosaccharide.





5.6 Ligand geometry [i](#)

5 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	A	459	-	4,4,4	0.48	0	6,6,6	1.11	1 (16%)
3	PO4	C	459	-	4,4,4	1.02	0	6,6,6	1.25	0
3	PO4	C	461	-	4,4,4	0.50	0	6,6,6	1.46	2 (33%)
3	PO4	C	460	-	4,4,4	0.61	0	6,6,6	1.45	1 (16%)
3	PO4	C	462	-	4,4,4	0.99	0	6,6,6	1.20	0

There are no bond length outliers.

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	C	461	PO4	O4-P-O2	2.61	116.03	107.91
3	A	459	PO4	O3-P-O2	2.48	115.62	107.91
3	C	461	PO4	O3-P-O1	-2.24	103.04	110.95
3	C	460	PO4	O4-P-O3	-2.08	101.44	107.91

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

3 monomers are involved in 3 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	C	461	PO4	1	0
3	C	460	PO4	1	0
3	C	462	PO4	2	0

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	377/458 (82%)	0.05	14 (3%)	45 49	5, 21, 38, 48	8 (2%)
1	B	377/458 (82%)	0.03	11 (2%)	53 58	4, 21, 36, 45	11 (2%)
1	C	377/458 (82%)	0.45	15 (3%)	42 46	6, 29, 45, 56	12 (3%)
All	All	1131/1374 (82%)	0.18	40 (3%)	47 51	4, 23, 40, 56	31 (2%)

All (40) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	C	312	ALA	10.0
1	C	310	GLY	9.2
1	B	311	PRO	8.5
1	C	311	PRO	7.9
1	B	312	ALA	7.4
1	B	310	GLY	7.0
1	A	311	PRO	6.6
1	C	286	ASN	6.2
1	C	368	GLU	6.1
1	A	34	GLN	5.9
1	C	161	HIS	5.8
1	A	312	ALA	5.6
1	B	34	GLN	5.5
1	A	310	GLY	5.4
1	C	88	ASP	4.8
1	A	161	HIS	4.4
1	C	136	MET	4.2
1	B	174	GLU	4.1
1	B	159	CYS	3.9
1	B	286	ASN	3.9
1	A	182	GLU	3.8
1	B	234	GLU	3.8
1	A	136	MET	3.7

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Mol	Chain	Res	Type	RSRZ
1	A	223	GLY	3.7
1	C	182	GLU	3.7
1	B	368	GLU	3.5
1	B	136	MET	3.1
1	C	234	GLU	3.1
1	A	108	GLU	2.9
1	A	226	ALA	2.8
1	C	159	CYS	2.6
1	C	216	THR	2.5
1	A	159	CYS	2.3
1	B	372	CYS	2.3
1	A	286	ASN	2.2
1	C	213	THR	2.2
1	A	282	ASP	2.0
1	C	170	ASP	2.0
1	C	314	GLY	2.0
1	A	372	CYS	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](#)

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.

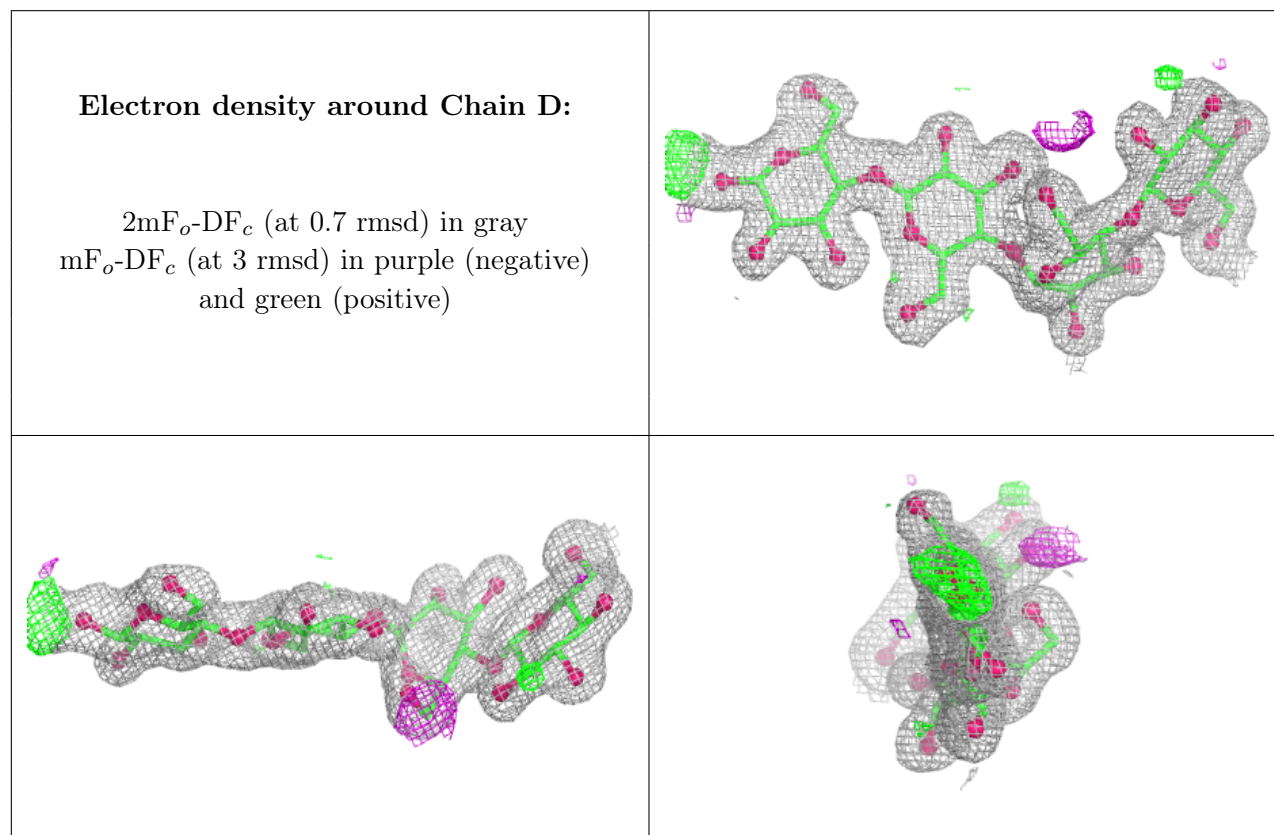
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
2	BGC	E	3	11/12	0.89	0.12	25,29,31,31	0
2	BGC	D	1	12/12	0.91	0.09	24,30,38,45	0
2	BGC	F	1	12/12	0.91	0.09	38,40,48,52	0
2	BGC	F	2	11/12	0.91	0.09	37,39,40,42	0
2	BGC	F	3	11/12	0.91	0.09	32,35,39,39	0
2	BGC	E	4	11/12	0.92	0.08	26,31,34,35	0
2	BGC	D	2	11/12	0.92	0.08	26,27,28,33	0
2	BGC	E	2	11/12	0.93	0.07	23,26,30,31	0
2	BGC	F	4	11/12	0.93	0.08	29,33,37,38	0
2	BGC	E	1	12/12	0.94	0.08	20,27,33,38	0
2	BGC	D	3	11/12	0.95	0.07	21,26,28,30	0

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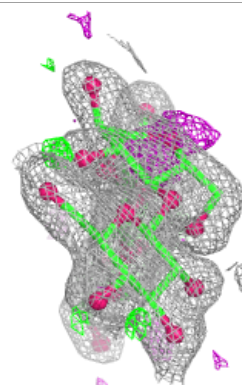
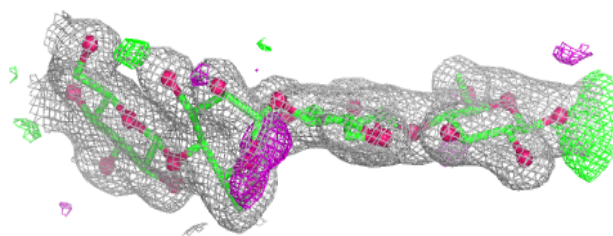
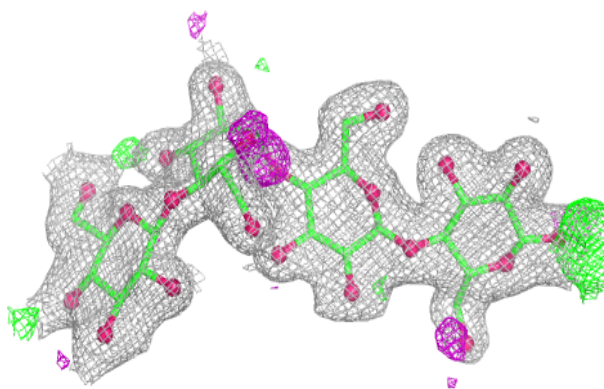
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
2	BGC	D	4	11/12	0.96	0.06	21,27,29,32	0

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.

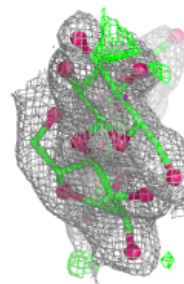
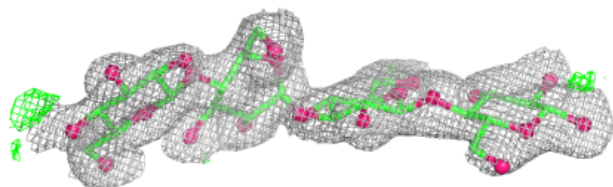
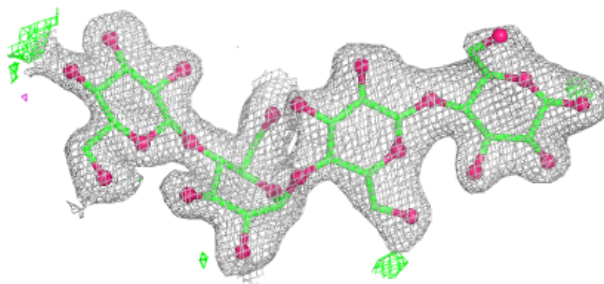


Electron density around Chain E:

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

**Electron density around Chain F:**

$2mF_o-DF_c$ (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($\text{\AA}^2$)	Q<0.9
3	PO4	C	462	5/5	0.87	0.11	34,39,41,45	0
3	PO4	C	459	5/5	0.90	0.10	32,38,44,46	0
3	PO4	A	459	5/5	0.96	0.06	33,39,40,43	0
3	PO4	C	461	5/5	0.98	0.07	24,25,26,30	0
3	PO4	C	460	5/5	0.99	0.05	19,23,27,28	0

6.5 Other polymers [i](#)

There are no such residues in this entry.