



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 9, 2026 – 07:12 PM UTC

PDB ID : 1R64 / pdb_00001r64
Title : The 2.2 Å crystal structure of Kex2 protease in complex with Ac-Arg-Glu-Lys-boroArg peptidyl boronic acid inhibitor
Authors : Holyoak, T.; Kettner, C.A.; Petsko, G.A.; Fuller, R.S.; Ringe, D.
Deposited on : 2003-10-14
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

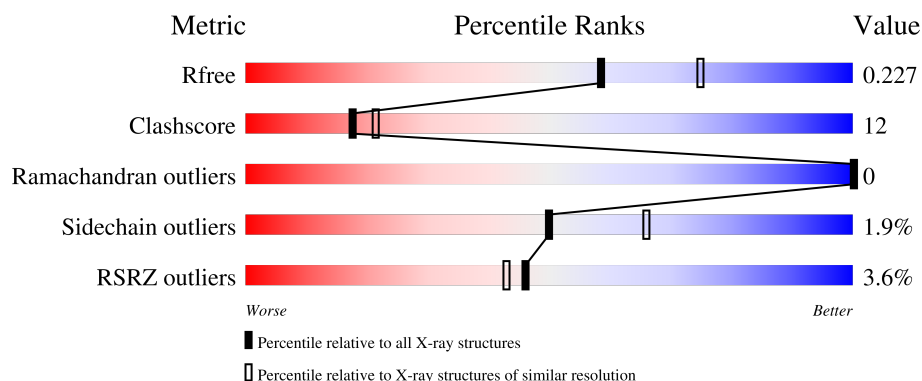
1 Overall quality at a glance

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	481	2% 78% 20% .
1	B	481	5% 77% 21% .
2	C	5	80% 20%
2	D	5	20% 80% 20%
3	E	2	50% 50%

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Mol	Chain	Length	Quality of chain
3	F	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
4	NAG	A	906	-	-	X	-
7	BTB	B	1901	-	-	X	-

2 Entry composition [i](#)

There are 8 unique types of molecules in this entry. The entry contains 8397 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 Kexin.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	481	Total	C	N	O	S	0	0	0
			3708	2319	632	746	11			
1	B	481	Total	C	N	O	S	0	0	0
			3708	2319	632	746	11			

- Molecule 2 is a protein called Ac-Arg-Glu-Lys-boroArg peptide inhibitor.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	C	5	Total	B	C	N	O	0	0	0
			44	1	24	11	8			
2	D	5	Total	B	C	N	O	0	0	0
			44	1	24	11	8			

- Molecule 3 is an oligosaccharide called 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose.



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
3	E	2	Total	C	N	O	0	0	0
			28	16	2	10			
3	F	2	Total	C	N	O	0	0	0
			28	16	2	10			

- Molecule 4 is 2-acetamido-2-deoxy-beta-D-glucopyranose (CCD ID: NAG) (formula: C₈H₁₅NO₆).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
4	A	1	Total	C	N	O	0	0
			14	8	1	5		
4	A	1	Total	C	N	O	0	0
			14	8	1	5		
4	B	1	Total	C	N	O	0	0
			14	8	1	5		

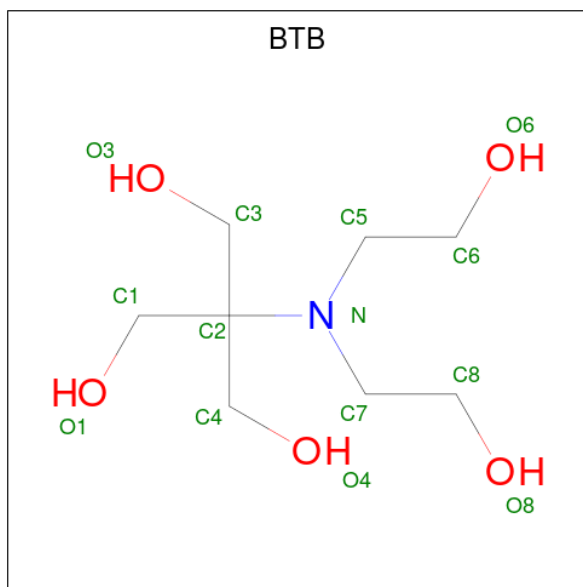
- Molecule 5 is CALCIUM ION (CCD ID: CA) (formula: Ca).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	3	Total	Ca	0	0
			3	3		
5	B	3	Total	Ca	0	0
			3	3		

- Molecule 6 is POTASSIUM ION (CCD ID: K) (formula: K).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	3	Total	K	0	0
			3	3		
6	B	3	Total	K	0	0
			3	3		

- Molecule 7 is 2-[BIS-(2-HYDROXY-ETHYL)-AMINO]-2-HYDROXYMETHYL-PROPAN E-1,3-DIOL (CCD ID: BTB) (formula: C₈H₁₉NO₅).



Mol	Chain	Residues	Atoms				ZeroOcc	AltConf
7	B	1	Total	C	N	O	0	0
			14	8	1	5		

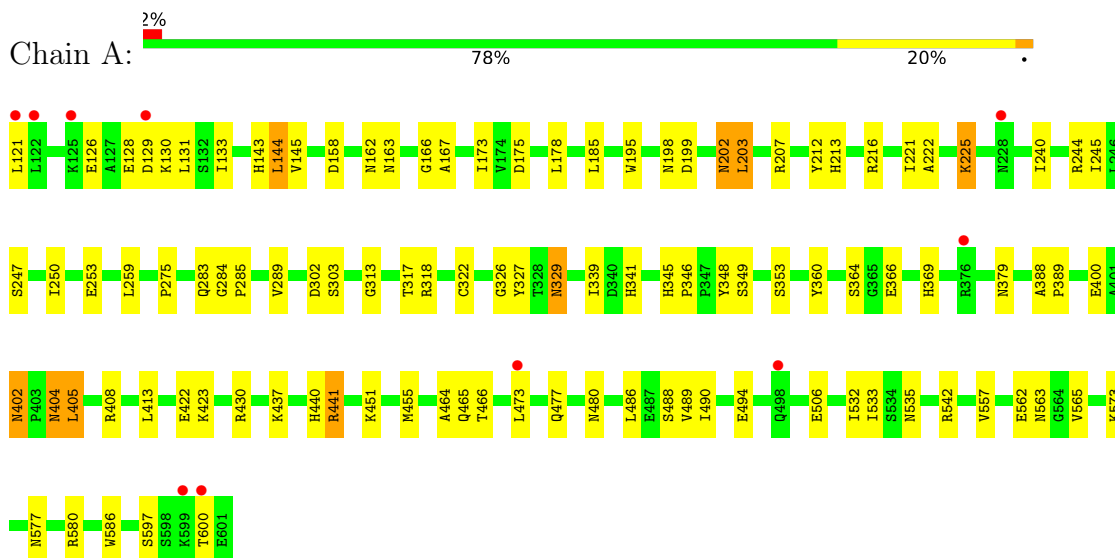
- Molecule 8 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
8	A	413	Total	O	0	0
			413	413		
8	B	345	Total	O	0	0
			345	345		
8	C	8	Total	O	0	0
			8	8		
8	D	3	Total	O	0	0
			3	3		

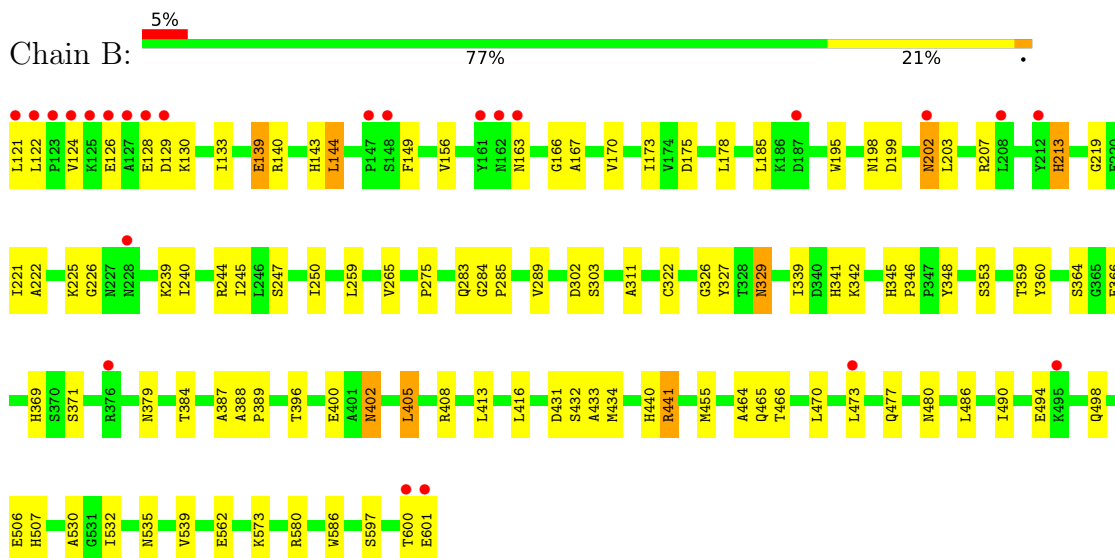
3 Residue-property plots [i](#)

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.

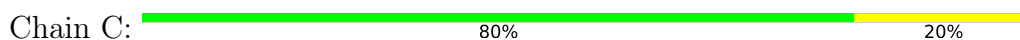
- Molecule 1: Kexin



- Molecule 1: Kexin

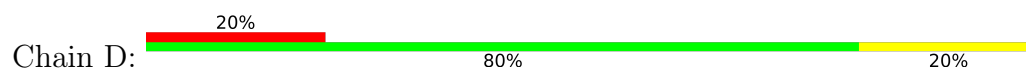


- Molecule 2: Ac-Arg-Glu-Lys-boroArg peptide inhibitor

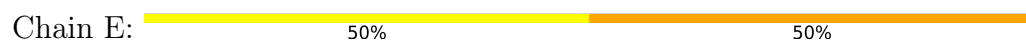




- Molecule 2: Ac-Arg-Glu-Lys-boroArg peptide inhibitor



- Molecule 3: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose



- Molecule 3: 2-acetamido-2-deoxy-beta-D-glucopyranose-(1-4)-2-acetamido-2-deoxy-beta-D-glucopyranose



4 Data and refinement statistics

Property	Value	Source
Space group	P 65 2 2	Depositor
Cell constants a, b, c, α , β , γ	113.54Å 113.54Å 364.97Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	50.00 – 2.20 50.00 – 2.20	Depositor EDS
% Data completeness (in resolution range)	89.2 (50.00-2.20) 83.6 (50.00-2.20)	Depositor EDS
R_{merge}	0.05	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.81 (at 2.20Å)	Xtriage
Refinement program	CNS 1.1	Depositor
R, R_{free}	0.197 , 0.234 0.190 , 0.227	Depositor DCC
R_{free} test set	6042 reflections (9.44%)	wwPDB-VP
Wilson B-factor (Å ²)	22.9	Xtriage
Anisotropy	0.009	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.39 , 45.8	EDS
L-test for twinning ²	$\langle L \rangle = 0.49$, $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	No twinning to report.	Xtriage
F_o, F_c correlation	0.94	EDS
Total number of atoms	8397	wwPDB-VP
Average B, all atoms (Å ²)	27.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.65% 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: BOR, ACE, NAG, K, BTB, CA

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	0.40	0/3791	0.90	9/5150 (0.2%)
1	B	0.41	0/3791	0.91	11/5150 (0.2%)
2	C	0.28	0/29	0.49	0/36
2	D	0.24	0/29	0.71	0/36
All	All	0.40	0/7640	0.90	20/10372 (0.2%)

There are no bond length outliers.

All (20) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	B	360	TYR	N-CA-C	9.39	123.74	110.50
1	A	360	TYR	N-CA-C	8.20	122.06	110.50
1	A	557	VAL	N-CA-C	-7.02	106.16	112.90
1	B	322	CYS	N-CA-C	6.13	120.48	113.19
1	B	221	ILE	N-CA-C	5.64	115.88	110.74
1	B	402	ASN	CA-C-N	5.64	125.26	119.56
1	B	402	ASN	C-N-CA	5.64	125.26	119.56
1	B	222	ALA	N-CA-C	5.53	117.96	110.88
1	B	213	HIS	N-CA-C	5.51	117.74	111.02
1	A	222	ALA	N-CA-C	5.39	117.79	110.88
1	A	402	ASN	CA-C-N	5.25	124.92	119.56
1	A	402	ASN	C-N-CA	5.25	124.92	119.56
1	B	202	ASN	N-CA-C	5.25	117.08	111.36
1	A	202	ASN	N-CA-C	5.21	117.04	111.36
1	B	139	GLU	CA-CB-CG	-5.17	103.76	114.10
1	B	140	ARG	N-CA-C	-5.15	107.37	113.97
1	A	322	CYS	N-CA-C	5.10	119.26	113.19
1	A	404	ASN	N-CA-C	5.09	118.76	112.54
1	B	396	THR	N-CA-C	-5.09	105.81	111.36
1	A	221	ILE	N-CA-C	5.03	115.32	110.74

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	3708	0	3526	85	0
1	B	3708	0	3526	86	0
2	C	44	0	47	1	0
2	D	44	0	47	2	0
3	E	28	0	25	2	0
3	F	28	0	25	2	0
4	A	28	0	26	8	0
4	B	14	0	13	4	0
5	A	3	0	0	0	0
5	B	3	0	0	0	0
6	A	3	0	0	0	0
6	B	3	0	0	0	0
7	B	14	0	19	18	0
8	A	413	0	0	12	0
8	B	345	0	0	9	0
8	C	8	0	0	0	0
8	D	3	0	0	0	0
All	All	8397	0	7254	185	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 12.

All (185) 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)
7:B:1901:BTB:C2	7:B:1901:BTB:N	1.70	1.50
1:A:577:ASN:HB3	3:E:1:NAG:H81	1.48	0.95
1:B:198:ASN:HD22	1:B:244:ARG:HG2	1.31	0.91
1:A:404:ASN:HB2	4:A:906:NAG:HN2	1.36	0.90
1:B:473:LEU:HD23	1:B:586:TRP:HE1	1.36	0.90
1:B:530:ALA:HB1	7:B:1901:BTB:O4	1.73	0.88

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:431:ASP:HB2	7:B:1901:BTB:O1	1.81	0.80
1:A:423:LYS:HB2	8:A:1117:HOH:O	1.80	0.80
1:A:404:ASN:CB	4:A:906:NAG:HN2	1.96	0.79
1:B:128:GLU:HA	1:B:133:ILE:HB	1.67	0.76
1:A:198:ASN:HD22	1:A:244:ARG:HG2	1.51	0.76
1:A:440:HIS:HE1	1:A:535:ASN:H	1.31	0.76
1:B:473:LEU:HD23	1:B:586:TRP:NE1	2.02	0.74
1:B:440:HIS:HE1	1:B:535:ASN:H	1.35	0.74
7:B:1901:BTB:C2	7:B:1901:BTB:C7	2.67	0.73
1:A:329:ASN:C	1:A:329:ASN:HD22	1.95	0.72
1:A:440:HIS:CE1	1:A:535:ASN:H	2.07	0.71
3:F:1:NAG:O3	3:F:2:NAG:H2	1.90	0.71
7:B:1901:BTB:C2	7:B:1901:BTB:C5	2.70	0.69
1:A:404:ASN:CB	4:A:906:NAG:N2	2.56	0.69
1:A:318:ARG:HD3	8:A:1132:HOH:O	1.93	0.68
1:A:402:ASN:CG	4:A:906:NAG:H5	2.17	0.68
1:A:404:ASN:HB2	4:A:906:NAG:N2	2.07	0.68
1:A:128:GLU:HA	1:A:133:ILE:HB	1.76	0.67
1:A:580:ARG:HH11	1:A:580:ARG:HB2	1.60	0.67
1:B:202:ASN:ND2	1:B:203:LEU:HD13	2.10	0.67
1:B:580:ARG:HH11	1:B:580:ARG:HB2	1.59	0.67
1:B:440:HIS:CE1	1:B:535:ASN:H	2.11	0.66
1:A:422:GLU:OE2	1:A:437:LYS:HD2	1.97	0.65
1:B:329:ASN:C	1:B:329:ASN:HD22	2.03	0.65
1:A:473:LEU:HD23	1:A:586:TRP:HE1	1.63	0.64
1:B:166:GLY:N	1:B:400:GLU:OE1	2.30	0.64
1:B:139:GLU:HG3	8:B:2214:HOH:O	1.97	0.64
1:B:432:SER:O	7:B:1901:BTB:H52	1.99	0.63
1:B:198:ASN:ND2	1:B:244:ARG:HG2	2.11	0.62
1:B:480:ASN:HB3	1:B:580:ARG:NH1	2.14	0.62
1:B:126:GLU:O	1:B:130:LYS:HG3	1.99	0.61
1:B:597:SER:HA	1:B:600:THR:HG22	1.83	0.61
7:B:1901:BTB:H42	8:B:2035:HOH:O	2.00	0.61
1:A:369:HIS:HD2	1:A:379:ASN:OD1	1.84	0.60
1:A:143:HIS:CD2	1:A:144:LEU:HD13	2.37	0.60
1:A:162:ASN:O	1:A:163:ASN:HB3	1.99	0.60
1:B:353:SER:HB3	1:B:440:HIS:CE1	2.37	0.60
1:B:600:THR:O	1:B:600:THR:HG23	2.02	0.59
1:A:329:ASN:C	1:A:329:ASN:ND2	2.60	0.59
1:A:402:ASN:ND2	4:A:906:NAG:H5	2.17	0.59
1:A:580:ARG:HB2	1:A:580:ARG:NH1	2.17	0.58

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:A:906:NAG:H83	8:A:1108:HOH:O	2.03	0.58
1:A:318:ARG:HD2	1:A:542:ARG:NH1	2.19	0.58
1:A:532:ILE:HD12	1:A:562:GLU:CD	2.29	0.58
7:B:1901:BTB:N	7:B:1901:BTB:C4	2.62	0.58
1:B:143:HIS:CD2	1:B:144:LEU:HD13	2.38	0.58
1:B:369:HIS:HD2	1:B:379:ASN:OD1	1.87	0.58
1:B:173:ILE:N	1:B:173:ILE:HD12	2.18	0.57
1:B:601:GLU:HB3	8:B:2061:HOH:O	2.04	0.56
1:A:341:HIS:HE1	1:A:364:SER:O	1.89	0.56
1:A:402:ASN:CG	1:A:405:LEU:HD13	2.31	0.56
1:B:283:GLN:NE2	2:D:1:ACE:H3	2.20	0.56
1:A:341:HIS:HD2	8:A:1209:HOH:O	1.89	0.56
1:A:345:HIS:CE1	1:A:441:ARG:HD2	2.41	0.56
1:B:175:ASP:OD2	1:B:213:HIS:HB3	2.05	0.56
1:A:473:LEU:HD23	1:A:488:SER:OG	2.06	0.56
1:A:597:SER:HA	1:A:600:THR:HG22	1.88	0.56
1:B:580:ARG:HB2	1:B:580:ARG:NH1	2.21	0.56
1:B:329:ASN:C	1:B:329:ASN:ND2	2.64	0.55
1:A:126:GLU:O	1:A:130:LYS:HG3	2.07	0.55
1:A:465:GLN:HG2	1:A:466:THR:N	2.22	0.55
1:A:413:LEU:HD22	1:A:455:MET:HG3	1.88	0.54
1:A:175:ASP:OD2	1:A:213:HIS:HB3	2.07	0.54
1:B:388:ALA:HB3	1:B:389:PRO:HD3	1.90	0.54
1:A:580:ARG:HD3	8:A:1046:HOH:O	2.07	0.54
1:A:600:THR:HG23	1:A:600:THR:O	2.08	0.54
1:B:532:ILE:HD11	7:B:1901:BTB:H72	1.90	0.54
1:B:245:ILE:HB	1:B:250:ILE:HD13	1.90	0.53
1:B:345:HIS:CE1	1:B:441:ARG:HD2	2.42	0.53
7:B:1901:BTB:N	7:B:1901:BTB:C1	2.63	0.53
1:A:464:ALA:HB3	1:A:600:THR:CG2	2.39	0.53
1:A:577:ASN:HB3	3:E:1:NAG:C8	2.30	0.53
1:A:480:ASN:HB3	1:A:580:ARG:NH1	2.24	0.53
1:B:339:ILE:HA	1:B:346:PRO:HD3	1.91	0.53
1:A:388:ALA:HB3	1:A:389:PRO:HD3	1.91	0.53
1:B:283:GLN:HE22	2:D:1:ACE:H3	1.74	0.53
1:A:302:ASP:O	1:A:303:SER:HB2	2.08	0.53
1:B:470:LEU:HD22	1:B:490:ILE:CD1	2.39	0.53
1:B:225:LYS:HG2	1:B:226:GLY:N	2.24	0.52
7:B:1901:BTB:N	7:B:1901:BTB:C3	2.69	0.52
1:B:441:ARG:HD3	8:B:2083:HOH:O	2.09	0.51
1:B:433:ALA:HB2	7:B:1901:BTB:H82	1.92	0.51

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:430:ARG:NH1	1:A:533:ILE:HG23	2.26	0.51
1:A:339:ILE:HA	1:A:346:PRO:HD3	1.91	0.51
1:B:413:LEU:HD22	1:B:455:MET:HG3	1.91	0.51
1:B:195:TRP:CE3	1:B:202:ASN:HA	2.46	0.51
1:B:285:PRO:HG3	1:B:327:TYR:CE2	2.46	0.50
1:A:202:ASN:ND2	1:A:203:LEU:HD13	2.26	0.50
1:B:341:HIS:HE1	1:B:364:SER:O	1.95	0.50
1:B:366:GLU:OE1	1:B:369:HIS:HE1	1.95	0.50
1:B:124:VAL:HG11	1:B:139:GLU:HG2	1.93	0.50
1:B:199:ASP:OD2	1:B:207:ARG:HD2	2.12	0.50
1:A:198:ASN:HD21	1:A:247:SER:H	1.59	0.49
1:B:259:LEU:HD12	1:B:289:VAL:HG13	1.94	0.49
1:A:131:LEU:O	1:A:225:LYS:HE2	2.12	0.49
1:A:464:ALA:HB3	1:A:600:THR:HG23	1.95	0.49
1:B:470:LEU:HD22	1:B:490:ILE:HD12	1.95	0.49
1:B:431:ASP:CB	7:B:1901:BTB:O1	2.59	0.48
1:A:167:ALA:O	1:A:400:GLU:HG3	2.13	0.48
1:B:408:ARG:HD2	1:B:506:GLU:OE2	2.14	0.48
1:B:402:ASN:CG	1:B:405:LEU:HD13	2.39	0.48
1:A:284:GLY:HA3	1:A:326:GLY:HA3	1.95	0.48
1:B:494:GLU:HG2	1:B:498:GLN:NE2	2.28	0.48
1:A:253:GLU:HB2	8:A:1144:HOH:O	2.13	0.48
1:A:408:ARG:NE	1:A:465:GLN:HB2	2.29	0.48
1:B:416:LEU:HD21	1:B:434:MET:HE3	1.97	0.47
1:B:202:ASN:HD22	1:B:203:LEU:HD13	1.78	0.47
1:A:158:ASP:HB2	8:A:1178:HOH:O	2.14	0.47
1:A:198:ASN:ND2	1:A:247:SER:H	2.12	0.47
1:A:285:PRO:HG3	1:A:327:TYR:CE2	2.50	0.47
1:B:149:PHE:CZ	1:B:342:LYS:HE2	2.50	0.47
1:A:166:GLY:N	1:A:400:GLU:OE1	2.48	0.47
1:B:465:GLN:HG2	1:B:466:THR:N	2.29	0.47
1:B:539:VAL:HG23	8:B:2080:HOH:O	2.15	0.47
1:A:195:TRP:CE3	1:A:202:ASN:HA	2.51	0.46
1:B:163:ASN:O	4:B:903:NAG:O7	2.32	0.46
1:A:490:ILE:HG13	8:A:1235:HOH:O	2.16	0.46
1:A:353:SER:HB3	1:A:440:HIS:CE1	2.50	0.46
1:A:451:LYS:HD3	8:A:1237:HOH:O	2.16	0.46
1:B:400:GLU:OE2	4:B:903:NAG:C8	2.64	0.45
1:B:156:VAL:HG22	1:B:156:VAL:O	2.16	0.45
1:B:178:LEU:C	1:B:178:LEU:HD23	2.41	0.45
1:A:573:LYS:HB2	8:A:972:HOH:O	2.16	0.45

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:199:ASP:OD2	1:A:207:ARG:HD2	2.16	0.45
1:B:198:ASN:HD21	1:B:247:SER:H	1.65	0.45
1:A:212:TYR:O	1:A:216:ARG:HG3	2.16	0.45
1:A:348:TYR:CD1	1:A:349:SER:N	2.85	0.44
1:B:167:ALA:O	1:B:400:GLU:HG3	2.17	0.44
1:A:275:PRO:HB3	1:A:283:GLN:HG2	2.00	0.44
1:A:494:GLU:OE1	1:A:565:VAL:HG21	2.17	0.44
8:A:1135:HOH:O	7:B:1901:BTB:H61	2.16	0.44
1:A:259:LEU:HD12	1:A:289:VAL:HG13	1.99	0.44
1:A:173:ILE:HD12	1:A:173:ILE:N	2.32	0.44
1:A:285:PRO:HG3	1:A:327:TYR:CD2	2.53	0.44
7:B:1901:BTB:H72	7:B:1901:BTB:H41	1.98	0.44
1:B:464:ALA:HB3	1:B:600:THR:CG2	2.48	0.44
1:B:470:LEU:CD2	1:B:490:ILE:HD12	2.48	0.44
1:A:400:GLU:OE2	4:A:903:NAG:O7	2.36	0.43
1:A:440:HIS:HE1	1:A:535:ASN:N	2.08	0.43
1:B:507:HIS:HD2	8:B:1925:HOH:O	2.00	0.43
1:A:473:LEU:CD2	1:A:488:SER:OG	2.65	0.43
1:A:313:GLY:HA2	2:C:5:BOR:HD1	2.01	0.43
1:B:170:VAL:HB	1:B:265:VAL:O	2.19	0.43
1:B:302:ASP:O	1:B:303:SER:HB2	2.18	0.43
1:B:477:GLN:HB3	1:B:486:LEU:HD22	2.00	0.43
1:B:122:LEU:O	1:B:122:LEU:HD12	2.19	0.43
1:A:477:GLN:HE21	1:A:486:LEU:HD22	1.84	0.42
1:B:440:HIS:HD2	8:B:2082:HOH:O	2.02	0.42
1:A:318:ARG:NH2	7:B:1901:BTB:O6	2.52	0.42
7:B:1901:BTB:O4	8:B:1957:HOH:O	2.21	0.42
1:B:326:GLY:HA2	1:B:329:ASN:ND2	2.35	0.42
1:B:219:GLY:HA3	1:B:371:SER:OG	2.20	0.42
1:A:326:GLY:HA2	1:A:329:ASN:ND2	2.35	0.42
1:A:563:ASN:HB2	8:A:998:HOH:O	2.19	0.42
1:A:245:ILE:HB	1:A:250:ILE:HD13	2.00	0.42
1:A:408:ARG:HD2	1:A:506:GLU:OE2	2.19	0.42
1:B:400:GLU:OE2	4:B:903:NAG:H81	2.20	0.42
3:F:1:NAG:O4	3:F:2:NAG:H61	2.20	0.42
1:B:275:PRO:HB3	1:B:283:GLN:HG2	2.02	0.41
1:B:573:LYS:HB2	8:B:1975:HOH:O	2.19	0.41
1:B:597:SER:HA	1:B:600:THR:CG2	2.50	0.41
1:A:366:GLU:OE1	1:A:369:HIS:HE1	2.03	0.41
1:B:170:VAL:HG22	1:B:239:LYS:HB2	2.02	0.41
1:B:532:ILE:HD12	1:B:562:GLU:CD	2.45	0.41

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:178:LEU:C	1:A:178:LEU:HD23	2.45	0.41
4:B:903:NAG:O3	4:B:903:NAG:H83	2.20	0.41
1:A:489:VAL:HG12	1:A:490:ILE:N	2.36	0.41
1:A:318:ARG:CD	1:A:542:ARG:NH1	2.84	0.41
1:B:359:THR:HG21	1:B:387:ALA:O	2.21	0.41
1:B:530:ALA:HB1	7:B:1901:BTB:C4	2.51	0.41
1:B:185:LEU:HD22	1:B:240:ILE:CD1	2.50	0.40
1:B:408:ARG:NE	1:B:465:GLN:HB2	2.37	0.40
1:B:284:GLY:HA3	1:B:326:GLY:HA3	2.04	0.40
1:B:464:ALA:HB3	1:B:600:THR:HG23	2.03	0.40
1:A:185:LEU:HD22	1:A:240:ILE:CD1	2.52	0.40
1:A:317:THR:O	1:A:317:THR:HG22	2.21	0.40
1:B:311:ALA:HB1	1:B:384:THR:HB	2.04	0.40
1:A:422:GLU:CD	1:A:437:LYS:HD2	2.45	0.40
1:B:348:TYR:C	1:B:348:TYR:CD1	3.00	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	479/481 (100%)	453 (95%)	26 (5%)	0	100	100
1	B	479/481 (100%)	453 (95%)	26 (5%)	0	100	100
2	C	3/5 (60%)	2 (67%)	1 (33%)	0	100	100
2	D	3/5 (60%)	3 (100%)	0	0	100	100
All	All	964/972 (99%)	911 (94%)	53 (6%)	0	100	100

There are no Ramachandran outliers to report.

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	402/402 (100%)	393 (98%)	9 (2%)	45	61
1	B	402/402 (100%)	396 (98%)	6 (2%)	57	73
2	C	3/3 (100%)	3 (100%)	0	100	100
2	D	3/3 (100%)	3 (100%)	0	100	100
All	All	810/810 (100%)	795 (98%)	15 (2%)	50	66

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

Mol	Chain	Res	Type
1	A	121	LEU
1	A	129	ASP
1	A	144	LEU
1	A	145	VAL
1	A	203	LEU
1	A	225	LYS
1	A	329	ASN
1	A	405	LEU
1	A	441	ARG
1	B	121	LEU
1	B	129	ASP
1	B	144	LEU
1	B	329	ASN
1	B	405	LEU
1	B	441	ARG

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (19) such sidechains are listed below:

Mol	Chain	Res	Type
1	A	198	ASN
1	A	237	ASN
1	A	329	ASN
1	A	341	HIS

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Mol	Chain	Res	Type
1	A	369	HIS
1	A	440	HIS
1	A	477	GLN
1	A	507	HIS
1	B	162	ASN
1	B	198	ASN
1	B	228	ASN
1	B	281	HIS
1	B	283	GLN
1	B	329	ASN
1	B	341	HIS
1	B	369	HIS
1	B	440	HIS
1	B	498	GLN
1	B	507	HIS

5.3.3 RNA ⓘ

There are no RNA molecules in this entry.

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

2 non-standard protein/DNA/RNA residues 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	BOR	D	5	2,1	6,11,11	0.32	0	5,13,13	0.52	0
2	BOR	C	5	2,1	6,11,11	0.28	0	5,13,13	0.52	0

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '–' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
2	BOR	D	5	2,1	-	0/7/11/11	-
2	BOR	C	5	2,1	-	0/7/11/11	-

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	C	5	BOR	1	0

5.5 Carbohydrates [i](#)

4 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$
3	NAG	E	1	3,1	14,14,15	1.20	1 (7%)	17,19,21	0.97	0
3	NAG	E	2	3	14,14,15	1.04	1 (7%)	17,19,21	1.47	3 (17%)
3	NAG	F	1	3,1	14,14,15	0.75	0	17,19,21	1.07	1 (5%)
3	NAG	F	2	3	14,14,15	0.88	1 (7%)	17,19,21	0.75	0

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	NAG	E	1	3,1	-	3/6/23/26	0/1/1/1
3	NAG	E	2	3	-	2/6/23/26	0/1/1/1

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Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
3	NAG	F	1	3,1	-	2/6/23/26	0/1/1/1
3	NAG	F	2	3	-	2/6/23/26	0/1/1/1

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
3	E	1	NAG	C1-C2	3.72	1.57	1.52
3	E	2	NAG	O5-C5	2.30	1.47	1.43
3	F	2	NAG	C1-C2	2.29	1.55	1.52

All (4) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
3	E	2	NAG	C1-O5-C5	3.91	117.43	112.19
3	F	1	NAG	C2-N2-C7	-2.84	119.09	122.90
3	E	2	NAG	O5-C1-C2	2.54	115.22	111.29
3	E	2	NAG	C2-N2-C7	-2.12	120.06	122.90

There are no chirality outliers.

All (9) torsion outliers are listed below:

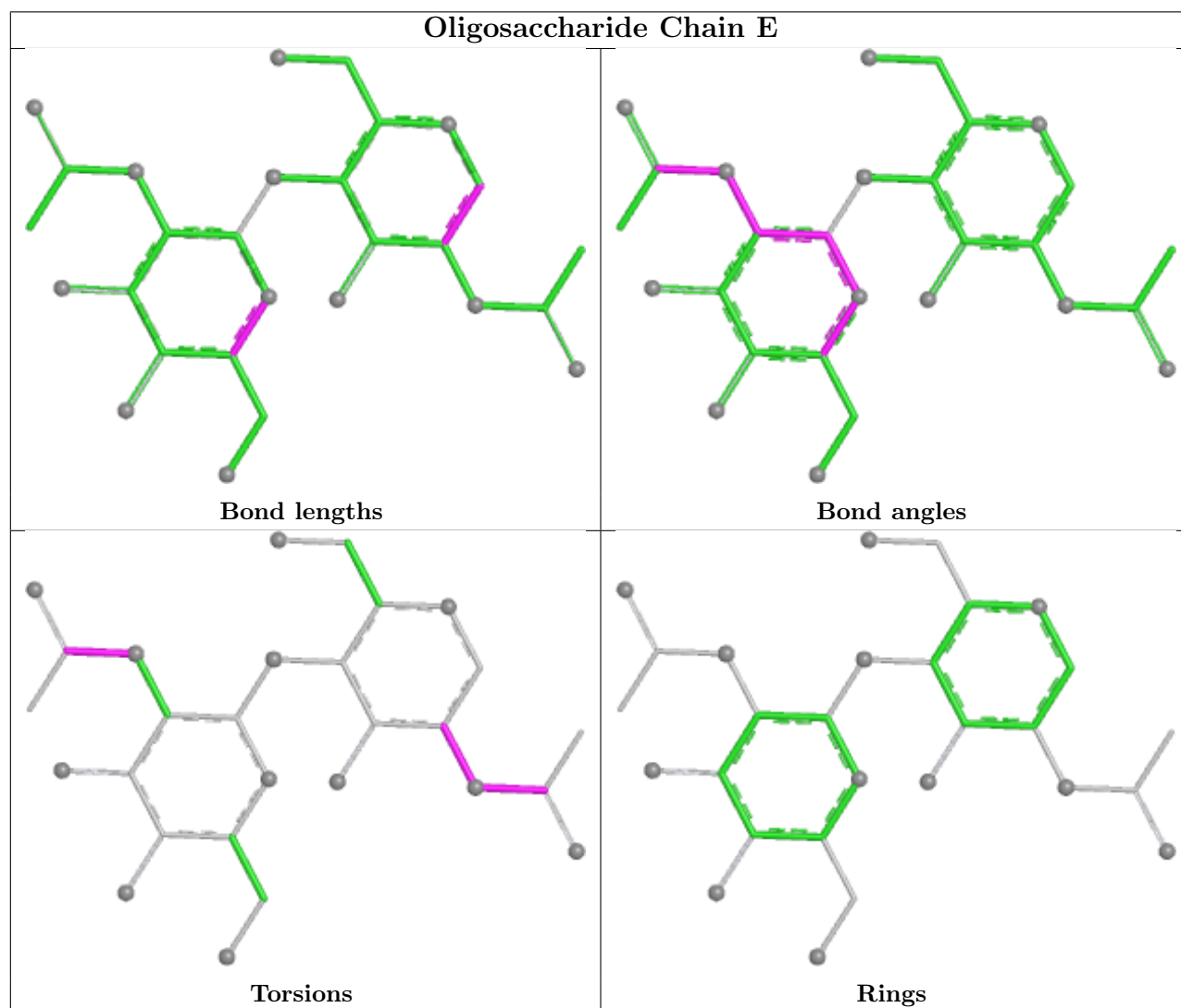
Mol	Chain	Res	Type	Atoms
3	E	2	NAG	C8-C7-N2-C2
3	E	2	NAG	O7-C7-N2-C2
3	F	2	NAG	C8-C7-N2-C2
3	F	2	NAG	O7-C7-N2-C2
3	F	1	NAG	C4-C5-C6-O6
3	F	1	NAG	O5-C5-C6-O6
3	E	1	NAG	C8-C7-N2-C2
3	E	1	NAG	O7-C7-N2-C2
3	E	1	NAG	C1-C2-N2-C7

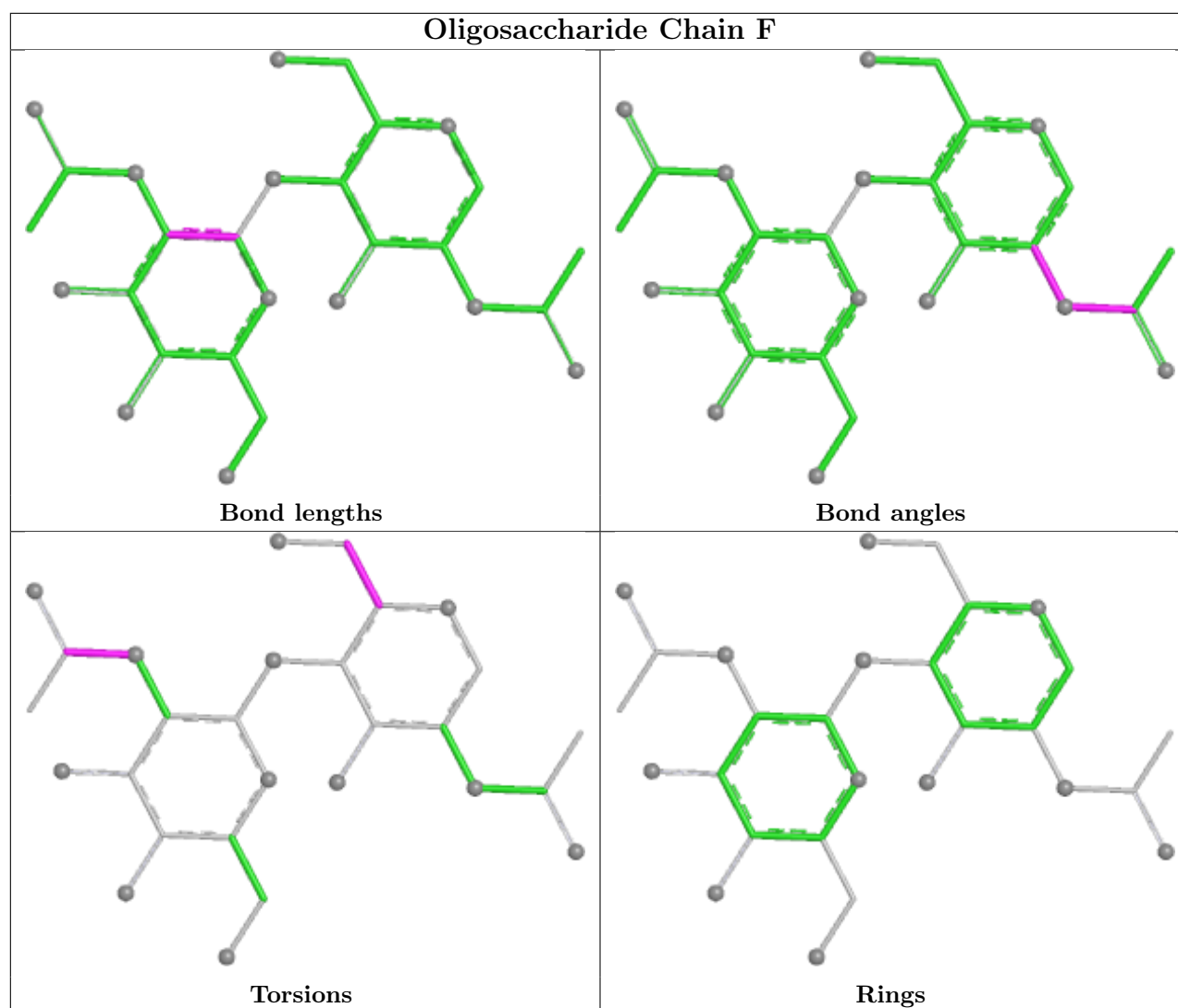
There are no ring outliers.

3 monomers are involved in 4 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
3	E	1	NAG	2	0
3	F	2	NAG	2	0
3	F	1	NAG	2	0

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





5.6 Ligand geometry [i](#)

Of 16 ligands modelled in this entry, 12 are monoatomic - leaving 4 for Mogul analysis.

In the following table, the Counts columns list the number of bonds (or angles) for which Mogul statistics could be retrieved, the number of bonds (or angles) that are observed in the model and the number of bonds (or angles) that are defined in the Chemical Component Dictionary. The Link column lists molecule types, if any, to which the group is linked. The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 2$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	$\# Z > 2$	Counts	RMSZ	$\# Z > 2$
4	NAG	B	903	1	14,14,15	1.83	2 (14%)	17,19,21	2.00	6 (35%)
4	NAG	A	903	1	14,14,15	0.88	1 (7%)	17,19,21	1.06	1 (5%)
4	NAG	A	906	1	14,14,15	0.86	1 (7%)	17,19,21	0.54	0

Mol	Type	Chain	Res	Link	Bond lengths			Bond angles		
					Counts	RMSZ	# Z > 2	Counts	RMSZ	# Z > 2
7	BTB	B	1901	-	13,13,13	4.64	5 (38%)	7,16,16	1.81	1 (14%)

In the following table, the Chirals column lists the number of chiral outliers, the number of chiral centers analysed, the number of these observed in the model and the number defined in the Chemical Component Dictionary. Similar counts are reported in the Torsion and Rings columns. '-' means no outliers of that kind were identified.

Mol	Type	Chain	Res	Link	Chirals	Torsions	Rings
4	NAG	B	903	1	-	3/6/23/26	0/1/1/1
4	NAG	A	903	1	-	5/6/23/26	0/1/1/1
4	NAG	A	906	1	-	3/6/23/26	0/1/1/1
7	BTB	B	1901	-	-	4/21/21/21	-

All (9) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
7	B	1901	BTB	C2-N	11.34	1.70	1.48
7	B	1901	BTB	C5-N	7.38	1.58	1.48
7	B	1901	BTB	C7-N	7.16	1.58	1.48
4	B	903	NAG	C1-C2	5.45	1.59	1.52
7	B	1901	BTB	C3-C2	5.42	1.59	1.53
7	B	1901	BTB	C1-C2	-3.13	1.49	1.53
4	A	906	NAG	C1-C2	2.79	1.56	1.52
4	B	903	NAG	C4-C5	-2.56	1.47	1.53
4	A	903	NAG	C6-C5	2.09	1.58	1.51

All (8) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
7	B	1901	BTB	O1-C1-C2	4.53	122.06	111.40
4	B	903	NAG	C8-C7-N2	4.44	123.47	116.12
4	B	903	NAG	C2-N2-C7	3.54	127.64	122.90
4	B	903	NAG	O7-C7-C8	-3.16	116.43	122.05
4	B	903	NAG	O5-C5-C6	2.62	112.77	107.66
4	A	903	NAG	C2-N2-C7	-2.46	119.60	122.90
4	B	903	NAG	O4-C4-C5	-2.42	103.38	109.32
4	B	903	NAG	C1-O5-C5	-2.37	109.00	112.19

There are no chirality outliers.

All (15) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	903	NAG	O7-C7-N2-C2
4	B	903	NAG	C8-C7-N2-C2
4	B	903	NAG	O7-C7-N2-C2
7	B	1901	BTB	C1-C2-C3-O3
7	B	1901	BTB	C4-C2-C3-O3
7	B	1901	BTB	N-C2-C3-O3
4	A	903	NAG	C8-C7-N2-C2
4	A	906	NAG	C8-C7-N2-C2
4	A	906	NAG	O7-C7-N2-C2
4	B	903	NAG	O5-C5-C6-O6
7	B	1901	BTB	N-C5-C6-O6
4	A	903	NAG	O5-C5-C6-O6
4	A	906	NAG	O5-C5-C6-O6
4	A	903	NAG	C4-C5-C6-O6
4	A	903	NAG	C3-C2-N2-C7

There are no ring outliers.

4 monomers are involved in 30 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	B	903	NAG	4	0
4	A	903	NAG	1	0
4	A	906	NAG	7	0
7	B	1901	BTB	18	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	481/481 (100%)	-0.15	10 (2%) 63 60	14, 22, 37, 67	0
1	B	481/481 (100%)	0.14	24 (4%) 34 31	13, 25, 44, 66	0
2	C	3/5 (60%)	-0.51	0 100 100	20, 20, 24, 32	0
2	D	3/5 (60%)	0.75	1 (33%) 1 0	30, 30, 41, 50	0
All	All	968/972 (99%)	-0.00	35 (3%) 46 43	13, 23, 42, 67	0

All (35) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	121	LEU	7.1
1	A	600	THR	6.9
1	A	121	LEU	5.9
1	B	122	LEU	5.6
1	B	600	THR	5.3
1	B	129	ASP	4.7
1	A	122	LEU	4.0
1	A	129	ASP	3.4
1	B	202	ASN	3.3
1	B	125	LYS	3.2
1	B	123	PRO	3.1
1	A	473	LEU	2.9
1	B	148	SER	2.9
1	A	376	ARG	2.8
1	B	127	ALA	2.5
1	B	376	ARG	2.5
1	B	208	LEU	2.5
1	B	147	PRO	2.5
1	B	124	VAL	2.5
1	B	495	LYS	2.4
1	A	125	LYS	2.4

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Mol	Chain	Res	Type	RSRZ
1	A	498	GLN	2.4
1	B	601	GLU	2.4
1	B	163	ASN	2.3
1	B	473	LEU	2.3
1	B	161	TYR	2.3
1	B	126	GLU	2.2
1	B	187	ASP	2.2
2	D	2	ARG	2.2
1	B	128	GLU	2.1
1	B	212	TYR	2.1
1	A	228	ASN	2.1
1	B	162	ASN	2.0
1	B	228	ASN	2.0
1	A	599	LYS	2.0

6.2 Non-standard residues in protein, DNA, RNA chains [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	BOR	D	5	12/12	0.94	0.08	18,23,26,27	0
2	BOR	C	5	12/12	0.95	0.07	17,19,21,22	0

6.3 Carbohydrates [i](#)

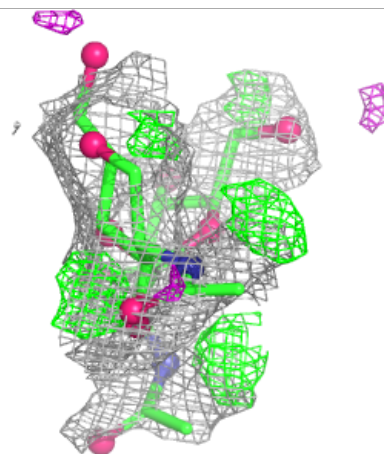
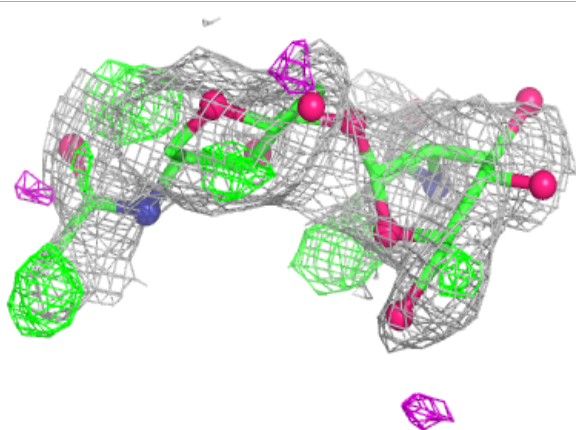
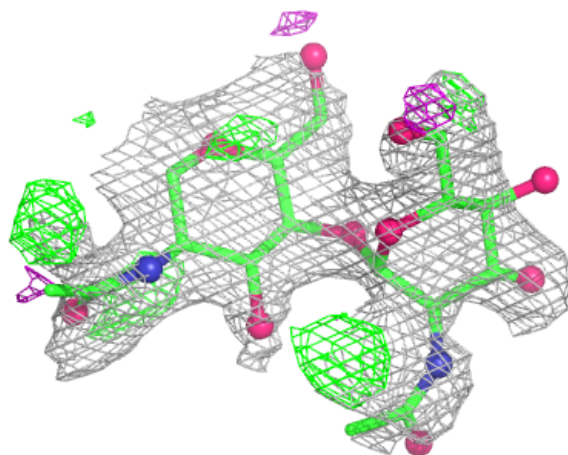
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists the number of atoms with occupancy less than 0.9.

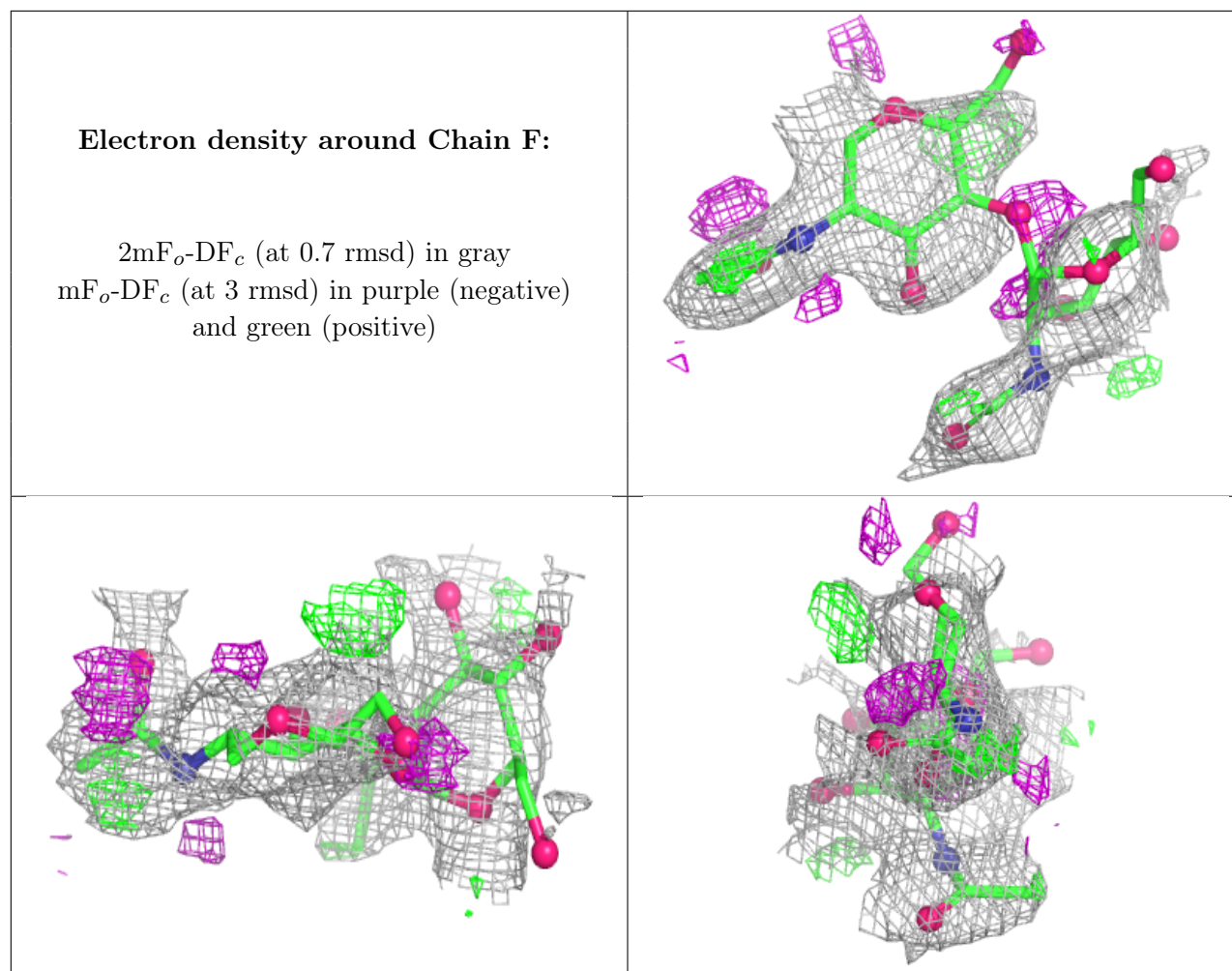
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
3	NAG	E	2	14/15	0.46	0.21	76,79,81,82	0
3	NAG	F	2	14/15	0.50	0.21	78,80,81,83	0
3	NAG	F	1	14/15	0.59	0.22	60,64,74,75	0
3	NAG	E	1	14/15	0.65	0.23	58,65,67,72	0

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)





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
4	NAG	A	903	14/15	0.49	0.27	73,80,82,82	0
4	NAG	A	906	14/15	0.57	0.24	69,75,79,82	0
4	NAG	B	903	14/15	0.62	0.22	73,77,80,82	0
7	BTB	B	1901	14/14	0.71	0.34	50,56,65,68	0
6	K	B	803	1/1	0.91	0.15	69,69,69,69	0
5	CA	B	701	1/1	0.95	0.05	37,37,37,37	0
6	K	B	800	1/1	0.95	0.08	41,41,41,41	0
6	K	B	801	1/1	0.97	0.05	39,39,39,39	0
6	K	A	801	1/1	0.98	0.06	36,36,36,36	0
6	K	A	802	1/1	0.98	0.04	36,36,36,36	0

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Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors($\text{\AA}^2$)	Q<0.9
5	CA	A	702	1/1	0.99	0.03	23,23,23,23	0
5	CA	A	700	1/1	0.99	0.02	18,18,18,18	0
5	CA	B	702	1/1	0.99	0.03	20,20,20,20	0
6	K	A	800	1/1	0.99	0.03	31,31,31,31	0
5	CA	A	701	1/1	0.99	0.02	24,24,24,24	0
5	CA	B	700	1/1	1.00	0.02	17,17,17,17	0

6.5 Other polymers [i](#)

There are no such residues in this entry.