



Full wwPDB X-ray Structure Validation Report ⓘ

Mar 8, 2026 – 03:00 PM UTC

PDB ID : 5D2D / pdb_00005d2d
Title : Crystal structure of human 14-3-3 zeta in complex with CFTR R-domain peptide pS753-pS768
Authors : Stevers, L.M.; Leysen, S.F.R.; Ottmann, C.
Deposited on : 2015-08-05
Resolution : 2.10 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

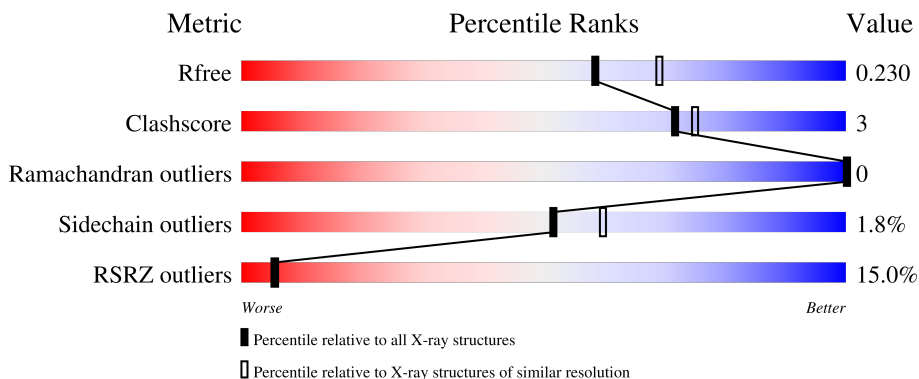
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.10 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	6658 (2.10-2.10)
Clashscore	190562	7164 (2.10-2.10)
Ramachandran outliers	187476	7099 (2.10-2.10)
Sidechain outliers	187428	7100 (2.10-2.10)
RSRZ outliers	180081	6662 (2.10-2.10)

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	230	
1	B	230	
2	C	28	
3	D	2	
3	E	2	

2 Entry composition

There are 5 unique types of molecules in this entry. The entry contains 4041 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.

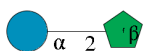
- Molecule 1 is a protein called 14-3-3 protein zeta/delta.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	229	1847	1159	309	368	11	0	9	0
1	B	226	1795	1127	299	360	9	0	4	0

- Molecule 2 is a protein called Cystic fibrosis transmembrane conductance regulator.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	N	O	P	S			
2	C	19	153	88	30	32	2	1	0	0	0

- Molecule 3 is an oligosaccharide called beta-D-fructofuranose-(2-1)-alpha-D-glucopyranose.



Mol	Chain	Residues	Atoms		ZeroOcc	AltConf	Trace
			Total	O			
3	D	2	23	11	0	0	0
3	E	2	23	11	0	0	0

- Molecule 4 is CHLORIDE ION (CCD ID: CL) (formula: Cl).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
			Total		
4	A	3	3	0	0
4	B	1	1	0	0

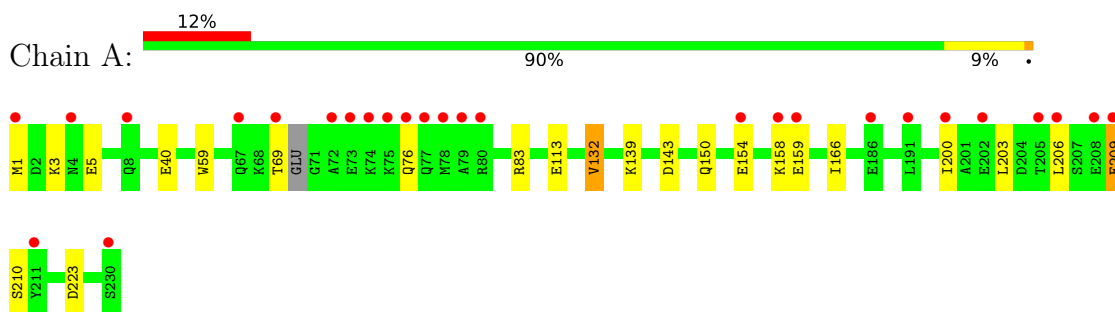
- Molecule 5 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
5	A	95	Total 95	O 95	0	0
5	B	85	Total 85	O 85	0	0
5	C	16	Total 16	O 16	0	0

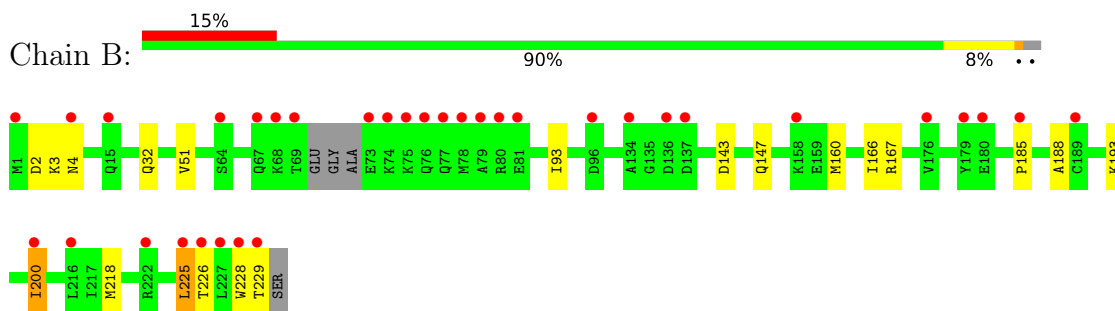
3 Residue-property plots [i](#)

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density ($RSRZ > 2$). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

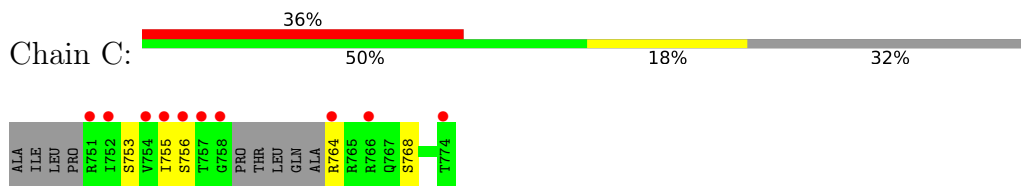
- Molecule 1: 14-3-3 protein zeta/delta



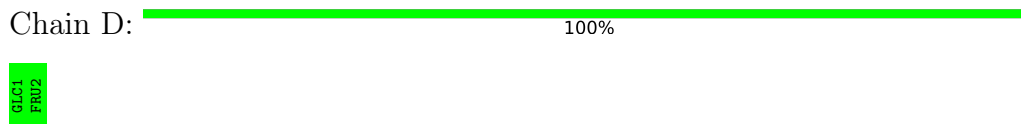
- Molecule 1: 14-3-3 protein zeta/delta



- Molecule 2: Cystic fibrosis transmembrane conductance regulator



- Molecule 3: beta-D-fructofuranose-(2-1)-alpha-D-glucopyranose



- Molecule 3: beta-D-fructofuranose-(2-1)-alpha-D-glucopyranose

Chain E:  100%

SELECT
FR02

4 Data and refinement statistics

Property	Value	Source
Space group	P 41 21 2	Depositor
Cell constants a, b, c, α , β , γ	112.86Å 112.86Å 158.19Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	48.09 – 2.10 48.09 – 2.10	Depositor EDS
% Data completeness (in resolution range)	100.0 (48.09-2.10) 95.8 (48.09-2.10)	Depositor EDS
R_{merge}	(Not available)	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.09 (at 2.10Å)	Xtrriage
Refinement program	PHENIX 1.8.4_1496	Depositor
R, R_{free}	0.193 , 0.220 0.208 , 0.230	Depositor DCC
R_{free} test set	3020 reflections (5.02%)	wwPDB-VP
Wilson B-factor (Å ²)	46.3	Xtrriage
Anisotropy	0.158	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.37 , 62.1	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	4041	wwPDB-VP
Average B, all atoms (Å ²)	56.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.84% 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: GLC, SEP, FRU, CL

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	0.54	0/1898	0.75	0/2556
1	B	0.49	0/1830	0.72	0/2467
2	C	0.49	0/129	0.69	0/167
All	All	0.52	0/3857	0.74	0/5190

There are no bond length outliers.

There are no bond angle outliers.

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	1847	0	1831	13	0
1	B	1795	0	1754	11	0
2	C	153	0	152	2	0
3	D	23	0	21	0	0
3	E	23	0	21	0	0
4	A	3	0	0	0	0
4	B	1	0	0	0	0
5	A	95	0	0	0	0
5	B	85	0	0	1	0
5	C	16	0	0	0	0
All	All	4041	0	3779	25	0

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

All (25) 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:A:223:ASP:O	2:C:764:ARG:NH2	2.14	0.81
1:B:193:LYS:HA	1:B:225:LEU:HD11	1.77	0.65
5:B:458:HOH:O	2:C:756:SER:HB3	1.99	0.62
1:A:158:LYS:NZ	1:A:159:GLU:OE2	2.31	0.60
1:B:226:THR:O	1:B:229[A]:THR:OG1	2.20	0.58
1:A:69:THR:O	1:A:76:GLN:NE2	2.39	0.54
1:B:2:ASP:OD1	1:B:4:ASN:N	2.44	0.51
1:A:59:TRP:CE2	1:A:132:VAL:HG22	2.48	0.48
1:A:209:GLU:H	1:A:209:GLU:CD	2.23	0.46
1:B:3:LYS:HB2	1:B:32:GLN:OE1	2.17	0.45
1:B:160:MET:HE1	1:B:166:ILE:HB	1.99	0.45
1:A:69:THR:C	1:A:76:GLN:HE21	2.23	0.44
1:A:1:MET:HE3	1:A:5:GLU:HB3	2.00	0.43
1:B:228:TRP:C	1:B:229[B]:THR:HG23	2.44	0.42
1:B:185:PRO:HA	1:B:188:ALA:HB3	2.01	0.42
1:A:150:GLN:O	1:A:154:GLU:HG2	2.19	0.42
1:B:200:ILE:HG13	1:B:218:MET:CE	2.49	0.42
1:A:203:LEU:HD12	1:A:203:LEU:HA	1.84	0.41
1:A:3:LYS:HD3	1:A:40:GLU:OE1	2.19	0.41
1:B:51:VAL:HG12	1:B:93:ILE:HD13	2.03	0.41
1:B:143:ASP:O	1:B:147:GLN:HG3	2.21	0.41
1:A:206:LEU:HD22	1:A:210:SER:HB3	2.03	0.40
1:B:160:MET:HE2	1:B:167:ARG:HB2	2.03	0.40
1:A:113:GLU:HG3	1:A:166:ILE:HD12	2.03	0.40
1:A:139:LYS:NZ	1:A:143:ASP:OD1	2.49	0.40

There are no symmetry-related clashes.

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

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

The Analysed column shows the number of residues for which the backbone conformation was

analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	235/230 (102%)	232 (99%)	3 (1%)	0	100	100
1	B	226/230 (98%)	222 (98%)	4 (2%)	0	100	100
2	C	13/28 (46%)	13 (100%)	0	0	100	100
All	All	474/488 (97%)	467 (98%)	7 (2%)	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	201/200 (100%)	197 (98%)	4 (2%)	48	56
1	B	192/200 (96%)	190 (99%)	2 (1%)	68	76
2	C	15/23 (65%)	14 (93%)	1 (7%)	15	12
All	All	408/423 (96%)	401 (98%)	7 (2%)	51	62

All (7) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	83	ARG
1	A	132	VAL
1	A	200	ILE
1	A	209	GLU
1	B	200	ILE
1	B	225	LEU
2	C	755	ILE

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (2) such sidechains are listed below:

Mol	Chain	Res	Type
1	B	15	GLN
1	B	150	GLN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

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	SEP	C	768	2	8,9,10	1.24	1 (12%)	7,12,14	0.80	0
2	SEP	C	753	2	8,9,10	1.58	1 (12%)	7,12,14	1.26	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
2	SEP	C	768	2	-	0/6/8/10	-
2	SEP	C	753	2	-	0/6/8/10	-

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
2	C	753	SEP	P-O1P	3.23	1.60	1.50
2	C	768	SEP	P-O1P	2.24	1.57	1.50

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	753	SEP	OG-CB-CA	2.19	110.28	108.14

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

No monomer is involved in short contacts.

5.5 Carbohydrates

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	GLC	D	1	3	11,11,12	0.34	0	15,15,17	0.34	0
3	FRU	D	2	3	11,12,12	0.48	0	10,18,18	0.49	0
3	GLC	E	1	3	11,11,12	0.34	0	15,15,17	0.52	0
3	FRU	E	2	3	11,12,12	0.54	0	10,18,18	0.54	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	GLC	D	1	3	-	0/2/19/22	0/1/1/1
3	FRU	D	2	3	-	0/5/24/24	0/1/1/1
3	GLC	E	1	3	-	0/2/19/22	0/1/1/1
3	FRU	E	2	3	-	0/5/24/24	0/1/1/1

There are no bond length outliers.

There are no bond angle outliers.

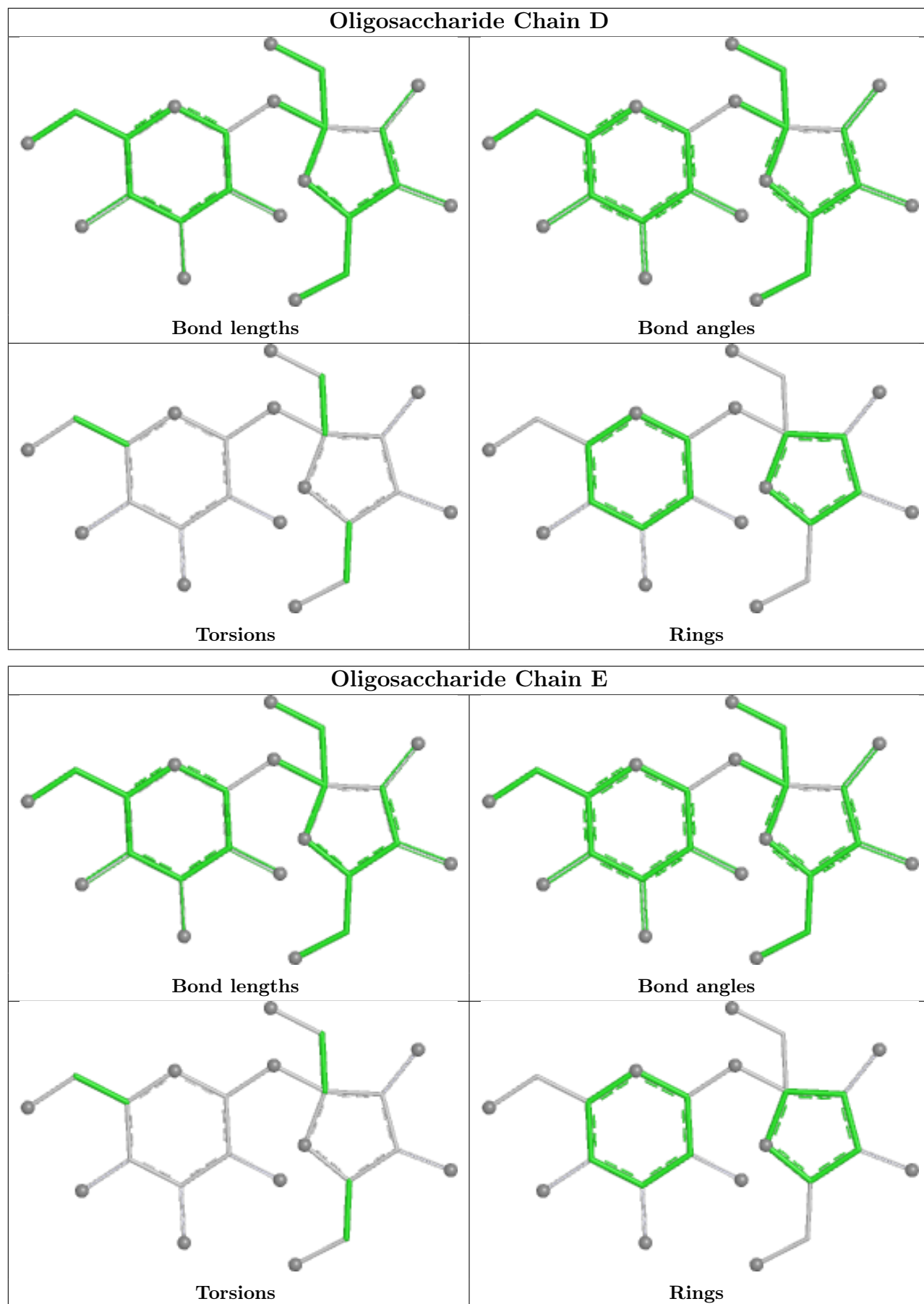
There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

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](#)

Of 4 ligands modelled in this entry, 4 are monoatomic - leaving 0 for Mogul analysis.

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.

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](#)

The following chains have linkage breaks:

Mol	Chain	Number of breaks
1	B	1

All chain breaks are listed below:

Model	Chain	Residue-1	Atom-1	Residue-2	Atom-2	Distance (Å)
1	B	228:TRP	C	229[B]:THR	N	3.90

6 Fit of model and data [i](#)

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

In the following table, the column labelled ‘#RSRZ > 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q < 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	229/230 (99%)	0.55	27 (11%) 9 9	24, 48, 89, 108	9 (3%)
1	B	226/230 (98%)	0.98	34 (15%) 5 5	21, 54, 91, 112	4 (1%)
2	C	17/28 (60%)	2.24	10 (58%) 0 0	36, 65, 92, 95	0
All	All	472/488 (96%)	0.82	71 (15%) 5 5	21, 51, 91, 112	13 (2%)

All (71) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	229[A]	THR	15.4
1	B	76	GLN	5.3
1	B	69	THR	5.2
1	B	75	LYS	5.0
1	B	227	LEU	5.0
1	B	228	TRP	4.9
2	C	752	ILE	4.7
2	C	755	ILE	4.6
1	B	179	TYR	4.5
2	C	757	THR	4.5
1	A	205	THR	4.3
2	C	751	ARG	4.3
2	C	774	THR	4.0
1	B	78	MET	4.0
1	B	185	PRO	3.9
1	B	1	MET	3.9
1	B	80	ARG	3.9
1	A	200	ILE	3.8
1	A	75	LYS	3.7
1	A	78[A]	MET	3.7
1	A	73	GLU	3.4
1	A	77	GLN	3.4
1	A	186	GLU	3.4

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Mol	Chain	Res	Type	RSRZ
1	B	225	LEU	3.4
1	B	226	THR	3.3
1	B	68	LYS	3.3
2	C	756	SER	3.3
2	C	764	ARG	3.2
1	A	208	GLU	3.2
1	A	230	SER	3.1
1	B	79	ALA	3.1
1	B	136	ASP	3.1
1	B	73	GLU	3.1
1	A	72	ALA	3.1
1	B	222	ARG	3.1
2	C	754	VAL	3.1
1	B	176	VAL	2.9
1	A	69	THR	2.9
1	A	209	GLU	2.9
1	A	158	LYS	2.9
1	A	206	LEU	2.8
1	B	216	LEU	2.8
1	B	64	SER	2.8
2	C	758	GLY	2.8
1	A	211	TYR	2.8
1	A	191	LEU	2.7
1	B	134	ALA	2.6
1	B	77	GLN	2.6
1	B	81	GLU	2.6
1	A	8	GLN	2.6
1	B	158	LYS	2.5
1	B	4	ASN	2.5
1	A	1	MET	2.4
1	A	80[A]	ARG	2.4
1	B	96	ASP	2.3
1	A	67	GLN	2.3
1	B	67	GLN	2.3
1	B	200	ILE	2.3
2	C	766	ARG	2.3
1	A	74	LYS	2.3
1	B	74	LYS	2.3
1	A	79	ALA	2.2
1	A	4	ASN	2.2
1	B	180	GLU	2.1
1	A	76	GLN	2.1

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Mol	Chain	Res	Type	RSRZ
1	A	159	GLU	2.1
1	B	15	GLN	2.1
1	A	202	GLU	2.1
1	B	137	ASP	2.1
1	B	189	CYS	2.0
1	A	154	GLU	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(Å ²)	Q<0.9
2	SEP	C	753	10/11	0.96	0.11	49,56,71,71	0
2	SEP	C	768	10/11	0.99	0.04	34,37,39,40	0

6.3 Carbohydrates [i](#)

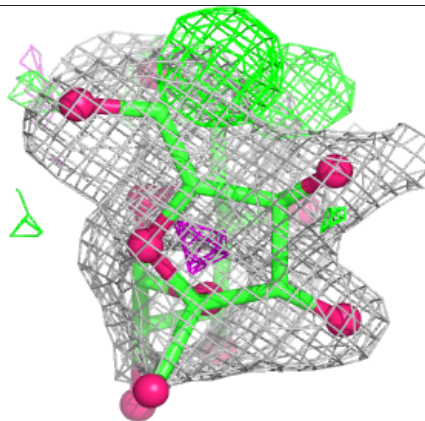
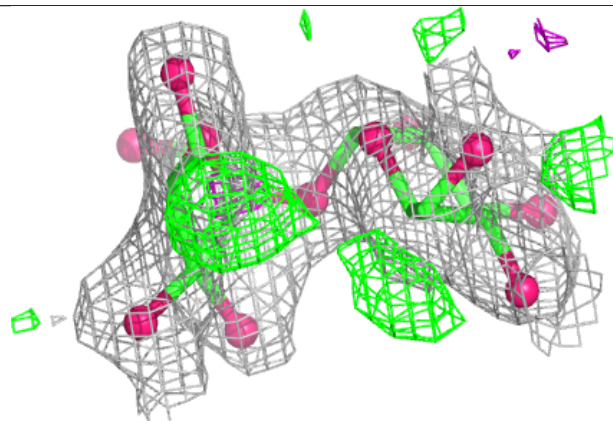
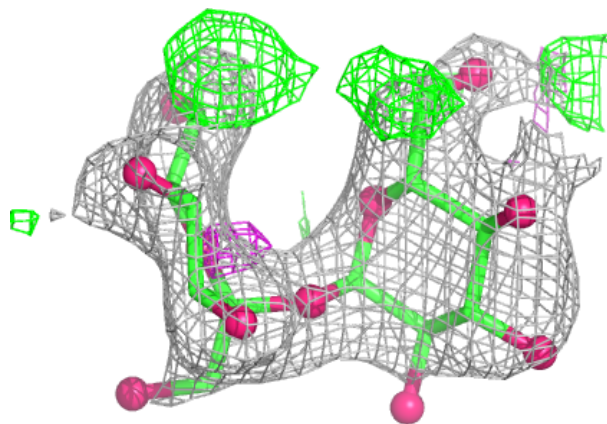
In the following table, the Atoms column lists the number of modelled atoms in the group and the number defined in the chemical component dictionary. The B-factors column lists the minimum, median, 95th percentile and maximum values of B factors of atoms in the group. The column labelled 'Q< 0.9' lists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

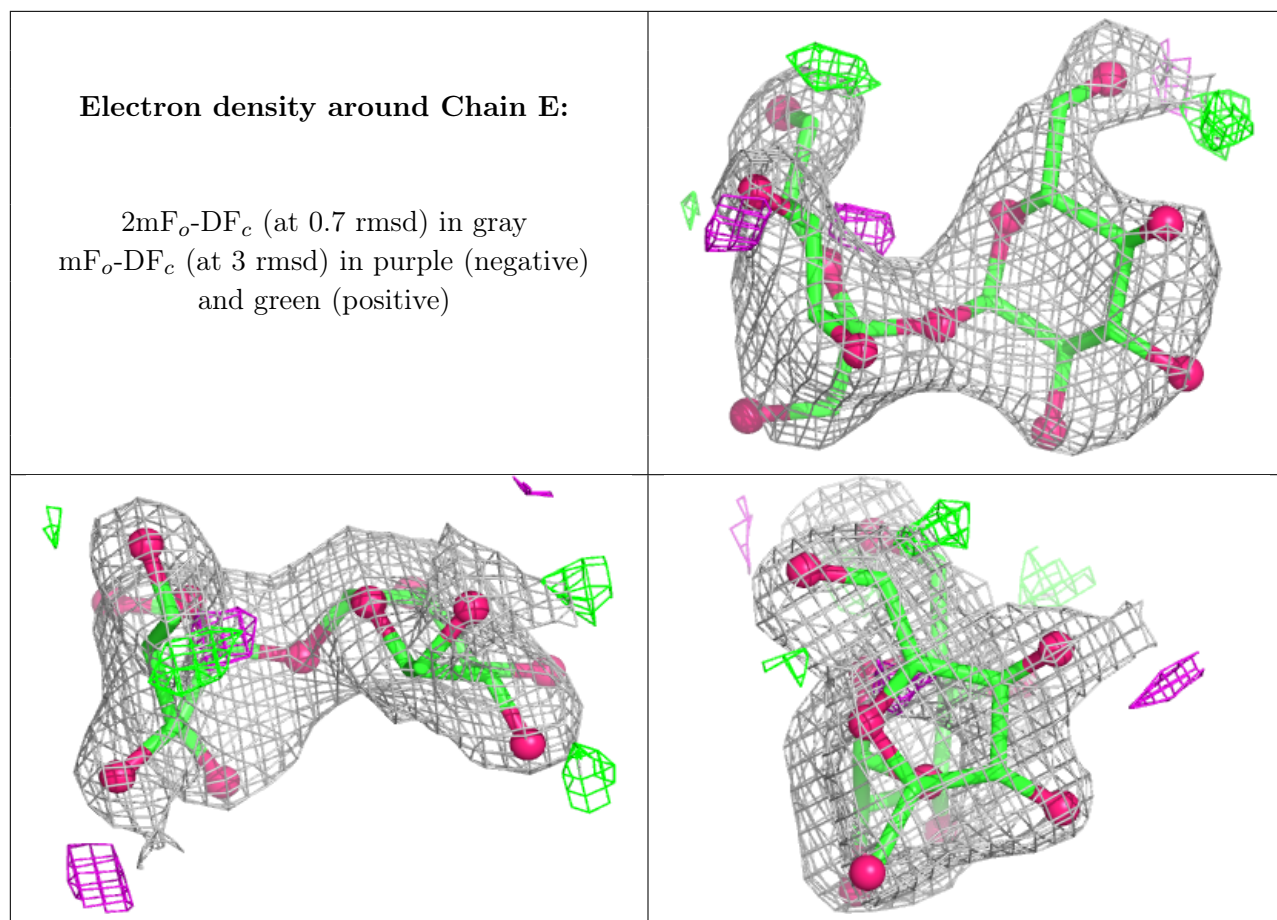
Mol	Type	Chain	Res	Atoms	RSCC	RSR	B-factors(Å ²)	Q<0.9
3	GLC	D	1	11/12	0.78	0.18	58,67,72,73	11
3	FRU	D	2	12/12	0.83	0.16	46,63,72,76	12
3	GLC	E	1	11/12	0.83	0.18	60,71,79,80	11
3	FRU	E	2	12/12	0.84	0.16	53,71,78,78	12

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 D:

$2mF_o-DF_c$ (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
4	CL	A	302	1/1	0.82	0.21	81,81,81,81	0
4	CL	B	302	1/1	0.85	0.14	80,80,80,80	0
4	CL	A	304	1/1	0.93	0.37	85,85,85,85	0
4	CL	A	303	1/1	0.96	0.12	73,73,73,73	0

6.5 Other polymers [i](#)

There are no such residues in this entry.