Full wwPDB X-ray Structure Validation Report ⓘ

Jan 13, 2024 – 11:38 pm GMT

PDB ID	:	6ZFN
Title	:	Structure of an inactive E404Q variant of the catalytic domain of human endo -alpha-mannosidase MANEA in complex with 1-methyl alpha-1,2-mannobiose
Authors	:	Sobala, L.F.; Fernandes, P.Z.; Hakki, Z.; Thompson, A.J.; Howe, J.D.; Hill, M.; Zitzmann, N.; Davies, S.; Stamataki, Z.; Butters, T.D.; Alonzi, D.S.; Williams, S.J.; Davies, G.J.
Deposited on	:	2020-06-17
Resolution	:	1.10 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:

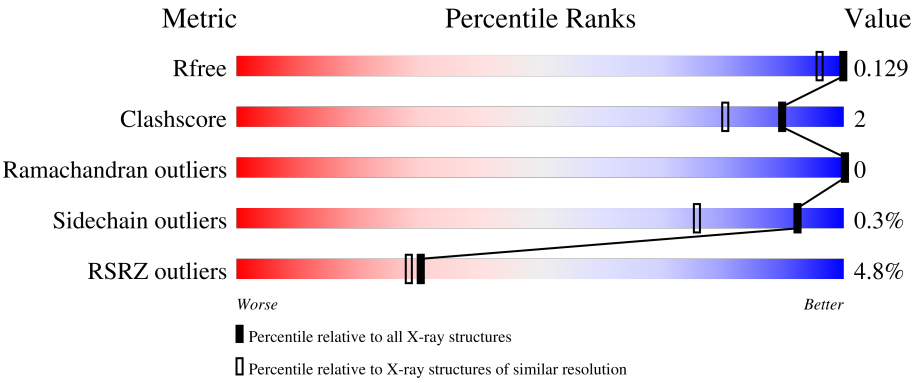
MolProbity	:	4.02b-467
Mogul	:	1.8.4, CSD as541be (2020)
Xtriage (Phenix)	:	1.13
EDS	:	2.36
Percentile statistics	:	20191225.v01 (using entries in the PDB archive December 25th 2019)
Refmac	:	5.8.0158
CCP4	:	7.0.044 (Gargrove)
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.36

1 Overall quality at a glance (i)

The following experimental techniques were used to determine the structure:
X-RAY DIFFRACTION

The reported resolution of this entry is 1.10 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}	130704	1619 (1.14-1.06)
Clashscore	141614	1671 (1.14-1.06)
Ramachandran outliers	138981	1615 (1.14-1.06)
Sidechain outliers	138945	1613 (1.14-1.06)
RSRZ outliers	127900	1588 (1.14-1.06)

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 <=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	AAA	382	4% 87% 5% 7%
2	A	2	50% 50%

2 Entry composition (i)

There are 4 unique types of molecules in this entry. The entry contains 3740 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.

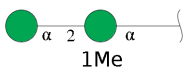
- Molecule 1 is a protein called Glycoprotein endo-alpha-1,2-mannosidase.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	AAA	354	Total	C	N	O	S	0	49	0
			3220	2100	540	571	9			

There are 18 discrepancies between the modelled and reference sequences:

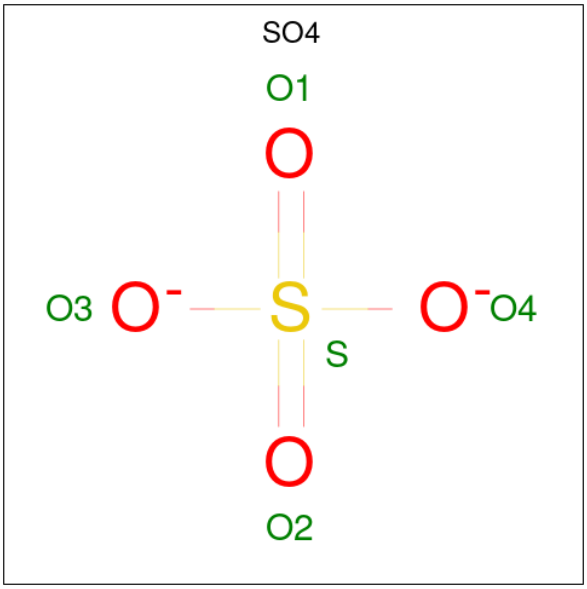
Chain	Residue	Modelled	Actual	Comment	Reference
AAA	81	MET	-	initiating methionine	UNP Q5SRI9
AAA	82	ASN	-	expression tag	UNP Q5SRI9
AAA	83	HIS	-	expression tag	UNP Q5SRI9
AAA	84	LYS	-	expression tag	UNP Q5SRI9
AAA	85	VAL	-	expression tag	UNP Q5SRI9
AAA	86	HIS	-	expression tag	UNP Q5SRI9
AAA	87	HIS	-	expression tag	UNP Q5SRI9
AAA	88	HIS	-	expression tag	UNP Q5SRI9
AAA	89	HIS	-	expression tag	UNP Q5SRI9
AAA	90	HIS	-	expression tag	UNP Q5SRI9
AAA	91	HIS	-	expression tag	UNP Q5SRI9
AAA	92	ILE	-	expression tag	UNP Q5SRI9
AAA	93	GLU	-	expression tag	UNP Q5SRI9
AAA	94	GLY	-	expression tag	UNP Q5SRI9
AAA	95	ARG	-	expression tag	UNP Q5SRI9
AAA	96	HIS	-	expression tag	UNP Q5SRI9
AAA	97	MET	-	expression tag	UNP Q5SRI9
AAA	404	GLN	GLU	engineered mutation	UNP Q5SRI9

- Molecule 2 is an oligosaccharide called alpha-D-mannopyranose-(1-2)-methyl alpha-D-mann opyranoside.



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf	Trace
2	A	2	Total C O 24 13 11	0	2	0

- Molecule 3 is SULFATE ION (three-letter code: SO4) (formula: O_4S).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	AAA	1	Total O S 5 4 1	0	0

- Molecule 4 is water.

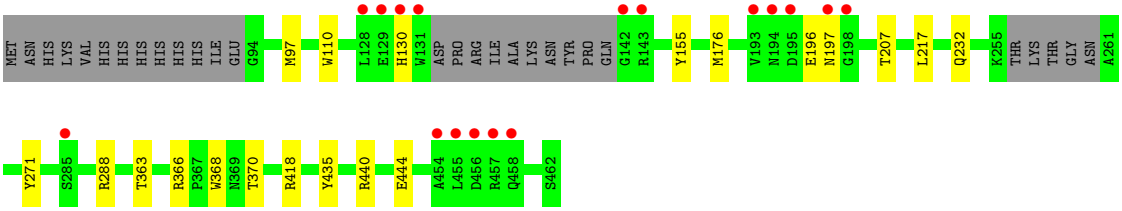
Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	AAA	478	Total O 491 491	0	42

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: Glycoprotein endo-alpha-1,2-mannosidase

Chain AAA:



• Molecule 2: alpha-D-mannopyranose-(1-2)-methyl alpha-D-mannopyranoside

Chain A:

4 Data and refinement statistics (i)

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α, β, γ	42.75Å 81.68Å 52.99Å 90.00° 92.93° 90.00°	Depositor
Resolution (Å)	52.92 – 1.10 52.92 – 1.10	Depositor EDS
% Data completeness (in resolution range)	97.5 (52.92-1.10) 97.6 (52.92-1.10)	Depositor EDS
R_{merge}	0.05	Depositor
R_{sym}	(Not available)	Depositor
$< I/\sigma(I) >$ [1]	3.00 (at 1.10Å)	Xtriage
Refinement program	REFMAC 5.8.0258	Depositor
R, R_{free}	0.106 , 0.128 0.107 , 0.129	Depositor DCC
R_{free} test set	7225 reflections (5.04%)	wwPDB-VP
Wilson B-factor (Å^2)	10.6	Xtriage
Anisotropy	0.249	Xtriage
Bulk solvent k_{sol}(e/Å^3), B_{sol}(Å^2)	0.36 , 49.8	EDS
L-test for twinning[2]	$< \|L\| > = 0.49$, $< L^2 > = 0.32$	Xtriage
Estimated twinning fraction	0.026 for h,-k,-l	Xtriage
F_o,F_c correlation	0.98	EDS
Total number of atoms	3740	wwPDB-VP
Average B, all atoms (Å^2)	16.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 5.86% of the height of the origin peak. No significant pseudotranslation is detected.*

[1] Intensities estimated from amplitudes.

[2] Theoretical values of $< |L| >$, $< L^2 >$ 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: MAN, MMA, SO4

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	AAA	6.65	2/3462 (0.1%)	0.91	7/4698 (0.1%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand.A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	AAA	0	1

All (2) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	AAA	197[A]	ASN	CB-CG	274.90	7.83	1.51
1	AAA	197[B]	ASN	CB-CG	274.90	7.83	1.51

All (7) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
1	AAA	366	ARG	NE-CZ-NH1	9.74	125.17	120.30
1	AAA	197[A]	ASN	CB-CG-ND2	-7.24	99.33	116.70
1	AAA	197[B]	ASN	CB-CG-ND2	-7.24	99.33	116.70
1	AAA	366	ARG	NE-CZ-NH2	-6.98	116.81	120.30
1	AAA	197[A]	ASN	N-CA-C	6.00	127.19	111.00
1	AAA	197[B]	ASN	N-CA-C	6.00	127.19	111.00
1	AAA	155	TYR	CB-CG-CD2	5.01	124.01	121.00

There are no chirality outliers.

All (1) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	AAA	435	TYR	Sidechain

5.2 Too-close contacts (i)

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	AAA	3220	0	3233	12	1
2	A	24	0	23	0	0
3	AAA	5	0	0	0	0
4	AAA	491	0	0	6	1
All	All	3740	0	3256	12	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 2.

All (12) 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:AAA:97[B]:MET:SD	1:AAA:444:GLU:OE2	2.29	0.91
1:AAA:363[A]:THR:HG21	1:AAA:370:THR:HG22	1.61	0.80
1:AAA:232[B]:GLN:HG2	1:AAA:288[B]:ARG:NE	2.03	0.74
1:AAA:97[C]:MET:CE	4:AAA:703:HOH:O	2.46	0.63
1:AAA:97[C]:MET:HE2	4:AAA:703:HOH:O	2.05	0.54
1:AAA:176[B]:MET:HB3	1:AAA:217[B]:LEU:HD21	1.89	0.53
1:AAA:130[B]:HIS:HB3	1:AAA:368:TRP:CG	2.46	0.51
1:AAA:271[B]:TYR:HB3	4:AAA:969[B]:HOH:O	2.11	0.50
1:AAA:207[B]:THR:HG21	4:AAA:635:HOH:O	2.14	0.47
1:AAA:97[C]:MET:HE3	4:AAA:703:HOH:O	2.13	0.45
1:AAA:418[B]:ARG:HG3	4:AAA:986:HOH:O	2.19	0.42
1:AAA:440[B]:ARG:HE	1:AAA:440[B]:ARG:HB3	1.57	0.41

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)
1:AAA:196[B]:GLU:OE2	4:AAA:867:HOH:O[1_455]	2.18	0.02

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	AAA	400/382 (105%)	391 (98%)	9 (2%)	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	AAA	366/345 (106%)	365 (100%)	1 (0%)	92 76

All (1) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	AAA	110	TRP

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. There are no such sidechains identified.

5.3.3 RNA

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates (i)

2 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	MMA	A	1[A]	2	13,13,13	0.70	0	18,18,18	1.01	0
2	MAN	A	2[A]	2	11,11,12	0.54	0	15,15,17	1.13	2 (13%)

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	MMA	A	1[A]	2	-	0/4/24/24	0/1/1/1
2	MAN	A	2[A]	2	-	0/2/19/22	0/1/1/1

There are no bond length outliers.

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(^{o})	Ideal(^{o})
2	A	2[A]	MAN	C1-O5-C5	2.44	115.50	112.19
2	A	2[A]	MAN	O5-C5-C6	2.20	110.65	107.20

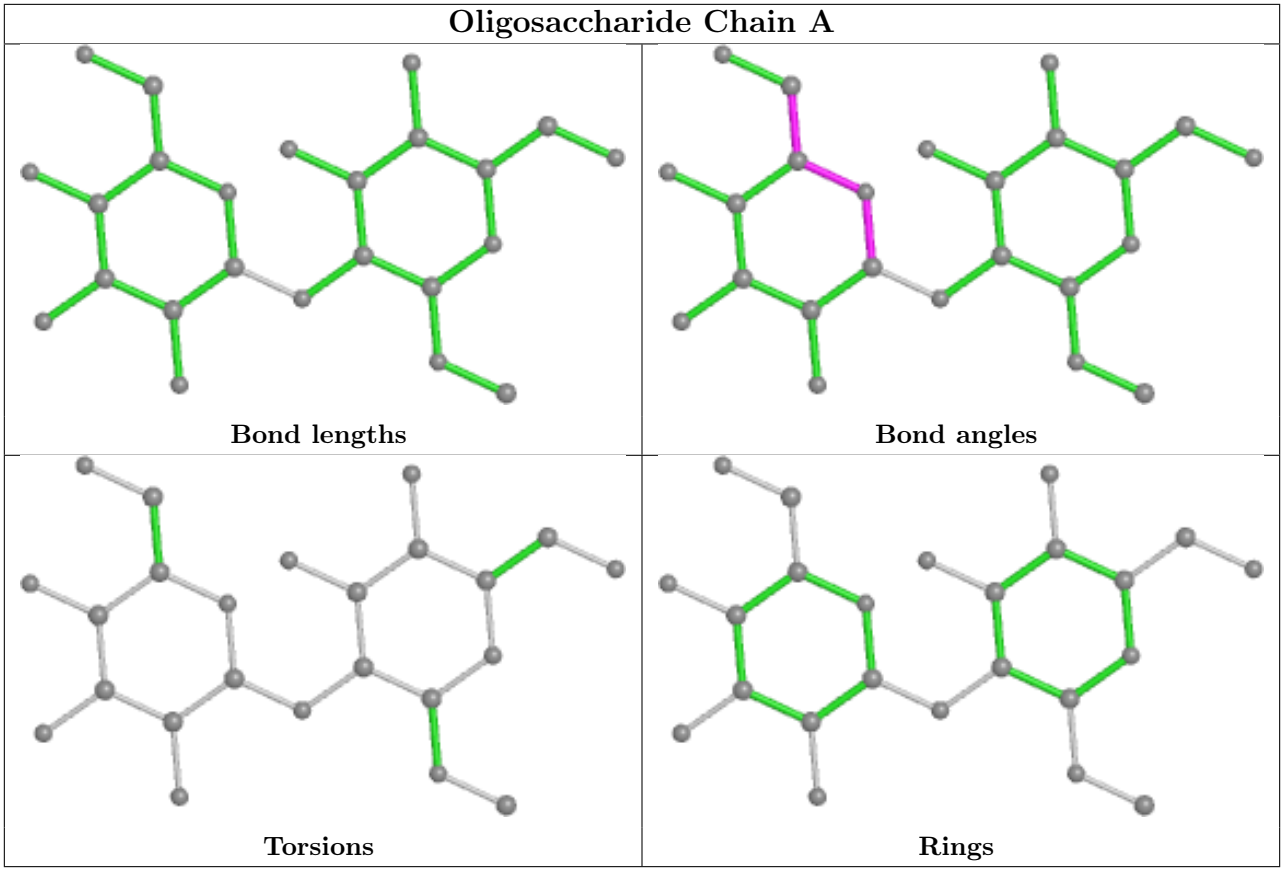
There are no chirality outliers.

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)

1 ligand is 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	SO4	AAA	501	-	4,4,4	0.24	0	6,6,6	0.80	0

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)

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, 95^{th} 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	AAA	354/382 (92%)	0.04	17 (4%) 30 28	6, 12, 31, 48	2 (0%)

All (17) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	AAA	455	LEU	10.9
1	AAA	456	ASP	6.3
1	AAA	131	TRP	6.0
1	AAA	457[A]	ARG	4.3
1	AAA	454	ALA	3.8
1	AAA	195[A]	ASP	3.6
1	AAA	142	GLY	3.6
1	AAA	130[A]	HIS	3.4
1	AAA	194[A]	ASN	3.3
1	AAA	458	GLN	3.0
1	AAA	129	GLU	2.7
1	AAA	128	LEU	2.7
1	AAA	198[A]	GLY	2.6
1	AAA	197[A]	ASN	2.6
1	AAA	285	SER	2.4
1	AAA	193	VAL	2.2
1	AAA	143	ARG	2.1

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

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

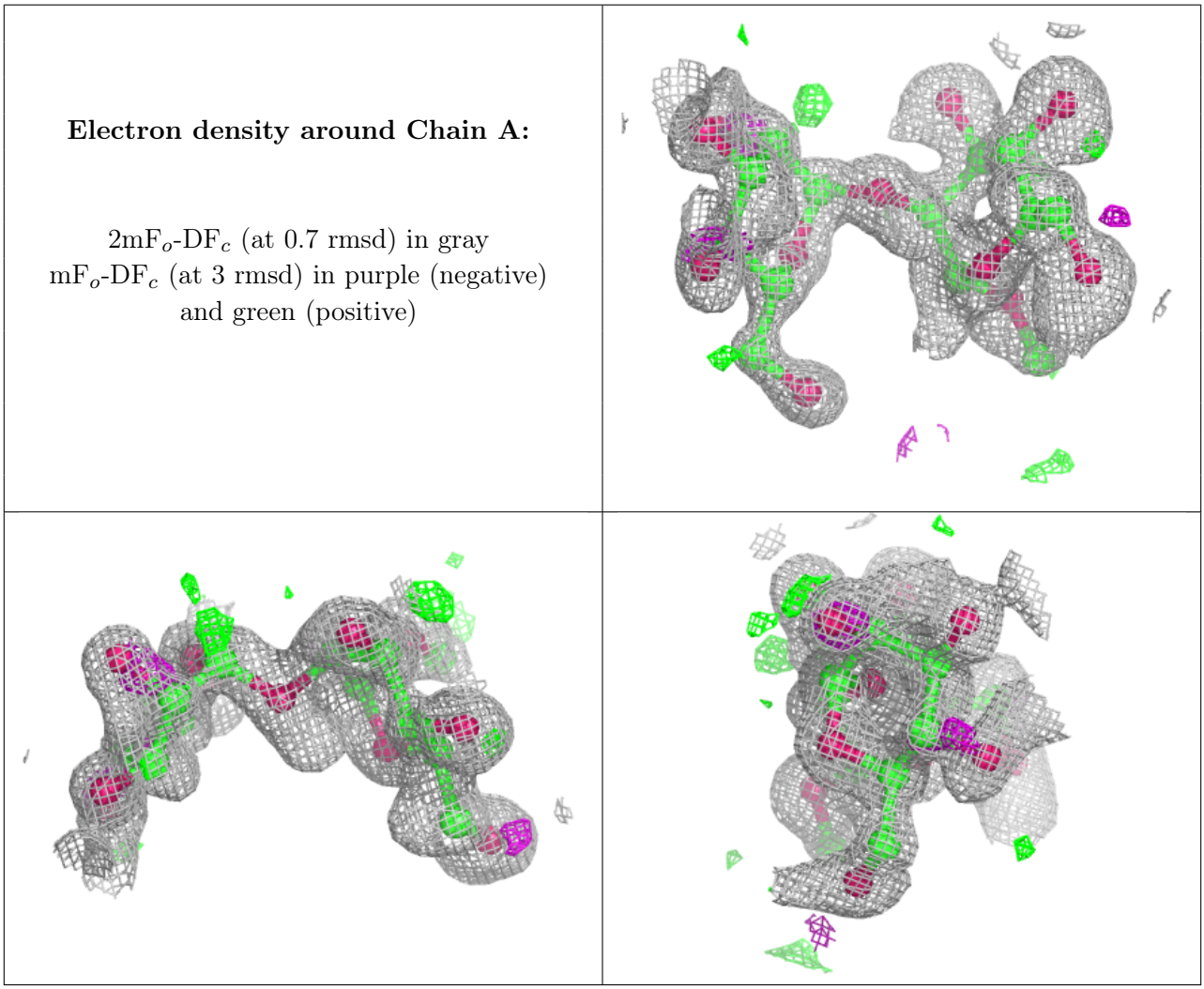
6.3 Carbohydrates

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, 95^{th} 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	MMA	A	1[A]	13/13	0.91	0.12	15,16,21,23	13
2	MAN	A	2[A]	11/12	0.92	0.23	16,18,22,25	11

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.



6.4 Ligands

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, 95^{th} 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	SO4	AAA	501	5/5	0.99	0.07	16,18,22,23	0

6.5 Other polymers (i)

There are no such residues in this entry.