



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 20, 2026 – 08:39 AM UTC

PDB ID : 7E7E / pdb_00007e7e
Title : The co-crystal structure of ACE2 with Fab
Authors : Xiao, J.Y.; Zhang, Y.
Deposited on : 2021-02-26
Resolution : 3.80 Å(reported)

This is a wwPDB X-ray Structure Validation Summary 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
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

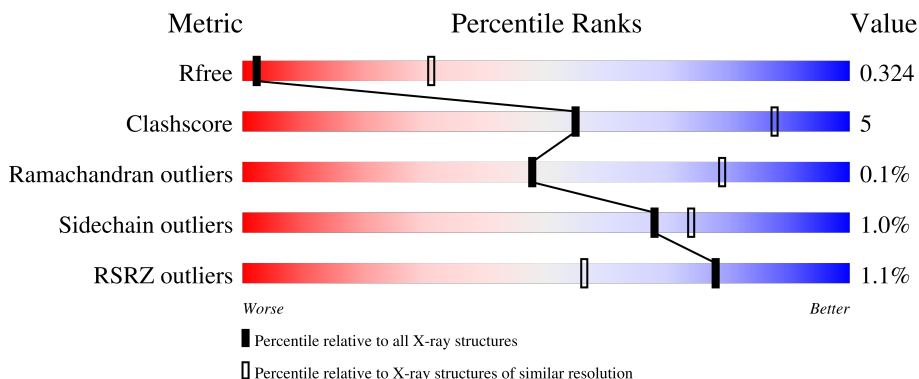
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION


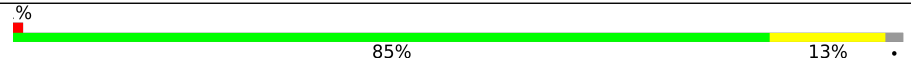
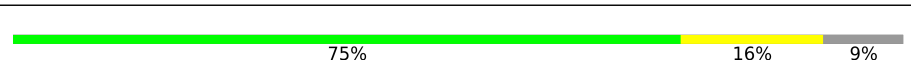
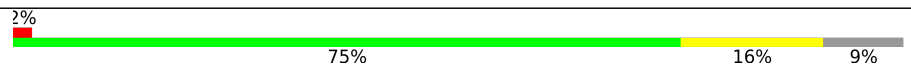
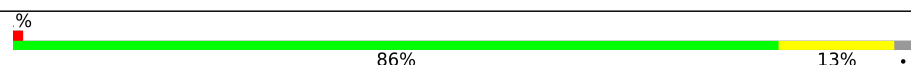
The reported resolution of this entry is 3.80 Å.

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.



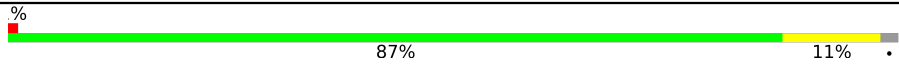
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	180053	1065 (3.96-3.64)
Clashscore	190562	1012 (3.94-3.66)
Ramachandran outliers	187476	1048 (3.96-3.64)
Sidechain outliers	187428	1043 (3.96-3.64)
RSRZ outliers	180081	1064 (3.96-3.64)

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	606	 2% 83% 13%
1	B	606	 2% 85% 13%
2	C	228	 75% 16% 9%
2	H	228	 2% 75% 16% 9%
3	D	214	 2% 86% 13%

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Mol	Chain	Length	Quality of chain
3	L	214	 <p>A horizontal bar chart representing the quality of chain. The bar is primarily green, indicating a high quality score of 87%. A small yellow segment at the end indicates a lower quality score of 11%. A small red square is visible at the very beginning of the bar. The percentage values '87%' and '11%' are printed below the bar.</p>

2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 16055 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 Processed angiotensin-converting enzyme 2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	588	Total	C	N	O	S	0	0	0
			4798	3071	796	902	29			
1	B	592	Total	C	N	O	S	0	0	0
			4828	3089	800	910	29			

There are 16 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	616	HIS	-	expression tag	UNP Q9BYF1
A	617	HIS	-	expression tag	UNP Q9BYF1
A	618	HIS	-	expression tag	UNP Q9BYF1
A	619	HIS	-	expression tag	UNP Q9BYF1
A	620	HIS	-	expression tag	UNP Q9BYF1
A	621	HIS	-	expression tag	UNP Q9BYF1
A	622	HIS	-	expression tag	UNP Q9BYF1
A	623	HIS	-	expression tag	UNP Q9BYF1
B	616	HIS	-	expression tag	UNP Q9BYF1
B	617	HIS	-	expression tag	UNP Q9BYF1
B	618	HIS	-	expression tag	UNP Q9BYF1
B	619	HIS	-	expression tag	UNP Q9BYF1
B	620	HIS	-	expression tag	UNP Q9BYF1
B	621	HIS	-	expression tag	UNP Q9BYF1
B	622	HIS	-	expression tag	UNP Q9BYF1
B	623	HIS	-	expression tag	UNP Q9BYF1

- Molecule 2 is a protein called h11B11-Fab.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	H	208	Total	C	N	O	S	0	0	0
			1585	1001	267	309	8			
2	C	208	Total	C	N	O	S	0	0	0
			1584	1001	267	308	8			

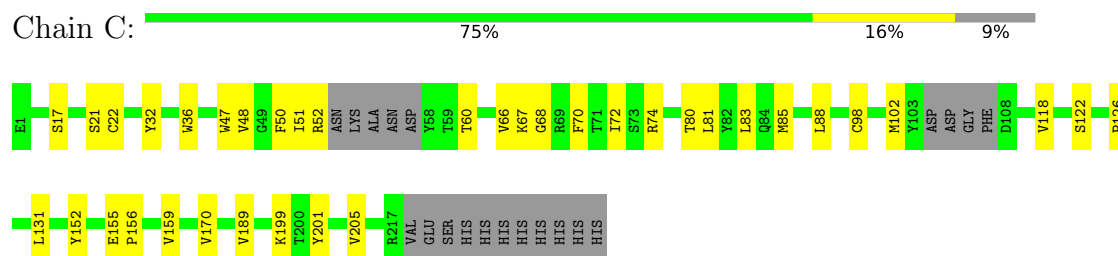
- Molecule 3 is a protein called h11B11-Fab.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	L	210	Total 1629	C 1021	N 274	O 328	S 6	0	0	0
3	D	210	Total 1629	C 1021	N 274	O 328	S 6	0	0	0

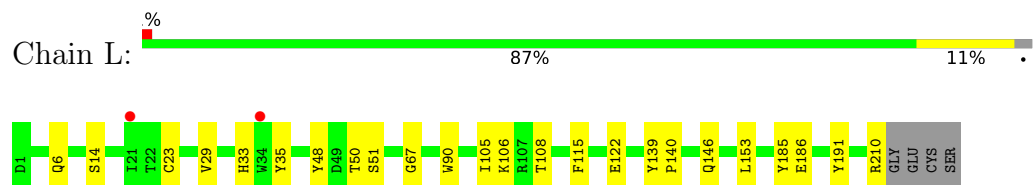
- Molecule 4 is ZINC ION (CCD ID: ZN) (formula: Zn) (labeled as "Ligand of Interest" by depositor).

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

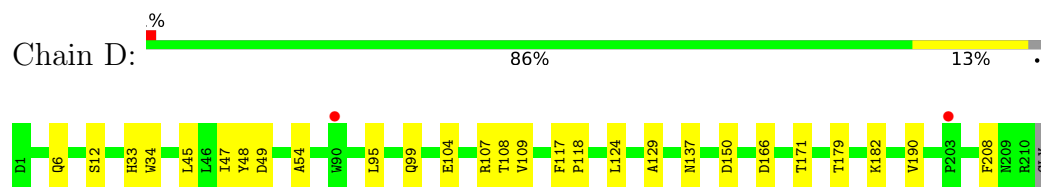
- Molecule 2: h11B11-Fab



- Molecule 3: h11B11-Fab



- Molecule 3: h11B11-Fab



4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, α , β , γ	98.78Å 115.46Å 224.67Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	49.84 – 3.80 49.84 – 3.80	Depositor EDS
% Data completeness (in resolution range)	99.1 (49.84-3.80) 99.1 (49.84-3.80)	Depositor EDS
R_{merge}	0.41	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	2.14 (at 3.77Å)	Xtrriage
Refinement program	PHENIX 1.19.1_4122	Depositor
R, R_{free}	0.276 , 0.327 0.277 , 0.324	Depositor DCC
R_{free} test set	1284 reflections (4.93%)	wwPDB-VP
Wilson B-factor (Å ²)	95.0	Xtrriage
Anisotropy	1.024	Xtrriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 127.7	EDS
L-test for twinning ²	$\langle L \rangle = 0.40$, $\langle L^2 \rangle = 0.23$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
F_o, F_c correlation	0.87	EDS
Total number of atoms	16055	wwPDB-VP
Average B, all atoms (Å ²)	118.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.76% 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:
ZN

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	0.16	0/4933	0.44	5/6701 (0.1%)
1	B	0.19	0/4963	0.39	0/6742
2	C	0.19	0/1621	0.44	0/2204
2	H	0.21	0/1622	0.47	2/2205 (0.1%)
3	D	0.18	0/1666	0.44	0/2262
3	L	0.19	0/1666	0.47	2/2262 (0.1%)
All	All	0.18	0/16471	0.43	9/22376 (0.0%)

There are no bond length outliers.

The worst 5 of 9 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	103	ASN	N-CA-C	9.70	122.76	108.60
1	A	107	VAL	N-CA-C	7.94	118.72	110.62
1	A	102	GLN	N-CA-C	-5.93	101.26	110.10
2	H	120	SER	N-CA-C	5.73	117.52	111.28
3	L	90	TRP	CA-C-N	-5.37	111.29	121.54

There are no chirality outliers.

There are no planarity outliers.

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	A	4798	0	4585	47	0
1	B	4828	0	4614	38	0
2	C	1584	0	1540	22	0
2	H	1585	0	1545	22	0
3	D	1629	0	1589	15	0
3	L	1629	0	1591	13	0
4	A	1	0	0	0	0
4	B	1	0	0	0	0
All	All	16055	0	15464	151	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 5.

The worst 5 of 151 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)
3:D:6:GLN:NE2	3:D:99:GLN:O	2.19	0.74
1:A:261:CYS:HB2	1:A:488:VAL:HG13	1.70	0.73
3:L:33:HIS:ND1	3:L:48:TYR:O	2.22	0.72
1:B:261:CYS:HB2	1:B:488:VAL:HG13	1.75	0.67
1:A:438:PHE:HD2	1:A:540:HIS:HE1	1.42	0.67

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	584/606 (96%)	568 (97%)	16 (3%)	0	100 100
1	B	588/606 (97%)	569 (97%)	17 (3%)	2 (0%)	36 67
2	C	202/228 (89%)	199 (98%)	3 (2%)	0	100 100
2	H	202/228 (89%)	195 (96%)	7 (4%)	0	100 100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
3	D	208/214 (97%)	201 (97%)	7 (3%)	0	100	100
3	L	208/214 (97%)	203 (98%)	5 (2%)	0	100	100
All	All	1992/2096 (95%)	1935 (97%)	55 (3%)	2 (0%)	48	79

All (2) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	301	ALA
1	B	364	VAL

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	519/536 (97%)	517 (100%)	2 (0%)	84	83
1	B	523/536 (98%)	518 (99%)	5 (1%)	68	74
2	C	177/196 (90%)	175 (99%)	2 (1%)	65	73
2	H	178/196 (91%)	175 (98%)	3 (2%)	53	67
3	D	187/190 (98%)	184 (98%)	3 (2%)	55	68
3	L	187/190 (98%)	185 (99%)	2 (1%)	65	73
All	All	1771/1844 (96%)	1754 (99%)	17 (1%)	68	74

5 of 17 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
3	D	107	ARG
3	D	109	VAL
1	B	101	GLN
1	B	109	SER
1	B	110	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 15 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	96	GLN
2	C	112	GLN
1	B	102	GLN
3	D	78	GLN
1	B	322	ASN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

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

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

Of 2 ligands modelled in this entry, 2 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](#)

There are no chain breaks in this entry.

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	588/606 (97%)	0.06	5 (0%) 81 60	72, 103, 159, 221	0
1	B	592/606 (97%)	0.10	9 (1%) 72 50	80, 113, 174, 263	0
2	C	208/228 (91%)	0.03	0 100 100	81, 119, 198, 283	0
2	H	208/228 (91%)	0.05	5 (2%) 59 41	85, 114, 161, 211	0
3	D	210/214 (98%)	0.07	2 (0%) 79 58	86, 126, 161, 204	0
3	L	210/214 (98%)	0.10	2 (0%) 79 58	101, 124, 171, 230	0
All	All	2016/2096 (96%)	0.07	23 (1%) 78 56	72, 114, 171, 283	0

The worst 5 of 23 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	349	TRP	5.0
1	B	51	ASN	4.1
2	H	29	PHE	4.0
1	B	359	LEU	3.6
1	A	263	PRO	3.5

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](#)

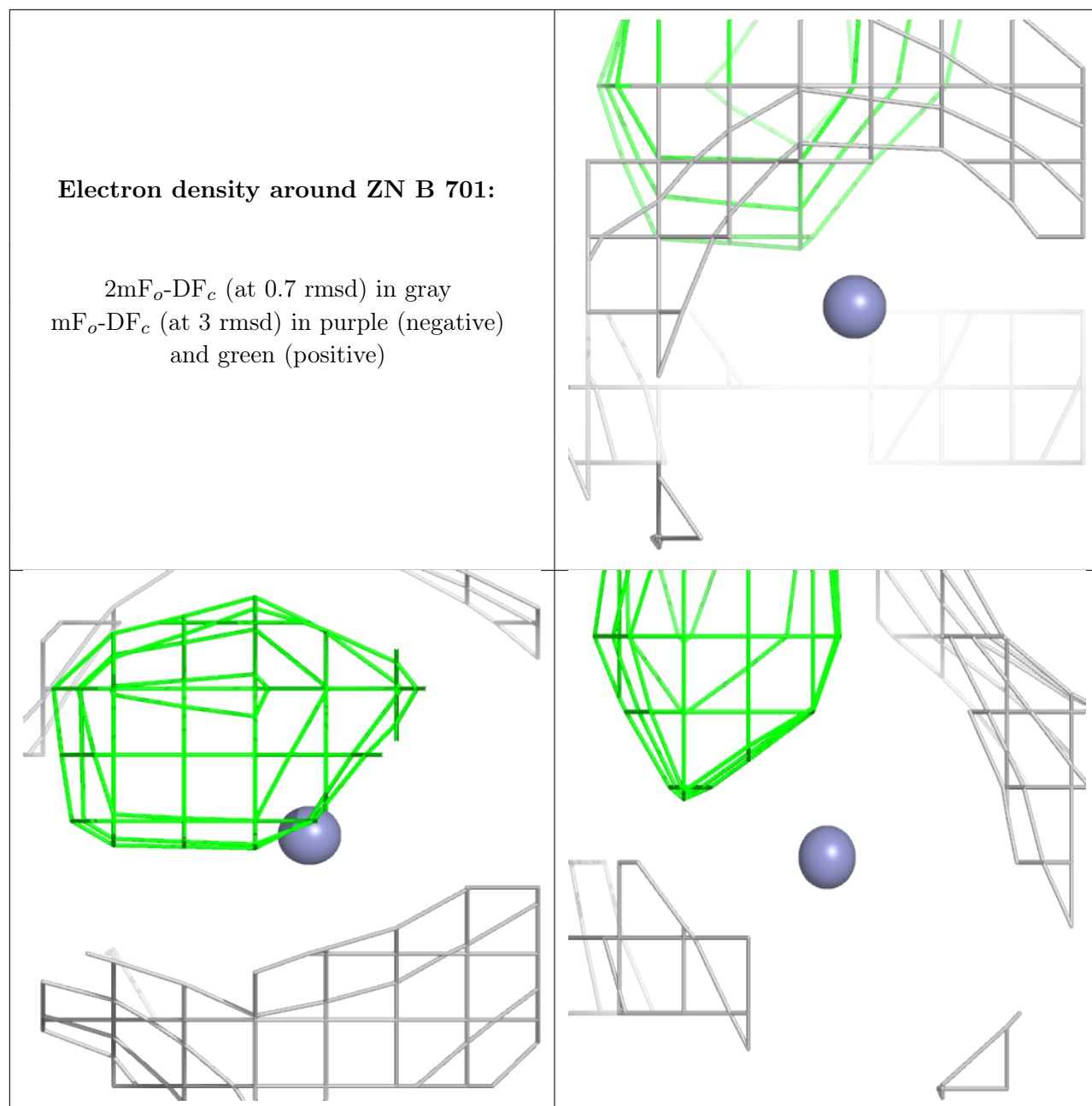
There are no oligosaccharides in this entry.

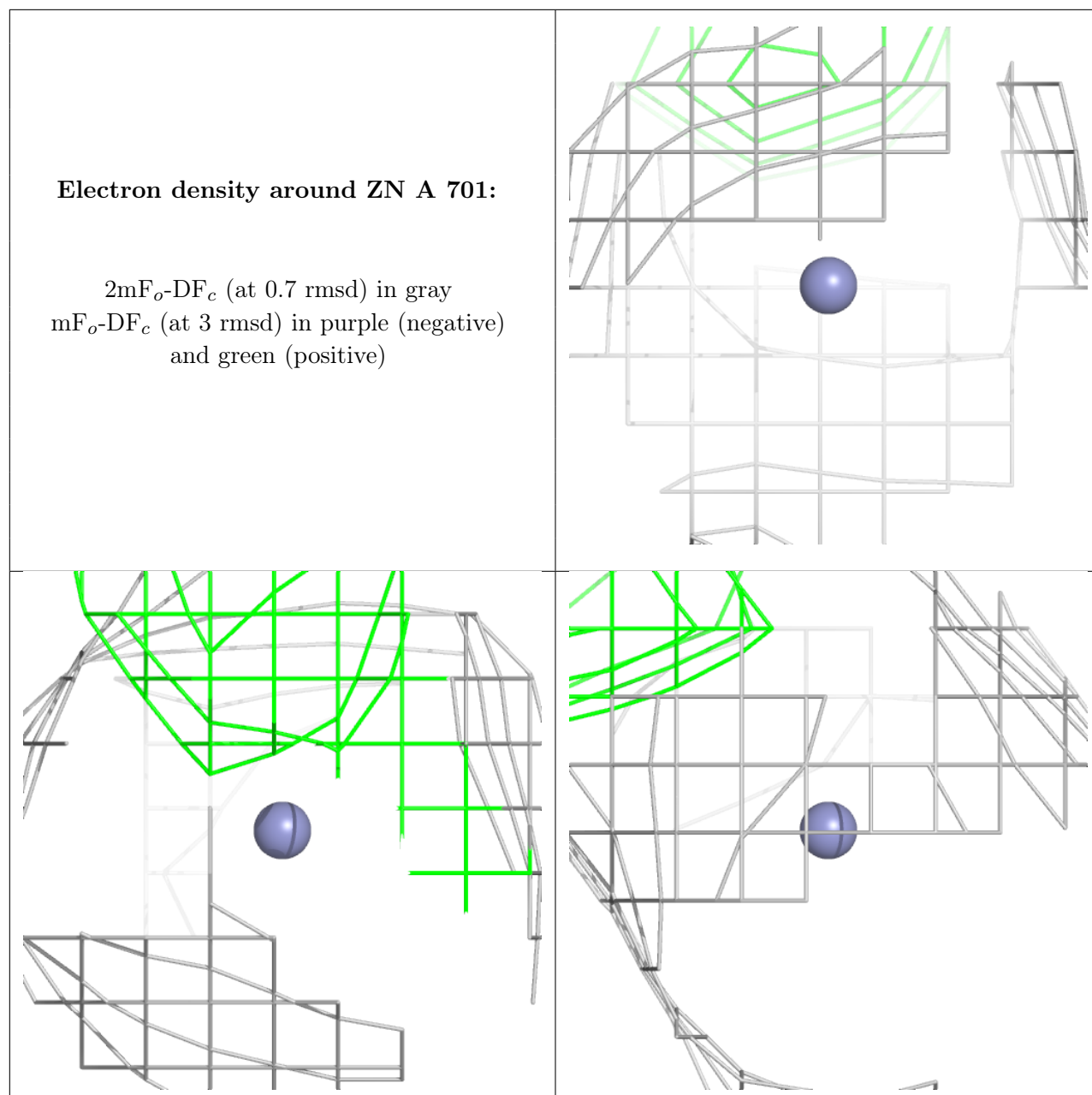
6.4 Ligands

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, 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	ZN	B	701	1/1	0.54	0.14	191,191,191,191	0
4	ZN	A	701	1/1	0.85	0.07	105,105,105,105	0

The following is a graphical depiction of the model fit to experimental electron density of all instances of the Ligand of Interest. In addition, ligands with molecular weight > 250 and outliers as shown on the geometry validation Tables will also be included. Each fit is shown from different orientation to approximate a three-dimensional view.





6.5 Other polymers ⓘ

There are no such residues in this entry.