



# wwPDB X-ray Structure Validation Summary Report ⓘ

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PDB ID : 5DO2  
Title : Complex structure of MERS-RBD bound with 4C2 antibody  
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Deposited on : 2015-09-10  
Resolution : 2.41 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](mailto:validation@mail.wwpdb.org)

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<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>.

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The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467  
Mogul : 1.8.5 (274361), 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

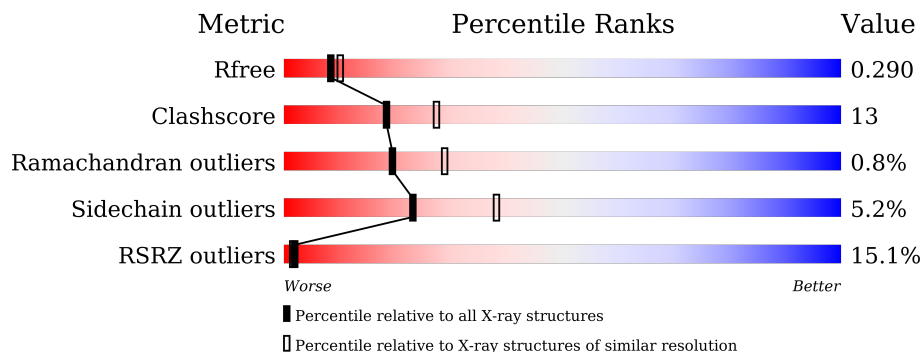
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.41 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	3907 (2.40-2.40)
Clashscore	141614	4398 (2.40-2.40)
Ramachandran outliers	138981	4318 (2.40-2.40)
Sidechain outliers	138945	4319 (2.40-2.40)
RSRZ outliers	127900	3811 (2.40-2.40)

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  $\geq 3$ , 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	251	
1	B	251	
2	C	219	
2	H	219	
3	D	214	
3	L	214	

## 2 Entry composition [i](#)

There are 5 unique types of molecules in this entry. The entry contains 9937 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 S protein.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	208	1608	1026	256	315	11	0	0	0
1	B	208	1608	1026	256	315	11	0	0	0

There are 22 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	362	ALA	-	expression tag	UNP W5ZZM0
A	363	ASP	-	expression tag	UNP W5ZZM0
A	364	GLY	-	expression tag	UNP W5ZZM0
A	365	ILE	-	expression tag	UNP W5ZZM0
A	366	GLN	-	expression tag	UNP W5ZZM0
A	607	HIS	-	expression tag	UNP W5ZZM0
A	608	HIS	-	expression tag	UNP W5ZZM0
A	609	HIS	-	expression tag	UNP W5ZZM0
A	610	HIS	-	expression tag	UNP W5ZZM0
A	611	HIS	-	expression tag	UNP W5ZZM0
A	612	HIS	-	expression tag	UNP W5ZZM0
B	362	ALA	-	expression tag	UNP W5ZZM0
B	363	ASP	-	expression tag	UNP W5ZZM0
B	364	GLY	-	expression tag	UNP W5ZZM0
B	365	ILE	-	expression tag	UNP W5ZZM0
B	366	GLN	-	expression tag	UNP W5ZZM0
B	607	HIS	-	expression tag	UNP W5ZZM0
B	608	HIS	-	expression tag	UNP W5ZZM0
B	609	HIS	-	expression tag	UNP W5ZZM0
B	610	HIS	-	expression tag	UNP W5ZZM0
B	611	HIS	-	expression tag	UNP W5ZZM0
B	612	HIS	-	expression tag	UNP W5ZZM0

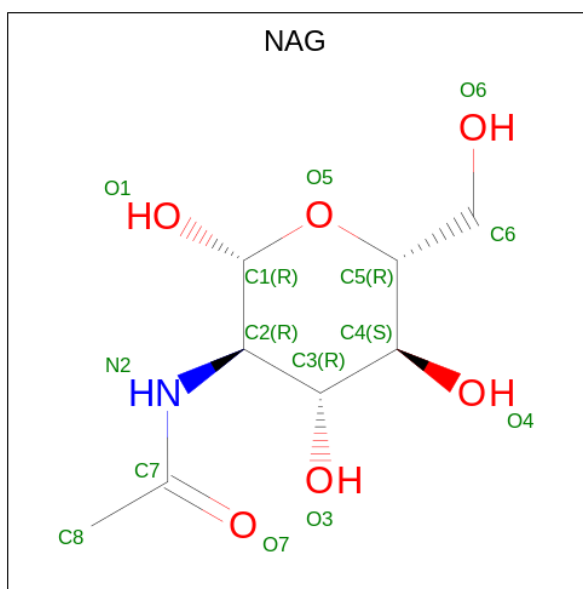
- Molecule 2 is a protein called 4C2 heavy chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	H	215	Total 1621	C 1021	N 264	O 327	S 9	0	0	0
2	C	215	Total 1621	C 1021	N 264	O 327	S 9	0	0	0

- Molecule 3 is a protein called 4C2 light chain.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	L	214	Total 1663	C 1026	N 284	O 346	S 7	0	0	0
3	D	214	Total 1663	C 1026	N 284	O 346	S 7	0	0	0

- Molecule 4 is 2-acetamido-2-deoxy-beta-D-glucopyranose (three-letter code: NAG) (formula: C<sub>8</sub>H<sub>15</sub>NO<sub>6</sub>).



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

- Molecule 5 is water.

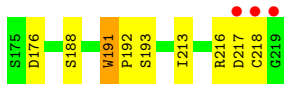
Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
			Total	O		
5	A	24	Total 24	O 24	0	0
5	H	31	Total 31	O 31	0	0

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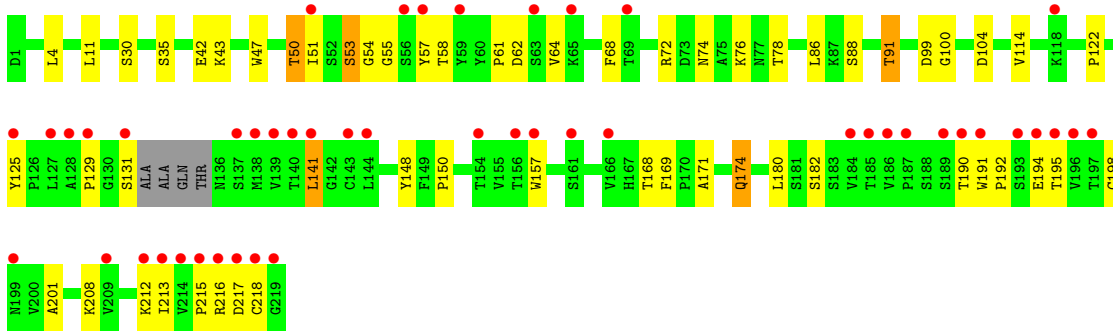
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<b>Mol</b>	<b>Chain</b>	<b>Residues</b>	<b>Atoms</b>		<b>ZeroOcc</b>	<b>AltConf</b>
5	L	29	Total 29	O 29	0	0
5	B	23	Total 23	O 23	0	0
5	C	11	Total 11	O 11	0	0
5	D	21	Total 21	O 21	0	0

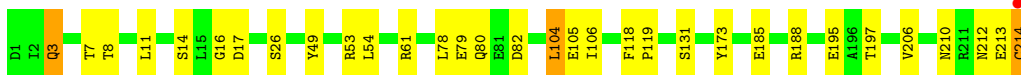
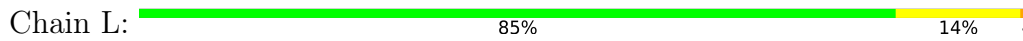




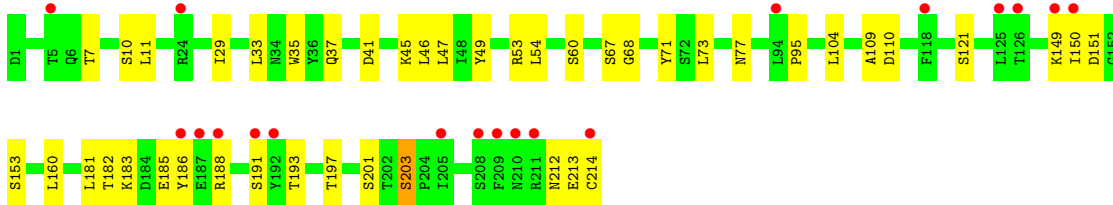
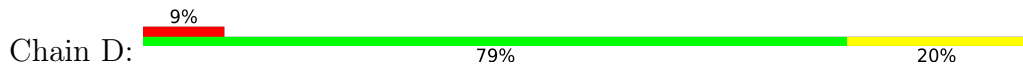
- Molecule 2: 4C2 heavy chain



- Molecule 3: 4C2 light chain



- Molecule 3: 4C2 light chain



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	74.08Å 110.40Å 172.98Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	46.53 – 2.41 46.53 – 2.41	Depositor EDS
% Data completeness (in resolution range)	98.8 (46.53-2.41) 93.7 (46.53-2.41)	Depositor EDS
$R_{merge}$	0.10	Depositor
$R_{sym}$	0.10	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	2.19 (at 2.42Å)	Xtrriage
Refinement program	PHENIX 1.9_1692	Depositor
R, $R_{free}$	0.245 , 0.289 0.248 , 0.290	Depositor DCC
$R_{free}$ test set	2789 reflections (5.07%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	42.6	Xtrriage
Anisotropy	0.323	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.30 , 34.3	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtrriage
Estimated twinning fraction	No twinning to report.	Xtrriage
$F_o, F_c$ correlation	0.92	EDS
Total number of atoms	9937	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	73.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 3.37% of the height of the origin peak. No significant pseudotranslation is detected.*

<sup>1</sup>Intensities estimated from amplitudes.

<sup>2</sup>Theoretical 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: NAG

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	0.26	0/1647	0.48	0/2249
1	B	0.25	0/1647	0.47	0/2249
2	C	0.28	0/1662	0.49	0/2266
2	H	0.34	0/1662	0.50	0/2266
3	D	0.24	0/1696	0.48	0/2299
3	L	0.27	0/1696	0.51	0/2299
All	All	0.28	0/10010	0.49	0/13628

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	1608	0	1573	37	0
1	B	1608	0	1574	86	0
2	C	1621	0	1572	44	0
2	H	1621	0	1572	29	0
3	D	1663	0	1587	51	0
3	L	1663	0	1587	20	0
4	A	14	0	13	1	0

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Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
5	A	24	0	0	12	0
5	B	23	0	0	56	0
5	C	11	0	0	17	0
5	D	21	0	0	38	0
5	H	31	0	0	12	0
5	L	29	0	0	6	0
All	All	9937	0	9478	257	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 13.

The worst 5 of 257 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:B:514:VAL:HG12	5:B:704:HOH:O	1.22	1.26
1:B:432:ALA:HB3	5:B:705:HOH:O	1.07	1.22
5:H:328:HOH:O	3:L:214:CYS:SG	2.01	1.17
3:D:186:TYR:HB3	5:D:304:HOH:O	1.47	1.14
1:B:448:TYR:N	5:B:701:HOH:O	1.80	1.11

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	206/251 (82%)	192 (93%)	10 (5%)	4 (2%)	8	10
1	B	206/251 (82%)	189 (92%)	13 (6%)	4 (2%)	8	10
2	C	211/219 (96%)	204 (97%)	6 (3%)	1 (0%)	29	41
2	H	211/219 (96%)	205 (97%)	5 (2%)	1 (0%)	29	41
3	D	212/214 (99%)	203 (96%)	9 (4%)	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
3	L	212/214 (99%)	204 (96%)	8 (4%)	0	100	100
All	All	1258/1368 (92%)	1197 (95%)	51 (4%)	10 (1%)	19	29

5 of 10 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	H	217	ASP
1	B	510	ASP
1	B	579	THR
1	A	462	GLY
1	A	510	ASP

### 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	190/224 (85%)	177 (93%)	13 (7%)	16	25
1	B	190/224 (85%)	180 (95%)	10 (5%)	22	37
2	C	187/189 (99%)	177 (95%)	10 (5%)	22	37
2	H	187/189 (99%)	178 (95%)	9 (5%)	25	41
3	D	192/192 (100%)	183 (95%)	9 (5%)	26	42
3	L	192/192 (100%)	184 (96%)	8 (4%)	30	47
All	All	1138/1210 (94%)	1079 (95%)	59 (5%)	23	38

5 of 59 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
3	L	185	GLU
3	D	104	LEU
1	B	484	VAL
3	D	60	SER
2	C	174	GLN

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. All (1) such sidechains are listed below:

Mol	Chain	Res	Type
2	H	174	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](#)

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

## 5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

## 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	$\# Z  > 2$
4	NAG	A	701	1	14,14,15	0.45	0	17,19,21	0.32	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
4	NAG	A	701	1	-	2/6/23/26	0/1/1/1

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (2) torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
4	A	701	NAG	O5-C5-C6-O6
4	A	701	NAG	C4-C5-C6-O6

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
4	A	701	NAG	1	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 [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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
1	A	208/251 (82%)	-0.01	7 (3%) 45 44	36, 55, 103, 127	0
1	B	208/251 (82%)	3.18	116 (55%) 0 0	44, 131, 190, 230	0
2	C	215/219 (98%)	0.89	47 (21%) 0 0	42, 78, 147, 206	0
2	H	215/219 (98%)	-0.27	3 (1%) 75 73	26, 40, 65, 179	0
3	D	214/214 (100%)	0.73	19 (8%) 9 9	38, 76, 130, 220	0
3	L	214/214 (100%)	-0.05	1 (0%) 91 89	28, 42, 62, 168	0
All	All	1274/1368 (93%)	0.74	193 (15%) 2 1	26, 60, 154, 230	0

The worst 5 of 193 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	B	577	TYR	20.4
2	H	219	GLY	12.3
1	B	479	LEU	11.7
1	B	414	LEU	11.4
1	B	383	CYS	10.8

### 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 monosaccharides in this entry.

## 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, 95<sup>th</sup> 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 <sup>2</sup> )	Q<0.9
4	NAG	A	701	14/15	0.66	0.28	81,81,81,81	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.