



# wwPDB X-ray Structure Validation Summary Report ⓘ

Nov 24, 2024 – 12:07 am GMT

PDB ID : 8RNE  
Title : HLA-E\*01:03 in complex with SARS-CoV-2 Nsp13 peptide, VMPLSAPTL  
Authors : Sun, R.; Achour, A.; Sala, B.M.; Sandalova, T.  
Deposited on : 2024-01-09  
Resolution : 1.71 Å(reported)

This is a wwPDB X-ray Structure Validation Summary Report for a publicly released PDB entry.

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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  
Xtriage (Phenix) : 1.13  
EDS : 3.0  
Percentile statistics : 20231227.v01 (using entries in the PDB archive December 27th 2023)  
CCP4 : 9.0.003 (Gargrove)  
Density-Fitness : 1.0.11  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : 2.40

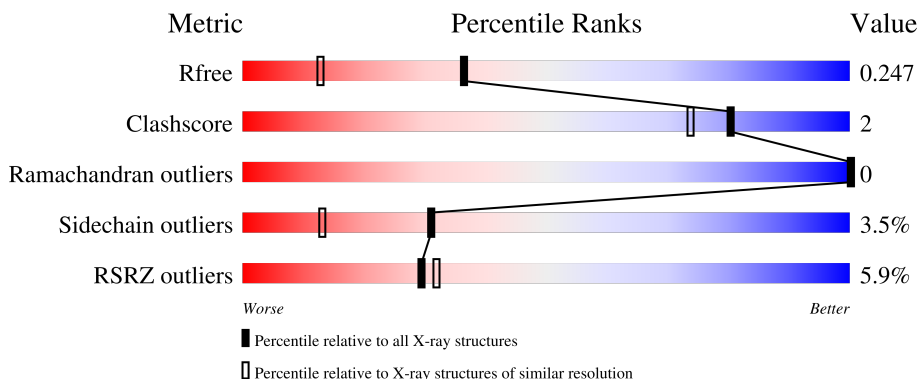
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.71 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.



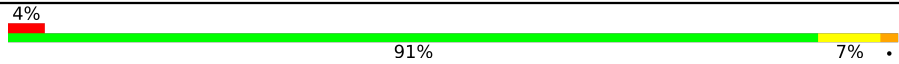

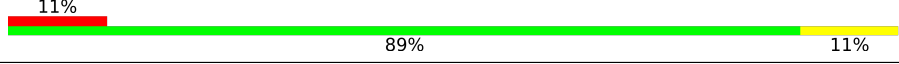
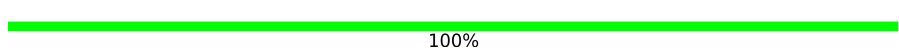
Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
$R_{free}$	164625	7106 (1.74-1.70)
Clashscore	180529	7746 (1.74-1.70)
Ramachandran outliers	177936	7654 (1.74-1.70)
Sidechain outliers	177891	7654 (1.74-1.70)
RSRZ outliers	164620	7104 (1.74-1.70)

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	274	 5% 94% 5%
1	C	274	 6% 91% 7%
1	F	274	 8% 93% 6%
2	B	100	 6% 90% 10%
2	D	100	 3% 94% 6%

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Mol	Chain	Length	Quality of chain
2	G	100	 4% 91% 7%
3	E	9	 11% 78% 22%
3	H	9	 11% 89% 11%
3	P	9	 100%

## 2 Entry composition [i](#)

There are 4 unique types of molecules in this entry. The entry contains 10052 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 HLA class I histocompatibility antigen, E alpha chain variant.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
1	A	274	Total 2231	C 1394	N 399	O 431	S 7	0	0	0
1	C	268	Total 2188	C 1370	N 390	O 421	S 7	0	0	0
1	F	274	Total 2231	C 1394	N 399	O 431	S 7	0	0	0

- Molecule 2 is a protein called Beta-2-microglobulin.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
2	B	100	Total 837	C 533	N 141	O 159	S 4	0	0	0
2	D	100	Total 837	C 533	N 141	O 159	S 4	0	0	0
2	G	100	Total 837	C 533	N 141	O 159	S 4	0	0	0

There are 3 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	1	MET	-	initiating methionine	UNP P61769
D	1	MET	-	initiating methionine	UNP P61769
G	1	MET	-	initiating methionine	UNP P61769

- Molecule 3 is a protein called Non-structural protein 7.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	E	9	Total 64	C 42	N 9	O 12	S 1	0	0	0
3	H	9	Total 64	C 42	N 9	O 12	S 1	0	0	0

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Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
			Total	C	N	O	S			
3	P	9	64	42	9	12	1	0	0	0

- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	188	Total 188	O 188	0	0
4	B	68	Total 68	O 68	0	0
4	C	126	Total 126	O 126	0	0
4	D	71	Total 71	O 71	0	0
4	E	3	Total 3	O 3	0	0
4	F	152	Total 152	O 152	0	0
4	G	80	Total 80	O 80	0	0
4	H	5	Total 5	O 5	0	0
4	P	6	Total 6	O 6	0	0

### 3 Residue-property plots [i](#)

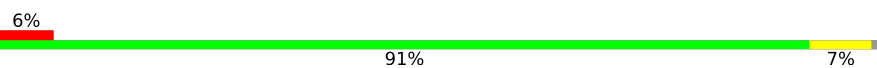
These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. 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.

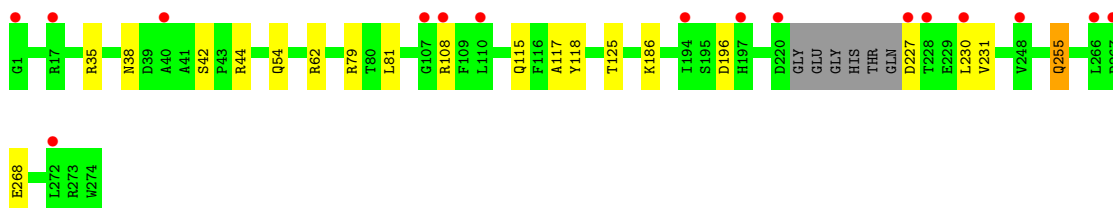
- Molecule 1: HLA class I histocompatibility antigen, E alpha chain variant

Chain A: 



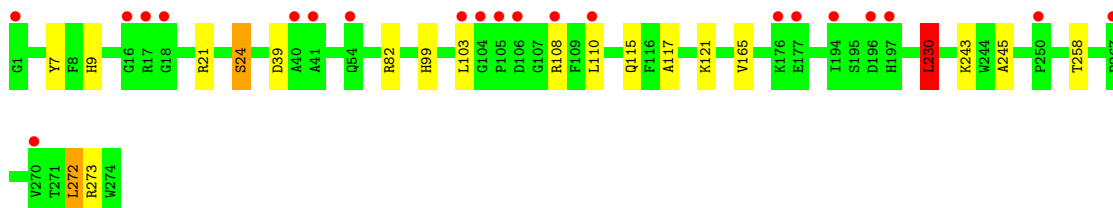
- Molecule 1: HLA class I histocompatibility antigen, E alpha chain variant

Chain C: 

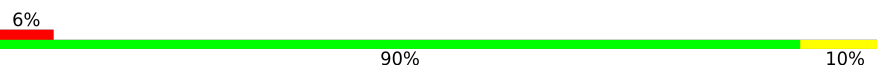


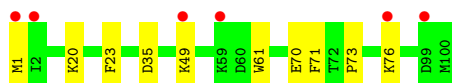
- Molecule 1: HLA class I histocompatibility antigen, E alpha chain variant

Chain F: 



- Molecule 2: Beta-2-microglobulin

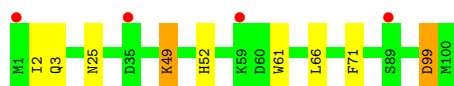
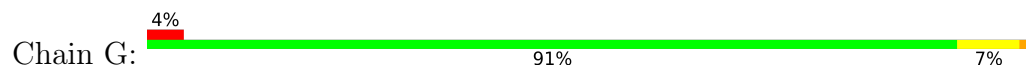
Chain B: 



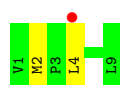
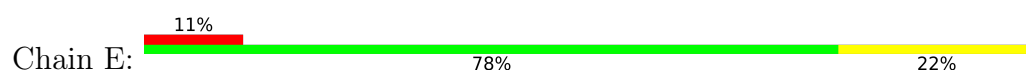
- Molecule 2: Beta-2-microglobulin



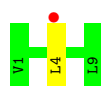
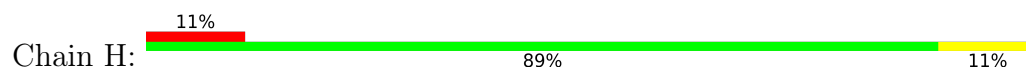
- Molecule 2: Beta-2-microglobulin



- Molecule 3: Non-structural protein 7



- Molecule 3: Non-structural protein 7



- Molecule 3: Non-structural protein 7



There are no outlier residues recorded for this chain.

## 4 Data and refinement statistics i

Property	Value	Source
Space group	C 1 2 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	120.49Å 67.60Å 152.23Å 90.00° 92.78° 90.00°	Depositor
Resolution (Å)	46.11 – 1.71 46.11 – 1.71	Depositor EDS
% Data completeness (in resolution range)	99.8 (46.11-1.71) 99.8 (46.11-1.71)	Depositor EDS
$R_{merge}$	0.07	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.68 (at 1.71Å)	Xtriage
Refinement program	REFMAC 5	Depositor
R, $R_{free}$	0.204 , 0.243 0.211 , 0.247	Depositor DCC
$R_{free}$ test set	6704 reflections (5.08%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	28.9	Xtriage
Anisotropy	0.010	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.35 , 31.9	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.33$	Xtriage
Estimated twinning fraction	0.008 for -1/2*h-3/2*k,-1/2*h+1/2*k,-l 0.009 for -1/2*h+3/2*k,1/2*h+1/2*k,-l 0.033 for 1/2*h-3/2*k,-1/2*h-1/2*k,-l 0.017 for 1/2*h+3/2*k,1/2*h-1/2*k,-l 0.013 for -h,-k,l	Xtriage
$F_o, F_c$ correlation	0.96	EDS
Total number of atoms	10052	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	35.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 4.85% 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

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	0.41	0/2297	0.86	3/3123 (0.1%)
1	C	0.37	0/2252	0.76	0/3061
1	F	0.38	0/2297	0.79	2/3123 (0.1%)
2	B	0.39	0/860	0.78	0/1162
2	D	0.39	0/860	0.82	0/1162
2	G	0.39	0/860	0.74	0/1162
3	E	0.45	0/65	1.13	1/88 (1.1%)
3	H	0.48	0/65	0.83	0/88
3	P	0.60	0/65	0.89	0/88
All	All	0.39	0/9621	0.80	6/13057 (0.0%)

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	A	0	2
1	C	0	1
All	All	0	3

There are no bond length outliers.

The worst 5 of 6 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	35	ARG	NE-CZ-NH2	-8.45	116.08	120.30
1	A	65	ARG	NE-CZ-NH2	-7.96	116.32	120.30
1	F	230	LEU	CB-CG-CD2	6.35	121.79	111.00
1	A	98	MET	CG-SD-CE	5.91	109.66	100.20
1	F	82	ARG	NE-CZ-NH1	5.83	123.21	120.30

There are no chirality outliers.

All (3) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	35	ARG	Sidechain
1	A	65	ARG	Sidechain
1	C	79	ARG	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	A	2231	0	2068	16	0
1	C	2188	0	2033	6	0
1	F	2231	0	2068	13	0
2	B	837	0	803	3	0
2	D	837	0	803	2	0
2	G	837	0	803	7	0
3	E	64	0	73	0	0
3	H	64	0	73	1	0
3	P	64	0	73	0	0
4	A	188	0	0	2	0
4	B	68	0	0	0	0
4	C	126	0	0	0	0
4	D	71	0	0	0	0
4	E	3	0	0	0	0
4	F	152	0	0	1	0
4	G	80	0	0	1	0
4	H	5	0	0	1	0
4	P	6	0	0	0	0
All	All	10052	0	8797	44	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 2.

The worst 5 of 44 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:253:GLU:CD	1:A:256:ARG:NH1	2.42	0.72

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
4:F:357:HOH:O	2:G:99:ASP:HB3	1.93	0.68
1:F:9:HIS:ND1	1:F:24:SER:HB2	2.10	0.65
2:G:49:LYS:O	2:G:49:LYS:HG3	2.00	0.62
1:C:115:GLN:HG2	1:C:125:THR:HG23	1.85	0.58

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	272/274 (99%)	268 (98%)	4 (2%)	0	100	100
1	C	264/274 (96%)	261 (99%)	3 (1%)	0	100	100
1	F	272/274 (99%)	267 (98%)	5 (2%)	0	100	100
2	B	98/100 (98%)	97 (99%)	1 (1%)	0	100	100
2	D	98/100 (98%)	96 (98%)	2 (2%)	0	100	100
2	G	98/100 (98%)	97 (99%)	1 (1%)	0	100	100
3	E	7/9 (78%)	7 (100%)	0	0	100	100
3	H	7/9 (78%)	7 (100%)	0	0	100	100
3	P	7/9 (78%)	7 (100%)	0	0	100	100
All	All	1123/1149 (98%)	1107 (99%)	16 (1%)	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	235/235 (100%)	230 (98%)	5 (2%)	48	31
1	C	231/235 (98%)	219 (95%)	12 (5%)	19	6
1	F	235/235 (100%)	229 (97%)	6 (3%)	41	22
2	B	95/95 (100%)	90 (95%)	5 (5%)	19	5
2	D	95/95 (100%)	92 (97%)	3 (3%)	34	15
2	G	95/95 (100%)	92 (97%)	3 (3%)	34	15
3	E	8/8 (100%)	7 (88%)	1 (12%)	3	1
3	H	8/8 (100%)	8 (100%)	0	100	100
3	P	8/8 (100%)	8 (100%)	0	100	100
All	All	1010/1014 (100%)	975 (96%)	35 (4%)	31	13

5 of 35 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	F	110	LEU
1	F	115	GLN
2	G	49	LYS
1	C	44	ARG
1	C	42	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 8 such sidechains are listed below:

Mol	Chain	Res	Type
2	G	3	GLN
1	F	226	GLN
2	D	84	ASN
1	C	218	GLN
1	F	72	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 oligosaccharides in this entry.

#### 5.6 Ligand geometry [i](#)

There are no ligands in this entry.

#### 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	274/274 (100%)	0.35	15 (5%) 32 35	18, 30, 55, 78	0
1	C	268/274 (97%)	0.59	16 (5%) 29 31	20, 34, 60, 78	0
1	F	274/274 (100%)	0.62	21 (7%) 21 22	21, 34, 65, 85	0
2	B	100/100 (100%)	0.52	6 (6%) 29 31	22, 34, 53, 94	0
2	D	100/100 (100%)	0.41	3 (3%) 52 57	21, 30, 55, 72	0
2	G	100/100 (100%)	0.31	4 (4%) 43 47	20, 29, 51, 85	0
3	E	9/9 (100%)	0.55	1 (11%) 12 12	26, 29, 39, 41	0
3	H	9/9 (100%)	0.78	1 (11%) 12 12	30, 32, 43, 46	0
3	P	9/9 (100%)	0.24	0 100 100	20, 24, 29, 31	0
All	All	1143/1149 (99%)	0.49	67 (5%) 29 32	18, 32, 58, 94	0

The worst 5 of 67 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	225	THR	3.7
2	B	1	MET	3.6
1	F	40	ALA	3.5
2	B	2	ILE	3.5
2	D	2	ILE	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 monosaccharides in this entry.

## 6.4 Ligands

There are no ligands in this entry.

## 6.5 Other polymers

There are no such residues in this entry.