



# Full wwPDB X-ray Structure Validation Report ⓘ

Nov 14, 2023 – 02:03 PM EST

PDB ID : 8U36  
Title : The crystal structure of the classical binding interface of Importin alpha 2 and a nuclear localisation signal sequence in Frog siadenovirus core protein VII  
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Deposited on : 2023-09-07  
Resolution : 2.60 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](mailto: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>.

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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 : 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

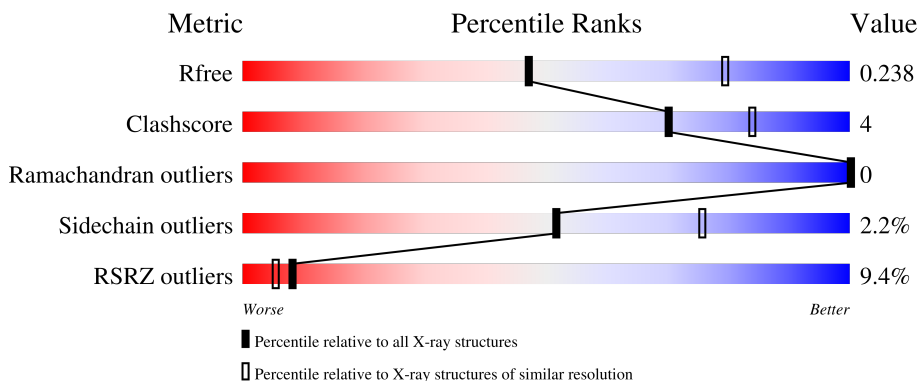
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 2.60 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	3163 (2.60-2.60)
Clashscore	141614	3518 (2.60-2.60)
Ramachandran outliers	138981	3455 (2.60-2.60)
Sidechain outliers	138945	3455 (2.60-2.60)
RSRZ outliers	127900	3104 (2.60-2.60)

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	510	 8% 72% 10% 17%
2	B	9	 11% 56% 11% 11% 22%
2	C	9	 11% 11% 22% 67%

The following table lists non-polymeric compounds, carbohydrate monomers and non-standard residues in protein, DNA, RNA chains that are outliers for geometric or electron-density-fit criteria:

Mol	Type	Chain	Res	Chirality	Geometry	Clashes	Electron density
3	NA	A	601	-	-	-	X

## 2 Entry composition

There are 4 unique types of molecules in this entry. The entry contains 6711 atoms, of which 3360 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 Importin subunit alpha-1.

Mol	Chain	Residues	Atoms						ZeroOcc	AltConf	Trace
			Total	C	H	N	O	S			
1	A	424	6457	2038	3260	542	607	10	0	0	0

There are 50 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	20	MET	-	expression tag	UNP P52293
A	21	HIS	-	expression tag	UNP P52293
A	22	HIS	-	expression tag	UNP P52293
A	23	HIS	-	expression tag	UNP P52293
A	24	HIS	-	expression tag	UNP P52293
A	25	HIS	-	expression tag	UNP P52293
A	26	HIS	-	expression tag	UNP P52293
A	27	SER	-	expression tag	UNP P52293
A	28	SER	-	expression tag	UNP P52293
A	29	GLY	-	expression tag	UNP P52293
A	30	LEU	-	expression tag	UNP P52293
A	31	VAL	-	expression tag	UNP P52293
A	32	PRO	-	expression tag	UNP P52293
A	33	ARG	-	expression tag	UNP P52293
A	34	GLY	-	expression tag	UNP P52293
A	35	SER	-	expression tag	UNP P52293
A	36	GLY	-	expression tag	UNP P52293
A	37	MET	-	expression tag	UNP P52293
A	38	LEU	-	expression tag	UNP P52293
A	39	GLU	-	expression tag	UNP P52293
A	40	THR	-	expression tag	UNP P52293
A	41	ALA	-	expression tag	UNP P52293
A	42	ALA	-	expression tag	UNP P52293
A	43	ALA	-	expression tag	UNP P52293
A	44	LEU	-	expression tag	UNP P52293
A	45	PHE	-	expression tag	UNP P52293
A	46	GLU	-	expression tag	UNP P52293

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Chain	Residue	Modelled	Actual	Comment	Reference
A	47	ARG	-	expression tag	UNP P52293
A	48	ASN	-	expression tag	UNP P52293
A	49	HIS	-	expression tag	UNP P52293
A	50	MET	-	expression tag	UNP P52293
A	51	ASP	-	expression tag	UNP P52293
A	52	SER	-	expression tag	UNP P52293
A	53	PRO	-	expression tag	UNP P52293
A	54	ASP	-	expression tag	UNP P52293
A	55	LEU	-	expression tag	UNP P52293
A	56	GLY	-	expression tag	UNP P52293
A	57	THR	-	expression tag	UNP P52293
A	58	ASP	-	expression tag	UNP P52293
A	59	ASP	-	expression tag	UNP P52293
A	60	ASP	-	expression tag	UNP P52293
A	61	ASP	-	expression tag	UNP P52293
A	62	LEU	-	expression tag	UNP P52293
A	63	ALA	-	expression tag	UNP P52293
A	64	MET	-	expression tag	UNP P52293
A	65	ALA	-	expression tag	UNP P52293
A	66	ASP	-	expression tag	UNP P52293
A	67	ILE	-	expression tag	UNP P52293
A	68	GLY	-	expression tag	UNP P52293
A	69	SER	-	expression tag	UNP P52293

- Molecule 2 is a protein called PVII.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace	
2	B	7	Total	C	H	N	O	0	0	0
			139	38	74	20	7			
2	C	3	Total	C	H	N	O	0	0	0
			57	18	26	10	3			

- Molecule 3 is SODIUM ION (three-letter code: NA) (formula: Na).

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
3	A	2	Total	Na	0	0
			2	2		

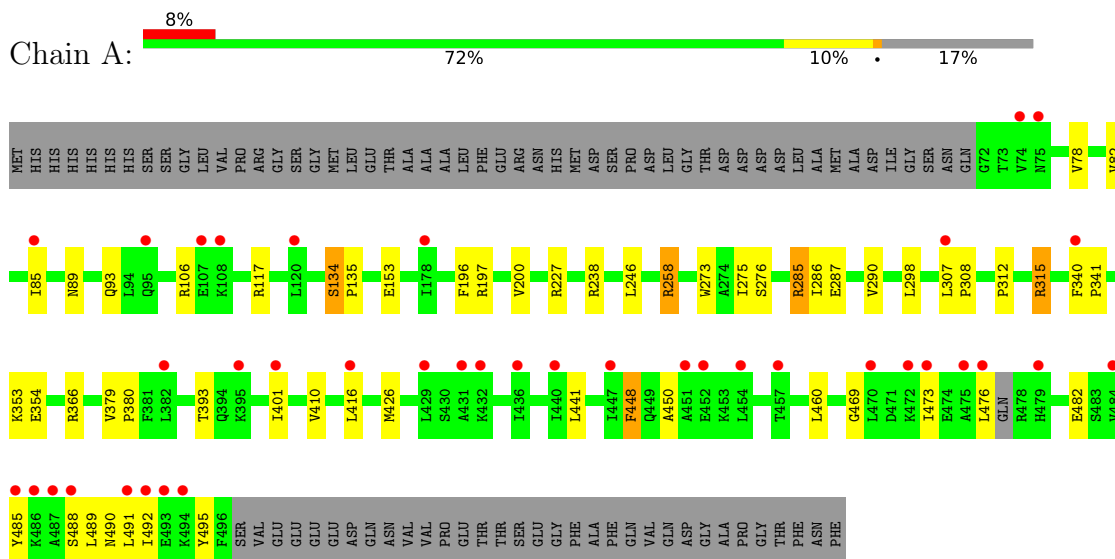
- Molecule 4 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
4	A	53	Total 53	O 53	0	0
4	B	3	Total 3	O 3	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: Importin subunit alpha-1



- Molecule 2: PVII



- Molecule 2: PVII



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 21 21 21	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	77.29Å 89.29Å 95.80Å 90.00° 90.00° 90.00°	Depositor
Resolution (Å)	47.90 – 2.60 47.90 – 2.50	Depositor EDS
% Data completeness (in resolution range)	98.8 (47.90-2.60) 98.8 (47.90-2.50)	Depositor EDS
$R_{merge}$	0.17	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.36 (at 2.51Å)	Xtrriage
Refinement program	PHENIX (1.20.1_4487: ???)	Depositor
R, $R_{free}$	0.218 , 0.242 0.215 , 0.238	Depositor DCC
$R_{free}$ test set	1122 reflections (4.82%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	54.0	Xtrriage
Anisotropy	0.321	Xtrriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.40 , 43.9	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	0.94	EDS
Total number of atoms	6711	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	69.0	wwPDB-VP

Xtrriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 6.17% 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 [i](#)

### 5.1 Standard geometry [i](#)

Bond lengths and bond angles in the following residue types are not validated in this section: NA

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	0.63	1/3253 (0.0%)	0.75	0/4437
2	B	0.74	0/64	1.20	1/81 (1.2%)
2	C	0.56	0/30	0.71	0/36
All	All	0.63	1/3347 (0.0%)	0.76	1/4554 (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	9
2	B	0	1
2	C	0	1
All	All	0	11

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	153	GLU	CD-OE1	5.08	1.31	1.25

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	B	143	ARG	NE-CZ-NH1	5.25	122.93	120.30

There are no chirality outliers.

All (11) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	106	ARG	Sidechain
1	A	117	ARG	Sidechain
1	A	197	ARG	Sidechain
1	A	227	ARG	Sidechain
1	A	238	ARG	Sidechain
1	A	258	ARG	Sidechain
1	A	285	ARG	Sidechain
1	A	315	ARG	Sidechain
1	A	366	ARG	Sidechain
2	B	145	ARG	Sidechain
2	C	145	ARG	Sidechain

## 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	3197	3260	3259	22	1
2	B	65	74	78	1	0
2	C	31	26	38	1	0
3	A	2	0	0	0	0
4	A	53	0	0	0	0
4	B	3	0	0	0	0
All	All	3351	3360	3375	24	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 4.

All (24) 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:353:LYS:HA	1:A:393:THR:HG23	1.78	0.66
1:A:473:ILE:HA	1:A:476:LEU:HD12	1.80	0.62
1:A:287:GLU:HA	1:A:290:VAL:HG22	1.82	0.60
1:A:441:LEU:HD11	1:A:476:LEU:HD13	1.84	0.58
1:A:286:ILE:O	1:A:290:VAL:HG13	2.07	0.55
2:B:143:ARG:HH11	2:B:143:ARG:HB2	1.75	0.52
1:A:401:ILE:HG23	1:A:416:LEU:HD21	1.92	0.50

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Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:A:379:VAL:HB	1:A:380:PRO:HD3	1.94	0.50
1:A:448:PHE:CD1	1:A:460:LEU:HD23	2.47	0.49
1:A:134:SER:N	1:A:135:PRO:CD	2.75	0.49
1:A:196:PHE:O	1:A:200:VAL:HG23	2.13	0.49
1:A:482:GLU:HA	1:A:485:TYR:CE2	2.52	0.45
1:A:491:LEU:HD23	1:A:495:TYR:CD2	2.52	0.45
1:A:307:LEU:N	1:A:308:PRO:CD	2.80	0.45
1:A:275:ILE:HG21	1:A:298:LEU:HD11	1.99	0.45
1:A:410:VAL:HG23	1:A:450:ALA:HB1	1.98	0.45
2:C:145:ARG:O	2:C:146:ARG:HB2	2.18	0.43
1:A:340:PHE:N	1:A:341:PRO:CD	2.81	0.43
1:A:273:TRP:CD2	1:A:312:PRO:HB3	2.54	0.42
1:A:246:LEU:HD21	1:A:285:ARG:HD3	2.01	0.41
1:A:85:ILE:HA	1:A:93:GLN:HG2	2.02	0.41
1:A:78:VAL:O	1:A:82:VAL:HG23	2.20	0.41
1:A:489:LEU:HA	1:A:492:ILE:HB	2.03	0.41
1:A:426:MET:HG2	1:A:469:GLY:HA3	2.03	0.40

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:A:89:ASN:HD21	1:A:258:ARG:O[3_544]	1.49	0.11

## 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	420/510 (82%)	415 (99%)	5 (1%)	0	100	100
2	B	5/9 (56%)	5 (100%)	0	0	100	100
2	C	1/9 (11%)	1 (100%)	0	0	100	100

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
All	All	426/528 (81%)	421 (99%)	5 (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	348/426 (82%)	341 (98%)	7 (2%)	55	78
2	B	6/8 (75%)	6 (100%)	0	100	100
2	C	3/8 (38%)	2 (67%)	1 (33%)	0	0
All	All	357/442 (81%)	349 (98%)	8 (2%)	52	76

All (8) residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	A	134	SER
1	A	276	SER
1	A	315	ARG
1	A	354	GLU
1	A	448	PHE
1	A	488	SER
1	A	490	ASN
2	C	146	ARG

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

Mol	Chain	Res	Type
1	A	261	HIS
1	A	352	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](#)

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

### 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<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	424/510 (83%)	0.74	39 (9%) <b>9</b> <b>6</b>	40, 57, 110, 131	0
2	B	7/9 (77%)	0.37	1 (14%) <b>2</b> <b>1</b>	47, 55, 61, 69	0
2	C	3/9 (33%)	2.06	1 (33%) <b>0</b> <b>0</b>	77, 77, 81, 82	0
All	All	434/528 (82%)	0.75	41 (9%) <b>8</b> <b>5</b>	40, 57, 110, 131	0

All (41) RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	A	491	LEU	7.1
1	A	476	LEU	7.1
1	A	429	LEU	6.6
1	A	484	VAL	6.2
1	A	473	ILE	5.8
1	A	479	HIS	4.5
1	A	493	GLU	4.3
1	A	452	GLU	4.3
1	A	416	LEU	4.0
1	A	440	ILE	3.8
1	A	492	ILE	3.7
1	A	432	LYS	3.7
1	A	494	LYS	3.7
1	A	436	ILE	3.6
1	A	454	LEU	3.4
1	A	431	ALA	3.4
1	A	382	LEU	3.1
1	A	488	SER	2.9
1	A	120	LEU	2.9
1	A	75	ASN	2.9
1	A	485	TYR	2.8
1	A	470	LEU	2.7
1	A	401	ILE	2.7

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Mol	Chain	Res	Type	RSRZ
1	A	486	LYS	2.7
2	C	144	LYS	2.6
2	B	149	ALA	2.5
1	A	475	ALA	2.4
1	A	74	VAL	2.4
1	A	107	GLU	2.4
1	A	447	ILE	2.4
1	A	487	ALA	2.3
1	A	472	LYS	2.3
1	A	457	THR	2.3
1	A	395	LYS	2.3
1	A	108	LYS	2.2
1	A	85	ILE	2.2
1	A	178	ILE	2.2
1	A	95	GLN	2.1
1	A	451	ALA	2.1
1	A	307	LEU	2.1
1	A	340	PHE	2.0

## 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
3	NA	A	601	1/1	0.71	1.38	81,81,81,81	0
3	NA	A	602	1/1	0.82	0.51	73,73,73,73	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.