



# wwPDB X-ray Structure Validation Summary Report ⓘ

Jul 14, 2016 – 08:40 PM EDT

PDB ID : 5E6R  
Title : Structures of leukocyte integrin  $\alpha$ Lb2: The  $\alpha$ I domain, the headpiece, and the pocket for the internal ligand  
Authors : Sen, M.; Springer, T.A.  
Deposited on : 2015-10-10  
Resolution : 2.90 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)  
A user guide is available at  
<http://wwpdb.org/validation/2016/XrayValidationReportHelp>  
with specific help available everywhere you see the ⓘ symbol.

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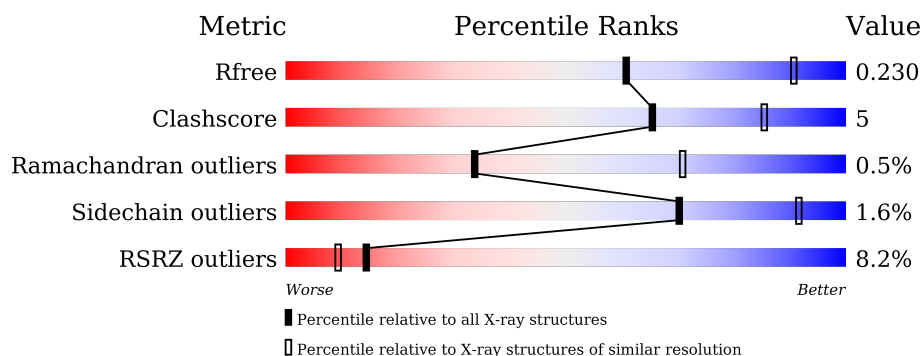
The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity : 4.02b-467  
Mogul : 1.7.1 (RC1), CSD as537be (2016)  
Xtriage (Phenix) : 1.9-1692  
EDS : rb-20027790  
Percentile statistics : 20151230.v01 (using entries in the PDB archive December 30th 2015)  
Refmac : 5.8.0135  
CCP4 : 6.5.0  
Ideal geometry (proteins) : Engh & Huber (2001)  
Ideal geometry (DNA, RNA) : Parkinson et al. (1996)  
Validation Pipeline (wwPDB-VP) : rb-20027790

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## X-RAY DIFFRACTION

A.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
$R_{free}$	91344	1451 (2.90-2.90)
Clashscore	102246	1668 (2.90-2.90)
Ramachandran outliers	100387	1630 (2.90-2.90)
Sidechain outliers	100360	1632 (2.90-2.90)
RSRZ outliers	91569	1456 (2.90-2.90)

Mol	Chain	Length	Quality of chain
1	A	795	<div> <div>2%</div> <div>64%</div> <div>8%</div> <div>27%</div> </div>
2	B	510	<div> <div>13%</div> <div>75%</div> <div>13%</div> <div>11%</div> </div>

## 2 Entry composition

There are 6 unique types of molecules in this entry. The entry contains 8264 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 Integrin alpha-L.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	581	Total	C	N	O	S	0	4	0
			4481	2834	768	863	16			

There are 53 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	189	TRP	ARG	variant	UNP P20701
A	645	ARG	ASN	engineered mutation	UNP P20701
A	701	ARG	ASN	engineered mutation	UNP P20701
A	746	PRO	-	expression tag	UNP P20701
A	747	ALA	-	expression tag	UNP P20701
A	748	ALA	-	expression tag	UNP P20701
A	749	LEU	-	expression tag	UNP P20701
A	750	GLN	-	expression tag	UNP P20701
A	751	THR	-	expression tag	UNP P20701
A	752	LEU	-	expression tag	UNP P20701
A	753	PHE	-	expression tag	UNP P20701
A	754	GLN	-	expression tag	UNP P20701
A	755	GLY	-	expression tag	UNP P20701
A	756	PRO	-	expression tag	UNP P20701
A	757	LEU	-	expression tag	UNP P20701
A	758	GLY	-	expression tag	UNP P20701
A	759	ALA	-	expression tag	UNP P20701
A	760	GLN	-	expression tag	UNP P20701
A	761	GLY	-	expression tag	UNP P20701
A	762	GLU	-	expression tag	UNP P20701
A	763	LYS	-	expression tag	UNP P20701
A	764	GLU	-	expression tag	UNP P20701
A	765	LEU	-	expression tag	UNP P20701
A	766	GLN	-	expression tag	UNP P20701
A	767	ALA	-	expression tag	UNP P20701
A	768	LEU	-	expression tag	UNP P20701
A	769	GLU	-	expression tag	UNP P20701

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Chain	Residue	Modelled	Actual	Comment	Reference
A	770	LYS	-	expression tag	UNP P20701
A	771	GLU	-	expression tag	UNP P20701
A	772	ASN	-	expression tag	UNP P20701
A	773	ALA	-	expression tag	UNP P20701
A	774	GLN	-	expression tag	UNP P20701
A	775	LEU	-	expression tag	UNP P20701
A	776	GLU	-	expression tag	UNP P20701
A	777	TRP	-	expression tag	UNP P20701
A	778	GLU	-	expression tag	UNP P20701
A	779	LEU	-	expression tag	UNP P20701
A	780	GLN	-	expression tag	UNP P20701
A	781	ALA	-	expression tag	UNP P20701
A	782	LEU	-	expression tag	UNP P20701
A	783	GLU	-	expression tag	UNP P20701
A	784	LYS	-	expression tag	UNP P20701
A	785	GLU	-	expression tag	UNP P20701
A	786	LEU	-	expression tag	UNP P20701
A	787	ALA	-	expression tag	UNP P20701
A	788	GLN	-	expression tag	UNP P20701
A	789	HIS	-	expression tag	UNP P20701
A	790	HIS	-	expression tag	UNP P20701
A	791	HIS	-	expression tag	UNP P20701
A	792	HIS	-	expression tag	UNP P20701
A	793	HIS	-	expression tag	UNP P20701
A	794	HIS	-	expression tag	UNP P20701
A	795	ALA	-	expression tag	UNP P20701

- Molecule 2 is a protein called Integrin beta-2.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
2	B	454	Total	C	N	O	S	0	2	0
			3516	2190	622	675	29			

There are 51 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
B	232	LYS	ASN	engineered mutation	UNP P05107
B	461	PRO	-	expression tag	UNP P05107
B	462	ALA	-	expression tag	UNP P05107
B	463	ALA	-	expression tag	UNP P05107
B	464	LEU	-	expression tag	UNP P05107
B	465	GLN	-	expression tag	UNP P05107

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Chain	Residue	Modelled	Actual	Comment	Reference
B	466	THR	-	expression tag	UNP P05107
B	467	LEU	-	expression tag	UNP P05107
B	468	PHE	-	expression tag	UNP P05107
B	469	GLN	-	expression tag	UNP P05107
B	470	GLY	-	expression tag	UNP P05107
B	471	PRO	-	expression tag	UNP P05107
B	472	LEU	-	expression tag	UNP P05107
B	473	GLY	-	expression tag	UNP P05107
B	474	ALA	-	expression tag	UNP P05107
B	475	GLN	-	expression tag	UNP P05107
B	476	GLY	-	expression tag	UNP P05107
B	477	LYS	-	expression tag	UNP P05107
B	478	LYS	-	expression tag	UNP P05107
B	479	LYS	-	expression tag	UNP P05107
B	480	LEU	-	expression tag	UNP P05107
B	481	GLN	-	expression tag	UNP P05107
B	482	ALA	-	expression tag	UNP P05107
B	483	LEU	-	expression tag	UNP P05107
B	484	LYS	-	expression tag	UNP P05107
B	485	LYS	-	expression tag	UNP P05107
B	486	LYS	-	expression tag	UNP P05107
B	487	ASN	-	expression tag	UNP P05107
B	488	ALA	-	expression tag	UNP P05107
B	489	GLN	-	expression tag	UNP P05107
B	490	LEU	-	expression tag	UNP P05107
B	491	LYS	-	expression tag	UNP P05107
B	492	TRP	-	expression tag	UNP P05107
B	493	LYS	-	expression tag	UNP P05107
B	494	LEU	-	expression tag	UNP P05107
B	495	GLN	-	expression tag	UNP P05107
B	496	ALA	-	expression tag	UNP P05107
B	497	LEU	-	expression tag	UNP P05107
B	498	LYS	-	expression tag	UNP P05107
B	499	LYS	-	expression tag	UNP P05107
B	500	LYS	-	expression tag	UNP P05107
B	501	LEU	-	expression tag	UNP P05107
B	502	ALA	-	expression tag	UNP P05107
B	503	GLN	-	expression tag	UNP P05107
B	504	HIS	-	expression tag	UNP P05107
B	505	HIS	-	expression tag	UNP P05107
B	506	HIS	-	expression tag	UNP P05107
B	507	HIS	-	expression tag	UNP P05107

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Chain	Residue	Modelled	Actual	Comment	Reference
B	508	HIS	-	expression tag	UNP P05107
B	509	HIS	-	expression tag	UNP P05107
B	510	ALA	-	expression tag	UNP P05107

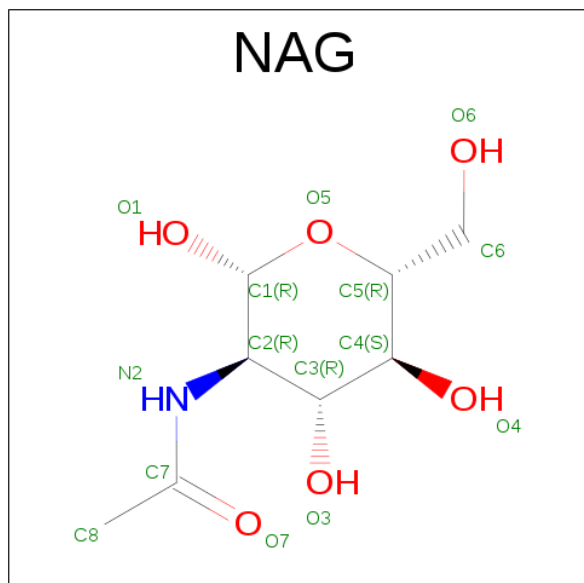
- Molecule 3 is MAGNESIUM ION (three-letter code: MG) (formula: Mg).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	1	Total Mg 1 1	0	0

- Molecule 4 is CALCIUM ION (three-letter code: CA) (formula: Ca).

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
4	B	2	Total Ca 2 2	0	0
4	A	2	Total Ca 2 2	0	0

- Molecule 5 is N-ACETYL-D-GLUCOSAMINE (three-letter code: NAG) (formula: C<sub>8</sub>H<sub>15</sub>NO<sub>6</sub>).



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

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

- Molecule 6 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
6	A	140	Total	O	0	0
			140	140		
6	B	66	Total	O	0	0
			66	66		





G453	
Y454	
I455	
G456	
K457	
N458	
C459	
GLU	
PRO	
ALA	
ALA	
LEU	
GLN	
THR	
LEU	
PHE	
GLN	
GLY	
PRO	
LEU	
GLY	
ALA	
GLN	
GLY	
LYS	
LYS	
LYS	
LEU	
GLN	
ALA	
LEU	
LYS	
LYS	
ASN	
ALA	
GLN	
LEU	
LYS	
THR	
LYS	
LEU	
GLN	
ALA	
LEU	
LYS	
LYS	
LEU	
ALA	
GLN	
HIS	
HIS	
HIS	
HIS	
HIS	
ALA	

## 4 Data and refinement statistics

Property	Value	Source
Space group	P 61	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	153.93Å 153.93Å 116.45Å 90.00° 90.00° 120.00°	Depositor
Resolution (Å)	46.24 – 2.90 46.24 – 2.90	Depositor EDS
% Data completeness (in resolution range)	97.7 (46.24-2.90) 97.7 (46.24-2.90)	Depositor EDS
$R_{merge}$	0.09	Depositor
$R_{sym}$	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.37 (at 2.91Å)	Xtriage
Refinement program	PHENIX (1.10_2155: ???)	Depositor
R, $R_{free}$	0.193 , 0.229 0.194 , 0.230	Depositor DCC
$R_{free}$ test set	2735 reflections (8.05%)	DCC
Wilson B-factor (Å <sup>2</sup> )	79.5	Xtriage
Anisotropy	0.019	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.32 , 53.1	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.043 for h,-h-k,-l	Xtriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	8264	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	85.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 2.62% 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: MG, CA, 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	0.29	0/4579	0.50	0/6195
2	B	0.29	0/3582	0.50	0/4851
All	All	0.29	0/8161	0.50	0/11046

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
2	B	0	5

There are no bond length outliers.

There are no bond angle outliers.

There are no chirality outliers.

All (5) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
2	B	429	ASP	Peptide
2	B	435	SER	Peptide
2	B	436	LEU	Peptide
2	B	437	CYS	Peptide
2	B	458	ASN	Peptide

### 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	4481	0	4354	41	0
2	B	3516	0	3403	39	0
3	A	1	0	0	0	0
4	A	2	0	0	0	0
4	B	2	0	0	0	0
5	A	14	0	13	0	0
5	B	42	0	39	1	0
6	A	140	0	0	3	0
6	B	66	0	0	3	0
All	All	8264	0	7809	79	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 79 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)
2:B:114:SER:OG	6:B:4001:HOH:O	2.08	0.70
2:B:138:ILE:HG22	2:B:139:THR:HG23	1.78	0.66
1:A:506:ILE:O	1:A:587:SER:OG	2.14	0.65
1:A:25:LEU:HD21	1:A:76:THR:HB	1.80	0.64
1:A:475:ARG:NH2	6:A:4004:HOH:O	2.30	0.64

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	581/795 (73%)	558 (96%)	23 (4%)	0	100	100
2	B	452/510 (89%)	420 (93%)	27 (6%)	5 (1%)	17	51

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles
All	All	1033/1305 (79%)	978 (95%)	50 (5%)	5 (0%)	34 71

All (5) Ramachandran outliers are listed below:

Mol	Chain	Res	Type
2	B	455	ILE
2	B	457	LYS
2	B	432	ARG
2	B	28	ASN
2	B	430	GLN

### 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	A	476/666 (72%)	470 (99%)	6 (1%)	76 94
2	B	389/440 (88%)	381 (98%)	8 (2%)	61 88
All	All	865/1106 (78%)	851 (98%)	14 (2%)	70 91

5 of 14 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
2	B	67	GLU
2	B	120	ASP
2	B	435	SER
1	A	566	LEU
2	B	429	ASP

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

Mol	Chain	Res	Type
2	B	89	GLN

### 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 ⓘ

There are no carbohydrates in this entry.

## 5.6 Ligand geometry ⓘ

Of 9 ligands modelled in this entry, 5 are monoatomic - leaving 4 for Mogul analysis.

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$
5	NAG	A	3064	1	14,14,15	0.59	1 (7%)	15,19,21	0.38	0
5	NAG	B	3028	2	14,14,15	0.64	1 (7%)	15,19,21	0.34	0
5	NAG	B	3094	2	14,14,15	0.71	1 (7%)	15,19,21	0.50	0
5	NAG	B	3190	2	14,14,15	0.38	0	15,19,21	0.70	1 (6%)

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
5	NAG	A	3064	1	-	0/6/23/26	0/1/1/1
5	NAG	B	3028	2	-	0/6/23/26	0/1/1/1
5	NAG	B	3094	2	-	0/6/23/26	0/1/1/1
5	NAG	B	3190	2	-	0/6/23/26	0/1/1/1

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
5	B	3094	NAG	O5-C1	-2.38	1.39	1.43
5	B	3028	NAG	O5-C1	-2.30	1.40	1.43
5	A	3064	NAG	O5-C1	-2.01	1.40	1.43

All (1) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
5	B	3190	NAG	C1-O5-C5	2.55	115.90	112.14

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

1 monomer is involved in 1 short contact:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
5	B	3028	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	581/795 (73%)	0.34	19 (3%)	50 42	48, 73, 115, 165	0
2	B	454/510 (89%)	0.77	66 (14%)	3 2	54, 85, 188, 224	0
All	All	1035/1305 (79%)	0.53	85 (8%)	14 9	48, 78, 134, 224	0

The worst 5 of 85 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
2	B	452	THR	9.6
2	B	423	CYS	8.1
2	B	433	ASP	7.8
2	B	34	ASP	7.6
2	B	431	SER	6.7

### 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 carbohydrates 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. LLDF column lists the quality of electron density of the group with respect to its neighbouring residues in protein, DNA or RNA chains. 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	LLDF	B-factors( $\text{\AA}^2$ )	Q<0.9
4	CA	B	2003	1/1	0.98	0.24	1.58	91,91,91,91	0
5	NAG	B	3094	14/15	0.91	0.20	-0.24	91,103,115,118	0
3	MG	A	2001	1/1	0.81	0.12	-0.85	86,86,86,86	0
4	CA	A	2002	1/1	0.82	0.08	-1.59	107,107,107,107	0
4	CA	A	2003	1/1	0.98	0.06	-1.88	95,95,95,95	0
4	CA	B	2002	1/1	0.99	0.07	-2.71	78,78,78,78	0
5	NAG	A	3064	14/15	0.78	0.32	-	128,141,148,149	0
5	NAG	B	3190	14/15	0.73	0.29	-	135,147,157,163	0
5	NAG	B	3028	14/15	0.74	0.53	-	169,177,188,188	0

## 6.5 Other polymers [i](#)

There are no such residues in this entry.