



# wwPDB X-ray Structure Validation Summary Report ⓘ

Nov 5, 2023 – 06:24 AM EST

PDB ID : 3I4W  
Title : Crystal Structure of the third PDZ domain of PSD-95  
Authors : Camara-Artigas, A.; Gavira, J.A.  
Deposited on : 2009-07-03  
Resolution : 1.35 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

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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

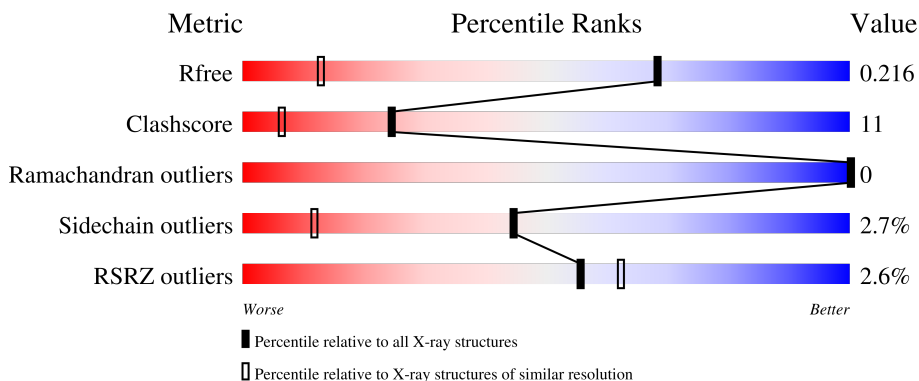
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*X-RAY DIFFRACTION*

The reported resolution of this entry is 1.35 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	1509 (1.38-1.34)
Clashscore	141614	1551 (1.38-1.34)
Ramachandran outliers	138981	1530 (1.38-1.34)
Sidechain outliers	138945	1530 (1.38-1.34)
RSRZ outliers	127900	1487 (1.38-1.34)

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	104	 81% 12% 6%
1	B	104	 83% 12% 6%
1	C	104	 83% 12% 6%
1	D	104	 79% 13% 6%

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
1	SNN	D	332	-	X	-	-
2	ACT	A	5	-	X	X	-
2	ACT	C	2	-	-	X	-
2	ACT	C	3	-	-	X	-

## 2 Entry composition [i](#)

There are 3 unique types of molecules in this entry. The entry contains 3241 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 Disks large homolog 4.

Mol	Chain	Residues	Atoms				ZeroOcc	AltConf	Trace
			Total	C	N	O			
1	A	98	754	471	136	147	0	2	0
1	B	98	741	463	134	144	0	0	0
1	C	98	747	466	135	146	0	1	0
1	D	98	741	463	134	144	0	0	0

There are 12 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	300	MET	-	expression tag	UNP P78352
A	301	GLY	-	expression tag	UNP P78352
A	332	SNN	ASP	engineered mutation	UNP P78352
B	300	MET	-	expression tag	UNP P78352
B	301	GLY	-	expression tag	UNP P78352
B	332	SNN	ASP	engineered mutation	UNP P78352
C	300	MET	-	expression tag	UNP P78352
C	301	GLY	-	expression tag	UNP P78352
C	332	SNN	ASP	engineered mutation	UNP P78352
D	300	MET	-	expression tag	UNP P78352
D	301	GLY	-	expression tag	UNP P78352
D	332	SNN	ASP	engineered mutation	UNP P78352

- Molecule 2 is ACETATE ION (three-letter code: ACT) (formula: C<sub>2</sub>H<sub>3</sub>O<sub>2</sub>).



Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
2	A	1	Total C O 4 2 2	0	0
2	A	1	Total C O 4 2 2	0	0
2	B	1	Total C O 4 2 2	0	0
2	C	1	Total C O 4 2 2	0	0
2	C	1	Total C O 4 2 2	0	0
2	D	1	Total C O 4 2 2	0	0

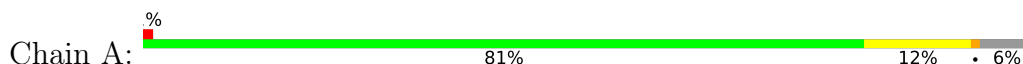
- Molecule 3 is water.

Mol	Chain	Residues	Atoms	ZeroOcc	AltConf
3	A	62	Total O 62 62	0	0
3	B	56	Total O 56 56	0	0
3	C	57	Total O 57 57	0	0
3	D	59	Total O 59 59	0	0

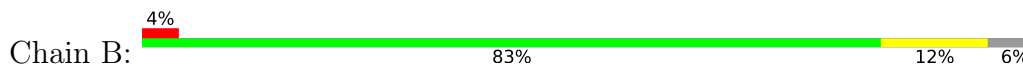
### 3 Residue-property plots [i](#)

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.

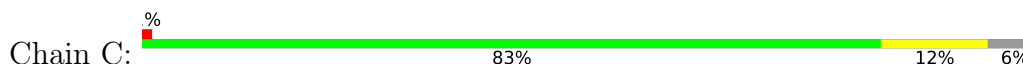
- Molecule 1: Disks large homolog 4



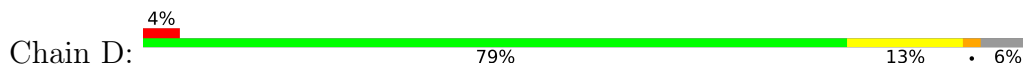
- Molecule 1: Disks large homolog 4



- Molecule 1: Disks large homolog 4



- Molecule 1: Disks large homolog 4



## 4 Data and refinement statistics

Property	Value	Source
Space group	P 1	Depositor
Cell constants a, b, c, $\alpha$ , $\beta$ , $\gamma$	43.32Å 42.15Å 47.60Å 90.00° 90.00° 92.08°	Depositor
Resolution (Å)	47.62 – 1.35 14.90 – 1.35	Depositor EDS
% Data completeness (in resolution range)	91.8 (47.62-1.35) 91.9 (14.90-1.35)	Depositor EDS
$R_{merge}$	0.06	Depositor
$R_{sym}$	0.06	Depositor
$\langle I/\sigma(I) \rangle$ <sup>1</sup>	1.99 (at 1.35Å)	Xtriage
Refinement program	REFMAC 5.5.0072	Depositor
R, $R_{free}$	0.187 , 0.216 0.188 , 0.216	Depositor DCC
$R_{free}$ test set	3424 reflections (5.05%)	wwPDB-VP
Wilson B-factor (Å <sup>2</sup> )	12.7	Xtriage
Anisotropy	0.025	Xtriage
Bulk solvent $k_{sol}$ (e/Å <sup>3</sup> ), $B_{sol}$ (Å <sup>2</sup> )	0.44 , 61.3	EDS
L-test for twinning <sup>2</sup>	$\langle  L  \rangle = 0.49$ , $\langle L^2 \rangle = 0.32$	Xtriage
Estimated twinning fraction	0.022 for -k,h,l 0.022 for k,-h,l 0.032 for -h,k,-l 0.033 for h,-k,-l 0.477 for -h,-k,l 0.032 for k,h,-l 0.029 for -k,-h,-l	Xtriage
$F_o, F_c$ correlation	0.95	EDS
Total number of atoms	3241	wwPDB-VP
Average B, all atoms (Å <sup>2</sup> )	18.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 14.37% 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 [i](#)

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

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

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	0.95	0/757	1.02	1/1019 (0.1%)
1	B	1.01	2/744 (0.3%)	1.01	0/1001
1	C	0.99	0/750	1.04	1/1009 (0.1%)
1	D	0.97	1/744 (0.1%)	1.05	0/1001
All	All	0.98	3/2995 (0.1%)	1.03	2/4030 (0.0%)

All (3) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	B	333	GLY	N-CA	5.94	1.54	1.46
1	D	333	GLY	N-CA	5.78	1.54	1.46
1	B	397	TYR	CE1-CZ	-5.31	1.31	1.38

All (2) bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	366	ASP	CB-CG-OD1	5.97	123.67	118.30
1	C	366	ASP	CB-CG-OD1	5.55	123.30	118.30

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	754	0	740	15	0
1	B	741	0	728	9	0
1	C	747	0	732	15	0
1	D	741	0	728	25	0
2	A	8	0	6	4	0
2	B	4	0	3	1	0
2	C	8	0	6	8	0
2	D	4	0	3	0	0
3	A	62	0	0	1	0
3	B	56	0	0	1	0
3	C	57	0	0	1	0
3	D	59	0	0	1	0
All	All	3241	0	2946	65	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 11.

The worst 5 of 65 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:D:305:GLU:HG2	1:D:354:ARG:NH2	1.45	1.32
1:D:316:ILE:CD1	1:D:388:ILE:HD12	1.91	1.01
1:D:316:ILE:HD12	1:D:388:ILE:HD12	1.44	0.99
1:D:305:GLU:CG	1:D:354:ARG:NH2	2.30	0.95
1:C:305:GLU:HB2	1:C:354:ARG:HH22	1.30	0.94

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	97/104 (93%)	97 (100%)	0	0	<b>100</b> <b>100</b>

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Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	B	95/104 (91%)	95 (100%)	0	0	100	100
1	C	96/104 (92%)	96 (100%)	0	0	100	100
1	D	95/104 (91%)	95 (100%)	0	0	100	100
All	All	383/416 (92%)	383 (100%)	0	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	77/79 (98%)	74 (96%)	3 (4%)	32	4
1	B	75/79 (95%)	73 (97%)	2 (3%)	44	12
1	C	76/79 (96%)	75 (99%)	1 (1%)	69	37
1	D	75/79 (95%)	73 (97%)	2 (3%)	44	12
All	All	303/316 (96%)	295 (97%)	8 (3%)	44	12

5 of 8 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	D	312	ARG
1	D	306	ASP
1	B	349	LEU
1	B	312	ARG
1	C	350	SER

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 6 such sidechains are listed below:

Mol	Chain	Res	Type
1	B	372	HIS
1	C	372	HIS
1	D	372	HIS

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Mol	Chain	Res	Type
1	A	384	GLN
1	A	372	HIS

### 5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

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

4 non-standard protein/DNA/RNA residues are 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
1	SNN	A	332	1	5,6,8	0.46	0	3,6,11	2.69	2 (66%)
1	SNN	C	332	1	5,6,8	0.66	0	3,6,11	2.12	2 (66%)
1	SNN	B	332	1	5,6,8	0.98	0	3,6,11	2.45	2 (66%)
1	SNN	D	332	1	5,6,8	1.18	1 (20%)	3,6,11	2.60	3 (100%)

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
1	SNN	A	332	1	-	3/3/5/12	-
1	SNN	C	332	1	-	3/3/5/12	-
1	SNN	B	332	1	-	3/3/5/12	-
1	SNN	D	332	1	-	3/3/5/12	-

All (1) bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	D	332	SNN	C4-CA	-2.38	1.48	1.54

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

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	332	SNN	C4-CA-C	-3.40	105.09	111.44
1	D	332	SNN	CA-C4-C5	-3.05	102.87	114.44
1	B	332	SNN	CA-C4-C5	-2.95	103.26	114.44
1	B	332	SNN	C4-CA-C	-2.87	106.08	111.44
1	A	332	SNN	CA-C4-C5	-2.65	104.39	114.44

There are no chirality outliers.

5 of 12 torsion outliers are listed below:

Mol	Chain	Res	Type	Atoms
1	A	332	SNN	O-C-CA-C4
1	A	332	SNN	C5-C4-CA-N
1	A	332	SNN	CA-C4-C5-O5
1	B	332	SNN	O-C-CA-C4
1	B	332	SNN	C5-C4-CA-N

There are no ring outliers.

No monomer is involved in short contacts.

## 5.5 Carbohydrates [i](#)

There are no monosaccharides in this entry.

## 5.6 Ligand geometry [i](#)

6 ligands are 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
2	ACT	A	4	-	3,3,3	0.94	0	3,3,3	2.39	1 (33%)
2	ACT	C	2	-	3,3,3	0.86	0	3,3,3	2.54	2 (66%)
2	ACT	C	3	-	3,3,3	0.94	0	3,3,3	3.15	2 (66%)
2	ACT	D	6	-	3,3,3	0.98	0	3,3,3	3.41	2 (66%)
2	ACT	B	1	-	3,3,3	0.85	0	3,3,3	3.22	2 (66%)
2	ACT	A	5	-	3,3,3	1.06	0	3,3,3	3.26	3 (100%)

There are no bond length outliers.

The worst 5 of 12 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
2	C	3	ACT	OXT-C-O	-4.76	104.52	122.05
2	D	6	ACT	OXT-C-CH3	4.67	134.47	115.18
2	B	1	ACT	OXT-C-CH3	4.40	133.35	115.18
2	A	5	ACT	OXT-C-CH3	4.32	133.03	115.18
2	A	4	ACT	OXT-C-O	-4.09	106.97	122.05

There are no chirality outliers.

There are no torsion outliers.

There are no ring outliers.

4 monomers are involved in 13 short contacts:

Mol	Chain	Res	Type	Clashes	Symm-Clashes
2	C	2	ACT	4	0
2	C	3	ACT	4	0
2	B	1	ACT	1	0
2	A	5	ACT	4	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	97/104 (93%)	-0.05	1 (1%) 82 85	8, 15, 29, 54	2 (2%)
1	B	97/104 (93%)	0.05	4 (4%) 37 43	8, 15, 31, 56	3 (3%)
1	C	97/104 (93%)	-0.04	1 (1%) 82 85	9, 15, 28, 54	3 (3%)
1	D	97/104 (93%)	0.07	4 (4%) 37 43	7, 15, 31, 55	3 (3%)
All	All	388/416 (93%)	0.01	10 (2%) 56 62	7, 15, 31, 56	11 (2%)

The worst 5 of 10 RSRZ outliers are listed below:

Mol	Chain	Res	Type	RSRZ
1	D	402	ALA	3.8
1	B	305	GLU	3.5
1	B	349	LEU	3.3
1	B	402	ALA	3.2
1	D	349	LEU	2.8

### 6.2 Non-standard residues in protein, DNA, RNA chains [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
1	SNN	D	332	7/8	0.97	0.07	11,12,16,19	0
1	SNN	B	332	7/8	0.98	0.07	11,12,17,18	0
1	SNN	C	332	7/8	0.98	0.06	11,12,16,21	0
1	SNN	A	332	7/8	0.98	0.05	10,11,16,22	0

### 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
2	ACT	B	1	4/4	0.86	0.11	22,22,23,33	0
2	ACT	D	6	4/4	0.88	0.11	20,20,21,31	0
2	ACT	C	3	4/4	0.89	0.14	15,17,29,30	0
2	ACT	A	5	4/4	0.92	0.09	14,16,30,37	0
2	ACT	A	4	4/4	0.94	0.11	9,23,25,28	0
2	ACT	C	2	4/4	0.95	0.12	9,24,25,28	0

### 6.5 Other polymers [i](#)

There are no such residues in this entry.