



# Full wwPDB NMR Structure Validation Report ⓘ

Feb 12, 2017 – 05:25 pm GMT

PDB ID : 1AA3  
Title : C-TERMINAL DOMAIN OF THE E. COLI RECA, NMR, MINIMIZED AVERAGE STRUCTURE  
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Deposited on : 1997-01-22

This is a Full wwPDB NMR Structure Validation Report for a publicly released PDB entry.

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A user guide is available at

<http://wwpdb.org/validation/2016/NMRValidationReportHelp>

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:

Cyrange	:	Kirchner and Güntert (2011)
NmrClust	:	Kelley et al. (1996)
MolProbity	:	4.02b-467
Percentile statistics	:	20161228.v01 (using entries in the PDB archive December 28th 2016)
RCI	:	v_1n_11_5_13_A (Berjanski et al., 2005)
PANAV	:	Wang et al. (2010)
ShiftChecker	:	trunk28760
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	recalc28949

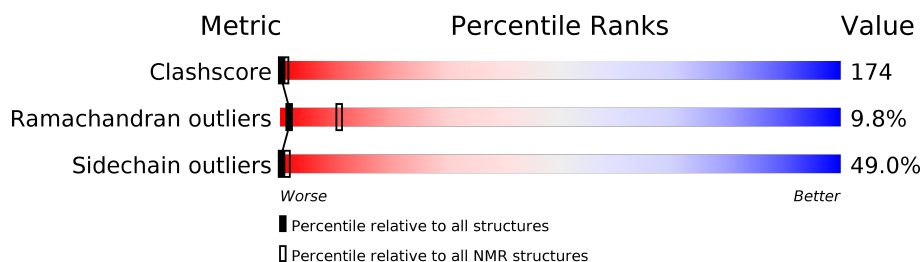
# 1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

*SOLUTION NMR*

The overall completeness of chemical shifts assignment was not calculated.

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)	NMR archive (#Entries)
Clashscore	125131	11601
Ramachandran outliers	121729	10391
Sidechain outliers	121581	10367

The table below summarises the geometric issues observed across the polymeric chains and their fit to the experimental data. The red, orange, yellow and green segments indicate the fraction of residues that contain outliers for  $\geq 3$ , 2, 1 and 0 types of geometric quality criteria. A cyan segment indicates the fraction of residues that are not part of the well-defined cores, and 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  $\leq 5\%$

Mol	Chain	Length	Quality of chain
1	A	63	

## 2 Ensemble composition and analysis ⓘ

This entry contains 1 models. Identification of well-defined residues and clustering analysis are not possible.

### 3 Entry composition [i](#)

There is only 1 type of molecule in this entry. The entry contains 1018 atoms, of which 516 are hydrogens and 0 are deuteriums.

- Molecule 1 is a protein called RECA.

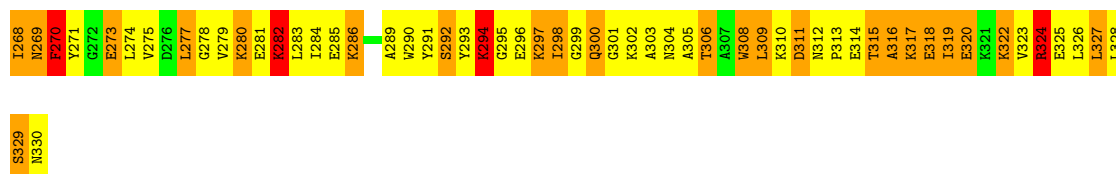
Mol	Chain	Residues	Atoms					Trace
1	A	63	Total	C	H	N	O	0
			1018	323	516	83	96	

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

These plots are provided for all protein, RNA and DNA chains in the entry. The first graphic is the same as shown in the summary in section 1 of this report. The second graphic shows the sequence where residues are colour-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. Stretches of 2 or more consecutive residues without any outliers are shown as green connectors. Residues which are classified as ill-defined in the NMR ensemble, are shown in cyan with an underline colour-coded according to the previous scheme. Residues which were present in the experimental sample, but not modelled in the final structure are shown in grey.

### • Molecule 1: RECA

Chain A: 



## 5 Refinement protocol and experimental data overview

The models were refined using the following method: *HYBRID DISTANCE GEOMETRY-SIMULATED ANNEALING*.

Of the 50 calculated structures, 1 were deposited, based on the following criterion: *AVERAGED MINIMIZED STRUCTURE*.

The following table shows the software used for structure solution, optimisation and refinement.

Software name	Classification	Version
X-PLOR	refinement	3.1
AZARA	structure solution	1.0
FELIX	structure solution	2.3
X-PLOR	structure solution	3.1

No chemical shift data was provided. No validations of the models with respect to experimental NMR restraints is performed at this time.

## 6 Model quality

### 6.1 Standard geometry

There are no covalent bond-length or bond-angle outliers.

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	Planarity
1	A	0	1
All	All	0	1

There are no bond-length outliers.

There are no bond-angle outliers.

There are no chirality outliers.

All planar outliers are listed below.

Mol	Chain	Res	Type	Group
1	A	324	ARG	Sidechain

### 6.2 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 each 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 averaged over the ensemble.

Mol	Chain	Non-H	H(model)	H(added)	Clashes
1	A	502	516	513	177
All	All	502	516	513	177

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 174.

All clashes are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Clash(Å)	Distance(Å)
1:A:293:TYR:OH	1:A:319:ILE:HG23	0.93	1.63
1:A:298:ILE:HG23	1:A:308:TRP:CE3	0.85	2.05
1:A:284:ILE:HG23	1:A:298:ILE:CD1	0.85	2.02

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Atom-1	Atom-2	Clash(Å)	Distance(Å)
1:A:328:LEU:HD23	1:A:329:SER:N	0.81	1.90
1:A:291:TYR:CE1	1:A:301:GLY:HA3	0.80	2.12
1:A:279:VAL:HG22	1:A:284:ILE:HB	0.79	1.52
1:A:271:TYR:OH	1:A:316:ALA:HB1	0.78	1.77
1:A:284:ILE:HD12	1:A:298:ILE:CD1	0.76	2.10
1:A:283:LEU:HD21	1:A:322:LYS:CB	0.75	2.12
1:A:279:VAL:HG21	1:A:291:TYR:CE2	0.75	2.16
1:A:274:LEU:HD21	1:A:309:LEU:HD21	0.72	1.59
1:A:275:VAL:O	1:A:279:VAL:HG23	0.72	1.83
1:A:274:LEU:HD21	1:A:319:ILE:HG21	0.71	1.62
1:A:283:LEU:CD1	1:A:323:VAL:HG23	0.71	2.15
1:A:312:ASN:O	1:A:316:ALA:HB2	0.70	1.86
1:A:279:VAL:HG21	1:A:291:TYR:HE2	0.70	1.47
1:A:298:ILE:CG2	1:A:308:TRP:CE3	0.70	2.74
1:A:284:ILE:HG21	1:A:291:TYR:HD2	0.69	1.46
1:A:284:ILE:HG21	1:A:291:TYR:CD2	0.69	2.22
1:A:291:TYR:CE1	1:A:301:GLY:CA	0.68	2.76
1:A:309:LEU:HD21	1:A:319:ILE:HG21	0.68	1.63
1:A:270:PHE:CE1	1:A:274:LEU:HD22	0.66	2.25
1:A:270:PHE:N	1:A:270:PHE:CD1	0.66	2.63
1:A:284:ILE:HD13	1:A:293:TYR:CE1	0.65	2.25
1:A:274:LEU:HD11	1:A:319:ILE:CG2	0.65	2.20
1:A:281:GLU:OE1	1:A:326:LEU:HD21	0.65	1.91
1:A:284:ILE:HG23	1:A:298:ILE:HD11	0.65	1.67
1:A:270:PHE:O	1:A:271:TYR:HB2	0.64	1.92
1:A:291:TYR:CD1	1:A:301:GLY:CA	0.64	2.80
1:A:293:TYR:CD2	1:A:308:TRP:CH2	0.62	2.87
1:A:271:TYR:HB3	1:A:306:THR:OG1	0.62	1.94
1:A:283:LEU:HD11	1:A:323:VAL:HG23	0.62	1.71
1:A:274:LEU:HD11	1:A:319:ILE:HG22	0.62	1.70
1:A:278:GLY:O	1:A:282:LYS:N	0.61	2.33
1:A:306:THR:O	1:A:310:LYS:N	0.61	2.34
1:A:271:TYR:O	1:A:306:THR:HG21	0.61	1.96
1:A:312:ASN:O	1:A:316:ALA:CB	0.61	2.48
1:A:284:ILE:HG23	1:A:298:ILE:HD12	0.60	1.73
1:A:270:PHE:CE2	1:A:320:GLU:CG	0.60	2.85
1:A:271:TYR:CE2	1:A:309:LEU:O	0.59	2.55
1:A:315:THR:HG23	1:A:319:ILE:CD1	0.59	2.28
1:A:315:THR:O	1:A:318:GLU:N	0.59	2.36
1:A:283:LEU:CD2	1:A:322:LYS:CB	0.59	2.80
1:A:316:ALA:O	1:A:319:ILE:HG12	0.59	1.98
1:A:283:LEU:HD21	1:A:322:LYS:HB2	0.58	1.74

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Atom-1	Atom-2	Clash(Å)	Distance(Å)
1:A:308:TRP:CE3	1:A:308:TRP:C	0.58	2.77
1:A:284:ILE:HD12	1:A:298:ILE:HD12	0.57	1.74
1:A:270:PHE:CZ	1:A:274:LEU:HD13	0.57	2.33
1:A:277:LEU:O	1:A:281:GLU:N	0.57	2.38
1:A:283:LEU:HD21	1:A:322:LYS:HB3	0.57	1.76
1:A:270:PHE:CE2	1:A:320:GLU:HG3	0.57	2.35
1:A:294:LYS:CD	1:A:294:LYS:O	0.56	2.53
1:A:327:LEU:HD23	1:A:330:ASN:CB	0.56	2.30
1:A:278:GLY:O	1:A:281:GLU:N	0.56	2.39
1:A:300:GLN:O	1:A:305:ALA:N	0.55	2.39
1:A:271:TYR:OH	1:A:316:ALA:CB	0.55	2.53
1:A:301:GLY:O	1:A:305:ALA:HB2	0.55	2.01
1:A:269:ASN:O	1:A:270:PHE:CB	0.55	2.55
1:A:274:LEU:HD11	1:A:319:ILE:CB	0.55	2.32
1:A:293:TYR:O	1:A:295:GLY:N	0.54	2.39
1:A:275:VAL:HG13	1:A:284:ILE:HG13	0.54	1.80
1:A:285:GLU:O	1:A:292:SER:N	0.54	2.41
1:A:291:TYR:O	1:A:297:LYS:HG3	0.54	2.02
1:A:315:THR:O	1:A:317:LYS:N	0.54	2.40
1:A:292:SER:OG	1:A:297:LYS:CD	0.54	2.56
1:A:283:LEU:CD2	1:A:322:LYS:HB2	0.54	2.33
1:A:275:VAL:HG11	1:A:305:ALA:HB1	0.53	1.80
1:A:311:ASP:C	1:A:313:PRO:HD3	0.53	2.23
1:A:291:TYR:CD1	1:A:301:GLY:HA2	0.53	2.38
1:A:294:LYS:CE	1:A:315:THR:OG1	0.53	2.57
1:A:298:ILE:HA	1:A:308:TRP:HB3	0.53	1.81
1:A:281:GLU:OE1	1:A:326:LEU:CD2	0.53	2.57
1:A:327:LEU:HD23	1:A:330:ASN:HB3	0.53	1.81
1:A:270:PHE:CG	1:A:274:LEU:HB2	0.53	2.39
1:A:270:PHE:CD2	1:A:274:LEU:HB2	0.53	2.39
1:A:271:TYR:HH	1:A:316:ALA:HB1	0.52	1.65
1:A:303:ALA:O	1:A:304:ASN:ND2	0.52	2.43
1:A:299:GLY:O	1:A:300:GLN:O	0.52	2.28
1:A:273:GLU:O	1:A:277:LEU:N	0.52	2.42
1:A:312:ASN:O	1:A:316:ALA:N	0.52	2.41
1:A:271:TYR:O	1:A:306:THR:CG2	0.52	2.57
1:A:309:LEU:HD11	1:A:316:ALA:HA	0.52	1.81
1:A:269:ASN:C	1:A:270:PHE:CG	0.52	2.83
1:A:281:GLU:O	1:A:282:LYS:CB	0.51	2.57
1:A:284:ILE:HD13	1:A:293:TYR:HE1	0.51	1.63
1:A:294:LYS:NZ	1:A:315:THR:OG1	0.51	2.43
1:A:274:LEU:HD21	1:A:319:ILE:CG2	0.50	2.34

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Atom-1	Atom-2	Clash(Å)	Distance(Å)
1:A:286:LYS:HD3	1:A:291:TYR:CE1	0.50	2.42
1:A:300:GLN:CB	1:A:303:ALA:HB3	0.50	2.37
1:A:316:ALA:C	1:A:319:ILE:HG12	0.50	2.27
1:A:281:GLU:CD	1:A:326:LEU:CD2	0.50	2.80
1:A:269:ASN:O	1:A:270:PHE:CG	0.49	2.65
1:A:298:ILE:HA	1:A:308:TRP:CB	0.49	2.38
1:A:277:LEU:CD1	1:A:281:GLU:HG2	0.49	2.38
1:A:285:GLU:O	1:A:292:SER:HB2	0.48	2.07
1:A:274:LEU:CD1	1:A:319:ILE:HB	0.48	2.38
1:A:308:TRP:CD2	1:A:308:TRP:C	0.48	2.86
1:A:298:ILE:CG2	1:A:305:ALA:O	0.48	2.61
1:A:283:LEU:CD2	1:A:322:LYS:HB3	0.48	2.39
1:A:277:LEU:O	1:A:281:GLU:HB2	0.48	2.09
1:A:319:ILE:N	1:A:319:ILE:HD13	0.48	2.24
1:A:312:ASN:ND2	1:A:315:THR:HB	0.48	2.24
1:A:290:TRP:CZ3	1:A:299:GLY:HA2	0.47	2.44
1:A:327:LEU:CD2	1:A:330:ASN:CB	0.47	2.92
1:A:283:LEU:HD13	1:A:323:VAL:HG23	0.47	1.86
1:A:270:PHE:CZ	1:A:320:GLU:CB	0.47	2.98
1:A:271:TYR:CD2	1:A:306:THR:OG1	0.47	2.68
1:A:311:ASP:O	1:A:313:PRO:CD	0.47	2.62
1:A:289:ALA:O	1:A:301:GLY:N	0.46	2.48
1:A:296:GLU:O	1:A:297:LYS:C	0.46	2.51
1:A:293:TYR:HD1	1:A:298:ILE:HD11	0.46	1.71
1:A:306:THR:OG1	1:A:306:THR:O	0.46	2.33
1:A:315:THR:CG2	1:A:319:ILE:CD1	0.46	2.93
1:A:275:VAL:O	1:A:279:VAL:CG2	0.46	2.60
1:A:286:LYS:CB	1:A:291:TYR:HA	0.45	2.42
1:A:292:SER:OG	1:A:297:LYS:HD2	0.45	2.10
1:A:271:TYR:CG	1:A:306:THR:OG1	0.45	2.69
1:A:270:PHE:CD1	1:A:271:TYR:N	0.45	2.85
1:A:320:GLU:O	1:A:324:ARG:N	0.45	2.45
1:A:284:ILE:CD1	1:A:293:TYR:CE1	0.45	2.99
1:A:293:TYR:CD1	1:A:298:ILE:CD1	0.45	3.00
1:A:271:TYR:CB	1:A:306:THR:OG1	0.45	2.64
1:A:291:TYR:O	1:A:297:LYS:CG	0.45	2.65
1:A:269:ASN:C	1:A:270:PHE:CD1	0.45	2.90
1:A:278:GLY:HA2	1:A:283:LEU:CD1	0.45	2.42
1:A:291:TYR:O	1:A:297:LYS:HD2	0.45	2.11
1:A:298:ILE:O	1:A:308:TRP:HB3	0.45	2.11
1:A:281:GLU:HA	1:A:281:GLU:OE1	0.45	2.12
1:A:294:LYS:HE3	1:A:315:THR:OG1	0.45	2.11

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Atom-1	Atom-2	Clash(Å)	Distance(Å)
1:A:285:GLU:O	1:A:292:SER:CB	0.45	2.65
1:A:311:ASP:O	1:A:313:PRO:HD2	0.45	2.12
1:A:298:ILE:CA	1:A:308:TRP:HB3	0.44	2.41
1:A:311:ASP:C	1:A:313:PRO:CD	0.44	2.85
1:A:284:ILE:CG2	1:A:291:TYR:HB3	0.44	2.42
1:A:278:GLY:O	1:A:279:VAL:C	0.44	2.55
1:A:299:GLY:HA3	1:A:304:ASN:CB	0.44	2.43
1:A:291:TYR:CG	1:A:301:GLY:HA2	0.44	2.48
1:A:327:LEU:O	1:A:328:LEU:C	0.44	2.56
1:A:283:LEU:HD23	1:A:319:ILE:HA	0.44	1.90
1:A:300:GLN:HB3	1:A:303:ALA:HB3	0.44	1.88
1:A:271:TYR:HB3	1:A:306:THR:CB	0.43	2.42
1:A:274:LEU:HD11	1:A:319:ILE:HB	0.43	1.87
1:A:303:ALA:O	1:A:304:ASN:CG	0.43	2.57
1:A:296:GLU:HB3	1:A:308:TRP:NE1	0.43	2.28
1:A:293:TYR:CZ	1:A:319:ILE:HG23	0.43	2.46
1:A:325:GLU:HA	1:A:328:LEU:CB	0.43	2.43
1:A:308:TRP:O	1:A:312:ASN:HB2	0.43	2.14
1:A:314:GLU:CG	1:A:315:THR:N	0.43	2.82
1:A:274:LEU:HD21	1:A:309:LEU:CD2	0.43	2.38
1:A:281:GLU:O	1:A:282:LYS:HB3	0.43	2.14
1:A:277:LEU:O	1:A:281:GLU:CB	0.43	2.67
1:A:268:ILE:O	1:A:269:ASN:C	0.42	2.57
1:A:296:GLU:HB3	1:A:308:TRP:HE1	0.42	1.74
1:A:294:LYS:HD3	1:A:294:LYS:O	0.42	2.14
1:A:298:ILE:HA	1:A:308:TRP:CG	0.42	2.48
1:A:268:ILE:O	1:A:270:PHE:N	0.42	2.51
1:A:271:TYR:N	1:A:271:TYR:CD1	0.42	2.87
1:A:315:THR:CG2	1:A:319:ILE:HD11	0.42	2.44
1:A:277:LEU:HB3	1:A:323:VAL:HG21	0.42	1.90
1:A:270:PHE:O	1:A:271:TYR:CB	0.42	2.62
1:A:320:GLU:O	1:A:324:ARG:HB2	0.42	2.13
1:A:309:LEU:CD2	1:A:319:ILE:HG21	0.42	2.40
1:A:299:GLY:O	1:A:300:GLN:C	0.42	2.56
1:A:279:VAL:CG2	1:A:291:TYR:CE2	0.42	3.00
1:A:291:TYR:HB2	1:A:299:GLY:O	0.42	2.14
1:A:327:LEU:CD2	1:A:330:ASN:HB3	0.42	2.43
1:A:293:TYR:CD1	1:A:298:ILE:HD11	0.41	2.50
1:A:271:TYR:HB3	1:A:306:THR:HG21	0.41	1.91
1:A:293:TYR:CE2	1:A:315:THR:HG21	0.41	2.50
1:A:278:GLY:C	1:A:280:LYS:N	0.41	2.73
1:A:308:TRP:CD2	1:A:308:TRP:O	0.41	2.73

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Atom-1	Atom-2	Clash(Å)	Distance(Å)
1:A:315:THR:O	1:A:319:ILE:CD1	0.41	2.69
1:A:308:TRP:CH2	1:A:312:ASN:ND2	0.41	2.89
1:A:283:LEU:CD2	1:A:319:ILE:HA	0.41	2.46
1:A:300:GLN:O	1:A:305:ALA:CA	0.40	2.69
1:A:306:THR:CA	1:A:309:LEU:HB3	0.40	2.46
1:A:298:ILE:HB	1:A:305:ALA:O	0.40	2.16

## 6.3 Torsion angles [i](#)

### 6.3.1 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 PDB entries followed by that with respect to all NMR entries. 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	61/63 (97%)	43 (70%)	12 (20%)	6 (10%)	1	10
All	All	61/63 (97%)	43 (70%)	12 (20%)	6 (10%)	1	10

All 6 Ramachandran outliers are listed below. They are sorted by the frequency of occurrence in the ensemble.

Mol	Chain	Res	Type
1	A	300	GLN
1	A	294	LYS
1	A	270	PHE
1	A	269	ASN
1	A	316	ALA
1	A	282	LYS

### 6.3.2 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 PDB entries followed by that with respect to all NMR entries. 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	51/51 (100%)	26 (51%)	25 (49%)	0	1

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Mol	Chain	Analysed	Rotameric	Outliers	Percentiles
All	All	51/51 (100%)	26 (51%)	25 (49%)	<b>0</b> <b>1</b>

All 25 residues with a non-rotameric sidechain are listed below. They are sorted by the frequency of occurrence in the ensemble.

Mol	Chain	Res	Type
1	A	329	SER
1	A	317	LYS
1	A	309	LEU
1	A	277	LEU
1	A	319	ILE
1	A	273	GLU
1	A	311	ASP
1	A	318	GLU
1	A	294	LYS
1	A	324	ARG
1	A	315	THR
1	A	282	LYS
1	A	286	LYS
1	A	327	LEU
1	A	292	SER
1	A	308	TRP
1	A	320	GLU
1	A	268	ILE
1	A	322	LYS
1	A	298	ILE
1	A	280	LYS
1	A	270	PHE
1	A	306	THR
1	A	302	LYS
1	A	297	LYS

### 6.3.3 RNA ⓘ

There are no RNA molecules in this entry.

## 6.4 Non-standard residues in protein, DNA, RNA chains ⓘ

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

## 6.5 Carbohydrates [i](#)

There are no carbohydrates in this entry.

## 6.6 Ligand geometry [i](#)

There are no ligands in this entry.

## 6.7 Other polymers [i](#)

There are no such molecules in this entry.

## 6.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

## 7 Chemical shift validation

No chemical shift data were provided