Supplementary Table 1. Sequences of primers used in PCR.

	Forward Primers	Reverse Primers
1	5’-Biotin-GGGAAGTCAGAAGAACCACCAGTGA	5’-CCTAGCTACTGGGGAGACTGAGGTA
2	5’-Biotin-AGAGCACACTACCACGCCTGGCCAA	5’-ACTGTACTCCAGCCTGGGCAACAGA
3	5’-Biotin-CCTCCTACTTATCAGCTCCAAAGCA	5’-CTCTTGTAGTCCCAGCTACTCAGGA
4	5’-Biotin-GAGGAGTGACTTTGGTTCTCTGCAA	5’-CCATTCCTATGACTTCAGCAGCTGA
5	5’-Biotin-TGGAATCATACGGCTGGAATTGGAA	5’-CTGAGTTTGCAGAGAACCAAAGTCA
6	5’-Biotin-ATACAGTTTGTAAGTGGCTGAACCA	5’-TTTCCTACTTCCTACGAGCCTCTGA
7	5’-Biotin-TCTTTTCGTTTGAACCTTGAGTGGA	5’-GCCAATCAAAAAAAGGGCTAGAGGA
8	5’-Biotin-CTAGCCCTTTTTTTGATTGGCACCA	5’-CTAGCCCTTTTTTTGATTGGCACCA
9	5’-Biotin-AGTACAGTGGCTCGATCTTGGCTCA	5’-TAATCCCAGCACTTTGGGAGGCCAA
10	5’-Biotin-AAAAGAAGAGAGCTACTCAGTGGAA	5’-AGCTGATAAGTAGGAGGTTATCAGA
11	5’-Biotin-TCCTGCGCATCCTCTTTTTGTGTCA	5’-CACAAGACAGTAGAGAGCGGCCACA
12	5’-Biotin-GCTTGGTGTACGAATGATCCTGTCA	5’-GCTCTCTTCTTTTGGGGGCTTCTGA
13	5’-Biotin-GCCCAGATATGACTTCATGAGGGTA	5’-TGACTTTTTTTTCCCCATGGTGTGA
14	5’-Biotin-CCTACCTCAGTCTCCCCAGTAGCTA	5’-CAGTAAGAGCTGACTACCGGGGCTA
15	5’-Biotin-TAGGTAGCTGCGTGGCTAACGGAGA	5’-GCATGAGATTGGCGGTCTGGGGAGA
16	5’-Biotin-TGATCCTCCCACCTTGGCCTCCCAA	5’-GAGGCACATTCTGGTCAAAGGCACA
17	5’-Biotin-TTACAGACAGTGATGTGTGTTCTGA	5’-TCGAATCAGGCGCTTAAATTTCTCA
18	5’-Biotin-CGCTAAGTCGCTGGCCATTGGTGGA	5’-CGCTTCCGGTTCAAACCCTGCGTGA
19	5’-Biotin-CCCCGGTAGTCAGCTCTTACTGAGA	5’-GGAAAGTCCTTCTCCTATCCATCCA
20	5’-Biotin-TATTTTGTGGGTTTTCAGCTGCTGA	5’-CTACCTCTATGAGTCCCTTTAAGGA
21	5’-Biotin-GACTCAAGAGGGCTTTAAACTGAGA	5’-TCTTCTGACTTCCCCCATCCCCCAA
22	5’-Biotin-GCAGGCTTAATTTATTGGCTGGCAA	5’-CAAGGCCTAACTCCTACAAGACCAA
23	5’-Biotin-GGCCAGGCTAGTCTCAAACTCCTGA	5’-AAGTGTTGGTTCTGACAGCCAAGGA
24	5’-Biotin-GCCACGATCATGCTATTGCACTCCA	5’-AGGTAGCTAGGACTACAGGCAAGCA
25	5’-Biotin-AGTCTCTGTAAGTAGGCTGGGCACA	5’-TGGGCTCAAGCAATCTTCCTCCCTA
26	5’-Biotin-TAATCCCAGCACTTTGGGAGGCCAA	5’-AGTGTAGTGGCGTAATCTCAGCTCA
27	5’-Biotin-CTAGGACTACAGAAGTGCATCACCA	5’-TAGAGAGGGCATCCAAGACTGGGTA
28	5’-Biotin-GTCTCGAACTCCTGACCTCAAGTGA	5’-CCACTGTGCCCAGCCTACTTACAGA
29	5’-Biotin-GCTGAGATTGTGCCATTGCACTCCA	5’-CCACACGAACTCGCATCTCAGAGGA
30	5’-Biotin-GCGACAGAGCGAGACTGTCA	5’-TCAGAGGAGAGTAGCATAAAACCTA
31	5’-Biotin-AGTGTGGGCCTCTACTTACAGGGAA	5’-AGCCAGACATGGTGGCCCATGCCTA
32	5’-Biotin-GCAGAGACAAAGGAAAACTACACCA	5’-AAAAGGTTTGTTCACTGCAAGGCAA
33	5’-Biotin-GTTCACAAGACTTCAGATTAGAGGA	5’-CCTGTTTGCCACTCCTGTCCAGCAA
34	5’-Biotin-TTCGTTGTAAACACCACTGCACTCA	5’-CAGGAGGATCACTTAGGAACAGAGA
35	5’-Biotin-GGCTTAACAGATTACTGTCGCGTGA	5’-CGAATTGATCACAACCAGTTACAGA
36	5’-Biotin-GTGATCTGCCTGCCTCTGCCTTCCA	5’-TTACTTGGGAAGCTGAGGCGGGAGA
37	5’-Biotin-GTTGTCCTTCAGTGTTTATGACAGA	5’-GAATGCTGGGTGCATATTTGACCTA
38	5’-Biotin-CTTGGATGCCCTCTCTACGTCCCTA	5’-GCCATGTTGGTCAGGCTGGTCTCGA
39	5’-Biotin-ACGAAAAGATTGGAGGGTTGATGGA	5’-GGCAACAAAGCAAGACTCTGTCTCA

40	5’-Biotin-TAGTCTCAGCACTTTGGGAGGCCAA	5’-AGTGGCATGATCACACCCAACAGCA
41	5’-Biotin-TGGGATCATTTTTGGTCTAACACCA	5’-GTAATTCTCCCACCTCAGCCTCCAA
42	5’-Biotin-GAATTACTTGAACCCAGGAGGTGGA	5’-AAGACAGAGGTGACCACATGGCCTA
43	5’-Biotin-CATCATAGGAAAACCCTAATCCAGA	5’-TGAAAACTTGGCATGACTACACACA
44	5’-Biotin-ATGCACAGGGTACTAGAAAAAAGGA	5’-TTGCCATAACTATGAGCAGAACACA
45	5’-Biotin-TCATATTCCCAGGGCTGTTGCTGCA	5’-ACCCCTGCCATAAAGGTGGGACACA
46	5’-Biotin-AGGAAGAATTGGGCCCTACAAAGCA	5’-TGCACACTTCATGTTTCCTTGAGGA
47	5’-Biotin-TCCCACCTTTATGGCAGGGGTGGAA	5’-GGTGACAGAGCAAGACTCTGTCTCA
48	5’-Biotin-CTCAAGATTCCAAACGCAGCACCAA	5’-TAGATTGGGATGTGGGAACTGGAGA
49	5’-Biotin-CCCTCCCCCATCAACTACCATGTGA	5’-TGCATTCAGAGTAGGGTGAAGCTCA
50	5’-Biotin-ACCGTGTTAGCCAGGATGGTCTCGA	5’-AGCCCTTCCCTTCCAACAGAACACA
51	5’-Biotin-GACAAGCTACATGTAATCAAGCTCA	5’-GCATTCCAGTATTACAAGGTTGGAA
52	5’-Biotin-ACTGCTGGAGAAATCAGAATTTGGA	5’-TAATCTGGACACAACTGTTCAAGCA
53	5’-Biotin-ATGCAAACGAAATCTCAGGTGAGCA	5’-ACACTGAGCACAGTGCCTTCTTCCA
54	5’-Biotin-GCAGTTAGCTGTTCTGAACTGCCAA	5’-AGTTCTAAATCTGGGTGGATCCAGA
55	5’-Biotin-CCCAGGATGGAAAGCTTGGGTGTGA	5’-AAAGCAGAGATGTTCCTTAAGACCA
56	5’-Biotin-ACAGTTGTGTCCAGATTAAGGGAGA	5’-ACTATTCTAGTCTTTACGCTGTCCA
57	5’-Biotin-GCTGCGGAGATTAACAAATGGGTGA	5’-GAACAGTTCTCCAGAAGTCAAACCA
58	5’-Biotin-AAAAAGGTTTTGGCAAGCTGGA	5’-TCTCCAAATTCTGATTTCTCCAGCA
59	5’-Biotin-ACATACAGATCACAAGCCTAGGAGA	5’-CCTTGGCAGTTTTCTATCTTAGTCA
60	5’-Biotin-CAGCATTTCTCTGTGTTCTGTTGGA	5’-CGCAGCTGGGATGAACATTTTCCTA
61	5’-Biotin-AGGAGTTCGAGACCAGCCTGGCCAA	5’-TTTCGCTCTTGTCACCCAGGCTGGA
62	5’-Biotin-TCCCCTCATTTTTTTCTGAGACAGA	5’-GAGACCATCCTGGCTAACACGGTGA
63	5’-Biotin-AAAGCCCTGAAATCTTCATGGGTGA	5’-ATACTTGAACAGAACAGGAGCCTCA
64	5’-Biotin-CATCTGAGGTACCAGGTTCATCTCA	5’-TTTTAAGCCGGTCCAAAAAGCGCAA
65	5’-Biotin-CCTTTGCCATTGTAAGGACTTTGGA	5’-AGTGAGATGAACCTGGTACCTCAGA
66	5’-Biotin-TCACACGGCAGGGTACTCCAACAGA	5’-TGAGGAACTGCGTTCCTTTGGAGGA
67	5’-Biotin-CGGCTTAAAAAACGGCGCACCACGA	5’-TCTCCTTGAGCTGTGGTGGGTTCCA
68	5’-Biotin-AACATTCCATGCTCATGGGTAGGAA	5’-GAAGTCAGGTAGTGTGATGCCTCCA
69	5’-Biotin-TACCCTCAAAGGGAAGCCCATCAGA	5’-TTTTAGGGTAGGCCTGGTGGTGACA
70	5’-Biotin-CAGAATGTACAAGTTAGCCCCCACA	5’-ACTTCAAAACCAAGGGCTTGTGTCA
71	5’-Biotin-TTCAGCTTTAGGAGGGTGCTTCTCA	5’-AGGCCAGGAGAGACAAATACACTGA
72	5’-Biotin-GCTAGATGACGAGTTAGTGGGTGCA	5’-AATTCGGACAGATTTACGGAGGGAA
73	5’-Biotin-AAGAGCTATCTATGACAAACCCAGA	5’-ATCATGTCATCTGCAAACAGGGACA
74	5’-Biotin-ACGAGAACAAAGACACAACGTACCA	5’-TCTATTTCCTTCAGTTCTGCTCTGA
75	5’-Biotin-CAACAGGTGCTGGAGAGGATGTGGA	5’-ATGCCGCAATAAACATACGTGTGCA
76	5’-Biotin-ATAATGACAGGATCAAACTCCCACA	5’-AACCCCTGCCTTTTTTTGTTTTCCA
77	5’-Biotin-GGGAGACTTTAACACCCCACTGTCA	5’-TTTGCTGAGGAGAGCTTTACTTCCA
78	5’-Biotin-GCTCGAGAACTATGTGAAGAATGCA	5’-CCATTCTCCCCATCACTTTCAGGTA
79	5’-Biotin-AACAGGCAACCTACAAAATGGGAGA	5’-CTCTGATGGCCAGTGATGATGAGCA
80	5’-Biotin-GAGGAACTGGTACCATTCCTTCTGA	5’-ATAAGCTTTTGGATGTGCTGCTGGA
81	5’-Biotin-CACAATAGCAAAGACTTGGAACCAA	5’-GTTCAATTCCCACCTATGAGTGAGA
82	5’-Biotin-CCAAAACAACATGGTACTGGTACCA	5’-GTATCAGGTGTAAGGAAGGGATCCA

83	5’-Biotin-CAACAAAATTGATAGACCGCTAGCA	5’-TTCTTCCTGGTTTAGTCTTGGGAGA
84	5’-Biotin-CCAGGAGAACTTCCCCAATCTAGCA	5’-GCCGAGAGATCTGCTGTTAGTCTGA
85	5’-Biotin-ATATCTAGAAAACCCCACTGTCTCA	5’-TCCTTCACATCCCTTGTAAGTTGGA
86	5’-Biotin-AACTATCTCTCAGACCACAGTGACA	5’-CACACTGCTTTGAATGTGTCCCAGA
87	5’-Biotin-AAACAAAAAAAGGCAGGGGTTGCAA	5’-TCTAAGTCTCTTTGTAGGTCACTCA
88	5’-Biotin-TGGCTAGCCATATGGAGAAAGCTGA	5’-TTGCCATTGCTTTTGGTGTTTTGGA

Supplementary Table 2. Labeling numbers of strand-specific FISH probes.

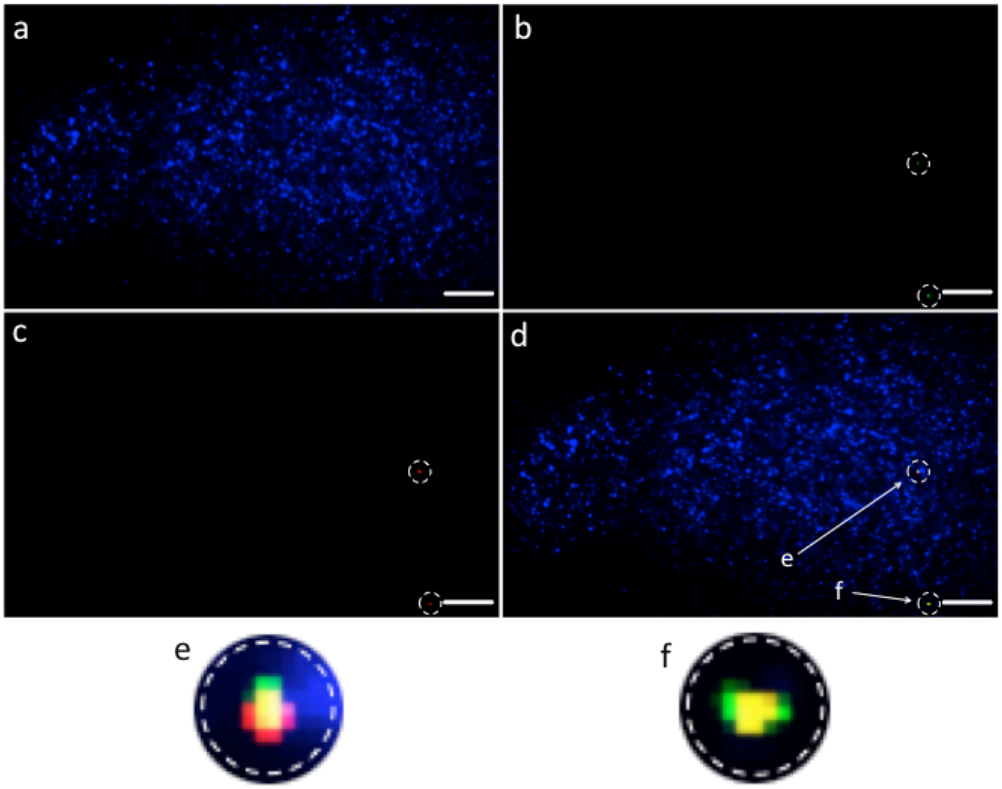
	Probes for the 3’ region of ATM TS	Probes for the 3’ region of ATM NTS	Probes for the 5’ region of ATM TS	Probes for the 5’ region of ATM NTS
Labeling number per 100 bases	6.1	6.2	6.0	5.4

Supplementary Table 3. Percentage of DNA in comet tails from cells irradiated with 0.1 J/m^2 UV light, and not digested with T4 endonuclease V.

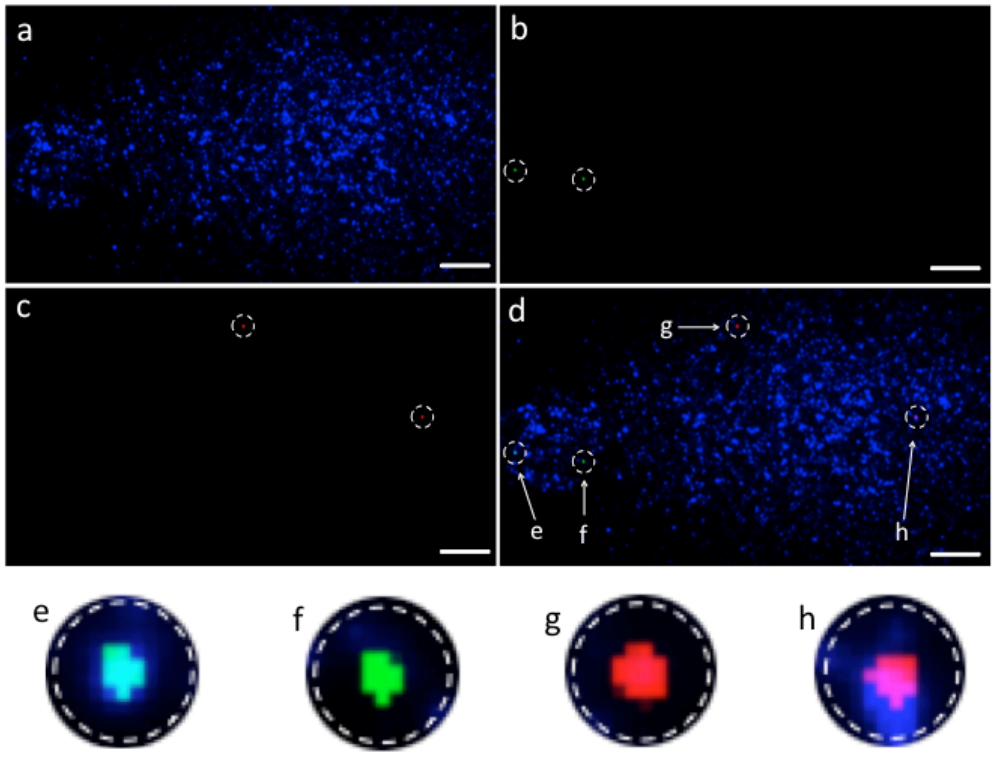
Cell types	Wild type	CSB	XPC	α-Amanitin treated XPC
Average	0.7	0.8	1.3	1.0
Standard deviation	0.7	0.9	1.1	1.0

Supplementary Table 4. Percentage of DNA in comet tails from cells treated with $KBrO_3$ and not digested with hOGG1.

Cell types	Wild type	CS-B	UV^SS-A	α-Amanitin treated wild type	hOGG1 KD	XP-A
$KBrO_3$	60 min	60 min	60 min	60 min	40 min	60 min
hOGG1	-	-	-	-	-	-
Repair time (min)	30	30	30	30	30	30
Average	1.5	1.1	1.2	2.2	8.7	9.5
Standard deviation	1.1	1.3	1.3	2.1	2.7	3.3



Supplementary Figure 1. Representative comet-FISH images of a UV-damaged cell with two intact ATM strands showing (**a**) the bulk DNA stained with DAPI, (**b**) Alexa 488 labeled probes targeting the 3' regions of the ATM strands, (**c**) Alexa 594 labeled probes targeting the 5' regions of the ATM strands, (**d**) an overlay of Supplementary Figure 1a, b and c (scale bars, 5 μm), (**e**) and (**f**) enlargements of the probes signals from Supplementary Figure 1d.



Supplementary Figure 2. Representative comet-FISH images of a UV-damaged cell with two damaged ATM strands showing (**a**) the bulk DNA stained with DAPI, (**b**) Alexa 488 labeled probes targeting the 3' regions of the ATM strands, (**c**) Alexa 594 labeled probes targeting the 5' regions of the ATM strands, (**d**) an overlay of Supplementary Figure 2a, b and c (scale bars, 5 μm), (**e**) (**f**) (**g**) and (**h**) enlargements of the probes signals from Supplementary Figure 2d.