

Preshower Tile Radiation Hardness

- 8 preshower tiles were placed around Hall A, generally near ion chambers (yellow tube).
- Preshower tiles are from CNCS and Kedi, and previously tested in 2015.
- Each tile was wrapped in tyvek and black tedlar and contained two fibers with 2.5 turns each.
- [Radiation hardness website](#)



Irradiative Preshower Results

Tile #	Location in Hall A	Radiation Dose	Before Radiation	With Old Grease	After Replacing Grease
Kedi 1	Beam Right lumis	161-164 kRad	87.1	56.6	74.4
Kedi 2	Upstream of scattering chamber	185-189 kRad	85.4	57.6 (fibers were kinked)	67.3
Kedi 3	Beamline grider	31-38 kRad	87.0	66.0	69.7
Kedi 4	Compton Chicane	9-17 kRad	91.0	55-74*(?) (broken fiber replaced)	86.5
CNCS 1	Beam Left lumis	156-172 kRad	83.4	56.2	49.7 [^]
CNCS 2	Beam Right scattering chamber	43-53 kRad	84.7	61.6	71.0
CNCS 3	Beam Left Scattering chamber	20-24 kRad	81.8	62.5	69.3
CNCS 4	Hall A Dump	230-286 kRad	83.4	41.2	47.2

* These measurements used a different PMT, S/N 23963, with a loose wire connection on the voltage divider and results may not be reliable. It was removed and replaced with PMT S/N 26799.

[^] These measurements were taken with PMT S/N 26799, but this PMT was not able to produce consistent results. It was removed and replaced with PMT S/N 27587.

Irradiative Preshower Results

Tile #	Radiation Dose	Before Radiation	With Old Grease	After Replacing Grease	After Replacing Fibers	After Replacing Tyvek Wrapping
Kedi 1	161-164 kRad	87.1	56.6	74.4 [#]	73.3 [#]	N/M
Kedi 2	185-189 kRad	85.4	57.6 (fibers were kinked)	67.3	68.0 [^]	80.3
Kedi 3	31-38 kRad	87.0	66.0	69.7 [#]	77.3	N/M
Kedi 4	9-17 kRad	91.0	55-74*(?) (broken fiber replaced)	86.5 [#]	N/M	N/M
CNCS 1	156-172 kRad	83.4	56.2	49.7 [^]	70.0	N/M
CNCS 2	43-53 kRad	84.7	61.6	71.0	74.5	N/M
CNCS 3	20-24 kRad	81.8	62.5	69.3	N/M	80.2
CNCS 4	230-286 kRad	83.4	41.2	47.2	54.0	58.9

These measurements were taken with PMT S/N 27587 and produced reliable results.

(N/M) no measurement was taken for these configurations. For CNCS 3, both the fibers and Tyvek wrapping were replaced at the same time.

Notes on Test Conditions

- CNCS 3 was placed in Hall A on 23 February, all other tiles were placed in January.
- After the test, one fiber for Kedi 4 was broken, and both fibers for Kedi 2 have a kink.
- The tile grooves were coated with optical grease, which expired in 2014.
- Most tests were conducted with XP2262 PMTs , S/N 24561 and S/N 26799 (2015) and S/N 24561 (post irradiation), expired optical grease, and fibers embedded during the irradiation test, except for Kedi 4, which has one fiber replaced.
- A few tests were conducted with PMTs S/N 23963, 26799 and 27587; and only the tests with S/N 27587 of those three produced reliable and consistent results.
- Other sets of measurements were conducted after replacing the expired optical grease with new grease, fibers with new fibers and in a few cases the Tyvek wrapping with new paper. In general, improvement was seen with each of the changes.

IHEP Test 2015 and 2016 Results

Run	NPE	Coments
N/A	94.6	Average of measurements from 2015
1608	94.6	PMT S/N 24561, Taken in April 2016
1652*	86.4	PMT S/N 24561
1672	80.6	PMT S/N 24561
1673	66.0	PMT S/N 26799
1674	70.7	PMT S/N 26799
1675	94.1	PMT S/N 27587

* The optical grease was replaced in the grooves in June 2016 with expired grease. The WLS fibers are optically cemented into the DDK connector.

Kedi 1 2016 Results

Run	NPE	Coments
N/A	87.1	Best result from 2015
1657	56.6	PMT S/N 24561
1664	56.3	PMT S/N 23963 With grease replaced
1665	42.5	PMT S/N 23963 Same as run 1664
1668	49.6	PMT S/N 23963 Same as run 1665
1677	74.4	PMT S/N 27587 Same except PMT replaced
1680	73.3	PMT S/N 27587 Fibers replaced

Kedi 2 2016 Results

Run	NPE	Coments
N/A	85.4	Average from 2015
1660	57.6	PMT S/N 24561
1662	67.3	PMT S/N 24561 With grease replaced
1670	68.0	PMT S/N 26799 With fibers replaced
1674	80.3	PMT S/N 24561 With Tyvek replaced

Kedi 3 2016 Results

Run	NPE	Coments
N/A	87.0	Best result from 2015
1654	66.0	PMT S/N 24561
1666	59.0	PMT S/N 23963 With grease replaced
1678	69.7	PMT S/N 24561 Same except PMT replaced
1680	77.3	PMT S/N 24561 Fibers replaced

Kedi 4 2016 Results

Run	NPE	Coments
N/A	91.0	Best result from 2015
1661	55.0-74.0	PMT S/N 23963 Difficult to isolate SPE
1663	63.3	PMT S/N 23963 With grease replaced
1678	86.5	PMT S/N 27587 Same as run 1664

CNCS 1 2016 Results

Run	NPE	Comments
N/A	83.4	Best result from 2015
1655	56.2	PMT S/N 24561
1664	47.1	PMT S/N 24561 With grease replaced
1665	45.2	PMT S/N 24561 Same as run 1664
1672	49.7	PMT S/N 26799 Same except PMT switched
1675	68.2	PMT S/N 24561 Fibers replaced
1676	71.8	PMT S/N 27587 Same as run 1675

CNCS 2 2016 Results

Run	NPE	Coments
N/A	84.7	Best result from 2015
1661	61.6	PMT S/N 24561
1668	71.0	PMT S/N 24561 With grease replaced
1676	74.5	PMT S/N 24561 Fibers replaced

CNCS 3 2016 Results

Run	NPE	Coments
N/A	81.8	Average from 2015
1653	62.5	PMT S/N 24561
1666	69.3	PMT S/N 24561 With grease replaced
1677	80.2	PMT S/N 24561 Fibers and Tyvek replaced

CNCS 4 2016 Results

Run	NPE	Coments
N/A	83.4	Average from 2015
1658	41.2	PMT S/N 24561
1662	28.7	PMT S/N 23963 With grease replaced
1663	47.2	PMT S/N 24561 Same except PMT switched
1669	53.7	PMT S/N 23963 Fiber replaced
1670	55.9	PMT S/N 24561 Same except PMT switched
1671	52.4	PMT S/N 26799 Same except PMT switched
1673	58.9	PMT S/N 24561 Tyvek replaced
1679	58.8	PMT S/N 27587 Same except PMT switched