Tables S1 and S2 show the experimental settings for the different irradiation experiments for pASW and cASW, respectively. The irradiation order indicates consecutive irradiations at the same ice spot. Experiments on pristine ice have irradiation order “1”. The power is measured at the FEL initial station prior to any gold mirror steering of the beam into the bays.
area and before the CsI window separating LISA from the rest of the beamline. Therefore the actual power reaching the ice is estimated to be roughly half the values reported in the tables.

Table S1: Irradiation experiments on pASW (June 2018)

| Irradiation order | Wavelength ($\mu$m) | Duration (minutes) | Power (mJ) | Notes |
|-------------------|---------------------|-------------------|------------|-------|
| “blue to red” series |                     |                   |            |       |
| 1                 | 2.7                 | 5                 | 9          |       |
| 2                 | 2.8                 | 5                 | 12         |       |
| 3                 | 2.9                 | 5                 | 11         |       |
| 4                 | 3.0                 | 5                 | 14         |       |
| 5                 | 3.1                 | 5                 | 14         |       |
| 6                 | 3.2                 | 1.5               | 12         | FELIX was unstable |
| 7                 | 3.25                | 5                 | 6          |       |
| “red to blue” series |                     |                   |            |       |
| 1                 | 3.25                | 2                 | 6          |       |
| 2                 | 3.2                 | 2                 | 10         |       |
| 3                 | 3.1                 | 2                 | 13         |       |
| 4                 | 3.0                 | 2                 | 13         |       |
| 5                 | 2.9                 | 2                 | 11         |       |
| 6                 | 2.8                 | 2                 | 9          |       |
| 7                 | 2.7                 | 2                 | 8          |       |
| Single irradiation |                     |                   |            |       |
| 1                 | 3.1                 | 5                 | 12.5       |       |
Table S2: Irradiation experiments on cASW (August 2018)

| Irradiation number | Wavelength (µm) | Duration (minutes) | Power (mJ) | Notes |
|--------------------|-----------------|-------------------|------------|-------|
|                    |                 |                   |            |       |
| **“blue to red” series** |
| 1                  | 2.7             | 3                 | 7          |       |
| 2                  | 2.8             | 3                 | 11         |       |
| 3                  | 2.9             | 3                 | 14         |       |
| 4                  | 3.0             | 3                 | 13         |       |
| 5                  | 3.1             | 3                 | 15         |       |
| 6                  | 3.2             | 3                 | 15         |       |
| 7                  | 3.25            | 3                 | 15         |       |
| **“red to blue” series** |
| 1                  | 3.25            | 3                 | 15         |       |
| 2                  | 3.2             | 3                 | 20         |       |
| 3                  | 3.1             | 3                 | 20         |       |
| 4                  | 3.0             | 3                 | 14         |       |
| 5                  | 2.9             | 3                 | 14         |       |
| 6                  | 2.8             | 3                 | 14         |       |
| 7                  | 2.7             | 3                 | 14         |       |