The icing problem

Experiences from LCLS experiments of the CFEL group*

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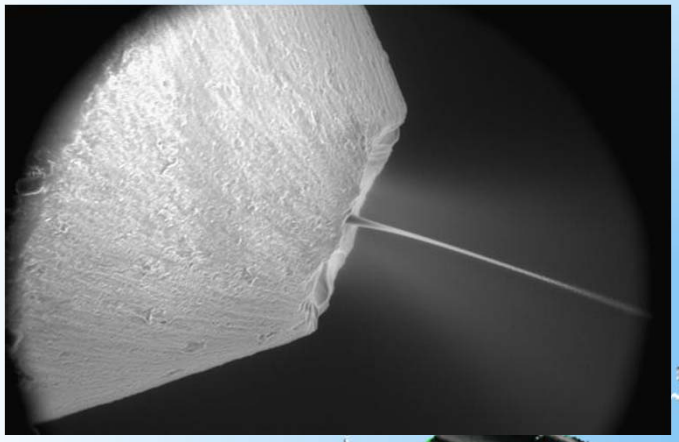
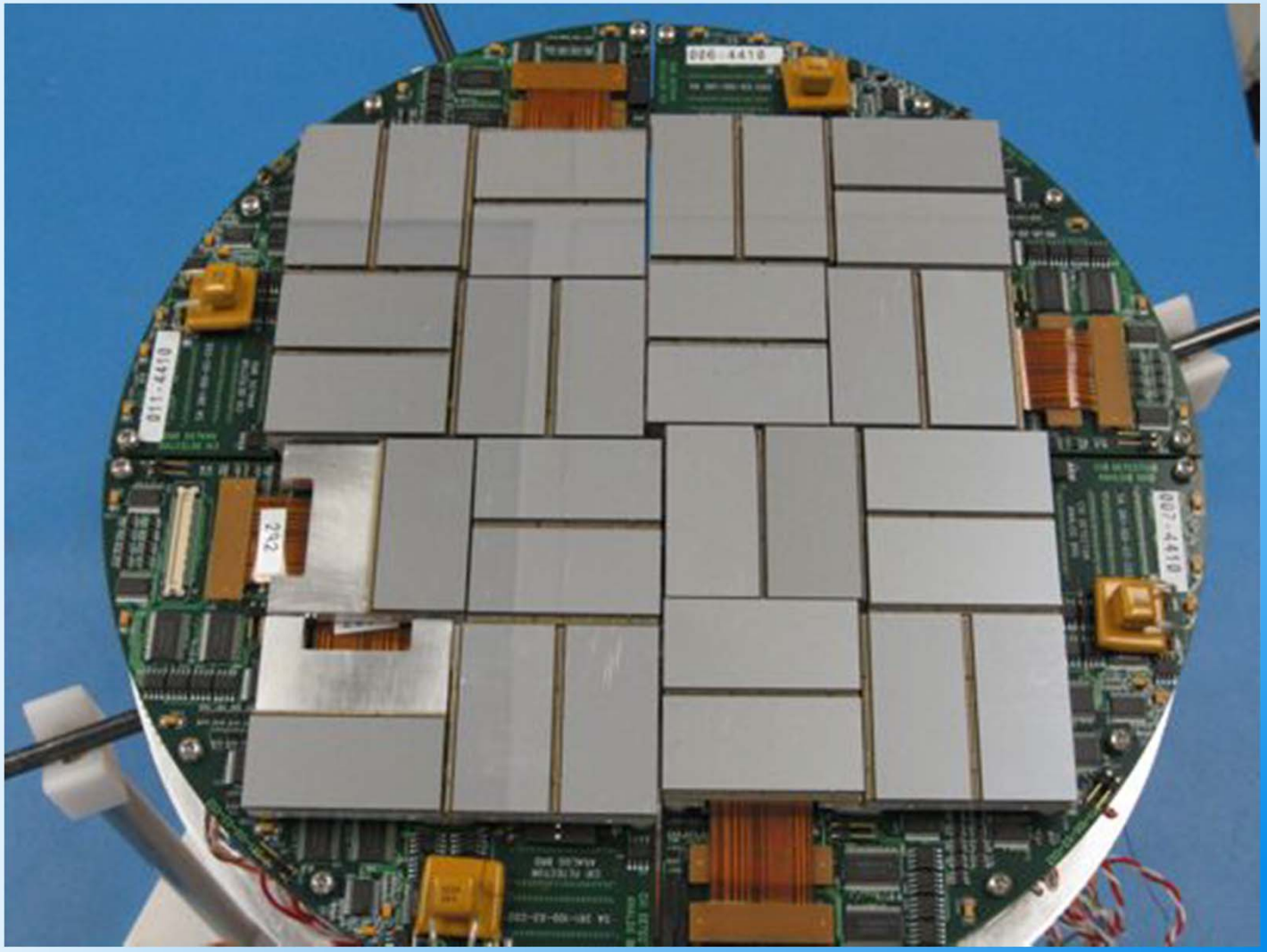
*Data courtesy of Anton Barty from CFEL

Experimental set-up at LCLS

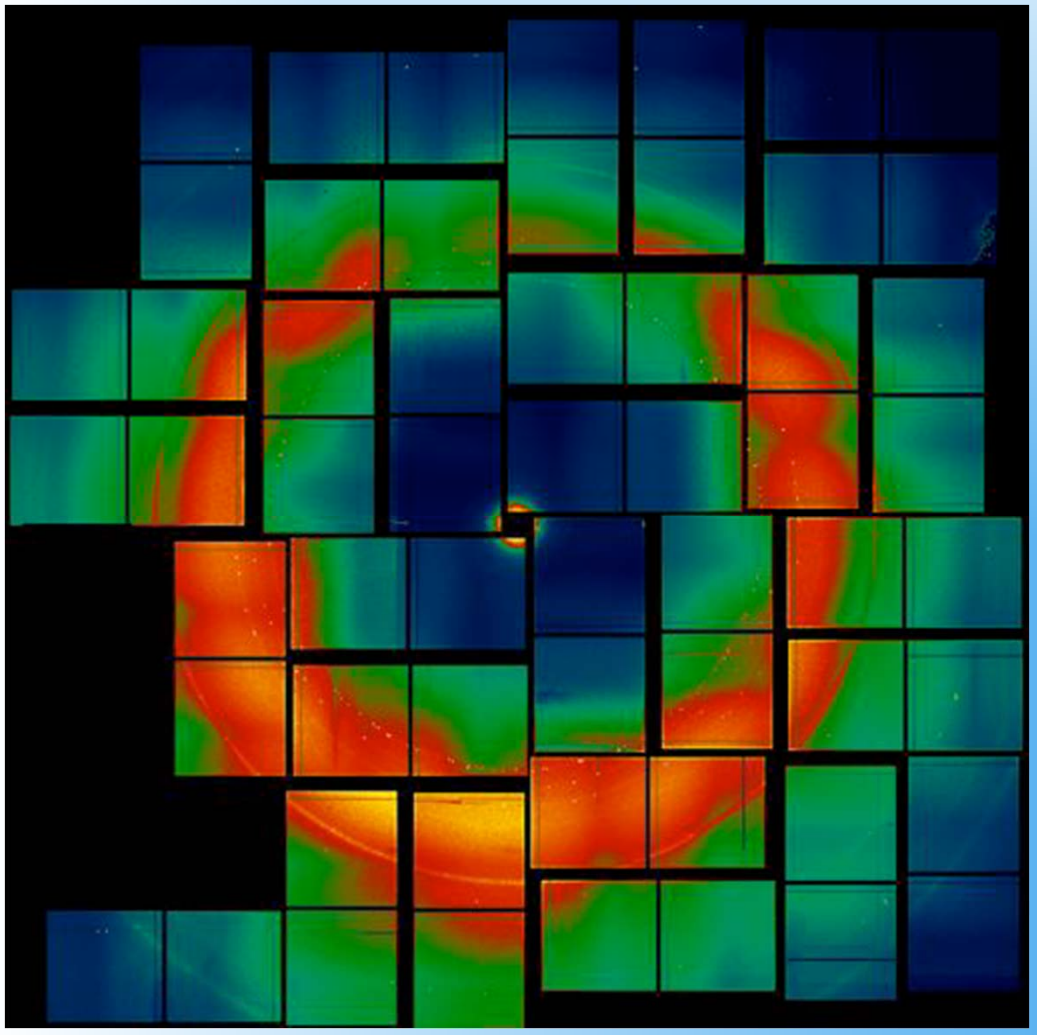


Jet freezes at 10^6 K/s !!!

Not using pnCCD but csPAD



Sum of all frames is dominated by water ring

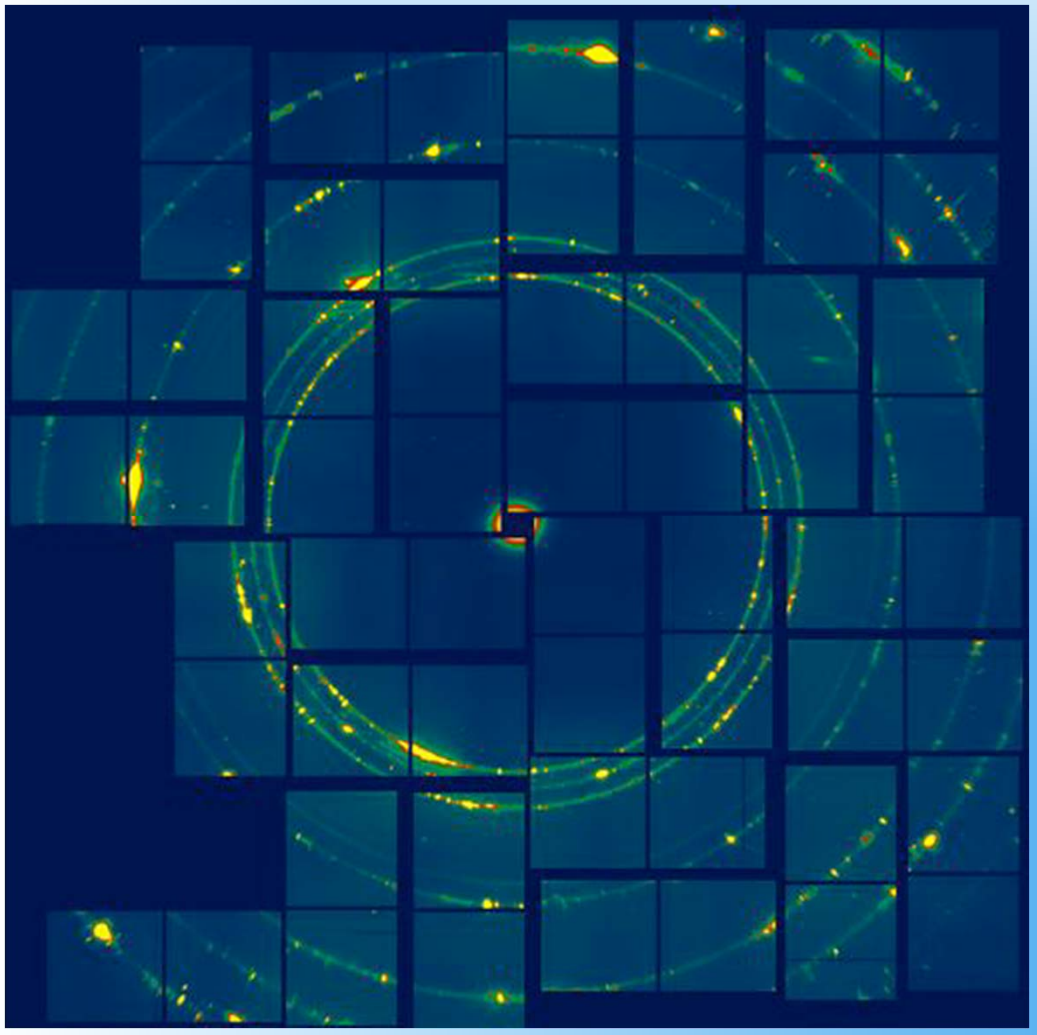


LCLS pulses:
2,292,468

Acquisition time:
19,103 sec
(5 hr 18 min)

Photon energy:
9.4 keV

Ice gives rise to strong diffraction peaks on the detector

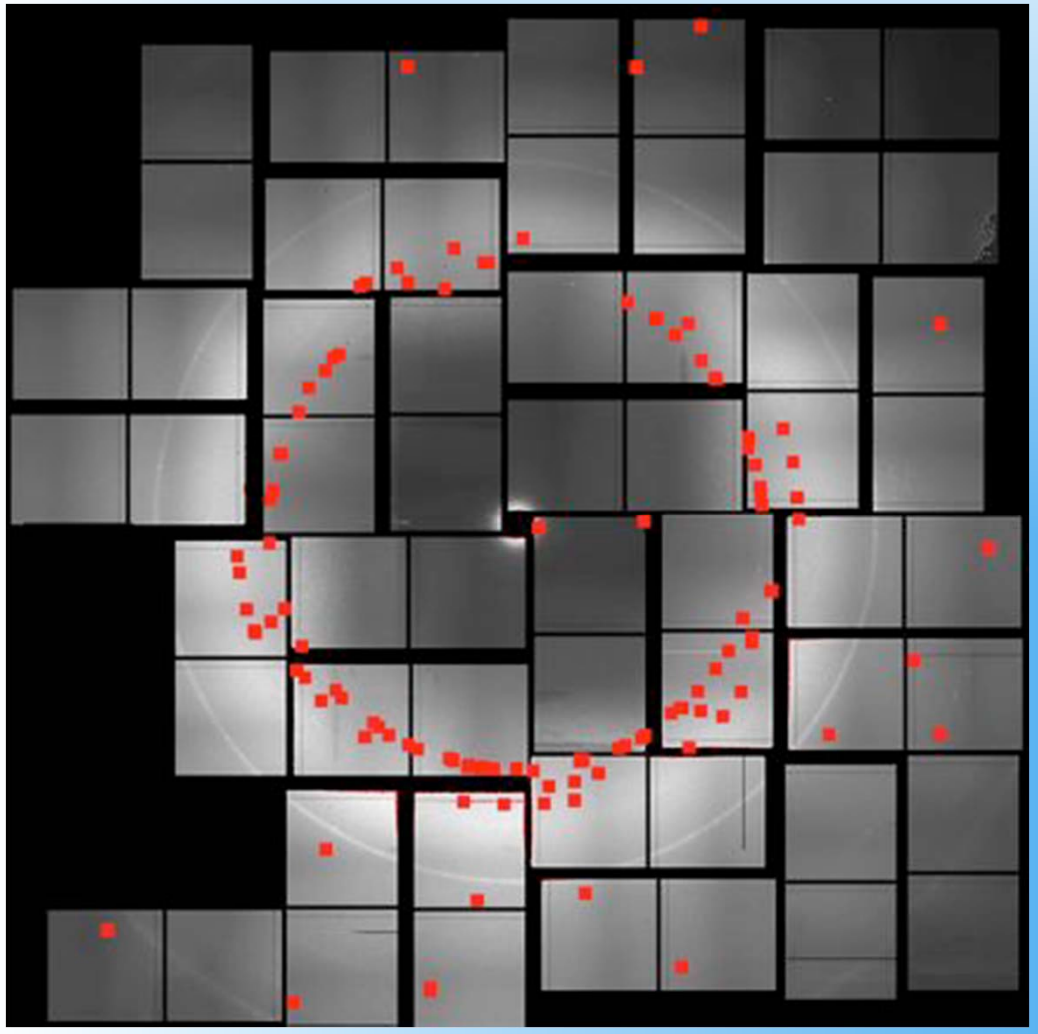


FEL pulses:
4,293

Acquisition time:
35 seconds

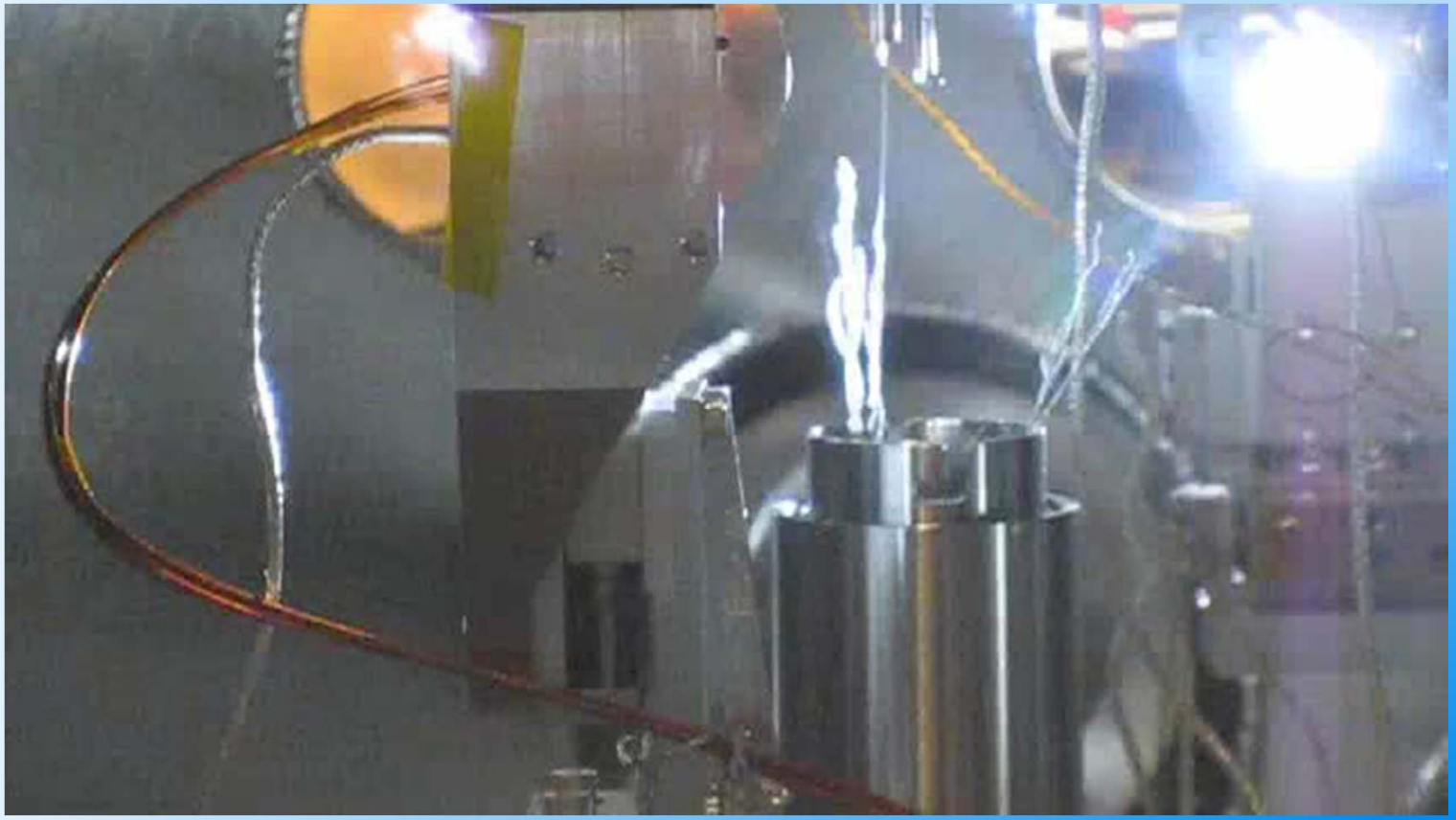
Photon energy:
9.4 keV

Dead pixels accumulate during the course of the experiment



Virtually no dead pixels before the experiment

How big can the crystal get?

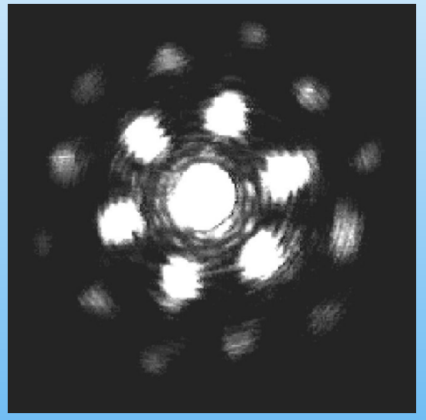


Back of the envelope

How many photons can there be in a Bragg-peak?

Total number of scattered photons:

( )



Divide by 16 to account for hexagonal symmetry and higher orders:

Assuming H_20, resp. ice 1h on linear dimension d:

___ ___

___

and:

Can AGIPD stand this high instantaneous fluxes?

We cannot solve the icing problem, but…

- At what intensity will the ASIC break?
- What can be done to increase this?
  - Protection diodes?
- What would be the cost of additional protection?
  - Noise?
  - Area?
  - Design time?