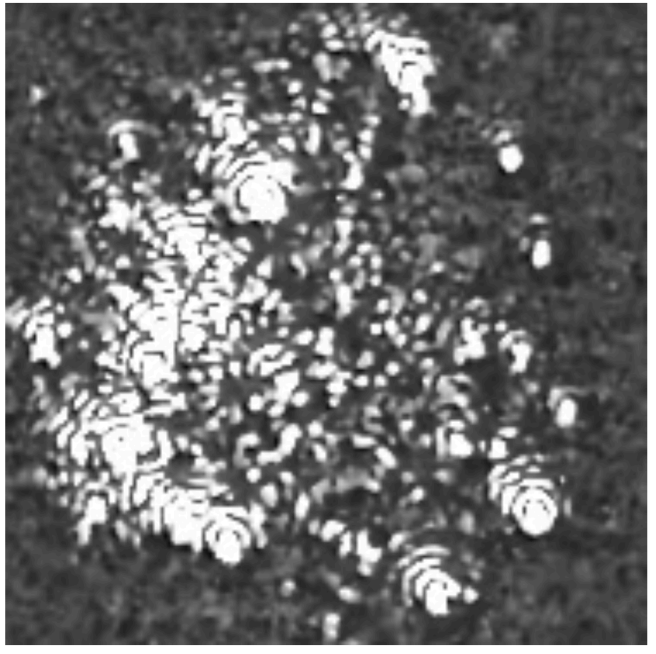
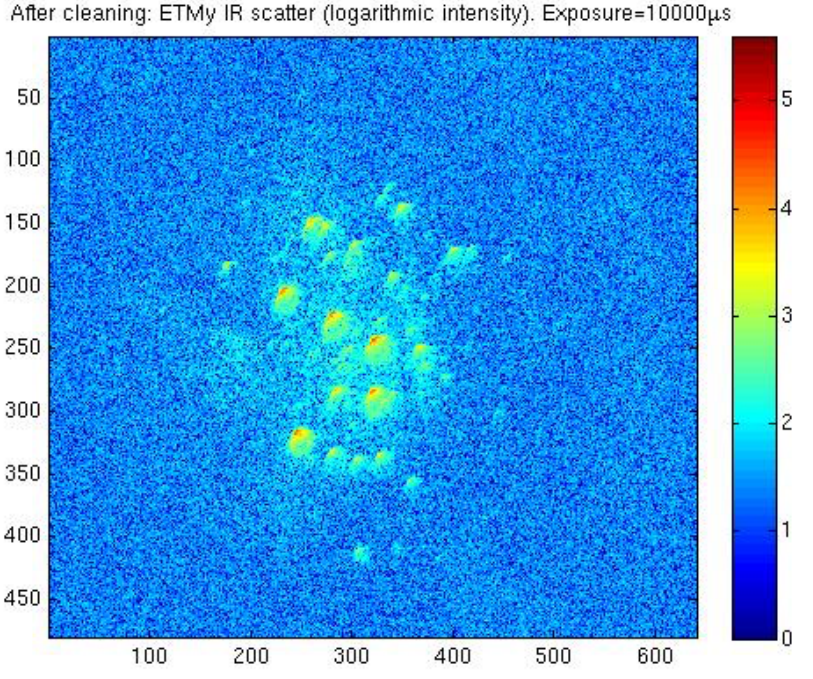
Beam centering onto test masses

H1 ITMX infrared GigE view
(when fully locked)



Credit: C. Vorvick, LHO log 35304

H1 ETMY infrared GigE view
(when fully locked)



Credit: E.King, LHO log 15879

Kiwamu Izumi for
KAGRA commissioning and MIF teams

Beam positioning is essential

- **No alignment, no interferometer locking.**
- **This had been a hot topic in LIGO as well.**

  https://dcc.ligo.org/LIGO-G1401257/public

  https://dcc.ligo.org/LIGO-G1400193/public

- **Very critical even for the 3km Michelson.**
- **Perhaps, this is a good opportunity to think through the alignment process (for now and future).**
- **In particular, beam positioning (or centering) onto the ETMs are the most critical for the upcoming 3km Michelson.**

In other words

- **How do we make sure that the beam is at the center of ETMs during the 3km Michelson run?**

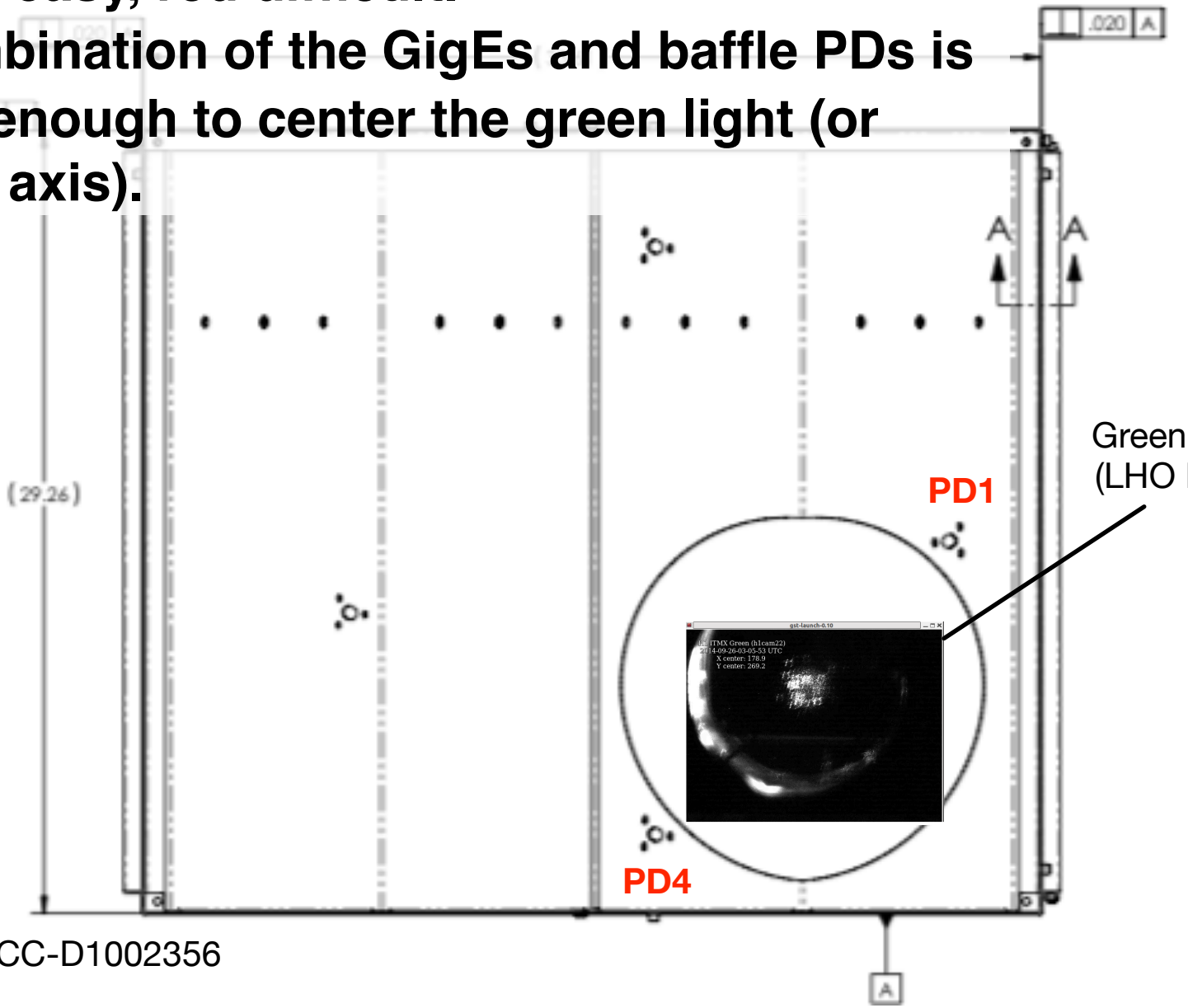
- **The worst scenario would be something like:**

  We completely lost a good alignment of PR3 and now have to perform the initial alignment without opening the ETM chambers.

- **What do we do then?**

Consensus (among LIGO people)

- **Green easy, red difficult.**
- **A combination of the GigEs and baffle PDs is good enough to center the green light (or cavity axis).**

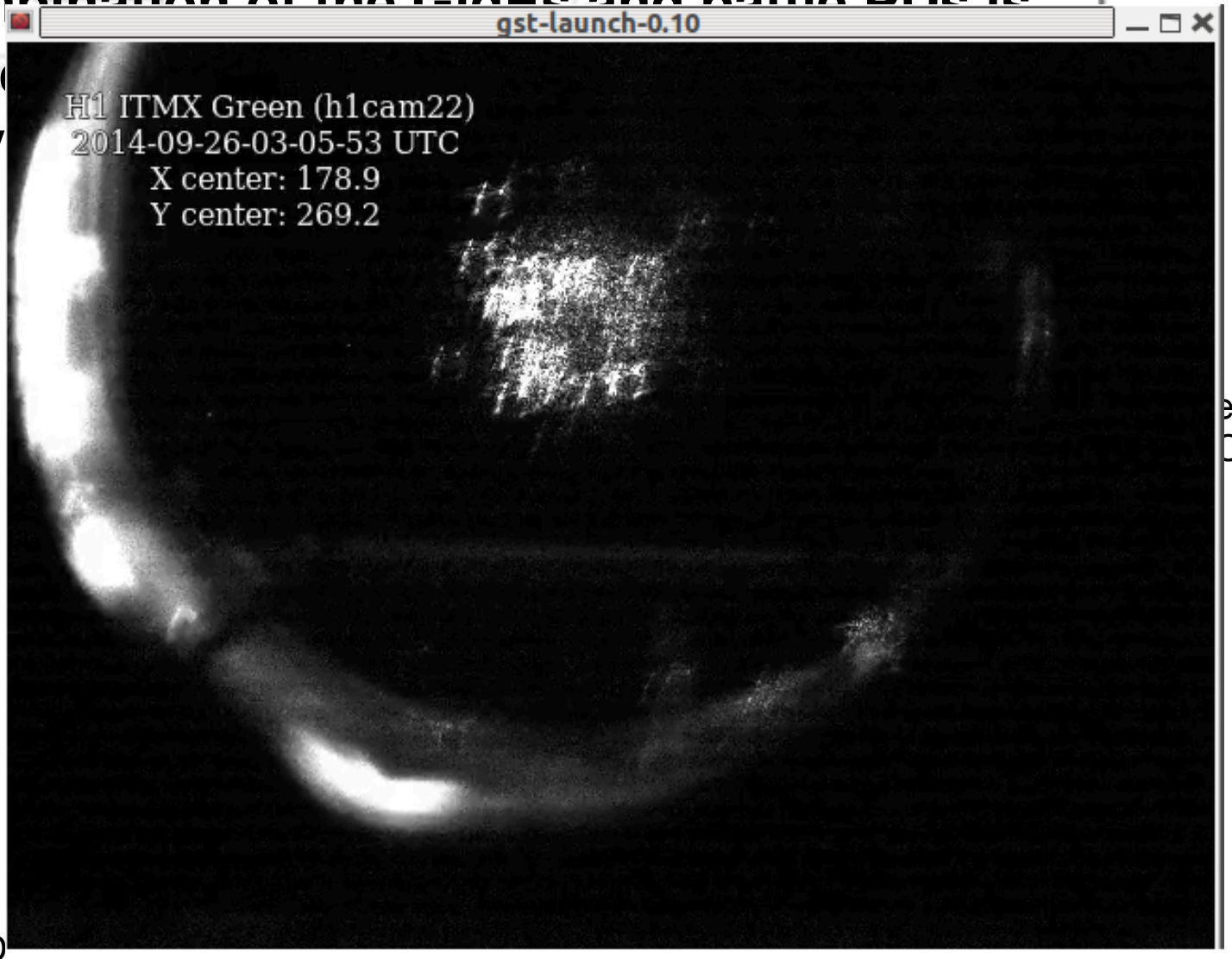


Green GigE view
(LHO log 14160)

LIGO-DCC-D1002356

Consensus (among LIGO people)

- **Green easy, red difficult.**
- **A com[illegible] good [illegible] cavity**



[illegible]en GigE view
[illegible]O log 14160)

Here are our problems

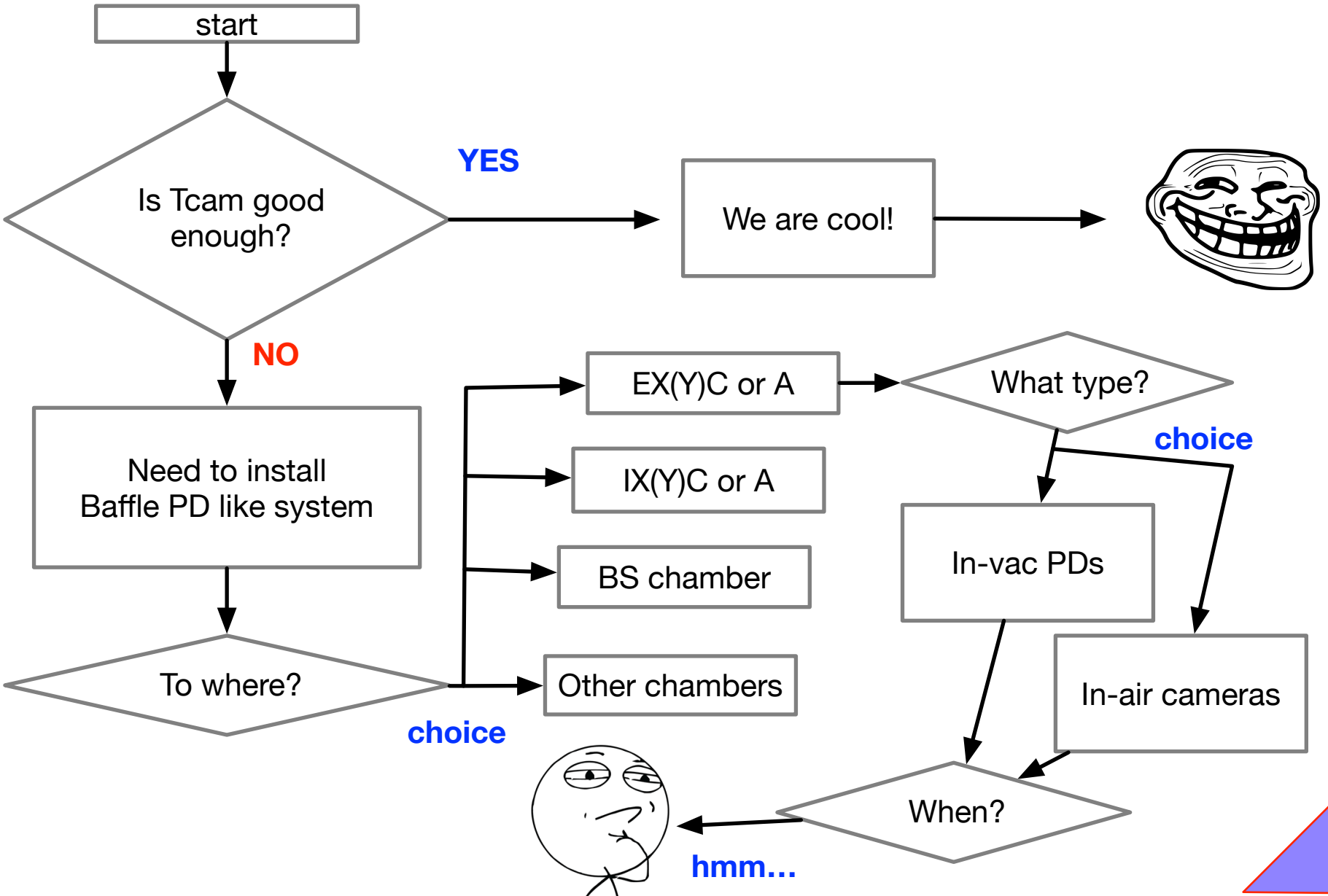
- **NAB(narrow angle baffle) won't be installed in time.**
  => no baffle PD technique.

- **3km Michelson doesn't have an arm cavity**
  => no way to resonate green or IR light anyway.
  => hard to directly monitor the spot position w.r.t. the mirrors by cameras.

- **The planned GigEs for ETMs don't have a large enough field of view.**
  => they only see a part of the mirror surfaces.

- **Is Tcam the only way?**
  => but needs to intentionally misalign the beam onto the recoil mass cage to make it bright enough.

Questions we have to answer



Optimistic Scenario

- **The suspended mirrors are stable over months.**
- **Once the initial alignment is done manually, the beam won't miss any mirrors.**

But, we already know that this is not the case!

(iKAGRA followed this scenario though)