The Balloon Experimental Twin Telescope for Infrared Interferometry (BETTII)

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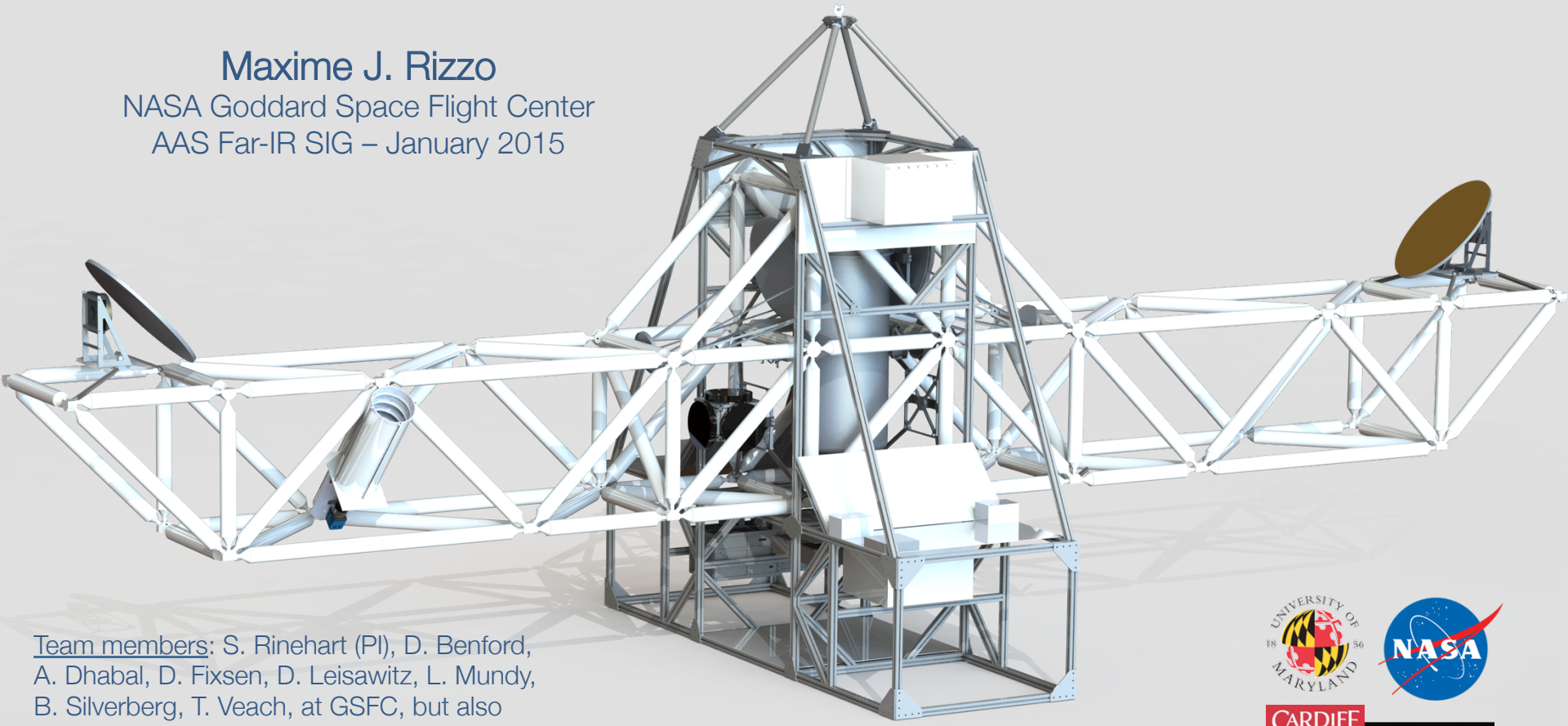
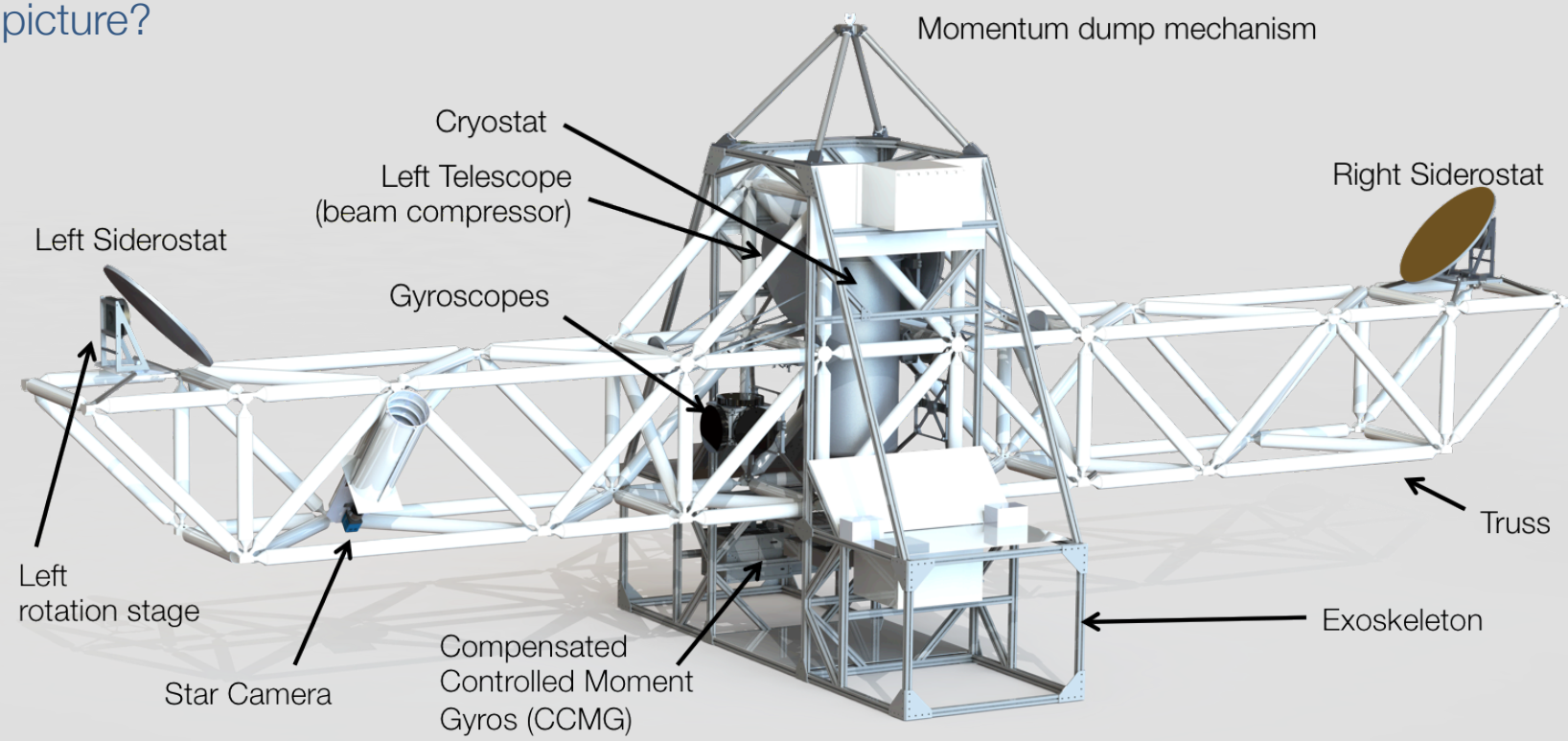
AAS Far-IR SIG – January 2015



Team members: S. Rinehart (PI), D. Benford, A. Dhabal, D. Fixsen, D. Leisawitz, L. Mundy, B. Silverberg, T. Veach, at GSFC, but also P. Ade, M. Griffin, R. Juanola-Parramon, G. Savini, L. Spencer, E. Pascale and the rest of the team at Cardiff and UCL

Outline

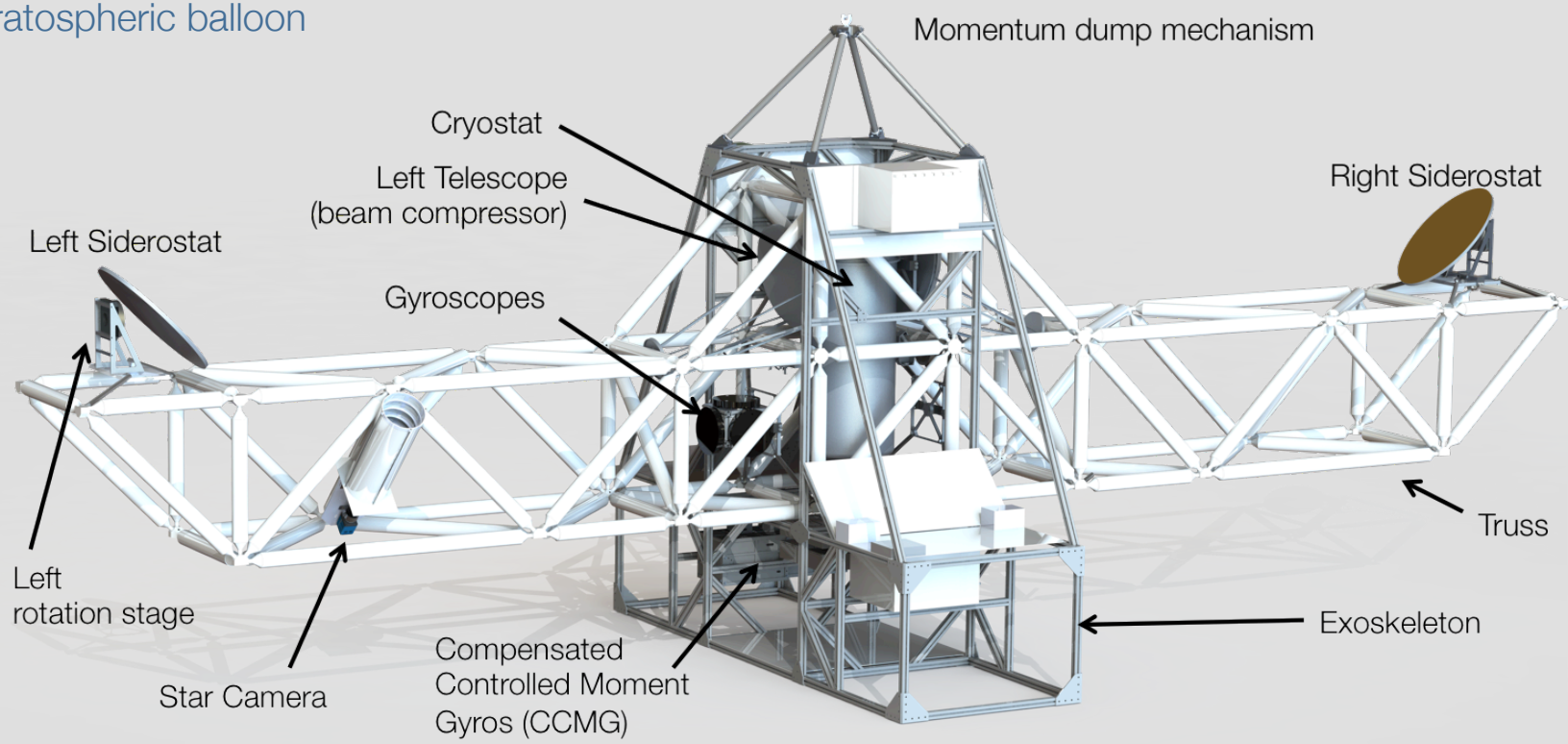
1. What is BETTII?
2. Why does it exist?
3. What can it do?
4. How does it work?
5. How far along is it?
6. What's BETTII in the big picture?



What is BETTII?

BETTII in 7 subsystems

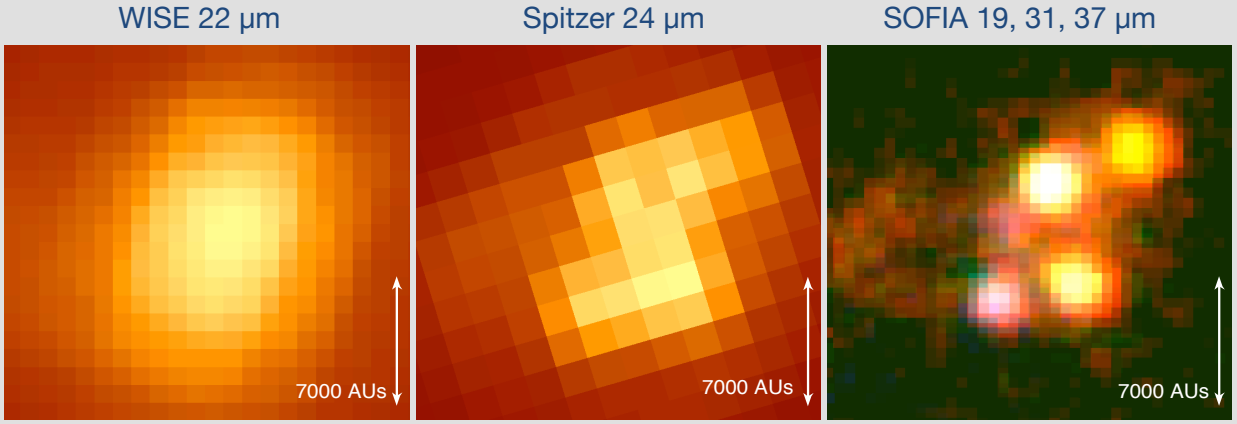
1. Two 50-cm telescopes/collectors, relay optics
2. An 8-m truss
3. Cryogenic far-IR detectors
4. A far-IR beam combiner and filters
5. A cryogenic delay line
6. A control system and gondola
7. A stratospheric balloon



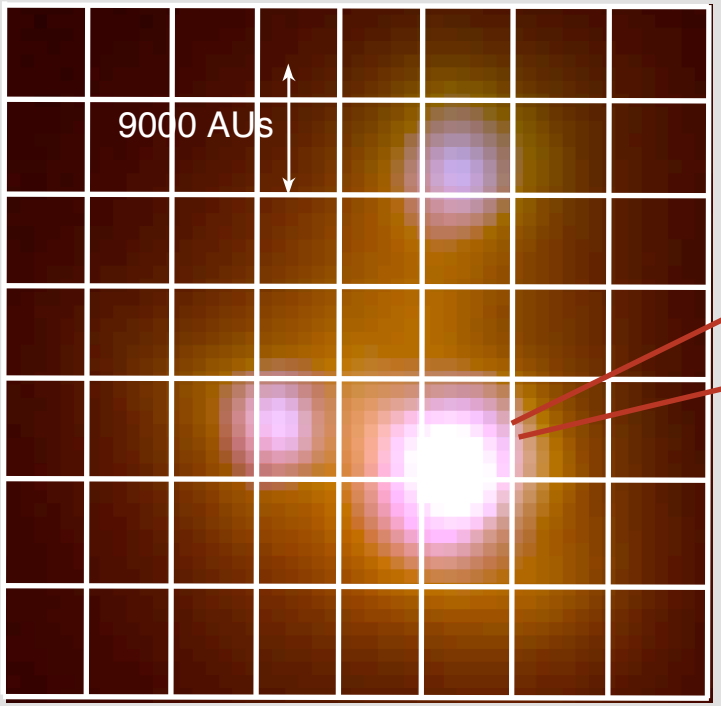
Why does it exist?

1. SPIRIT/WIIT heritage: double-Fourier interferometry works
2. Let's show that we can do this above the atmosphere
3. Far-IR Science
   - Higher angular resolution: 1" (3 times better than SOFIA)
   - Key wavelength coverage: 30-90 μm
   - Studies star formation and AGNs by observing structure of dust (continuum)
   - Can resolve and determine SEDs of deeply embedded sources

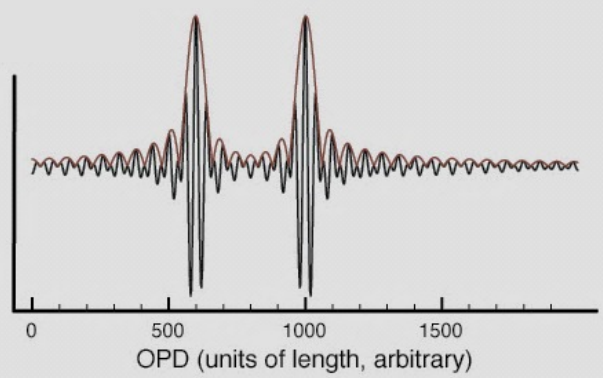
IRAS20050
See poster 256.12



What can BETTII do?

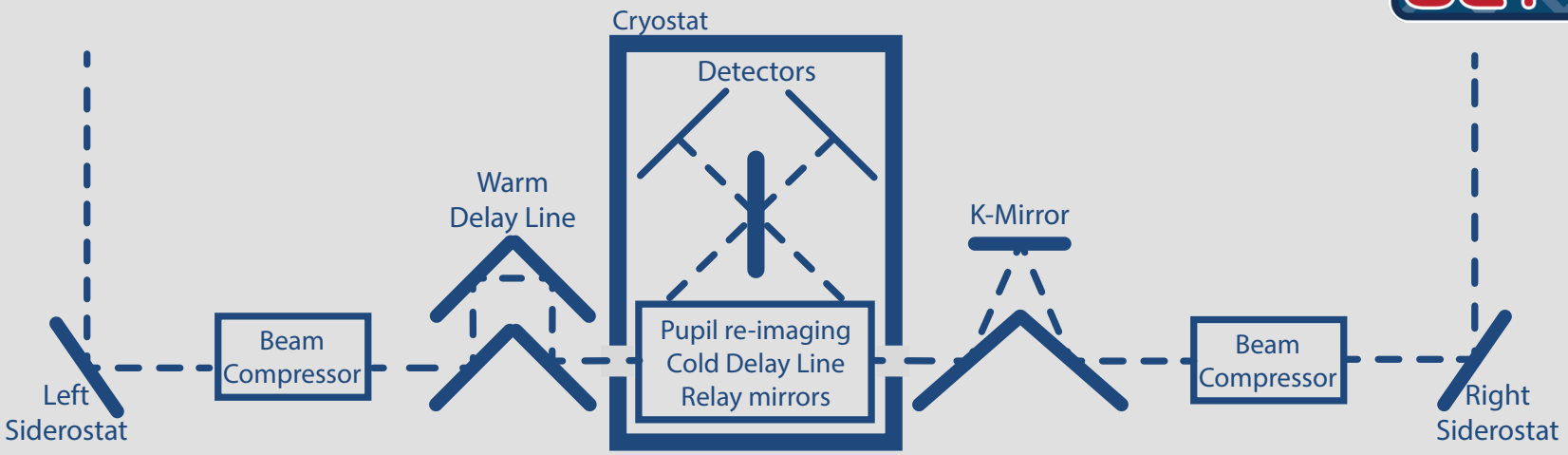


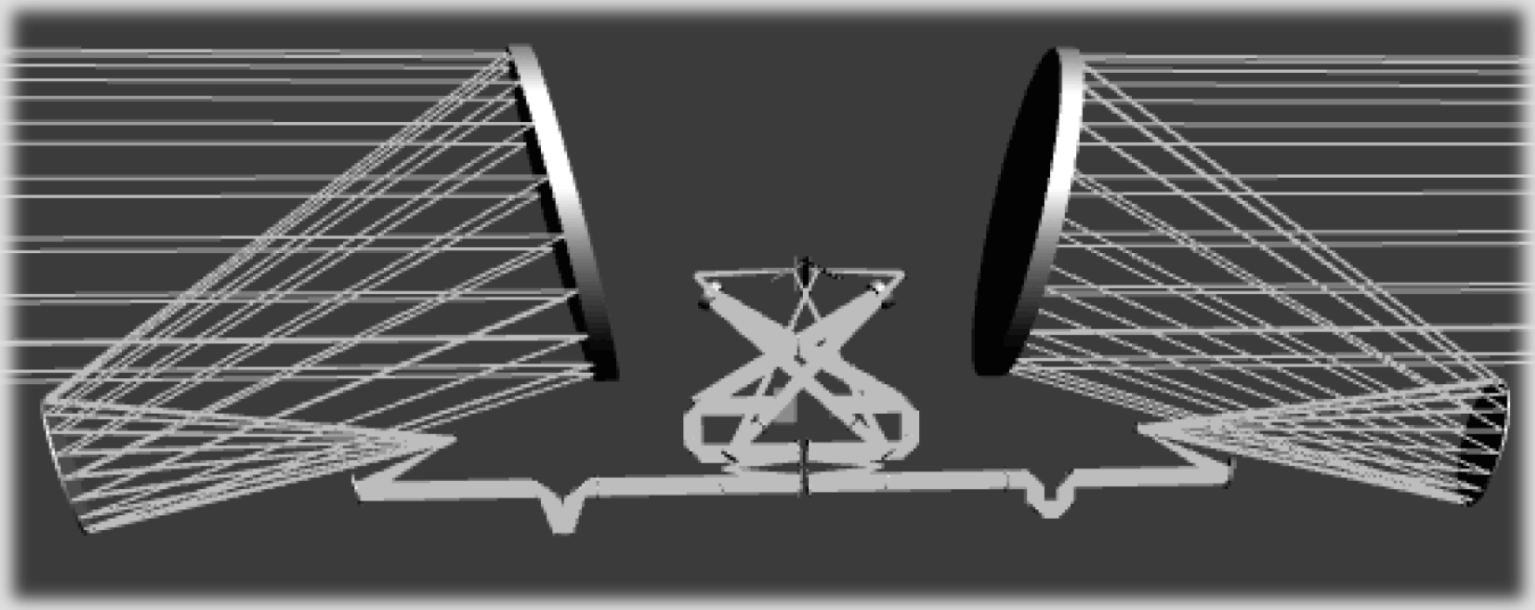
S140 19 (B), 31 (G), 37 (R) μm image from SOFIA



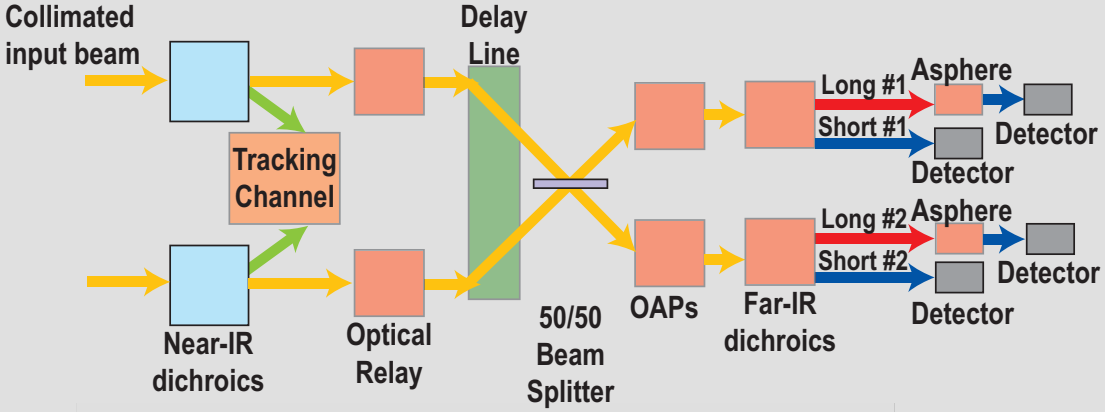
1. Source multiplicity?
2. SED of individual sources
3. Separation between sources
4. Exact location of point source(s)
   (to be compared with dust envelope)

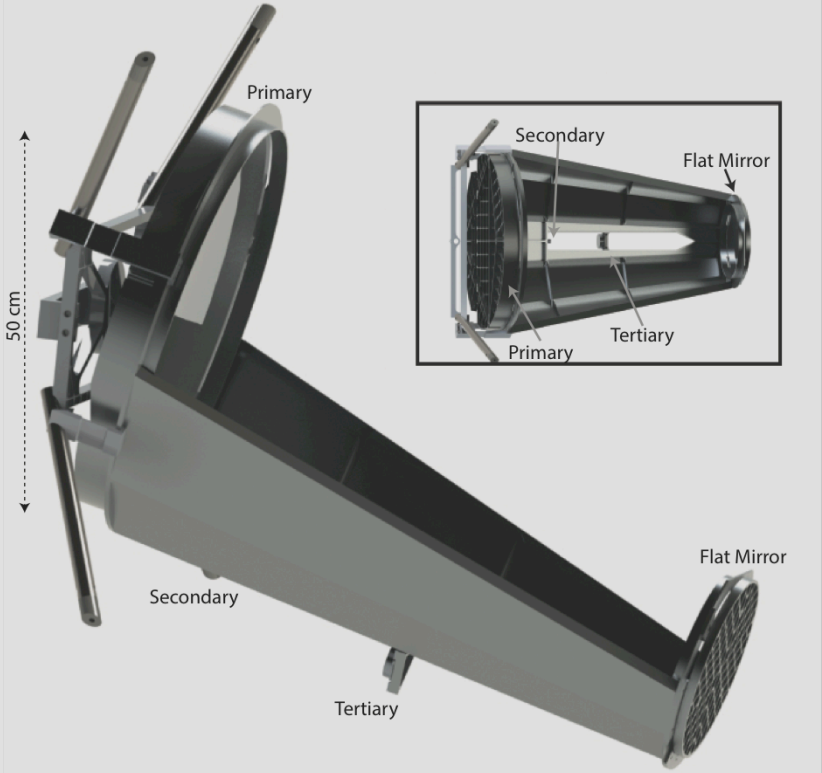
How does it work?

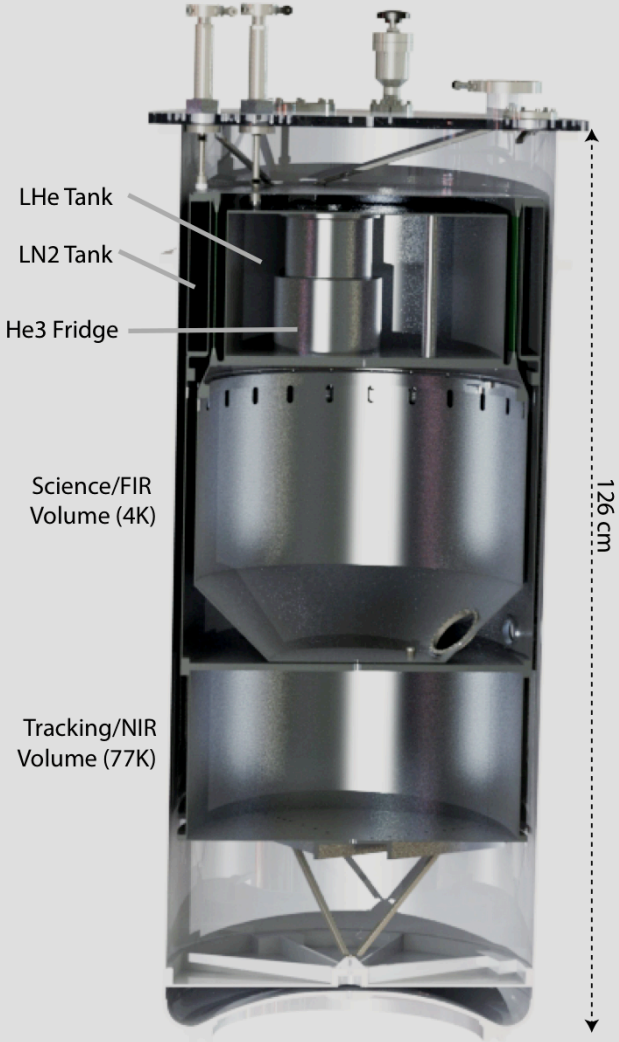




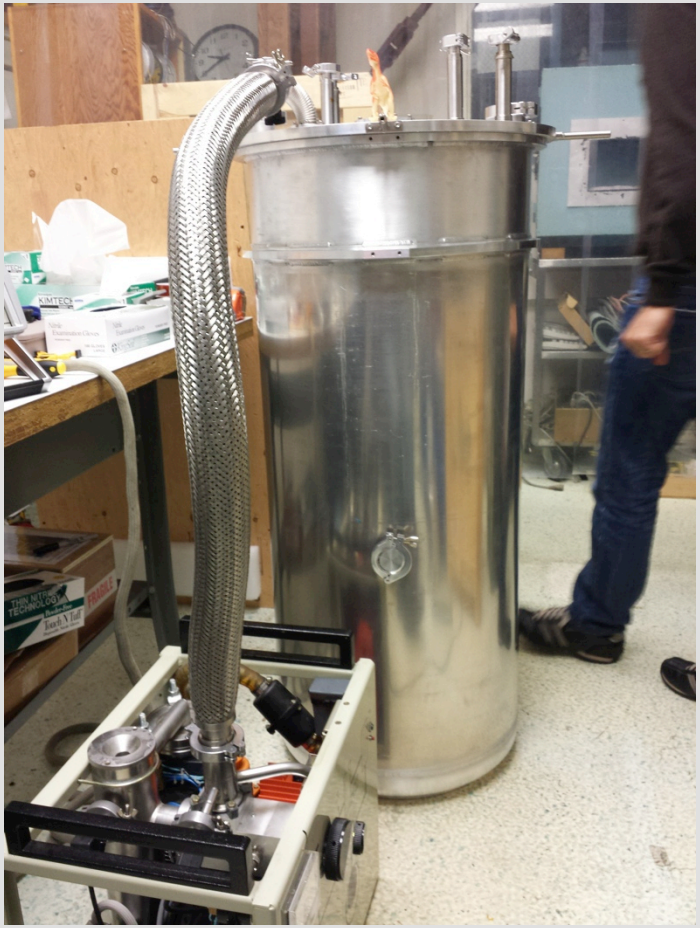
How does it work?

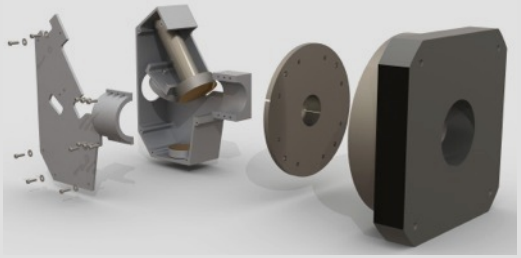


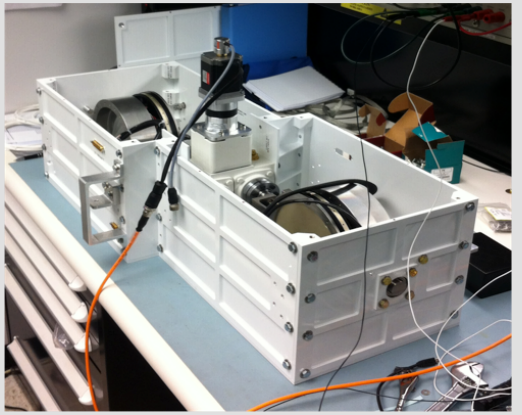




How far along is it?








OVERHEAD DOOR
OVERHEAD DOOR

What's BETTII in the big picture?

- BETTII is relevant in the context of a space mission:
  - It has most aspects of a double-Fourier far-IR space instrument
  - It can learn from its mistakes for cheap
  - It shows what's really hard about making such a mission
    - E.g. in-flight calibration procedures, alignment, optics manufacturing, detectors
  - Understand constraints of double-Fourier concepts on mission design and systems engineering

- In fact, BETTII in space would be easier
  - Orders of magnitude less background noise
  - Easier pointing
  - Environment is much more predictable & stable

Thank you!

Take-home points:

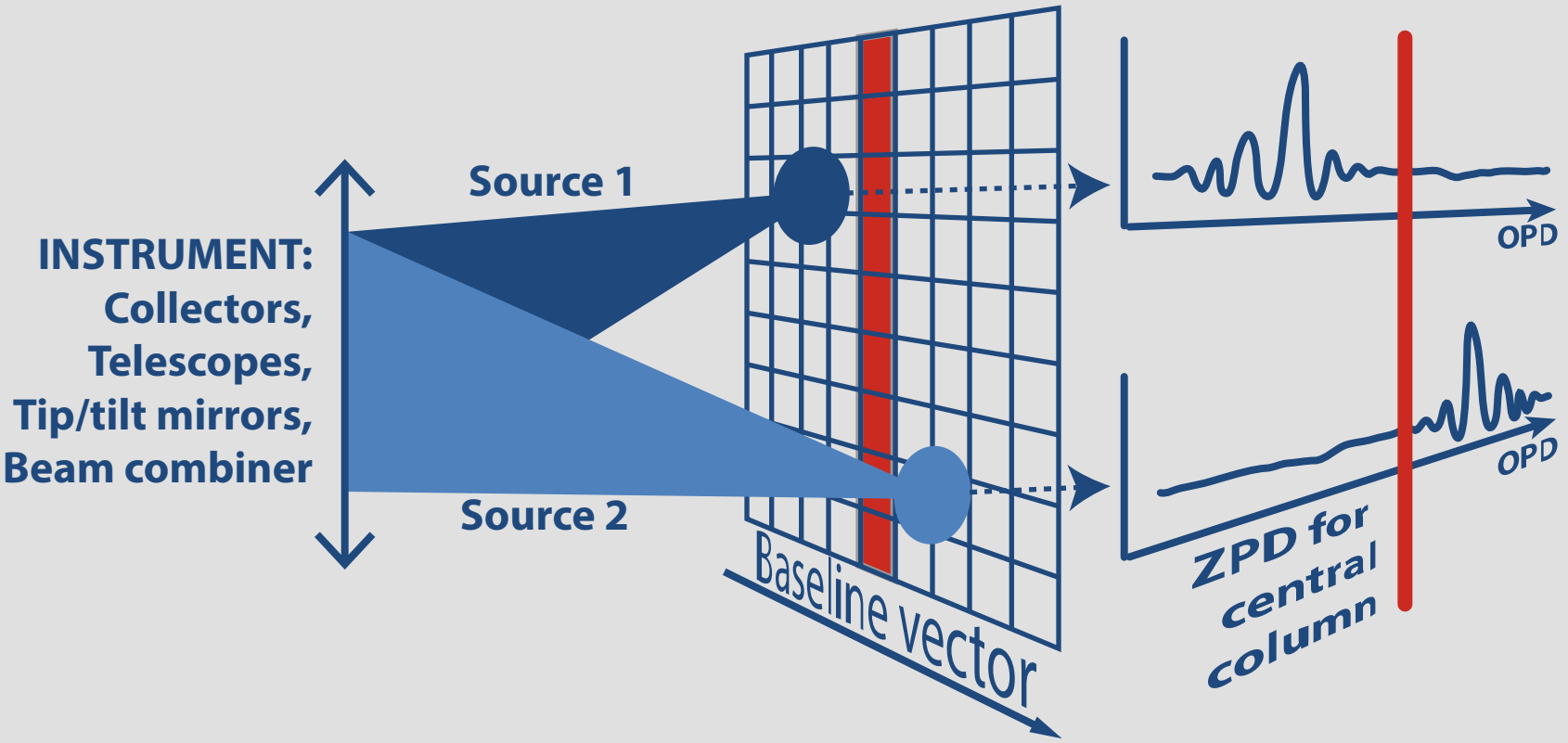
1. In-flight interferometry is happening soon in the far-IR
2. It will implement the double-Fourier method and show its potential on real sources
3. This paves the way for a space interferometry mission, with lots of lessons learned

Backup slides

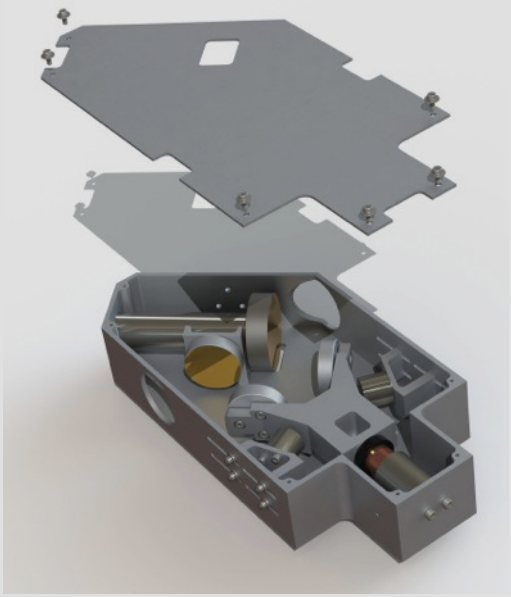
InFoCuS hanging from its launch vehicle
in Fort Sumner, New Mexico

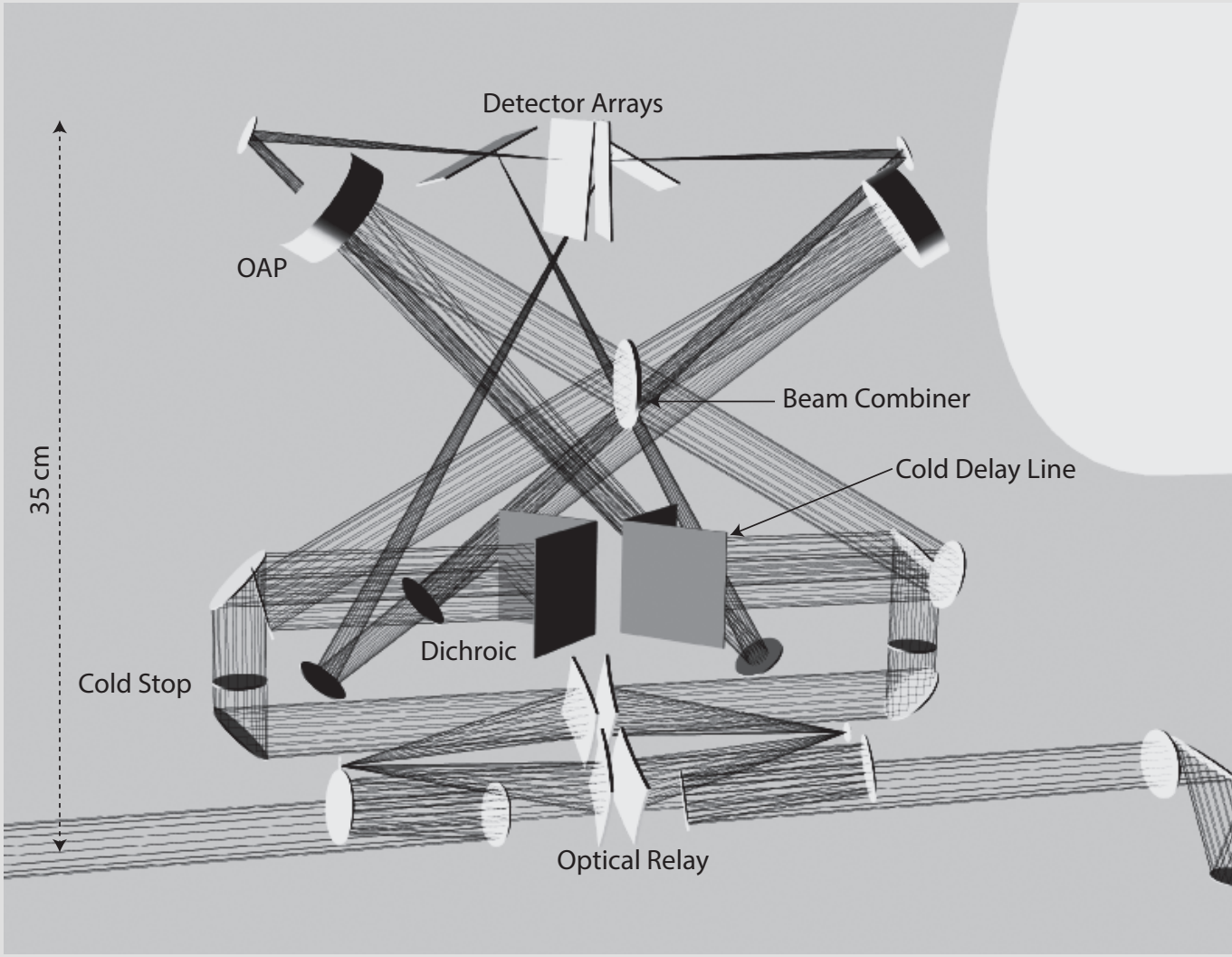
Balloon ready for launch
in Antarctica

How does it work?



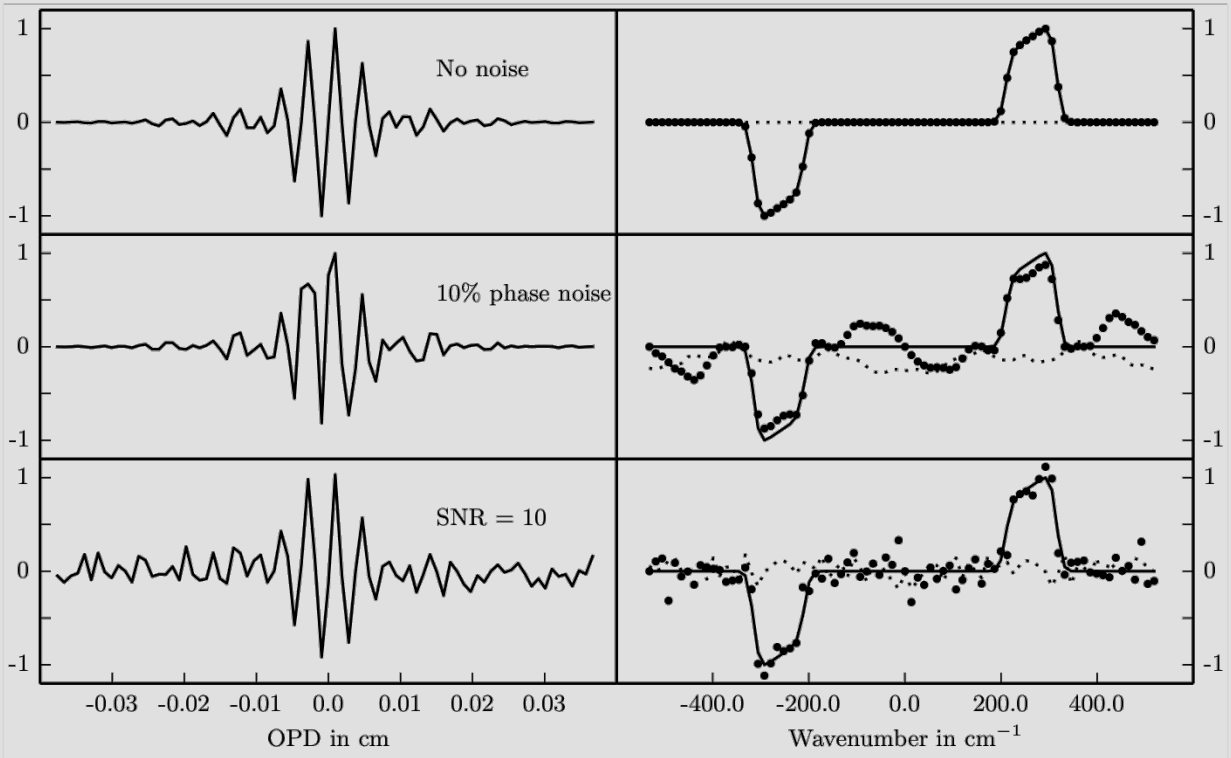
How far along is it?





How far along is it?

Modeled interferograms



Rizzo *et al*. (2015, submitted)