SPUD (aka The Keck-Array)

Clem Pryke (Minnesota)

Astrophysics from the South Pole: Status and Future Prospects

4 Apr 2011

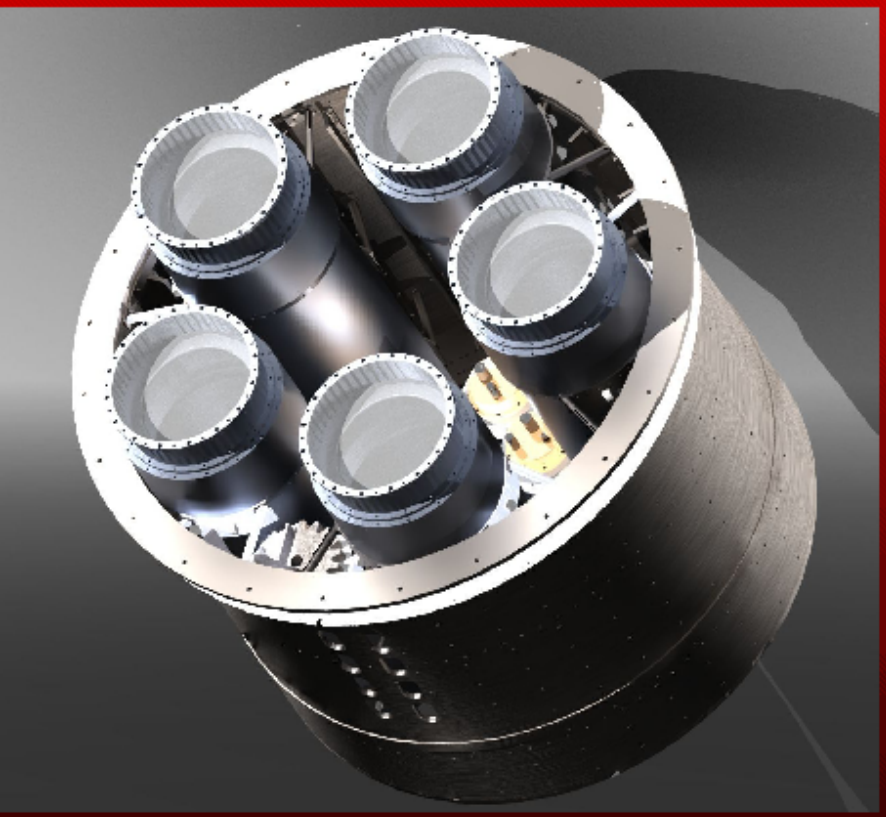
SPUD Rational

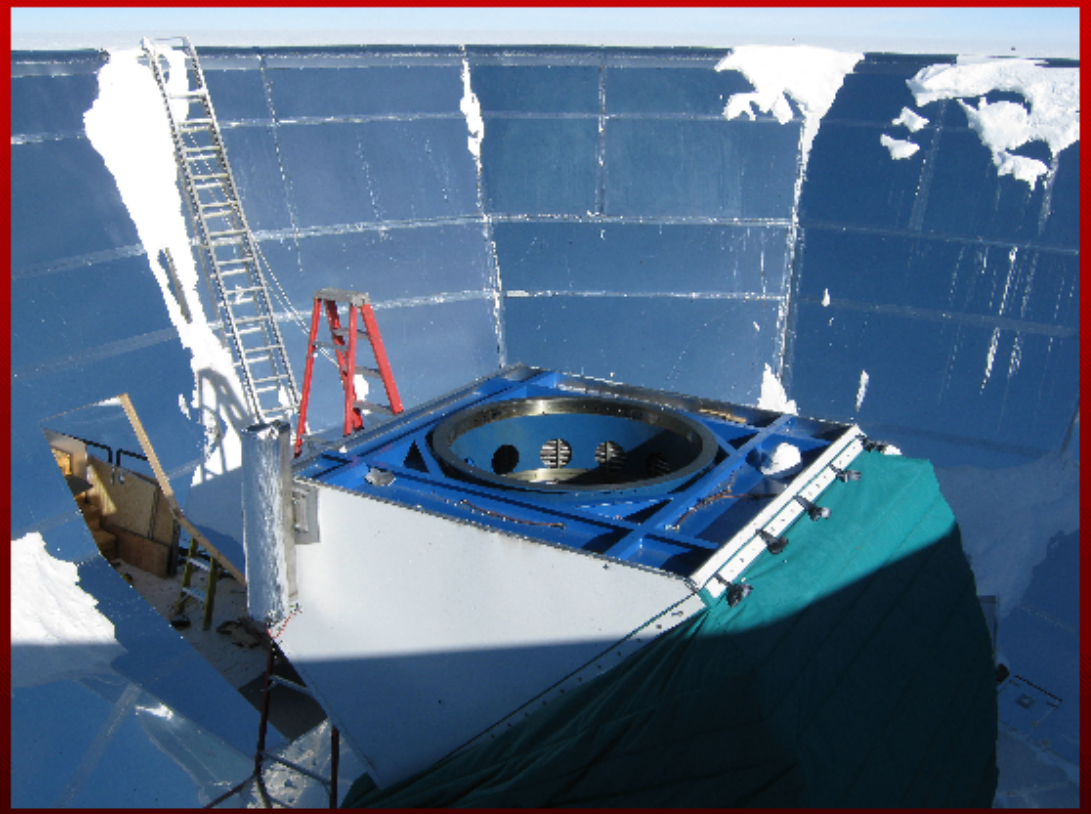
- Take the search for gravity waves to the next level (again!)
- Maximally exploit existing infrastructure at Pole:
  - DASI mount and compressor room (and MAPO)
- Maximally exploit technology developed for BICEP2:
  - Detectors, focal-plane, telescope
- Switch from liquid helium to new technology Pulse Tube Coolers
  - Cool to 4K (-452F) using electric power (8kW each)
- This year 3x BICEP2 - next year 5x (if power approved)

SPUD Collaboration

- Minnesota
  - Cryostats, Mount adaptation, science analysis
- Harvard
  - Optics, beam mapping, science analysis
- Stanford
  - Camera inserts, integration, science analysis
- Caltech/JPL
  - Detectors, focal-planes, science analysis
- Plus:
  - NIST: SQUIDS
  - UBC: Readout electronics
  - Toronto: House-keeping electronics
  - Case Western: waveplates
  - Plus many specialized commercial vendors...

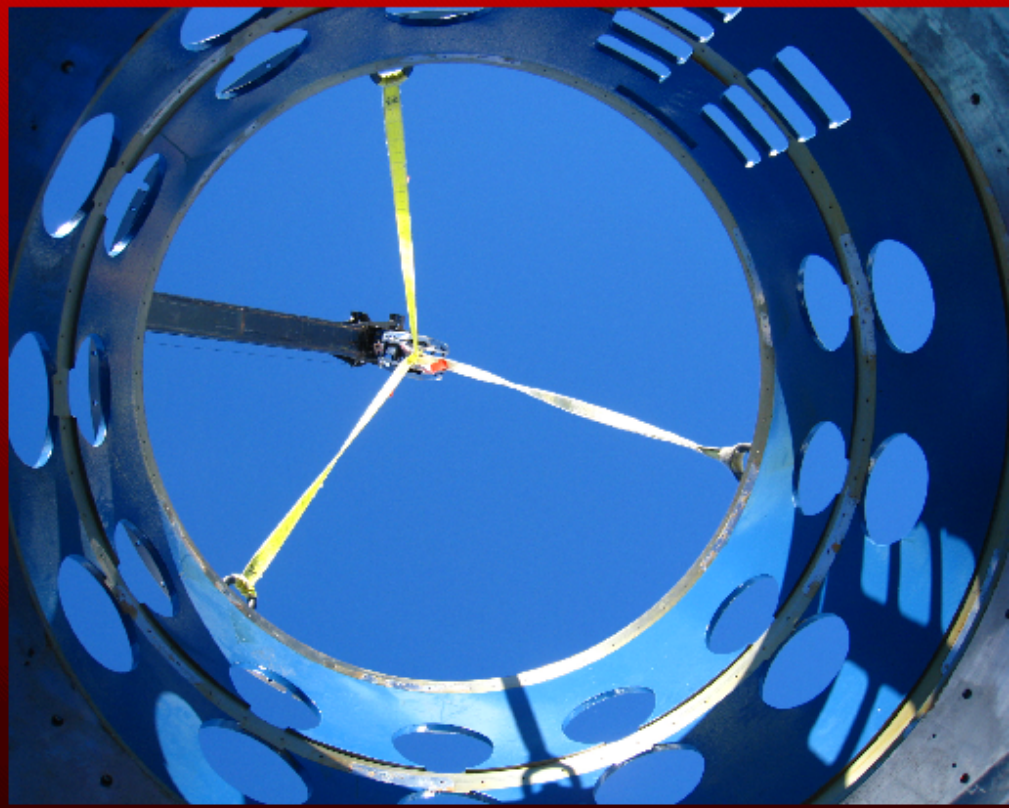
DASI Mount Adaptation





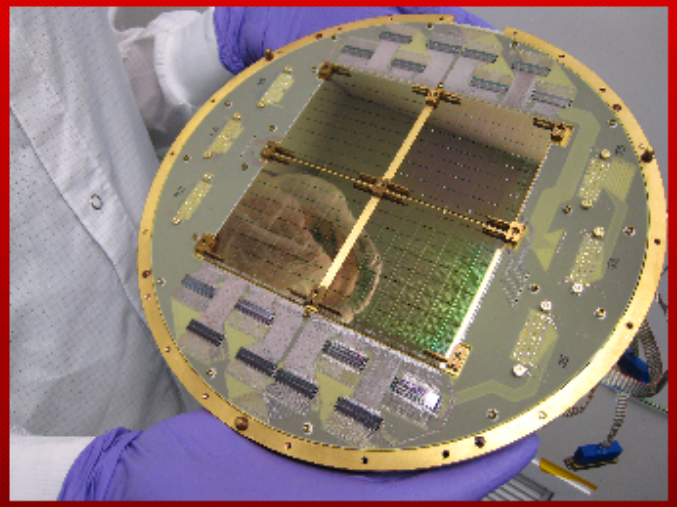
- New "drum" installed in mount last December
  - Thanks to science carps and crane operator!

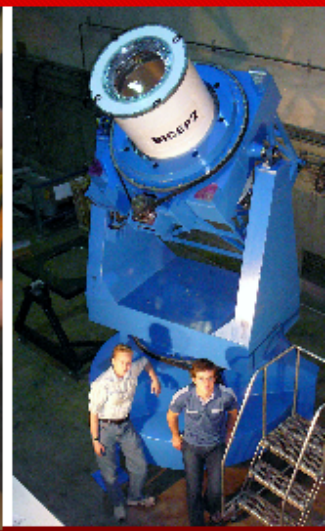
Installing New Drum



Planning paid off -
beautiful fit of new part into old machine

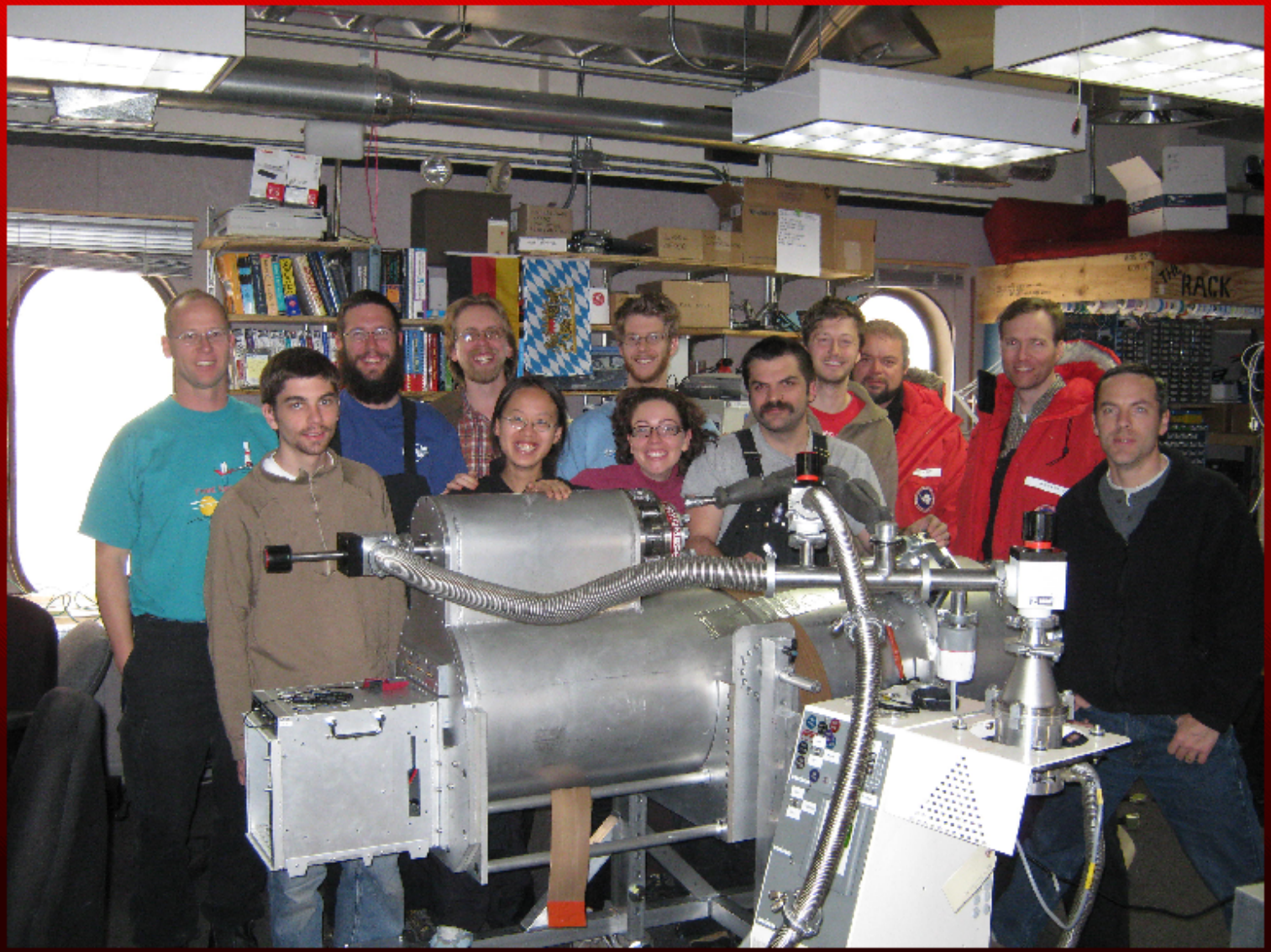
Receiver Production Line





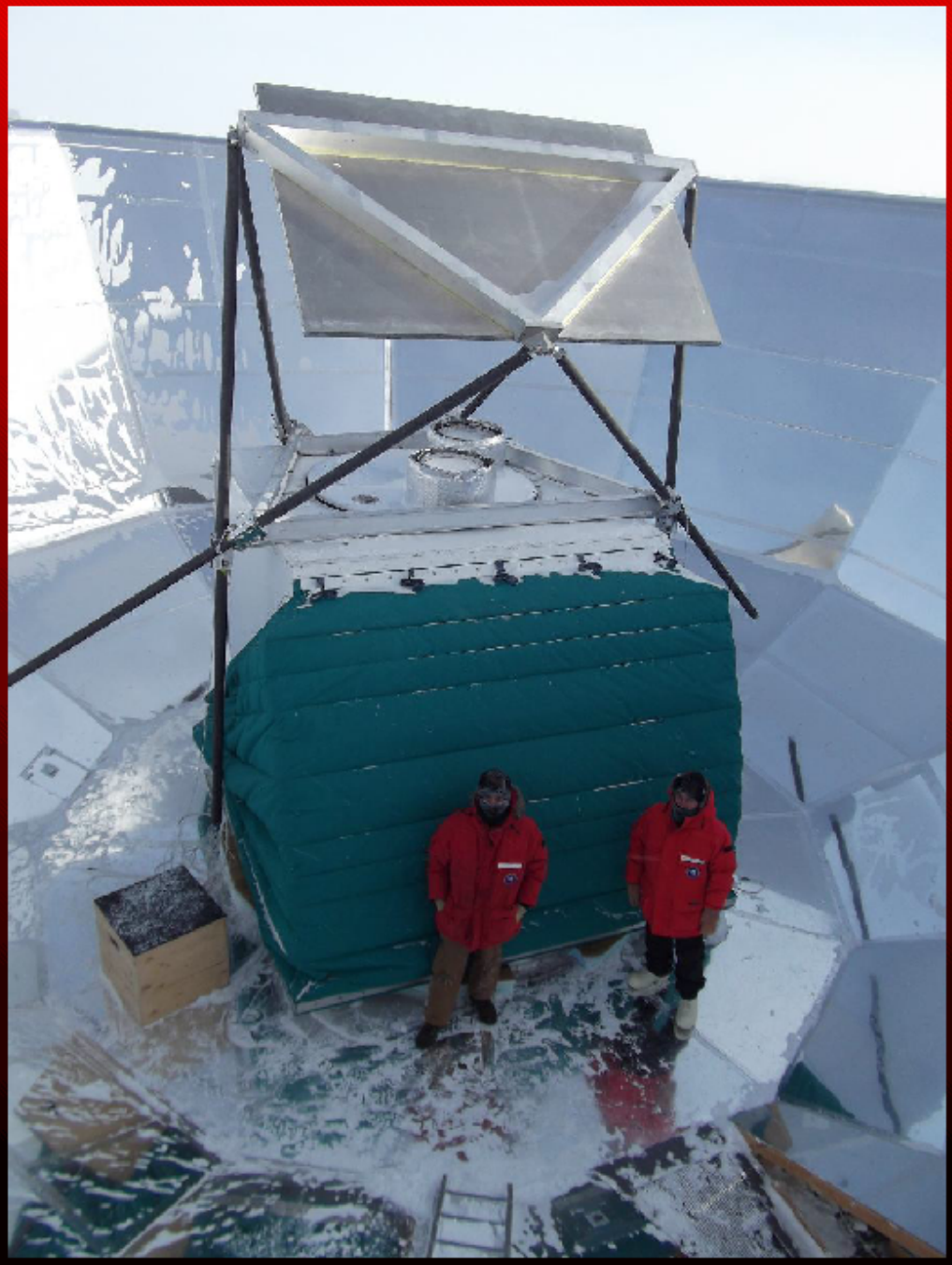
- Minnesota outfit cryostat shell - and test
- Caltech/JPL make detectors and integrate focal-plane - and test
- Ship both to Stanford who integrate with camera assembly - and test
- Ship to Harvard for beam mapping
  - And on to Pole!...

Last Season MAPO was a Hive of Activity



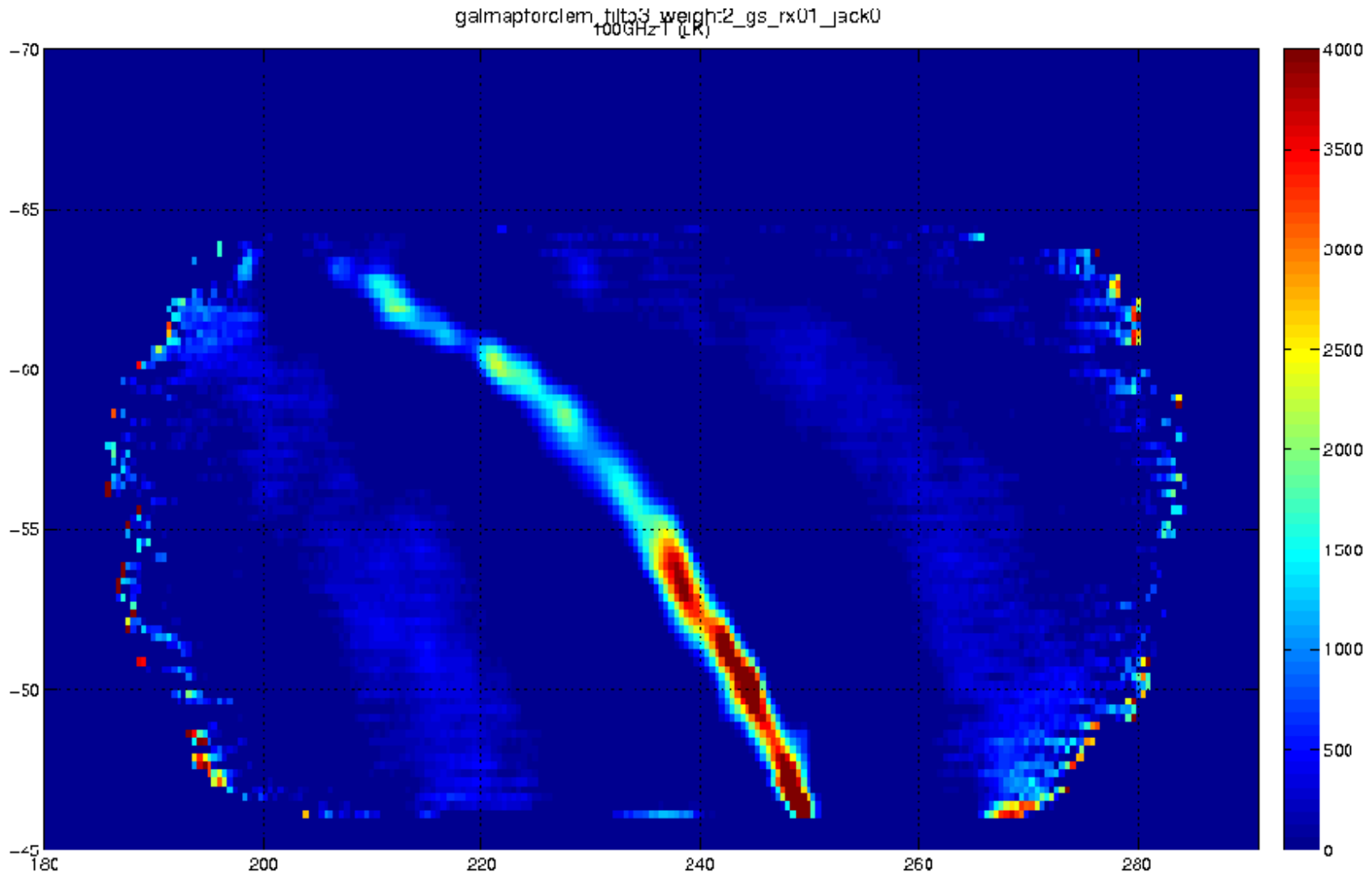
- Big team on site (14 at max simultaneous)
- All 3 receivers working by station close

Calibration Flat Mirror



Just Before Station Close

SPUD Galaxy Map



A few days of data from last week

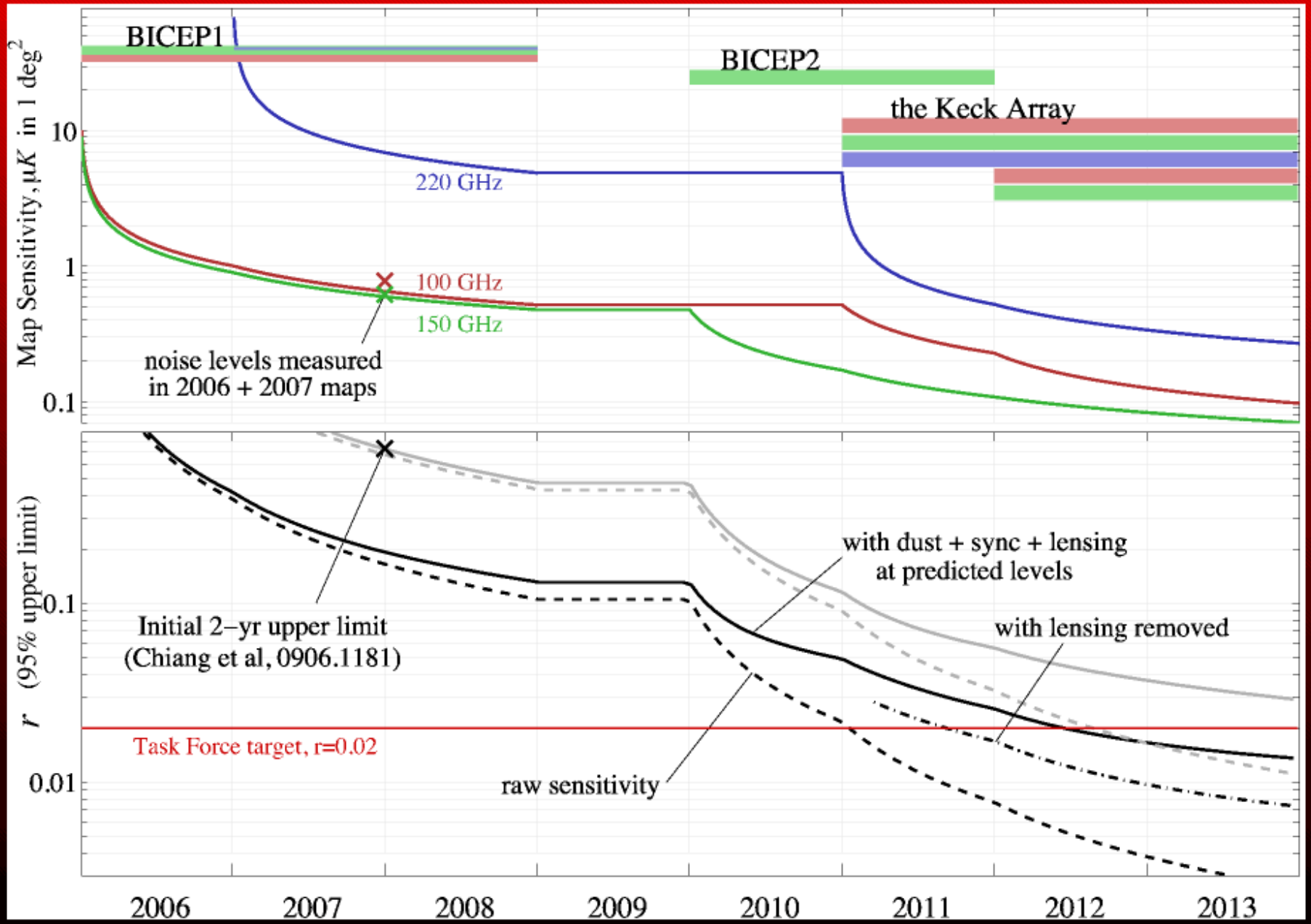
SPUD Conclusions

- For 2011 season three 150GHz receivers are installed
  - each with 512 detectors
  - two of those with half wave plates
  - telescope working - observations running
  - data is flowing north - analysis getting going

- For 2012 plan to install 2 more receivers
  - probably one more 150GHz and a trial 100GHz unit
  - improve existing detectors?...

- Funded for 2 seasons (2011 and 2012)
  - will propose for 2 more
  - likely switch out freq mix in future seasons

Program Sensitivity Timeline



John Kovac

BICEP/BICEP2/SPUD Conclusions

- Aggressive "get there first" program
  - Can we show that gravity wave B-modes exist?
    - If they do very expensive experiments become justifiable...

- "Foreground avoidance" strategy
  - Observe the cleanest 2% of the sky and target l=70 bump
  - Use multi frequency if necessary to push below r=0.03