SPICA
FPC (Focal Plane Camera)

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1. Backgrounds (1/2)

- ‘AKARI’ Collaboration (SNU, Hyung Mok Lee)
  - Development of data reduction software
  - Science collaborations
- Collaboration of Korea first infrared satellite ‘MIRIS’: KASI & ISAS/JAXA
  - Thermal & Optical design

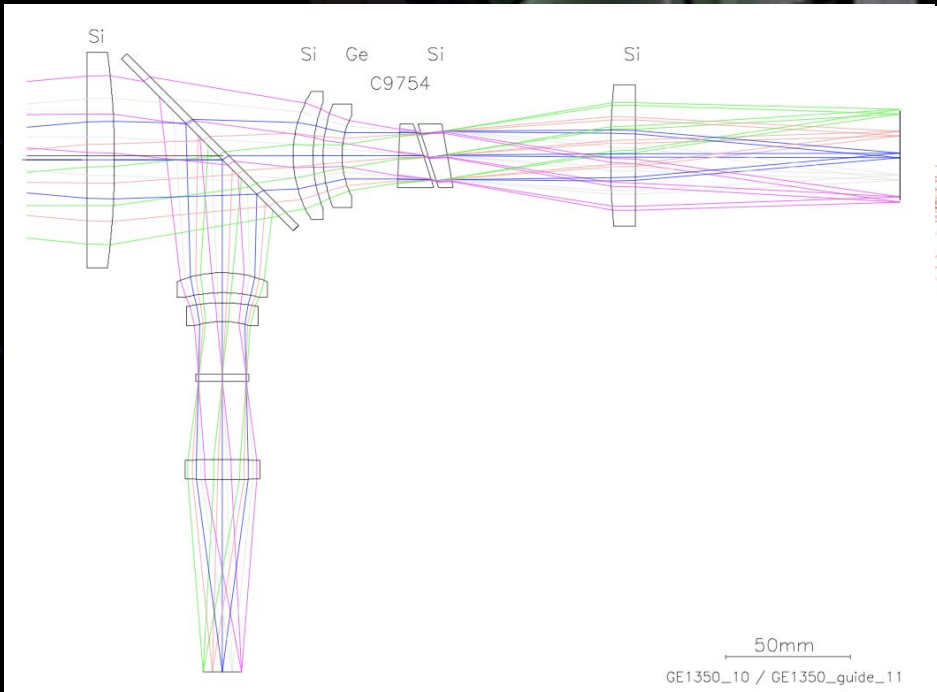
- SPICA Collaboration
  - Korea side: hope to develop the hardware
  - Initial plan: 1 channel of MIR instrument (totally 4 channels)
  - Design for MIR camera was changed (reduce 2 channels)
  - Efficient to develop MIR instrument in one institute

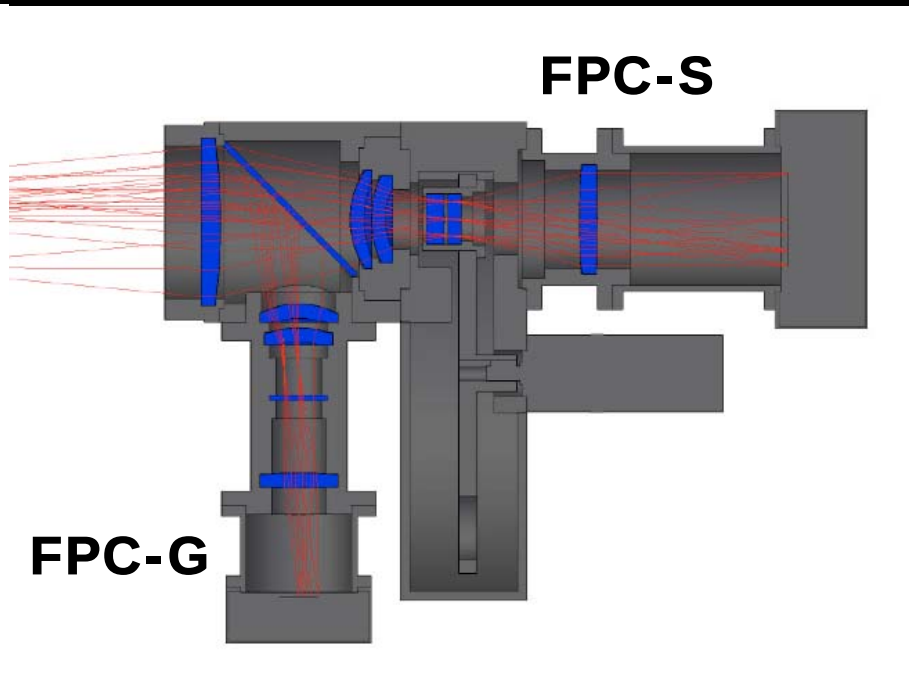
Backgrounds (2/2)

- SPICA Collaboration
  - Requirement of Focal Plane Camera (FPC) as a fine guider by Attitude Control Team
  - Alternative proposal: development of FPC
    → Fine Guider & Astronomical observations
  - NAOJ (M. Tamura): investigation of NIR camera
  - Collaborative work between Korea (KASI & SNU) and NAOJ: hardware & science
  - Legacy science meeting (Feb. 2009)
    Korea & NAOJ

2. Specification of FPC

- FPC: Near Infrared Camera with 2 parts
- FPC-S: astronomical observations
- FPC-G: fine guider
- Total mass < 10 kg (current estimation ~9kg)





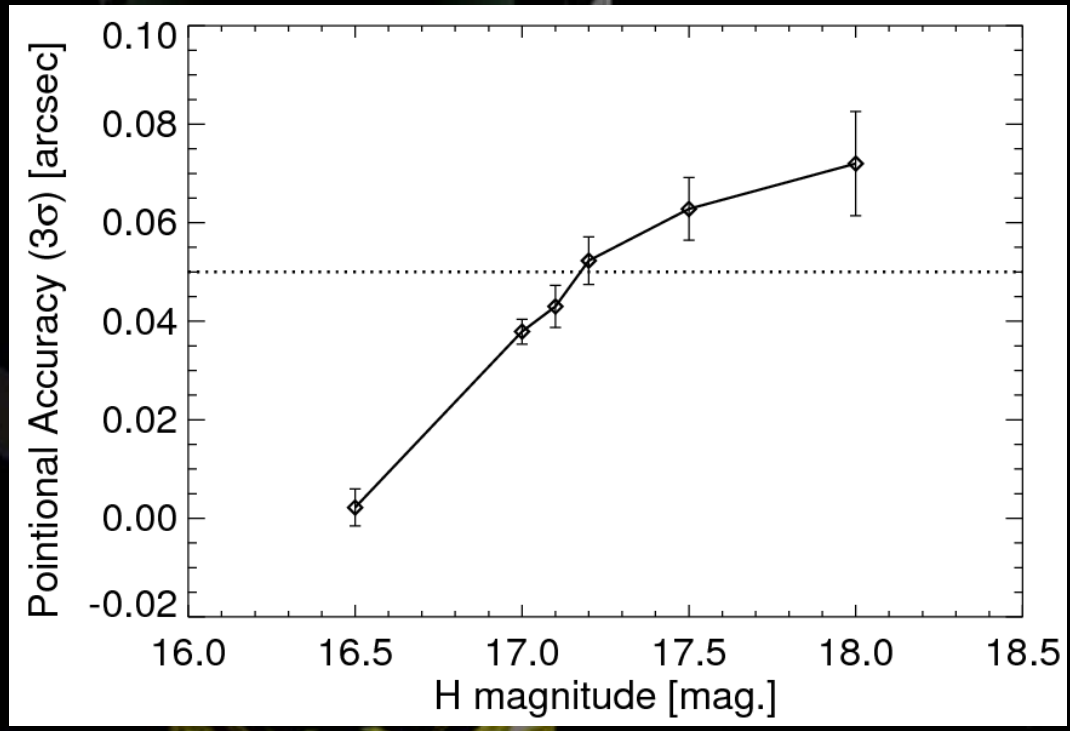
FPC-G

- Accuracy of position determination
  < 0.05 arcsec (3σ) (requirement)

- Wavelength band
  H or K
- Catalog (TBD)

- Detector (tentative)
  - InSb 512 x 412 array (4.3 x 3.5 $arcmin^2$)
  - Pixel size: 40μm, 0.5 arecsec/pixel
  - Operating temperature 13K
  - Heat generation < 1 mW

Expected Performance of FPC-G



- To get the required pointing accuracy (< 0.05), H magnitude of a guiding star should be **better than 17.1 mag**.
- Number of guiding stars per FPC-G FoV: ~ 13

FPC-S

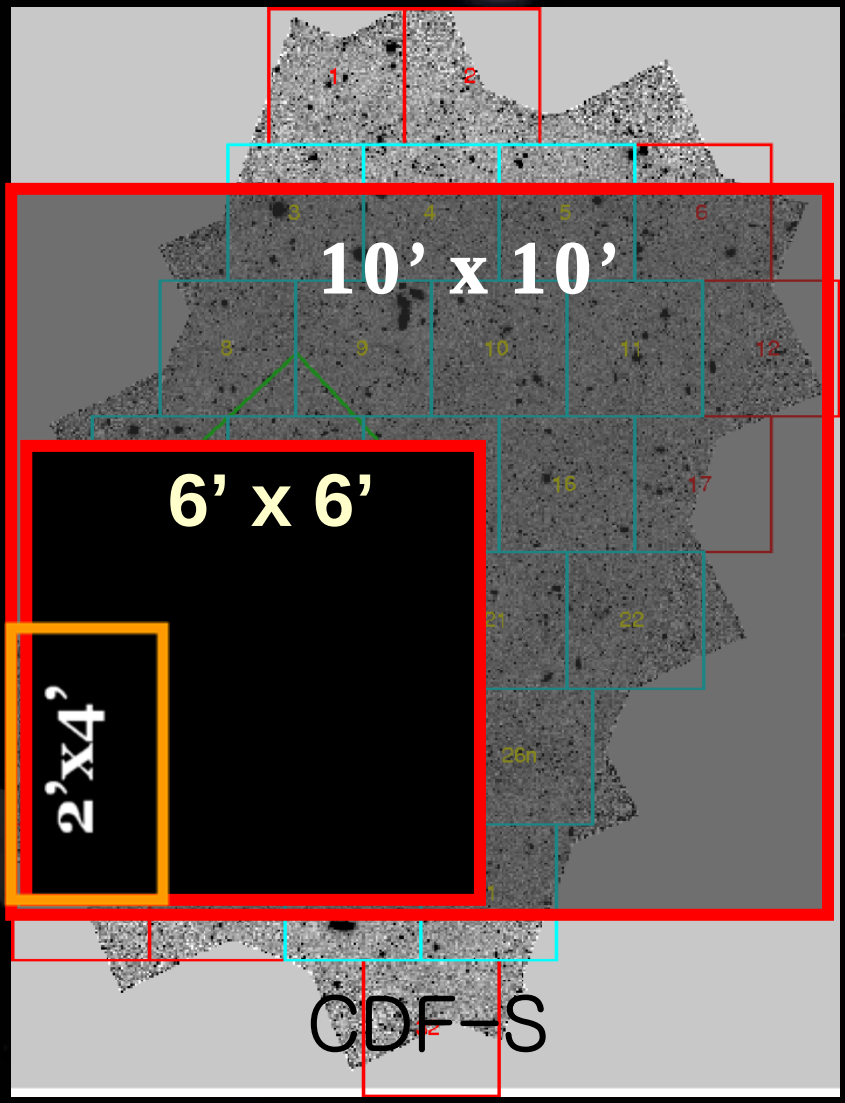
- Detector
  - HgCdTe 2K x 2K array (6 x 6 arcmin^2)
  - Pixel size: 18μm, 0.18 arcsec/pixel
    → With larger pixel, Larger FoV? e.g., 0.3 arcsec/pixel
  - Operating temperature < 37K
    (lower temperature operation must be examined)
  - Heat generation < 2mW

- Filter wheel: 8 positions (2 – 5μm)
  - Grism/Prism
  - Narrow band filters, etc

- Expected sensitivity: 27.3 AB mag at 1 hr (5σ)
  (or 25.1 AB mag at 1 min; 24.7 AB mag at 30 sec)

2. Competition with JWST (1/2)

- Bigger field of view is better to compete with JWST/30m class telescopes
- Many VLT nights were used to obtain the data to the depth of K ~ 25 AB mag
- With respect to JWST, SPICA has a comparable (6’ x 6’) or better survey power (10’ x 10’, x 12 times area)



2. Competition with JWST (2/2)

- Parallel Imaging Survey
  - FoV = 36 arcmin^2, assume 1hr per field
  - 1 day → 36*20hrs = 720 arcmin^2
  - 5 years → 360 deg^2 to the depth of 27 mag.
  - Realistically ~50 deg^2 for several filters, extragalactic field consideration

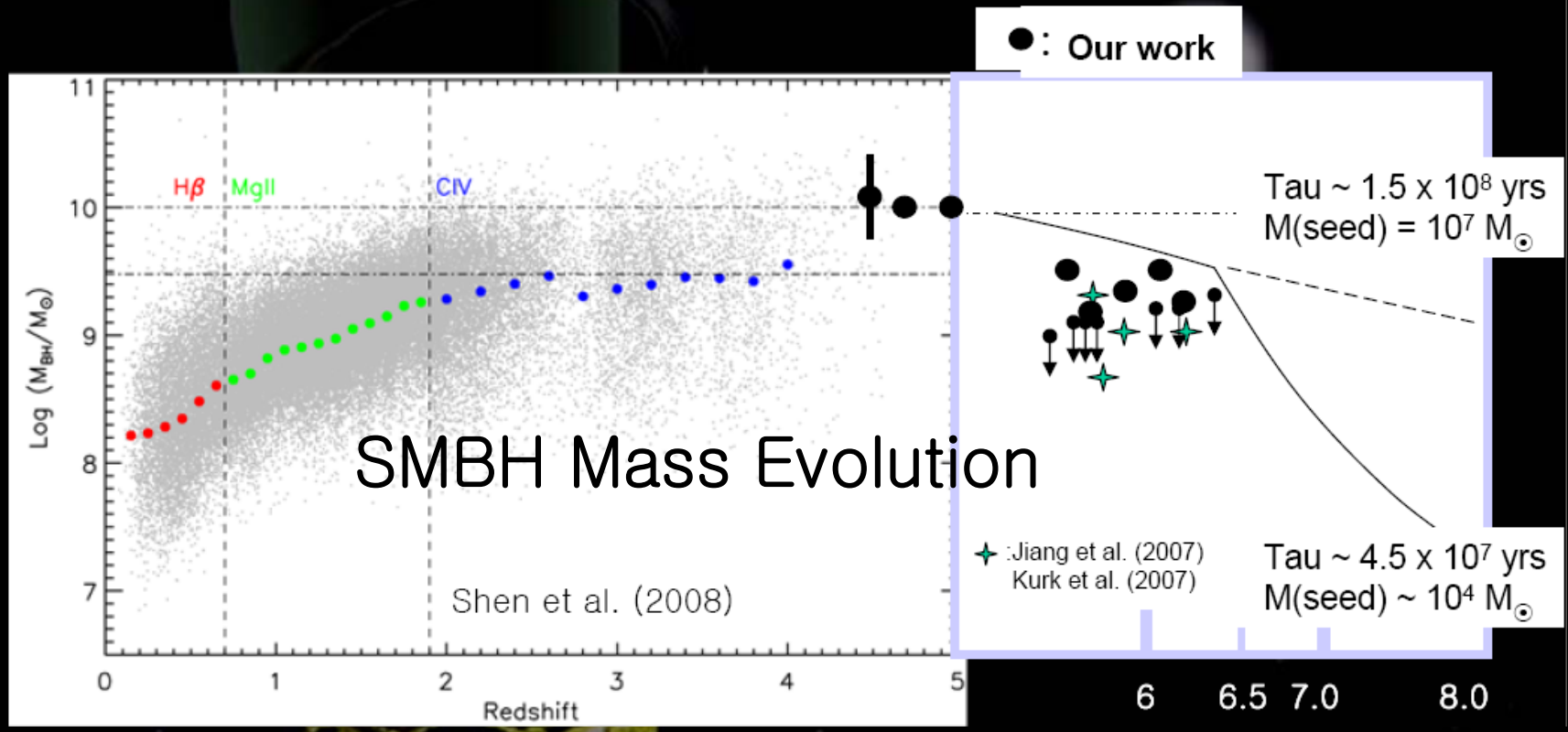
  → Unique survey of high redshift galaxies/QSOs

- If pixel = 0.3”, FoV = 10 arcmin^2
  - 5 years , ~150-200 deg^2. for several filters

3. Legacy Science (1/2)

- One Deep Field Survey (SDF)
  - 3 deg^2 to 27.9 mag.
  - To detect star forming galaxies, massive structure, and AGNs at $1 < z < 10$ and study the early universe
  - ~1000 galaxies at z=8-10, ~200 galaxies at z=11-14
- One Medium Deep Survey (SMDS)
  - ~150 - 200 deg^2 to 26.3 AB mag
- One Wide Area Survey (SWIMSS)
  - 1000 deg^2 to 25 AB mag (1000 hrs give 1000^2 deg!)
  - To discover the first quasars (z > 8-10), and study the evolution of massive galaxies and large scale structures from high redshift as well as cool stars in Our Galaxy

Study of z>7 Universe



- Significant growth of SMBHs is happening at z>7
- Key diagnostics redshifted to z>7 for galaxies & AGN → Need for IR spectroscopy beyond 5μm to extend the AKARI capability in wavelength and sensitivity

3. Legacy Science (2/2)

- A Spectroscopic Survey (SGS)
  - To detect Balmer lines and Oxygen lines of star forming galaxies and AGNs at $1 < z < 12$
  - To understand star formation history of the emission line objects

- Near-by Galaxies and clusters of galaxies
  - To investigate the star formation history of n earby large galaxies using deep NIR photome try of AGB stars
  - To study galaxy mass functions, intracluster s tellar populations, and star formation activit y of nearby clusters of galaxies