

Report on German Activities 2014

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Outline (chronological)

- AAS Washington DC (6 Jan 2014): Guesten's GREAT review
- DLR Program Council (5 Feb 2014): future instrument funding
- GSSWG Meeting (6 Feb 2014): SOFIA's new org. structure
- SOFIA Winter School Univ. Cologne (10-14 Feb 2014, [Link](#))

- GREAT news (HZ), FIFI-LS commissioning (Randolf Klein)
- DSI preparation CfP Cycle 3 (to be released after mid-May)
- forward look: GREAT H-channel to be commissioned
- conferences: Ringberg March 2015, Zermatt Oct. 2015

- Political activities in Germany after NASA's announcement to "put SOFIA into storage" unless new partners can be found
- Heavy Maintenance Visit (HMV) at LHT in Hamburg: postpone?

SOFIA winter school (10-14 Feb at Univ. Cologne)

- idea: tutorial lectures
on molecular spectroscopy + ISM physics and chemistry
- some 30 lectures in 4 days + tutorial on GREAT observing
(see Web-Link www.astro.uni-koeln.de/sofia-ws2014/talks)
- some 60 participants from 10 different institutions (incl. abroad)
- 1 day devoted to discussion about future instruments + science
- highlight: tera-hertz heterodyne arrays of ~100 pix within reach
- another high point: tour of Cologne cathedral (up on the roof)

- SMO participation through Goeran Sandell, Erick Young, & HZ
- Supported by SFB 956 (Stutzki) and ISM-SPP 1073 (Garching)

- **PS. Perhaps need a similar workshop in the US (eg. for EXES)**

Overview (Rolf Guesten, AAS Washington DC)

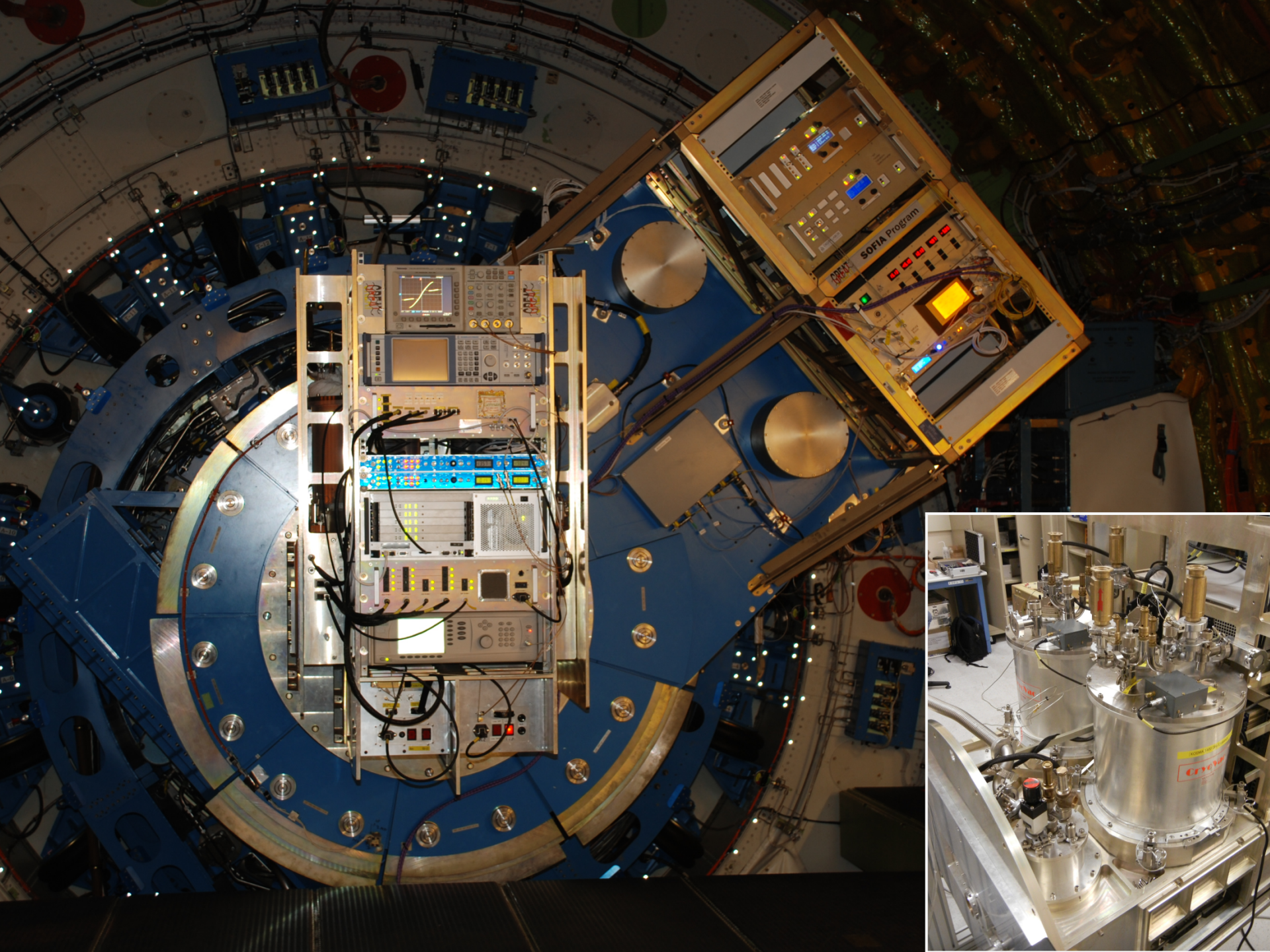
GREAT - instrument status and science

- Introducing the instrument
 - system overview
 - performance as of today
- Instrument upgrades (within next year)
- Operation Modes /Access to communities
- Science highlights

GREAT - System Overview

- GREAT is a highly modular heterodyne spectrometer ($R \sim 10^8$)
- operating in science-defined frequency bands $1.25 < \nu < 4.7$ THz
- 2 out of currently 4+1 cryostats can be operated simultaneously
- channel availability (as of Jan 2014)
 - 2 low-frequency channels are operational since Early Science (2011)
 - 2 mid frequency channels:
 - M_a operational; M_b on hold for mixer upgrade, waiting for commissioning slot
 - high-frequency channel (lab verified, ready to go, commissioning 05/14)

Channel		Frequencies [THz]	Lines of interest	
low-frequency	L1	1.26 – 1.52	[NII], CO series, OD, H_2D^+	operational
low-frequency	L2	1.82 – 1.91	NH_3 , OH, CO(16-15), [CII]	operational
mid-frequency	M_a	2.49 – 2.56	$(^{18}O)OH(^2\Pi_{3/2})$,	operational
	M_b	2.67	HD	on hold
high-frequency	H	4.74	[OI]	ready to go (May '14)
upGREAT	LFA	14x (1.9– 2.5)	CO(16-15), [CII] and above	commissioning Q1 15
upGREAT	HFA	7x [4.74]	[OI]	1 yr after LFA



System Performance

The modular design allows for short technological turn-arounds, keeping GREAT at technological forefronts.

Since commissioning in 2011 we have exchanged /upgraded

- all our HEB mixers
- all local oscillator sources (and related, the common optics)
- all our spectrometer back-ends

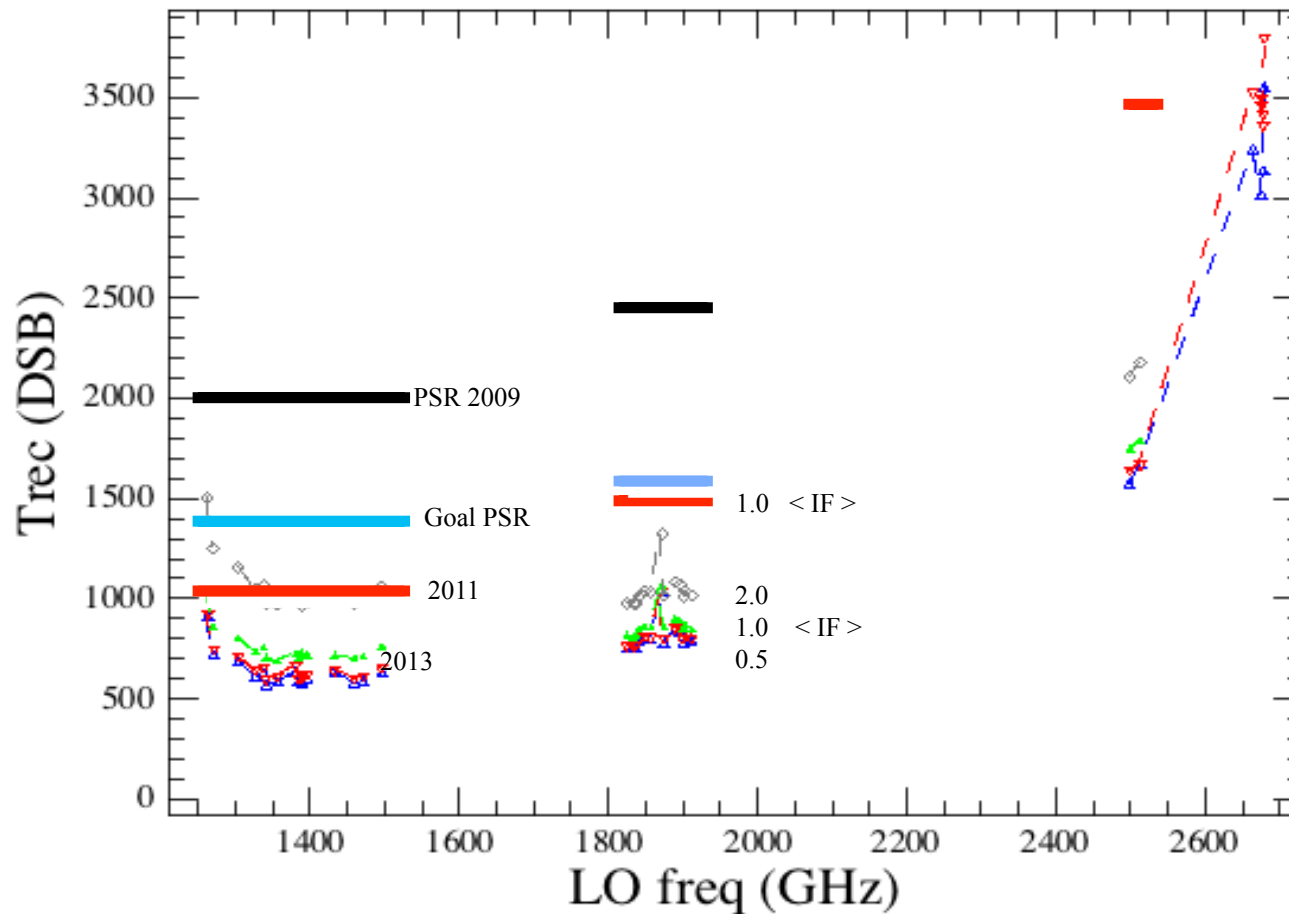
You, as our customer, should have noticed

- increasingly wider RF coverages (still limited to selected bands)
- much improved system noise temperatures
- wider IF bandwidths (defined by HEB roll-off), processed by
- monolithic spectrometers providing highest spectral resolution

Receiver noise temperatures

The performance of the Cycle-1 GREAT has improved significantly !!

Trec vs RF - all bands



Community Access to GREAT

- GREAT is available to SOFIA communities in **collaboration**
 - „rules“ stated in Cycle 1-2 call-for-proposals
- GREAT as PI instrument operates in **service mode** only
 - observations are performed by the GREAT team
- observations are executed via **observing scripts**
 - preparation supported by SMO (based on your uploaded AORs)
- GREAT delivers calibrated data in standard **CLASS** format
 - raw data (FITS format) into archive within 2 days after flight
 - quick look analysis (prelim. reduced) within 2 weeks
 - calibrated data within 45 days after end of flight series

cf. Community access and 3D-IFS data reduction issues for FIFI-LS :

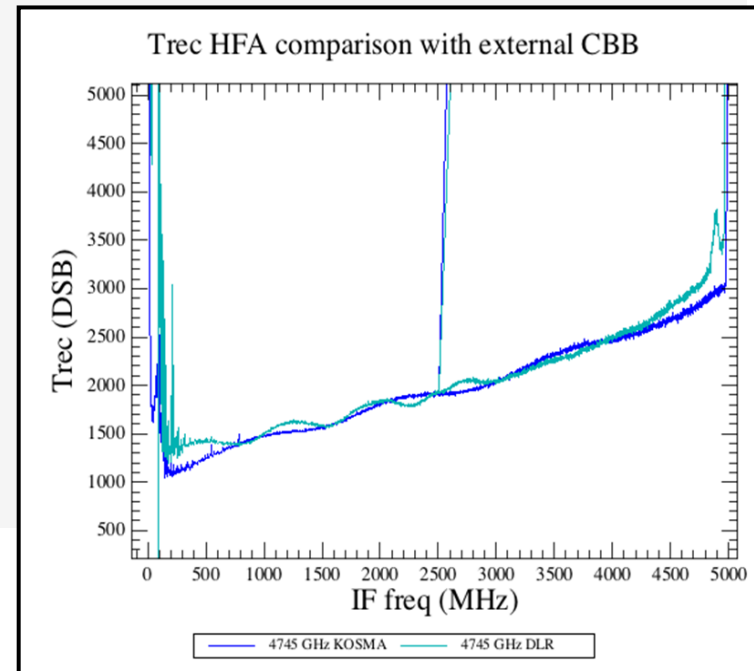
Lack of DSI man-power after spring of 2015 (DLR funding running out)

→ FIFI-LS will transition from a PI instrument to an FI instrument 2015

4.7 THz H channel - ante portas (May 2014 comm.)

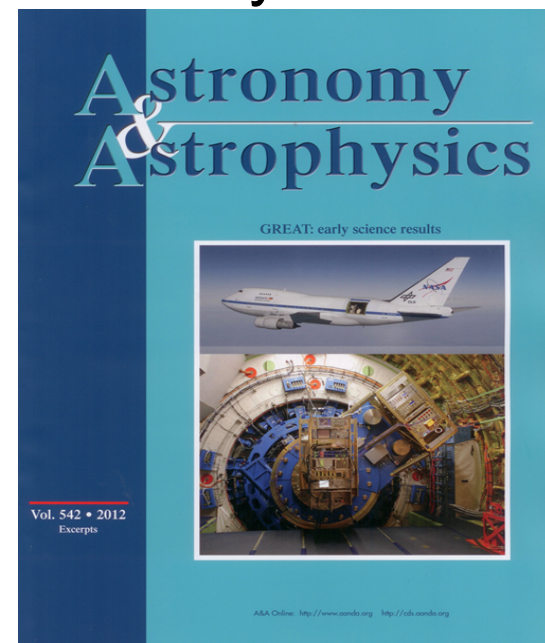
Our latest addition, the high-frequency channel passed pre-shipment verification in the labs of MPIfR with truly outstanding performance:

- aiming at observations of [OI] at 4.74 THz (mostly galactic, due to ATM)
- based on new technologies: the NbN HEBs will be pumped by a novel QCL local oscillator (DLR-Pf)
- amazingly, we have a choice of 2 mixers with comparable noise figure $T_{rx} \sim 1500$ K
 - an open-structure HEB [DLR-Pf, Hübers]
 - a waveguide HEB [KOSMA, Jacobs]
- the integrated system complies with specs
 - optics, stability, tuneability – all fine
- we prepare for commissioning in May 2014 (3 PI consortium flights May 12, 14, 16).



GREAT Flight Records

- GREAT performed 15+2 flights during SOFIA's Early Science
 - observed a total of 26 science projects (G+US)
 - final release of data completed in Nov 2011
 - 22 papers published in A&A Special (Vol.542)
- during Cycle 1 GREAT completed
 - 18 successful flights
 - 9 flights during New Zealand deployment
 - 3 out of 5 during Jan/Feb 2014 (still Cycle 1).
- calibrated data for all community projects were released in Nov. 2013
- expect that with completion of Cycle1 more than 2 dozen projects will have received quality-validated data.
- We aim again at another „pooled“ publication (A & A) like in June 2012

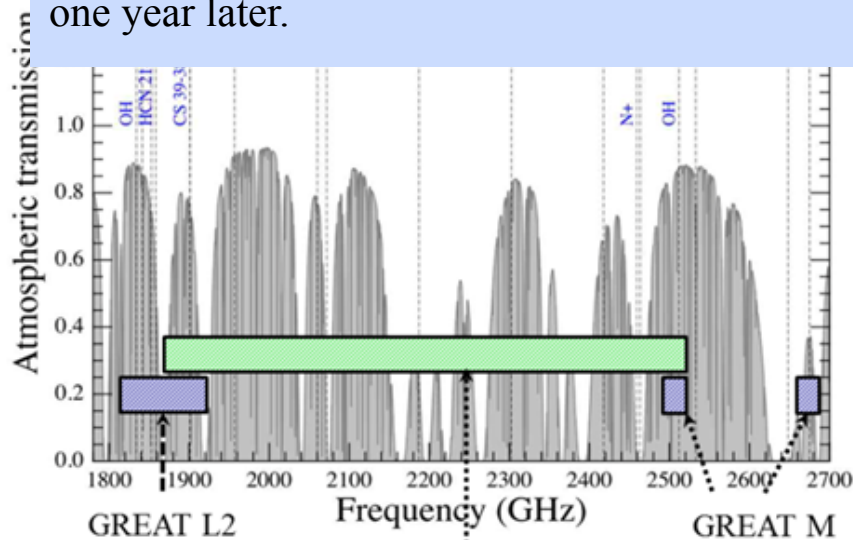


upGREAT – GREAT multiplexed...

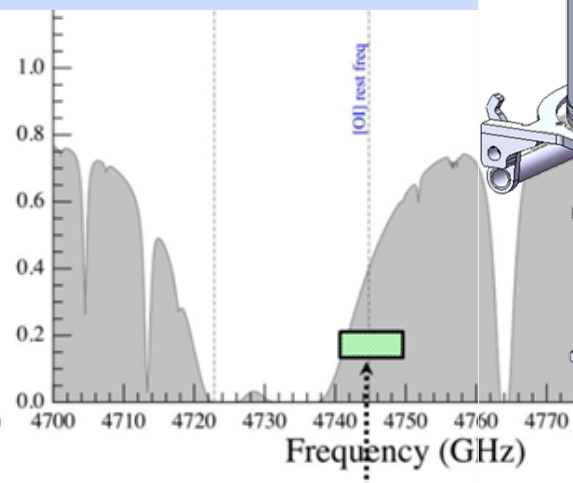
the extension of GREAT into 2 hex arrays, operating in parallel

- 2x 7 low-frequency pixels (LFA) and
- 1x 7 high-frequency pixels (HFA),
- or (m)any combination with GREAT's single pixel detectors

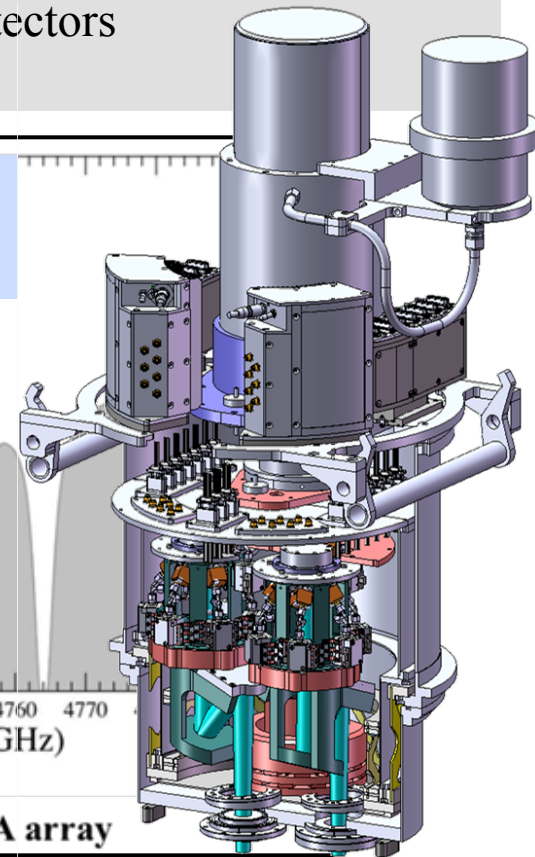
project is on schedule, aiming at LFA commissioning in Q1 2015. HFA one year later.



upGREAT LFA array



upGREAT HFA array



German Call for Proposals Cycle 3

- In prep. The earliest that DSI can release the call is mid-May
 - This implies a deadline around July 15 (after HVM starts ...)
 - TAC meeting foreseen for mid-September, results end of Sept
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- HZ visited IRAM in Grenoble to learn about IRAM TAC issues

Report from the GSSWG Meeting (12 of 18 topics)

- Major discussion on keeping internal schedule agreements
- face-to-face contact desirable to avoid mis-communications
- Stutzki reports on his 2M\$ request at DLR program council for instrument development (50% of the total still needed).
- The timing of the HMV is discussed (Galactic Center time)
- Comments on the German Cycle 2 low oversubscription rate
- HZ proposes a Ringberg MPIfR SOFIA Workshop in 2/2015
- Stutzki announces 6th Zermatt ISM Conference in 10/2015
- Set of publications from the NZ deployment sub. by mid-July
- Cycle 3: two NZ southern deployments with two instruments!
- SUG recommendation to start Obs Cycle in March welcome
- Opportunity to present SOFIA during HMV in Hamburg (VIP)
- Discussion on the new NASA SOFIA org. structure (TA part)

Political activities against termination of SOFIA

- NASA announcement to “mothball” SOFIA came as a complete surprise to DLR and the German community
- GSSWG asked for an emergency meeting at DLR which resulted in GSSWG letters to the two relevant ministries
- The President of the Max-Planck Society stepped in, too
- The **DLR Chairman, Prof. Woerner**, did a blog protesting the procedure and says it harms US international trust+reliability (recall: SOFIA is the biggest bilateral US-German project)
in a similar vein, see also the **Nature editorial from April 24**
- member of German Parliament contacted US congress
antipode prompted by the DLR (Mr. Willsch, Mr. Palazzo)
- IRS Stuttgart (Prof. Fasoulas/Prof. R”oser) wrote to DLR
- Stuttgart MdB Mr. Kaufmann: educational aspects of SOFIA
- HZ asks Mr. Bolden, visiting Ames, a few critical questions
- BMWI ministerial undersecretary to visit US in early June