



# ISMAR

## Latest news and planned developments

Ian Rule and Chawn Harlow, ISMAR workshop, Paris, 28<sup>th</sup> to 30<sup>th</sup> September 2015



# Contents

This presentation covers the following areas

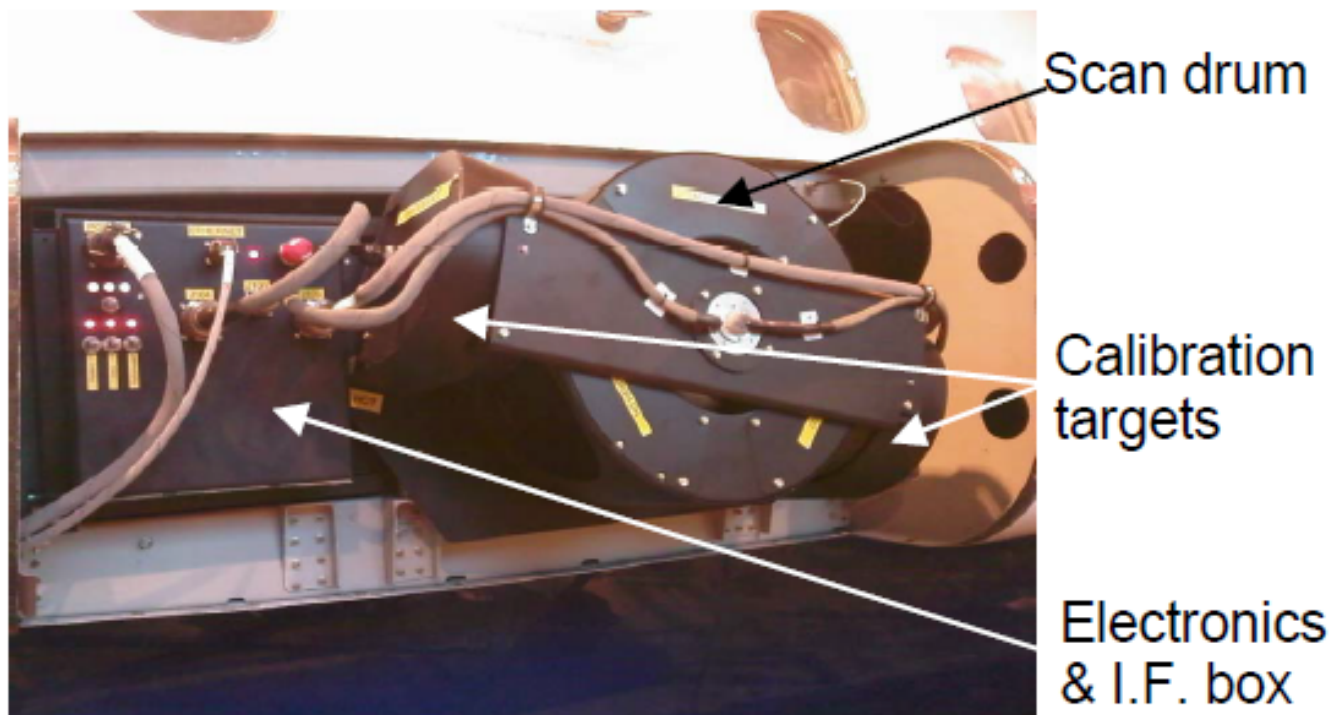
- Description of ISMAR – a quick reminder
- Latest news
- Planned developments
- Questions



# ISMAR Description

- Scanning multi channel microwave and millimetre wave radiometer
- Current receivers fitted – 118GHz, 243GHz, 325GHz, 448GHz and 664GHz

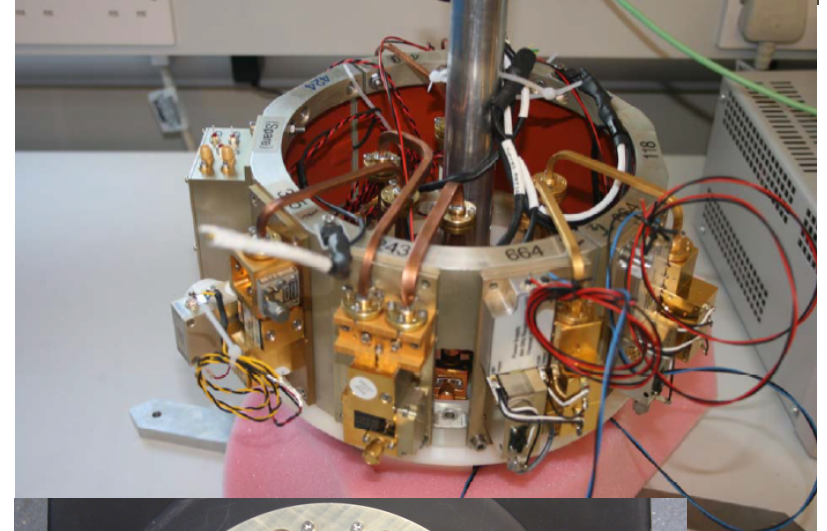
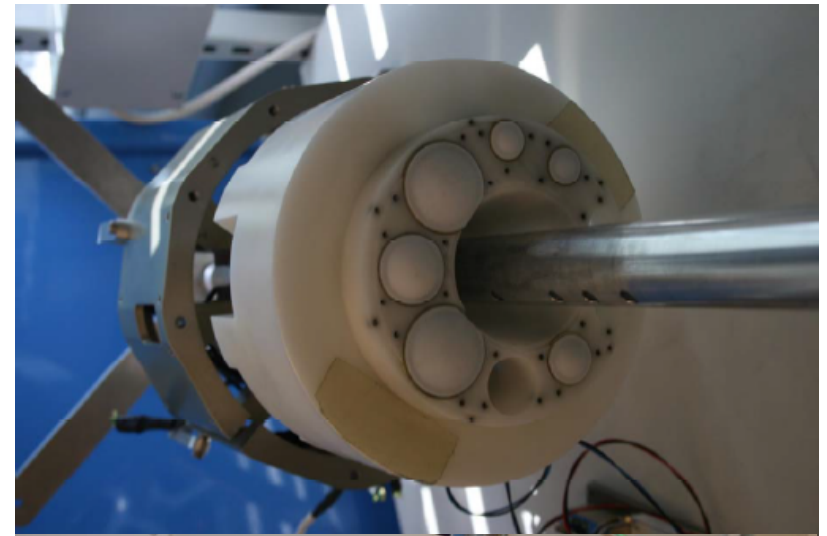
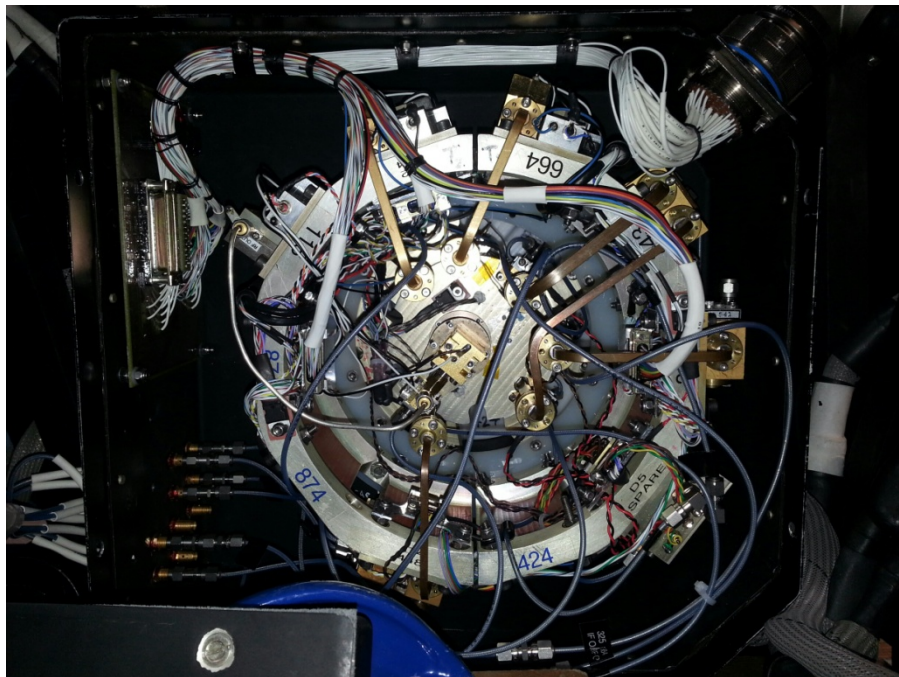
- Scan drum houses a 45° reflecting mirror machined to optical standards and plated with 5µm thick gold
- Mirror is heated to eliminate condensation
- Calibration loads designed and manufactured by RAL – one is heated the other ambient
- Data acquisition unit based on NI CompactRIO
- Separate enclosure for I.F. amplifiers etc
- Approx dimensions 1.1m x 0.4m x 0.5m and 90kg



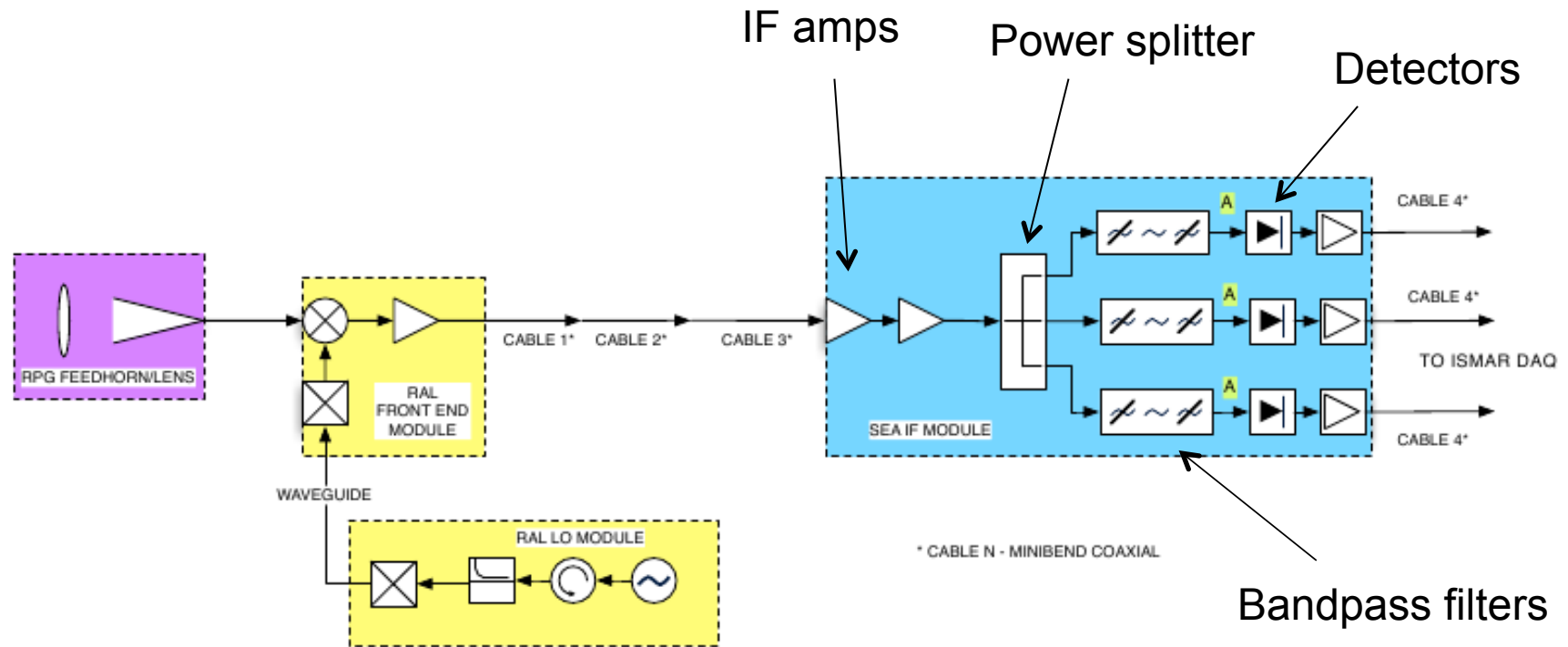


# ISMAR Description

- Receivers are arranged into a 'Plug' such that they all have direct vision of the scan mirror
- Local Oscillators and power regulation mount onto the 'Turret'
- I.F. Signal from mixers sent to I.F amplifiers, filters and video amps in a separate box



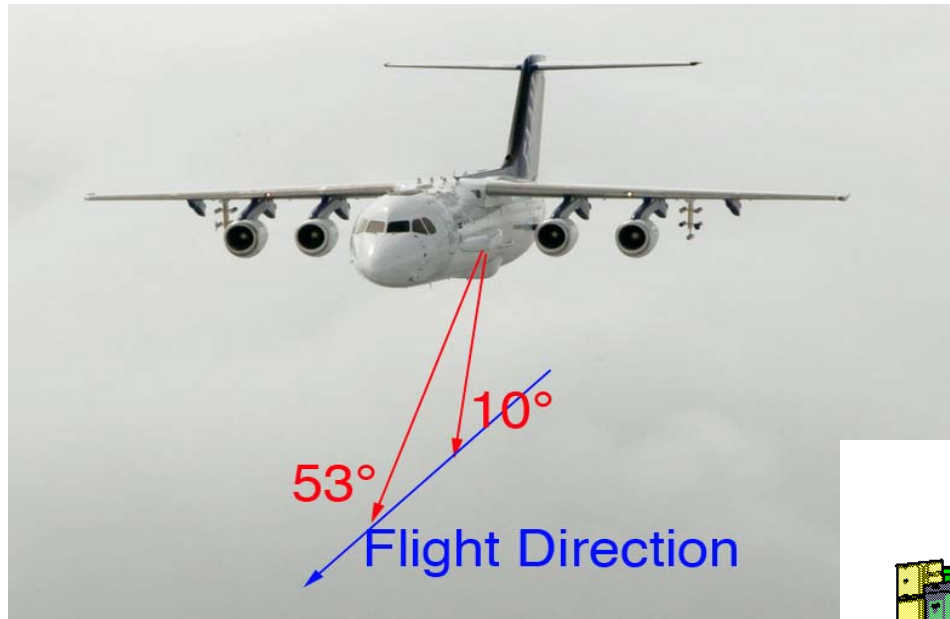
# Example 448 GHz diagram



- Front End, behind scan drum
  - Purple – in plug, Yellow – in turret
- Back End, IF Box – Blue



## ISMAR - Description

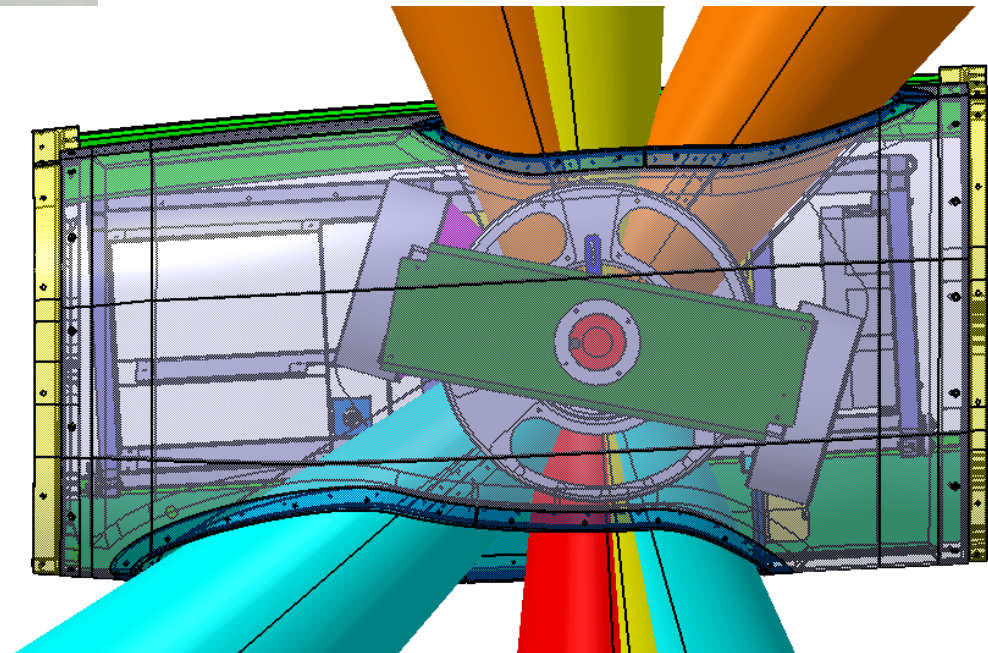


- ISMAR is fitted into the large radiometer blister on the FAAM BAe-146 aircraft. It has viewing directions along the track of the aircraft:

- +53 deg to -10 deg nadir
- +10 deg to -40 deg zenith

- Typical multi position scan sequence takes about 4 seconds

- Scan positions are user selectable





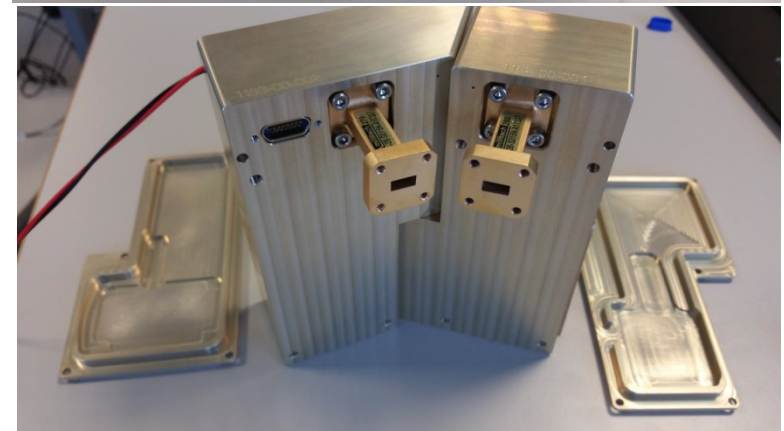
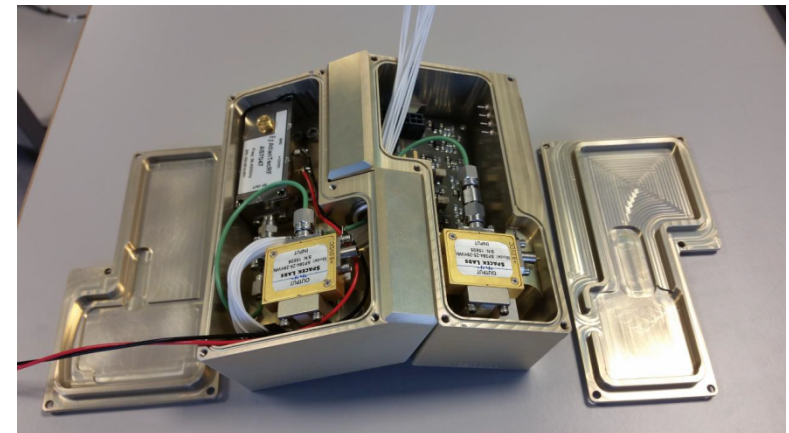
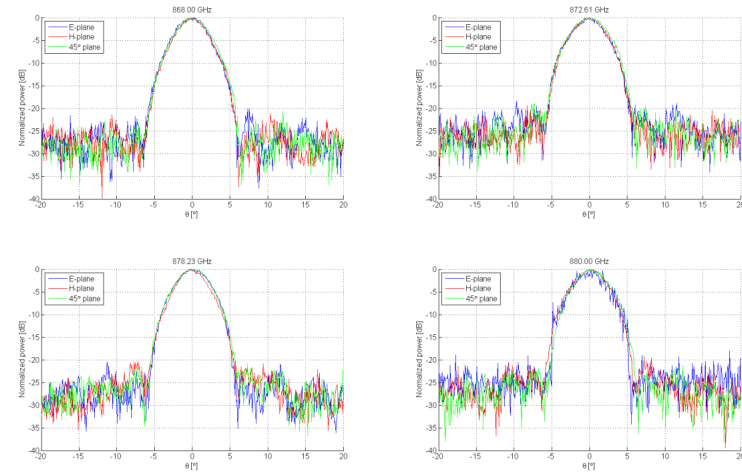
# News since last workshop

- An 8 $\mu$ m polypropylene window was fitted in front of the hot target
  - The hot target remains exactly at temperature set point at all times
  - The spread of temperatures across the target PRT's is greatly reduced
  - No obvious adverse effects have been found.
- Additional ventilation was added to the Front End Cover box
  - This has improved the Front End temperature stability in flight
  - But not on the ground or in warm conditions unfortunately – further work is required
- An additional heater was fitted to the IF enclosure
  - This has improved the warm up speed and temperature stability for longer at high levels
  - But further work is required...
- ISMAR flew scientifically on two campaigns, Nov 2014 and March 2015, both based at Prestwick Airport



# News since last workshop

- The 874GHz dual polarisation receivers are nearing completion by Omnisys
  - Beam patterns have been optimised and measured at several frequencies
  - LO boxes are essentially complete
  - Multipliers and integrated mixers/feeds are expected complete by the middle of October
  - System testing is due to be complete by the end of November
- Met Office will fund the design and build of the 874GHz Back End receiver, to be made by Omnisys
- Omnisys have offered to build a 424GHz dual polarisation Front End receiver for ISMAR, free of charge (they have offered almost any frequency we might want...)







# Planned work

- Modifications to improve instrument environment – 2016
  - Enlargement and improved ventilation of the Front End cover box
  - Improved mount for polypropylene window over hot target
  - New power supply for hot target to ease load for other heaters
  - Rearranged insulation and improved air circulation for I.F. enclosure and reduction of normal operating temperature
  - Digitisation of cold target PRT's at source to reduce noise
  - New improved overall insulation jacket for cold flights
- Performance improvements to CaPAR channels – 2016
  - Full bench set-up of F.E.'s to B.E.'s replacing amplifiers where required
  - Confirmation of poor LO output on 325GHz receiver and repair or replace
- Integration of 874GHz receivers – 2016 or more likely 2017
- 424GHz receiver design and build 2016 - 2017

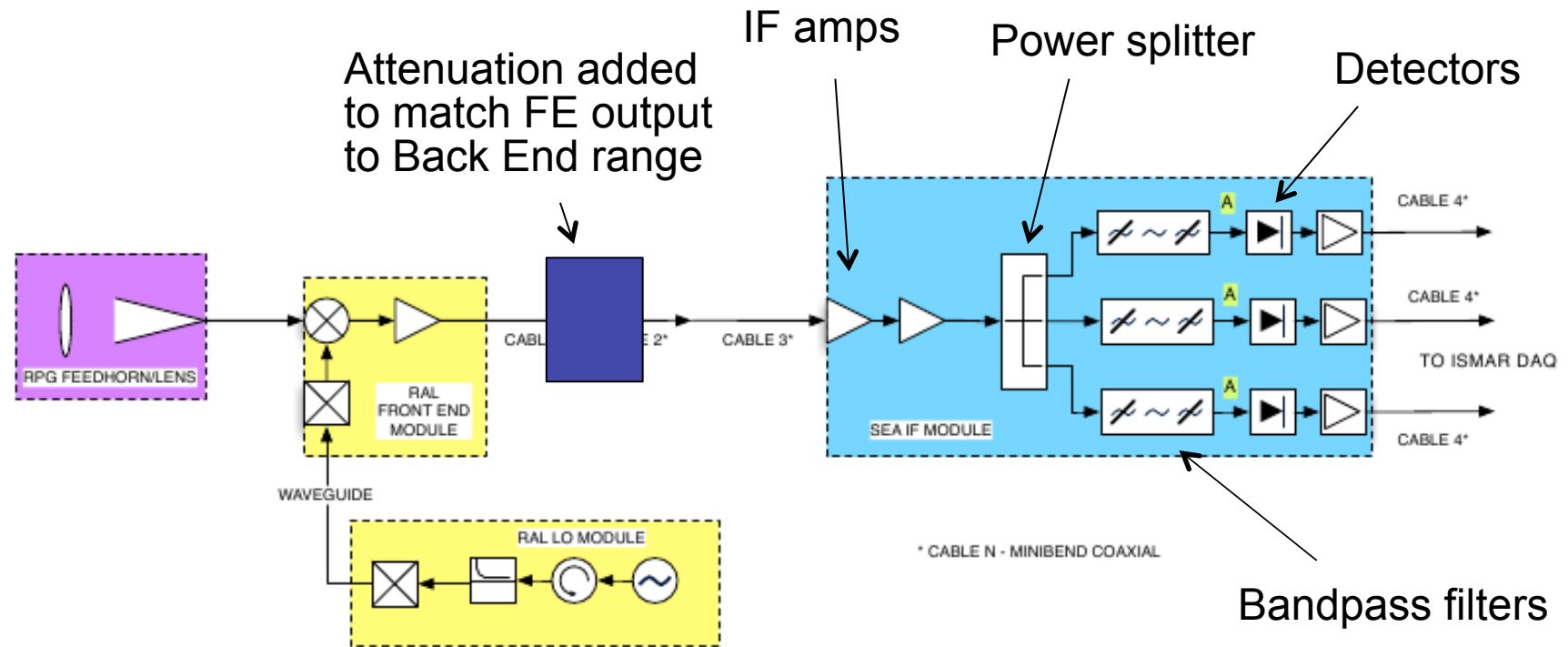


Met Office



Any Questions?

# Example 448 GHz diagram



- Voltage range of Output of Front End too large (BE poorly matched)
- Necessitated introduction of attenuation to bring signal in range
- This attenuation reduces signal-to-noise ratio