



Measurement setup for ALMA Band 5 Prototype Cartridge

M. Strandberg*¹, V. Belitsky¹, B. Billade¹, V. Desmaris¹, D. Dochev¹, S.-E. Ferm¹, R. Finger²,
M. Fredrixon¹, D. Henke¹, K-Å. Johansson³, U. Kylanfall³, I. Lapkin¹, D. Meledin¹, O. Nyström¹,
A. Pavolotsky¹, H. Rashid¹, E. Sundin¹

¹*Group of Advanced Receiver Development (GARD), Chalmers University of Technology,
SE41296, Gothenburg, Sweden.*

²*Departamento de Astronomía, Universidad de Chile, Casilla 36-D, Santiago, Chile*

³*Onsala Space Observatory*

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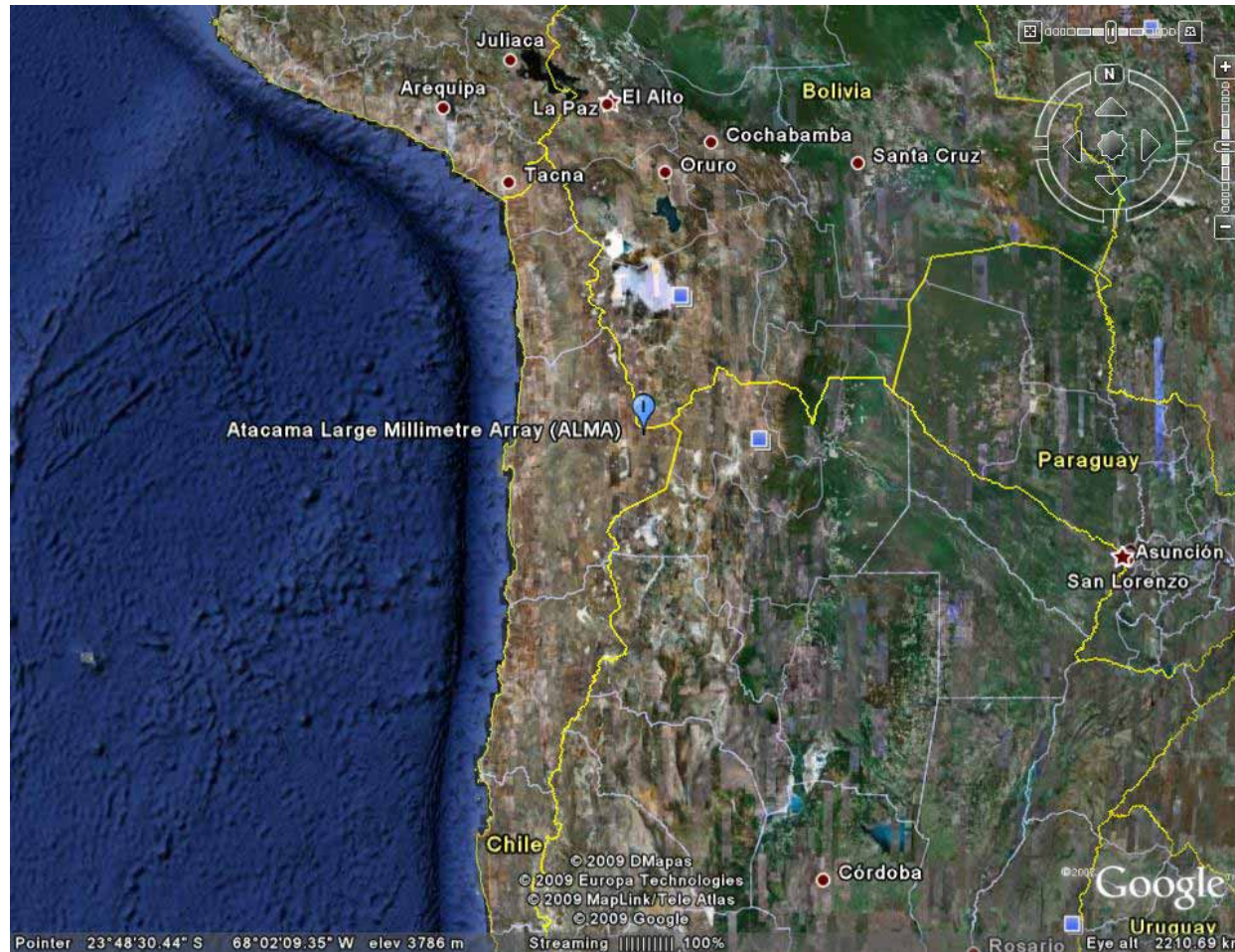


OUTLINE

- **Introduction of the ALMA Project and Band 5**
- **Cartridge Test Assembly**
 - **Hot/Cold measuring system**
 - **Beam measuring system**
 - **Gain Saturation**
 - **Control/measuring system**
 - **Automation Software**



ALMA Project



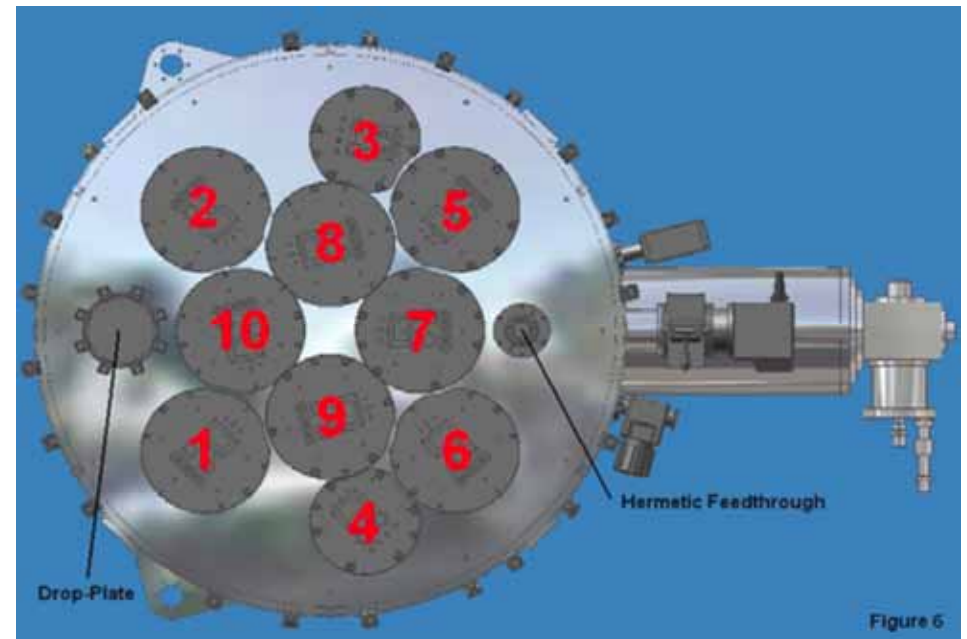
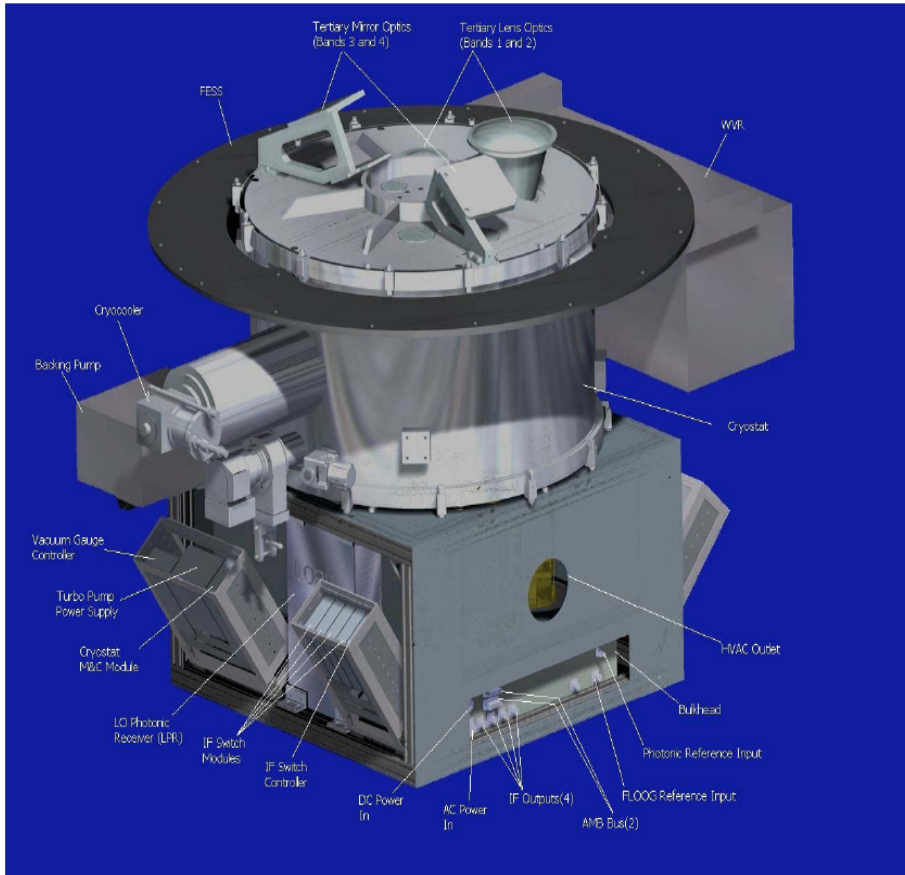


ALMA Project



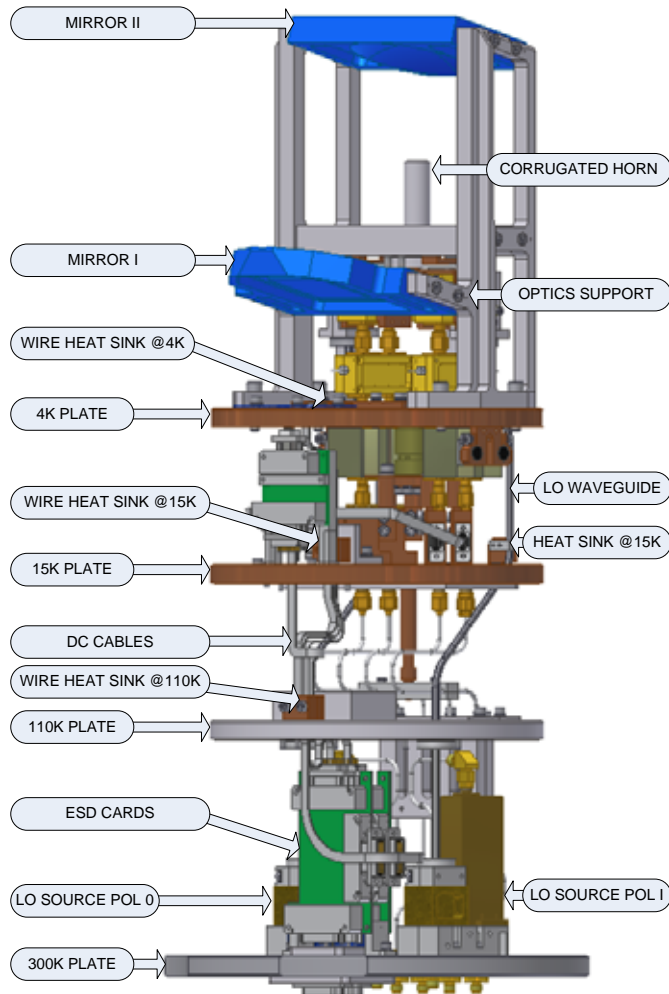


ALMA Cryostat



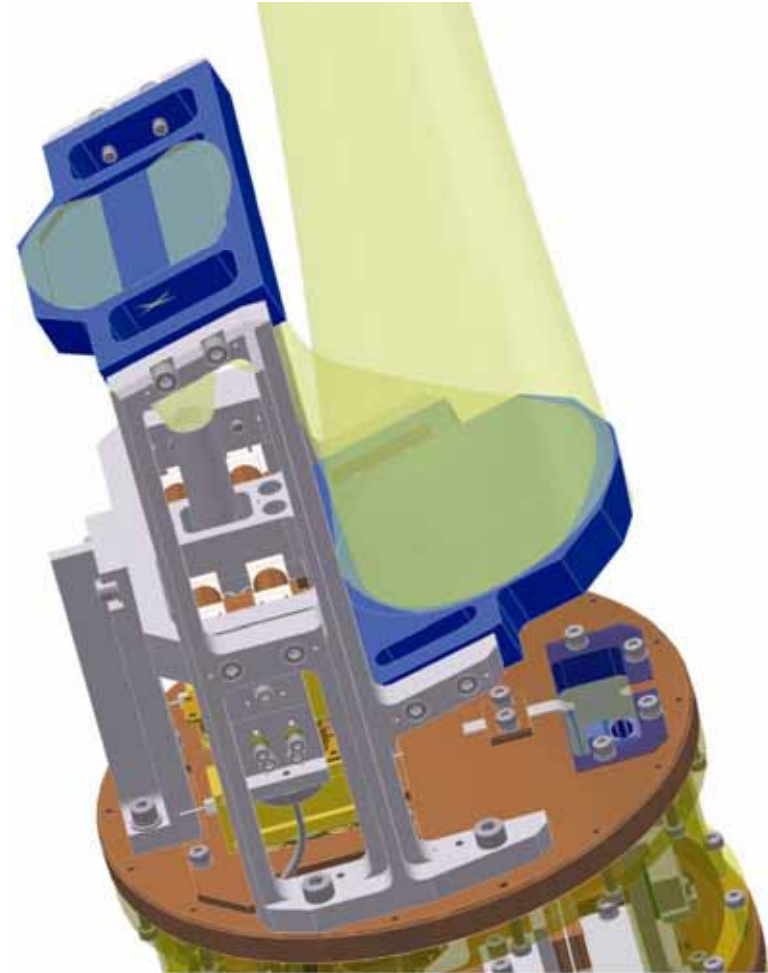
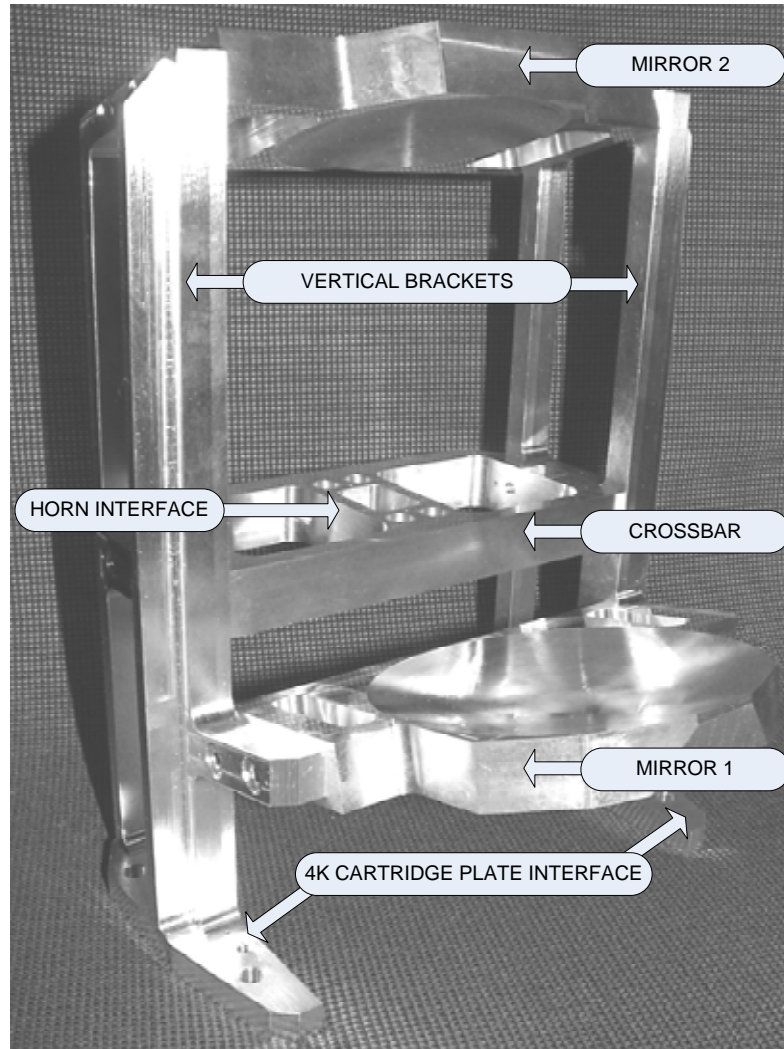


Band 5 Cartridge



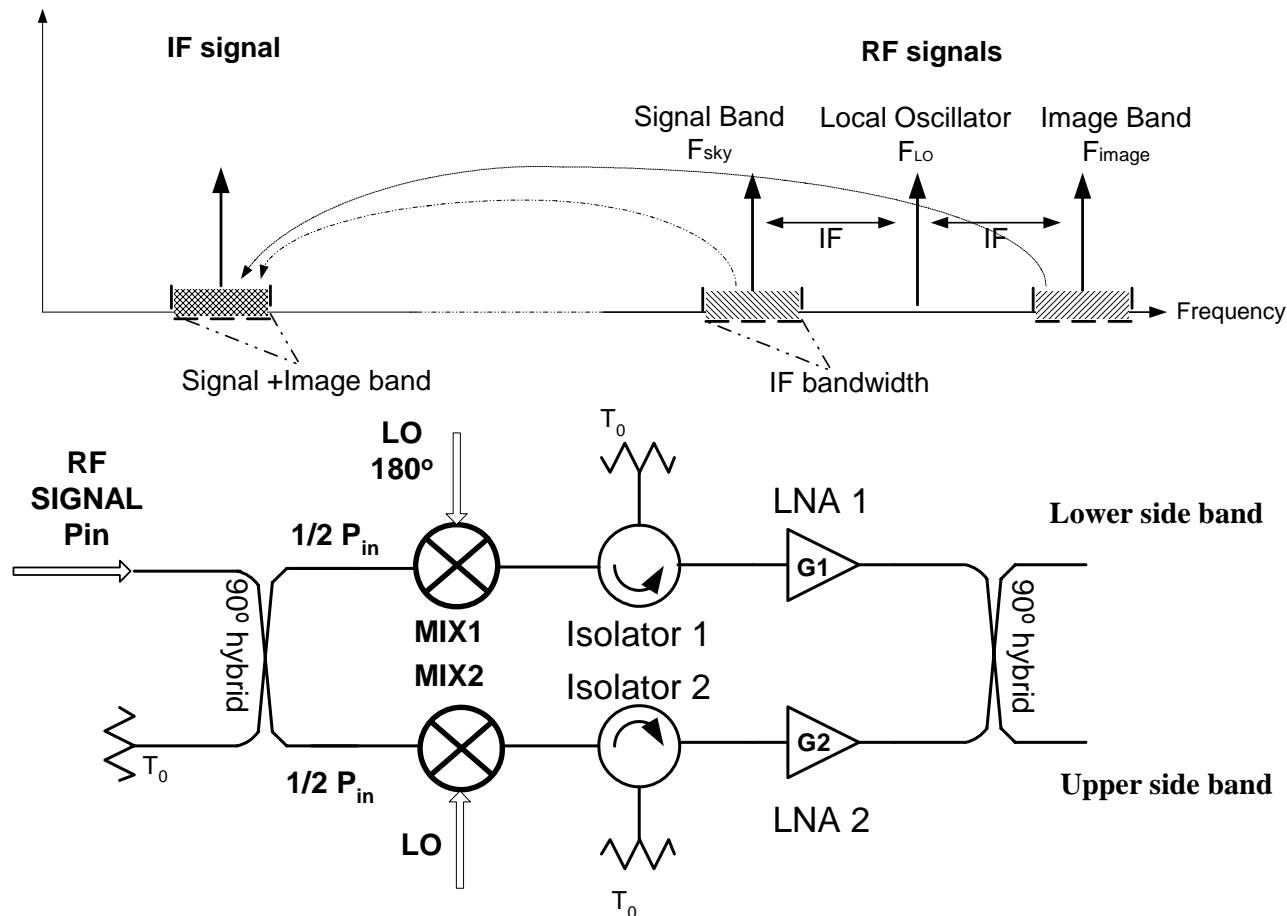


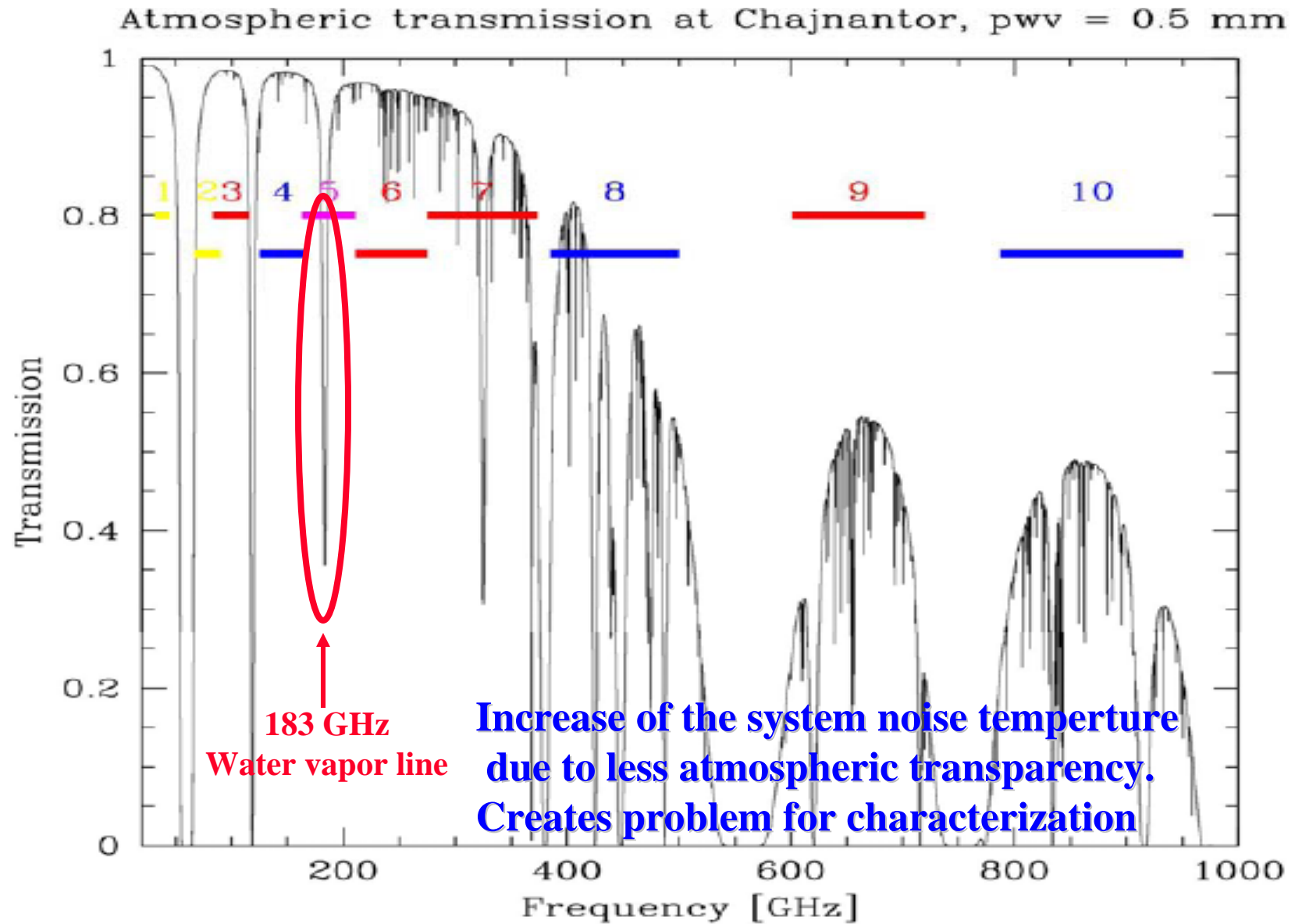
Band 5 Cartridge Optics





2SB SIS Mixer







Humidity in Gothenburg

Current Weather | 7-day Forecast | Weather History | Averages (1961-1990)

Home | All stations | Vicinity | personal services

Weather in Gothenburg, Sweden Lat:57.71 Lon: 11.96 average elevation: 2m. [\(map\)](#)

Station reporting GOTEORG/SAVE at 11.8 Km from Gothenburg. Elevation: 16m

[More Stations](#) →

Current Weather Report
(Online)

Jun 11, 10:50 Local Time

Gothenburg, SE
Temp: 15 °C

Few clouds

Rel Humidity: 77%

Wind: W at 19 km/h
Visibility: > 10000m
Pressure: 1008.1 mb

More Details:
Scattered clouds at 790m

[units](#) →

[7-day Meteogram for Gothenburg](#)

SMS | E-MAIL | FEED

12 hour weather forecast for Gothenburg, SE [tomorrow](#) → [7-days](#) →

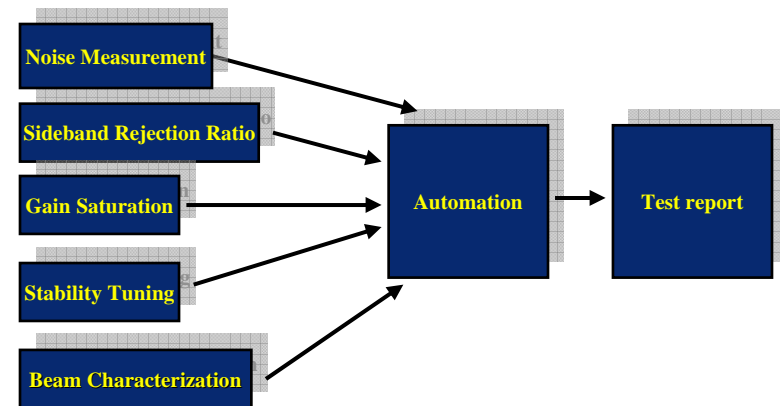
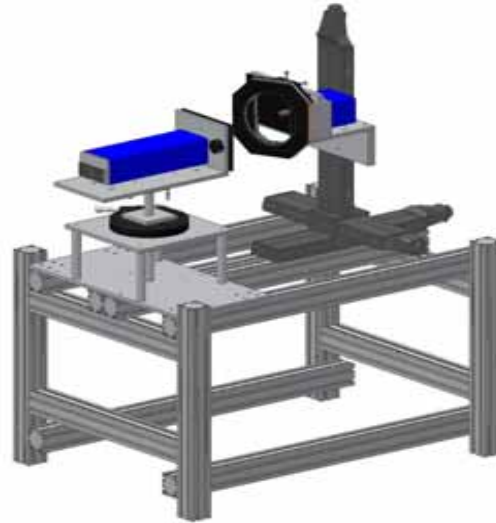
Local Time	Weather	Temp °C	R. Hum %	Wind km/h
14:00	Cloudy skies	17 °C	66%	WSW at 11 km/h (2 Bf)
17:00	Cloudy skies	16 °C	70%	WNW at 10 km/h (2 Bf)
20:00	Chance of rain	14 °C	77%	NNW at 16 km/h (3 Bf)
23:00	Light rain	12 °C	85%	N at 20 km/h (4 Bf)

- Gothenburg is situated close to open sea.
- Appropriate measures have to be considered for band 5 frequency range.

-> enclosed setup!



Overview of setup



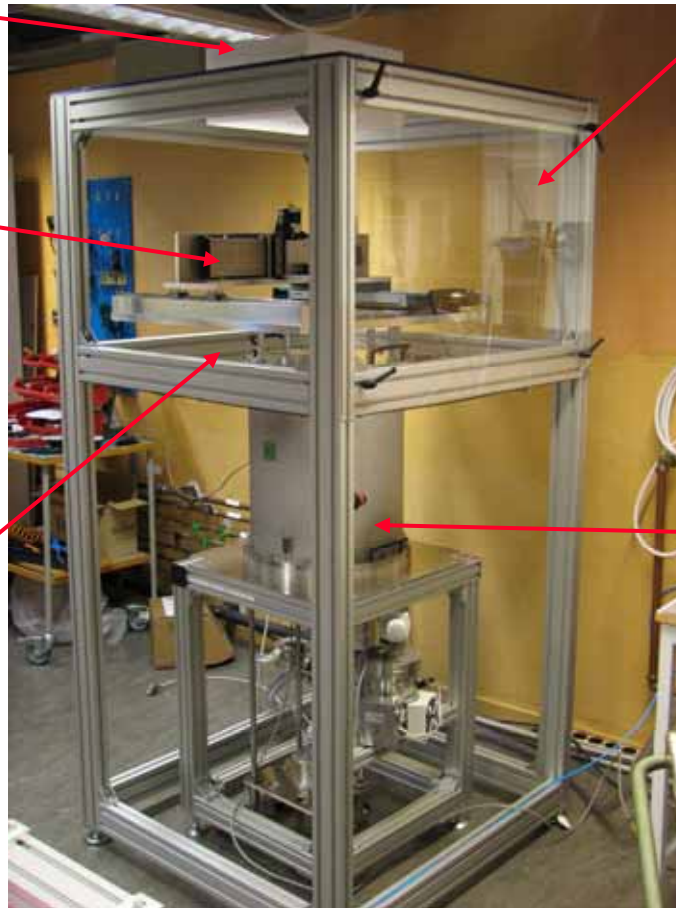
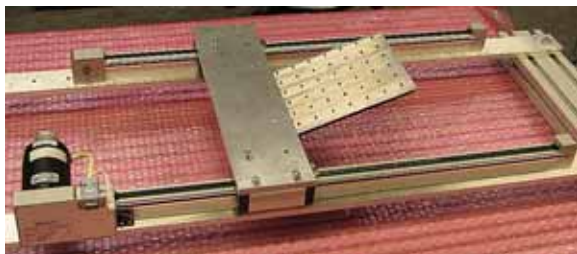


Cartridge Test Assembly

LN2 bath
cold load for Y-factor
measurements

xyz-scanner

Hot load on
separate scanner



Filled dry nitrogen
enclosure

RF-source for beam
measurements is
used for sideband
rejection measurements

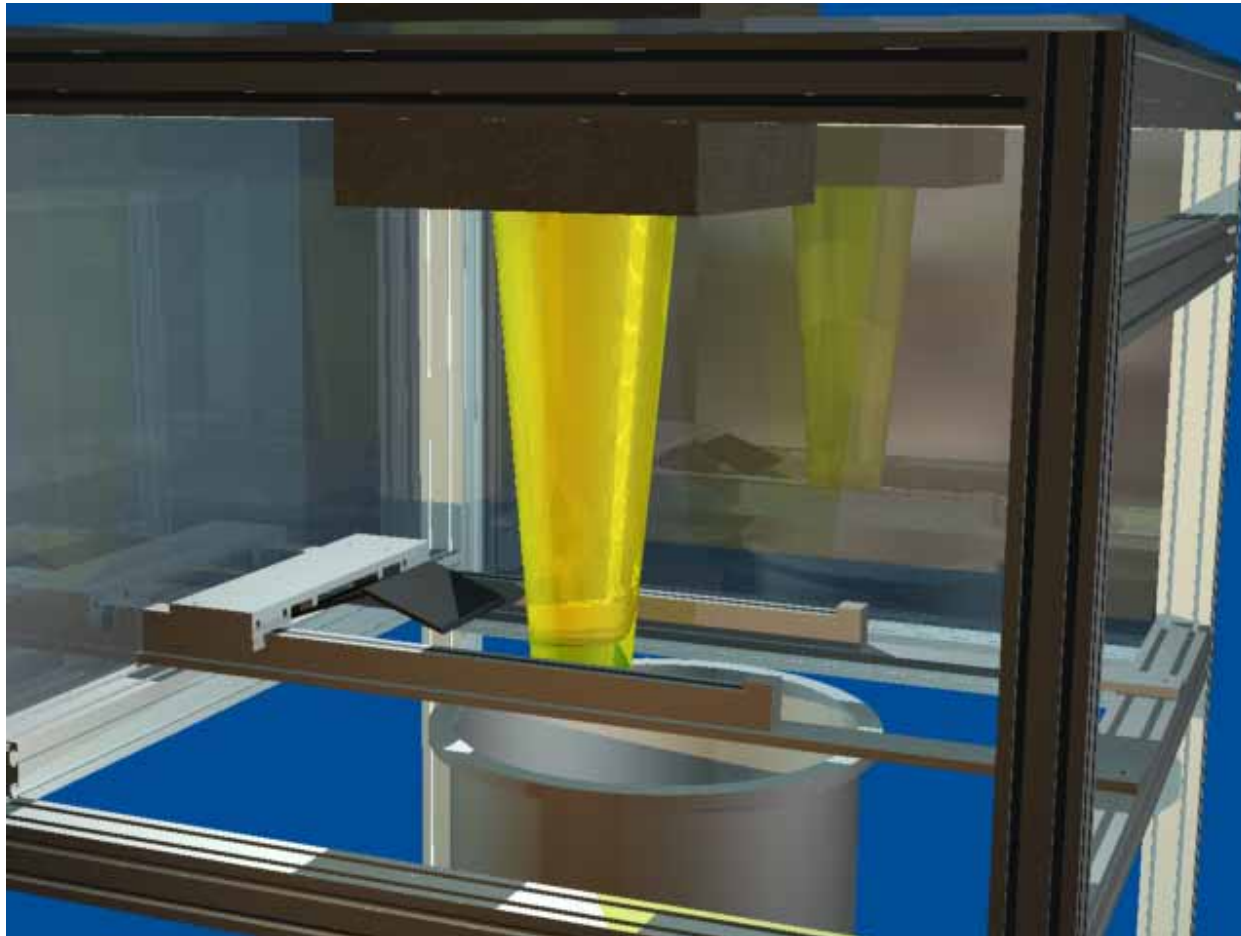
Test cryostat

Automation
Software capabilities
LabView, LabWindows,
MatLab

Based on Olle Nyström's presentation



Hot/Cold measurement

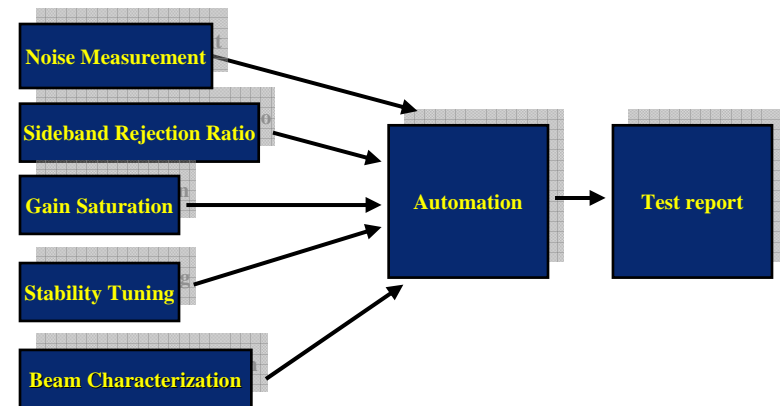
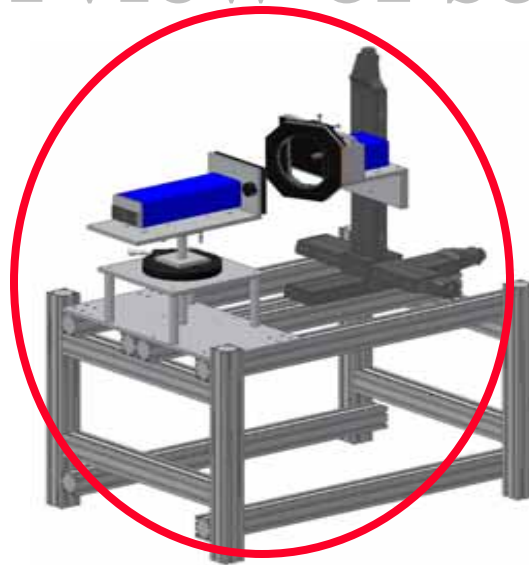


$$T_e = \frac{T_{hot} - Y_{factor} \cdot T_{cold}}{Y_{factor} - 1}$$

$$Y_{factor} = \frac{P_{hot}}{P_{cold}}$$

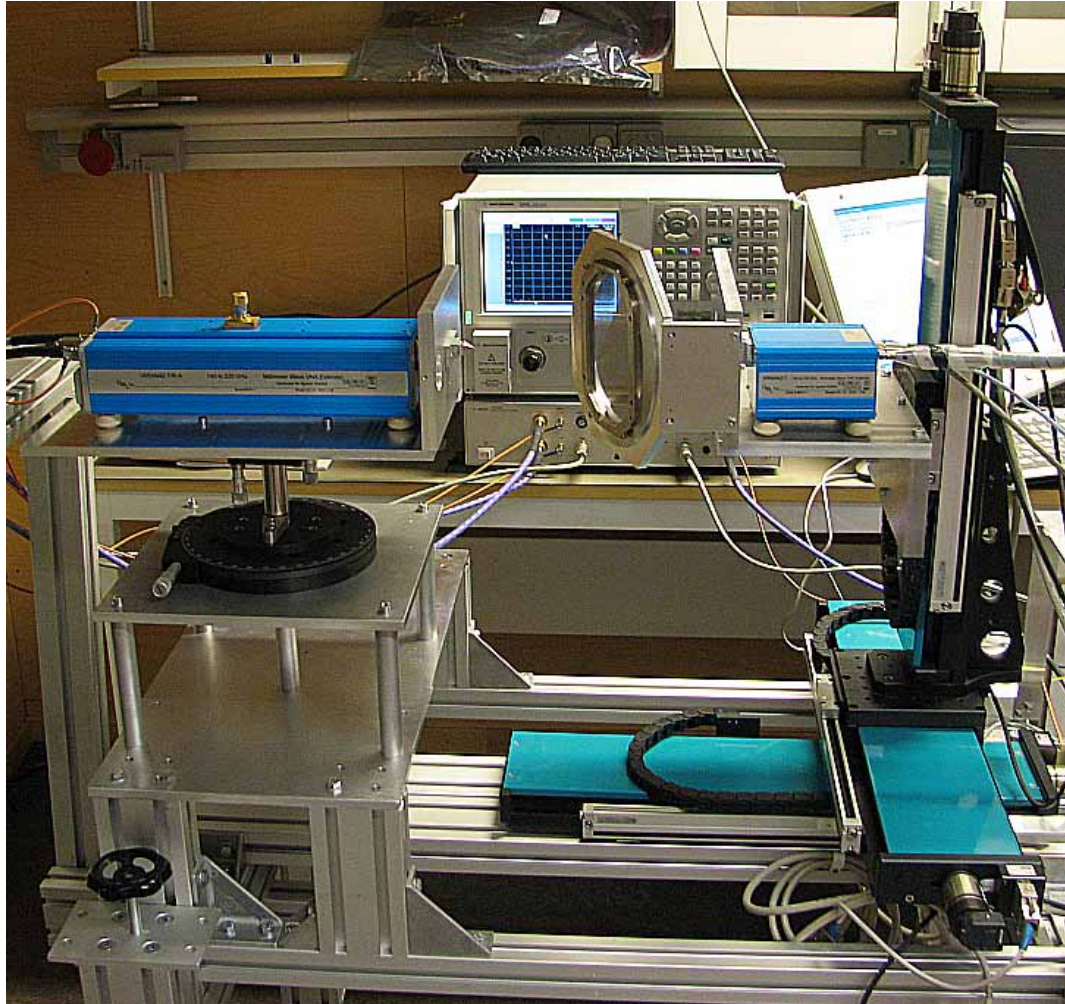


Overview of setup



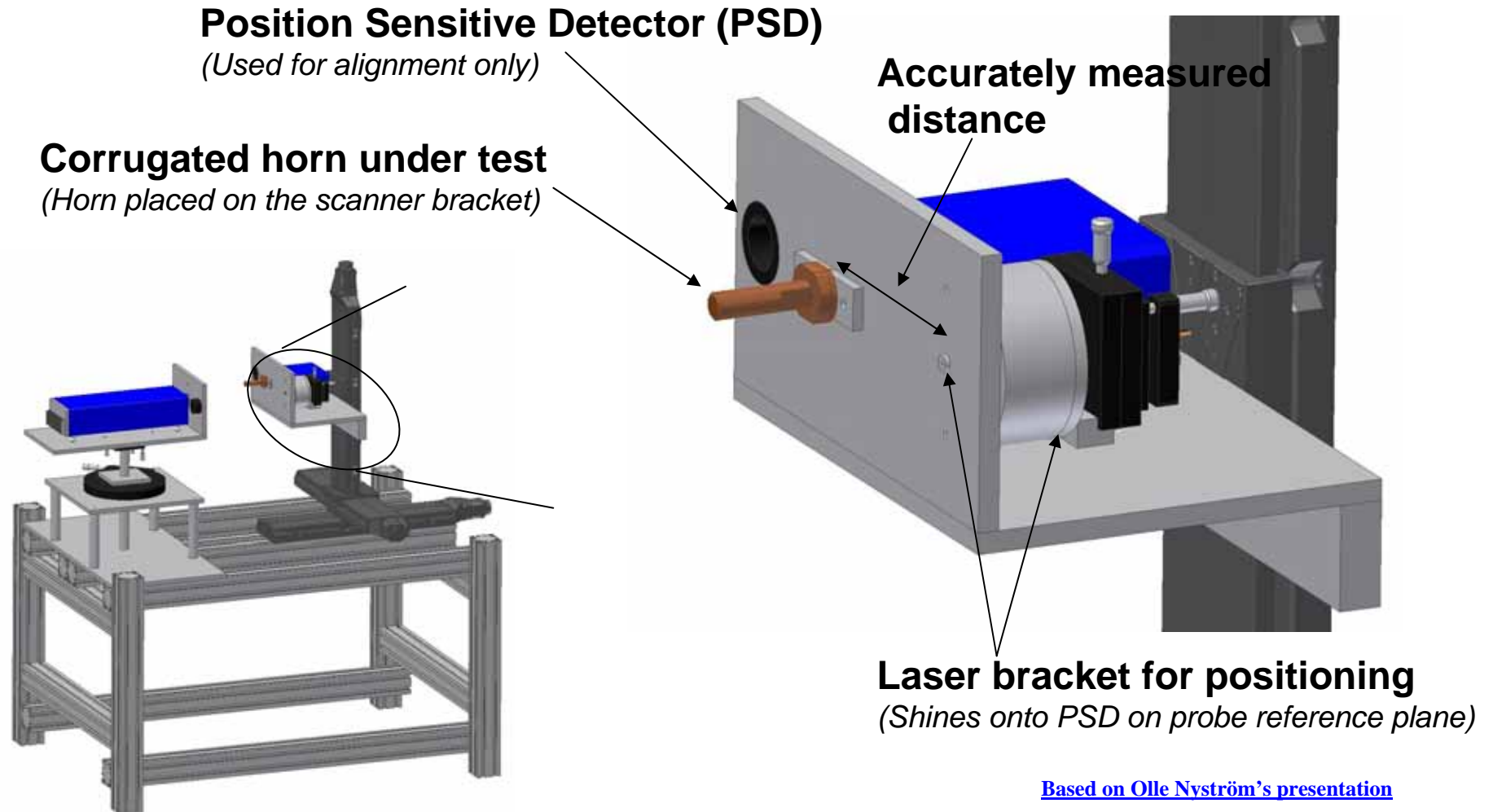


Beam Characterization System





Scanner Bracket





Probe Bracket

Position Sensitive Detector (PSD)

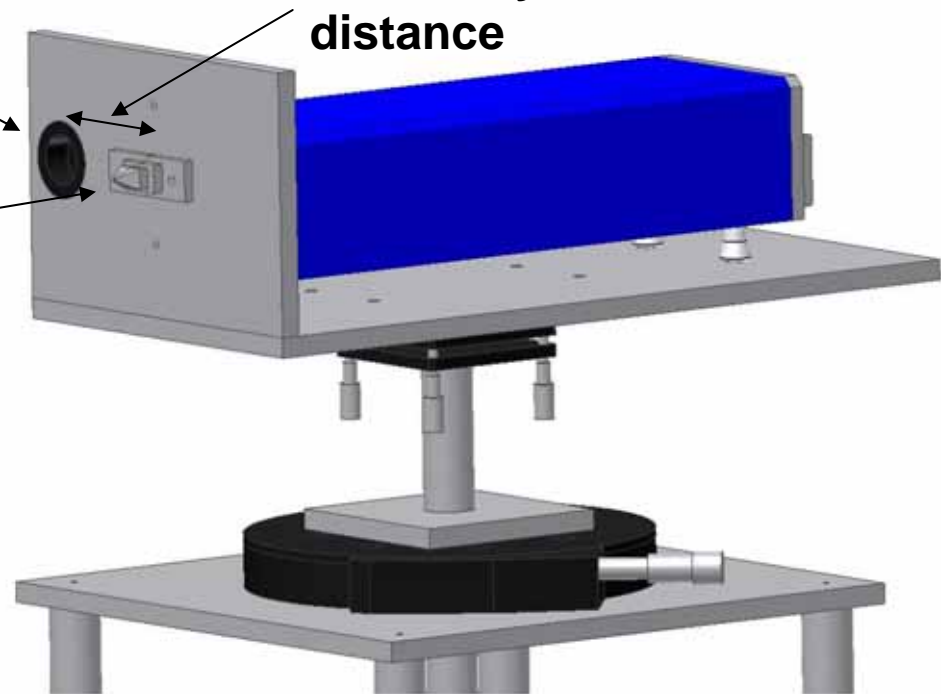
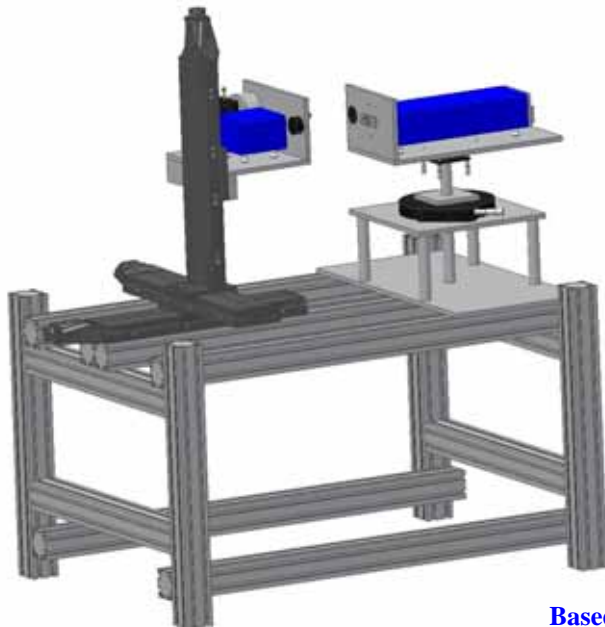
(Used for establish reference point)

Open-ended waveguide

(Chamfered to reduce standing waves)

Accurately measured distance

distance



Rotational and tilt stages for mechanical alignment

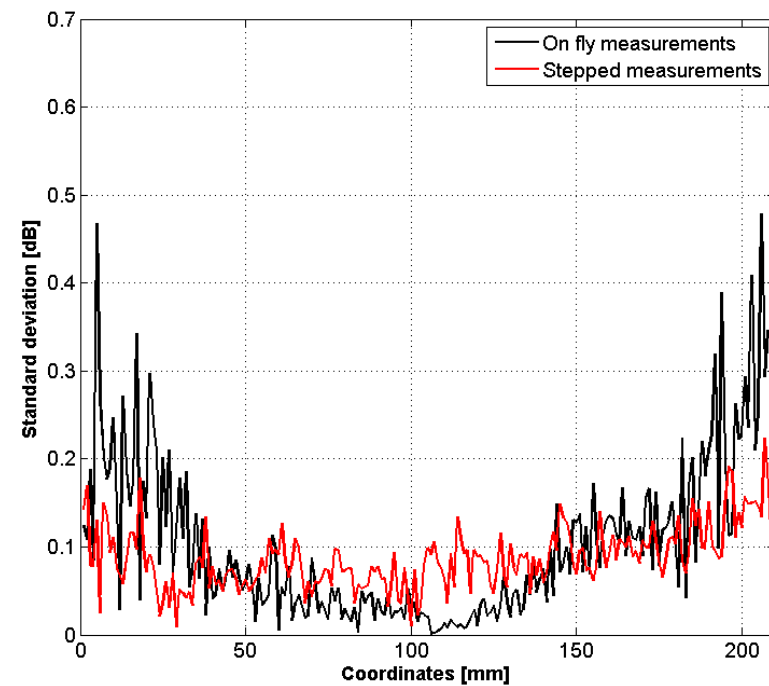
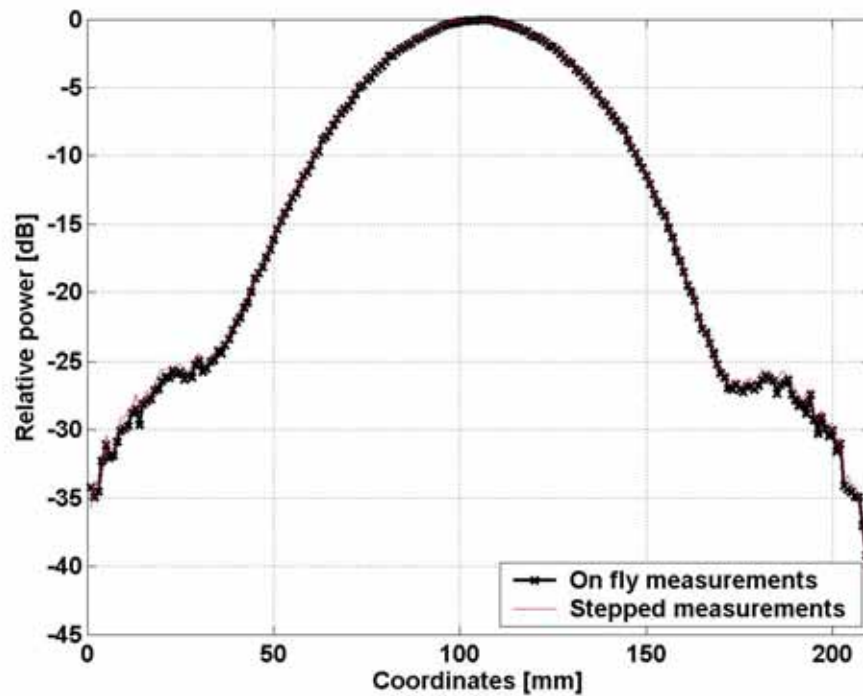
Laser bracket for positioning

(Are mounted in the position of the probe during alignment procedure)

[Based on Olle Nyström's presentation](#)

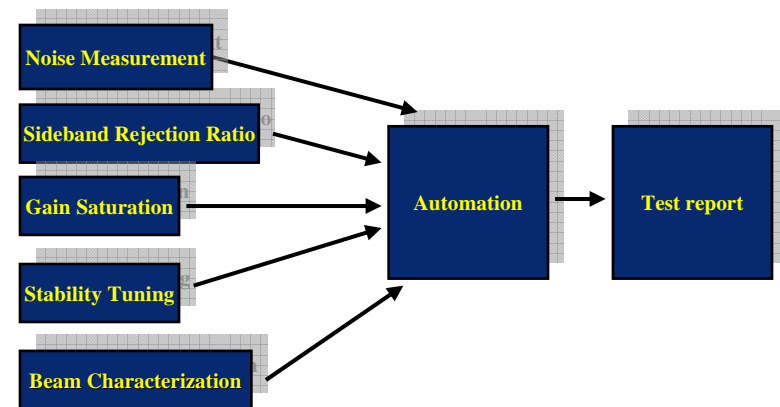
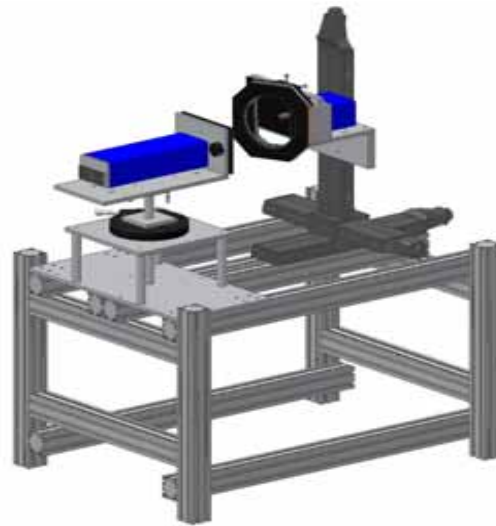


Stepped scan vs On-the-fly



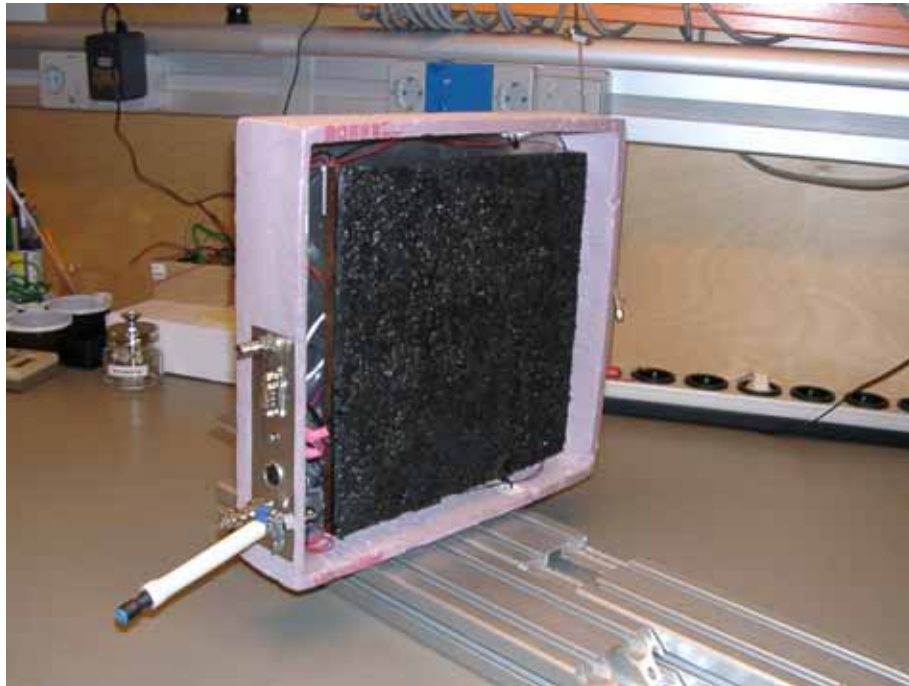


Overview of setup



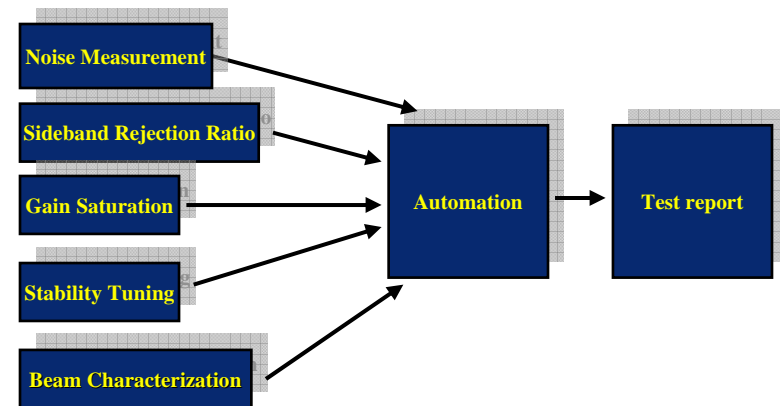
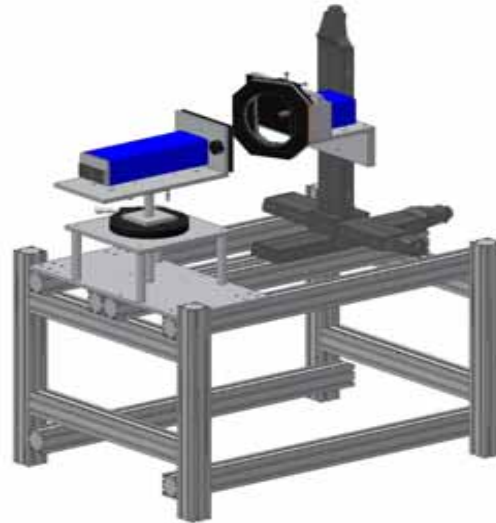


Gain Saturation



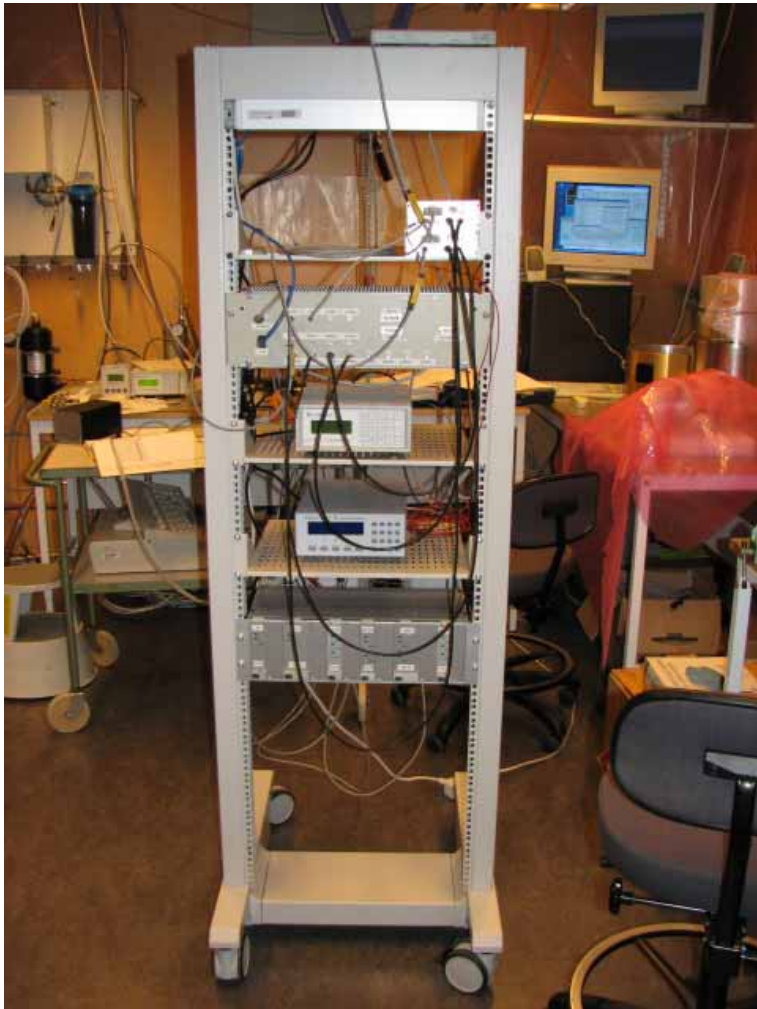


Overview of setup



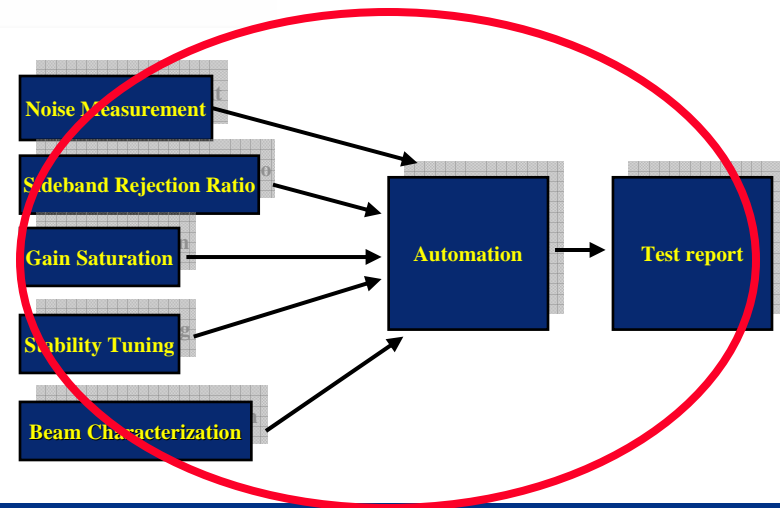
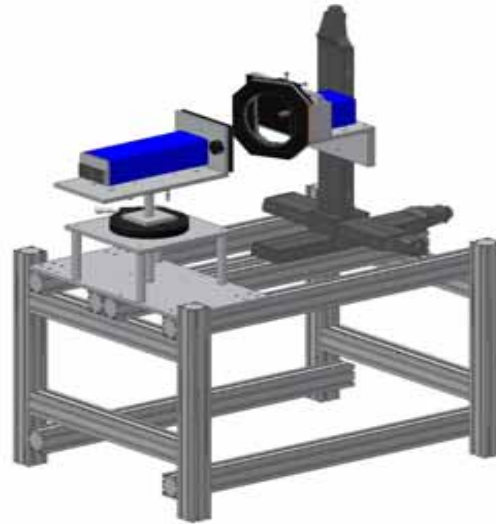


Control/measuring System



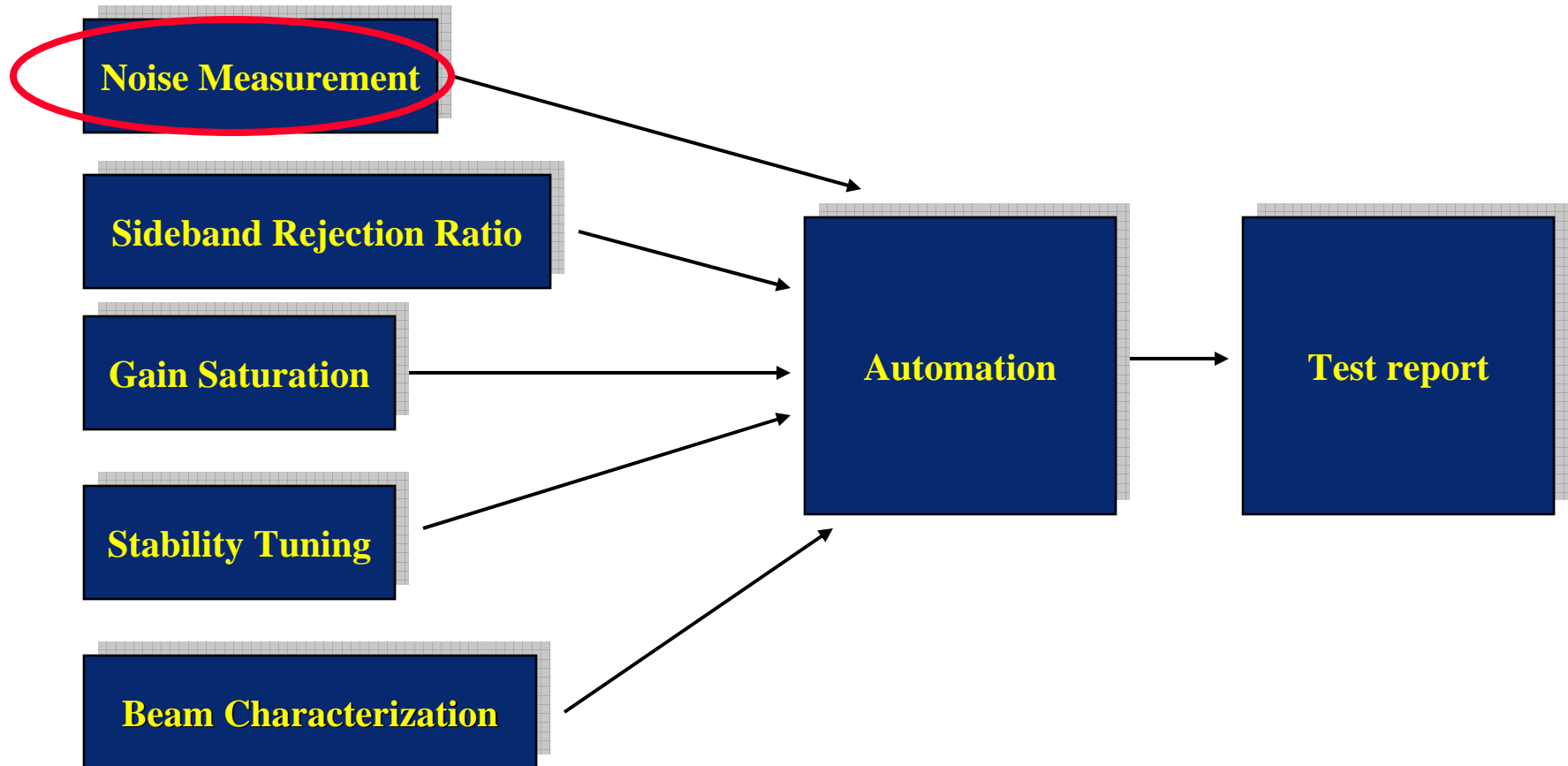


Overview of setup



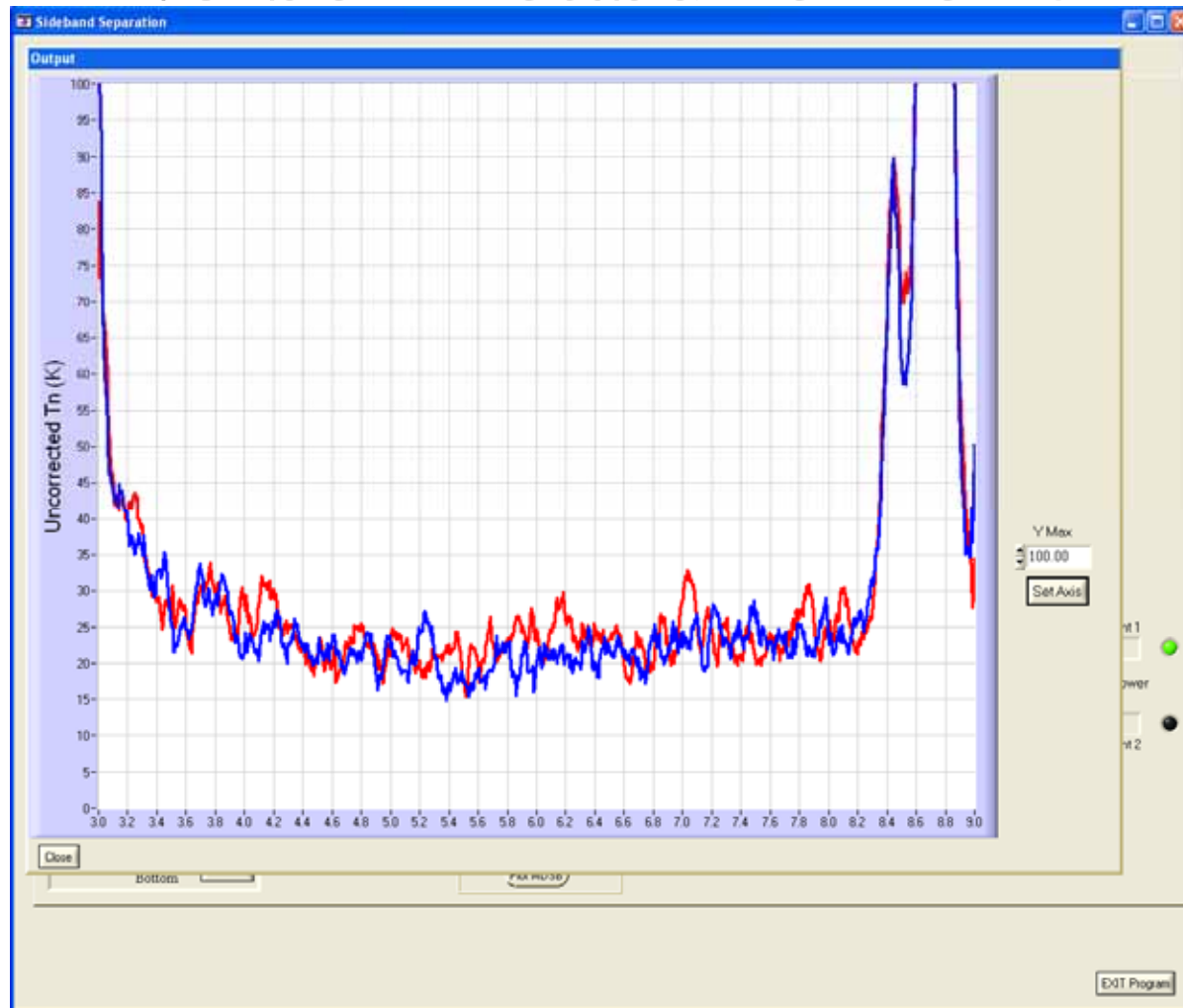


Automation Software



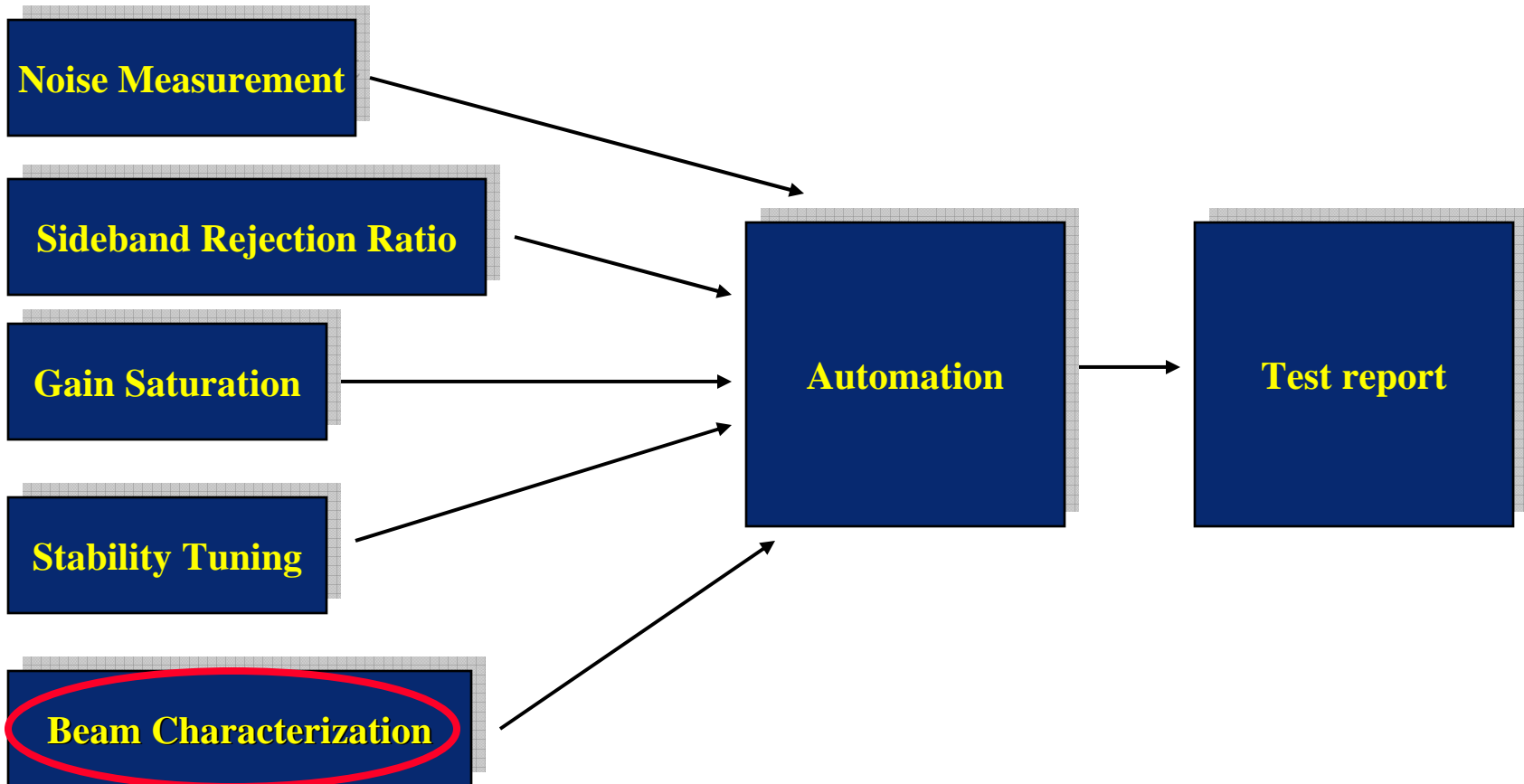


Noise Measurement





Automation Software





Beam Characterization Program

The screenshot displays the MATLAB environment with the following components:

- Code Editor:** Shows MATLAB code for beam characterization, including file handling, coordinate generation, and measurement loops.
- Contour Plot:** A 2D plot showing concentric contour lines, representing the beam's radiation pattern. The X and Y axes range from 20 to 180.
- Settings Dialog Box:** A window titled 'Setting' with fields for 'X position', 'Y position', and 'Z position', each with a corresponding input box and a 'Get position' button. A 'Start Beam measurement' button is also present.

```

925 - f=str2num(ScanSettings(7));
926 - AveragePnts=str2num(AveragePoints(1));
927
928 - % *****
929
930 - % Looping trough the whole program with different coord
931 - for ProgramLoop=1:1:1
932
933 -     currentTime=clock;
934 -     currentTime=[num2str(currentTime(4)), 'h', num2str(cu
935 -     saveStr=[pwd, '\', date, '\', currentTime, '_Scanfile',
936
937 -     fp = fopen(saveStr, 'w');
938 -     fclose(fp);
939
940 -     Create scan coordinates
941 -     if strcmp(get(handles.HornMeasurementTag, 'checked')
942
943 -     try
944 -         disp('Coord')
945 -         [X Y Z]=CreateScanFiles(scan_center_x, scan_
946 -         disp('COORD OK')
947 -     catch CreateScanError
948 -         disp(lastwarn);
949 -         msgbox('Could not create scan coordinates. please see command window')
950 -     end
951 - end
952
953 - Move to coordinate, measure and save into file.
954 - y
955 - t_start=clock;
956 - hbar = waitbar(0, '0% Completed');
957
958 - for i=1:length(X);
959 -     loopCnt=0;
960 -     errX=1;
961 -     errY=1;
962 -     errZ=1;
    
```



Summary

- **The GARD group has developed a measurement/test setup for ALMA Band 5 prototype cartridge.**
- **Design details for hot/cold measuring system, beam measuring system and cryogenic measurement was presented.**
- **Appropriate measures have been considered due to the humidity @ Gothenburg for ALMA Band 5 frequency range.**