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Date:

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Fax #:

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Subject/Sujet:

Pages: (including cover page) (incluant celle-ci)

COMMENTS/COMMENTAIRES:

I will sort out the format problem for future communications!
Happy 2000,
Charles.

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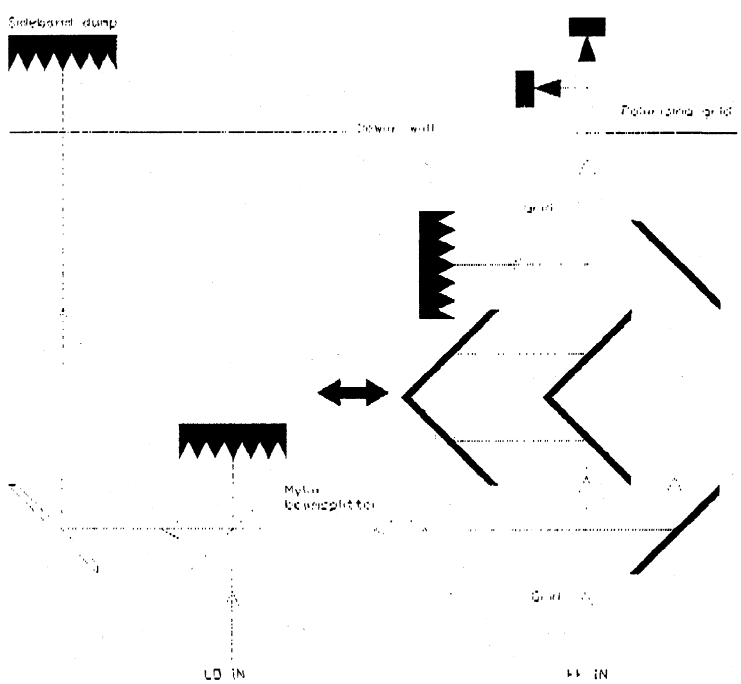
I have been thinking over our ALMA receiver discussions in Grenoble would like to suggest an approach to the receiver design which I hope will be useful and stimulate further discussion.

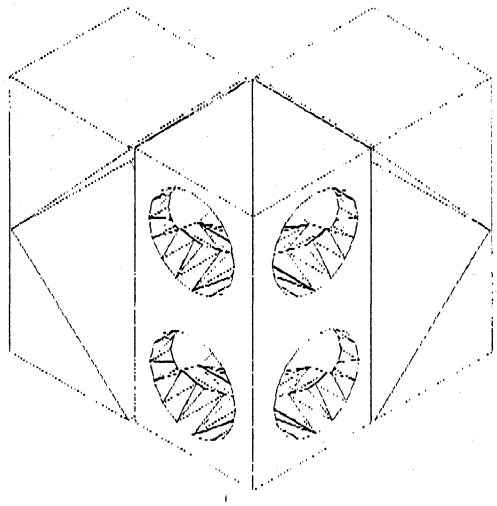
My preference for the overall design is similar to that chosen for the Harvard-Smithsonian array. That is, a cryostat with the cryogenics arranged on the axis of symmetry and containing mixer modules which are inserted from the bottom. As I mentioned in the meeting I am reluctant to locate the interferometers and local oscillator chains inside the cryostat and prefer to put these components on the top plate. Besides the reliability and access issues this arrangement allows a simple upgrade path as and when side-band separating mixers become available at the higher frequencies. On the negative side the losses due to the warm optics will be greater, the multipliers cannot be pumped as hard and there will be more windows to load the cryogenics and contribute to leaks.

In an effort to minimise the complexity of the optics which has to combine the signal and LO and separate the side-bands I have not used series MPI's and suggest that we consider using a Mach-Zehnder amplitude splitting design. This has worked well in our 345 GHz receiver for the JCMT and the following schematic drawings indicate a possible arrangement.

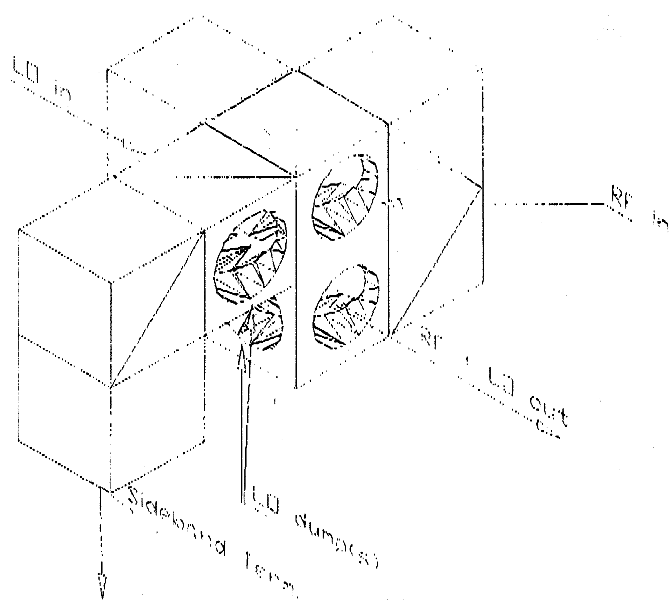
The RF beam enters one of the interferometer input ports while the LO signal enters the other port via a mylar beam-splitter. One of the drawbacks is that this is obviously an inefficient LO coupling mechanism. The unwanted side-band is rejected via this (LO input) port and passes through the mylar to be dumped into a cold termination. Of course one can always trade off LO coupling efficiency against termination temperature. The beam from the output port of the interferometer is directed into the dewar where it is split by a polarising grid and fed to the two mixers. Thus we require two windows (for each of the four highest frequency channels) if we adopt this scheme. Note that this will probably not affect the overall cryogenic loading too much as this will be dominated by the larger low-frequency windows.



Here is a cartoon of the diplexer which consists of two rooftop mirrors and a central beam-splitter module which contains the two 50% amplitude splitting grids (free standing mesh which is rectangular but appears square when viewed at 45 degrees).



The following illustration shows the diplexer optics with some additional elements but still missing (for clarity) things such as the LO source, two LO dumps and mirrors to direct the beam into the unit and down into the dewar.



Finally here is a rough sketch of the top of the dewar with the beams of the various channels arranged around the 183 GHz water vapour meter. The dewar is 1 metre across. I have sketched in optics for the higher frequency channels, approximately to scale, just to show that there is space! The total number of windows is fourteen. It assumes that channel one and a cold calibration load are located in a separate dewar.