Comments for the SAGMA Project

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The Joint Proposal (of Febr. 1975) suggests strongly to choose Mauna Kea on Hawaii as the site for the European millimeter-wave observatory, and E. Blum has asked D. Heeschen about the possibility of a cooperation of NRAO with the SAGMA project. This will be discussed at an NRAO meeting, beginning of May, and thereafter a discussion with Blum is planned. Because of my more personal connections with the Bonn institute, however, I would like to mention my own opinions directly to the Bonn coleagues.

1. Cooperation SAGMA-NRAO ?

If both our projects would join together, there would be certainly only one millimeter observatory. Whereas, if both plans are carried on separately, there will be hopefully two new observatories.

The financial size of the projects seems really not large enough to call for a cooperation between Europe and the USA, nor to reduce the number of future millimeter observatories from two to one. The chances for the European project actually looked already very promising; the situation of the NRAO project is less clear but we do have some hope.

Thus, if there is enough hope to get both projects financed separately, then two separate observatories should be planned. But some informal cooperation during the planning state would of course be desirable.

2. Northern and Southern Hemisphere

It might be a good division to have one observatory in the northern and one in the southern hemisphere, neither one too far from the equator (more sky, and mutual overlapping). For example, Mauna Kea on Hawaii is considered a very good northern site; optical astronomers have chosen La Silla and Cerro Tololo in Chile, while for millimeter astronomy a site at higher altitude would be preferred, in the Andes of

Chile or Peru. This division then would need a decision as to who goes where. Unfortunately, distances do not help this decision as the following table shows:

	Distance (km) to	
	Bonn	Charlottesville
Hawaii	12 000	7 500
Chile	11 500	7 500

If one wants the European site closer to home, and if southern Spain would not be good enough regarding altitude and geographical latitude, have sites in northern Africa been considered seriously? For example, the Grand Atlas mountain chain in Morocco looks very promising; the highest mountain, Jebel Toubkal, is 4200 m, and there are several others with about 4000 m, too. These regions might have a nice desert climate, and they are even sufficiently close to a socalled mTs region, desired by optical and infrared astronomers (maritime Tropic stable; see McInnes, Hartley and Gough, The Observatory, 94, 14, 1974).

3. Best Single Site

For observing the largest amount of sky, the best site would be right at the equator. Kenya has several high mountain regions to offer; for example, Mt. Kenya is 6600 m high, and is located only 120 km from Nairobi, Kenya's capital. Although the equator is farther from home, it still is only half as far as Hawaii or Chile.

The following table summarizes some geographic data about the sites mentioned. It would be desirable to obtain whatever data are available about climate, wheather, and roads, concerning sites in Morocco and Kenya. From these data one then should decide, whether some of these sites should be included in the future site testing program of SAGMA.

	to Bonn (km)	altitude (m)	geogr.Latitude (degrees)	max. elevation of Gal. center (degrees)
Calar Alto, Spain	1 700	2 100	+ 37	25
Grand Atlas, Morocco	2 500	4 200	+ 32	30
Mt. Kenya, Kenya	6 500	6 600	0	62
La Silla, Chile	11 500	2 400 *)	- 29	90
Mauna Kea, Hawaii	12 000	4 200	+ 20	42

*) many higher altitudes available in Chile or Peru.

4. Surface Accuracy of the 30-m Telescope

I would like to add one more comment, on a different subject. The SAGMA proposal (Feb. 1975) says on page 45: "Further discussions with von Hoerner has led to the following values"; then follows a breakdown of surface errors, adding up to 0.125 mm rms; which, multiplied by 16, would give λ = 2.0 mm. This, however, disagrees with my estimates and the proposal to go to λ = 1.2 mm (Comments of Dec.22, 1974). It also disagrees internally with the 1.2 mm mentioned on pages 36 and 42 of the SAGMA proposal.

For λ = 1.2 mm, the errors should add up to 1.2/16 = 0.075 mm rms. Counting the following six major contributions, each one then is allowed $0.075/\sqrt{6} = 0.031$ mm if evenly distributed. Since the thermal deformation of the backup structure seems the hardest problem, and gravity the easiest one, a reasonable distribution then would be:

Deformation		rms	
1. gravity	backup	0.02 mm	
2. thermal	backup	.04	
3. manufacturing	panels	.03	.052
4. gravity	panels	.03	.052
5. thermal	panels	.03	.052
6. measur.+adjust.	panels	.03	
		.075 (x 16 = 1.2 mm)	

In my Comments of December 22, I have shown that these values can be achieved. The gravitational deformations of the backup structure can be made so homologous that the remaining deviations are completely negligible, which has been shown already by Krupp; the value of 0.02 mm given above then is just the contribution from manufacturing and erection tolerances, as obtained by scaling our 65-m results (but to be repeated independently for the 30-m design). And the thermal deformations can be achieved, with proper specifications for maximum wall thickness of members, and for thermal stability inside a radome, as given in my Comments.