





**Trip Report
ESA/ESTEC Noordwijk
23-24 February 2009
Fritz Caspers & Frank Zimmermann**

possibilities for *CERN-ESA cooperation*

ESA security checkpoint, Monday morning,
after EASYJET flight Geneva-Amsterdam at 6:15 am



**Successful
Ariane Launch**

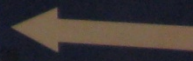
Date: 12 February
Time: 23:09 CET
Ariane 5 ECA

Payload: Hot Bird 10 & NSS-9 &
Two small Spirale Satellittes

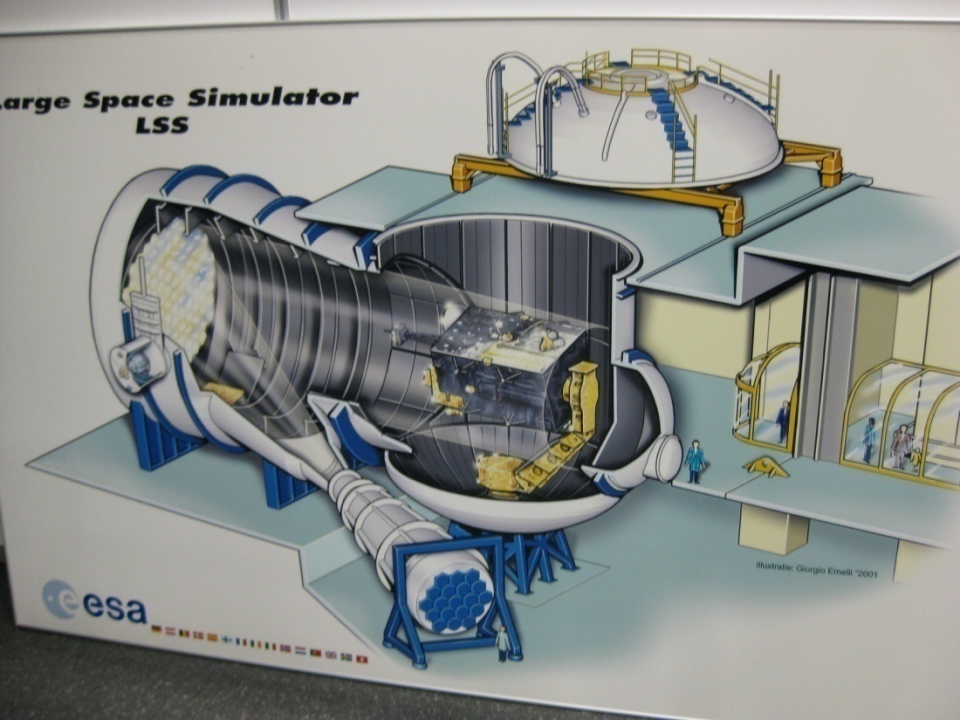
Info: Communications Office, Ca007, 53007

SAMSUNG

PEDESTRIAN
ACCESS







qualification of satellites:
w.r.t. solar light,
acceleration,
EMC, vibrations,...

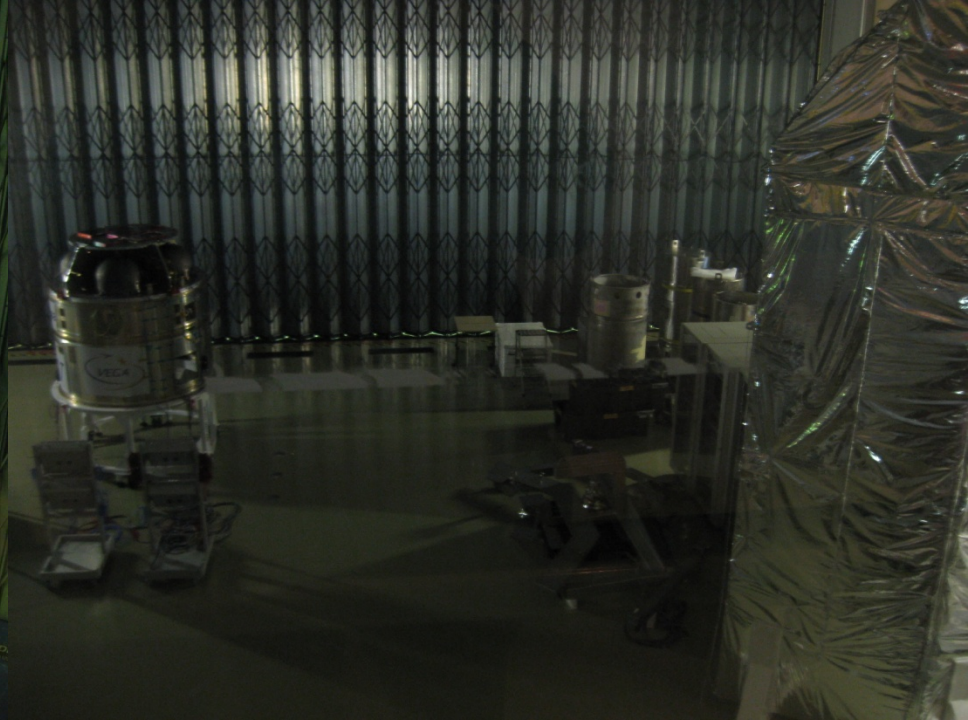
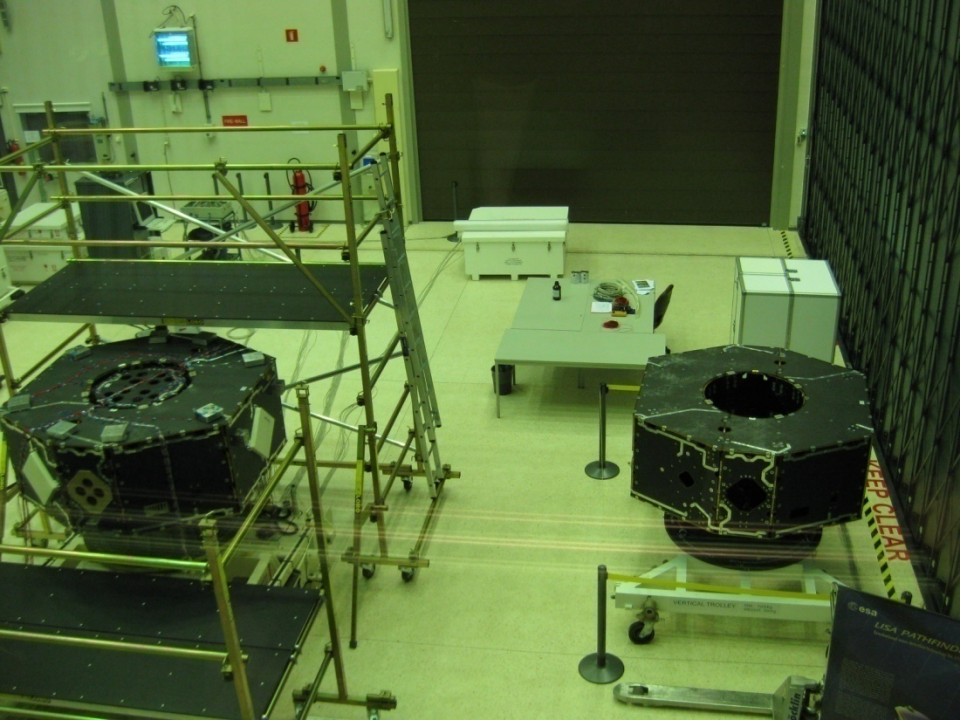


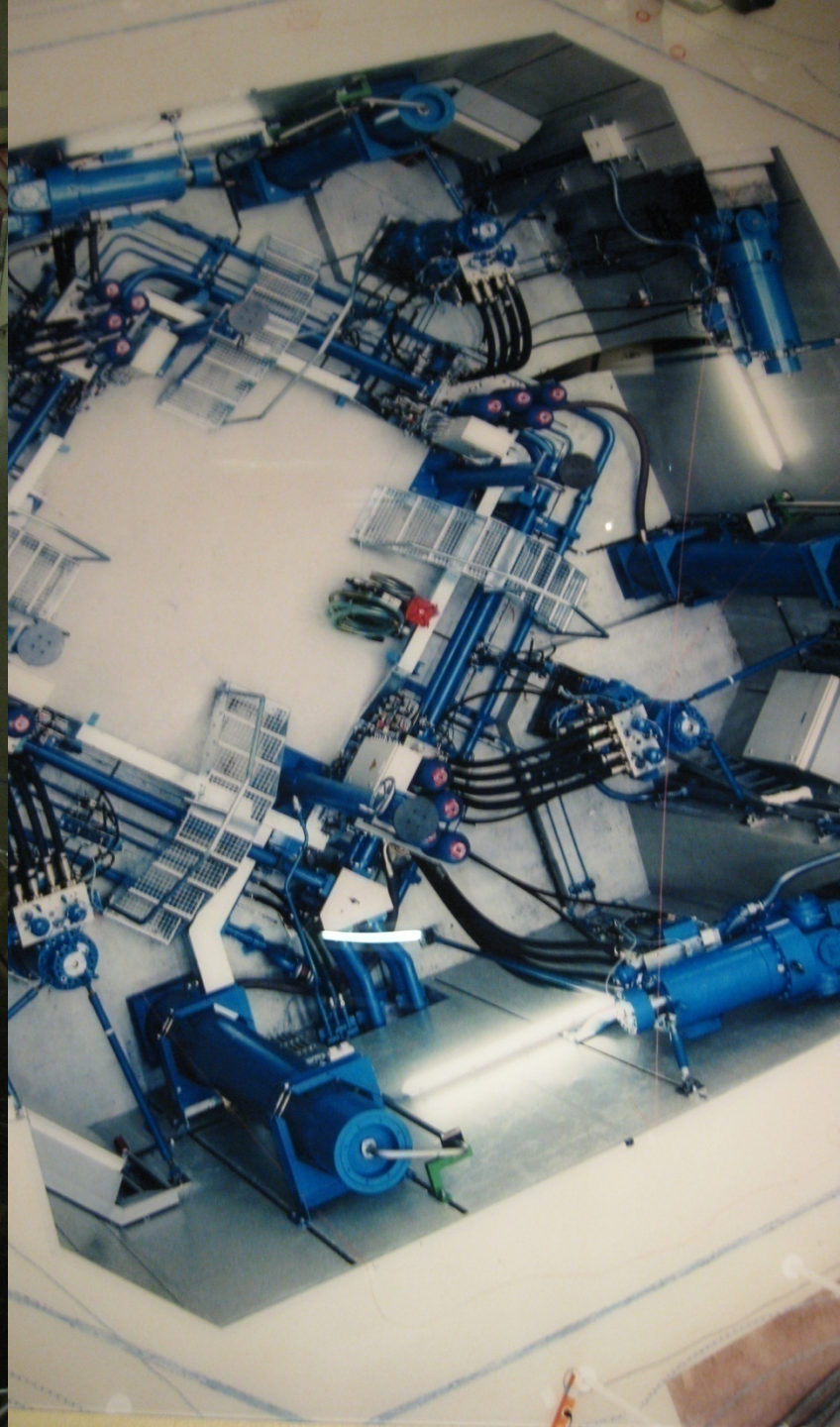
photo motif suggested by Fritz

NO PHOTOGRAPHY



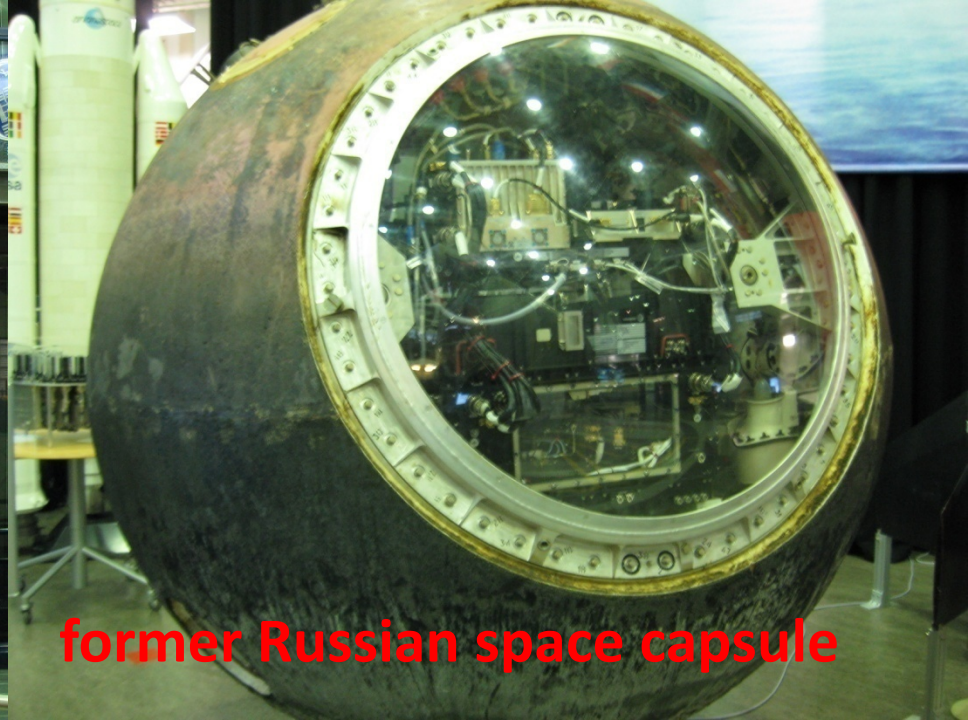
NO PHOTOGRAPHY

measuring the response to vibrations





inside the "ISS"



DATE	FLT NO.	LAUNCHER	PAYLOAD
10 FEB	32P	SOYUZ	CARGO
12 FEB	15A	STS-119	S6
25 MAR	18S	SOYUZ	CREW
22 APR	33P	SOYUZ	CARGO
15 MAY	2J/A	STS-127	JEM-EF
27 MAY	19S	SOYUZ	CREW

flight schedule

ESA-CERN collaboration on e-cloud suppression via coating & locally modulated static magnetic field

ESA coating activity in Madrid

- co-supported by Spanish government, CICYT
- possible extension to include CERN

validation of local magnetizing scheme (Fritz' invention)

- already **exploratory measurements** by I. Montero (UAM) for computer hard disk with field pattern $\sim \mu\text{m}$ level
- **optimum pattern $\sim 100 \mu\text{m}$ scale**
- **magnetic sensors to characterize pattern: magnetic viewer card** (~ 100 Euro) ordered by UAM to see field pattern; may use **ESA diagnostics** for fields near atomic clocks (~ 20 kEuro)
- proposed **experimental demonstration using silver coated wave guide at ESA** with magnetic Ni layer, in **"two-wire experiment"**, mimicking magnetic tape, tests of different configurations; magnetic field that may be reached; add coil on the ESA 12 GHz multipactor test set up (vacuum, rad. source for seeding)

ongoing ESA experimental tests & activities

multipacting in waveguides, and (for ESA) **in circulators**:
ferrite with bias field; coating on circulator could help;
need for multipacting **simulations** in circulators

ESA SEY database in Europe

ESA microwave components & microwave laboratory

- complete renovation every 2 years

new multicarrier test facility

– phase-locked synthesizers

problems:

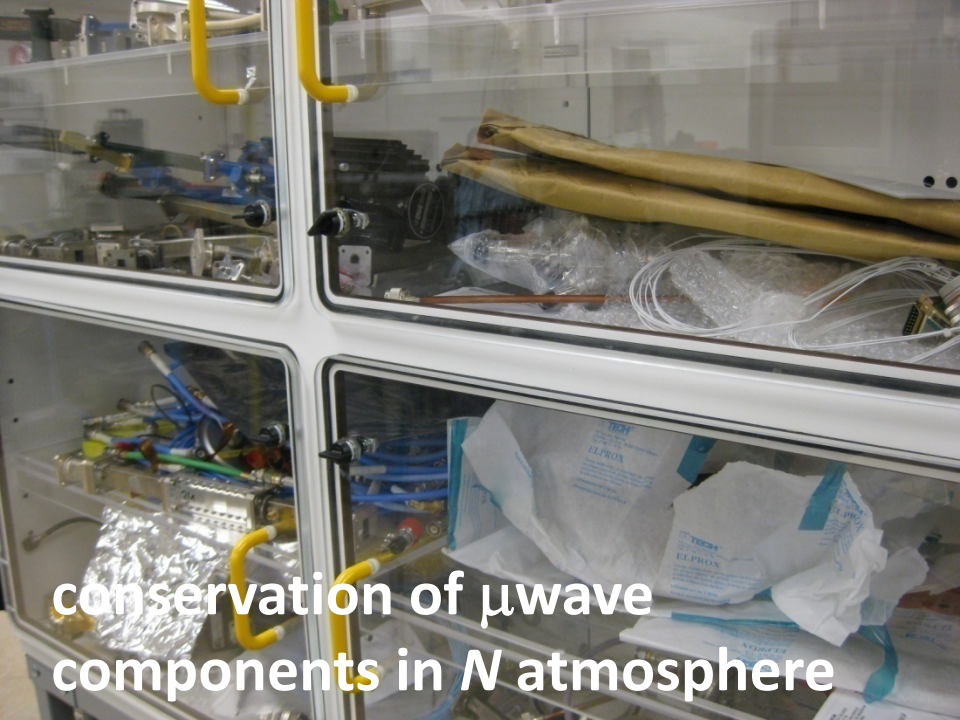
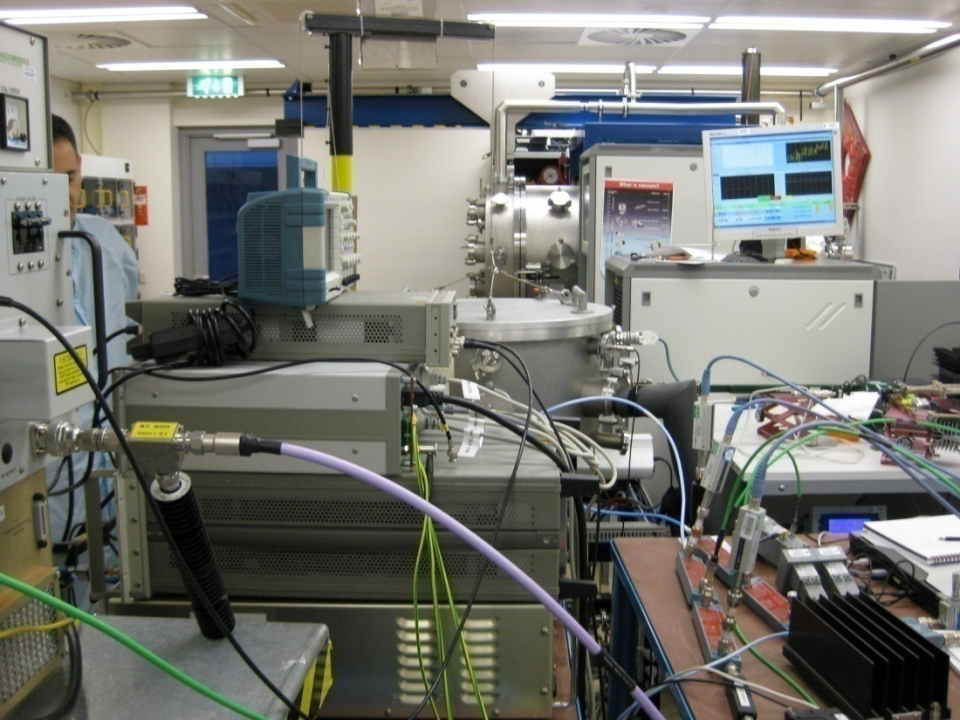
- **bad coating stability with respect to the SEY;** *common*
reproducibility of coating *problem w. CERN*
- space charge not yet included in simulations *CERN expertise*
- **e- interaction with EM fields** *common problem w. CERN*



inside the ESA microwave lab



4 independent methods to detect & qualify RF breakdown



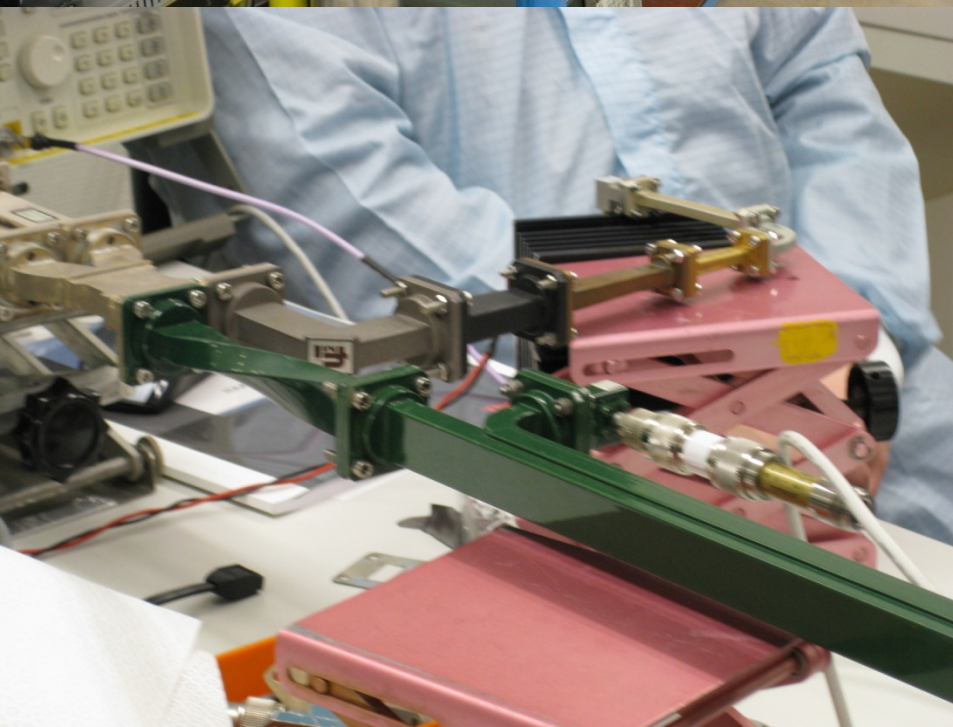
conservation of μ wave components in N atmosphere



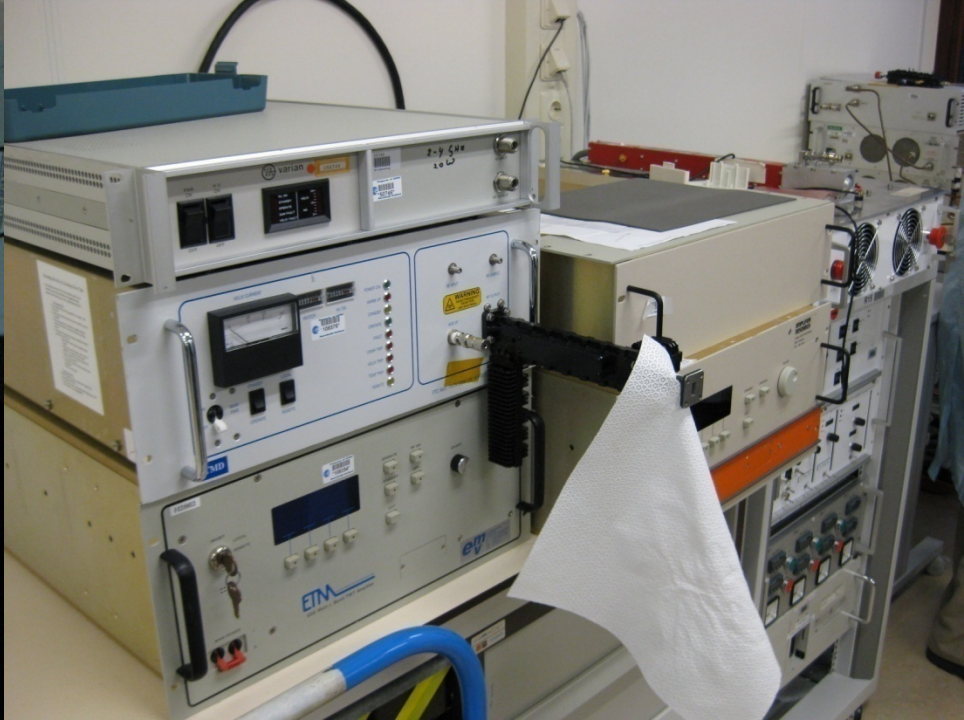
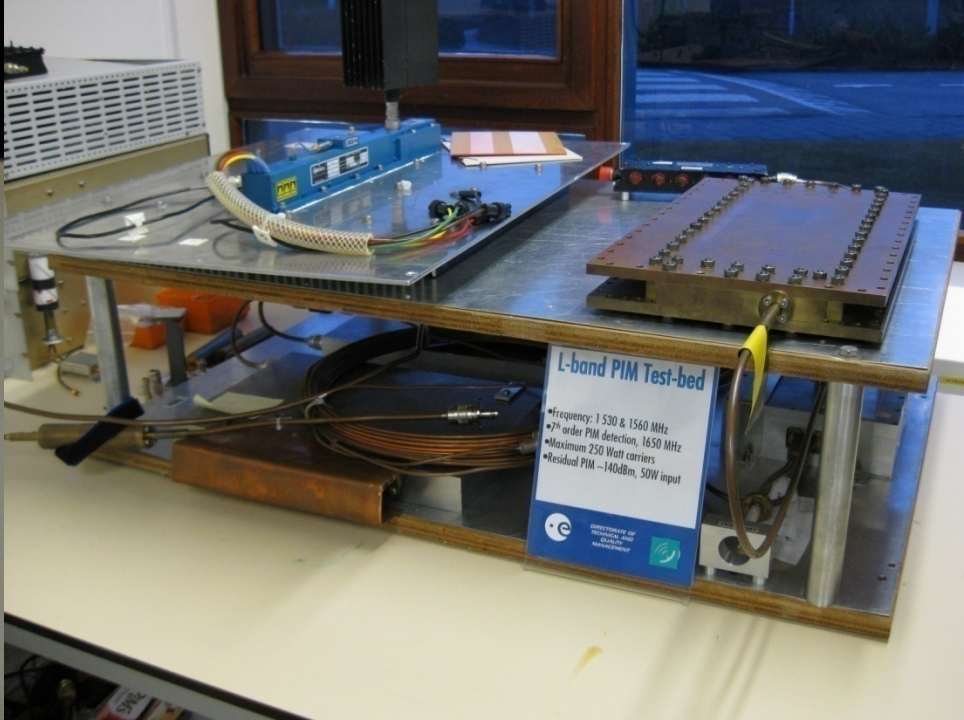
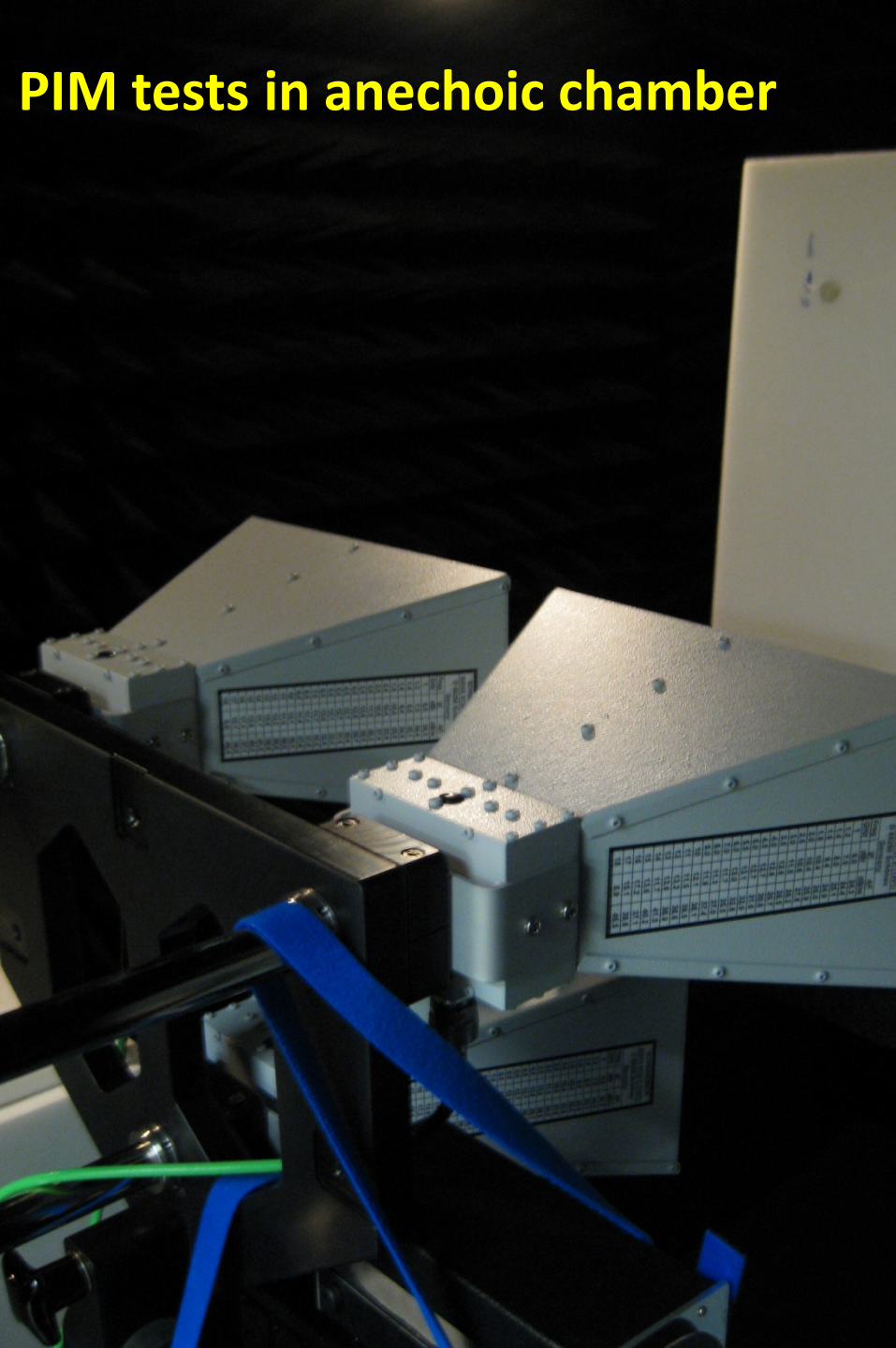
still inside the ESA microwave lab

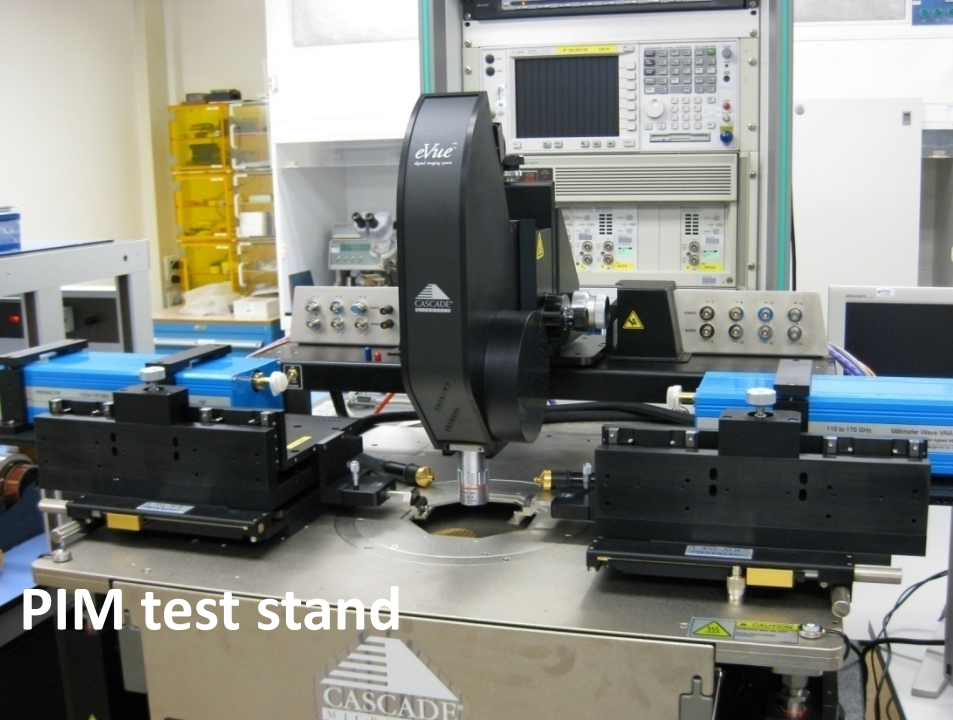


multipacting test stand



PIM tests in anechoic chamber





PIM test stand



more "PIMs"



RF power sources



large international high power rf research and test center

proposed by ESTEC director (to retire in May 2010)

“proof of concept” facility; measurements methods;
model; hardware & software/modeling testing

new buildings in “ESTEC-II” laboratory

split into two parts **R&D and industry support**

partners can come to do R&D at any time

number of facilities/benches working in parallel

ESA interested in partners: ESA, CERN, CICYT, **satellite operators**

(Eutelsat, Astra, Inmarsat, Hispasat, Meteosat,...),

universities (UAM, Valencia, EPLF, Lancaster, TUD, Chalmers,...)

satellite operators very interested; they provide the actual needs

(e.g. mercury mission), and large part of lab financing

ESA is non-profit organization, only ESA manpower is charged

how to participate: financially, manpower, and/or sharing R&D ideas

6 partners with 5000 Euros per year each may be enough

industry shall be charged ; procedure to send students;

important – all should be agreed before February 2010

large international high power rf research and test center - II

Next actions:

David Raboso will visit satellite operators in March

CICYT already approached

universities to be contacted in March

dossier to be ready in May-June for ESA DG review

ESA DG to meet other directors

potential commitment and potential use

partners will define the facility

new much enlarged facility can be tailored to user needs

present facility is fully booked, all last year through September this year;

1500 hours last year were handled by single person;

multipactoring and PIM check-list sheets

a broader view

international RF research center can be first part of a **much wider collaboration**; **other ESA departments** would like to participate ; e.g. science department, interplanetary mission, and X-ray missions (interest from particle physicists at CERN?); applications for landmine detection etc.

other discussion topics

space / **onboard experiments**, e.g. for locally modulated field?
test of plasma cloud around satellites using microwaves (Fritz)
ion thrusters, **charging of spacecraft** in interplanetary missions
proposed space experiment: SENER company Madrid, U Surrey, total cost 800 kEuro

flight cost 10 k\$/kg, for Russian satellites on elliptical orbit
GSTP – general studies technology programm, **Swiss money often not used**

proposed ESA **diagnostics in space**: cold ion detector (CID); electron plasma sensor (EPS); compact electron detectors (CED); many SEY detectors in parallel, various materials, in “natural” space weather, necessity to do it in space? undefined conditions? LHC collimator test?

potential ESA experiments / studies at CERN: irradiation tests, rf breakdown threshold change in presence of beam loss ; pulsed or cw; space charge; interaction of electrons with e-m. waves

Solenoid field effect on waveguide breakdown?!

x-ray tomography for all satellites, components & full satellites



Lunch corner 20

24/02/2009 Tuesday
08:30 - 14:00

CERN-ESA cooperation
- tray lunch

Organiser:

David Raboso /TEC-ETM

a few key points from Fritz

ESA has very strong interest in collaboration with CERN
possibility of experiment in ISS was mentioned several times
(but is it meaningful, except for CERN PH experiments?)

we have offered that ESA & Co. could do several tests at CERN
with primary, secondary und tertiary beams to simulate
high energy particle situations in space

to follow up

interest from various CERN groups?!

X-band test facility for CLIC?

particle physics / astrophysics interest? (e.g. cosmic accelerators)

surface coatings – interest? (grooves ~0.1 mm, black gold – thermal stability, NEG coatings, C coatings,...)

– long-term stability?

magnetic roughness, clearing electrodes, electrets?

ceramic coatings

simulations for magnetic surface roughness

bunker for high-power cavity tests

contacted so far before and/or after the visit:

Miguel Jimenez, Paolo Chiggiato, Sergio Calatroni

for coatings; **Steve Myers, Paul Collier, J.-P. K. et al;**

Erk Jensen, Walter Wuensch, J.-P. Delahaye for CLIC

Maarten Wilbers for collaboration frame

John Ellis for CERN-ESA collaboration and PH interest



the end - thank you!