STEREO IMPACT

BERKELEY TEAM MEETING
SWEA (CESR PART)
2001 December 14

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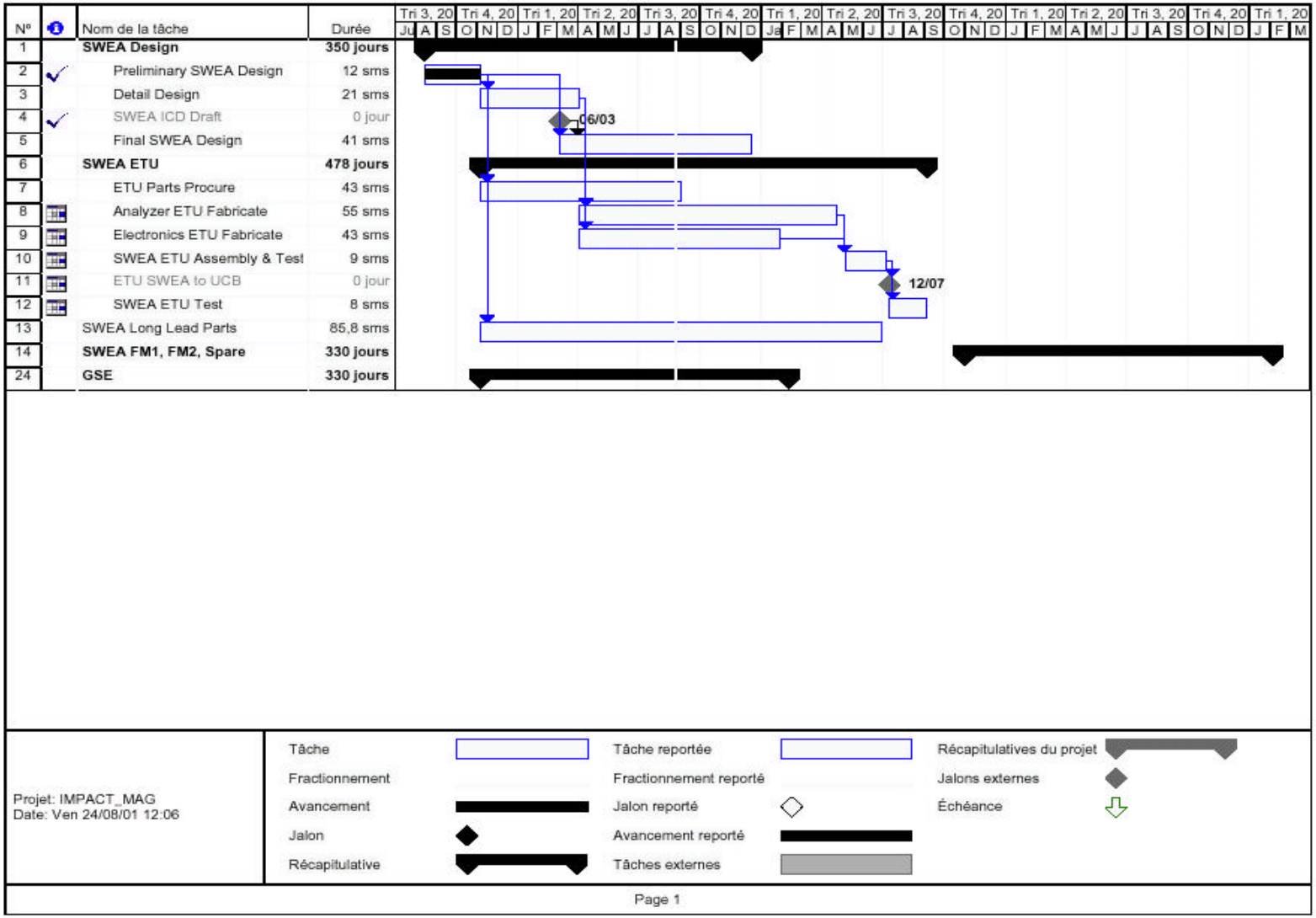
N°
Nom de la tâche
Durée
Tri 3, 20
Tri 4, 20
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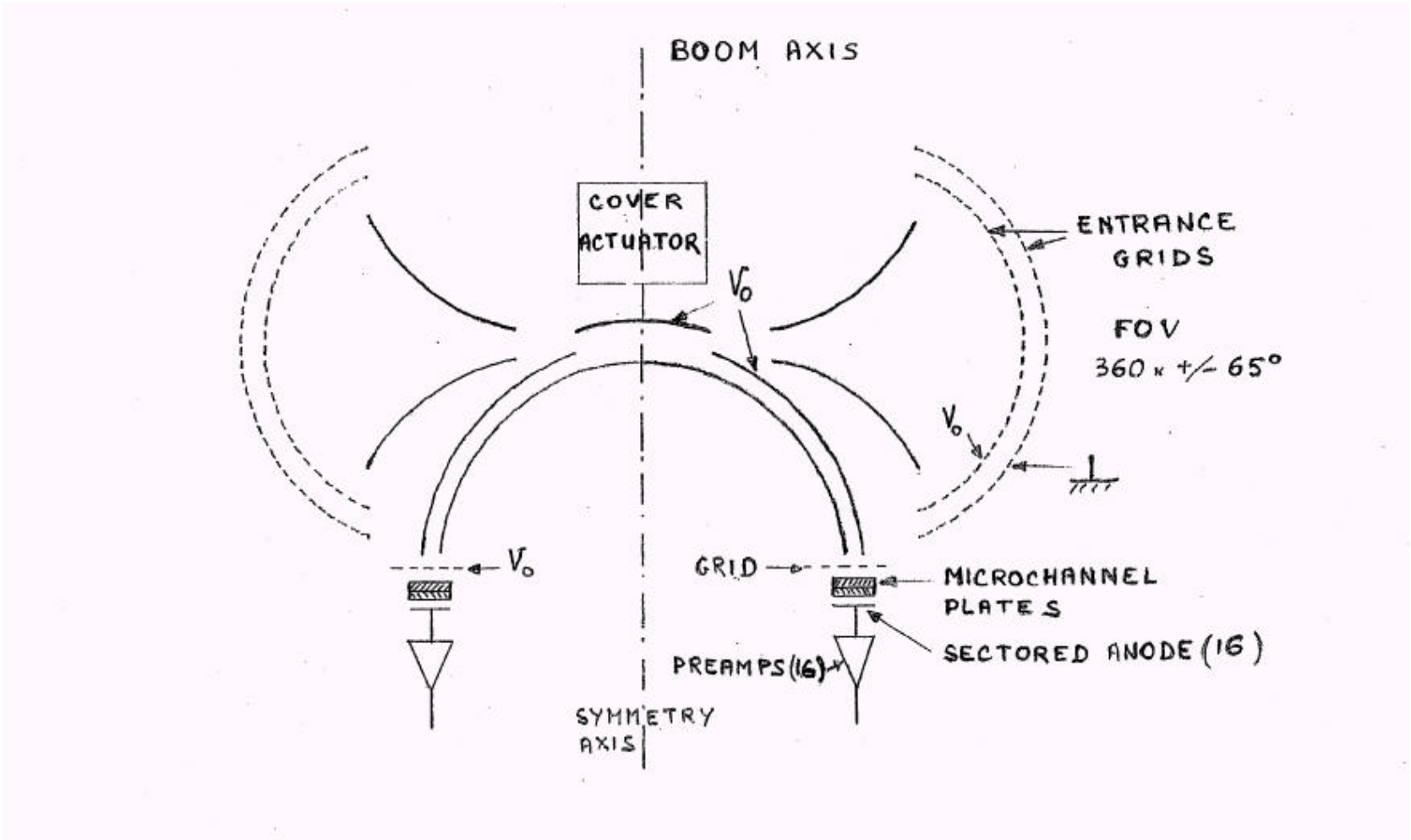
Tri 4, 20
Tri 1, 20
1 SWEA Design 350 jours
2 Preliminary SWEA Design 12 sms
3 Detail Design 21 sms
4 SWEA ICD Draft 0 jour
5 Final SWEA Design 41 sms
6 SWEA ETU 478 jours
7 ETU Parts Procure 43 sms
8 Analyzer ETU Fabricate 55 sms
9 Electronics ETU Fabricate 43 sms
10 SWEA ETU Assembly & Test 9 sms
11 ETU SWEA to UCB 0 jour
12 SWEA ETU Test 8 sms
13 SWEA Long Lead Parts 85,8 sms
14 SWEA FM1, FM2, Spare 330 jours
24 GSE 330 jours
06/03
12/07
Projet: IMPACT_MAG
Date: Ven 24/08/01 12:06
Tâche
Fractionnement
Avancement
Jalon
Récapitulative
Tâche reportée
Fractionnement reporté
Jalon reporté
Avancement reporté
Tâches externes
Récapitulatives du projet
Jalons externes
Échéance
Page 1

SWEA REQUIRED CAPABILITIES

- Measure wide energy range 0 to 5000 eV with high spectral and angular resolution
- At low energy (?20 eV) have the capability to :
  - Improve the nominal energy resolution
  - Reduce geometrical factor
- Field of view
  - 360° in a plane, combined with +/- 65° coverage in elevation out of plane
- Space resolution : 22,5 degrees x 22,5 degrees
- Geometric factor 0,01 cm^2 ster E (eV)
- Maximum count rate (per 22,5 degree sector) : 1.10^6 counts/sec
- One complete sequence of measurements in 2 sec
- Low power, weight

- One electrostatic optics made of :
  - An electrostatic « top-hat » Analyzer (ESA), 360° field of view, with outer hemisphere at allowed variable potential Vo
  - 2 deflectors in front of analyzer entrance
  - 2 toroidal grids :
    - outer one at spacecraft ground
    - inner one at Vo potential
- Microchannel plate detector – two rings
- 16 sectors anode to provide 22,5° resolution in azimuth
- A retractable cover

SCHEMA OF ELECTRON ANALYZER



- 16 charge sensitive preamplifiers (CSP) and discriminators
- One non regulated High Voltage Power Supply (HVPS) that supply :
  - 3 High Voltages Amplifiers (HVA) programmed by analog voltage levels
    - Analyzer : HVA (0 to + 750 volts)
    - deflector 1 or 2 : HVA (- 25 to + 1500 volts)

- One regulated HVPS for MCP (0 to + 3500 volts)

- One programmable power supply (Vo : 0 to – 25 volts)

- Top hat analyzer
  - Inside surfaces of analyzer covered with black conducting coating (to be discussed) !
- Deflectors
  - Simulations of particle collection shows dissymmetry between positive and negative elevation
  - Manufactured in ULTEM and recovered with gold (to be discussed) !
- MCP
  - Two complete rings stacked with 50 µm space between them
  - Mounting on board with all high voltage coupling components
  - Two rings in front at Vo potential and entrance of MCP at + 300 volts
- Grids
  - Each surface obtained with 4 sectors
  - One support structure in AU2GN with 8 ribs
- Retractable cover : actuated with shape memory alloy pinpuller **P5-403-10S**

SWEA MECHANICAL DESIGN APPROACH AND FEATURES

- **SWEA is composed of an electrostatic optics, 3 electronic boards, one housing**
- **Packaging design approach is based on having :**
  - The electrostatic analyzer mounted on the MPC Board
  - The 3 electronics board mechanically assembled together and with feedthrough contacts for electrical connections
  - Grid structure is mounted on the housing and support upward deflector, cover and cover actuator
- **Connection with the interface board (UCB) with a pig-tail connector (micro-D 51 pin)**
- **Electrical cables routed to the top of the instrument through two ribs of the grid structure (cover + 28V, cover Ret, deflector 1 voltage)**
  Vo will be distributed to the cover via the inner grid
- **Purging tube is going through holes at the center of electronic boards to the MCP isolated between mounting board and outer hemisphere of the analyzer**
- **Venting by small holes at the base of the analyzer**

- TWO ELECTRICAL TEST UNITS – ETU – WILL BE ASSEMBLED
  - One "complete"
    - It will be used at CESR to prepare calibrations (grids on one sector 90° for first verification)
  - One with a limited number of preamplifiers and without retractable cover
    - It will be delivered to UCB for interface test, software testing and UCB test setup checkout
    - If necessary one sector of 90° equipped with grids for calibration purpose.
- TWO FLIGHT MODELS
- SPARE PARTS

THERMAL DESIGN APPROACH AND FEATURES 1/2

- In normal operation instrument will be in the shade
- Temperature will be programmed to a set point with the help of an operational heater controlled by software
- In no operating mode, SWEA is provided with 1,00 watt (TBC) through a thermostatically controlled heater
- Temperature dependant of mean value of S for the detector aperture and thermal conduction with the boom
- Due to the relative complexity of this aperture (2 toroidal grids with large transparency, shape of deflector), mean S was estimated between 0,05 and 0,15

THERMAL DESIGN APPROACH AND FEATURES 2/2

- Detail analysis in progress with :
  - New value for the power dissipation (1,47 watts)
  - Conductance to boom 0,013 W/K Boom temperature : -90°C
  - Grids golded (? =0,03) and KAPTON MLI (? =0,025, α=0,016)
  - Solar thermal constant : 1068 w/m² , 1366,5 w/m² , 1769 w/m²

  Preliminary results are :

  In operating mode T = 238 K

  Non operating mode

  back illuminated T = 249 K to 256 K
  lateral illuminated T = 294 K to 315 K

- Need test to validate a model
- One sensor will monitor temperature of the MCP

MASS ALLOCATION AND STATUS

SUB SYSTEM	ESTIMATE	ALLOCATION
Detector support, spheres	297	1 210 g
Top hat, pin puller, grids, deflector	303	
MCP board	70	
Preamplifier board	80	
HVPS board	150	
Mechanical housing	103	
Connector, cabling…	45	
Total	1 048 g	

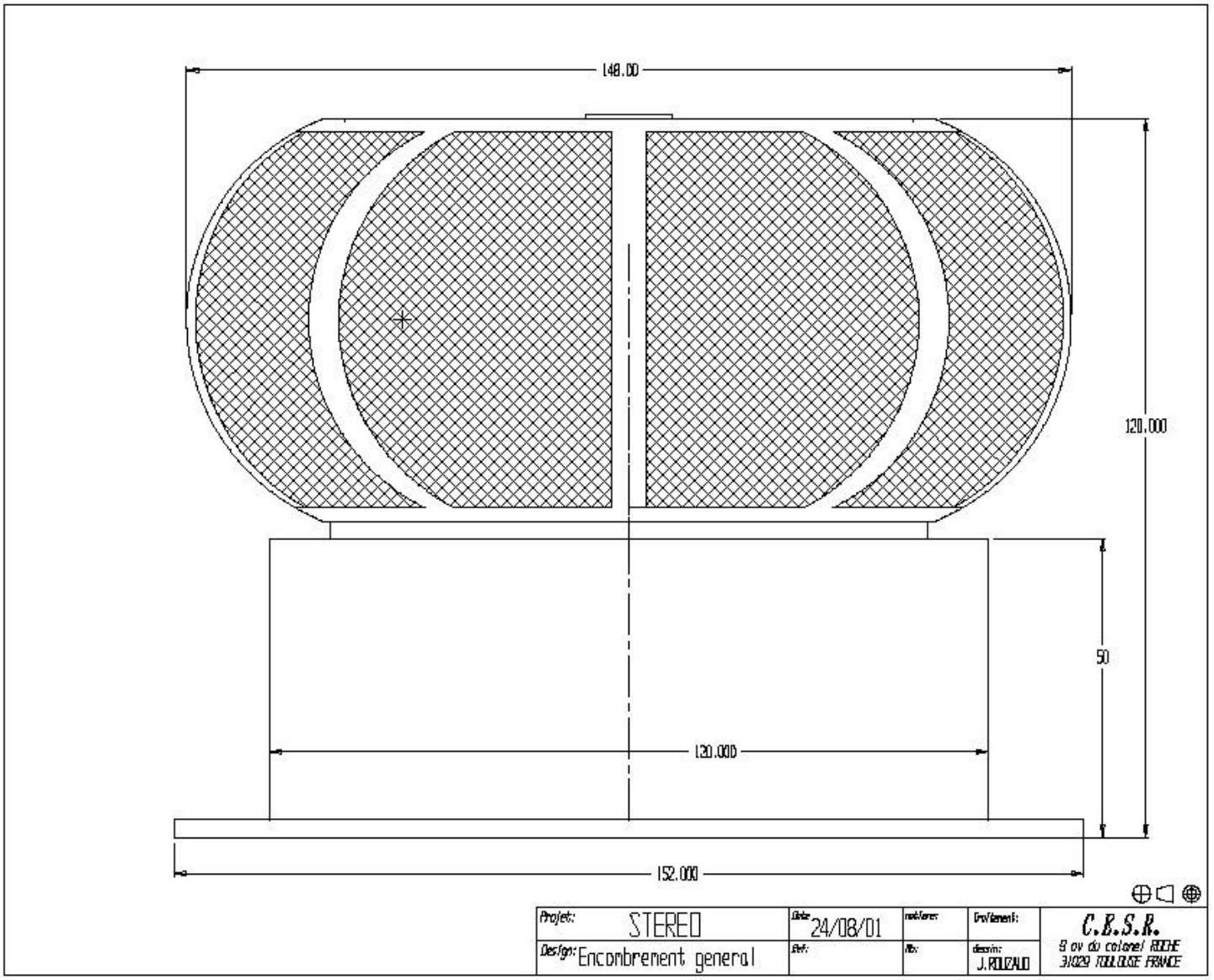
Not included :

- Thermal blanket
- Heaters and thermoswitches

POWER ALLOCATION AND STATUS

SUBSYSTEM	PHASE A (mW)	CURRENT (mW)	TEST CONDITIONS
Preamplifiers dis.	100	100	
HVPS MCP	250	211 – 230	Vs = 2500 V R = 50MO
HVPS analyzer	100	45 min 102 max	C_L = 20pF
HVPS deflectors	60	40 min 140 max	
Vo polarisation	30	50	
Total	540	446 min 662 max	

Allocation 540 mW


148.00
120.000
50
120.000
152.000
Projet: STEREO
Date: 24/08/01
Dessin: Encombrement general
Def:
J.POUZAUD
C.E.S.R.
9 av du colonel ROCHE
31029 TOULOUSE FRANCE

- Mechanical pieces (electrostatic optics and housing)
  - Preliminary study prepared by CESR
  - Detail manufacturing drawings, machining of all pieces, surface treatment subcontracted to a company in Toulouse - COMAT – working for space instrumentation
  - Grids will be manufactured by CORIMA
  - Detailed design performed : to be validated these days

- Electronics boards
  - Detail schemas prepared by CESR
  - Lay-out of printed boards, components soldering subcontracted to a company in Toulouse – MICROTEC – working for space instrumentation
  - Printed boards manufactured by SYSTRONICS at space level
  - Integration of MCP on detection board at CESR
  - Electrical tests, vacuum tests at board level and assembly at CESR
  - Layout on the way – detail schematics given to subcontractor

IMPORTANT TOPICS TO BE DISCUSSED

- Deflector shape : detail design to be validated
- Thermal : study to be done soon – can have impact on the mechanical design
- Necessity of black coating (which kind) on deflectors and spheres
- Routing of the purging tube
- Routing of cables from CESR part to UCB part – position of 51 pins connector
- Mechanical Interface between CESR part and UCB part
- Number of grids to be provided for the ETU
- Experiment axis system definition
- Status of components : Amptek, LT1024