AMS02 TRD Meeting

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- Radiator
- Test Beam: Module Production and Test

Radiators
Outgassing Measurements

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Radiators, Outgassing Measurements

NASA-Tests:

- ASTM E 595 (thermal vacuum test I)
  - outgassing, evaporation under vacuum
    (screening test, 24 h at 125 ^{o}C)
    LIMITS: TML$\leq 1.0\%$**, CVCM** $\leq 0.1\%$
- ASTM E 1559 (thermal vacuum test II)
  - outgassing, evaporation, sublimation and redeposition test,
    mass-loss as a function of time,
    mass-loss after 144 h

Radiators, Outgassing Measurements

Deposition rate on nearby attached payloads:

LIMIT: $10^{-14}\ \frac{\mathrm{g}}{\mathrm{s \cdot cm^2}}$

$\rightarrow$ maximum allowable outgassed mass flow rate: (2 vents diameter: 2.54 cm each)

$$1.4 \cdot 10^{-6} \frac{\mathrm{g}}{\mathrm{s}}$$

$\rightarrow$ max. allowable outgassed mass flow rate of radiator: (total area of radiator $\approx 110\ m^2$)

$$1.2 \cdot 10^{-12} \frac{\mathrm{g}}{\mathrm{s \cdot cm^2}}$$

Radiators

1) LRP 375 BK vlies (used by ATLAS)

   – fibermaterial: Polypropylene
   – fiber thickness 10 μm
   – density: 0.06 $\frac{\mathrm{g}}{\mathrm{cm}^3}$

2) Separet 2396

   – fibermaterial: Polyacryl
   – fiber thickness 19 μm
   – density: 0.064 $\frac{\mathrm{g}}{\mathrm{cm}^3}$

3) Separet 405

   – fibermaterial: Polyacryl
   – fiber thickness 14 μm
   – density: 0.08 $\frac{\mathrm{g}}{\mathrm{cm}^3}$

1) - 3) manufacturer: Freudenberg Vliesstoffe KG
69465 Weinheim, Germany

Radiators

Cleaning Procedures for LRP375

1.) hand washed

2.) **U**ltra **S**onic with H_2O dest.
5 min. in US-bath, 2 h drying, 3 min in aceton,
1 h at 60^oC in a dryer.

3.) supercritical CO_2
at T=60^oC, $\rho = 0.75$ g/cm^3, p=305 bar,
duration of extraction = 20min

4.) supercritical CO_2
at T=80^oC, $\rho = 0.83$ g/cm^3, p=300 bar,
duration of extraction = 20min

5.) CH_2Cl_2
Extraction 90 min at normal conditions

Outgassing Results

Thermal Vacuum Test I, 24 h Screening Test

ESA-PSS01-702, ASTM E 595

LIMITS: TML $\leq$ 1.0%, CVCM $\leq$ 0.1 %

Sample	TML (%)	WVR (%)	RML (%)	CVCM (%)
LRP 375BK				
not cleaned	0.22	0.02	0.20	-0.01
hand washed	0.73	0.02	0.71	0.00
US/dest	0.20	0.05	0.15	0.00
CO_2 (T=60 C)	0.07	0.01	0.06	0.00
CO_2 (T=80 C)	0.06	0.01	0.05	0.00
CH_2Cl_2	**0.04**	**0.02**	**0.02**	**-0.01**
Separet				
2396	0.25	0.17	0.09	0.01
405	**0.20**	**0.15**	**0.05**	**0.00**

Radiators

Conclusion

- All radiators passed the ASTM E 595 test.
- LRP 375BK after cleaning with CH_2Cl_2 (soxhlett extraction) reaches the limit of $1.2 \cdot 10^{-12} \frac{\mathrm{g}}{\mathrm{s \cdot cm^2}}$ of ASTM E 1559
- Separet 405 under investigation

Outlook

- Have to proof that cleaning of LRP 375BK with CH_2Cl_2 doesn't effect transition radiation effect
- Development of soxhlett extraction setup for larger amount of radiator material
- If Separet 405 okay → transition radiation

Test Beam
Module Production and status

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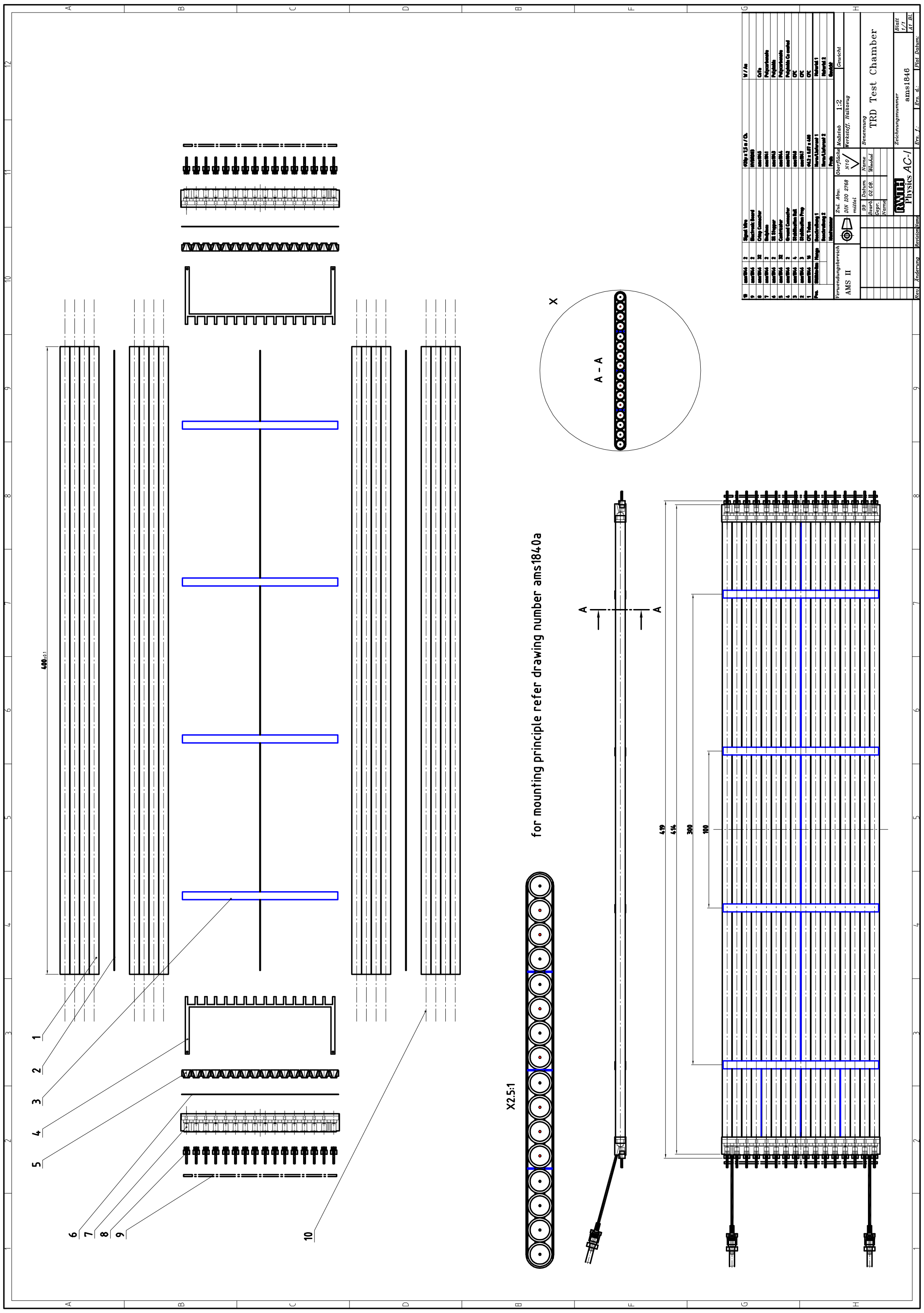
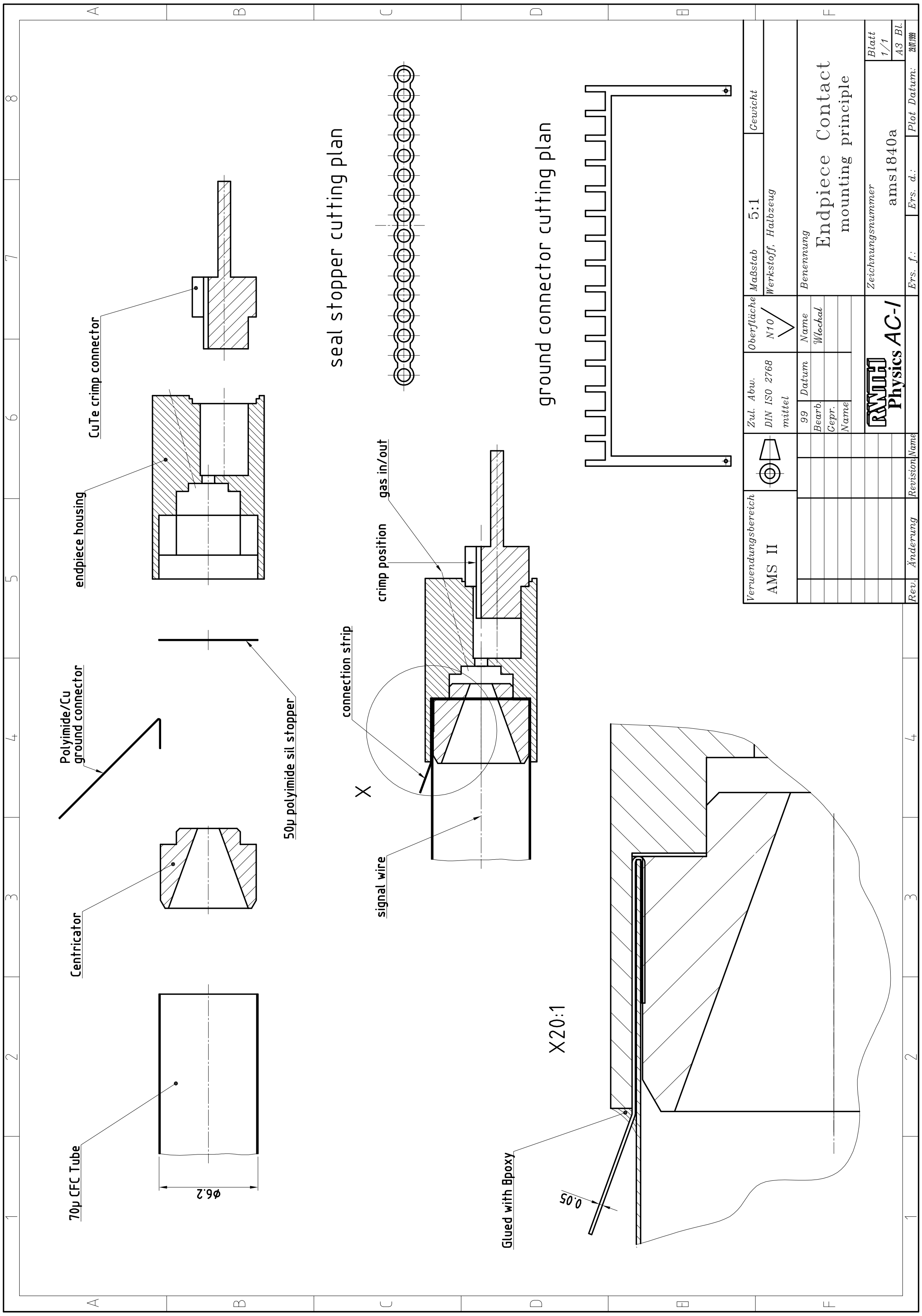
GOAL: 40 prototype modules for testbeam




70µ CFC Tube
φ6.2
Centricator
Polyimide/Cu ground connector
50µ polyimide sil stopper
endpiece housing
CuTe crimp connector
seal stopper cutting plan
ground connector cutting plan
connection strip
crimp position
gas in/out
signal wire
X
X20:1
Glued with Epoxy
0.05
Verwendungsbereich
AMS II
Zul. Abw.
DIN ISO 2768
mittel
Oberfläche
N10
Maßstab 5:1
Werkstoff. Halbzeug
Gewicht
Datum
Name
Bearb.
Gepr.
Wlochal
Benennung
Endpiece Contact
mounting principle
Zeichnungsnummer
ams1840a
Blatt
1/1
A3 Bl.
RWTH Physics AC-I
Rev
Änderung
Revision
Ers. f.:
Ers. d.:
Plot Datum:

Production Process

- **FVT**: glueing of 16 straws and stiffeners (cleanroom, 2 modules per day)
- **AC I:** endpieces glued to straws (cleanroom)
- wire tensioning
  - 1. test: signal feedthrough
  - preview test: noise spectrum (HV, Ar/CO_2)
  - 3. test = 1. test
- straw module potting, HV-board mounting
  - 1. test
- final potting
- operational tests
  - serial-test: gas-tightness, dark current
  - gasgain: G(HV) (Ar/CO_2, Fe^{55})
  - long term test: gasgain

Production Status

30 straw modules

- 12 modules ready for preview test
- 18 modules after final potting
  - 2 modules †
  - 16 modules gastight
    - 5 modules ok.
    - 8 modules each with 1 broken wire
    - 3 modules under operational tests