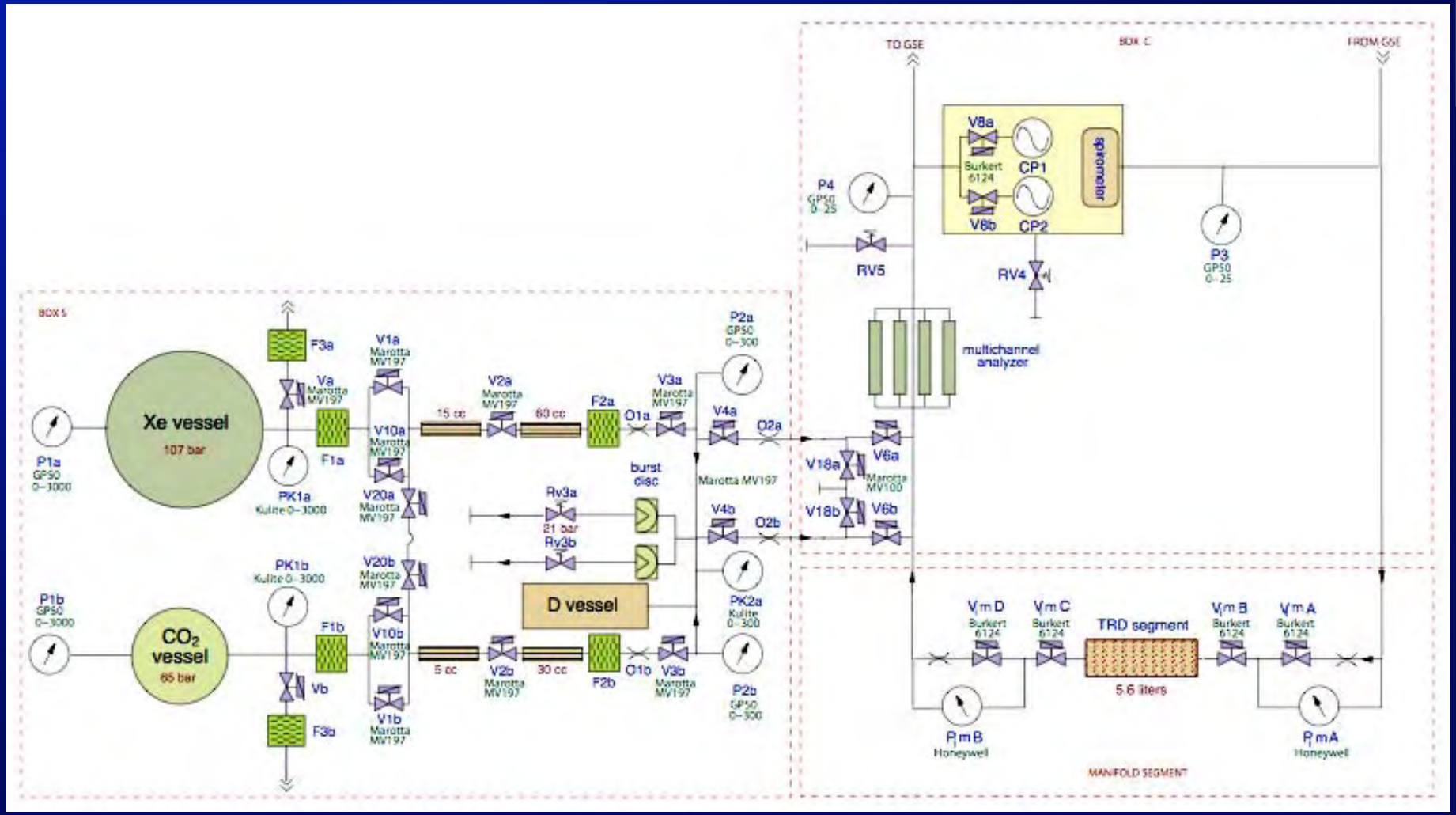
Gas System Status Report
Rome

- UGPS qualification
- Control Electronics production schedule
- Gas circuit testing
- Software commands and safety
- Report from MIT

B. Borgia
TIM April 2006

Gas Circuit



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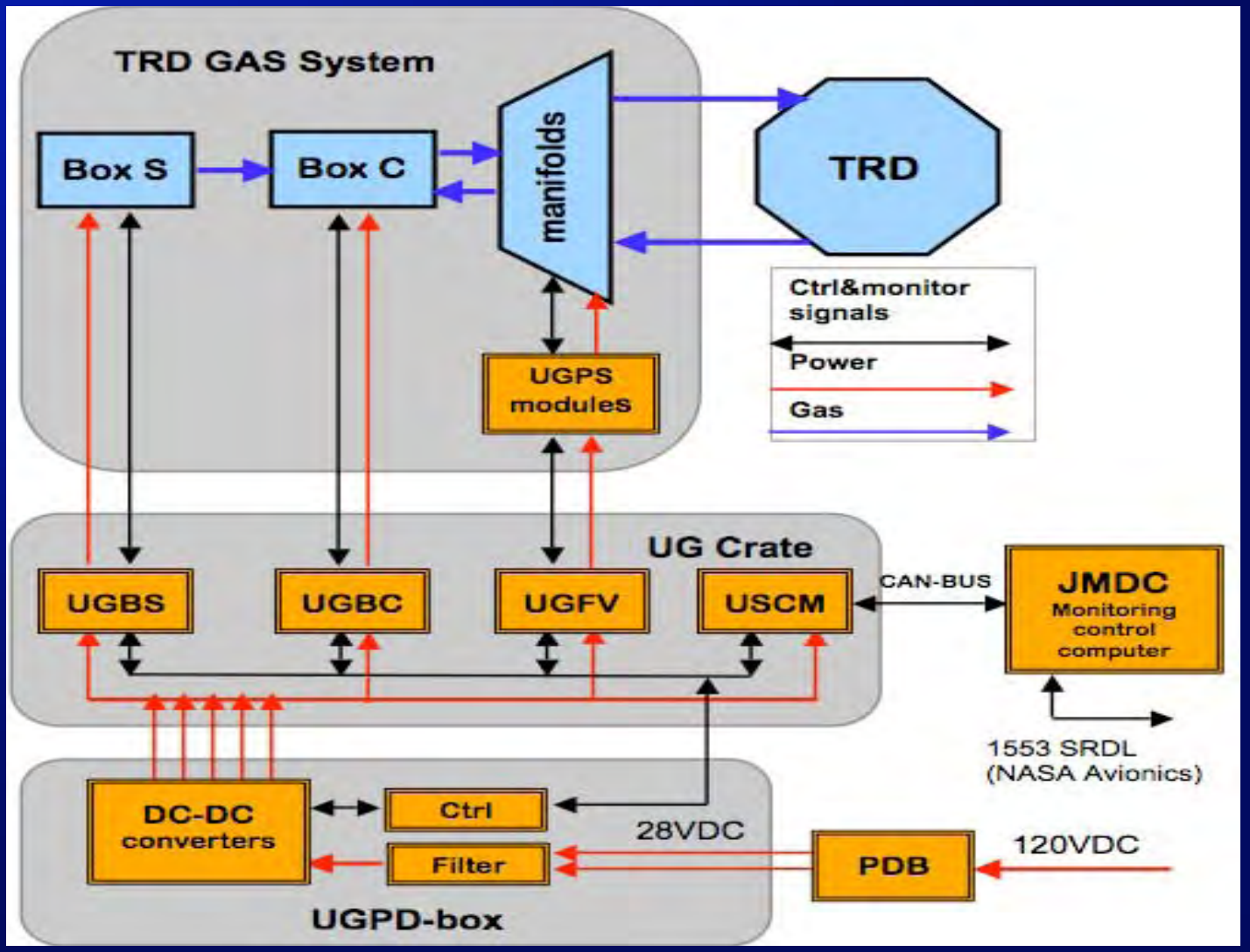
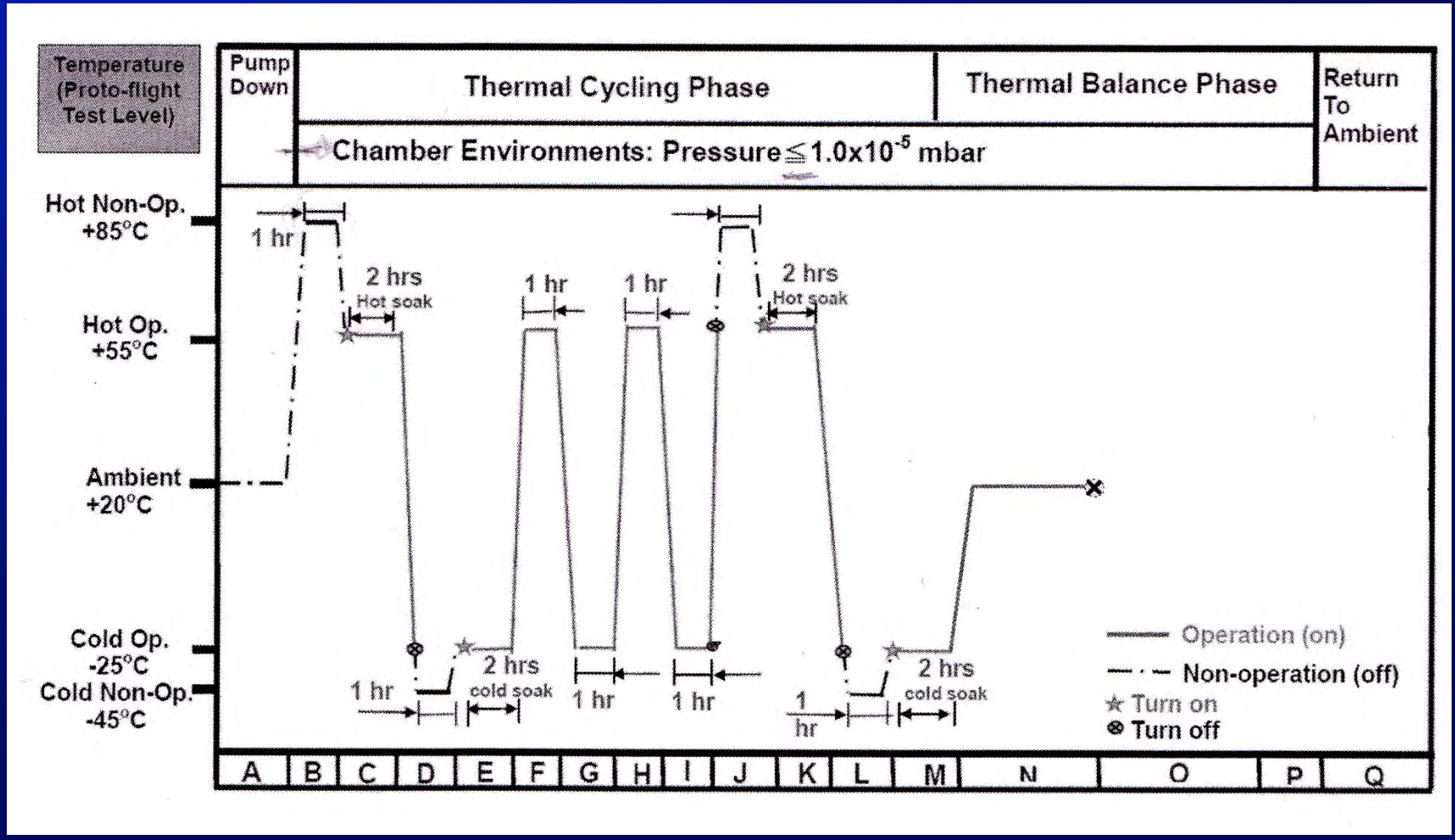
Control Electronics



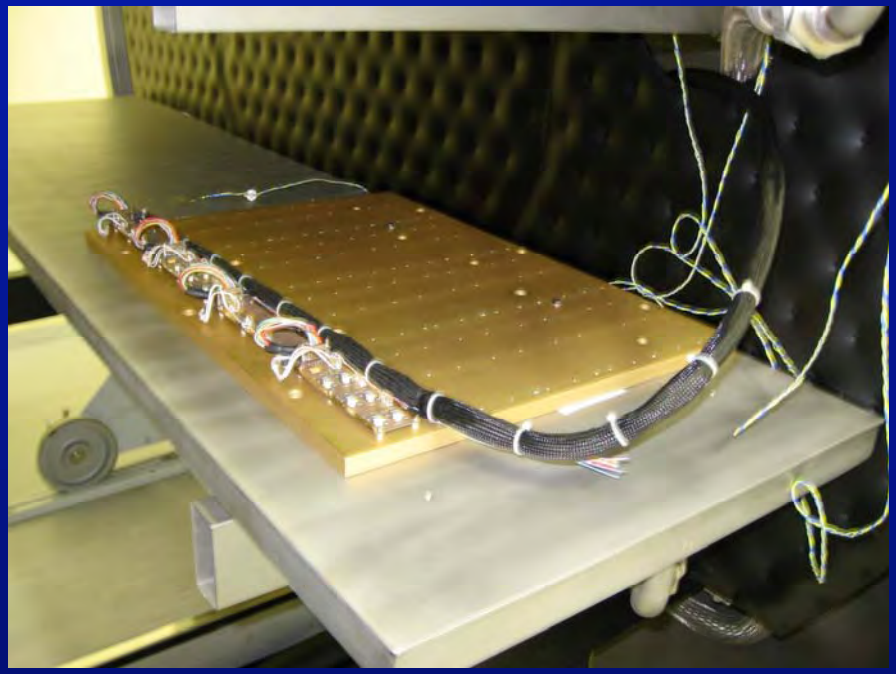
UGPS qualification

- UGPS cards located on TRD gas manifolds with preamps for differential pressure (Δp) signals at manifold input/output
- Qualification tests:
  - TVT
  - Vibration
  - EMC
- All test passed, preliminary data report

TermoVacuum Test

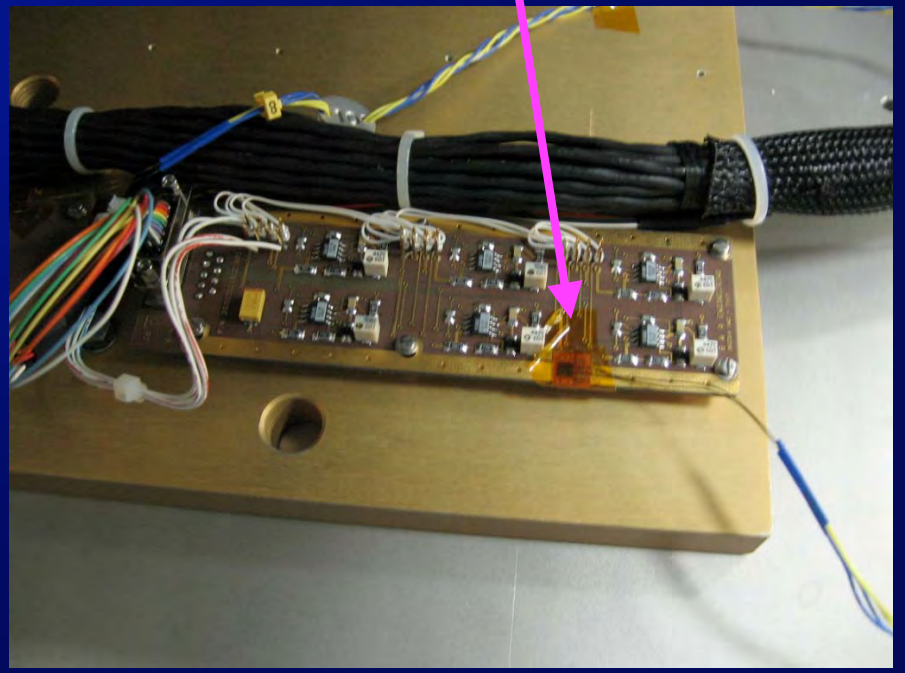


UGPS-QM TVT

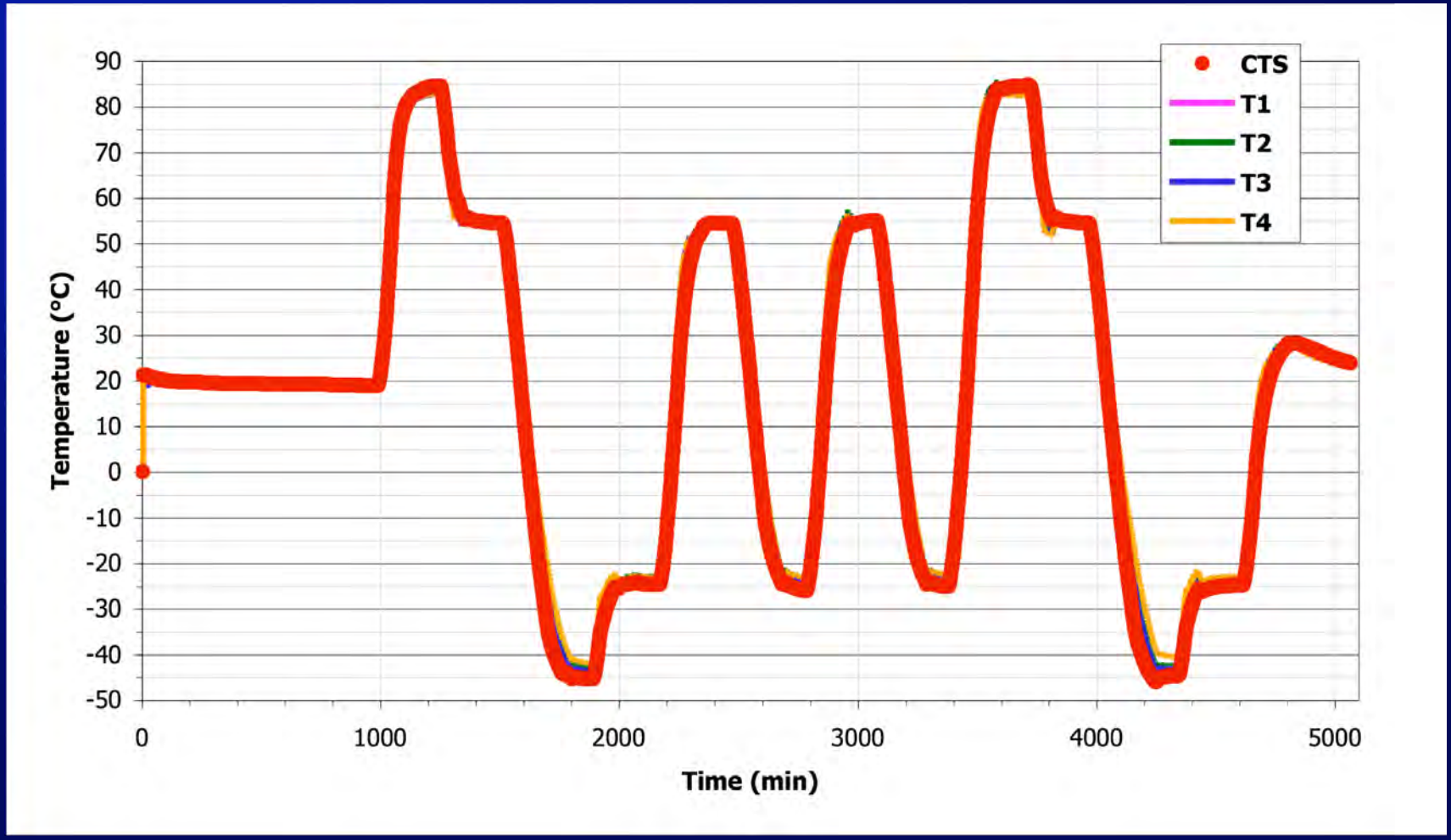


cold plate

T sensor



Actual T profile



TVT

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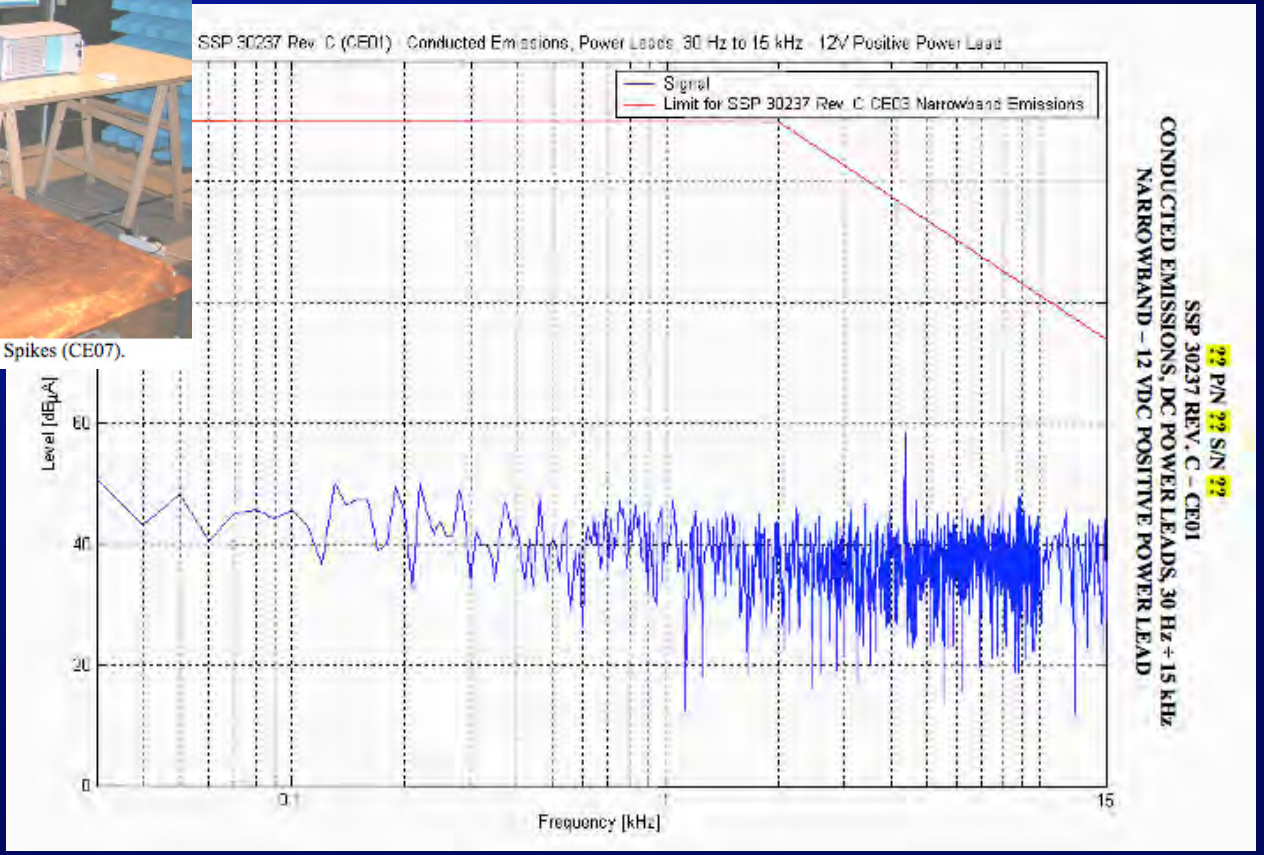
EMC tests

Fig. 3: Conducted Emissions, DC Power Leads, Switching Spikes (CE07).



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TIM April 2006

Radiated Emission

UNIVERSITA' DEGLI STUDI DI PERUGIA
POLO SCIENTIFICO E DIDATTICO DI TERNI
Facoltà di Ingegneria
Laboratorio di Caratterizzazione Elettromagnetica

TEST REPORT
N° 061, Rev. 0

Equipment Under Test (EUT)
UGPS QM

P./N.	S/N.
28303101A121A01	100
28303101A121A01	101
28303101A122A01	100
28303101A122A01	101

Required by
G&A Engineering
Località Miole 100, Oricola (AQ) – 67063 Italy

OBJECT

TEST	STANDARD
Conducted Emissions, Power Leads, 30 Hz – 15 kHz	SSP 30237 Rev. F CE01
Conducted Emissions, DC Power Leads, 10 kHz – 50 MHz	SSP 30237 Rev. F CE02
Conducted Emissions, DC Power Leads, Switching Spikes, Time Domain	SSP 30237 Rev. F CE07
Conducted Susceptibility, AC Power Leads, 30 Hz ÷ 50 kHz	SSP 30237 Rev. F CS01
Conducted Susceptibility, AC Power Leads, 50 kHz ÷ 50 MHz	SSP 30237 Rev. F CS02
Conducted Susceptibility, Spikes, DC Power Leads	SSP 30237 Rev. F CS06
Radiated Emissions, Electric Field, 14 kHz ÷ 20 GHz	SSP 30237 Rev. F RE02
Radiated Susceptibility, Magnetic Induction Field	SSP 30237 Rev. F RS02
Radiated Susceptibility, Electric Field, 10 kHz ÷ 18 GHz	SSP 30237 Rev. F RS03

Terni, 19 April 2006

Test Report issued by:
Ing. Antonio Faba

Approved by:
Prof. Ing. Ermanno Cardelli

CEM Laboratorio Caratterizzazione ElettroMagnetica
Polo Scientifico e Didattico di Terni – Facoltà di Ingegneria
Via Pentima Bassa 21, 05100 Terni – Tel. +39 0744/492912 – Fax. +39 0744/492925
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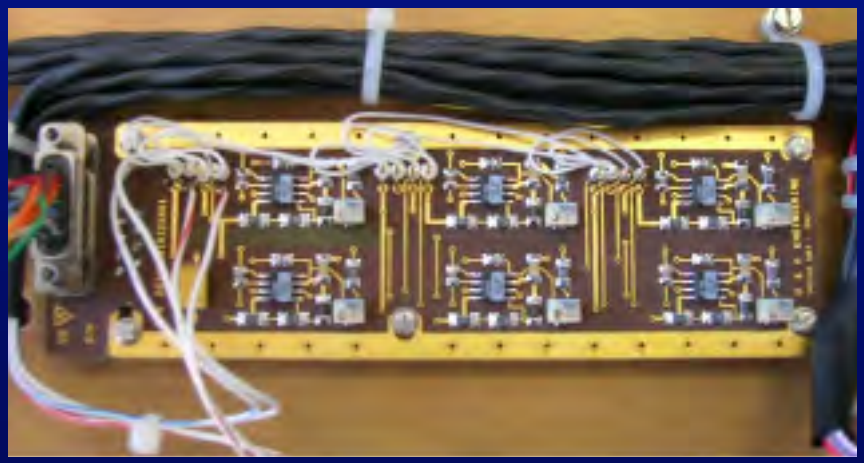

UNIVERSITA' DEGLI STUDI DI PERUGIA	ELECTROMAGNETIC COMPATIBILITY TEST REPORT	*N.°* 061 *Rev.* 0 *Date* 19 April 2006
	EUT: **UGPS QM** **P./N. 28303101A121A01 S./N. 100 ÷ 101** **P./N. 28303101A122A01 S./N. 100 ÷ 101**	Test Date 3 ÷ 7 April 2006

12. CONCLUSIONS

From 3 up to 7 April 2006 with the Laboratory of Electromagnetic Characterization of the "Polo Scientifico e Didattico di Terni", University of Perugia, Faculty of Engineering, Via Pentima Bassa 21, 05100 Terni, have been performed the EMC Tests on the equipment:

UGPS QM
P./N. 28303101A121A01 S.N. 100
P./N. 28303101A121A01 S.N. 101
P./N. 28303101A122A01 S.N. 100
P./N. 28303101A122A01 S.N. 101

produced by

G&A Engineering
Località Miole 100, Oricola (AQ) – 67063 Italy

The results obtained in the emissions and susceptibility tests are in the following table:

TEST	STANDARD	TEST RESULT
Conducted Emissions, Power Leads, 30 Hz – 15 kHz	**SSP 30237 Rev. F CE01**	Compliance
Conducted Emissions, DC Power Leads, 10 kHz – 50 MHz	**SSP 30237 Rev. F CE02**	Compliance
Conducted Emissions, DC Power Leads, Switching Spikes, Time Domain	**SSP 30237 Rev. F CE07**	Compliance
Conducted Susceptibility, AC Power Leads, 30 Hz ÷ 50 kHz	**SSP 30237 Rev. F CS01**	Compliance
Conducted Susceptibility, AC Power Leads, 50 kHz ÷ 50 MHz	**SSP 30237 Rev. F CS02**	Compliance
Conducted Susceptibility, Spikes, DC Power Leads	**SSP 30237 Rev. F CS06**	Compliance
Radiated Emissions, Electric Field, 14 kHz ÷ 20 GHz	**SSP 30237 Rev. F RE02**	Compliance
Radiated Susceptibility, Magnetic Induction Field	**SSP 30237 Rev. F RS02**	Compliance
Radiated Susceptibility, Electric Field, 10 kHz ÷ 18 GHz	**SSP 30237 Rev. F RS03**	Compliance

Left intentionally blank

Terni, 19 April 2006.

Test Report issued by:
Ing. Antonio Faba

Approved by:
Prof. Ing. Ermanno Cardelli

CEM Laboratorio Caratterizzazione ElettroMagnetica
Polo Scientifico e Didattico di Terni – Facoltà di Ingegneria
Via Pentima Bassa 21, 05100 Terni – Tel. +39 0744/492912 – Fax. +39 0744/492925
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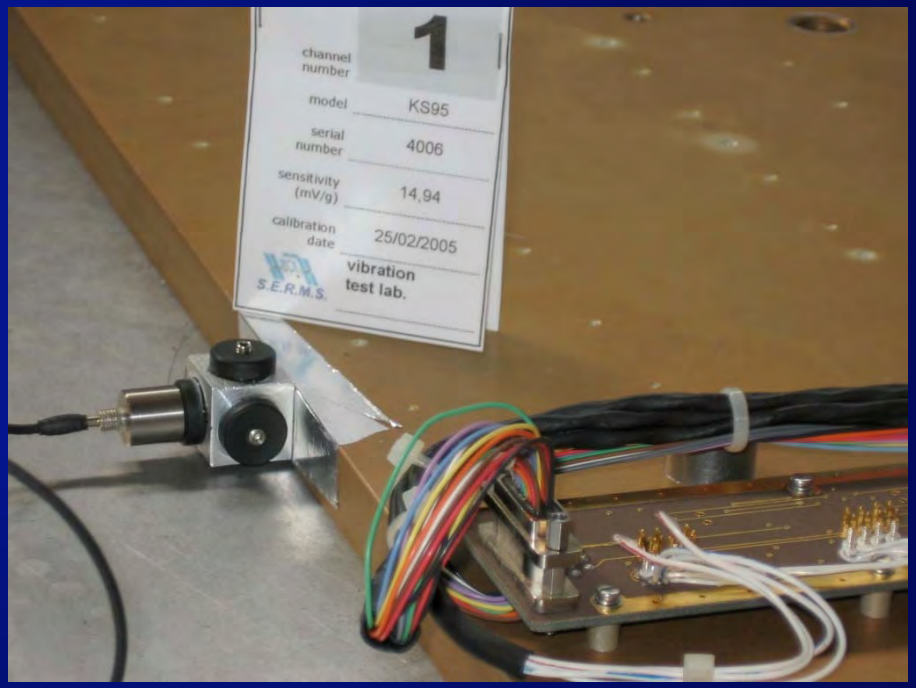
B. Borgia
TIM April 2006

Vibration test



Cards always on during vibration cycles

Functionality test
before/after OK.

B. Borgia
TIM April 2006

No failures

Electronics production schedule

- UGPS-FM ready to go to production
- UGPS-FM acceptance test
  - 1st week June
- {UGBS/UGBC/UGFV}-QM qualification
  - last week June
- {UGBS/UGBC/UGFV}-FM acceptance
  - July 15th

  ⇒ all UG electronics ready by November 2006

  upon avalaibility of Terni Laboratory

TRD GAS SYSTEM STATUS

Francesca Bucci, Francesca Spada

Roma, 13-3-06

Summing up

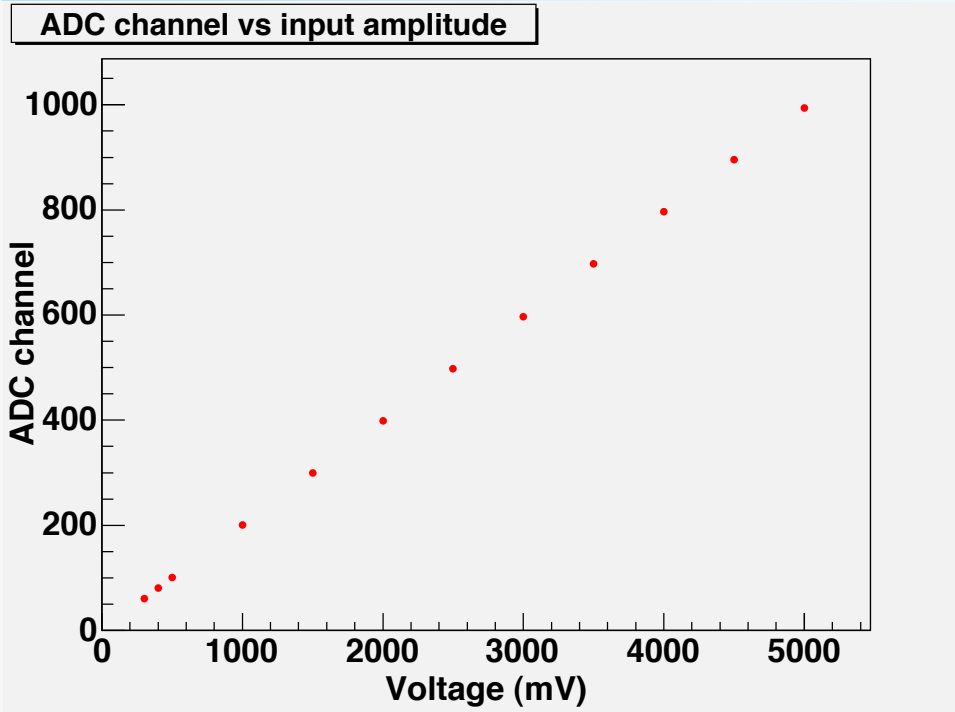
- EM Box S:
  - Heaters tested for both Xe and CO_2;
  - Mixing cycles successfully executed under computer control;
  - Emergency procedure tried:
    - Ar through CO_2 line opening V1a, V20a&V20b, V2b, V3b: too little gas transferred to D vessel → buffers too small;
    - CO_2 through Xe line opening V1b, V20a&V20b, V2a, V3a: controllable;
  - Pressure sensors noise eliminated with rewiring.

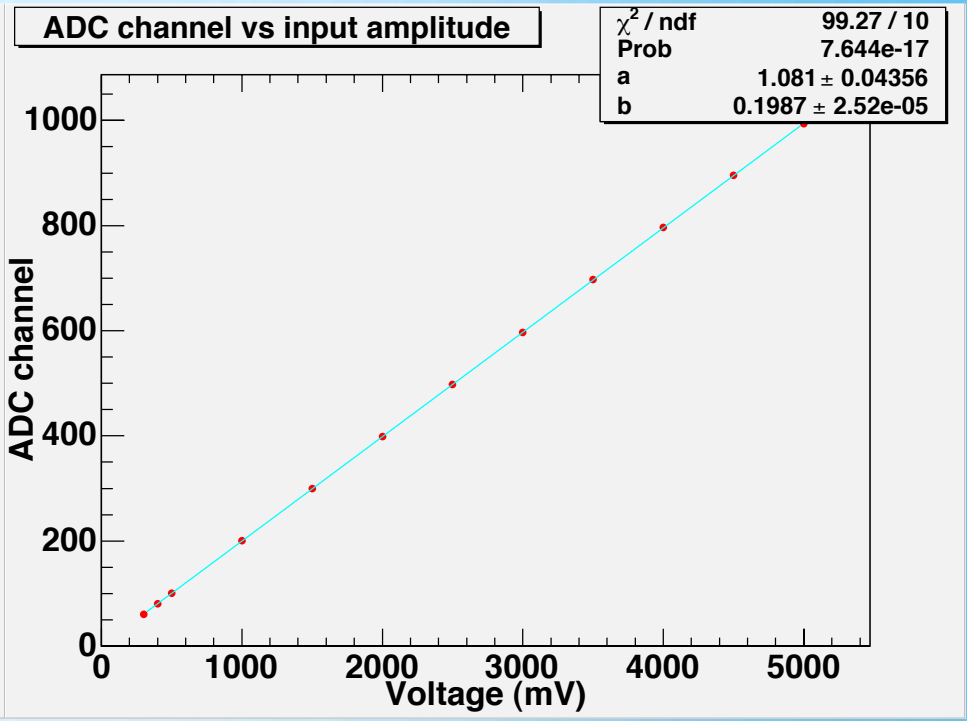
  - *Dallas temperature sensors calibrated with Pt termometers*

- EM Box C:
  - All components tested and operated successfully under computer control;
  - MCA calibrated;
  - Preamplifier connected and tested;
  - Monitor tubes connected and tested.

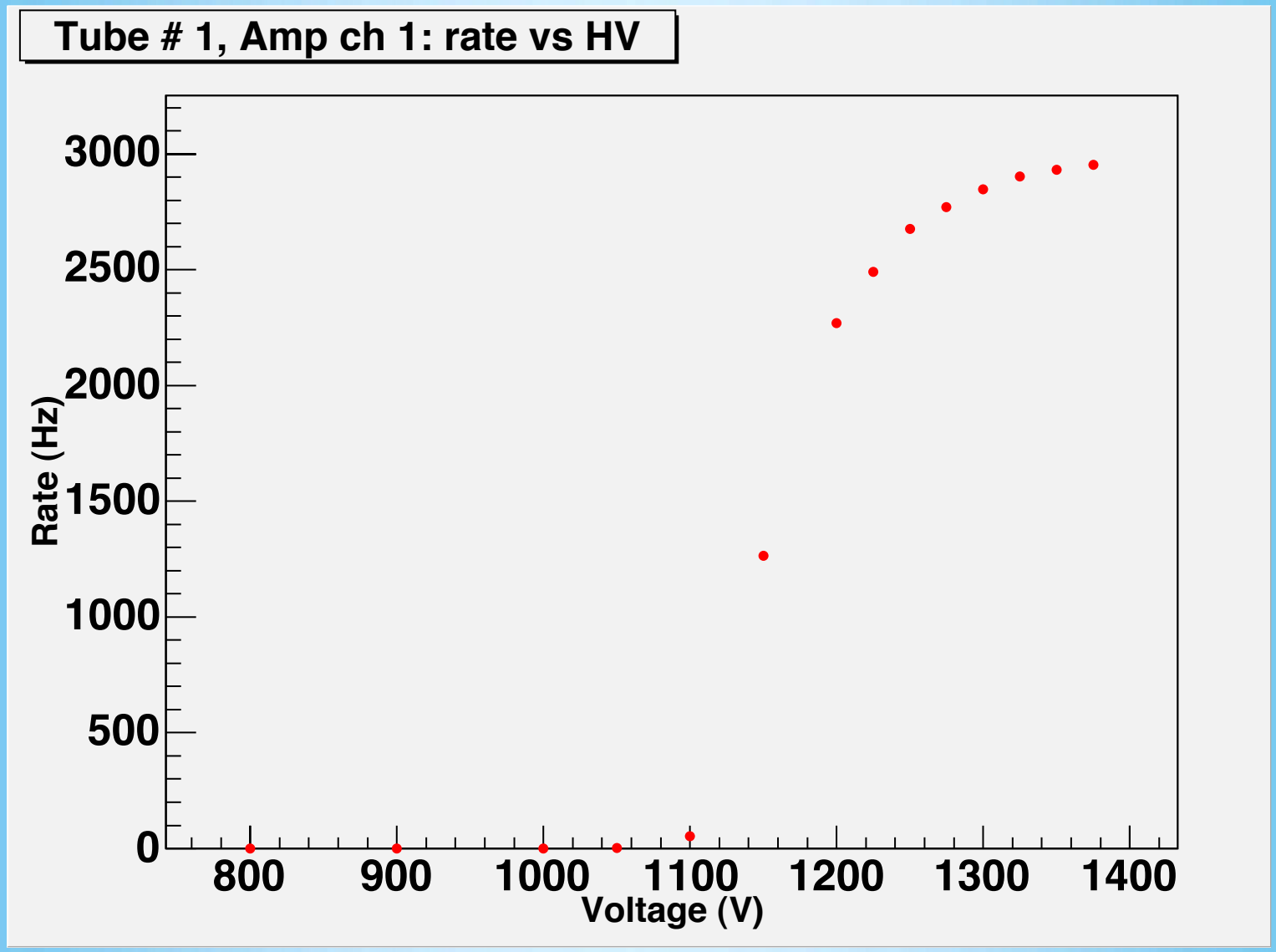
- EM Electronics:
  - 2 USCMs plugged in;
  - UHVG connected and tested.

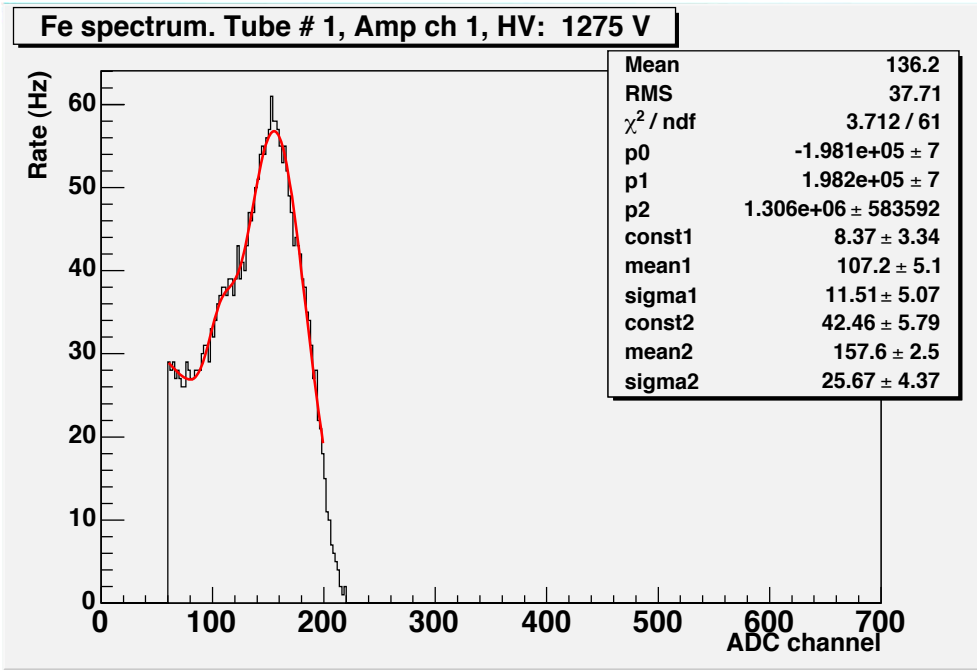
- MCA calibration for input range [0,10] V

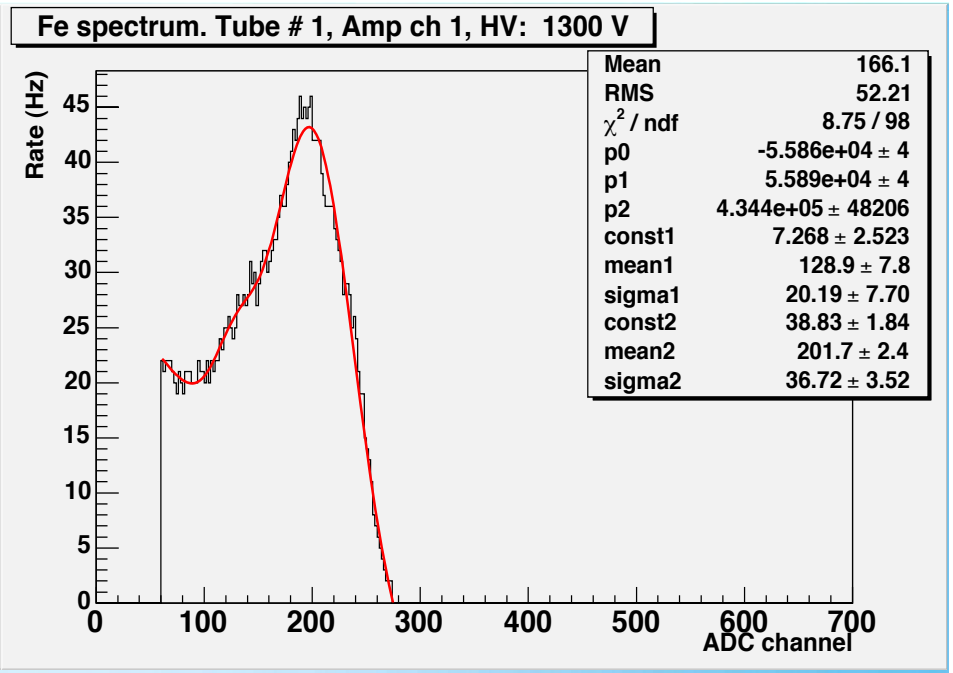




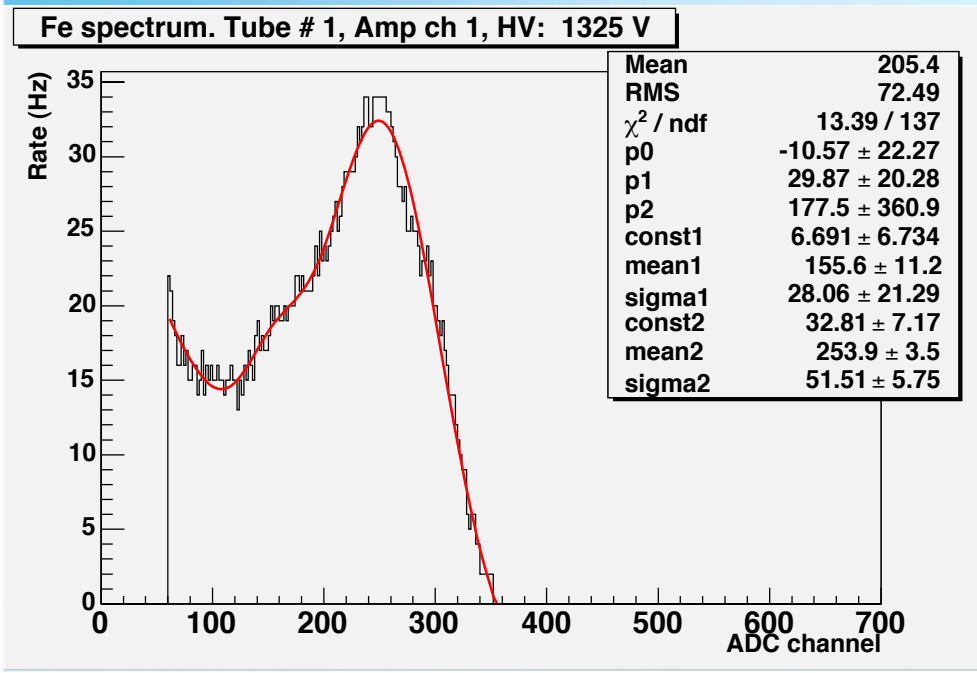
- ^{55}Fe spectra:
  - Tube 1, amp ch 1: cut on ADC channels ≤ 60

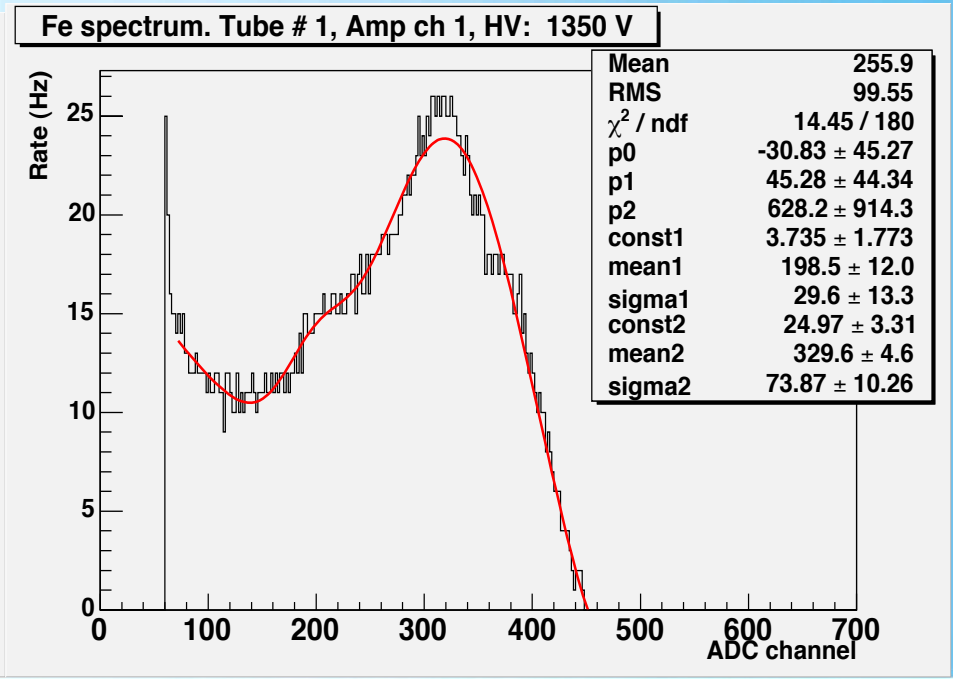






All spectra fitted using an exp function for background + two gaussian functions





- EM Electronics:
  - UHVG working properly:
    - HV up to 1800 V;
  - USCMs, UGBSs, UGBCs hot & cold tested:
    - Each module working properly in hot or cold mode;
    - No conflicts between board while using any combination of USCM hot or cold with UGBS, UGBC hot or cold;
    - **A note on the test results is available at**

    http://www.cern.ch/spada/AMS/IntegratedTestReport.ps.gz

Status Report on Software Interface with TRD GAS Control Electronics WINCAN

F.Spada/Rome

Code and Manual available at:
http://www.cern.ch/spada/AMS/

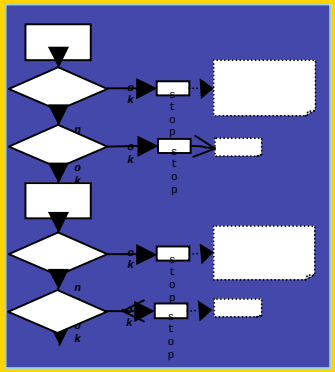
Evolution of the gas system control for flight

WINCAN Macro

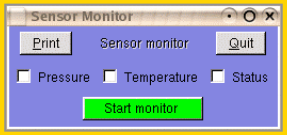
WINCAN Diagnostic

WINCAN

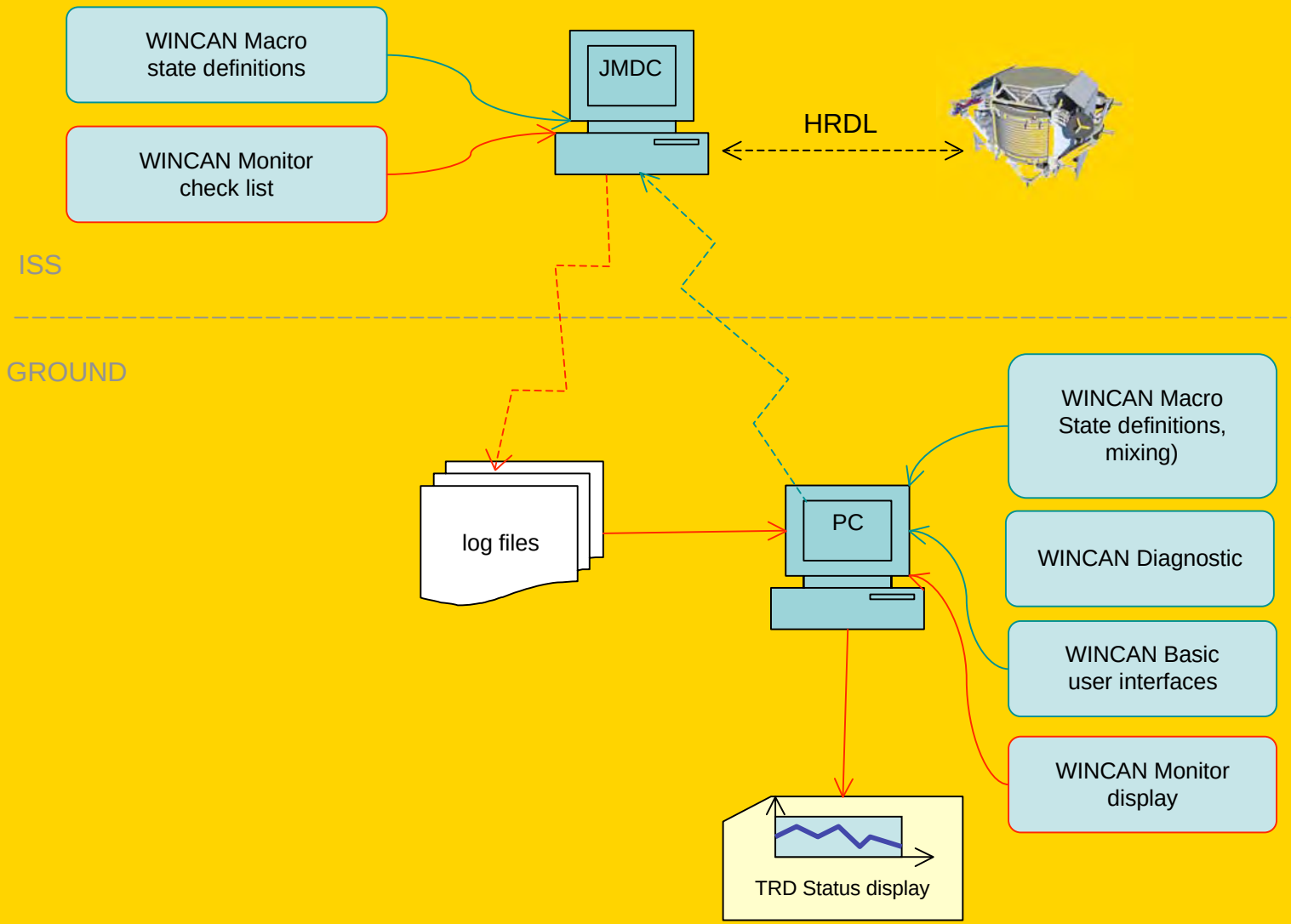
WINCAN Basic



WINCAN Monitor



ISS <-> ground data communication – software location



Security checks

- Security conditions to be verified before operating on the system
  - ***On valves:***
    - **Prevent** opening a valve if the last temperature readout is too old or if temperature is under a fixed threshold
    - Before opening a valve on the tank - D vessel line, **disable** the upstream one (avoid two valves open at a time)
  - ***On heaters***
    - **No heater** on **if** a Marotta valve is open (not enough power)
    - **Prevent** opening a valve if a heater is on (not enough power)

- These conditions are automatically taken into account in following commands and procedures.

Defined states of the gas system/1

To minimize the communication with space:
- define states of the system – the definition resides on the JMDC
- from ground only send command “bring system in status *x*”

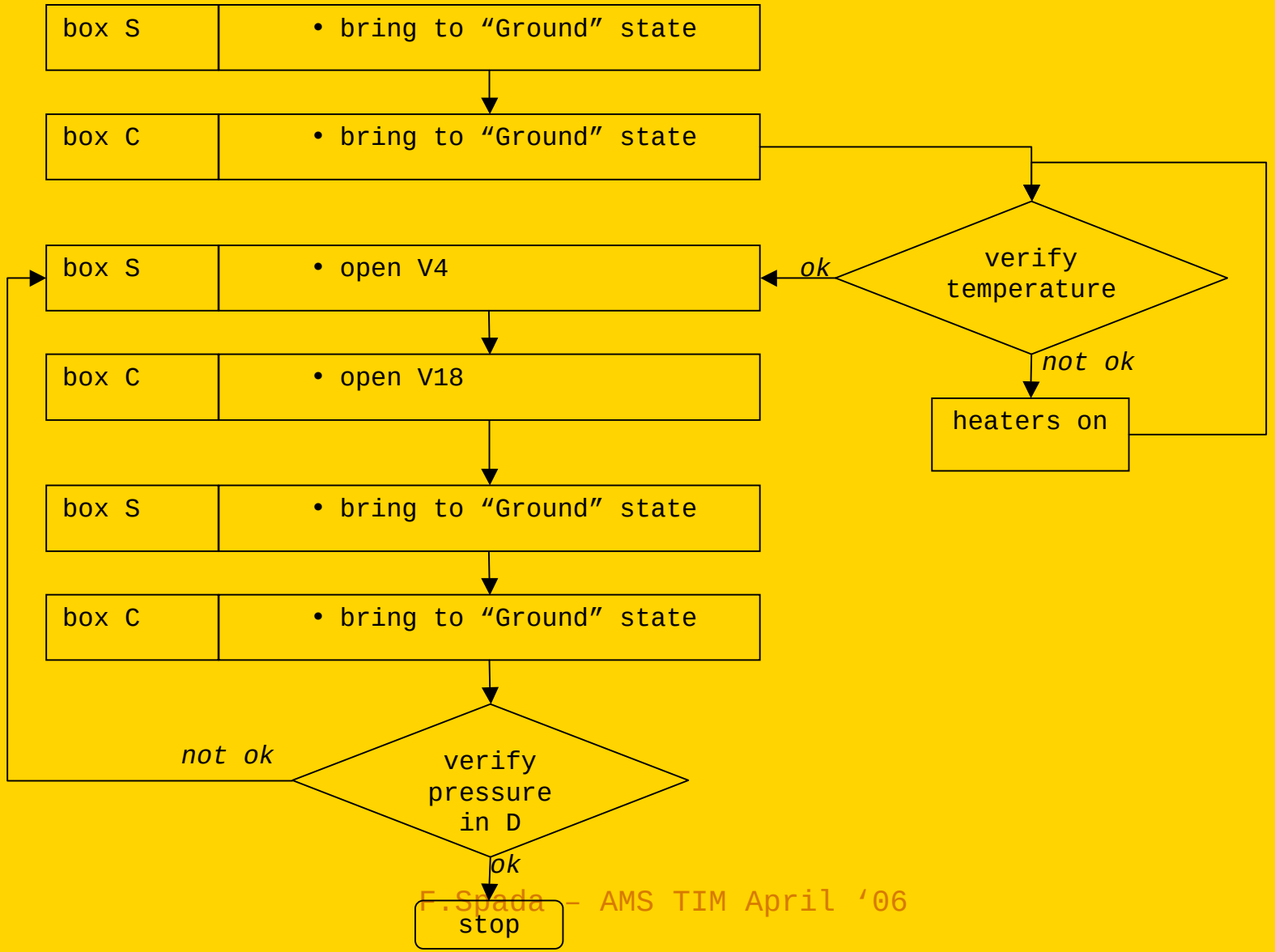
Examples of defined states:

*state “**Ground**”*

box S	• Disable all Marotta • Heaters off
box C	• Disable all Marotta • Close V8 • Pumps off • HV off • Heaters off
manifold	• Close all VA, VB, VC, VD

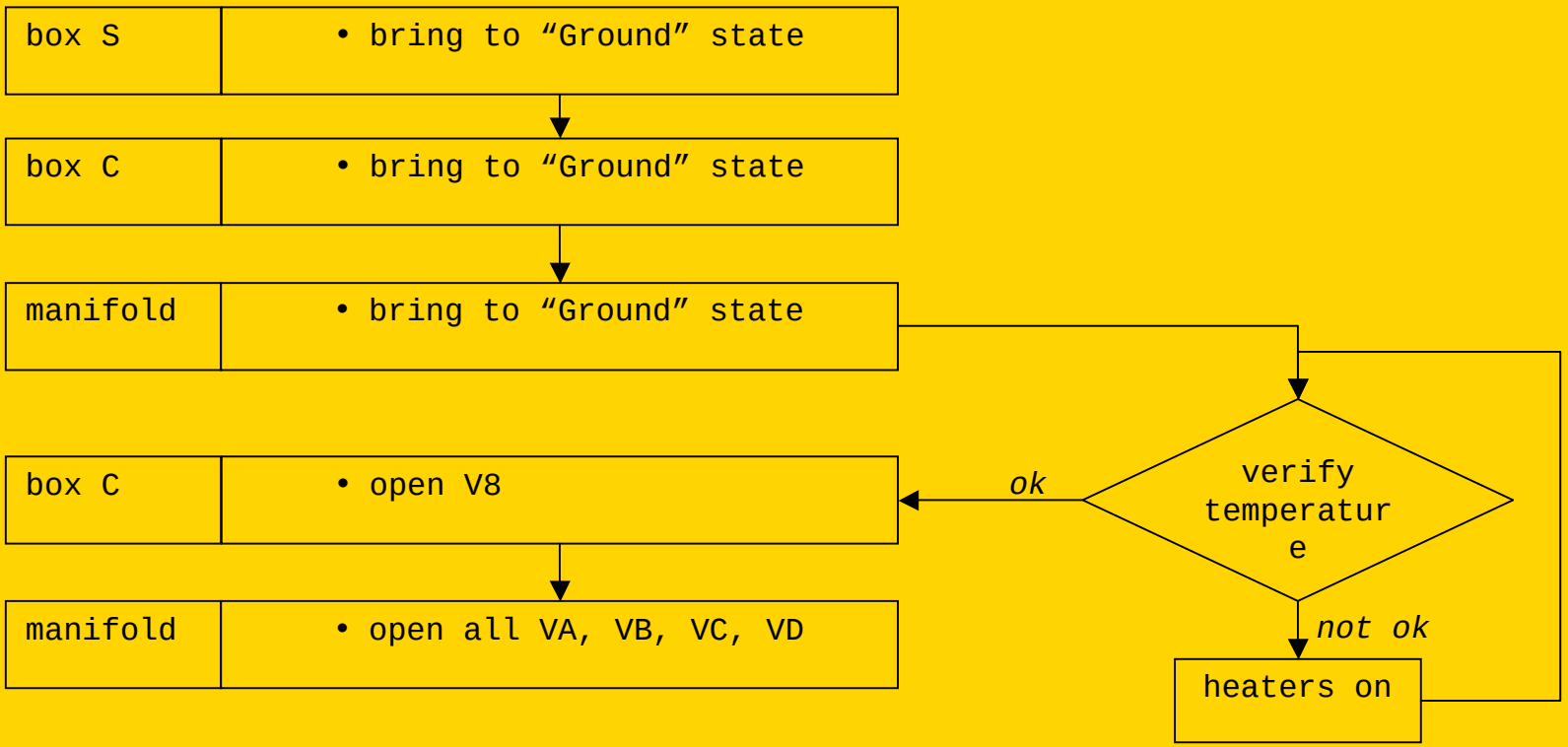
Defined states of the gas system/2

state ***"Empty"***

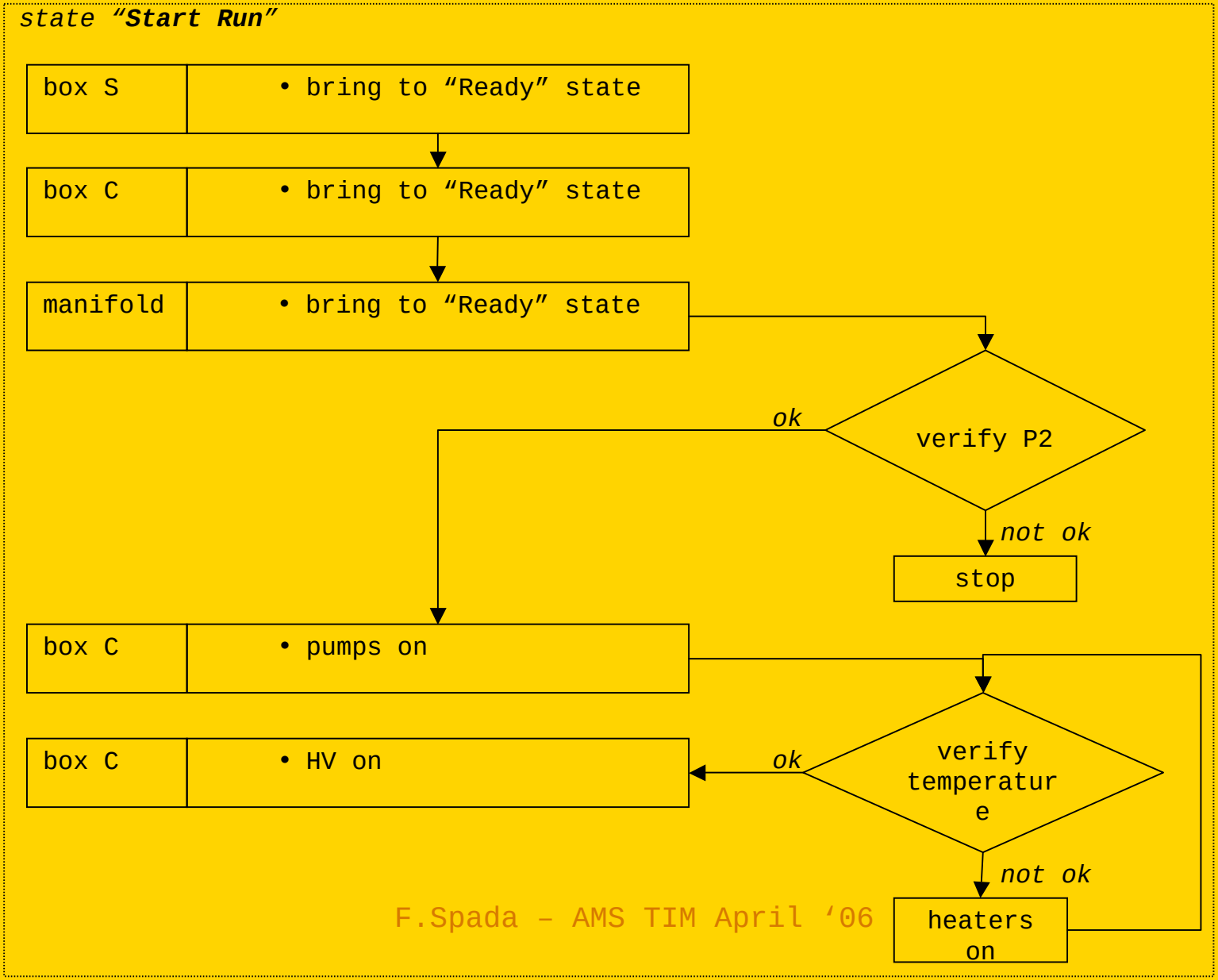


Defined states of the gas system/3

*state "**Ready**"*

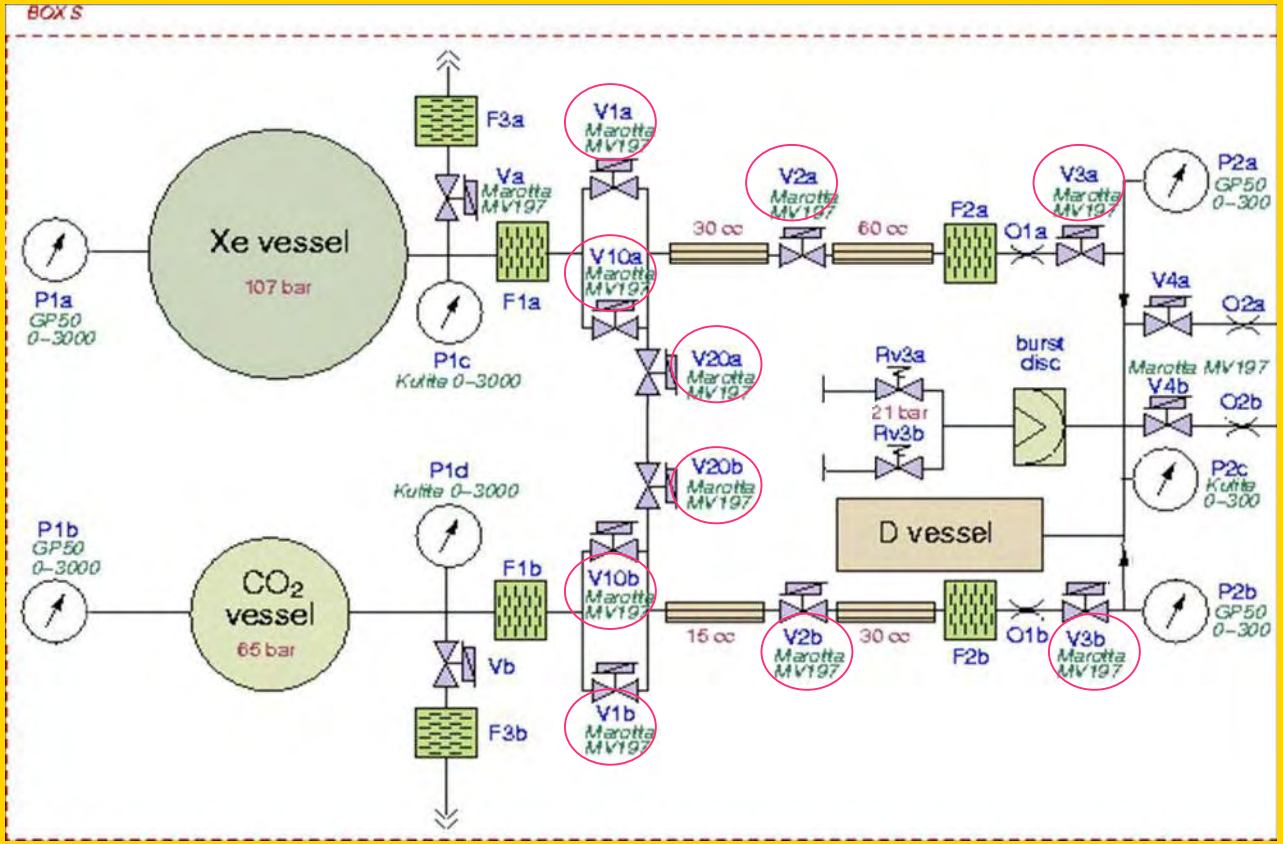


Defined states of the gas system/4

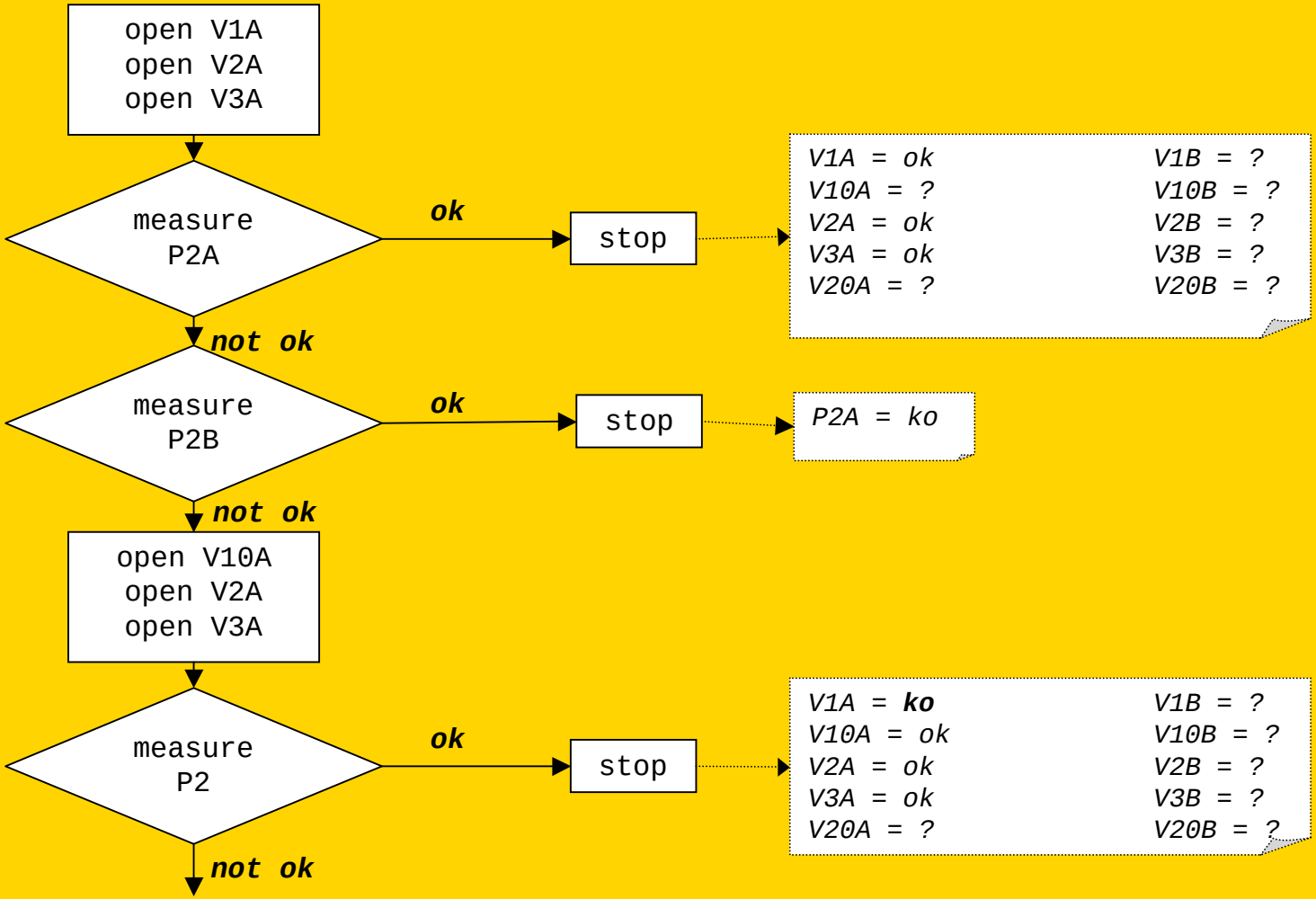


Diagnostic procedures/1

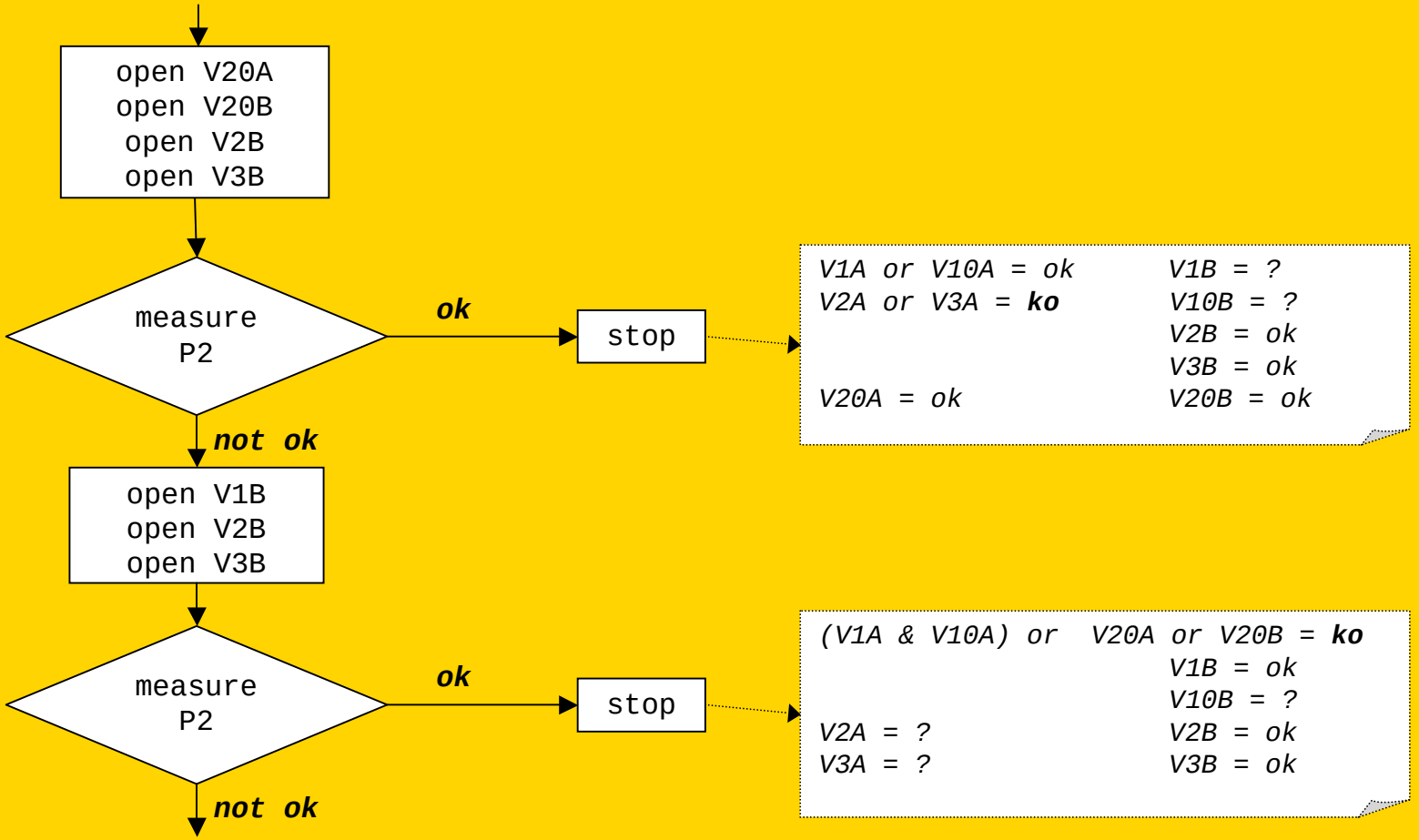
Example of a procedure to determine the status of electromechanical components: check of the Marotta valves in the box S after a dysfunctional behaviour of the pressure in the D vessel.



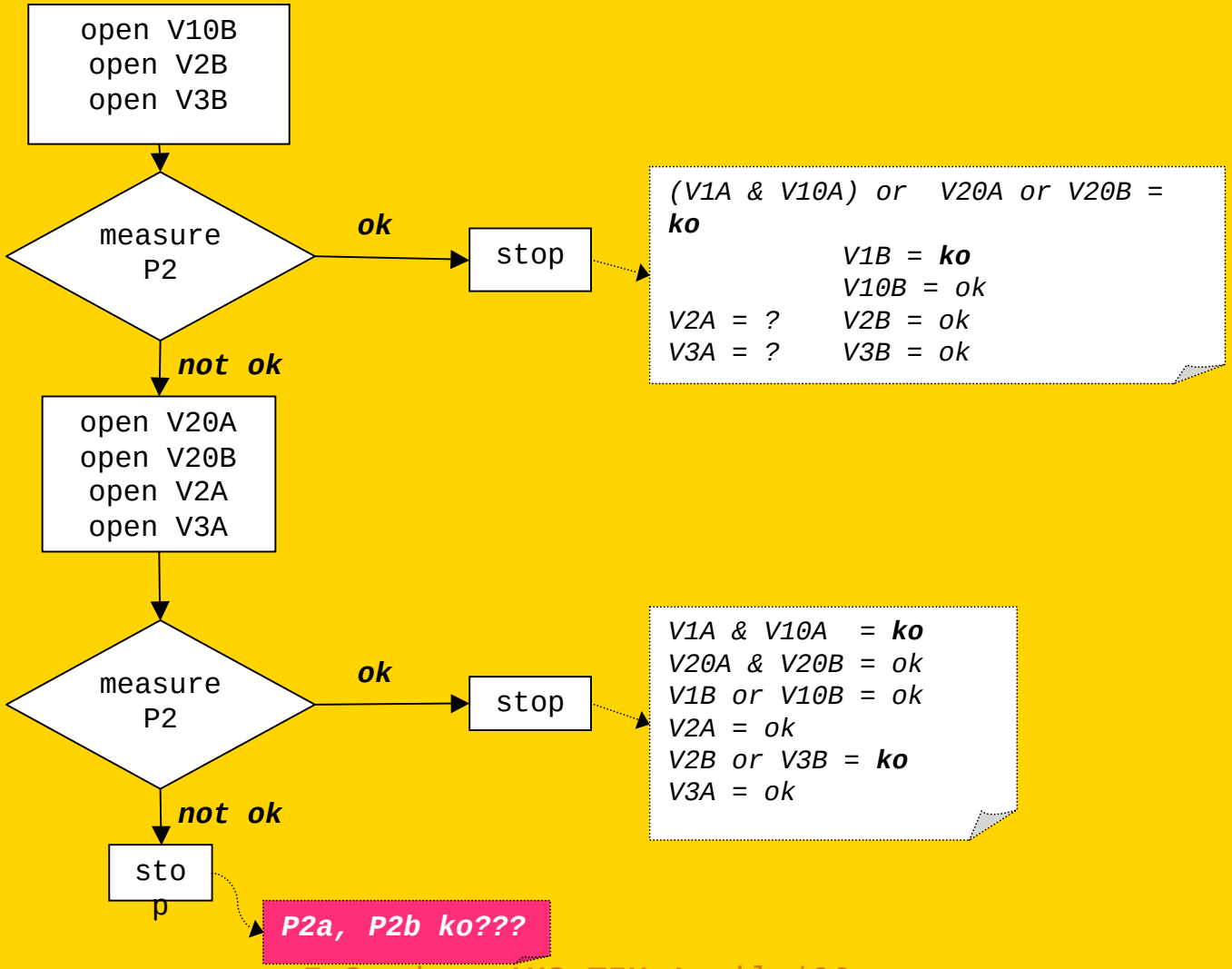
Diagnostic procedures/2



Diagnostic procedures/3



Diagnostic procedures/4



Summary

- WINCAN split in four branches
  - Basic
  - Monitor
  - Macro
  - Diagnostic
- Security conditions included
- Defined states of the system

To do:

- Continue with safety study
- Define operational procedure
- More diagnostic procedures
- Develop monitor
- …

Summary

- Gas control electronics is in qualification and production line
- Gas circuit is estensively tested but needs better understanding of procedures
- Software commands needs in deep analysis mainly for safety

Progress On TRD Gas System

AMS TIM at CERN

April 22, 2006

Flight Module – Added components

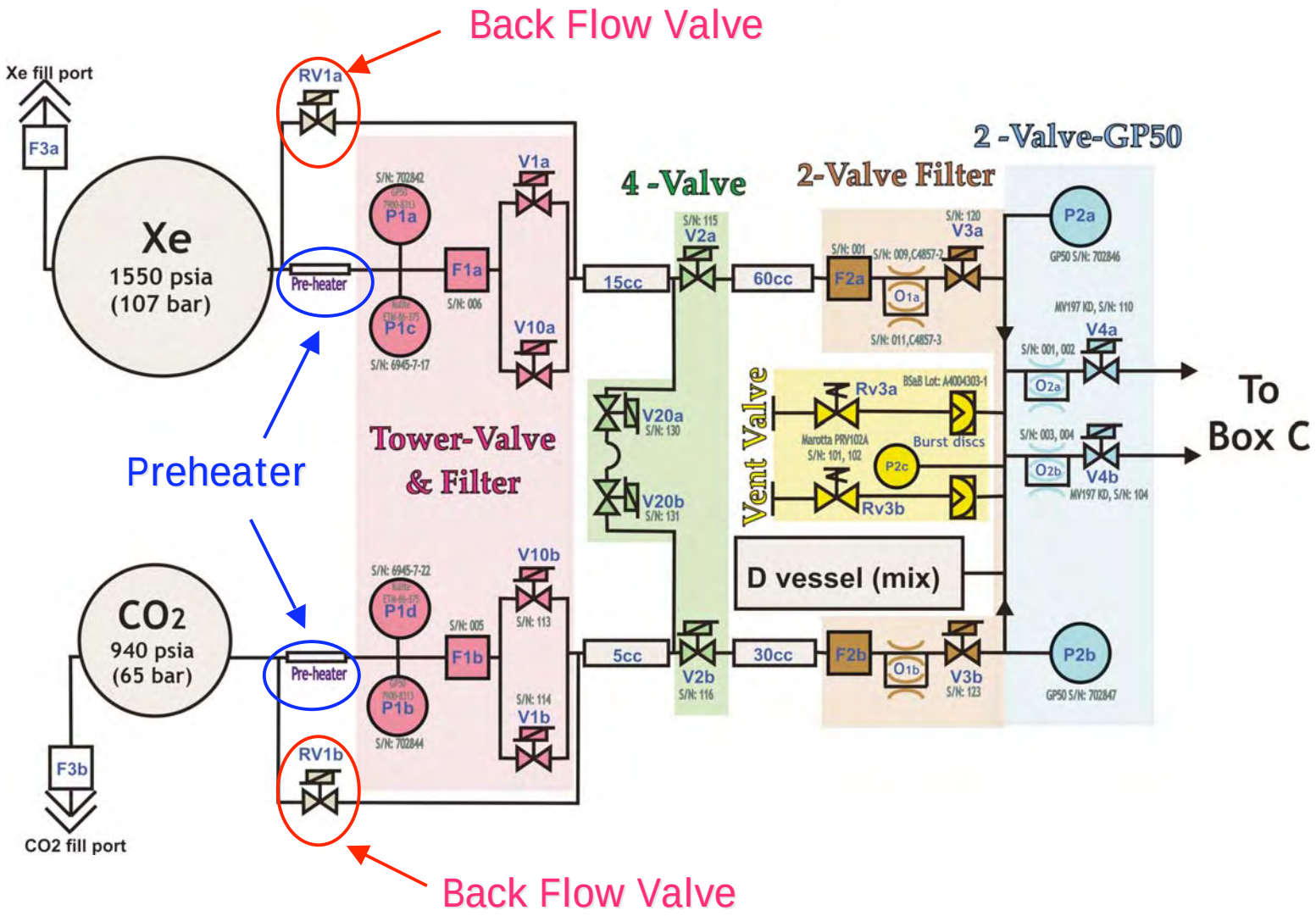
Pre-heater

- Control amount of CO_2/Xe transfer
- Comparable EM/QM tests & thermal model results

Back-flow Valves

- Provision for excess pressure trapped in 1st buffer vol. → storage vessel

Box S Additions: a) backflow valves, b) Pre-heaters



Flight Module - Components

- **Heaters – in hand**
- **Thermostats – in hand**
- **Preheater-Vol – at Arde**
- **Back Flow Valves – received**

Flight Module – Progress

Vessel fill - CO_2/Xe (Linde)

- Procedures in progress
- Vessel DOT exemption: Xe – from previous exemption
  CO_2 – further inquiry by Arde
- Fill location: TBD (Ohio / KSC?)

• Back-flow Valve

- Housing design (The Lee Co)

• Wire Soldering

- To be performed by MIT Space Center (space qualified)

FM Box S – Arde's revised schedule

- Complete all subassemblies (~May 5/06)
- System assembly (~May 15/06 – June 16/06)
- System Test (June 26 - 30/06)
- Ship to MIT (July/06)