PK-4 scientific campaign preparation

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Introduction

- PK-4 is operated in prescheduled campaigns

- Each campaign is thoroughly planned. Resources (e.g. crew time, high rate data channel, etc.) are available for limited time.

- Experiments should be programmed using CSL-based libraries developed by DLR-CP

- Campaign preparation is performed by the Core Team coordinated by M. Pustylnik

- DLR-CP is the interface between science and operations

Development and execution stages

- Scientific (and technical) campaign program
- Experiment documentation
- Draft script programming and tests
- Flight script preparation
- Flight script validation

- Update of libraries

No script/library changes possible below this line

- Tests at CADMOS
- Refreshment
- Campaign

Campaign N program development: collection of ideas

Start: Campaign N-1 end
Duration: 2-4 weeks

To propose an experiment for Campaigne N one needs to:

- Notify the Core Team **asap** within the period above
- In discussion with the Core Team, take several decisions within the period above
  - Preliminary workflow of the experiment
  - Approximate duration of the experiment
  - Is crew participation necessary?
  - Which gas? (argon or neon)

Core Team will decide on the feasibility of each proposed experiment (taking into account the up-to-date status of the facility) and regarding the inclusion of each proposed experiment into a particular campaign

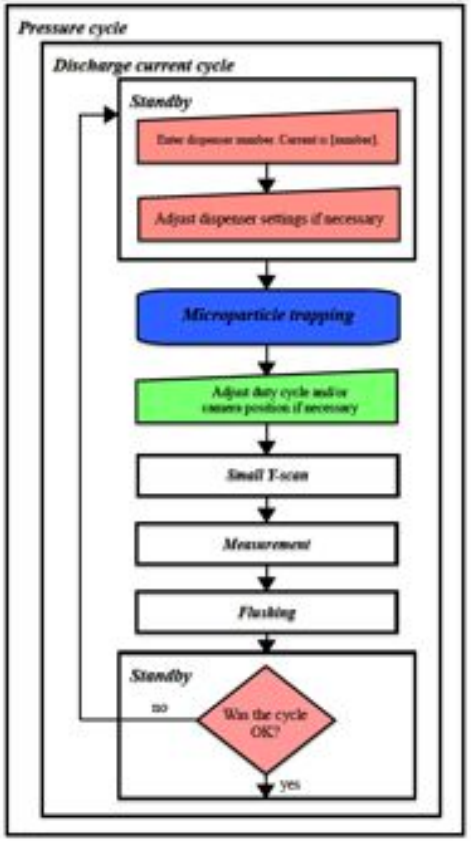
Campaign experiment documentation development: formalisation and polishing of ideas

- Division of an experiment into blocks
- Definition of logical connections between blocks
- Definition of user actions (pauses)
- Preliminary decision on parameterization of different devices

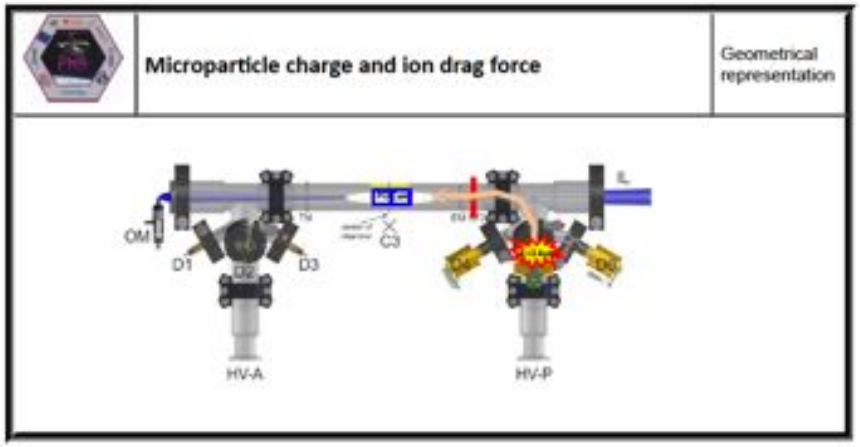
	Microparticle charge and ion drag force	Operational information	
		Total runs	30
	Script name: PartChargeIonDrag_C03 .epl	Recorded videodata per run [GB]	
	Keywords: Microparticle charge, ion drag force Measurement of the microparticle charge and ion drag force from the steady-state microparticle velocity in DC plasma 18/08/2016 05:22:07 PM	Time per run [s]	
		Gas	neon
		Crew activity	Particle trapping

Module	Power	HV	RF	TMTA	PO	OM	DCGC	VC	Pos
Usage	x	x		x	x		x	x	x

	Microparticle charge and ion drag force	Flowchart



Parameters				
	Constant	Variable within experimental run	Feedback from HCI variation in pauses	Variable between experimental runs
HV	Active electrode: pulse generator EM electrode not used	***Microparticle trapping*** with 100 Hz polarity switching frequency, residual-drift-corrected 50% duty cycle ***Measurement:*** polarity switching 100 Hz polarity switching frequency, residual-drift-corrected 50% duty cycle and dc plasma ***Small Y-scan:*** polarity switching 100 Hz polarity switching frequency, residual-drift-corrected 50% duty cycle ***Standby*** (except for the very first occasion): polarity switching with 0.5 mA current, 100 Hz polarity switching frequency, residual-drift-corrected 50% duty cycle	***Microparticle trapping:*** offset (psOffset): 7.2/10	**Discharge current cycle** ***Measurement*** with current_[mA]: 0.5, 0.7, 1.0, 1.2, 1.5 Waiting time negative current [s]: 2, 2, 2, 2, 2 Waiting time positive current [s]: 8, 8, 8, 8, 8
TMTA	Not parameterized			
PO	PO cameras: FoV: 1600x480 central cutout gain 0 black level 600 frame rate 70 fps exposure time 14 ms PGO cameras: full FoV gain 512	***Microparticle trapping, Small Y-scan, Polarity switching, Measurement, Flushing:*** Illumination laser current 1.1 A ***Standby*** Illumination laser current 0.75 A		



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	**Microparticle charge and ion drag force**		Step-by-step procedure
Step number	Description	Execution	Remark
1.	Set illumination laser current 0.75 A	Script	
2.	**Begin *Pressure cycle***	Script	
2.1.	Set current pressure	Script	
2.2.	**Begin *Discharge current cycle***	Script	
2.2.1.	**Begin *Standby***		
2.2.1.1.	Set gas flow 0.5 sccm	Script	
2.2.1.2.	User action: Enter dispenser number	Ground	**CP 1**: Possible LOS break. Dispenser 5
2.2.1.3.	User action: Adjust dispenser parameters if necessary	Ground	**CP 2**: Possible LOS break or crew notification. Continue only if crew ready for the activity
2.2.2.	**End *Standby***		
2.2.3.	Start recording all cameras	Script	
2.2.4.	Start spectrometer acquisition	Script	
2.2.5.	Set illumination laser current 1.1 A	Script	
2.2.6.	Wait 10 s	Script	

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	Microparticle charge and ion drag force	To be filled on console	CADMOS OPS	cons.	crew	Scientist	Console protocol
	p = 0.4 mbar	Date		Start time			

Step number	User action message/ *Experiment block*	1	2	3	4	5	Remark
		I = 0.5 mA	*I* = 0.7 mA	*I* = 1.0 mA	*I* = 1.2 mA	*I* = 1.5 mA	
1.	Standby: Enter dispenser number						Possible LOS break
2.	Standby: Adjust dispenser [number] settings						Possible LOS break or crew notification. Continue only if crew ready for the activity.
	▶/●						
	Microparticle trapping						Crew activity
3.	Adjust duty cycle and/or camera position if necessary						Fast execution on the scientists' request
	Small Y-scan						
	Measurement						
	Flushing						
	■/●						
4.	Standby: Was the cycle OK?						Possible LOS break

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Draft script programming and tests: finalizing the parametrization

- Finalizing the parametrization down to the smallest detail (e.g. cameras on full screen)
- Definition the parameters to be changed in flight scripts
- Final definition of text messages, log-file entries, etc.
- Simultaneous update of the documentation
- Major changes difficult

Flight script preparation: final checks

- Change of all parameters to flight values
- Formal check by an engineer
- Adding necessary technical steps (e.g. starting from and finishing in the pumping mode, LED and SAMS synchronization, etc.)
- Test run by a scientist
- Major changes unwanted

Flight script validation: formal run

- Execution of the entire campaign from initialization till switching off

- Scientific scripts are executed using the respective console protocols

- Each logical branch must be executed at least once

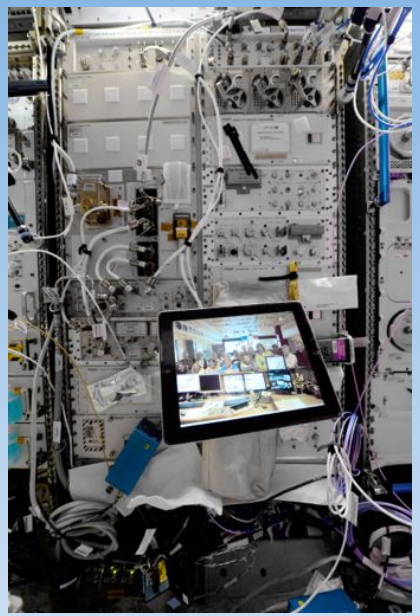
- After successful validation no changes allowed

Script delivery to OHB:
Campaign N – 6 weeks

Refreshment and campaign

Science team members are welcome!

PK-4 models

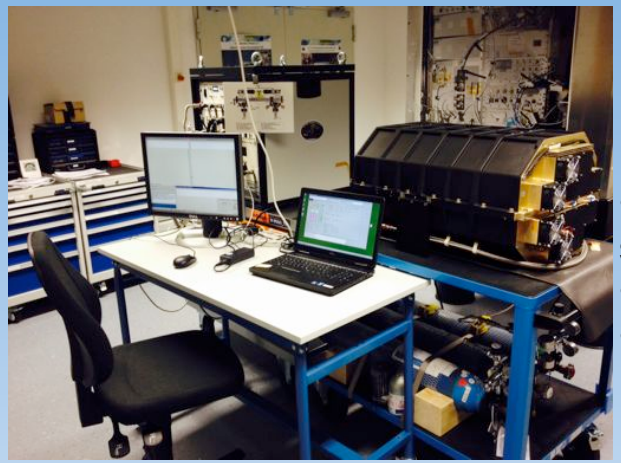


Flight model on the ISS

Experiment execution

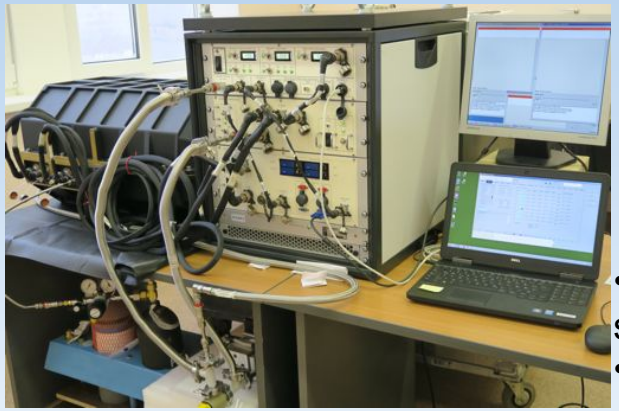
Ground model in CADMOS, Toulouse

Tests with EPM infrastructure



Science-Reference Model 1 in DLR-CP, Oberpfaffenhofen

- Tests of draft and flight scripts
- Flight script validation
- Refreshment



Science-Reference Model 2 in JIHT, Moscow

- Tests of draft and flight scripts
- Refreshment