ALIS_4D

Status report and some thoughts on the possibilities for using ALIS_4D as a testbed for establishing a common user interface for EISCAT_3D and complementary instruments

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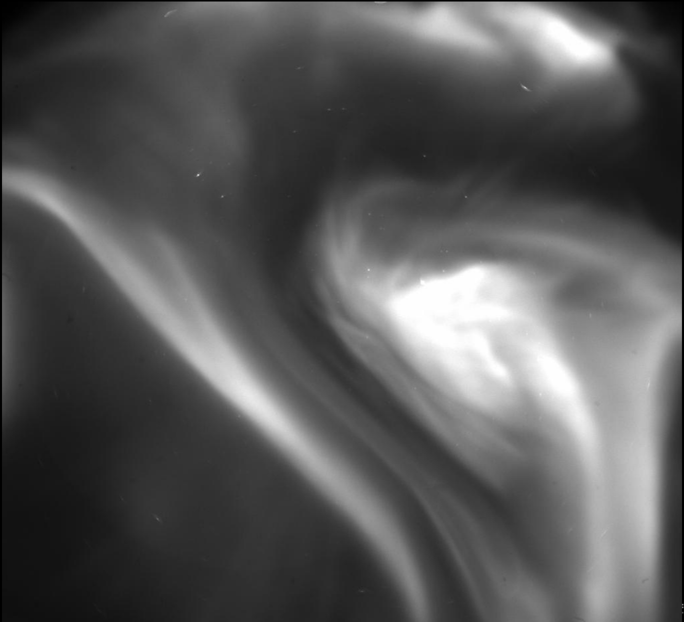
2019-05-20

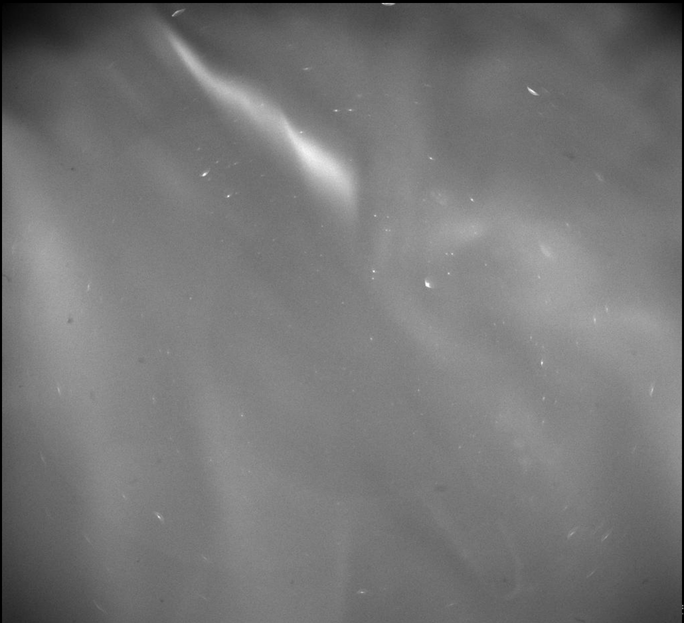
ALIS_4D

First light 2019-02-28 18:38:00.005608 11.006 s 6750 Å



ALIS_4D

First light 2019-02-28 18:42:00.005076 11.006 s 6562 Å



ALIS_4D

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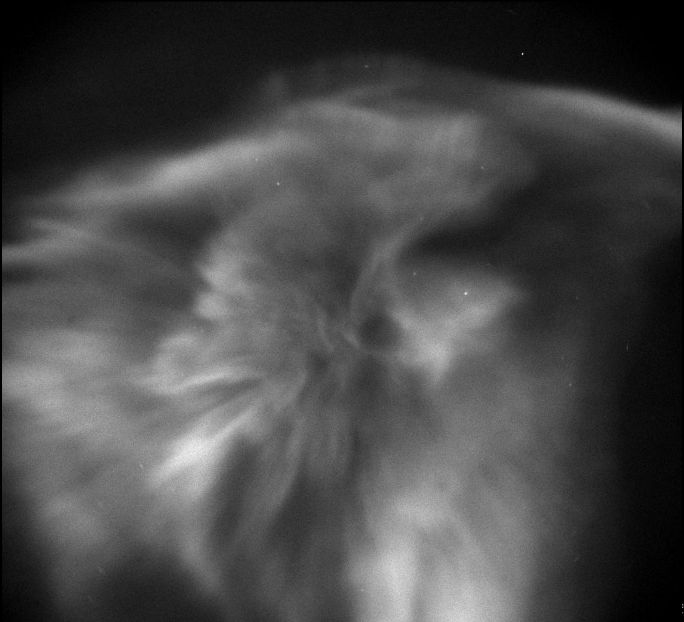

ALIS_4D

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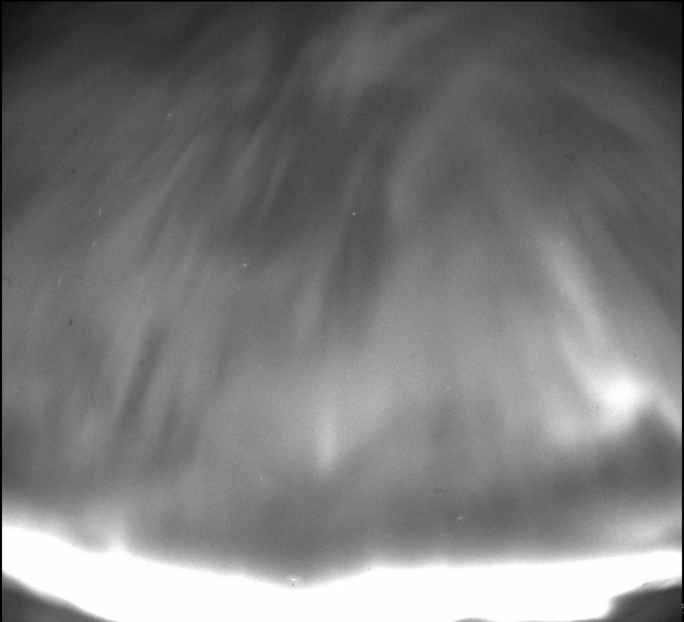
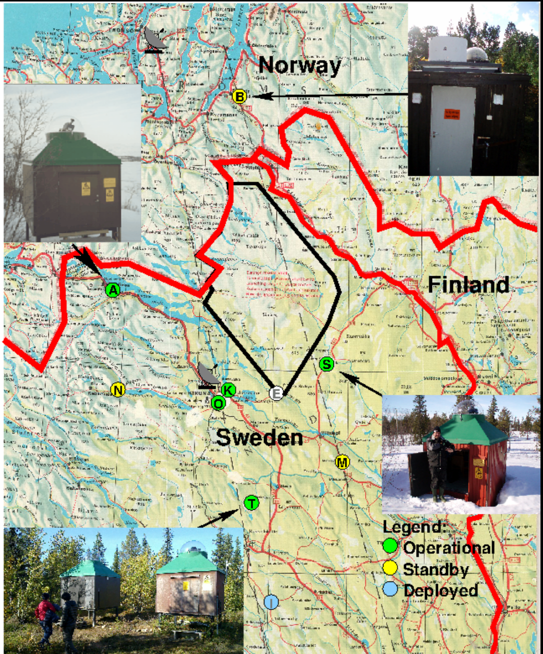


AILS_4D

A Swedish contribution to complementary instruments for EISCAT_3D

- High-time resolution ($>$ 25 FPS)
- Continuous operation (observatory modes)
- Status
  - 2016: (summer) Funding application (granted in November)
  - 2017: Procurement procedures, four imagers delivered, optics ordered
  - 2018: Optics delivery (April) Main development work. Tests in fall.
  - 2019: Continuous operations from fall. Ground support for SPIDER2 rocket.
- Funded by *Kempestiftelserna*, Faculty of Science and Technology at UmU and IRF.
- PIs Urban Brändström (IRF), Asta Pellinen-Wannberg (UmU)

ALIS_4D sites



ALIS/ALIS_4D

Comparision

	ALIS	ALIS_4D phase II
FoV	4 CCD $\approx 60°$ 1 EMCCD $\approx 30°$ (1 EMCCD $\approx 15°$)	4 EMCCD $\approx 136°$ 1 EMCCD $\approx 30°$ (1 EMCCD $\approx 15°$)
Res	$1024^2 \approx 100\mathrm{m}$ $256^2 \approx 500\mathrm{m}$	$1024^2 \approx 750\mathrm{m}$ $512^2 \approx 1.5\mathrm{km}$
Time	12 FPM	$>$ 25 FPS
Mode	Campaign only	monitoring/campaign
 worst case	 Sort of an Àttje	 normal

ALIS/ALIS_4D

Available filters

λ [Å]	$\Delta\lambda$ [Å]	Line	Remarks	#
3950	92	Ca, Fe	Meteors	1
4227	280	Ca, Fe, H_2O, ...	Meteors	1
4340.5	25	H_γ, Balmer series	Meteors	1
4278	50	N_2^+ 1Neg.	Aurora/Airglow	6
4861.3	25	H_β, Balmer series	Meteors	1
5100	40		Background	4
5577	40	$O(^1S)$	Aurora/Airglow	6
5893	200	Na, ...	Meteors	1
6230	40		Background	4
6300	40	$O(^1D)$	Aurora/Airglow	6
6562	70	H_α	SPIDER	4
6562.8	25	H_α, Balmer series	Meteors	1
6750	200	$N_2 1P$	SPIDER/LEEWAVES	4
8000	1000	OH Meinel	Airglow LEEWAVES	4
8446	40	$O(3p^3P)$	Aurora/Airglow $(O(3p^3P))$	4

ALIS/ALIS_4D

Preliminary absolute calibration

	Res.	Hz	R/count	λ_c
ALIS (CCD)	1024^2	0.04	13.4	5577Å
ALIS (CCD)	256^2	0.2	0.78	5577Å
ALIS (CCD)	256^2	0.2	1.74	4278Å
ALIS_4D (EMCCD)	1024^2	25	2.9	4278Å
ALIS_4D (EMCCD)	1024^2	25	0.4	5577Å
ALIS_4D (EMCCD)	1024^2	25	0.4	6300Å

Data production

“Harddisks are either new or full” Gustavsson

Hz	resolution	GiB/h	total GiB/h	GiB/night
0.1	256^2	0.02	0.09	1
0.1	512^2	0.09	0.4	6
0.1	1024^2	0.35	14.1	22
1	256^2	0.22	0.88	14
1	512^2	0.9	3.51	56
1	1024^2	3.5	14.06	225
25	256^2	11	44	352
25	512^2	44	176	1406
25	1024^2	176	703	5625

ALIS_4D

Software summary 2019-05-21

Aniara Software suite for ALIS/ALIS_4D written in C (GPL)

- `mima` Imager site daemon
- `saba` Positioning daemon
- `ud` "universal daemon" uses dynamic libraries (modules) for interfacing to various hardware (housekeeping unit, etc.)
- `fonoglob` Text-based user interface and interfacing daemon (web-interface, other things]

Not yet Real-time streaming quicklooks and keograms.

AIDA_tools Gustavsson, Sergienko (Matlab, Scilab) Main analysis software for ALIS/ALIS_4D, etc.

ALIS_4D

Status summary 2019-05-21

- Design goal: to be compatible with EISCAT_3D and similar efforts (in particular optical) in Norway, Finland (and Russia?).
- Both long-time monitoring and campaign mode observations
- Mechanical modifications of four ALIS filter-wheels for ALIS_4D nearly complete (May 2019).
- One prototype filter-wheel tested in lab. and dome.
- Initial absolute calibration of that system looks promising.
- ALIS_4D has usable software for operation, however some work remains.
- Much to explore regarding operating modes, observatory vs. campaign modes, etc.
- More or less on schedule (knock on wood)

Complementary experiences

ALIS/EISCAT campaigns 1990-present

- Many instruments lacks (proper) user interfaces
- Many combinations of operating systems, platforms and software.
- Realtime data access has improved over the years
- Observations missed as many experimenters assumed continous operation (ALIS)
- No common data license but many groups moving in that direction.
- Many of us re-invent the wheel several times
- No joint scheduling of EISCAT and complementary instruments, many PIs to contact
- Increasing Nordic collaboration on these matters

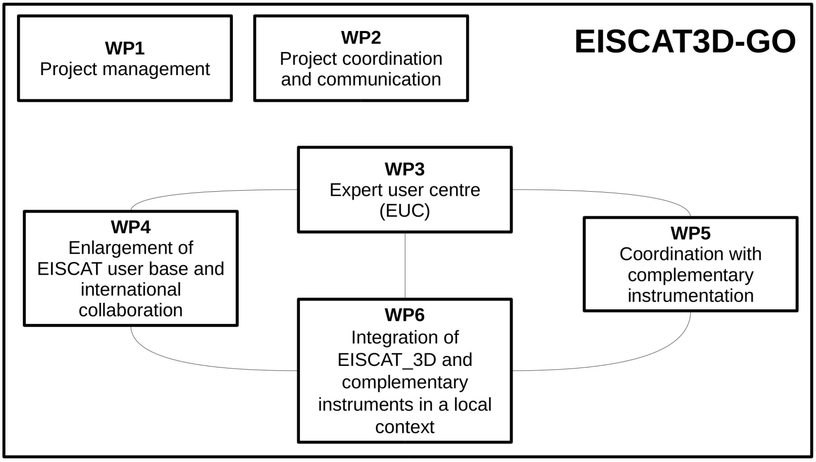
Disclaimer!

This is work in progress

- The work towards a common interface specification has not officially started yet!
- Just my thoughts for now on the possibilities for using ALIS_4D as a testbed for working towards a common interface specification
- Everyone is welcome to join this effort!

EISCAT_3D-GO

H2020-INFRADEV-2018-2020



EISCAT_3D-GO

WP6 Objectives

The EISCAT_3D project will enhance international interests to combine already existing instruments and deploy new instrumentation in northern Scandinavia for polar atmosphere and geospace studies.

The aims of this work package are:

- to facilitate the deployment, operation, and combined usage of these instruments together with EISCAT_3D,
- to enable user friendly access to interdisciplinary and multi-instrument data for polar atmosphere and geospace studies, and
- to provide support in coordinating and gaining access to EISCAT_3D observation time and data processing.

EISCAT_3D-GO

WP6 Tasks

- Task 5.1: Roadmap of complementary instruments
- Task 5.2: Scheduling and interoperability of EISCAT_3D and complementary instruments
  1. Participating complementary instruments needs to be included in the EISCAT scheduling system, this would simplify both for the users and instrument PIs.
  2. By adopting a common interface specification for accessing complementary instruments, it will be possible to include monitoring and control of these instruments from the main EISCAT_3D user interface. This is also a requirement for possibilities of automatic triggering and fast rescheduling of experiments based on real-time data.
  3. Agreement between participating instrument PIs of data usage policies, and conditions for taking control of a selected instrument.
- Task 5.3: Intelligent scheduling based on space weather monitoring

Towards a common interface specification

Suggested design requirements

- Platform independent (Everyone must be able continue to use their favourite operating systems and tools)
- Interoperability with other systems such as EISCAT_3D
- Possibility of combining several national infrastructures and instruments into larger units. One such example: BIFROST/ALIS_4D/MIRACLE

ALIS_4D

data levels

Level	Usage	Archived	Metadata
Level 0	N/A	N/A	N/A
Level 1	Binary dumps (technical tests only)	yes	no
Level 2	Unprocessed (raw) data stored as FITS-files	yes	yes
Level 3	Processed data in physical units	yes?	yes
Level 4	Higly processed data in physical units (e.g. 3D volume emission rate from tomography)	yes?	yes
(Level 5)	Final scientific results (e.g. publications)	yes	yes

Suggested levels of control

	Level of control	For example
C0	Not controllable, data only	Magnetometer, simple riometer
C1	Basic control ability	Simple ASC
C2	Advanced configuration and control abilities	ALIS/ALIS_4D Modern Ionosondes
C3	Realtime analysis capabilites capable of bidirectional command and control	Not yet
C4	As C3 but autonomous bidirectional decision-making and control	Not yet

The Open Systems Interconnection model

OSI (Open Source Interconnection) 7 Layer Model

Layer	Application/Example		Central Device/ Protocols			DOD4 Model
Application (7) Serves as the window for users and application processes to access the network services.	**End User layer** Program that opens what was sent or creates what is to be sent Resource sharing • Remote file access • Remote printer access • Directory services • Network management		**User Applications** SMTP		GATEWAY Can be used on all layers	Process
Presentation (6) Formats the data to be presented to the Application layer. It can be viewed as the "Translator" for the network.	**Syntax layer** encrypt & decrypt (if needed) Character code translation • Data conversion • Data compression • Data encryption • **Character Set Translation**		JPEG/ASCII EBDIC/TIFF/GIF PICT			
Session (5) Allows session establishment between processes running on different stations.	**Synch & send to ports** (logical ports) Session establishment, maintenance and termination • Session support - perform security, name recognition, logging, etc.		**Logical Ports** RPC/SQL/NFS NetBIOS names			
Transport (4) Ensures that messages are delivered error-free, in sequence, and with no losses or duplications.	**TCP** Host to Host, Flow Control Message segmentation • Message acknowledgement • Message traffic control • Session multiplexing	PACKET FILTERING	TCP/SPX/UDP			Host to Host
Network (3) Controls the operations of the subnet, deciding which physical path the data takes.	**Packets** ("letter", contains IP address) Routing • Subnet traffic control • Frame fragmentation • Logical-physical address mapping • Subnet usage accounting		**Routers** IP/IPX/ICMP			Internet
Data Link (2) Provides error-free transfer of data frames from one node to another over the Physical layer.	**Frames** ("envelopes", contains MAC address) [NIC card — Switch — NIC card] (end to end) Establishes & terminates the logical link between nodes • Frame traffic control • Frame sequencing • Frame acknowledgment • Frame delimiting • Frame error checking • Media access control		**Switch Bridge WAP** PPP/SLIP	Land Based Layers		Network
Physical (1) Concerned with the transmission and reception of the unstructured raw bit stream over the physical medium.	**Physical structure** Cables, hubs, etc. Data Encoding • Physical medium attachment • Transmission technique - Baseband or Broadband • Physical medium transmission Bits & Volts		**Hub**			

Suggested layers of instrument control

Layer	Description	For example (ALIS_4D)
7	Top level interfaces	EISCAT_3D user interface
6	Translation	Between native interface(s) and other systems via a common interface specification (CIS)
5	Native user interface or API	web- and/or text-based user interfaces
4	Communication	`fonoglob -d` ("concentrator" daemon)
3	Instrument software	(`mima` imager daemon)
2	Internal firmware	(Imager firmware)
1	Hardware	(Imager, filterwheel, etc.)

Summary

- Start simple, (Absolutely not a “Grandiose master control of everything”)
- Instead: Free independent instruments in collaboration!
- We need a platform independent standard! (World-wide Web, TCP/IP)
- Need compatible data-licenses (credits authorship issues, etc)
- Joint scheduling by PI agreement
- Authorisation by PI agreement and scheduled requirements. (General, or per-experiment)
- Direction of control: EISCAT_3D controls ALIS_4D or vice versa (or both)
- Text-based interfaces for experts, web-based for simpler usage. (One does not exclude the other)
- Please join!
- Work in progress!

References I