A permanent double-station meteor camera setup in the Netherlands

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Introduction

The cameras

Pointing geometry

Data processing

Status and initial results

Conclusions and future work

Introduction

- Previous activities of ESA/RSSDs meteor group:
  - observing campaigns during meteor showers, in particular for the Leonid storms in 1999, 2001, and 2002 (e.g. Koschny *et al.* 2002)
- Lately: mount existing equipment permanently to set up a double-station camera system
  - continously monitor meteor activity throughout the year
  - Produce height and orbit data
- First setup is in place in the Netherlands
  - has been producing useful data
- Another setup in the Canary Islands is in preparation – see Jonathan's talk

The Cameras

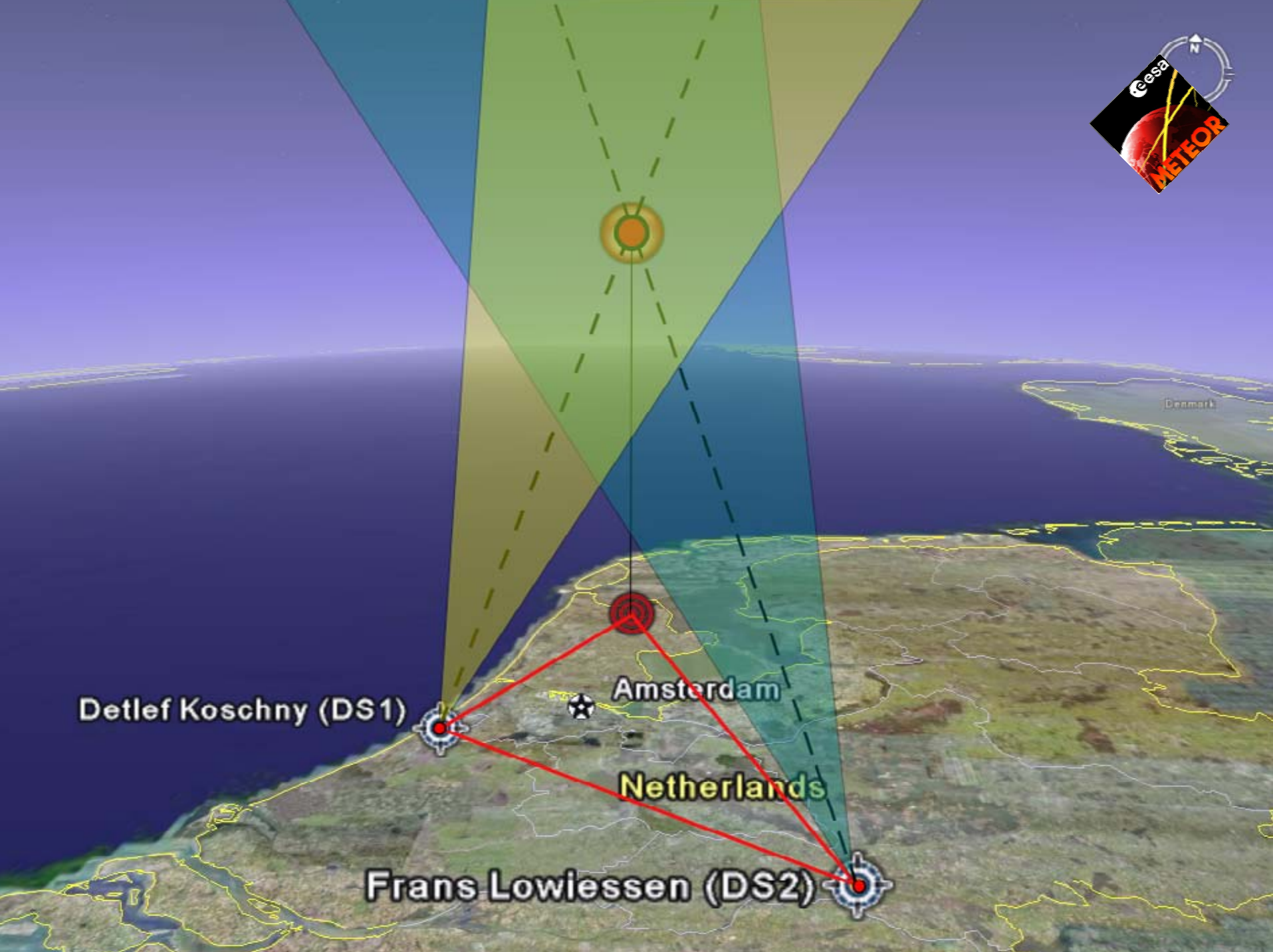
- ESA/RSSD uses image-intensified video cameras (called ICC = Intensified Video Camera) with the following properties:
- Fujinon 25 mm f/0.85 lens yielding a field of view of 22 deg x 28 deg
- Lens heater - from Kendrick, operated on 12 V
- Image intensifier - 2nd Generation MCP intensifiers with fiber input window from DEP, model no. XX1700DB. Operated on 3 V.
- Sony XC-77CE Video camera, 2/3" CCD (directly coupled via fiber taper to output of intensifier), 756 (H) x 581 (V) pixels, 50 dB (12 bit) dynamical resolution, operating on 12 V.

Pointing Geometry

- The pointing of the two cameras was selected to fulfill the following requirements:
  - Point higher than 45 degrees above the horizon
  - Point towards the north such that the sun and the moon will not enter the field of view
  - Point to a common altitude of 100 km

Table 1: Station coordinates and pointing direction

Station name	Camera code	Latitude	Longitude	Pointing azimuth	Pointing elevation
Noordwijkerhout	ICC4	52°15'55"	04°29'26"	217.6°	60.6°
Bergharen	ICC2	51°51'51"	05°39'10"	153.7°	45.1°
Aiming point		52°40'00"	05°00'00"	100 km height	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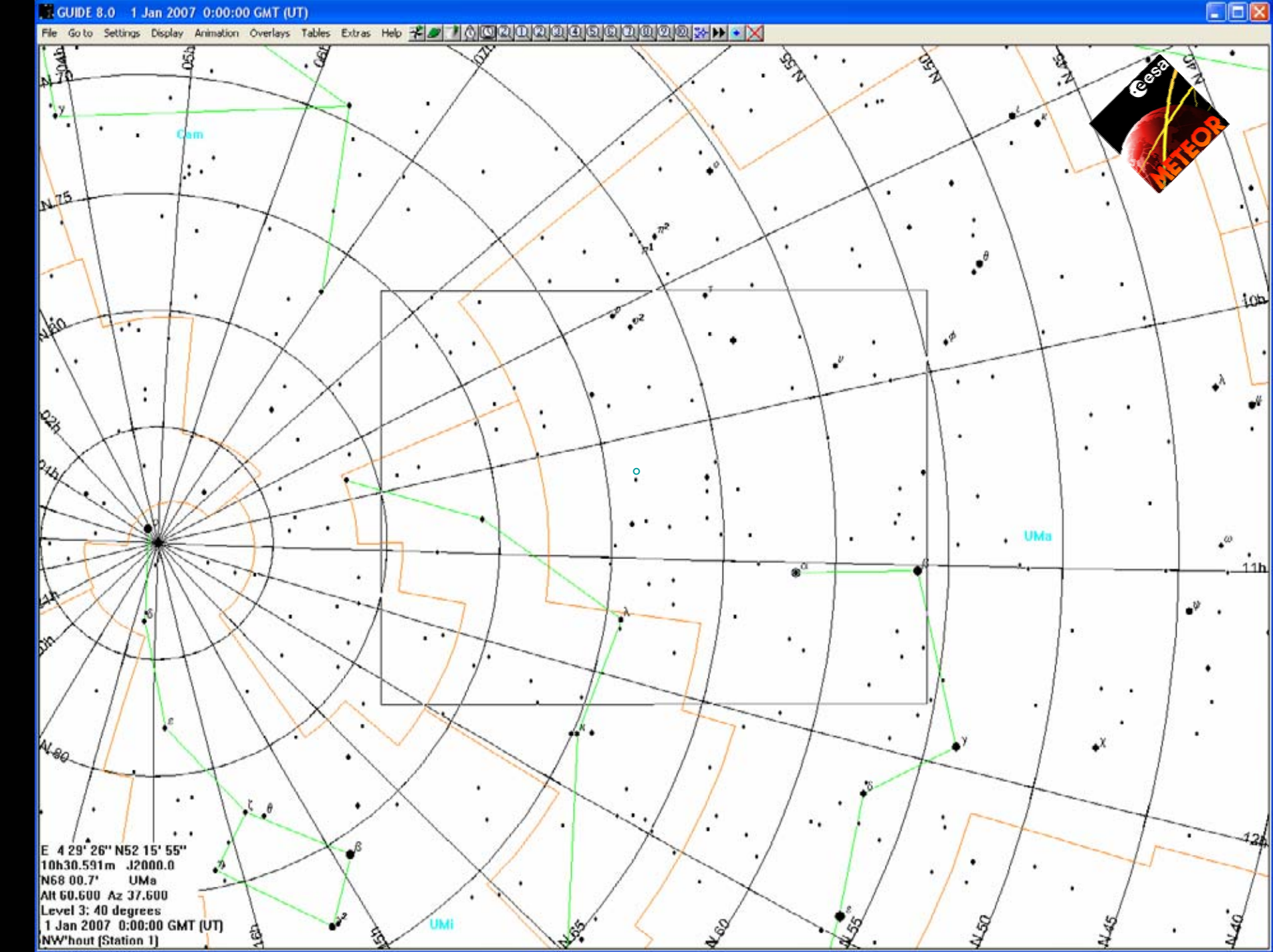
Denmark
Amsterdam
Detlef Koschny (DS1)
Netherlands
Frans Lowiessen (DS2)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UMa
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N70
N65
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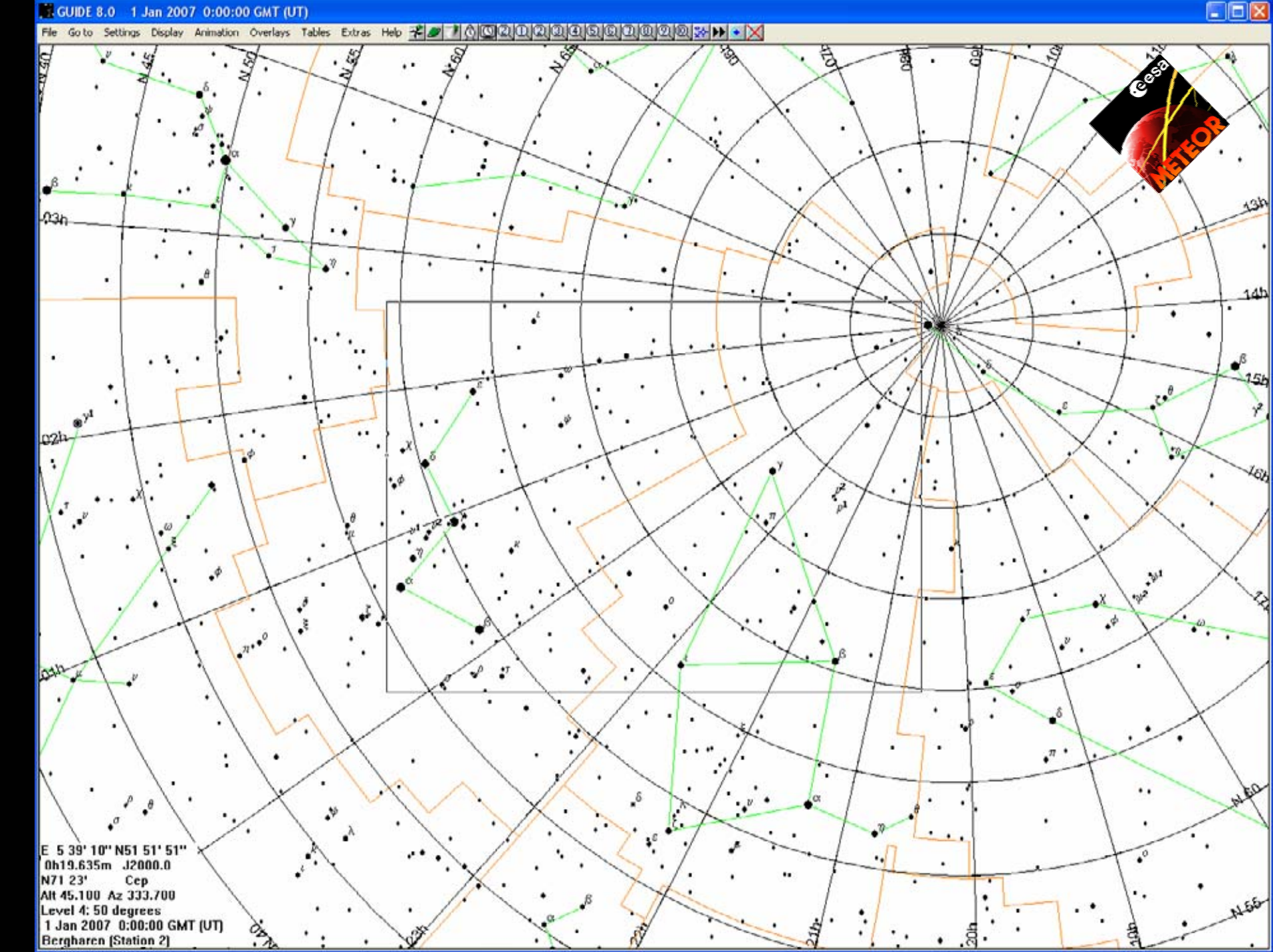
N40
02h
01h
00h
23h
10h
11h
12h
E 4 29' 26" N52 15' 55"
10h30.591m J2000.0
N68 00.7' UMa
Alt 60.600 Az 37.600
Level 3: 40 degrees
1 Jan 2007 0:00:00 GMT (UT)
NW'hout (Station 1)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esa
METEOR
E 5 39' 10" N51 51' 51"
0h19.635m J2000.0
N71 23' Cep
Alt 45.100 Az 333.700
Level 4: 50 degrees
1 Jan 2007 0:00:00 GMT (UT)
Bergharen (Station 2)

Data Processing

- Video signal -> Matrox Meteor II frame grabber card -> MetRec running on PC (Molau and Nitschke, 1996) with DOS
  - Detect meteors automatically, storing
  - a total image of a detection
  - an animation
  - a file containing the event position and brightness for each frame the event was detected
- At the end of the night, use PostProc to
  - delete false detections (clouds, airplanes)
  - put data on common ftp server, where it is analysed using the Meteor Orbit and Trajectory Software MOTS (Koschny and Diaz, 2002b) to find parallel meteor observations an compute height profiles and orbits.

Status

- Setup is in operation since January 2007
  - ICC2: 27 nights (until end of April)
  - ICC4: 30 nights
- Parallel operations in 17 nights
- In a typical night, between 10 and 30 meteors were recorded, with 5 to 10 meteors observed simultaneously.
- Non-simultaneous meteors occur when:
  - The meteor is too close or too far away from one station to be visible in both field of views;
  - One station had clouds;
  - The meteor was very faint and could only be recorded at the station with the better visibility conditions (typically this was ICC2, which has darker skies)
- In the moment, the software routines to select the simultaneous meteors are still being tested and debugged.

Table 2: Times of meteors as recorded by ICC2 and ICC4 on 20 Apr 2007. During about 3 hours of simultaneous operations, 5 parallel meteors were observed.

ICC2	ICC4
21:31:32	
21:44:29	
21:52:25	
22:03:12	
22:11:45	
22:30:53	
	22:50:47
23:02:12	
	23:11:49
	23:19:05
	23:24:55
23:49:06	
23:53:23	23:53:23
23:59:10	
0:09:33	0:09:33
0:34:01	0:34:00
	0:35:04
1:27:00	
1:44:17	
1:58:16	
2:00:54	
	2:04:18
2:07:47	2:07:46
	2:13:26
2:14:38	2:14:37
2:27:04	
2:43:33	2:43:32
2:44:14	
2:46:37	
2:56:10	
2:58:19	
3:01:41	
3:02:51	

Initial Results

#	St.	Time	Pos. (begin) x	Pos. (begin) y	Pos. (End) x	Pos. (End) y	Max. Mag.	Max Obs Mag.	Vel. (Km/s) v	Vel. (Km/s) ±v	Height (meters) Begin	Height (meters) End	Height (meters) ±pos	Radiant (RA:Hours, Dec:°) alpha	Radiant (RA:Hours, Dec:°) delta
1	1	23:53:23	0.003	0.416	0.043	0.402	4.2	5.5	41.318	46.064	165225.6	158100.1	360.3	17.982	35.347
1	2	23:53:23	0.547	0.090	0.692	0.301	4.4	5.2	56.666	9.672	125528.7	111519.2	419.9	17.900	39.338
2	1	00:09:33	0.491	0.777	0.488	0.794	4.7	4.8	17.533	2.102	88769.7	86018.0	12.6	15.950	71.654
2	2	00:09:33	0.544	0.640	0.560	0.690	3.9	4.6	17.676	1.393	94029.4	89338.7	20.3	15.868	70.928
3	1	02:07:46	0.063	0.778	0.059	0.911	2.8	3.0	48.199	2.901	92757.6	81450.7	25.1	17.363	53.335
3	2	02:07:47	0.340	0.186	0.377	0.495	3.8	4.5	53.171	43.332	107273.5	84477.4	1104.5	17.739	54.819
4	1	02:14:37	0.310	0.773	0.324	0.793	4.6	5.0	46.954	0.000	99694.0	98007.1	0.0	18.104	33.220
4	2	02:14:38	0.424	0.432	0.433	0.516	4.3	5.1	45.474	3.123	102118.3	97555.4	9.2	18.093	32.160
5	1	02:43:32	0.501	0.090	0.696	0.164	-1.7	-1.5	60.358	7.526	103815.2	98857.1	46.6	19.362	-2.669
5	2	02:43:33	0.860	0.285	0.902	0.584	4.3	5.8	12.527	14.134	107864.8	133399.0	4367.8	20.058	-67.723

Conclusions and future work

- The double-station meteor camera has started to deliver data, which can be used to produce meteoroid orbits on a daily basis. Ongoing work includes:
  - Double-checking the orbit code and comparing it to other codes
  - Automating the setup
  - Defining and implementing a database for the orbit data
  - Implementing a similar station under better sky conditions in the Canary Islands

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