Status of the CAMS-BeNeLux network

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Status of the CAMS-BeNeLux network

CAMS = Cameras for All Sky Meteor Surveillance
= Professional project financed by NASA
= To validate the IAU Working List of Meteor Showers
= Running since November 2010
= Totals > ~250.000 accurate meteor orbits

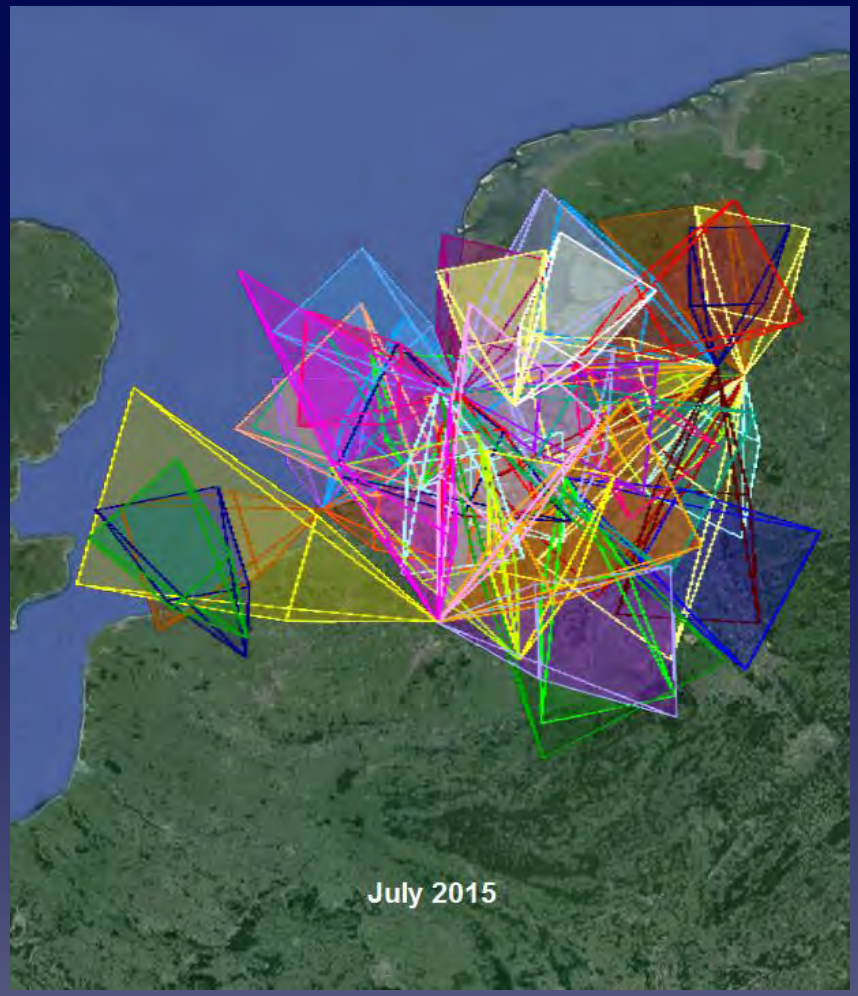
Single CAMS = Introduced by Pete Gural in June 2011
= Used for the Draconids 2011
= Play time for amateurs during Orionids 2011
= Start of CAMS-BNL in March 2012

Status of the CAMS-BeNeLux network

CAMS California & New Zealand

Single CAMS by amateurs

Status of the CAMS-BeNeLux network



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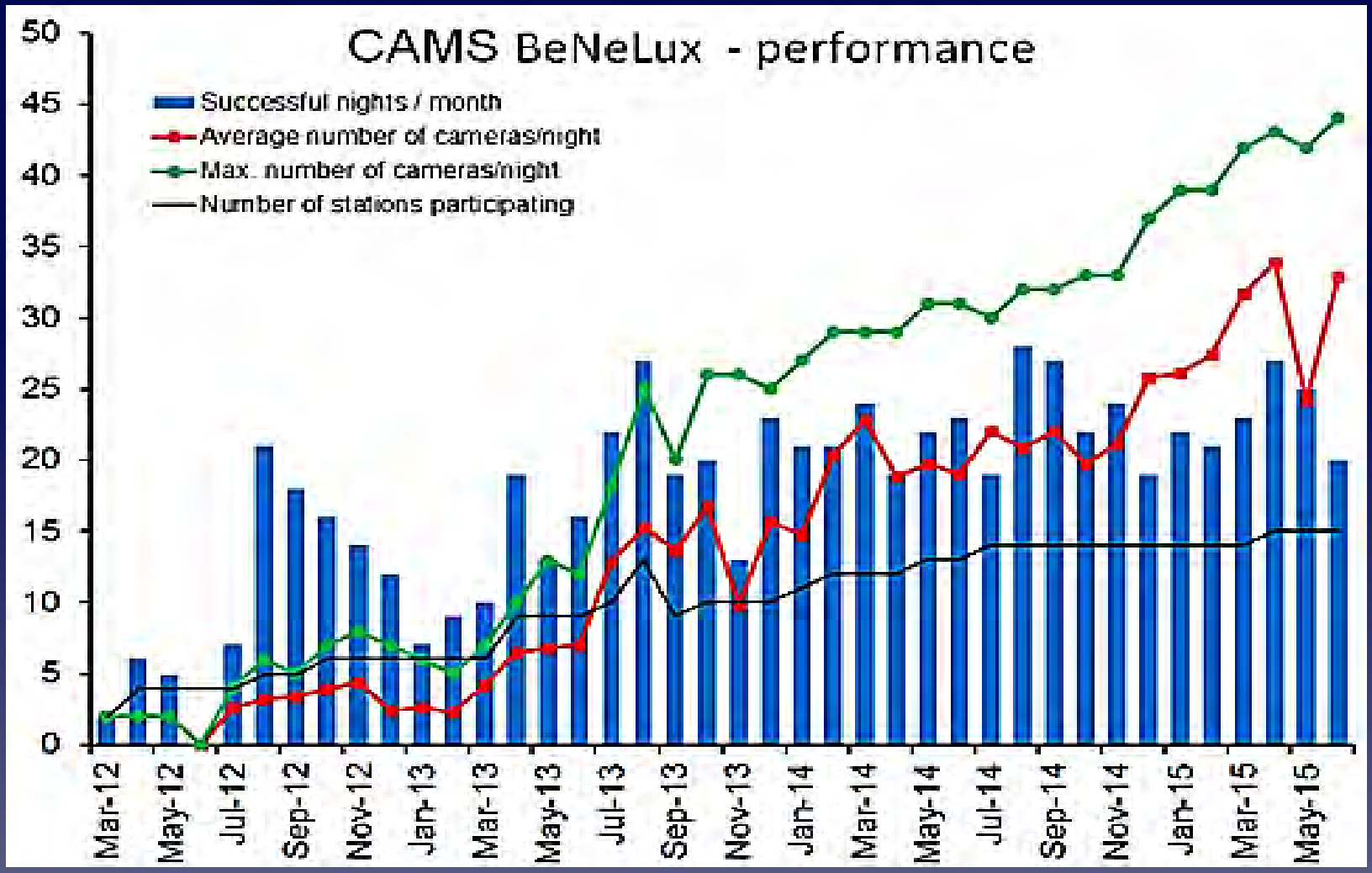

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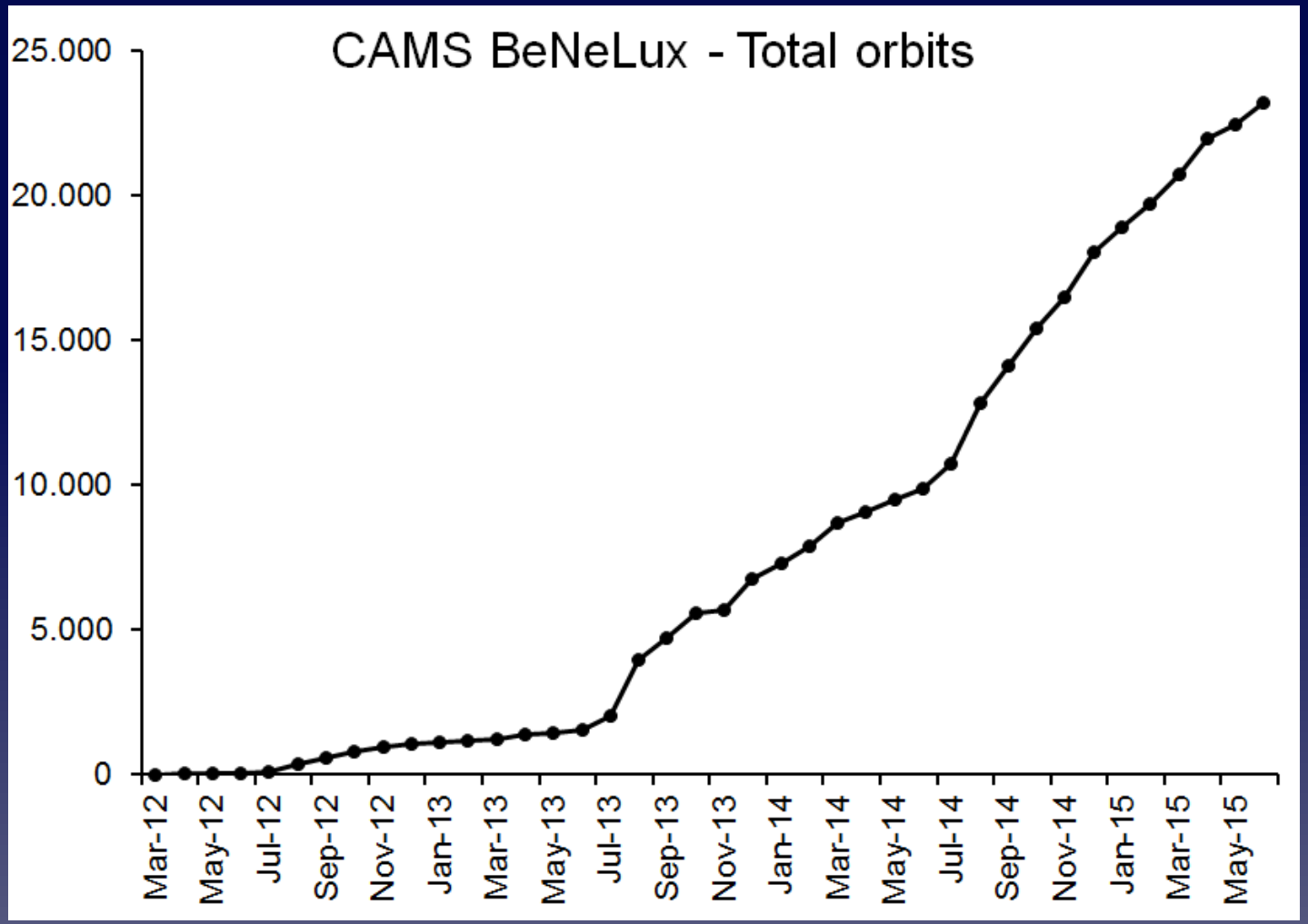


Status of the CAMS-BeNeLux network

TOTAAL	01-02	02-03	03-04	04-05	05-06	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24	24-25	25-26	26-27	27-28	28-29	29-30	30-31	31-01	
Januari	1	53	456	68	2	57	10	21	36	90	64	13	76	6	99	88	1	7	0	11	57	44	5	46	1	43	4	35	13	28	8	1.443
Februari	62	85	76	89	65	128	5	29	9	4	33	30	43	16	93	19	51	32	5	5	89	55	74	142	5	72	100	0	0	0	0	1.416
Maart	28	44	117	91	65	80	122	80	83	84	144	168	82	6	5	60	71	0	29	1	30	113	48	49	70	54	78	41	52	2	10	1.907
April	41	35	4	64	39	74	15	97	47	42	79	10	40	90	76	69	100	78	122	162	64	101	106	0	17	2	77	65	10	58	0	1.784
Mei	14	33	63	34	65	16	0	0	34	27	2	77	66	25	43	48	65	48	59	49	2	6	64	30	24	15	7	32	14	29	5	996
Juni	25	29	64	60	60	86	64	40	49	51	90	56	18	30	77	64	27	1	0	11	13	33	12	5	28	0	76	8	73	110	0	1.260
Juli	61	10	59	0	13	22	25	30	37	0	8	0	18	53	45	30	80	66	16	60	42	65	134	100	17	39	0	19	77	136	101	1.363
Augustus	158	126	73	207	161	87	119	99	166	303	446	754	252	155	160	1	43	19	79	86	57	59	63	37	40	168	123	76	46	30	152	4.345
Septembe	12	175	147	116	128	22	60	51	11	40	129	84	41	105	79	88	117	64	18	7	15	78	23	35	54	55	172	108	76	104	0	2.214
Oktober	78	115	136	18	27	91	62	16	45	43	44	4	67	0	33	34	33	213	80	48	132	25	114	21	27	139	215	21	44	211	212	2.348
November	53	19	29	28	34	84	79	18	12	297	37	91	15	39	4	24	7	12	7	27	52	11	20	216	66	0	16	107	25	1	0	1.430
December	2	22	8	68	31	112	128	24	99	241	123	235	651	91	23	16	2	0	114	75	0	30	0	85	81	20	174	24	111	13	107	2.710
																																23.216

0 orbits:	17
>0 orbits:	348
>100 orbits	63

Status of the CAMS-BeNeLux network

CAMS-BNL Highlights from July 2014 till June 2015:

- 189 Kappa Cygnids orbits associated in 2014, did the 2007 event repeat itself?
- 890 Perseid orbits (Full Moon 10 August 2014) > for a later topic
- Any trace of the 1567 Leonids dust trail?
- 528 Geminids orbits > for a later topic
- 163 Quadrantid orbits in 2015, did we see the radiant contract?
- February a boring month meteor-wise?
- 86 Lyrids orbits in 2015
- June 2015: Phi Piscids and Upsilon Andromedids orbits.

Status of the CAMS-BeNeLux network

250 **K-Cygnids**

For the range

$\alpha \approx [220^\circ$ to $310^\circ]$

$\delta \approx [+39^\circ$ to $+74^\circ]$

$V_g \approx [12$ to 34 km/s$]$

$i \approx [16^\circ$ to $46^\circ]$

$\omega \approx [150^\circ - 216^\circ]$

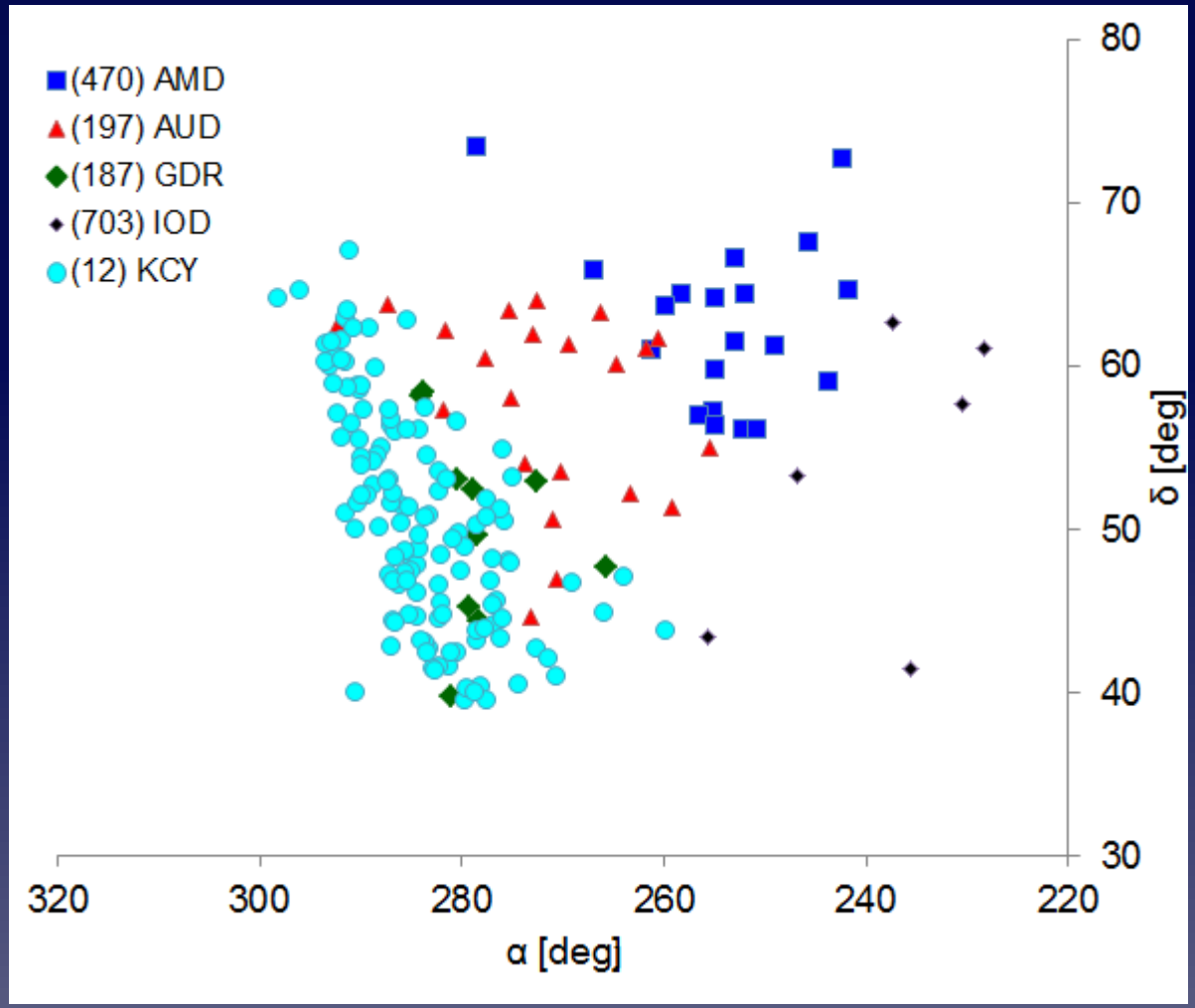
$\lambda_\odot [115^\circ - 158^\circ]$

At right:

189 radiant positions

D-criterion < 0.105

with the associated sources according to the best D_{SH}-value



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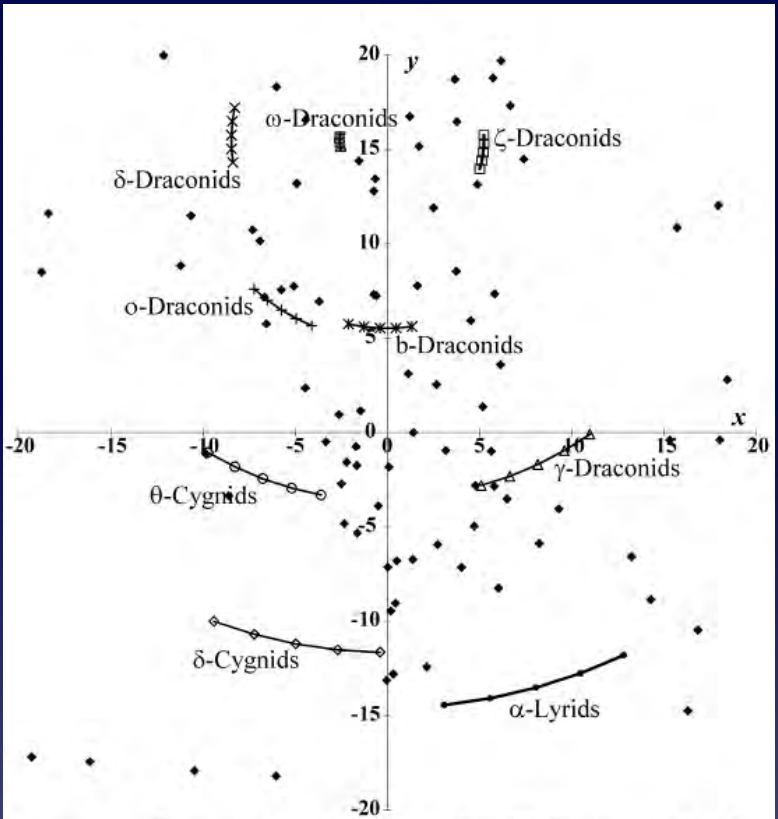


Figure 1 – Denning's radiants in the CDC area with photographic radiants (solid diamonds; see Koseki 2009): azimuthal equidistant projection in ecliptic coordinates centered at $(\lambda-\lambda_\odot, \beta)=(160^\circ, +75^\circ)$. The line $\lambda-\lambda_\odot=160^\circ$ runs along the y-axis. Ecliptic pole at (x,y)=(0,15). Intervals on axes marked in degrees.

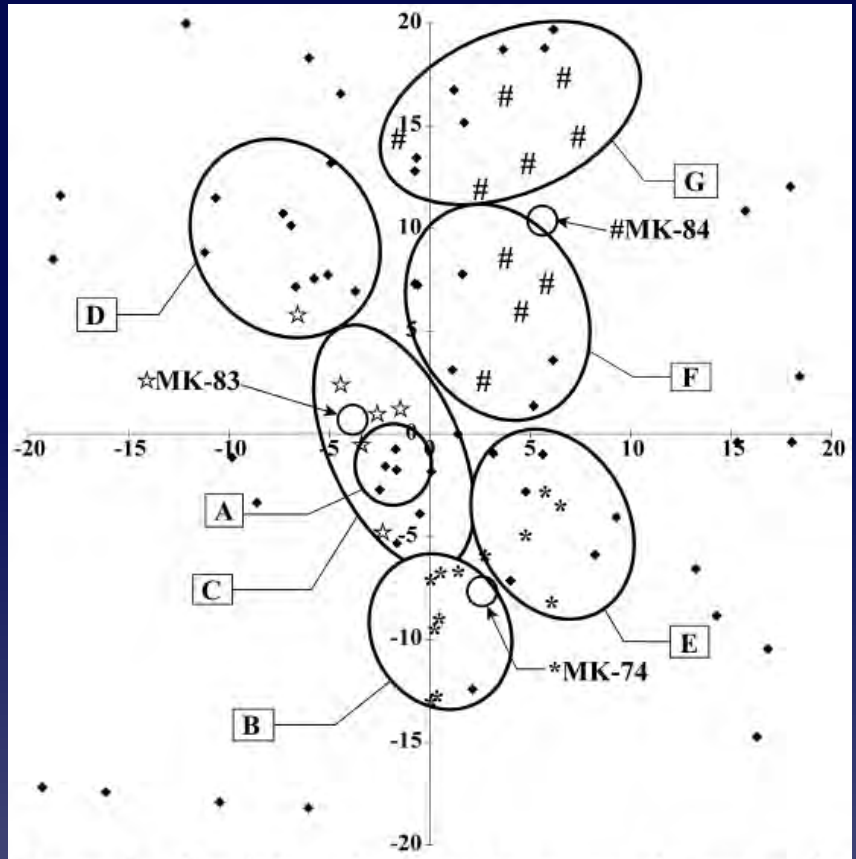


Figure 5 – Koseki's 3 photographic meteor showers in the CDC area: asterisks are members of MK-74, stars are members of MK-83, and sharps are members of MK-84. For ellipses A–G see Figure 6.

Status of the CAMS-BeNeLux network

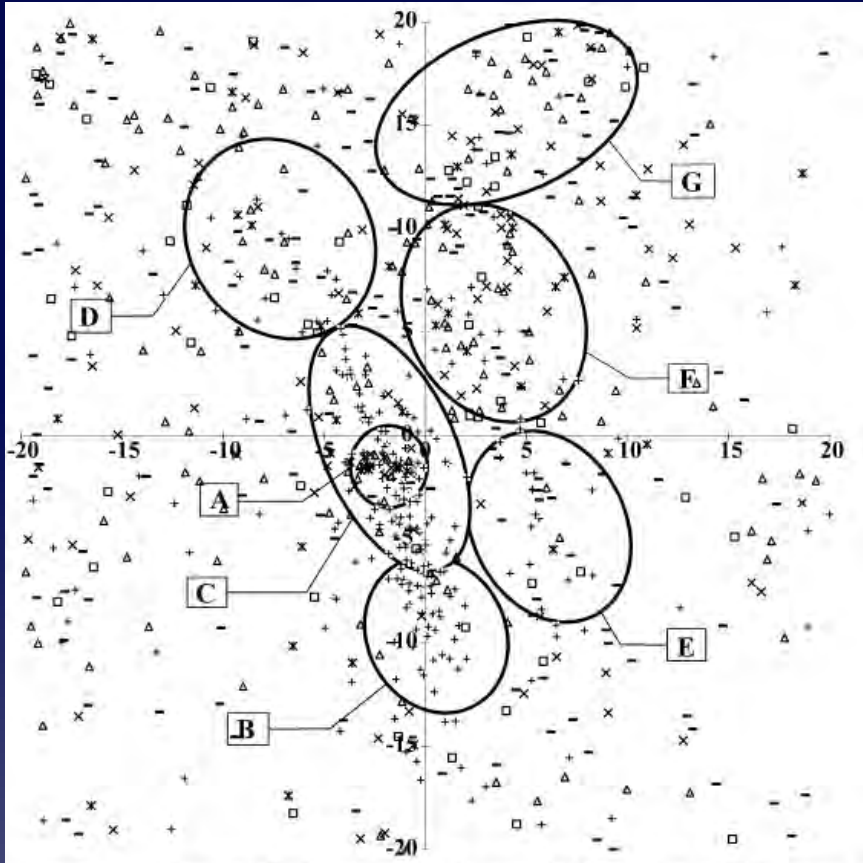
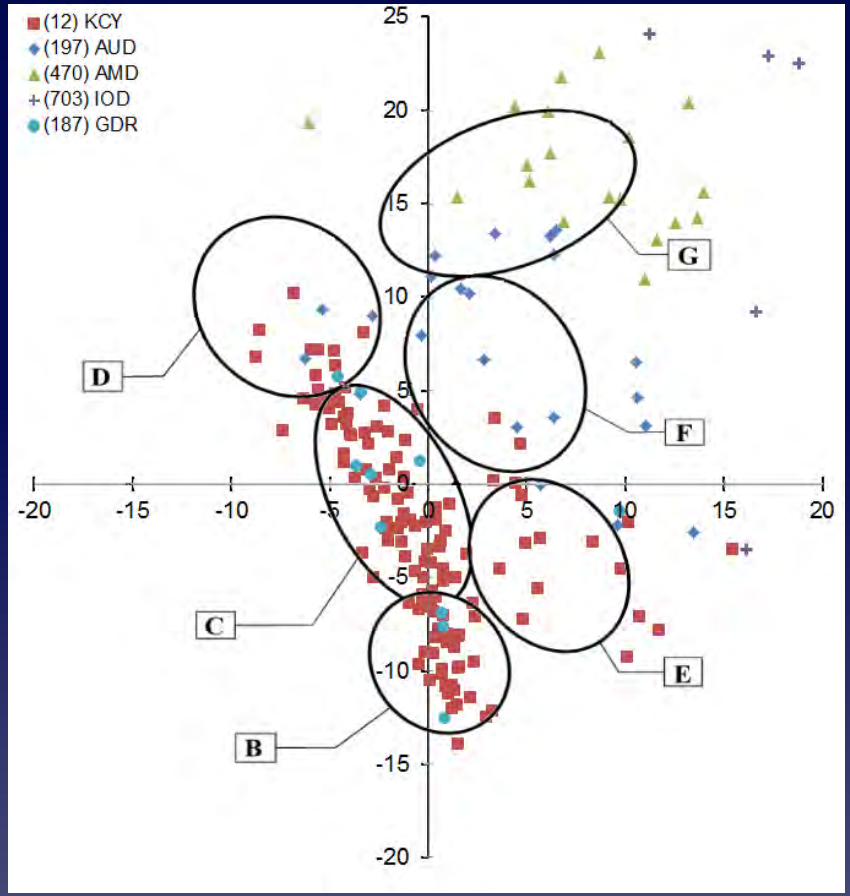
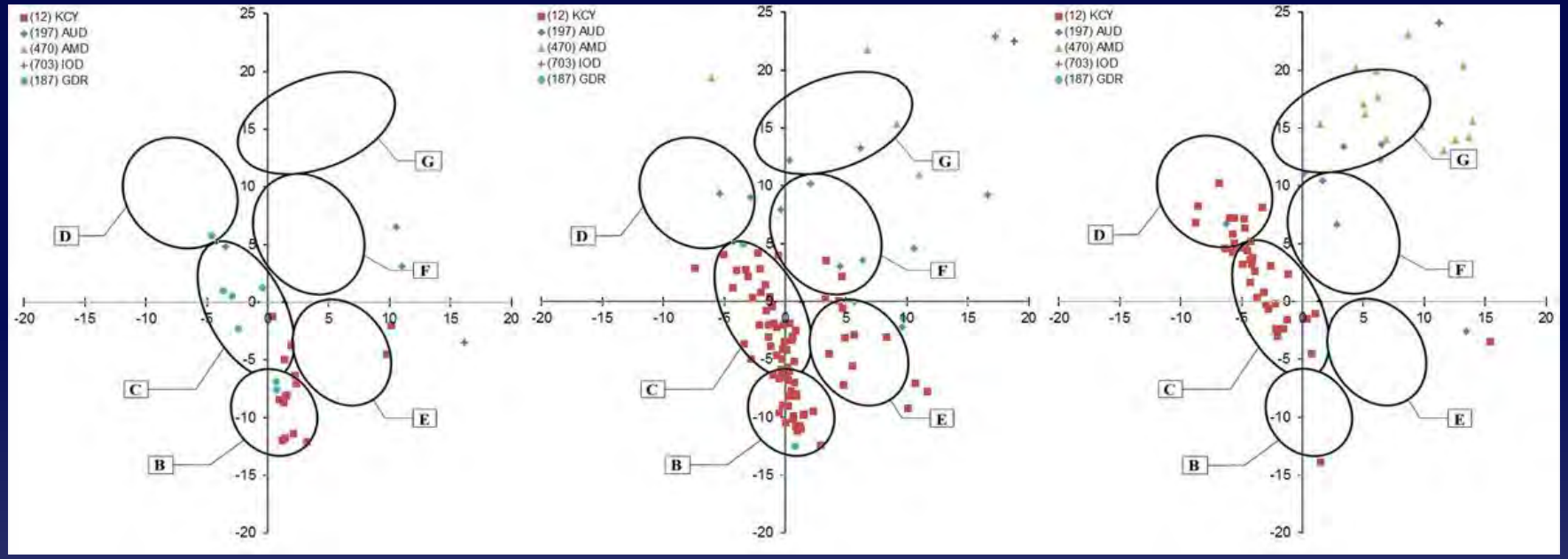


Figure 6 – SonotaCo's video radiants 2007–12 in CDC area $120 \leq \lambda_{\odot} < 160°$. Meteor radiants concentrate in 7 ellipses A–G. Symbols are 2007 (plus), 2008 (asterisk), 2009 (cross), 2010 (triangle), 2011 (square), and 2012 (short bar).



The 2007 Kappa Cygnid event re-occurred in 2014.

Status of the CAMS-BeNeLux network

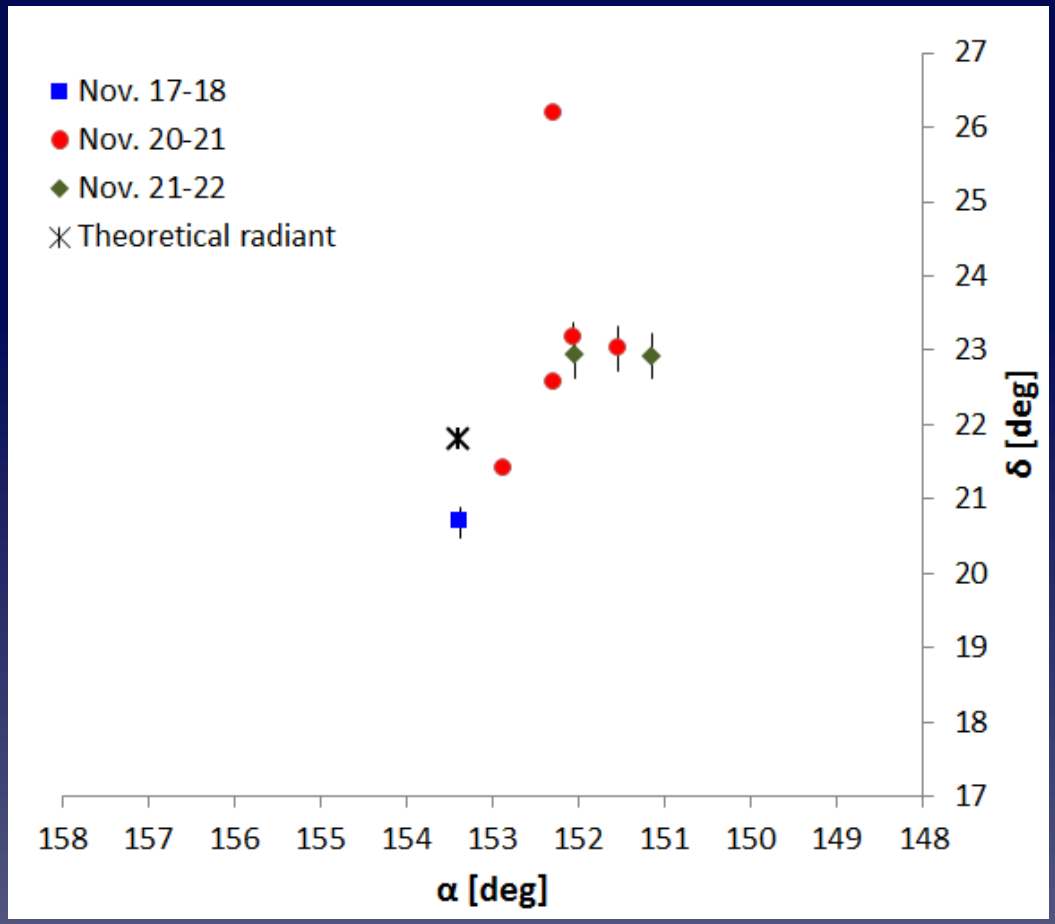


189 radiant positions for 2014 with a $D_{SH} < 0.105$ and the associated sources according to the best D_{SH}-value, plotted in ecliptic coordinates relative to the groups previously described by Koseki (2014) splitted in three periods of time: at left $\lambda_{\odot} < 130°$, in the middle $130° < \lambda_{\odot} < 145°$ and at right $\lambda_{\odot} > 145°$.

Based on the 131 κ-Cygnid with $D_{SH} < 0.105$, a radiant drift:
$\Delta\alpha/\Delta\lambda_{\odot} = +0.51°$, $\Delta\delta/\Delta\lambda_{\odot} = +0.59°$. = much more than used in the IMO Shower Cal.
Koseki (2014) has $\Delta\alpha/\Delta\lambda_{\odot} = +0.60°$, $\Delta\delta/\Delta\lambda_{\odot} = +0.62°$ (interval $120° < \lambda_{\odot} < 150°$).

Status of the CAMS-BeNeLux network

Any trace of the 1567 Leonids dust trail?



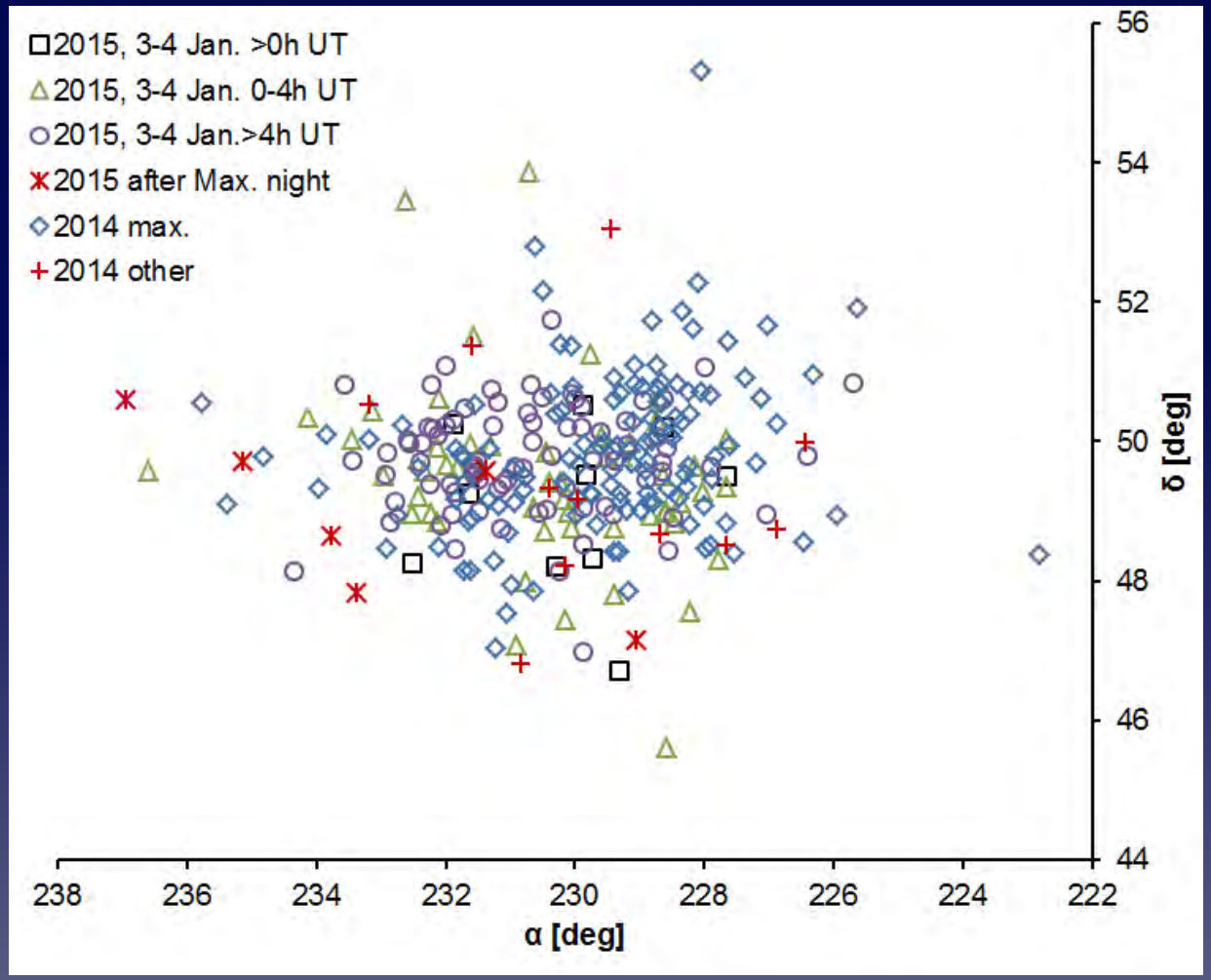
Status of the CAMS-BeNeLux network

Quadrantids

38 cameras on 3–4 Jan. 2015
270 orbits, 143 Quadrantids of high quality.
Max.: January 4, at 2^h UT

27 cameras on 3–4 Jan. 2014
186 orbits, 125 Quadrantids of high quality.
Max.: January 3, at 20^h UT

IMO : $\alpha = 230°$, $\delta = +49°$
2014: $\alpha = 229.6° \pm 1.9°$ and $\delta = +49.8° \pm 1.2°$ (CAMS)
2015: $\alpha = 230.6° \pm 1.7°$ and $\delta = +49.6° \pm 1.0°$ (CAMS)
Compact radiant, not diffuse!



Status of the CAMS-BeNeLux network

Quadrantids

The information about a diffuse Quadrantid radiant with a very compact radiant nucleus during the peak hours appeared systematically in the IMO Shower Calendar as well as in the older Handbooks.

Prentice (1940) mentions "*It is well known that the radiant of the quadrantid shower is exceedingly complex and apparently covers a wide area at least 20° in diameter, with center about 230° +50°*". (This was the source of the information in the IMO publications).

In CAMS data we could not find any indication for a diffuse Quadrantid radiant. But the number of orbits beyond the maximum night is indeed small.

Status of the CAMS-BeNeLux network

Oh, so boring month of February

39 Cameras active, 21 partial clear nights, 777 orbits:
10 minor showers from the IAU Working list of Meteor showers could be identified.

427 FED (Feb. η-Draconids):

- 3–4 February 2011, CAMS in California registered 6 orbits; Nothing found with SonotaCo;
- Two very similar orbits by CAMS-BNL on 3-4 Feb. 2015;
- Nothing by CAMS California although perfect conditions;
- Very short duration source?

	California	BNL-1	BNL-2
YYYYMMDD	2011.02.04	2015.02.04	2015.02.04
Time (UT)		$18^h15^m55.86$	$18^h21^m09.30$
H_b (km)	103.6±1.4	108.4	101.6
H_e (km)	95.7±1.5	89.9	90.8
α (°)	239.92±0.50	239.92±0.11	240.92±0.34
δ (°)	+62.49±0.22	+62.31±0.23	+62.36±0.44
V_g (km/s)	35.58±0.34	35.18±0.11	35.06±0.17
q (AU)	0.971±0.0001	0.97083±0.00027	0.97238±0.00061
$1/a$ (AU^{-1})	-0.004±0.025	0.0293±0.0119	0.0299±0.0212
e	>1	0.9715±0.0115	0.9709±0.0206
i (°)	55.2±0.34	54.916±0.163	54.725±0.295
ω (°)	194.09±0.35	194.260±0.106	193.501±0.291
Ω (°)	315.07±0.10	315.3951±0.0003	315.3988±0.0004
Π (°)	149.2	149.655±0.106	148.900±0.292

Status of the CAMS-BeNeLux network

Oh, so boring month of February

February γ-Lyrids? Outburst (radio) 2015 February 5 10^h - 11^h UT.

- Canadian Meteor Orbit Radar: concentration at $\alpha = 285°$ and $\delta = +35°$.
- CAMS-BNL 38 cameras 4–5 Feb. 41 orbits, 5–6 Feb. 56, orbits 6–7 Feb. 116 orbits.
- Not any single orbit of CAMS-BNL matches the CMOR orbit.

429 ACB (α-Coronae Borealids):

- 2015 CAMS-BNL has 4 candidate orbits begin February, 2 end of January.
- D-criterion confirms 4 definitely belong to this minor shower.

506 FEV (February ε-Virginids):

- $\alpha = 201.7°$, $\delta = +10.4°$, $V_g = 63$ km/s.
- 2015 dataset CAMS-BNL has 3 orbits for this stream with a D-criterion 0.03 - 0.05.

Activity from 2015 CA40? Marco Langbroek discovered a fast moving minor planet that possibly crossed the Earth orbit some 3000 years ago.

- Checking for slow meteors 20–24 Feb. from $\alpha = 267°$, $\delta = 68°$ and $V_g = 8.1$ km/s.
- No meteors match orbit of this object, neither CAMS-BNL nor CAMS in California.

Status of the CAMS-BeNeLux network

Lyrids 2015

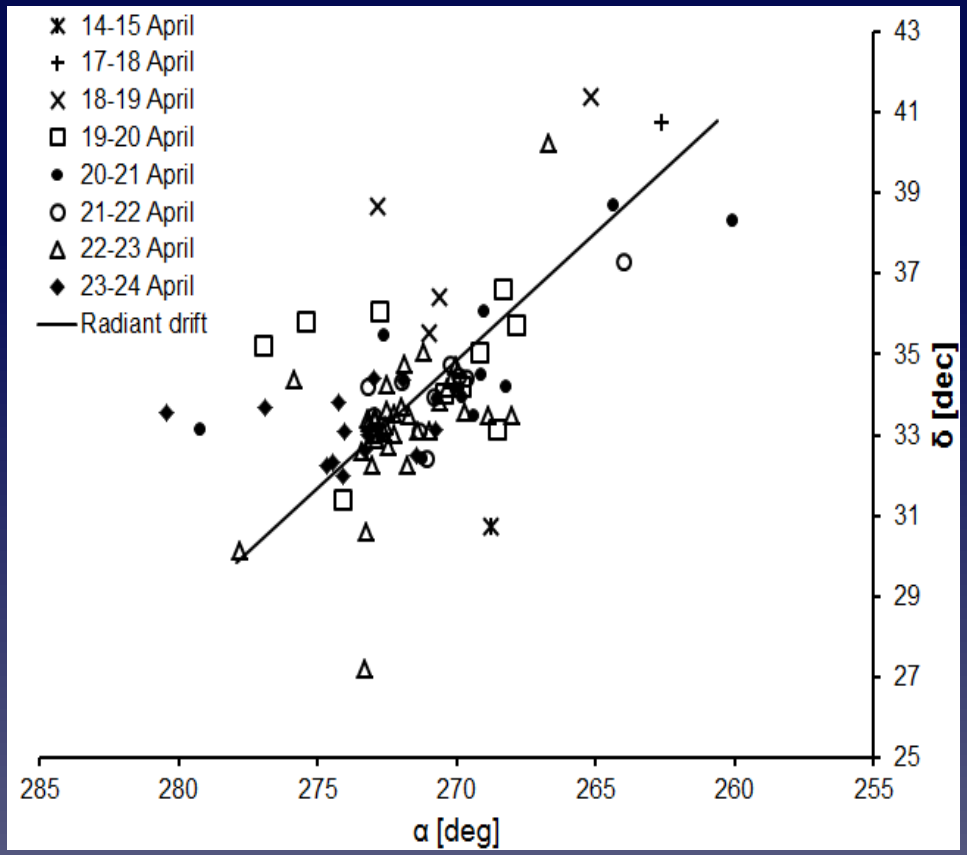
An exceptional period with clear night allowed the CAMS-BNL network to function with up to 43 cameras during 27 nights, 11 of which were only partial clear. In total 1212 orbits were obtained this month. The Lyrid activity could be well monitored and 86 Lyrid orbits were identified with a D-criterion < 0.105.

Rather diffuse radiant:
$\alpha = 271 \pm 3$ and $\delta = +34 \pm 2$ (°).
The radiant drift:
$\Delta\alpha = +0.78°$ and $\Delta\delta = -0.49°$.

Date	$\lambda_\odot$	CAMS	Orbits	Lyrids	α (°)	δ (°)
14–15	24.41	40	67	1	268.7	+30.7
15–16		38	35	0		
16–17		16	13	0		
17–18	27.38	41	89	1	262.6	+40.7
18–19	28.53	42	63	4	269.9	+38.0
19–20	29.41	42	88	10	271.3	+34.7
20–21	30.40	42	87	12	269.5	+34.9
21–22	31.42	41	58	10	270.5	+34.1
22–23	32.32	32	69	34	272.0	+33.3
23–24	33.33	43	69	14	273.9	+33.1

Status of the CAMS-BeNeLux network

Lyrids 2015



Date	$\lambda_\odot$	V_g	q	e	i	ω	Ω
14–15	24.41	50.8	0.921	1.097	85.8	212.53	24.40
17–18	27.38	40.1	0.929	0.905	65.8	212.60	27.37
18–19	28.53	43.6	0.948	0.915	73.5	207.92	28.52
19–20	29.41	46.3	0.935	0.963	78.6	210.49	29.40
20–21	30.40	45.1	0.921	0.934	76.3	213.91	30.39
21–22	31.42	45.7	0.918	0.940	77.4	214.85	31.41
22–23	32.32	46.6	0.918	0.952	79.3	214.67	32.31
23–24	33.33	47.0	0.925	0.945	80.4	213.22	33.32
All	31.44	46.2	0.923	0.948	78.4	213.50	31.44
DMS	32.4	46.6	0.921	-	79.6	214.3	31.8
Brown	32	46.6	0.915	0.916	80.0	215.71	32.0

Status of the CAMS-BeNeLux network

June 2015: 372 PPS (φ Piscids) and 507 UAN (υ Andromedids)

(372) PPS φ Piscids													
Year	$\lambda_\odot$	N	$\lambda_\odot$	α_{geo} (°)	Δα	δ_{geo} (°)	Δδ	V_{geo}	q	e	i (°)	ω (°)	Ω (°)
Brown 2010		1395	106	20.1	1.6	+24.1	0.4	62.9	0.856	0.590	152.6	125.2	106.0
PJ 2013		43	94	12.9		+22.0		67.1	0.883	0.898	152.6	136.7	97.7
SonotaCo				16.3		+23.4		66.6	0.882		152.2	136.2	101.6
VMN				15.3		+23.5		69.1					
CAMS 2014	95 - 101	13	100	18.9	0.77	+27.2	0.6	66.9	0.892	0.920	150.7	138.2	99.7
CAMS 2015	95 - 108	37	102	18.7	0.77	+26.9	0.3	66.1	0.891	0.882	148.5	137.6	101.9
(507) UAN υ Andromedids													
Year	$\lambda_\odot$	N	$\lambda_\odot$	α_{geo} (°)	Δα	δ_{geo} (°)	Δδ	V_{geo}	q	e	i (°)	ω (°)	Ω (°)
PJ 2011		13	98	19.8	1.18	+42.5	0.35	58.8	0.688	0.968	116.4	110.3	98.0
PJ 2010/13		28	96	7.1	0.96	+40.3	0.39	59.3	0.849	0.910	117.8	130.0	101.0
CAMS 2014	95 - 100	17	99	16.7	1.74	+43.2	0.60	58.2	0.759	0.931	114.9	118.4	98.6
CAMS 2015	95 - 109	20	99	20.5	1.07	+43.6	0.53	57.6	0.691	0.947	113.4	109.9	102.8

Status of the CAMS-BeNeLux network

Conclusions

- July 2014 – June 2015: 13313 orbits (8355 July 2013 – June 2014).
- 30 cameras at the beginning of this period and 45 at the end;
- Kappa Cygnids had a comparable enhanced activity as in 2007
- Few orbits may have been obtained for the 1567 Leonid dust trail
- More orbits for 10 Minor Shower sources in February
- No indication for a diffuse Quadrantid radiant
- A diffuse Lyrid radiant
- Interesting dataset for Phi Piscids and Upsilon Andromedids

Status of the CAMS-BeNeLux network

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- Pete Gural for having created the single CAMS software and continuous support.

Status of the CAMS-BeNeLux network

Thanks for your attention!

Questions?

Status of the CAMS-BeNeLux network

Table 1 – Comparing orbits from different sources for the Cygnid-Draconid-Complex. The CAMS-BNL dated, marked in bold, are compared with global CAMS-data, DMS data and sources described by Koseki (2014). The κ-Cygnids for CAMS-BNL (*) marked in italics are all κ-Cygnids, including the 40 orbits which result in a slightly better D_{SH} value for one of the minor streams.

Stream	$\lambda_\odot$	α	δ	V_g	q	e	i	ω	Ω	N	Source
184 GDR	125.3	280.1	+51.1	27.4	0.978	0.947	40.2	202.3	125.3	22	SonotaCo (2009)
184 GDR	125.3	279.6	+50.4	27.5	0.978	0.972	40.2	202.3	124.7	25	CAMS (2015)
184 GDR	125.9	278.3	+50.1	26.2	0.980	0.929	38.4	201.2	125.9	10	CAMS-BNL
Group A	125.9	280.2	+51.2	27.3	0.980	0.948	40.2	201.7	125.9	45	Koseki (2014, Tab.9)
703 IOD	135.79	239.0	+53.2	17.3	1.005	0.662	25.3	174..0	135.8	6	CAMS-BNL
α-Lyrids	136.9	278.7	+44.8	20.2	0.971	0.723	29.3	204.7	136.9	21	Photo (Koseki, 2014)
MK74	137.2	281.0	+44.6	20.7	0.968	0.728	30.1	206.4	137.2	12	Koseki (1982, 2009)
Group E	139.9	275.5	+44.7	18.1	0.983	0.645	26.5	201.5	139.9	80	Koseki (2014, Tab.9)
12 KCG	140.7	285.0	+50.1	21.9	-	-	-	-	-	213	SonotaCo (2009)
12 KCG	140.8	283.9	+50.5	22.0	0.977	0.694	33.6	203.5	140.8	131	CAMS-BNL
12 KCG	141	276.9	+53.6	21.4	0.995	0.688	32.6	197.4	141	32	DMS-1993
197 AUD	141.3	271.6	+57.7	20.8	1.006	0.626-	33.1	189.6	141.3	22	CAMS-BNL
Group B	141.8	286.8	+45.5	21.3	0.958	0.712	31.2	209.1	141.8	92	Koseki (2014, Tab.9)
12 KCG	141.9	279.1	+52.5	21.7	0.984	0.681	33.3	198.7	141.9	171	CAMS-BNL (*)
Group C	141.9	286.8	+53.1	23.2	0.977	0.706	36.0	203.6	141.9	95	Koseki (2014, Tab.9)
197 AUD	143	271.8	+58.8	21.1	1.008	0.640	33.5	188.9	142.8	28	CAMS (2015)
Group F	143.9	274.1	+57.3	21.0	1.003	0.634	33.3	191.6	143.9	89	Koseki (2014, Tab.9)
MK83	148.5	290.8	+55.8	25.0	0.978	0.758	38.8	202.5	148.5	6	Koseki (1982, 2009)
470 AMD	149	254.4	+62.5	21.3	1.009	0.648	33.8	175.5	149.5	53	CAMS (2015)
Group D	149.2	290.1	+63.6	27.2	0.993	0.720	44.0	195.4	149.2	29	Koseki (2014, Tab.9)
Group G	149.7	260.6	+63.0	21.8	1.010	0.643	34.8	178.2	149.7	77	Koseki (2014, Tab.9)
470 AMD	149.8	254.2	+62.6	21.1	1.008	0.638	33.4	174.3	149.8	20	CAMS-BNL
ζ-Draconids (P)	149.9	269.0	+61.7	22.0	1.008	0.659	35.0	184.3	149.0	18	Photo (Koseki, 2014)
ζ-Draconids (V)	151.3	255.1	+62.4	21.3	1.006	0.641	33.8	174.5	151.3	108	Video (Koseki, 2014)
MK84	152.4	267.1	+60.6	21.6	1.009	0.659	34.3	183.5	152.4	11	Koseki (1982, 2009)
703 IOD	157	232.3	+53.3	17.8	0.990	0.664	26.1	161.5	157.2	12	CAMS (2015)