

ERTMS Solutions

The Fast Track to ERTMS

Stanislas Pinte

ERTMS SOLUTIONS 



History

- Founded in 2003
- ERTMS Solutions
 - Privately owned
 - Track record in high-tech software products
- 2010: ERTMS Solutions Group
 - Brussels
 - Stockholm
 - *More to come (2012)*
- 30 People
 - 29 computer scientists and ERTMS specialists
 - Academic publication track record



A high-speed train, likely a Shinkansen, is shown in motion, blurred background, with text overlay. The train is white with blue accents and is moving towards the left. The background is a blurred landscape with power lines overhead.

What is our business?

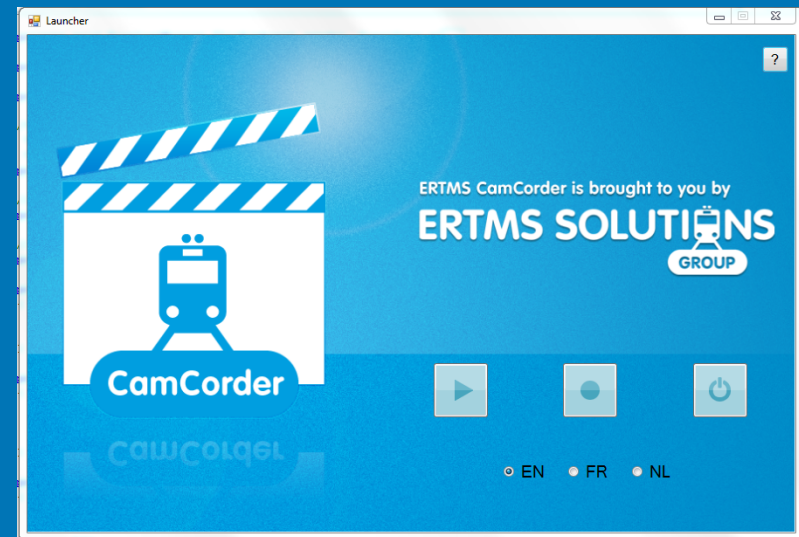
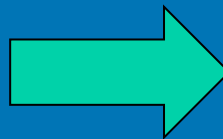
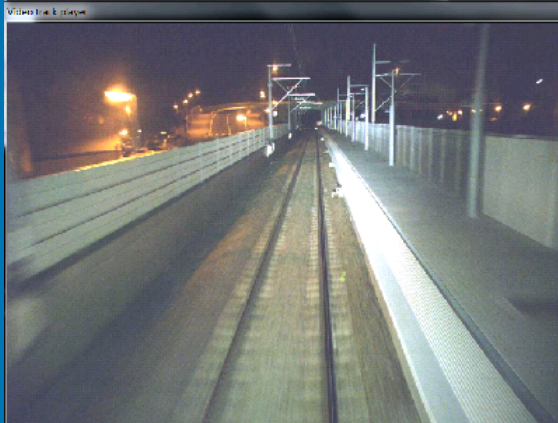
We provide standard
software and hardware
components to the
ERTMS industry

What is done today to gather evidence for ERTMS onsite tests?

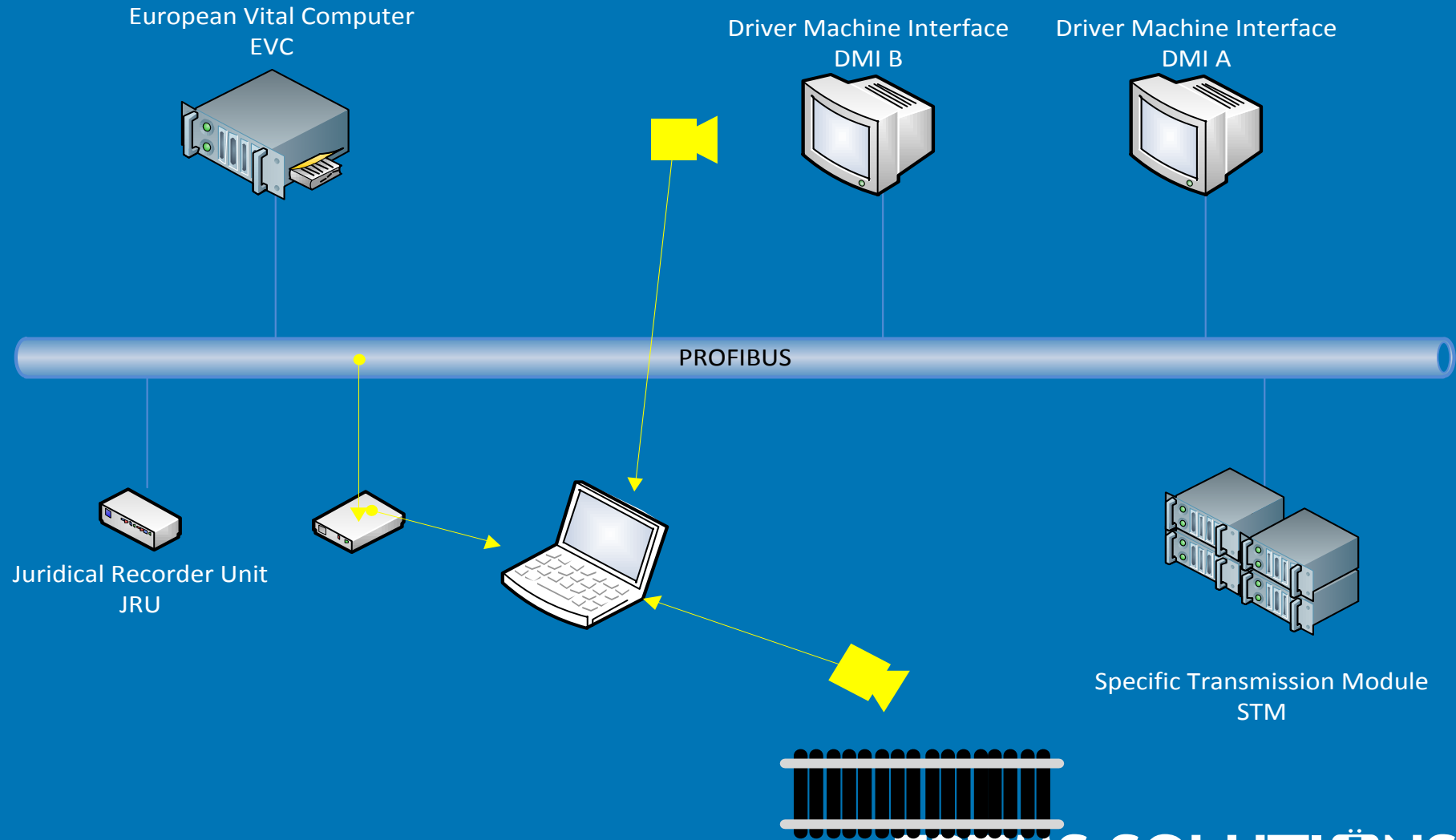


Unsynchronized, unintegrated data

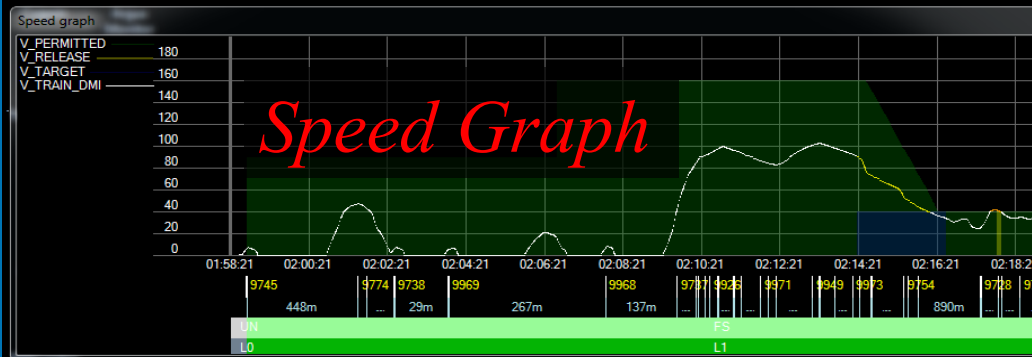
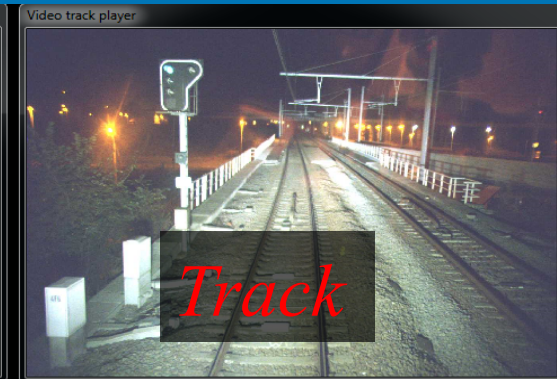
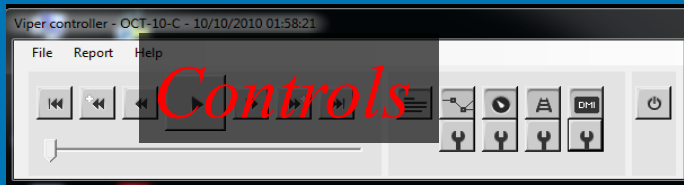
Synchronized recording of JRU Track and DMI



Synchronized recording of JRU Track and DMI



Analysis Overview



Messages

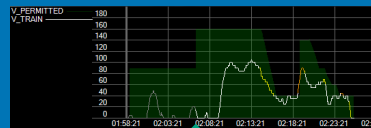
Filter Annot. |

Balises Euroradio Annotations Reverse
 Brake General Poi

Time	Nr	Mod	Lev	NID_L1	NID_C	V_1	D_LRI	Q_DIRLF	Q_DLRB	L_C	L_C	NIC	NID_OPER
01:58:21	34	UN	LO	9656	255	0	384	Nominal	Reverse	47	56	0...	1111FFFF
01:58:26	242	UN	LO	9656	255	0	384	Nominal	Reverse	47	56	0...	1111FFFF
01:58:31	458	UN	LO	9656	255	0	384	Nominal	Reverse	47	56	0...	1111FFFF
01:58:36	672	UN	LO	9656	255	0	384	Nominal	Reverse	48	57	0...	1111FFFF
01:58:41	884	UN	LO	9656	255	5	381	Nominal	Reverse	49	57	0...	1111FFFF
01:58:44	1016	UN	LO	9656	255	5	377	Nominal	Reverse	49	58	0...	1111FFFF
01:58:44	1017	UN	LO	9656	255	5	377	Nominal	Reverse	49	58	0...	1111FFFF
01:58:46	1089	FS	L1	9745	255	5	19	Nominal	Nominal	13	13	0...	1111FFFF
01:58:46	1090	FS	L1	9745	255	5	19	Nominal	Nominal	13	13	0...	1111FFFF
01:58:51	1300	FS	L1	9745	255	5	29	Nominal	Nominal	14	14	0...	1111FFFF
01:58:56	1510	FS	L1	9745	255	5	37	Nominal	Nominal	15	15	0...	1111FFFF
01:59:01	1720	FS	L1	9745	255	5	43	Nominal	Nominal	15	16	0...	1111FFFF
01:59:06	1936	FS	L1	9745	255	0	43	Nominal	Nominal	15	16	0...	1111FFFF
01:59:11	2148	FS	L1	9745	255	0	43	Nominal	Nominal	15	16	0...	1111FFFF
01:59:16	2360	FS	L1	9745	255	0	43	Nominal	Nominal	15	16	0...	1111FFFF
01:59:21	2570	FS	L1	9745	255	0	43	Nominal	Nominal	15	16	0...	1111FFFF
01:59:26	2780	FS	L1	9745	255	0	43	Nominal	Nominal	15	16	0...	1111FFFF
01:59:31	2994	FS	L1	9745	255	0	43	Nominal	Nominal	15	16	0...	1111FFFF
01:59:36	3202	FS	L1	9745	255	0	43	Nominal	Nominal	15	16	0...	1111FFFF
01:59:41	3410	FS	L1	9745	255	0	43	Nominal	Nominal	15	16	0...	1111FFFF
01:59:46	3620	FS	L1	9745	255	0	43	Nominal	Nominal	15	16	0...	1111FFFF
01:59:52	3832	FS	L1	9745	255	0	43	Nominal	Nominal	15	16	0...	1111FFFF
01:59:57	4048	FS	L1	9745	255	0	43	Nominal	Nominal	15	16	0...	1111FFFF

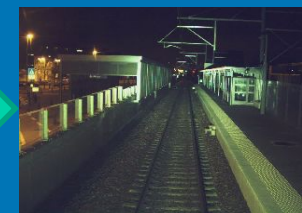
Events List

Analysis - Synchronisation

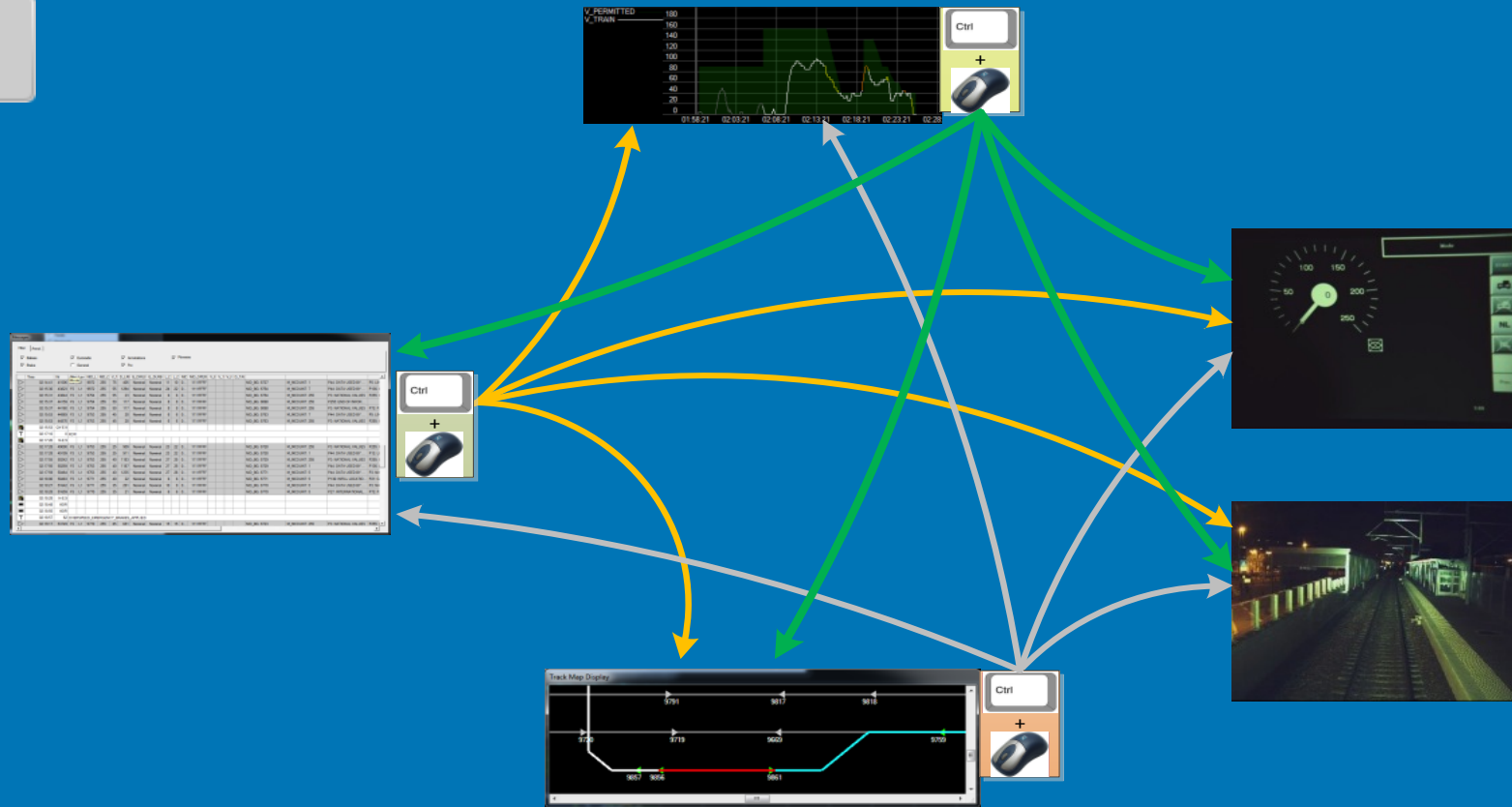


*DMI video
synchronizes Track
Video, Events list,
Speed Graph and
Track Map windows*

Time	Speed	Location
01:58:21	0	Station
01:58:22	10	Station
01:58:23	20	Station
01:58:24	30	Station
01:58:25	40	Station
01:58:26	50	Station
01:58:27	60	Station
01:58:28	70	Station
01:58:29	80	Station
01:58:30	90	Station
01:58:31	100	Station
01:58:32	110	Station
01:58:33	120	Station
01:58:34	130	Station
01:58:35	140	Station
01:58:36	150	Station
01:58:37	160	Station
01:58:38	170	Station
01:58:39	180	Station
01:58:40	190	Station
01:58:41	200	Station
01:58:42	210	Station
01:58:43	220	Station
01:58:44	230	Station
01:58:45	240	Station
01:58:46	250	Station
01:58:47	260	Station
01:58:48	270	Station
01:58:49	280	Station
01:58:50	290	Station
01:58:51	300	Station
01:58:52	310	Station
01:58:53	320	Station
01:58:54	330	Station
01:58:55	340	Station
01:58:56	350	Station
01:58:57	360	Station
01:58:58	370	Station
01:58:59	380	Station
01:59:00	390	Station
01:59:01	400	Station
01:59:02	410	Station
01:59:03	420	Station
01:59:04	430	Station
01:59:05	440	Station
01:59:06	450	Station
01:59:07	460	Station
01:59:08	470	Station
01:59:09	480	Station
01:59:10	490	Station
01:59:11	500	Station
01:59:12	510	Station
01:59:13	520	Station
01:59:14	530	Station
01:59:15	540	Station
01:59:16	550	Station
01:59:17	560	Station
01:59:18	570	Station
01:59:19	580	Station
01:59:20	590	Station
01:59:21	600	Station
01:59:22	610	Station
01:59:23	620	Station
01:59:24	630	Station
01:59:25	640	Station
01:59:26	650	Station
01:59:27	660	Station
01:59:28	670	Station
01:59:29	680	Station
01:59:30	690	Station
01:59:31	700	Station
01:59:32	710	Station
01:59:33	720	Station
01:59:34	730	Station
01:59:35	740	Station
01:59:36	750	Station
01:59:37	760	Station
01:59:38	770	Station
01:59:39	780	Station
01:59:40	790	Station
01:59:41	800	Station
01:59:42	810	Station
01:59:43	820	Station
01:59:44	830	Station
01:59:45	840	Station
01:59:46	850	Station
01:59:47	860	Station
01:59:48	870	Station
01:59:49	880	Station
01:59:50	890	Station
01:59:51	900	Station
01:59:52	910	Station
01:59:53	920	Station
01:59:54	930	Station
01:59:55	940	Station
01:59:56	950	Station
01:59:57	960	Station
01:59:58	970	Station
01:59:59	980	Station
02:00:00	990	Station



Analysis - Synchronisation



*(on train route
balises)*

Analysis – Event list

Messages

Filter Annot.

Balises Euroradio Annotations Reverse
 Brake General Poi

Time	Nr	Moc	Lev	NID_L	NID_C	V_1	D_LRI	Q_DIRLF	Q_DLRB	L_C	L_C	NID	NID_OPER	V_F	V_1	V_F	D_TAI				
02:24:06	67140	FS	L1	9865	255	45	510	Reverse	Reverse	13	13	0...	1111FFFF	--	40	40	30				
02:24:07	67156	FS	L1	9865	255	45	515	Reverse	Reverse	13	13	0...	1111FFFF	--	40	40	26				
02:24:07	67172	FS	L1	9865	255	45	518	Reverse	Reverse	13	13	0...	1111FFFF	--	40	40	22				
02:24:08	67188	FS	L1	9865	255	45	523	Reverse	Reverse	13	13	0...	1111FFFF	--	40	40	17				
02:24:08	67206	FS	L1	9865	255	45	527	Reverse	Reverse	13	13	0...	1111FFFF	--	40	40	14				
02:24:08	67216	FS	L1	9865	255	45	531	Reverse	Reverse	13	14	0...	1111FFFF	--	40	40	10				
02:24:09	67232	FS	L1	9865	255	45	535	Reverse	Reverse	13	14	0...	1111FFFF	--	40	40	5				
02:24:09	67246	FS	L1	9865	255	45	539	Reverse	Reverse	13	14	0...	1111FFFF	--	40	40	1				
02:24:09	67266	FS	L1	9865	255	45	543	Reverse	Reverse	13	14	0...	1111FFFF	--	--	40					
02:24:12	67372	FS	L1	9834	255	45	21	Nominal	Nominal	6	6	0...	1111FFFF					NID_BG: 9834	M_MCOUNT: 5	P44: DATA USED BY ...	P136: IN
02:24:12	67373	FS	L1	9834	255	45	21	Nominal	Nominal	6	6	0...	1111FFFF					NID_BG: 9834	M_MCOUNT: 255	P3: NATIONAL VALUES	P255: E
02:24:12	67374	FS	L1	9834	255	45	21	Nominal	Nominal	6	6	0...	1111FFFF								
02:24:12	67390	FS	L1	9834	255	45	26	Nominal	Nominal	6	6	0...	1111FFFF	--	--	40					
02:24:17	67616	FS	L1	9834	255	45	93	Nominal	Nominal	7	7	0...	1111FFFF					NID_BG: 9845	M_MCOUNT: 1	P255: END OF INFOR...	
02:24:17	67617	FS	L1	9834	255	45	93	Nominal	Nominal	7	7	0...	1111FFFF					NID_BG: 9845	M_MCOUNT: 1	P44: DATA USED BY ...	P3: NAT
02:24:17	67618	FS	L1	9834	255	45	93	Nominal	Nominal	7	7	0...	1111FFFF								
02:24:22	67826	FS	L1	9834	255	40	156	Nominal	Nominal	8	7	0...	1111FFFF								
02:24:24	67910	FS	L1	9834	255	40	179	Nominal	Nominal	8	8	0...	1111FFFF	--	--	40					
02:24:29	68122	FS	L1	9834	255	35	232	Nominal	Nominal	9	9	0...	1111FFFF								
02:24:34	68334	FS	L1	9834	255	35	278	Nominal	Nominal	10	10	0...	1111FFFF								
02:24:38	68480	FS	L1	9834	255	35	310	Nominal	Nominal	10	10	0...	1111FFFF					NID_BG: 9833	M_MCOUNT: 5	P44: DATA USED BY ...	P12: LE
02:24:38	68481	FS	L1	9834	255	35	310	Nominal	Nominal	10	10	0...	1111FFFF								
02:24:38	68497	FS	L1	9833	255	35	19	Nominal	Nominal	6	6	0...	1111FFFF					NID_BG: 9833	M_MCOUNT: 255	P3: NATIONAL VALUES	P255: E

Analysis – Event detail

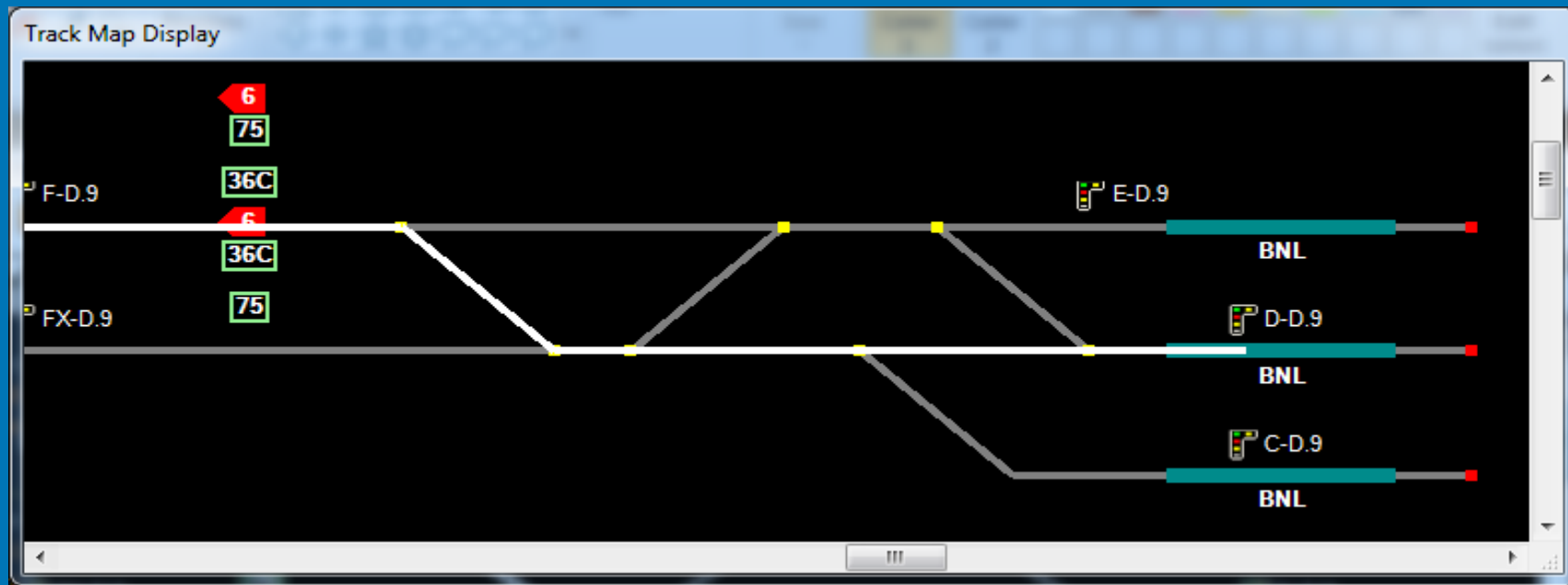
02:15:31.194

Name	Raw Value	Decoded Value	Description
006 TELEGRAM FROM BALISE			
NID_MESSAGE_ALSTOM	6	6	filler
EUROBALISE			Eurobalise
Q_UPDOWN	1	Up link telegram	Balise telegram transmission direction
M_VERSION	16	Class 1	Version of the ETCS language
Q_MEDIA	0	Balise	Qualifier to indicate the type of media
N_PIG	1	2	Position in Group
N_TOTAL	1	2 balises in group	Total number of balise(s) in the group
M_DUP	0	No duplicates	Duplicate balise
M_MCOUNT	255	The telegram fits with all telegra...	Message counter
NID_C	255	255	Identity number of the country or region
NID_BG	9754	9754	Identity number of the balise group
Q_LINK	1	Linked	Link Qualifier
PACKETS [0..1]:PACKETS			
[0]:P3: NATIONAL VALUES			Downloads a set of National Values to the train
NID_PACKET	3	3	Packet identifier
Q_DIR	1	Nominal	Validity direction of transmitted data
L_PACKET	196	196 bit	Packet length
Q_SCALE	1	1 m scale	Qualifier for the distance scale.
D_VALIDNV	0	0 m	Distance to start of validity of national values
N_ITER	2	2	Number of iterations of a data set following this variable in a packet
[0..1]			
V_NVSHUNT	8	40 km/h	Shunting mode (permitted) speed limit
V_NVSTFF	8	40 km/h	Staff Responsible mode (permitted) speed limit
V_NVONSIGHT	8	40 km/h	On Sight mode (permitted) speed limit
V_NVUNFIT	32	160 km/h	Unfitted mode (permitted) speed limit
V_NVREL	5	25 km/h	Release Speed (permitted) speed limit
D_NVROLL	10	10 m	Roll away distance limit
Q_NVSRBKTRG	0	No	Permission to use service brake when braking to a target is supervised
Q_NVEMRRLS	0	Release only at standstill possible	Qualifier Emergency Brake Release
V_NVALLOWOVTRP	3	15 km/h	Maximum speed limit allowing the driver to select the "override EOA" func...
V_NVSUPOVTRP	8	40 km/h	Permitted speed limit to be supervised when the "override EOA" function i...
D_NVOVTRP	100	100 m	Maximum distance for overriding the train trip
T_NVOVTRP	255	255 s	Maximum time for overriding the train trip
D_NVPOTRP	200	200 m	Maximum distance for reversing in Post Trip mode
M_NVCONTACT	1	Apply service brake	T_NVCONTACT reaction
T_NVCONTACT	26	26 s	Maximal time without new "safe" message

Analysis – Speed Graph



Analysis – Track Map

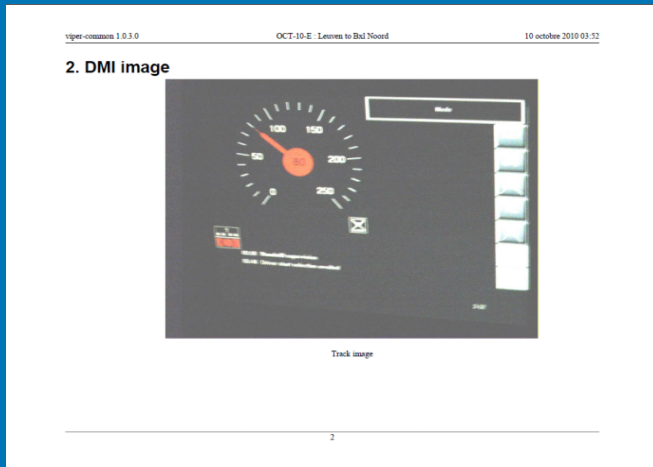


- ▶ Balise
- ▶ Balise read
- ▶ Balise error

- Signal
- Panel
- Speed change

- Station
- Switch
- Dead end

Analysis - Reports



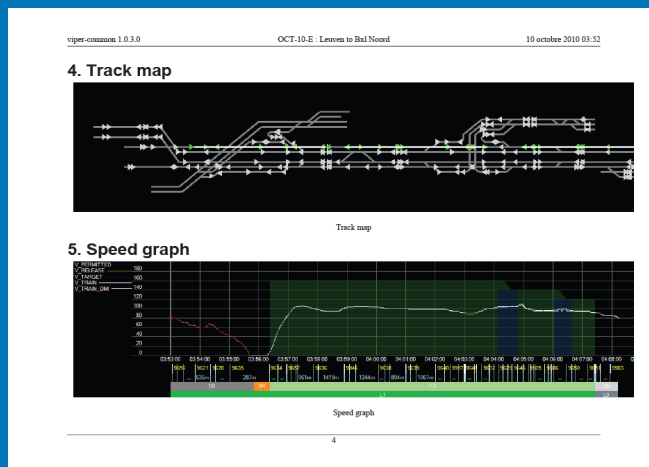
viper-common 1.0.3.0 OCT-10-E: Leuven to Bxl Noord 10 octobre 2010 03:52

6. Messages list

Tabel 2. Messages list

TIME	NR	DIR	TYPE	DIR	DIR	DIR	DIR	DIR	DIR	DIR	DIR	DIR	DIR	DIR	DIR	DIR	DIR	DIR	DIR
03:53:00	92	SB	L1	9656	255	80	92	Nominal	Reverse	72	95	00000000	00000000						
03:53:03	226	SB	L1	9656	255	80	16	Nominal	Reverse	76	97	00000000	00000000						9656
03:53:03	227	SB	L1	9656	255	80	16	Nominal	Reverse	76	97	00000000	00000000						
03:53:03	243	SB	L1	9656	255	80	24	Nominal	Nominal	13	13	00000000	00000000						9656
03:53:03	244	SB	L1	9656	255	80	24	Nominal	Nominal	13	13	00000000	00000000						
03:53:08	456	SB	L1	9656	255	80	137	Nominal	Nominal	14	14	00000000	00000000						
03:53:13	666	SB	L1	9656	255	75	244	Nominal	Nominal	15	16	00000000	00000000						9870
03:53:13	667	SB	L1	9656	255	75	244	Nominal	Nominal	15	16	00000000	00000000						9870
03:53:13	668	SB	L1	9656	255	75	244	Nominal	Nominal	15	15	00000000	00000000						
03:53:18	872	SB	L1	9656	255	75	348	Nominal	Nominal	16	17	00000000	00000000						
03:53:23	1078	SB	L1	9656	255	70	450	Nominal	Nominal	17	18	00000000	00000000						
03:53:25	1146	SB	L1	9656	255	70	482	Nominal	Nominal	17	18	00000000	00000000						9622
03:53:25	1147	SB	L1	9656	255	70	482	Nominal	Nominal	17	18	00000000	00000000						
03:53:25	1163	SB	L1	9622	255	70	21	Reverse	Reverse	13	13	00000000	00000000						9622
03:53:25	1164	SB	L1	9622	255	70	21	Reverse	Reverse	13	13	00000000	00000000						
03:53:30	1372	SB	L1	9622	255	70	119	Reverse	Reverse	14	15	00000000	00000000						
03:53:35	1578	SB	L1	9622	255	70	216	Reverse	Reverse	15	17	00000000	00000000						
03:53:36	0	REAR																	
03:53:36	1625	SB	L1	9622	255	65	234	Reverse	Reverse	15	18	00000000	00000000						
03:53:41	1833	SB	L1	9622	255	65	326	Reverse	Reverse	15	20	00000000	00000000						
03:53:47	2045	SB	L1	9622	255	65	416	Reverse	Reverse	16	22	00000000	00000000						

5



viper-common 1.0.3.0 OCT-10-E: Leuven to Bxl Noord 10 octobre 2010 03:52

8.2. ALSTOM MESSAGE 03:53:03.732

Tabel 4. ALSTOM MESSAGE 03:53:03.732

Name	Raw value	Decoded value	Description
ALSTOM HEADER			
LENGTH	143	143	filler
REL_TIME	45693	45693	time
Q_SCALE	0	0	Qualifier for the distance scale
NID_LRBG	4187576	4187576	Identity of last relevant balise group
D_LRBG	238	238	Distance between the last relevant balise group and the estimated front end of the train (the side of the active cab)
Q_DIRLRBG	1	1	Orientation of the train in relation to the direction of the LRBG
Q_DLRBG	1	1	Qualifier telling on which side of the LRBG the estimated front end is
L_DOUBTOVER	131	131	Over-reading error
L_DOUBTUNDER	131	131	Under-reading error
V_TRAIN	16	80 km/h	Actual Train speed
DRIVER_ID	0000000B		This field contains the driver identifier number
NID_OPERATIONAL	4	4	Train Running Number
LEVEL	2	2	Current Operating Level
MODE	6	6	Onboard operating mode
006 TELEGRAM FROM BALISE			
NID_MESSAGE_ALSTOM	6	6	filler
EUROBALISE			Balise balise
Q_UPDOWN	1	Up link telegram	Balise telegram transmission direction

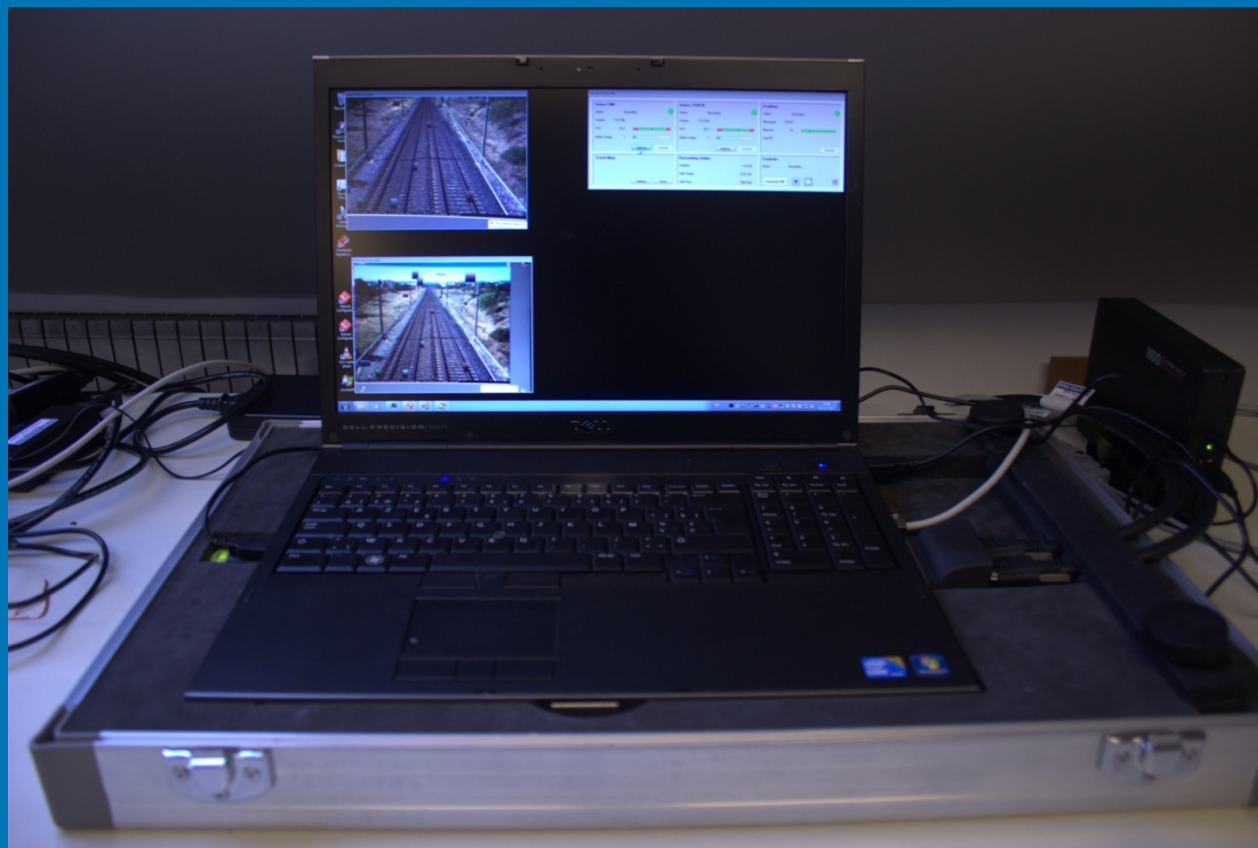
12

Details on Video acquisition

- Movie quality
- Night-time enabled
- Single-button
- Compression

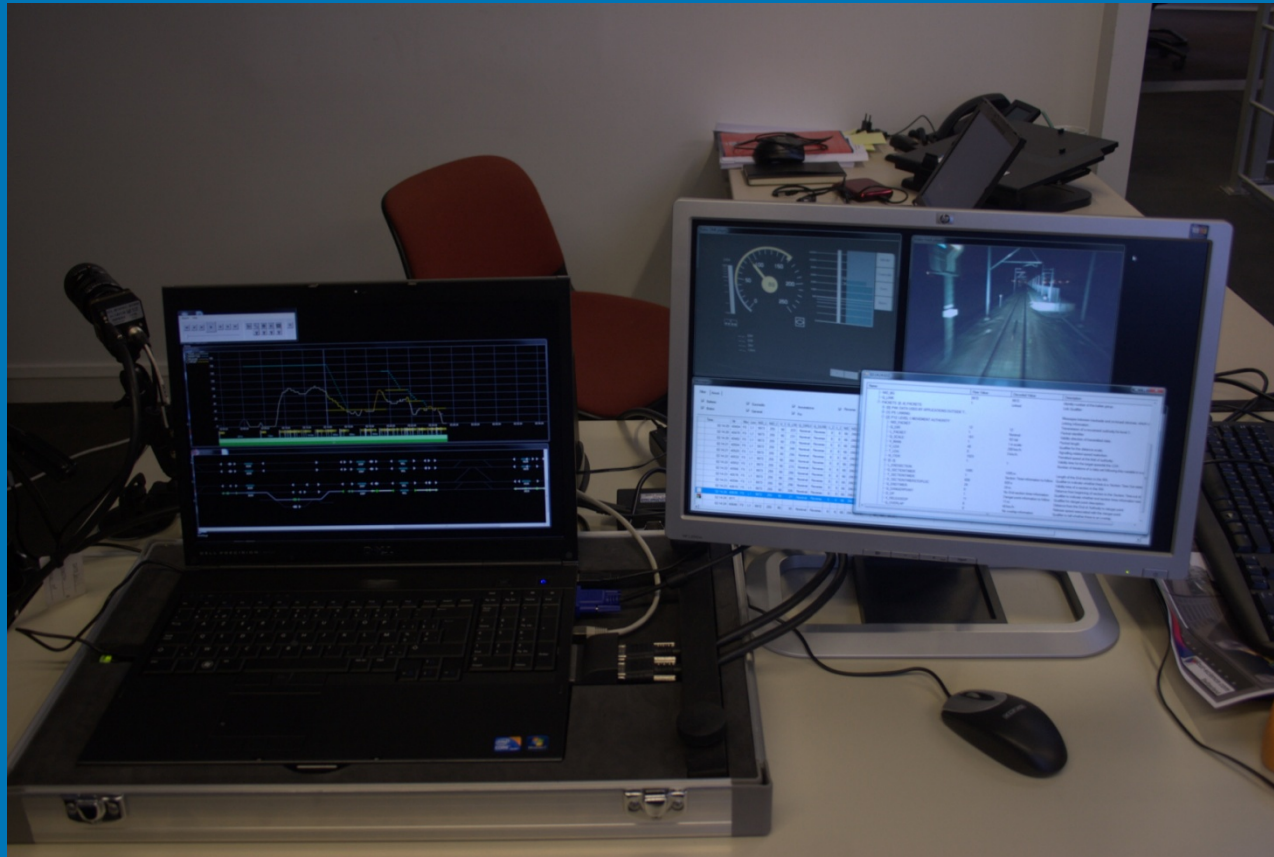


How does the system look like in your locomotive?



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How does the system look like in your offices?



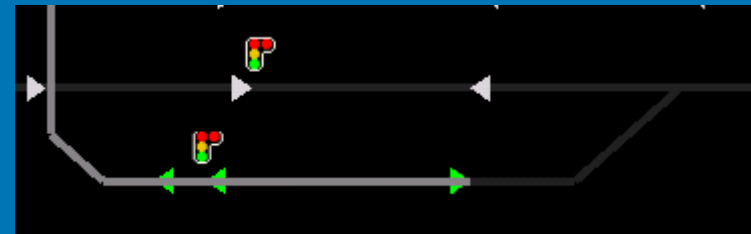
Details on JRU acquisition

- PROFIBUS – *MVB* – *CAN - Custom*
- Realtime acquisition
- SpyBox
- Subset-027 Serial Line
- Batch acquisition



Project-specific modules

- JRU Message protocol
 - Subset-027 different for every supplier/project
 - Different transport protocols
- Infrastructure Database
 - Every infrastructure manager has its own database format
 - *Subset-112*

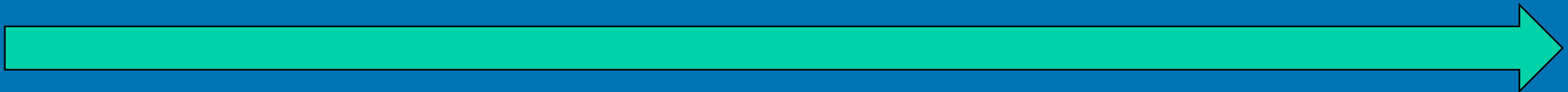


Your ERTMSCamCorder Roadmap

1: Proof of concept

2: Deployment

3: Maintenance



Your ERTMSCamCorder Roadmap

1: Proof-of-concept

ERTMSCamCorder proof-of-concept steps:

1. Select a locomotive + a test track
2. Provide the specifications of EVC-JRU interface (PROFIBUS or Serial)
3. Organize a test session
4. workshop with your team to analyze the data

Fixed-price

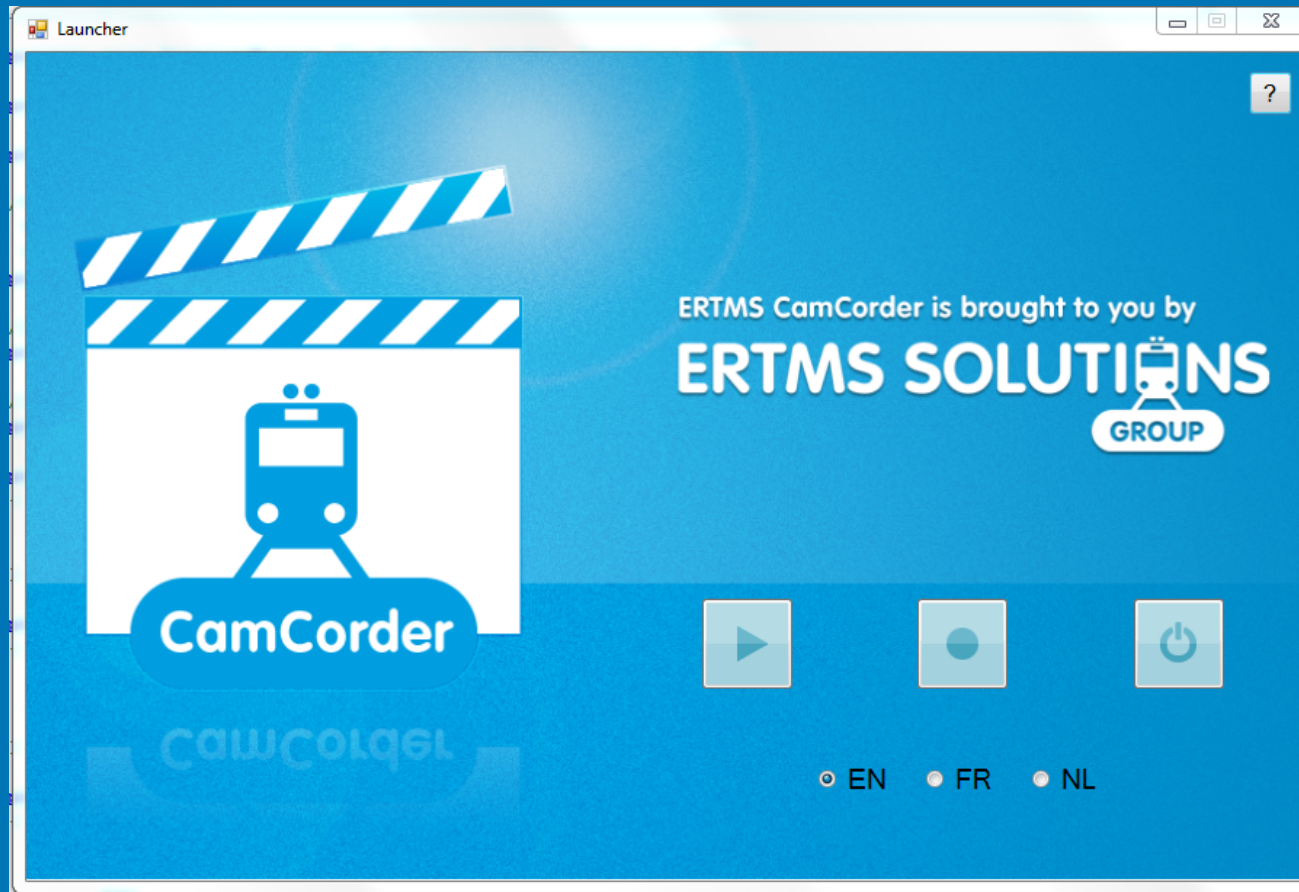
Optional: track database importing

13.500 Eur

Benefits



1: Independent tool



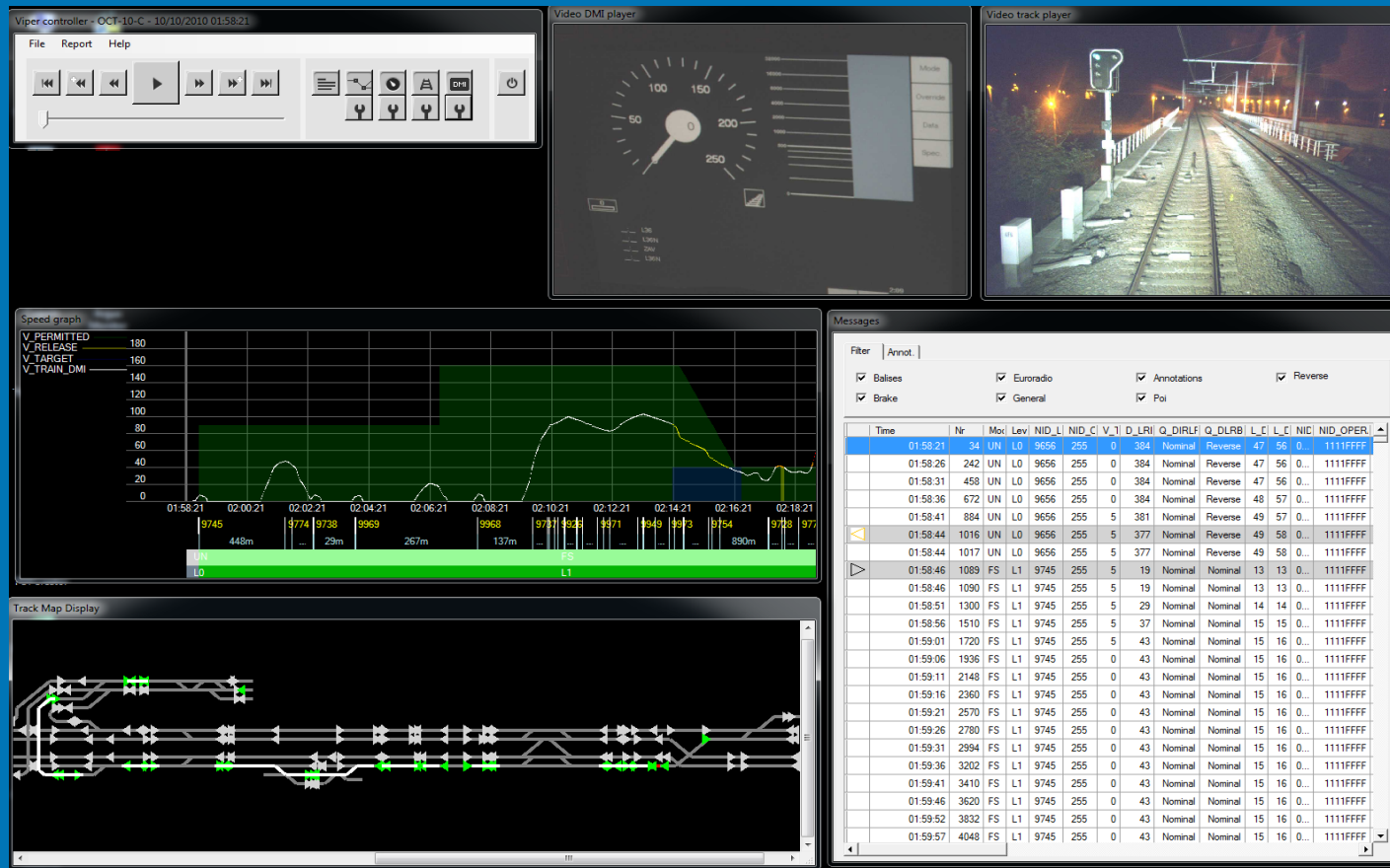
2: Higher precisions

- JRU data
 - 5 km/h precision -> not enough for testing
- PROFIBUS data
 - 1 km/h precision

*3: Cut down 50% to 90% of the time
needed to process and analyze ERTMS
onsite tests*

- INFRABEL L1 statistics
 - 182 test scenarios
 - 25 test nights ~7 scenarios per night
 - 27 hours of recording time
- Without ERTMSCamCorder: 35 man/day
- With ERTMSCamCorder: 6 man/day

4: Build tangible/usable/independent onsite test evidence

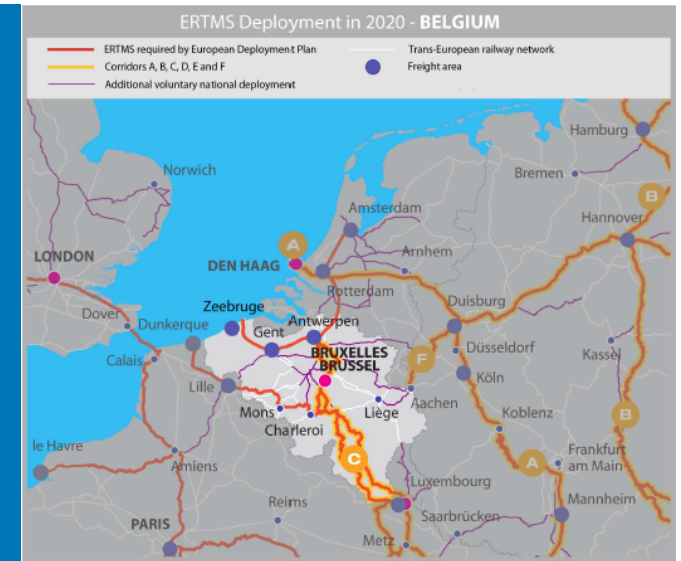


Why is the ERTMSCamCorder important to Infrastructure Managers?



- Because ERTMS lines require onsite testing
- Onsite testing is an expensive activity

The ERTMSCamCorder enables to reduce onsite testing costs



- INFRABEL Case Study:
 - L36 Brussels-Leuven
 - 30 km
 - 240 signals
 - 25 test nights
- Actual man/day gain for 25 test nights: 54
- Man/day gain per test night: 2,16

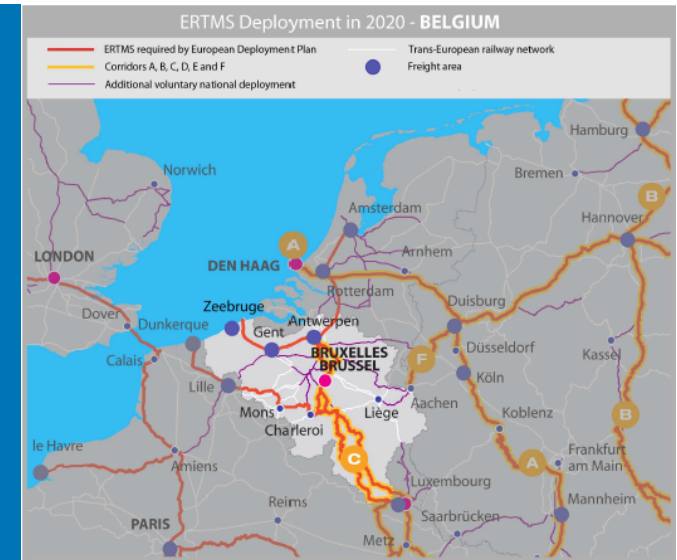
The ERTMSCamCorder enables to reduce onsite testing costs

- INFRABEL Case Study

Siemens uses ERTMSCamCorder for recording and analysing onsite testing on Belgium part of Corridor C

Siemens Signalling Belgium assists Infrabel for the ETCS L1 lines that pertain to ERTMS Corridor C, due to be ready end of 2013 (main path). In this context, Siemens will perform some onsite testing activities required to commission the different segments of the Belgian part of Corridor C. In this process, Siemens will make extensive use of the ERTMSCamCorder, which is nowadays used by INFRABEL for onsite testing.

INFRABEL: "The implementation of the complete Corridor C project, including 350 km of ETCS L1 tracks and 1800 eurobalises, is a very intense ERTMS implementation challenge. The ERTMSCamCorder has enabled us to obtain significant time and productivity gains on the L36/L36N project. We are very happy to repeat these productivity gains on all Corridor C projects."



RFI benefit extrapolation (Only Corrs. A-B-D)



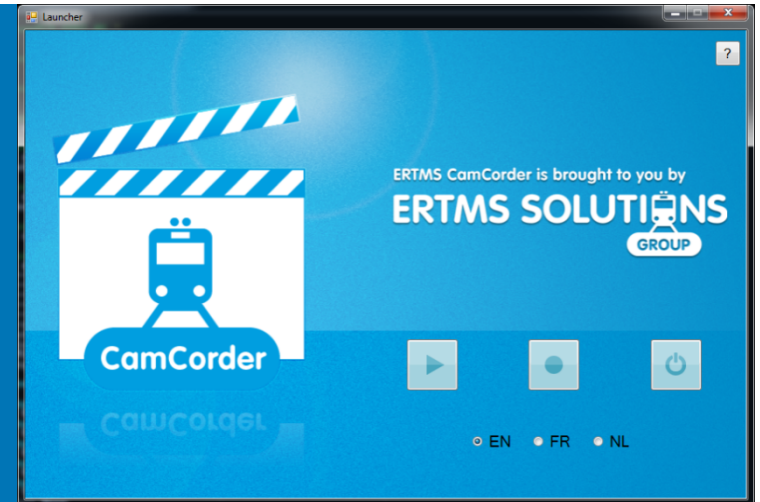
- Man/day gain per test night: 2,16 (INFRABEL REX)
- Estimated test nights needed: 1808 (30km → 2170km)
- Estimated man/day gain: 3906
- Estimated total gain: 2.929.500€ (man/day @ 750 eur)

RFF benefit extrapolation (Only Corrs. A-B-D)



- Estimated total gain of 2.929.500€ needs to be refined:
 - Include other RFI ERTMS projects
 - Refine total test nights estimation per project / sub-project
 - Include rolling stock and track cost reduction
 - Include NOBO cost reduction for test results assessment

ERTMSCamCorder intangible benefits



- Better testing of ERTMS tracks
 - Reduce the risk of a safety incident
- Better communication with the ERTMS trackside suppliers
- Tool independent from ERTMS trackside supplier
- ERTMSCamCorder accepted by NOBOs (RFU-STR-030)
- Better communication with the Stakeholders (for Marketing, project presentations, ...)

Customer references

- INFRABEL
- Thalès
- Belgorail
- Siemens
- *CAF/EliopSeinalia Q4 2012*

Customer references

- INFRABEL

INFRABEL uses ERTMSCamCorder on DBahn ICE3 to test new ERTMS L1 line

Brussels, 12th of July 2011

Last month, Deutsche Bahn AG. allowed INFRABEL to use the ERTMSCamCorder on one of its Alstom-equipped ICE3 trains, to record onsite testing sessions on the new Brussels-Leuven ERTMS L1 line (L36).

The ERTMSCamCorder successfully recorded Track+DMI videos and signalling information for all ICE3 tests on this track.

This paves the way for a streamlined test process for commercial trains on ERTMS lines.

Customer references

- Thales / CFL

ERTMSCamCorder used by Thales to film Track and Dmi

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This year, CFL hosts the 3rd Thales ERTMS/ETCS User Group which takes place in Luxembourg the 20th of October.

During its ERTMS/ETCS User Group, Thales has used the ERTMSCamCorder solutions to film the Track and DMI, and to display the movies on high-resolution screens installed in each wagon of the train, enabling more than 100 passengers to see the Track and DMI in real-time, while enjoying the explanations of CFL representatives.

Press Contact: Stanislas Pinte – Sales Director – stan@ertmssolutions.com – +32 499 25 94 24

More information on the company websites:

<http://www.cfl.lu/>

<http://www.ertmssolutions.com/>

Customer references

- Belgorail (Belgian NOBO)

ERTMSCamCorder used by Belgorail on Thalys train to film Track and Dmi

In the context of Thalys certification on INFRABEL's new ERTMS L1 line connecting Brussels to Leuven at 200km/h, Belgorail has used the ERTMSCamCorder solutions to film the Track and DMI during the test nights.

The ERTMSCamCorder provided Belgorail with synchronized, high-quality videos of the tests performed with the Thalys, allowing Belgorail to build strong and easily analyzable evidence of the onsite tests.

Press Contact: Stanislas Pinte – Sales Director – stan@ertmsolutions.com – +32 499 25 94 24

More information on the company websites:

<http://www.belgorail.be/>

<http://www.ertmsolutions.com/>

Next steps

Work together with RFI to:

- Organize ERTMSCamCorder proof-of-concept on RFI ERTMS line
- Refine ERTMSCamCorder benefit extrapolation (*was 2.929.500€*)

Contact us for your project.

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