



# **TOWARDS SHARED DIGITAL BOUNDARY LINES**

*Belarus TAIEX  
September  
2016*



2016

2018



2020



**GOALS**  
**SENSITIVE POINTS**  
**CONCRETELY**  
**TYPES OF AGREEMENTS**  
**GOOD PRACTICE**



# INSPIRE DIRECTIVE 2007, ARTICLE 10.2



” IN ORDER TO ENSURE THAT SPATIAL DATA RELATING TO A GEOGRAPHICAL FEATURE,

THE LOCATION OF WHICH SPANS THE FRONTIER

BETWEEN TWO OR MORE MEMBER STATES, ARE COHERENT, MEMBER STATES SHALL, WHERE

APPROPRIATE, DECIDE BY MUTUAL CONSENT ON THE DEPICTION AND POSITION OF SUCH COMMON FEATURES.



# PROVIDE INTEROPERABLE AUTHORITATIVE AND CORE DATA



1950



1980



1990



2010



2020

map 1: 25 000 => Database => Geoportail => Services => BigData



Raster : 1 data for all informations (pixels)

Vector : layers (of points, lines, surfaces) for each theme (AU, HY, TN)

# INFRASTRUCTURE ORGANISATION

“Reply to environment laws and ecological questions”

- Build an infrastructure (national and regional catalogs+ portals)
- Structure the data with standards
- Implement services (consult, unload)

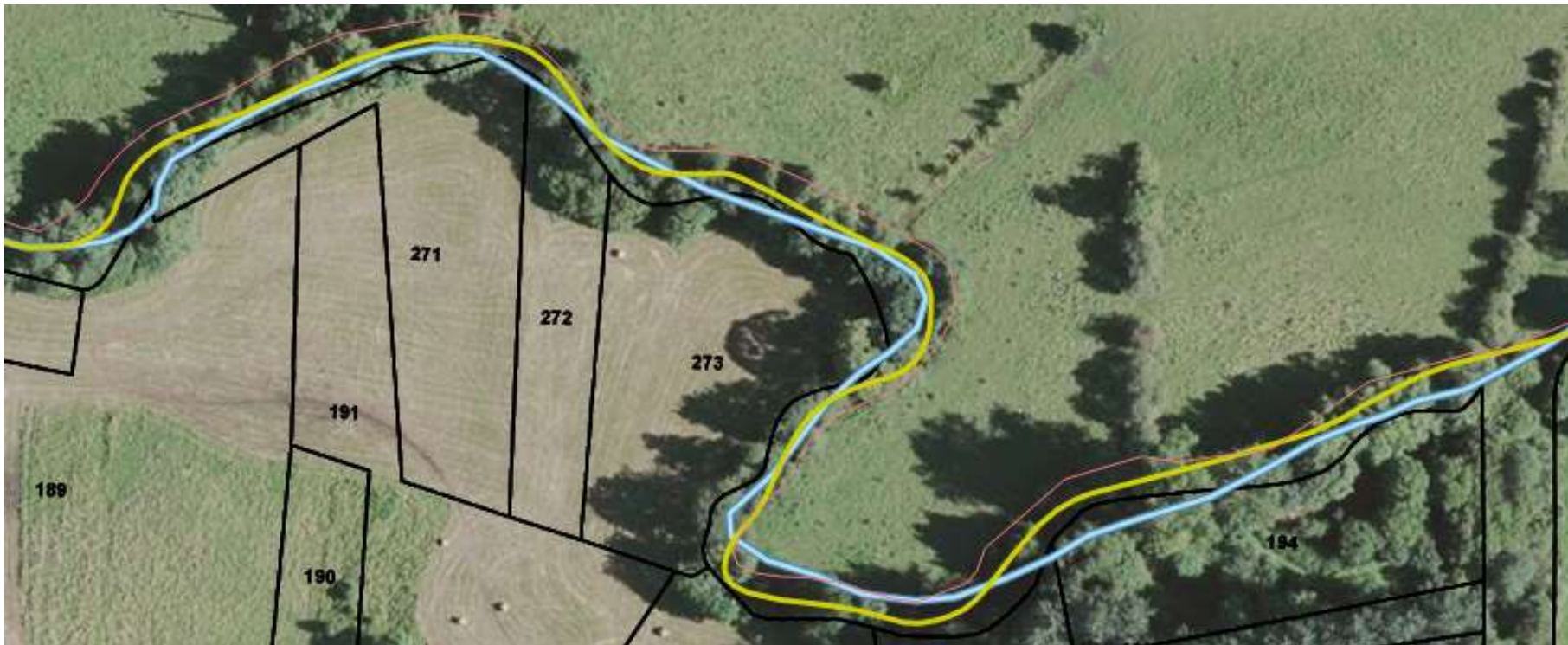


“Open the data”




- Economic interest

## EXCHANGES

- Information has to be reachable, fluent exchange
- For access to all, the different lines at each step are displayed on Internet <http://cnig.gouv.fr/apigeoportail/pageapi.php>



# EUROPEAN PRIORITIES

	Priority	Level	Period Time	Necessity
	1)	Projet ELF	ready for 2016	contract
	2)	INSPIRE	2018	Directive : «where appropriate»
	3)	SBE-KEN	no	long term

# FROM TEXT TO DIGITAL LINE

## 2 conceptions at play

- The text and traditional perception of the boundary lines
- The expectation for large scale european databases access.  
(new legislative frame PSI et INSPIRE for DG Env)

## An accelerated passage between old and new world



## => crossborder actions

- Text study
- Exchange
- Comparisons

## decisions with Technical arguments

- Restitutions
- GPS mesures



# SENSITIVE POINTS

**GOALS**  
**SENSITIVE POINTS**  
**CONCRETELY**  
**TYPES OF AGREEMENTS**  
**GOOD PRACTICE**

■ ■

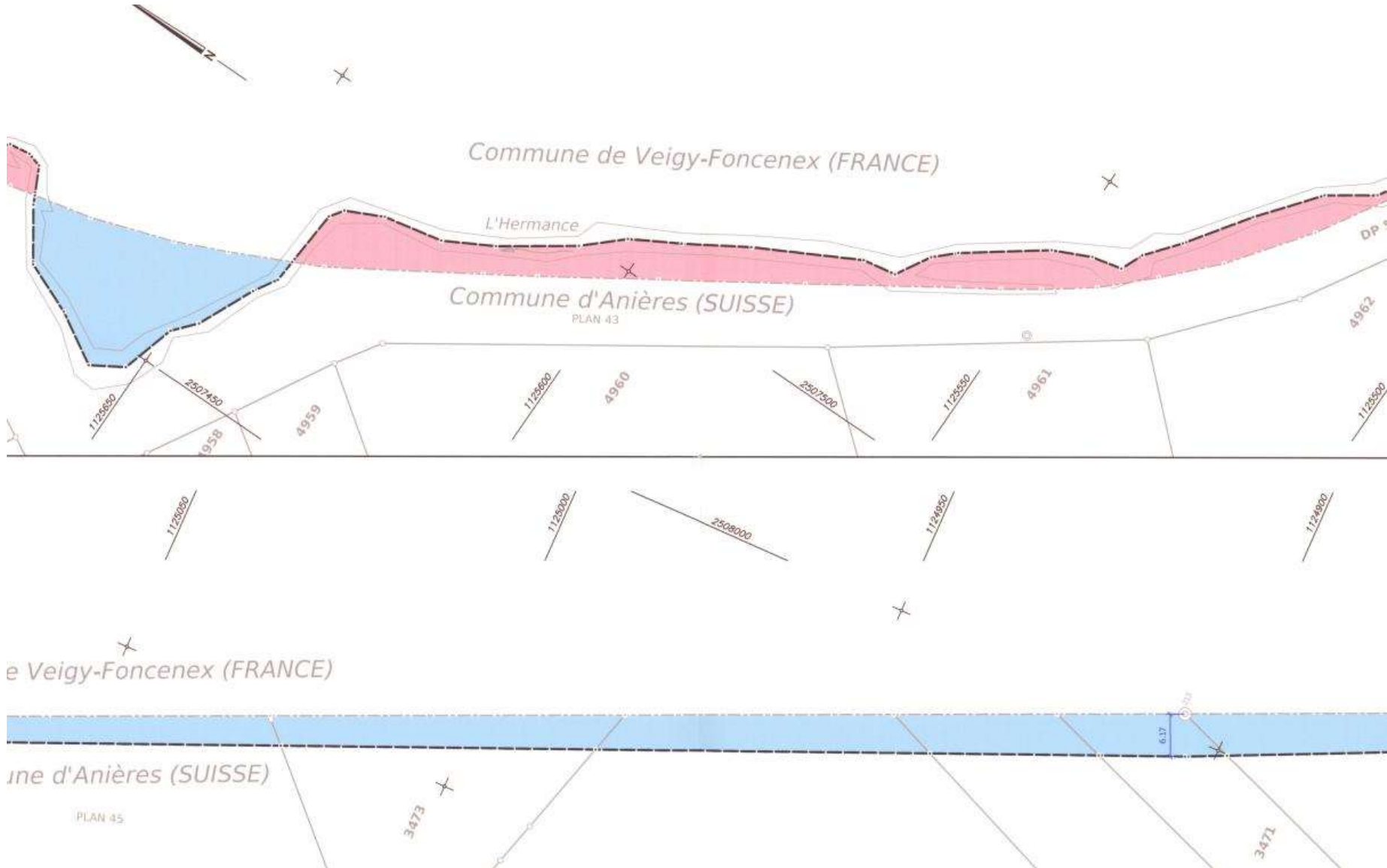
# MOVING BOUNDARIES (1)



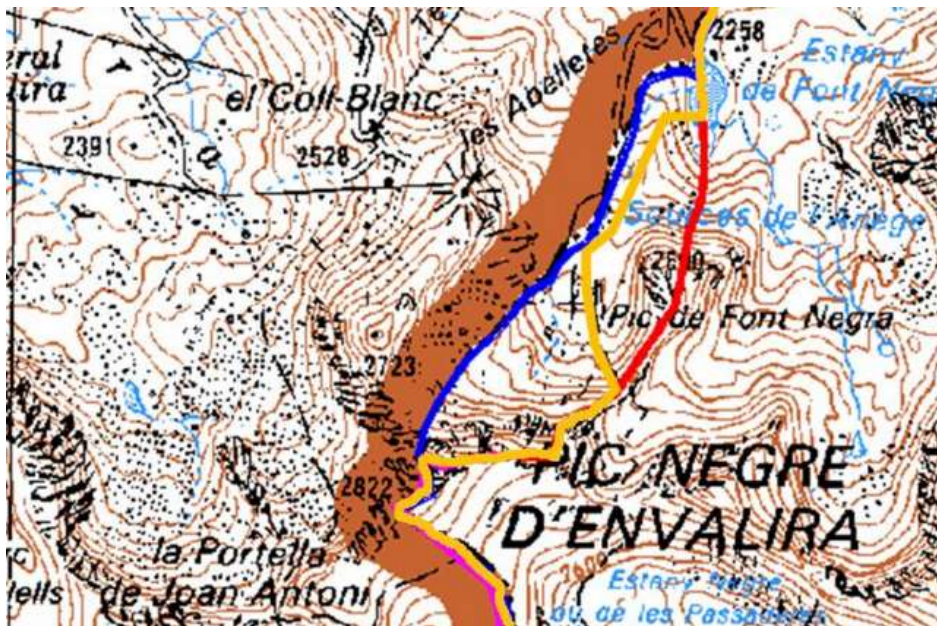
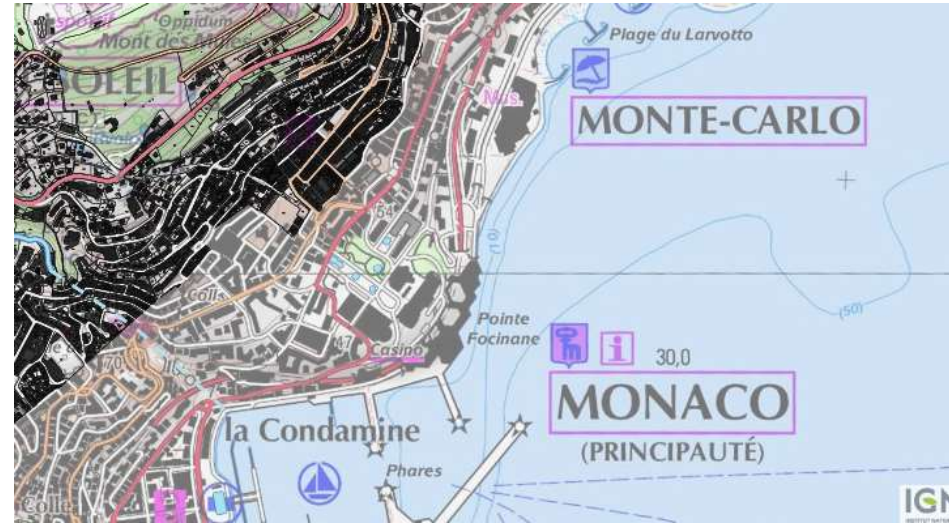
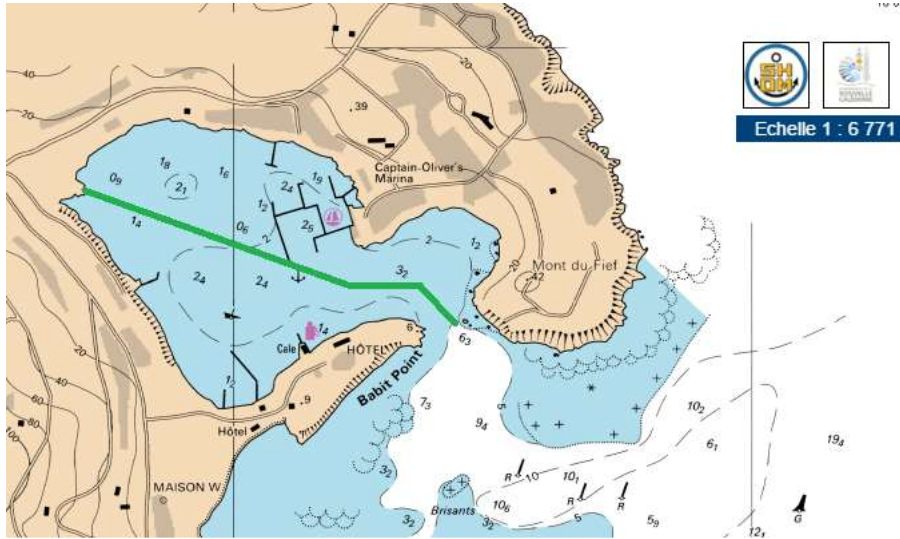
- Glaciers
- Rivers
- Movable boundaries :  
historic preeminence  
is only oral recognition



# MOVING BOUNDARIES (2)



# BOUNDARIES WITHOUT WRITTEN TREATIES



# VALIDATION STEPS

Types de validation

Accord DGFIP



Accord commission mixte



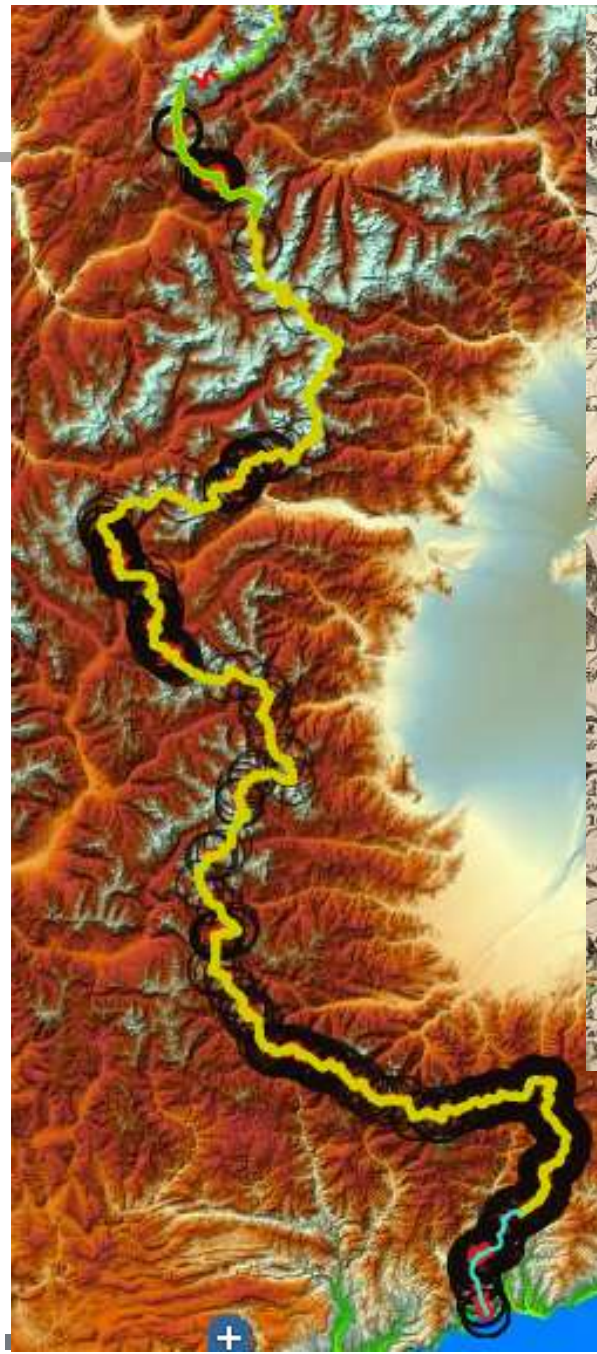
Accord technique



En cours d'étude



Désaccord diplomatique



# TEMPORARY COMPROMISE

Why?

- Quick and temporary
- Avoid intermediate solutions

Steps :

- Compare lines
- List a count of the gap differences
- Balance the distribution of compromissions





# CONCRETELY

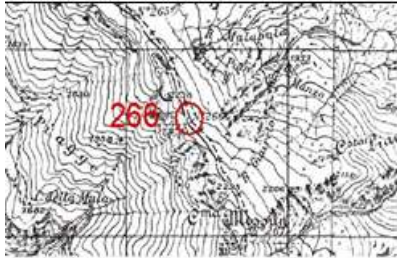


# FRENCH ITALIAN BOUNDARY DOCUMENTATION

COMMISSIONE MISTA ITALO-FRANCESE PER LA MANUTENZIONE DEI TERMINI E DELLA LINEA DI CONFINO

COMMISSION MIXTE FRANCO-ITALIENNE POUR L'ENTRETIEN DES BORNES ET DE LA LIGNE FRONTIÈRE

Località / Emplacement:	SETTORE / SECTEUR VII	N° 266
	Cippo in granito Borne en granit	



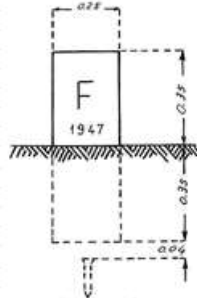
Descrizione della linea di confine verso il termine  
Description de la frontière vers la borne suivante

Dal cippo 266 la mulattiera di creta che va da NO verso SE, rotando in territorio francese, cartucciere la linea di confine fino ad una incavatura della linea di creta dallo quale sale fino a Cima Mizrun. Da qui scende in direzione NE (?) e poi descrive una ganita accentuata verso sud interna a Cima Mizrun. Il punta 267 è parzuta tale ganita ad est della mulattiera di creta. La frontiera sulle zone mulattiere di creta orientate NO / SE lascia in territorio francese, jusqu'à une échancrure de la ligne de crête de laquelle elle monte à la cime Mizrun. Elle décrit ensuite un virage marqué vers le Sud autour de la cime Mizrun. Le point 267 se trouve dans ce virage à l'Est du sentier mulattier. De la borne 266, la frontière suit le sentier



Foto / Photo: 1948

PROSPETTO E SEZIONE / ÉLÉVATION ET COUPE



Demarcazione / Implantation: 1948

L'Esperto tecnico italiano

L'Expert technique français

Il Presidente della Delegazione italiana

Le Président de la Délégation française

Coordinate / Coordonnées: ETRS89  
Ellissoide / Ellipsoïde: GRS80

lat.	44° 06' 18,8952"
long.	7° 41' 30,1451"
q.ell. / haut.ell.	2276,20

COMMISSIONE MISTA ITALO-FRANCESE PER LA MANUTENZIONE DEI TERMINI E DELLA LINEA DI CONFINO

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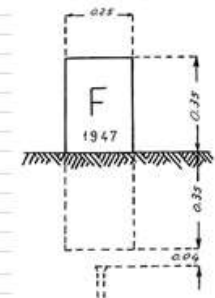
La linea di confine continua a seguire la mulattiera di creta, mantenendola in territorio francese. Dopo aver piegata verso S.-S.O. intorno a Cima Mizrun, prosegue verso S. E. fino all'incavatura di Cella Cravirera. Il cippo 268 è parzuta a N.E. della mulattiera.

La ligne frontière continue à suivre le sentier mulattier de crête, laissé à la France: après un virage vers le SSO, autour de la cime Mizrun, elle poursuit vers le SE jusqu'à l'encellement du col du Cravirera. La borne 268 est positionnée au NE du chemin mulattier.



Foto / Photo: 1948

PROSPETTO E SEZIONE / ÉLÉVATION ET COUPE



Demarcazione / Implantation: 1948

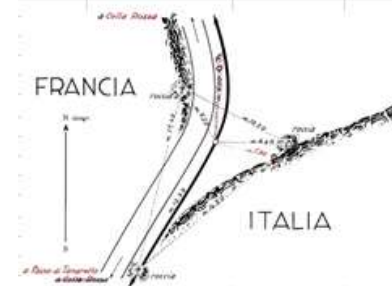
L'Esperto tecnico italiano

L'Expert technique français

Il Presidente della Delegazione italiana

Le Président de la Délégation française

SCHIZZO E RIFERIMENTI / CROQUIS ET REPÈREMENT

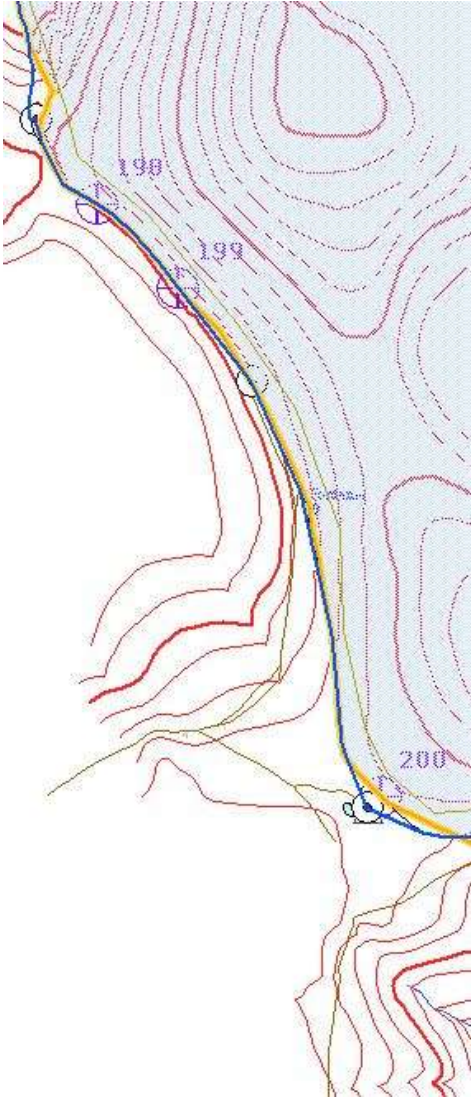


Coordinate / Coordonnées: ETRS89  
Ellissoide / Ellipsoïde: GRS80

lat.	44° 06' 00,5586"
long.	7° 41' 47,0988"
q.ell. / haut.ell.	2370,20



## QUALITY ATTRIBUTE AND TECHNICAL INSURANCE



### Points :

Shared coordinates of the Markers  
(1=>10 cm < 1m)

### Lines :

1 : 25 000 map, 30m guaranteed  
Cadaster 1m to 30m guaranteed  
(depends on urban zones)

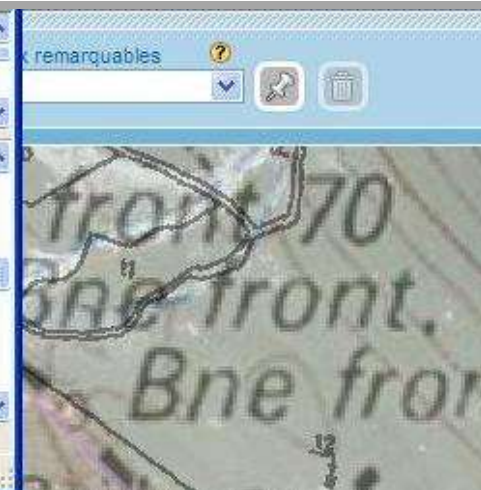
improved by

- specific photogrammetry in mountains and
- georeferenced cadastre

New lines created for INSPIRE directive  
with shared metric accuracy (1m=>5 m)

# FIRST STEP : GNSS MESURES

A	B	C	D	E	F	G	H	I	J	K	L	M
Coordonnées Lieu	Nom e du point	Coordonnées e Type du point	Mesure e GPS	Latitude Latitude	Longitude Longitude	Quota ellip. Hauteur ellips.	N	E	Quota geoidic a Altitude	Y	X	Quota geoidic a Altitude
Colle della Maddalena	65A	P/P	1999	44°25'23" 5772	6°54'27" 7707	2297,10	4921027,50	1333475,50	2242,70	246010,80	963795,70	2243,00
	66	I/G	2005	44°25'22" 6414	6°54'25" 3590	2293,90	4920999,99	1333421,43	2239,81	245979,00	963744,03	2239,76
	67	C/B	1999	44°25'13" 4495	6°54'10" 1868	2089,60	4920725,00	1333078,70	2035,20	245677,10	963424,70	2035,50
	68	P/P	1999	44°25'18" 7944	6°54'00" 1466	2071,00	4920895,60	1332860,90	2016,50	245829,50	963193,80	2016,80
	69	ND/NM		44°25'20" 2142	6°53'56" 9115		4920941,71	1332791,33		245869,32	963119,93	
	69(R)	C/B	1999	44°25'20" 1808	6°53'57" 0071	2055,40	4920940,20	1332792,60	2001,00	245868,40	963122,10	2001,30
	70	C/B	1999	44°25'18" 7688	6°53'54" 4221	2047,50	4920898,10	1332734,30	1993,10	245821,70	963067,40	1993,40
Colle della Maddalena	71	C/B	1999	44°25'15" 6218	6°53'51" 4066	2087,60	4920802,70	1332665,20	2033,10	245721,10	963006,20	2033,40
	72	C/B	1999	44°25'14" 8296	6°53'50" 6835	2090,30	4920778,60	1332648,50	2035,90	245695,80	962991,60	2036,10
	73	C/B	1999	44°25'15" 1662	6°53'34" 1794	2161,20	4920798,40	1332283,80	2106,80	245685,90	962626,50	2107,10
	74	P/P	1999	44°25'11" 4579	6°53'32" 9490	2165,60	4920684,70	1332253,70	2111,10	245570,20	962605,70	2111,40
	75	C/B	1999	44°25'05" 6039	6°53'34" 8883	2157,50	4920503,00	1332291,90	2103,10	245392,10	962658,50	2103,40



# COMPARE THE PHOTOGRAMMETRIC RESTITUTIONS



# EUREF

6 IGS stations  
whose coordinates  
are known in  
ETRS89 system



# IGN : 2002 GEODETIC MISSION SANTO DOMINGO



Suprema Corte De Justicia de la República Dominicana

Programa de Modernización de Jurisdicción de Tierras

municipio  
**Sabana dela Mar**

Provincia  
**Monte Plata**



IGN-HI 2002

**SMAR**
Red de los Puntos fijos de Materialización Tradicional

Coordenadas geográficas		Elipsoide : IAG- GRS80
-69°22'53"47620	19°03'37"24970	-34.66 m
longitud	latitud	Altura elipsoid
Coordenadas cartesianas en el ITRF 2000		
2123628.58 m	-5644294.35 m	2069653.03 m
X	Y	Z
Coordenadas planas en el ITRF 2000		Proyeccion MTU fuseau 19
2107548.39 m	459859.20 m	
Xplano	Yplano	



Observaciones 2002



software de oñulo : Trimble Total Control 2.5  
Geolab 3.2

tempo de observación : 6 horas

cadena : 30 s

precisión planimétrica : 0.006 m

precisión altimétrica : 0.017 m

Hoja al 1:50 000 : Sabana dela Mar  
revisada en (1988)

**Dirección**

Camino de pescadores, frente al mar

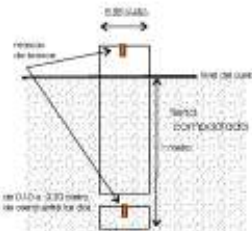
**Itinerario**

Cruzar Sabana y a tres esquinas del Muelle, doblar a la derecha para tomar la calle Rinsí que se dirige casi hasta el mar. Cuando la calle gira a noventa grados, continuar a pie 120 metros por el camino de los pescadores

**TEXTO**

	marca geodetica		plano de cancha
	distancias en metros		pozo
	cota		pozo
	pozo		pozo
	pozo		pozo

**Fecha de construcción :** Octubre 2002



**MATERIALIZACIÓN**  
Marca de Bronce de Ø 12mm implantada en el centro de un mojon de concreto

Fijación antigua en Datum NAD 1927

Longitud
Latitud
elevación

## IGN : FOREIGN MISSION

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IGN : experience in delimitation

- Saudi Arabia / Qatar 2005
- Benin / Niger 2003
- Tchad lake 1990






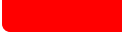
- And former missions

(Algeria/ Lybia 1958, Mauritanie 1957, Djibouti / Ethiopia 1950...)

# TYPES OF AGREEMENTS

2016

2018

-  ELF Half-shared line
-  Temporary agreed line
-  One proposal agreed by the neighbour
-  Agreements with shared parts
-  Juridical validation process
-  Diplomatic lock

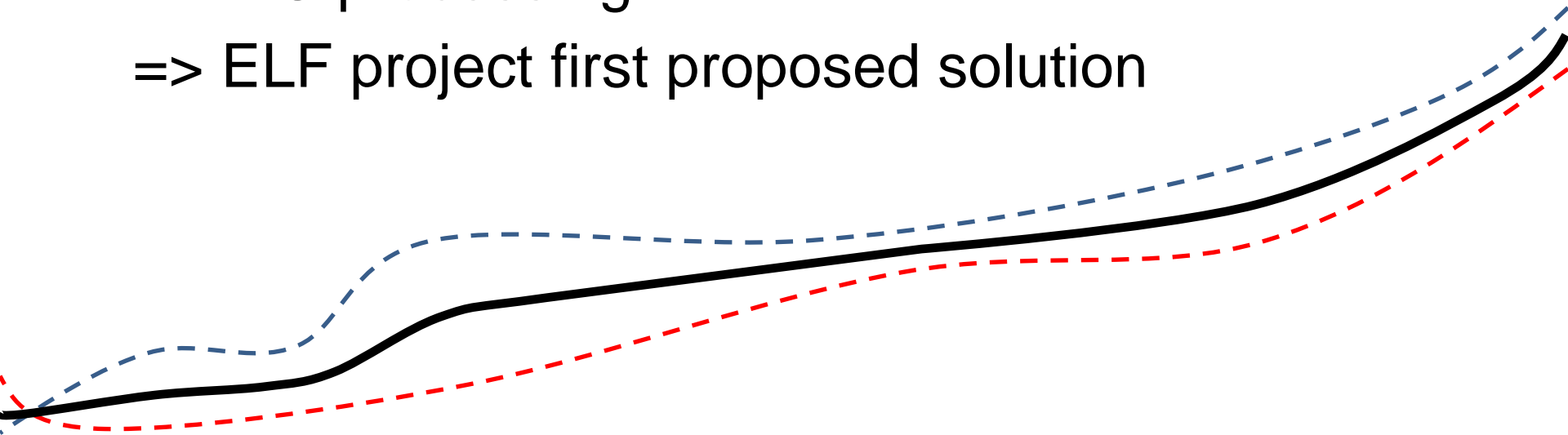
## WAYS TO GET AN UNIQUE LINE

### Half-shared



- Creation of a half-shared line from 2 lines by BKG processing

=> ELF project first proposed solution





## WAYS TO GET AN UNIQUE LINE

### simple agreement



- Contact and data Exchange
  - No Technical differences
  - One side accept the foreign line
- => Line waiting for an official bilateral validation

## WAYS TO GET AN UNIQUE LINE

### Shared agreement type between 2 providers



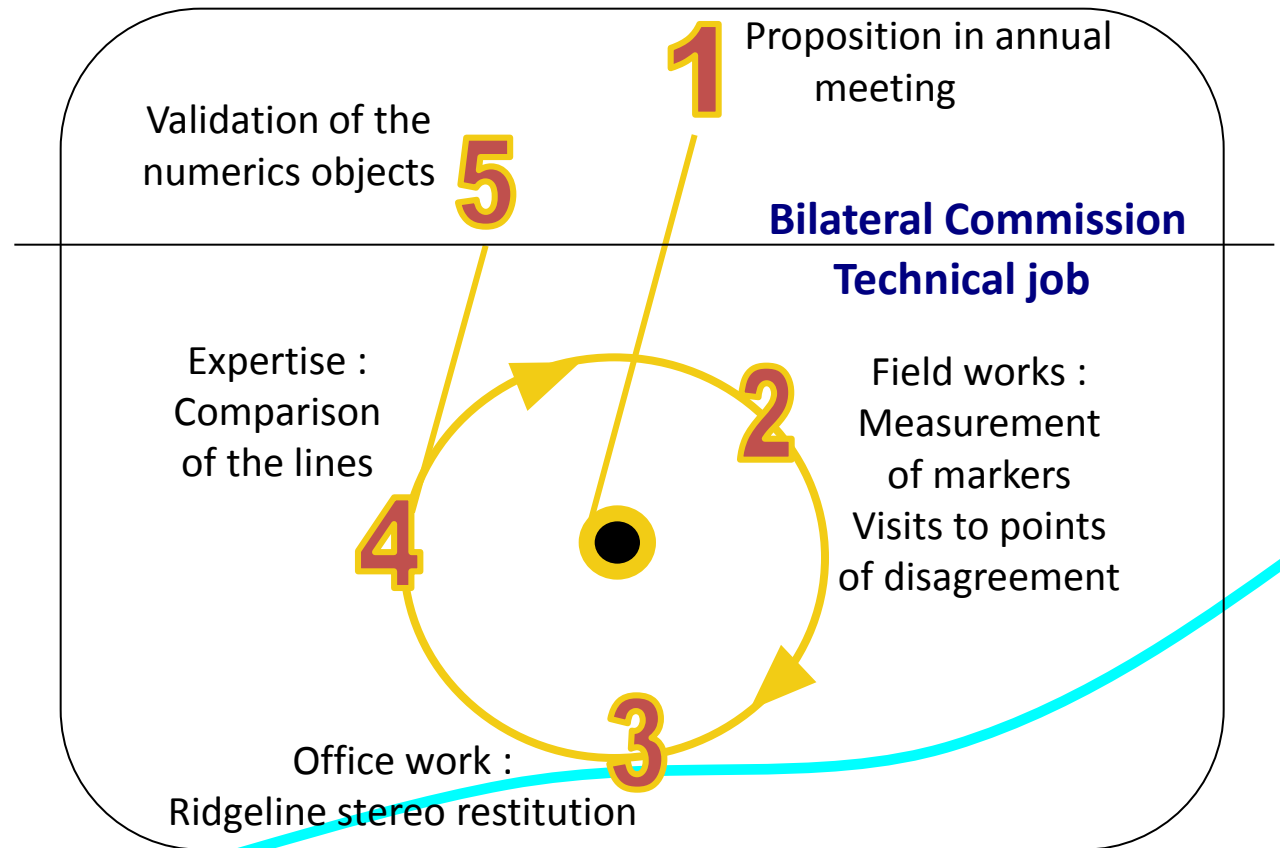
- Contact and data Exchange
  - Technical differences ?
  - What kind of edge match?
- => Line waiting for an official bilateral validation

# WAYS TO GET AN UNIQUE LINE

## Juridical validation in CMA



Validation  
process  
(can be long)



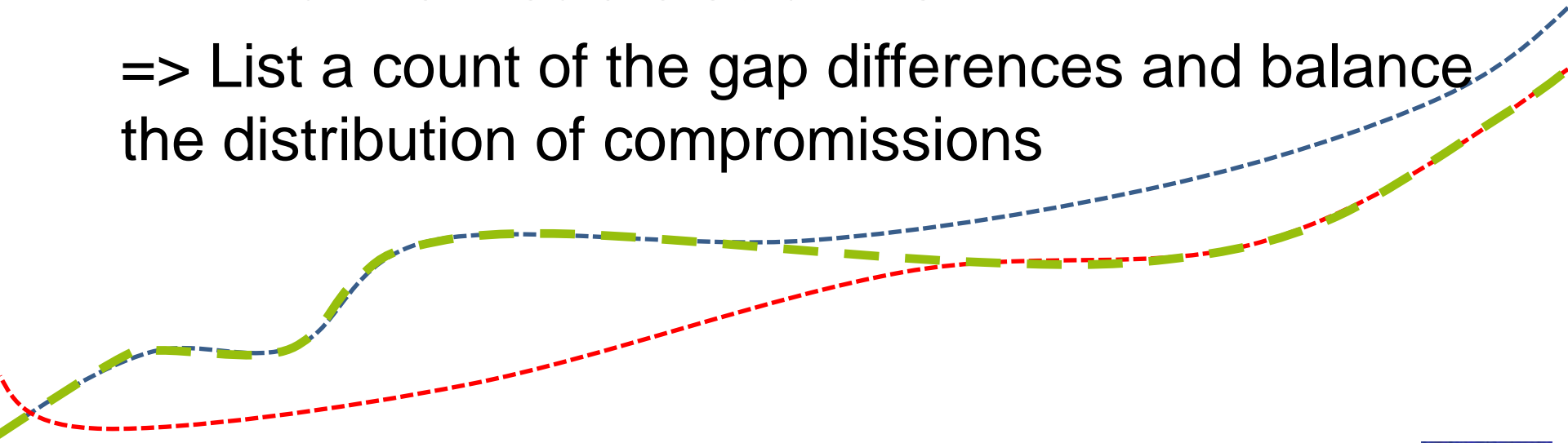
## WAYS TO GET AN UNIQUE LINE

### Temporary validation



- Agreement with future actions planned
- Quick and temporary
- Avoid intermediate solutions

=> List a count of the gap differences and balance the distribution of compromissions



## WAYS TO GET AN UNIQUE LINE

### Disagreement

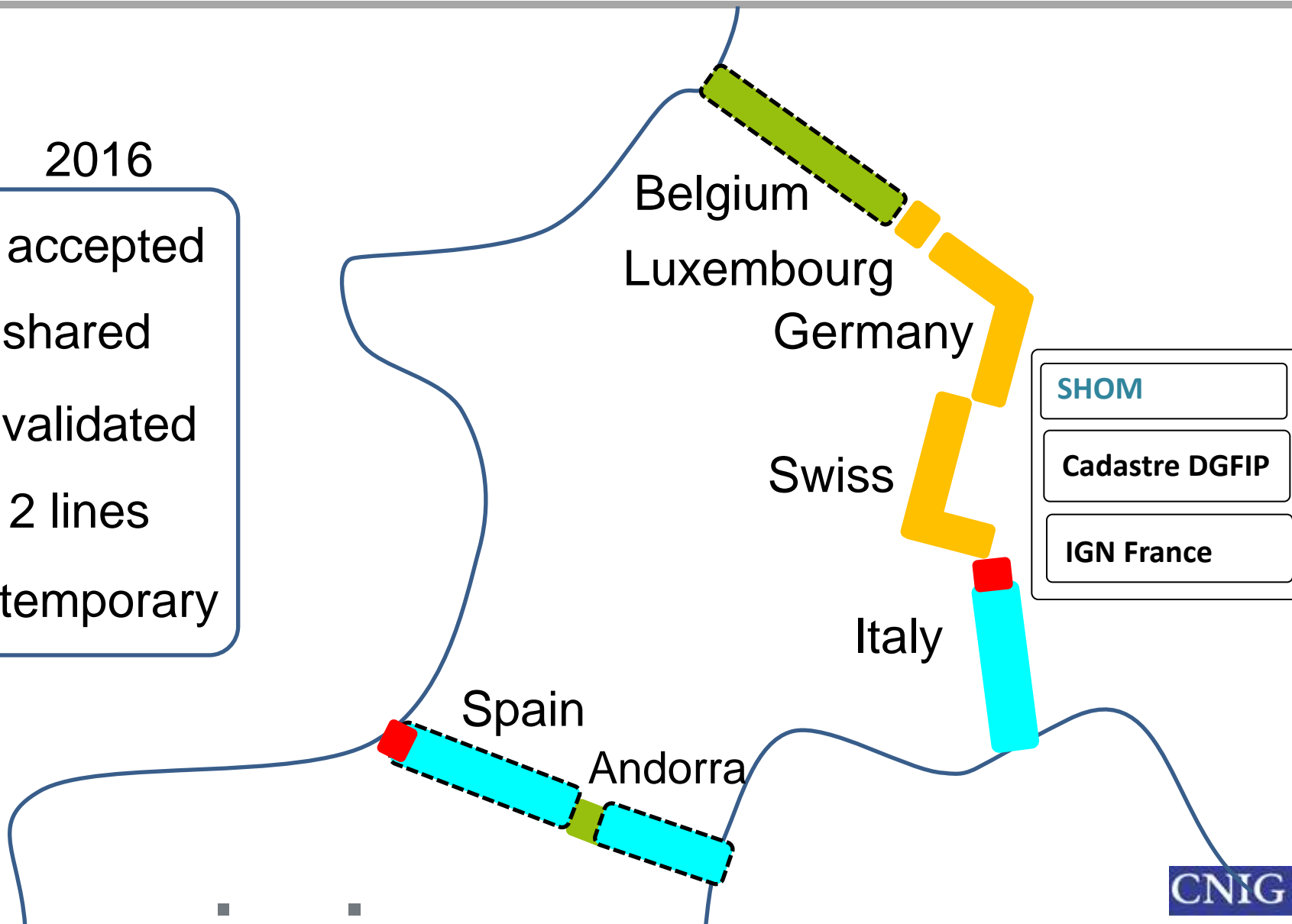


- To be treated at a politic level
  - must stay out of negotiations
  - 2 lines on such sector
- => future uncontrolled area?

# 2016 : ALL FRENCH BOUNDARIES ARE BILATERAL

2016

- accepted
- shared
- validated
- 2 lines
- temporary

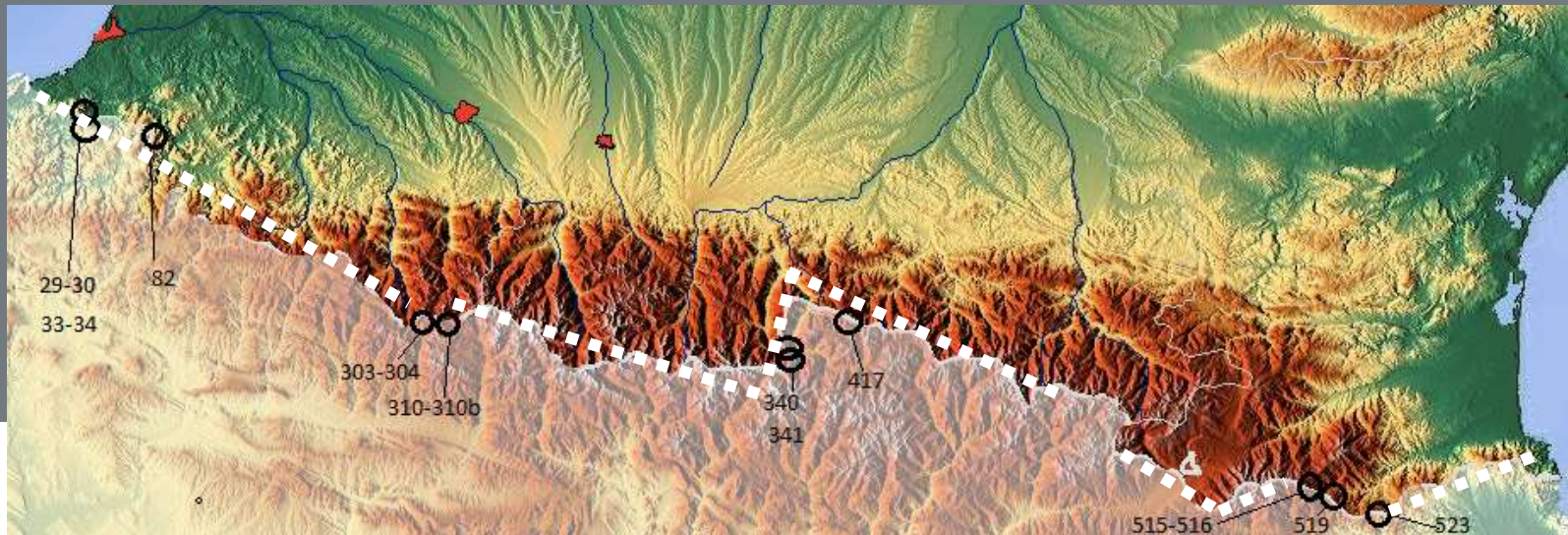


SHOM

Cadastre DGFiP

IGN France

# GOOD PRACTICE



CGE - IGNF- Navarra - Cataluña

2011: observation of 600 markers planned

2014: restitutions compared : 20 m >72 divergences> 400 m

2015: shared line firmed

# NEW JURIDICAL ASPECTS

“...wherever the two states have adopted common limits and determinable by reference to the same system, demarcation is considered proved by reference to that system...”

## Official agreements and maintenance

Positions defended by France with foreign countries



Responsible in coordination and maintenance of the border work, he manages funds

## Others

When the best expertise is from cadastre



Cartographic or geodetic expertise



Local expertise



## COMPROMISE LINE

Bidassoa mouth without solution

=> 1 double boundary line obliged

Adoption of a restituted boundary line with corrections

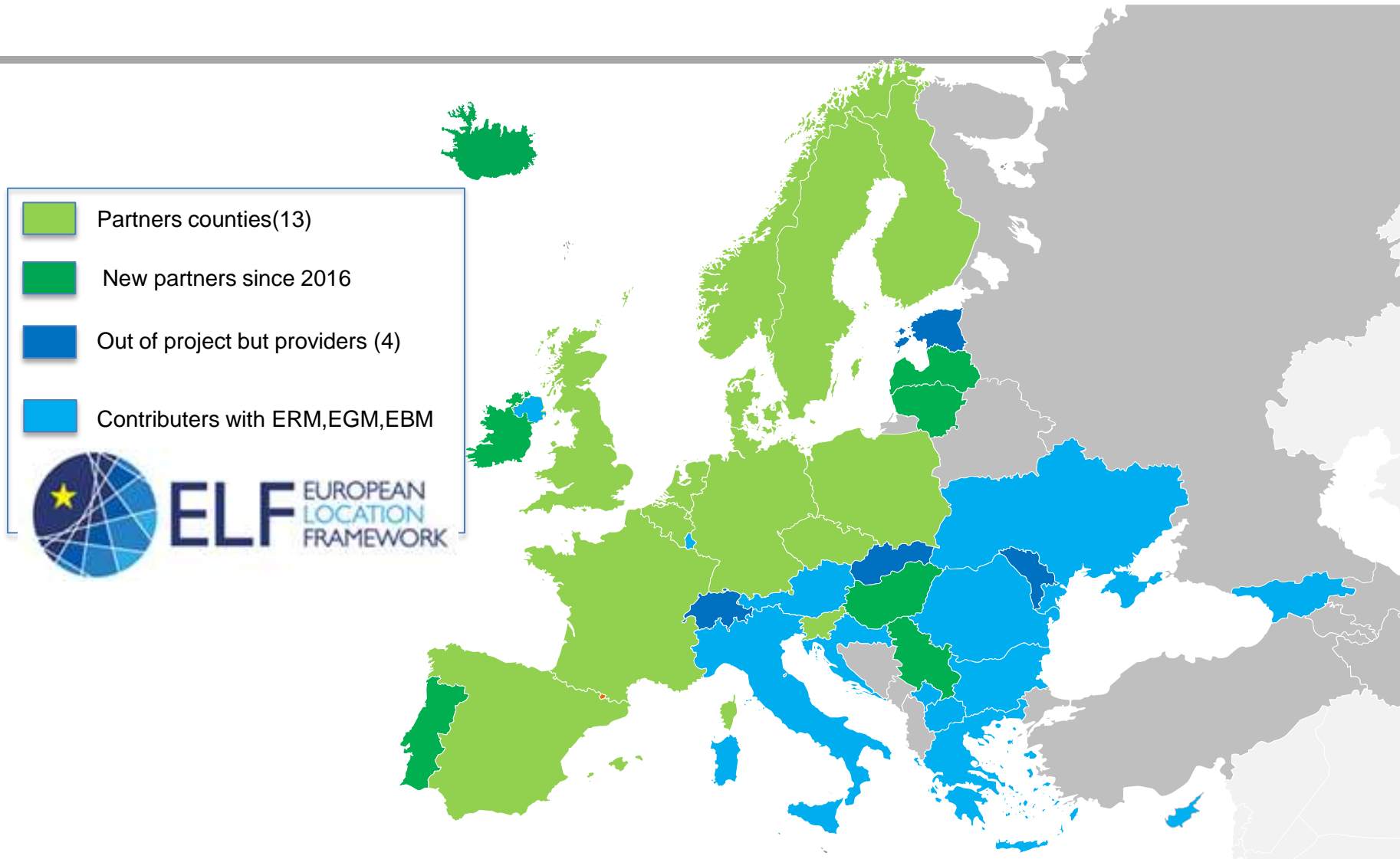
- 1) Some historic lock retraced
- 2) Three solutions proposed and argued :
  - No other double line
  - 5 double boundary lines in sensitive points
  - 72 double lines



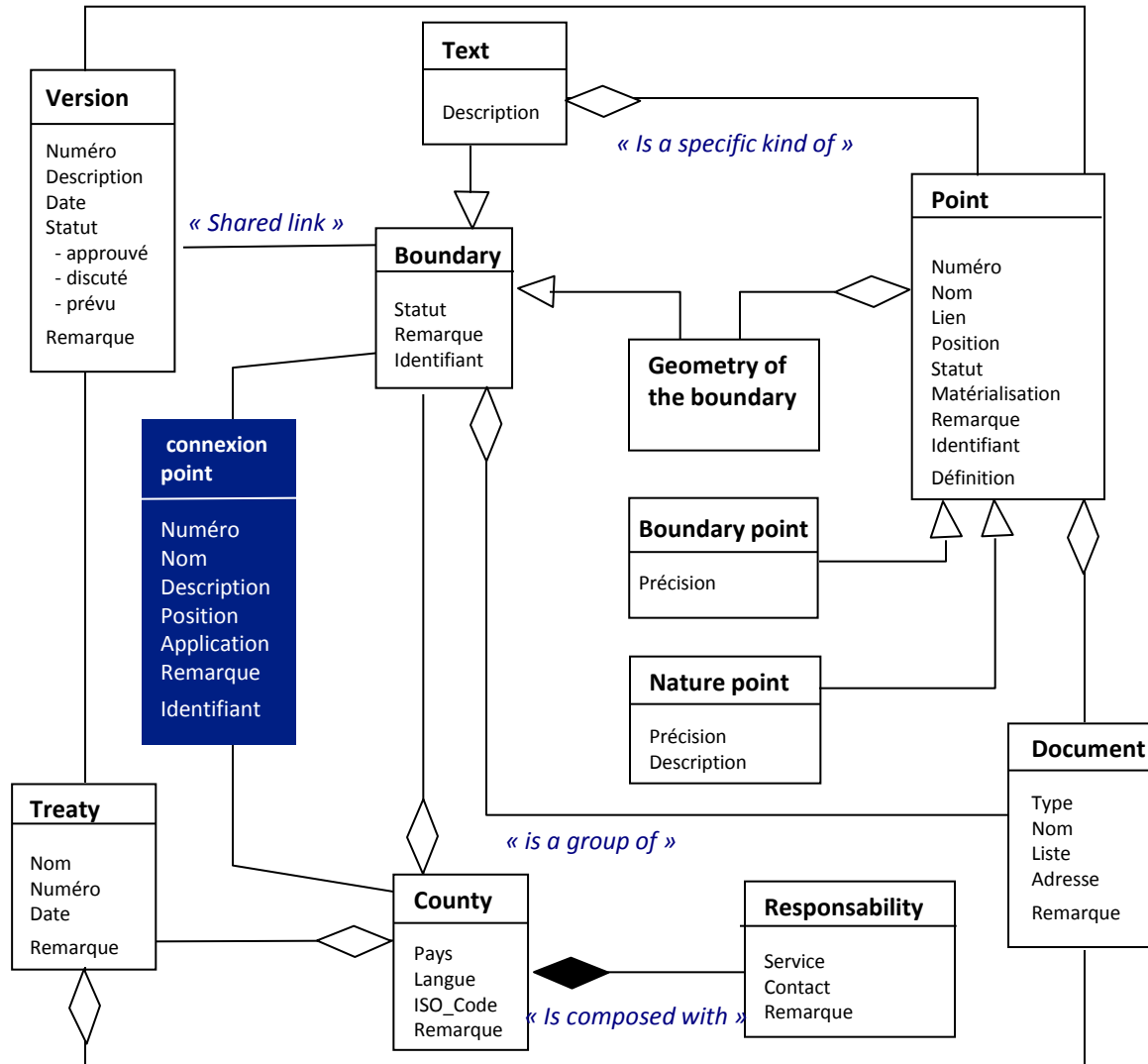
# FRANCE-SPAIN COMMISSION PROPOSAL

MAXIMUM PLAN AGREEMENT ( PLAN A) 1 double boundary line on water	PLAN MINIMUM PLAN B (or C) 6 double bordelines areas (or 72)
<b>ADVANTAGES</b>	
Interoperable line for all boundary data.	Move forward a compromise on sound bases, with minimal risk of being challenged in the future.
To solve ancient conflicts, take advantage of the Directive . Advanced compromise can anticipate future problems of definition of the boundary, which will increase with the years (and the costs )...	Validation will be accepted without bad effects by most of the stakeholders.
<b>DISADVANTAGES</b>	
It is more difficult to change an existing line than to define a new, not yet resolved	Users of GI do not understand that national datasets are not consistent at boundaries
	A conflict zone loses its economic potential

# LES FOURNISSEURS DE DONNÉES ELF EN 2016/17

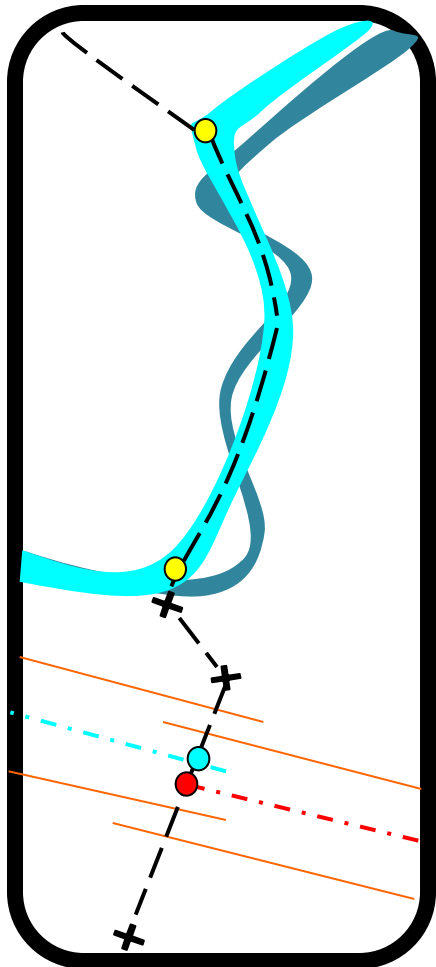


# SBE APPLICATION SCHEMA : HOW ARE ORGANISED THE DATA IN THE GIS



UML  
Class diagram

# INTEROPERABILITY : EDGEMATCH POINTS



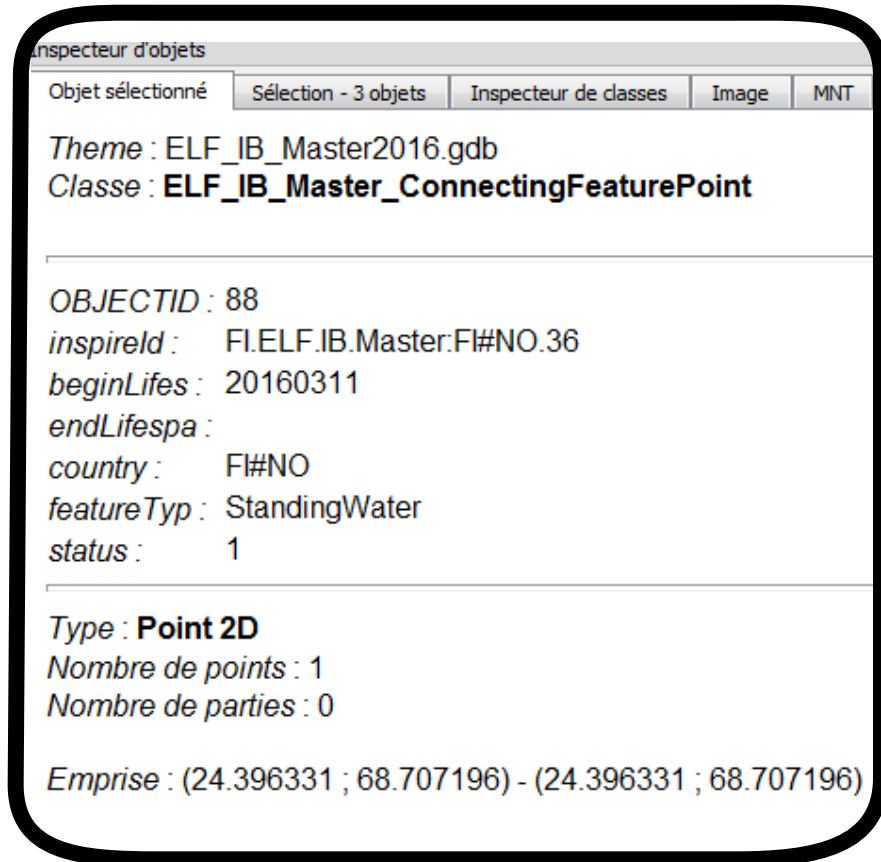
## AXES MUST NOT BE BRAIDED

To edgematch data :

- Crossing object must share the same geometry on the boundary line
- Rivers or road axes must be shared

=> A shared commune line is needed

# 2016 ELF EDGEMATCHINGS



**Format exchange : shape**

**4 themes concerned**

- UA, TN, HY, BU

**CFs : 2 kinds of objects**

- Points (TN, HY)

- Line (UA, TN, HY, BU)

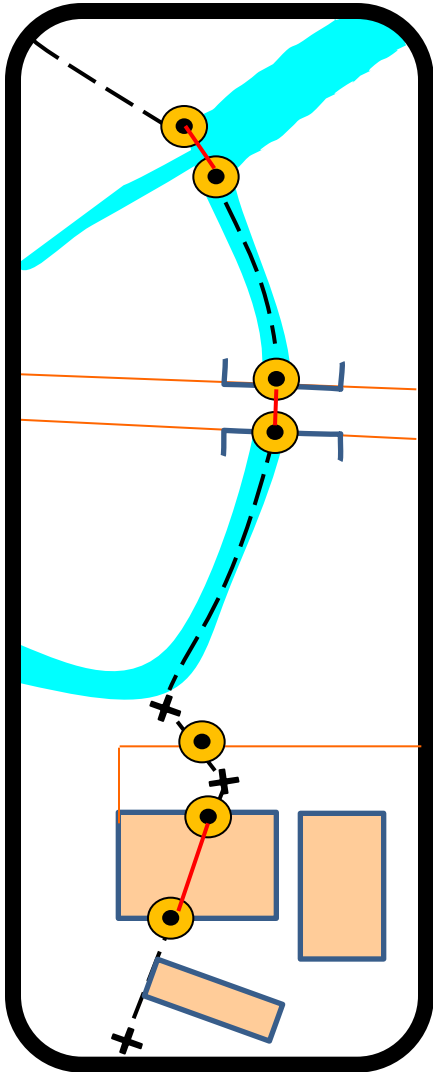
**CFs Elements**

- Feature type

- ETRS89

Geodetic coordinates

# EDGEMATCHING : CFs CANDIDATES & LINES



Lines :

River polygons

Bridges

Customs shared houses

Private houses

CFs Candidates :

With Belgium (620 km)

TN : 1500 CFs

HY : 1500 CFs

BU : 15 buildings + 75 bridges

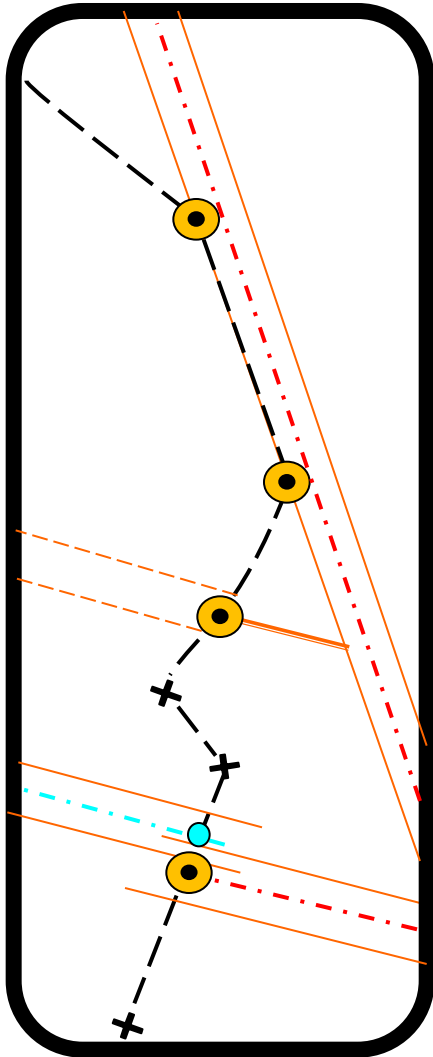
With Spain (623 km)

TN : 1000 CFs (?)

HY : 100 CFs (?)

BU : 0 + 20 bridges (?)

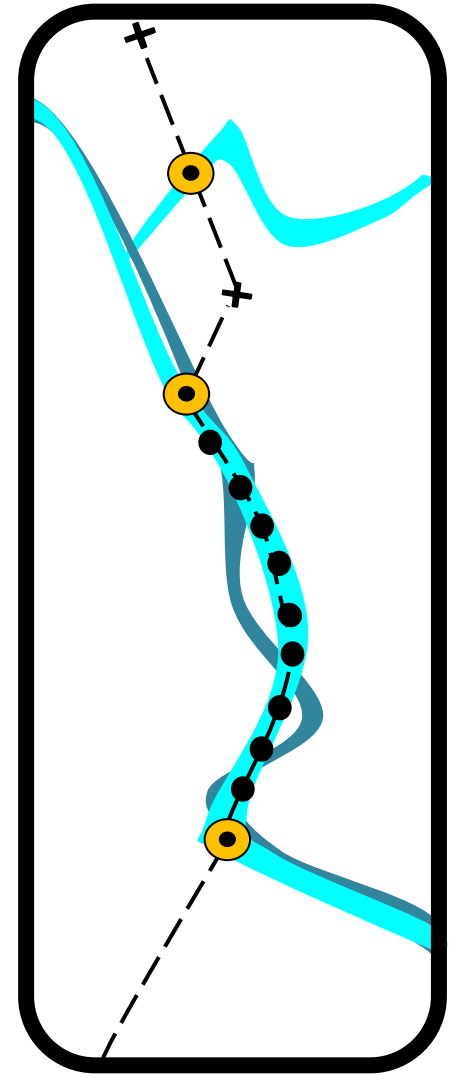
## EDGEMATCHING : CONNECTING POINTS



=> One boundary line carrying edgematch points

2 ways :

- Adopt 1 unic line (a process of improvment has to be foreseen)
- Remove the candidate CF along the line (?)







European  
Commission

*Вопросы?...?*

