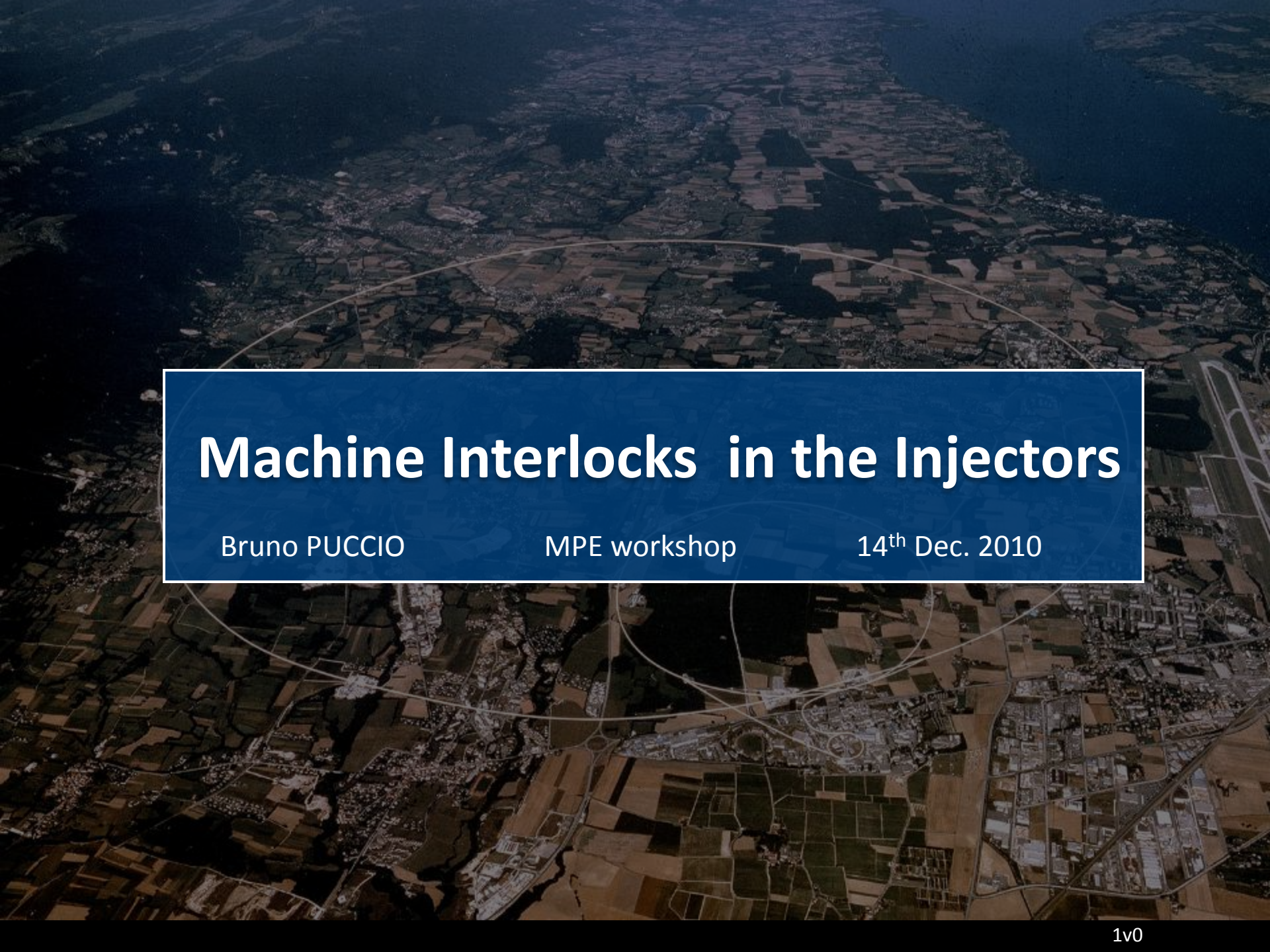


Machine Interlocks in the Injectors

Bruno PUCCIO

MPE workshop

14th Dec. 2010

What do we call “Injectors”?

P Injectors chain: **Linac2** → **Booster** (Transfer line) → **PS** (Transfer line) → **SPS** (TT2) ⇢ **TT60 & Ti2** lines / **TT40 & Ti8** lines

Ions Injectors chain : **Linac3** → **LEIR** (Transfer line) → **PS** (Transfer line) → **SPS** (TT2) ⇢ **TT60 & Ti2** lines / **TT40 & Ti8** lines

Other machines & facilities:

- **Isolde**
- **AD**
- **N-ToF**
- **CTF-3**
- **TT41 line (CNGS)**
- **SPS North area**
- **…**

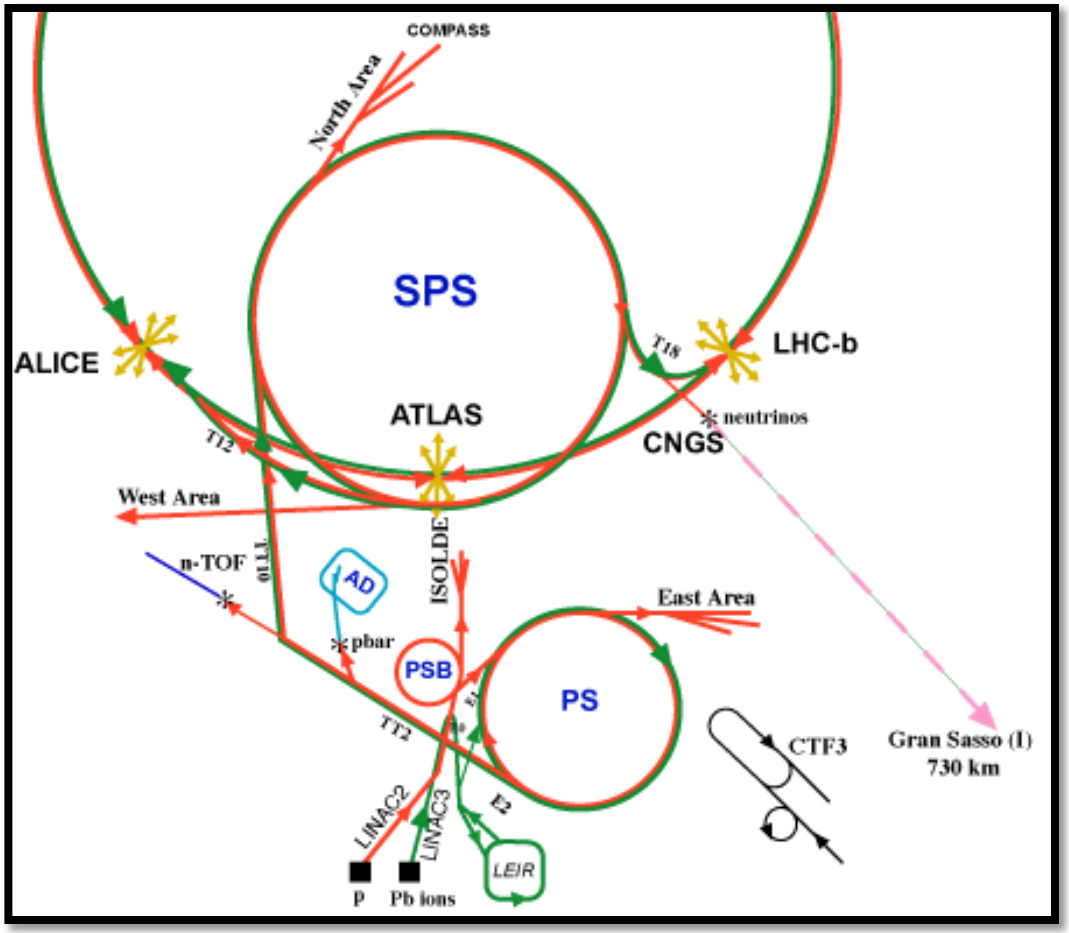
In the coming months:

- **TT66 line (HiRadMat)**
- **3MeV Test Stand of Linac4**

In the future:

- Booster upgrade
- **Linac4**
- Elena ring
- **HIE-Isolde**

… PS2 ?

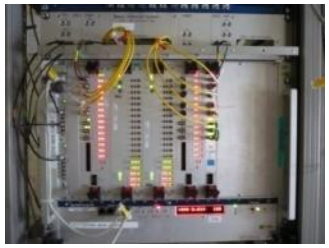


What are the “Machine Interlocks”?

for protecting the Equipments for Beam Operation

Beam Interlock System

(VME based)



+

BIS

PIC

Safe Machine Parameters System

(VME based)

SMP

FMCM

Fast Magnet Current change Monitor

for protecting Super Conducting Magnets and Normal Conducting Magnets

Powering Interlock Controllers

(PLC based)

+

WIC

Warm magnet Interlock Controllers

(PLC based)

Common Approach

BIS

PIC

SMP

Projects
Design

WIC

FMCM

RS422

Fail Safe concept

Reliability vs. Availability

Redundancy

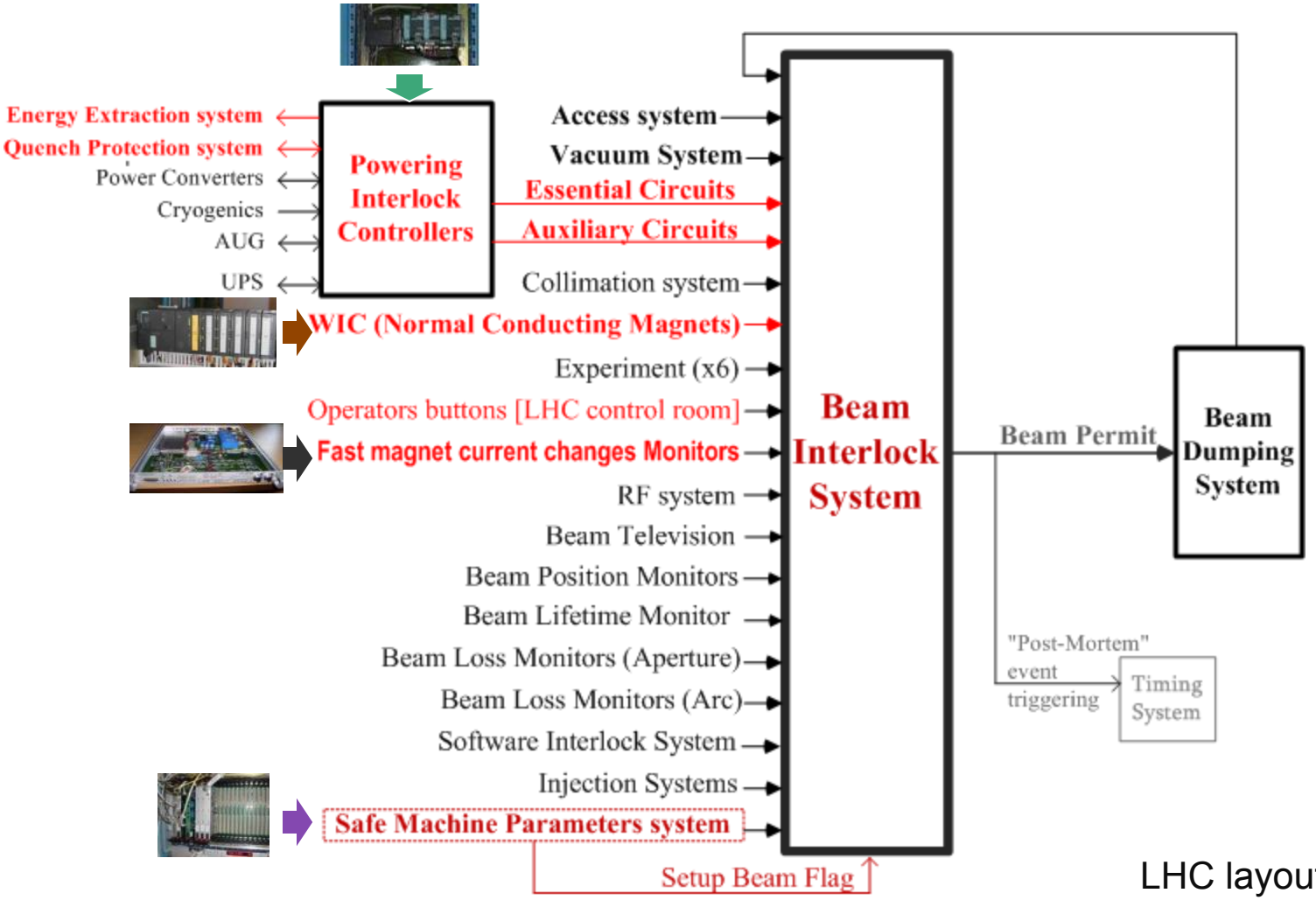
Maintainability

Critical functions in Hw

+

- Pre operational checks
- Full online consistency monitoring during operation
- Post operational checks

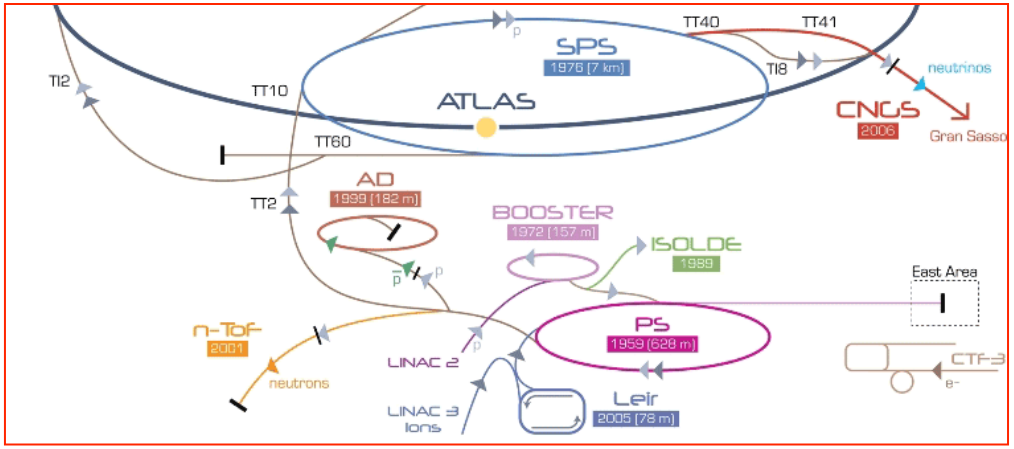
Machine Interlocks Hierarchy



LHC layout

(MPE systems shown in red)

already deployed in the Injectors…



	Linac2	Booster	PS	SPS	TT60 & Ti2 lines / TT40 & Ti8 lines	TT41 line (CNGS)
~~PIC~~						
WIC	*no*	*no*	*no*	*no*	YES	
BIS	*no*	*no*	*no*	YES	YES	
SMP				YES	YES	
FMCM						YES

	Linac3	LEIR
WIC	YES	YES
BIS	*no*	*no*

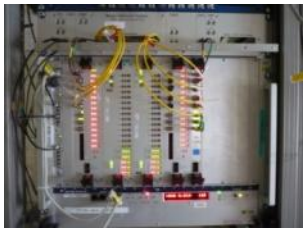
Except these ones, MI systems not deployed in other machines & facilities of the complex, like **Isolde, AD, N-ToF, CTF-3,…**

Future deployments of the WIC system



Machine	Number of			Installation date
	Protected Magnets	PLC crate	Remote I/O crates	
HiRadMat	25	2	2	Jan. 2011
Booster	172	4	53	during 2011 + Xmas 2011/12
Linac4 & Transfer line	98	2	6	2013/2014
Isolde	17	1	2	*not yet known*
Elena ring	48	1	1	*not yet known*
PS main	100	1	11	*not known*
PS Auxiliary	50	2	1	*not known*
SPS ring +auxiliaries	900	9	15	*Deployment not approved*

Future deployments of the BIS



Machine	Number of		Installation date
	User Interface	Controller	
HiRadMat	10	1	Jan. 2011
3 MeV Test Stand (*)	7	1	during 2011
Linac4 & Transfer line	23	3	2013/2014
Booster ring & ejection	24	2	2015?

(*) low energy part of future Linac4

Straight forward activities?

- Enough resources?
  - WIC deployment:
    - 1 Staff + 1 FSU member: Preparation, Procurement, Test, Installation, & Commissioning
    - **Support from EN/ICE (PLC software + PVSS)**
    - Support from BE/CO (Configuration DB)
  - BIS deployment:
    - 1 Staff + 1 FSU member: Prep., Procurem., Test, Installation, & Commissioning
    - 1 student (FESA class, SW configuration, DB,…)
    - Support from BE/OP (Java application)
    - Support from BE/CO (Configuration DB)
- Technical issues?
  - WIC : compatibility between Siemens items
  - BIS : future HW no longer "identical" to current one?
    - New VME system (new CPU, new OS, new crate, new Power supply…)
    - Obsolescence of components

see 1st talk of session#3

“MI in the injectors”: Wrap-up

- Few MI systems already present in Injectors complex.

  But not uniformly installed:
  - BIS deployed in SPS transfer-lines to LHC & CNGS and in SPS-ring
  - WIC deployed in SPS transfer-lines to LHC & CNGS (but not in SPS-ring),
  - and also in LINAC3 & LEIR.

- Next deployments:
  - 2011 => HiradMat (BIS + WIC), 3MeV Test stand (BIS) and **Booster** (BIS + WIC)
  - Later on: **Linac4** (BIS + WIC), HIE-Isolde (WIC + PIC?), Elena ring (WIC),….

- Foreseen to be expanded with “copy/paste” LHC solution
  - But possible issues with backward compatibility and with components obsolescence

- Resources
  - Rely on support from external manpower: FSU, Fellows, Students, EN/ICE group,…
  - Minimal level of staffing for the coming deployments (and subsequently the maintenance)

    What about “piquet” type?
  - Not possible to tackle large installations in the near future

Fin

Thank you for your attention