IEFC Workshop 2011

Session 2: “MTE and High Intensity Operation”

Short summary/Follow-up items

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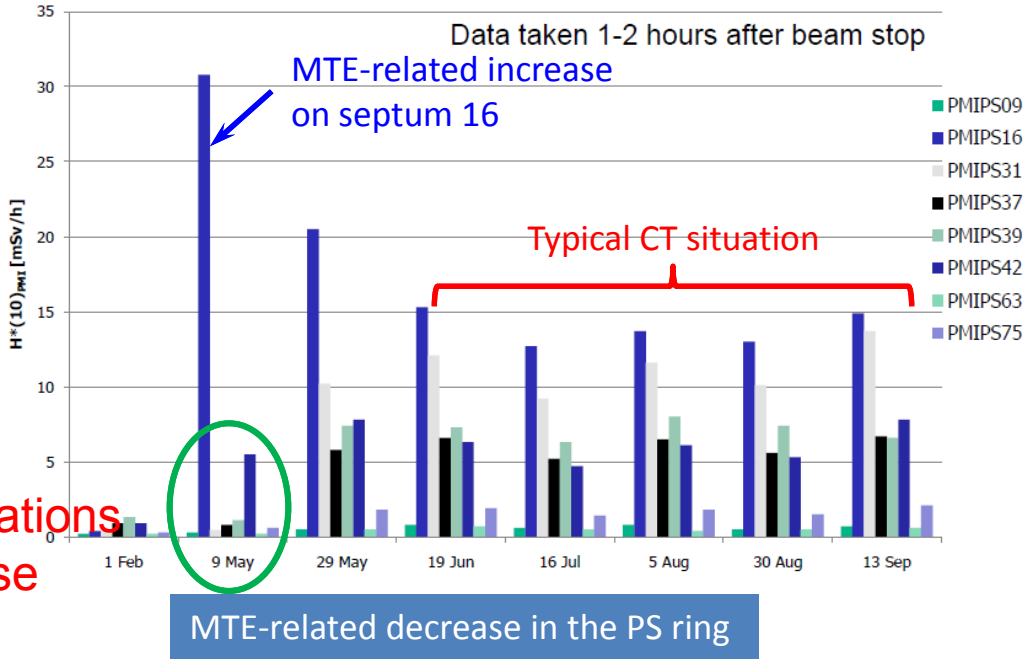
Presentations:

M.Giovannozzi	MTE Roadmap - Beam Physics Aspects
R.Steerenberg	MTE Roadmap seen from OP
J.Borburgh	Requirements and Constraints for ABT Equipment
J.-J.Gras	BI Improvements across the Complex
K.Cornelis	High Intensity Beams and their Performance
B.Puccio	Machine Interlocks

MTE Roadmap – Beam Physics Aspects

MTE used in operation in early 2010
2.2-2.3e13 p in 1 PS extraction to CNGS
Extraction efficiency 97-98 % (CT 93-94)
SPS transmission of MTE beam ≤ 94 %
(inj. optics not matched for islands)



Losses concentrated on SMH16 (2-3 x)
Fluctuating PS trapping efficiency
Reason not known yet – no clear correlations
Lots of data analysed, and still to analyse
Fluctuations longer than one cycle
Most losses occur and injection/start of ramp
Fluctuating SPS injection trajectories

Mitigation + tests (ongoing/to come):

Conclude on by mid 2011

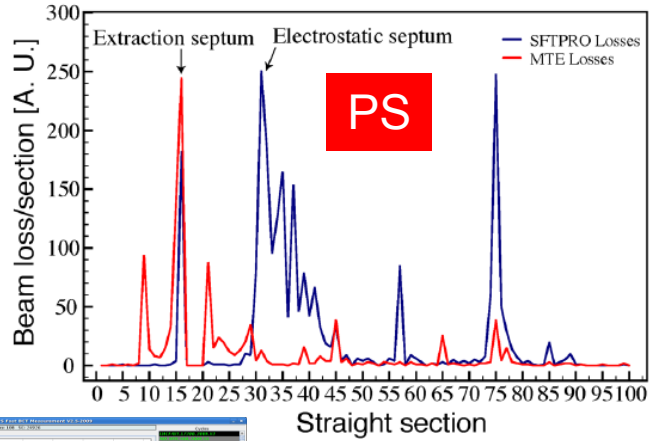
Dummy septum in SS15 (LS1) to concentrate losses on a low-maintenance device (??)
Testing new extraction (using SEH31) – feasibility not clear yet (w/o dummy septum ??)
Check correlations with B-field fluctuations (first attempt fooled by ADC prb), POPS
Cycle setting-up with INCA slow, noisy tune measurement, instruments precision ?
Manpower barely sufficient for studies – rely heavily on OP to drive + CO, BI, … support
Gaps in beam not acceptable (SPS RF limitation) – final word ?

CT likely to be needed beyond LS1

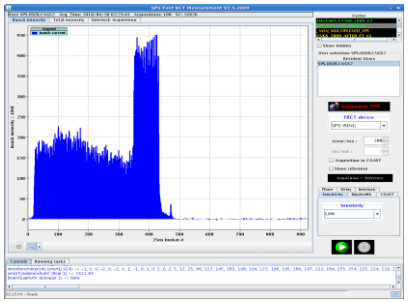
MTE Roadmap seen from OP

PS benefits – less irradiation (equipment (except SS16 …) + environment)
Removes intensity bottleneck, and opens way to further optimisation
If not done, Linac4 and PSB/PS upgrade possibilities cannot be fully exploited
SPS short term benefit – (just) less spiky spill structure
Longer term prospects for
neutrino physics etc.

SPS



MTE uses equipment (e.g. BI) in different ways
(usually more demanding)
Developments for MTE benefit OP in general



Problems of measurement precision (BCT, …)
"Shooting on a moving target" (fluctuations) with a spreading gun (instruments precision)
OP favours dummy septum (over potential hybrid MTE/CT system)
Main focus on understanding the fluctuations

Matter of priority (cycles, time + manpower to prepare/carry out/analyse MDs)
How to follow up issues and to get improvements rapidly implemented ?

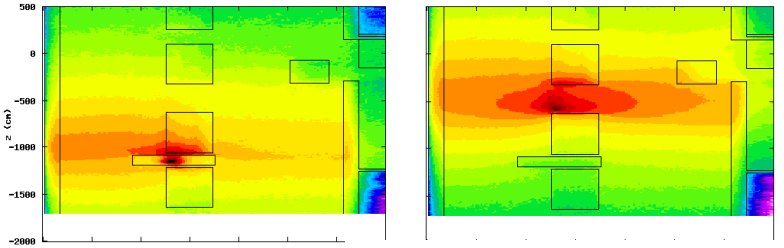
Requirements and Constraints for ABT Equipment

Need to overhaul (broken) SEH31.3 in 2011 as oper. spare (SEH31.2 too hot for now)
Lots of CT equipment "obsolete" (no investment in past years in view of MTE operation)
(controls, electrical distribution, interlocks, PVC HV cables, other safety concerns, …)
can only be done in LS1

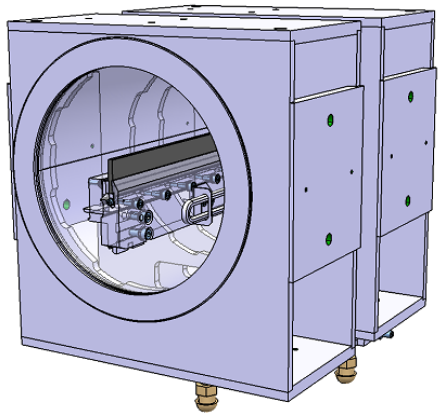
Consolidation for MTE infrastructure (not done due to lack of time and to keep cost low)

Need to exchange operational SEH16 in TS2011/12, and start building additional spare

"Spoiler" (in SS16) not useful
Dummy septum (in SS15) will have good effect
(10-40 x in SS16, 3-5 x for local stray radiation)



	Cost (MCHF)	Resources (MY)
CT	1.6	5
MTE	1.6	6
MTE- CT hybrid	2.4	9



Cost estimate for new generators (3 times faster kicker rise time ?) to be re-made
(new building needed (MCHF !) – B367 re-affected to POPS)

BI Improvements across the Complex

Presentation not focused on MTE only, but intended to cover also LIU, consolidation, …

Ongoing consolidation, concentrated mainly on modern acquisition chain
(electronics, SW, preserving existing monitor (yet trying to get best poss. performance)

New requirements (MTE, LIU, …) can be partly incorporated, some others require different approaches (and level of effort)

Went through list of instruments: SEM, wire scanners, BLM, BCT, orbit, tune/chroma, ….
Lots of questions after presentation …

Clear, consistent and agreed specifications needed (not just “as good as possible”)
Reaction: What is the present performance ?? Not so clear, and not easy to say
(at least time consuming)

Specifications will define funding (LIU), time scales, priorities, …

Problems of rapid drift (resp frequent loss) of calibration (TT2 BPM) – specialists needed

“BI supervisor” should be beneficial – role to be defined.

High Intensity Beams and their Performance

$N_p = N_{days}$ * Intensity * Duty cycle * Availability

Beams looked at: CNGS, FT (COMPASS + NA62), nTOF, future v facilities, LHC25

CNGS:

Losses in PS raise strongly with intensity (not linearly)

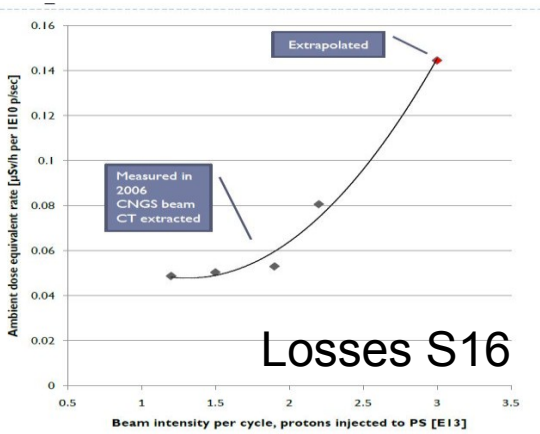
Direct limitations (Route Goward, SMH16),

but also higher wear on equipment (also SPS)

Better to run with lower intensity and higher duty cycle

MTE needed to overcome PS bottleneck

SPS limitations: RF power, vertical aperture



FT:

Reduced duty cycle (concurrency of LHC, CNGS) led to request higher intensities/cycle

Limitations (other than above): ZS losses/spark rate, splitter losses → max 4e13

I_{rms} of MPS (SPS-FT can not be used alone …)

Perturbations from unscheduled cycle changes (LHC setting up/filling)

Technical stops re-scheduling on short notice

LHC25:

Beam dynamics (RF, e-cloud, TMCI → adressed by LIU)

Kicker performance (ripple) → demanding for SPS damper (high power, high gain)

Stress on SPS dump from prolonged setting up (step-wise) and MD

Kicker heating (addressed by LIU)

Duty cycle optimisation as important as record intensities.

Presentation focused on

BIS = Beam Interlock System (VME based), also SIS (Software Int'lk System)

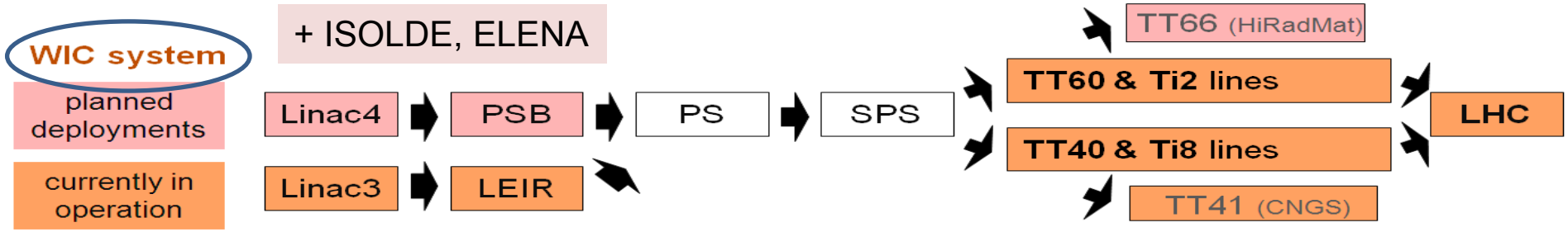
WIC = Warm magnet Interlock Controllers (PLC based)

Highly reliable (available) systems, generic, well integrated, good software tools

Rely on continued good collaboration with EN-ICE (WIC)

Clear plans for coming years (pink below = ready for after LS1, resp. before)

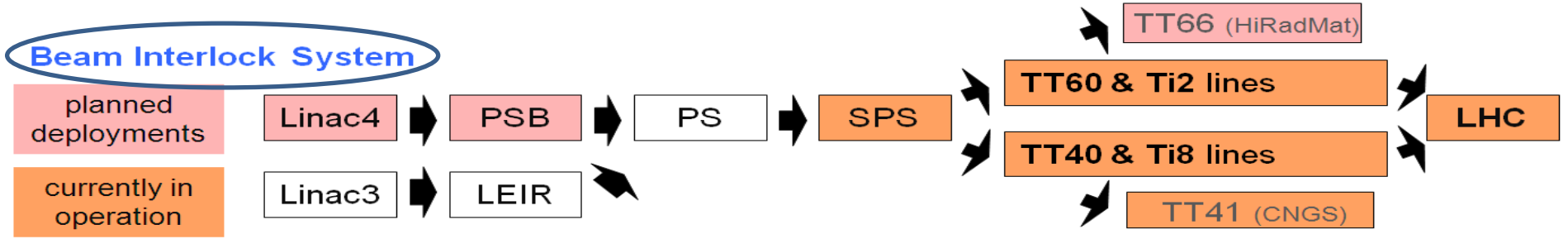
Manpower barely sufficient (planned deployments and maintenance), tight planning



PS (100 main + 50 aux magnets) →15 crates (only study for time being)

SPS (900 magnets) → 24 crates (presently no resources to tackle such a big inst.)

Spare situation for present SPS "WIC system" (TE-MSC) – a concern ??



No decision yet for PS deployment