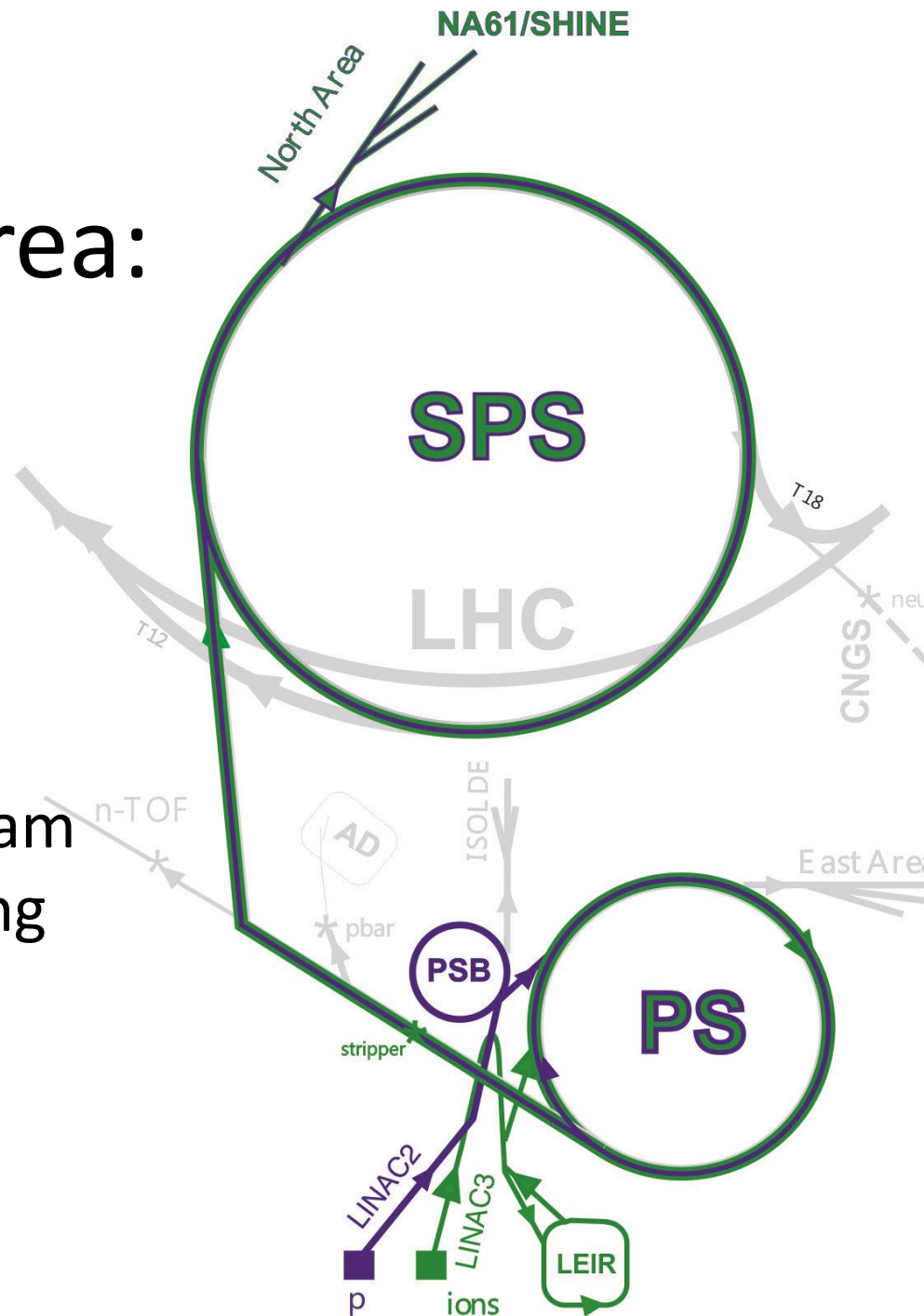


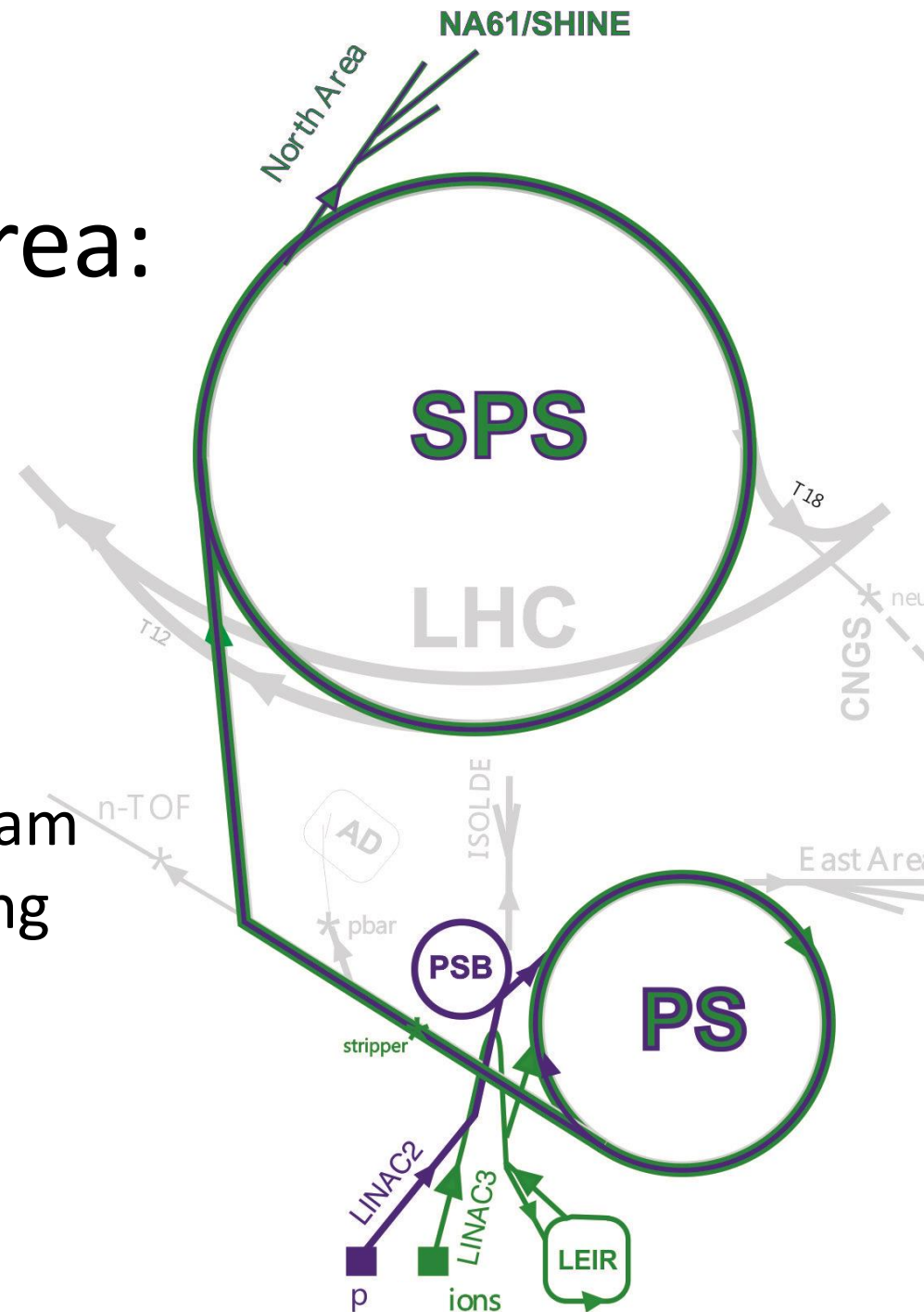
Xenon for North Area: How? What? When?

D.Manglunki for the ion team
BE/OP/SPS section meeting
21/2/2017



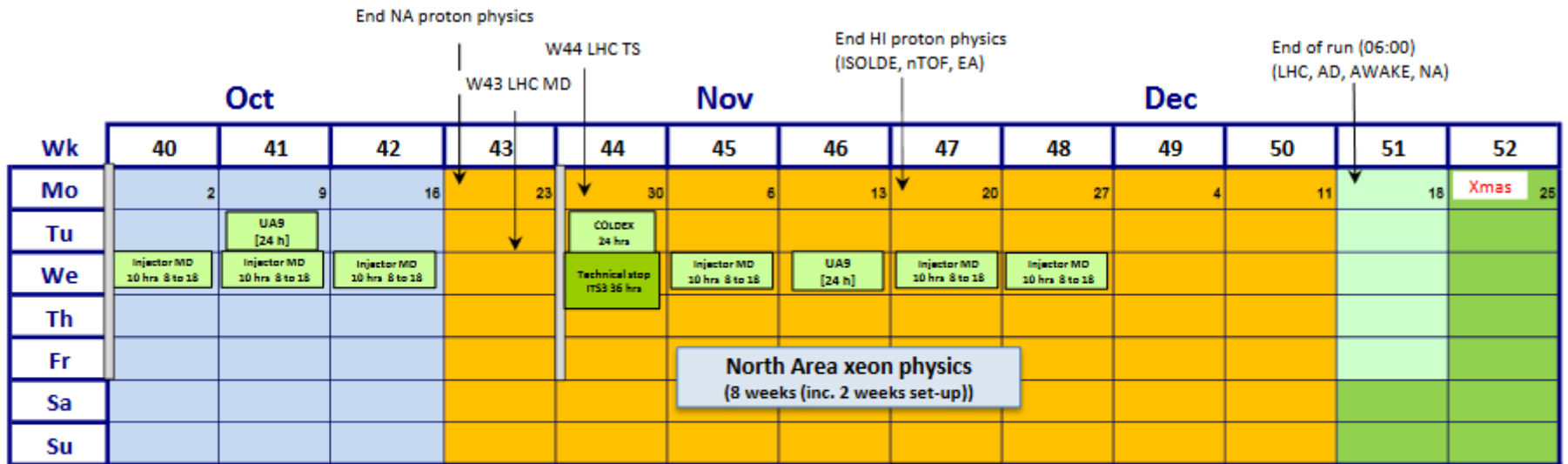
Xenon for North Area: What? When? How?

D.Manglunki for the ion team
BE/OP/SPS section meeting
28/2/2017



WHAT? Xenon in NA

- 6 extraction momenta for NA61: 13, 19, 30, 40, 75 & 150 AGeV/c
- 8 week run from October 23rd to December 18th
- Very similar to argon but we've never had this beam at CERN before...



Injector Complex MD Block

Technical stop for the Injector Chain

HiRadMat: possible beam request

Ions to NA

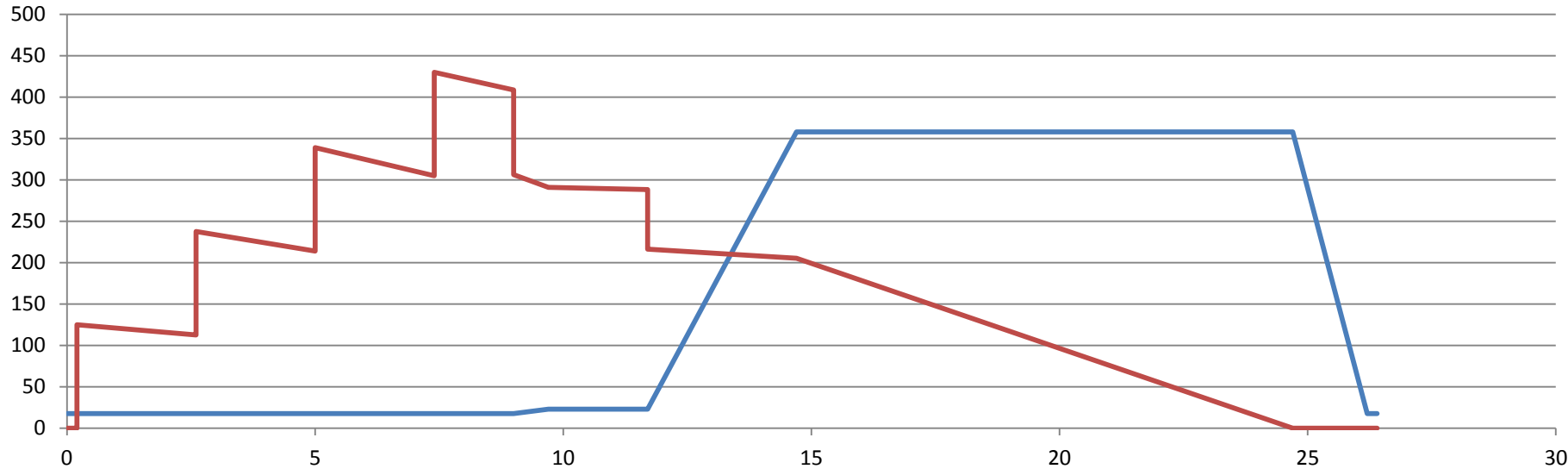
WHAT else? Ion MDs in 2017

- With Xe beams in LEIR
 - For LIU (Pb optics)
- With Xe beams in the SPS (setting up time needed):
 - In coast for UA9 (1x24h, tentatively November 15th)
 - Possible 24h Xe MD in the LHC (JMJ's request)
 - Partially stripped Xe³⁹⁺ (and Xe⁵²⁺ ?) for Gamma-factory
- With Oxygen beams in LEIR
 - For BioLEIR. Currently not planned but not excluded

WHAT? Xe ($A=129$; $Z=54$) in 2017

- Charge states
 - Source/Linac $Q=21+$
 - Stripped to $Q=39+$ at Linac3 exit for LEIR/PS
 - Fully stripped (or not... see MD slide!) to $Q=54+$ in TT2
- Transfer energies
 - Linac3 \rightarrow LEIR at 4.2MeV/u as usual.
With $Q/A = 0.302$, injection $B\rho=0.98\text{Tm}$, $p/Q = 294 \text{ MeV}/c$
(for $\text{Pb}54+$, injection $B\rho = 1.14\text{Tm}$, $p/Q = 342 \text{ MeV}/c$)
 - LEIR \rightarrow PS 96MeV/u (maximum LEIR $B\rho = 4.8\text{Tm}$ as usual)
 - “Similar” LEIR cycle as argon: single injection, single bunch “EARLY” type
 - PS \rightarrow SPS at $B\rho$ 9% lower than maximum, due to constraint imposed by frequency range of PS & SPS respective RF systems (same $\gamma = 7.74$ as Ar)
 - Strip to $Q=54+$ in TT2
 - SPS injection $B\rho = 57 \text{ T.m}$ (as for 17.07 GeV/c protons, same as Pb)
- Cycle and RF gymnastics in PS: similar to Ar
 - Single bunch on $h=21$
 - rebucketing on 80MHz
 - Acceleration to 23.64 ZGeV/c (6.28 GeV/u)
 - Transfer to SPS on $h_{\text{PS}}=423$ ($h_{\text{SPS}}=4653$)

WHAT? SPS cycle (26.4 s = 22 BP)



- 7.8 s flat bottom at 17.07 ZGeV/c
 - 4 injections (eases debunching and intensity needed > 2e10 charges)
- Accelerating ramp ~ 0.65 s to 24.5 ZGeV/c (10.25 AGeV/c, $\gamma=11.05$) on fixed frequency RF system.
- Debunching at 10.25 AGeV/c for 2s intermediate flat top
- Acceleration to top energy on fixed harmonic RF system
 - Max 3 s to 358 ZGeV/c (150 AGeV/c)
- Extraction flat top: 10s at 13, 19, 30, 40, 75 or 150 AGeV/c (equivalent to 31, 45, 71, 95.5, 179, 358 ZGeV/c for proton momenta)
- Ramp down: 1.5s
- Duty cycle $\sim 30\%$ (LHCPILOT cycle present)

WHAT? Planned intensities

- 27 eμA of Xe³⁹⁺ out of Linac3 after stripper
- For a pulse length of 200 μs this corresponds to 3.4E10 charges or 8.6E8 Xe³⁹⁺ ions
- 1.7E10 charges or 4.3E8 Xe³⁹⁺ ions in LEIR (single injection)
- 1E10 charges or 2.5E8 Xe³⁹⁺ ions in PS
- 1.1E10 charges or 2E8 Xe⁵⁴⁺ ions per injected bunch into SPS

WHEN? Detailed schedule 2017 (I)

- NOTE: for Argon this was spread over 3 years (49 weeks):
 - 2013 First beam in source, RFQ & Linac3 (13 weeks)
 - 2014 recommission Linac3 (2 weeks), commission LEIR(8 weeks), the PS (6 weeks), and the SPS (10 weeks)
 - 2015 Restart complex with ions + Physics run (2+8 weeks)
- 27/2 - 8/5 Commission Xe beam in source/RFQ/Linac3 :
 - 2 weeks – hardware setup
 - 4 weeks – source setup (maybe only 2 needed)
 - 2 weeks – RFQ & Linac3 setup
 - 2 weeks end March/begin April
during which the Linacs team is busy restarting Linac2.
- 18/4 – 5/5 LEIR HW tests + Cold check out
 - Prepare and test new cycle

WHEN? Detailed schedule 2017 (II)

- 8/5 - 12/6 Commission Xe beam in LEIR
 - 5 weeks, daytime, 4 days/week
 - Steering from Linac3 to LEIR, injection, cooling, acceleration, extraction
 - retrieve Ar-like performance.
- 12/6 - 26/6 Commission Xe beam in PS
 - 2 weeks, nr of days/week tbc
 - new cycle, different from Ar and Pb
(lower handover rigidity, eq to 23.64GeV/c protons)

WHEN? Detailed schedule 2017 (III)

- 26/6 - 22/10 Commission Xe beam for FT in SPS
 - 16 weeks, 1-2 days/week, but possible dedicated MDs on Wednesday
 - One short cycle to prepare
 - the first acceleration ramp on fixed frequency,
 - debunching on an intermediate flat top
 - the second acceleration ramp at fixed harmonic to top momentum.
 - Six physics cycles with 10" extraction flat top
 - Respectively at 13, 19, 30, 40, 75, and 150 AGeV/c
 - Equivalent to 31, 45, 71, 95.5, 179, and 358 ZGeV/c (proton momenta)
- At some point during summer (~mid July?)
 - 1 week source maintenance for exchange of plasma chamber
- 23/10 - 18/12 Xe Physics run in parallel with LHC p-p
 - 6 weeks of data taking for 6 momenta: first 150, then 13, 19, 30, 40, 75 and back to 150 AGeV/c
 - interleaved with
 - 13 days of lines setting up
 - 3x10h injector MD
 - 24h COLDEX run + 36h technical stop (31/10-2/11)
 - 24 h UA9 Xe coast run (15-16/11)

HOW? Manpower

- LEIR supervisors in 2017
 - MEA, Nicolo, Sergio, Steen
 - Jérôme & Django until ~ end of May
- SPS operators involvement
 - After local HW tests, cold checkout & beam commissioning from CCC
 - Generation of LEIR Xe cycle by SPS experts
 - LEIR-S + Verena + SPS Shift leader commission Xe beam
 - SPS technician in charge of SPS
 - **NO AWAKE, HiRadMat, or parallel SPS MDs**
 - *(only during afternoon shift???)*



Thanks for your attention!