# PROBLEM SITUATION

RUN 4 REQUESTS FOR ION BEAMS:

- NA61/SHINE: LIGHT IONS (O, Mg, B) AT THREE MOMENTA (13A, 30A, 150A GeV/c), ABOUT ONE MONTH PER YEAR
  ADDENDUM SUBMITTED TO SPSC

- NA60++: Pb IONS AT SEVERAL MOMENTA, ABOUT ONE MONTH PER YEAR
  LOI SUBMITTED TO SPSC

~ MANY TEST USERS EXPECTED

AS FOR NOW, A COMPATIBILITY WITH P-BEAM USERS LIMITS THE ION PERIOD TO ABOUT ONE MONTH PER YEAR

⇒ RUN 4 ION-AND-PROTON PLANS ARE INCOMPATIBLE

## POSSIBLE SOLUTION:

- UPGRADE NA TO ALLOW FOR 'PARALLEL' PROTON-ION OPERATION
- MODIFY BEAM REQUESTING AND SCHEDULING

ASSUMPTIONS:

- BEAM WILL BE USED FOR

EXCLUSIVE - RUNS - RECORD A MAXIMUM NUBER OF EVENTS IN A GIVEN TIME (LONG PERIOD OF PHYSICS DATA TAKING)

# EVENTS ~ (DUTY-CYCLE) · TIME

=) MAX DUTY-CYCLE SHOULD BE USED

SHARED - RUN - HAVE SUFFICIENT TIME FOR SETUP, TESTS, CALIBRATION, SHORT PERIODS OF DATA TAKING NEEDING A SIGNIFICANT SETUP TIME...

SHARED - RUN DOES NOT REQUIRE THE MAXIMUM DUTY-CYCLE

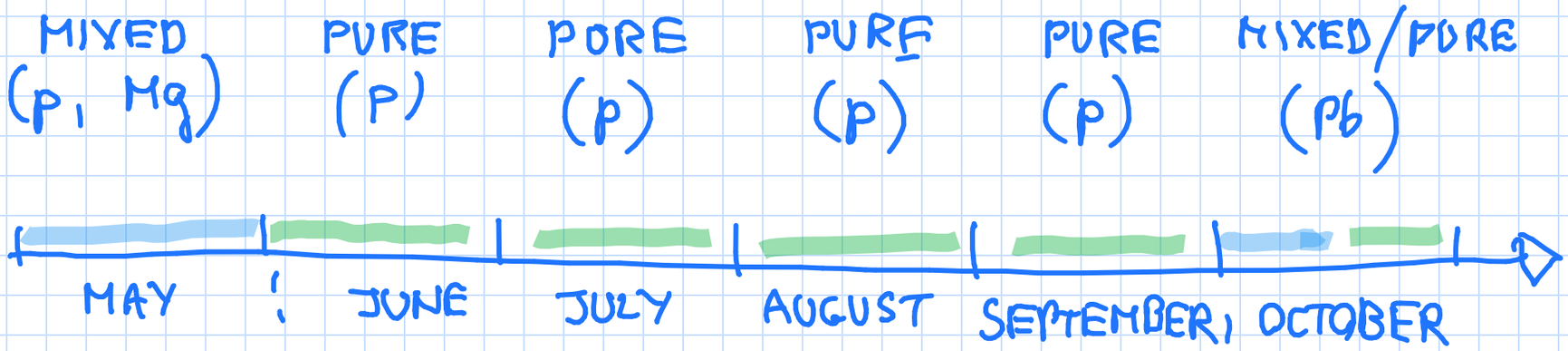
- NA CAN OPERATE IN TWO MODES:
  - PURE-MODE - ONLY PROTON OR ION BEAM IS EXTRACTED TO NA
  - MIXED-MODE - ION AND PROTON BEAM ARE EXTRACTED TO NA IN 'PARALLEL'

THE MIXED-MODE ALLOWS TO HAVE SHARED-RUNS OF PROTON AND ION USERS IN PARALLEL => MORE EFFICIENT USE OF THE TOTAL TIME

# EXAMPLE: SOLVING THE RUN4 PROBLEM SITUATION

YEAR 2023+

NA:




SHARED - RUNS OF NA61 (Mg) AND p USERS

DUTY-CYCLE = = 50% MAX

PROTON EXCLUSIVE RUNS

DUTY-CYCLE = MAX

pb ~ SHARED AND EXCLUSIVE RUNS

## IMPACT ON ARATON USERS:

SHARED RUNS NOT NEEDED → MAXIMUM REDUCTION OF BEAM TIME BY $(4-2) \times 0.5$ WEEKS = 1 WEEK (ABOUT 5% OF TOTAL TIME)

6 WEEKS OF SHARED RUNS NEEDED → MAXIMUM GAIN OF BEAM TIME BY TWO WEEKS (ABOUT 10% OF TOTAL TIME)

## CONCLUSIONS:

RUNNING NA IN THE MIXED MODE (PROTNS AND IONS IN PARALLEL) FOR ABOUT ONE MONTH PER YEAR WOULD GIVE A LONG-TERM POSSIBILITY TO INCREASE PHYSICS OUTPUT OF NA EXPERIMENTS

IN PARTICULAR, IN THE RUN4 PERIOD:

- NA61/SHINE PROGRAMS ON ONSET OF QGP FIREBALL (LIGHT IONS) AND NUCLEAR FRGMENTATION CROSS-SECTION MEASURMENTS (Pb AT LOW ENERGY) AND

CAN BE EXECUTED WITHOUT COMPROMISING NA60++ AND NA61/SHINE DATA TAKING ON OPEN CHARM AND DI-MUONS (Pb BEAM)

AND HAVING A LIMITED (NO?) IMPACT ON P-BEAM USERS