

# Status and Development of the ASTRID2 Facility

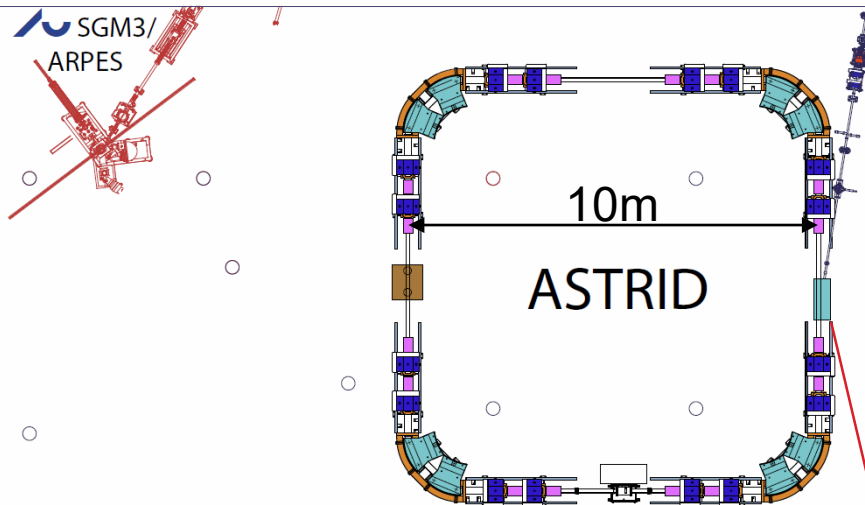
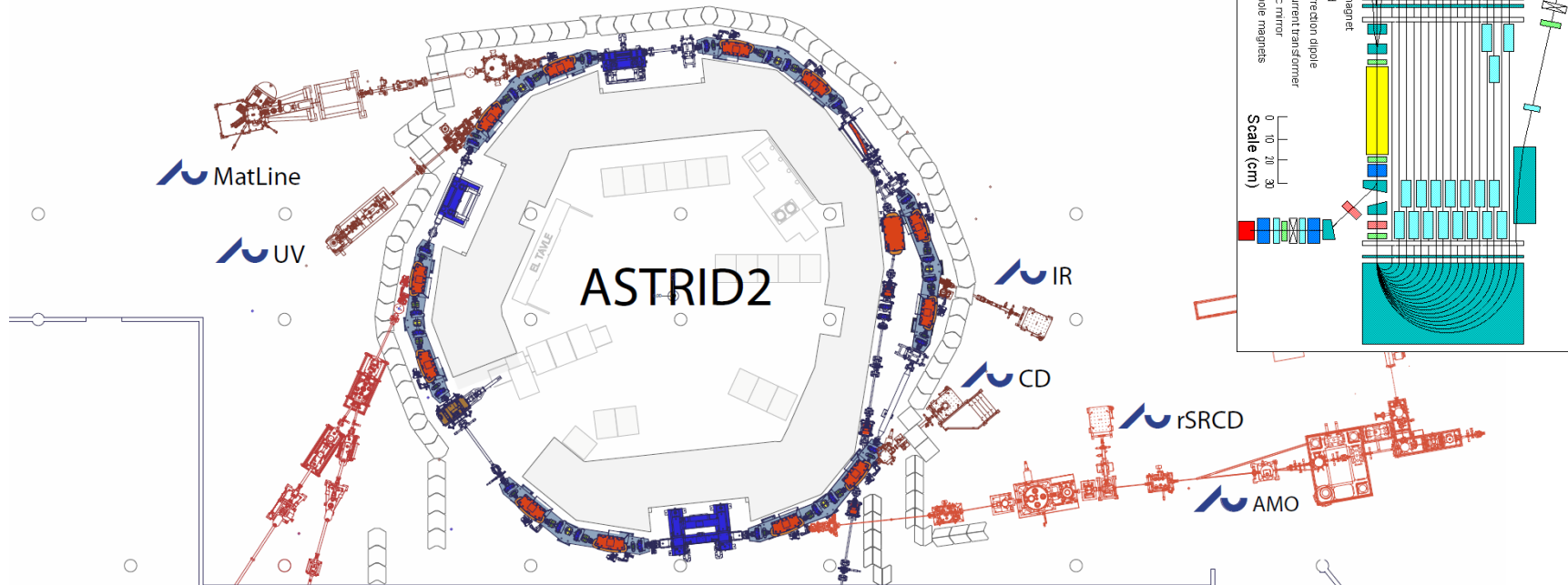
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(on behalf of the machine group)  
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# ASTRID2

- ▶ ASTRID2 is the “new” synchrotron light source in Aarhus, Denmark, since 2013
- ▶ ASTRID2 main parameters
  - Electron energy: 580 MeV
  - Emittance: 12 nm
  - Beam Current: 200 mA (presently 180 mA)
  - Circumference: 45.7 m
  - 6-fold symmetry
    - lattice: DBA with 12 combined function dipole magnets
      - Integrated quadrupole gradient
  - 4 straight sections for insertion devices
  - Using ASTRID as booster (full-energy injection)
    - Allows top-up operation

# The ASTRID 2 facility



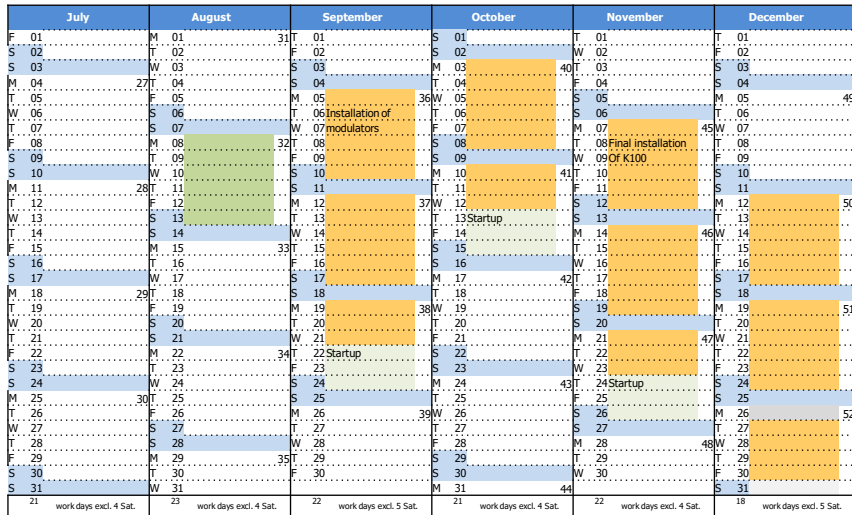
## ASTRID2 main parameters

Circumference	45.71 m
Energy	580 MeV
Current	180 mA
Critical SR energy	257 eV
RF frequency	105 MHz
Harmonic	16
Horiz. emittance	12 nmrاد
#Straight sections	6
Length of straight sections	2.82 m
#ID's	3

# Energy Savings

- ▶ Have been asked by the University to cut down operation by 50% in Sep.–Dec. 2022 and by 25% in 2023

2022 Calendar



2022

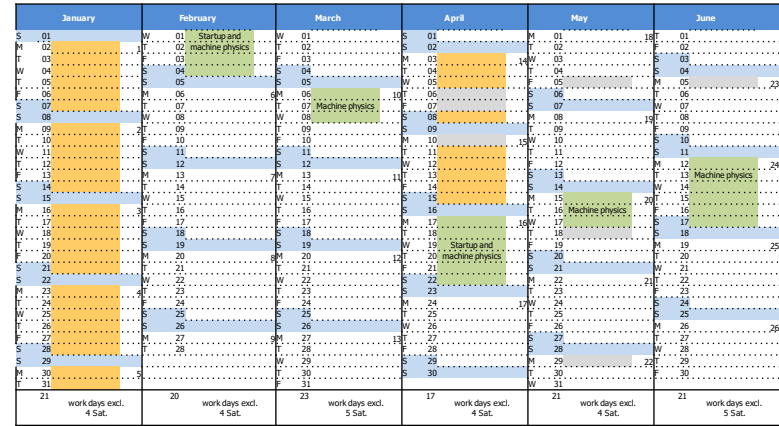
**ASTRID2 shutdown**

Note that some of the marked time would have been shutdown anyway due to service and upgrades, but it is a significant cut down.

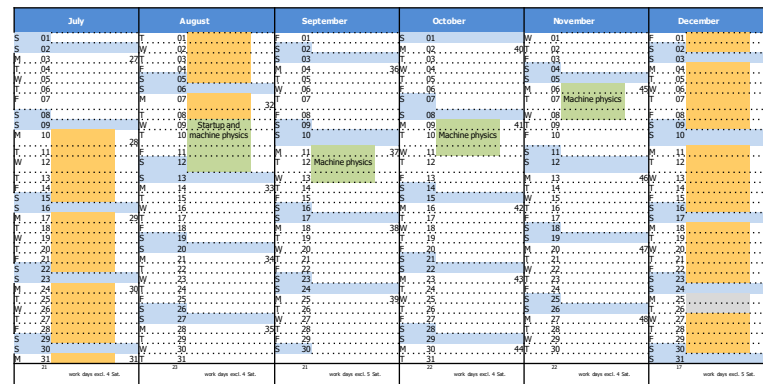
2023 Calendar

Schedule - proposed in August 2022

2023



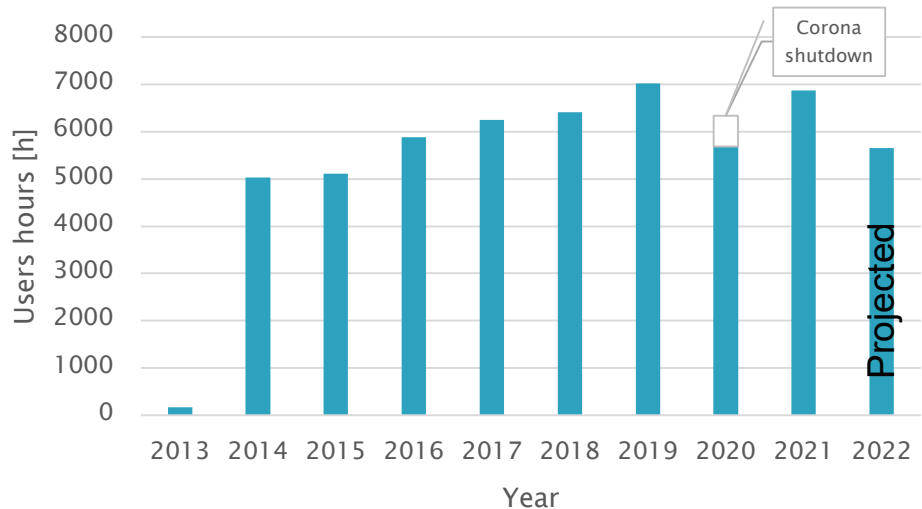
2023 Calendar



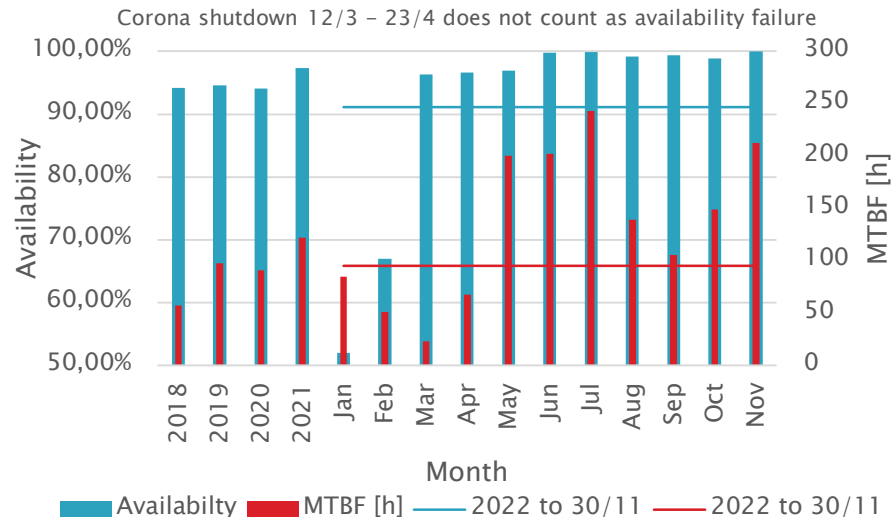
# User hours and reliability

Downtime: If current goes below 90% of top-up set current

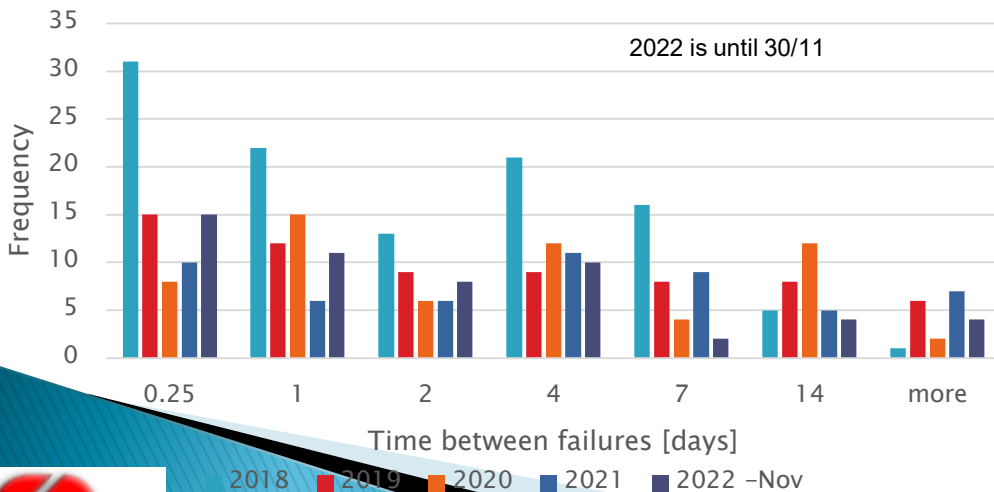
ASTRID2 User hours



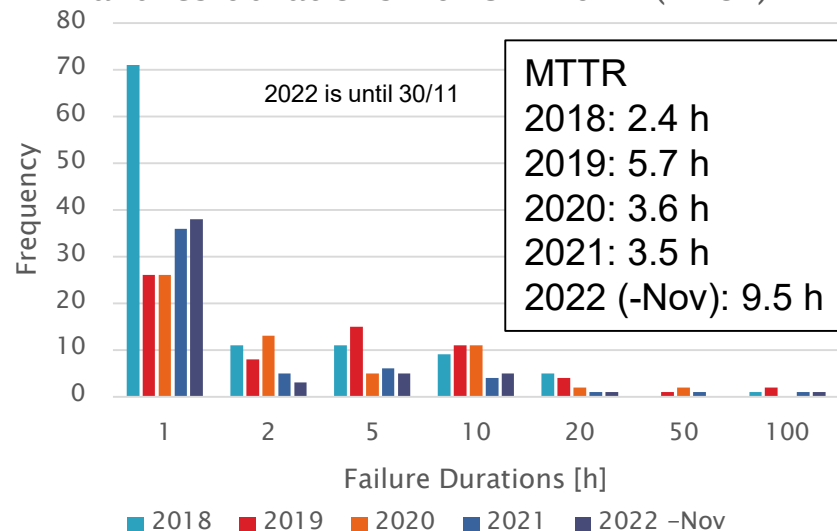
Availability / MTBF 2018-2022



Time between failures 2018 - 2022 (-Nov)



Failures durations 2018 - 2022 (-Nov)



# Failures

- ▶ 2022 has not been the best year
  - MTBF: 2018: 57 h, 2019: 98 h, 2020: 91 h, 2021: 122 h , 2022: 98 h (until 30/11)
- ▶ Jan.: ASTRID
  - Septum supply failure (1600 A DC supply)
    - 3 rectifying diodes burned– hard to get new ones
  - 415 h (17 days) lost !!
- ▶ Feb–April: ASTRID2
  - Intermittent failures in main dipole supply
    - Turned out to be a poor soldering in the interlock chain
  - 34 h lost, but beam lost 32 times over ~2 months!
- ▶ May: ASTRID
  - RF control computer had died and needed a restart
  - 11 h lost because of weekend
- ▶ Feb: All
  - Compressed air failure
  - 10 h lost because of evening and night
- ▶ Plus, various other failures

Note:  
No operator or technician on call during evenings, nights and weekends

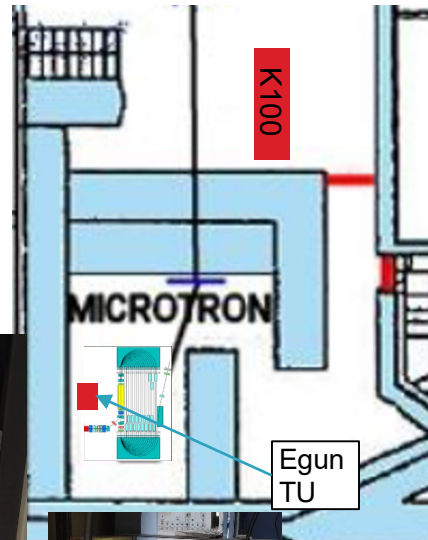
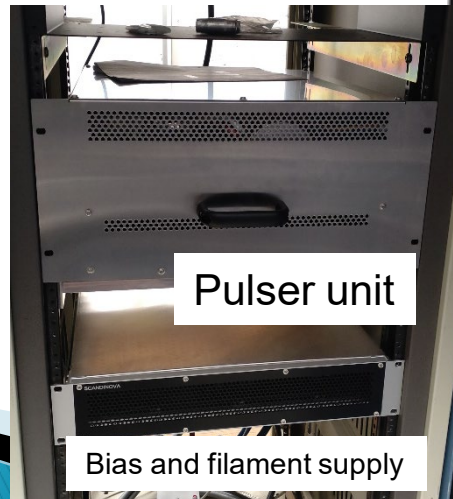
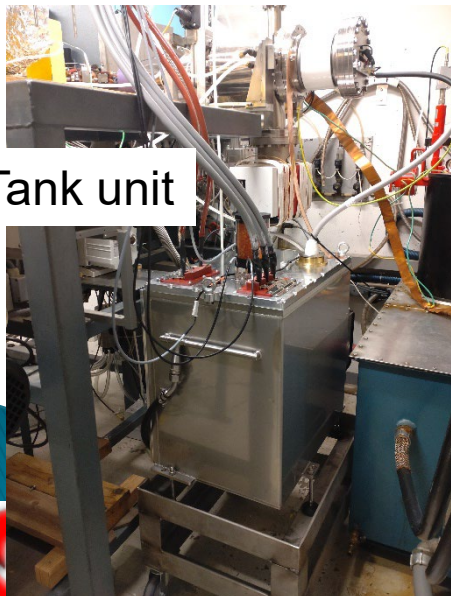


# New Microtron modulators

- ▶ **New ScandiNova modulators:**
  - K100 standard solid-state modulator with Canon klystron
    - 3 GHz, 7.5 MW,  $\sim 3 \mu\text{s}$  pulse length,  $< 10 \text{ Hz}$  rep. rate
    - Canon E3779,B klystron (waveguide + SF6)
  - 70 kV Gun modulator
- ▶ **Was delivered in September and installed October–November**
  - Has replaced the  $> 30$  years old PFN
    - Had one PFN feeding both klystron and e-gun (two transformers in oil-tank)

# New Microtron modulators

- ▶ K100 standard solid-state modulator with Canon E3779,B klystron
  - 3 GHz, 7.5 MW (need ~3.5 MW)
  - ~3  $\mu$ s pulse length
  - <10 Hz rep. rate (typical < 2 Hz)
  - Has been placed outside Mic. bunker
- ▶ 70 kV Gun modulator
  - Modified M100 unit
  - Gun current: <1 A



K100 unit



# Other new development

- ▶ **Changed power supply capacitors in all our Libera Electron BPM processors**
  - Saw increased beam current dependence.
    - Has helped, but not eliminated beam current dependence.
    - Many of the capacitors had degraded quite a lot (after ~10 years of operation)
- ▶ **Started to operate our 3<sup>rd</sup> harmonic Landau cavity at an elevated temperature (30–35°C)**
  - Allows to detune a Higher Order Mode, so we can achieve a smaller detuning of the main mode, giving a better beam lifetime
    - If we run a too high a temperature, we see an increase in vertical beam size, which is varying
      - Believe it is ions captured by the beam, and we expect this to condition away
  - Now have a beam lifetime of ~2.8 h instead of ~2.0 h
    - And we have less Longitudinal Coupled Bunch Instability
    - Smaller horizontal beam size on our SR diagnostic camera (dispersion  $\ll 0$ )

Thank you for your attention

LEGO model of ASTRID2 by Nykola Jones:



*ASTRID2, ISA, Aarhus University*

# ASTRID2 Layout

