Institute for Storage ring facilities, Aarhus

- **ASTRID** is operating ~40 weeks/year, 24 hours/day, 7 days/week
- ~150 users annually, 50/25/25 % from abroad/Aarhus/DK

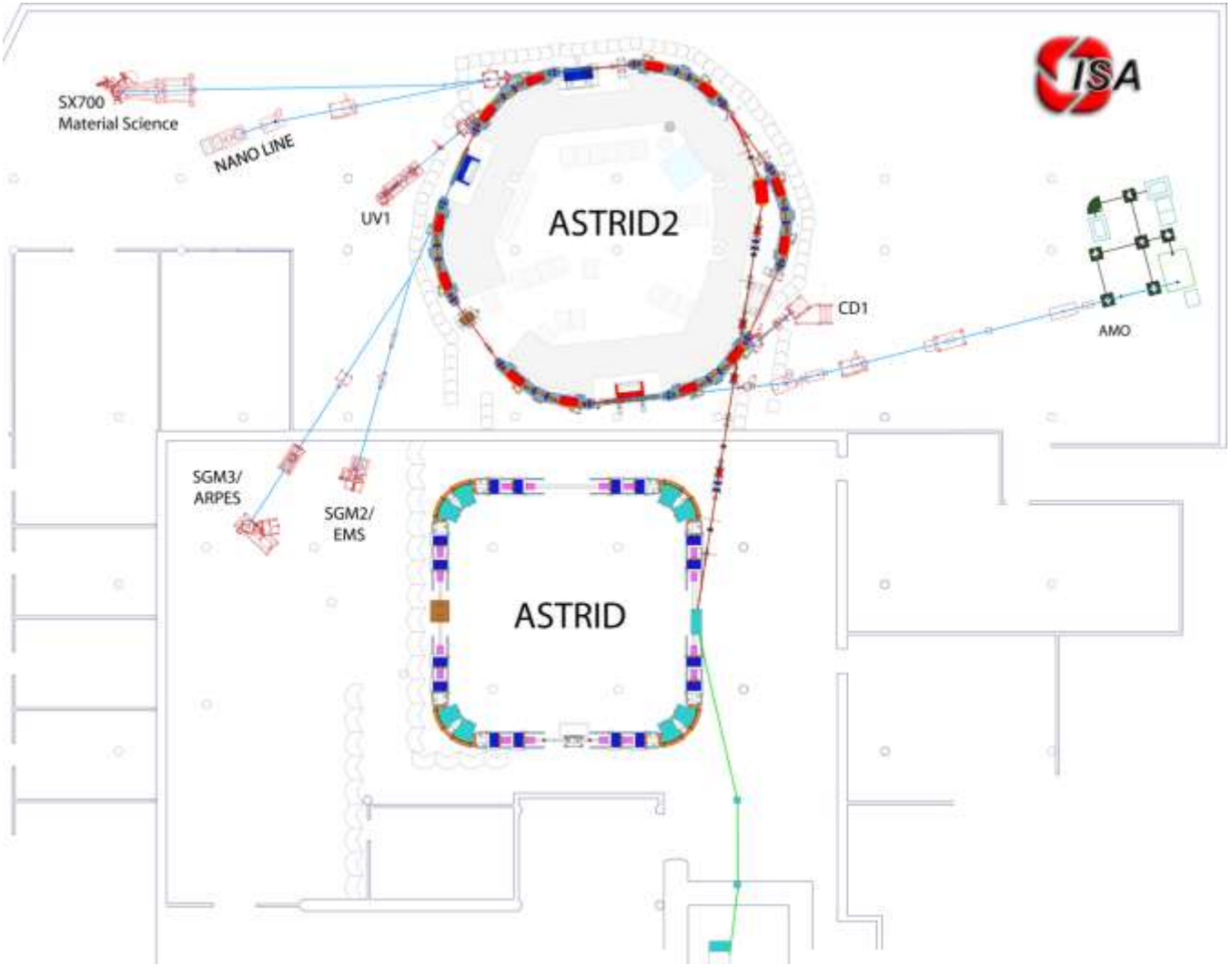
FUNDING for **ASTRID2** 37 MDKK (5 M€) 08/2009-02/2013:

- ASTRID modifications (mainly fast extr. kicker)
- Transfer beamline
- ASTRID2
- 2T MPW
- Smaller SR beamline modifications/upgrades

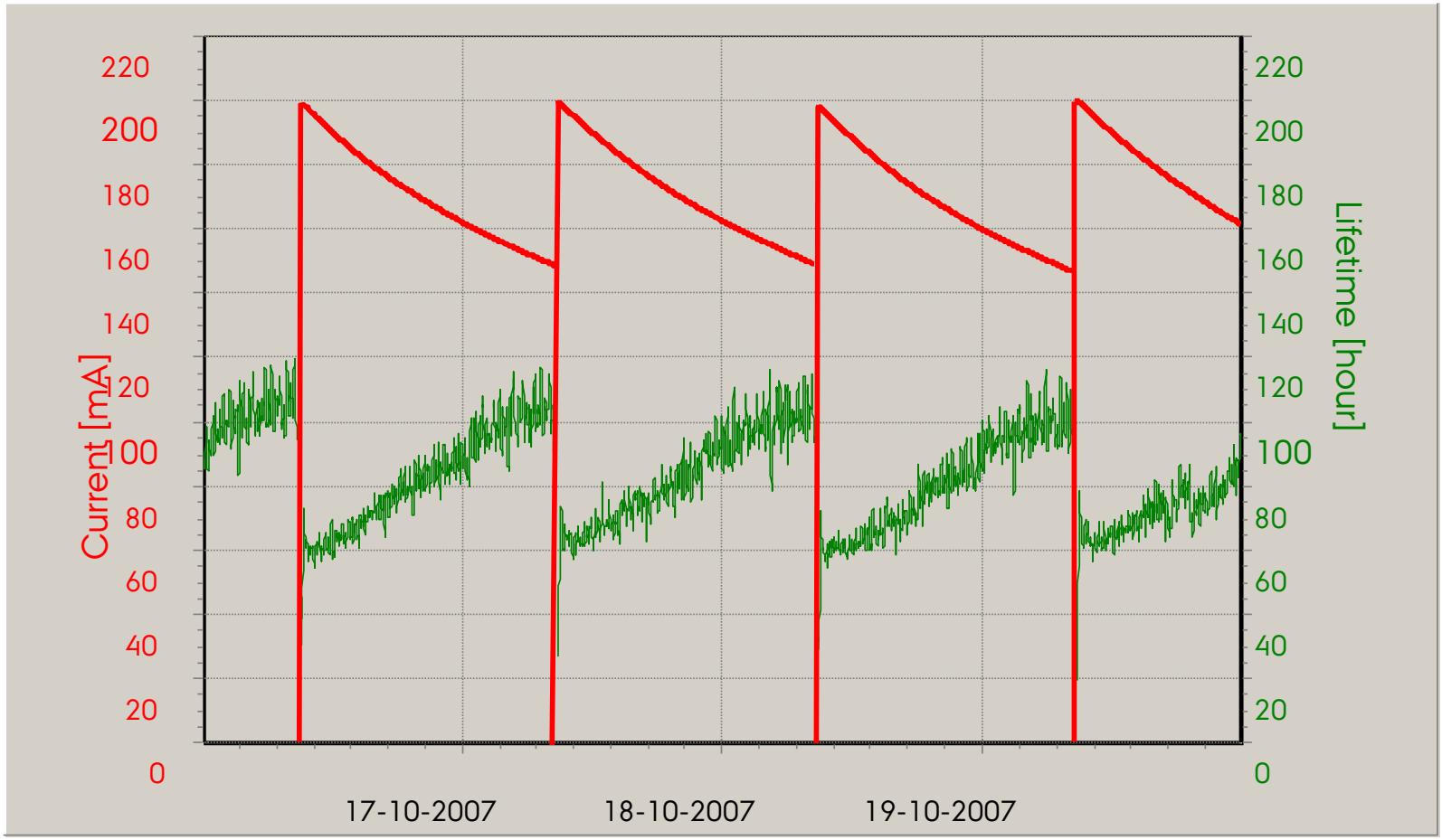
10 MDKK for AMOLINE (incl. U-53)

Future (X-mas): Materials/iNANO/STM beamline

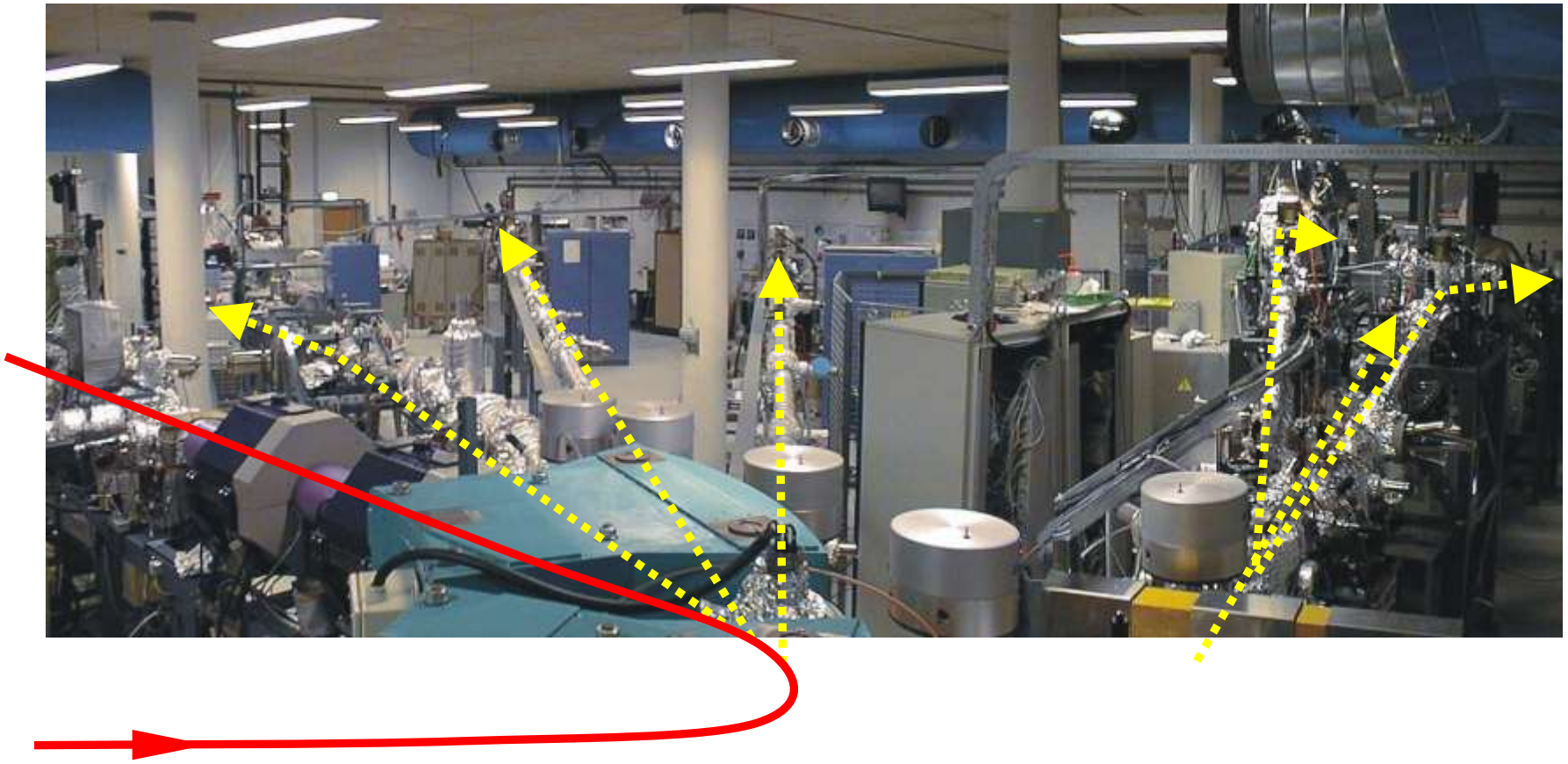
ASTRID2 with beamline layout



Present ASTRID injections



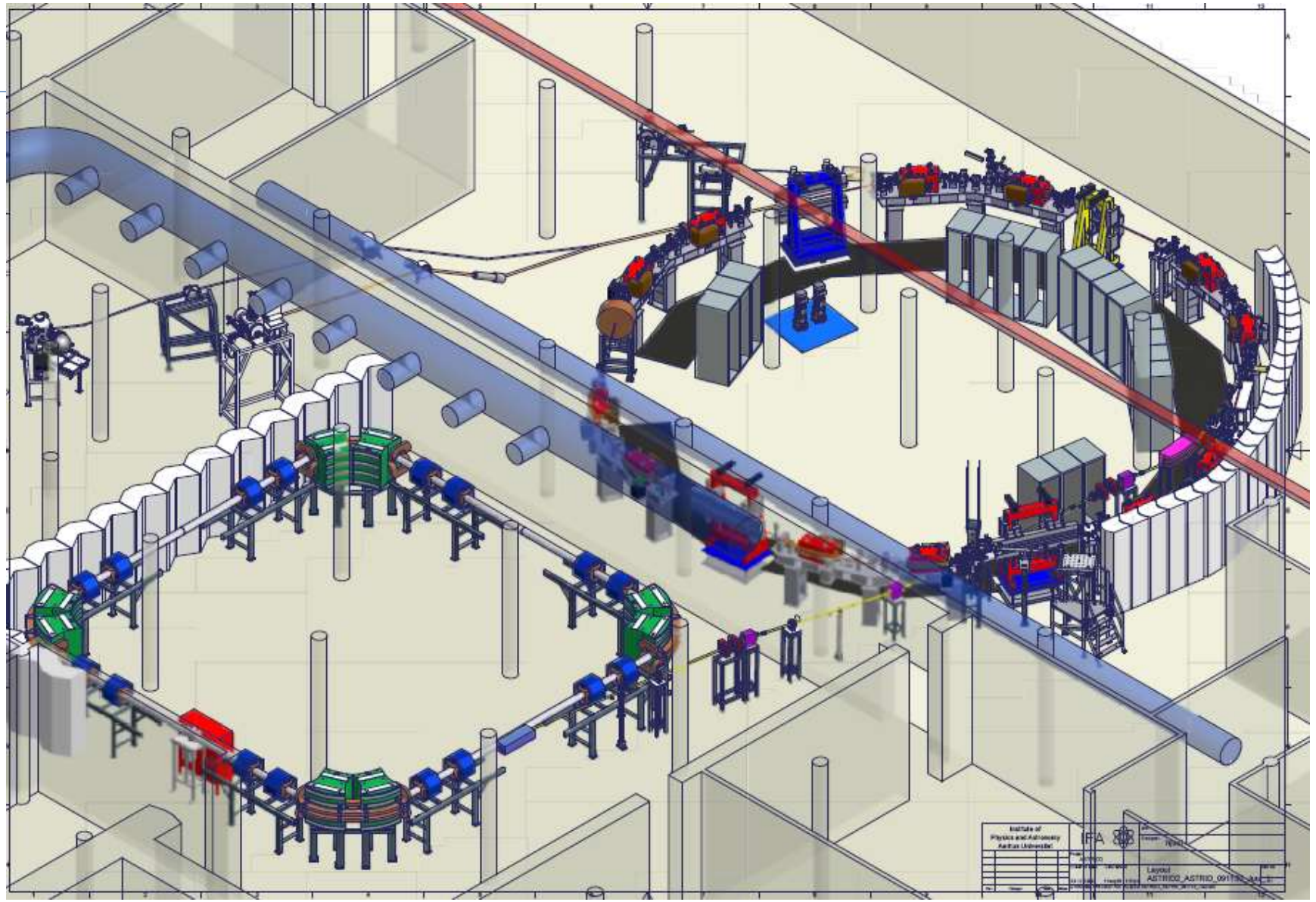
Beamlines at ASTRID



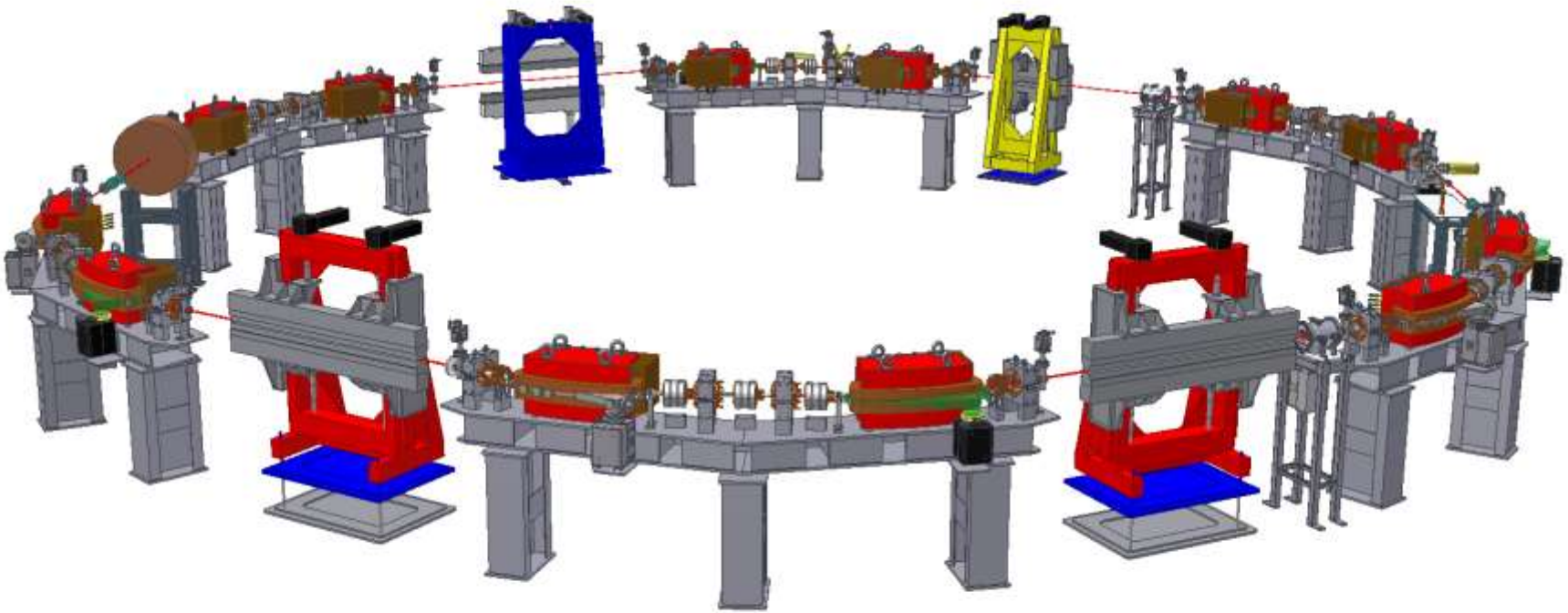
ASTRID2 schedule

37 MDKK (5M€) 08-2009/02-2013

- 2010 normal ASTRID operation with SR
- 2011 install ASTRID2
- 2012 Commission ASTRID2 and first beamline
- 2013 ASTRID2 operating in full including all beamlines



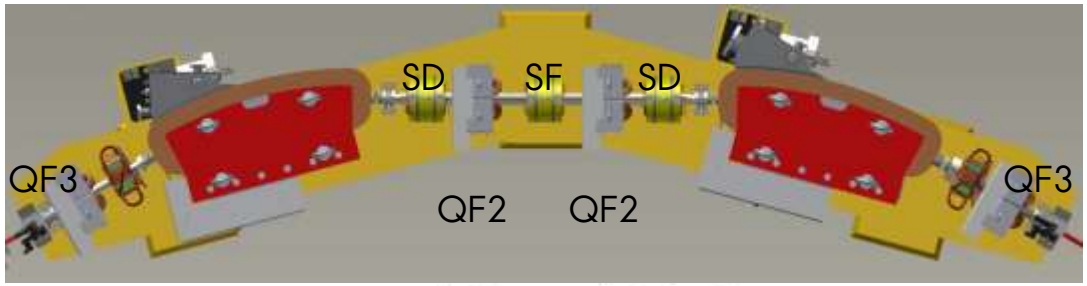
ASTRID2 with 4 ID's



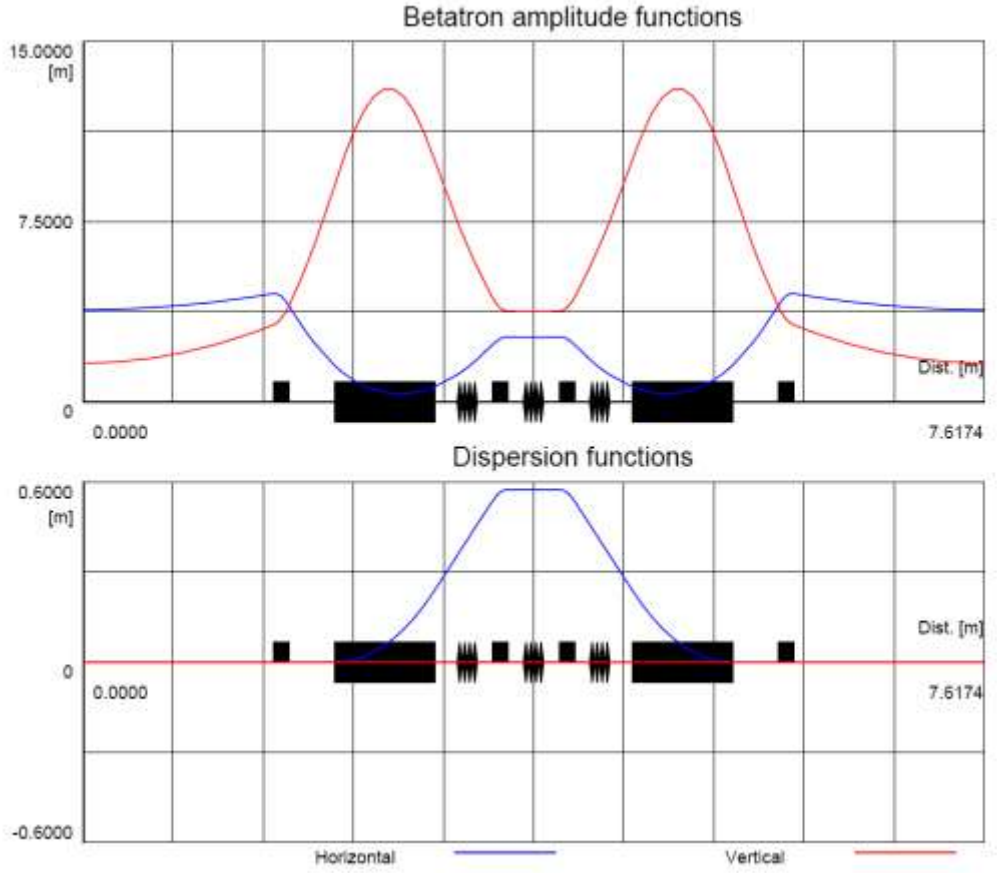
ASTRID vs. ASTRID2

Parameter	ASTRID2	ASTRID
Energy	580 MeV	580 MeV
Circumference	45.7 m	40.0 m
Current	200 mA	200 mA
Lifetime	Top-up (~few hours)	~100 hours
Horizontal emittance	~10 nm	140 nm
H/V tunes	5.23/2.14	2.29/2.69
H/V Chromaticity	-6.4/-11.2	-4.0/-7.1
Energy spread	0.24/0.45 keV	0.36 keV
Characteristic energy Dipole/MPW	0.43 ‰	0.43 ‰
Characteristic wavelength	5.2/2.8 nm	3.5 nm
Straight sections (number and length)	4x3.0 m	1×2.0 m

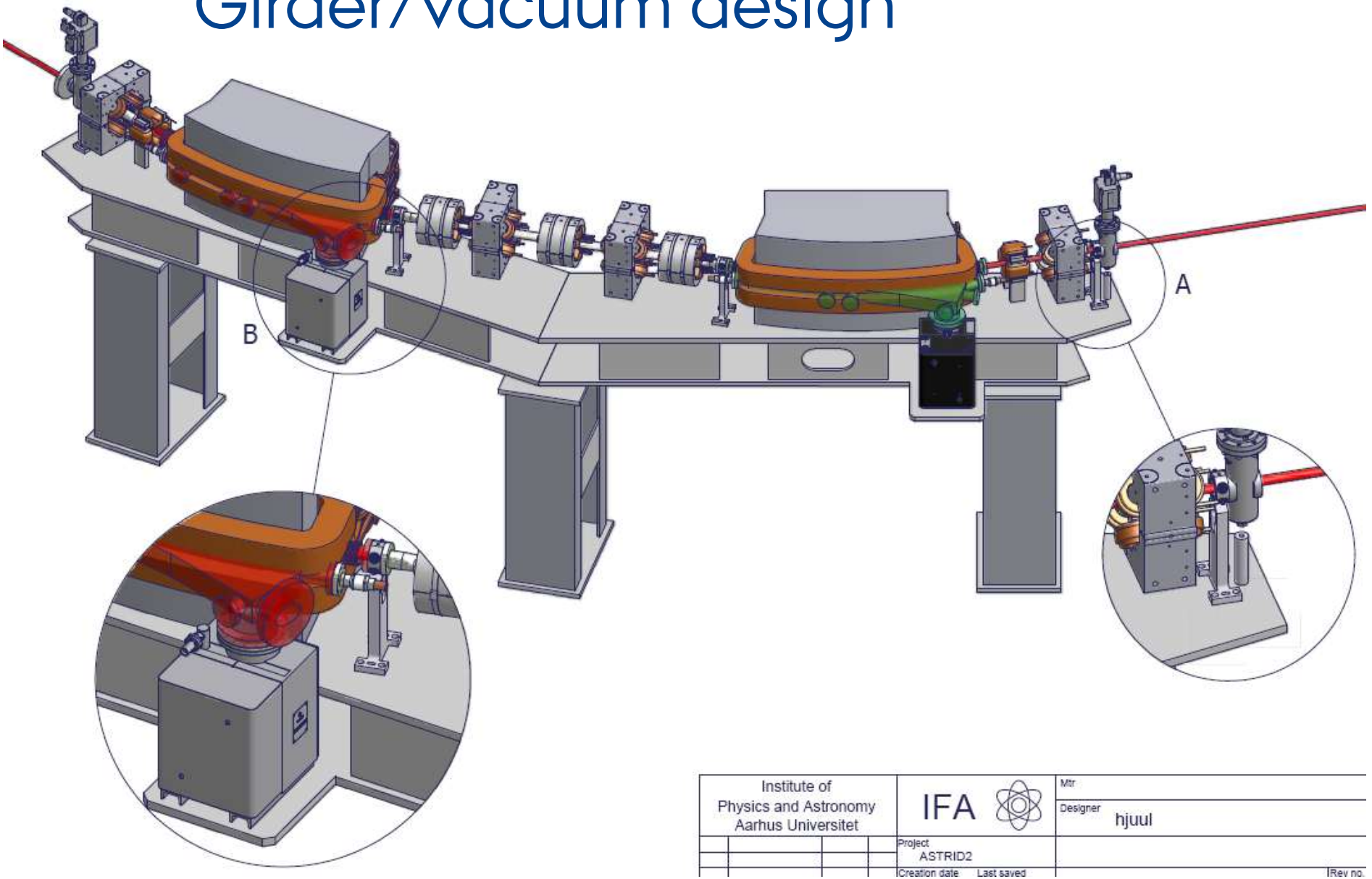
ASTRID2 lattice



- **DBA**
- **6-fold symmetry**
- **Each period**:
  - 2 combined function dipole magnets
    (+ pole-face strips for qpole
  - 2 quadrupole families
  - 2 sextupole families
  - 4 H/2 V correctors
  - 4 BPM's

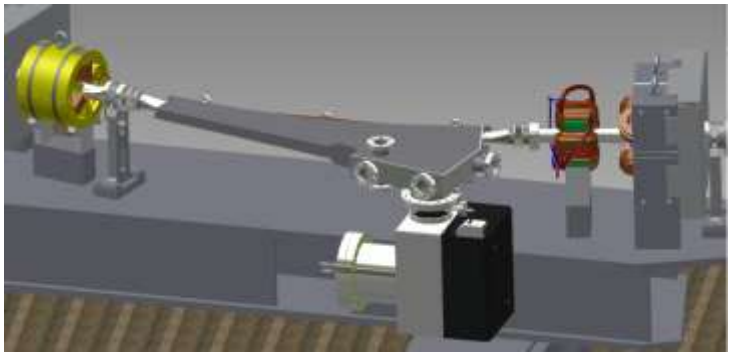


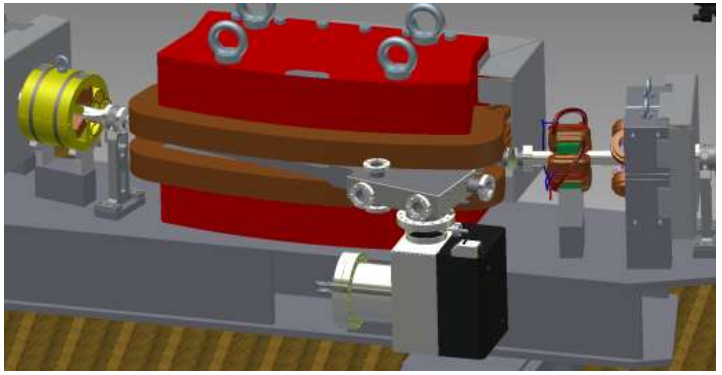
Girder/vacuum design



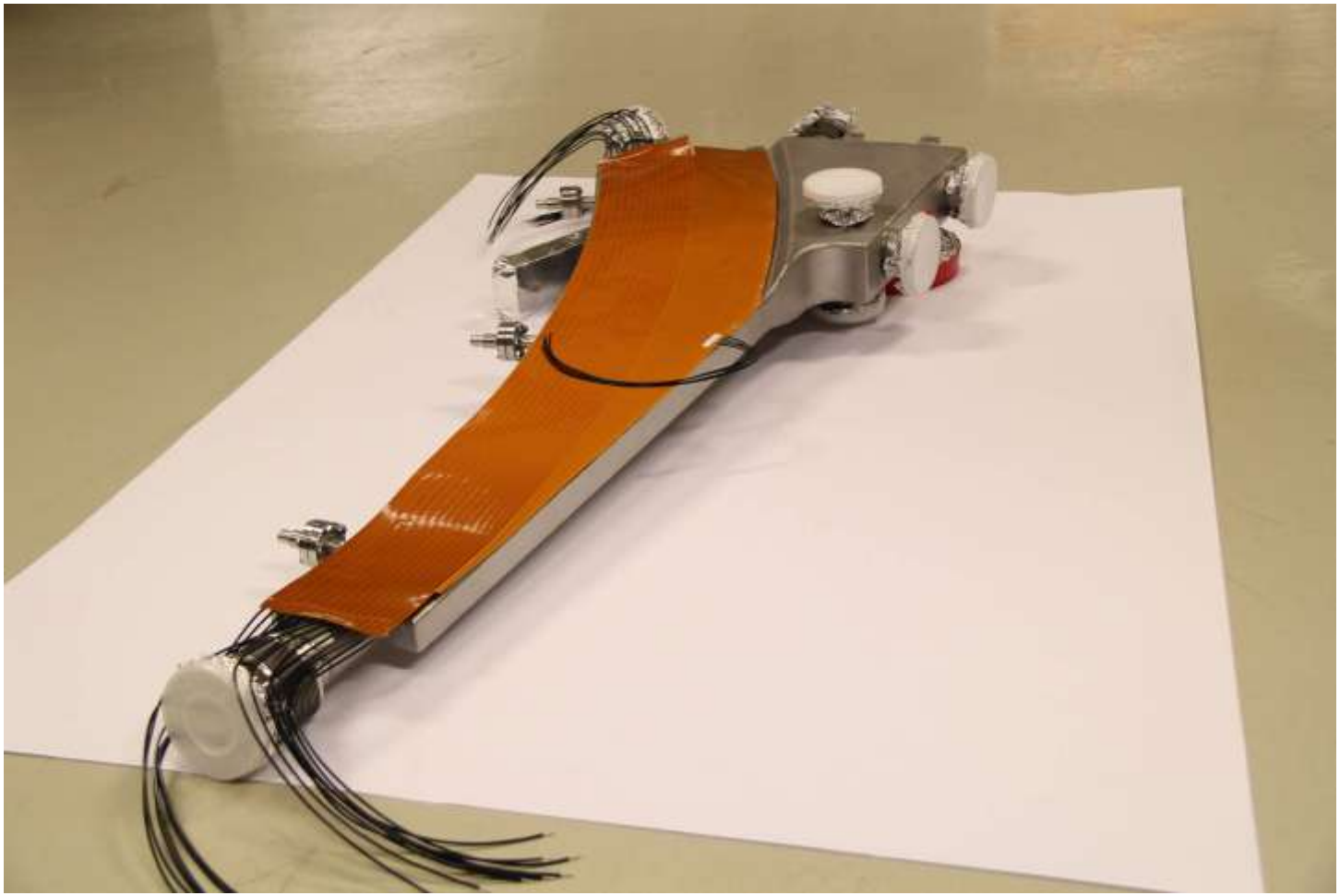
ASTRID2 Vacuum

- Each dipole chamber has
  - one 150 l/s ion pump with integrated TSP
  - All interconnecting tubes (Ø38mm) are NEG coated
- Insertion straights
  - ID chambers are NEG coated
- Bake out: In-situ
  - Dipole chambers: ~150°C
  - Interconnecting tubes (NEG): ~200°C
  - Heating: Thin (<0.5 mm) heating foil (Soleil)
  - Isolation: Thin (~1 mm) ceramic "paper"
- Bake-out of first sector has ended today





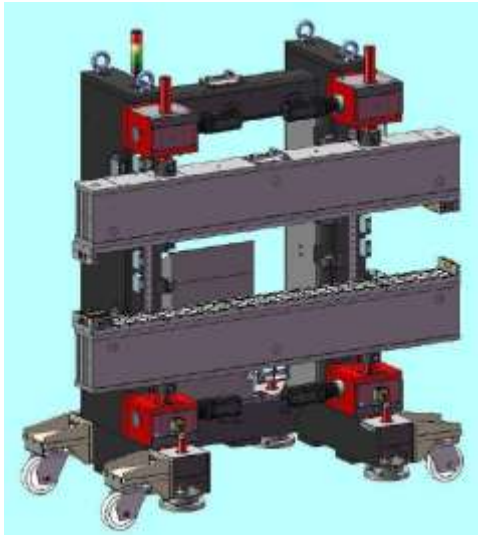
Dipole chamber with pole-face strips



ASTRID2 JAN-SEPT 2011

Insertion devices for ASTRID2

1. ASTRID U55, 0.56 T, 48 poles
2. New W116 mm period, 2 T, 14 poles
3. New U53, 1.06 T, 87 poles, ordered from KYMA for AMO beamline



ASTRID → ASTRID2

- ASTRID2 will be operated in **top-up** mode using ASTRID as a booster
  Long cycle time of ASTRID, ~10 s

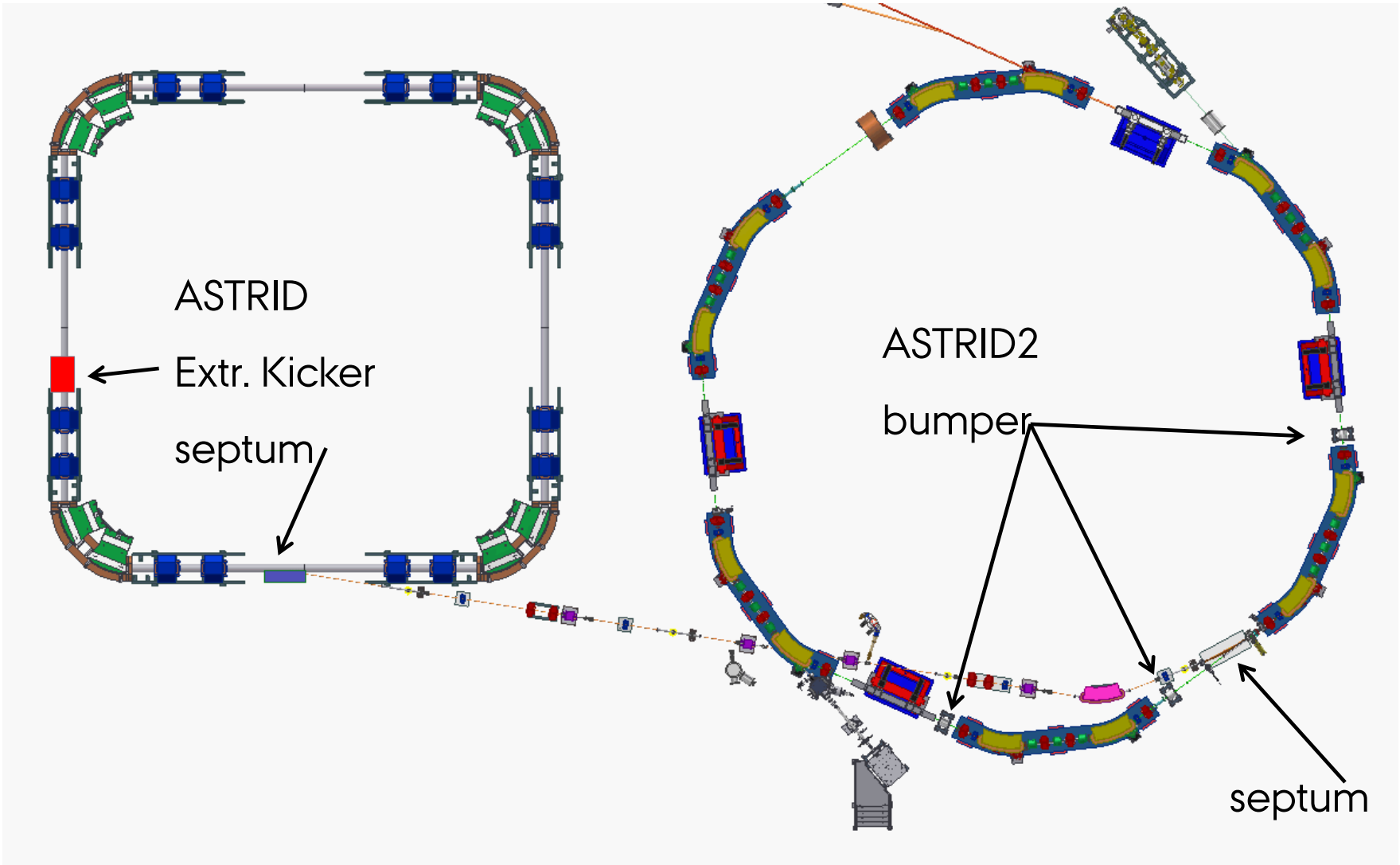
- 1 ¼ turn ASTRID extraction using the existing DC septum (12mm, 9°) and new fast kicker (150 mm long, 132 gauss, <50 ns, flat-top jitter < ±0.02)

- Transfer beamline to take the beam below ASTRID2 through the girder injecting into ASTRID2 from the inside.

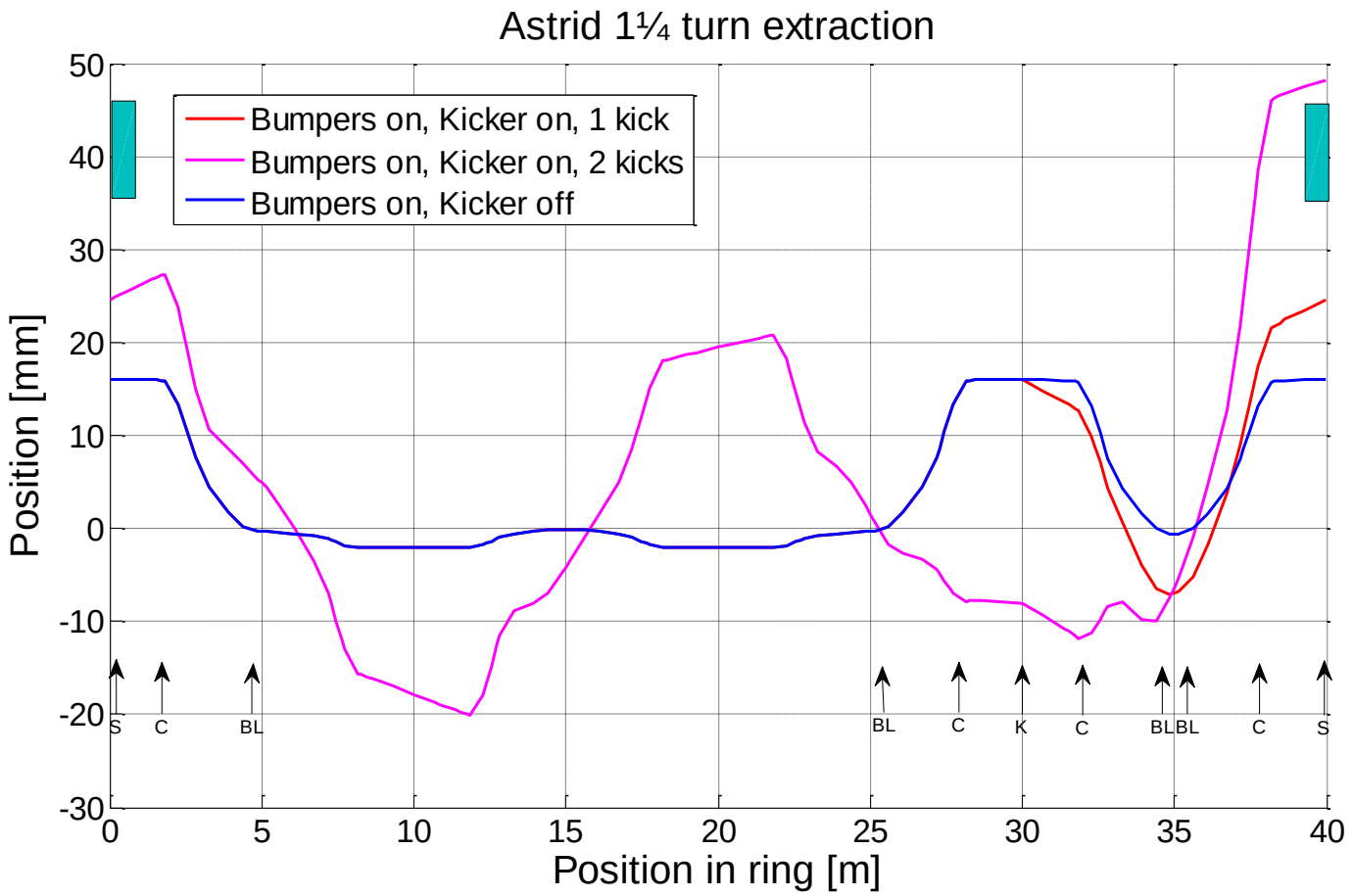
- Beam is injected into ASTRID2 with a pulsed septum (15°)and 3 bumpers (250 Gauss)

- ASTRID2 commissioned alternating with ASTRID operation and beamline transfer → minimize dark period

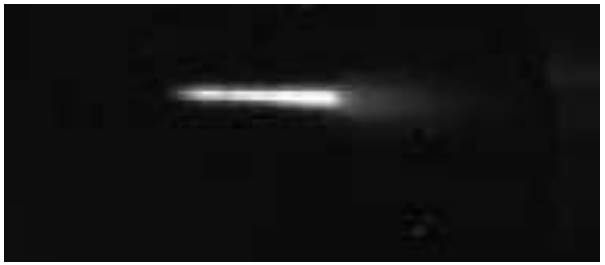
ASTRID2 injection

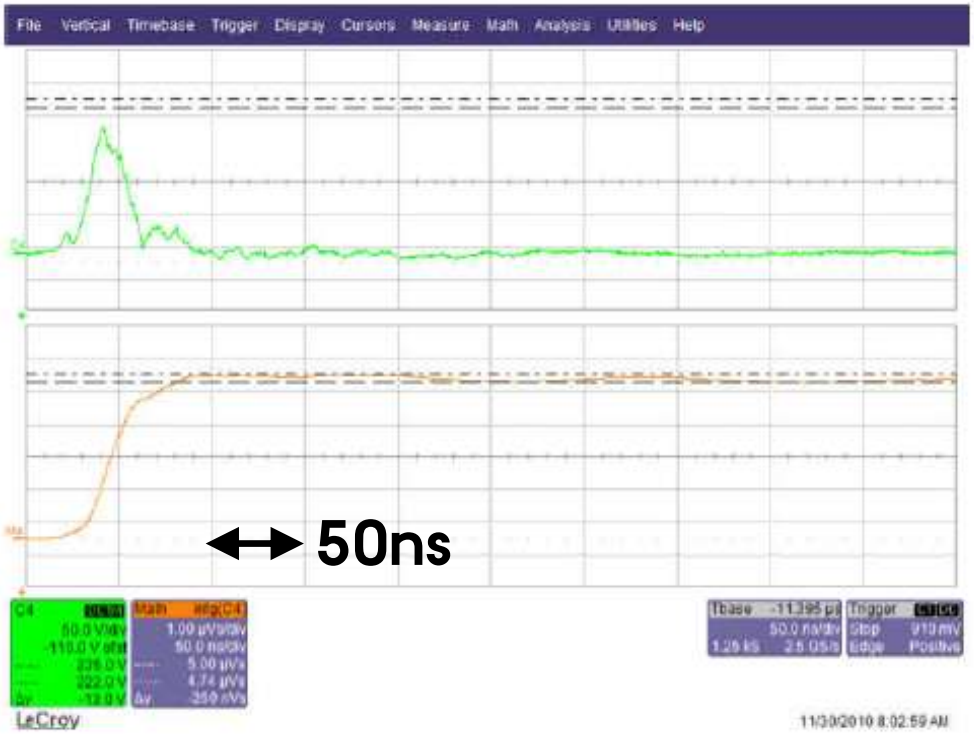


ASTRID 1¼ turn extraction



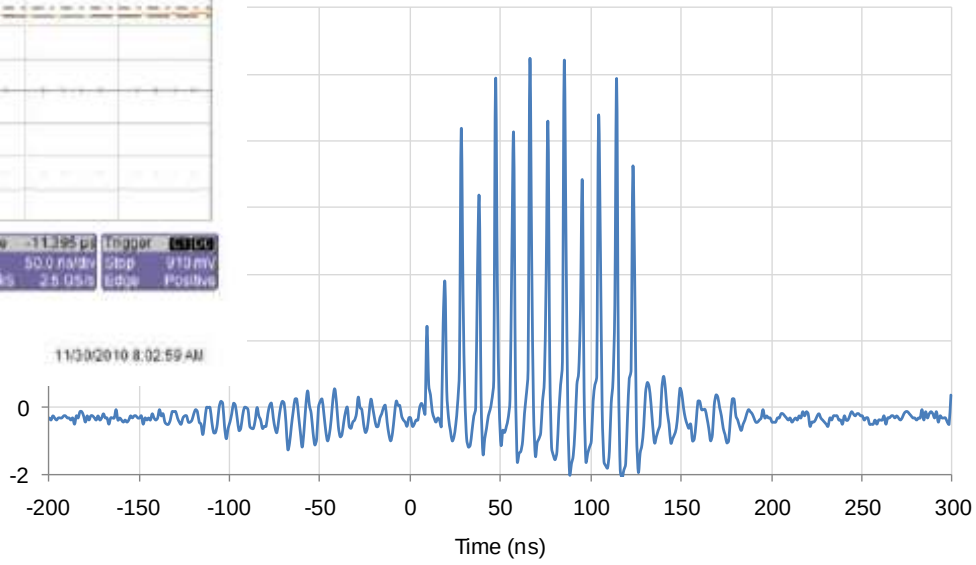
ASTRID extraction kicker



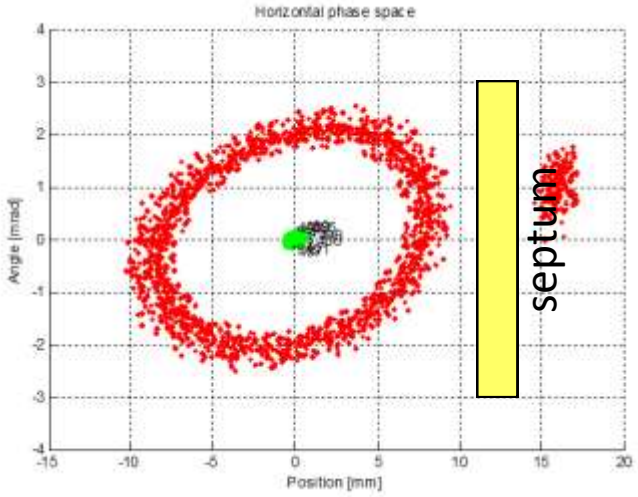


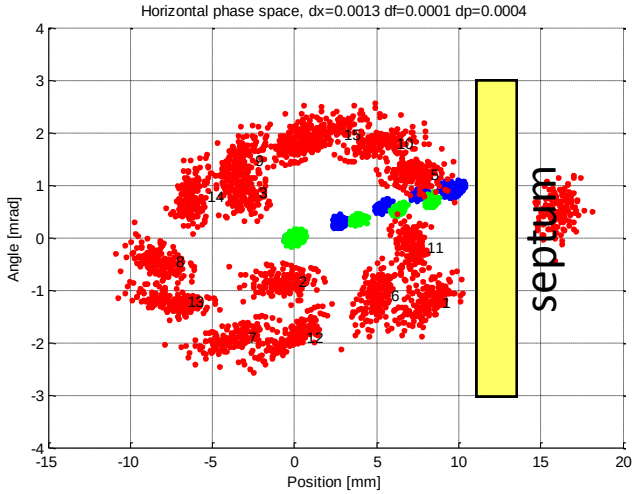
Beamline: Fast Current Transformer Signal

Background subtracted



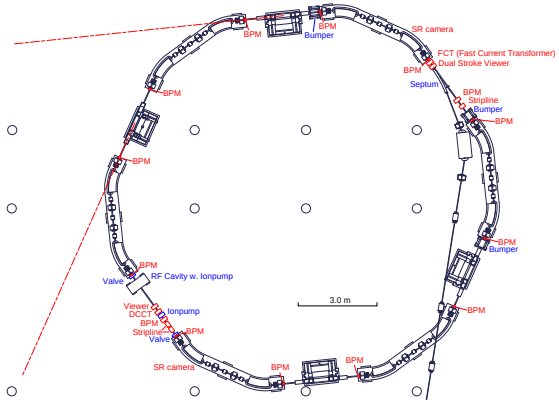
Simulated ASTRID2 injection





Diagnostics instruments

Standard suite of beam diagnostics
Since last, we chose LIBERA Electron BPM system (24), which has been received.



ASTRID2 RF system

- 105 MHz (like ASTRID)
- Main ASTRID2 RF parameters
  - ❑Synchrotron radiation power: ~1.4 kW (incl. IDs)
  - ❑Harmonic: 16
  - ❑RF voltage: 50-150 kV
  - ❑Synchrotron frequency: 10-20 kHz
  - ❑Cavity power: 0.8-7 kW
  - ❑8 kW solid state amplifier has been ordered from TOMCO

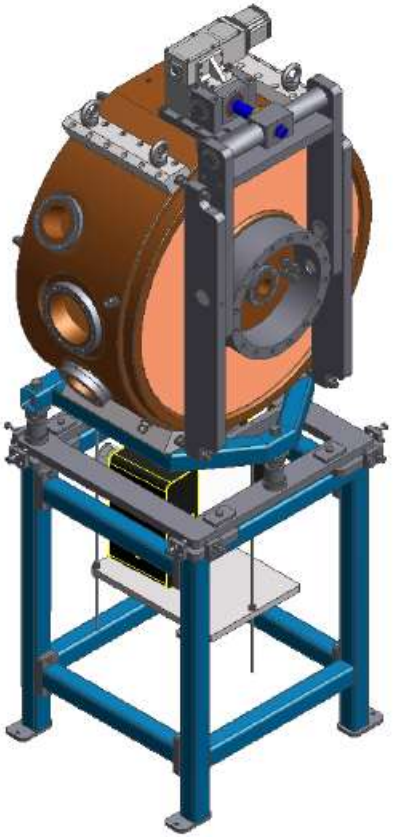
ASTRID/ASTRID2 RF

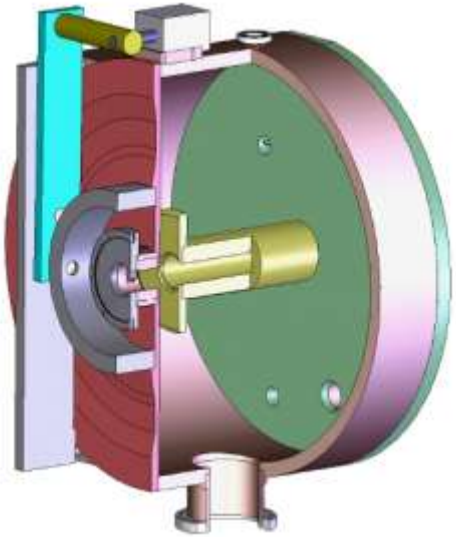
- Old 105 MHz Cu-plated capacity-loaded cavity with stubs operating since 20 years
- Several (outside) water leaks has been fixed!!
- 20 kW tetrode transm. (tube changed once)

- For ASTRID2 and ASTRID, 2 ebeam welded cavities are procured together with MAXLAB from RI.
- Delivery of first cavity February 2012.
- Intend to procure Landau cavity together with MAXLAB

(Thank you **Åke** and others)

ASTRID/2 105 MHz Cu cavity





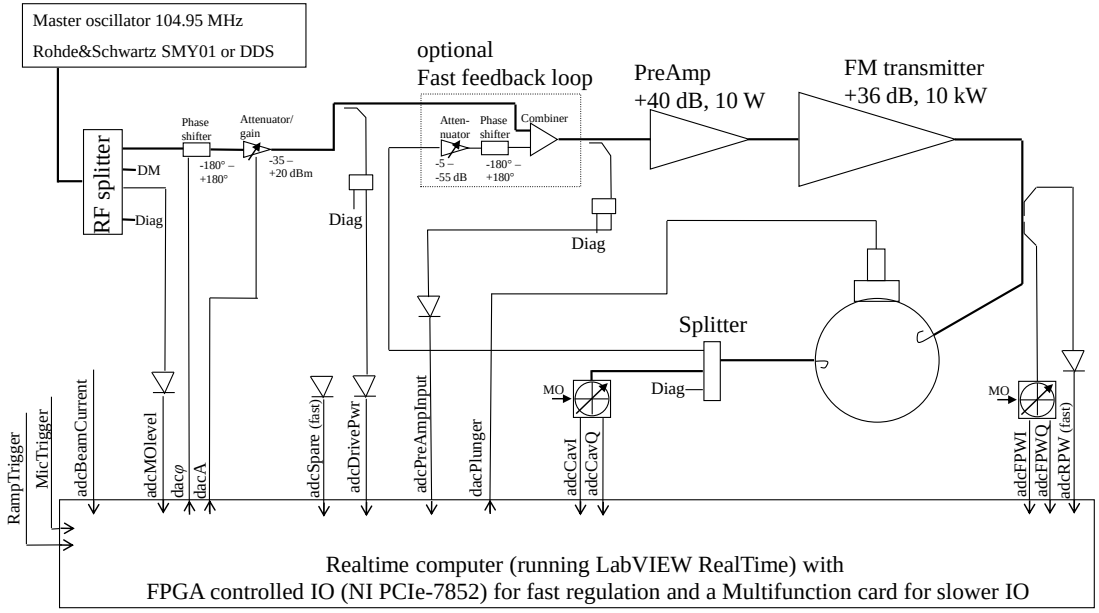
research instruments

MAXLAB Landau cavity

LLRF

Home-built digitally controlled analogue system. PC running LabVIEW Real-Time with a commercial FPGA.

Operated at ASTRID since one year.



Missing/late items/nearest future

Installation, cabling and mechanical mounting ongoing.

RF solid state amplifier (TOMCO) (late Jan. 12)

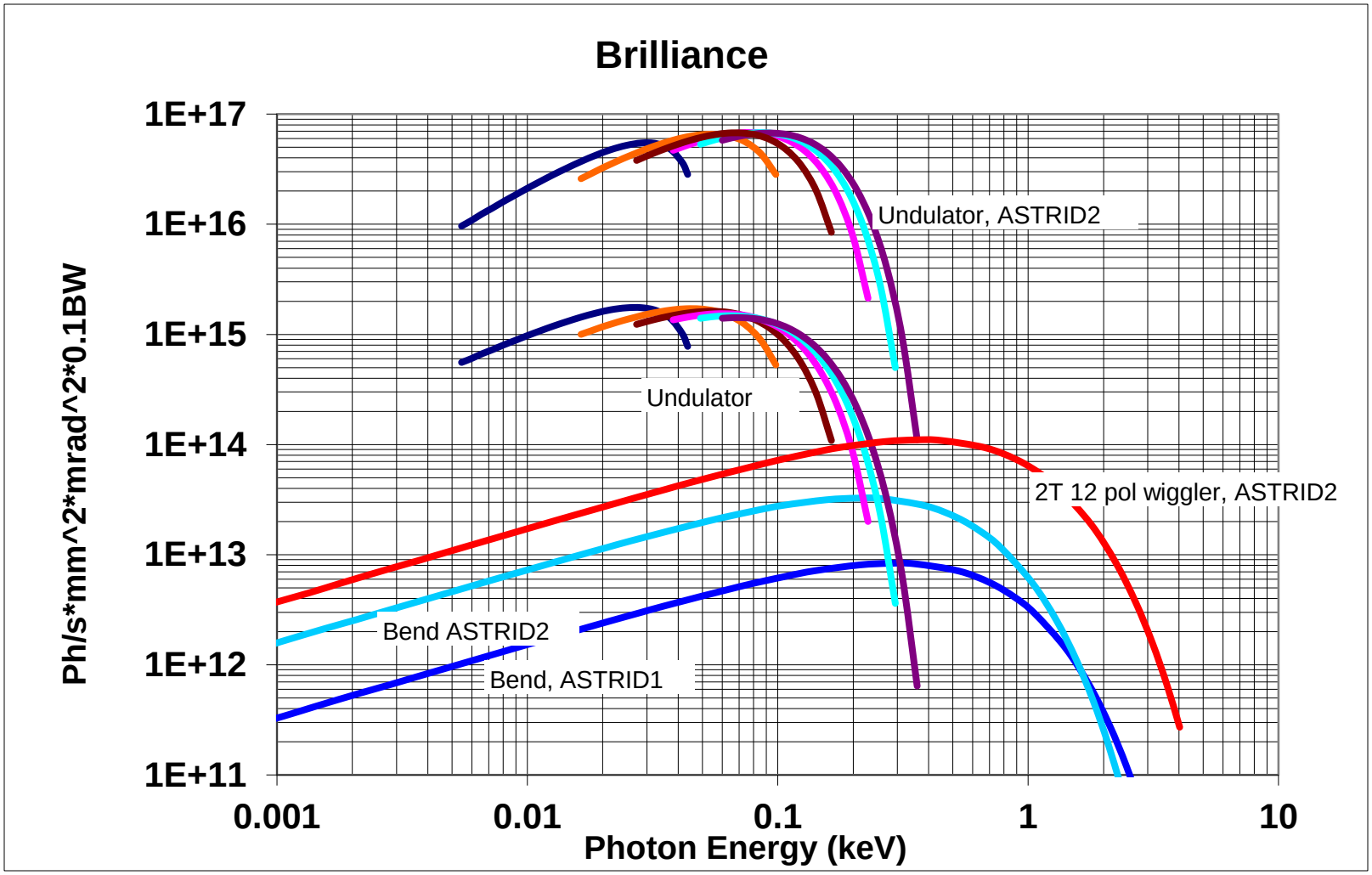
RF cavity (February)

BPM blocks Coorstek Advanced Materials (Saint-Gobain) ordered Dec. 2010. 11 out of 26 received (1 leaks)!

First commissioning in February 2012 (?)


THANK YOU FOR YOUR ATTENTION
SØREN PAPE MØLLER

ASTRID-ASTRID2 comparison



ESLS XIX
23rd & 24th november

Søren Pape Møller

Welcome & ASTRID2

Aarhus University, Denmark

- ~40.000 students
- ~11.000 staff (~6.500 academic,
  ~4.500 tech/adm.)
- Budget 800 M€
- Established in 1928
- 2nd largest university in Denmark
- Has all the standard academic areas
- Merging with
  Aarhus School of Business and
  Engineering College of Aarhus

Department of Physics and Astronomy

- ~100 students/year
- ~100 staff (~50 academic, ~50 tech/adm.)
- Established in 1933 (for teaching medical students)
- Part of Faculty of Science and Technology (from 1954)
- Main research areas
  - Atomic, molecular and optical (AMO) physics
  - Condensed matter physics and nanophysics, surface physics, statistical physics and biophysics
  - Subatomic physics
  - Astrophysics and cosmology

Institute for Storage Ring Facilities (ISA)

- ~10 staff +
- Operate and develop the synchrotron ASTRID and ASTRID2
- Other accelerator projects:
  ELISA (electrostatic storage ring for ions)
  several other small electrostatic accelerators and storage rings
- Involvement in:
  DANFYSIK projects
  PT
  ESS