Apollon multi-PW laser users facility

Presentation and scientific program

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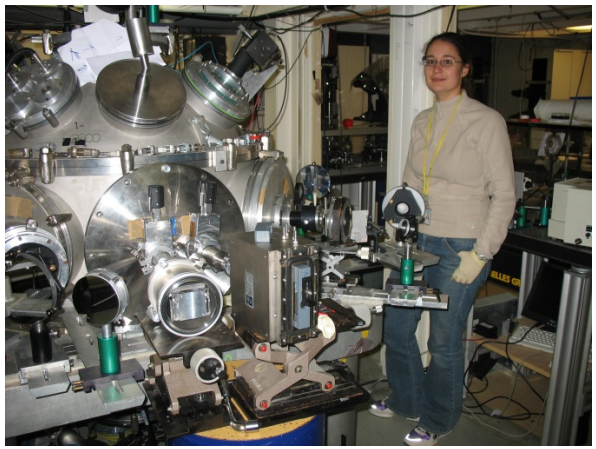
& CILEX – Apollon team

Present

LULI 2000 Facility
kJ/ns + 40 J/ps

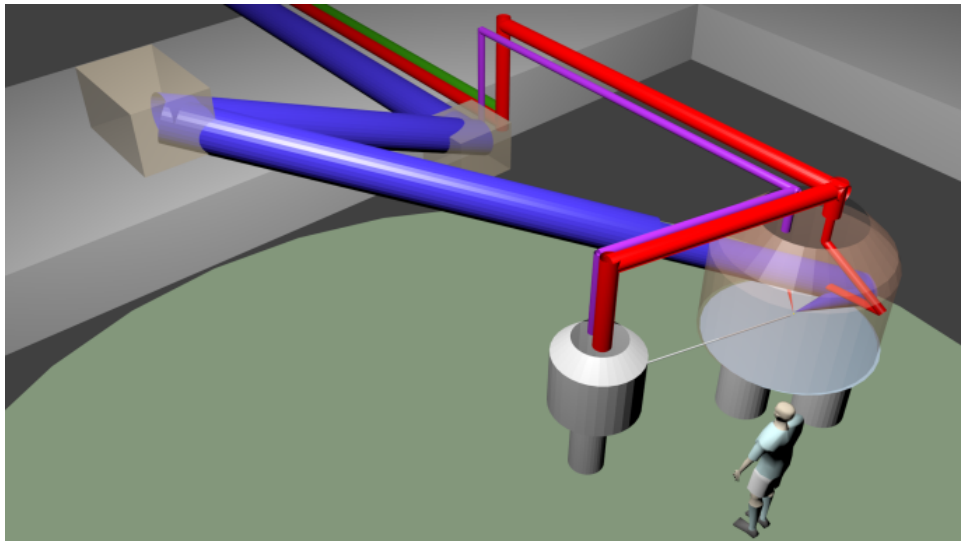
ELFIE Facility
(30 J / 300 fs)



Future (2018)

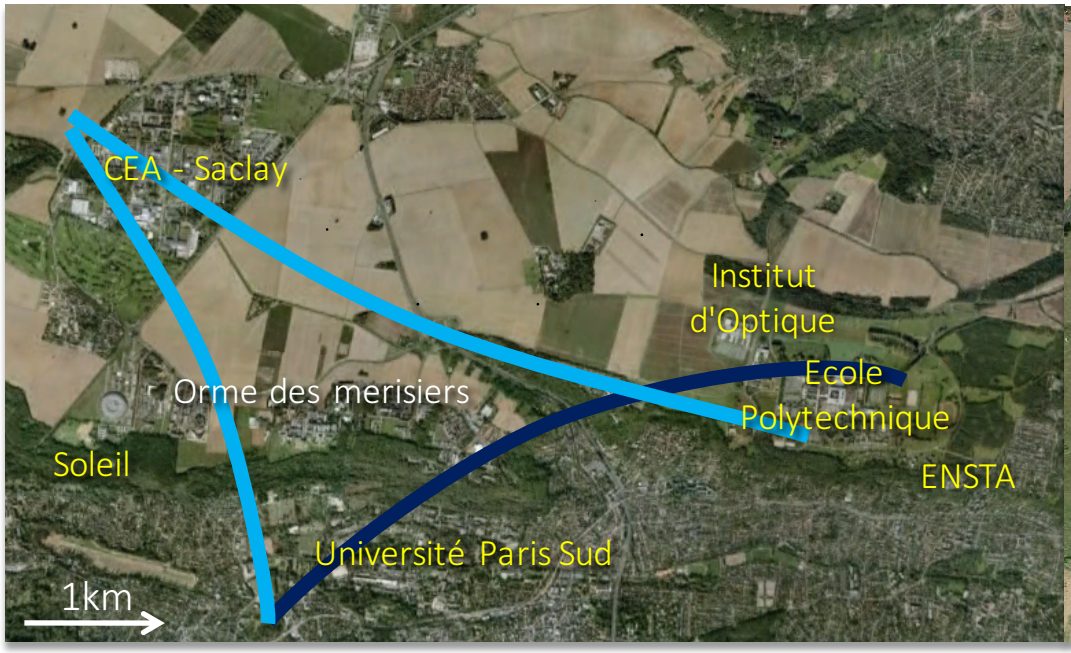
-

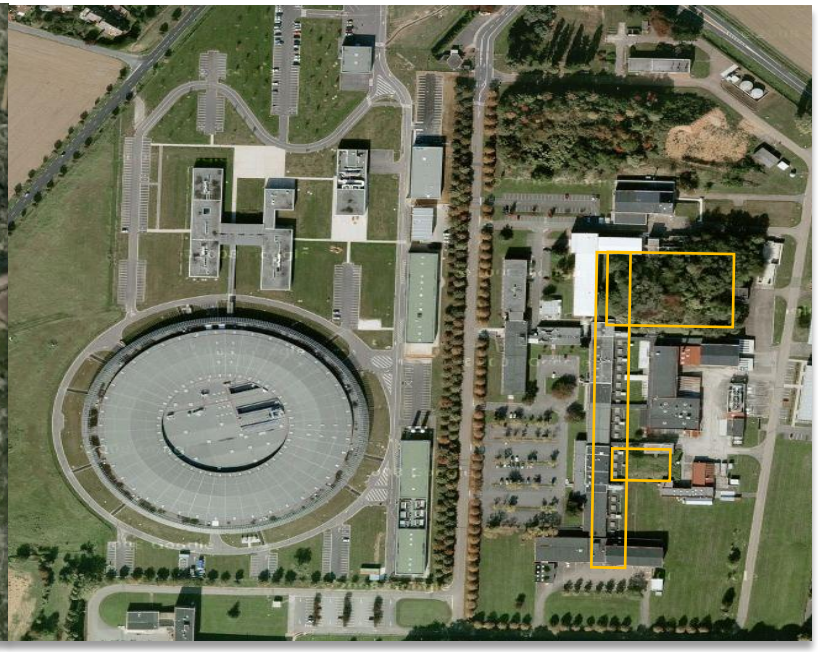
Apollon



A project by laser, plasma, accelerator and high-energy scientists on Plateau de Saclay

Develop new instruments and an interdisciplinary centre to address physics at unexplored power densities





Apollon: a combination of ultra-high intensities and multiple beams

High laser intensity

- $I > 10^{22} W/cm^2$

Several complementary beams

- to perform pump probe experiments and multi-stage laser acceleration

High repetition rate: *one shot/minute*

- To adjust laser and experiment parameters
- To have enough statistics

High contrast

- To be able to interact with solids without pre-formed plasmas

Reliability and stability

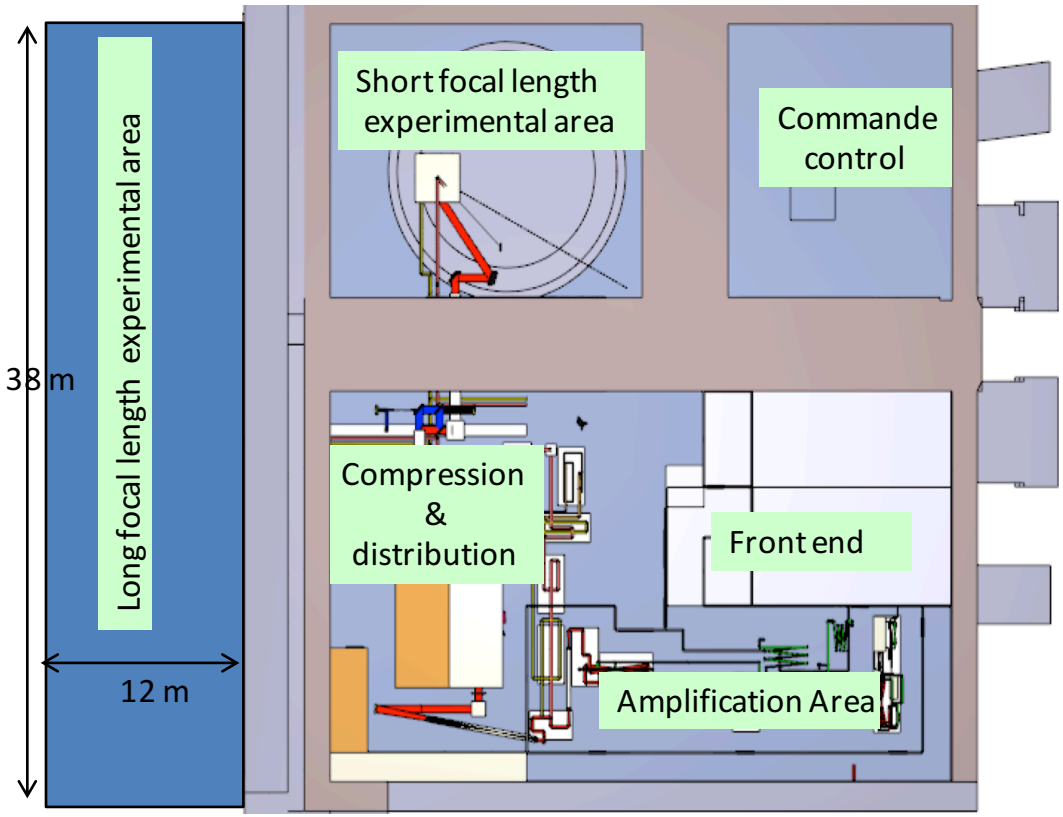
Good characterization of the beams

Flexibility for a variety of different experiments

Apollon : a multi-PW laser facility

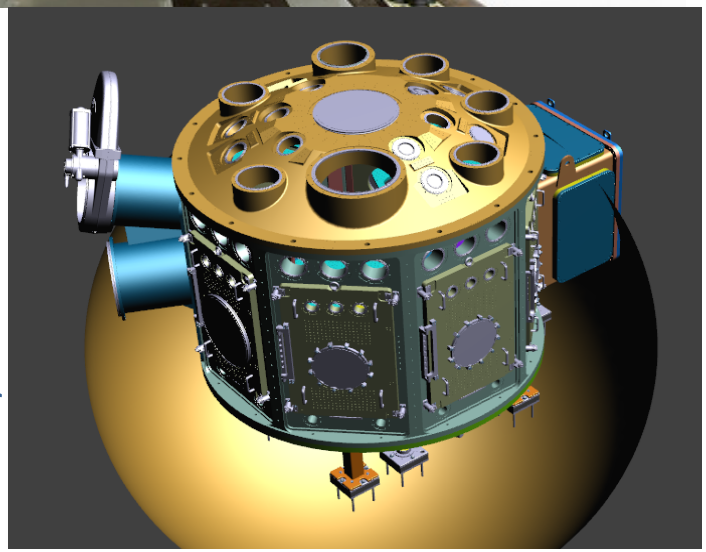
4 synchronised beams and 2 experimental areas to address various scientific fields

- 4 PW beam: 15 fs / 60 J max
- 1 PW beam: 15 fs / 15 J max
- Uncompressed beam: 1 ns / 150 J max
- Probe beam: 20 fs / 200 mJ



Total energy presently limited to 150 J possibility to increase up to 330 J

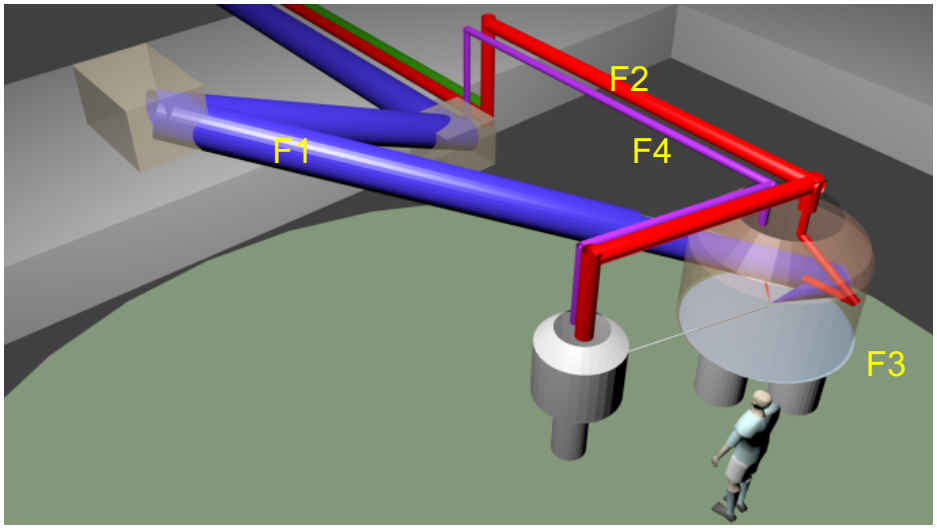
Apollon: Current Status

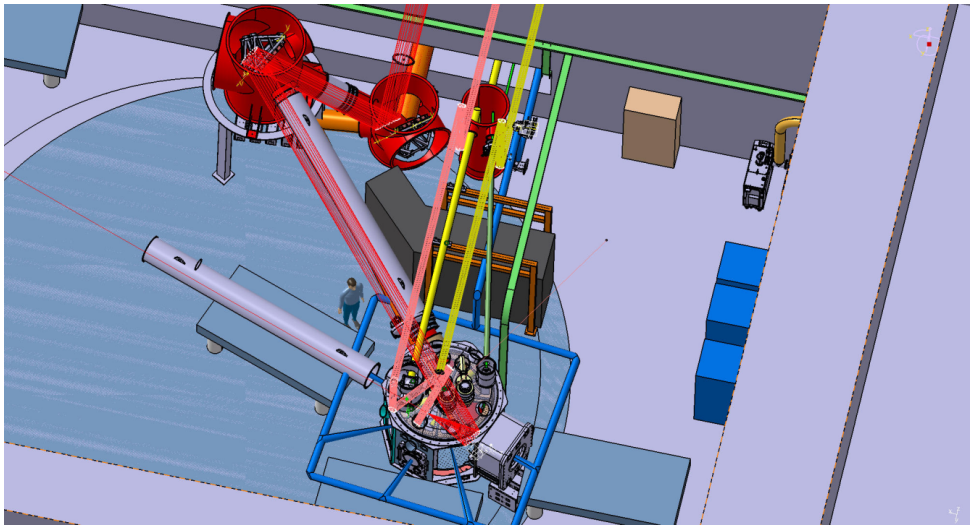


- The building was delivered on March 2015
- Compressor chamber is in place
- The 3 first amplifiers are in place
  - Expected 30 J compressed by the end of the year

Short-focal-length area

Versatile area and chamber adapted to various experiments





f/2.5 focussing → intensity > 10^{22}W/cm^2

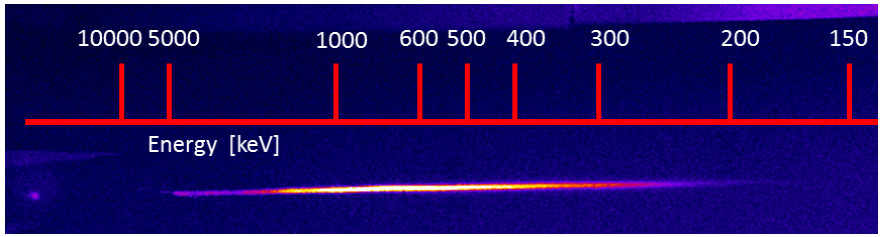
1 PW beam at any angle from 10 PW beam

–> extreme (high energy, high dose, ultrashort, directional) beams of ions, X-rays and γ-rays

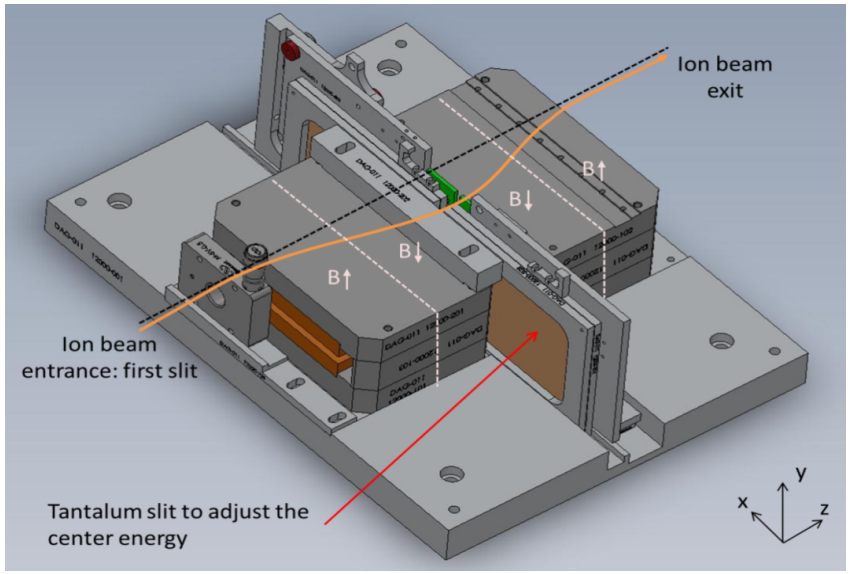
–> exploit the unique properties of the ion beam as a probe and for a variety of applications

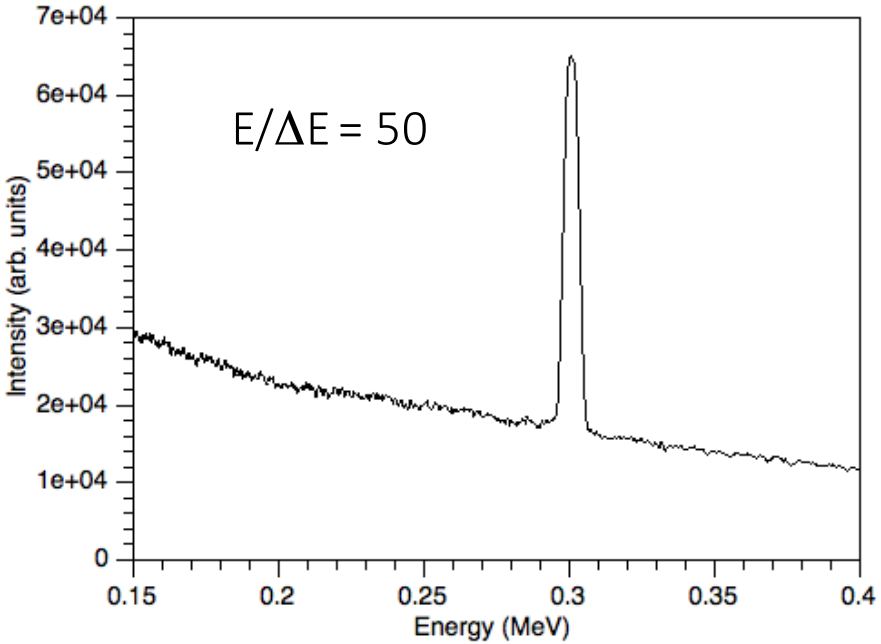
Compact Ion Beamline

Short Pulse Laser accelerated ions are inherently broadband up to the cut-off energy



Selected proton beam centered at 300 keV





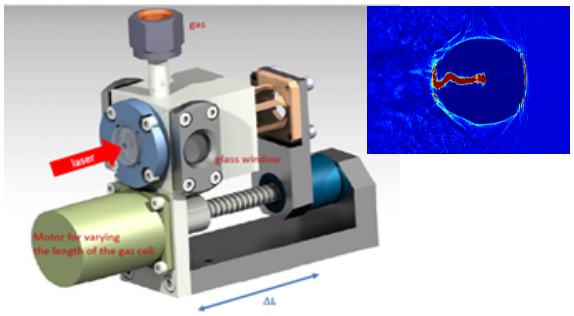
Compact Beamline ~is 40 cm long

Toward a stable two-stage multi-GeV e^- beam

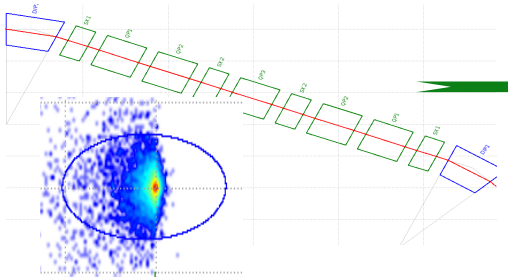
A two-stage approach on the way to a high-energy all-optical electron accelerator

Special attention on stability, reproducibility, and quality of the e^- beam

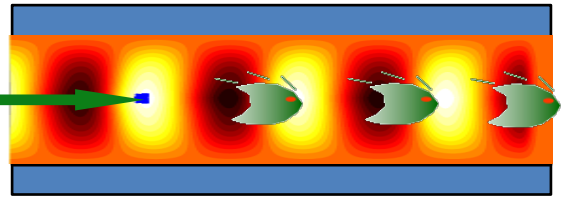
all-optical source



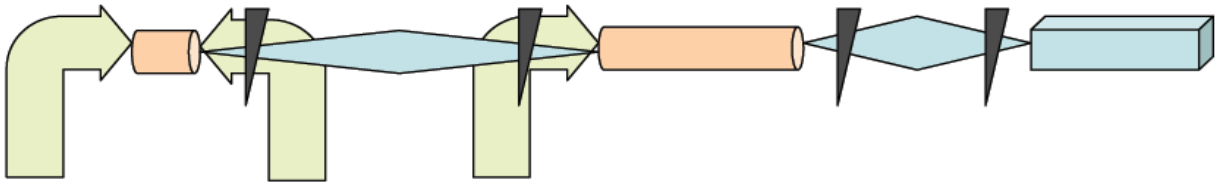
transport



acceleration to multi-GeV

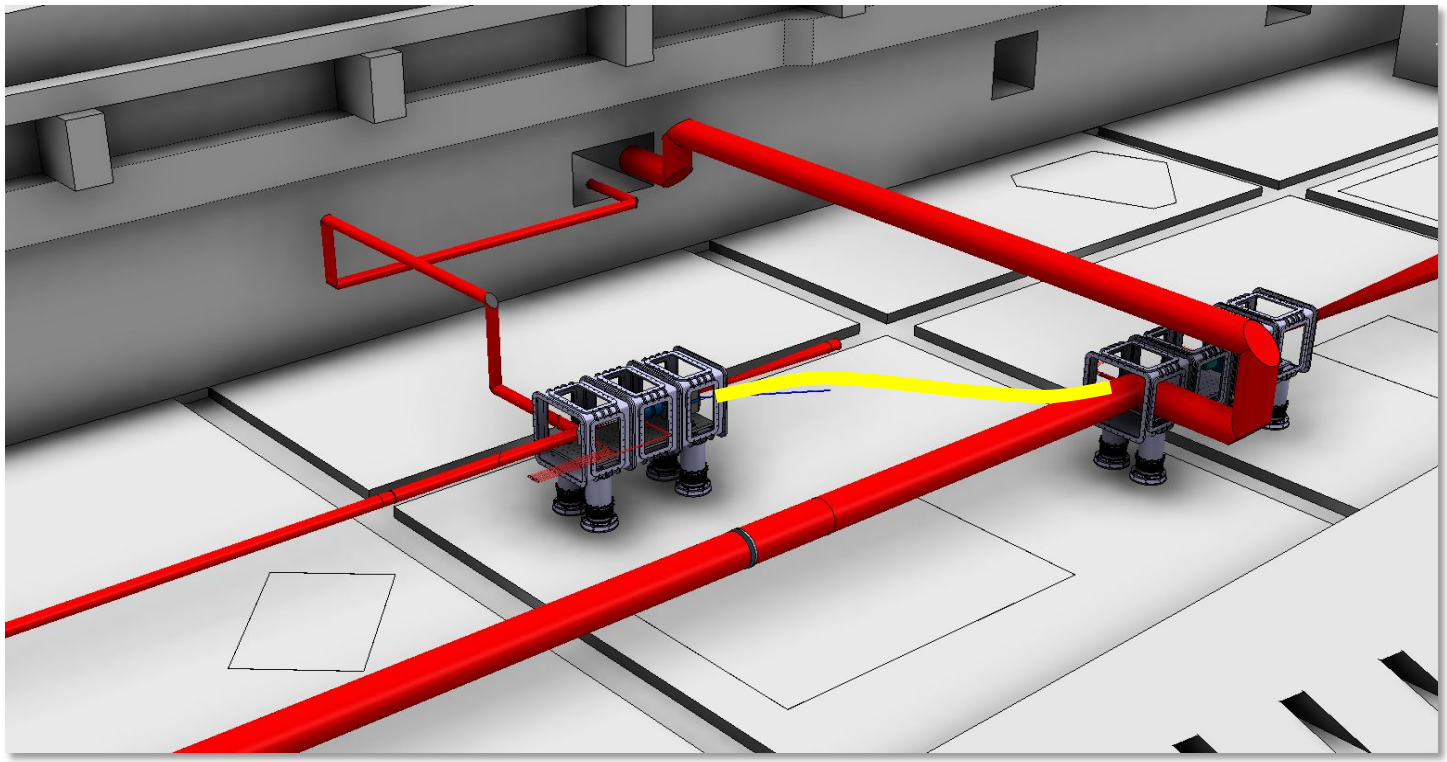


electron source transport acceleration diagnostics beam dump



Long focal-length area

Two chambers allowing 1 PW and 10 PW experiments and 2-stage schemes



And very long focal lengths up to ≈ 30 m possible
e.g. for electron acceleration

Operation of the Apollon Facility

- Facility will be opened to national and international scientists
  - The experimental programs on APOLLON will be decided, on an annual basis, by the Steering Committee, taking into account suggestions from an independent Program Committee.
- Beam time allocation per year
  - The goal is 140 days for users divide in 20 campaigns
  - Maintenance and configuration changes 60 days
  - Laser development 50 days
- Experiments
  - Each experimental area will alternate
  - The laser will deliver pulse sequences on demand for users 5 hours per day.

First Annual Users' Meeting: Feb 11-12, 2016

Apollon

CileX

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INVESTISSEMENTS D'AVENIR

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