STAR

Southern Europe TBS source for Applied Research

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MaTeRiA

materiali, tecnologie e ricerca avanzata

cnism

Summary

- Location
- Team
- The project
- Funding
- Problems
- State of the art
- Future

Calabria

Convergency regions

Funds for development from the European Community, including research infrastructures

Gross domestic product per capita (US Dollars)	
Italy	35.000
Calabria	23.000

University of Calabria

- 35.000 students
- Strong physics department

The STAR Project
A TBS (IC) user facility

UniCal, The University of Calabria

CNISM, Italian Consortium on Physical Sciences of Matter (1300 reasercher from 39 universities)

Funding €15.700.000
- 8.4 M€ STAR source - CNISM
- 6.6 M€ Laboratories and building - UniCal
- 0.7 M€ Master program – UniCal

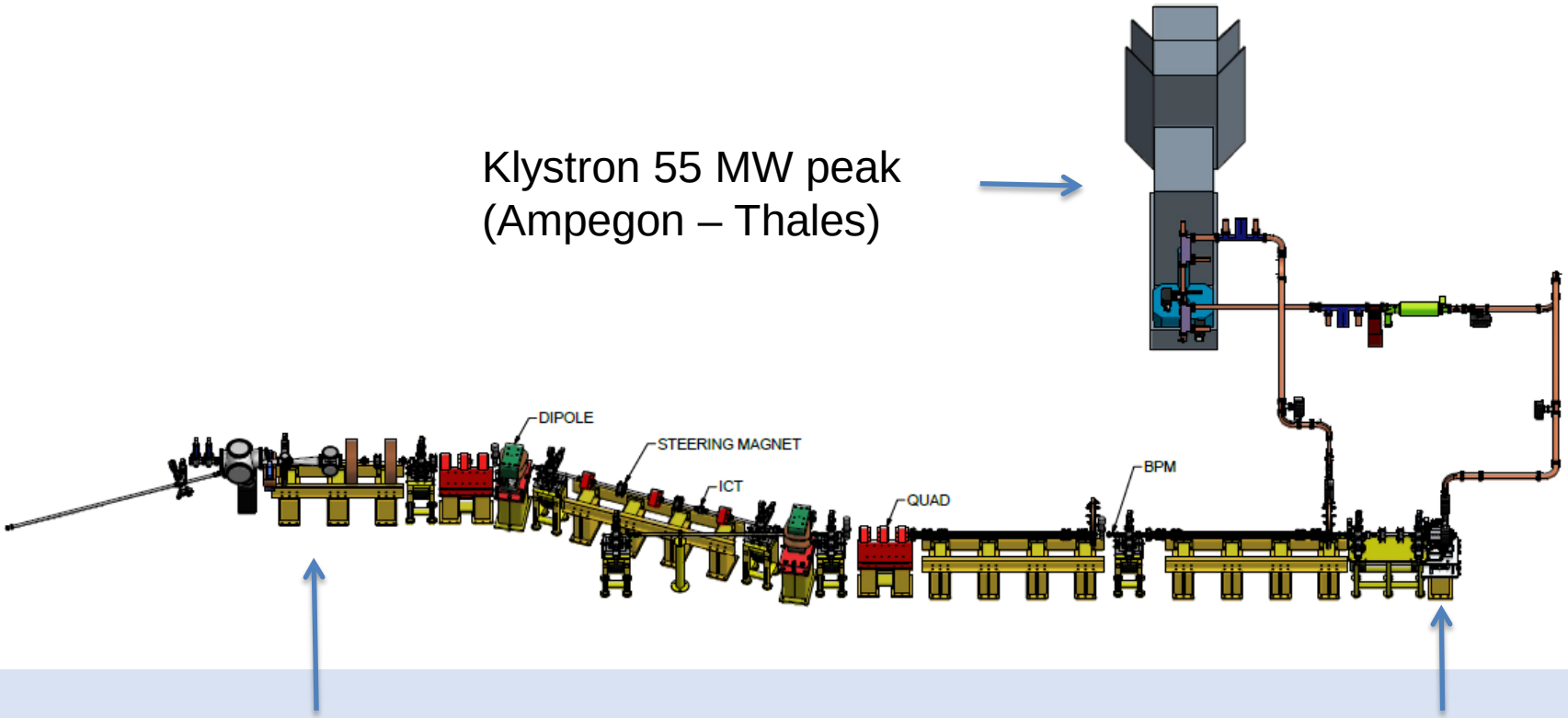
In collaboration with **INFN** and **Elettra – Sincrotrone di Trieste**

Start Date: 01.01.2012 **End Date**: 31.07.2015

Features of available X-ray sources

	Cost (M€)	Size (m)	Energy (keV)	Features
Syncrotrons	500	500	0.1 - 100	General purpose
FEL	1000	1000	0.01 - 10	Peak intensity, time resolution
ELI – NP (TBS for γ)	300	100	20000	Only available γ source
STAR (TBS for X)	15	30	7-120 (240)	Cost, portability, tunability

Machine layout



Joule class Yb interaction laser from (Amplitude)

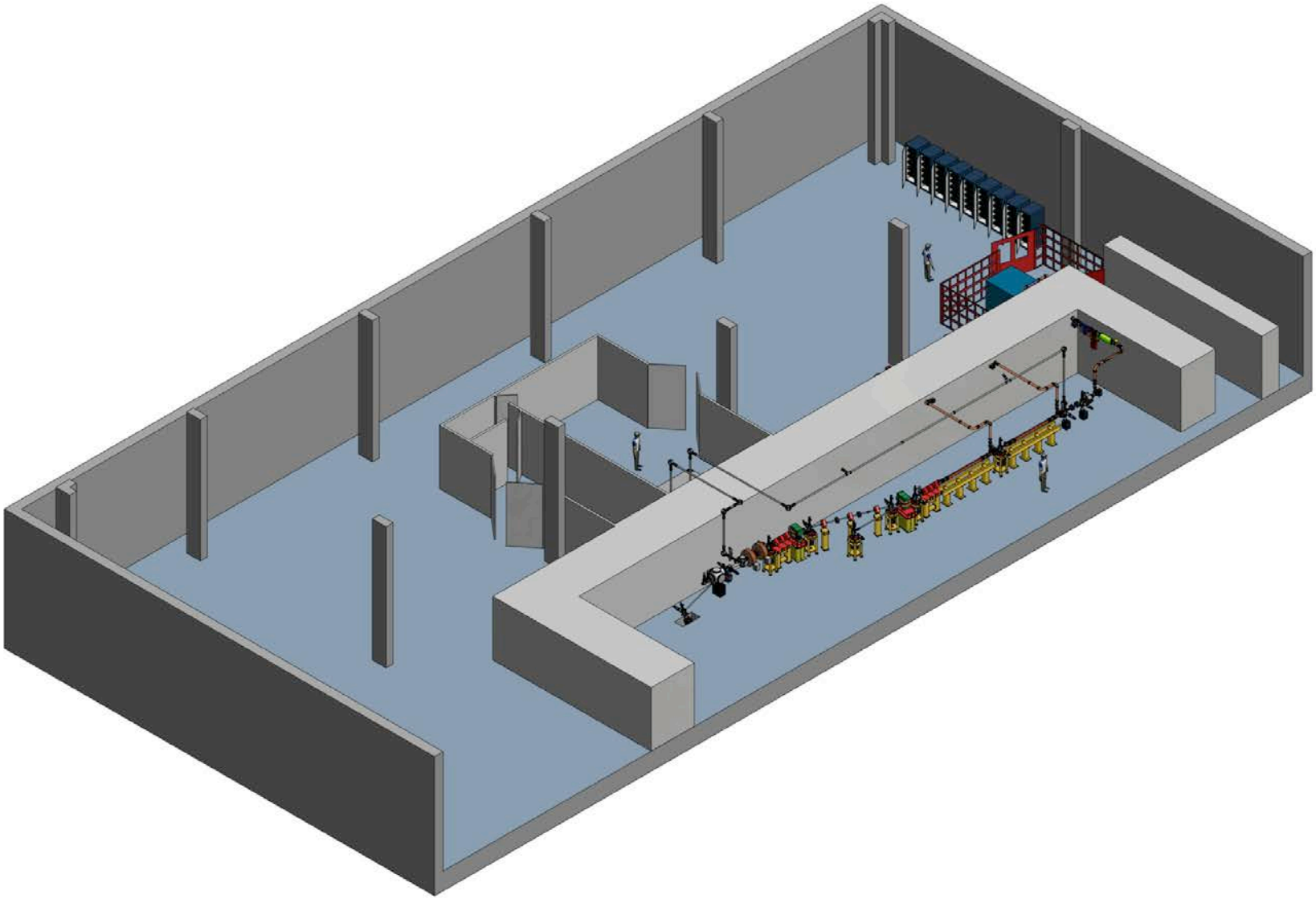
100 Hz electron gun (Radia Beam)

STAR specification

Phase 1 (present budget 7 M€) : non recirculation, single bunch mode
Phase 2 : multi-bunch, laser recirculation (>50 turns),
X-band corrector, 2nd accelerating section

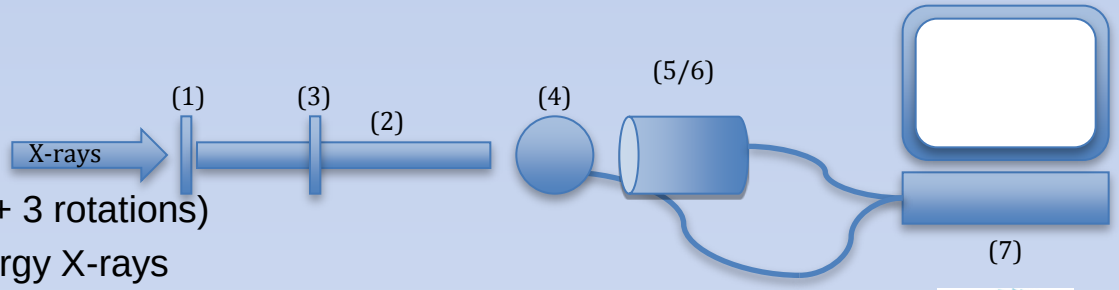
Table 1: X-ray beam characteristics

	Phase-1	Phase 2
Photon energy (KeV)	7-120	7-240
Photons/sec (@ 100 Hz)	$5*10^{9}$	10^{12}
Bandwidth (rms)	< 5%	<2%
Rms Pulse length (psec)	< 5	<5
Linear Polarization	>95%	>98%



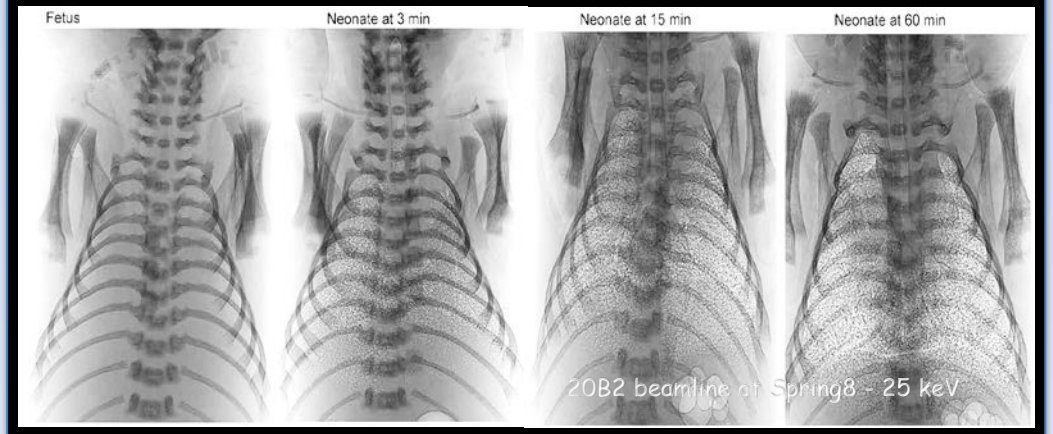
X rays tomography - **µTomo** Beamline

① Front end
② X-ray transfer line
③ Slits
④ Sample-holder (2 translations + 3 rotations)
⑤ Detectors pair for high/low energy X-rays
⑥ Detector stage (3 translations + 2 rotations)
⑦ Data acquisition system



In collaborazione con elettra

Application: Time resolved phase-contrast micro-radiography



Images of the flow of air into the lungs of a neonatal rabbit using X-ray phase-contrast imaging. (S.B. Hooper et al., Clinical and Experimental Pharmacology and Physiology, 36, pp. 117–125 [91])

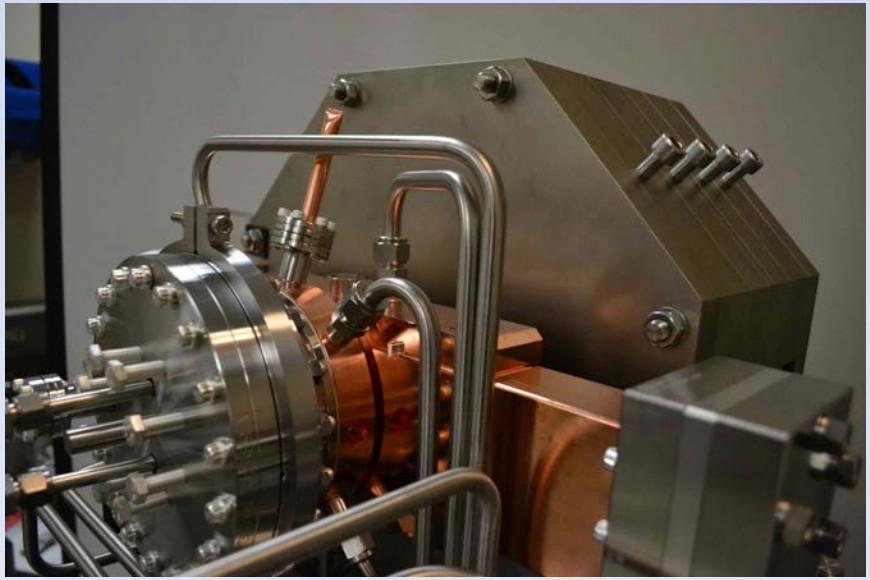
October 2013


CAT


Bunker STAR


CAMPOBASSO
ATAG

RF photoinjector from RadiaBeam




AMPEGON
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AMPEGON

Future

- End 2016: installation
- End 2017: tuning
- Find resources for the operation
- Find resources for phase II (good chances)