BoCXS: a Compact X-ray Source for the Bologna Metropolitan Area

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THE BOLOGNA PROPOSAL

Develop a **Compact System** to produce **High Quality X-ray Beams**
for Interdisciplinary Research in Physics, Biology and Medicine

$E_X \leq 120\ keV \quad \phi \sim 2x10^{10}\ ph/s$

$E_X \leq 240\ keV \quad \phi \sim 5x10^{9}\ ph/s$ (second harmonic)

Compact ICS sources can produce high quality X-ray beams
and can be installed in **Clinical Laboratories and Universities**
operated by a **small team**

BoCXS: A COMPACT ICS X-Ray SOURCE

An Advanced Medical Imaging Facility in the center of a Scientific Triangle

MAIN TARGET

Pre-clinical and Clinical Imaging of Soft Tissues

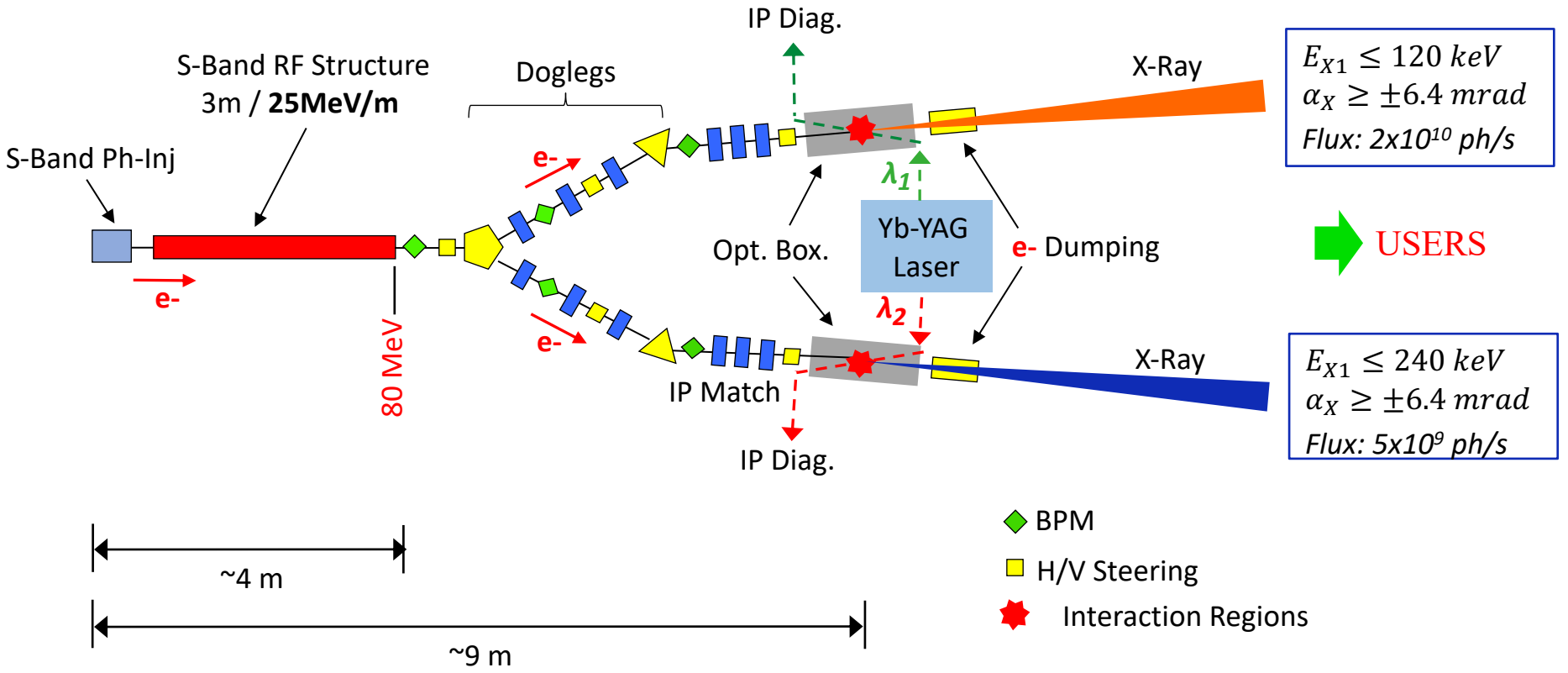
COMPLEMENTARY ACTIVITIES

Detector development

Non-destructive analysis of Mechanical Samples

Cultural Heritage Science

Double Arm S-Band STAR-like Source



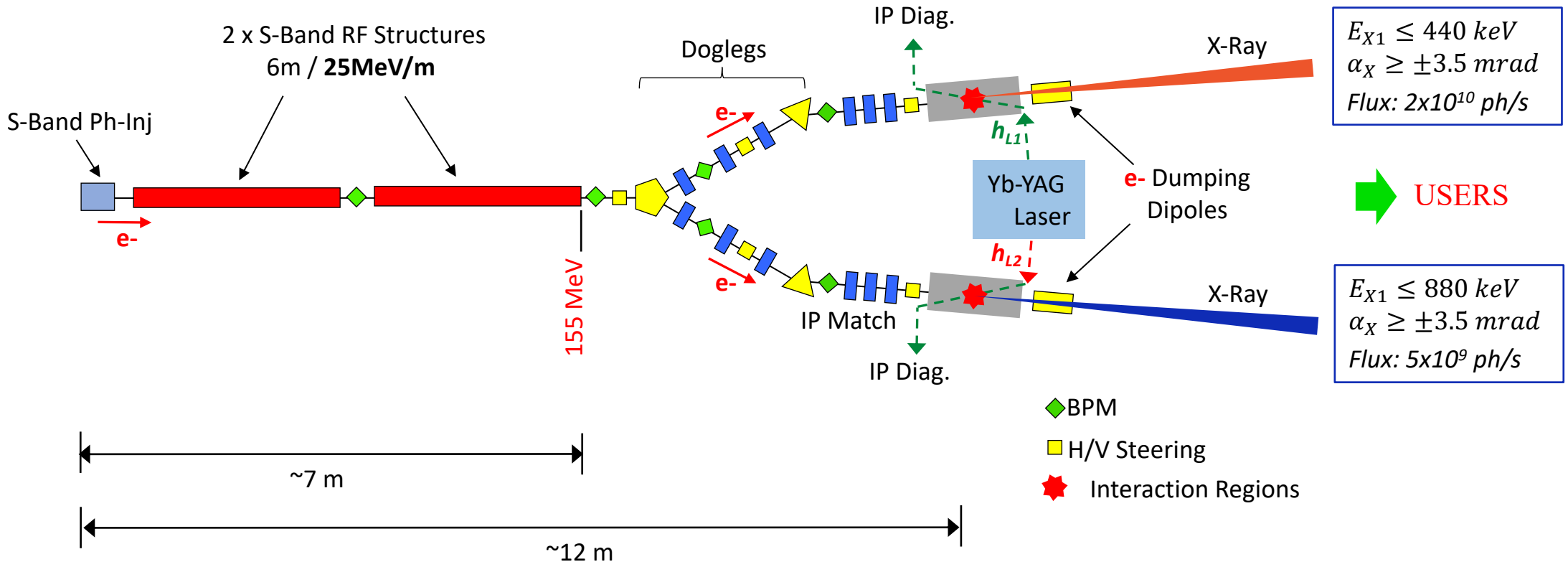
$E_{X1} \leq 120\ keV$
$\alpha_X \geq \pm 6.4\ mrad$
Flux: 2x10¹⁰ ph/s

USERS

$E_{X1} \leq 240\ keV$
$\alpha_X \geq \pm 6.4\ mrad$
Flux: 5x10⁹ ph/s

FOOTPRINT ~ 3 x 9 m²

Upgraded S-Band STAR-like System



FOOTPRINT ~ 3 x 12 m²

OPERATIONAL PHASES

PHASE I – *e- ENERGY: 80 MeV*

X-ray ENERGY : (120 – 240) keV

X-ray FLUX : (20 – 5)x10^9 ph/s

X-ray DIVERGENCE : +/- 6.4 mrad

PHASE II – *e- ENERGY: 155 MeV*

X-ray ENERGY : (440 – 880) keV

X-ray FLUX : (20 – 5)x10^9 ph/s

X-ray DIVERGENCE : +/- 3.3 mrad

Rep. rate = 100 Hz

Laser: Fund. & 2nd harm.

ROADMAP

Conceptual Design ready
Linac and Photo-Injector (STAR-like)
Laser Systems (photocathode + interaction region)
Transport lines optimized to match applications
All components commercially available

Detailed evaluation of Costs, Schedule and Manpower: **3 months**

Acquisition phase: 12 months
Bunker construction: 18 months (in parallel with acquisition)
Installation: 12 months
Commissioning: 6 months

Network
BO (Uni and INFN), MI-INFN, LNF-INFN
FE (Uni and INFN), NA (Uni and INFN).
(FE and NA are also Users).

A PROJECT IS A DREAM WITH A DEADLINE

THANK YOU FOR YOUR TIME

ICS TECHNOLOGY

ACCELERATOR-DRIVEN COMPACT SOURCE ACCESSIBLE TO

ACADEMIC

CLINICAL and

INDUSTRIAL INSTITUTIONS

X-ray BEAMS with SOPHISTICATED CHARACTERISTICS

ENERGY TUNABILITY

HIGH BRIGHTNESS

QUASI-MONOCHROMATICITY

OUTLOOK

HIGH BRIGHTNESS, ENERGY-TUNABLE, QUASI-MONOCHROMATIC

X-ray BEAMS

PROVIDE ADVANCED BIOMEDICAL AND **SOFT TISSUE IMAGING QUALITY**

- **IMPROVED SPACIAL RESOLUTION**
- **REDUCED BEAM EXPOSURE**
- **NO CONTRAST AGENTS** IN RADIOLOGICAL EXAMINATIONS
- **FRIENDLY TO PATIENTS** CARRYING **METALLIC IMPLANTS** AND/OR **STIMULATORS**

A POTENTIALLY MULTIDISCIPLINARY
COMPACT ICS X-ray SOURCE
INSTALLED IN CLINICAL LABORATORIES OR UNIVERSITIES
WOULD REPRESENT AN INVALUABLE INSTRUMENT IN
BIOMEDICAL IMAGING DIAGNOSTICS
AND OTHER APPLICATIONS

PROPOSED FACILITY

- Accelerator-Driven Compact X-ray Source
- STAR-like
- Energy Tunable and Upgradable
- OTS components
- Contained Footprint
- Twin User Areas

THE MESSAGE

Bring ADVANCED IMAGING QUALITY and

IMPROVED VISUALIZATION DIAGNOSTICS

for BIOMEDICAL APPLICATIONS to

CLINICS and UNIVERSITY INSTITUTIONS

SYSTEM REQUIREMENTS / COMPETENCES

Electron beam

- High average current
- Multi-bunch Photo-Injector option

Linac Technology — LNF – INFN MI – UNIBO

Laser system

- High Pulse Energy (close to 1J)
- Recirculator option

Non-linear Optics — LNF – INFN MI

Scattered radiation

- Monochromaticity
- High Brilliance
- Energy tunability
- Spatial coherence
- Dual color option

X-ray Characterization and Manipulation — UNIFE