



Italian National Agency for New Technologies,
Energy and Sustainable Economic Development



IFMIF-DONES

Technical Meeting INFN-ENEA

Mariano Tarantino presentata da M. Ciotti

Brasimone, 1st July 2021

Fusion and Technology for Nuclear Safety and Security Department (FSN)



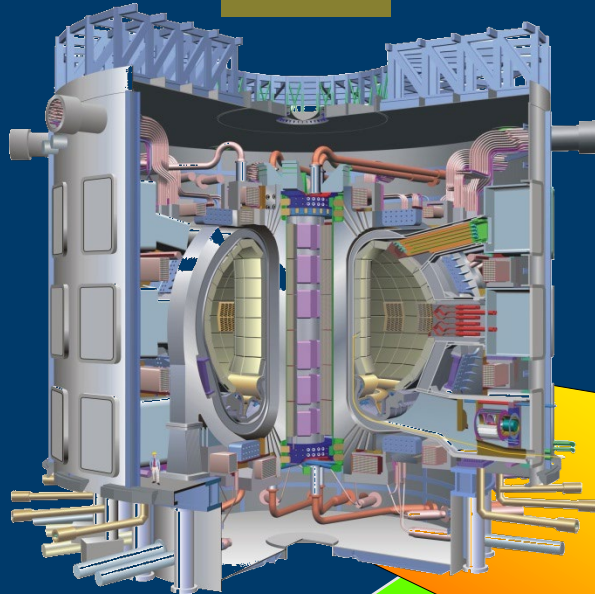
Goal

DEMO



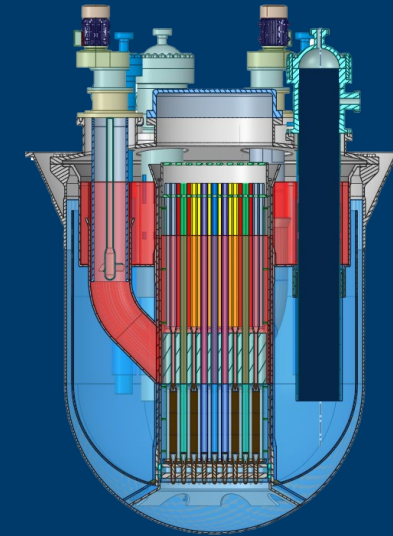
One of the main differences between ITER and DEMO is the radiation dose: at DEMO more that two orders of magnitude higher

ITER



3 dpa/lifetime

Gen IV



~30 dpa/year

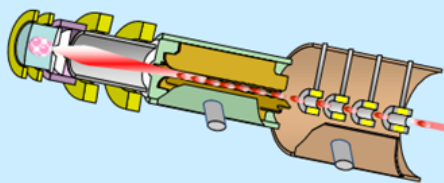
Mandatory: a dedicated facility for material qualification that best mimics 14MeV neutrons with reasonable irradiation volume, fluence, and optimized homogeneity in T with the objective to (finally) validate in-vessel materials

What is IFMIF-DONES?

A fusion-like neutron source required for the qualification of the materials to be used in the EU DEMO

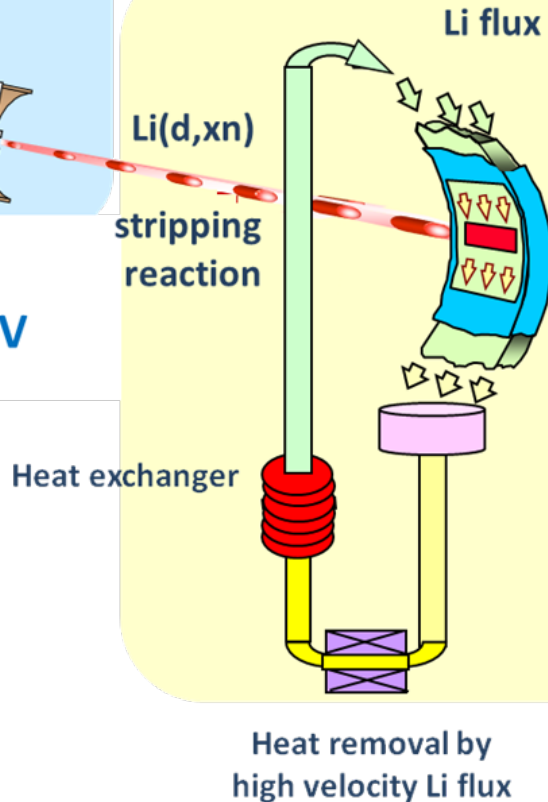
Accelerator

Deuterons: 40 MeV 125 mA (5 MW)

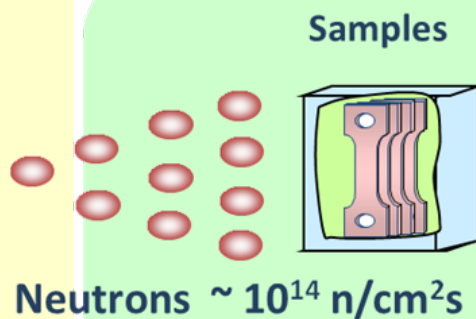


Deuterons at 40 MeV
collide on a liquid
Li screen
flowing at 15 m/s

Lithium Loop (Target)



Test (Irradiation) Module



High Flux Test Module:

20-50 dpa/y at 100 cm^3

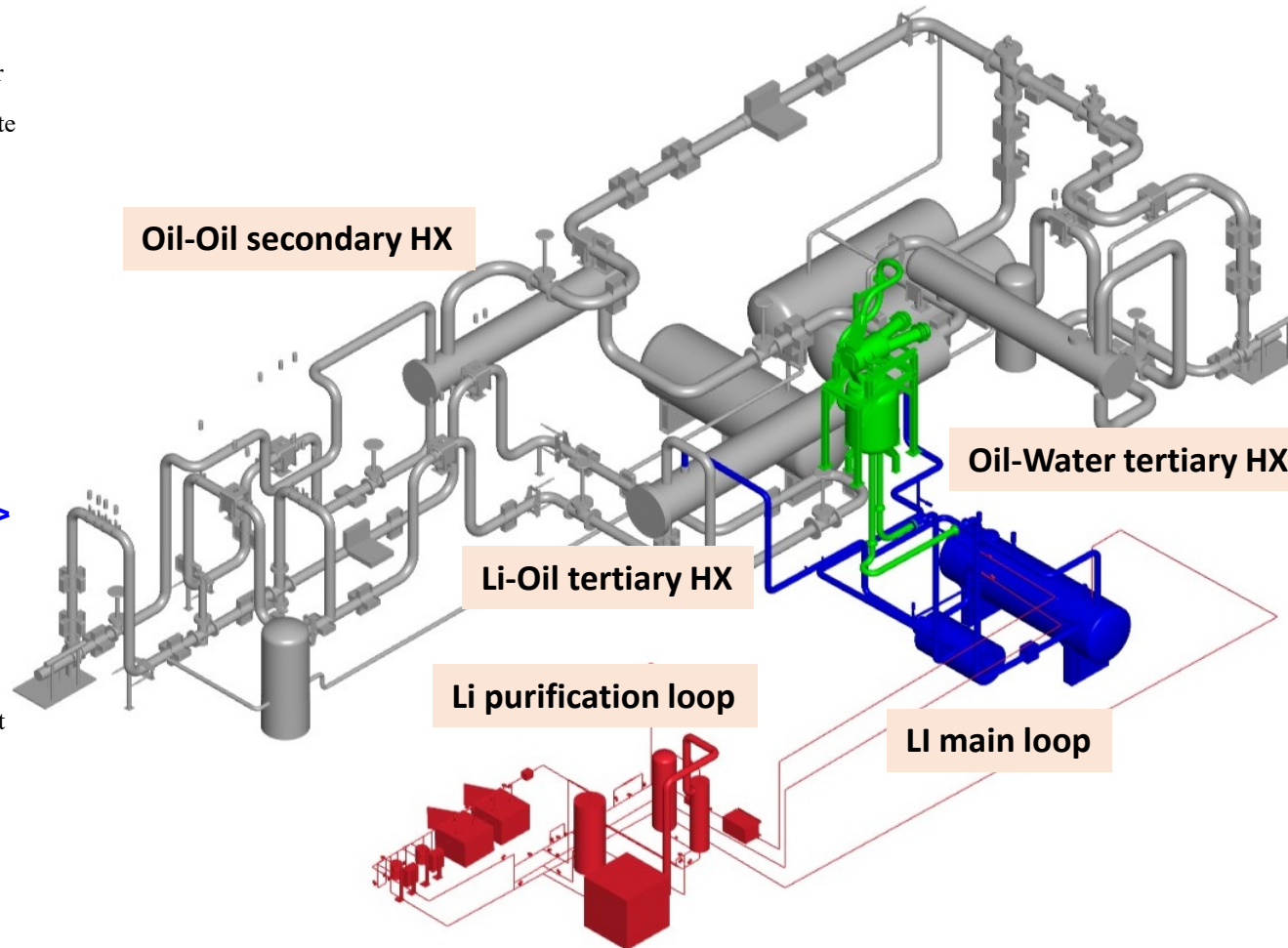
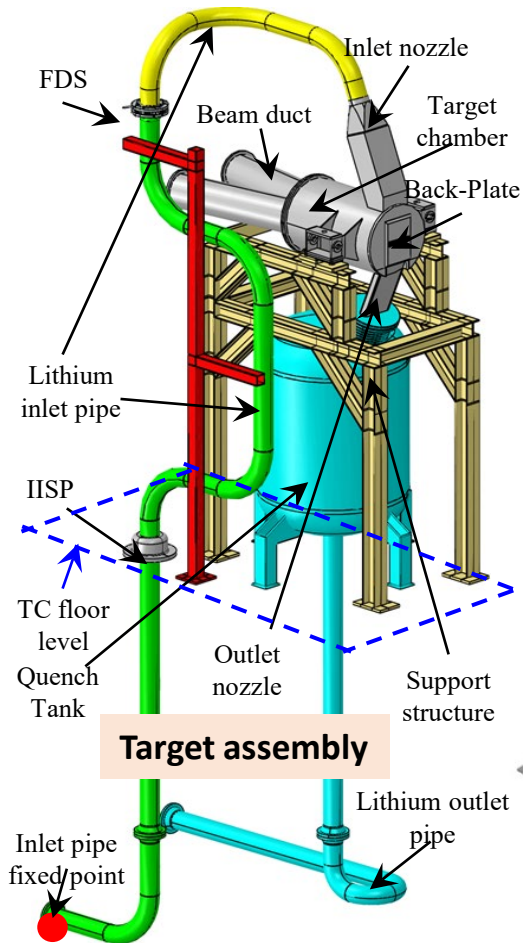
Controlled temperature:

$250 < T < 550 \text{ }^\circ\text{C}$

A neutron flux of $\sim 10^{14} \text{ cm}^{-2}\text{s}^{-1}$
is generated with neutron
spectrum up to 50 MeV energy

Lithium System (ENEA skills & interest)

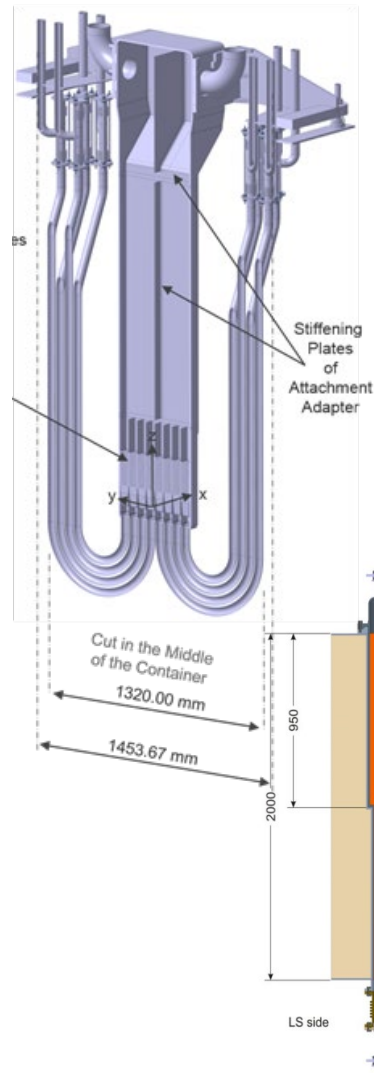
- 5 MW power handling, 15 m/s Li velocity, remote handling
- Main requirements: Li flow stability and Li impurities control



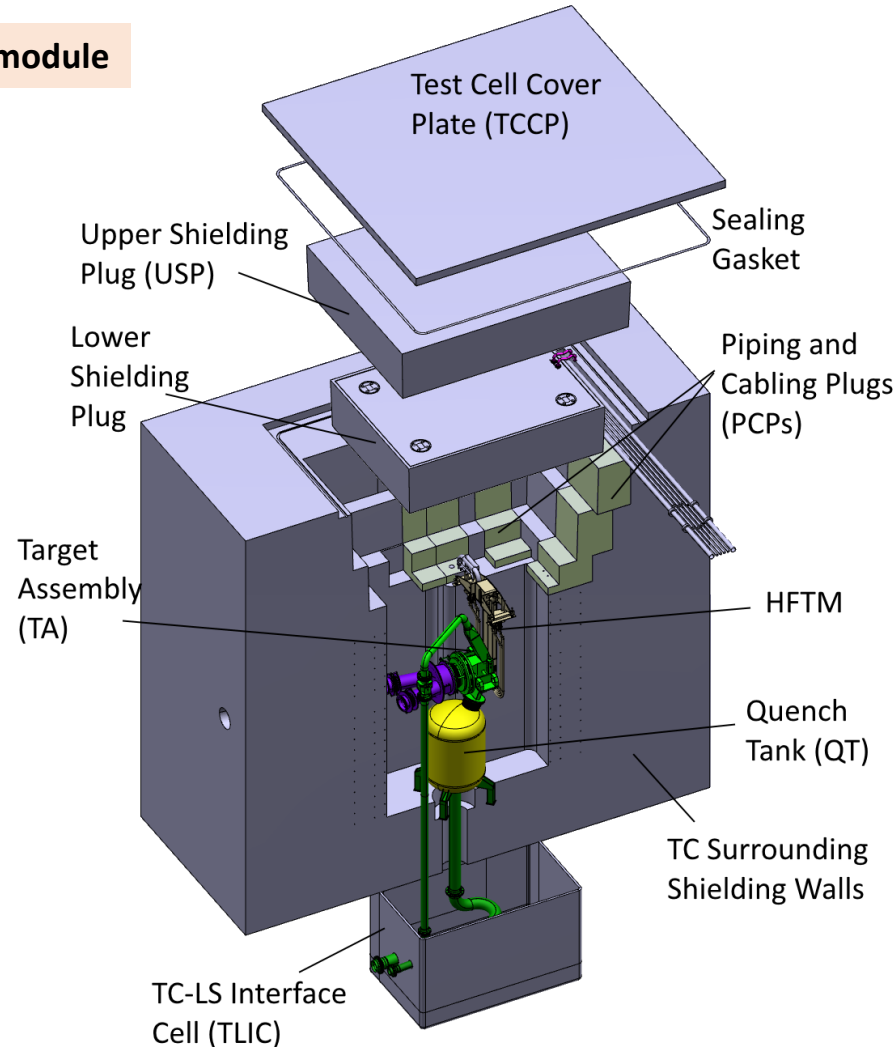
Challenging!!!!

(Biggest Li loop,
power
management,
impurities
management –
corrosion risks-
reability,
lifetime,...)

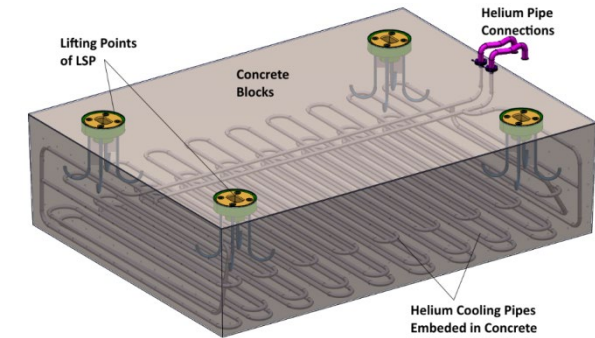
Test System Summary (ENEA skills & interest)



Irradiation module



Cooled shielding plug

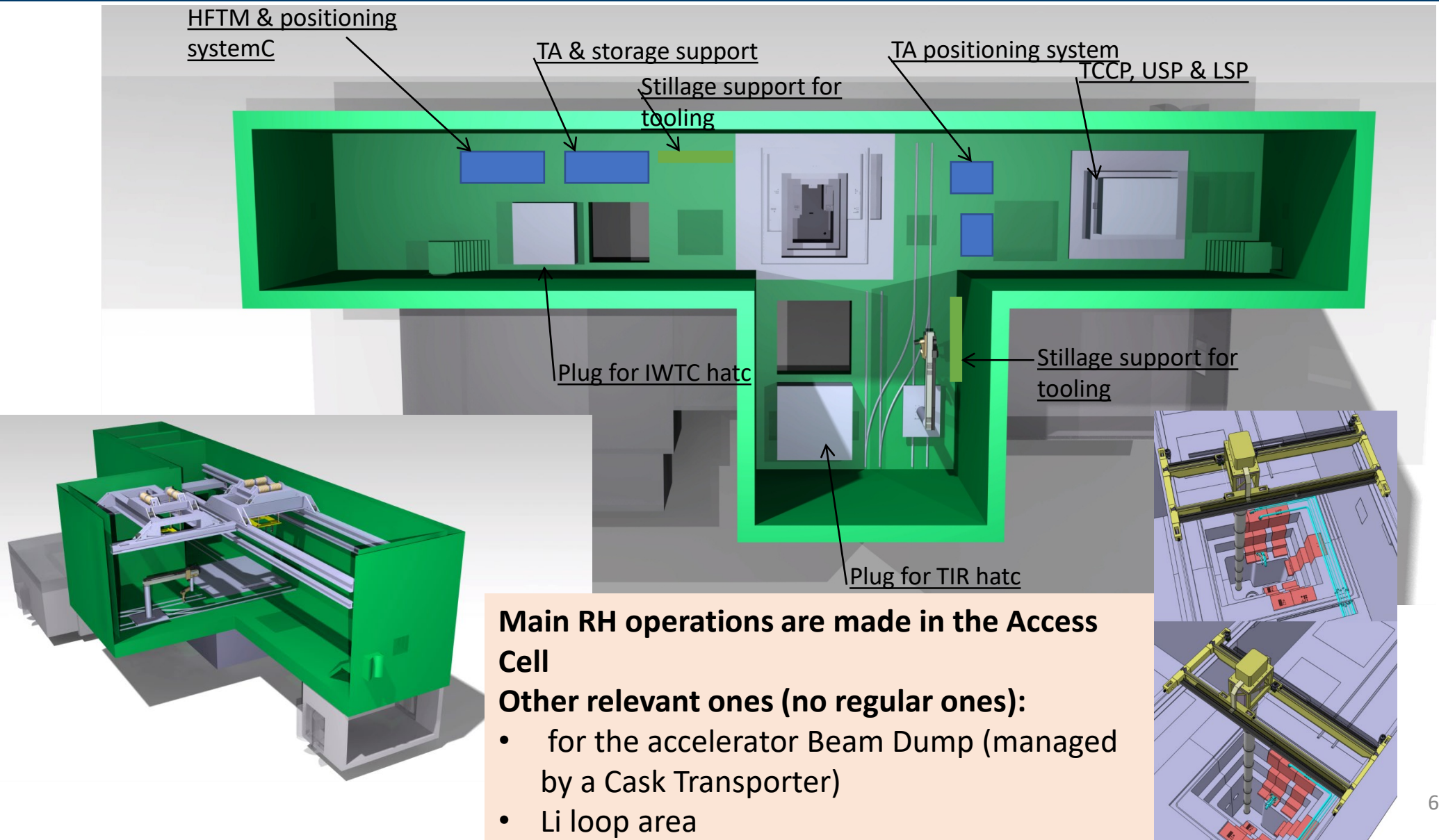


Main characteristics driven by the presence of neutrons and Li

- Internal components cooling by He
- Remote Maintenance required

Challenging!!!!:(RH, reability and long term control,...)

Remote Handling System (ENEA skills & interest)



Take-away message

- ENEA has large capabilities and competencies which can drive the involvement of national industry on the construction phase of DONES
 - Lithium technology
 - Target
 - Remote Handling
- IFMIF-DONES is a fundamental milestone toward DEMO. For the Italian perspective on the **fusion technology is mandatory to be part of the game.**