
AREVA

TN-PNS : An Innovative Cask for PNS Transport

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Looking to the future PATRAM 2010

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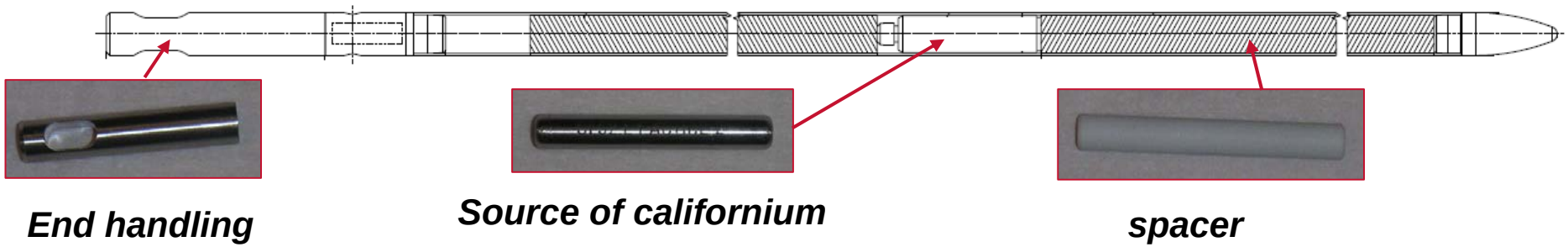
Why TN-PNS ?

- **TN-PNS (type A package)**
  - Conceived and manufactured to meet AREVA CERCA requirements
  - Designed for transport of Primary Neutron Source rods
  - Needed with the construction of new type EPR™ nuclear reactor
  - Used to calibrate new reactor security systems

- **Contents to be transported**
  - Up to 6 PNS rods
  - Maximum activity = 100 GBq
  - Made of 252 californium sources under special form (activity < 1A1)

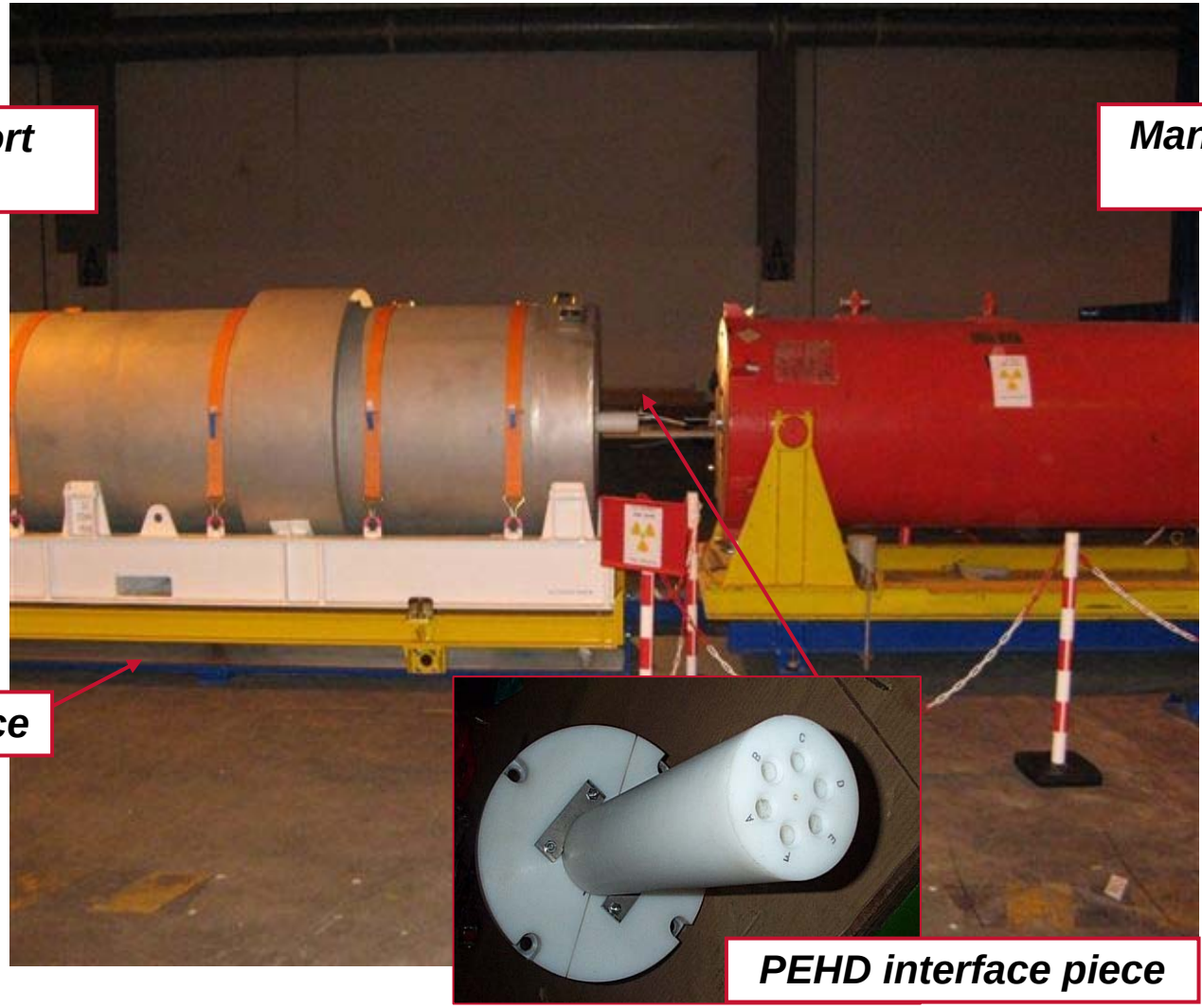


End handling *Source of californium* *spacer*

Cask Specifications

- **The Special Form ensure the containment of the material**
- **Resistance under routine conditions**
  - **No deformation of the rods**
- **Resistance to the regulatory drop test (NCT)**
  - **closing systems and the structure**
  - **No displacement of the source**
  - **Increase in maximum dose rate < 20%**
- **Shielding: respect of the regulatory criteria**
  - **Air transport: 0.1 mSv/h at 1 meter (Japan)**
- **All means of transport (road, rail, sea, air)**
  - **Transportable in a 20 feet container**
  - **Total weight < 6 tons**

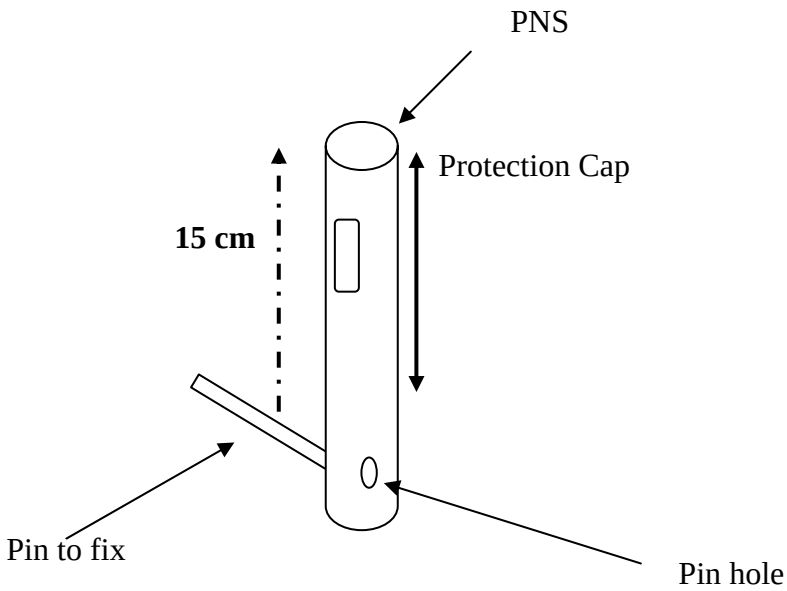
Cask Specifications: horizontal loading



Cask Specifications: vertical unloading

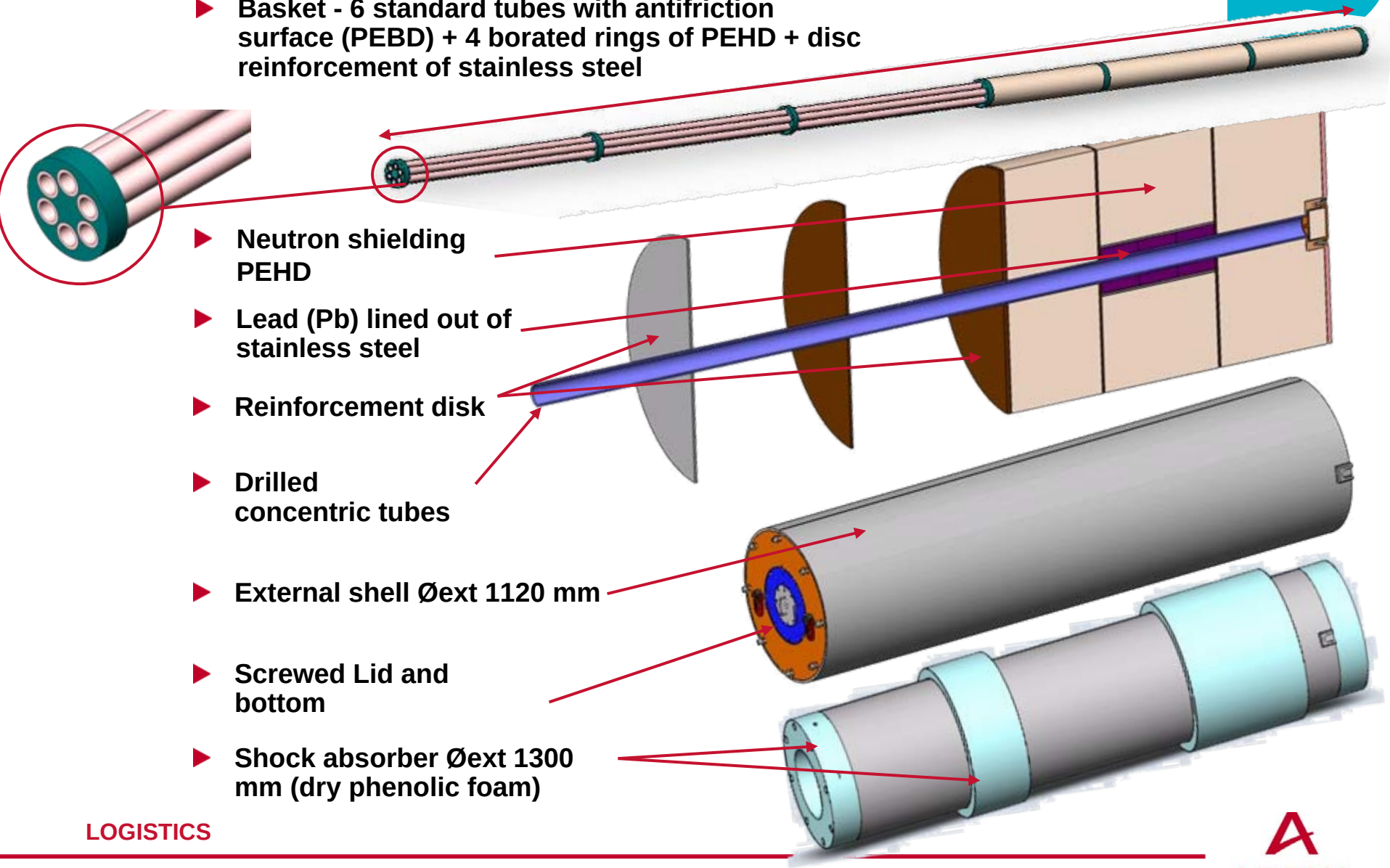
- **Stabilizer**

- **Easy Access to the rods**



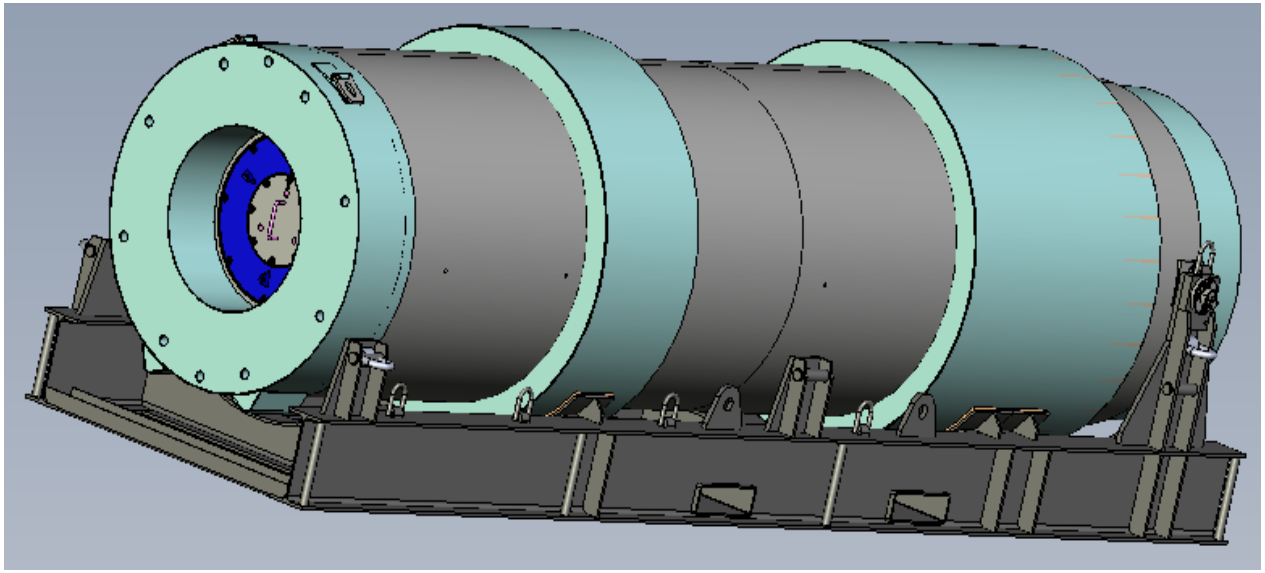
TN-PNS Cask Design

- **Basket - 6 standard tubes with antifriction surface (PEBD) + 4 borated rings of PEHD + disc reinforcement of stainless steel**
- **Neutron shielding PEHD**
- **Lead (Pb) lined out of stainless steel**
- **Reinforcement disk**
- **Drilled concentric tubes**
- **External shell Øext 1120 mm**
- **Screwed Lid and bottom**
- **Shock absorber Øext 1300 mm (dry phenolic foam)**

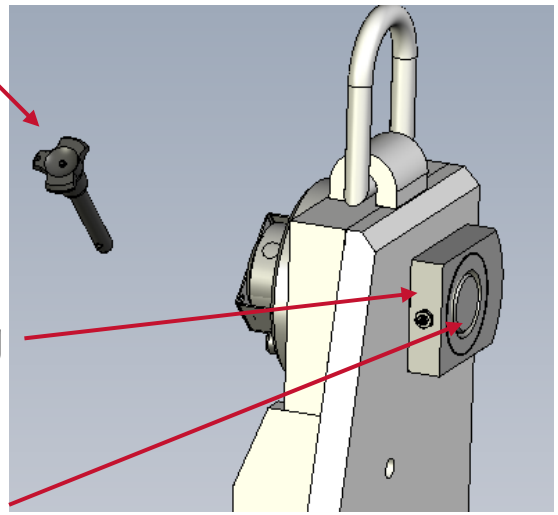


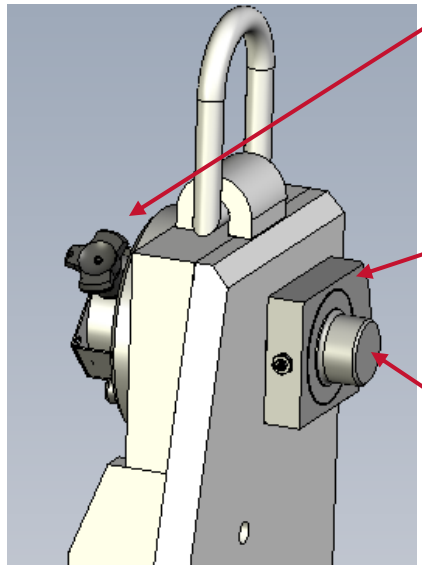
TN-PNS Cask Design

- **Drop test with skid : no consequences on package**
  - **Absence of appendage on the surface**
    - No trunnions
    - Removable tilting rings
  - **Fusible bronze rings on skid**
  - **Shock absorbers positioned between the package and the skid**



TN-PNS Cask Design: Tilting Axis

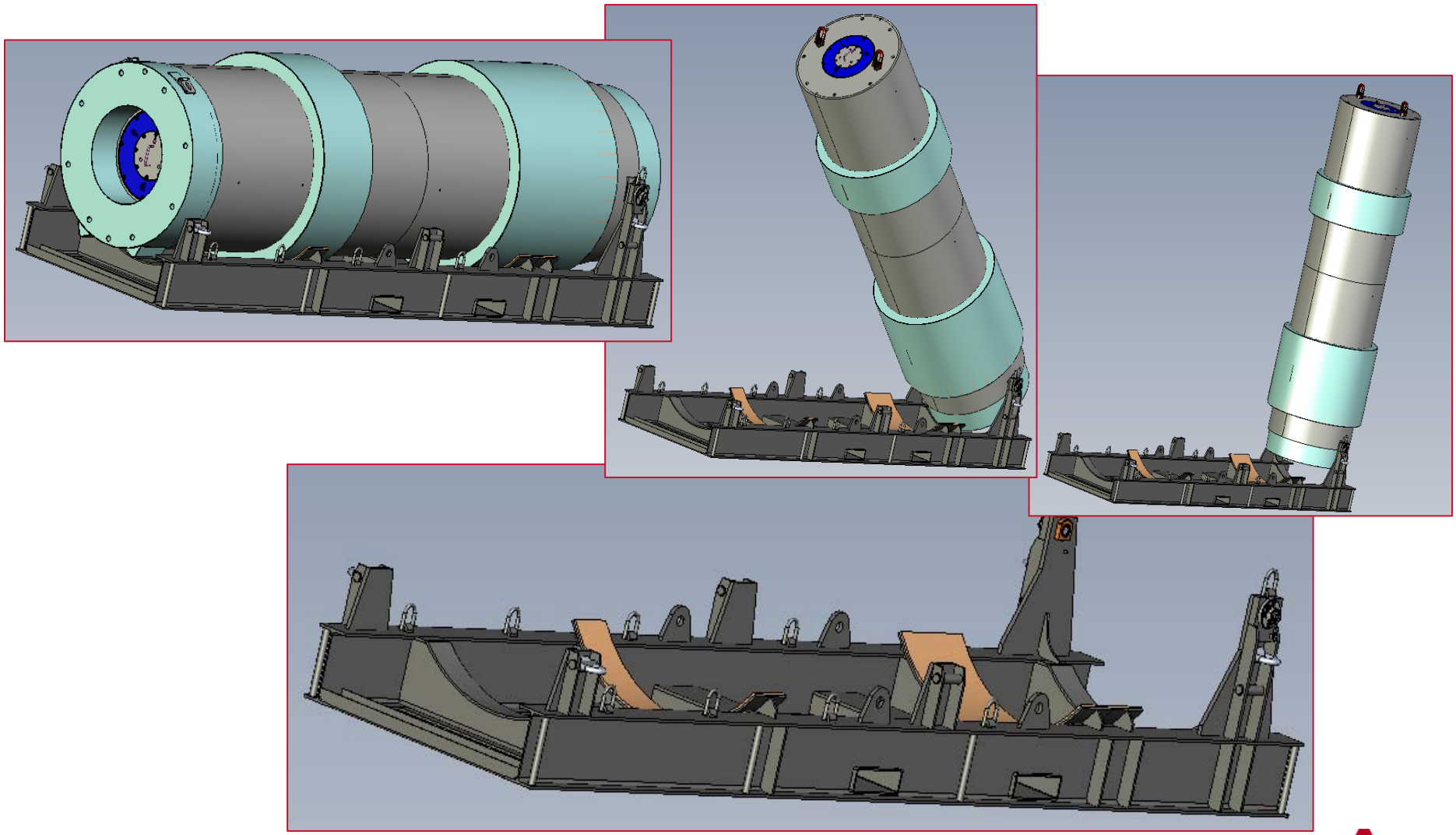




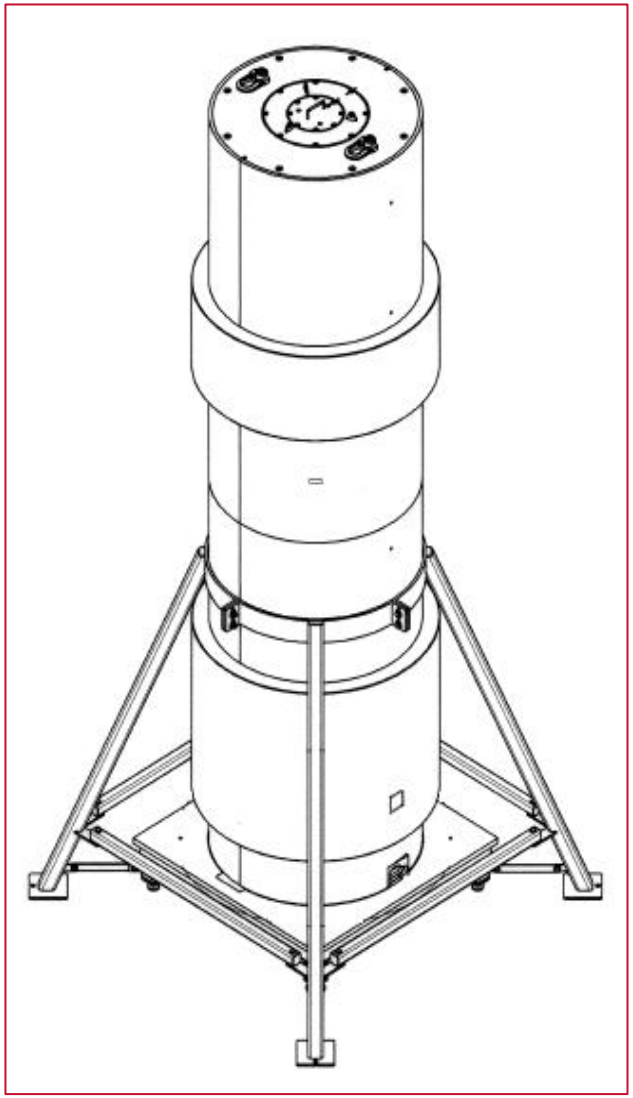
Unloading configuration

Transport and tilting configuration

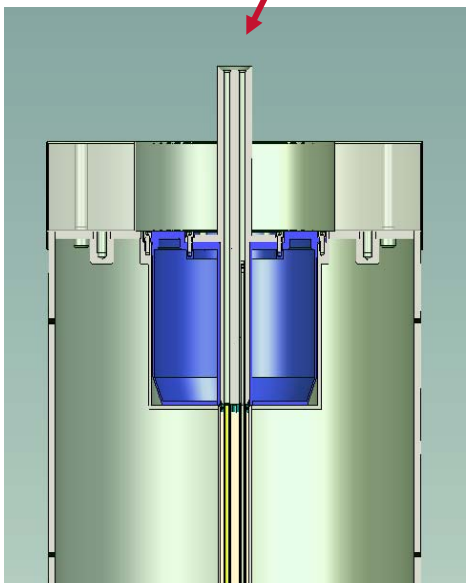
TN-PNS Cask Design: Tilting Operations

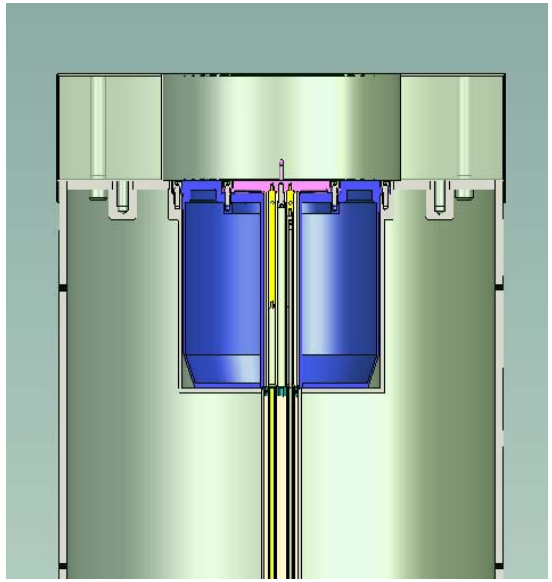


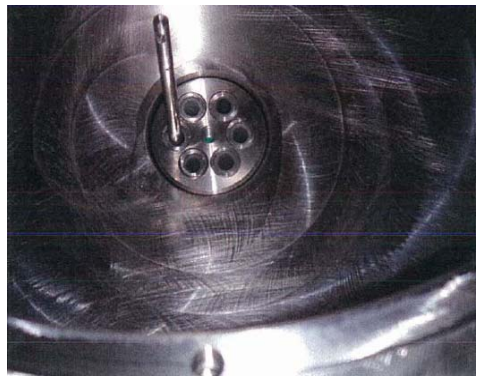
TN-PNS Cask Design: Vertical support

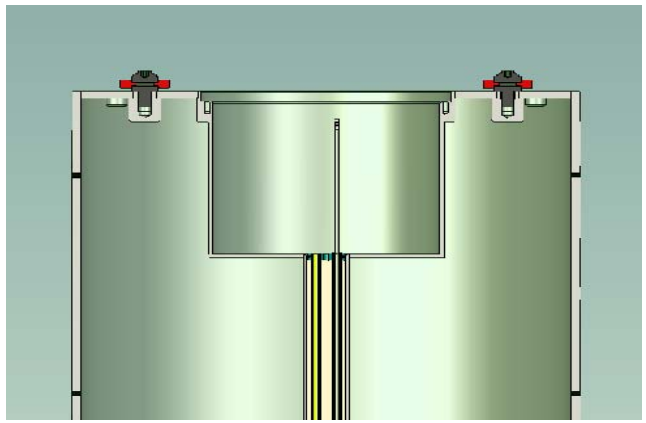


TN-PNS Cask Design: Easy Rods Loading / Unloading









Loading configuration

Transport configuration

Unloading configuration

LOGISTICS

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TN-PNS Cask Design: Stowing

Conclusion

- **Low cost design :**
  - Increased use of standard materials and semi-finished products
- **Innovations:**
  - System of negative trunnions with tilting skid
  - Multiple functions of the axes: support for the tilting, more security during use and stowing
- **Short dead line:**
  - 15 months from design to delivery
- **First successful transport:**
  - End 2008 from France to Japan by road, air and sea