

# 08.05.2008 Seminar

## Posiva Oy

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POSIVA

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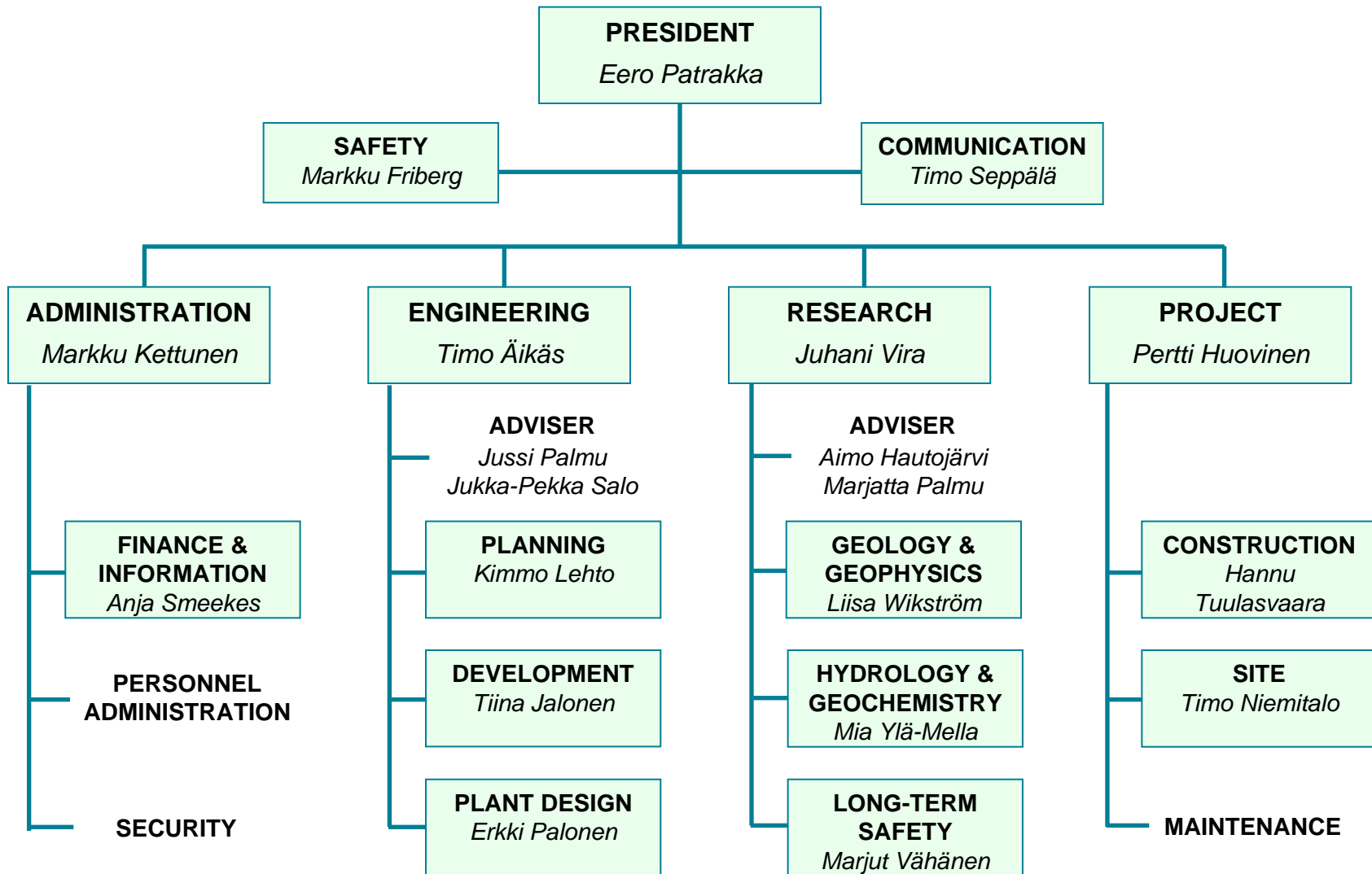
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# Posiva Oy

- Company established in 1995
  - Ownership: Teollisuuden Voima Oyj 60 %, Fortum Power and Heat Oy 40 %
- Mission: Final disposal of spent nuclear fuel of the owners and other tasks of expertise within nuclear waste management
- Gradual change from R&D company to implementing organisation
  - Organisation adjusted according to changing demands
  - Long-term planning of the organisation ongoing
- Steadily developing staff
  - Own staff about 70 persons
  - Extensive use of contractors
- Turnover growing
  - Accrued in 2007 : EUR 47 million
  - Estimated for 2008: EUR 55 million

# Posiva Organisation



# Finnish concept for final disposal of spent fuel

- According to the Nuclear Energy Act, all nuclear waste generated in Finland must be handled, stored and permanently disposed of in Finland.
- The disposal of spent fuel from Olkiluoto and Loviisa NPPs is implemented by Posiva Oy.
- The repository will be located in crystalline bedrock at Olkiluoto and the disposal will be based on the KBS-3 concept.
- The site suitability shall be confirmed through underground characterisation of the intended host rock.
- For this purpose an underground rock characterisation facility, ONKALO, is now under construction
- In parallel progress is being made in the development of the technology needed for the encapsulation and disposal of the spent fuel.

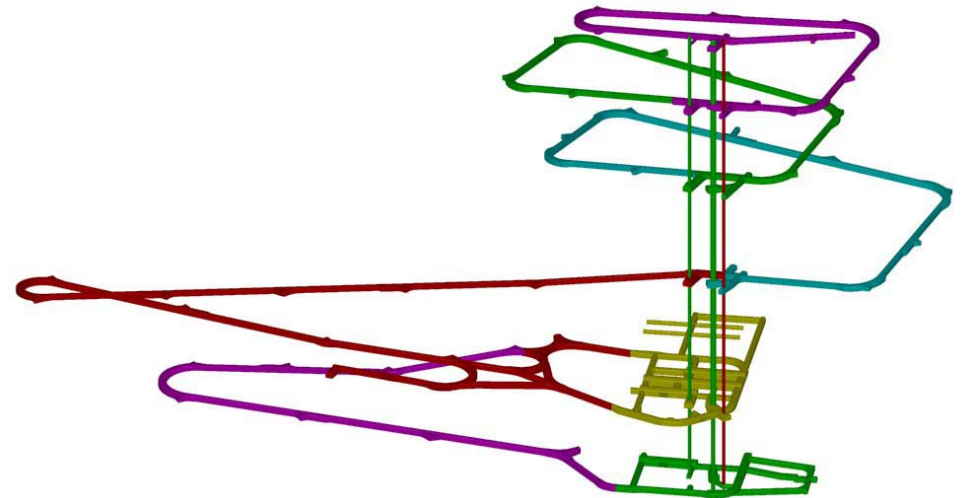
# Role of Underground Characterisation and Research Facility ONKALO

- ONKALO will be a site-specific underground characterisation facility
- ONKALO will be constructed to make possible to obtain construction license for disposal facility
- ONKALO will later serve the deep repository as one of the access routes needed

# ONKALO and research

ONKALO	2004	2005	2006	2007	2008	2009	2010	2011	2012
Access tunnel to the depth of final disposal	[Bar from 2004 to 2009]								
Main characterisation level, extension of the access tunnel							[Bar from 2010 to 2011]		
Construction works and installations								[Bar from 2011 to 2012]	
<b>Bedrock investigations</b>									
Characterisations above ground and from the tunnel	[Bar from 2004 to 2009]								
Characterisations at the depth of final disposal							[Bar from 2010 to 2012]		

- Technical information
  - Volume of excavated solid rock 365
  - Access tunnel
    - Width 5.5 km
    - Gradient 1:10
    - Size 5.5 x 6.3 m = approx. 34 m<sup>2</sup>
  - Total length of tunnels 9 km
- Diameter of shafts 3.5, 4.5 & 3.5 m
- Characterisation levels
  - -420 m
  - -520 m (optional)

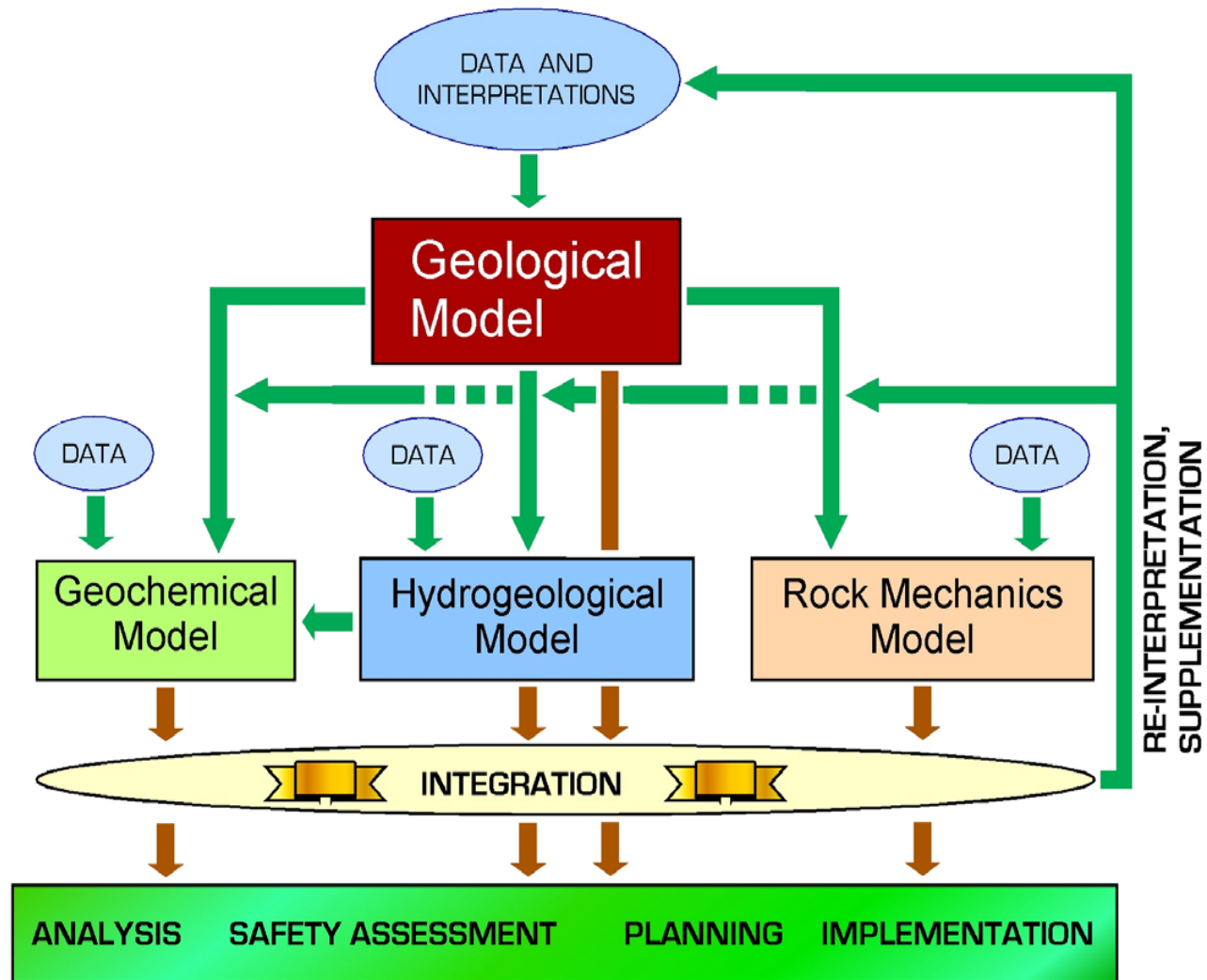


# Organisation of site characterisation

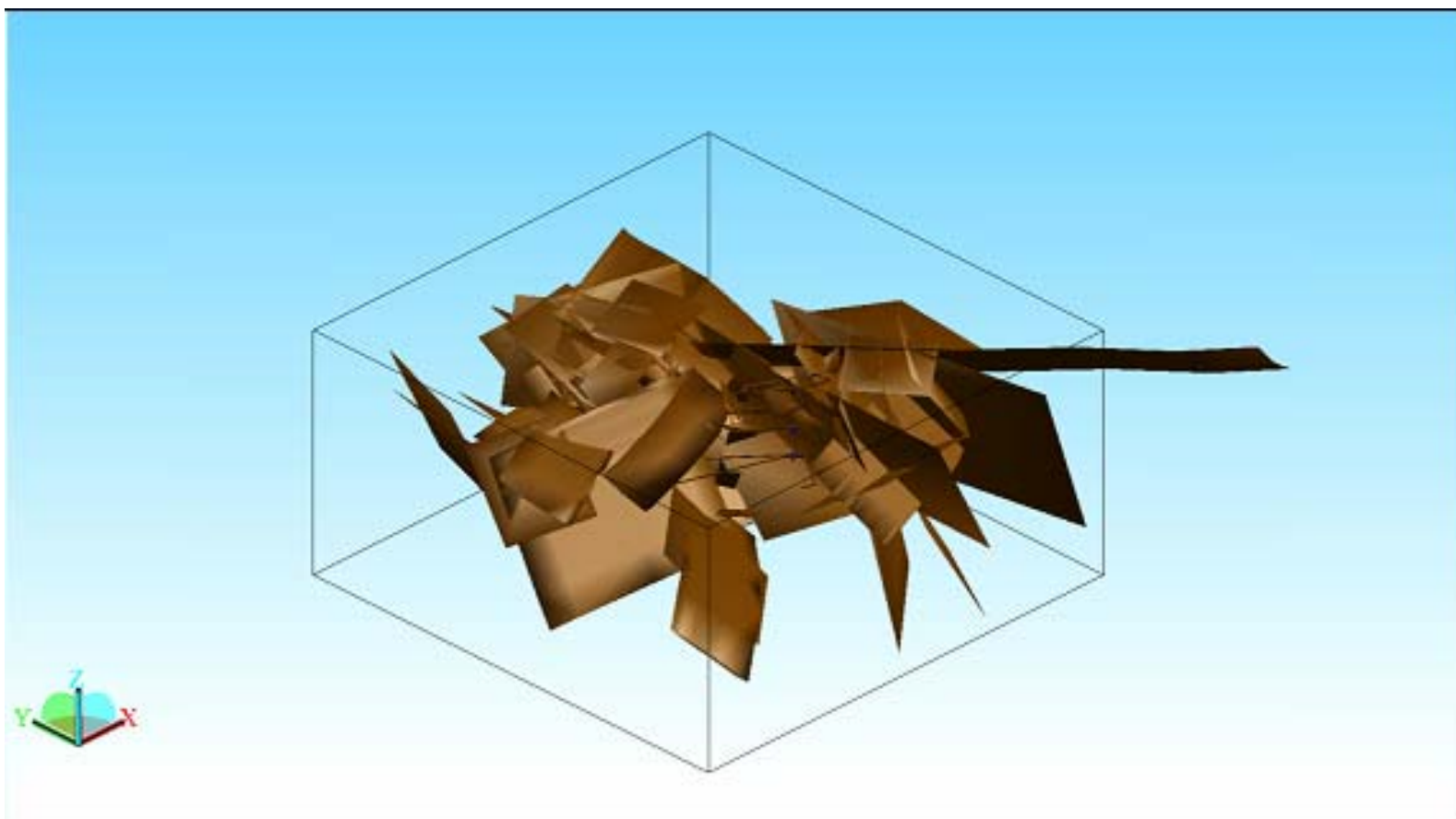
- Olkiluoto Site Characterisation Programme VARTU
  - Overall responsibility for confirming site characterisation on the surface and underground, including investigations related to the ONKALO construction
- Olkiluoto Modelling Task Force OMTF
  - Responsible for the integrated interpretation, description and modelling of the site
  - Four modelling groups: geology, rock mechanics, hydrogeology, hydrogeochemistry
- Olkiluoto Monitoring Programme OMO
  - Responsible for monitoring the impacts due to the ONKALO construction



# Modelling strategy



# WR 2007-92 Geological Model of the Olkiluoto Site, Version 1.0

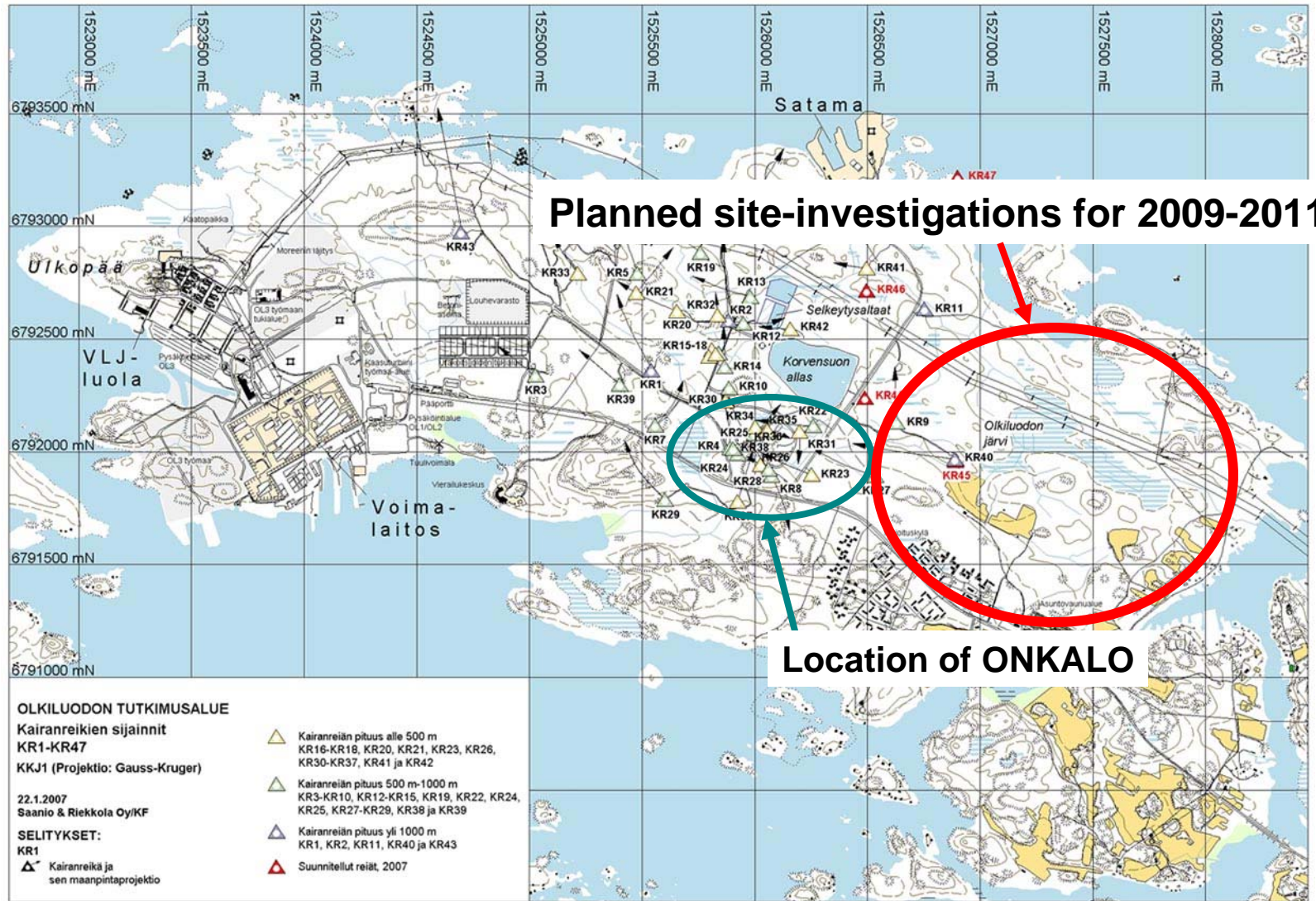


Local brittle deformation zones

# Stages of site characterisation

- Stage 1
  - Surface-based investigations before the construction of the ONKALO access tunnel (->2004, will continue in all stages)
- Stage 2
  - Construction of the ONKALO access tunnel and shafts with parallel site investigations (2004-2009)
- Stage 3
  - Construction of the main (and lower, opt.) characterisation levels of the ONKALO with associated underground site investigations and demonstrations (2009-2012)

# Site investigations focused in Olkiluoto



# Outcome of site characterisation and evaluation

- Field investigation focused
  - Developing bedrock models (site descriptive model)
  - Obtaining hydrological data
  - Obtaining hydrogeochemical data
  - Acquiring rock mechanical information
- Hydrological modelling and hydrogeochemical modelling key areas in site evaluation
  - Main purpose of the modelling is to answer question "is the site good enough"

# Aims for underground characterisation

- From the ground surface it is difficult to obtain detailed information which is needed for
  - Adapting the KBS-3 concept to site specific conditions of Olkiluoto
  - Design of the repository
  - Testing and verification of designed solutions
  - Assessing the safety
- Learning of the organisation to investigate, evaluate, design, construct, operate and seal disposal facility in accordance of high quality demands

# ONKALO investigations

- Tunnel mapping
- Probe holes
- Pilot holes
- Characterisation holes
- Investigation niches
- Hydrological measurements

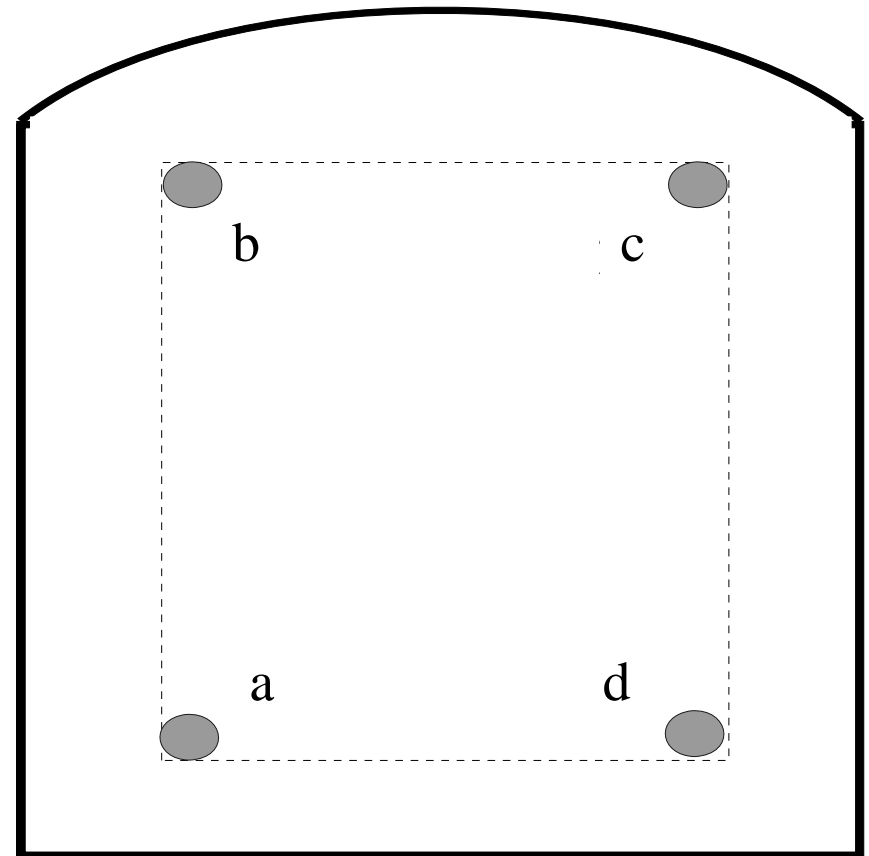
# ONKALO tunnel mapping

- Three separate mapping stages
  - Round mapping during tunnel excavation
    - Initial data for design of temporary rock support and grouting
  - Systematic mapping 100-200 m behind the tunnel face.
    - during drilling, pre-grouting, charging (does not interrupt tunnel excavation)
    - Main phase of rock characterisation
    - Initial data for permanent rock support
  - Supplementary studies
    - Deformation zone
    - Water leakage mapping



# Probe holes in ONKALO

- Four probe holes every 4 rounds
  - Drilled by jumbo
  - Remain inside tunnel perimeter
  - Length 20-26 m
  - Measurement
    - Outflow measurement
    - Flow logging
    - Lugeon testing



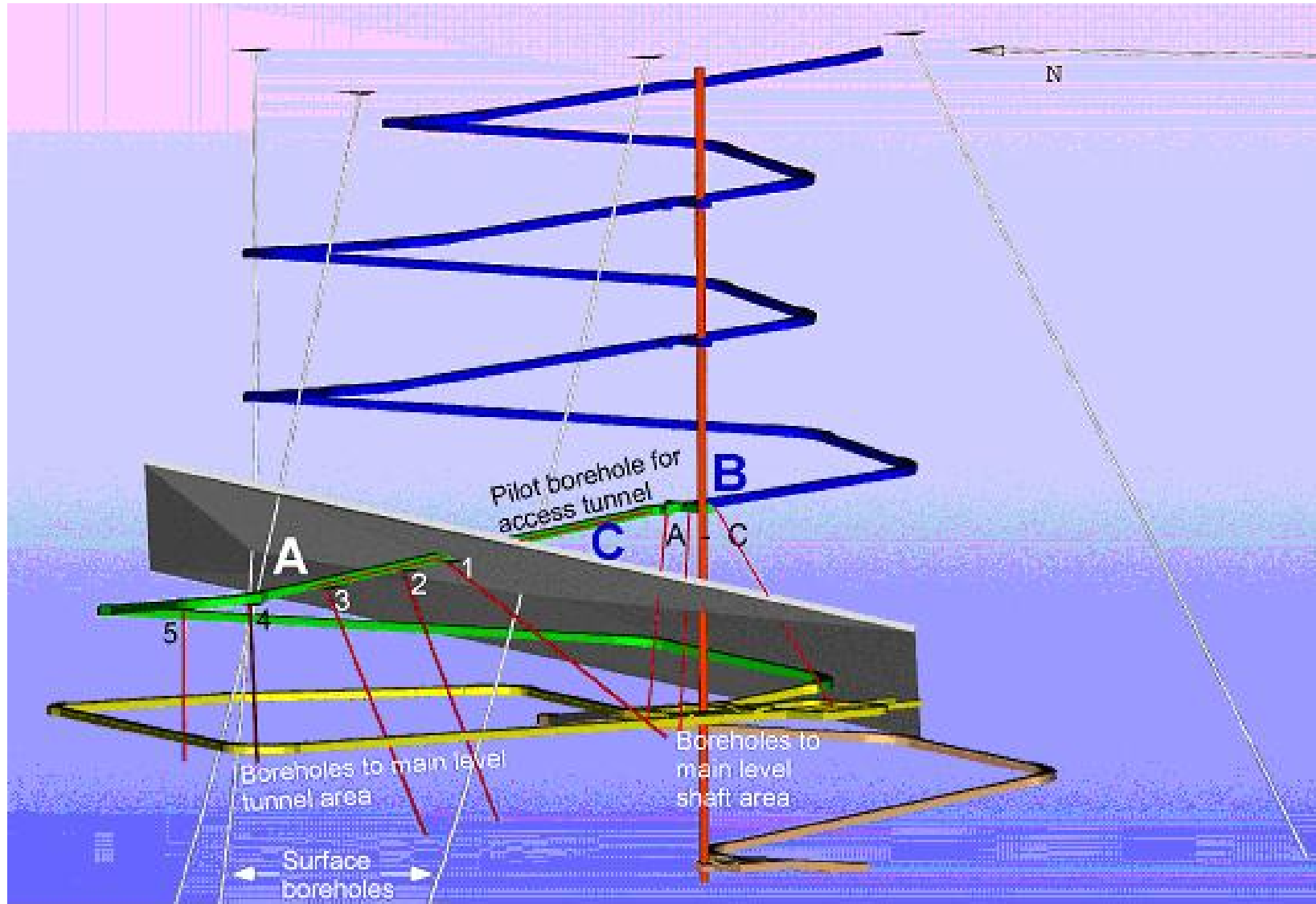
# Pilot holes in ONKALO

- Drillholes shall remain inside the tunnel perimeter
- Drillhole length 50-300 m
- This far seven pilot holes has been drilled
  - OL-PH1 160 m (from ground surface)
  - ONK-PH2-7 96-202 m
- Investigations
  - Geological core logging
  - Geophysical inhole measurements  
(density, susceptibility, resistivity, nat.gamma, radar, acoustic, optical imaging survey)
  - Hydrogeological measurement
  - Geochemical water sampling
  - Lugeon test
  - Pressure build-up test

# Characterisation holes and niches

- Characterisation holes
  - Drillholes directed outwards from the tunnel, length up to 300 m
  - Drilled from niches
  - Not yet done, long charact. holes below –300 m
  - Characterisation strategy will be defined in TKS-2006 program
- Characterisation niches
  - Geological, rock mechanics, hydrogeological, hydrogeochemical characterisation
  - Preliminarily 5 niches
  - First niche at chainage 1475

# Characterisation holes from ONKALO



# Monitoring programme OMO

- Programme for monitoring of impacts due to construction and operation of ONKALO
  - Hydro(geo)logy (groundwater levels, hydr. pressures etc.)
  - Hydrogeochemistry (geochemical changes by repeated sampling)
  - Rock Mechanics (microseismics, GPS, rock movements in tunnel etc.)
  - Environment (biosphere, traffic, noise etc.)
  - Stray materials (control of materials used in ONKALO)

# Main aspects of the RSC-program

- RSC-Rock Suitability Criteria: Defining volumes suitable for final disposal (Repository scale – panel scale – deposition tunnel scale – deposition hole scale)
- First target below the "20-domain" is to:
  - enhance the methodology to derive the suitability criteria
  - to define the location for the first panel

# Characterisation needs below the 20-domain

- After passing the 20-domain, RSC needs are focused on:
  - Characterisation of the properties of intact rock
  - Characterisation of small-scale features (both known and unknown)
  - Providing more detailed data for DFN-models
- In addition, this is the first phase to get detailed information close to the planned repository level
  - Enhancing predictive capability
  - Testing methodology close to repository depth

## In addition:

- To test the RSC methodology *in time*, a specific tunnel section is needed:
  - Testing the RSC from the beginning all the way to the drilling on the locations of possible disposal holes, i.e. modelling – pilot holes – excavation – disposal hole selection – confirming the results/improving the system
  - This needs to be constructed just after reaching the planned repository level



# Entrance to the ONKALO in summer 2007

