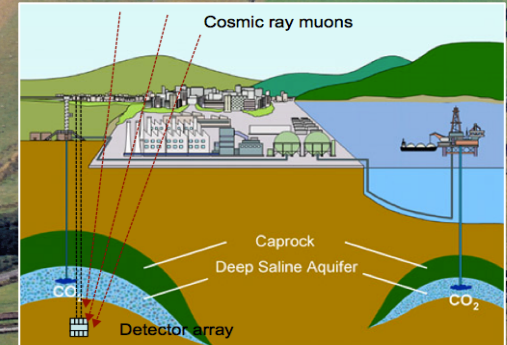
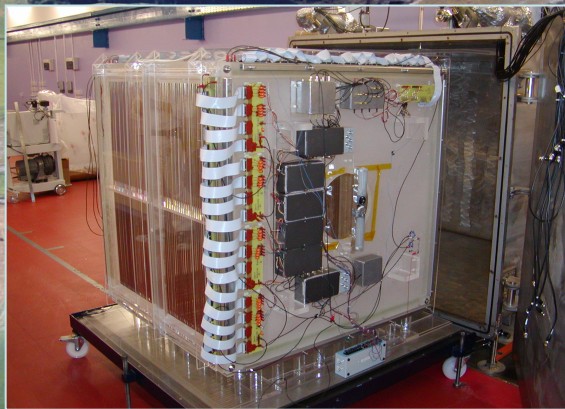


Sean Paling STFC Boulby Underground Science Facility

**DRIFT- Directional
Dark Matter Search**



**Multi-disciplinary studies: climate, the
environment, life on earth & beyond!**

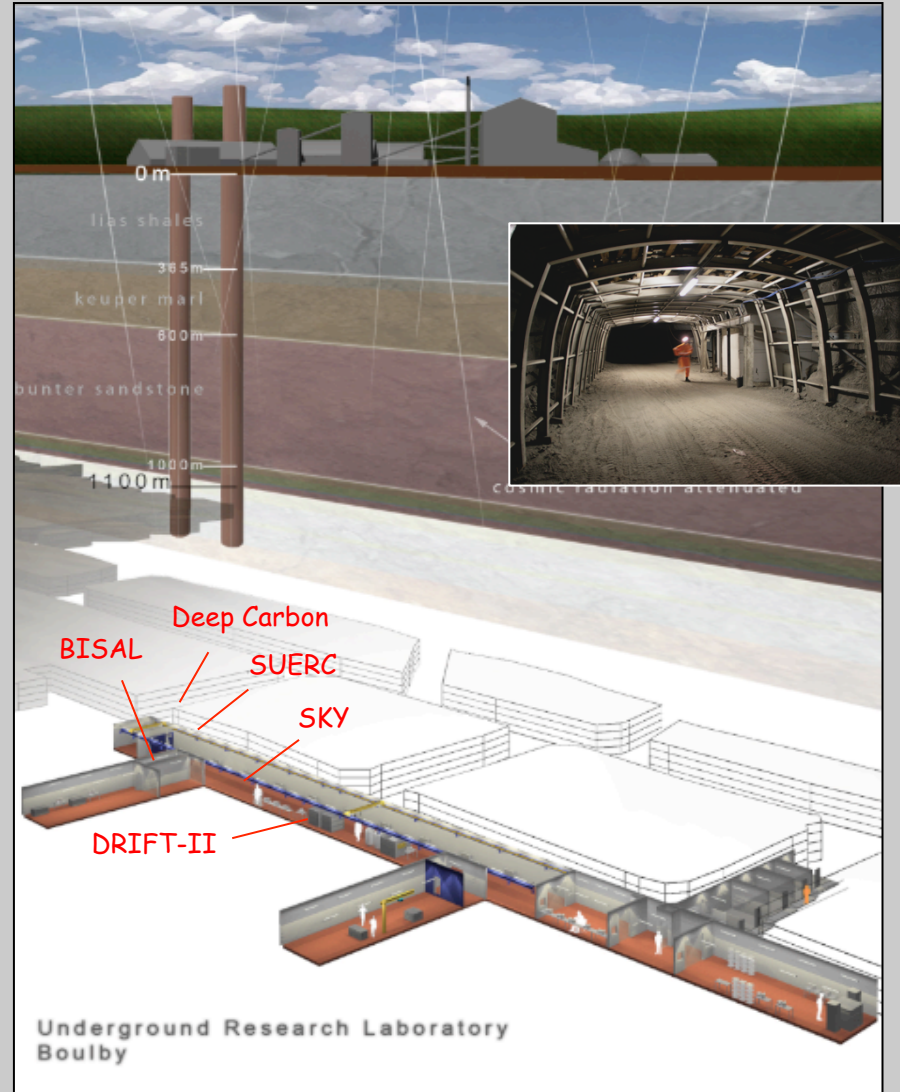
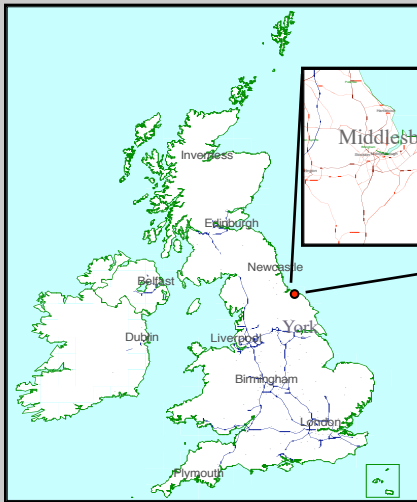
Boulby Underground Science Facility: Status & future plans...



Low background counting

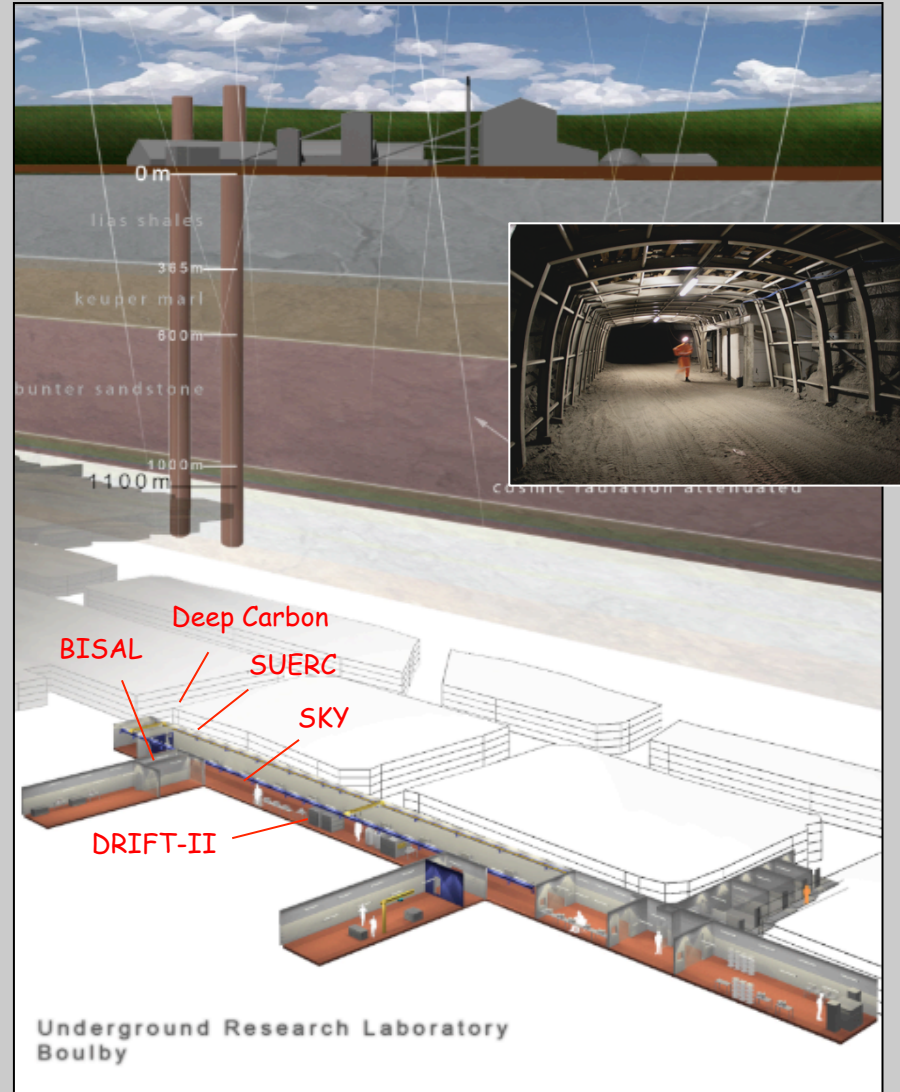
Boulby Underground Lab

- The UK's Deep underground Science Facility. Operating in a working Potash and Salt Mine
- 'Palmer Lab': a 100+m, fully equipped underground lab. Power, internet & telephone comms, lifting, air con / filtration, clean room.
- 1100m deep (2805mwe) – CR flux reduced by 10^6 . Surrounding Rock Salt naturally low in U/Th giving low gamma, neutron and Rn backgrounds.



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Underground Science @ Boulby Mine

- DRIFT: Directional Dark Matter Search
- Boulby-Ge: Low Background Counting
- SKY: Cosmic Rays, Aerosols & Climate
- Deep Carbon: Muon Tomography for CCS (etc)
- ERSaB: Environmental Low-Background Counting
- BISAL: Geomicrobiology / Astrobiology studies
- Misc Geology / Geoscience
- Etc... (More to come).

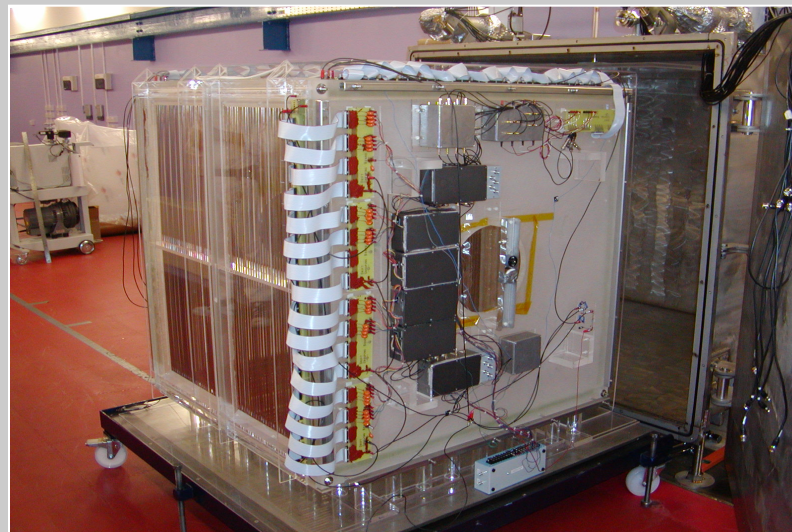
A growing multi-disciplinary science programme addressing RCUK priority themes. From astrophysics to studies of climate, geology, the environment, life on Earth and beyond...

DRIFT-II @ Boulby...

A **DIRECTIONAL** Dark Matter Detector.

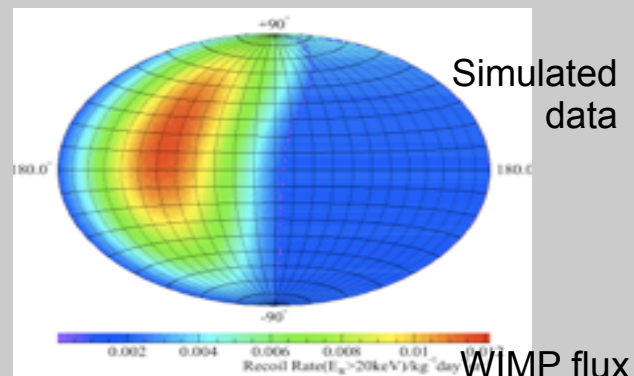
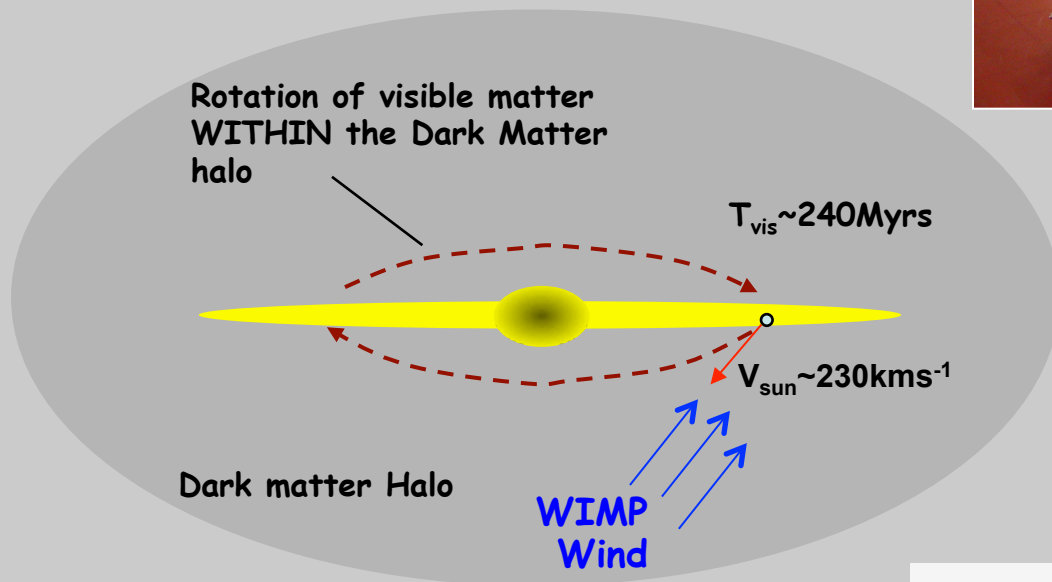
Sheffield, Edinburgh, Occidental College, New Mexico, Colorado State, Boulby

Status: Operating @ Boulby since 2001. New 3 year (2011-2014) NSF funding for expanded ops & R&D....



DRIFT-II@d Boulby

Directional detection



Directional DM detection – providing the most powerful direct detection signature

Our movement within the Dark Matter Halo

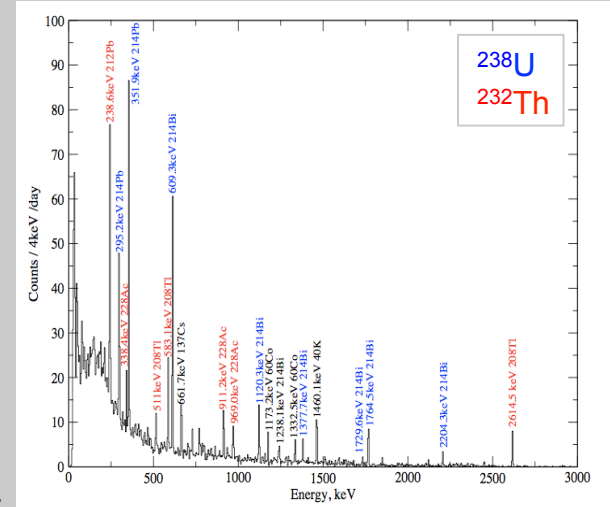
Low-Background Counting

Low-background gamma spectroscopy and radon emanation facilities to support astro-physics & misc 'rare-event' studies



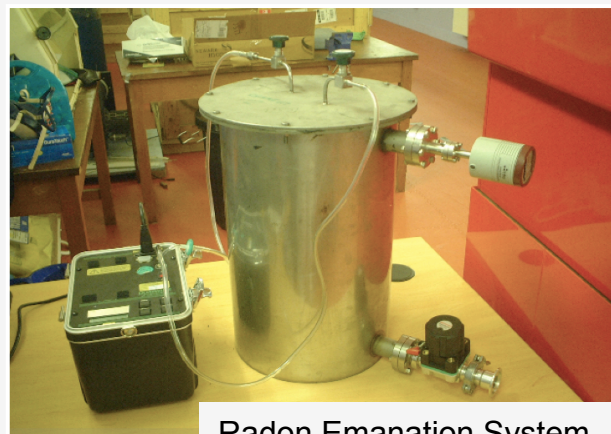
Activity testing of ZIII PMTs

Ametek 2kg (90% efficient)
Low BG Ge detector
Sensitivity of mBq/kg & below.

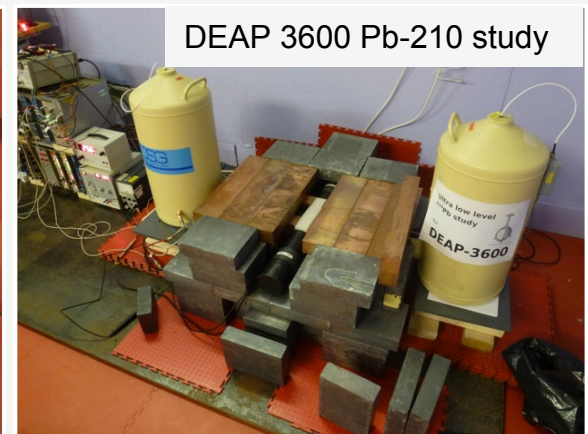


Status: Various low BG counting studies underway supporting **SuperNEMO**, **DRIFT**, **DM-Ice** and **DEAP-3600** experiments.

Proposals now submitted to **EXPAND/IMPROVE** low BG counting capabilities



Radon Emanation System



DEAP 3600 Pb-210 study

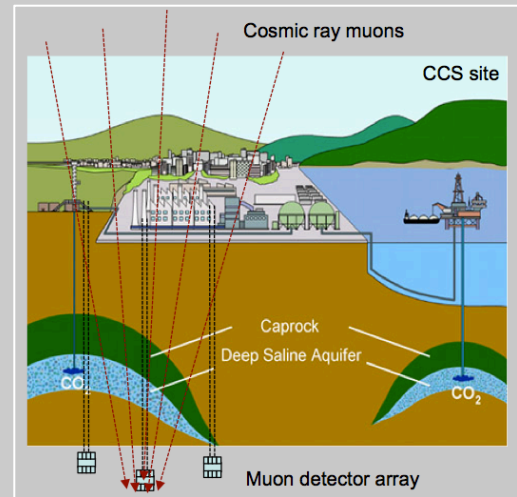
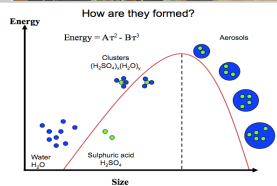
Boulby Multi-Disciplinary Studies



SKY-II: UK/danish study of ion-induced aerosol nucleation and climate

DEEP-Carbon: Muon Tomography for deep geological mapping applications including CCS

Boulby, Manchester, Oxford, Birmingham, Danish Space Inst.



Boulby, Durham, Sheffield, Bath, Premier Oil, CPL.

Astrophysics to climate, geology, the environment, life on Earth & beyond...



ERSaB: Gamma spectroscopy & low BG counting environmental radioactivity studies

Boulby, Scottish Universities Env. Research Ctr (SUERC)



Boulby, Edinburgh, NASA, DLR, CPL etc.

Plus Misc. Geology & Geoscience (& more to come)...



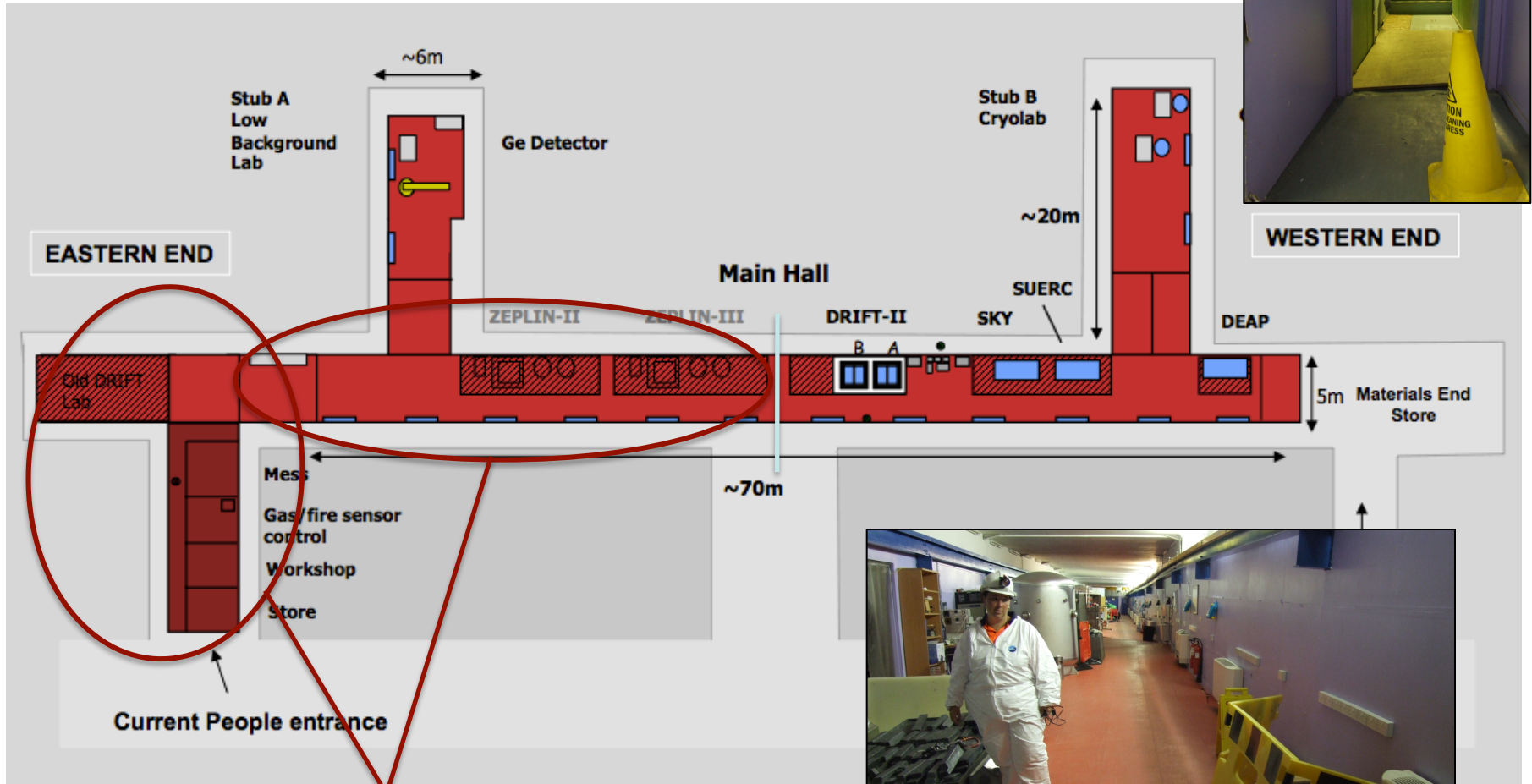
BISAL: Astrobiology / Geo-microbiology. Studies of life in salt, life on Earth & beyond

Latest news & next steps

- ❖ STFC recently confirmed Boulby facility operations funding to (at least) April 2017. To support UK & international astrophysics & low-background studies, also studies of environment, climate, geology/geophysics, life on earth and beyond.
- ❖ STFC/BIS have recently confirmed capital funding for a new underground laboratory at Boulby to support the science ongoing and planned for the next 10 years (+)... Construction underway...
- ❖ Boulby is keen to continue / increase support for UK astrophysics and low background studies...
 - We offer laboratory space, support infrastructure/equipment and (some) facility manpower support available...
 - We are developing world-class material screening facilities.. Support for LZ, SuperNEMO and more...
- ❖ Come and visit and/or work with us!



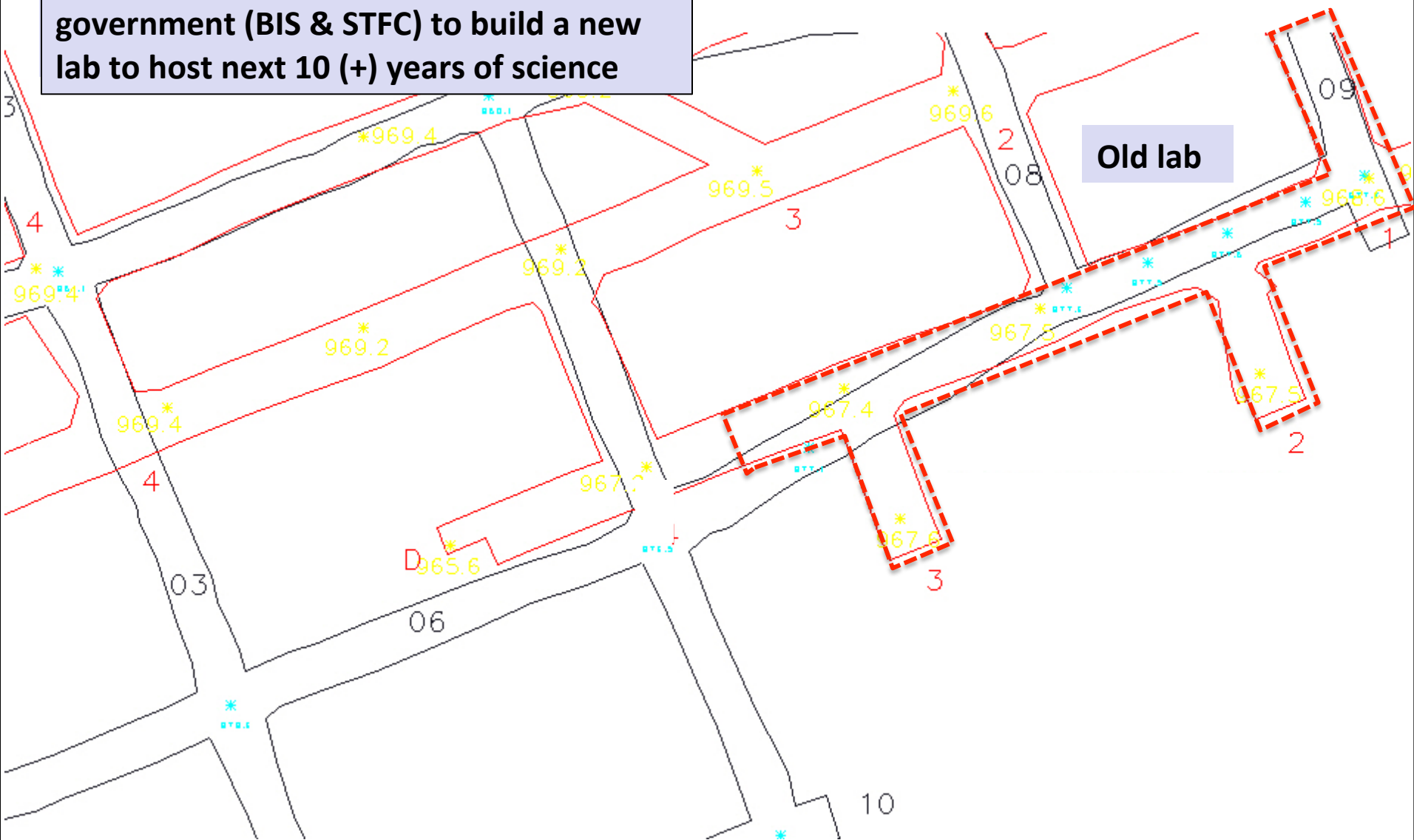
Boulby new underground lab plans



Eastern end: Degradation of lab – due to local fault line



**£1.77M - funding now offered by
government (BIS & STFC) to build a new
lab to host next 10 (+) years of science**

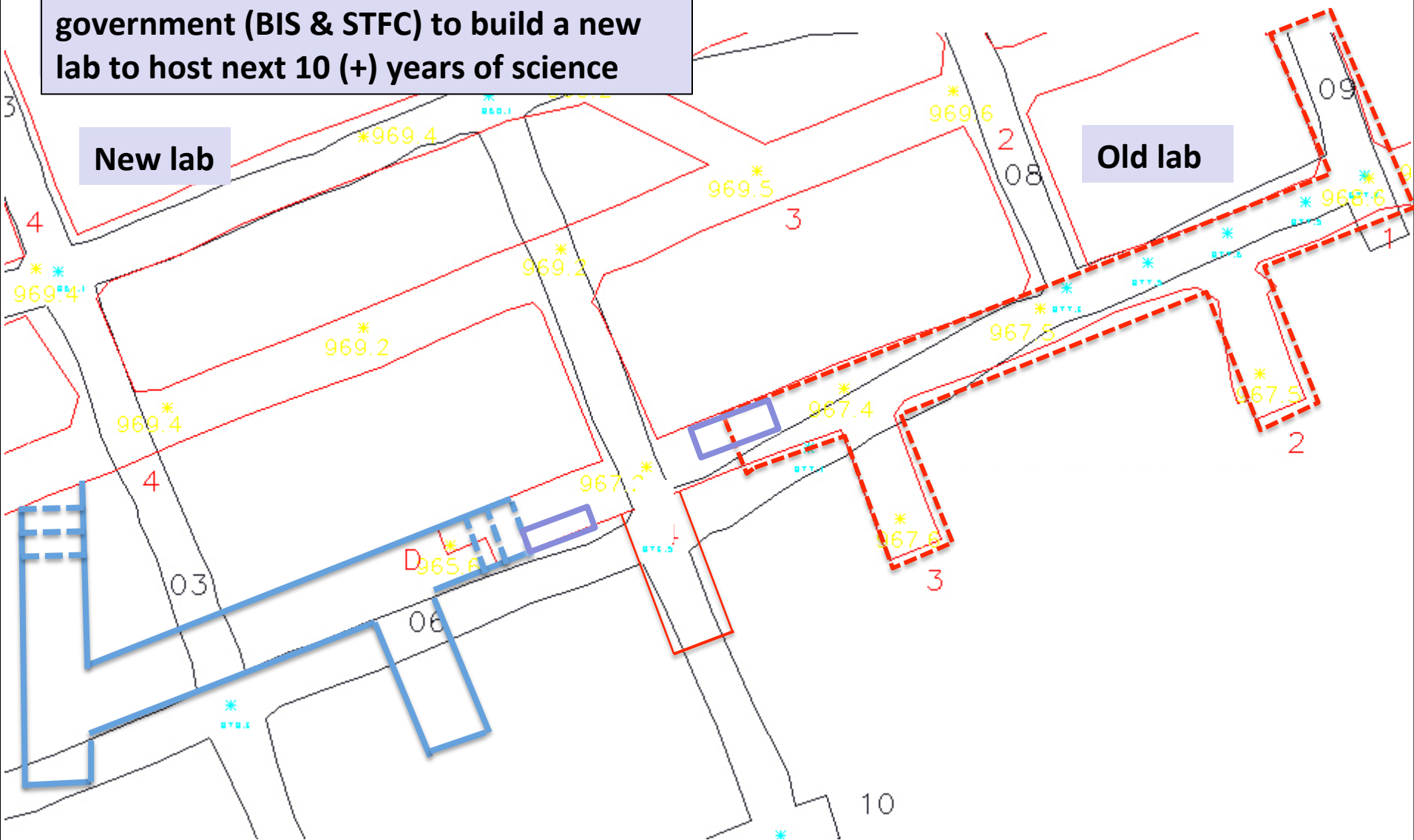


New lab design: Jan 2014

£1.77M - funding now offered by government (BIS & STFC) to build a new lab to host next 10 (+) years of science

New lab

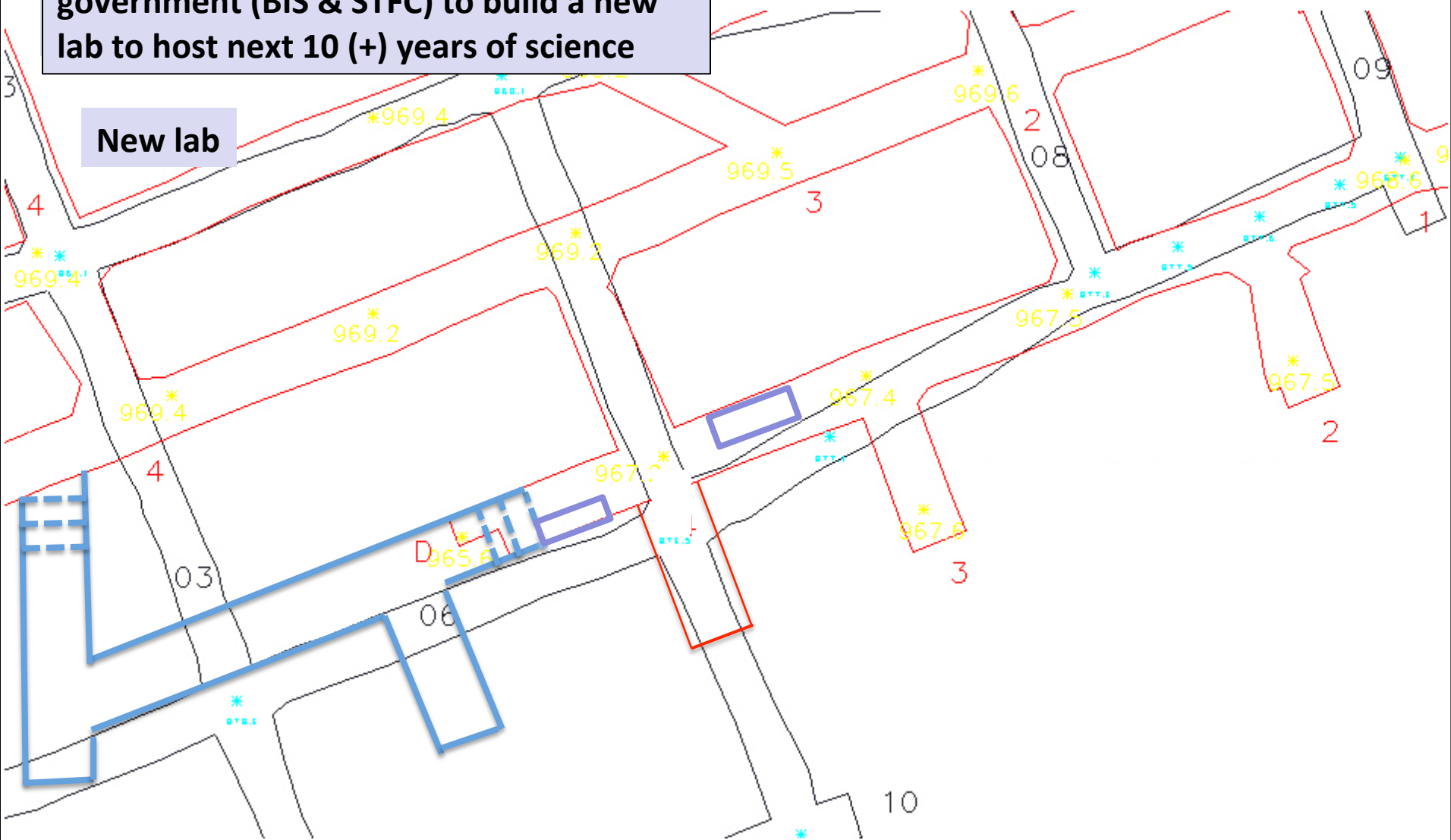
Old lab



New lab design: Jan 2014

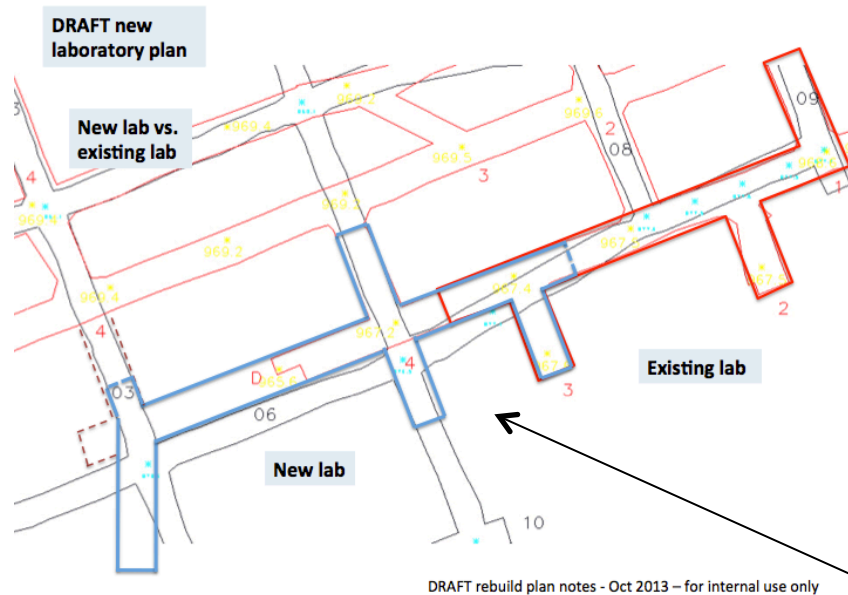
£1.77M - funding now offered by government (BIS & STFC) to build a new lab to host next 10 (+) years of science

New lab



New lab design: Jan 2014

New Lab plans....



Design criteria:

Larger internal dimensions

- Main hall: 7m (W), 4m (H)
- Large Expt Cave: 7m(W), 6-8m(H)

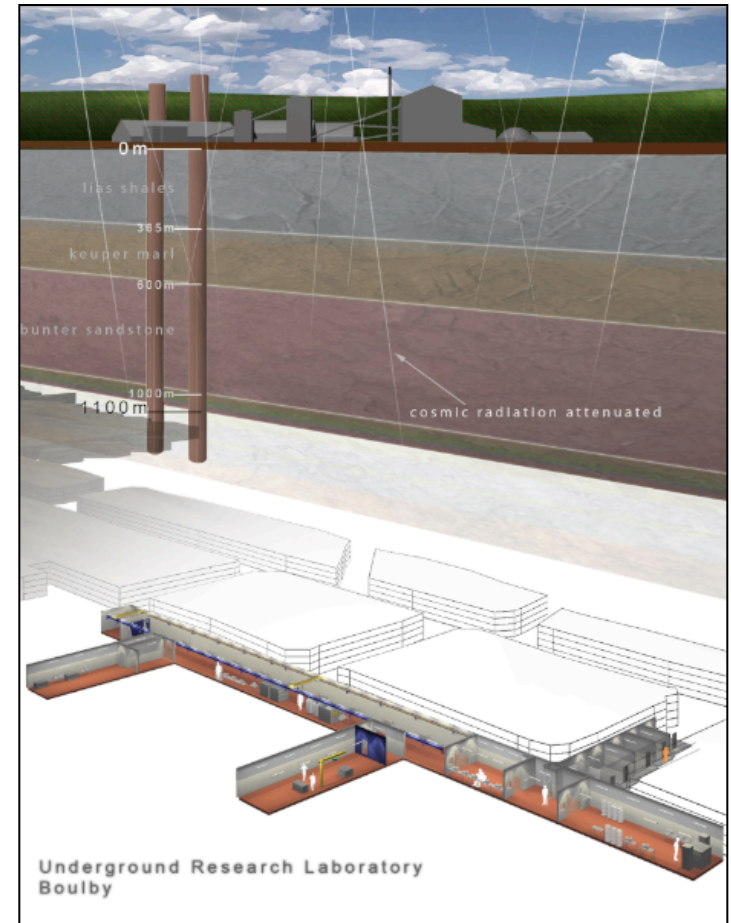
Greater overall floor space than Palmer lab (1200m²)

2-10T Lifting capacity

Solid floor throughout

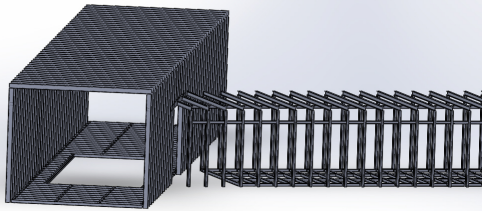
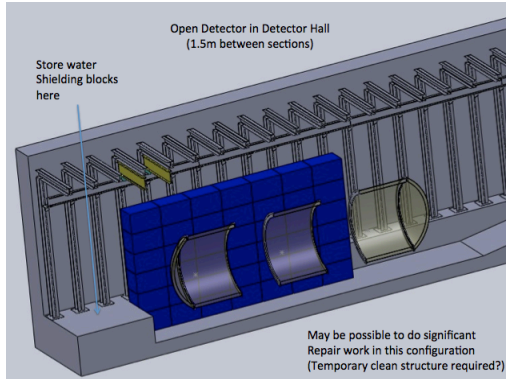
Movement tolerant for 10+ years

Timescales: Project end July 2015

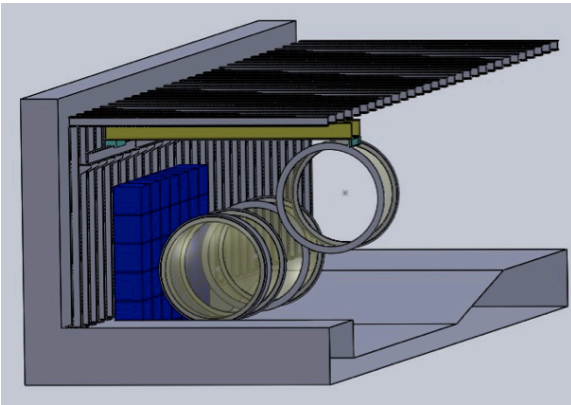


DRAFT rebuild plan notes - Oct 2013 - for internal use only

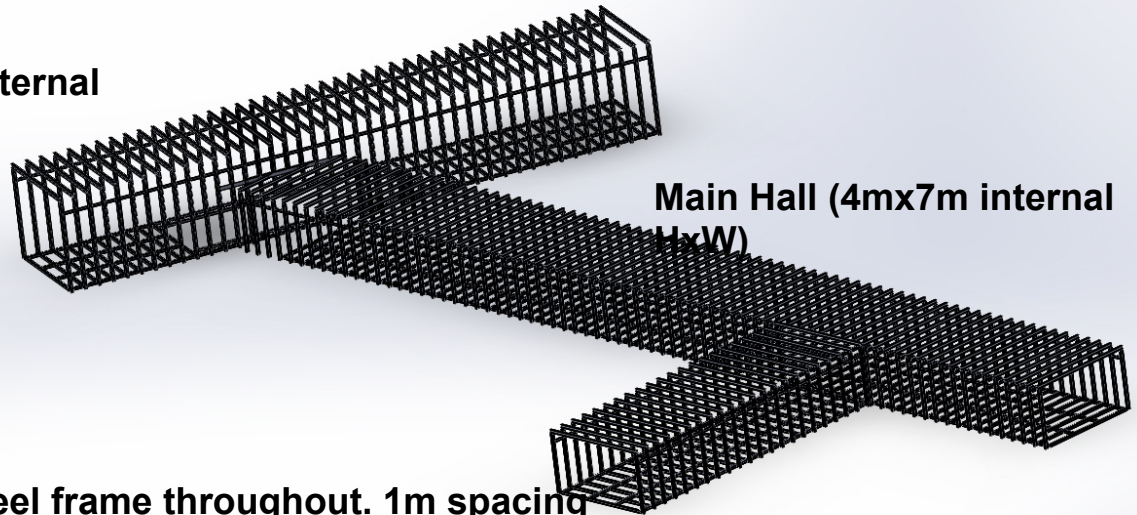
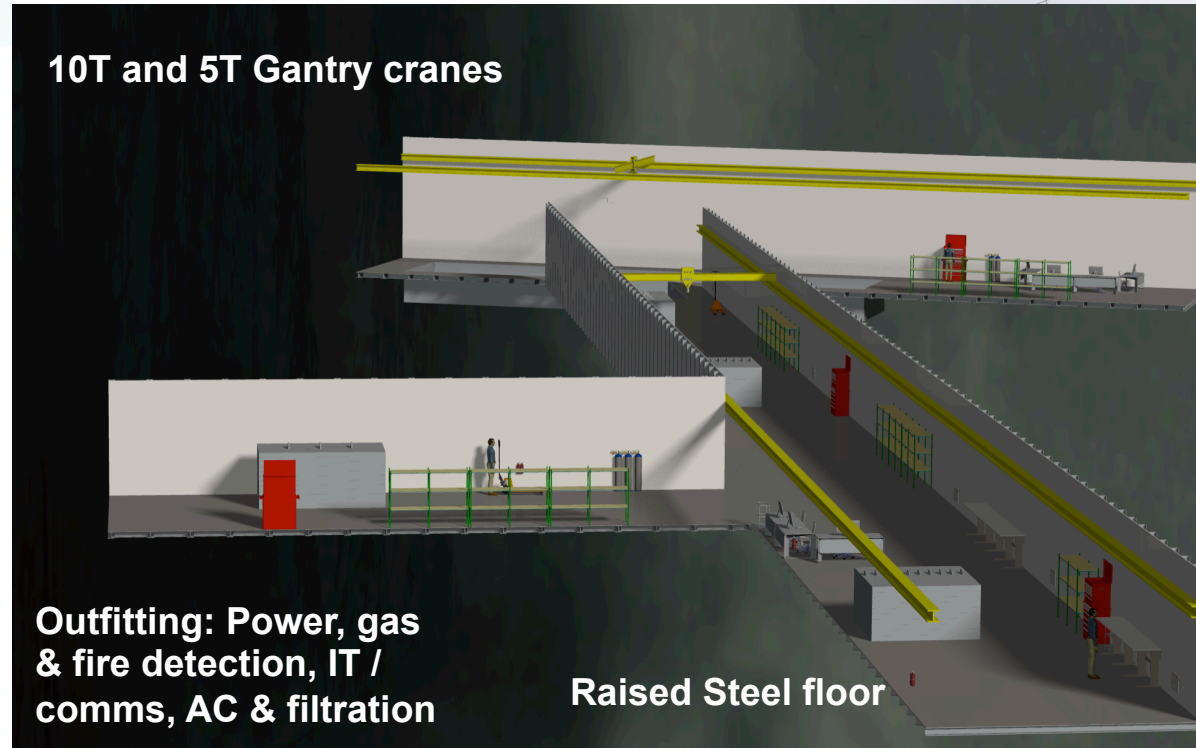
New Laboratory Details



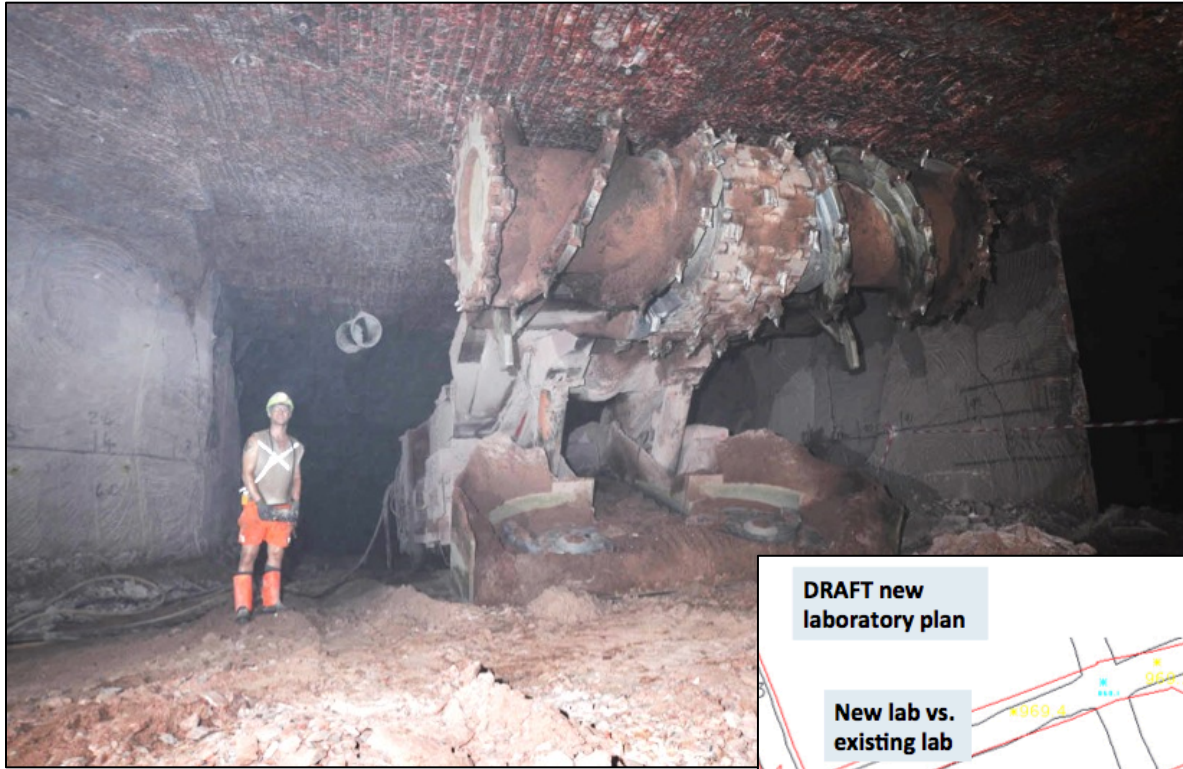
**Large Experimental Cavern (6mx7m Internal
HxW)**



10T and 5T Gantry cranes

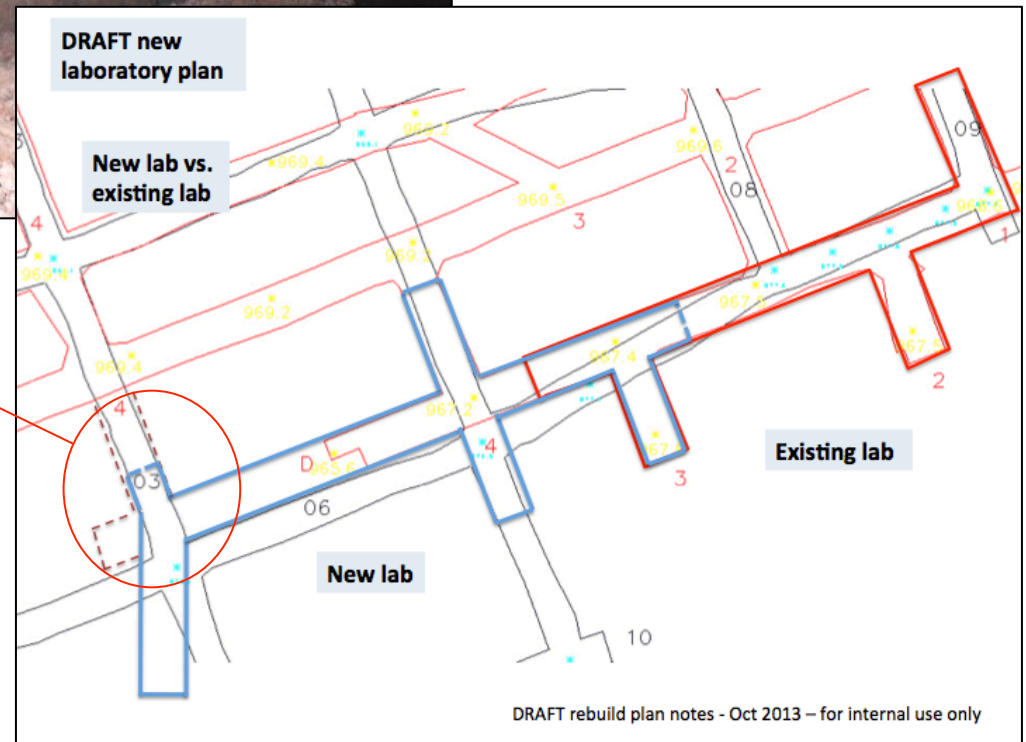


Steel frame throughout. 1m spacing



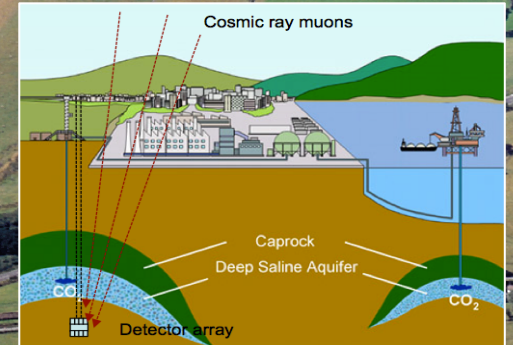
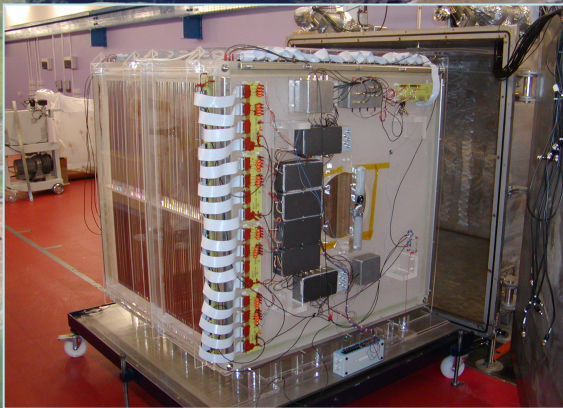
40m of tunnel dug so far...

Construction Status: June 2014



Sean Paling STFC Boulby Underground Science Facility

**DRIFT- Directional
Dark Matter Search**



**Multi-disciplinary studies: climate, the
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Boulby Underground Science Facility: Status & future plans...



Low background counting

Government funding for a new Laboratory...

- Recognising the importance of Boulby for UK science the government Dept of Business Innovation & Skills (BIS) and the Science and Technology Facilities Council (STFC) have offered (Nov 2013) money to build a new facility to host proposed Boulby science programme for coming 10 years...
- **Total of £1.77M offered** (£1.5M from BIS, £0.27M from STFC).

Aim:

- A new underground lab capable of supporting planned-for science for the next 10 years
- Fully outfitted – electrics, internet, air con, communications, water, comp air.
- Clean & dust free (HEPA filtered air).
- Resistant to rock movement for 10 years...

BIS

Department for
Business Innovation
& Skills

