The DEAP-3600 Dark Matter Detector

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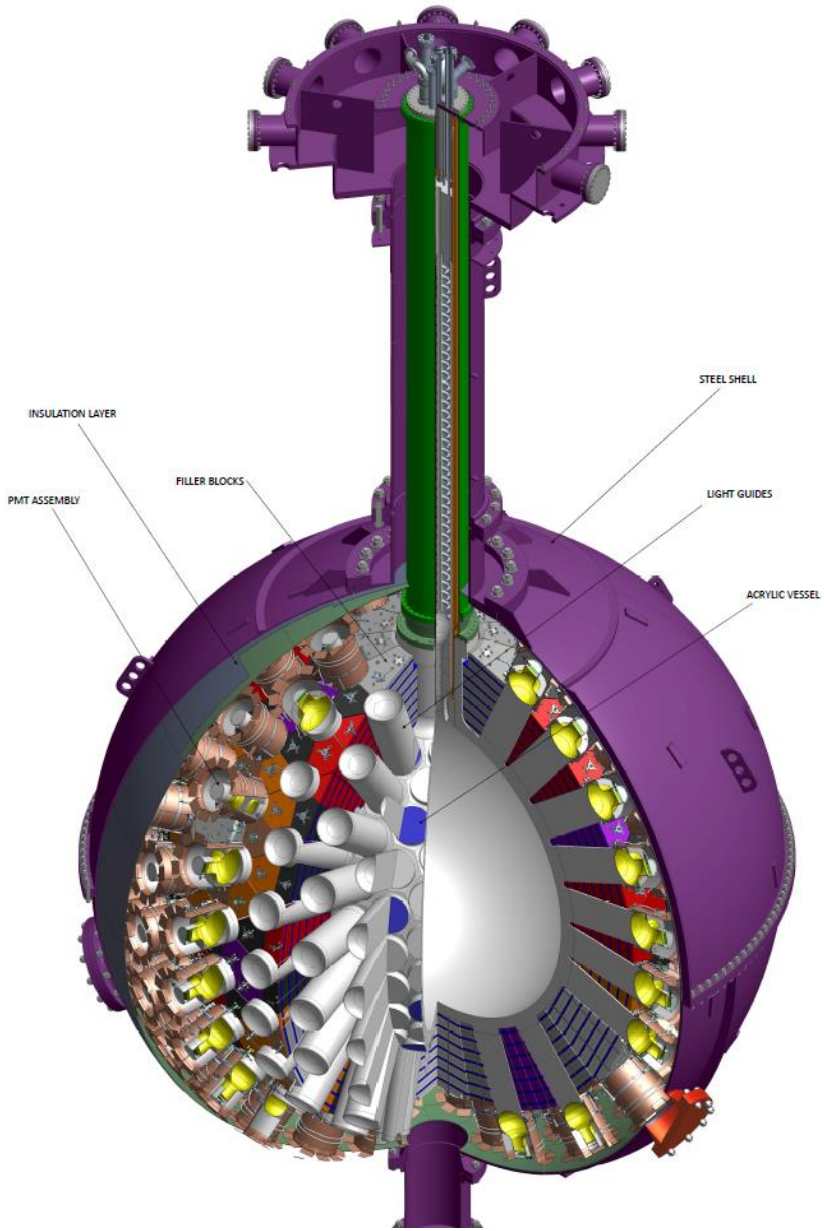
CAP MEETING, JUNE 2014



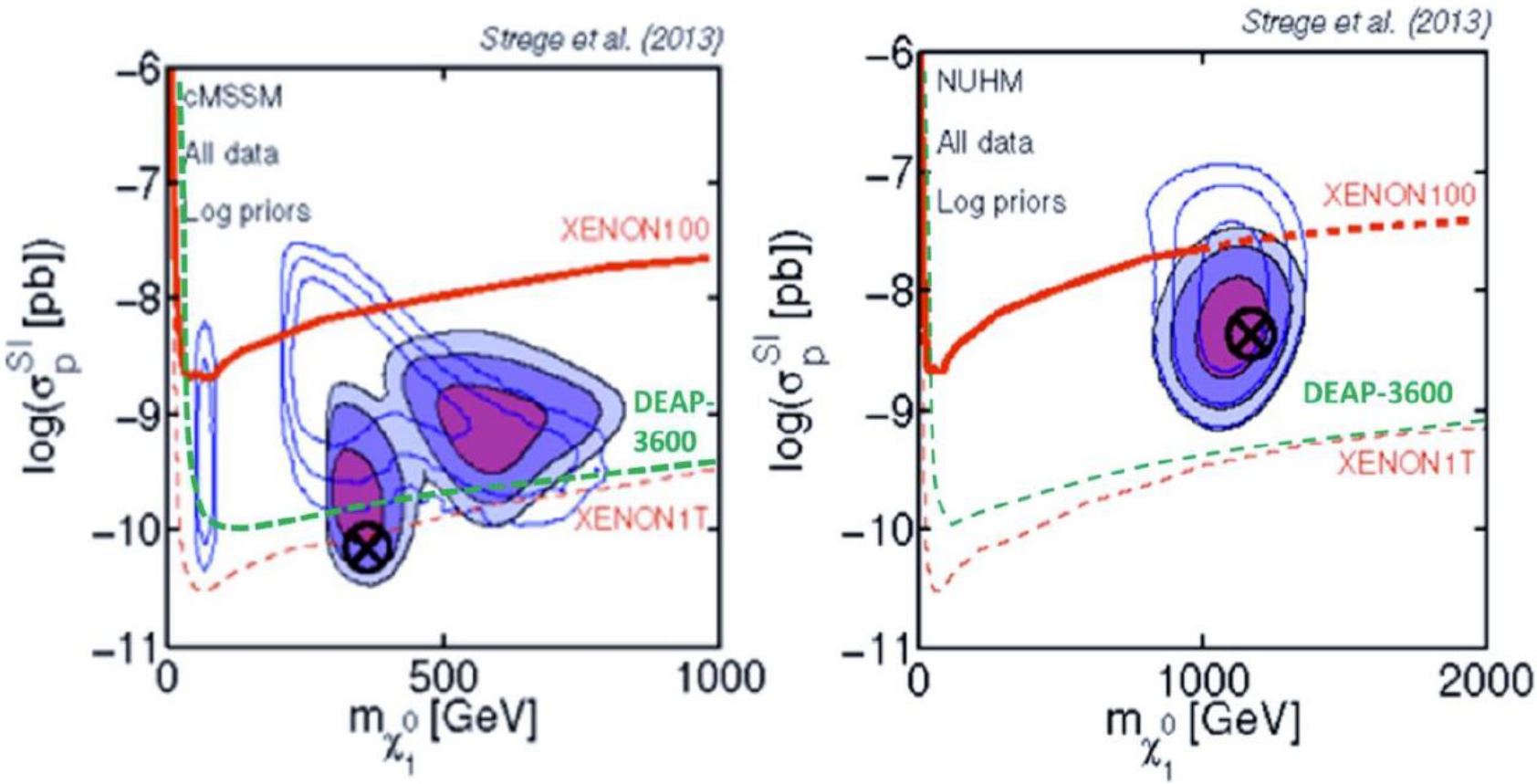
Design is based on the ability to control background radioactivity with:

- Underground location
- Ultrapure materials and resurfaced acrylic
- Shielding: lightguides are part of the neutron shield
- PMTs (~room temperature)
- Pulse shape discrimination

Detection Process:

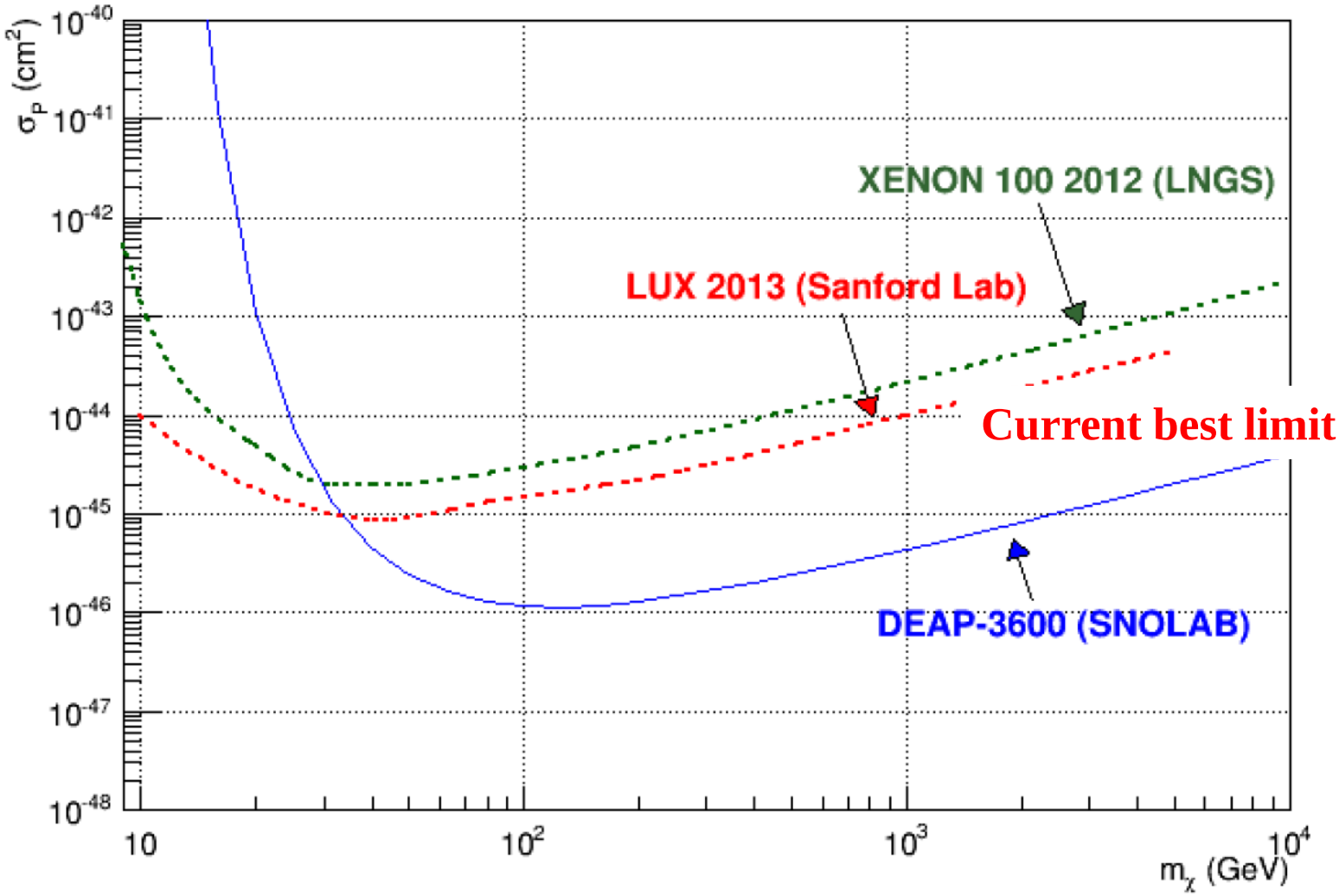
1. WIMP elastic scattering
2. Argon ionization
3. Argon Dimers (7 ns singlets, 1600 ns triplets)
4. UV scintillation from Argon (128 nm)
5. TPB wavelength shifter (400 nm)
6. Visible photons detected in PMTs

Physics Sensitivity



Sensitivity to parameters of simple SUSY models (cMSSM and NUHM)

DEAP-3600 Projected Physics Sensitivity



DEAP-3600 Background Budget (3 year run)

Background	Raw No. Events in Energy ROI	Fiducial No. Events in Energy ROI	
Neutrons	30	<0.2	Acr+H_2O shield
Surface α's	150	<0.2	Resurfacer
^{39}Ar β's (natural argon)	1.6×10^9	<0.2	PSD
^{39}Ar β's (depleted argon)	8.0×10^7	<0.01	

Need to resurface inner vessel and ensure purity of acrylic.

- removal of 1 mm acrylic
- ^{210}Pb < 1.1×10^{-19} g/g for 0.1 events/3 years (strict control of Rn exposure)

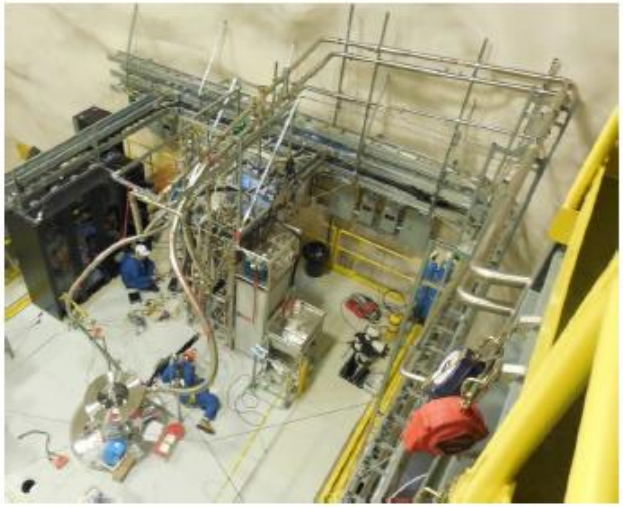
AV Fabrication (RPT Colorado and U of A)

Bonded underground, finish machined and then light guides attached:

See poster
Thomas McElroy

Status of DEAP-3600 Installation at SNOLAB

Completed inner detector



Cryosystem, electronics

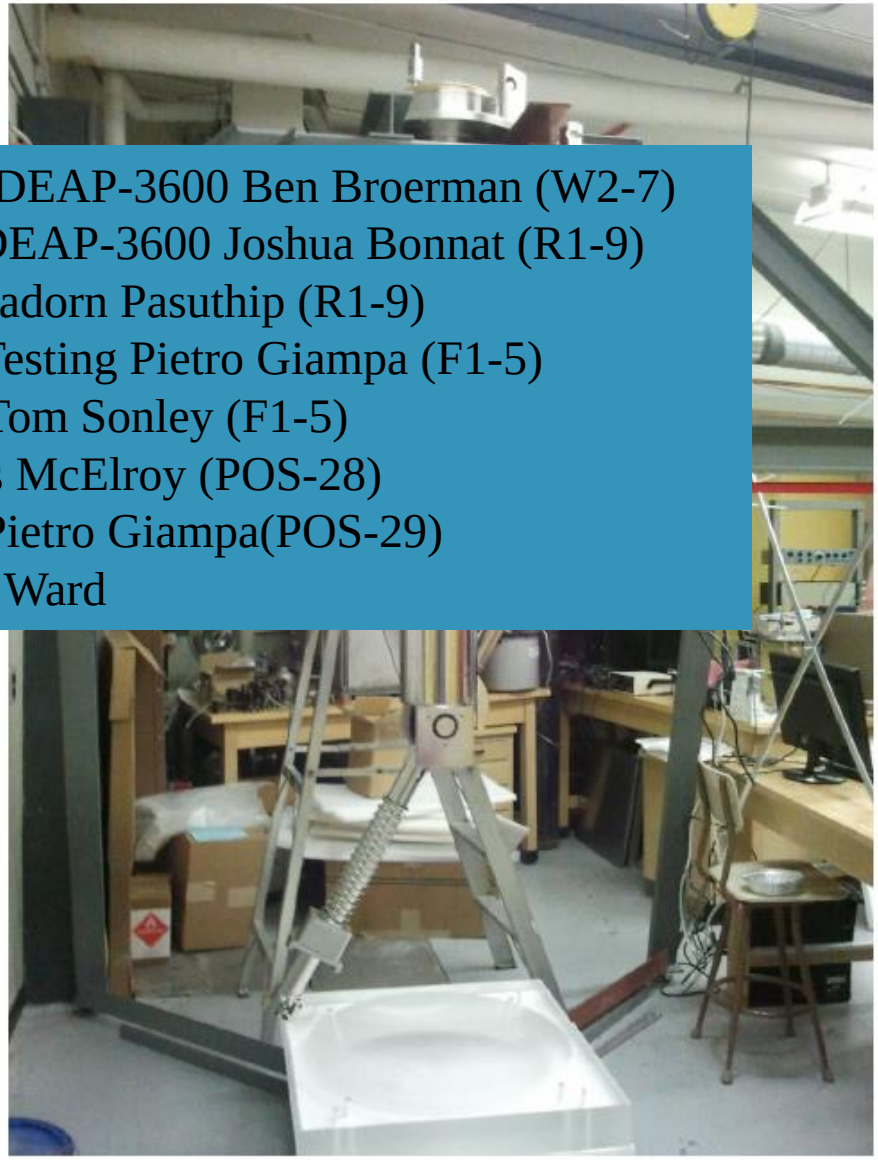
Detector ready for Critical Lift 1

Steel Shell in shield tank

Neck cooling coil on deck

Acrylic Vessel Resurfacer

- Low-Radon emanation components



Organic Thin Film Deposition System for DEAP-3600 Ben Broerman (W2-7)
Surface Alpha Background Mitigation in DEAP-3600 Joshua Bonnat (R1-9)
Characterization of DEAP-3600 PMTs Paradorn Pasuthip (R1-9)
DEAP-3600 Resurfacer Deployment and Testing Pietro Giampa (F1-5)
Cryogenic Liquid Safety for DEAP-3600 Tom Sonley (F1-5)
DEAP-3600 Light Guide Bonding Thomas McElroy (POS-28)
DEAP-3600 Optical Calibration Systems Pietro Giampa(POS-29)
DEAP-3600 Argon Process Systems Mark Ward

Project Timeline

Milestone	Date
Installation of Detector under Neck	June 23, 2014
Start of Resurfacing	July 2014
Calibrations and commissioning (warm)	Aug 2014
Start of Physics Data Collection	Oct-Nov, 2014

DEAP Collaboration

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