**SPACEWALKS FOR AMS**

**A-ROLL FINAL**

**SUGGESTED WEB CUE:**

ESA astronaut Luca Parmitano will soon be taking part in several challenging spacewalks to repair the International Space Station’s largest scientific instrument.

The Alpha Magnetic Spectrometer (AMS) is a sub-atomic particle detector that looks for dark matter, antimatter and measures cosmic rays - high energy particles that travel through space at close to the speed of light.

The AMS took 16 countries nearly 20 years to develop. It was assembled at CERN, tested at ESA’s ESTEC facility in The Netherlands and installed on the Space Station in 2011. Since then it has collected over 145 billion cosmic ray events across a range of energy levels and has already provided the first insights into potential antimatter and dark matter.

The repair of the AMS’ cooling system will ensure that it can continue to provide more data and more groundbreaking science. This film contains soundbites from the instrument’s Principal Investigator, Nobel Prize winning physicist Professor Samuel Ting (MIT/CERN).

**A-ROLL STARTS: 10:00:00**

**VT STARTS: 10:00:10**

**10:00:10**

[ANIMATION; CREDIT: ESO/M. KORNMESSER/L.CALÇADA]

Our Universe is a giant cosmic puzzle - because most of it appears to be missing.

The matter that forms the stars in our galaxy and the planets in our Solar System only accounts for around five percent of the Universe. To discover the elusive particles that make up this missing dark matter, scientists have been using an instrument called the AMS…

**10:00:34**

[STILLS ISS]

… attached to the outside of the International Space Station.

**10:00:39**

[Professor Samuel TING

AMS Principal Investigator, CERN/MIT]

*“The detector is a magnetic spectrometer. It’s a very precise magnetic spectrometer normally used in accelerators like CERN and this is the first time anyone has ever put a very precise long duration magnetic spectrometer in space.”*

**10:01:09**

[AMS IN CERN CLEAN ROOM; CREDIT CERN]

The Alpha Magnetic Spectrometer, or AMS, is a particle detector that took 16 countries nearly 20 years to develop. Assembled at CERN, tested at ESA’s ESTEC facility, its Principal Investigator is a Nobel prize winning physicist.

The AMS looks for dark matter, antimatter and measures…

**10:01:30**

[ANIMATION; CREDIT: ESO/M. KORNMESSER/L.CALÇADA]

…cosmic rays - high energy particles that travel through space at close to the speed of light.

**10:01:3**7

[INSET CLIP: Professor Samuel TING, AMS Principal Investigator, CERN/MIT ]

*“Inside AMS are seven layers of different detectors to identify all the cosmic particles, such electrons, positrons, protons, antiprotons and elements across the periodic table.”*

**10:01:54**

[ISS AND AMS GVS AND STILLS, 2011]

The AMS has been searching for the unknown since it was installed on the Space Station in 2011 - the first instrument of its kind to work in space. Since then it has collected over 145 billion cosmic ray events that range from low to extremely high energy levels.

**10:02:14**

[MOONBASE ANIMATION; CREDIT: ESA]

Some of this cosmic radiation is dangerous to human health so we need to improve our knowledge in order to eventually live on the Moon and Mars.

**10:02:25**

[CERN PAYLOAD OPERATIONS CONTROL CENTRE GVS; CREDIT: CERN]

Data from the AMS is sent via NASA for analysis at CERN’s Payload Operations Control Centre.

Excitingly, the results are contradicting existing theoretical models of subatomic physics and according to professor Ting, are beginning to revolutionise…

**10:02:42**

[ANIMATION; CREDIT: ESO/M. KORNMESSER/L.CALÇADA]

… our understanding of cosmic rays.

[PARMITANO TRAINING GVS AND BEYOND MISSION ANIMATION; CREDIT: ESA]

But the AMS cooling system was originally designed for three years and so ESA’s Luca Parmitano will perform several challenging spacewalks to replace it. He arrived on the Space Station as part of the Beyond Mission in July and knows that scientists on Earth are depending on him.

**10:03:05**

[INSET CLIP: PROFESSOR SAMUEL TING]

*“What is important is the person is very calm and knows the instrumentation and is very careful because often one mistake is your last mistake and so I think we’re really very happy that Luca is there.”*

10:02:26

[ISS SPACEWALK GVS]

The repair of the Space Station’s largest instrument will ensure that the AMS can continue to provide more data and more groundbreaking science. It has already provided the most precise measurements yet of high energy cosmic rays and the first insights into potential antimatter and dark matter. Scientists now want to make sure…

**10:03:50**

[ANIMATION; CREDIT: ESO/M. KORNMESSER/L.CALÇADA]

 …that what was observed resulted from collisions of the elusive and enigmatic dark matter.

**10:03:57**

[ESA STING]

10:04:01

[ENDS]

**BROLL**

**10:03:57**

**Professor Samuel TING**

**AMS Principal Investigator, CERN/MIT**

**[ENGLISH]**

*“None of our results agree with current theoretical models and so we want to understand what is the true nature of cosmic rays and for this we need to take more data for more elements and to higher precision. We also begin to see indication of antimatter and traces of dark matter. We want to make sure what we observed indeed come from dark matter collisions.”*

*“This is the only precision magnetic detector which can distinguish all the cosmic rays. It took us 20 years from 16 countries to build it and it was difficult to build, to calibrate it at CERN, to assemble it at CERN. CERN made a major contribution to this, so has NASA, so has ESA. I think in the future, the next immediate future I don’t see any plans to such a device in space and therefore we need to make sure to use every possibility to understand cosmic rays. It’s just like you walk into a dark room and you turn on the lights, you see many, many different things.”*

**10:05:39**

**AMS in Clean Room at CERN**

**Credit: CERN**

**10:11:22**

**Moonbase Animation**

**Credit: ESA**

**10:11:54**

**Ams Payload Operations Control Centre,**

**CERN**

**Credit: CERN**

**10:15:57**

**ESA Astronaut Luca Parmitano**

**Training for Beyond Mission**

**EAC, Cologne, Germany, January 2019**

Training shots of European Space Agency astronaut Luca Parmitano at the European Astronaut Centre (EAC), Germany.

**10:16:47**

**ESA Astronaut Luca Parmitano**

**Training for Beyond Mission**

**Johnson Space Center, Houston, Usa,**

**February 2019**

Training shots of European Space Agency astronaut Luca Parmitano at NASA’s Johnson Space Centre, USA.

**10:18:06**

**EVAs On International Space Station**

Generic EVA (extra vehicular activity) or spacewalk shots during repairs of the International Space Station.

**10:19:03**

**AMS on International Space Station**

**10:19:38**

**Professor Samuel Ting in Clean Room with AMS**

**10:20:00 (END)**

**10:20:05(GEN END)**