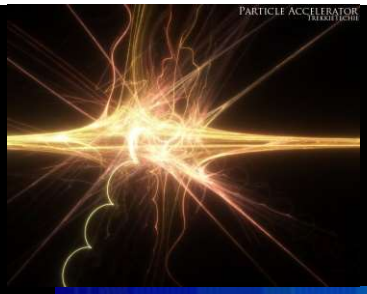


RD_FCC Collaboration Meeting

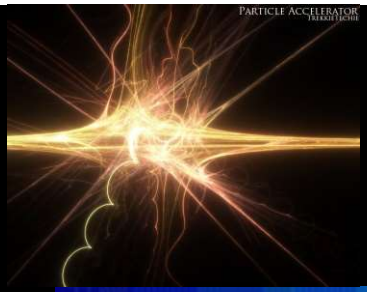
Franco Bedeschi

RD_FCC Coll. Meet.

16 Feb. 2021

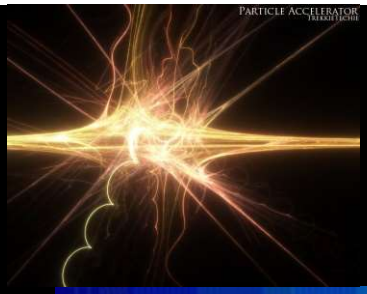
Sommario

- Stato generale
- Budget
- Spunti per discussione di domani
- Agenda



Stato generale (1)

- ESU approvata dal CERN council
  - «**An electron-positron Higgs factory is the highest-priority next collider**……. a feasibility study of the colliders and related infrastructure should be …. completed on the timescale of the next Strategy update.»



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- Implicazioni su tempistica:

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  - «**An electron-positron Higgs factory is the highest-priority next collider**……. a feasibility study of the colliders and related infrastructure should be …. completed on the timescale of the next Strategy update.»

- Implicazioni su tempistica:
  - LoI esperimenti per nuova EU strategy 2025/26
    - Completati R&D
  - FCCee detector TDR 2028
    - Disegni dettagliati dei rivelatori

Stato generale (1)

FCC project milestones for the next 20 years

- **Infrastructure and Machine** — **Physics, Experiments, Detectors**

(exact dates to be discussed in the coming months)

Milestone / activity	Target date	Possible timeline
First e^+e^- collisions in FCC-ee	2040	FCC-ee detector commissioning
Start machine installation	2037	Start FCC-ee detector installation
Tunnel completion	2035/36	
Start tunnel construction	2030	Start FCC-ee detector construction
Project approval	2028	FCC-ee Detector TDR's and approvals
Next ESPPU	2026/27	
Key prototypes (feasibility proof)	2025/26	FCC-ee Proto-collaborations and LoI's
CDR++/TDR (feasibility proof)	End 2025	CDR++ (Common work) Physics, Software, Technologies, R&D

Patrick Janot — FCC Physics and Experiments General meeting, 28 Sep 2020 — 6

Stato generale (2)

- FCCee al CERN ancora in stato di transizione
  - Sigla non ancora formalizzata
    - Transizione management ha rallentato le cose
  - Sforzo per definire struttura organizzativa in corso

Stato generale (2)

- FCCee al CERN ancora in stato di transizione

Adapted Physics Performance Chart

- Adapted chart

P & E Study Coordination

Detector Concepts
tbd, tbd

Detector Requirement (DR) Committee

Physics Performance
Patrizia Azzi
Emmanuel Perez

Physics Benchmark (PB) Committee

Physics Programme
tbd, tbd

Det. Area 1
Det. Area 2
Det. Area 3
Det. Area 4
. . .

CS_1 | CS_2 | CS_3 | .. Case Studies .. | CS_{N-1} | CS_N

- Make the link between physics measurements and detector requirements
- Initiate and coordinate the corresponding case study teams
  - ✓ Already one team at work (H→bb,cc,gg measurement)
- Maintain and complete the list of case studies with PB committee
- Have Snowmass LoI's prepared (deadline: August 2020)
  - ✓ Can be groups of abstracts rela… e; WW threshold; HZ running; top-pair threshold
  - ✓ Can also be extended abstracts
- Organize November Physics Workshop session

Done

Physics Programme WG1
Physics Programme WG2
Physics Programme WG3
Physics Programme WG4
…

Physics Tools, Analysis Code, Detector Requirements, Public Documentation

Same mandate
Same objectives
Same outcome

Patrick Janot — PED Steering Group Meeting 26 Jan 2021 — 3

Stato generale (2)

- FCCee al CERN ancora in stato di transizione
  - Sigla non ancora formalizzata
    - Transizione management ha rallentato le cose
  - Sforzo per definire struttura organizzativa in corso
    - Case studies → advanced (see Patrizia talk)
    - Physics Program → completing – deciding conveners (P.Azzurri proposed)
    - Detector concept → discussion in progress

Physics groups

- **Current/Previous organization (not all conveners are active)**

Physics and Experiment Studies coordination
A. Blondel, P. Janot (EXP), C. Grojean, M. McCullough, M. Mangano, J. Ellis (TH)

EW Physics with Z's and W's	Higgs properties	Top quark physics	ee → H
J. Alcaraz, P. Azzurri, E. Locci, A. Freitas	M. Klute, K. Peters, C. Grojean	P. Azzi, F. Blekman	D. d'Enterria

QCD and γγ physics	Flavours physics	New physics	Global Analysis Synergies	Precision Calculations
D. d'Enterria, P. Skands	S. Monteil, J. Kamenik	M. Pierini, C. Rogan, M. McCullough, S. Heinemeyer	J. De Blas	J. Gluza, A. Freitas

1. **EW physics,** covering:
   - precision EW at the Z peak and WW thresholds, including W mass
   - High energy EW: Diboson, difermion
   - precision theory calculations
   - Monte-Carlo generators and fitting formulae
2. **Higgs**, including ee->H, and including precision TH calculations, MCs and fitting formulae
3. **Flavour physics**:
   - heavy quarks
   - tau lepton
4. **BSM**:
   - Bring all BSM-related topics under the same WG. In particular:
   - indirect sensitivity, including model-specific global fits
   - direct BSM searches, including Feebly interacting particles, LLPs, light DM, ...
5. **QCD** (includes the dedicated precision theory calculations, MC generators, fitting formulae..)
6. **Top** (includes the dedicated precision theory calculations, MC generators, fitting formulae..)

Azzurri proposed)

Stato generale (2)

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  - Si comincia ad avere tools utili

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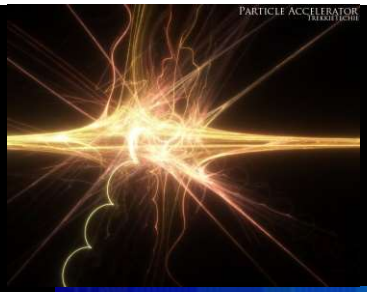
- Molto lavoro su key4HEP/Delphes
  - Si comincia ad avere tools utili
- ECFA R&D road map in preparazione



Stato generale (3)

- Impegno in Snowmass 2021- DELAYED!

Stato generale (3)

❖ Impegno in Snowmass 2021- DELAYED!

Announcement of the Snowmass Delay Guidelines

January 2021

Dear members of the Snowmass community,

Because of the COVID-19 pandemic, the Snowmass Report and the Community Summer Study meeting (CSS) will be delayed by one year until 2022. The overall schedule for the Snowmass process will be adjusted accordingly. After extensive consultation with our community and the frontier conveners/advisors, the Snowmass Steering Group recommends the following general guidelines for the implementation of the Snowmass delay:

- High-level activities will be on hold until the end of June, 2021.
  These activities include Frontier-level and Topical Group-level workshops,
  All-conveners meetings, Advisory Group meetings and Newsletters.
- Other Topical Group and cross-frontier activities should be either paused or reduced to a significantly lower level, proceeding only as necessary to ensure scientific continuity, meet essential programmatic needs, or maintain collaborative work with other units and communities.
  - No critical decisions will be made during the hiatus.
  - No individuals should feel obligated to participate in these activities.
- Individual, collaborative and self-organized work can continue at the discretion of the individuals involved.

All paused individual or group activities will continue to receive full consideration once the Snowmass process formally resumes.

Stato generale (3)

❖ Impegno in Snowmass 2021- DELAYED!

Announcement of the Snowmass Delay Guidelines

January 2021

With respect to the timelines:

- White Paper submission to arXiv: no later than March 15, 2022.
  Late submissions and updates are likely not to be incorporated in the working group reports, but will be included in the Snowmass on-line archive documents.
- Preliminary reports by the Topical Groups due: no later than May 31, 2022.
- Preliminary reports by the Frontiers due: no later than June 30, 2022.
- Snowmass Community Summer Study (CSS): July, 2022 at UW-Seattle.
- All final reports by TGs and Frontiers due: no later than September 30, 2022.
- Snowmass Book and the on-line archive documents due: October 31, 2022.

Additional remarks on the plans of the individual frontiers can be found in the Snowmass Newsletter of January 2021 on the Snowmass wiki page. The Snowmass Steering Group will continue to monitor the process.

We thank you for participating in the Snowmass activities!

Tao Han
Chair, APS DPF
On behalf of the Snowmass Steering Group (snowmass-steering@listserv.fnal.gov):
Joel Butler (DPF), Sekhar Chivukula (DPF), Priscilla Cushman (DPF), Glennys Farrar (DAP), Young-Kee Kim (DPF), Yury Kolomensky (DNP), Sergei Nagaitsev (DPB), Nicolas Yunes (DGRAV)

Stato generale (3)

- Impegno in Snowmass 2021- DELAYED!
  - Molte LoI sottomesse in connessione con FCCee
    - Lista completa in https://indico.cern.ch/event/951830/
  - Per IDEA e attivita' R&D INFN:
    - IDEA general
    - Micro-Rwell
    - Drift chamber
    - Dual Readout
    - Infrastructure software Key4HEP

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    - Dual Readout
    - Infrastructure software Key4HEP
- Impegno per CEPC
  - Aggiornati documenti per IDRC su R&D che coinvolgono INFN
    - Si tracking, Drift chamber, DR calorimeter, muon detector

Budget 2021

INFN CSN1

Year	Acronym	People	FTE	Missioni Request	Missioni Assigned	Altro Request	Altro Assigned	Total Request	Total Assigned
2021	RD_FCC	91	17.45	223.0	192.0	155.0	113.5	378.0	305.5
2021	RD_MUCOL	89	17.00	177.0	117.0	245.0	134.5	422.0	251.5
2020	**RD_FA**	**118**	**24.00**	**292.5**	**220.0**	**255.0**	**199.0**	**547.5**	**419.0**

Other:

- **FCC-IS – The Future Circular Collider Innovation Study.**
  - This INFRARED Research and Innovation Action project receives funding from the European Union's H2020 Framework Programme under grant agreement no. 951754
    - INFN partecipa con LNF – M. Boscolo responsabile scientifico
- FEST – Non chiaro cosa riusciremo ad usare nel 2021
- CREMLIN+ - v. talk F. Grancagnolo
- AidaInnova – In partenza il 1 Aprile 2021
  - Molti R&D coinvolti – Diversi preparatory meetings
- ARCADIA – Ultimo anno
- WhatNext – Divulgazione - In pieno svolgimento

New opportunities

PRIN 2021 - Submitted

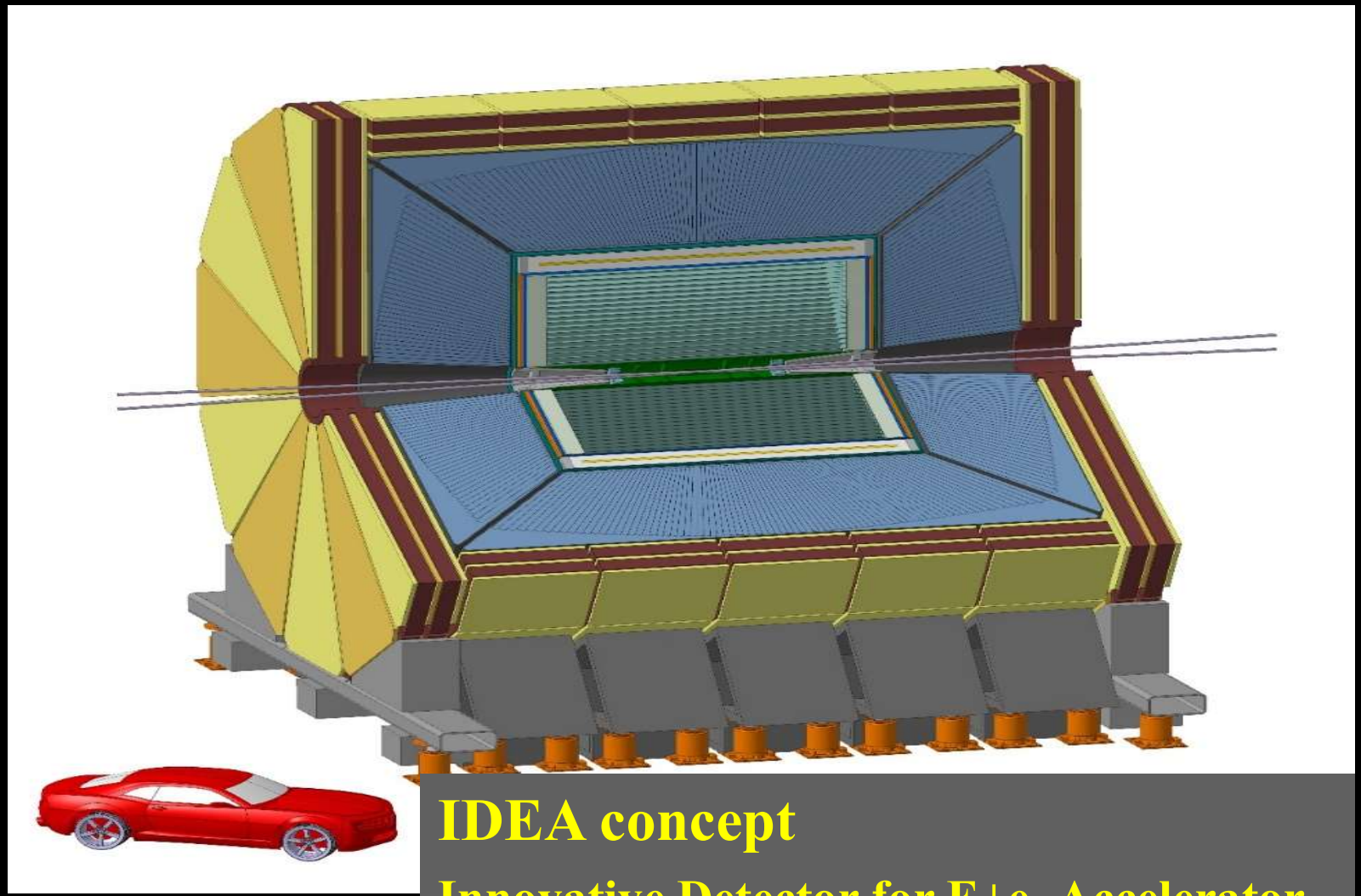
- **RAZOR:** Study of the Z-boson couplings to heavy fermions at the Future Circular electron - positron Collider:
  - trillions of Z's for extreme precision to challenge the Standard Model while looking for new physics.
- Resistive Micro-Pattern Gaseous Detectors with Integrated Electronics for Frontier Research and Technological Applications
- **MonSiPh**: Monolithic Single Photon Sensors for Biophotonics and Particle Physics

Call CSN5 - Planned

- Dual Readout hadronic prototype

Spunti per discussione

- I rivelatori di IDEA



IDEA concept

Innovative Detector for E+e- Accelerator

Spunti per discussione (1)

- Silicon trackers
  - Collaborazione impostata per CEPC, ma FCC?
  - Oltre ARCADIA?
  - Piani per Vtx e Wrapper da soli o in compagnia
    - Path to CDR+/TDR? Collaboration expansion potential?

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- Drift chamber
  - Collaborazione Italia/internazionale? Interesse in crescita …
  - R&D time scales? Path to CDR+/TDR?

Spunti per discussione (2)

- Dual readout
  - Evoluzione collaborazione? Come gestiamo i coreani/US?
  - Cristalli?
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- Muon/pre
  - Evoluzione collaborazione?
  - R&D time scales? Path to CDR+/TDR?
- Engineering
  - Niente finora! Meccanica Vtx, DCH, DR ….
  - Interazione con MDI?
  - Abbiamo manpower?

Spunti per discussione (3)

- Software
  - Full GEANT di IDEA fondamentale! Come?
    - Vogliono mettere CLD come baseline solo perche' ha una simulazione che funziona ….dobbiamo metterci tutto lo sforzo che possiamo
  - Delphes in ottimo stato. Dobbiamo cominciare ad usarlo per la fisica come gia' fanno in molti. Piani?

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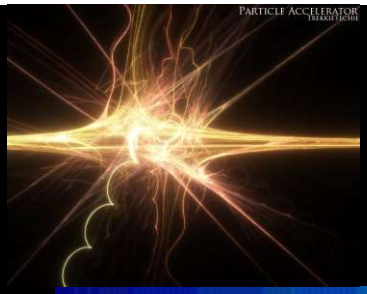
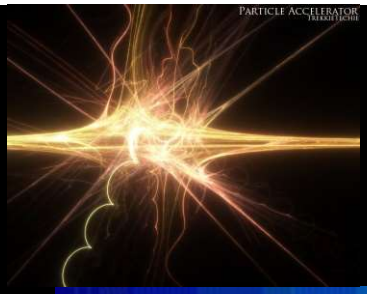
- Physics
  - Va organizzato lavoro e dobbiamo cominciare ad essere presenti ai meeting di fisica a FCC.
  - Come ci muoviamo? Tesi? Chi guida?
  - Info minimali per iniziare?
    - MC files? Basic Delphes instructions? Tutorials?



Agenda

- Oggi:
  - Overview del lavoro su hardware
  - Tommaso: tecniche ML per detector optimization
- Domani mattina:
  - Overview del lavoro su software e fisica
- Domani pomeriggio:
  - Discussione hardware
  - Discussione software/fisica



Informazioni aggiuntive

Anagrafica FCC

- 2020:
  - FCC: 73/13.93
- 2021:
  - FCC: 91/17.45
  - 3 sezioni hanno sigla

Sezione	FTE FCC	FTE altro	FTE tot	R/T FCC	R/T altro	R/T total
BA.DTZ	1.35	0.35	1.70	9		9
BO	2.25	0.1	2.35	11		11
CT.DTZ	0.40	0.00	0.40	2		2
FE.DTZ	0.25	0.45	0.70	1	6	7
FI.DTZ	0.1	0.15	0.25	2	1	3
LE.DTZ	0.95	0.25	1.20	6	1	7
LNF	2.4	0.9	3.30	12		12
MI	2	0	2.00	4		4
PD.DTZ	0.45	0.05	0.50	3		3
PI.DTZ	1.15	0.05	1.20	13		13
PV.DTZ	1.7	0	1.70	9		9
RM1.DTZ	0.1	0	0.10	1		1
RM3.DTZ	0.5	0	0.50	4		4
TO.DTZ	0.4	0	0.40	4		4
TS.DTZ	0.2	0	0.20	2		2
Totali	**14.20**	**2.30**	**16.50**	**83**	**8**	**91**

+0.95 17.45

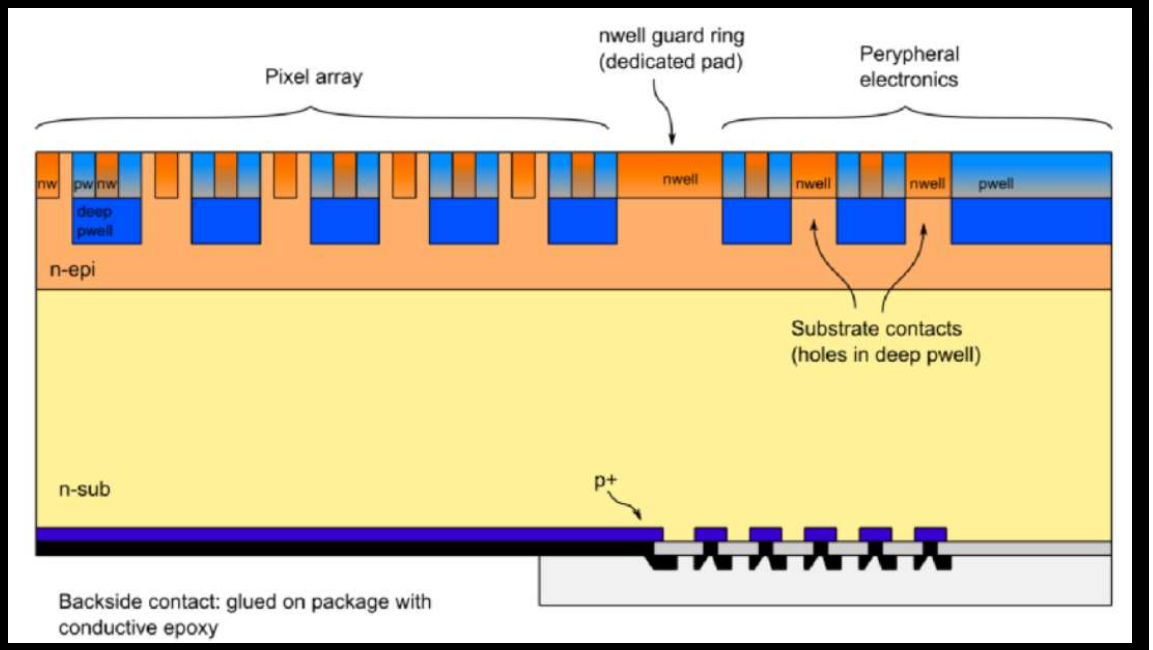
ARCADIA

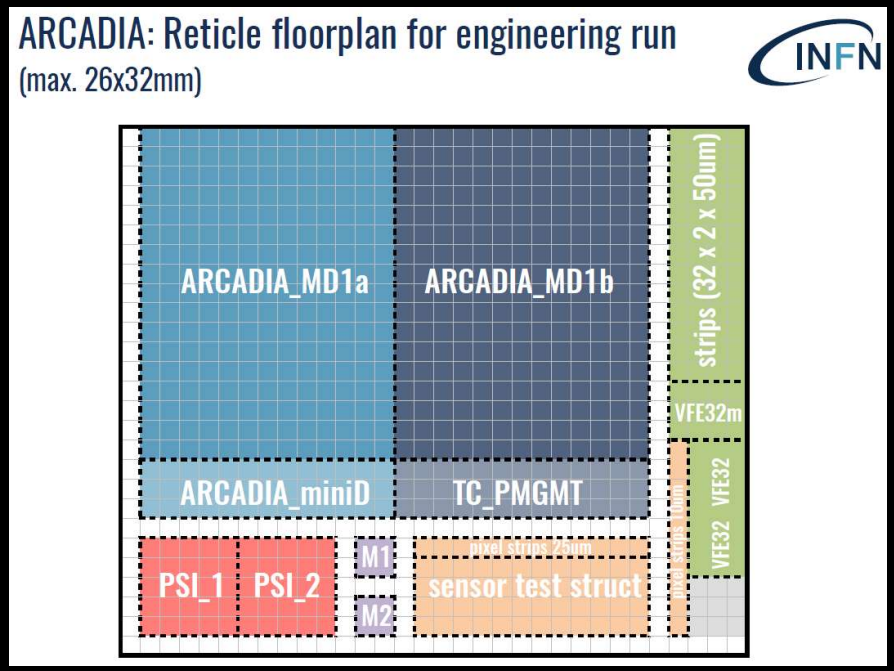
Fondi esterni (2)

- Programmi in fase di approvazione
  - AIDAinnova (EU)
    - WP 5 – Pixel MAPS – tasks: 5.2.1/ 5.2.2
      - ARCADIA/Belle2
    - WP 7 – Gas Detectors – tasks: 7.3.2/ 7.4.1
      - μRwell chambers/drift chamber readout
    - WP 8 – Calorimetria – tasks: 8.4.2
      - Dual readout calorimeter
    - WP 10 – Cooling per VTX – tasks: 10.2
      - Cooling substrates/microcooling
    - WP 11 – Microelettronica – tasks: 11.3
      - ASICS per μRwell
    - WP 12 – Software – tasks: 12.2.1 /12.4.2/ 12.5.2
      - Key4HEP/MPGD simulation/Particle flow for Dual readout cal.

Silicio

- Due percorsi (TO/MI) – qualche overlap:
  - Pixel detector a DMAPS (ARCADIA/LFoundry)
    - Test beam con staves per ~ 2023
    - CSN5 call – 2019-2021
    - Assicurati > 400 kE (fondi esterni) oltre il budget di CSN5
    - In lavorazione MoU per attività 3rd-parties in ambito ARCADIA





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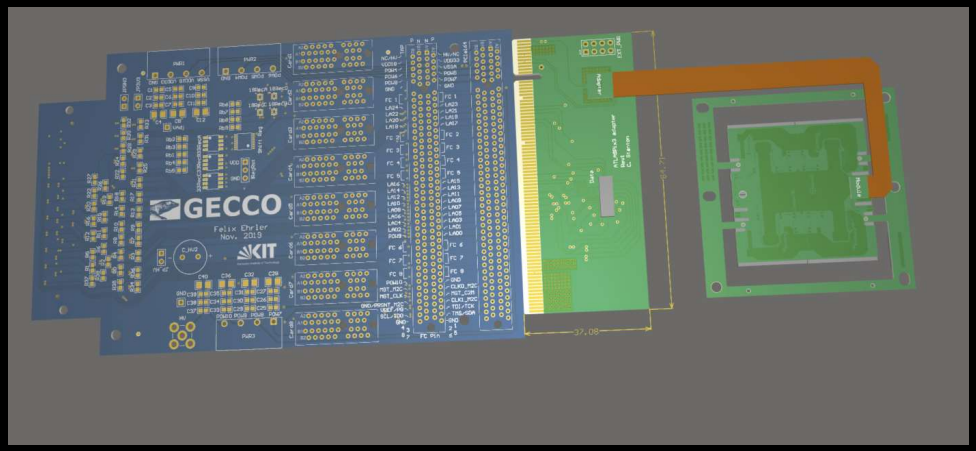

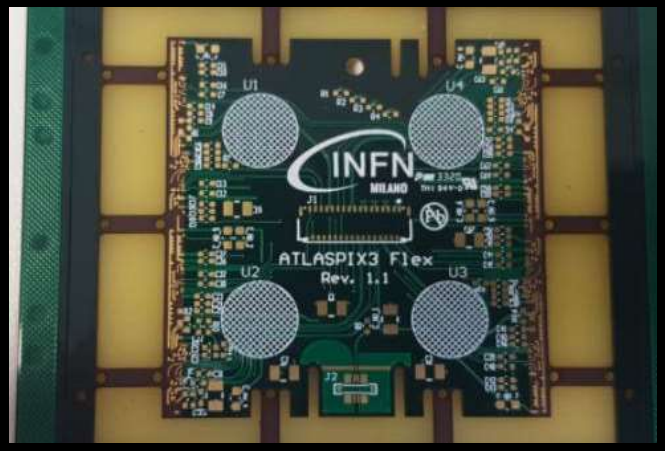

  - Large area silicon (Pixels e strips)
    - Dimostratori iniziali usano AtlasPix3 → moduli per mini-staves a Milano
    - Full system test su fascio previsto per il 2022/23
    - Sviluppi di nuovi pixels FCEPCPix1 in AMS
    - Sviluppi di strip passive a Lfoundry
    - Grossa collaborazione internazionale:
      - **China**: Harbin, IHEP, NWPU, Shandong, SJTU, Tsingua, UTSTC; **Germany**: KIT; **Italy**: Milano, Pisa, Torino; **UK**: Bristol, Daresbury, Edinburgh, Lancaster, Liverpool, RAL, Sheffield, Warwick

Drift Chamber

- Sinergia camera per CMD3/STC factory con BINP
  - BA/LE con buon supporto da Cremlin+ (2020-2023)

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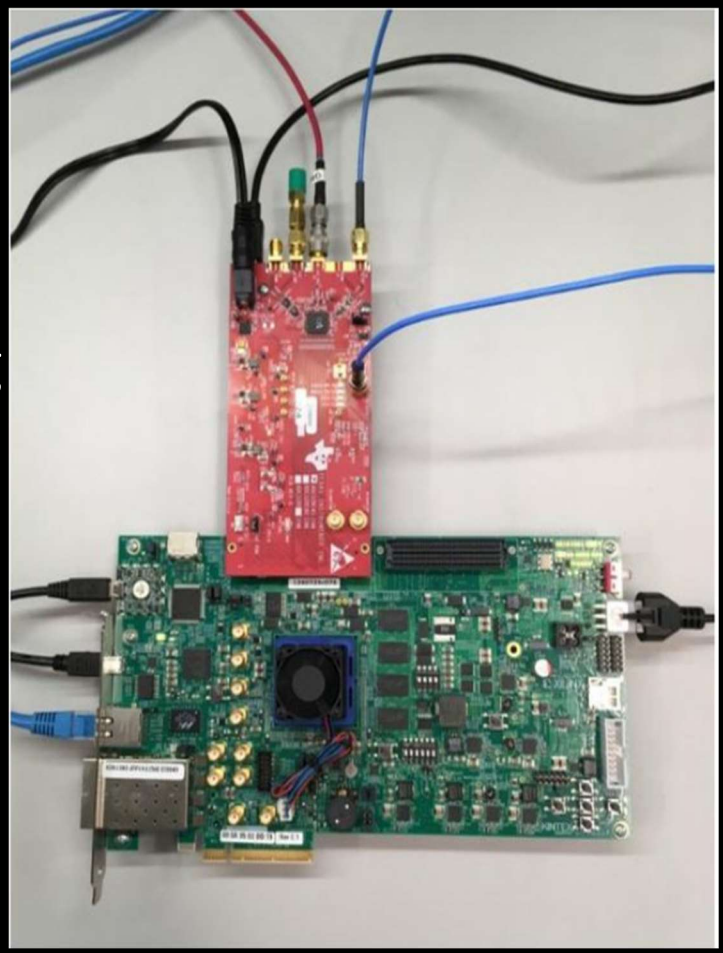

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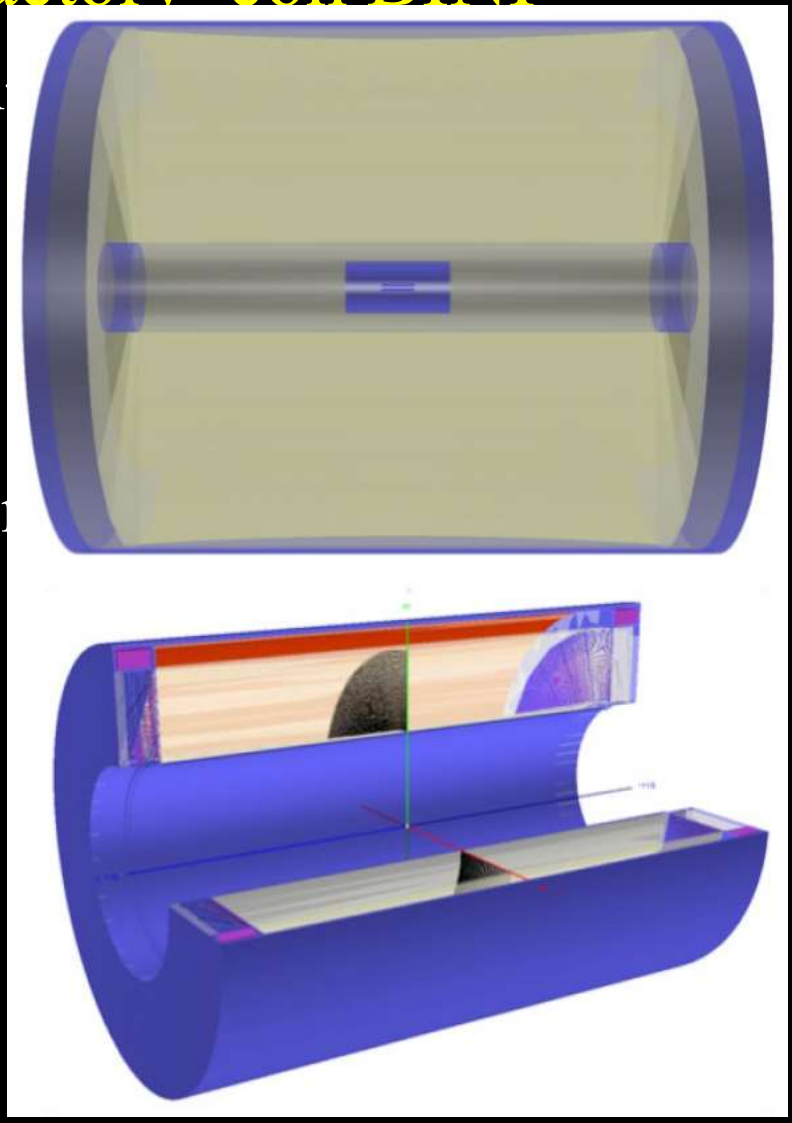
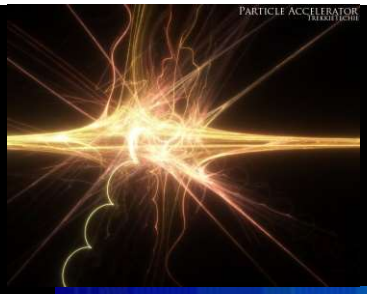
  - Sviluppo elettronica per cluster counti
  - Software simulazione e ricostruzione

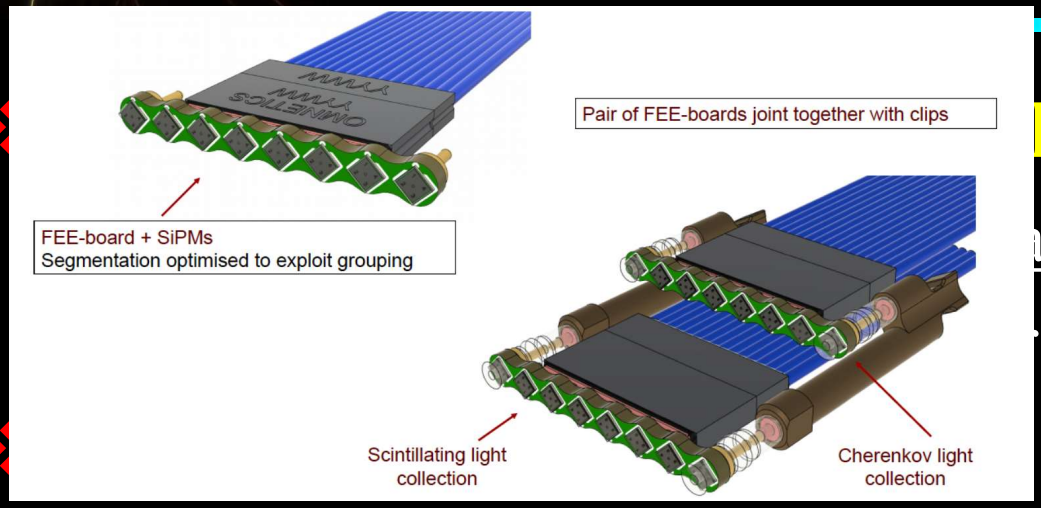


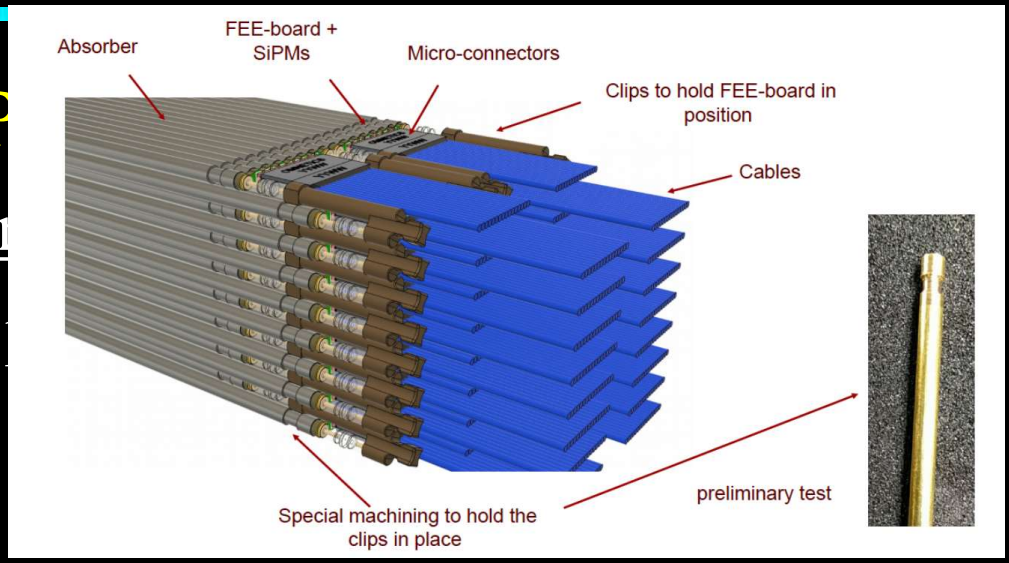


Dual Readout calorimeter

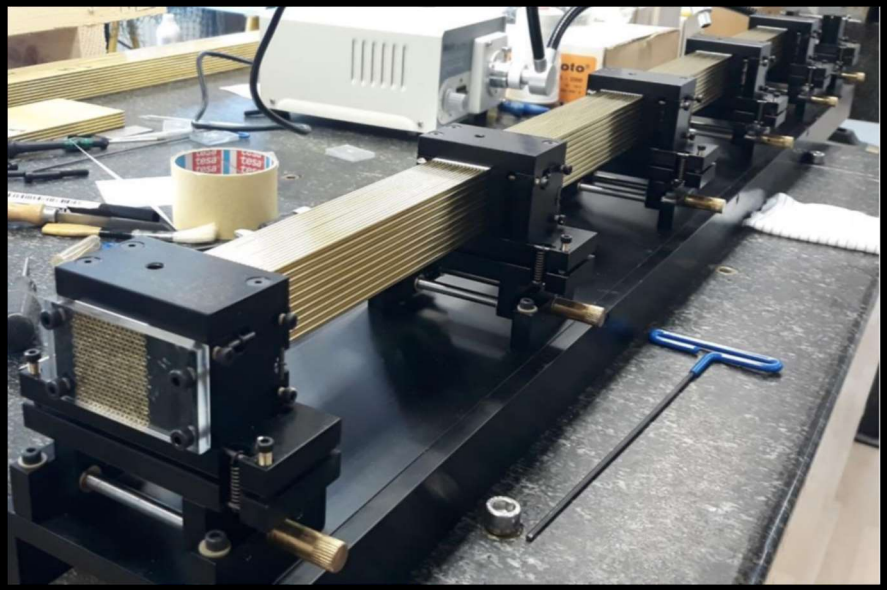
- Collaborazione (BO, CT,MI, PI, PV):
  - RBI (Croazia), Sussex (UK), varie universita' (Corea – 2 M$/5 yr)
  - Princeton, Maryland (USA) per possibile estensione a cristalli

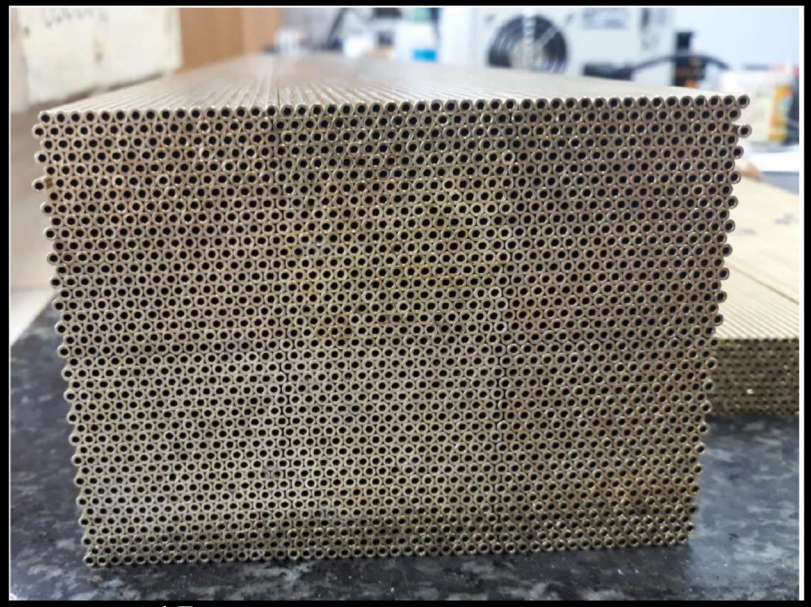
Dual Readout calorimeter





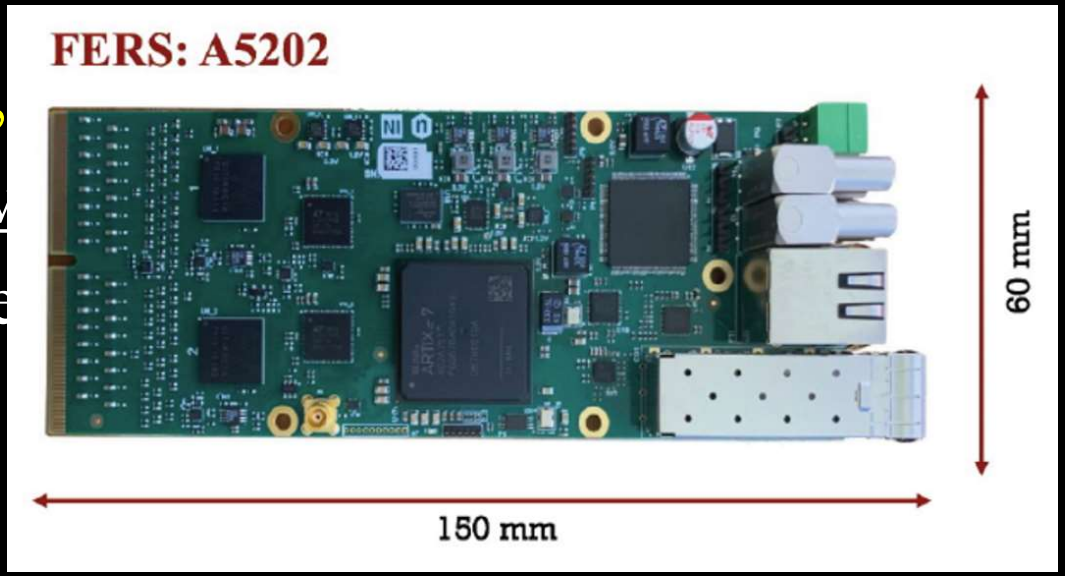
- Sviluppo meccanica scalabile

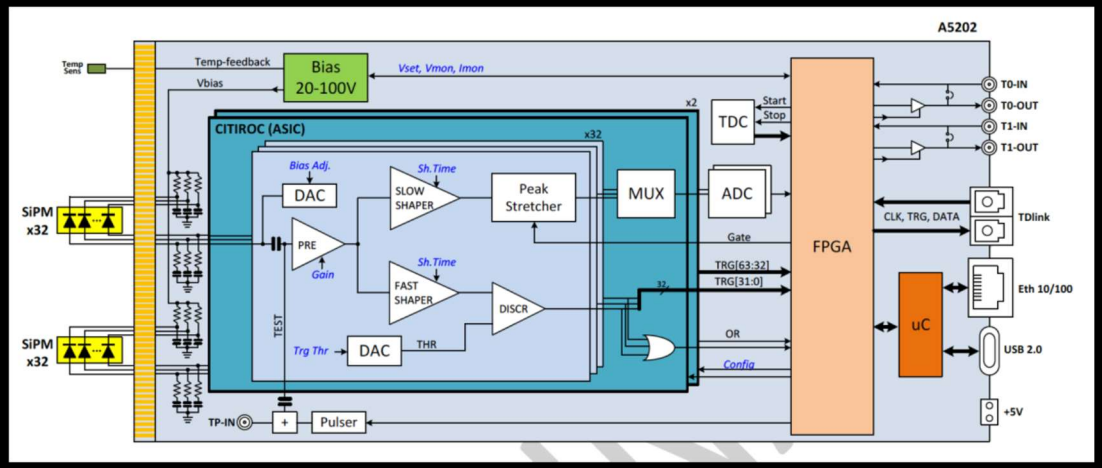


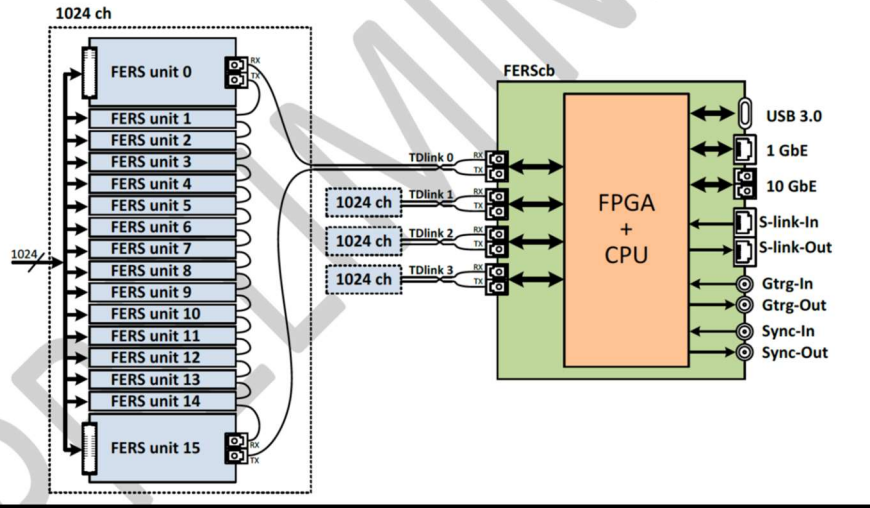


Dual Readout calorimeter

- Collaborazione (BO, CT,MI,
  - RBI (Croazia), Sussex (UK), v
  - Princeton, Maryland (USA) pe
- Attivita':
  - Sviluppo meccanica scalabile
  - Sviluppo readout SiPM scalabile (meccanica + elettronica)







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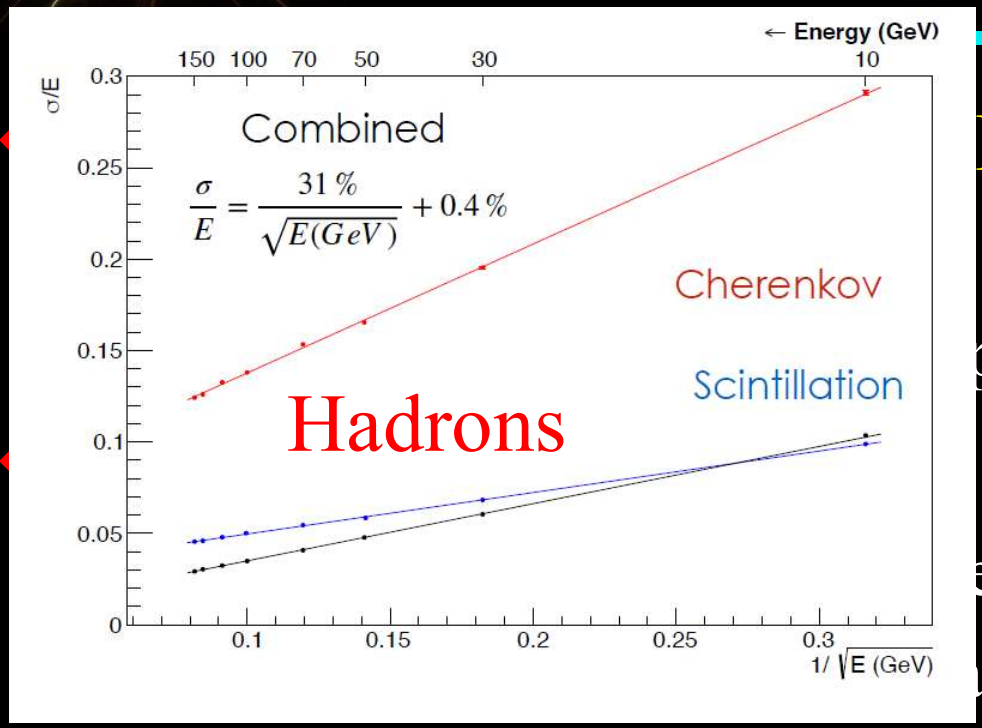

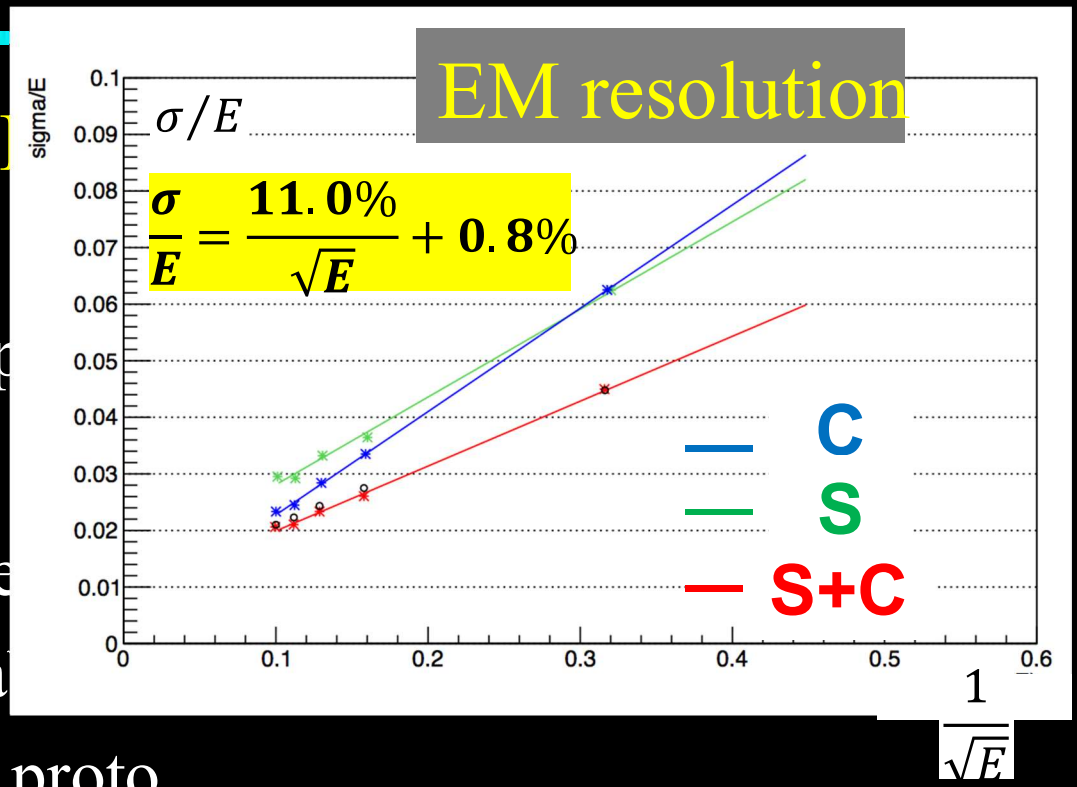

- Dimostrazione performance/ proto
  - EM 2021, HAD ~ 2024

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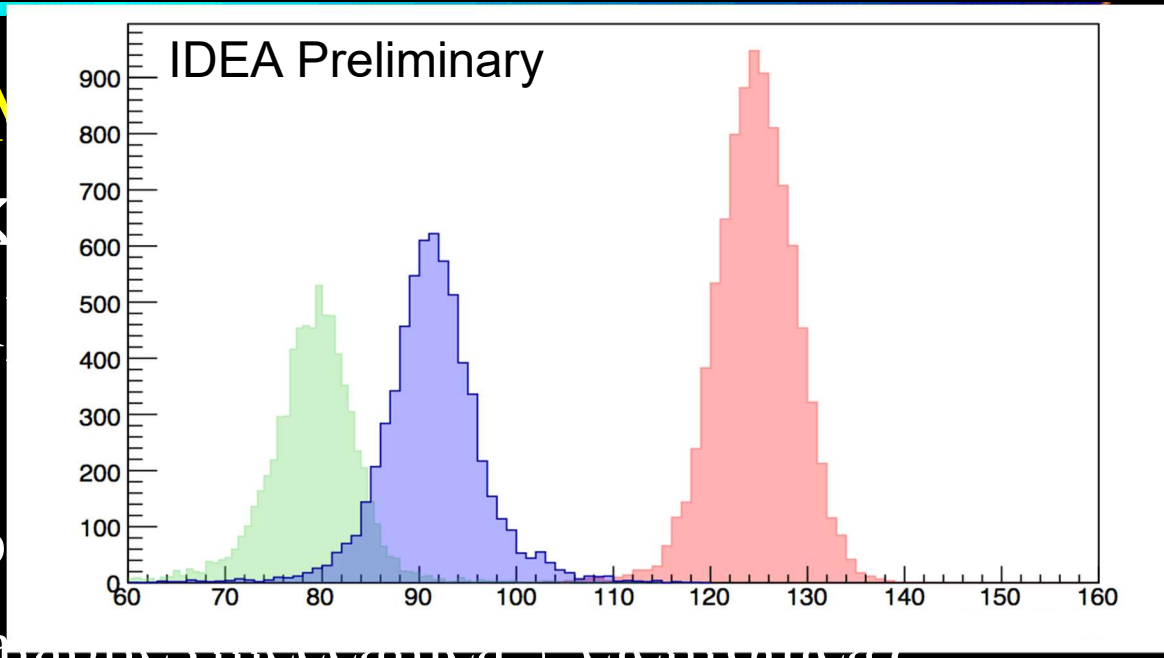
    - EM 2021, HAD ~ 2024
  - Software simulazione e ricostruzione

$$e^+e^- \to HZ \to \chi^0\chi^0 jj$$
$$e^+e^- \to WW \to \nu_\mu \mu jj$$
$$e^+e^- \to HZ \to bb\nu\nu$$



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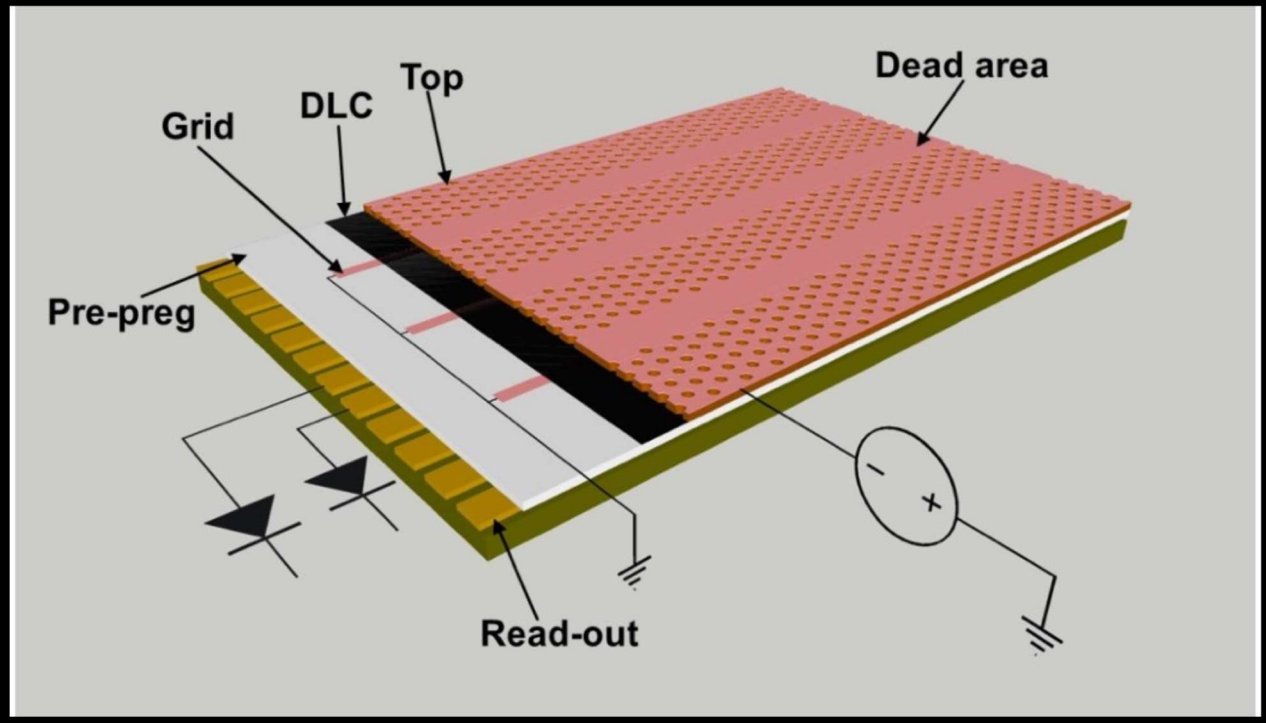

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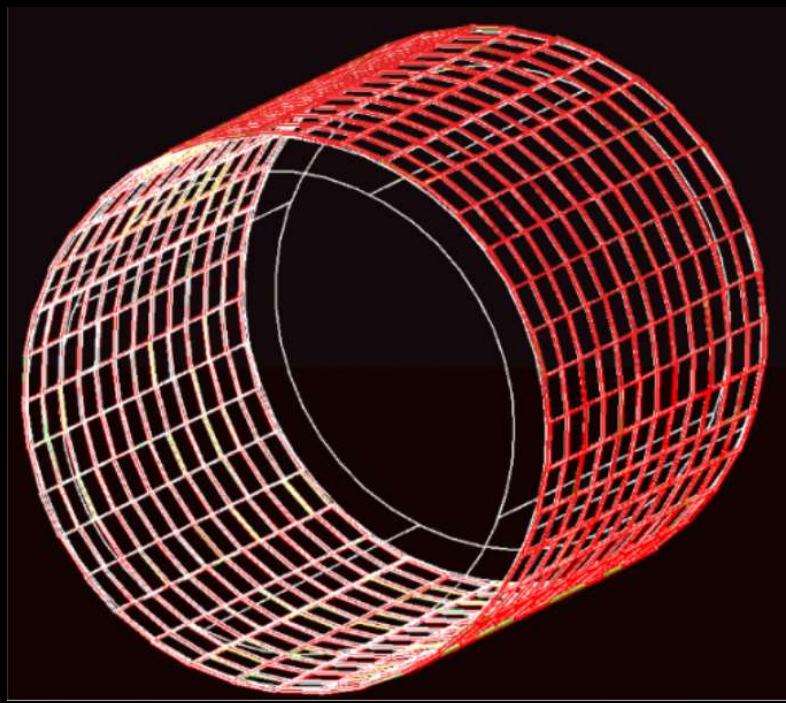

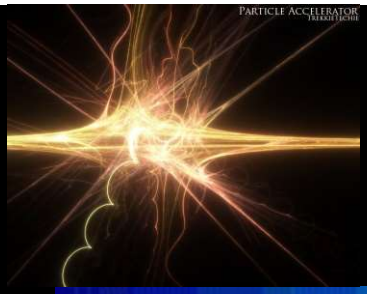

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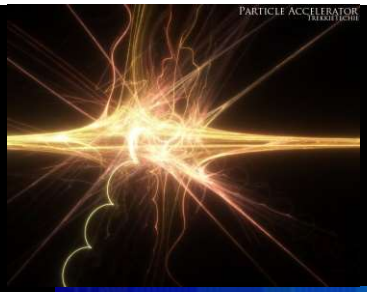

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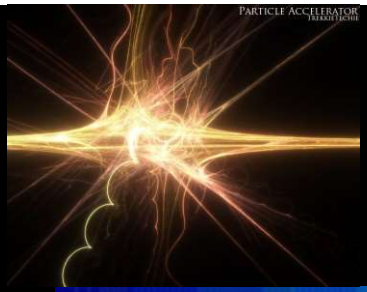

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- Continua allargamento della collaborazione ad altri istituti internazionali e la ricerca di ulteriori fondi esterni di finanziamento
  - Dopo la ESU l'Europa si sta risvegliando
  - Potenziali ulteriori fondi esterni, potenziali collaboratori e potenziali competitori!

FCC-IS Design Study – just approved by EU-H2020 NEW!

- **FCC-IS** (Innovation Study) is a **design study** project: **3M€ for 4 years**
- Kick-off: 9-10 November 2020

Goal of the FCC-IS study: Carry out the technical design study for a 100 km long luminosity frontier circular collider infrastructure at CERN that will extend Europe's leadership in the domain of fundamental physics research until the end of the 21st century.

The study **focuses on the high priority topics to prepare the ground for a construction project by 2026.**

First priority: optimisation of the particle collider design.

It includes both design and prototyping.

- INFN-LNF participates to FCC-IS (*Scientific Responsible for INFN: M. Boscolo*)
- MDI is included in the proposal as well as instabilities and impedance studies

- There is usually **strong competition** for Design Studies. Proposals come from every field of science, including social sciences and humanities. At the last call (November 2019) the success rate was only **18%** (10 project approved out of 60 submitted, only 1 for physics selected: FCC-IS).
- **Examples**: at the moment, for accelerators 2 DS have just completed (EuPraxia for a compact plasma-based FEL and EuroCirCol for FCC), ESSnuSB for a neutrino superbeam at ESS is ongoing, FCC-IS, for FCC-ee, has been just approved.

Back

Impatto ARCADIA

- Sinergia con ARCADIA (call CSN5)

NON CONTEGGIATO

  - +12.6 FTE contando solo sezioni in comune con FCC
    - Escluso PG e TIFP
  - +0.95 considerando solo persone con FTE su FCC
    - 4 pers./0.8 FTE Milano, 1 pers./0.15 FTE Torino

SEZIONE	NOME COGNOME	TIPO	CONTRATTO	QUALIFICA	RICERCATORI		TECNOLOGI		TOT. PERS.	FTE	FTE / PERS.
BO					0.5 fte	3 pers.	0 fte	pers.	3	0.5	0.167
MI					0.8 fte	4 pers.	0 fte	pers.	4	0.8	0.200
PD					3.6 fte	9 pers.	0 fte	pers.	9	3.6	0.400
PG					1 fte	5 pers.	0 fte	pers.	5	1.0	0.200
PV					0 fte	pers.	2.1 fte	6 pers.	6	2.1	0.350
TIFP					3 fte	9 pers.	0 fte	pers.	9	3.0	0.333
TO					4.18 fte	9 pers.	1.4 fte	5 pers.	14	5.6	0.399
TOTALE					13.08 FTE	39 PERS.	3.5 FTE	11 PERS.	50	16.58	0.332

Sommario richieste

- +Calcolo CNAF: 100 TB (15 k€), 1 kHS06 (~10 k€)
  - Richiesta inserita in CALC-TIER1

Struttura	missioni		consumo		altri_cons	inventario	apparati		spservizi		TOTALI	
BA.DTZ	4.00		10.00								14.00	
BO	11.00		3.00		6.00	8.50					28.50	
CT.DTZ	4.50		2.00								6.50	
FE.DTZ	5.00		3.00		1.00						9.00	
FI.DTZ	0.50										0.50	
LE.DTZ	6.00	2.00	7.00	2.50		10.00					23.00	4.50
LNF	15.50		25.00		2.00						42.50	
MI	9.00		23.00			6.00					38.00	
PD.DTZ	7.00										7.00	
PI.DTZ	67.00	60.00	18.50			5.00					90.50	60.00
PV.DTZ	13.00		20.50			2.00					35.50	
RM1.DTZ	0.50										0.50	
RM3.DTZ	4.00	6.00									4.00	6.00
TO.DTZ	5.50										5.50	
UD.DTZ	0.50										0.50	
Totali	**153.00**	*68.00*	**112.00**	*2.50*	**9.00**	**31.50**					*305.50*	*70.50*

Altri dettagli allegati

Dettaglio richieste: Silicio

Back

- Sommario richieste silicio 10 kE
  - Pixel detector ARCADIA ancora coperto da call CSN5
  - Large area silicon
    - Flex hybrid — 5 kE – MI consumi
    - Wafer Si per produzione AtlasPix3 — 5 kE – MI consumi

Dettaglio richieste: DCH

Sommario richieste DCH – 27 kE + 2.5 kE SJ

Back

- Strumentazione per misura velocita' di drift 10 kE – BA cons.
  - Include metabolismo
- Metabolismo 2.0 kE – LE cons.
- Dual channel ADC 2.5 kE SJ – LE cons
  - SJ ad approvazione AIDAinnova
- Consumi studio fili 3.0 kE – LE cons.
- Consumi scheda cluster counting 2.0 kE – LE cons.
  - Cavi, connettori adattatori
- Alimentatore per plasma coating 10 kE – LE inv.

Dettaglio richieste: Calorimetro

Sommario richieste calorimetro 71 kE

Back

SiRead evaluation board	6 kE – BO inv.
Metabolismo test SiPM	2 kE – CT cons.
Mini FE boards	7 kE – MI cons.
SiPM	3 kE – MI cons.
Micro-cavi coax.	3 kE – MI cons.
SiRead evaluation board	6 kE – MI inv.
Fibre scintillanti	12 kE – PI cons.
Fibre chiare	1.5 kE – PI cons.
Componenti test fibre	5 kE – PI cons.
PMT	5 kE – PI inv.
Colla	0.5 kE – PV cons.
Meccanica assmblaggi capillary	15 kE – PV cons.
Capillari metallici	5 kE – PV cons.

Dettaglio richieste: µRwell

Sommario richieste mRwell 41.5 kE

Back

Metabolismo	3 kE – BO cons.
TIGER readout board	3 kE – BO alt. cons.
TIGER FE board	1 kE – BO alt. cons.
Bombole gas	2 kE – BO alt. cons.
PS CAEN A2519	2.5 kE – BO inv.
Metabolismo	1 kE – FE cons.
TIGER transition board	2 kE – FE cons.
10 prototipi camera	25 kE – LNF cons.
Bombole gas	2 kE – LNF alt. cons.

Sommario FEST

- FEST trasla di un anno per Covid – Situazione come 2020
  - Spesa aggiuntiva di 75 kE (solo 28 kE su plafond missioni di CSN1)
  - 47 kE diventano fondi per AdR
    - Non contribuiscono al plafond delle missioni di CSN1
    - Ulteriori 18 kE a INFN (non inclusi in tabella, perche' non passano da CSN1)

Diaria Cina	120 E/day	FEST A	2100 E/month	Risparmio CSN1	
Viaggi Cina	900 E/viaggio	FEST B	1800 E/month	AdR	

Sezione	MU FEST	Diaria tot	Viaggi	Viaggi tot	Totale	FEST A	FEST B	ASS.	SJ	Cost CSN1
BA	6	21,600	7	6,300	27,900	12,600	10,800	4,500	23,400	15,300
BO	2	7,200	5	4,500	11,700	4,200	3,600	3,900	7,800	7,500
FE	1	3,600	4	3,600	7,200	2,100	1,800	3,300	3,900	5,100
LE	8	28,800	12	10,800	39,600	16,800	14,400	8,400	31,200	22,800
LNF	1	3,600	4	3,600	7,200	2,100	1,800	3,300	3,900	5,100
MI	3	10,800	3	2,700	13,500	6,300	5,400	1,800	11,700	7,200
PV	1	3,600	1	900	4,500	2,100	1,800	600	3,900	2,400
PV-DR	4	14,400	4	3,600	18,000	8,400	7,200	2,400	15,600	9,600
Totali	26	93,600	40	36,000	129,600	54,600	46,800	28,200	101,400	75,000